Dataquest
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A Decade of Semiconductor Start-Ups

Third Edition

A Strategic Analysis Report

Dataquest

A Decade of Semiconductor Start-Ups

Third Edition

Technology Products Group

Published by Dataquest Incorporated

Table of Contents

Table of Contents (Continued)

List of Tables

List of Tables (Continued)

List of Figures

A Decade of Semiconductor Start-Ups

Introduction

During the last ten years, there has been an explosion of new activity in the semiconductor industry. Dataquest has identified 170 start-ups formed between 1979 and 1989. These start-ups are developing new niche markets and technologies that did not exist only a few years ago. Several new companies already have become $100 million operations. In the 1990s, some may well become $1 billion companies. Although several start-ups have failed, the ranks were quickly replenished by a host of newcomers. As new technologies and applications emerge, Dataquest expects to see many more start-ups in Europe, Asia, and the United States by the year 2000.

Dataquest believes that it is crucial to watch these swiftly moving start-ups—the industry's barometers of change—because they represent emerging new technologies, markets, and applications.

For our client's convenience, Dataquest has prepared *A Decade of Semiconductor Start-Ups—Third Edition*, a compendium of information about these start-ups. The information contained in this directory was gathered through surveys, telephone interviews, and publicly available material. Some of the text was integrated directly from background information provided by the companies. This report, updated regularly, provides the following information:

- Historical trends in start-up activity
- Key factors of successful start-ups
- Venture capital financing information
- Strategic alliances
- Technology trends (memory, microprocessors, digital signal processing (DSP), application-specific ICs (ASICs), GaAs, linear/analog, and others as they emerge)
- Company profiles

Definition of a Start-Up

Dataquest defines a start-up as a semiconductor manufacturer that designs and ships finished products in the merchant or captive sectors; they need not have in-house wafer fabrication facilities. Because of the high cost of state-of-the-art plants and equipment, we observe that most start-ups use silicon foundries to reduce up-front costs. The start-up completes the circuit designs, sends the masks to foundries for fabrication, and may or may not complete packaging in-house. Most start-ups conduct in-house testing.

Because a company must first ship a product to be considered a start-up, Dataquest does not include design houses in its definition of a start-up. However, Dataquest does include captive manufacturers under the start-up title, provided they have begun operations during the past 10 years. We also consider semiconductor operations of large corporations to be start-up activities if the corporation was not previously involved in semiconductor activity.

For purposes of this directory, a start-up's age will not exceed 10 years. After a company is 10 years old, Dataquest no longer considers it a start-up, and the company is dropped from the book. Also, many of the companies profiled in previous editions have become highly successful operations. For this reason, we have created the concept of the graduate—a company that has become too large to be considered a start-up. To become a graduate, a company must exceed $100 million in revenue *twice* in its lifetime. A list of graduates is shown in Table 2c.

Historical Trends

The semiconductor industry is a vibrant industry that has gone through numerous business cycles and technology developments during its 30-year history. Dataquest observes that the industry has had the following six distinct phases since the early 1950s:

- Establishment of the industry under Bell Labs and Schockley Transistor (1947 to 1957)
- Domination by Fairchild, National Semiconductor, Raytheon, Signetics, and other early start-ups (1957 to 1967)
- A boom in start-up companies such as AMD, Intel, and MMI that offered NMOS standard products (1968 to 1974)
- Consolidation of the industry through mergers and acquisitions (1975 to 1979)
- A boom in ASIC start-ups in 1982 and 1983; high-performance CMOS and GaAs start-ups in 1984; and HCMOS, DSP, ASICs, PC chip sets, and telecommunications IC start-ups (1985 to 1988)
- A second consolidation of the industry through mergers, acquisitions, and fab agreements

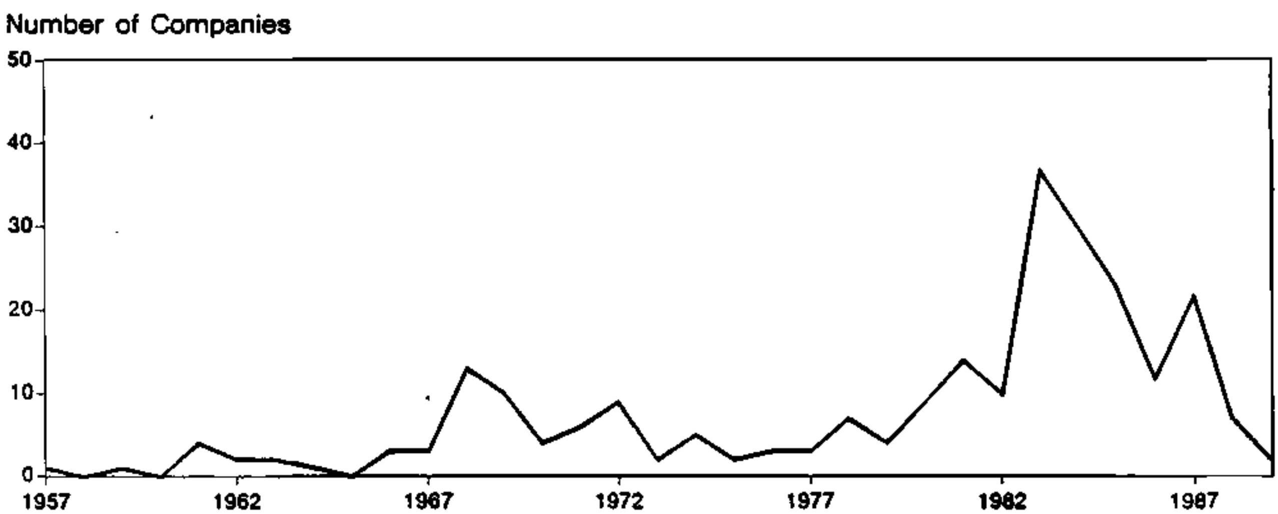
As shown in Figure 1, there have been three waves of semiconductor start-ups, each triggered by new process technologies. During the mid-1950s, companies such as Fairchild, Schockley Transistors, and Texas Instruments, all specializing in transistors and PMOS technology, rose to prominence. In the late 1960s, AMD, Intel, National, and others introduced NMOS technology. Since the late 1970s, a third wave of start-ups has developed next-generation technologies such as high-performance CMOS and GaAs processes; gate arrays, standard cells and silicon compilers for IC design; DSP, power transistors, and graphics and telecommunications ICs.

Historically, Dataquest has observed the following major trends in semiconductor start-up activity:

- A 12- to 15-year period between waves of start-ups, suggesting a technology life cycle that takes this amount of time to progress from initial research to commercialization and then to a gradual decline
- Technological and market leadership by key start-ups within a decade of existence
- Consolidation, acquisition, and a shakeout of start-ups following each peak of start-up activity
- A rapid loss of market share among older companies that are unable to compete with start-ups in emerging technologies
- Successively larger waves of start-up companies and increasing competition

Figure 1

Start-Up Activity by Year (1957-1989)



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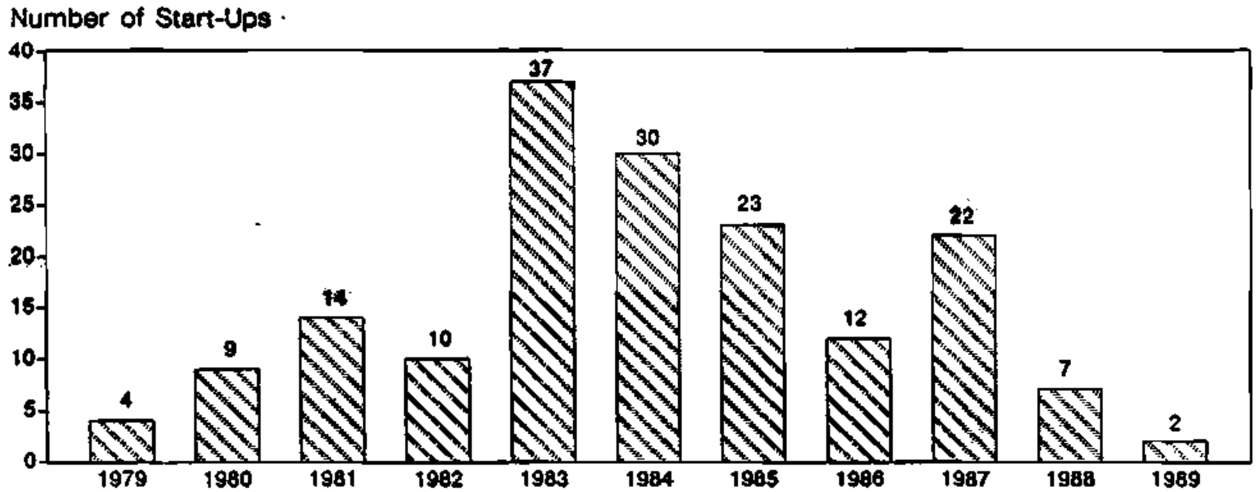
Source: Dataquest
January 1990

Figure 2

Semiconductor Start-Ups by Year
1979-1989



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Source: Dataquest
January 1990

- An emphasis on niche market strategies involving proprietary designs, CAD software, and excellent service

- Dispersion of start-up activity outside Silicon Valley due to the growing role of noncomputer applications, venture capital newcomers, and foreign government sponsorship

The latest wave of start-ups, which peaked in 1983, gradually is slowing down as existing start-ups commercialize their products and seek new rounds of financing. Figure 2 shows start-up activity for the 1979 through 1989 period. After a slow year in 1986, 1987 was strong, with the introduction of 22 new companies. Although the figures for 1988 have not been finalized, it appears at this time that 1988 will be a slower year than 1987 in terms of the number of start-ups. Dataquest believes that the industry has entered another phase of consolidations, mergers, and failures. This market shakeout occurs as niche markets become crowded and companies search for new directions in technology, products, and applications. In the mid-to-late 1990s, however, we anticipate a fourth wave of start-ups that will be involved with GaAs, optoelectronics, artificial intelligence (AI), parallel processors, three-dimensional ICs, voice recognition and synthesis, bioelectronics, and other emerging fields. These start-ups will become the major technology drivers as we enter the 21st century.

Start-Up Activity, 1988 and 1989

In 1988 and 1989, start-up activity in the semiconductor industry fell off quite substantially. In 1988, Cypress Semiconductor developed another satellite, Multichip Technology, which specializes in multichip memory modules. In 1989, Video Seven and G-2, two affiliates of LSI Logic, merged to form Headland Technology. Also in 1989, two executives from Chips and Technologies left to form S3, Inc., which will specialize in silicon subsystems. Overall, Dataquest identified only seven start-ups in 1988 and two so far in 1989. Because Dataquest does not identify a company as a viable entity until significant financing is secured or until a product is introduced, it is likely that the number of start-ups for 1988 and 1989 will increase as more companies meet Dataquest's definition of a start-up.

One of the main reasons for the decline in start-up activity is the lack of venture funding available for semiconductor start-ups. Beginning in 1987, the venture capital community has become increasingly disenchanted with the semiconductor industry. It is becoming extremely difficult for a new company to secure the venture financing necessary to bring a product to market. Without venture funding, many start-ups never get off the ground.

In addition, many of the niches that start-ups have recently pursued are becoming quite crowded. The markets for ASICs and fast SRAMs are especially so; start-up fatality rates are rising and entry rates are falling as a consequence. Start-ups, therefore, currently are searching for new niches to inhabit, and Dataquest expects start-up activity to be limited until a market with significant growth potential is uncovered.

Tables 1a through 1k list start-up activity by year.

Table 1a

Start-Up Activity by Year—1989 (2)

Company	Location	Product
Headland Technologies, Inc.	Fremont, CA	Micros
S3, Inc.	Santa Clara, CA	Micros

Source: Dataquest
January 1990

Table 1b

Start-Up Activity by Year—1988 (7)

Company	Location	Product
Advanced Hardware Architectures	Moscow, ID	Micros
ISSI	Sunnyvale, CA	Memory
Multichip Technology	San Jose, CA	Memory
Plus Logic	San Jose, CA	ASICs
Power Integrations	Mt. View, CA	Analog
The DSP Group	Emeryville, CA	DSP
TranSwitch	Shelton, CT	Telecom

Source: Dataquest
January 1990

Table 1c

Start-Up Activity by Year—1987 (22)

Company	Location	Product
ACC Microelectronics	Santa Clara, CA	Micros
Aspen Semiconductor	San Jose, CA	Memory, ASICs
Chartered Semiconductor	Singapore	ASICs, foundry
Cree Research	Durham, NC	Discretes
Genesis Microchip	Canada	ASICs
G-2 Incorporated (Merged into Headland)	Milpitas, CA	Micros
Hualon Micro-Electronics Corp.	Taiwan	Analog, ASICs, micros, telecom
Integrated Information Technology	Santa Clara, CA	Micros

(Continued)

Table 1c (Continued)

Start-Up Activity by Year—1987 (22)

Company	Location	Product
Intergraph Adv. Processor Div.	Palo Alto, CA	Micros
Linear Integrated Systems	Fremont, CA	Analog
MOSPEC Semiconductor	Taiwan	Discretes, foundry
nCHIP	San Jose, CA	Multichip modules
Oak Technology	Sunnyvale, CA	Micros
Oxford Computer	Oxford, CT	Memory
Paradigm Technology (formerly GL Micro Devices)	San Jose, CA	Memory
Photonic Integration Research	Columbus, OH	Opto
RAMAX	Australia	Memory
SIMTEK Corp.	Colorado Springs	Memory
Synergy Semiconductor	Santa Clara, CA	Memory
Togai InfraLogic	Irvine, CA	Fuzzy logic
US2	San Jose, CA	ASICs
VIA Technologies, Inc. (Formerly LOGICSTAR)	Fremont, CA	Micros

Source: Dataquest
January 1990

Table 1d

Start-Up Activity by Year—1986 (12)

Company	Location	Product
Advanced Microelectronic Products	San Jose, CA	Discretes
BKC International Electronics	Lawrence, MA	Discretes
Gazelle Microcircuits	Santa Clara, CA	GaAs
HNC, Inc.	San Diego, CA	Neural networks
Innovative Silicon Technology	Carrollton, TX	ASICs
MemTech Technology Corp.	Santa Clara, CA	Bubble memory
PLX Technology Corp.	Mt. View, CA	ASICs
Powerex, Inc.	Youngwood, PA	Discretes
Synaptics, Inc.	San Jose, CA	Neural networks
TSMC	Taiwan	Foundry
Telcom Devices Corp.	Newbury Park, CA	GaAs
Triad Semiconductors	Colorado Springs, CO	Memory

Source: Dataquest
January 1990

Table 1e

Start-Up Activity by Year—1985 (23)

Company	Location	Product
ABM Semiconductor[1]	San Jose, CA	GaAs opto
Actel Corp.	Sunnyvale, CA	ASICs
Acumos	San Jose, CA	ASICs
Advanced Linear	Sunnyvale, CA	Linear
Alliance Semiconductor	San Jose, CA	Memory
ANADIGICS	Warren, NJ	GaAs analog and digital
Catalyst Semiconductor	Santa Clara, CA	Memory
Chips & Technologies[2]	San Jose, CA	Micros
Dolphin Integration	France	ASICs
ES2	West Germany	ASICs
GAIN Electronics[1]	Somerville, NJ	GaAs ASICs
Hittite Microwave	Woburn, MA	GaAs MMICs
Intercept[1]	Sunnyvale, CA	ASICs
Krysalis[3]	Sunnyvale, CA	Ferroelectric memory
Level One Communications	Folsom, CA	Telecom
NovaSensor	Fremont, CA	IC sensors
Orbit Semiconductor	Sunnyvale, CA	Foundry
Sahni[4]	Sunnyvale, CA	ASICs
Saratoga Semiconductor[5]	Cupertino, CA	BiCMOS memory
Tachonics[1]	Plainsboro, NJ	GaAs
Three-Five Systems	Phoenix, AZ	GaAs opto
Topaz Semiconductor	San Jose, CA	Discrete, linear
Wolfson Microelectronics	Scotland	ASICs, DSP

[1]Inactive
[2]Graduate
[3]Acquired
[4]Closed
[5]Chapter 11

Source: Dataquest
January 1990

Table 1f

Start-Up Activity by Year—1984 (30)

Company	Location	Product
Advanced Power Technology	Bend, OR	Power MOSFETs
ATMEL	San Jose, CA	ASICs, memory, linear
Austek Microsystems	Australia	Micros
Celeritek	San Jose, CA	GaAs FETs, MMICs
Cirrus Logic	Milpitas, CA	Micros
Crystal Semiconductor	Austin, TX	Linear
Custom Arrays	Sunnyvale, CA	ASICs
Dallas Semiconductor	Dallas, TX	Memory, linear, micros
Edsun Laboratories	Waltham, MA	Micros
Epitaxx Inc.	Princeton, NJ	GaAs opto
Integrated CMOS Systems	Sunnyvale, CA	ASICs

(Continued)

Table 1f (Continued)

Start-Up Activity by Year—1984 (30)

Company	Location	Product
Integrated Power Semi[1]	Scotland	Linear
Lytel	Somerville, NJ	GaAs opto
Molecular Electronics	Torrance, CA	Bioelectronics
NMB Semiconductor	Chatsworth, CA	Memory, foundry
NSI Logic	Marlboro, MA	Micros
Novix	Cupertino, CA	Micros
Pacific Monolithics	Sunnyvale, CA	GaAs MMICs
Performance	Sunnyvale, CA	Memory, micros, logic
PromTech	San Jose, CA	Memory
Quasel Taiwan[2]	Taiwan	Memory
Ramtron	Colorado Springs, CO	Ferroelectric memory
SID Microelectronics	Brazil	Discretes, linear
Silicon Macrosystems[1]	San Jose, CA	Memory
TMMIC[3]	Mt. View, CA	GaAs MMIC
TriQuint Semiconductor	Beaverton, OR	GaAs analog/digital
Vitesse Semiconductor	Camarillo, CA	GaAs digital, foundry
VTC	Bloomington, MN	Linear, ASICs, foundry
Wafer Technology[4]	Rancho Palos Verdes, CA	Logic
Xilinx	San Jose, CA	ASICs

[1]Acquired
[2]Hybrid
[3]Removed
[4]Closed

Source: Dataquest
January 1990

Table 1g

Start-Up Activity by Year—1983 (37)

Company	Location	Product
Altera	Santa Clara, CA	ASICs
Asahi Kasei Microsystems	Japan	ASICs, linear, micros, memory
BIT	Beaverton, OR	DSP
Brooktree	San Diego, CA	Linear
Calmos Systems	Canada	ASICs, DSP, linear, memory
Calogic	Fremont, CA	Linear, ASICs
Custom Silicon	Lowell, MA	ASICs
Cypress Semiconductor[1]	San Jose, CA	Memory, ASICs, DSP
Elantec	Milpitas, CA	Linear
Electronic Technology	Ames, IA	ASICs
Exel Microelectronics	San Jose, CA	Memory, micros, ASICs
Hyundai America[2]	Santa Clara, CA	Memory
iLSi	Colorado Springs, CO	ASICs
ICT	San Jose, CA	Memory, ASICs
Inova	Santa Clara, CA	Memory

(Continued)

Table 1g (Continued)

Start-Up Activity by Year—1983 (37)

Company	Location	Product
Iridian[2]	Chatsworth, CA	GaAs FETs
IXYS	San Jose, CA	Power FETs, ICs
Laserpath[2]	Sunnyvale, CA	ASICs
Lattice Semiconductor	Hillsboro, OR	ASICs
Logic Devices	Sunnyvale, CA	Memory, DSP, micros
Maxim Integrated Products	Sunnyvale, CA	Linear
Micro Linear	San Jose, CA	ASICs, linear
Mietec N.V.	Belgium	ASICs
Modular Semiconductor	Santa Clara, CA	Memory, micros
MOS Electronics	Sunnyvale, CA	Memory
Opto Tech	Taiwan	GaAs opto
Samsung Semiconductor	San Jose, CA	Linear, discretes, logic, memory
Seattle Silicon	Bellevue, WA	ASICs
Sierra Semiconductor	San Jose, CA	ASICs, memory, micros, linear
S-MOS Systems[1]	San Jose, CA	Memory, micros, ASICs, linear
Texet[2]	Allen, TX	Discretes
Vadem	San Jose, CA	Micros
Vatic[3]	Mesa, AZ	ASICs
Visic[4]	San Jose, CA	Memory
Vitelic	San Jose, CA	Memory
WaferScale Integration	Fremont, CA	Memory, ASICs, micros
Zoran	Santa Clara, CA	DSP

[1]Graduate
[2]Closed
[3]Merged
[4]Acquired

Source: Dataquest
January 1990

Table 1h

Start-Up Activity by Year—1982 (10)

Company	Location	Product
Array Devices[1]	San Diego, CA	ASICs
Custom MOS Arrays[2]	Milpitas, CA	ASICs
IC Sensors	Milpitas, CA	Pressure sensors
ICI Array Technology	San Jose, CA	ASICs
Isocom	England	Opto
Microwave Monolithics	Simi Valley, CA	GaAs MMICs
Microwave Technology	Fremont, CA	GaAs FETs, MMICs
Sensym	Sunnyvale, CA	IC sensors
Solid State Optronics	San Jose, CA	Opto
XTAR	San Diego, CA	Micros

[1]Closed
[2]Merged

Source: Dataquest
January 1990

Table 1i

Start-Up Activity by Year—1981 (14)

Company	Location	Product
Adaptec	Milpitas, CA	Micros
Barvon Research[1]	Milpitas, CA	ASICs
GigaBit Logic	Newbury Park, CA	GaAs ASICs, logic, memory
IMP	San Jose, CA	ASICs
LTC	Milpitas, CA	Linear
LSI Logic[2]	Milpitas, CA	ASICs, DSP, micros
Opto Diode	Newbury Park, CA	GaAs LEDs
Panatech Semi[1]	Santa Clara, CA	ASICs
SEEQ Technology	San Jose, CA	Memory, micros
Signal Processor[1]	Salt Lake City, UT	DSP
Silicon Systems[1]	Tustin, CA	Linear, micros
Telmos[3]	Sunnyvale, CA	ASICs, linear, opto
Weitek	Sunnyvale, CA	DSP
Zytrex[3]	Sunnyvale, CA	Memory, logic

[1]Acquired
[2]Graduate
[3]Closed

Source: Dataquest
January 1990

Table 1j

Start-Up Activity by Year—1980 (9)

Company	Location	Product
California Micro Devices	Milpitas, CA	ASICs, linear
Comlinear	Ft. Collins, CO	Analog
Harris Microwave Semiconductor	Milpitas, CA	GaAs FETs, MMICs
IDT[1]	Santa Clara, CA	Memory, logic, DSP, micros
Kyoto Semiconductor	Japan	Optoelectronics
Si-Fab	Scotts Valley, CA	Foundry
Spectrum Microdevices	Frederick, MD	ASICs
Trilogy[2]	Cupertino, CA	Waferscale integration
VLSI Design Assoc.[3]	Campbell, CA	Micros

[1]Graduate
[2]Sold semiconductor operations
[3]Now Avasem

Source: Dataquest
January 1990

Table 1k

Start-Up Activity by Year—1979 (4)

Company	Location	Product
AMCC	San Diego, CA	ASICs
Matra-Harris	France	ASICs, memory, micros
United Microelectronics	Taiwan	Linear, micros, memory, foundry
VLSI Technology[1]	San Jose, CA	ASICs, memory, micros

[1]Graduate

Source: Dataquest January 1990

The Driving Factors

Why was there such a strong surge in semiconductor start-up activity in the late 1970s and early 1980s? Semiconductor start-ups faced increasingly expensive plant and equipment costs, growing competition from Asia, and a depressed market in 1981 and 1982. Yet a record number of semiconductor companies were started in 1983. Dataquest believes that the following factors drove this explosion of activity:

- The infusion of venture capital
- The strong start-up activity in computers, telecommunications, design workstations, and consumer electronics, all of which required state-of-the-art ICs
- The proliferation of specialized market niches that required fast turnaround times
- A growing number of experienced engineers and managers frustrated by the sluggishness of innovation within larger companies
- More user-friendly CAD systems and support software
- Worldwide fabrication facility overcapacity and silicon foundries that allowed start-up companies to defer fabrication investments
- The entry of U.S., Japanese, South Korean, and Taiwanese companies with sizeable financing
- The growing demand for higher-performance ICs with reduced power consumption (i.e., CMOS)

During the early 1980s, Dataquest observed a mismatch between U.S. and foreign vendors that specialized in NMOS processes and the growing demand for CMOS ASICs, memory, logic devices, and other new products. Start-ups were quickly able to fill these market gaps by emphasizing advanced process technologies, design, and focused marketing.

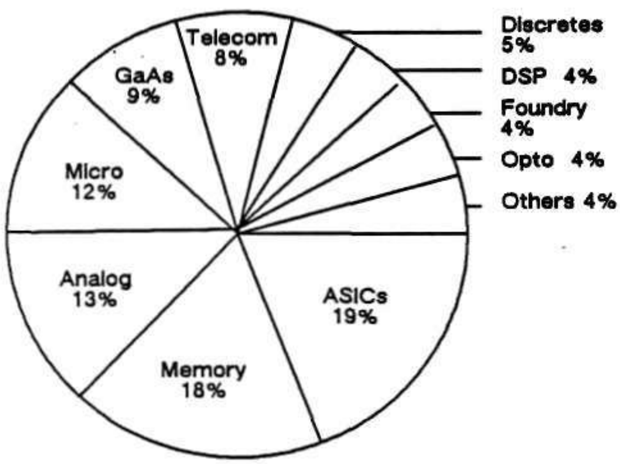
The Third Wave

The third wave of start-ups differs from previous start-up generations because of the sheer variety and number of companies, which makes generalizations difficult. However, Dataquest notes that the following several trends may have a major impact on the industry:

- More start-ups are being located outside Silicon Valley, especially in the Southwest and East Coast of the United States, and in Europe.
- Increasingly, start-ups are using silicon foundries as an alternative to building their own fabs, which shortens time to market and allows these companies the opportunity to focus on IC design, product development, and marketing.
- Increasingly, Asian silicon foundries are being used because of their high-quality wafers and an apparent lack of interest among U.S. vendors to compete.
- Numerous strategic alliances are occurring between start-ups and Asian companies to develop, manufacture, market, and distribute products jointly.

Figure 3

Semiconductor Start-Up Product Lines



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Source: Dataquest
January 1990

- More corporate investors and government backers throughout the world are participating in start-ups.
- Most start-ups have chosen to be niche players, where profit margins tend to be higher; and most are concentrated in fast-growing markets, such as ASICs, microcomponents (especially microperipherals), and telecommunications.

The third wave of start-up companies offers a wide variety of products, as shown in Figure 3. Application-specific ICs (ASICs) and high-performance CMOS memory and logic are attracting most of the attention. The microcomponent segment has grown substantially during the past two years; it currently represents 12 percent of semiconductor start-up product lines.

One of the fastest-growing product areas is the PC peripheral chip set market. The market for logic chip sets has attracted a host of new entrants in 1988 and 1989 and is approaching the saturation point. Dataquest expects a similar growth pattern in the other peripheral chip set markets (e.g., graphics, communication, mass storage, modem, and fax). Dataquest also expects significant growth in the market for telecommunications ICs.

Dataquest has recognized very little growth in the GaAs market segment. Two companies, GAIN Electronics and Tachonics, have failed, and we have not identified any new GaAs start-ups. The technology still is in its developmental stages, and it may be quite some time before it gains wide acceptance.

Keys to Success

The third wave of start-ups share many common characteristics. In general, the more successful companies tend to be as follows:

- Highly focused, flexible, and able to move quickly out of stagnant markets and into high-growth markets
- Willing to develop new markets and educate users about their products and design services
- Positioned at the leading edge because of their advanced process technologies and proprietary CAD software
- Resourceful in attracting venture capital from U.S. and foreign venture capitalists, corporate investors, and OEMs
- Aggressive in building strategic alliances to develop new applications jointly and secure wafer fab capacity, especially in Asia

Of course, not all recent start-ups fit this profile. Some companies are failing and are being acquired because of faulty management, weak finances, or poor product planning and marketing. Table 2a lists the companies that are no longer operating or have filed for Chapter 11 protection. Table 2b lists those companies that have been acquired by or merged with another company. Table 2c is a list of companies that have graduated from start-up status by achieving $100 million in annual sales twice in their lifetimes.

Table 2a

Companies That Are No Longer Operating

Company	Year Formed	Location	Product
ABM	1985	San Jose, CA	GaAs opto
Array Devices	1982	San Diego, CA	ASICs
GAIN Electronics	1985	Somerville, NJ	GaAs ASICs
Hyundai America	1983	Santa Clara, CA	Memory
Intercept Microelectronics	1985	Sunnyvale, CA	ASICs
Iridian	1983	Chatsworth, CA	GaAs FETs
Laserpath	1983	Sunnyvale, CA	ASICs
Sahni	1985	Sunnyvale, CA	ASICs
Saratoga Semiconductor	1985	Cupertino, CA	BiCMOS memory
Tachonics	1985	Plainsboro, NJ	GaAs
Telmos	1981	Sunnyvale, CA	ASICs, linear
Texet	1983	Allen, TX	Discretes
Trilogy	1980	Cupertino, CA	Waferscale
Wafer Tech	1984	Rancho Palos Verdes, CA	Logic
Zytrex	1981	Sunnyvale, CA	CMOS logic

Source: Dataquest
January 1990

Table 2b

Companies That Have Been Acquired or Merged

Company/Year Formed	Product	Acquired by	Year Acquired
Barvon Research (1981)	ASICs	Sipex	1988
Custom MOS Arrays (1982)	ASICs	CMD	1986
Exel Microelectronic (1983)	Memory, micros, ASICs	Exar	1986
G-2 Incorporated (1987)	Micros	Headland	1989
Integrated Power Semiconductor (1984)	Linear	Seagate	1987
Krysalis (1985)	NV memory	National	1989
Panatech (1981)	ASICs	Ricoh	1987
Signal Processor (1981)	DSP	Analog Devices	1983
Silicon Macrosystems (1984)	Memory	Austek	1986
Silicon Systems (1981)	Micros	TDK	1989
Vatic (1983)	ASICs	Thomson-Mostek	1986
Visic (1983)	Memory	VLSI Technology	1986
VTC (1984)	Linear, ASICs, foundry	Control Data	1987

Source: Dataquest
January 1990

Table 2c

Companies That Have "Graduated" from Start-Up Status

Company	Year Formed	Location	Product
Chips & Technologies	1985	San Jose, CA	Micros
Cypress Semiconductor	1983	San Jose, CA	Memory, ASICs, DSP
IDT	1980	Santa Clara, CA	Memory, logic, DSP, micros
LSI Logic	1981	Milpitas, CA	ASICs, DSP, micros
S-MOS Systems, Inc.	1983	San Jose, CA	Memory, micros, ASICs, linear
VLSI Technology	1979	San Jose, CA	ASICs, memory, micros

Source: Dataquest
January 1990

Table 3

Geographic Dispersion of Start-Up Companies

Silicon Valley	75
Southwest United States	21
Northwest United States	7
Midwest United States	3
Northeast United States	11
Southeast United States	2
ROW	18
Total	137

Source: Dataquest
January 1990

Geographic Dispersion of Start-Up Companies

Silicon Valley still leads with the number of semiconductor start-ups, but other areas are beginning to attract more start-ups. As shown in Table 3, 75 of the 137 companies identified in this book are located in Silicon Valley. This figure translates to 55 percent of these start-ups. In recent years, Dataquest has noticed a trend toward location outside Silicon Valley due to the increased availability of local financing and government support. Figure 4 shows the geographic concentration of start-ups in the United States.

Dataquest anticipates more worldwide start-up activity due to growing public and private interest in promoting venture capitalism and entrepreneurialism. In the future, we expect the following regions to become increasingly active:

- The East Coast of the United States, especially New Jersey ("Gallium Gulch"), Maryland ("Bioelectronics Center"), and North Carolina ("Research Triangle")
- The Southwest United States, especially Austin and Dallas, Texas
- Europe, especially Scotland, West Germany, and France
- Israel
- Asia, especially Taiwan, China, Singapore, Malaysia, and India

By the year 2000, we expect to see a semiconductor industry that is not so concentrated in existing areas, but is much more global in scope. The trend toward closer vendor/user ties will accelerate this global shift. Because of the grass roots nature of start-ups, they will have a significant impact on the direction of regional industries and economies.

Tables 4a through 4g list start-up companies by location and region.

Figure 4

Geographic Concentration of Start-Up Activity

0005344-4

Source: Dataquest
January 1990

Table 4a

Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
ACC Microelectronics	Santa Clara	1987
Actel Corp.	Sunnyvale	1985
Acumos	San Carlos	1985
Adaptec	Milpitas	1981
Advanced Linear Devices	Sunnyvale	1985
Advanced Microelectronic Products	San Jose	1986
Alliance Semiconductor	San Jose	1985
Altera Corporation	Santa Clara	1983
Aspen Semiconductors	San Jose	1987
ATMEL Corporation	San Jose	1984
Avasem Corporation	San Jose	1980
California Micro Devices	Milpitas	1980
Calogic Corp.	Fremont	1983
Catalyst Semiconductor	Santa Clara	1985
Celeritek	San Jose	1984
Cirrus Logic	Milpitas	1981
Custom Arrays Corp.	Sunnyvale	1984
The DSP Group	Emeryville	1988
Elantec	Milpitas	1983
Exel Microelectronics	San Jose	1983
Gazelle Microcircuits	Santa Clara	1986
Harris Microwave Semiconductor	Milpitas	1980
Headland Technologies, Inc.	Fremont	1989
IC Sensors	Milpitas	1982
ICI Array Technology	San Jose	1982
Inova Microelectronics Corp.	Santa Clara	1983
Integrated CMOS Systems	Sunnyvale	1984
Integrated Information Technology	Santa Clara	1987
Intergraph—Adv. Processor Div.	Palo Alto	1987
International CMOS Technology	San Jose	1983
IMP	San Jose	1981
Isocom Ltd.	Campbell	1982
ISSI	Sunnyvale	1988
IXYS Corp.	San Jose	1983
Krysalis Corp.	Sunnyvale	1985
Linear Integrated Systems	Fremont	1987
Linear Technology Corp.	Milpitas	1981
Logic Devices Inc.	Sunnyvale	1983
Maxim Integrated Products	Sunnyvale	1983
MemTech Technology Corp.	Santa Clara	1986
Micro Linear Corp.	San Jose	1983
Microwave Technology, Inc.	Fremont	1982
Modular Semiconductor	Sunnyvale	1983
MOS Electronics Corp.	Sunnyvale	1983
Multichip Technology	San Jose	1988
nCHIP, Inc.	San Jose	1987
NovaSensor	Fremont	1985
Novix	Cupertino	1984
Oak Technology, Inc.	Sunnyvale	1987

(Continued)

Table 4a (Continued)

Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
Orbit Semiconductor	Sunnyvale	1985
Pacific Monolithics	Sunnyvale	1984
Paradigm Technology	San Jose	1987
Performance Semiconductor	Sunnyvale	1984
Plus Logic	San Jose	1988
PLX Technology Corp.	Mountain View	1986
Power Integrations	Mountain View	1988
PromTech	San Jose	1984
Samsung Semiconductor, Inc.	San Jose	1983
SEEQ Technology, Inc.	San Jose	1981
Sierra Semiconductor	San Jose	1984
Si-Fab Corp.	Scotts Valley	1981
Sensym, Inc.	Sunnyvale	1982
Solid State Optronics	San Jose	1982
S3	Santa Clara	1989
Synaptics, Inc.	San Jose	1986
Synergy Semiconductor Corp.	Santa Clara	1987
Topaz Semiconductor	San Jose	1985
US2	San Jose	1987
Vadem	San Jose	1983
VIA Technologies	Fremont	1987
Vitelic Corp.	San Jose	1983
WaferScale Integration	Fremont	1983
Weitek Corp.	Sunnyvale	1980
Xilinx Inc.	San Jose	1984
Zoran Corp.	Santa Clara	1983

Source: Dataquest
January 1990

Table 4b

Start-Ups in the Southwest (21)

Company	Location	Date Formed
AMCC	San Diego, CA	1979
Brooktree Corp.	San Diego, CA	1983
Comlinear Corp	Ft. Collins, CO	1980
Crystal Semiconductor	Austin, TX	1984
Dallas Semiconductor	Dallas, TX	1984
GigaBit Logic	Newbury Park, CA	1981
HNC	San Diego, CA	1986
Innovative Silicon Technology	Carrollton, TX	1986
Integrated Logic Systems	Colorado Springs, CO	1983
Microwave Monolithics	Simi Valley, CA	1982
Molecular Electronics Corp.	Torrance, CA	1984
NMB Technologies	Chatsworth, CA	1984

(Continued)

Table 4b (Continued)

Start-Ups in the Southwest (21)

Company	Location	Date Formed
Opto Diode Corp.	Newbury Park, CA	1981
Ramtron Corp.	Colorado Springs, CO	1984
SIMTEK Corp.	Colorado Springs, CO	1987
Telcom Devices Corp.	Newbury Park, CA	1986
Three-Five Systems, Inc.	Phoenix, AZ	1985
Togai InfraLogic	Irvine, CA	1987
Triad Semiconductors	Colorado Springs, CO	1986
Vitesse Semiconductor	Camarillo, CA	1984
XTAR Corp.	San Diego, CA	1982

Source: Dataquest
January 1990

Table 4c

Start-Ups in the Northwest (7)

Company	Location	Date Formed
Advanced Hardware Architectures	Moscow, ID	1988
Advanced Power Technology, Inc.	Bend, OR	1984
Bipolar Integrated Technology	Beaverton, OR	1983
Lattice Semiconductor	Hillsboro, OR	1983
Level One Communications	Folsom, CA	1985
Seattle Silicon Corp.	Bellevue, WA	1983
TriQuint Semiconductor	Beaverton, OR	1984

Source: Dataquest
January 1990

Table 4d

Start-Ups in the Midwest (3)

Company	Location	Date Formed
Electronic Technology Corp.	Ames, IA	1983
Photonic Integration Research	Columbus, OH	1987
VTC Inc.	Bloomington, MN	1984

Source: Dataquest
January 1990

Table 4e

Start-Ups in the Northeast (11)

Company	Location	Date Formed
ANADIGICS	Warren, NJ	1985
BKC International	Lawrence, MA	1986
Custom Silicon	Lowell, MA	1983
Edsun Laboratories	Waltham, MA	1984
Epitaxx Inc.	Princeton, NJ	1984
Hittite Microwave Corp.	Woburn, MA	1985
Lytel	Somerville, NJ	1984
NSI Logic	Marlboro, MA	1984
Oxford Computer	Oxford, CT	1987
Powerex	Youngwood, PA	1986
TranSwitch	Shelton, CT	1988

Source: Dataquest
January 1990

Table 4f

Start-Ups in the Southeast (2)

Company	Location	Date Formed
Cree Research	Durham, NC	1987
Spectrum Microdevices	Frederick, MD	1980

Source: Dataquest
January 1990

Table 4g

Start-Ups in the ROW Region (18)

Company	Location	Date Formed
Asahi Kasei Microsystems	Japan	1983
Austek Microsystems	Australia	1984
Calmos Systems	Canada	1983
Chartered Semiconductor	Singapore	1987
Dolphin Integration	France	1985
European Silicon Structures	West Germany	1985
Genesis Microchip	Canada	1987
Hualon Micro-Electronics Corp.	Taiwan	1987
Kyoto Semiconductor Corp.	Japan	1980
Matra-Harris Semiconducteur	France	1979
Mietec N.V.	Belgium	1983
MOSPEC Semiconductor Corp.	Taiwan	1987
Opto Tech Corp.	Taiwan	1983
RAMAX Ltd.	Australia	1987
SID Microelectronics	Brazil	1984
TSMC	Taiwan	1986
UMC	Japan	1979
Wolfson Microelectronics Ltd.	Scotland	1985

Source: Dataquest
January 1990

Success Factors

As competition intensifies in the semiconductor industry, building a successful start-up company will become increasingly difficult. What are the key factors that will distinguish the winners from the losers? Based on the track records of existing companies and our discussions with venture capitalists, Dataquest believes that the following factors are critical:

- Management
  - A strong management team, top-notch engineers, and excellent marketing managers
  - A unique business strategy with achievable goals including a clear definition of a customer's problem to be solved, rather than technology looking for an application
  - A stable source of financing that will allow sustained operation for five to eight years—maybe longer in a new market
- Product Development
  - Access to leading-edge processing expertise
  - Access to quality CAD software and support tools
  - Close relations with customer base
- Manufacturing
  - An experienced operations manager and strong in-house manufacturing knowledge
  - A silicon foundry agreement during initial years
  - A plan to ensure access to a state-of-the-art wafer fabrication facility
- Marketing
  - Global marketing perspective
  - Highly focused marketing plan
  - Asia monitoring capability (especially Japan)
  - A plan for overseas sales, marketing, and distribution agreements in the second or third year of production

Absolutely critical for success is the building of a strong management team. Successful new companies are those that attract talented and experienced personnel to fill positions in key areas including development, manufacturing, and international operations. Companies with only one or two of these positions filled with first-rate managers usually have trouble during the product commercialization phase. In general, the start-ups most likely to fail are those that are strong in technology but weak in marketing, manufacturing, and general management. Many companies are built around engineers who do not have the breadth of management and marketing experience required to run a company successfully.

The lack of marketing intelligence is another common pitfall. Most start-ups concentrate on the U.S. market and ignore overseas markets until they attain a certain sales volume. Unfortunately, these companies overlook significant sales opportunities and emerging foreign competitors. Dataquest believes that a global posture is critical for start-up companies, especially with the growing competition from European and Asian companies.

In evaluating start-up companies, we believe the following questions should be asked:

- What are the prior achievements of key officers and managers?
- Is the product line unique or a significant improvement over its competitors? Is it diversified enough to withstand fierce price competition?
- How much does the start-up invest in R&D?
- Does the start-up have plans to conduct joint research with universities and strategic partners?
- What is the start-up's marketing strategy? Is it domestic only or a global strategy?
- Is the start-up planning foundry agreements and/or plant construction? What is the timing?
- If the start-up has an agreement with an Asian company, is it giving away the store?
- Is the company prepared to respond to rapid technological innovation?

Financing

The start-ups in this directory have raised more than $2 billion in venture funding so far. In addition, public offerings have made up an additional $1.2 billion to start-up capital stock. The 1989 public offering totals are skewed by a $460 million public offering for NMB Semiconductor. Tables 5a and 5b contain information regarding public offerings by start-ups. Table 5a lists initial public offerings including company, date, and amount raised. Table 5b lists all public offerings by start-ups. Figure 5 shows start-up financing by year, highlighting monies raised by public offerings and those raised by other means. Table 6 contains to-date totals for funding by start-up and provides information regarding the source of funds for each company.

Table 5a

Initial Public Offerings by Start-Ups

Company	Date	Amount
VLSI Technology	February 1983	$ 53.0M
LSI Logic	May 1983	$160.0M
ZyMOS Corp.	July 1983	$ 46.9M
SEEQ	September 1983	$ 20.0M
Integrated Devices Technology	February 1984	$ 16.1M
United Microelectronics	July 1985	$ 7.5M
Linear Technology Corp.	May 1986	$ 24.0M
Cypress Semiconductor	June 1986	$ 72.0M
California Micro Devices	October 1986	$ 5.2M
Chips & Technologies	October 1986	$ 11.3M
IMP	June 1987	$ 22.3M
Dallas Semiconductor	September 1987	$ 35.1M
Maxim Integrated Products	February 1988	$ 7.0M
Altera Corp.	March 1988	$ 15.0M
Weitek Corp.	September 1988	$ 8.35M
Logic Devices	November 1988	$ 5.4M
NMB Semiconductor	September 1989	$460.0M
Cirrus Logic	June 1989	$ 24.0M
International CMOS Technology	June 1989	$ 3.6M
Lattice	November 1989	$ 14.0M

Source: Dataquest
January 1990

Table 5b

Public Offerings by Start-Ups

Company	Date	Amount
VLSI Technology	February 1983	$ 53.0M
LSI Logic	May 1983	$160.0M
ZyMOS Corp.	July 1983	$ 46.9M
SEEQ	September 1983	$ 20.0M
Integrated Logic Systems	January 1984	$ 5.0M
Integrated Device Technology	February 1984	$ 16.1M
Micron Technology	June 1984	$ 25.0M
Micron Technology	May 1985	$ 25.0M
United Microelectronics	July 1985	$ 7.5M
VLSI Technology	April 1986	$ 33.0M
Linear Technology Corp.	May 1986	$ 24.0M
Cypress Semiconductor	June 1986	$ 72.0M
Adaptec, Inc.	June 1986	$ 10.0M
Micron Technology	August 1986	$ 13.4M

(Continued)

Table 5b (Continued)

Public Offerings by Start-Ups

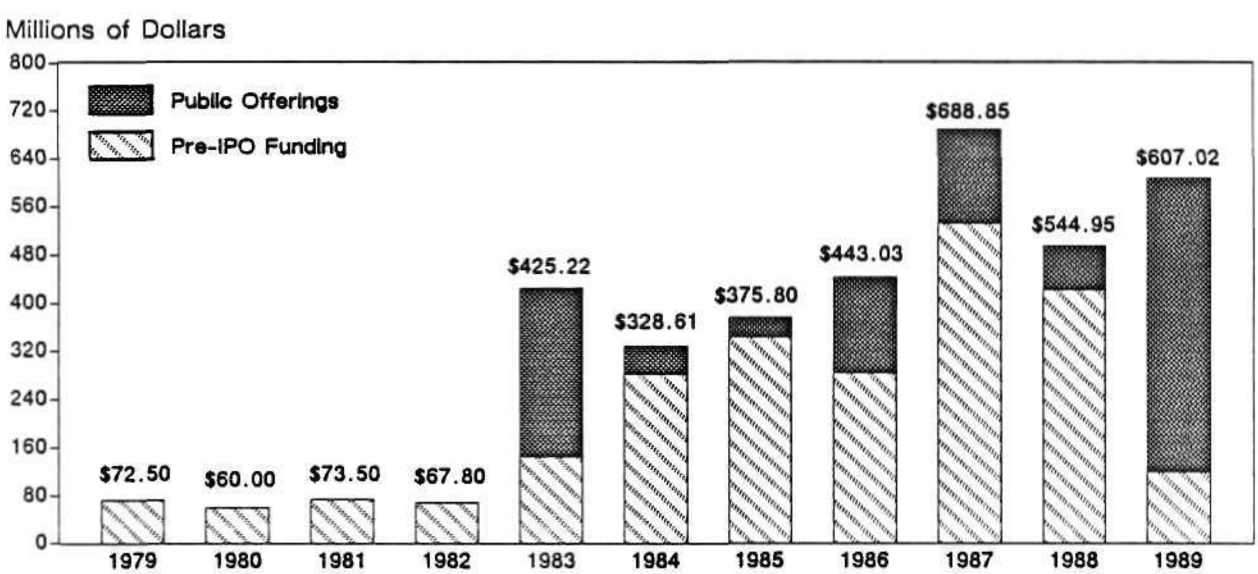
Company	Date	Amount
California Micro Devices	October 1986	$ 5.2M
Chips & Technologies	October 1986	$ 11.3M
LSI Logic	April 1987	$ 21.0M
Xicor	April 1987	$ 22.8M
Cypress Semiconductor	June 1987	$ 39.8M
IMP	June 1987	$ 22.3M
Chips & Technologies	July 1987	$ 15.5M
Dallas Semiconductor	September 1987	$ 35.1M
Maxim Integrated Products	February 1988	$ 7.0M
Xicor	March 1988	$ 17.0M
Altera Corp.	March 1988	$ 15.0M
SEEQ	April 1988	$ 19.5M
Weitek Corp.	September 1988	$ 8.35M
Logic Devices	November 1988	$ 5.4M
NMB Semiconductor	1989	$460.0M
International CMOS Technology	June 1989	$ 3.6M
Cirrus Logic	June 1989	$ 24.0M
Lattice	Filed September 1989	N/A

N/A = Not Available

Source: Dataquest
January 1990

Figure 5

Start-Up Financing by Year
1979-1989



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Source: Dataquest
January 1990

Table 6

Capitalization by Company to Date (Millions of Dollars)

Company	Amount	Sources
Actel Corp.	$ 19.70	Venture capital, private corporate
Advanced Power Technology	$ 13.80	Venture capital
Altera Corp.	$ 42.90	Lease, venture capital, public offering
ANADIGICS	$ 29.00	Venture capital, corporate
AMCC	$ 22.00	Venture capital, corporate
Aspen Semiconductor	$ 7.40	Corporate
ATMEL	$ 3.30	Venture capital
Austek Microsystems	$ 6.70	Venture capital
Bipolar Integrated Technology	$ 56.10	Lease, government, venture capital, corporate
BKC International	$ 2.52	Private, loan
Brooktree	$ 30.90	Venture capital, corporate
California Micro Devices	$ 5.20	Public offering
Calmos Systems	$ 5.50	Private
Calogic Corp.	$ 0.02	Private
Catalyst Semiconductor	$ 4.50	Private
Celeritek	$ 8.40	Venture capital
Chartered Semiconductor	$ 40.00	Corporate
Cirrus Logic	$ 51.60	Public offering, venture capital, corporate
Cree Research	$ 3.00	N/A
Crystal Semiconductor	$ 31.20	Venture capital, corporate
Custom Arrays	$ 2.35	Corporate, private
Dallas Semiconductor	$ 74.40	Public offering, bond, venture capital
Dolphin Integration	$ 0.60	Corporate, private
Elantec, Inc.	$ 23.40	Venture capital, corporate
Electronic Technology Corp.	$ 2.00	Venture capital, government
Epitaxx Inc.	$ 1.50	Venture capital
ES2	$ 44.00	Corporate, venture capital
Exel Microelectronics	$ 36.00	Private, corporate, venture capital
Gazelle Microcircuits	$ 17.20	Venture capital
GigaBit Logic	$ 46.30	Venture capital, corporate
HNC	$ 6.63	Private, venture capital
Hualon Micro-Electronics	$ 30.00	Corporate
IMP	$ 81.90	Public offering, venture capital, corporate, lease
Inmos	$100.00	Government, venture capital
Inova	$ 14.80	Venture capital, corporate
Integrated CMOS Systems	$ 12.20	Venture capital, private
Integrated Logic Systems	$ 5.00	Public offering
International CMOS Technology	$ 13.50	Venture capital, public offering, corporate
ISSI	$ 2.80	Corporate, private, venture capital
IXYS	$ 16.70	Venture capital, private
Krysalis	$ 4.20	Venture capital
Lattice	$ 15.20	Public offering, credit, private, venture capital
Level One Communications	$ 14.05	Venture capital, private
Logic Devices	$ 5.40	Public offering

(Continued)

Table 6 (Continued)

Capitalization by Company to Date
(Millions of Dollars)

Company	Amount	Sources
Linear Technology Corp.	$ 59.00	Lease, corporate, venture capital, public offering
Lytel	$ 20.00	Corporate
Matra-Harris Semiconducteur	$ 40.00	Corporate
Maxim Integrated Products	$ 30.30	Public offering, venture capital, lease, corporate
Micro Linear Corp.	$ 53.30	Lease, venture capital corporate
Micron Technology	$151.90	Private, public offerings
Microwave Technology	$ 10.10	Venture capital, corporate
MOSel	$ 6.00	Corporate, private
MOSPEC	$ 11.75	Private
nCHIP	$ 4.80	Venture capital, private
NMB	$471.11	Public offering, private
Novix Inc.	$ 1.00	Venture capital
Oak Technology	$ 6.00	Venture capital, private
Pacific Monolithics	$ 8.50	Venture capital
Paradigm Technology	$ 12.60	Venture capital
Performance Semiconductor	$ 32.90	Venture capital, private, lease
Photonic Integration Research	$ 10.00	Corporate, private
Plus Logic	$ 5.00	Venture capital
PLX Technology	$ 1.90	Venture capital
Power Integrations	$ 10.60	Venture capital, corporate
PromTech	$ 0.20	Private
RAMAX	$ 0.85	Government
Ramtron	$ 34.50	Corporate
S3	$ 6.00	Venture capital
Samsung Semiconductor	$ 13.00	Venture capital, corporate
Seattle Silicon	$ 28.80	Venture capital, corporate
SEEQ	$ 82.50	Public offerings, venture capital, corporate, private
Sensym	$ 14.20	Venture capital, corporate
SID Microelectronics	$ 14.20	Private
Sierra Semiconductor	$ 51.10	Venture capital, corporate
Synaptics	$ 2.10	Venture capital
Synergy Semiconductor	$ 12.90	Venture capital, private
TSMC	$282.00	Venture capital, corporate, government
Three-Five Systems	$ 5.50	Venture capital, corporate
Togai InfraLogic	$ 4.20	Venture capital
United Microelectronics	$ 20.00	Public offering, corporate, government
US2	$ 4.52	Venture capital
Vitelic	$ 55.20	Venture capital, corporate
Vitesse Semiconductor	$ 25.40	Venture capital, government
WaferScale Integration	$ 45.60	Venture capital, corporate
Weitek Corp.	$ 15.85	Public offering, venture capital
Xilinx	$ 21.00	Venture capital, corporate
Zoran	$ 33.80	Venture capital, corporate

N/A = Not Available

Source: Dataquest
January 1990

Venture Capital

Beginning in 1983, venture capital funding of semiconductor start-ups grew at a substantial rate. In 1986, funding slowed in the face of an industry recession. The industry recovered in 1987 and attracted new venture financing. Since that time, however, the venture capital community has shown declining interest in the semiconductor industry. The prevailing feeling among venture capital investors is that U.S. start-ups cannot compete with Japanese companies. In addition, the 1987 stock market crash has caused lower stock valuations industrywide, which is causing investors to think twice about floating their start-up companies on the stock market. Despite the fact that the stock market has recovered from the crash to post all-time highs, high-tech stocks remain in disfavor. Without a strong stock market as a means of recovering investment costs, many venture capitalists are choosing to stay out of this uncertain market.

Dataquest has identified a similar pattern among European investors as well. European investors are choosing to fund medium-size companies rather than start-ups. The venture capital industry is looking to back companies that want to acquire or buy stakes in small electronics companies. This method avoids the cost and risk of flotation and often provides a higher return on investment.

Japanese venture capitalists typically are more conservative than investors in the United States. Japanese companies rarely invest in start-ups; investors in Japan are more likely to invest in established companies. Japanese venture capitalists also tend not to fund high-tech companies and now are finding significant return in service industries, which support Japan's growing affection for leisure activities.

During the past few years, Dataquest has identified a general increase in total venture capital funding worldwide. Despite this fact, we are witnessing a growing disenchantment with the semiconductor industry among venture capitalists. This disenchantment is causing start-ups to seek new funding alternatives such as private placements or large loans. For this reason, Dataquest predicts a decline in start-up activity for the near future.

Venture Capital Companies

Of the 115 companies that released funding information to Dataquest, 61 companies reported the use of venture capital funding. This number may actually be much higher because, in many cases, profiled companies provided limited financial information. Dataquest identified 331 venture capital companies that provided funding to start-ups between 1979 and 1989. Thirty-four companies have been involved in five or more rounds of financing. Table 7 provides information about the 66 venture capitalists that were involved in three or more rounds of financing during this period.

Table 7

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (17)	VLSI Technology	December 1980
	LTC	September 1981
	Xilinx	March 1984
	Austek Microsystems	July 1984
	Exel Microelectronics	September 1984
	Crystal Semiconductor	October 1984
	Integrated CMOS Systems	1985
	Seattle Silicon	February 1985
	Exel Microelectronics	August 1985
	Gazelle Microcircuits	August 1986
	Sierra Semiconductor	October 1986
	Gazelle Microcircuits	April 1987
	Seattle Silicon	August 1987

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (Continued)	Seattle Silicon	August 1988
	Gazelle Microcircuits	September 1988
	Integrated CMOS Systems	October 1988
	Vitelic	January 1989
Kleiner, Perkins, Caufield & Byers (17)	VLSI Technology	December 1980
	LSI Logic	January 1981
	SEEQ	March 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Xilinx	March 1984
	Zoran Corp.	October 1985
	Crystal Semiconductor	February 1986
	Gazelle Microcircuits	August 1986
	SEEQ	October 1986
	Gazelle Microcircuits	April 1987
	Synaptics	June 1987
	Power Integrations	May 1988
	Gazelle Microcircuits	September 1988
	S3, Inc.	April 1989
	nCHIP	August 1989
	Power Integrations	August 1989
Merrill, Pickard, Anderson & Eyre (13)	LSI Logic	February 1982
	Maxim Integrated Products	1983
	Weitek Corporation	March 1983
	Cypress Semiconductor	April 1983
	Dallas Semiconductor	June 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Saratoga Semiconductor	May 1986
	Synergy Semiconductor	February 1988
	Gazelle Microcircuits	September 1988
	Plus Logic	January 1989
	S3	April 1989
	Power Integrations	August 1989
Sequoia Capital (12)	LTC	September 1981
	LSI Logic	February 1982
	Cypress Semiconductor	April 1983
	Microwave Technology	August 1983
	Sierra Semiconductor	January 1984
	Elantec, Inc.	December 1986
	Vitesse Semiconductor	February 1987
	Synergy Semiconductor	July 1987
	Elantec, Inc.	September 1988
	Integrated CMOS Systems	October 1988
	Plus Logic	January 1989
	S3	April 1989

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Adler & Company (11)	AMCC	April 1979
	IXYS Corp.	1983
	AMCC	March 1983
	Zoran Corp.	August 1983
	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Maxim Integrated Products	February 1985
	IXYS Corp.	October 1985
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
Oak Investment Partners (11)	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Vitelic	March 1984
	Dallas Semiconductor	June 1984
	IXYS Corp.	October 1985
	Pacific Monolithics	September 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	Vitesse Semiconductor	January 1988
	Synergy Semiconductor	February 1988
	IXYS Corp.	August 1988
Robertson, Colman & Stephens (10)	IMP	August 1981
	Sensym	October 1982
	AMCC	March 1983
	WaferScale Integration	February 1984
	Cirrus Logic	March 1984
	Cypress Semiconductor	April 1984
	Sensym	May 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	AMCC	September 1987
U.S. Venture Partners (10)	AMCC	March 1983
	Microwave Technology	August 1983
	Performance Semiconductor	October 1984
	IXYS Corp.	October 1985
	Micro Linear Corp.	February 1986
	Elantec, Inc.	December 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
Brentwood Associates (9)	Maxim Integrated Products	1983
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Cirrus Logic	May 1985

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Brentwood Associates (Continued)	California Devices	August 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	June 1986
	Performance Semiconductor	August 1988
	Plus Logic	January 1989
Mayfield Fund (8)	LSI Logic	January 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Cypress Semiconductor	August 1985
	Celeritek, Inc.	August 1986
	Synergy Semiconductor	July 1987
	S3	April 1989
	nCHIP	August 1989
Mohr, Davidow Ventures (8)	Sierra Semiconductor	January 1984
	Actel Corp.	June 1986
	Vitesse Semiconductor	January 1988
	Power Integrations	May 1988
	US2	March 1989
	S3	April 1989
	nCHIP	August 1989
	Power Integrations	August 1989
Burr, Egan, Deleage & Co. (7)	Elantec, Inc.	August 1984
	Sierra Semiconductor	April 1985
	IXYS Corp.	October 1985
	Celeritek, Inc.	August 1986
	IXYS Corp.	August 1987
	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
DSV Partners (7)	Maxim Integrated Products	1983
	Epitaxx Inc.	March 1984
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Integrated CMOS Systems	May 1987
	Integrated CMOS Systems	October 1988
New Enterprise Associates (7)	Microwave Technology, Inc.	August 1983
	Dallas Semiconductor	February 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	Dallas Semiconductor	April 1987
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Technology Venture Investors (7)	LTC	September 1981
	Sierra Semiconductor	January 1984
	Altera Corp.	April 1984
	Cirrus Logic	May 1985

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Technology Venture Investors (Continued)	Inova	February 1986
	Synaptics	May 1986
	Synaptics	June 1987
Venrock Associates (7)	VLSI Technology	December 1980
	Sierra Semiconductor	January 1984
	Celeritek, Inc.	March 1985
	Gazelle Microcircuits	April 1987
	Integrated CMOS Systems	May 1987
	Gazelle Microcircuits	September 1988
	Integrated CMOS Systems	October 1988
Advanced Technology Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	Performance Semiconductor	October 1984
	Actel Corp.	October 1985
	Actel Corp.	June 1986
	Togai InfraLogic	December 1988
Alex Brown & Sons (6)	IMP	June 1983
	ANADIGICS	April 1985
	Weitek	January 1986
	Dallas Semiconductor	March 1986
	Dallas Semiconductor	April 1987
	ANADIGICS	January 1989
Concord Partners (6)	Microwave Technology	August 1983
	Zoran Corp.	October 1985
	Power Integrations	May 1988
	Micro Linear	August 1989
	US2	March 1989
	Power Integrations	August 1989
Crosspoint Venture Partners (6)	Sensym	October 1982
	Laserpath	June 1983
	Sensym	May 1984
	Laserpath	July 1985
	Krysalis	May 1986
	Krysalis	December 1986
Harvard Management (6)	Cypress	March 1985
	BIT	May 1986
	Performance Semiconductor	November 1986
	Elantec	December 1986
	Elantec	September 1988
	Gazelle Microcircuits	September 1988
J.H. Whitney (6)	Cypress	April 1983
	WaferScale	February 1984
	Vitelic	March 1984
	Xilinx	March 1984
	Vitesse	February 1987
	Synergy	February 1988

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Rothschild Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	ANADIGICS	April 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	August 1988
	Togai InfraLogic	December 1988
Bessemer Venture Partners (5)	Maxim Integrated Products	1983
	WaferScale Integration	February 1984
	Vitelic	March 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
Grace Ventures (5)	IXYS	October 1985
	Zoran Corp.	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Harvest Ventures (5)	IMP	August 1981
	IXYS	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Hillman Ventures (5)	SEEQ	March 1981
	IMP	June 1983
	SEEQ	October 1986
	Actel Corp.	August 1988
	Power Integrations	August 1989
J.F. Shea & Company (5)	Advanced Power Technology	N/A
	Altera	April 1984
	Dallas Semiconductor	June 1984
	Exel Microelectronics	September 1984
	IXYS	August 1988
Matrix Partners (5)	AMCC	March 1983
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
	AMCC	September 1987
	Synergy Semiconductor	February 1988
Sutter Hill Ventures (5)	LSI Logic	January 1981
	LTC	September 1981
	Weitek Corp.	February 1982
	Sierra Semiconductor	January 1984
	Celeritek	March 1985
Accel Partners (4)	AMCC	March 1983
	WaferScale Integration	February 1984
	Micro Linear	November 1985
	AMCC	September 1987

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Associated Venture Investors (4)	Sierra Semiconductor	January 1984
	Elantec	August 1984
	Elantec	September 1988
	PLX Technology	August 1989
Bay Partners (4)	Sierra Semiconductor	January 1984
	Exel Microelectronics	September 1984
	California Devices	August 1985
	IXYS	August 1988
Continental Illinois Venture Corp. (4)	IMP	August 1981
	WaferScale Integration	November 1984
	Three-Five Systems	September 1987
	HNC	June 1988
John Hancock Venture Capital (4)	Dallas Semiconductor	June 1984
	California Devices	September 1986
	SEEQ	October 1986
	Saratoga Semiconductor	March 1987
Julian, Cole & Stein (4)	Advanced Power Technology	N/A
	Level One	December 1985
	Level One	December 1986
	Level One	September 1987
Norwest Venture Capital Management (4)	Seattle Silicon	February 1985
	Actel Corp.	June 1986
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
Republic Ventures (4)	IMP	August 1982
	Dallas Semiconductor	June 1984
	BIT	May 1986
	GigaBit Logic	September 1988
Riordan Venture Group (4)	GigaBit Logic	March 1982
	Exel Microelectronics	September 1984
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Union Venture Corp. (4)	IDT	June 1983
	GigaBit Logic	February 1985
	BIT	May 1986
	GigaBit Logic	September 1988
Venture Growth Associates (4)	AMCC	March 1983
	Altera Corp.	April 1984
	Dallas Semiconductor	June 1984
	AMCC	September 1987
Alan Patricof Associates (3)	ANADIGICS	April 1985
	California Devices	August 1985
	ANADIGICS	January 1989

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Alpha Partners (3)	Altera Corp.	June 1983
	Inova	1984
	Inova	February 1986
Arthur D. Little (3)	IXYS	October 1985
	ANADIGICS	November 1986
	IXYS	August 1988
Berkeley International (3)	Crystal Semiconductor	June 1987
	Sierra Semiconductor	September 1987
	Performance Semiconductor	August 1988
Berry Cash Southwest Partnership (3)	Crystal Semiconductor	October 1984
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
Bryan & Edwards (3)	Sierra Semiconductor	April 1985
	Inova	February 1986
	Vitesse	February 1987
Cowen & Company (3)	LTC	April 1983
	BIT	July 1987
	Performance Semiconductor	August 1988
Fairfield Venture Partners (3)	Micro Linear	October 1983
	ANADIGICS	April 1985
	BIT	July 1986
GE Venture Capital Corp. (3)	ANADIGICS	April 1985
	Laserpath	July 1985
	SEEQ	October 1986
Hambro International Venture Fund (3)	Integrated CMOS Systems	May 1987
	Edsun Labs	July 1988
	Integrated CMOS Systems	October 1988
Hill, Kirby & Washing (3)	Seattle Silicon	February 1985
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
HLM Partners (3)	Dallas Semiconductor	March 1986
	Saratoga Semiconductor	March 1987
	Dallas Semiconductor	April 1987
Hook Partners (3)	California Devices	October 1986
	Vitesse Semiconductor	January 1988
	Plus Logic	January 1989
InnoVen (3)	Weitek Corp.	January 1981
	Weitek Corp.	February 1982
	California Devices	August 1985
Merrill Lynch Venture Capital (3)	California Devices	August 1985
	Micro Linear	August 1988
	Elantec	September 1988

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
New Venture Partners (3)	Dallas Semiconductor	June 1984
	Cirrus Logic	June 1987
	Vitesse Semiconductor	April 1989
Rainier Venture Partners (3)	Seattle Silicon	February 1985
	Xilinx	December 1985
	Seattle Silicon	August 1987
Robert Fleming Investment Management (3)	AMCC	March 1983
	IMP	June 1983
	Cypress	April 1984
Shaw Venture Partners (3)	Pacific Monolithics	August 1985
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Sprout Group (3)	Synaptics	May 1986
	Synaptics	June 1987
	Actel Corp.	August 1988
TA Associates (3)	Exel Microelectronics	September 1984
	Exel Microelectronics	August 1985
	Paradigm Technology	May 1989
Warburg, Pincus Ventures (3)	WaferScale Integration	February 1984
	Epitaxx Inc.	March 1984
	Level One	September 1987
Weeden Capital Partners (3)	Krysalis	May 1986
	Krysalis	December 1986
	BIT	April 1988
Welsh, Carson, Anderson & Stowe (3)	IMP	August 1981
	Altera Corp.	April 1984
	Zoran Corp.	October 1985

N/A = Not Available

Source: Dataquest
January 1990

Strategic Alliances

An important development in the start-up area is the proliferation of licensing and joint-development agreements with established companies. At a time when venture capital has become increasingly scarce, small companies often are under pressure for near-term funding. In addition to seeking funds, start-ups are entering strategic alliances for a variety of other reasons, such as the following:

- To avoid the prohibitive costs of a fab
- To increase production capacity
- To defray increasing product development costs
- To strengthen product portfolios
- To increase a worldwide presence
- To protect the start-up from the danger of obsolescence of a process technology by entering fab agreements

Strategic alliances can be valuable to both start-up companies and larger companies. Large companies often enter into alliances with technology-rich start-ups as a way of entering emerging markets. Through agreements with large companies, start-ups are able to take advantage of the manufac- turing, marketing, and financial power of large companies. Table 8 lists the advantages of strategic alliances to start-ups.

Until recently, companies that sought access to new technologies or markets often would resort to acquisition. Acquisition arrangements, however, can be ill-conceived, inefficient, and unsuccessful. Acquisitions frequently trigger a flight of top engineers and lower employee morale in the acquired company.

Corporate partners are seeking something more than mere dollar gains. Agreements include access to technology, designs, and guaranteed production.

To accomplish strategic objectives, companies are considering a broader range of limited and focused cooperative agreements, such as the following:

- Minority equity investments
- Technology licensing
- Joint marketing
- Joint ventures
- All or part of manufacturing

Figure 6 shows the number of start-up alliances per year for the period 1979 through 1989. Tables 9a through 9k list start-up alliances by year.

Table 8

Advantages of Start-Up Strategic Alliances

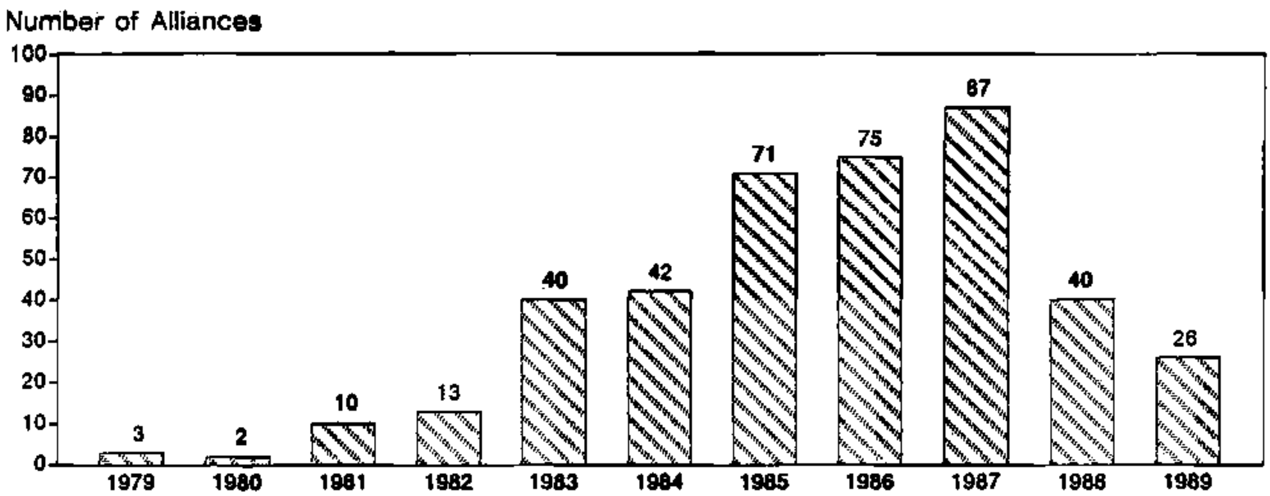
Offense	Defense
Secure technologies	Work with potential rivals
Gain access to markets	Keep out competitors
Rapid market entry	Monitor technology and market trends
Fill in product portfolios	Cut production costs
Foundry capacity	Financial viability
Cash infusions	
Greater product acceptance	
Ease trade frictions	

Pitfalls and Problems of Alliances
Management
Language and cultural differences
Management styles
Conflicting business goals
Unequal levels of commitment
Differing negotiating styles
Technology
Giving away the store
Receiving little in return
Stuck with a nonindustry standard
Market
Quarrels over territory
Loss of overseas expansion potential
Encroachment into U.S. market

Source: Dataquest
January 1990

Figure 6

Alliances by Year
1979-1989



0005344-6

Source: Dataquest
January 1990

Table 9a

1989 Alliances (26)

Companies	Description
ACC Microelectronics Motorola	April 1989—Motorola to second-source the ACC82020 and ACC82300 chip sets and cache controller and tag RAM to be introduced in late 1989
Crystal Semiconductor Analogic	June 1989—Analogic to become VAR of the Crystal ADC product line
HNC Fusion Group	September 1989—Partnership to market software utilities designed to integrate neural computing into financial applications
ICT AMD	July 1989—ICT and AMD to codevelop 1Mb EPROM with an access time of 55ns
IIT Ascii	1989—Ascii to distribute IIT products in Japan
IIT Mitsui	1989—Mitsui to distribute IIT products in Japan
IIT Yamaha	1989—Yamaha to provide wafer fab services to IIT
IMP Mitel	March 1989—Mitel to exchange four communications chip designs for IMP's 1.2-micron MxCMOS process, ACL1.2-DCL1.2 cell libraries, and mixed A/D design methodology

(Continued)

Table 9a (Continued)

1989 Alliances (26)

Companies	Description
ISSI UMC	January 1989—Licensing and manufacturing agreement with UMC, which will provide foundry services to ISSI
ISSI TSMC	August 1989—TSMC to provide foundry services to ISSI
ISSI LSI Logic	September 1989—Licensing and manufacturing agreement, LSI to provide foundry services to ISSI
Lattice AMD	May 1989—Cross-licensing agreement: Lattice gained rights to AMD's 22V10 PLD and the use of 22V10 architecture in manufacturing Generic Array Logic devices. AMD to manufacture GAL devices using Lattice's architecture
Oxford Computer Scan Graphics	September 1989—Joint development of image scanning devices using Oxford's "Intelligent Memory Chip" technology
RAMAX Epi Materials	October 1989—RAMAX to market EML's epi-treated wafers into Asia
Ramtron Seiko-Epson	April 1989—S-E to help finance FRAM basic development. Joint development of submicron CMOS FRAM production process
Ramtron Alcan Aluminum	June 1989—Ramtron and Alcan to codevelop advanced ferroelectric materials. Alcan made 6.5 percent equity investment in Ramtron
SEEQ National	June 1989—SEEQ and National scale back 1987 agreement to cover only current flash technology. SEEQ to continue to develop 0.8-micron flash chips alone
Samsung NCR	January 1989—Technology exchange and license agreement gives Samsung ASIC capability and NCR SRAM capability
Samsung Zilog	June 1989—Two licensing and marketing agreements permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 MCUs and the Z85C30 Serial Communications Controller
Samsung Quadtree Software	February 1989—Quadtree to develop full-function software models of Samsung's high-performance DRAM controllers
Seattle Silicon GigaBit Logic	June 1989—Seattle Silicon and GBL to develop comprehensive set of design software tools for GaAs ASICs
Togai InfraLogic Mitsubishi	September 1989—Togai and Mitsubishi Heavy Industries to codevelop air conditioning system based on fuzzy logic controller
VIA Technologies Fujitsu	March 1989—Partnership to codevelop peripheral chip sets for Sun-compatible workstations

Source: Dataquest
January 1990

Table 9b

1988 Alliances (40)

Companies	Description
Actel Corp. Texas Instruments	November 1988—TI to alternate source Actel's ACT 1 family of gate arrays and resell the Action Logic System, Actel's CAE system. Actel gains access to TI's EPIC 1 CMOS wafer processing technology and manufacturing capabilities
AMCC Plessey	January 1988—Jointly develop high-performance ECL gate arrays with up to 14,000 gates
Adaptec Chips & Technologies	October 1988—Joint introduction of a series of products for IBM PS/2 Models 50-, 60-, and 80-compatibles
Adaptec Chips & Technologies	January 1988—Adaptec and Chips to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80
BIT Arizona Microtek	July 1988—BIT and AZM to codevelop custom ICs using BIT's high-performance BIT-1 technology. AZM will serve as independent design house to develop LSI designs for BIT customers
Brooktree Analog Devices	January 1988—Analog Devices to second-source Brooktree's video DACs
Calmos Siltronics	February 1988—Calmos' acquisition of Siltronics' bipolar component business for $500,000
Catalyst Semiconductor Oki	November 1988—Oki to second-source the CAT35C102 and CAT35C202 serial EEPROMs
Cirrus Logic Award Software	July 1988—Award to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets
Cirrus Logic Phoenix Technologies	September 1988—Phoenix will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus
Cree General Instrument	August 1988—Cree and GI agreed to codevelop and manufacture silicon-based rectifiers
Custom Arrays Teledyne	February 1988—Custom and Teledyne to codevelop a new family of BiCMOS semicustom and cell-based libraries
ES2 Philips	February 1988—Philips to provide foundry services on its 1.5-micron CMOS line
ES2 US2	January 1988—ES2 establishes US2, a U.S.-based affiliate
GAIN Interface Tech	March 1988—GAIN to supply personalized versions of its GFL gate array product family
GBL Cray Research	January 1988—Cray placed $6.5 million foundry offer
Gazelle TriQuint	September 1988—TriQuint to manufacture GaAs devices for Gazelle; $16.9 million contract

(Continued)

Table 9b (Continued)

1988 Alliances (40)

Companies	Description
GigaBit Logic NKT (Denmark)	September 1988—GBL and NKT form GIGA to serve European and Israel markets for ICs
GigaBit Logic SC Hightech	December 1988—GBL to market SC Hightech's GaAs ICs worldwide, excluding Japan. Provides opportunity for codevelopment of GaAs ICs in the future. SC Hightech may provide foundry services to GBL
ICI Array National	March 1988—ICI Array Technology to use National Semiconductor's design systems and process specifications to develop proprietary ASICs
IXYS ABB	May 1988—IXYS and ASEA Brown Boveri form joint venture to strengthen industrial power control marketplace using ABB's patented copper substrate bonding technology and IXYS' smart power, IGBTs, and MegaMOS expertise
LSI Logic Sun	March 1988—LSI Logic to manufacture, market, modify, and enhance MPU-related components, software, and systems using Sun's SPARC
LSI Logic ITI	March 1988—Imaging Technology Inc. (ITI) to design a new generation of imaging products using LSI Logic's L64200 series of real-time image processing chips
Level One Mitel	May 1988—Joint development agreement
Matra-Harris Aspen Cypress	April 1988—R&D agreement. MHS to provide $4.57M in funding, and technical and design expertise for development of ultrahigh-speed ECL circuits to be developed by Aspen
Maxim Supertex	April 1988—Agreed to jointly develop 690 family of MPU supervisory circuits
Micron Intel	March 1988—Intel to market Micron DRAMs under Intel's label, beginning with 256K products
Micron SMC	April 1988—Micron's purchases 1.6 million shares of Standard Microsystems Corp. (SMC) common stock at $6.03 per share
Ramtron ITT Semiconductor	June 1988—Codevelopment program to develop submicron ferroelectric manufacturing process
Ramtron NMB Semiconductor	October 1988—Codevelopment and licensing program to develop 4Mb DRAM process technology and products utilizing Ramtron's ferroelectric materials
Ramtron TRW	November 1988—Codevelopment program to develop rad-hard NV memory for aerospace and defense applications
Seattle Silicon Oki	August 1988—Seattle Silicon and Oki to codevelop a compiler for a process-independent, five-port, high-speed SRAM module
TriQuint MSC	March 1988—Microwave Semiconductor Corporation (MSC) and TriQuint to provide interchangeable GDS-II tape with equivalent performance for GaAs analog and digital ICs and MMICs

(Continued)

Table 9b (Continued)

1988 Alliances (40)

Companies	Description
VLSI Technology Harris	April 1988—Codevelop a rad-hard gate array and future commercial and nonrad-hard military gate arrays
VLSI Technology Sanyo	April 1988—Sanyo to manufacture and market VLSI Technology's 32-bit ACORN RISC Machine IC family worldwide
Vadem Intel	March 1988—Intel invests in IBM Model 30 and PC XT-compatible chip set that Vadem is developing
Vadem Intel	September 1988—Intel to refer customers to Vadem for Vadem's PC chip set
Zoran Toshiba	January 1988—Technology and manufacturing alliance
Zoran SGS-Thomson	March 1988—Technology and manufacturing alliance
iLSi Oki	April 1988—Oki to manufacture and sell gate arrays based on iLSi technology and provide foundry service

Source: Dataquest
January 1990

Table 9c

1987 Alliances (87)

Companies	Description
ANADIGICS Bendix	June 1987—Contract from Bendix Aerospace to develop CAD tools for the DOD's MMIC program
ATMEL Sanyo Electric	1987—ATMEL and Sanyo signed a foundry contract to produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs
Adaptec SCO	October 1987—Adaptec and the Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system
Adaptec Conner Peripherals	October 1987—Adaptec to supply disk controller ICs to Conner Peripherals
Alcatel Mietec SGS-Thomson	1987—Alcatel, Mietec, SGS-Thomson—transfer of a 1.2-micron CMOS process
Alliance NMB	December 1987—Five-year agreement covering 256K and 1Mb DRAMs; NMB to manufacture and sell the devices worldwide
Altera WSI Sharp	January 1987—Codevelop a family of standalone microsequencer products with wafers manufactured by Sharp of Japan

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Altera Cypress	June 1987—Codevelop a family of CMOS EPLDs
Asahi Kasei Crystal Semi	January 1987—Asahi Chemical's acquisition of an 8 percent share in Crystal for approximately $4 million; Asahi Kasei to manufacture and market Crystal's devices for the far eastern market
Asahi Kasei ICT	January 1987—Asahi Kasei's receipt of a license to ICT's technology; Asahi Kasei to market ICT's EEPROMs
Aspen Cypress	December 1987—Cypress' guaranteed $7.4 million to Aspen, a wholly owned subsidiary of Cypress, which will fabricate and sell ECL devices
Austek ZyMOS	October 1987—ZyMOS licensed to make and sell the Austek Microcache as part of the POACH chip set
BIT Sun	July 1987—Sun's license of a bipolar 32-bit RISC MPU to BIT
Batelle Institute Photonic MEC NTT	July 1987—The Batelle Institute, Mitsubishi Electric Corporation (MEC), and NTT—formation of Photonic Integration
CDI IST	April 1987—Joint product development and second-source agreement covering two families of ASICs using channelless architectures
CMD Tachonics	March 1987—Tachonics to manufacture commercial and military GaAs ICs using CMD cell design and tools in the 1.0- to 0.5-micron range
CMD Telefonica	November 1987—Joint venture agreement to form a company named California Micro Devices SA in Spain
Calmos Samsung	January 1987—Calmos' license of its 8200 series of devices to Samsung in exchange for a foundry commitment
Catalyst Oki Electric	March 1987—Previous agreement extended to include a wide range of CMOS EEPROMs
Chartered National Sierra STC	October 1987—National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation established joint-venture company, Chartered Semiconductor Corporation
Cirrus Logic WDC	January 1987—Cirrus Logic's license of a custom Winchester disk drive controller IC to Western Digital Corporation
Cirrus Logic DIA-Semicon	October 1987—DIA-Semicon Systems to distribute new and existing products in Japan
Cirrus Logic Award Software	November 1987—Award Software to develop a VGA graphics BIOS and demonstration board for Cirus Logic's GD510/520 VGA chip set

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Cypress Sun	July 1987—Joint development of a CMOS RISC MPU product line based on Sun's SPARC
Cypress Matra-Harris	December 1987—Prior agreement extended to include manufacture and marketing of five Cypress 64K SRAMs
Dallas Xecom	May 1987—Three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families
Dallas AMP	August 1987—Dallas and AMP R&D partnership to develop interconnect techniques
ES2 Lattice Logic	1987—ES2's acquisition of Lattice Logic
ES2 Philips	February 1987—ES2, Philips, and TI joint agreement for the manufacture of the SystemCell; TI and Philips to supply volume parts, ES2 to provide prototypes and low-volume quantities
ES2 Mitsui & Co.	October 1987—ES2 and Mitsui & Co. joint purchase of a Japanese software and design company called Best, which will market ES2's products in Japan
Elantec Micro Power	November 1987—Micro Power to market Elantec's FET power buffers
G-2 LSI Logic	July 1987—LSI Logic's establishment of G-2 as a wholly owned subsidiary; LSI Logic to provide macrocells, megacells, and gate arrays
Genesis National	October 1987—Design center and manufacturing agreement
GigaBit Logic Tachonics	October 1987— Mutual second-sourcing of GaAs standard and ASIC products developed by each other
GigaBit Logic Cray Research	January 1987—Cray Research's $3.3 million foundry order
GigaBit Logic Cray Research	May 1987—Cray Research's January order increased from $3.2 million to $5.5 million
GigaBit Logic Seattle Silicon WTC	April 1987—GBL, Seattle Silicon, and the Washington Technology Center (WTC) to form a joint design project and fabricate a functional, compiler-based GaAs IC design
IDT VTC	January 1987—IDT to second-source VTC's FCT product line
IDT MIPS Computer	November 1987—IDT to manufacture MIPS Computer's complete line of 32-bit RISC MPUs
IMP Electrolux	November 1987—Five-year agreement with Electrolux to develop ASIC devices for home appliances

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
IST SDA Systems	May 1987—SDA Systems to develop CAD systems for use by Innovative Silicon Technology's (IST's) customers
Inova Westinghouse	June 1987—Westinghouse Advanced Technology Division to work with Inova in long-term strategic planning areas
Intergraph Fujitsu	Early 1987—Fujitsu to provide wafer fabrication services to Intergraph's Advanced Processor Division
Krysalis National	December 1987—Seven-year agreement with National Semiconductor to pursue UniRAM technology jointly
LSI Logic Stellar Computer	January 1987—LSI Logic to supply custom ASICs to Stellar Computer for use in a graphics supercomputer
LSI Logic Aida Corp.	January 1987—Aida Corp. to incorporate LSI Logic's gate array libraries into its design automation tools
LSI Logic ZyCAD Corp.	February 1987—LSI Logic's acquisition of the marketing rights to a customized version of ZyCAD's Logic Evaluator circuit design accelerators
LSI Logic Case Technology	March 1987—Joint development to allow LSI Logic's schematic libraries to be designed on Case Technology's workstations
LSI Logic Sun	April 1987—LSI Logic and Sun's joint establishment of an ASIC laboratory project at San Jose State University
LSI Logic Logic Automation	May 1987—Joint development to incorporate LSI Logic's channeled gate arrays on Logic Automation's Mentor Graphics workstations
LSI Logic Asix Systems	June 1987—LSI Logic's licensing of its ASIC design verification software to Asix Systems Corp.
LSI Logic Video Seven	July 1987—LSI Logic's acquisition of 20 percent of Video Seven for $7 million in cash
LSI Logic ACT	August 1987—Joint venture company named Inter-Act Corporation, which will develop and market software/hardware development system for the MIL-STD-1750 embedded system market
LSI Logic MIPS Computer	November 1987—LSI Logic to manufacture and market MIPS Computer Systems' entire family of circuits, including its 32-bit RISC MPU and floating point coprocessor
LTC TI	March 1987—Five-year agreement allowing TI to select six LTC circuits every six months; TI to pay royalties
Lattice SGS	February 1987— LSC's licensing of its GAL products to SGS Semiconductor; both companies to cooperate on future PLD products
Lattice National	April 1987—National Semiconductor's minority investment in LSC and licensing of its GAL technology
Lattice MMI	November 1987—LSC's licensing of MMI's patent; exchange of rights to worldwide patents in PLDs

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Matra-Harris Intel	June 1987—CIMATEL dissolved by Intel
NMB TI	November 1987—NMB to manufacture and supply TI with TI-designed 1Mb field RAMs
Pacific Monolithics TriQuint Ford	November 1987—PM and TriQuint are team members with Ford for smart weapons, radar, electronic warfare contracts
Pacific Monolithics TriQuint Allied-Bendix	November 1987—PM and TriQuint are team members with Allied-Bendix for two communications and radar contracts
Performance MIPS Computer	November 1987—Performance to manufacture and market MIPS Computer Systems' 32-bit RISC MPU, floating-point coprocessor, and other peripherals
PromTech Yamaha	1987—PromTech's licensing of its EPROM technology to Yamaha Corp., which will combine it with voice- and image-processing capabilities
RAMAX Ramtron	June 1987—RAMAX's licensing of ferroelectric process technology from Ramtron
SEEQ National	October 1987—Four-year agreement to develop and market a new family of CMOS flash EEPROMs
SEEQ Hamilton-Standard	October 1987—SEEQ to supply 256K EEPROMs to Hamilton-Standard
Samsung Intel	June 1987—Samsung to supply Intel with 64K and 256K DRAMs, which Intel will sell under its own label
Seattle Semiconductor National	October 1987—National's 1.25-micron and 1.20-micron VHSIC CMOS processes qualified for design with Concorde, Seattle Silicon' ASIC compiler
Seattle Silicon UTMC	June 1987—Seattle Silicon and UTMC to jointly design and fabricate ASICs used in tactical and strategic radiation environments
Sierra Mentor Graphics	September 1987—Sierra's MIXsim behavioral modeling tools available on Mentor Graphics' Idea workstation
TriQuint TRW	June 1987—Jointly develop and supply Class-S level GaAs devices for space applications
VLSI Technology Visic	1987—VLSI's acquisition of Visic for approximately $525,000
VLSI Technology TCMC	March 1987—Agreement covering second-sourcing and product development for memory designs including FIFOs, dual-port RAMs, cache-tag RAMs, and SRAMs

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
VLSI Technology Zilog	May 1987—VLSI to second-source Zilog's Super8 MCU and FIFOs
VLSI Technology GE Solid State	July 1987—GE to produce and market VLSI's VGT10 and VGT100 families of CMOS gate arrays
VLSI Technology Daisy Systems	November 1987—Gate array design kit offered for Daisy's CAE workstation
VLSI Technology Oak Technology	November 1987—Codevelop IBM PS/2 logic chips, using VLSI Technology's software tools
VTC Control Data	1987—VTC became a wholly owned subsidiary of Control Data (CDC); VTC's award of a $7.5 million contract from CDC's Government Systems Division to supply ASIC chips
VTC TRW	March 1987—TRW Components International and VTC to cross sample space-quality, Class-S devices including rad-hard CMOS SRAMs, comparators, amps, and transceivers
VTC VME Technology	September 1987—VTC's contract to design, develop, and manufacture a VMEbus interface IC (VMIC) for the VME Technology Consortium
Vitesse E-Systems	August 1987—E-systems to use Vitesse's GaAs technology in its current and future programs
Vitesse Ford	October 1987—Vitesse and Ford Microelectronics to mutually second-source each other's IC foundry services
Vitesse VLSI Technology	September 1987—Vitesse to develop a GaAs cell library for VLSI's design tools
WSI GE/RCA	July 1987—Prior agreement expanded to include EPROM manufacturing
Weitek HP	May 1987—Hewlett-Packard to manufacture and incorporate the Weitek model 2264/65 chip set in current and future HP Precision Architecture computers
Xicor Intel	June 1987—R&D agreement terminated; cross-licensing and royalty obligations remain in force
ZyMOS Intel	November 1987—Intel to market ZyMOS' POACH AT system logic set bundled with its 80286 MPU, which will be sold as 82X3X multifunctional peripherals
iLSi Yamaha	December 1987—Yamaha's purchase of a license for iLSi's gate arrays in exchange for royalties and foundry service

Source: Dataquest
January 1990

Table 9d

1986 Alliances (75)

Companies	Description
Actel Corp. Data General	June 1986—Joint development agreement covering gate arrays and a fab arrangement
Altera Data I/O FutureNet	May 1985—OEM marketing agreement with Data I/O's FutureNet for the DASH schematic capture packages
BIT Raytheon	July 1986—Joint development of ASICs
Brooktree Fairchild	April 1986—Broad-ranging partnership combining Brooktree's D/A conversion technology with Fairchild's manufacturing capability
CMD CMA	September 1986—Merger of CMD and Custom MOS Arrays (CMA)
CMD Fuji	November 1986—CMD's licensing of HCMOS gate array and cell-based design technology to Fuji Photo Film for $1 million
CSi Motorola	August 1986—CSi to act as the northwestern independent design center for Motorola
CSi NCR	September 1986—NCR's licensing of CSi's cell-based library
Catalyst Thomson-CSF	1986—Catalyst and Thomson to conduct R&D in France
Catalyst Oki Electric	July 1986—Long-term R&D of NVRAMs for ASICs, using CMOS EPROMs and EEPROMs
Chips National	November 1986—National Semiconductor to manufacture CMOS ICs for Chips & Technologies under fabrication agreement
Cirrus Logic Silicon Systems	October 1986—Cirrus Logic's and Silicon Systems' exchange of controller and buffer manager functions
Custom Array Teledyne	1986—Joint development agreement for a new family of BiCMOS semi-custom and cell-based libraries
Dallas Thomson-Mostek	January 1986—Thomson-Mostek's receipt of Dallas' multiport memory in exchange for laser production equipment and TCMC's MK4501 FIFO
ES2 British Aerospace	January 1986—British Aerospace investment of $5 million
ES2 SDA Systems	January 1986—ES2 to market SDA Systems' design systems throughout Europe and to use them in design centers
ES2 Philips TI	May 1986—ES2, Philips-Elcoma, and Texas Instruments—cooperation on the SystemCell cell-based library
Exel Microelectronics Exar	February 1986—Exar's completion of the $5.5 million acquisition of Exel
GAIN NTT	September 1986—Technology transfer giving GAIN access to NTT's self-aligned implantation for N+layer translator (SAINT) technology

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
ICI Array ICI	January 1986—Imperial Chemical Industries Plc—acquisition of Array Technology
ICT Gould Semiconductor	April 1986—ICT's transfer of its CMOS EEPROM technology and products in exchange for foundry service and second-sourcing of PEEL and EEPROM devices
IMP Lattice Logic	May 1986—Lattice Logic's CHIPSMITH Silicon complier software available with IMP's design rules
IMP Silicon Compilers	June 1986—SCI and IMP to develop analog compilation capability for SCI's Genesil Silicon Development
IMP Micro Linear MBB	August 1986—IMP and Micro Linear—agreement to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period
IMP Lasarray	August 1986—IMP and Lasarray to cooperate on a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module
IXYS Samsung	January 1986—Samsung's receipt of IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high current power MOS devices in Samsung facility
LSI Logic Raytheon	January 1986—Raytheon to second-source LSI Logic's LL700 Series of logic arrays; LSI Logic will provide its LDS software system to design and produce the logic arrays
LSI Logic Master Images	March 1986—LSI Logic's acquisition of a 20 percent equity interest in Master Images, a photomask supplier
LSI Logic Sun	April 1986—LSI Logic to sell and use internally Sun Microsystems' workstation and advanced schematic capture system
LSI Logic STC	May 1986—LSI Logic's acquisition of a majority stake in STC's semiconductor division
LTC National	July 1986—Patent licensing agreement Linear Technology Corp. (LTC) rights to products under two national BiFET patents; National was granted rights to LTC's BiFET-related patents
Lattice Seiko-Epson	January 1986—Seiko-Epson licensed to Lattice's high-speed 64K SRAM
MOSel Hyundai	February 1986—MOSel—8Kx8 and 1Mb SRAMs and 1.2- and 1.5-micron CMOS processes provided to Hyundai in exchange for a foundry commitment
MOSel Sharp	June 1986—MOSel—a 256K SRAM design based on a 1.2-micron CMOS process provided to Sharp, which provided 256K SRAMs
Matra-Harris Silicon Compilers	June 1986—MHS to integrate its 2-micron, double-metal CMOS process with Silicon Compilers' Genesil silicon design systems

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Matra-Harris Weitek	March 1986—Matra-Harris Semiconducteur's (MHS) receipt of Weitek's 16-bit integer multiplier product family; Weitek has preferred access to the MHS CMOS process in exchange for foundry services
Maxim Intersil	April 1986—Second-source agreement
Micro Linear Analog Design	July 1986—Micro Linear to integrate its micro and macrocell libraries into Analog Design tools' workbench CAE system
Micro Linear Daisy Systems	November 1986—Daisy Systems to port Micro Linear's cell libraries to its workstations
Micron Samsung	July 1986—Samsung's purchase of a 2.7 percent interest in Micron for $5 million as part of an out-of-court settlement; Micron received Samsung SRAM and EEPROM technologies for a 1.0 percent royalty
NMB National	September 1986—NMB to manufacture fast SRAMs; this agreement is no longer in effect
Novix Harris	July 1986—The Novix FORTH language MPU included in Harris' ASIC library
Performance Westinghouse	August 1986—Performance to fabricate a VHSIC Phase-I, 11,000-gate gate array designed by the Westinghouse Defense and Electronics Center
Powerex Westinghouse Mitsubishi	1986—Powerex formed by Westinghouse, GE, and Mitsubishi Electric; Powerex received licenses and technology from the companies
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems, using Seiko-Epson's CMOS process
SEEQ AMD/MMI	November 1986—Monolithic Memories acquisition of 16 percent of SEEQ for $4 million; jointly develop CMOS EEPROM-based PLDs
SEEQ Motorola	December 1986—Engineering development agreement to develop an EEPROM microcomputer
Samsung Mostek	1986—Agreement covering Mostek's 256K DRAM technology
Samsung Goldstar Hyundai	1986—Samsung, Goldstar, and Hyundai to cooperate on a 1Mb DRAM
Seattle Silicon Gould AMI	September 1986—Gould AMI provides Seattle Silicon with proprietary geometric design rules and performance characteristics of selected fab processes
Seattle Silicon Burroughs	August 1986—Seattle Silicon and Burroughs to jointly develop a new-generation design system for ICs
Sierra Mentor Graphics	December 1986—Sierra's cell library supported on Mentor Graphics' workstations

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Silicon Systems Ferranti	February 1986—SSi to second-source Ferranti's data conversion ICs in the United States
Silicon Systems Telmos Universal	August 1986—Universal's second-source agreement between Telmos and Silicon Systems acquired for the fabrication of analog/digital arrays
Silicon Systems RCA	February 1986—RCA to second-source SSi's monolithic modem ICs; RCA gained rights to SSi's analog CMOS process; SSi gained rights to RCA's digital 2-micron CMOS process; RCA also agreed to supply SSi with CMOS wafers over three years
Silicon Systems Oki Electric	September 1986—Oki to second-source SSi's K-series modems; Oki will pay royalties, furnish DSP chips, and provide foundry services
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems using Seiko-Epson's CMOS process
TSMC Philips	1986—N.V. Philips' 27.5 percent interest in Taiwan Semiconductor Manufacturing Corp. and option to purchase controlling interest in the company
TriQuint EEsof	May 1986—EEsof to incorporate TriQuint's custom GaAs MMIC foundry models into Touchstone, a minicomputer and workstation-based MMIC CAD program
UMC TRW	April 1986—Joint development of 1.25-micron VLSI products
UMC SMC	June 1986—Contract to cooperate on computer ICs
VLSI Technology Mosaic Systems	1986—Joint agreement to build die and plug them together on the Mosaic process
VLSI Technology Intel	1986—Codeveloped a single-chip interface for the Intel-based Multibus II system bus architecture
VLSI Technology Acorn Computer	May 1986—Codeveloped a single chip, 32-bit RISC MPU, and associated controller chips
VTC Silicon Compilers	May 1986—VTC to provide its 1.6- and 1.0-micron two-layer metal CMOS processes to users of Genesil; VTC to develop a rad-hard cell for Genesil
Vitelic Philips	March 1986—Vitelic's access to Philips' process technology; Vitelic to design a family of high-performance CMOS SRAMs
Vitelic Sanyo	October 1986—Jointly develop a high-speed 64K SRAM family; Sanyo will manufacture the SRAMs

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Vitesse TRW	December 1986—Vitesse to supply TRW with high-performance wafers, die, and packaged devices, which TRW will assemble, test, qualify, and sell to the space quality, Class-S level market
WSI GE/RCA Sharp	March 1986—GE/RCA and Sharp have a five-year agreement with WSI to jointly develop an advanced cell library
Weitek Step Engineering	March 1986—Step Engineering to produce development tools for debugging and microcoding of Weitek's floating-point integer processor designs
Weitek Quadtree	April 1986—Quadtree Software to develop behavioral simulators for the WTL2264/2265 chip set
Weitek Matra-Harris	May 1986—Technology exchange and foundry agreement. MHS granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to MHS' CMOS process in exchange to manufacturing a variety of Weitek products
XTAR Fairchild	September 1986—Fairchild to alternate-source XTAR's X1000/X2000 graphics MPU chip set, which Fairchild will redesign and manufacture using its FACT fabrication process
Xilinx MMI/AMD	June 1986—MMI/AMD to manufacture and market Xilinx's Logic Cell Arrays and development system
ZyMOS Daewoo Corp.	April 1986—Controlling interest in ZyMOS acquired by Daewoo Corp.
iLSi Motorola	June 1986—iLsi's licensing of its line of gate arrays to Motorola
iLSi Sumitomo	December 1986—Sumitomo's licensing of ASIC design technology from iLSi exchange for royalty payments and foundry services

Source: Dataquest
January 1990

Table 9e

1985 Alliances (71)

Companies	Description
AMCC Sanders	February 1985—Sanders to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only
AMCC Seiko-Epson	May 1985—AMCC and Seiko-Epson entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process was merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
Altera Intel	June 1985—Extension of 1984 agreement with Intel for two years; includes additional products using Intel's CHMOS process and its evolutions
Altera P-CAD Systems	February 1985—Marketing agreement with P-CAD Systems
ATMEL General Instrument	March 1985—ATMEL technology provided to GI for fab capacity; this agreement is no longer in effect
Barvon Research Micron Technology	November 1985—Micron's acquisition of a 16 percent equity interest in Barvon to design ASICs for Micron
Brooktree Toshiba	1985—Brooktree's Technology licensed by Toshiba for consumer digital audio applications
CMD TRW	July 1985—TRW to manufacture HCMOS gate arrays in its JAN-qualified fab, using CMD/CMA's 1.2-micron design rules
CSi Viewlogic	October 1985—Custom Silicon's (CSi's) cell-based library offered on Viewlogic's Workview workstation
Catalyst Zilog	December 1985—Joint development and second-sourcing agreement; initial product will be a version of Zilog's Z8 MCU
Chips Toshiba Yamaha Fujitsu	November 1985—Foundry services from these companies subcontracted by Chips & Technologies
Cirrus Logic AMD	September 1985—Cirrus Logic's development of an MCU for AMD in exchange for foundry services
Cypress Matra-Harris	October 1985—Cypress masks for its SRAMs and 1.2-micron CMOS process transferred to MHS, which received 2 percent of Cypress' stock for $25 million
Cypress Weitek	October 1985—Joint development of a series of VLSI logic circuits designed by Weitek and manufactured by Cypress
ES2 Lattice Logic	1985—ES2 to market Lattice's logic compiler in Europe
ETC NCR	October 1985—Electronic Technology Corp. (ETC) to establish design centers and design cell-based ICs for NCR
Exel Microelectronics Samsung	May 1985—Prior agreement extended to include second-source Exel's 2Kx8 NMOS EEPROM
GAIN Mitsui	1985—Mitsui's acquisition of 30 percent interest in GAIN

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
ICS VLSI Technology Toshiba	1985—VLSI Technology and Toshiba to provide foundry services for Integrated CMOS Systems (ICS)
ICS Universal	1985—Cooperative gate array agreement to personalize wafers and designs supplied by ICS
IDT Internix	April 1985—Sales contract for Internix to sell IDT's products in Japan
IMP Iskra	April 1985—IMP's and Iskra's codevelopment of a CMOS analog cell library for which IMP provides foundry services
IMP National	April 1985—IMP to second-source National's 2-micron gate arrays
Inmos NMB/Minebea	March 1985—NMB/Minebea to ship 50 percent of its 256K DRAM output to Inmos
Inova UMP	November 1985—UMP to provide wafers to Inova
LSI Logic Toshiba	June 1985—Four-year joint venture to develop a 50,000-gate sea-of-gates array
LSI Logic C. Itoh	April 1985—C. Itoh to sell LSI Logic's products in Japan
LSI Logic Kawasaki Steel	August 1985—Formed joint-venture gate array company in Japan, Nihon Semiconductor
LTC Motorola	January 1985—Agreement granting each company rights to a number of patents
MOSel UMC	October 1985—MOSel's EEPROM, a 2Kx8 SRAM, and a 2-micron process transferred to UMC in exchange for fab capacity
MOSel Fuji Electric	September 1985—Fuji Electric supplied 4- and 6-inch wafers, using MOSel 1.5- and 2.0-micron processes; companies to jointly develop CMOS 16K and 64K SRAMs for MOSel
Maxim Brown Boveri	February 1985—Maxim to design and manufacture devices for Brown Boveri
Micro Linear Rockwell	1985—Rockwell's $1.2 million investment in Micro Linear and receipt of ASIC linear product technology; Rockwell provides wafers
Micro Linear Toko	October 1985—Toko to make bipolar devices for Micro Linear at its Saitama, Japan, plant
NMB Vitelic	November 1985—A 1Mb CMOS DRAM license granted to NMB's plant capacity

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
Quasel Taiwan ERSO	May 1985—Technology license
Ramtron General Motors	1985—Contract with General Motors to demonstrate ferroelectric feasibility in special applications such as space and automotive
S-MOS Siliconix	November 1985—Agreement allowing Siliconix to produce 1.5- and 2.0-micron gate arrays designed by Seiko-Epson and S-MOS
SEEQ Silicon Compilers	July 1985—All EEPROM designs provided by SEEQ for integration into SCI's Genesil System
Samsung Intel	January 1985—Samsung licensed to second-source certain Intel micros
Samsung Exel Microelectronics	May 1985—Prior agreement extended to include 64K EEPROMs
Samsung Zytrex	June 1985—LSI Logic devices and proprietary ICE-MOS process provided to Zytrex: Zytrex is no longer in business
Sierra VLSI Technology	January 1985—Sierra Semiconductor licensed by VLSI for IC software design tools in exchange for Sierra's cell-based designs
Silicon Systems Rogers	November 1985—Joint venture to design, manufacture, and market value-added intelligent flexible subsystems, called SMARTFLEX Systems
Tachonics Grumman	July 1985—Tachonics became a subsidiary of the Grumman Corporation
Topaz Hytek	July 1985—Topaz acquired by Hytek Microsystems; Hytek and Topaz cooperated on developing precision standard hybrid circuits
UMC Unicorn	January 1985—Unicorn, a design center based in Silicon Valley, funded by UMC for $2.5 million; joint development of a cell library
UMC Honeywell Synertek	July 1985—Nonexclusive product licenses gained by UMC for 18 ICs formerly produced by Synertek
Universal Edsun Laboratories	September 1985—Joint development with Edsun Laboratories for computer-related CMOS products
VLSI Technology Rockwell	1985—Jointly develop erasable programmable logic arrays
VLSI Technology Honeywell Synertek	April 1985—Rights to a CRT controller, interface circuits, 4O SRAMs, and a 16K ROM acquired by VLSI
VLSI Technology National	April 1985—National Semiconductor CMOS EPROM technology supplied to VLSI; VLSI manufactured the part and supplied wafers

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
VLSI Technology Nihon Teksei	June 1985—Sales contract to sell mainly standard product LSIs into the Japanese market
VLSI Technology Daisy Systems	June 1985—VLSI's design tools and silicon compliers available on CHIPMASTER and SILICONMASTER workstations
VLSI Technology Zilog	June 1985—Zilog licensed to use VLSI's design software; cooperate to develop megacell versions of Zilog products
VLSI Technology Hewlett-Packard	October 185—Hewlett-Packard to use selected VLSI design tools on HP workstations
VLSI Technology MEM	1985—VLSI's process technology, which will be used by VLSI installed by Microelectronics-Marin (MEM)
VLSI Technology Olivetti	1985—Joint design center in Italy
VLSI Technology Bull Group	1985—VLSI's design technology licensed by Bull to develop computer products
VLSI Technology University of Louvain	1985—Agreement to install VLSI's IC design methodology to teach advanced IC design to students
Vitelic Sony	June 1985—Sony's access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity
Vitelic Hyundai	July 1985—Hyundai obtains license to Vitelic memory products in exchange for manufacturing capacity
Vitesse AMD	November 1985—Jointly develop and manufacture AMD's AM2900 family of MPUs in GaAs
WSI Sharp	October 1985—Prior agreement extended to include WSI's 1.6-micron CMOS technology
Weitek Intel	October 1985—Weitek to develop an interface IC that Intel will second-source; Intel to provide foundry services
Weitek National	October 1985—National to design, manufacture, and market an interface chip
Xicor Intel	August 1985—R&D technology exchange agreement to develop EEPROMs; both companies cross-licensed their EEPROM technology
Xilinx Seiko-Epson	December 1985—Codevelop logic cell arrays and development systems; Seiko-Epson to manufacture; jointly develop Seiko-Epson's CMOS process
ZyMOS General Instrument	April 1985—Extended agreement for an additional three years; covers cell library and foundry services
ZyMOS Source III	September 1985—ZyMOS to provide foundry services for Source III

Source: Dataquest
January 1990

Table 9f

1984 Alliances (42)

Companies	Description
AMCC Honeywell	August 1984—Honeywell to second-source AMCC's Q700 gate arrays and to alternative-source bipolar gate arrays
Altera Intel	August 1984—CHMOS EPROM fabrication technology and foundry services provided by Intel; Altera provided its EPLD design, test, and development support
Calogic Koki Company	December 1984—Koki to sell Calogic's CMOS data bus driver ICs in Japan
Custom Arrays ATAC-Diffusion	1984—ATAC to operate a design center and conduct marketing for Custom Arrays in Europe
Custom Arrays Ferranti-Interdesign	1984—The MM family is the result of a joint venture with Ferranti, which also acts as a second source
Custom Arrays Interdesign	1984—Jointly developed the MM family of linear arrays
Custom Silicon FutureNet	March 1984—CSi's cell-based design available on the FutureNet DASH design system
ETC Gould-AMI	1984—Agreement for 3- and 5-micron single-layer metal CMOS gate arrays; AMI provides foundry services
ICT IMP	July 1984—Codevelopment of a CMOS EEPROM process
IMP National	1984—Five-year technology exchanges and second-sourcing agreement covering IMP's cell-based designs and National's CMOS process
IMP Micro Linear	June 1984—Codevelopment of a 10V CMOS process; IMP provides foundry services
IXYS Ricoh	1984—Wafers provided by Ricoh; IXYS provided its power MOSFET HDMOS process
Inmos NMB	June 1984—NMB to produce the Inmos 256K CMOS DRAM for an initial sum and royalties; NMB will also cooperate on the Inmos 64K and 1Mb DRAMs
Inmos Thorn-EMI	1984—Thorn-EMI's acquisition of 76 percent of Inmos
Inmos Hyundai	December 1984—Hyundai—$6 million payment for the Inmos 256K DRAM technology
LSI Logic AMD	August 1984—Jointly develop CMOS standard cell definitions and a library for design of large-scale ICs
LSI Logic Intersil	February 1984—Agreement covering LSI Logic's HCMOS process logic arrays and Intersil's CMOS gate array family

(Continued)

Table 9f (Continued)

1984 Alliances (42)

Companies	Description
LTC Signetics	June 1984—Signetics to purchase die in wafer form and receive manufacturing rights for three precision op amps and other products; Signetics provided LTC with certain small outline packaging services
LTC Interdesign	July 1984—The right to design IC arrays, using up to three of LTC's processes, and dedicated foundry capacity to manufacture the Interdesign designs granted by LTC
Lattice Synertek	July 1984—Cross-licensing and second-sourcing agreement covering Lattice's UltraMOS process in exchange for Synertek's production capacity
Lattice VLSI Technology	September 1984—Lattice CMOS EEPROM and SRAM technology provided to VLSI in exchange for foundry services
Maxim Intersil	1984—Agreement to exchange products as part of a legal settlement
Micron National	November 1984—A license to manufacture and sell Micron's 64K DRAM purchased by National for about $5 million
Modular Ricoh	November 1984—Modular Semiconductor CMOS designs and processes for a 16K SRAM and 256K DRAM provided to Ricoh
NMB Minebea	1984—NMB is the subsidiary of and is financed by Minebea
NMB Inmos	June 1984—NMB to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the output
Novix Sysorex	March 1984—Sysorex International participant in first-round financing
PromTech Japanese Company	1984—PromTech licensed technology
S-MOS IMI	April 1984—Two-year agreement with International Microcircuits Inc. (IMI) to second-source 2-micron CMOS gate arrays and share cell-based libraries
Sierra National	July 1984—Technology exchange covering selected CMOS products and processes; Sierra leased a facility from National
TriQuint Tektronix	January 1984—TriQuint is a subsidiary of Tektronix
VLSI Technology Visic	February 1984—VLSI Technology and Visic to design and market CMOS 64Kx1 and 16Kx4 CMOS DRAMs
VLSI Technology Fairchild	May 1984—Joint development and second-source of Fairchild's 2-micron CMOS gate arrays

(Continued)

Table 9f (Continued)

1984 Alliances (42)

Companies	Description
VLSI Technology Silicon Compilers	October 1984—VLSI licensing of Silicon Compilers' RasterOp graphics processor chip in exchange for foundry services for customers who design circuits using SCI's design systems
VLSI Technology Western Digital	1984—Joint agreement to develop CMOS versions of propriety WD products and second-source several of WD's products; VLSI provides foundry support for three years
VTC CDC	October 1984—Control Data Corp. (CDC) invests $56 million in VTC; the arrangement includes a fabrication technology license
Vitelic Kyocera	March 1984—Kyocera participated in first-round financing
Vitelic ERSO	May 1984—ERSO and Vitelic to codevelop EPROMs and 64K and 256K CMOS DRAMs
Vitesse Norton Company	July 1984—The initial investment of $30 million provided by the Norton Company
WSI Sharp	December 1984—Sharp to produce a 64K CMOS EPROM for manufacturing capacity and royalties licensed by WSI
ZyMOS Intel	July 1984—ZyMOS ZyP design automation system provided for Intel's CHMOS II process; ZyMOS to manufacture Intel's 80C49 8-bit MCU

Source: Dataquest
January 1990

Table 9g

1983 Alliances (40)

Companies	Description
AMCC Signetics	September 1983—AMCC and Signetics to exchange future families of gate arrays and processes
AMCC Daisy Systems	February 1983—The Q-700 gate array family on Gatemaster supported by Daisy
Acrian Bharat	1983—Acrian technology transferred to Bharat Electronics Limited
Asahi Kasei Hitachi Limited	1983—Hitachi Limited's advanced CMOS process technology licensed by Asahi Kasei
BIT Analog Devices	1983—Equity investment
CDI Olympus Optical	January 1983—CDI gate array technology transferred to Olympus Optical Co.

(Continued)

Table 9g (Continued)

1983 Alliances (40)

Companies	Description
CDI Western Microtechnology	1983—CDI's gate arrays sold through Western Microtechnology's design center
CMD/CMA Ricoh	1983—Joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and cell-based ICs
CMD/CMA Micro Innovators	January 1983—Merge of CMD/CMA with Micro Innovators, a team of custom MOS/LSI designers
Custom Silicon NCR	November 1983—CSi to design and recall NCR's cell-based and gate array products in New England
Cypress MMI/AMD	June 1983—Cypress 1.2-micron CMOS process and warrants received by MMI/AMD in exchange for loan guarantees
ETC Exar	December 1983—Foundry services provided by Exar
Exel Microelectronics Samsung	1983—Samsung Semiconductor license to second-source its 16K EEPROMs granted by Exel
GBL Kidder, Peabody	December 1983—R&D partnership to develop four ultrahigh-speed GaAs SRAMs
ICT Hyundai	October 1983—International CMOS Technology (ICT) and Hyundai to jointly develop devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs; Hyundai allocated 30 percent of its wafer fab capacity for an equity interest in ICT
IMP Zoran	June 1983—Codevelopment of a CMOS PROM technology
IMP IXYS	November 1983—Codevelopment of a high-voltage CMOS process
Inmos General Instrument	October 1983—Inmos' 8Kx8 EEPROM licensed by General Instrument
Inmos Intel	December 1983—Intel and Inmos to develop consistent specifications on 64K and 256K CHMOS DRAMs
LSI Logic RCA	April 1983—RCA to second-source LSI Logic's 5000 Series
LSI Logic SGS	April 1983—SGS licensed by LSI as an LSI 500 Series and CAD software alternative source
LSI Logic Toshiba	June 1983—Jointly developed a channelless compacted array
LTC Teijin Japan Macnics Technology Trading	June 1983—Agreements for distribution in Japan

(Continued)

Table 9g (Continued)

1983 Alliances (40)

Companies	Description
Lattice Floating Point Systems	1983—Lattice UltraMOS technology provided in exchange for FSP's DSP and array processor technologies; FSP also made an equity investment
Micron ITT/STC	January 1983—ITT/STC granted a worldwide license by Micron to manufacture and sell 64K DRAMs
Micron Samsung	June 1983—Samsung granted a license by Micron to manufacture and market Micron's 64K and 256K DRAMs in exchange for cash
Micron Commodore	August 1983—Commodore licensed by Micron to produce a 64K DRAM; this agreement is no longer in effect
Mietec Sprague	1983—Cross-licensing agreement with Sprague for a BiMOS process
Samsung SST	1983—Samsung Semiconductor is the U.S. subsidiary of Samsung Semiconductor and Telecommunications (SST)
S-MOS Seiko-Epson	1983—S-MOS affiliated with Seiko-Epson, which holds 30 percent of S-MOS
SEEQ Silicon Compilers	1983—SEEQ to manufacture SCI's Ethernet data link controller
UMC AMI	April 1983—Dialer ICs produced in cooperation with AMI
Universal Siliconix	June 1983—Siliconix to set up a design center for Universal's gate arrays in Swansea, Wales
Universal Western Digital	August 1983—Western Digital to second-source Universal's CMOS gate arrays
VLSI Technology Ricoh	1983—Technology exchange for NMOS and CMOS mask ROMs
VLSI Technology KIET	1983—VLSI's 32K ROM technology licensed by KIET in exchange for foundry services
VLSI Technology Texas Instruments	July 1983—VLSI to second-source TI's TME4500A DRAM controller and developer of its 256K DRAM controller
VLSI Technology Wang Labs	November 1983—Wang purchased 15 percent of VLSI's stock for $34 million
ZyMOS Intel	January 1983—ZyMOS ZyP CAD system provided for Intel's CHMOS I process; codevelop a cell library
ZyMOS General Instrument	August 1983—GI to use ZyP software and Zy40000 to design the Zy4000 cell library

Source: Dataquest
January 1990

Table 9h

1982 Alliances (13)

Companies	Description
AMCC Sorep	January 1982—AMCC and Sorep to design, assemble, test, and market gate arrays in France
AMCC Thomson-CSF	July 1982—Thomson-CSF to alternate-source and develop AMCC's bipolar Q-700 series of gate arrays
Acrian Communications Transistor	1982—Acrian acquisition of Communications Transistors Corp.
CDI Telmos	1982—CDI's linear CMOS products licensed by Telmos
CDI Corintech	October 1982—Corintech, a thick-film manufacturer, to make and sell CDI gate arrays in Britain
CMD/CMA Ricoh	Ricoh wafers provided to CMD/CMA
CMD/CMA Racal	1982—CMD/CMA to manufacture and sell Racal's CMOS gate arrays in the United States
LSI Logic AMD	January 1982—A five-year license to manufacture the LCA 1200 Series of ECL macrocell arrays received by AMD
LSI Logic Fujitsu	1982—Agreement covering HCMOS gate arrays
LTC Silicon General	July 1982—Technology exchange and second-sourcing agreement; Silicon General provided PWMs and two additional circuits and second-sources several high-current series pass regulators developed by LTC
SEEQ Rockwell	July 1982—SEEQ 16K EEPROM and 16K UV EPROM technology provided to Rockwell for cash, a lease, and a royalty
SEEQ TI	August 1982—SEEQ EEPROM licensed to TI in exchange for TI's TMS7000 8-bit MCU
Universal Siliconix	December 1982—Second source for Universal's 5-micron ISO-5 and 3-micron ISO CMOS gate arrays
VLSI Technology Ricoh	1982—All wafers provided by Ricoh

Source: Dataquest
January 1990

Table 9i

1981 Alliances (10)

Companies	Description
Barvon Research Ricoh	1981—Foundry services provided by Ricoh
Barvon Research Goldstar	1981—Foundry services provided by Goldstar; joint development of an analog/digital CAD
CDI LSI Logic	July 1981—CDI's HC Series of gate arrays exchanged for LSI Logic's LDS1 CAD system

(Continued)

Table 9i (Continued)

1981 Alliances (10)

Companies	Description
CDI Giltspur	November 1981—A U.K. design center for CDI gate arrays established by Giltspur, a supplier of MPUs
Inmos TI	October 1981—Agreement for 64K DRAMs
LSI Logic Toshiba	August 1981—Joint development of a family of 1,000- to 10,000-gate CMOS arrays
Matra-Harris Intel	March 1981—Agreement covering NMOS circuits and a joint design facility, named Cimatel, in Nantes, France
SEEQ Amkor	1981—IC products assembled by Amkor
VLSI Technology Bendex	August 1981—Warrant guarantee for 14 percent of VLSI Technology preferred stock; $2 million R&D funding, $15 million equipment lease line
ZyMOS Intermedics	November 1981—Additional financing from Intermedics for $4 million

Source: Dataquest
January 1990

Table 9j

1980 Alliances (2)

Companies	Description
CDI AMI	1980—CDI HC series licensed to AMI
VLSI Technology Amkor	1980—Assembly for VLSI Technology's IC products provided by Amkor

Source: Dataquest
January 1990

Table 9k

1979 Alliances (3)

Companies	Description
AMCC Signetics	April 1979—Signetics to alternate-source the Q700 Quick-Chip series
UMC ERSO	1979—ERSO granted UMC a license for design and process technology for 4-inch silicon wafers
ZyMOS Intermedics	1979—Financing from Intermedics, Inc., for $10 million and lease guarantee for $5 million; ZyMOS supplied custom ICs

Source: Dataquest
January 1990

Start-Up Affiliations

In addition to strategic alliances, many start-ups have agreed to affiliations or acquisitions and have even acquired the assets of former companies. A number of companies in this directory are the result of joint ventures of other larger companies. Start-ups are a part of acquisitions and affiliations for the following reasons:

- To gain financial backing
- To exploit technologies developed at parent companies
- To gain mobility to enter new product markets
- To enlarge product lines
- To penetrate markets in other areas

Table 10 shows a list of start-up companies that either have been acquired, are affiliated with other companies, or have acquired other companies.

Table 10

Start-Up Company Affiliates or Subsidiaries of Larger Companies

Company	Affiliation
Aspen Semiconductor	Subsidiary of Cypress Semiconductor
Austek	Acquired Silicon Macrosystems (1986)
Chartered Semiconductor	Joint Venture among National Semiconductor, Singapore Technology Corp., and Sierra Semiconductor
Crystal Semiconductor	Acquired Texas Micro-Circuit (1984)
Custom Arrays	Subsidiary of ATAC
Electronic Technology Corp.	Subsidiary of J-TEC
Exel Microelectronics	Acquired by Rohm (1988)
Harris Microwave	Subsidiary of Harris Corp.
Headland Technology	Affiliate of LSI Logic
ICI Array Technology	Acquired by ICI Plc (1986)
Intergraph Advanced Processor Division	Division of Intergraph Corp., acquired via acquisition of Fairchild Advanced Processor Division (1987)
IXYS	Acquired ASEA Brown Boveri Power Semiconductor Group (1989)
Krysalis Corporation	Acquired by National Semiconductor (1989)
Matra-Harris Semiconducteur	Joint venture between Matra and Harris Corp.
MemTech Technology Corp.	Acquired Crystal Division of Materials Progress Corp. (1987)
Microwave Technology, Inc.	Acquired Monolithic Microsystems (1987)
MOSPEC Semiconductor	Subsidiary of President Enterprises Corp.
Multichip Technology	Subsidiary of Cypress Semiconductor
NMB Semiconductor	Division of NMB Technologies, which is a subsidiary of Minebea Co. Ltd. of Tokyo
NMB Semiconductor	Acquired Composite Recording Head Division of Seagate Technology
Orbit Semiconductor	Comdial was acquired by Orbit Instruments in 1985 and was renamed Orbit Semiconductor
Powerex, Inc.	Joint Venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corp.
Ramtron Corp.	Subsidiary of Newtech Development Corp.
Samsung Semiconductor	Subsidiary of Samsung Electronics Co., of the Samsung Group, a South Korean conglomerate
Sensym, Inc.	Acquired by Fasco Sensors & Controls (1989)
Spectrum Microdevices	Part of Fairchild Communications & Electronics

(Continued)

Table 10 (Continued)

Start-Up Company Affiliates or Subsidiaries of Larger Companies

Company	Affiliation
Telecom Devices	Subsidiary of Opto Diode Corp.
Three-Five Systems	Formed via leveraged buyout of National Semiconductor's Optoelectronics business unit (1985)
Topaz Semiconductor	Subsidiary of Hytek Microsystems
TriQuint Semiconductor	Subsidiary of Tektronix
United Silicon Structures	Affiliate of ES2
VTC Incorporated	Subsidiary of Control Data Corp.

Source: Dataquest
January 1990

Technology Trends

General Trends

Start-up companies in the United States historically have been at the leading edge of new product and process technology trends. The newest wave of start-up companies offer leading-edge process technologies, but many start-ups are subcontracting to external fabs. Many start-ups currently are planning products with submicron geometries, using advanced CMOS and BiCMOS technologies.

CMOS requires less power and generates less heat than bipolar and NMOS. Designers therefore can pack more circuits and functions onto a single chip, providing better price performance. Other advantages of CMOS that make it applicable for very large scale integration (VLSI) are broad operating temperature ranges, superior noise immunity, and improved electrostatic discharge protection. It also is a very versatile process technology that can be applied to both analog and digital circuits and can be combined with bipolar technologies to result in hybrid technologies such as BiCMOS. Most start-ups currently use a CMOS process technology.

Some other innovative technologies include bipolar ECL, BiCMOS, GaAs, and the Josephson Junction that IBM abandoned. Dataquest has identified many companies that are developing GaAs processes, and a few start-ups are beginning to explore BiCMOS. In fact, Aspen Semiconductor currently is offering BiCMOS ECL RAMs and PLDs.

Many of the companies also are taking a systems approach to designing ICs, an activity that mainline companies have not traditionally pursued. In recent years, Dataquest has identified a trend toward the "system on a chip." The ultimate expression of this idea would be a monolithic system chip that integrates logic and memory into the microprocessor. As companies pursue higher system performance through the use of ASICs and specialized peripheral chip sets, we have noticed that these companies find value in design engineers who possess both IC logic and systems expertise.

Current changes in the marketplace present the following challenges:

- Technology barriers as the industry approaches 0.5-micron design rules
- A demand for specialized chips with smaller overall markets
- Development costs of memory products that will reach as much as $100 million
- Rising costs for manufacturing equipment

To meet these challenges, companies are doing the following:

- Developing increasingly sophisticated computer and software tools
- Developing other technologies such as GaAs
- Focusing on end-use markets
- Emphasizing service

Table 11 lists the start-up companies alphabetically along with the product markets in which they participate.

Table 11

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
ACC						x	
Actel Corp.		x					
ANADIGICS				x			
ATMEL	x				x		Telecom
Acumos		x					
Adaptec						x	
AHA						x	
Advanced Linear	x						
AMP							Discrete
Advanced Power							Discrete
Alliance					x		
Altera		x					
AMCC		x					
Asahi Kasei	x	x			x	x	Telecom
Aspen		x			x		
Austek					x		
Avasem		x					
BKC							Discrete
BIT			x				
Brooktree	x						
CMD		x					
Calmos	x	x	x		x	x	Telecom
Calogic	x	x					
Catalyst					x	x	
Celeritek	x			x			Discrete
Chartered		x					Foundry
Cirrus Logic						x	
Comlinear	x						
Cree							Discrete
Crystal	x						Telecom
Custom Arrays	x						
Custom Silicon		x					
Dallas	x		x		x	x	Telecom
Dolphin		x					
DSP Group			x				
Exel Microelectronics		x			x		Telecom
Edsun						x	
Elantec	x						
ETC		x					
Epitaxx Inc.				x			Opto
ES2		x					
Gazelle				x			
Genesis		x					
GigaBit		x		x	x		Foundry
Harris				x			
Headland						x	

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Hecht-Nielson							Neural network
Hittite				x			
Hualon	x				x	x	Telecom
IC Sensors	x						
ICI Array		x					
ISSI					x		
IXYS							Discrete
IST		x					
Inova					x		
Integrated CMOS		x					
IIT						x	
Integrated Logic		x					
Intergraph APD						x	
ICT		x			x		
IMP		x					
Isocom							Opto
Krysalis					x		
Kyoto				x			Opto
Lattice		x					
Level One							Telecom
LIS	x						
LTC	x						
Logic Devices			x		x	x	
Lytel				x			Opto
Matra-Harris		x	x		x	x	Telecom
Maxim	x						
MemTech							Opto
Micro Linear	x	x					
M/W Monolithics			x				
M/W Technology	x			x			
Mietec		x					
Modular					x	x	Telecom
MOSel					x		
MOSPEC							Discrete, foundry
Multichip					x		
nCHIP							Multichip modules
NMB					x		Foundry
NovaSensor	x						
Novix						x	
NSI						x	
Oak Technology					x		
Opto Diode				x			Opto

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Opto Tech				x			Opto, discrete
Orbit							Foundry
Oxford					x		
PLX Technology	x						
Pacific Mono.				x			
Paradigm					x		
Performance					x	x	
Photonic Integration							Telecom
Plus Logic		x					
Power Integ.	x						
Powerex							Discrete
PromTech					x		
RAMAX					x		
Ramtron					x		
S3						x	
SEEQ					x		
SID	x						Discrete
SIMTEK					x		
Samsung	x				x		Discrete, telecom
Seattle Silicon		x					
Sensym	x						
Si-Fab							Foundry
Sierra	x	x			x		Telecom
Solid State							Discrete
Spectrum		x					
Synaptics							Neural network
Synergy					x		
TSMC							Foundry
Telcom Devices				x			Opto
Three-Five				x			
Togai							Fuzzy logic
Topaz							Discrete
TranSwitch							Telecom
TriQuint				x			
Triad					x		
UMC	x	x			x	x	Foundry, telecom
US2		x					
VIA Technologies						x	
VTC	x	x					
Vadem						x	
Vitelic					x		

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Vitesse		x		x	x	x	
WaferScale		x			x		
Weitek			x				
Wolfson		x					
XTAR						x	
Xilinx		x					
Zoran			x				

Source: Dataquest
January 1990

Product Analysis

Emerging Technology Companies

Start-up companies in the United States historically have been at the leading edge of new trends in product and process technology. Many of the start-ups in this directory follow this same pattern. Table 12 lists some of the emerging technology companies and the areas in which they are developing.

ASICs

ASICs are transforming the electronics industry. System manufacturers are shifting their procurement content from standard ICs to ASICs. The functions of the standard ICs are being put into cell libraries used by system designers to incorporate a number of specific functions on one chip, thus providing a "single-chip system solution." This design methodology provides system manufacturers with a technique to accomplish the following:

- Reduce system size
- Reduce system cost
- Improve system security
- Reduce system development time
- Improve system performance
- Improve system reliability

Table 12

Emerging Technology Companies

Company	Technology/Product
Cree Research	Silicon carbide discretes
HNC	Neural network ICs
Krysalis	Ferroelectric memory
Molecular Electronics	Biomembranes (bioelectronics)
Photonic Integration	Optoelectronic ICs
RAMAX	Ferroelectric memory
Ramtron	Ferroelectric memory
Synaptics	Neural network ICs
Togai InfraLogic	Fuzzy logic processors

Source: Dataquest
January 1990

ASICs were a $7.4 billion market in 1988 and are projected to be a $17.8 billion market by 1994. More than 59 percent of all logic ICs consumed during 1988 were ASICs; the ASIC market consists of the following four product categories:

- Programmable logic devices (PLDs)
- Gate arrays
- Cell-based ICs (CBICs)
- Full-custom ICs

With the development of industry standards in the gate array segment, gate arrays have become a commodity product. As a result, companies with high-volume manufacturing capabilities, especially Japanese companies, now are dominating the market. More start-ups are entering the PLD market because there are no standards, it is a more fragmented market, and companies can protect their products with patented architectures. To survive, start-ups must avoid products that require large manufacturing muscle and develop strong ties with the customer. The key to success in this market is to provide a unique ASIC solution. This solution may take the form of a unique architecture or the development of cells for specific applications, such as telecommunications. Table 13 lists the companies that participate in the ASIC market.

Table 13

Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Actel Corp.	x				
Acumos	x				
Altera				x	
AMCC	x				
Asahi Kasei	x		x		
Aspen				x	
Avasem			x		
Calmos	x		x		
Calogic	x				
CMD	x		x		
Custom Arrays		x			
Custom Silicon	x				
Dolphin			x		
ETC		x			
ES2					x
Exel Microelectronics				x	
Genesis	x		x		
GigaBit			x		
ICI Array	x	x			
IST	x		x		
ICS	x				
iLSi	x				
ICT				x	
IMP	x		x		
Lattice				x	
Matra-Harris		x			
Micro Linear		x			
Mietec			x		
PLX				x	
Plus Logic				x	

(Continued)

Table 13 (Continued)

Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Seattle Silicon			x		x
Sierra			x		
Spectrum Micro	x				
UMC	x		x	x	x
US2					x
VTC	x		x		x
WaferScale			x		
Xilinx				x	

Source: Dataquest
January 1990

Analog ICs

The term "analog" defines electrical signals that have the property (or potential) of being continuously variable and that do not represent encoded numerical values. From 1988 through 1993, Dataquest predicts a compound annual growth rate (CAGR) of 12.4 percent for the analog IC market. Historically, analog ICs have grown well, between 16 and 20 percent in revenue during the last 10 years. The need to interface between the digital world and the real world has driven this growth. The need for accuracy, an easier means of design, and higher speed and precision also have been large factors. We expect these factors to continue to drive growth. Of great interest to the future growth of analog ICs, however, will be the development of analog ASIC circuitry, as employed in arrays and cell libraries.

Companies that offer analog products are concentrating on high-growth products, particularly analog ASICs, data converters, and telecom-specific products. A very specialized niche is the IC sensor segment. Three companies that offer sensor products are IC Sensors, NovaSensor, and Sensym.

Application-specific analog ICs, another analog approach, are expected to be a key area. Companies that can design cost-effective and reliable analog and digital circuits on a single chip will be able to provide a valuable service to the market. Companies that currently offer analog array design services are listed in the subsection entitled "ASICs."

Product segments in the analog marketplace include the following:

- Operational amplifiers
- Comparator products
- Consumer circuits
- Data conversion products
- Interface products
- Voltage regulators/voltage references
- Sensor products

Telecommunications ICs, which constitute an additional analog market segment, are listed separately in the subsection entitled "Telecommunications."

Dataquest believes that analog ASICs and telecom IC products will be the only areas that will show growth in 1989. In the long range (i.e., 1988 through 1993), Dataquest anticipates strong growth in the areas of analog ASICs, data converters, and telecom ICs. The CAGRs for each of these segments are 21.4 percent, 17.3 percent, and 16.2 percent, respectively. Major markets for analog ICs include data processing, communications, industrial, military, consumer, and transportation/automotive.

Table 14 lists the participants in the market for analog ICs.

Table 14

Companies That Offer Analog ICs

	Op Amps	Comparators	Consumer	Data Conv.	Interface	Regulators/ References	Sensors
ALD	x	x					
Asahi Kasei				x			
ATMEL				x	x		
Avasem				x			
Brooktree	x		x	x			
Calmos	x			x			
Calogic	x					x	
Celeritek	x						
Comlinear	x			x			
Crystal	x			x			
Dallas					x		
Elantec	x	x			x		
Hualon			x				
IC Sensors							x
LIS				x			
LTC	x	x		x	x	x	
Maxim	x			x	x	x	
Micro Linear				x	x		
Microwave Technology	x						
NovaSensor							x
Power Integrations				x			
Samsung	x	x		x	x	x	
Sensym							x
Sierra				x			
Topaz				x	x		
UMC			x	x			
VTC	x	x		x	x		

Source: Dataquest
January 1990

Digital Signal Processing

The digital signal processing (DSP) market is a fast-growing area with many niche market opportunities for innovative start-up companies. DSP applications have emerged as consumers of substantial numbers of ICs, particularly in the communications and military market segments, which currently represent approximately 75 percent of all DSP applications. However, technology and products are migrating quickly into mainstream commercial and consumer areas.

DSP products, as defined by Dataquest, comprise four categories: single-chip DSP microprocessors, microprogrammable devices, special-function circuits, and ASIC DSP products. DSP microprocessors are analogous to the MPUs used in the PC environment; the main difference is that their architectures are optimized to solve digital signal processing problems. Microprogrammable products are used to build customized architectures to solve high-performance problems and include multipliers, multipliers/accumulators, sequencers, and other traditional bit-slice products. Special-function devices include modems, codecs, filters, and speech- and image-processing devices. ASIC DSP products use a cell-based approach and are designed specifically for DSP applications.

Table 15 shows the companies that participate in the DSP market.

Table 15

Companies That Offer DSP Products

	DSP MPU	Microprogrammable	Special Function
BIT		x	
Calmos			x
Dallas	x		
The DSP Group			x
Logic Devices		x	
Matra-Harris		x	
Weitek		x	
Wolfson		x	
Zoran	x		x

Source: Dataquest
January 1990

Discrete Semiconductors

The term "discrete" refers to a packaged semiconductor device that has a single function, meaning that one or several functioning circuits are in the package. Technically, optoelectronic devices belong in this category, but for the purpose of this directory, we are treating them separately.

Dataquest divides the discrete market into seven separate categories: small signal and power transistors; small signal, power, and zener diodes; thyristors; and other discretes. Power field-effect transistors (FETs) are included as a separate category because many of the newer companies are concentrating in this area. FETs differ from most bipolar transistors in that they are voltage-controlled rather than current-controlled devices. FETs are available in two types: junction types (JFETs) and metal oxide types (MOSFETs).

The value of the discrete market was $7.5 billion in 1988. The discrete market grew at a CAGR of 13.4 percent from 1982 through 1987. We believe that the CAGR will be considerably less from 1988 through 1993, at 7 percent. The strongest product growth is expected to be in the power device and other discrete categories. Table 16 shows the companies that participate in the discrete semiconductor market.

Table 16

Companies That Offer Discrete Products

	Diodes	Transistors	Power FETs	Thyristors	Others
AMPi			x		
APT			x		
BKC International	x				
Celeritek		x			
Cree Research	x				
IXYS			x		x
MOSPEC		x	x		
Powerex	x			x	
SID		x			
Samsung		x	x		
Topaz			x		

Source: Dataquest
January 1990

Table 17

Companies That Offer Foundry Services

Company	Location
Chartered Semiconductor	Singapore
GigaBit Logic	United States
MOSPEC Semiconductor	Taiwan
NMB Semiconductor	Japan
Orbit Semiconductor	United States
Si-Fab Corporation	United States
Taiwan Semiconductor Manufacturing	Taiwan
UMC	Taiwan

Source: Dataquest
January 1990

Foundry

The companies listed in Table 17 offer semiconductor foundry services. GigaBit Logic, MOSPEC, and NMB also offer other products and services. The most recently formed company is Chartered Semiconductor Corporation, which was formed as a joint venture among National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation to establish a technology base in Singapore.

Gallium Arsenide

Gallium arsenide (GaAs) and other III-V compound semiconductors have made a slow transition from the laboratory to commercial applications. Users of supercomputers, telecommunications hardware, instrumentation, and consumer products are discovering major benefits in performance and improved functionality by taking advantage of this space-age technology. The worldwide market for GaAs semiconductors surpassed the $2.5 billion mark in 1988, up from 1987 shipments of an estimated $2.2 billion to more than $2.7 billion. The predominant devices were discrete optoelectronics; ICs make up less than 10 percent of these figures. GaAs is projected to exceed $4 billion by 1992; however, less than 30 percent of this value will be in ICs.

Advantages of GaAs over Silicon

The following are advantages that GaAs semiconductors have over silicon:

- Circuit switching 3 to 10 times faster
- Speed/power product 5 to 6 times more efficient
- Relative insensitivity to temperature and power supply variations
- Upper temperature limit of 350°C versus 175°C
- Superior levels of radiation tolerance
- Integrated optoelectronics on a single chip
- Wider range of resistivity due to semi-insulating substrates

Disadvantages of GaAs versus Silicon

The disadvantages of GaAs semiconductors compared with silicon are as follows:

- Higher wafer cost (typically 20 times or more)
- Lower level of digital circuit integration at a given point in time
- Lack of volume-production parametric test capability
- Design tasks more difficult; fewer expert engineers

GaAs has potentially wide-range applications in military, communications, and data processing market segments. Although GaAs is not likely to replace silicon in the foreseeable future as the workhorse semiconductor material, we do expect substantial growth in the GaAs market.

The following are potential GaAs IC applications:

- Telecommunications: opto and microwave electronics
- Computers and peripherals
- Instrumentation
- Consumer electronics
- Robotics
- Automotive
- Military/government

GaAs products are segmented into the following classifications:

- Analog ICs—MIC amps, MIC converters, frequency multipliers, ASICs
- Digital ICs—Logic, memory, ASIC, dividers, cost models
- Optoelectronics—LEDs, lasers, detectors, photovoltaic cells, isolators, couplers, integrated opto devices
- Discretes—Small-signal transistors, power FETs

Table 18 shows the participants in the gallium arsenide market.

Memory

Because it is very difficult for a start-up to compete in a commodity market such as DRAMs or slow SRAMs, most memory start-ups are entering niche markets. It is important for a start-up to enter a market that matches its abilities. For this reason, many new memory companies have chosen to enter the market for fast SRAMs. This market is well suited to start-up participants for the following reasons:

- It offers good margins.
- It requires a strong process technology.
- It requires strong technical support.
- It requires close customer contact, which is necessary to design products to fit client needs.
- It does not require a large fab.

Table 18

Companies That Offer GaAs Products

	Analog MMICs	Digital Linear	RAMs	ASICs	Std. Logic	Discretes	Opto
ANADIGICS	x	x					
Celeritek	x	x				x	
Epitaxx Inc.							x
Gazelle				x			
GigaBit		x	x	x	x		
HMS	x	x			x	x	
Hittite	x						
Isocom							x
Kyoto							x
Lytel							x
M/W Monolithics	x						
M/W Technology	x	x					
Opto Diode							x
Opto Tech						x	x
Pacific	x	x		x			
Telecom Devices							x
Three-Five							x
TriQuint	x	x		x	x		
Vitesse		x	x	x	x		

Source: Dataquest
January 1990

Most start-ups are well positioned to meet the success requirements in the fast SRAM market. U.S. companies have a particular advantage over Japanese companies in one crucial area: U.S. companies are able to establish much closer contact with their U.S. clients because of their domestic production capability. The goal of most start-ups is to become niche players. To sustain success with a niche strategy, however, the company must dominate the niche.

Other niches that start-ups are pursuing include the high-speed EPROM and EEPROM markets and other nonvolatile memory markets such as ferro-electric memory. In addition, a number of start-ups are positioning themselves in markets for specialty memories such as FIFO and dual-port devices.

Table 19 lists the participants in the memory product market.

Table 19

Companies That Offer Memory Products

	DRAM	SRAM	ROM	EPROM	EEPROM	FIFO	Others
Alliance	x	x					
Asahi Kasei		x	x				
Aspen		x					
ATMEL				x	x		x
Austek							x
Calmos		x					
Catalyst		x		x	x		
Dallas		x				x	x
Exel							x
GigaBit		x					
Hualon		x	x				
ISSI		x					
Inova		x					
ICT				x	x		
Krysalis							x
Logic Devices		x				x	x
Matra-Harris		x					x
Modular		x					
MOSel		x				x	x
Multichip		x					
NMB	x						
Oxford							x
Paradigm		x					
Performance			x				
PromTech				x			
RAMAX							x
Ramtron							x
Samsung	x	x			x		
SEEQ				x	x		
Sierra					x		
SIMTEK							x
Synergy		x					
Triad		x					x
UMC		x				x	
Vitelic	x	x				x	x
Vitesse		x					
WaferScale				x			

Source: Dataquest
January 1990

Microcomponents

Microcomponent products generally command higher ASPs than other ICs, frequently are sole-sourced, and have fostered the development of high-end niche markets. Start-up companies are offering graphics controllers, hard and floppy disk controllers, CRT controllers, and peripheral chip sets. A small number of start-ups are producing microprocessors, but the microprocessor market is dominated by larger companies such as Intel and Motorola.

During the past two years, the logic chip set market has been the fastest-growing segment of the microcomponent market. Worldwide, there were only 6 PC logic chip set vendors in 1987. In 1988, the number of vendors climbed to 13, a figure that continues to grow. Many of these new entrants are start-ups. Dataquest believes that the rapid increase in new entrants and capacity has carried this market to the point of saturation. We expect this saturation to lead to aggressive price competition, causing vendors to look for penetration of these products into new applications and markets. At this point, the growth rate of chip set shipments will be tied directly to the growth rate of PC shipments. The CAGR for chip set shipments from 1989 to 1993 is estimated to be only 12.2 percent. This growth level should attract fewer new entrants and cause some participants to exit the industry.

Dataquest believes that this rapid market saturation is bound to be repeated in each of the PC peripheral chip set markets—logic, graphics, communications, mass storage, modem, and fax—as established chip set and semiconductor companies follow one another into these most obvious product-line extensions. The graphics chip set market already is showing signs of saturation, marked by severe pricing pressure. At the same time, apparently low barriers to entry invite many new market participants.

Table 20 lists the companies that offer microcomponent products.

Table 20

Companies That Offer Microcomponent Products

	MPU	MCU	MPR Commun.	Mass Storage	Sys. Support	Key/Display
ACC Micro					x	
Adaptec				x		
Asahi Kasei		x				
Avasem					x	
Calmos	x			x	x	
Catalyst		x				
Cirrus Logic			x	x		x
Dallas		x			x	x
Edsun			x		x	x
Headland						x
Hualon			x		x	x
IIT	x					x
Intergraph APD	x					
Logic Devices			x		x	
Matra-Harris	x	x			x	x
Modular					x	
Novix	x					
NSI Logic						x
Oak Technology					x	x
Performance	x				x	
SEEQ	x				x	
S3					x	
UMC	x	x		x	x	x
XTAR						x

Source: Dataquest
January 1990

Optoelectronics

Optoelectronics is a field that combines the technologies of optics and electronics. Visible devices, including light-emitting device (LED) lamps and LED displays, are the market segments concerned with the interactions between light-emitting and filtering devices and electronics. LEDs are commodity products. Optocouplers and other opto areas are more customized products. Both of these products are growing at a faster pace than LEDs. Other opto areas include products such as photodiodes and phototransistors, solar cells, infrared lamps, lasers, and CCD sensors.

Dataquest divides the optoelectronics market into four separate categories: LED lamps, LED displays, optoelectronic couplers, and other optoelectronic devices. The total market for optoelectronics grew at a rate of 15.8 percent compounded annually from 1982 through 1987. Dataquest expects this growth rate to continue at the lesser rate of 11.4 percent compounded annually from 1988 through 1993. Price pressure in the industry is eroding dollar growth, although new technologies and applications continue. The optoelectronics segment is being fueled by the communications and computer industries, which use light as a medium for communication. Optoelectronics also are heavily used in the consumer market.

Table 21 lists the companies that offer optoelectronic products.

Telecommunications ICs

The telecommunication IC market is growing faster than the analog IC market, of which it is a segment. In fact, Dataquest predicts a CAGR of 16.2 percent for the telecom IC segment in the 1988 through 1993 period. One factor driving the growth of telecommunication ICs is the need to automate the office by linking personal computers. Another factor is the need to communicate faster, farther, and in a variety of ways, including satellites and facsimile machines. The demand for better and faster communication also is spurring the development of new devices such as line interfaces and switch arrays.

Table 22 lists the companies that offer telecommunications ICs.

Table 21

Companies That Offer Optoelectronic Products

	Light Emitting	Light Sensing	Others
Cree Research	x		
Epitaxx Inc.	x	x	
Isocom			Optocouplers
Kyoto	x	x	
Lytel	x		Lasers
Opto Diode	x		
Opto Tech	x		Photodiodes Phototransistors
Solid State	x	x	
Telcom Devices			Photodiodes

Source: Dataquest
January 1990

Table 22

Companies That Offer Telecommunications ICs

	Dialer	Modem	UART/ DUART	Line Interface	Codec/ Filter	Switch Array	Others
Asahi Kasei					x		
ATMEL					x		
CMD	x				x		
Calmos					x		x
Crystal	x	x		x			x
Dallas			x				
Exel			x				
Hualon	x						x
Level One				x			
Matra-Harris		x		x	x		
Modular			x				
Photonic							x
Samsung	x				x		x
Sierra	x	x			x		
Topaz						x	
TranSwitch							x
UMC	x		x				

Source: Dataquest
January 1990

Company Profiles

Dataquest has profiled 137 semiconductor start-ups in the following subsection. The data for these profiles were collected through personal and telephone interviews, surveys, and publicly available material. Some of the text was integrated verbatim from background information provided by the companies.

The 1990 edition contains some information not included in earlier editions of this directory. The asterisks (*) in the board of directors and company executives sections denote company founders. At the end of each profile, the name of the company's PR firm is listed if one exists.

ACC Microelectronics Corporation

3295 Scott Blvd., Suite #400
Santa Clara, CA 95054
408/980-0622
Fax: 408/980-0626

ESTABLISHED: February 1987 **NO. OF EMPLOYEES: 50**

BACKGROUND

ACC Microelectronics Corporation was established in February 1987 to design, produce, and market VLSI devices for advanced computer and communication products. The Company was founded by W.T. Chiang, a designer of the Intel 80386. ACC is concentrating on developing VLSI circuit device chip sets to be used as "gap bridging" solutions in several major application areas such as communications, computer systems controllers, and computer system board integration.

The Company has developed a full line of high-performance products, including nine chip sets and 15 individual chips. These products include a single-chip turbo-IBM PC XT-compatible peripheral controller, a single-chip floppy disk controller for XT, AT, PS/2 Model 30, and PS/2 Models 50, 60, 70, and 80-compatible computers, a 386 chip set, and a 386SX chip set. ACC's target markets include OEMs, distributors, and value-added integrators of computer and communication systems.

In April 1989, ACC announced a strategic alliance with Motorola's Semiconductor Products Sector. The agreement allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Previously, ACC and Motorola announced an alternate-source licensing agreement for the ACC3200 series of disk controllers.

In the future, ACC Microelectronics will offer a complete line of system-level VLSI chip set solutions for advanced computers and communications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*W.T. Chiang
Intel, Senior Manager

VP Eng
Mark Shieu
Amiga, Director

Dir Prod Mktg
Jack Yuan
Genoa, Prod Mktg Mgr

*Founder

FINANCING

ACC Microelectronics is privately financed.

RECENT HIGHLIGHTS

November 1989
ACC introduced a four-device chip set for IBM PC AT-compatible computer systems. The new ACC-82021 chip set operates at up to 20 MHz and supports Intel 80286 and 80386SX microprocessors.

November 1989
ACC announced its three-device ACC-82300 chip set for IBM PC AT-compatible computer systems. The new chip set operates at 20 or 25 MHz and supports the Intel 80386 microprocessor.

November 1989
ACC introduced the ACC-82030 single-chip AT controller. The new highly integrated controller chip is packaged in a unique 256-pin surface mount device developed by Motorola as part of ACC's earlier agreement with Motorola.

ALLIANCES

Motorola
April 1989
ACC and Motorola announced a strategic alliance that allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Motorola also gained second-source rights to a cache controller and a tag RAM developed by ACC.

MANUFACTURING

Technology

1.5- and 1.0-micron CMOS

Facilities

Santa Clara, CA
Design, test

PRODUCTS

Single Chip XT—ACC1000
Single Floppy Disk Controller—ACC3201
386SX AT Chip Set—ACC82020
386 AT Chip Set—ACC82300

OTHER INFORMATION

ACC's PR firm is Shotwell Public Relations.

Actel Corporation

955 E. Arquez Avenue
Sunnyvale, CA 94086
408/739-1010
Fax: 408/739-1540

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 60**

BACKGROUND

Actel Corporation designs, manufactures, and markets user-configurable integrated solutions for the design and implementation of ICs in electronic systems.

The Company was founded by Amr Mohsen, a former Intel program manager of advanced technology development.

Actel has developed a CMOS gate array based on proprietary architecture and customer-configurable interconnect technologies. Customers can map applications instantly with Actel's design automation systems, which includes development software and system hardware.

In 1987, Actel received $750,000 in follow-on funding, bringing first-round financing to $9.1 million. In March 1988, William Davidow, an Intel veteran and well-known venture capitalist, was elected chairman of Actel.

BOARD
(Name and Affiliation)

William H. Davidow, Chairman
Mohr, Davidow Ventures

*Amr Mohsen
Actel Corporation

Carver Mead
California Institute of Technology

Jos Henkens
Advanced Technology Ventures

Vahe Sarkissian
Data General Corporation

Ed Zshau
Censtor Corporation

John East
Actel, President/CEO

Robert G. Spencer
Hillman Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
John East
AMD, VP Logic Products

VP Operations
Paul Franklin
MMI, GM-Memory, Digital & Logic Divisions

Sr VP Sales/Mktg
M. Douglas Rankin
Signetics, VP WW Sales

VP Finance
Richard S. Mora
HHB, VP Finance

VP Engineering
Jeff M. Schlageter
AMD, Managing Dir Peripheral Products

*Founder

FINANCING

October 1985
Initial
$0.5M
Private, Advanced Technology Capital, Shaw Venture Partners

June 1986
Round 1
$9.1M
Advanced Technology Ventures; Brentwood Associates; Mohr, Davidow Ventures; Norwest Venture Capital; Oak Associates; Shaw Venture Partners; Data General

August 1988
Round 2
$9.3M
Hillman Ventures, Sprout, DLJ Ventures, Rothschild Ventures, Equity Venture Capital, Hughes Aircraft

RECENT HIGHLIGHTS

February 1988
Actel introduced the ACT 1 family of FPGAs, which can be designed, programmed, and tested from a 386-based PC in a matter of hours.

July 1988
Actel disclosed technical details of its Programmable Low Impedance Circuit Element (PLICE) antifuse nonvolatile interconnect, a strategic technology important to the company's thrust into desktop-configurable products.

ALLIANCES

Data General
1986
Actel signed a three-year joint development agreement with Data General that allowed Data General to design and develop semiconductor products based on Actel's technology. In return, Data General supplied Actel with use of test equipment, wafer fabrication, and engineering facilities (expired).

Texas Instruments
November 1988
Actel and TI signed a seven-year technology and licensing agreement. Under the pact, TI will alternate-source the ACT 1 family of gate arrays and resell the Action Logic System (ALS)—Actel's fully-automatic CAE system. Actel will gain access to TI's advanced EPIC 1 CMOS wafer-processing technology and manufacturing capabilities.

MANUFACTURING

Technology

CMOS

Facilities

Sunnyvale, CA
30,000 sq. ft.
R&D, development, marketing, administration

PRODUCTS

A family of field-programmable Gate Arrays supported by a design automation system

Gate Arrays

Device	Description
Act 1010	1,200-gate FPA
Act 1020	2,000-gate FPA
Action Logic TM System	Development hardware and software

OTHER INFORMATION

Actel's PR firm is Tsantes and Associates.

Acumos, Inc.

1531 Industrial Road
San Carlos, CA 94070
415/591-1488
Fax: 415/591-1483

ESTABLISHED: 1985 | **NO. OF EMPLOYEES: 15**

BACKGROUND

Acumos, Inc., specializes in analog-to-digital arrays, small-to-medium high-drive and high-voltage arrays, and analog switching arrays that incorporate both CMOS and DMOS switches. The Company offers both full-custom and standard cell devices.

In 1987, Acumos offered the A300 gate array that incorporates analog and digital functions. The device, which is a PLD replacement part, is designed for voice filtering, robotics, magnetic disk drive applications, and communications markets. The Company plans later introductions of specialty high-voltage products.

In 1985, the Company acquired Semi Processes Inc.'s gate array assets, including inventory, wafers, and test equipment. The Company is servicing SPI's customer base for low-density CMOS gate arrays in the 50- to 700-gate range.

Acumos subcontracts manufacturing and assembly with U.S. and offshore companies. The Company plans to sell into the Japanese and U.S. markets.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Man Shek Lee
GTE, Mgr IC Design

VP
*Chieh Chang
GTE, Sr Design Engr

*Founder

FINANCING

Not available

ALLIANCES

None

MANUFACTURING

Technology

3.0-, 4.0-, 5.0-micron silicon-gate CMOS

Facilities

San Carlos, CA
4,000 sq. ft.
Design and test

PRODUCTS

Gate Arrays

Device	Linewidth	Gates	Description
7001/7004/7005	4-micron	100 to 700	High 15V Output Drive Digital Gate Arrays, Typical 3ns Delay
D315-D3120 Series	3-micron	150 to 1,200	Typical 2ns Delay
A300	4-micron	300	Analog/Digital Array with Op Amps, Resistors, Capacitors, Comparators, 5ns-Internal Gate Delay
CD01/CD02		30-100	CMOS/DMOS Monolithic Gate Array

OTHER INFORMATION

Acumos does not employ a PR firm.

Adaptec, Inc.

691 S. Milpitas Boulevard
Milpitas, CA 95035
408/945-8600
Fax: 408/262-1845

ESTABLISHED: May 1981 | **NO. OF EMPLOYEES: 567**

BACKGROUND

Adaptec, Inc., is one of the leading suppliers of high-performance input/output (I/O) solutions. Product offerings include proprietary VLSI circuits, a broad line of small computer systems interface (SCSI) host adapters and enhanced small device interface (ESDI) disk controller boards for personal computers, local area network (LAN) interface units, a family of SCSI test and development systems, and imaging systems controller products. Adaptec stock is traded over the counter under the NASDAQ symbol ADPT.

Adaptec designs full-custom, semicustom, and gate array circuits in NMOS, CMOS, and bipolar technologies in geometries ranging from 4.0- to 1.0-micron. Products are targeted to customers in three segments of the microcomputer market: the personal computer market; the multiuser systems, network file server, and engineering workstation market; and the supercomputer market for scientific and business applications. Adaptec also designs and manufactures host adapters and controller boards for the AT, Micro Channel and, soon, extended industry standard architecture (EISA) bus architecture microcomputers.

Adaptec is one of the leaders in the SCSI industry with chips, boards, test and development systems, software support, and communication products. The Company eventually will apply the interface to its laser printer controller boards. Adaptec's SCSI protocol chip has been incorporated into a host adapter made by IBM, and its controller chips have been selected by peripheral customers such as Conner, Hitachi, Quantum, Seagate, Seiko-Epson, and Sony. Adaptec has won contracts for its board products from microcomputer makers such as Nokia, Tandy, Unisys, and Zenith. Additionally, the Company's network interface unit, the Nodem, was "blessed" by Apple Computer and featured in the introduction of Apple's Macintosh Portable.

The Company subcontracts all IC production; however, it also performs final test on all products to maintain the quality and reliability of its devices. High-volume board products are assembled in Singapore by Adaptec's wholly owned manufacturing entity, Adaptec Manufacturing Singapore (AMS).

Adaptec markets and distributes controller boards and circuits to a broad spectrum of computer and disk drive manufacturers, a number of reseller channels, and domestic and international industrial distributors. The Company has 15 manufacturers' representative organizations, 5 industrial distributors, and 19 international distributors.

BOARD
(Name and Affiliation)

John G. Adler
Adaptec, Inc., President/CEO

Lawrence B. Boucher
Adaptec, Inc., Chairman

Robert J. Loarie
Lawrence, WPG Partners, General Partner

David F. Marquardt
Technology Venture Investors, General Partner

B. J. Moore
Outlook Technology Inc., President

W. Ferrell Sanders
Asset Management Co., Senior Associate

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
John G. Adler
Amdahl, VP Product Dev

VP Engineering
Larry Sasscer
Amdahl, Mgr Channel Dev

VP/GM
Jeffrey A. Miller
Intel, Mktg Mgr/MPU Ops

VP Finance/CFO
Paul Hansen
Raychem, Asst Controller

VP Systems
Bernard G. Nieman
Shugart, Project Manager

VP Sales
Roger McLean
Imagen Corp., VP OEM Sales/Mktg

VP Mfg
Gary J. Weitz
Finnigan, General Manager

VP Peripheral Products
G. Venkatesh
Commodore Int'l, Director of Mktg

FINANCING

June 1986
IPO
$10.0M
Initial public offering

RECENT HIGHLIGHTS

1979
Adaptec founders created SCSI.

1983
Adaptec introduced the industry's first programmable disk controller chips.

1984
Adaptec introduced the industry's first multitasking disk controllers/host adapters.

January 1987
Adaptec established a subsidiary in Singapore. The new company, called Adaptec Manufacturing Singapore, manufactures surface-mount controllers.

October 1987
Adaptec signed a $5 million contract to supply Conner Peripherals with disk controller ICs during 1988.

1988
Adaptec introduced the industry's first PS/2 Micro Channel disk controllers.

June 1988
Adaptec announced a major corporate restructuring. Under the new plan, the Company is organized into four major groups: Test and Development Systems, Chips, Boards, and Communications Products. Each group is nearly autonomous, with separate marketing, management, and profit-and-loss responsibility.

July 1989
Adaptec established a regional sales and support office in Singapore, headed by K.S. Yeo, regional sales manager.

ALLIANCES

SCO
October 1987
Adaptec signed an agreement with The Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system.

Chips & Technologies
January 1988
Adaptec and Chips & Technologies aligned to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80.

MANUFACTURING

Technology

4.0- to 1.0-micron NMOS, CMOS, bipolar

Facilities

Milpitas, CA
100,000 sq. ft.
Administration, development

Singapore
45,000 sq. ft.
Manufacturing

PRODUCTS

Integrated Circuit Products

Device	Description
AIC-010F	10-Mbps Programmable Storage Controller
AIC-011F	15- and 24-Mbps Programmable Storage Controller
AIC-250F	MFM Encoder/Decoder
AIC-270F	2,7 RLL Encoder/Decoder
AIC-300F	Dual-Port Buffer Controller
AIC-301	Enhanced Dual-Port Buffer Controller
AIC-500	SCSI Interface Circuit
AIC-560	PC AT Interface Chip
AIC-610F	10-Mbps Integrated Programmable Storage Controller
AIC-6110	Single-Chip Synchronous SCSI Controller
AIC-6160	Single-Chip PC AT Mass Storage Controller
AIC-6190	Single-Chip Micro Channel Mass Storage Controller
AIC-6225	33-Mbps (1,7 RLL) Data Separator
AIC-6250	20MB Host Transfer with SCSI Protocol Circuit

Board Products

SCSI Host Adaptors

AHA-1540	PC AT-to-SCSI Host Adaptor
AHA-1542	PC AT-to-SCSI Host Adaptor
AHA-1640	Micro Channel-to-SCSI Host Adaptor

Hard Disk Controllers

ACB-231X	AT-to-ST412/506 MFM Hard Disk Controller, 5 Mbps
ACB-237X	AT-to-ST412/506 RLL Hard Disk Controller, 7.5 Mbps
ACB-232X	AT-to-ESDI NRZ Hard Disk Controller, 10 Mbps
ACB-232XB-8	AT-to-ESDI NRZ Hard Disk Controller, 15 Mbps
ACB-2610	Micro Channel-to-ST412/506 MFM Hard Disk Controller
ACB-2670	Micro Channel-to-ST412/506 RLL Hard Disk Controller
ACB-2620	Micro Channel-to-ESDI Hard Disk Controller

SCSI Test and Development Systems

SDS-1	SCSI Development System with Initiator Emulation
SDS-2	SCSI Development System with Target and Initiator Emulation
SDS-3	Synchronous SCSI Development System with Target and Initiator Emulation

SCSI-to-LAN Interface Unit

Nodem	Connects SCSI-based PCs to Ethernet

OTHER INFORMATION

Adaptec does not employ a PR firm.

Advanced Hardware Architectures, Inc.

P.O. Box 9669
Moscow, ID 83843
208/883-8000
Fax: 208/882-0105

ESTABLISHED: February 1988 **NO. OF EMPLOYEES: 25**

BACKGROUND

Advanced Hardware Architectures (AHA) was formed in 1988 to develop VLSI products based on a proprietary sorting and error-correction technologies developed by the Idaho Research Foundation. The Company's first products are a family of high-speed, single-chip Reed-Solomon encoder/decoder chips and a family of sorter coprocessor boards. AHA implements its patented sorting and error-correction technologies with very high speed hardware architectures.

AHA is the first commercial venture of the Idaho Research Foundation, the high-technology development arm of the University of Idaho. The Company is headed by John Overby, who joined AHA after holding the position of CEO with Advanced Input Devices.

The Company uses both CMOS and GaAs process technologies for its current product offerings and will use other technologies as the need arises. All of the Company's wafer fabrication operations are contracted to outside firms. AHA plans to set up a small fab of its own eventually. The Company currently operates two facilities in Moscow, Idaho, that total 10,000 square feet. AHA's future product focus will continue to be proprietary sorting and coding products. The Company plans to expand its capacity to allow for rapid product growth.

BOARD

(Name and Affiliation)

John Overby
Advanced Hardware Architectures, President

Dr. Richard Callahan
Idaho Research Foundation, Inc.

Dr. Gary Maki
UI/Microelectronics Research Center

Steve Shinn
Investor

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
John Overby
A.I.D., President and CEO

VP Finance
Gordon Scott
A.I.D., COO and CFO

VP Sorting Products
Dr. J. Shovic
University of Idaho/MRC, Research

VP Coding Products
Dr. Pat Owsley
University of Idaho/MRC, Research

FINANCING

Advanced Hardware Architectures has had three rounds of financing, which totaled more than $1 million.

ALLIANCES

None

MANUFACTURING

Technology

CMOS, GaAs, and others as needed

Facilities

Moscow, ID
Two locations that total 10,000 sq. ft.
R&D, marketing, test

PRODUCTS

PerFEC Series—Very High Speed, Single-Chip Reed-Solomon Encoder/Decoder Chips
Aha!Sort Series—Sorter Coprocessor Boards

OTHER INFORMATION

Advanced Hardware Architectures' PR firm is Hanna-Wheeler.

PerFEC and Aha!Sort are trademarks of Advanced Hardware Architectures, Inc.

Advanced Linear Devices, Inc.

1180 F. Mariloma Way
Sunnyvale, CA 94086
408/720-8737
Fax: 408/720-8297

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 10**

BACKGROUND

Advanced Linear Devices, Inc., (ALD) designs, develops, manufactures, and markets linear ICs for low-power, low-voltage precision applications. Products are manufactured using a proprietary silicon-gate CMOS technology optimized for 5V operation. They are used for industrial control and electronic instrumentation, computer and peripheral equipment, medical instrumentation, telecommunications, aerospace, and military systems.

The Company offers two product lines. A series of about 25 standard products that include timers/oscillators, op amps, comparators, and n-channel and p-channel MOSFETs.

The second product line, which was offered in March 1988, is a Function-Specific Standard Cell Linear Program for the design of custom and semicustom ICs. The library includes timers/oscillators, op amps, comparators, and MOSFETs, as well as diodes, resistors, and capacitors. The program consists of a kit of 86 standard ICs of 20 different types and a design manual. Customers use the parts to bread board the desired circuit, then return the working design to ALD, which then designs the circuit.

ALD subcontracts wafer fabrication to two foundries in the United States and assembly to contractors in the Far East. ALD conducts all wafer probe, sort, and final test at its facility in Sunnyvale, California. In 1987, ALD put in place its U.S. and Canadian network of sales representatives and established a U.S. distributor network.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Robert Chao
Supertex, VP Product

VP Product Opns
*Larry Iverson
Supertex, Mgr Process Engr

VP Mktg/Sales
*Michael O'Neal
Micropower, VP Mktg/Sales

*Founder

FINANCING

Not available

RECENT HIGHLIGHTS

April 1986
ALD offered its first product, the ALD55 monolithic CMOS timer. It features 500ns monostable mode and 2-MHz astable mode operation.

August 1986
ALD offered the ALD2301 silicon-gate CMOS dual comparator with typical response time of 650ns.

November 1986
ALD offered the ALD1502/2502/4501 family of quad CMOS timers that operate on 2V to 12V supplies. The series is available in commercial and military grades.

March 1987
ALD offered the ALD2701 CMOS dual rail-to-rail op amp. The device operates from single or dual supplies and input and output signal levels both extended to the supply voltage rails.

March 1988
ALD offered the function-specific standard cell ASIC approach for linear ICs.

ALLIANCES

Not available

MANUFACTURING

Technology

3.0-, 5.0-micron silicon-gate CMOS

Facilities

Sunnyvale, CA
10,000 sq. ft.
Manufacturing
Design, test
Administration

PRODUCTS

Device	Description
ALD1701	CMOS, Rail-to-Rail, Micropower Amplifier
ALD1702	CMOS, Rail-to-Rail, Oscillation Resistant Amplifier
ALD1703	CMOS, Low-Cost Amplifier
ALD1704	CMOS, Low-Cost, JFET-Replacement Amplifier
ALD1706	CMOS, Rail-to-Rail, Very Low Power Amplifier
ALD2701	Dual, CMOS, Rail-to-Rail, Micropower Amplifier
ALD4701	Quad, CMOS, Rail-to-Rail, Micropower Amplifier
ALD2301	Dual, CMOS, Open Collector Output Comparator w/Drivers
ALD4302	Quad, CMOS, Push-Pull Outputs Comparator w/Drivers
ALD555/1502/1504	Single-Precision Timer/Oscillator
ALD2502/2504	Dual-Precision Timer/Oscillator
ALD4501/4503	Quad-Precision Timer/Oscillator
ALD1101	Dual N MOSFET Transistors
ALD1102	Dual P MOSFET Transistors
AlD555-1	One-volt Single Timer/Oscillator

OTHER INFORMATION

ALD does not employ a PR firm.

Advanced Microelectronic Products, Inc.

1/F #17 Industriale E. 2nd Road
Hsinchu, Taiwan

North American Headquarters
1887 O'Toole Avenue, Ste. C-111
San Jose, CA 95131
408/727-8880
Fax: 408/727-6320

ESTABLISHED: June 1986 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Advanced Microelectronic Products, Inc. (AMPi), was formed to design, manufacture, and market power MOSFETs. The Company is implementing a three-pronged strategy. Initially, the Company entered the market with standard, functional equivalents to International Rectifier's line of leading power MOSFETs. Concurrently, it designed value-added products from its standard product line. Future plans involve using proprietary technology to offer smart power devices.

In August 1986, the Company produced its first prototype product, the IRF450 power amplifier. By April 1987, the Company readied its line of International Rectifier-compatible products and opened its North American headquarters in Santa Clara.

AMPi has established relationships with ERSO (Taiwan), which will conduct manufacturing, and Lingsen (Taiwan) and New Era (Hong Kong), which will perform assembly for AMPi.

Sales representatives have been signed in the United States, Canada, and the Far East.

BOARD
(Name and Affiliation)

Bob Jih, Chairman of the Board
Advanced Microelectronic Products, CEO

COMPANY EXECUTIVES
(Position and Name)

President
James Yen

CEO
Bob Jih

CFO
H.K. Hu

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

3-micron MOS

Facilities

Santa Clara, CA
Design, marketing

Hsinchu, Taiwan
Headquarters, engineering, manufacturing, assembly, test

PRODUCTS

Device	Voltage	Drain Source (Amps)	Current Package
AM0610LL/AM2222LM	60	15.0, 19.0	TO-92
AM10KLM/AM2222LM	60	0.25, 0.3	TO-237
AM4000 Family	100 to 500	18.0 to 56.0	AMPAK-04
IRF100-400	60 to 500	12.0 to 33.0	TO-3
IRF500-800/BUZ	50 to 500	1.3 to 30.0	TO-220AB

OTHER INFORMATION

AMPi does not employ a PR firm.

Advanced Power Technology, Inc.

405 S.W. Columbia Street
Bend, OR 97702
503/382-8028
Fax: 503/388-0364

ESTABLISHED: June 1984 **NO. OF EMPLOYEES: 70**

BACKGROUND

Advanced Power Technology (APT) designs, manufactures, and markets low-cost, high-power MOSFETs for advanced electric power switching applications, such as data processing and telecommunications equipment, defense systems, and variable-speed electric motors.

APT has developed a family of large-die MOSFETs that match the power and price advantages of low-speed thyristors and bipolar transistors with equivalent switching speeds. The MOSFETs feature lower on resistance and lower input capacitance, achieved with a metal-gate and 6-micron feature sizes. APT has also reduced manufacturing costs by developing a simpler MOSFET design that reduces the number of masks required.

The Company's future plans include developing a line of hybrids and insulated gate bipolar transistors (IGBTs).

BOARD
(Name and Affiliation)

Charles Cole, Chairman
Julian, Cole & Stein, General Partner

Leib Orlanski
Freshman, Marantz, Orlanski, Cooper and Klein, Attorney, Partner

Patrick Sireta
Advanced Power Technology, Inc., President/CEO

Ed Snape
The Vista Group, General Partner

Dave Stein
Julian, Cole & Stein, General Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Patrick Sireta
TI, VP CMOS Div

VP Marketing
Barry Chenes
PowerTek, VP Sales

VP Operations
John Hess
SEEQ, Dir Operations

CFO
Robert M. Holburn
TI, Ctr WW MOS Mem

VP Engr
Dah Wen Tsang
Theta-J, Dir Research

Sales Manager
Terry Bowman
Micron, VP Sales/Mktg

FINANCING

1985
Seed
$0.4M

1985
Round 1
$2.5M

1986/1987
Round 2
$8.1M

1988
Round 3
$2.8M
Major investors include Julian, Cole & Stein; The Vista Group; Orien Ventures; 1st Chicago Investment Advisors; Sunwestern Ventures Company; J.F. Shea Company; and Mitsui & Company (U.S.A.), Inc.

RECENT HIGHLIGHTS

October 1986
First prototype MOSFETs produced.

March 1987
Internal wafer fabrication facility became fully operational.

June 1987
APT shipped its first sample MOSFETs for evaluation.

December 1987
First production MOSFETs were shipped to customers.

February 1989
APT introduced the world's most powerful MOSFET, Monster MOS. It can supply 10KW through a single full-bridge configuration.

ALLIANCES

Not available

MANUFACTURING

Technology

5-micron metal-gate MOS
4-inch wafers

Facilities

The Company conducts all manufacturing in its Bend, Oregon, facility. Assembly for military products is done in the United States; other assembly is conducted by companies overseas.

Bend, OR
31,750 sq. ft.
Total area

18,250 sq. ft.
Administration, assembly, test

13,500 sq. ft.
R&D, engineering, wafer fabrication (including 4,000 sq. ft. Class 10 clean room)

PRODUCTS

Device	Vds Volts	Id cont. Amps	Idm Amps	Available
AP35XX	350	7.5 to 183.0	30.0 to 732.0	Now
APT40XX	400	7.5 to 183.0	30.0 to 732.0	Now
APT45XX	450	6.5 to 152.0	26.0 to 608.0	Now
APT50XX	500	6.5 to 152.0	26.0 to 608.0	Now
APT55XX	550	5.3 to 122.0	10.6 to 488.0	Now
APT60XX	600	5.3 to 122.0	10.6 to 488.0	Now
APT75XX	750	4.O to 91.0	16.0 to 364.0	Now
APT80XX	800	4.0 to 91.0	16.0 to 364.0	Now
APT90XX	900	3.0 to 76.0	12.0 to 304.0	Now
APT100XX	1,000	3.0 to 76.0	12.0 to 304.0	Now

OTHER INFORMATION

APT does not employ a PR firm.

Alliance Semiconductor

1930 Zanker Road
San Jose, CA 95112
408/436-1860

ESTABLISHED: 1985 **NO. OF EMPLOYEES: 1,000**

BACKGROUND

Alliance Semiconductor was formed to design, manufacture, and market SRAMs and DRAMs. The Company is using a 1.2-micron CMOS planar process which, when combined with architectural innovations, produces value-added high-speed devices.

In December 1987, Alliance offered the AS4C188 16Kx4 SRAM that features access times of 25ns, 30ns, and 35ns. In 1988, the Company introduced a pair of 1Mb DRAMs in 1Mbx1 and 256Kx4 configurations. Products are designed for superminis, workstations, and other computing applications using 32-bit MPUs running at 20-MHz or better.

The Company's future plans are to offer FIFOs and other specialty memories, and to encourage designers to consider the high-speed DRAMs as complete replacements for cache memories.

Alliance has signed agreements to have some of its DRAMs manufactured by NMB Semiconductor in Japan, while the SRAMs are being manufactured by Goldstar in South Korea.

Alliance is now manufacturing 1Mb DRAMs in its new Lee's Summit, Missouri, facility.

BOARD
(Name and Affiliation)

N.D. Reddy, Chairman
Alliance Semiconductor

C.N. Reddy
Alliance Semiconductor

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*N.D. Reddy
Modular Semiconductor, President

VP Sales/Mktg
Robert Reid
Oki Semiconductor, SR VP

VP Engineering
*C.N. Reddy
Cypress Texas Instruments, SRAM Dsn Mgr

*Founder

FINANCING

The Company has financed its developmental activity with private investment and seed funding from its offshore corporate partners.

March 1989
$1.2M
UtiliCorp United

$1.2M
Hallmark

$0.2M
Kansas City Valve & Fitting Co.

$0.2M
Black and Veatch

$0.1M
Dunn Industries

Tax credits, loan guarantees, grants
$2.27M
State of Missouri

Letter of credit
$3.0M
Private investor

RECENT HIGHLIGHTS

March 1989
Alliance agreed to lease manufacturing facilities outside Kansas City, Missouri, from AT&T.

ALLIANCES

NMB
December 1987
Alliance Semiconductor signed a five-year agreement with NMB Semiconductor covering 256K and 1Mb DRAMs. NMB will manufacture the devices and sell them worldwide.

MANUFACTURING

Technology

1.2- and 1.0-micron CMOS

Facilities

Kansas City, MO
120,000 total sq. ft.
Manufacturing

45,000 sq. ft.
Used for Class 10 clean room

PRODUCTS

Device	Description	Speed
AS4C188	16Kx4 SRAM	25, 30, 35ns
AS4C1000	1Mbx1 DRAM	60, 70, 80ns
AS44C256	256Kx4 DRAM	60, 70, 80ns

OTHER INFORMATION

Alliance does not employ a PR firm.

Altera Corporation

2610 Orchard Parkway
San Jose, CA 95134-2020
408/984-2800
Fax: 408/296-3140

ESTABLISHED: June 1983 **NO. OF EMPLOYEES: 225**

BACKGROUND

Altera Corporation designs, manufactures, and markets user-configurable EPROM-based ICs and associated CAE development systems and is focused entirely on developing this market. Altera invented and was the first company to ship electrically programmable logic devices (EPLDs).

The Company's products are specified for operation over commercial, industrial, and military operating ranges. The predominant users are manufacturers that supply equipment for the industrial, office automation, and telecommunications markets as well as military and aerospace contractors. Altera is qualified to supply devices to the requirements of MIL-STD-883 Revision C.

Altera's CAE tools and user-configurable devices allow design engineers to create custom logic functions on the IBM PC. Wafers using 1.0- and 0.8-micron CMOS technology are obtained through technology agreements. This strategy allows Altera to concentrate on architecture, circuit design, software, and service, which has earned the Company a reputation for providing excellent service and easy-to-use CAD software. The Company's goals are to achieve $100 million in annual sales in 1990 and to be recognized as the technology leader in the user-configurable IC market.

In March 1988, Altera amended its registration statement for an initial public offering of 4 million shares of common stock at $5.50 per share. Of the shares being offered, 1 million were sold by certain selling shareholders. The statement was originally filed in October 1987. Net proceeds will be used principally for working capital and for repayment of long-term debts.

In 1987, Altera began offering function-specific EPLDs. The StandAlone Microsequencer (SAM) family integrates 448 words of EPROM memory with a microcoded sequencer and pipelined register for microcoded state machines and sequencer applications. The Buster family of configurable bus interface peripheral devices combines a programmable bus interface, PLD, and storage elements in a single device.

In January 1988, Altera introduced three new products for the IBM PS/2 add-in board market. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface, the EPB2002 direct memory access (DMA) arbitration chip integrates the additional logic needed for DMA capability, and the MCMap provides software design support. The interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems. Add-in boards are licensed and encouraged by IBM and serve to add functions not included in the basic computers such as expanded memory, communications interfaces, peripheral equipment, and other functions as fax and voice mail.

The Company markets its products in North America, Europe, Australia, the Far East, and the Pacific Rim through direct sales offices and a network of distributors and sales representatives. Altera's distributors include Hall-Mark, Lionex, Pioneer, Quality Components, Schweber Electronics, and Wyle in the United States, and Future Electronics and Semad in Canada.

BOARD

Rodney Smith
Michael Ellison
Paul Newhagen
T. Peter Thomas

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Rodney Smith
Fairchild, GM/Linear Div

VP Marketing
David A. Laws
AMD, VP Bus Dev

VP Sales
John Duffy
Fairchild, VP Sales/Mktg

VP/IC Engr
*Robert F. Hartmann
Source III, President

VP Technology
*Dr. James Sansbury
Hewlett-Packard, Production Mgr

VP Finance
*Paul Newhagen
Source III, Controller/CFO

VP Operations
Bipin Shah
Fairchild, Operations Mgr

VP Software Engr
Clive McCarthy
Fairchild, Marketing Mgr

Mgr Human Res
John Waller
Zoran, Mgr Human Res

*Founder

FINANCING

June 1983
Round 1
$1.3M
Alpha Partners

April 1984
Round 2
$6.0M
Allstate Investments; Cable, Howse & Cozadd; F. Eberstadt & Company Inc.; John F. Shea; Technology Venture Investors; Welsh, Carson, Anderson & Stowe; Venture Growth Associates

Lease
$2.0M
Bank of America

March 1985
Round 3
$9.9M
Original investors; Analog Devices Ent.; Citibank N.A.; DeMuth, Folger, & Terhune Venture Capital; Institutional Venture Partners; Parker Drilling Company

Lease
$2.0M
Bank of America

May 1986
Round 4
$5.0M
European investors

Lease
$1.7M
Bank of America

March 1988
$15.0M
Initial public offering

RECENT HIGHLIGHTS

November 1986
Altera achieved full compliance to the Class B requirements of MIL-STD-883, Revision C for the EP310 and EP1210 devices. All other Altera devices in most package styles are available screened and environmentally tested to the MIL-STD specifications while compliancy requirements are being satisfied.

February 1987
Altera and Monolithic Memories, Inc., (MMI) settled the patent infringement suit brought against Altera by MMI. Altera agreed to the entry of a consent of judgment and the parties agreed to license each other under certain patents in the programmable logic field.

March 1987
Altera offered the StandAlone Microsequencer (SAM) family of EPLDs. The devices are user-configurable ICs designed for complex state machines and high-performance controller applications operating up to 30 MHz. These are the first products resulting from the Company's agreement with WaferScale Integration.

March 1987
Altera's LogiCaps now supports IBM's EGA and the Hercules graphics controllers. Altera also reduced the price of LogiCaps from $950 to $695.

October 1987
Altera introduced two families of function-specific EPLDs. SAM for complex state machines and high-performance controllers, and Buster for user-configurable MPU peripherals.

January 1988
Altera announced three new products for IBM PS/2 add-in boards. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface. The EPB2002 is a direct memory access (DMA) arbitration chip that integrates the additional logic needed for DMA capability. The MCMap provides software design support. The EPB2001 interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems.

March 1988
Altera amended its registration statement for an IPO of 4 million shares of common stock at $5.50 per share, originally filed in October 1987. Of the shares being offered, 1 million were being sold by certain shareholders. The net proceeds will be used principally for working capital and for repayment of long-term debt.

ALLIANCES

Intel
August 1984
Altera signed a five-year technology exchange agreement with Intel. Intel provided CHMOS EPROM fabrication technology and foundry services; Altera provided its EPLD design and test technology and software and hardware development support. Intel will be an alternate source for the CHMOS EPLDs. Both companies cooperate on developing support tools for EPLD development systems.

June 1985
The agreement with Intel was extended for two additional years and includes additional products using Intel's CHMOS process and its evolutions.

P-CAD Systems
February 1985
Altera entered a marketing agreement with Personal CAD Systems, Inc., which called for combining P-CAD's PC-CAPS, used for schematic capture, and PC-LOGs, a logic simulator, with Altera's A+PLUS and LogicMap software (expired).

Data I/O FutureNet
May 1985
Altera entered an OEM marketing agreement with Data I/O's FutureNet for the DASH series of schematic capture packages (expired).

Cypress
June 1987
Cypress Semiconductor and Altera signed a five-year agreement to develop a family of CMOS EPLDs. The 5,000-gate family is named MAX for Multiple Array Matrix. Altera is providing architecture, circuit design, and software support. Cypress is providing 0.8-micron CMOS EPROM process, manufacturing, and marketing support.

WSI
January 1987
Altera Corporation and WaferScale Integration, Inc., (WSI) announced a five-year technology agreement focused on the development of new, high-performance, user-configurable logic products. Altera will provide architecture, circuit design, and software support for the new family of products. WSI will contribute its strengths in high-speed CMOS process and EPROM memory device development. Wafers will be provided by Sharp of Japan.

Texas Instruments
July 1988
Altera Corporation and Texas Instruments (TI) announced the signing of a long-term agreement that encompasses a seven-year technology exchange and supply agreement for high-performance, high-density, user-configurable integrated circuits. Altera will provide architecture, circuit design, and software technology. TI will make available worldwide manufacturing capabilities and its high-voltage EPIC advanced CMOS process.

MANUFACTURING

Untested wafers are provided through technology exchange agreements with Intel, WaferScale/ Sharp, Cypress Semiconductor, and other foundry relationships. Assembly operations are subcontracted to two vendors. Volume production assembly is conducted in the Far East; quick-turn and prototype assembly is performed locally. Assembled components are final tested, burned-in, marked, packed, and shipped at Altera.

Technology

1.2-micron CHMOS
0.8- and 1.0-micron CMOS EPROM

Facilities

Santa Clara, CA
52,000 sq. ft.
Administration, engineering, manufacturing, marketing

PRODUCTS

User-Configurable ICs

Part No.	Description	Speed
EP3XX	300-gate EPLD	35, 40 MHz
EP6XX	600-gate EPLD	26, 45 MHz
EP9XX	900-gate EPLD	26, 45 MHz
EP12XX	1,200-gate EPLD	28 MHz
EP18XX	2,100-gate EPLD	20 MHz
EPS448	StandAlone Microsequencer (SAM)	30 MHz
EPB1400	Configurable Peripheral (Buster)	25 MHz
EPB2001	Microchannel Interface Chip	
EPB2002	DMA Arbitration Chip	
EPM5032	32 Macrocell 88 MHz EPLD	88 MHz
EPM5128	128 Macrocell 50 MHz EPLD	50 MHz

Most of the above are available in commercial, military, and industrial temperature ranges in a variety of speed grades. The components are offered in both ceramic and plastic dip packages and J-lead surface-mount packages. Pin-grid array packages are also available.

Design Tools

Part No.	Description
PLDS2	Development System for EPSeries Devices
A+Plus	Software Logic Compilers for Programmable Logic
LogiCaps	Schematic Capture
PLSME	State Machine Software
PLFSIM	Simulation Software
PLSLIB	TTL Macrofunction Library
MCMap	IBM PS/2 Micro Channel Interface Software Support
PLDS-SAM	Development System for SAM Devices
SAM+PLUS	SAM Design Processor
Hardware	Hardware Programming Units and Package Adaptors
PLCAD-SUPREME	Development system for EPSeries Devices
PLCAD-ENCORE	Development system for EPSeries Devices and EPM Devices
PLDS-MAX	Development system for EPM Series Devices

Altera's development systems run on Daisy Systems Corporation's Personal LOGICIAN workstation, and on more than 18 personal computers including AT&T, COMPAQ Plus, COMPAQ Deskpro, Columbia, Columbia Portable, Corona, IBM PC/XT/AT, IBM Portable, ITT XTRA, Leading Edge, MAD 86186, Panasonic SR. Partner, Televideo, Sperry, ISI Model 5160, Zenith 100 and 151 PC, and Intersil System PC.

OTHER INFORMATION

Altera's PR firm is Paul Franson Associates.

ANADIGICS, Inc.

35 Technology Drive
Box 4915
Warren, NJ 07060
201/668-5000
Telex: 510-600-5741
Fax: 201/668-5068

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 70**

BACKGROUND

ANADIGICS, Inc., designs, manufactures, and markets gallium arsenide (GaAs) analog and digital ICs for the telecommunications, military, and instrumentation markets. The Company is currently offering RF microwave and signal conditioning amplifiers, A/D converters, dividers, and multiplexers/demultiplexers. In addition, ANADIGICS offers GaAs services and designs both catalog and custom GaAs ICs, as well as custom hybrid assemblies, including fiber-optic data links.

The founders are Ronald Rosenzweig and George Gilbert, who cofounded Microwave Semiconductor Corporation, and Dr. Charles Huang, who was director of GaAs R&D and wafer fabrication services at Avantek.

The Company's strategy is to establish its own niche in producing GaAs ICs for high-frequency analog and digital applications in the defense and communications markets.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Ronald Rosenzweig
Microwave Semiconductor Corporation, President

Exec VP/COO
*George Gilbert
Microwave Semiconductor Corporation, Exec VP Opns

VP Engr
*Dr. Charles Huang
Avantek, Dir GaAs R&D

Dir Sales/Mktg
Michael P. Gagnon
TRW LSI Products, Mgr Strat Plan

Dir Finance
John Lyons
General Electric, Dir Finance

*Founder

FINANCING

April 1985
Round 1
$10.0M
Alan Patricof Associates, NY; Alex Brown & Sons; Fairfield Ventures; General Electric Venture Capital; Orange Nassau; Rothschild Inc.; Smith Barney Venture Capital

Lease
$10.0M
GE Credit Corp., EQUITEC, and others

November 1986
Round 2
$10.0M
First-round investors; Arthur D. Little Co.; Century IV Fund; Englehard Corp.; Memorial Drive Fund; Metropolitan Life Insurance Co.

January 1989
Round 3
$9.0M
Thomson-C.S.F. Ventures; Canaan Venture Partners (formerly GE Venture); Philadelphia Ventures (formerly Century IV); Smith, Barney, Harris, Upham; Atlas Associates, Inc.; Alan Patricof Associates; Alex Brown and Sons; Metropolitan Life Insurance; Memorial Drive Trust

RECENT HIGHLIGHTS

January 1987
ANADIGICS offered the AOP3510 350-MHz unity gain stable GaAs op amp in commercial and military grades. The device has a bandwidth of 70 MHz and a settling time of 20ns.

March 1987
ANADIGICS offered the AWA20601 and ADA25001 wideband MMIC gain amplifiers. The Company also offered the ADV3040 4-to-1 divider.

June 1987
ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

July 1987
ANADIGICS offered the ACP10010 comparator for ATE and high-speed fiber-optic receivers.

September 1987
ANADIGICS offered the ATA30010, a 3-GHz transimpedance amplifier.

January 1988
ANADIGICS introduced the ALD30010, a 3-GHz laser driver.

February 1988
ANADIGICS was awarded a $500,000 contract from the navy to develop a chip set for X-band radars.

March 1988
ANADIGICS completed the first stage of a $4 million equity financing. Investors were ABS Ventures, Alan Patricof Associates Inc., Alex Brown Emerging Growth, Canaan Venture Limited Partnership, Century IV Partners, Fairfield Ventures, First Century Partnership III, Investments Orange Nassau, Memorial Drive Trust, Metropolitan Life, and Rothschild Inc.

April 1989
ANADIGICS introduced two new transimpedance amplifiers, the ATA03010 and the ATA30011.

ALLIANCES

Bendix
June 1987
ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

SERVICES

GaAs IC design
GaAs foundry
Assembly
Test

MANUFACTURING

Technology

1.0m and 0.5m-GaAs MESFET

Low-power D-MESFET process technologies will be available in the future.

Facilities

Warren, NJ
55,000 sq. ft.
Design, test, manufacturing, administration

10,000 sq. ft.
Clean room

PRODUCTS

Device	Description
AOP1510	Op Amp, 150 MHz
AOP3510	Monolithic Op Amp, 350 MHz
AWA20601	10dB Gain Amplifier, 2 to 6 GHz
ACP10010	Comparator, 1.0ns Typical Delay
ADA25001/25002	25dB Gain Amplifier, 3 GHz
ADV3040	4-to-1 Divider
ALD30010	Laser Driver, 3 GHz
ATA30011	Transimpedance Amplifier, 3 GHz
APS30010	Phase Splitter, 3 GHz
ATA0310	Transimpedance 300-MHz Amplifier
ASW40010	DC—4-GHz Spdt switch
ASW80010	DC—8-GHz Spdt switch fiber optic receiver products
AAR10010	1-GHz, 1,330nm Analog Receiver
AAR10015	1-GHz, 800nm Analog Receiver
AAR10020	1-GHz, High-Output, 1,300nm Analog Receiver
AAR10025	1 GHz, High-Output, 800nm Analog Receiver
ADR16010	1.6-Gbps, 1,300nm Digital Receiver
ADR16015	1.6-Gbps, 800nm Digital Receiver
ADR16020	1.6-Gbps,ECL Output, 1,300nm Digital Receiver
ADR16025	1.6-Gbps, ECL Output, 800nm Digital Receiver
ADR16030	1.6-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR16035	1.6-Gbps, 800nm Digital Rcvr/Clock Recovery
ADR12030	1.2-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR12035	1.2-Gbps, 800nm Digital Rcvr/Clock Recovery

OTHER INFORMATION

ANADIGICS' PR firm is Norm Fenichel.

Applied Micro Circuits Corporation

6195 Lusk Boulevard
San Diego, CA 92121
619/450-9333
Fax: 619/450-9885

ESTABLISHED: April 1979 **NO. OF EMPLOYEES: 225**

BACKGROUND

Applied Micro Circuits Corporation (AMCC) specializes in the design and manufacture of high-speed ECL gate arrays. In 1987, the Company began offering BiCMOS gate arrays. AMCC targets its products at OEMs that make industrial instruments, high-performance computers, electronic warfare systems, test equipment, graphics hardware, and telecommunications equipment.

AMCC is a privately held company that was formed by Howard Bobb and Joe Mingione, who had previously been American Microsystems Inc.'s chairman of the board and marketing manager, respectively. AMCC was founded in Cupertino, California, but later acquired Solitron Devices' 32,000-square-foot facility in San Diego. After converting it to run 4-inch wafers, AMCC's fab facility became operational late in 1981. Under the leadership of Roger Smullen, AMCC refocused its efforts in 1983 to the high-performance array marketplace. Mr. Smullen replaced the founders as president and CEO.

There are 29 sales representative organizations with more than 90 sales people that handle AMCC's gate arrays in North America, Europe, Israel, and the Far East.

BOARD
(Name and Affiliation)

Roger A. Smullen, Chairman
Plus Logic

William K. Bowes, Jr.
U.S. Venture Partners

F.K. Fluegel
Matrix Partners, L.P.

Franklin P. Johnson
Asset Management Corporation

Albert Martinez
Applied Micro Circuits Corp.

Gregorio Reyes
ASET

Arthur Stabenow
Micro Linear

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Albert Martinez
TRW, VP/GM LSI Products Div

VP Finance/Admin
Joel O. Holliday
Spin Physics, VP Finance

VP Mktg/Sales
A. C. D'Augustine
Inmos, Dir. Worldwide Sales

VP Operations
Don Schrock
Burr-Brown, VP/GM Data Products Div

VP Engineering
Ray Yuen
National Semiconductor, Design Manager

FINANCING

April 1979
Round 1
$5.0M
Fred Adler & Co., Ampersand Associates, International Industrial Investments Inc., Kimball Organ, Timex

March 1983
Round 2
$5.0M
Accel Capital; Adler & Co.; Asset Mgmt. Co.; Harrison Capital; International Industrial Investments (France); Kemper; Matrix Partners; Oak Investment Partners II; Prime Capital; Robert Fleming Ltd.; Robertson, Colman & Stephens; US Ventures; Venture Growth Associates

September 1987
Round 3
$12.0M
Accel Capital; Adler & Co.; Asset Mgmt. Co.; Eberstadt Fleming Venture Capital; Harrison Capital; International Industrial Investments (France); Jamieson & Co.; Kemper; Kimball Manufacturing; Matrix Partners; Oak Investment Partners; Olivetti; PaineWeber Ventures; PM Investment; Prime Capital; Robertson, Colman & Stephens; Time, Inc.; US Venture Partners; Venture Growth Associates

RECENT HIGHLIGHTS

May 1987
AMCC offered the Q5000 Series of bipolar products and entered the BiCMOS logic array market with its Q14000 series. The Q14000 is the result of a two-year joint development agreement with Seiko-Epson.

July 1987
AMCC named Albert Martinez president and chief executive officer, filling a vacancy that had existed since March 1987 when former presi- dent Jonathon K. Yu left the Company. Mr. Martinez was most recently vice president and general manager of TRW's LSI Product Division in La Jolla, California.

September 1987
AMCC completed a private sale of $12 million in convertible preferred stock. The funds are being used to reduce short-term borrowing and provide working capital for anticipated growth, including expansion into its recently completed facility in San Diego, California.

September 1987
AMCC moved into its new corporate facility in San Diego. The 100,000-square-foot building, on a 6.5-acre site, houses engineering, marketing, and administrative staff. The additional facility brings AMCC's total space to 121,000-square-feet, which includes a Class 10 fab and production facility.

January 1988
AMCC and Plessey signed an agreement to jointly develop a family of high-performance ECL gate arrays. The arrays, which range up to 18,000-gates, will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

June 1988
AMCC announced a major contract with Datatape, Inc., for seven logic array circuits. This contract is expected to be worth $3 million to $4 million over the next two years.

ALLIANCES

Signetics
April 1979
Signetics and AMCC agreed to allow Signetics to provide alternate sourcing of the Q700 Quick-Chip series. AMCC was licensed to market designs for Signetics' 8A-1200 gate array family.

September 1983
AMCC and Signetics signed an extension of the prior agreement that covers a technology transfer of future gate array families and junction-isolated and oxide-isolation processes.

Thomson-CSF
July 1982
AMCC signed an agreement with Thomson-CSF under which Thomson-CSF provided alternate sourcing and will develop AMCC's high-performance, bipolar Q-700 series of gate arrays. AMCC received $1 million over five years.

Daisy
February 1983
Daisy offered support for AMCC's Q-700 gate array family on its Gatemaster gate array development system; AMCC provided the design software.

Honeywell
August 1984
Honeywell signed an agreement to second source AMCC's Q700 series gate arrays and to alternate source AMCC's bipolar gate arrays.

Sanders
February 1985
Sanders agreed to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only.

Seiko-Epson
May 1985
Seiko and AMCC entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process is merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process.

Plessey
January 1988
AMCC and Plessey agreed to jointly develop a family of high-performance ECL gate arrays up to 16,000 gates. It will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

MANUFACTURING

Technology

2.0-, 3.0-, and 5.0-micron double-level-metal bipolar
1.5-micron BiCMOS
Three-level fine pitch metal
4-inch wafers

Facilities

San Diego, CA
116,000 sq. ft.
Administration, marketing, development, manufacturing

5,000 sq. ft.
Class 10 clean room

PRODUCTS

ECL Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
Q700	Bipolar	5.0	0.9	250 to 1,000
Q1500	Bipolar	5.0	0.9	1,500 to 1,700
Q3500	Bipolar	3.0	0.6	1,300 to 3,500
Q5000	Bipolar	2.0	0.3	1,300 to 5,000
Q20000	Bipolar	1.0	0.1	1,000 to 16,000

BiCMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
Q14000	BiCMOS	1.5	0.7	2,160 to 13,440

Foundry

Process	Minimum Geometries	Number of Base Layers	Number of Metal Layers/Pitch	Wafer Size
Bipolar Junction Isolated	5.0-micron	7	2/10, 16	4"
Bipolar Oxide Isolated	3.0-micron	10	2/7, 10	4"
Bipolar Oxide Isolated	2.0-micron	10	3/5.5, 8.0, 15	4"
BiCMOS Oxide Isolated	1.5-micron	11	3/4.5, 6, 7	4"

OTHER INFORMATION

AMCC does not employ a PR firm.

Asahi Kasei Microsystems Co., Ltd.

Imperial Tower 1-1
Uchisaiwai-cho 1-chome
Chiyoda-ku, Tokyo, Japan
03/507-2371
Fax: 03/591-2567

ESTABLISHED: June 1983 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Asahi Kasei Microsystems Co., Ltd., manufactures and markets memory, application-specific ICs, linear, and microcontroller products. The Company was originally founded as Asahi Microsystems, Inc., by Asahi Chemical of Japan and American Microsystems Inc. (AMI) in June 1983. The Company focused on the design and marketing of custom and ASICs based on AMI technology.

In 1986, the Company became a wholly owned subsidiary of Asahi Chemical and changed its name to Asahi Kasei Microsystems. Asahi Kasei Microsystems has established an Electronics Research Laboratory in Atsugi, Japan, to develop new bipolar and CMOS process technologies and new applications, and plans to set up a manufacturing facility in two years.

The Company has established technical ties with Hitachi Ltd. for the acquisition of its advanced CMOS process technology. Asahi Kasei will manufacture and market Crystal's devices for the Far Eastern market, and International CMOS Technology (ICT) will market its EEPROMs.

AMI manufactures all the custom and standard products it develops and Hitachi manufactures its digital ICs. The Company manufactures new products developed through its tie-up with ICT on a small scale at an Atsugi plant.

BOARD

Not available

COMPANY EXECUTIVES

Not available

FINANCING

Not available

ALLIANCES

Hitachi
Asahi Kasei has licensed Hitachi Limited's advanced CMOS process technology.

Crystal Semiconductor
Asahi Kasei will manufacture and market Crystal's devices for the Far East market.

ICT
Asahi Kasei will market International CMOS Technology's (ICT) EEPROMs.

MANUFACTURING

Technology

2- and 3-micron CMOS

Facilities

Not available

PRODUCTS

SRAMs

Device	Description	Speed (ns)
AKM6264	64K 8Kx8	100, 120, 150
AKM6287	64K 64Kx1	45, 55, 70
AKM6288	64K 16Kx4 (In Development)	25, 35, 45
AKM62256	256K 32Kx8	85, 100, 120, 150
AKM6207	256K 256Kx1 (In Development)	35, 45
AKM6208	256K 64Kx4 (In Development)	35, 45
AKM66203	1Mb Module 128Kx8	100, 120, 150

ROMs

AKN623257/8	256K 32Kx8	150, 200
AKN62321	1Mb 128Kx8	150, 200
AKN62312	2Mb 256Kx8	200
AKN62412	2Mb 256Kx8/128Kx16	200
AKN62304	512Kx8	200
AKN62404	512Kx8/256Kx16	200

Gate Arrays

Family	Gates	Typical Internal Delay (ns)
AK61H	448 to 2,560	2.0
AK62B	4,032 to 7,136	1.8
AK62H	4,309 to 24,020	0.7

Cell-Based Library

Device	Description
Digital Cells	CPU/Peripheral Cells—Clock Generator, Bus Controller, DMA Controller, Programmable Counter/Timer, Multiplier Memory Cells—ROM, RAM
Analog Cells	Op Amps, A/D Converter, SCF Filters

Microcontrollers

AKMC4608	4-Bit Telephone Chip with DTMF Generator, LCD Driver, Real-Time Clock, 8Kx10 ROM, 1Kx4 RAM
AKMC4678	4-Bit Answering Machine Chip with DTMF Receiver, 8Kx10 ROM, 512x4 RAM
AKMC4919	4-Bit General-Purpose MCU with 1 microsecond of Instruction Time, 16Kx10 ROM, 992x4 RAM

Linear ICs

CS31412	A/D Converter
CS7008	Programmable Universal Filter

OTHER INFORMATION

Asahi Kasei Microsystems does not employ a PR firm.

Aspen Semiconductor Corporation

58 Daggett Drive
San Jose, CA 95134
408/432-7050
Fax: 408/943-2741

ESTABLISHED: December 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Aspen Semiconductor Corporation was formed in December 1987 to design and develop ultrahigh-speed ECL-compatible memory and PLD products with subthree nanosecond access times. The Company was formed and financed by Cypress Semiconductor Corporation and operates as a wholly owned subsidiary of Cypress.

Aspen is the brainchild of Cypress chief T.J. Rodgers, who has also established Multichip Technology and Ross Technology as Cypress subsidiaries. Rodgers' plan is to establish a number of small satellite companies under Cypress' control as an alternative to the large corporation. Hopefully, this type of organization will help maintain an aggressive start-up mentality within the corporation. Cypress provided the initial $7.4 million in financing and has an option to repurchase the Company at any time.

Aspen currently offers four ECL RAM products and four ECL PLDs. All of these devices are manufactured using a 0.8-micron BiCMOS process at Cypress' fabrication facilities. Aspen currently is shipping 1K and 4K SRAMs and plans to introduce a 64K device in Q1 1990. All Aspen-developed products are marketed by Cypress and sold under the Cypress logo. ECL RAMs and PLDs will be the basis of the Aspen product line in the future. New products currently are under development but no indication has been given as to the nature of these products.

BOARD
(Name and Affiliation)

Dr. T.J. Rodgers, Chairman
Cypress Semiconductor Corp., President/CEO

L.J. Sevin
Sevin-Rosen Management Company, President

Larry Sonsini
Wilson, Sonsini, Goodrich and Rosati, Partner

Robert C. Lutz
Aspen Semiconductor Corporation, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Robert C. Lutz
AMD, Director

Dir Marketing
David C. Ford
Actel, Director of Mktg

FINANCING

December 1987
Round 1
$7.4M
Cypress Semiconductor

ALLIANCES

Cypress
December 1987
Cypress provided initial funding in the amount of $7.4 million. Aspen operates as a wholly owned subsidiary of Cypress and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Aspen-developed devices will be fabricated by Cypress and sold through Cypress' sales organization.

MANUFACTURING

Technology

0.8-micron BiCMOS
1.0, 0.8-micron bipolar

Facilities

San Jose, CA
12,000 sq. ft.
Administrative, design, development, marketing

PRODUCTS

ECL RAMs

10/100E422	256x4	3ns
10/100E422L	256x4	5 to 7ns low power
10/100E474	1Kx4	3ns
10/100E474L	1Kx4	5 to 7ns low power

ECL PLDs

10/100E301	16P8	3, 4, 6ns
10/100E302	16P4	2.5, 4.0 6.0ns
10/100E301L	16P8	4, 6ns low power
10/100E302L	16P4	4, 6ns low power

OTHER INFORMATION

Aspen does not employ a PR firm.

ATMEL Corporation

2125 O'Nel Drive
San Jose, CA 95131
408/441-0311

ESTABLISHED: December 1984 **NO. OF EMPLOYEES: 152**

BACKGROUND

ATMEL (Advanced Technology-Memory & Logic) specializes in the design, manufacture, and marketing of high-speed EPROM, Flash EPROM, EEPROM, EPLD, and analog products. The Company's products are manufactured using a CMOS technology with geometries as low as 1-micron combined with two-layer metal and silicide processes.

ATMEL was founded by George Perlegos, Gust Perlegos, and T.C. Wu with private funds. Its first products were a CMOS 64K EEPROM at 120 to 450ns and a CMOS 256K EPROM operating at 120 to 250ns. They were followed by a CMOS 512K EPROM operating at 120 to 250ns. Currently, ATMEL offers additional EPROM, EEPROM, EPLD, 5-volt only Flash EPROM, and analog devices in a variety of organizations and densities.

In 1987, ATMEL introduced a line of linear products, including the AT76C10 programmable amplifier/delay equalizer, which is designed for use in modem and data communication equipment.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*George Perlegos
SEEQ, VP Engineering

VP Technology
*Dr. T.C. Wu
SEEQ, Process Dev Mgr

VP/General Manager
*Dr. Gust Perlegos
SEEQ, Engr Manager

VP Finance
Raymond Ostby
Intel, Ctlr Europe Ops

VP Sales
Jack Peckham
Semi Processes, Dir Sales/Mktg

VP Plan & Info Sys
Mikes Sisois
Qronos, VP Prod Dev

VP Marketing
B. Jeffrey Katz
Intel, Dir of Mktg

*Founder

FINANCING

December 1987
Round 2
$3.3M
Institutional Venture Partners

RECENT HIGHLIGHTS

June 1989
ATMEL agreed to purchase Honeywell's Solid State Electronics Division in Colorado Springs, Colorado. The facilities contain three wafer-fabrication areas, including a 6-inch facility, and related assembly, testing, and engineering facilities.

ALLIANCES

General Instrument
March 1985
ATMEL provided technology for its OTP EPROM, UV EPROM, and EEPROM in exchange for fab capacity at GI's plant in Chandler, Arizona (expired).

Sanyo Electric
1987
ATMEL and Sanyo signed a foundry contract under which Sanyo will produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs.

MANUFACTURING

Technology

1.25-micron two-level-metal CMOS
1.00-micron two-level-metal CMOS

Facilities

San Jose, CA
100,000 sq. ft.
Administration, engineering, design, test, sales and marketing

Colorado Springs, CO
250,000 sq. ft.
Fabrication, assembly, test, and engineering

PRODUCTS

High-Speed EPROM

Device	Density	Organization	Speed (ns)
27H64	64K	8Kx8	45-90
27HC256	256K	32Kx8	55-120
27HC1024	1Mb	64Kx16	55-120
EPROM			
27C128	128K	16Kx8	120-250
27C256	256K	32KX8	120-250
27C512	512K	64KX8	120-250
27C513	512K	4x16Kx8	150-250
27C1024	1Mb	64Kx16	150-250
27C010	1Mb	128Kx8	150-250
CMOS PROM			
28HC191/291	16K	2Kx8	35-90
27HC641/642	64K	8Kx8	35-90
EPROM (5-volt only Flash EPROM)			
29C256	256K	32Kx8	150-250
29C010	1Mb	128Kx8	150-250
High-Speed EEPROM			
28HC16	16K	2Kx8	45-120
28HC64	64K	8Kx8	55-120
28HC256	256K	32Kx8	70-120
EEPROM			
28C04	4K	512x8	150-350
28C16/17	16K	2Kx8	150-350
28C64	64K	8Kx8	150-350
28PC64	64K	8Kx8 Paged	150-350
28C256	256K	32Kx8	150-350
28C010	1Mb	128Kx8	150-350
28C1024	1Mb	64Kx16	120-250

EPLD

Device	Gates	Speed (ns)
22V10	500	15-40
V750	750	30-40
V2500	2,500	35-45
V5000	5,000	30-40

Linear

Device	Description
76C10	Programmable Telephone Line Delay Equalizer/Amplifier
76C171, 176	Triple 6-Bit color palette DAC; 50-65 MHz

OTHER INFORMATION

ATMEL does not employ a PR firm.

Austek Microsystems Pty. Inc.

2903 Bunker Hill Lane #201
Santa Clara, CA 95054
408/988-8556
Fax: 408/988-0818

Austek Microsystems Pty. Ltd.

Technology Park, Adelaide
South Australia 5095, Australia
8/260-0155
Fax: 8/260-8261

ESTABLISHED: July 1984 **NO. OF EMPLOYEES: 85**

BACKGROUND

Austek designs, manufactures, and markets VLSI components for the cache controller and digital signal processor markets. The Company was founded in 1984 as a design source and supplier of VLSI components. From 1984 to 1987, Austek developed custom products for Australian and U.S. customers. Through these programs, the Company gained considerable expertise in cache architectures, digital signal processing, and floating point processing. Austek has built on these experiences to establish itself as supplier of proprietary standard products to the high-performance cache memory and DSP markets.

The Company was the first to introduce integrated cache controllers for the 30386 (the A38152 in June 1987) and 80286 (the A28285 in November 1988). Its first DSP product, the A41102 frequency domain processor (FDP), was introduced in November 1988; the FDP implements the fast Fourier transform and is used in imaging and instrumentation applications.

Austek designs and fabricates system level design examples incorporating its products for customer evaluation purposes and to provide its customers with tools to reduce their product development cycle time.

Austek subcontracts wafer fabrication to Hewlett-Packard and VLSI Technology in the United States and Ricoh in Japan. High-volume assembly is subcontracted to Indy and Pantronix in the United States, Anam in Korea, and Seiko-Epson in Japan. Austek qualifies and tests each product in-house.

Austek is a privately held Delaware corporation and has two main facilities. One is in Santa Clara, California, where activities include corporate headquarters, marketing, sales, applications engineering, the cache products business unit, and manufacturing. The other, located in Adelaide, Australia, focuses on product development, CAD, the DAP products business unit, and advanced development.

BOARD
(Name and Affiliation)

A.C. Summers, Chairman
Bennett and Fisher Ltd.

Denis L. Redfern
Austek Microsystems, President and CEO

Dr. Ivan Sutherland
Evans & Sutherland, Cofounder

Roger Buckeridge
CP Ventures, Director

Jos Henkens
Advanced Technology Ventures, General Partner

Barry Hilson
Australia Industry Development Corporation

Dr. J. Craig Mudge
Austek Microsystems, Director Advanced Development

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President and CEO
Denis Redfern
Wormald Data Systems, Division Manager

VP Sales
George Adler
AMD, VP Sales—West

VP Marketing
Roger Fisher
TI, Strategic Marketing Manager

VP Engineering
Geoff Smith
CSIRO, Engineering Manager

VP Manufacturing
John Gloekler
NSC, Product Engineering Manager

CFO and VP Finance
Steve Pekarthy
Ultron Labs, VP F & A

Dir Advanced Development
Dr. J. Craig Mudge
DEC, Director VLSI

FINANCING

July 1984
Round 1
$6.7M
Advanced Technology Ventures, Hambrecht and Quist, Rothschild Ventures, Caznove Ltd., Newmarket Ltd., Australian Industry Development Corp., Bennett and Fisher, and other individual investors

November 1986
Round 2
$6.4M
Original investors

March 1988
Round 3
$3.2M
Original investors

September 1989
Round 4
$1.3M
Original investors

RECENT HIGHLIGHTS

August 1989
Austek offered the A38202 Microcache cache controller for systems using Intel's 80386.

September 1989
Austek offered the A38204 Burst Mode Memory Controller for systems using Intel's 80386 and Austek's A38202 Microcache. This device is a companion to the A38202.

November 1989
Austek and Western Digital signed a letter of intent whereby Western Digital will use Austek cache controllers in its system logic products.

December 1989
Austek offered the A38202SX Microcache, cache controller for systems using Intel's 80386SX.

ALLIANCES

ZyMOS
October 1987
Austek and ZyMOS cooperated in the marketing and sales of Austek's A38152 Microcache with the ZyMOS POACH chip set for Intel 80386-based systems.

SERVICES

VLSI and system design
VLSI manufacturing management
VLSI test

MANUFACTURING

Technology

1.0-, 1.2- and 1.5-micron double-metal CMOS

Facilities

Santa Clara, CA
10,000 sq. ft.

Adelaide, Australia
20,000 sq. ft.

PRODUCTS

Device	Description
A38152	Microcache cache controller for Intel 80386, 32Kb cache size, 16, 20, and 25 MHz
A29285	Microcache cache controller for Intel 80286, 32Kb and 64Kb cache sizes, 20 and 25 MHz
A38202	Microcache cache controller for Intel 80386, 32Kb, 64Kb, and 128Kb cache sizes, 25 and 33 MHz
A38204	Burst mode memory controller for Intel 80386 and Austek A30202 systems, implements burst fills and two-level write buffer, 25 and 33 MHz
A41102	Frequency domain processor, implementing the fast Fourier transform, 40 MHz

OTHER INFORMATION

Austek Microsystems employs Joyce Lekas Public Relations as its PR firm.

Avasem Corporation

(Formerly: VLSI Design Associates)
1271 Parkmoor Avenue
San Jose, CA 95126
408/297-1201
Fax: 408/925-9460

ESTABLISHED: May 1980 **NO. OF EMPLOYEES: 48**

BACKGROUND

Avasem Corporation was formed to provide application-specific IC design, prototyping, and production services for electronic systems OEMs. The Company specializes in mixed analog and digital devices. Products are developed using the Company's standard cells and automated design tools. Proprietary design rules allow for multi-source wafer fabrication. The Company has established strategic alliances with production foundries.

In 1984, the Company introduced its first standard IC product—the V3829 floppy disk separator. The offering was followed by the V8500, a SCSI bus interface device introduced in 1986, and the V8580, a SCSI bus host device introduced in 1987. In March 1988, the Company announced the VDA-176, the first product in a family of RAMDAC devices. The device features a 256x18 SRAM color look-up table with triple 6-bit D/A converters for use as a color palette in computer graphics systems. A pipeline design allows pixel rates of up to 80 MHz. A pixel word mask allows displayed colors to be changed in a single write cycle, rather than by modifying the look-up table.

BOARD

*Mark R. Guidry, Chairman, President, CFO
Carolyn C. Guidry, Secretary
Richard S. Miller, VP Analog Products
K. Venkateswaran, VP Digital Products

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CFO
*Mark Guidry
Fairchild Semiconductor, Manager

VP Analog Prod
Richard Miller
Fairchild Semiconductor, Manager

VP Digital Prod
K. Venkateswaran
Fairchild Semiconductor, Manager

CFO
Mike Cleland
ICT Array Technology, Manager

*Founder

FINANCING

Initial capital was provided by founders, receivable financing by Saratoga National Bank.

SERVICES

Design
Prototypes
High-Rel Processing
Test

MANUFACTURING

Technology

1.2- to 5.0-micron CMOS

Facilities

San Jose, CA
27,000 sq. ft.
Design and test

PRODUCTS

Device	Description
V3829	Floppy Disk Separator
V8500	SCSI Bus Interface Device
V8580	SCSI Bus Host Device
V3676	Color Palette RAMDAC
V2116	2Kx8 CMOS SRAM
V2102	256Kx8 CMOS SRAM
V8520	Winchester Disk Controller

OTHER INFORMATION

Avasem does not employ a PR firm.

Bipolar Integrated Technology

1050 Northwest Compton Drive
Beaverton, OR 97006
503/629-5490

ESTABLISHED: July 1983 **NO. OF EMPLOYEES: 165**

BACKGROUND

Bipolar Integrated Technology, Inc. (BIT), designs, manufactures, and markets high-performance bipolar VLSI computational building blocks for the high-end digital signal processing (DSP) and data processing markets.

The Company's founders include George Wilson, Kenneth Schlotzhauer, James Pickett, Kenneth Giles, and Les Soltesz. Steve Cooper recently joined BIT as president and chief executive officer. Mr. Cooper was most recently president and COO at Silicon Systems.

BIT has developed a VLSI bipolar process named BIT1. The process is based on 2-micron lithography and polysilicon self-aligning techniques. BIT1 density is said to be comparable to 1.5-micron CMOS and is five times denser than existing bipolar ECL.

The Company's ECL and TTL products include 16x16 integer multipliers, 16x16 multiplier-accumulators, five-port register files, and a floating-point multiplier/ALU 2-chip set. BIT has also developed ECL gate arrays with Raytheon and will produce a bipolar 32-bit RISC MPU as a result of an agreement with Sun Microsystems.

BIT has established a nationwide network of sales representatives and has opened sales offices in Norcross, Georgia, and in Saratoga and Costa Mesa, California.

BOARD
(Name and Affiliation)

*George Wilson, Chairman
Bipolar Integrated Technology, CTO

Stephen E. Cooper
Bipolar Integrated Technology, President & CEO

Larry Sullivan
Analog Devices Enterprises

Wayne Kingsley
InterVen Partners

Jeff Watts
Union Venture Corp.

Dr. William Lattin
Logic Automation, Pres/CEO

Randall R. Lunn
Fairfield Ventures, General Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CTO
*George Wilson
Tektronix, Sr Engr/Bip Div

President/CEO
Stephen E. Cooper
Silicon Systems, President/COO

VP Tech Dev
*Dr. Keneth Schlotzhauer
Tektronix, Sr Engr

VP Mktg
Chris DeMonico
TI, Strat Mktg Mgr VLSI Products

VP Finance
*Keneth Giles
Columbian Co., VP Finance

VP Engr
John Deignan
Intel, Design Mgr

VP Operations
Kevin Stewart
VTC, Operations Mgr

*Founder

FINANCING

1983
Seed
$0.3M
Analog Devices, Inc.

May 1984
Start-up
$3.7M
Analog Devices, Inc.; First Interstate Venture Capital; BancBoston Ventures

Lease
$3.4M
Bank of Boston

$4.1M
Oregon State Revenue Bond

May 1986
Round 1
$7.7M
Original investors, Harvard Mgmt. Co., Raytheon Company, Republic Ventures, Union Venture Corp.

July 1986
Round 2
$2.5M
Fairfield Venture Partners, InterVen

July 1987
Round 3
$10.0M
Round 1 & 2 investors, Cowen & Co., DFC Ventures, Manufacturers Hanover, Pell Rudman & Co.

April 1988
Round 4
$11.2M
Round 3 investors, Bancorp Hawaii, Sun Microsystems, Weeden Capital Mgmt.

June 1988
Round 5
$13.5M
Oxford Partners, New England Capital Corp., Analog Devices, Raytheon Co., InterVen Partners

RECENT HIGHLIGHTS

November 1986
BIT offered two 16x16 fixed-point multiplier/accumulators, the B3011 and B2011. The B3011 is an ECL version and the B2011 is a TTL version.

November 1986
BIT sampled the B3210 1K register file with a typical read-cycle time of 6ns.

February 1987
BIT offered a chip set that consists of a floating-point multiplier and a floating-point ALU and offers 60-mflop performance for nonpipelined 64-bit operations. The B3110 multiplier and B3210 ALU are ECL 10KH compatible. The B2110 multiplier and B2120 ALU are TTL versions.

July 1987
BIT signed an agreement with Sun Microsystems to produce a bipolar 32-bit RISC MPU.

October 1987
Stephen E. Cooper was elected chairman of the board and CEO of BIT.

January 1988
BIT was selected by *Electronic Business* magazine as one of the 38 "hot" electronics industry start-ups. The results were based on a poll of 125 leading venture capitalists.

ALLIANCES

Analog Devices
1983
Analog Devices participated in all rounds of BIT financing.

Raytheon
July 1986
Raytheon and BIT agreed to jointly develop VLSI ECL gate arrays and standard cell devices using the BIT1 process. Raytheon will use its CAD/CAE facilities, and BIT will perform wafer fabrication with Raytheon marketing the resulting products.

Sun Microsystems
July 1987
Sun Microsystems licensed BIT to produce a 32-bit bipolar RISC MPU using its BIT1 process. The part uses Sun's scalable processor architecture (SPARC) developed for workstation applications. BIT has full marketing rights including software support. BIT plans to offer a higher performance RISC SPARC chip in 1989 using its BIT2 process.

Arizona Microtek
July 1988
BIT and AZM agreed to develop custom ICs using BIT's high-performance BIT-1 technology. AZM will act as an independent design house providing complete capabilities to develop custom LSI designs for current and future BIT customers.

MANUFACTURING

Technology

1.2-micron bipolar

Facilities

Beaverton, OR
46,000 sq. ft.
Design and manufacturing
6,000 sq. ft.
Class 10 clean room

PRODUCTS

Device	Description	Clocked Multiply Time
B3018	ECL 16x16 Integer Multiplier	13ns
B2018	TTL 16x16 Integer Multiplier	19ns
B3011	ECL 16x16 Multiplier-Accumulator	15ns
B2011	TTL 16x16 Multiplier-Accumulator	16ns
B3210	ECL 64x18-bit Five-Port Register File	7ns
B2210	TTL 64x18-bit Five-Port Register File	16ns
B3110/2110	2-Chip Set Floating-Point Multiplier	50ns
B3120/2120	Floating-Point ALU 25ns	

OTHER INFORMATION

BIT's PR firm is KVO, Inc.

BKC International Electronics, Inc.

6 Lake Street
Lawrence, MA 01841
508/681-0392
Fax: (508) 681-9135

ESTABLISHED: January 1986 **NO. OF EMPLOYEES: 100**

BACKGROUND

BKC International Electronics was founded in 1985 by three former ITT Semiconductor Employees, who purchased the geranium diode line and hi-rel test lab from ITT in 1985 and began operations in 1986. The Company produces a wide range of high-reliability discrete semiconductors, including small signal switching diodes, zener diodes, rectifiers, and germanium diodes.

By February 1, 1986, BKC had received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types approved and manufactured by ITT. In November 1986, BKC announced the purchase of the silicon wafer fab facility from ITT. The purchase included all the equipment, process, and quality specifications and procedures necessary to produce JAN, JANTX, and JANTXV switching diodes and zener diodes. Final approval from DESC was granted April 29, 1987.

To date, the Company has raised $2.5 million in financing through bank loans and the private sale of common stock. BKC conducts operations in an 80,000 square foot plant in Lawrence, Massachusetts, which houses design, wafer fab, assembly and test operations. During the next three years, the Company plans to increase wafer fab capabilities to include mesa construction. In the future, BKC plans to add new discrete semiconductors such as 5W zeners, Schottky diodes and rectifiers, switching rectifiers, and transient suppressors to its product lines.

BOARD

Not Available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Gerald T. Billadeau
ITT, CFO

VP Marketing
*John L. Campbell
ITT, Sales

VP Operations
*William J. Kady
ITT

*Founder

FINANCING

1985-1989
Bank Loans
$2.0M Total
Comfed Savings Bank

1985, 1986, 1987
Multiple offerings
Private sale of common stock
$525,000
Private investors

RECENT HIGHLIGHTS

February 1986
BKC received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types previously approved and manufactured by ITT.

November 1986
BKC announced the purchase of the silicon wafer fab facility from ITT.

MANUFACTURING

Technology

BKC uses Planar, mesa, and germanium gold bonding process technologies.

Facilities

Lawrence, MA
80,000 sq. ft.
Headquarters, wafer fab, assembly, test, design

PRODUCTS

- Small Signal Switching Diodes
- Zener Diodes
- Rectifiers
- Germanium Diodes

OTHER INFORMATION

BKC does not employ a PR firm.

Brooktree Corporation

9950 Barnes Canyon Road
San Diego, CA 92121
619/452-7580
Fax: 619/452-1249
Telex: 383596

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 290**

BACKGROUND

Brooktree Corporation designs, develops, and markets high-performance data conversion devices. The Company currently offers a complete line of VIDEODACs, which are D/A converters designed for use in video applications; RAMDACs, which are a combination of VIDEODACs and a color look-up table on one chip; and other related products. Brooktree's products are based on the Brooktree Matrix, a proprietary design technology that allows the combination of analog and digital processes on a single chip. The Company uses standard CMOS or bipolar manufacturing processes.

One of the founders of Brooktree was Dr. Henry Katzenstein, who developed the Brooktree Matrix. The Matrix is a fundamental advance in data conversion architecture and was the initial impetus for the formation of the Company. James Bixby, president of the Company, previously was director of engineering at Spin Physics, a division of Eastman Kodak. While at Spin Physics, Mr. Bixby developed a high-speed motion analysis system.

In November 1987, Brooktree acquired Manx Engineering Corp., a small company that has developed specialized hardware for document compression/decompression. The acquisition gives Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

Brooktree also intends to broaden its customer base with the addition of a product line aimed at ATE and instrumentation applications. The Company is currently offering a series of timing vernier ICs for ATE use.

BOARD
(Name and Affiliation)

*Myron Eichen, Chairman
Brooktree Corporation

James Bixby
Brooktree Corporation

*Ellsworth Roston
Roston and Schwartz

Sid Webb
Titan Corporation

Jack Savidge
Venture Strategies

F. Duwaine Townsend
Ventana Corporation

Bill Mobratten
Independent

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
James Bixby
Spin Physics, Dir Engr

VP/Chief Scientist
*Henry Katzenstein
Quantrad, VP/Ch Scientist

VP/CFO
William Peavey
Monitor Labs, VP Finance/CFO

VP
Steve Ou
Rockwell, Dir Dev Engr

VP Distribution
Joseph Santen
Burr-Brown, GM Data Conv

VP/Sales
Richard Lee
Mostek, VP Sales

VP/GM Components
Charles Long
GE, VP/GM

VP Strat Plan
Stewart Kelly
Intel, Strat Bus Chrmn

VP Human Resources
Bob Zabaronick
Cipher Data Prod, P Human Rescs

VP/Dir Subsystems
Jeffrey Teza
Integrated Circuit Engineering, Mgr Custom Design

*Founder

FINANCING

January 1982
Start-up
$0.4M
Founders

Late 1982-Early 1983
Seed
$0.3M
Management, private investors

Summer 1983
Round 1
$0.7M
Management, private investors

Early 1985
Round 2
$5.0M
Institutional investor

Summer 1985
Round 3
$5.0M
Institutional investor

Early 1986
Round 4
$10.0M
Institutional investor, individual and foreign investors, Fairchild Semiconductor

Early 1987
Round 5
$5.0M
Institutional investor

Late 1987
Round 6
$5.0M
Shintech (a division of Shin-Etsu), individual and foreign investors

RECENT HIGHLIGHTS

July 1987
Brooktree offered radio-frequency identification (RF ID) chips that are being used to automate tool changing. The chips are a mix of on-chip logic, PROMs, and communication components that identify the right tool so the host computer can direct its attachment.

November 1987
Brooktree acquired Manx Engineering Corp., a small company that developed specialized hardware for document compression/ decompression. The acquisition gave Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

January 1988
Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

ALLIANCES

Toshiba
1985
Toshiba signed a royalty-bearing licensing agreement to utilize Brooktree technology for consumer digital audio applications.

Fairchild
April 1986
Brooktree and Fairchild signed a broad-ranging partnership coupling Brooktree's D/A conversion technology with Fairchild's manufacturing capability. Fairchild made an equity investment and provides foundry services (expired April 1988).

Analog Devices
January 1988
Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

MANUFACTURING

Technology

3.0-, 2.0-, 1.2-micron Silicon-Gate Double-Metal CMOS
2.0-, 1.5-micron ECL bipolar

Facilities

San Diego, CA
73,000 sq. ft.
Headquarters, design, development, test

PRODUCTS

Video DACs

Device	Description	Clock Rate (MHz)
Bt101	Triple 8-Bit, Pipelined Operation	50, 30
Bt102	Single 8-Bit, 0, 7.5, or 10 IRE Pedestal	75
Bt103	Triple 4-Bit, Pipelined Operation	75, 30
Bt106	Single 8-Bit, Pipelined Operation	50, 30
Bt107	Single 8-Bit, 2:1 Multiplexed Pixel Inputs	400
Bt108	Single 8-Bit, Pipelined Operation	400, 300, 200
Bt109	Triple 8-Bit, Pin Compatible to TDC1318	250

Imaging

Device	Description	Conv. Rate (MHz)
Bt208	8-Bit Flash Video A/D Converter	15, 18
Bt251	Single-Channel 8-Bit Image Digitizer	15
Bt253	Triple-Channel 8-Bit Image Digitizer	15

RAMDACs

Bt450	Triple 4-Bit, 16x12 Dual-Port Color Palette RAM	70, 50, 30
Bt451	Triple 4-Bit, 256-Word Dual-Port Color Palette RAM	25, 110, 80
Bt453	Triple 4-Bit, 256-Word Color Palette RAM	66, 40
Bt454	Triple 4-Bit 16x12 Color Palette RAM	170, 110
Bt457	Single 8-Bit, 256x8 Dual-Port Color Palette RAM	125, 100, 80
Bt461	Single 8-Bit, Multiplexed TTL Pixel Ports	170, 110, 80
Bt471	Triple 6-Bit, 256x18 Color Palette RAM	80, 50, 35
Bt473	Triple 8-Bit True Color, 256-Word Palette	35, 50, 66, 80
Bt476	Triple 6-Bit, 256-Word Color Palette	35, 50, 66
Bt478	Triple 6/8-Bit, 256-Word Color Palette	35, 50, 66, 80
Bt459	Triple 8-Bit, 256-Word Color Palette with Cursor	80, 110, 135
Bt492	Single 8-Bit, 256-Word Palette, 100K ECL	360

Graphics Peripheral Devices

Device	Description	Conv. Rate (MHz)
Bt401-404	256x8 Pipelined SRAM, Optional 3x8 Overlay Registers, 10KH and 100K ECL Compatible	250
Bt424	40-Bit Multi-Tap Shift Register, 10KH ECL/TTL Compatible	250
Bt431	64x64 User Definable Cursor 35 MHz per 5 pixels	
Bt438	Clock Generator Chip for 125-MHz CMOS RAMDACs	250
Bt439	Clock Generator/Synchronizer Chip for Single Channel 125-MHz CMOS RAMDACs	150
Bt501/502	Octal ECL/TTL Bidirectional Transceiver/Translator, 10KH and 100K ECL Compatible	N/A

D/A Converters

Device	Description	Settling Time
Bt104	Monolithic Single 12-bit, Unlatched Data Inputs	40ns
Bt105	Monolithic Single 12-bit, Latched Version of Bt104	40ns
Bt110	Monolithic Octal 8-bit, Standard MPU Bus Interface	100ns

ATE Devices

Device	Description
Bt601	Dynamically Programmed Timing Edge Vernier, 10KH ECL Compatible
Bt602	Programmable Timing Edge Vernier, 20ps Resolution, 10KH ECL Compatible
Bt603	Programmable Timing Edge Delay, 20ns to 200ns span, 10KH ECL Compatible
Bt604	125-MHz 10KH ECL Compatible Dynamically Programmed Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt605	125-MHz 10KH ECL Compatible Programmable Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt606	Programmable Timing Edge Delay, 20ns to 200ns Span
Bt687	Ultrafast ECL Dual Comparator

Military Devices

Bt101/883	MIL-STD-883C Version of Bt101 VIDEODAC, 30-MHz Clock Rate
Bt102/883	MIL-STD-883C Version of Bt102 VIDEODAC, 66-MHz Clock Rate
Bt453	MIL-STD-883C Version of Bt453 RAMDAC, 40-MHz Clock Rate, 40-Pin Ceramic Sidebrazed DIP Package
Bt458/883	MIL-STD-883C Version of Bt458 RAMDAC, 100-MHz Clock Rate, 84-Pin Ceramic PGA Package

OTHER INFORMATION

Brooktree's PR firm is Rigoli, Pamphilon, Demeter.

California Micro Devices Corporation

215 Topaz Street
Milpitas, CA 95035-2398
408/263-3214
Fax: 408/263-7846

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 300**

BACKGROUND

California Micro Devices Corporation (CMD) designs, manufactures, and markets a wide range of high-performance electronic components through its thin-film, ASIC, and microcircuits divisions. The components are marketed to military, aerospace, medical, computer, and communications customers.

CMD was formed originally in 1980 to acquire the assets of Capsco Sales, Inc., a thin-film company founded in 1976. In 1982, CMD established Custom MOS Arrays (CMA), which designed, manufactured, and marketed HCMOS cell-based ICs and gate arrays in the 200- to 2,000-gate range. In September 1986, CMD and CMA merged into one company. Dr. Handel H. Jones, formerly president of CMA, became president and COO of the new company.

CMA operates as the ASIC division of CMD and produces primarily gate array and cell-based ICs based on 2.5-, 2.0-, and 1.25-micron HCMOS technologies, with complexities of from 100 to 20,000 gates. The Company has adapted its cell-based designs to analog and digital products and has increased the level of integration by depositing precision thin film onto the ICs.

The thin-film division designs and manufactures precision resistive products including networks, capacitors, and metallized substrates for both hybrid and microwave applications. The division also produces nonimpact, high-density, color ink-jet printheads. In November 1985, the Company introduced its proprietary SX resistor chip materials for high-performance applications that require precision resistance and stability characteristics.

In August 1987, CMD acquired the assets of GTE Communication Systems' Microcircuits Division for $14.5 million. The acquisition covered all of Microcircuits' assets including inventory, receivables, trade payables, intellectual properties, five acres of land, silicon wafer foundry and test facilities, and personnel. In the transaction, GTE Communication Systems also granted a preferred vendor status to CMD and a license to proprietary technology in custom chips.

The division, which operates as the Microcircuits Division of CMD, offers custom telecommunications circuits, MPU and peripherals ICs, and gate arrays used in telecommunications systems. R&D efforts focus on products in the telecommunications arena. About 60 percent of sales is into the telecommunications market, 20 percent in the personal computer market, with the remainder from foundry business. The division provides about 50 percent of its production to support the internal requirements of GTE Communications Systems.

In January 1989, CMD formed the Vanguard Semiconductor Division, which will be run by former Aspen founder/president/CEO Narpat Bhandari.

BOARD
(Name and Affiliation)

*Chan M. Desaigoudar, Chairman
California Micro Devices Corporation, CEO

James P. Burgess
Cambur Company, President

Dr. C. Lester Hogan
Fairchild Instruments, Former
Vice Chairman, President & CEO

Dr. Handel H. Jones
International Business Strategies, Chairman

Dr. Angel G. Jordan
Carnegie-Mellon University, Provost

Stuart Schube
Acorn Ventures, Inc., President

California Micro Devices Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Chan M. Desaigoudar
ITT Semiconductor, Far East Sales Dir

CFO/VP Finance, Asst Secretary
Steven J. Henke
Monsanto, Div Controller

VP/GM Microcircuits Div
Dr. Tarsaim L. Batra
Gould/AMI, Director Process Technology

VP Technology, Pres—Vanguard Semiconductor
Narpat Bhandari
Aspen Semiconductor (Div of Cypress Semiconductor), Founder, Pres and CEO

VP/GM Thin Film Division
Satish Kumar
United Supertek, Dir of Mktg

VP Sales and Tactical Mktg
Stephen R. Pass
Linear Technology, VP Sales

VP Foundry and Int'l Ops
Zia H. Malik
LSI Logic, Mgr Technical Liaison

*Founders

FINANCING

October 1986
$5.2 M
Initial public offering

RECENT HIGHLIGHTS

September 1986
CMD and Custom MOS Arrays merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

October 1986
CMD made an initial public offering of 1 million shares of common stock at $6 per share. The offering raised $5.2 million.

August 1987
CMD acquired the assets of GTE Microcircuits Division.

November 1987
CMD offered the G8870, a CMOS DTMF receiver that is a combination decoder and filter. The device is said to detect all 16 DTMF tone pairs and convert them into code.

August 1988
California Micro Devices announced that it entered into an agreement with Gould Inc. to acquire the assets and assume selected liabilities of American Microsystems Inc., a wholly owned subsidiary of Gould Inc., for approximately $70 million in cash.

January 1989
California Micro Devices announced the formation of Vanguard Semiconductor Division.

ALLIANCES

Ricoh
1982
Ricoh provided wafers to CMA.

1983
CMD signed a joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and standard cells.

Racal
January 1982
Racal agreed to allow CMA to design, manufacture, and sell Racal's new 5-micron silicon-gate CMOS gate arrays in the United States.

Micro Innovators
January 1983
CMA merged with Micro Innovators, Inc., to acquire a team of seasoned custom MOS/LSI designers and expand its product line to include standard cell and full-custom designs in silicon-gate CMOS at both 5- and 3-micron geometries.

TRW
July 1985
TRW agreed to manufacture HCMOS gate arrays of from 500 to 25,000 gates in its JAN-qualified fab, using CMA's 1.2-micron design rules. TRW will use the rules internally for its DSP products.

CMA
September 1986
CMD and CMA merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

Fuji Photo Film
November 1986
CMD signed an agreement with Fuji Photo Film Co., Ltd., under which CMD will license its HCMOS gate array and cell-based design technology for $1 million. Fuji Photo Film will use the technology internally in image- and information-processing equipment.

Tachonics
March 1987
CMD signed an agreement with Tachonics Corporation that calls for Tachonics to manufacture commercial and military GaAs ICs at its foundry in New Jersey. CMD will provide cell design and tools in the 1.0- to 0.5-micron range. Initial products will be GaAs gate arrays in the 500- to 2,500-gate range and with radiation-hardened capability.

Telefonica
November 1987
CMD and Telefonica signed a joint venture agreement to form a company named California Micro Devices SA in Spain. CMD plans to invest about $2 million and will own approximately one-third of the company. CMD SA will offer thin-film passive components for hybrid assemblies, gate arrays, cell-based ICs, and nonimpact printhead substrates. CMD and Telefonica will also jointly develop ASICs. CMD will provide technology and training.

MANUFACTURING

Technology

1.25-, 1.5-, 2.0-, and 2.5-micron HCMO
Silicon-gate, single- and dual-layer metal
4-inch and 6-inch wafers

Facilities

Milpitas, CA
40,000 sq. ft.
Total space

15,000 sq. ft.
Class 1,000 clean room

Tempe, AZ
46,000 sq. ft.
Manufacturing, test—Class 1,000

20,000 sq. ft.
Clean room—Class 100 & 10

PRODUCTS

CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
C1000	Si-Gate	1.5	0.8	5,000 to 18,000
C2000	Si-Gate	2.0	2.0, 1.25	200 to 3,100
C3000	Si-Gate	2.5	2.5	1,500 to 10,500
C5000	Si-Gate	1.25	0.4	500 to 25,000

CMOS Cell Library

Process	Linewidth (Microns)	Delay (ns)	Cells
Si-Gate	1.25	0.25	120 gates, 200 MSI, RAM, ROM, PLA, 2901 Family, DMA Controllers, UART, USART
Si-Gate	2.0	1.2	Same as above
Si-Gate	2.5	2.5	Same as above

Linear

G8870	CMOS DTMF Receiver that Combines Decoder and Filter
G8912	PCM Filter

OTHER INFORMATION

California Micro Devices does not employ a PR firm.

Calmos Systems, Inc.

20 Edgewater Street
Kanata, Ontario, Canada K2L 1V8
613/836-1014
Fax: 613/831-1742
Telex: 053-4501

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 65**

BACKGROUND

Calmos Systems designs, develops, and markets a variety of devices, including VHSIC-level products that use CMOS and bipolar processes. The Company's CMOS products consist of the CA80C85B MPU and the 8000 series of peripherals, including SCSI and SCC devices. The bipolar product line is centered on a family of wireless components for cellular radio and pager applications. The Company also offers fast-turn prototyping and low-volume production runs that use e-beam technology.

In February 1988, Calmos acquired Siltronics' bipolar IC line. The acquisition adds about $2.5 million to Calmos' sales, which were $2 million in 1987. Calmos has purchased Siltronics' assets, especially the equipment for testing and assembly of the circuits.

Calmos hired about 24 of Siltronics' key employees, including founder and Vice President Gyles Panther, doubling the size of Calmos' work force.

The Siltronics product line consists of FM receiver chips for data and cellular radio applications, a delta codec chip based on an exponentially variable step-size algorithm, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

The Company participates in a EUREKA, a European consortium R&D project and is working with European Silicon Structures (ES2) to exploit the technology in ASIC design. Calmos, together with ES2, offers quick-turn prototyping using direct-write e-beam technology, which can implement several design projects on the same wafer.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Dr. Adam Chowaniec
Commodore, VP Technology

VP R&D
John Roberts
Mosaid, Dir Mktg

VP Sales/Mktg
William Woodley
Mosaid, VP/Bus Mgr

VP Finance/GM
D. Rosati
Cognos, Controller

VP Engineering and Technology
Andrew Herrington
Amiga, Dir Engineering

GM Manufacturing
S. Henthorn
Siltronics, Dir Mfg

FINANCING

Not available
Round 1
$1.0M
Private

Not available
Round 2
$0.4M
Private

Not available
Round 3
$3.6M
Private and grants

November 1987
Round 4
$0.5M
Private

RECENT HIGHLIGHTS

January 1987
Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

September 1987
Calmos announced that it has developed a prototype of a public-key data-encryption system implemented on a chip. The chip uses an algorithm developed at the University of Waterloo in Ontario that allows encryption by exponentiation at speeds of several hundred bits per second.

November 1987
Calmos received a federal contribution of more than $3 million from the Canadian DRIE to join the EUREKA program. The project involves the expansion of the Company's headquarters located in Kanata, Ontario, to include packaging and test facilities for semiconductor products and the expansion of its CAE system.

February 1988
Calmos acquired Siltronics' bipolar component business for $500,000. Siltronics' product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

ALLIANCES

Samsung
January 1987
Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

European Silicon Structures
February 1987
Calmos formed an alliance with ES2 to offer quick-turn prototyping.

Siltronics
February 1988
Calmos acquired Siltronics' bipolar component business for $500,000. The product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

SERVICES

Prototyping
Low-Volume Production

MANUFACTURING

Technology

2.0- and 3.0-micron CMOS
0.9- to 1.5-micron CMOS VHSIC
3.0- and 5.0-micron bipolar

Facilities

Kanata, Ontario, Canada
20,000 sq. ft.
Manufacture, test, design

PRODUCTS

ASICs

Device	Description
CMOS Gate Arrays	228 to 1,000 Gates, 2ns Typical Delay
Structured Cell Library	80 Cells Including 4-Bit Adders Shift Registers
Macro Cell Library	RAM, ROM, Dual-Port RAM, 29C01, 80C85, and 8200 Series of Peripherals

Microcomponents

Device	Description	Speed
CA80C85B	8-Bit MPU with Extended Instruction Set	3 to 5 MHz
CA80C85S	CA80C85B with Static Operation (2Q88)	6 to 10 MHz
8000 Series Peripherals		
CA82C12	8-Bit MPU	8 to 10 MHz
CA82C37A	Static DMA Controller	5 to 10 MHz
CA82C54	Static Interval Timer	8 to 10 MHz
CA82C55A	Static Peripheral Interface	5 to 10 MHz
CA82C59A	Static Interrupt Controller	5 to 10 MHz
CA82C84A	Static Clock Generator/Driver	8 to 10 MHz
CA82C88	Static Bus Controller	5 to 10 MHz
CA53C80	Static SCSI Interface Controller	1.5 to 3.0 Mbps
CA34C168	Real-Time Data Encryption Processor	300 Kbps

DSP

CA29C128	Digital FIR Filter Controller	25 MHz
DFS001-P	PC Board with Programmable FIR Filter and with Software Interface	
FIRCALC-PC	FIR Filter CAD Program	

Memory

CA16C08	2Kx8 SRAM	25ns
CA16C09	2Kx9 SRAM	25ns
CA64C08	8Kx8 SRAM	35ns
CA64C09	8Kx9 SRAM	35ns

Bipolar IC Product Line

Communications Circuits

S422	FM Receiver
S412	Cellular Radio Receiver
S404/406	FM Receiver Two-Chip Set
S408/410	FM Receiver for Data
S2842	Delta Codec

Power Supply Circuits

S420/424	Low-Voltage DC-DC Converters
S2862	Power Supply Monitor

Specialty Circuits

S416	Programmable Monolithic Diode Matrix
S2854	MPU Control Circuit
S144	Triple Op Amp

OTHER INFORMATION

Calmos does not employ a PR firm.

Calogic Corporation

237 Whitney Place
Fremont, CA 94539
415/656-2900

ESTABLISHED: July 1983 **NO. OF EMPLOYEES: 50**

BACKGROUND

Calogic Corporation designs, develops, and manufactures DMOS analog products, CMOS and bipolar linear products, and gate arrays. The Company also builds fabrication facilities and markets semiconductor equipment.

The Company was founded without venture capital. From 1985 to 1987, it initially concentrated on foundry contracts and building mini fabrication facilities using its own facility as a model. Calogic has set up fabrication facilities for Data Linear, Microwave Device Modules, and other foreign companies.

In the first quarter of 1988, Calogic began ramping up its proprietary line of linear products, which includes op amps, reference, and regulators.

Calogic achieved a positive cash flow within its first year of operation. The Company is profitable, with sales of about $5 million and continues to grow at a rate of approximately 50 to 100 percent per year.

BOARD
(Name and Affiliation)

*Manny Del Arroz, Chairman

*Dr. Charlie Allen, Consultant

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Manny Del Arroz
Intel, Process Manager

*Founder

FINANCING

1983
Initial
$0.025M
Private

ALLIANCES

Koki Company
December 1984
Calogic and Koki reached an agreement regarding the sale of Calogic's CMOS data bus driver ICs by Koki in Japan. (expired)

MANUFACTURING

Technology

3-micron DMOS
5.0- to 3.0-micron metal-gate CMOS
3.0-micron bipolar linear with thin film
High-Speed Complementary Bipolar on DI

Facilities

Fremont, CA
30,000 sq. ft.
Design, manufacturing, and test
7,000 sq. ft.
Including a Class 100 clean room

Calogic Corporation

PRODUCTS

- Op Amps
- Regulators
- References
- DMOS FET
- CMOS MPR
- DMOS Switching Arrays
- J Fet
- High-Speed Buffer Amplifiers
- Current Feedback Amplifiers
- Other Linear Analog Products

OTHER INFORMATION

Calogic does not employ a PR firm.

Catalyst Semiconductor, Inc.

2231 Calle De Luna
Santa Clara, CA 95054
408/748-7700
Fax: 408/980-8209
Telex: 5106017631

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 52**

BACKGROUND

Catalyst Semiconductor, Inc., was formed to design, develop, and manufacture leading-edge, nonvolatile memories as well as to provide this technology to application-specific and peripherals ICs. This design base is directed toward consumer, industrial, and military applications.

The Company was founded by B.K. Marya, previously the founder and CEO of Exel Microelectronics, Inc. Its long-term strategy is to gain ASIC leadership through the use of nonvolatile memory technology.

BOARD
(Name and Affiliation)

*B.K. Marya
Catalyst Semiconductor, president

George Pottorff
Pottorff, MacFarlane & Associates, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
B.K. Marya
Exel, President

Exec VP
Stephen Michael
GE Solid State, VP Custom ICs

VP Corp Dev
Hide Tanigami
Exel, Bus Dev/Japan

Dir European Sales
Barry Stanley
Mostek, Sales/Manager

Dir American Sales
Thomas Malgesini
Intel, Field Sales Engineer

Dir Tactical Mktg
Reggie Huff
Exar, Sales Mgr

Dir Strat Mktg
Nick Samaras
National, Mktg Mgr

*Founder

FINANCING

October 1985
Round 1
$4.5M
Private placement

RECENT HIGHLIGHTS

January 1987
Catalyst offered the CAT93C46 and CAT59C11, two CMOS 1K serial EEPROMs. The devices offer selectable serial memory organization and automatic write instruction.

March 1987
Catalyst and Oki Electric extended a previous agreement to include a wide range of CMOS EEPROMs. The agreement includes 1K serial EEPROMs; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs.

April 1987
Stephen Michael, formerly vice president of GE Semiconductor's Custom Integrated Circuit Department, joined Catalyst as executive vice president and COO. He has responsibility for all day-to-day operations.

June 1987
Catalyst offered the CAT62C580, a CMOS 8-bit MCU with 16K of EEPROM on-chip.

The device also includes 3 Kbytes of mask-programmable ROM and 128 bytes of data RAM.

June 1987
Catalyst offered the KASK 52580 program development and evaluation system for the CAT62C580 single-chip, 8-bit MCU. The system runs on the IBM PC AT or compatible MS-DOS machines.

July 1987
Catalyst offered its first CMOS SRAMs. The CAT71C256 and CAT71C256L are low-power 32Kx8 devices with an access/cycle time of 85ns. The CAT71C88 is a 16Kx4 SRAM with an access time of 45ns.

Sept. 1987
Catalyst sampled a 1Mb EPROM with an access time of 120nsCAT27010.

October 1987
Catalyst introduced the CAT28C16A and CAT28C17A, its first 16K EEPROMs. Both are organized as 2Kx8 and offer a 150ns access time.

1988 Developments

Catalyst introduced the CAT28C64A and CAT28C65A 64K EEPROMs.

Catalyst introduced the CAT35C102 and CAT35C202 2-Kbit serial EEPROMs.

Catalyst introduced the CAT35C104 and CAT35C204 4-Kbit serial EEPROMs.

Catalyst offered the CAT62C780, a CMOS 8-bit MCU with 8K of EEPROM on-chip. The device also includes 6Kbytes of mask-programmable ROM and 192 bytes of data RAM.

Catalyst introduced the CAT35C704 and CAT35C804 Secure Access Serial EEPROMs. These unique memories offer password-protected access to data and feature configuration.

Catalyst introduced its first military temperature device with the CAT27HC256. This is a 256-Kbit EPROM that provides 55ns access times. It also is available in industrial and commercial temperature grades as well as a low-power version, the CAT27HC256L.

Catalyst introduced a CMOS 1-Mbit EPROM, the CAT27C210, configured as 64Kx16 for 16- and 32-bit processor applications.

ALLIANCES

Zilog
December 1985
Catalyst and Zilog entered into a joint development and second-source agreement for user-programmable standard products. The Companies' initial effort will be a version of Zilog's Z8 microcontroller with on-chip, electrically alterable capabilities that use Zilog's 1.25-micron, n-well CMOS process.

Thomson CSF
1986
Catalyst and Thomson will conduct research and development in France.

Oki Electric
July 1986
Catalyst and Oki entered into an agreement that calls for long-term research and development of NVRAMs for ASICs using CMOS EPROMs and EEPROMs. Terms include a nonexclusive marketing agreement.

March 1987
Catalyst and Oki Electric extended the previous agreement to include a wide range of CMOS EEPROMs. The two companies planned a joint introduction of a 1K serial EEPROM; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs by the end of 1987.

November 1988
Catalyst and Oki signed an agreement that gives Oki a second-source license to sell the Catalyst 2K CMOS serial EEPROM, the CAT35C102, and the CAT35C202 on a worldwide basis.

Seiko
February 1987
Catalyst and Seiko Instruments signed a technology exchange and foundry agreement.

MANUFACTURING

Technology

1.2-micron design rules
Double-metal, double-poly CMOS
Submicron technology in development

Facilities

Santa Clara, CA
20,000 sq. ft.
Offices, test

PRODUCTS

Device	Description
CMOS SRAM	
CAT71C256	32Kx8
CAT71C256L	32Kx8 (low-power version)
CMOS NVRAMs	
CAT22C10	64x4
CAT22C12	256x4
CAT24C44	16x16 Serial RAM
CMOS EPROMs	
CAT27HC256	32Kx8
CAT27HC256L	32Kx8 (low power)
CAT27C210	1 Mbit (64Kx16)
NMOS EPROMs	
CAT2764A	8Kx8 (OTP)
CAT27128A	16Kx8 (OTP)
CAT27256	32Kx8 (OTP)
CAT27512	64Kx8 (OTP)
CAT27010	1 Mbit (128Kx8) OTP and UV versions
Parallel CMOS EEPROMs	
CAT28C16A/28C17A	2Kx8
CAT28C64A/28C65A	8Kx8
CAT28C256	64Kx8
Serial CMOS EEPROMs	
CAT93C46/59C11	1K Serial
CAT35C102/CAT35C202	2K Serial
CAT35C104/CAT35C204	4K Serial
CAT35C704/CAT35C804	4K Secure Access Serial
Microcontrollers (SmartCard Chips)	
CAT62C580	8-Bit MCU, 16K of EEPROM on-chip, 3 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM
CAT62C780	8-bit MCU, 8K of EEPROM on-chip, 6 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM
Development Tools	
EASE 62580	A Program Development and Evaluation System for the CAT62C580 Single-Chip, 8-Bit MCU

OTHER INFORMATION

Catalyst's PR firm is John Ranavicks.

Celeritek, Inc.

617 River Oaks Parkway
San Jose, CA 95134
408/433-0335
Fax: 408/433-0991

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 110**

BACKGROUND

Celeritek, Inc., designs, manufactures, and markets GaAs FETs, MMICs, and custom subsystems such as up/down converters for military and commercial applications.

The Company has developed a thin-film microwave amplifier technology and manufactures many of its low-noise and medium-power GaAs FETs in-house. All microwave amplifier thin-film circuits use a high-energy sputtering process for reliable and repeatable metal adhesion. The Company can also manufacture silicon MOS capacitors. Celeritek uses a family of standard amplifier modules that can be combined and aligned to achieve customer-specific specifications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Tamer Husseini
Granger Assoc., VP Operations

VP Amp Ops
*Gary Policky
Avantek, Mgr Adv Dev M/W

VP SC Ops
*Ross Anderson
Avantek, Mgr GaAs Dev

VP Finance
*John Beman
ROLM, Controller

VP Marketing
*Robert Jones
Avantek, Dir Marketing

*Founder

FINANCING

March 1985
Round 1
$3.2M
Greylock Management, Sutter Hill, Venrock Associates

August 1985
Follow-on
$1.0M
Original investors

August 1986
Round 2
$4.2M
Original investors; Burr, Egan, Deleage; Glynn Ventures; Mayfield Fund; Morgan Stanley

RECENT HIGHLIGHTS

July 1987
Celeritek leased 23,860 square feet of R&D space in San Jose, California.

December 1987
Avantek filed a suit against Celeritek and two of its founders, Tamer Husseini and Ross Anderson, charging theft of trade secrets.

ALLIANCES

None

MANUFACTURING

Technology

GaAs

Facilities

San Jose, CA
23,860 sq. ft.
Research and development and manufacturing

1,000 sq. ft.
Class 100 clean room

PRODUCTS

Low-Noise Amplifiers

Family	Frequency	Power Output
CMA Series	0.5 to 18.0 GHz	+18 dBm
CMT Series	2 to 18 GHz	+18 dBm
CMT Series	18 to 40 GHz	+10 dBm

Medium-Power Amplifiers

CPA Series	6 to 18 GHz	+27 dBm
CPT Series	6 to 18 GHz	+30 dBm

Microsize Connectorless Amplifiers

240/400 Series	2 to 18 GHz
520 Series	0.5 to 4.0 GHz

MMIC Chips

CMM-2 Amp	2 to 6 GHz
CMM-4 Amp	2 to 18 GHz
CMS-12 Switch	DC to 18 GHz

GaAs FETs

CF004-02	2 to 40 GHz	+13 dBm
CF003-01	2 to 20 GHz	+22 dBm
CF010-01	2 to 18 GHz	+28 dBm

Integrated Assemblies

Frequency Converters
Switched Amplifiers
Log Amplifiers

OTHER INFORMATION

Celeritek does not employ a PR firm.

Chartered Semiconductor Pte Ltd.

3-Lim Teck Kim Road
STC Building 10-02
Singapore 0208
Phone: 65-320-7271

ESTABLISHED: October 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Chartered Semiconductor Pte Ltd. is a result of a joint venture among National Semiconductor Corporation, Singapore Technology Corporation, and Sierra Semiconductor Corporation. Singapore Technology holds 74 percent of the Company, Sierra holds 17 percent, and National holds the remaining 9 percent. Total initial investment in the facility and equipment was about $40 million.

The Company, which is located at a 170,000-square-foot site in the Singapore Science Park, will initially fabricate and test CMOS wafers and ASIC devices primarily for Sierra Semiconductor and National Semiconductor. Chartered Semiconductor began construction in October 1987 and began its first wafer starts in Q2 1989. The facility fabricates submicron devices in a Class 1 clean room with an initial capacity of 5,000 6-inch wafers per month. The facility will be capable of generating about $50 million in revenue per year.

Sierra is contributing its proprietary Triple Technology CMOS process, technical management, and training. National is providing CMOS process technology, technical training, and technical support in the construction and start-up of the clean-room facility. Singapore engineers have been training at Sierra's San Jose, California, facility for more than two years. Tom Klein, vice president and founder of Sierra, will supervise the facility construction and start-up of the manufacturing process. Sierra's Triple Technology is capable of integrating analog, digital, and EE memory on one chip.

BOARD
(Name and Affiliation)

Ming Seong Lim, chairman

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Managing Director
B. John Hambridge
Fairchild, VP Logic Division

FINANCING

Oct. 1987
Round 1
$40.0M
National Semiconductor Corporation; Sierra Semiconductor Corporation; Singapore Technology Corporation

ALLIANCES

National, Sierra, Singapore
Oct. 1987
National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation cooperated in a joint venture to form Chartered Semiconductor.

SERVICES

Foundry
Manufacturing

MANUFACTURING

Technology

Submicron CMOS
6-inch wafers

Facilities

Singapore
170,000 sq. ft.
Manufacturing

The Company started wafer production in Q2 1989. The facility includes a Class 1 clean room and has an initial capacity of 5,000 wafers per month.

PRODUCTS (Planned)

CMOS Wafers
ASIC Devices

OTHER INFORMATION

Chartered Semiconductor does not employ a PR firm.

Cirrus Logic, Inc.

1463 Centre Pointe Drive
Milpitas, CA 95035
408/945-8300

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 175**

BACKGROUND

Cirrus Logic, Inc., designs, manufactures, and markets optimized mass storage controllers, communications controllers, and graphics controller chips for data communications, mass storage control, and display/graphics control applications. The Company's VLSI circuits use a proprietary silicon compilation technique and can be designed as standard products, as well as market- and customer-specific derivatives.

Cirrus Logic is the commercial follow-on to Patil Systems, a research laboratory founded in 1981. In 1984, financing was received from Nazem & Company of New York, and Cirrus Logic acquired Patil Systems.

Cirrus Logic developed a proprietary IC design method called Storage/Logic Array (S/LA) to design custom ICs in design times equivalent to those for standard cells with the density and performance of full-custom devices. Suhas Patil invented the S/LA concept, a type of silicon compilation technology with supporting CAD tools for logic design, simulation, and automatic layout.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Michael Hackworth
Signetics, Sr VP

Exec VP/Strat Ops
Kamran Elahian
CAE Systems, Founder/President

VP R&D
*Dr. Suhas Patil, Chairman
Patil Systems, Founder

VP Engineering
Kenyon Mei
Intel, GM OEM Comm

VP Manufacturing
Michael L. Canning
Teledyne, President/GM

VP Marketing
George Alexy
Intel, Mktg Mgr MPUs

VP Finance
Marilyn Guerrieri
Zitel, Dir Finance

VP Sales
Bill Caparelli
VLSI Technology, VP Sales/Mktg.

*Founder

FINANCING

March 1984
Seed
$1.6M
Nazem & Company; Robertson, Colman & Stephens

May 1985
Round 1
$7.5M
Brentwood Associates; Nazem & Company; New Enterprise Associates; Robertson, Colman & Stephens; Technology Venture Investors

May 1986
Round 2
$3.0M
Previous investors; Institutional Venture Partners

November 1986
Round 3
$4.5M
Previous investors; Kuwait & Middle East Financial; New York Life Insurance

June 1987
Round 4
$11.0M
Previous investors; Berkeley Development Capital; Evergreen Management Partners; New Venture Partners; T.R. Technology Investment; UNC Ventures

June 1989
IPO
$24.0M
Initial public offering

RECENT HIGHLIGHTS

June 1987
Cirrus Logic raised $11.0 million in funding. The funds were used to expand manufacturing and test capabilities, with the intent of doubling test capacity. Cirrus Logic also purchased $1.5 million worth of Sun Microsystems workstations for its design centers.

October 1987
Cirrus Logic offered the CL-GD510/520, a video graphics array device for the IBM PS/2-compatible market. A custom version of the device was developed in part with Video Seven.

November 1987
Cirrus Logic offered the CL-SH135 CMOS enhanced Winchester hard-disk formatter chip.

Cirrus Logic offered the CL-SH250, a CMOS single-chip SCSI disk controller that consists of a formatter, buffer manager, and SCSI bus interface.

December 1987
Cirrus Logic announced that it had begun volume production of the CL-GD510/520 chip set.

April 1988
Cirrus Logic offered the CL-SH260, a CMOS single-chip PC XT/AT-compatible disk controller that consists of a formatter, buffer manager, and PC XT/AT bus interface.

July 1988
Cirrus Logic announced a family of single-chip controllers, the RPX family, for raster printer acceleration. The first two chips in the RPX family are designed as coprocessors specifically to enhance the speed and reduce the systems costs of laser printers.

ALLIANCES

AMD
September 1985
Cirrus Logic and AMD agreed to a technology exchange wherein Cirrus Logic will use silicon-compiled, 1.6-micron, double-metal CMOS-processed wafers to develop an MCU for AMD. AMD provides foundry services. (completed)

Silicon Systems
October 1986
Cirrus Logic and Silicon Systems agreed to exchange controller and buffer manager functions and mutually second-source the devices. Both chips will be processed with a 2-micron CMOS technology. (completed)

WDC
January 1987
Cirrus Logic licensed a custom Winchester disk drive controller IC to WDC, which gained indirect access to the product when it acquired Adaptive Data Systems, Inc., a board manufacturer.

DIA-Semicon Systems
October 1987
Cirrus Logic signed an agreement with DIA-Semicon Systems in Japan to distribute new and existing products in Japan. Cirrus Logic began sales of its Winchester disk controller chip set in Japan. DIA-Semicon Systems was founded in 1986 and is 80 percent owned by Mitsubishi Electric Corporation.

Award Software
November 1987
Award Software, Inc., of Los Gatos, California, agreed to develop a VGA graphics Basic I/O System (BIOS) and demonstration board for Cirrus Logic's GD510/520 VGA chip set. The agreement includes a complete hardware and software solution for PS/2-compatible graphics.

July 1988
Award announced an agreement to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets.

Phoenix Technologies Ltd.
September 1988
Phoenix Technologies will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus Logic.

MANUFACTURING

Technology

3.0-micron NMOS and CMOS
1.2-, 1.5-, and 2.0-micron, double-metal CMOS

Facilities

Milpitas, CA
50,000 sq. ft.
Administration, engineering, design, and marketing

10,000 sq. ft.
Class 1,000 clean room (test facility)

PRODUCTS

Mass Storage Controllers

Device	Description
CL-SH120	CMOS Buffer Storage Manager
CL-SH130	CMOS Winchester Hard Disk Formatter
CL-SH135	CMOS Enhanced Winchester Hard-Disk Formatter
CL-SH250	SCSI Disk Controller with Formatter, Buffer Manager
CL-SH260	Disk Controller with Formatter, Buffer Manager, XT/AT Bus Interface

Display Controller

CL-GD510A/520A	Video Graphics Array—IBM New Generation
CL-GD610/620	Controller chips for laptop computers
CL-GD315	Laser printer coprocessors
CL-GD340	Laser printer coprocessors
CL-CD180	Multichannel communications controller (8 channel)

OTHER INFORMATION

Cirrus Logic does not employ a PR firm.

Comlinear Corporation

4800 Wheaton Drive
Fort Collins, CO 80525
303/226-0500
Fax: 303/226-0564

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 150**

BACKGROUND

Comlinear Corporation, located in Fort Collins, Colorado, was formed in 1980 by David Nelson, a former Hewlett-Packard employee. The original technical staff and management were drawn heavily from Hewlett-Packard. Comlinear is a manufacturer and supplier of high-performance analog signal processing components. Comlinear's amplifier products include high-speed hybrid and monolithic operational amplifiers, buffers, and clamping amplifiers. Converter products include track/hold amplifiers, A/D converters, and D/A converters. The corporate philosophy is to focus development on products that make a significant contribution toward solving customer problems.

Comlinear Corporation is housed in a custom-built facility, which is DESC certified to MIL-STD-1772. This facility houses the manufacturing, quality assurance, R&D, administration, and marketing operations for the Company.

Comlinear's proprietary signal processing components are sold worldwide to a diverse group of commercial, industrial, and military customers.

Application areas include communications (satellite systems, radar, fiber optics), avionics (electronic countermeasures, instrumentation), video (high-resolution displays, video processing, and distribution), and automatic test equipment.

BOARD
(Name and Affiliation)

David Nelson, Chairman
 Comlinear Corp., CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President, CFO
Barry Rowan
 Hewlett-Packard, Finance

VP R&D
John Farnbach
 Hewlett-Packard, R&D Manager

Executive VP Marketing
David Ford
 Hewlett-Packard, Product Manager

VP QA
Bob Vinton
 National Semiconductor, Quality Manager—Mil. Aero.

VP Manufacturing
Hal Chase
 Hewlett-Packard, Manager—Hybrid Products

CEO, Director Advanced Products
*David Nelson
 Hewlett-Packard

*Founder

FINANCING

Not available

ALLIANCES

TRW LSI
May 1988
 Comlinear and TRW LSI agreed to a joint development of high-resolution, high-speed data conversion products.

MANUFACTURING

Facilities

Ft. Collins, CO
50,000 sq. ft.
Design, manufacturing, test, administration

PRODUCTS

Op Amps
Unity Gain Buffer Amplifiers
Linear (Video) Amplifiers
Track & Hold Amplifiers
Encased Amplifiers
A/D Converters
D/A Converters

OTHER INFORMATION

Comlinear's PR firm is Tallant/Yates.

Cree Research Inc.

2810 Meridian Parkway
Durham, NC 27713
919/361-5709
Fax: 919/361-4630

ESTABLISHED: 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Cree Research Inc. was formed to develop, design, manufacture, and market discrete devices using silicon carbide (SiC) technology developed at North Carolina State University (NCSU). Founders of the Company are Eric Hunter; Calvin H. Carter, Jr.; Neal Hunter; John A. Edmond; and John Palmour—all former research team members at the university. Cree Research has obtained exclusive worldwide rights on the university's 10 U.S. SiC patents and on any future filings.

Initially, the Company is focusing on simple devices—diodes and blue LEDs that have immediate benefit to customers in aircraft engine applications, deep well drilling, and digital color imaging. Prototypes were introduced in April 1988.

In November 1987, the Company raised $500,000 in financing to fund itself through the prototype stage. In March 1988, $2.5 million was raised in first-round financing. The funds are being used to establish an 8,200-square-foot manufacturing facility, which was completed in July 1988.

The Company has won contracts with the Department of Defense, has set up arrangements for assembly and test services, and is discussing arrangements with major semiconductor manufacturers.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Eric Hunter
MKS Instruments, District Sales Mgr

Dir Technology
Calvin H. Carter
NCSU, Assoc Professor

FINANCING

November 1986
Seed
$0.5M
Not available

March 1988
Round 1
$2.5M
Not available

ALLIANCES

GI
August 1988
Cree and GI entered into a joint-development program to develop and manufacture silicon-based rectifiers.

SERVICES

Assembly
Test

MANUFACTURING

Technology

MESFETs and MOSFETs on silicon carbide

Facilities

Durham, NC
10,000 sq. ft.
Development, design, manufacturing

PRODUCTS

Diodes

High-Temperature pn, 350° Centigrade with Reverse-Bias Leakage Current of less than 1 nanoamp at +125V

Blue LEDs

OTHER INFORMATION

Cree Research does not employ a PR firm.

Crystal Semiconductor Corp.

4210 South Industrial Road
P.O. Box 17847
Austin, TX 78760
512/445-7222
TWX: 910-874-1352
Fax: 512/445-7581

ESTABLISHED: October 1984 **NO. OF EMPLOYEES:** 100

BACKGROUND

Crystal Semiconductor Corp. develops, manufactures, and markets advanced smart analog ICs that combine analog and digital functions on a single CMOS device for the telecommunications/ data communications, instrumentation, and industrial automation market segments.

Crystal is a privately held company founded by Michael J. Callahan and James H. Clardy. Crystal acquired the assets and technology of Texas Micro-Circuit Engineering, a company that Michael Callahan founded and served as president.

Crystal is developing three product lines for a variety of niche markets: telecommunications/ data communications including PCM transceivers and data communications transceivers; digitally enhanced analog-to-digital and digital-to-analog data acquisition products; and signal-conditioning and application-specific filters.

In April 1986, Crystal Semiconductor announced its first product, the CSC8870B, a DTMF receiver. The circuit can be used in telephone-answering machines and credit card verification systems. In June 1986, the CSC7008 Universal Filter and Crystal-ICE Filter Development System was offered. The development system is a PC-based system that incorporates filter synthesis, coefficient-generation software, and an in-circuit emulator (ICE).

Crystal Semiconductor markets its products through the combined efforts of a direct sales force and a worldwide network of manufacturers' representatives and distributors.

BOARD
(Name and Affiliation)

H. Berry Cash, Chairman
  Berry Cash Southwest Partnership

L.J. Sevin
  Sevin, Rosen Management Company

*James H. Clardy
  Crystal Semiconductor

*Michael J. Callahan
  Crystal Semiconductor

*Dietrich R. Erdmann
  Sevin, Rosen Management Company

Steven Sharp
  Independent Venture Cap., Megatest
  Power Integrations Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
James H. Clardy
  Harris, VP WW Ops

VP Engineering
Michael J. Callahan
  Texas Micro-Circuit, Founder/Pres

VP Marketing
Craig H. Ensley
  Rockwell, Director Mktg

VP Technology
Eric J. Swanson
  AT&T, Telecom Engr Mgr

VP Sales
Alan R. Schuele
  Cypress Semiconductor, Regional Sales Mgr

*Founder

FINANCING

October 1984
Round 1
$4.5M
Berry Cash Southwest Partnership; Dietrich Erdmann; Hambrecht & Quist; The Hill Partnership; InterWest Partners; Republic Investment Co.; Sevin, Rosen Management Company

February 1986
Round 2
$6.7M
Original investors; Coronado Venture Fund; Crown Associates; Kleiner, Perkins, Caufield & Byers; Rho Management Company; Rust Ventures

January 1987
Equity
$15.0M
Asahi Chemical

June 1987
Round 3
$5.0M
Berkeley International

RECENT HIGHLIGHTS

January 1987
Asahi Chemical acquired an 8 percent share in Crystal for about $4 million. Asahi Kasei Microsystems, a subsidiary of Asahi Chemical, will manufacture and market Crystal's devices for the Far Eastern market. The agreement gives Crystal an aggregate financial package of $15 million.

April 1987
Crystal offered the CS61534 analog line interface, which combines the analog transmit and receive line interface functions for T1/CEPT applications. The device features a programmable line driver and on-chip data-and-timing recovery circuit.

April 1987
Crystal offered the CS5016 16-bit, self-calibrating D/A converter featuring conversion time of 16 microseconds, MPU interface, three-state output buffers, and digitally selectable unipolar or bipolar output ranges.

May 1987
Crystal offered the CSZ511X Series of 12-, 14-, and 16-bit successive approximation A/D converters for DSP systems.

September 1987
Crystal offered the CS7820 8-bit A/D self-contained converter with a 1.36-microsecond conversion time.

October 1987
Crystal offered the CS3112 self-calibrating, 12-bit, 1-microsecond track-and-hold amplifier.

December 1987
Crystal offered the CS5012-7 self-calibrating, 12-bit, 100-KHz sampling A/D converter with on-chip sample-and-hold amplifier.

January 1988
Crystal offered the CSZ5412 monolithic 12-bit, 1-MHz, self-calibrating A/D converter with on-chip track-and-hold amplifier, MPU interface, three-state output, and overrange output.

August 1989
Crystal reported its first quarterly profit since the company was founded in 1984.

ALLIANCES

Asahi Chemical
January 1987
Asahi Chemical acquired an 8 percent share in Crystal for about $4 million.

Analogic Corp.
June 1989
Crystal Semiconductor and Analogic Corp. signed a strategic alliance which established Analogic as a value-added re-seller of the Crystal ADC line.

MANUFACTURING

Technology

2.0-, 3.0-micron CMOS silicon-gate
2-layer poly structure, single layer of metal

Facilities

Austin, TX
25,000 sq. ft.
Design and test

Crystal is planning a production facility in 1990. Currently, Orbit Semiconductor and International Microelectronic Products in the United States, Mitel Semiconductor of Canada, and Asahi Chemical of Japan provide foundry services.

PRODUCTS

Jitter Attenuators
T1 1.5-MHz and CCITT 2.0-MHz Jitter Attenuators, 4.5- to 8.5-MHz Token-Ring Jitter Attenuators

DTMF Receivers

Fiber-Optic Transmitters/Receivers
Optimodems, Fiber-Optic T1 Transmitter/Receivers, LEDs

Analog Data Converters
Crystal offers a full line of 12-, 14-, 16-, and 20-Bit A/D converters, with varying speeds and operating frequencies.

Amplifiers
Quad, 1-microsecond Acquisition Time, Track and Hold
Single, 1-microsecond Acquisition Time, Track and Hold

Filters
Universal Digitally Programmable Switched-Capacitor Filter, ICE Development System

Evaluation Boards
Available for all product lines

ISDN Primary Rate Line Interfaces
T1 (1.544 MHz and PCM-30 (2.048 MHz) Line Interfaces, T1 Analog Interface

ISDN Primary Rate Transceiver
T1 Transceiver

Military Devices
12-, 14-, and 16-microsecond A/D Converters

OTHER INFORMATION

Crystal Semiconductor does not employ a PR firm.

Custom Arrays Corporation

525 Del Rey Avenue
Sunnyvale, CA 94086
408/749-1166
Fax: 408/749-1718
Telex: 510-600-5119

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 10**

BACKGROUND

Custom Arrays Corporation was formed to design and manufacture analog bipolar linear arrays that are supported by a CAE design software environment and run on MS-DOS on a PC AT hardware platform. The Company also offers quick-turn prototyping services.

The Company's founder is Pierre R. Irissou, who also serves as the Company president and the vice president of research and development. Mr. Irissou remains a board member of ATAC, which has exclusive marketing rights for Custom Arrays' products in France. In October 1987, the Company merged with a blind-pool public corporation and is listed on the pink sheets and traded OTC. The Company is incorporated in Nevada; however, all operations are conducted in Sunnyvale, California.

The Company's short-term strategy is to offer quick turnaround on prototypes based on its MM and MV families of bipolar arrays. The MM family consists of nine arrays with 2 to 28 macrocells. The MV family consists of five arrays with 4 to 20 macrocells. Both families are a result of a joint development venture with Ferranti-Interdesign, located in Scotts Valley, California.

The Company's long-term strategy is to expand its bipolar array offerings to include thin-film technology options, including laser-trim capability. Custom Arrays is developing new arrays based on a high-voltage BiCMOS process compatible with thin-film technology.

Custom Arrays has expanded its facilities to support in-house reticle and mask manufacture, direct-step-on-wafer (DSW) photolithography, wafer processing for metal patterning and top-glass passivation, dice-package assembly, and full-production testing at both the wafer and package level.

BOARD
(Name and Affiliation)

B. Bornette, Chairman
ELF Aquitaine, France

*Pierre R. Irissou
Custom Arrays Corporation

George Krautner
Custom Arrays Corporation

Emmanuel Celerier
SOFIPA, France

Herve Thiriez
Independent

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Pierre R. Irissou
ATAC Diffusion S.A., Managing Director

Exec VP
George Krautner
Ferranti-Interdesign, VP Mktg/Sales

VP Finance
William Hass
Ferranti-Interdesign, VP Finance

VP Corporate Development
Arun Pande
Not available

*Founder

FINANCING

October 1984
Seed
$300,000
ATAC Diffusion S.A. (division of ELF Aquitaine)

October 1986
Seed
$500,000
SOFIPA (investment division of ELF Aquitaine)

July 1987
Seed
$400,000
FINAXIA, private investors

October 1987
Seed
$145,000
Merger with Venture Nexus, Inc.

May 1988
Seed
$500,000
Societe Financiere Internationale de Participations

Gaz et Eaux
$500,000

ALLIANCES

ATAC-Diffusion
1984
ATAC operates a design center and conducts marketing for Custom Arrays in Europe.

Ferranti-Interdesign
1984
The MM family is the result of a joint development venture with Ferranti-Interdesign, Inc. Ferranti-Interdesign acts as a second source.

Teledyne
February 1988
Custom Arrays entered into a joint development agreement with Teledyne Semiconductor for a new family of BiCMOS semicustom and cell-based libraries. The technology will feature operating voltage levels of 18V.

SERVICES

Quick-turn prototyping

MANUFACTURING

Technology

Bipolar
BiCMOS

Facilities

Sunnyvale, CA
12,000 sq. ft.
Manufacture, assembly, test

PRODUCTS

Linear Arrays

MM Family of 20V Bipolar Analog Arrays with 2 to 28 Macrocells
MV Family of 40V Bipolar Analog Arrays with 4 to 20 Macrocells

Development Tools

B-SPICE	Circuit (SPICE) Simulator (PC 386)
LIBERTY	MM and MV Layout and Verification Software
PC-PG	Mask File Translator for Pattern Generation
LIKE	Cell-Based IC Design Software

OTHER INFORMATION

Custom Arrays Corporation's PR firm is Joyce Lekas Associates.

Custom Silicon Inc.

600 Suffolk Street
Lowell, MA 01854
617/454-4600
Fax: 617/458-4931

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 25**

BACKGROUND

Custom Silicon Inc. (CSi) was formed to serve the low-volume and high-complexity ASIC markets by acting as a "time-shared captive semiconductor division" to companies in regional markets. It acts as a value-added reseller of wafer fabrication capacity through its strategic relationships with major semiconductor manufacturers.

CSi's approach is one of extremely vertical marketing that focuses on applications. CSi offers 2- and 3-micron CMOS gate arrays and standard cells that are supported on Mentor, Daisy, FutureNet, and VIEWlogic workstations. CSi currently produces devices with up to 14,000 gates and planned to add a family of CMOS and bipolar linear arrays in the first quarter of 1987.

CSi is the ASIC distribution channel for NCR Corporation for both New England and the Pacific Northwest; it is also the northeastern independent design center for Motorola. In September 1986, WSI NCR licensed CSi's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSi's library was built from NCR's existing library.

CSi's sales strategy is to build a network of region- al operations to act as distribution channels for major manufacturers that serve the engineering-intensive segments of the ASIC market.

BOARD
(Name and Affiliation)

Albert P. Belle Isle
Custom Silicon Inc.

Richard A. Charpie
Paine Webber Ventures

David W. Guinther
Custom Silicon Inc.

Sumner Kaufman
Kaufman & Co.

Kenneth J. Revis
Turner Revis Associates

Henry R. Shean
Custom Silicon Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Albert P. Belle Isle
Wang, Vice President

VP R&D
Donald L. Gay
Wang, Program Mgr

VP Marketing
David W. Guinther
Wang, Program Dir

VP Finance
Henry R. Shean
Wang, Controller R&D

VP Sales
Robert J. Brown, Jr.
SGS, VP Sales

FINANCING

April 1983
Seed
$0.1M
Kaufman & Co.; private investors

February 1984
Round 1
$1.1M
Bank of New England; First Chicago; Turner · Revis Associates

June 1985
Round 2
$2.8M
Original investors; Massachusetts Capital Resource Company; Paine Webber Ventures

ALLIANCES

NCR
November 1983
CSi and NCR entered into an exclusive technology licensing and sourcing agreement under which CSi will design and resell cell-based and gate array products in New England. The products use NCR's 3.0-micron CMOS and NMOS technologies. NCR provides manufacturing.

September 1986
NCR licensed CSi's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSi's library was built from NCR's existing library.

FutureNet
March 1984
CSi offered its standard cell library on the FutureNet DASH design system.

VIEWlogic
October 1985
CSi offered its standard cell library on VIEWlogic's Workview PC-based workstation. The library includes 165 digital primitives and 7,400 TTL macrocells.

Motorola
August 1986
CSi agreed to act as the northeastern independent design center for Motorola.

SERVICES

Wafer fabrication agent

MANUFACTURING

Technology

3.0-, 2.0-, and 1.5-micron CMOS and bipolar

Facilities

Lowell, MA
12,000 sq. ft.
Design

CSi has a long-term licensing and sourcing agreement with NCR, which provides preferred access to multiple manufacturing facilities.

PRODUCTS

CMOS Standard Cells

Device	Description
Micro Blocks Family	200 Cells Including Adders, ALUs, Multiplexers; Dual-Port RAMs; Multiplexers, Shift Registers; and Three-State Bus Drivers
TTL Macro Cells	Encoders, Decoders, Adders, Shift Registers, Multiplexers, Counters
Supercells	ROM, RAM, EEPROM, PLA, MPU, Timer, SCSI Controller
Analog Cells	General-Purpose Op Amp and Comparator, 8-Bit A/D and D/A Converter, Current-Bias Generator, Analog Switch, Oscillators

CMOS Gate Arrays

Family	Linewidth (Microns)	Delay (ns)	Gates
HCA 6200	2.0	1.9	2,430 to 4,860
HCA 6300	3.0	2.5	648 to 2,295
HCA 62A00	2.0	1.1	600 to 8,558

CMOS Standard Cells (Continued)

Bipolar Gate Arrays

Family	Technology	Delay (ns)	Gates
MCA ECL	ECL	0.5	652 to 2,500
MCA ALS	TTL	1.1	500 to 2,800
MCA ETL	Mixed ECL/TTL	1.1	2,950

OTHER INFORMATION

Custom Silicon does not employ a PR firm.

Dallas Semiconductor Corporation

4350 Beltwood Parkway
Dallas, TX 75244
214/450-0400
Fax: 214/450-0470

ESTABLISHED: February 1984 **NO. OF EMPLOYEES: 500**

BACKGROUND

Dallas Semiconductor Corporation designs, manufactures, and markets low-power CMOS memory, linear, and microcontroller circuits and subsystem products. The Company is an applications-oriented supplier that uses proprietary late-definition techniques to customize wafers after test and characterization. This flexibility, called soft silicon, is achieved through the use of lithium power sources, direct laser writing, high-energy ion implantation, and subsystem integration.

The resulting products offer OEMs the advantage of adding functionality without the redesign of existing systems. Some of the more innovative products are the Company's intelligent sockets, which add features such as nonvolatility and timekeeping ability; timekeeping circuits, which replace up to 20 discrete components in the IBM PC AT and PS/2-compatible computers; silicon timed circuits, which replace crystal and discrete components and feature-precise, system-signal timing; security products, which protect software from unauthorized use; teleservicing products that provide the capability to perform remote software upgrades and service equipment anywhere in the world over the telephone line; chips that provide the structure for two-way data transmission through the air, resulting in wireless, automatic identification; and a family of modular chip-laden subassemblies that snap into locking connectors for rapid construction of electronic systems.

In August 1984, Dallas purchased Commodore's Texas plant for $3.5 million. Until early 1987, the Company purchased all wafers and completed its late-definition technique at its plant in Texas. In 1987, Dallas completed construction of a $10 million wafer fabrication facility adjacent to its headquarters. The facility was expanded in 1988 to increase capacity. It includes a 10,420-square-foot, Class 1 clean room and has the capacity to produce 6-inch CMOS wafers with geometries down to 0.6-micron. Currently, Dallas processes about 90 percent of its wafer needs.

Dallas Semiconductor ships its wafers to assembly contractors in the Philippines and Korea for separation and packaging. It conducts burn-in and final testing on its devices and conducts its own subsystem assembly.

Dallas markets to OEMs in the United States, Canada, Europe, and Asia. The Company uses a direct sales force, worldwide distributors, and authorized manufacturers' representatives.

BOARD
(Name and Affiliation)

*C. Vin Prothro, Chairman
Dallas Semiconductor Corporation

*John Smith, Jr.
Dallas Semiconductor Corporation

Chao C. Mai
Dallas Semiconductor Corporation

M.D. Sampels
Worsham, Forsythe, Sampels, and Wooldridge

Richard L. King
Ventech Partners, L.P.

C. Richard Kramlich
New Enterprises Associates

Carmelo J. Santoro
Silicon System, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*John Smith, Jr.
Mostek, Facilities Dir

CEO
*C. Vin Prothro
Mostek, President, CEO, Chairman

VP Mfg
*Chao Mai
Mostek, VP R&D

VP Mktg & Prod
*Michael Bolan
Southwest Ent., Mgr Tech Planning Development

VP Sales
Sandy Scherpenberg
Mostek, Applications Engineer

Controller
Michael Pate
Arthur Young & Co., Senior Auditor

*Founder

FINANCING

February 1984
Seed
$2.0M
Abingworth Ltd., New Enterprises Associates, Southwest Enterprises Associates; Ventech Partners

June 1984
Round 1
$10.8M
Initial investors; Arscott, Norton & Assoc.; Crossroads Capital; First Source Capital Corp.; John Hancock Venture Capital Fund LP; Merrill, Pickard, Anderson & Eyre; New Venture Partners; Oak Investment Partners; Republic Venture Group; J.F. Shea & Company; Venture Growth Associates

Industrial Bond
$6.5M
Republic Bank, Dallas

March 1986
Round 2
$15.0M
Previous investors, British Petroleum Ventures, Alex Brown & Sons, Emerging Growth Stocks, HLM Partners, Merifin N.V.

April 1987
Round 3
$5.0M
Abingworth Ltd., Alex Brown & Sons, British Petroleum Ventures, Emerging Growth Stocks, HLM Partners, Merifin N.V., New Enterprise Associates, Southwest Enterprises Associates, T. Rowe Price, Threshold Fund, Ventech Partners

September 1987
$35.1M
Initial public offering

RECENT HIGHLIGHTS

Q1 1987
Dallas began producing wafers in a newly constructed, $10 million wafer fabrication facility adjacent to its headquarters.

February 1987
Dallas offered the DS2167 digital signal processor (DSP) said to double the link of full-duplex telephone transmission lines. The DS2167 combines a DSP with the adaptive differential pulse code modulation (ADPCM) standard.

March 1987
Dallas offered the DS5000 8-bit CMOS soft MCU, which features nonvolatile technology designed to preserve all information in the absence of power.

October 1987
Dallas offered 3.75 million shares of common stock at $9 per share in an initial offering and raised $36 million. The proceeds will be used for capital equipment and general corporate purposes.

October 1987
Dallas offered the DS1207 CMOS Timekey circuit designed to control access to PC software packages for specified periods of time.

May 1987
Dallas and Xecom signed a second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies will also cooperate on developing and manufacturing future modem-related products, the area of Xecom's expertise.

August 1987
Dallas and Amp, Inc., formed an R&D partnership to solve applications problems with semiconductor technology.

December 1987
Dallas filed a suit against Maxim Integrated Products. The suit was in response to warnings by Maxim that Dallas is violating certain receiver/transmitter patents held by Maxim.

December 1987
Dallas reported fourth-quarter revenue of $9.8 million and a net income of $1.5 million for the period ending December 31, 1987. Fiscal 1987 revenue was $30.7 million and net income was $2.6 million, which included an extraordinary benefit of $954,000.

ALLIANCES

Thomson-Mostek
January 1986
Thomson-Mostek (TCMC) was given royalty-free rights to second-source Dallas' multiport memory. In exchange for these rights, Dallas received an option to purchase a percentage of the products from Thomson. Dallas also received laser production equipment from Thomson and received technical information on TCMC's MK4501 FIFO.

Xecom
May 1987
Dallas and Xecom signed a three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies also agreed on the joint development of and manufacture of future modem-related products, the area of Xecom's expertise.

Amp
August 1987
Dallas and Amp, Inc., formed an R&D partnership that will develop innovative interconnect techniques.

MANUFACTURING

Technology

3.0- to 0.6-micron CMOS
6-inch wafers

Facilities

Dallas, TX
150,000 sq. ft.
Manufacturing area and a 10,420-square-foot Class 1 clean room

60,000 sq. ft.
Warehouse, offices

PRODUCTS

SRAMs
16K, 64K, 256K, and 1024K Nonvolatile SRAMs, and a 1024K Serial RAM

Multiport Memory Chips
512x9, 1024x9, 2048x9, and 4096x9 FIFOs and a quad-port Serial RAM

Microcontrollers
8-Bit Soft MCUs, 8-Bit Time MCUs, CMOS Microcontrollers, Evaluation Kits, Development Kits

Linear Telecommunications Circuits
Transceivers, Line Monitor and Line Interfaces, Network Interfaces, ADPCM Processors, Receiver Buffers

Timekeeping Devices
Clocks, Timekeepers, Clock plus NV SRAMs, Clock plus RAMs

Intelligent Sockets
Lithium-powered sockets—inserted CMOS RAMs become nonvolatile, some with timekeepers

Silicon Timed Circuits
5-Tap, 10-Tap, 3-in-1, and 7-in-1 Delay Lines

Security Products
Electronic Security Devices, Encrypted Keys, Time Keys, Electronic Keys

User-Insertable Memory
Memory Cartridges, Electronic Key Adaptors, Electronic Tags, PC Ports

Integrated Lithium Battery Backup
Lithium-powered NV controllers, Power Packs, Power Monitors, NVRAM Controllers

Systems Extensions
RS-232 Transceivers, Serial Ports, BankSwitches, Configurators, Micro Monitors, Micro Managers

SipStick Prefabs
FIFO, SRAM, DRAM, DAA, ADPCM, SoftModem, and Micro Packaging Options

Wireless Products
Proximity Key and Tags, Micro Power Receiver/Interpreters, Bytewide to Serial Converters, RF Communicators, Wireless SipSticks, Starter Kits

Teleservicing Components
TelelMicro Cartridges, Teleservicing Kits, 212A Modem Modules, Data Access Arrangements, Modem Evaluation Kits

OTHER INFORMATION

Dallas Semiconductor's PR firm is Simon McGarry.

Dolphin Integration SA

8, Chemin des Clos-ZIRST
38240 MEYLAN, France
33 (76) 41-10-96

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 20**

BACKGROUND

Dolphin Integration SA provides design, marketing, and fabrication subcontracting for selected niche market ICs and related software. The Company was launched as a design center and has developed a set of portable design rules for 2- to 1-micron CMOS technology. Dolphin's design rules adapt to any silicon foundry's process. Dolphin has enlarged its catalog of design rules to include analog technologies using double-poly from 3.0 to 1.5 micron. The Company has also developed signal-processing and protocol ICs.

BOARD
(Name and Affiliation)

Michael Depeyrot, Chairman
Dolphin Integration SA, President

Jean Gouliardon
SAGEM International

Michael Capart
EPICEA

Bernard Michelon
SOGINNOVE

Pierre Faurre
SAGEM, Chairman

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Michael Depeyrot
Thomson Semiconductors, VP Engr

PRODUCTS

Developmental Tools

VAX Network with Three Families
Tektronix X115, MicroVAX II, and COMPAQ 396
ECAD Software (ICAP and MASKAP)
LoF Cell Generator

OTHER INFORMATION

Dolphin Integration does not employ a PR firm.

FINANCING

1985
Initial
$600,000
EPICEA, SAGEM, SOGINNOVE, and founders

ALLIANCES

Dolphin has entered an agreement with a CAD/CAM group in California.

SERVICES

ASIC Design

MANUFACTURING

Technology

DIGIT—2.0- to 1.0-micron double-metal CMOS
DIANA—3.0- to 1.5-micron analog CMOS
DIXIE—Mixed high-power (BiMOS) and low-voltage CMOS

Facilities

Not available

The DSP Group Inc.

1900 Powell Street, Suite 1120
Emeryville, CA 94608
415/655-7311
Fax: 415/655-7537

ESTABLISHED: October 1988 **NO. OF EMPLOYEES: N/A**

BACKGROUND

The DSP Group Inc. was founded in October 1988 to develop technologies for a variety of applications, specializing in digital signal processing. The Company currently offers products in the telecommunications market. The DSP Group develops algorithms using digital signal processing as applied to voice/speech modification and enhancement.

The Company has a variety of technologies that it embeds in general-purpose digital signal processing chips. These chips are sold to OEMs, mostly high-volume consumer product manufacturers. DSP Group technologies, which can be used individually or in combinations, include noise reduction, voice-activated switching, voice compression, echo cancellation, voice recognition, and voice synthesis.

The DSP Group's current and future product offerings reflect these technologies. The Company currently is shipping telephone answering machine chip sets and cellular telephone chip sets. By the end of 1990, the company plans to have dictating equipment chip sets and integrated telephone/facsimile chip sets in volume production.

To date, the DSP Group has raised nearly $4.5 million in three rounds of financing, provided by private, corporate, and venture capital sources. All manufacturing is subcontracted; design and headquarters operations are located in the Company's Emeryville, California, facility. The DSP Group also has a subsidiary located in Israel.

BOARD
(Name and Affiliation)

Davibi Gilo
  The DSP Group, President

Donald Yost
  Dey Corporation/The DSP Group

Herman Fialkou
  PolyVenture

Shelton Wert
  Investor Group—Minneapolis

COMPANY EXECUTIVES
(Position and Name)

President
Davibi Gilo

VP R&D
Shabtai Albersberg

VP Mktg
Don Yost (Acting)

VP Finance
Gibi Bartak

GM Israel Operations
Zvi Slomimski

FINANCING

Round 1
$1.2M
  Davibi Gilo

Round 2
$750,000
  PolyVenture

Round 3
$750,000
  Minneapolis Group

Round 4
$1.8M
  Marubun-Japan

MANUFACTURING

Technology

DSP subcontracts all manufacturing.

Facilities

Emeryville, CA
Design, marketing, headquarters

Israel
R&D

PRODUCTS

Telephone Answering Machine Chip Sets
Cellular Telephone Chip Sets
Digitating Equipment Chip Sets
Integrate Telephone/Fax Chip Sets

OTHER INFORMATION

The DSP Group's PR firm is Paul Pease.

Edsun Laboratories, Inc.

564 Main Street
Waltham, MA 02154
617/647-9300

ESTABLISHED: 1984 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Edsun Laboratories was formed in 1984 by Steve Edelson. Edsun currently offers memory and modem controller chips as well as a chip used in PC accelerator boards. Edsun's flagship product, however, is the Continual Edge Graphics (CEG) color-palette DAC chip. The Company's mission is to enhance the graphics capability of PCs, workstations, and other display environments dramatically through its patented CEG technology.

Edsun's DAC chip is designed to improve the performance of VGA-based PC graphics dramatically. The Company claims that it will enhance the effective resolution of a 640 x 480-pixel screen to the equivalent of a 2,000 x 2,000-pixel screen. Edsun also claims that the chip will increase the effective number of colors in an 8-bit system from 256 to 700,000. It will smooth jagged PC graphics to the point where they rival those seen on high-resolution monitors used in engineering workstations or CAD/CAM systems. This new chip will allow existing graphics boards to be upgraded without modification or redesign. The circuit achieves high-resolution simulation by determining a shading value for the edge pixel and blending the shades to the new appropriately weighted color, giving the appearance of a perfectly smooth edge.

Edsun subcontracts all fab and assembly operations to outside companies. The Company conducts some test operations in-house. Although Edsun will continue to support its other existing products, the Company will focus on the development of a family of CEG products in the future. The Company plans to eventually offer CEG for PCs, laptops, and workstations.

BOARD
(Name and Affiliation)

*Steve Edelson, Chairman
Edsun Laboratories

Richard Simon
Edsun Laboratories, President

Ted Dintersmith
Aegis Funds, General Partner

Jerry Fishman
Analog Devices, Executive VP

Peter Santeusanlo
Hambro International Ventures Fund

COMPANY EXECUTIVES
(Position and Name)

President
Richard Simon

VP R&D
George Heron

*Founder

FINANCING

July 1988
Amount not available
Hambro International Ventures Fund, Aegis Venture Funds

ALLIANCES

Edsun has licensed its CEG technique to Dubner Computer Systems and Calcomp.

MANUFACTURING

Technology

Not available

Facilities

Waltham, MA
10,000 sq. ft.
Design, test, marketing

Edsun Laboratories, Inc.

PRODUCTS

Edsun Continual-Edge graphics
Microchannel Memory Controller (EL2010)
Microchannel Modem Controller (EL2050)
Accelerator Board Chip (EL286-88)

OTHER INFORMATION

Edsun Laboratories does not employ a PR firm.

Elantec, Inc.

1996 Tarob Court
Milpitas, CA 95035
408/945-1323

ESTABLISHED: July 1983 **NO. OF EMPLOYEES: 155**

BACKGROUND

Elantec, Inc., designs, manufactures, and markets high-performance analog circuits using dielectric-isolation (DI) monolithic and hybrid technologies. The circuits are designed to be used in military and high-performance commercial applications. The Company supplies products to more than 25 military OEMs.

Elantec concentrates on high-performance analog IC and hybrid solutions and has identified a niche for very high speed operational amplifiers and buffers in video, page scanner, and fast radar systems. Advanced technologies are employed, including dielectric isolation, which allows very high speed npn and pnp transistors in the same chip.

Initially, Elantec offered alternatively sourced products for National Semiconductor's high-performance multichip amplifiers. In 1985, Elantec introduced its first proprietary monolithic IC that uses both dielectric- and junction-isolation processing techniques. Early in 1986, Elantec expanded into alternatively sourced versions of Harris Semiconductor's components that use a complementary bipolar dielectric-isolation process. Harris-sourced devices include op amps and buffers. Elantec also is developing proprietary devices such as a servo loop controller. In the long term, the Company is considering data acquisition circuits.

One of the key strengths of the Company has been its military program. Elantec's facilities have been qualified by more than 25 major military OEMs including General Dynamics, Hughes, IBM, and Lockheed. The Company's facilities comply with MIL-STD-M38510, MIL-STD-1772A, and MIL-STD-883, Revision C. Elantec was the fourth among approximately 20 companies in the world to be certified to produce hybrid devices to MIL-STD-1772A. Elantec also places a great deal of emphasis on reliability and has adopted a two-for-one guarantee under which a part that fails is replaced with two good devices.

In December 1987, Elantec announced that its wafer fabrication facility in Milpitas, California, is operational. The facility uses its proprietary dielectric-isolation process and is capable of producing 2,000 4-inch wafers per month. Initially, the facility will produce 3-inch wafers. Elantec manufactures all military products onshore, with some commercial assembly done in Southeast Asia.

European operations are managed from London, and Japanese sales are handled by Internix, a Japanese distributor. Marshall, Wyle, and Zeus are signed as North American distributors. Elantec also has regional sales offices in Dallas, Texas, and in Boston, Massachusetts.

BOARD
(Name and Affiliation)

Tom Winter
Burr, Egan, Deleage

George Sarlo
Walden Capital Corporation

Jim Diller
Sierra Semiconductor

David O'Brien
Elantec, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
David O'Brien
PMI, President/CEO

VP Marketing
Dean Coleman
National Semiconductor, Analog Mktg Mgr

VP Operations
Richard Corbin
PMI, VP Technology

VP Sales
Ralph Granchelli
Teledyne Semiconductor, Ntl Sales Mgr

VP Engineering Design
Barry Siegel
National Semiconductor, Std Hybrid

FINANCING

July 1983
Round 1
$2.7M
Venture capital

August 1984
Round 2
$3.1M
ALTA-Berkeley Eurofund; Associated Venture Investors; BNP Venture Capital Corporation; Burr, Egan, Deleage & Co.; International Industrial Interests; Murray Electronics; Pacific Technology Ventures; Paribaven; Thorn EMI Venture Fund; Walden Capital Corporation

August 1985
Round 3
$2.5M
Original investors, Jean Claude Asscher, Paribas Technology, Hytec Investment

December 1986
Round 4
$7.8M
Capital Riksa Trust, CEI, Cypress Fund, Harvard Management, Morgan-Holland, Sequoia Capital, St. James Venture Capital Fund, U.S. Venture Partners, and others

September 1988
Round 5
$7.3M
First Century Partners; Merrill Lynch Venture Capital; Inman & Bowman; Sequoia Capital; U.S. Venture Partners; Morgan-Holland; Burr, Egan, Deleage; Walden Associates; Associated Venture Investors; and Harvard Management

RECENT HIGHLIGHTS

March 1987
Elantec offered the EL2017J/883B monolithic closed-loop servo controller that features both precision linear and high-current switching modes of operation.

May 1987
Elantec offered the EL2020, a 50-MHz current-feedback amplifier that is optimized for video and other applications, with gains between -10 and +10.

September 1987
David O'Brien joined Elantec as president and chief executive officer, and Richard Corbin joined as vice president of operations. Mr. O'Brien replaced Al Vindasius, who left the Company to pursue other interests.

November 1987
Elantec signed an agreement allowing Micro Power to market Elantec's FET power buffers.

December 1987
Elantec announced that its wafer fabrication facility is operational.

ALLIANCES

Micro Power
November 1987
Elantec reached a joint agreement under which Micro Power will market Elantec's FET power buffers (expired).

MANUFACTURING

Technology

5-micron bipolar
4-inch wafers

Facilities

Milpitas, CA
30,000 total sq. ft.
Corporate offices and manufacturing

8,500 sq. ft.
Class 1,000 clean room

PRODUCTS

Device	Description
EL2003/2033	Video Line Driver
EL2004	350-MHz FET Buffer
EL2005	High-Accuracy Buffer
EL2006	Precision High-Speed FET Amplifier
EL2007	Precision Servo Driver
ED2015	350-MHz Quad PNP
EN2016	300-MHz Quad NPN
EL2017	Servo Controller
EL2018	Fast, High-Voltage Comparator with Latch
EL2019	Fast, High-Voltage Comparator with Master/Slave Flip-Flop
EL2020	50-MHz Current-Mode Feedback Amplifier
EL2022	165-MHz Current-Mode Feedback Amplifier
EL2039/2040	Very High Slew, Wideband Op Amp
EL2190	Wideband, Fast-Settling Op Amp
ELH0002	100mA Current Buffer
ELH0021	1A Power Op Amp
ELH0032	High-Speed FET Op Amp
ELH0033	High-Speed FET Buffer
ELH0041	200mA Power Amp
ELH101	2A Power Op Amp
EDH0006	Current Driver
EDH0008	High-Voltage, High-Current Driver
EHA2500	Precision, High-Slew-Rate Op Amps
EHA2520	Uncompensated, High-Slew-Rate Op Amps
EHA2539	Very High Slew, Wideband Op Amp
EHA2600	Wide-Bandwidth, High-Impedance Op Amp
EHA2620	Wide-Bandwidth, Uncompensated Op Amps
EHA2540	Very High Slew Rate Op Amp
EHA5190	Wideband, Fast-Settling Op Amp
EHOS100	125-MHz Buffer
EHOS200	200-MHz Buffer
EL2031	550-MHz Buffer
EHA2400	4-Channel Programmable Amplifier
EL2021	Monolithic Pin Driver

OTHER INFORMATION

Elantec's PR firm is Independent Public Relations Associates.

Electronic Technology Corporation

Wholly Owned Subsidiary of J-TEC
ISU Research Park
2501 North Loop Drive
Ames, IA 50010-8284
515/296-7000
Fax: 515/296-7001

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 14**

BACKGROUND

Electronic Technology Corp. (ETC) provides linear and digital design with an emphasis on linear products. The Company also provides complete fabrication, packaging, and test services and guarantees that production units will be 100 percent compatible with prototypes.

ETC was funded initially by a midwestern consortium of venture organizations. ETC's primary customer base is in the midwestern corridor (extending from the eastern slopes of the Rockies to the Ohio Valley). The Company plans to become the midwest's major supplier and has a close working relationship with the Micro Electronics Research Center at Iowa State University in Ames.

ETC has agreements for foundry services with Exar and Gould Semiconductor. In October 1985, the Company signed an agreement with NCR to establish design centers for cell-based ICs.

BOARD
(Name and Affiliation)

Theodore Johnson, Chairman
J-TEC, President

Len A. van der Have
Electronic Technology Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Len A. van der Have
Datalinear, VP Marketing

Dir Technology
William A. Burkland
Micro Electronics Research Center, Associate Scientist

Dir Operations
Scott P. Yeager
NCR, Field Service Engineer

Dir Quality Assurance
Barbi Jo Cosgrove
Bournes, Inc., Quality Assurance Eng

Fin Mgr
Lynn A. Sackett
Clyde Industries, Accountant

FINANCING

1983
Initial
$2.0M
State and venture capital

ALLIANCES

Exar
December 1983
Exar provides foundry services for ETC.

AMI
1984
ETC and AMI signed agreements covering 3.0- and 5.0-micron, single-layer metal CMOS gate arrays. AMI provides foundry services.

NCR
October 1985
ETC agreed with NCR to establish design centers for standard cell ICs and to design standard cells for NCR (expired).

U.S. Government
March 1989
Prime contractor—federal government contract

SERVICES

Custom Design
Manufacturing
Packaging
Test
Military Standard Testing

PRODUCTS

Industry-Standard (20V) Array with 11 Arrays
High-Voltage (75V) Array with 1 Array
BiFET (36V) Arrays with 3 Arrays
Cellular (20V) Array with 1 Array
2.0-micron Bipolar Digital
5.0-micron Cell Custom Linear Digital/Bipolar
1.25 to 9.0-micron CMOS Digital
8.0-micron PMOS

OTHER INFORMATION

ETC does not employ a PR firm.

MANUFACTURING

Technology

2.0-, 5.0- and 9.5-micron CMOS
Bipolar

Facilities

Ames, IA
7,850 sq. ft.
Total space
500 sq. ft.
Class 100 clean room

Epitaxx Inc.

3490 U.S. Route One
Princeton, NJ 08540
609/452-1188
Fax: 609/452-0824

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 50**

BACKGROUND

Epitaxx Inc. produces indium gallium arsenide phosphide (InGaAsP) light-emitting diodes, lasers, and photodetectors for fiber-optic and infrared instrumentation applications. The Company also supplies InGaAsP using a proprietary crystal growth technique called vapor phase epitaxy (VPE), which allows the elements to be deposited from gases. Custom services include 2,000 and 2,500nm photodiodes, detector arrays, and pulsed laser diodes. Epitaxx sells its components to telecommunications vendors, such as GTE and ITT, and to fiber-optic companies such as Fibercom and Plantronics Wilcom.

In order to expand its products, Epitaxx conducts R&D sponsored by industry and the government. The following are some of the Company's development activities:

- InGaAs linear arrays for use in spectroscopy and imaging and airborne communication
- Extended-range sources and detectors for optical sensors and transoceanic communications applications
- InGaAs avalanche photodiodes for optical communications and sensors, range finding, and instrumentation applications
- 5mm InGaAs visible response (500 to 1,700nm) detectors for optical test and calibration and temperature sensors

The Company was founded by Dr. Gregory Olsen and Dr. Vladimir Ban, former research scientists at the RCA David Sarnoff Research Laboratories in Princeton, New Jersey. The founders developed the VPE applications while employed there.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Dr. Gregory Olsen
RCA, Scientist

Exec VP
*Dr. Vladimir Ban
RCA, Scientist

Marketing VP
Yves Dzialowski
General Optronic, Foreign Sales Manager

Finance VP
James Coleman
Lenox China, Account Exec

*Founder

FINANCING

March 1984
Round 1
$1.5M
DSV Partners, Warburg Pincus

RECENT HIGHLIGHTS

February 1988
Epitaxx announced that the Company was selected by the NASA Goddard Space Flight Center for a Phase-II Small Business Innovative Research (SBIR) contract to develop large-area InGaAs photodetectors for the 500 to 1,700nm spectral range.

March 1988

Epitaxx announced that the Company was awarded a $50,000, Phase-I SBIR contract by NASA's Goddard Space Flight Center to develop a linear array of InGaAs detectors. The array will have a minimum of 32 elements (30 x 30 microns each) and will be installed in a commercial multiplexer readout. Epitaxx plans to apply for a Phase-II program based on linear arrays of InGaAs detectors that are sensitive over the 0.8- through 2.2-micron spectral range.

April 1988

Epitaxx exhibited the following infrared components at CLEO '88:

- Edge-emitting LEDs (1,300 and 1,550nm) in a low-cost pigtailed package for local communication and optical instrumentation
- Large-area (0.5 to 3.0mm) InGaAs detectors for gyroscopes, gas sensors, space photography, SWIR detection, and fiber-optic test instrumentation
- High-speed, small-area, planar InGaAs PIN photodiodes for light-wave and range-finding receivers

ALLIANCES

Not available

MANUFACTURING

Technology

InGaAs

PRODUCTS

Device	Description
Epitaxx 1300	High-Power LEDs, 1,550 and 1,300nm
ETX60B	PIN InGaAs Photodetector, Low Capacitance and High Speed, 1,300 and 1,550nm
ETX75/100/300	InGaAs PIN Photodetectors, 900 to 1,700nm, with High Responsivity
ETX75F/100F	InGaAs Fibered Photodetectors with Low Dark Current and Capacitance, 1,300 and 1,550nm
ETX500/1000/2000	InGaAs Photodetectors, for Low Noise Measurements of Long Wavelengths (900 to 1,700nm)
ETX3000	Large-Area (3mm) InGaAs Photodetector for Low Noise Detection in the 0.8- to 1.7-Micron Spectral Range
ETX2550	InGaAs 2.5-micron
ETX-Array	256 element InGaAs Detector Array

OTHER INFORMATION

Epitaxx does not employ a PR firm.

European Silicon Structures

Headquarters
IndustriestraBe 17
8034 Germering, West Germany
089/8 49 39 0
Telex: 089/8 49 39 20

Hollybank House
Mount Lane
Bracknell, Berkshire
England
0344/525252
Fax: 0344/59412

72-78 Grande Rue
92310 Sevres, France
01/46264495
Fax: 01/45071423

ESTABLISHED: September 1985 **NO. OF EMPLOYEES: 150**

BACKGROUND

European Silicon Structures (ES2) was formed to design, develop, and offer quick-turn silicon prototyping and low-volume production (less than 50,000 units) of application-specific ICs for the European marketplace. The Company's objectives are to make ASIC design and production capability available to European systems manufacturers, generate a CAD product line, and offer fast turnaround with the use of e-beam technology.

The Company's Solo 1000 is based on Lattice Logic's Chipsmith system, and the Solo 2000 is based on the SDA Systems family of integrated CAD tools. Solo 1000 enables designers to produce full-custom and optimized designs and is available on PC AT-based hardware and UNIX-based workstations. Solo 2000 incorporates compiled macro blocks, which include RAM, ROM, PLA, ALU, and others. The Company's capability includes PLDs, optimized arrays, cell-based ICs, and handcrafted custom devices and circuits that will meet MIL-STD-38510 Class-B compliance.

In January 1987, ES2 introduced the ECDM20 CMOS, a process demonstrating subnanosecond gate delay performance. The n-well process features 5V digital CMOS; an epitaxial substrate for high latch-up immunity; and single-poly, two-layer metal using 10 masking steps. All processing is conducted using Perkin-Elmer Aeble 150 e-beam lithography equipment that is now operational.

ES2 is incorporated in Luxembourg and headquartered in Munich, West Germany. ES2's design automation technology is being developed by its software technology division located in Bracknell, England. The Company's manufacturing technology division is responsible for silicon manufacturing, which is conducted in Rousset, France, near Aix-en-Provence.

In November 1987, ES2 was granted a loan of $9 million by the Banque International and the European Investment Bank. The funds are being used to build ES2's production plant, called the Rousset Technology Center, at Rousset in southern France. The four-year loan is part of a larger financing package that could total $18 million. The manufacturing division also operates the Aeble 150 machine at the Exel Microelectronics plant in San Jose, California.

In 1987, ES2 acquired Lattice Logic and turned the Silicon Valley design arm of Lattice Logic into an ES2 design center named United Silicon Structures that serves the United States. Also in late 1987, ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

Through its own R&D and in conjunction with industrial partners and universities, ES2 is developing proprietary silicon compilation tools and is working to establish a set of standards for the European market.

BOARD
(Name and Affiliation)

Robert Wilmot, Cochairman
Wilmot Enterprises

Robert Heikes, Cochairman
Entrepreneur

Jean-Luc Grand-Clement
European Silicon Structures, CEO

Pierre Lesieur
European Silicon Structures, VP Finance

Viscount Etienne Davignon
Societe Generale de Belgique, Director

Albert Kloezen
EuroVenture, Benelux, Managing Director

Elserino Piol
Ing. C. Olivetti & Co., Executive Vice President

Klaus Volkholz
Philips International BV, Director of Corporate Planning

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO/Mng Dir
Jean-Luc Grand-Clement
Motorola, VP Europe Group

VP Fin/Admin
Pierre Lesieur
Motorola, Dir Finance

VP/Dir Ops
Rod Attwooll
TI, Mng Dir Bedford

VP/Mfg
Bernard Pruniaux
Thomson CSF, Dir Opns

VP/Dir S/W Tech
John Gray
Lattice Logic, Founder/Mng Dir

VP/Dir S. Europe
J.P. Demange
National Semiconductor, Dir Strat Mktg

VP/Dir Central Europe
H.P. Friedrich
N/A, Mng Dir

Wfr Fab Mgr
Francis Courreges
Sierra Semiconductor, Prod Eng Mgr

Dir Technology
Eric Demoulin
Thomson-CSF, Dir MOS Tech

FINANCING

1985
$5.0M
Advent, London; Techno-Venture Mgmt. Corp.

December 1985
$25.0M
Brown-Boveri and CIE (Switzerland), Ing. C. Olivetti & Co. (Italy), N.V. Philips (the Netherlands), Saab-Scandia AB (Sweden)

January 1986
$5.0M
British Aerospace

November 1986
$9.0M
Banque International a Luxembourg; European Investment Bank

ALLIANCES

Lattice Logic
1985
ES2 signed an agreement with Lattice Logic to market Lattice's logic compiler in Europe.

1987
ES2 acquired Lattice Logic. ES2 had been marketing Lattice Logic's compilers in Europe since 1985.

British Aerospace
January 1986
British Aerospace invested $5 million in ES2.

SDA Systems
January 1986
ES2 signed an agreement to market SDA Systems' design systems throughout Europe and to use them in a number of planned design centers.

Philips-Elcoma/Texas Instruments
May 1986
ES2, Philips-Elcoma, and Texas Instruments (TI) agreed to cooperate on the SystemCell standard cell library.

February 1987
ES2, Philips, and TI signed an agreement covering manufacturing of the SystemCell. TI and Philips would supply volume parts; ES2 would provide prototypes and low-volume quantities.

Philips
February 1988
ES2 and Philips announced an agreement that ensures rapid prototyping and high volumes of ASICs for customers worldwide implemented in Philips' standard 1.5u dual-layer metal CMOS process.

Mitsui & Co.
October 1987
ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

United Silicon Structures
January 1988
ES2 established US2, a U.S. partner.

SERVICES

Quick-turn ASIC prototyping
Low-volume production

MANUFACTURING

Technology

2.0-micron, double-metal CMOS
1.25-micron, double-metal (1988)
E-beam on 5-inch wafers

Facilities

Munich, West Germany
Headquarters

Bracknell, England
11,800 sq. ft.
Software products

Rousset, France
16,147 sq. ft.
Manufacturing, assembly, test

8,600 sq. ft.
Fab area

PRODUCTS

Development Tools

Device	Description
Solo 1000	A Low-Cost Development System with up to 5,000 Gates: Schematic Capture, Simulation, Layout, Back Annotation
Solo 2000	Advanced Software, Full-Custom Modules for ASICs with up to 150,000 Transistors: Structure Compiler, 250 Cells, Module Generators, Test Analyzer, Simulation, Automatic Place and Route

OTHER INFORMATION

ES2's PR firm is Bood and Partners.

Exel Microelectronics Inc.

2150 Commerce Drive
San Jòse, CA 95131
408/432-0500
Fax: 408/432-8710

ESTABLISHED: February 1983 **NO. OF EMPLOYEES: 280**

BACKGROUND

Exel Microelectronics Inc. designs, develops, and manufactures nonvolatile memory and microcomponent devices for the EDP, industrial controls, automotive, telecommunications, military, and robotics markets.

The Company leveraged its proprietary EEPROM expertise into a broad base of EE technology-based, high-performance, low-power products including bipolar PROM replacements, UV-EPROM replacements, and PLDs. Exel was the first to offer high-density, 55ns CMOS, 16K EEPROMs and was one of the first to move into 6-inch wafer production. In the long term, Exel plans to develop microcomponent products with on-chip EEPROM memory.

In February 1986, Exel Microelectronics was acquired by Exar Integrated Circuits for $5.5 million. In August 1988, Rohm Co., Ltd., acquired 81 percent of Exel from Exar. Exel now is an operating unit of Rohm.

BOARD

Kozo Sato, Chairman of the Board
Kenichiro (Ken) Sato
Yoshiaki Odani
Takashi (Todd) Kobayashi
Edwin M.W. Chow

COMPANY EXECUTIVES
(Position and Name)

President/Secretary
Takashi Kobayashi

Vice President
Edwin M.W. Chow

CFO
Shigeru (Fred) Sasa

FINANCING

February 1983
Initial
$1.0M
Sirjan L. Tandon

July 1983
Round 1
$5.5M
Private Placement

Round 1
$5.5M
Lease Line

September 1984
Round 2
$10.5M
BancBoston Ventures; Bay Partners; CH Partners; Chase Manhattan; Crown Advisors, Ltd.; Hambrecht & Quist; Horsley Keogh & Assoc.; Hutton Venture; IBM Retirement Fund; Montgomery Securities; Orange Nassau; Paribas Technology; Prudential-Bache; Riordan Venture Mgmt; Rothschild, Unterberg & Towbin Ventures; J.F. Shea & Co.; TA Assoc.; 3i Ventures

August 1985
$13.5M
Cable, Howse, & Cozadd; Hambrecht & Quist; Horsley Keogh & Assoc.; TA Associates

February 1986
$5.5M
Acquired by Exar Corporation

August 1988
$40.0M
Rohm acquired 81 percent of Exel

June 1989
$6.5M
Remaining 19 percent of Exel acquired by Rohm.

Exel Microelectronics Inc.

RECENT HIGHLIGHTS

February 1986
Exar completed its $5 million acquisition of Exel.

October 1987
Exel's Class 10 CMOS fabrication facility met MIL-STD-883C specifications. The first devices to be compliant with this specification are the XL2864B 8Kx8 EEPROM and the XL78C800 EPLD.

November 1987
Exel offered the XL46HC64, a CMOS 64K EEPROM with a 35ns access time. The device can be erased in 10 milliseconds and reprogrammed and retested at least 10,000 times.

ALLIANCES

Samsung Semiconductor
1983
Samsung entered into a joint development project to act as a second source for Exel's forthcoming 16K EEPROMs (expired).
May 1985
The prior Samsung agreement was extended to include second-sourcing for 64K EEPROMs.

Paribas Technology
September 1984
Paribas took part in second-round financing.

Oki Electric
March 1985
Oki is a second source for Exel's 2Kx8 NMOS EEPROM and produces 64K EEPROMs.

Exar
February 1986
Exar completed its $5.5 million acquisition of Exel.

MANUFACTURING

Technology

NMOSE2	2.0-micron design rules
CMOSE2	1.5-micron design rules
EXCMOS3	1.5-micron, dual-metal
5-inch wafers	

Facilities

San Jose, CA
62,500 sq. ft.
12,000 sq. ft.
Class 10 clean room

PRODUCTS

EEPROM

Device	Organization	Process	Delay (ns)
XL2804A	512x8	NMOS	250
XL2816A	2Kx8	NMOS	250
XL2817A	2Kx8	NMOS	200
XL2864A	8Kx8	NMOS	200
XL2865A	8Kx8	NMOS	200
CMOS PROM			
XL46C15	2Kx8	CMOS	55

Programmable Logic Device

78C800	CMOS ERASIC Family, 600 to 800 Gates
XL93C46	1K Serial CMOS EEPROM
XL26008	PLD development system (ERASIC family)
XL26002	PLD software—MultiMap/MultiSim

OTHER INFORMATION

Exel does not employ a PR firm.

Gazelle Microcircuits, Inc.

2300 Owen Street
Santa Clara, CA 95054
408/982-0900
Fax: 408/982-0222

ESTABLISHED: June 1986 | **NO. OF EMPLOYEES: 53**

BACKGROUND

Gazelle Microcircuits, Inc., was founded to design and market high-performance, digital LSI and VLSI GaAs ICs for high-volume commercial applications such as computation, communication, and military/aerospace. The Company is concentrating on product design and marketing development and does not plan to invest in a wafer fabrication facility.

Gazelle's product strategy is to offer high-yielding, low-cost circuits of large-scale complexity, using existing GaAs fabrication processes. The Company will concentrate on developing unique circuit design approaches to differentiate its performance-oriented devices.

The Company was formed by ex-GigaBit Logic executives Andrew Graham and David MacMillan. In January 1987, Jerry Crowley left Oki Semiconductor, where he was vice chairman and founder, to head Gazelle. In March 1988, Thomas Andrade joined Gazelle as vice president of technology from Pacific Monolithics where he was manager of semiconductor development. Mr. Andrade is responsible for identifying and qualifying the foundries and processes used to fabricate Gazelle's circuits. Before joining Pacific Monolithics, he developed the first of Avantek's microwave IC process and transferred it into volume manufacturing. He was a member of the research staff at IBM, where he did basic research on GaAs fabrication processes and materials. He also did work on NMOS processes, much of which was funneled into the VHSIC project.

In February 1988, Gazelle moved into its new 22,000-square-foot headquarters in Santa Clara, California. The facility is used for engineering development, circuit design, product evaluation, and marketing operations. Gazelle also has an option on an adjoining 24,000-square-foot space.

Gazelle has signed pacts with several U.S. manufacturers to supply GaAs wafers to the firms and plans to offer TTL-replacement devices in 1988.

BOARD
(Name and Affiliation)

Jerry R. Crowley, Chairman
Gazelle Microcircuits, Inc., President/CEO

*David MacMillan
Gazelle Microcircuits, Inc., Vice President

E. Floyd Kvamme
Kleiner, Perkins, Caufield & Byers, General Partner

Philip Young
Dillon Read—Concord Partners, Managing Director

David Hathaway
Venrock Associates, General Partner

Steve Sharp
Power Integrations, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Jerry Crowley
Oki Semiconductor, Vice Chairman

VP Marketing
David MacMillan
GigaBit Logic, Product Manager

VP Engineering
*Andrew Graham
GigaBit Logic, Dir of Memory Development

VP Technology
Thomas Andrade
Pacific Monolithics, Mgr Semi Dev

VP Sales
John Randall
Signetics, Dir Sales

VP Operations
George Schneer
Intel, VP Operations

*Founder

FINANCING

August 1986
Seed
$0.9M
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers

April 1987
Round 1
$5.5M
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates

August 1987
Lease Line
$1.5M
Comdisco, Ventures

April 1988
Lease Line
$2.5M
Comdisco Ventures

September 1988
Round 2
$6.8M
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates; Harvard Management Co. Inc.; JAFCO Ltd.

ALLIANCES

TriQuint
September 1988
Gazelle Microcircuits announced a two-year, $16.9 million gallium arsenide manufacturing contract with TriQuint Semiconductor, Inc., a subsidiary of Textronix.

MANUFACTURING

Technology

GaAs

Facilities

Santa Clara, CA
22,000 sq. ft.
Headquarters, engineering, design

The Company also has an option on an adjoining 24,000 square feet of space.

PRODUCTS

Part No.	Description
GA22VP10-7 GA22VP10-10	24-Pin PLD Superset with Improved Output Macrocells
GA22V10-7 GA22V10-10	24-Pin PLD Superset with Output Macrocells
GA23S8-7 GA23S8-10	20-Pin-Based Sequencer with Output Macrocells and six Buried Registers

OTHER INFORMATION

Gazelle's PR firm is Franson and Associates, Inc.

Genesis Microchip Inc.

2900 John Street
Markham, Ontario, Canada
L3R 5G3
416/470-2742
Fax: 416/470-2447

ESTABLISHED: January 1987 **NO. OF EMPLOYEES: 15**

BACKGROUND

Genesis Microchip Inc. was formed to be a supplier of design services, prototyping, and low-volume quantities of ASICs to the central North American market. Genesis offers gate array, cell-based ICs as well as full-custom design services. Products target the telecommunications, military, and industrial applications markets.

Initially, the Company operates as a Canadian design center for National Semiconductor's CMOS ASIC products under an agreement signed in October 1987. The agreement includes National's gate arrays and cell-based libraries, as well as the full range of design tools. National provides prototyping, volume manufacturing, and assembly and test of all CMOS ASIC devices designed by Genesis, using National's 2.0- and 1.5-micron technologies. National also provides manufacturing for Genesis customers that design custom cells not included in the National libraries.

BOARD
(Name and Affiliation)

W.L. Stapleton, Chairman
Corporate Systems Strategies Ltd.

*Paul M. Russo
Genesis Microchip Inc., President/CEO

*William H. White
Genesis Microchip Inc., Vice President

Jean-Claude Bonhomme
Investor

Marvin J. Singer
Armstrong, Schiralli & Dunne

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Paul M. Russo
GE, General Manager-MEC

Exec VP
William H. White
Harris Semi, Dir Engr Dig Prod

Comptroller
Peter W. Hawley
Consultant

*Founder

FINANCING

August 1987
Round 1
Undisclosed
Private investors

November 1987
Round 2
Undisclosed
Private investors

April 1988
Round 3
Undisclosed
Private investors

ALLIANCES

National
October 1987
National Semiconductor and Genesis signed a design center agreement that covers National's gate array and cell-based libraries and design tools. National provides prototyping and production for CMOS ASICs designed by Genesis using National's 2.0- and 1.5-micron technologies. Genesis operates as National's Canadian design center.

Genesis Microchip Inc.

SERVICES

Design
ASIC prototyping
Low-volume production

MANUFACTURING

Technology

2.0- and 1.5-micron CMOS

Facilities

Genesis plans to build a 100,000-square-foot Canadian fabrication facility that features a Class 10 clean room. The facility will have the capacity for processing 1.5- and 1.0-micron CMOS double-level metal ASICs on 6-inch wafers. The facility will be optimized for quick-turn, low-volume manufacturing and will support MIL-STD-883 conformance.

Markham, Ontario
4,000 sq. ft.
Administration and design

Hull, Quebec
2,000 sq. ft.
Sales, design

PRODUCTS

Genesis offers the full range of National's CMOS gate array (2.0-, 1.5-, and 1.0-micron) and cell-based (2.0-micron) families, including analog, RAM/ROM, EEPROM, and MCU cells. In addition, Genesis can design special cells and full-custom ICs as customer-owned tooling designs for manufacture by National Semiconductor.

OTHER INFORMATION

Genesis Microchip does not employ a PR firm.

GigaBit Logic, Inc.

1908 Oak Terrace Lane
Newbury Park, CA 91320
805/499-0610
Fax: 805/499-2751
Telex: 6711358

ESTABLISHED: August 1981 **NO. OF EMPLOYEES: 120**

BACKGROUND

GigaBit Logic (GBL) designs, develops, manufactures, and markets GaAs standard and application-specific digital ICs capable of 1-GHz to 5-GHz operation. GBL was founded in 1981 by Fred A. Blum and Richard C. Eden. GBL's goal is to be the leader in the commercial digital GaAs IC market, and the company is targeting product segments in the military, mainframe computers, RF communication and instrumentation, and test equipment markets. GBL's strategy is to penetrate high-performance equipment markets by offering products that are five to ten times faster than silicon for comparable prices. GigaBit's sales goal for 1990 is $50 million.

GBL uses sales representatives, distributors, and a direct sales force to sell its products worldwide. Currently, GBL has sales representatives nationwide and franchised distributors in Japan, West Germany, Italy, France, the United Kingdom, Israel, Canada, Sweden, Denmark, Taiwan, Australia/New Zealand, and South Korea.

BOARD
(Name and Affiliation)

John D. Heightley, Chairman
GigaBit Logic, Inc., President, CEO

Heinrich F. Krabbe
Analog Devices, Inc.

Richard C. Eden
GigaBit Logic, Inc.

David B. Jones
Interven Partners, Inc.

Lawrence T. Sullivan
Analog Devices, Inc.

Mark C. Masur
O'Donnel & Masur

Greg Barnum
Cray Research

Ole Steen Anderson
NKT (Denmark)

Chris C. Ellison
DFC of New Zealand

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
John D. Heightley
Inmos, President

VP R&D
Richard C. Eden
Rockwell, Principal Scientist

VP Prod Dev
Frank S. Lee
Rockwell, Design Engr Mktg

VP Sales
James Brye
Vitesse, VP-Marketing/Sales

VP Marketing
Mike Pawlik
Fairchild, Marketing Mgr

VP Finance
Spencer Brown
CR Technology, VP-Finance/CEO

VP Mfg
Bryant M. Welch
Rockwell, Mgr GaAs Technology

FINANCING

March 1982
Seed
$1.0M
First Interstate Capital Corp., Riordan Venture Group, Wood River Capital

November 1982
Round 1
$8.1M
Analog Devices Enterprises, First Interstate Capital Corp., and others

December 1983
R&D Partnership
$6.1M
Kidder, Peabody & Company

February 1985
Round 2
$12.1M
Analog Devices Enterprises, GE Venture Corp., Interfirst Venture Corp., First Interstate Capital Corp., Standard Oil Co., Union Venture Corp.

April 1987
Recapitalization
$14.9M
Analog Devices Enterprises, Cray Research, Digital Equipment Corp., DFC New Zealand, FAIC Capital, Fairfield Equity, First Interstate Capital Corp., GE Venture Corp., Hanover Capital, Interfirst Venture, Interven Partners, New Enterprises Associates, Riordan Venture Group

September 1988
Round 3
$4.1M
Analog Devices Enterprises, DFC New Zealand, Interven Partners, Republic Venture, New Enterprises Associates, Union Venture Corp, Riordan, NKT (Denmark), Canaan Venture, Courtland Investment

RECENT HIGHLIGHTS

January 1987
GBL named its president and CEO, John Heightley, chairman of the board. Mr. Heightley takes over the chairman's post from Heinrich Krabbe, who remains a director. Mr. Krabbe is vice president of new business development for Analog Devices, an investor in GBL.

January 1987
Cray Research placed a $3.2 million foundry order.

April 1987
GBL completed a private placement of convertible preferred stock and raised $14.9 million. The funds were used to recapitalize the company.

April 1987
GBL, Seattle Silicon, and Washington Technology Center (WTC) announced that a joint design project resulted in the fabrication of a functional GaAs IC design that is compiler based (see "Alliances").

May 1987
GBL announced that Cray Research increased its January 1987 foundry order from $3.2 million to $5.5 million. Cray will use the logic and memory devices procured under this order to enter the next phase of development of a GaAs-based parallel processor supercomputer.

July 1987
Prisma Corp., a manufacturer of high-speed computers, is planning to build a GaAs-based, 32-bit, real-time computer using GigaBit's logic devices and other ECL-based memory. The machine will incorporate RISC, will implement Ada language, and will offer performance in the 100- to 200-mips range. The first machine is expected to be shipped by the end of 1989. Future systems are expected to use FORTRAN, C, and Lisp. Prisma is a spin-off from Cray Research and is capitalizing on Cray's research into implementing computers with GaAs.

October 1987
Tachonics and GBL agreed mutually to second-source GaAs standard and ASIC ICs and to codevelop cell libraries to support future GaAs technologies (see "Alliances").

October 1987
GBL achieved profitability.

January 1988
Cray placed a $6.8 million foundry order.

September 1988
GBL and NKT (Denmark) initiated a joint venture—named GIGA—to serve the Europe and Israel markets for ICs (see "Alliances").

November 1988
Cray placed a $29.3 million foundry order.

December 1988
GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo, Japan—signed a marketing and product development agreement. Under the pact, GigaBit Logic will market SC Hightech's GaAs IC products throughout the world, excluding Japan. The agreement also provides the opportunity for codevelopment of future generations of GaAs ICs to the two companies. In addition, SC Hightech may provide foundry services for certain high-volume segments of GigaBit Logic's standard product line.

ALLIANCES

Kidder, Peabody & Company
December 1983
GBL and Kidder, Peabody & Company formed a research and development partnership to develop four ultrahigh-speed GaAs SRAMs.

Cray Research
April 1987
Cray Research is a contributor in the $14.4 million recapitalization of GigaBit Logic. In return, GBL will provide foundry services for Cray in its development of a GaAs-based parallel processor supercomputer, the CRAY-3.

Seattle Silicon, Washington Technology Center
April 1987
GBL, Seattle Silicon, and the Washington Technology Center (WTC) announced that their joint design project had resulted in the fabrication of a functional GaAs IC design based on GBL's cell library; Seattle Silicon's compiler; and WTC's design, engineering support, packaging, and test.

Tachonics
October 1987
GBL and Tachonics agreed mutually to second-source GaAs standard ASIC ICs. GBL also will transfer databases, schematics, and test specs of the PicoLogic cell-based families to Tachonics. The companies will codevelop cell libraries to support future GaAs technologies.

NKT (Denmark)
September 1988
GBL and NKT initiated a joint venture (GIGA) to serve the Europe and Israel markets for ICs. GIGA will provide a full-support design center and management for GigaBit's distributor network for standard products in Europe. This alliance makes GBL the first U.S. GaAs company to have full ASIC development capability based in Europe.

SC Hightech Corporation
December 1988
GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo—Japan, signed a marketing and product development agreement.

PRODUCTS

PicoLogic Digital and Analog GaAs ICs

Gates
Two and three Input NORs, two Input XOR/XNOR/Line Receivers, Dual AO/AOI

Drivers/Receivers/Comparators
2:1 Multiplexed Fanout Buffer, 1:4 Fanout Buffer Complementary Driver/Comparator

Flip-Flops and Registers
Dual-Precision D Flip-Flop, Quad D Flip-Flops with 2:1 MUXed or XOR Inputs, Octal Register/Shift Register and PN Code Generator

MUX/DEMUX/Crosspoint
Quad 2:1 MUX, 3:8 or Dual 2:4 Decoder/DEMUX, Quad 4:1 or Dual 8:1 MUX, 8x8x1 Expandable Crosspoint Switch, 16x16x1 Crosspoint Switch

Counters/Prescalers
2- and 7-Stage Ripple Counter/Dividers, 4-Bit Synchronous Programmable Counter, Variable Modulus Divider

Arithmetic Operations
Dual 9-Bit Parity Generator/Checker and 8-Bit Equivalence Checker, High-Speed 4-Bit Adder, Carry Lookahead Generator, 32-Bit DDS Phase Accumulator

Monolithic FET and Diode Arrays
15 mA Schottky Diode Array, Single Gate MESFET Array, Dual Gate MESFET Array

Fiber Communications Products
8:1 Time Division MUX, 8:1 Time Division DEMUX, Clock and Data Recovery Circuit, Low Power Clock and Data Recovery, 16G040 Demo Board, Transimpedance Amplifier, Laser Driver, LED Driver

Analog/ATE/Instrumentation Products
Phase/Frequency Comparator, Dual High-Speed Pin Driver

NANORAM and NANOROM Memory
256x4-Bit Registered, Self-Timed Static RAM, 1,024x4-Bit Latched Self-Timed Static RAM, 512x8-Bit Mask Programmable ROM

ASIC Products
SC5000 Standard Cell Library
SC10000 Standard Cell Library
GaAs Foundry Services

Prototyping and Support
Evaluation Boards for Transimpedance Amplifiers, Laser Drivers, and LED Drivers, Universal Prototyping Boards (for 36-, 40-, and 68-pin packages), High-Speed Sockets (for 40- and 68-pin leadless chip carriers)

OTHER INFORMATION

GigaBit Logic does not employ a PR firm.

Harris Microwave Semiconductor, Inc.

1530 McCarthy Blvd.
Milpitas, CA 95035
408/433-2222
Fax: 408/432-3268

ESTABLISHED: June 1980 | **NO. OF EMPLOYEES: 65**

BACKGROUND

Harris Microwave Semiconductor (HMS), Inc., was formed to develop and manufacture GaAs-based FETs, MMICs, and digital ICs. In addition to offering standard products, the Company offers full and semicustom capabilities and provides foundry services. HMS is a vertically integrated operation of Harris Corporation's Semiconductor Sector. One hundred percent of the Company's funding has been provided by the Harris Corporation.

The Company has capabilities for manufacturing GaAs crystals and wafers as well as ICs, packaged products, and discrete devices. HMS is said to have the world's largest high-purity GaAs ingot-growing capacity, which produces single-crystal GaAs ingots of up to 7 inches in diameter.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

President/Chief Executive Officer
John T. Hartley

Vice President/General Manager
Dr. Joseph Barrera

Marketing and Sales Director
Vic Kovacevic

FINANCING

Not available

RECENT HIGHLIGHTS

July 1987
HMS offered the HMM-10610, a dual-stage, 2- to 6-GHz, 0.5-micron, medium-power monolithic amplifier in die form.

February 1988
HMS introduced the HMM-10620, a 2- to 6-GHz low-current, cascadable, broadband MMIC amplifier designed to meet the electronic warfare systems' low-current requirements.

May 1988
HMS introduced the HMM-11810, a 6- to 18-GHz low-current, cascadable broadband MMIC amplifier designed to meet the low current requirements of electronic warfare systems.

June 1989
HMS introduced the HMR-1100, a GaAs MMIC Pi Attenuator. The MMIC is a practical solution for slope and gain control in a variety of military components such as amplifiers.

ALLIANCES

Not available

SERVICES

Foundry

MANUFACTURING

Technology

1.0- to 0.5-micron GaAs MESFET
2-, 3-, and 4-inch wafers

Harris Microwave Semiconductor, Inc.

Facilities

Milpitas, CA
37,000 sq. ft. total
15,000 sq. ft. manufacturing space

PRODUCTS

FETs (available in chip or packaged form)

Device	Description
HMF-0300	2-18 GHz, 125 mW Power
HMF-03100-100	2-20 GHz, Low Noise, Gain
HMF-03100-200	2-20 GHz, Gain/Drive
HMF-03100-300	2-20 GHz, Drive
HMF-0330	2-20 GHz, Low Noise, Low Current
HMF-0600	2-20 GHz, 250mW Power
HMF-0610	2-20 GHz, Gain
HMF-0620	2-14 GHz, High Transconductance
HMF-12000-100	2-16 GHz, 500mW Power
HMF-12000-200	2-16 GHz, 650mW Power
HMF-1210	2-20 GHz, Gain
HMF-24000-100	2-14 GHz, 800mW, Power
HMF-24000-200	2-14 GHz, 1.2W, Power

MMICs

HMR-11000	Pi Attenuator, DC-18 GHz
HMR-10502	Analog Amplifier, 0.5-5.0 GHz
HMR-10503	Analog Amplifier, 1-5 GHz
HMM-10610	Broadband Amplifier, 2-6 GHz
HMM-10620	Broadband Amplifier, 2-6 GHz, Low Current
HMM-11810	Broadband Amplifier, 6-18 GHz
HMM-11820	Broadband Amplifier, 6-18 GHz, Low Current

OTHER INFORMATION

Harris Microwave's PR firm is Ketchum Public Relations.

Headland Technology Incorporated

46221 Landing Parkway
Fremont, CA 94538
408/656-7800

ESTABLISHED: April 1989 **NO. OF EMPLOYEES: 200**

BACKGROUND

Headland Technology Inc. was formed in 1988, a result of the merger between G-2 Incorporated and Video Seven. In 1987, LSI Logic Corporation spun off G-2 to sell peripheral logic chip sets for the 80286 and 80386. LSI purchased 20 percent of Video Seven in 1988 and later increased its share to 80 percent. In July 1989, LSI merged G-2 and Video Seven to form Headland Technologies, an independent affiliate of LSI Logic Corporation. Headland maintains separate and independent marketing and engineering organizations. As an affiliate, Headland can draw upon LSI Logic's worldwide manufacturing facilities in the Far East, North America, and Europe. Headland also has access to LSI Logic's 24 design centers located throughout the world. Headland utilizes LSI Logic's HCMOS and BiCMOS process technology, which delivers submicron ICs in mass production.

Headland's initial focus is on the rapidly growing market for graphic and logic products for the IBM PC-compatible market. The G-2/Video Seven merger brings two product focuses under one roof. Video Seven, previously an independent graphics house, will provide Headland with video graphics expertise. In the graphics market, Headland currently offers VGA graphics cards, a single-chip EGA multimode graphics controller, and a VGA chip. Headland plans to offer an 8514A graphics chip set in early 1990 and will also introduce VGA chip sets for flat panel displays. The Company has an existing program with Sun Microsystems to produce a "virtual VGA" card for the 386i workstation. Headland expects to expand this product to other UNIX-based workstations.

Drawing from G-2's focus on PC chip sets, Headland offers a number of logic products. Headland's offerings include a PC AT chip set, a PS/2 Model 30/XT compatible chip, a 386 AT chip set, a 386 SX chip set, and a universal PS/2-compatible chip set. Headland expects to offer SPARC or MIPS chip sets in the near future.

Headland considers Chips & Technologies and Western Digital to be its two major competitors. Headland sells products to both OEM and retail customers. The Company's products will be sold through a mix of direct sales, independent representatives, and retail distribution. Headland has 8 national and 29 international distributors, as well as 2,100 authorized resellers that were acquired as part of the Video Seven holdings. Headland's strong retail sales channels should give the Company an advantage over its competitors, some of which have no retail distributors.

In 1988, G-2 raised approximately $19 million in revenue, and Video Seven reached the $50 million mark. By combining resources and taking advantage of economies of scale, LSI predicts that Headland's revenue could easily triple in 1989 and reach a rate of $200 million per year early in 1990.

In the future, Headland plans to support the new markets created by the integration of computers with all-digital communications and entertainment (i.e., ISDN, HDTV, interactive video), as well as the markets spurred by higher-performance graphics standards such as VGA and by the arrival of Presentation Manager's graphics environment.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

CEO
William J. O'Meara
G2, President

President
Paul Jain
USI International, President

VP, Manufacturing & Operations
Russ Faust
Ferix Corp.

Sr. VP, Research & Development
Don Bryson
Mouse Systems, VP Sales/Mktg

VP, Manufacturing & Operations
Bill Sams
Assisted Technology, VP Mktg

VP, OEM Sales
Fred Brown
LSI Logic, Sales

VP, Retail Sales
Michael Humphress
Mouse Systems, National Sales Mgr

VP, Systems Marketing
Greg Reznick
Mouse Systems, Prod Mgr

VP, Component Marketing
Elvet Moore
Kontron, President

VP, Research & Development
Steve Chan
LSI Logic, VP ASIC design

FINANCING

Not available

RECENT HIGHLIGHTS

April 1989
G-2 and Video Seven merged to form Headland Technologies, Incorporated.

July 1989
The Company's name was officially changed to Headland Technologies, Incorporated from Video Seven, Incorporated.

July 1989
Headland introduced the Video Seven VGA 1024i, a high-performance VGA adapter that enhances the industry-standard VGA.

ALLIANCES

Headland is an affiliate of LSI Logic Corporation.

MANUFACTURING

Facilities

Fremont, CA
Headquarters, marketing, test

Cupertino, CA
Engineering, R&D

PRODUCTS

VEGA Deluxe VGA Card
VEGA VGA Card
FastWrite VGA
V-RAM VGA
EGA Multimode Graphics Controller
Advanced VGA Chip

OTHER INFORMATION

Headland Technology's PR firm is Miller Communications.

Hittite Microwave Corporation

21 Cabot Road
Woburn, MA 01801
617/933-7267
Fax: 617/932-8903

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 12**

BACKGROUND

Hittite Microwave was formed to market custom and proprietary GaAs MMICs for military and commercial applications. The Hittite team has been involved in all aspects of design, development, and production of monolithic GaAs components, including participation in several Department of Defense GaAs technology development programs.

Hittite's expertise ranges from designing small, single-chip systems to 500-watt, continuous-wave, multichip components and subsystems. Hittite's facility is equipped to conduct design, layout, verification, packaging, and test of GaAs-based components. Wafer fabrication is conducted by foundries.

Hittite is part of the General Dynamics, Honeywell, TRW consortium that is addressing the critical technology, fabrication, and cost issues of inserting microwave/millimeter wave monolithic IC (MIMIC) technology into advanced tactical weapons systems. The team has targeted three main mission areas for MIMIC insertions—smart weapons, electronic warfare, and communications.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Pres/COO
Frank Paik
Raytheon, Business Dev Mgr

VP/CEO
*Yalcin Ayasli
Raytheon Research, Mgr R&D Monolithic ICs

CFO
Ronald Kaplan
Wang, Controller

*Founder

FINANCING

Private

ALLIANCES

Hittite is part of the General Dynamics, Honeywell, TRW consortium as part of the Department of Defense MIMIC program.

MANUFACTURING

Technology

0.5- and 1.0-micron GaAs MESFETs

Facilities

Woburn, MA
4,800 sq. ft. total
Offices, R&D, assembly, test

400 sq. ft.
Class 10 clean room

Hittite Microwave Corporation

PRODUCTS

Signal Control Components
Microwave Radar Ranging Systems
Other proprietary products

OTHER INFORMATION

Hittite Microwave does not employ a PR firm.

HNC, Inc.

5501 Oberlin Drive
San Diego, CA 92121
619/546-8877
Fax: 619/452-6524

ESTABLISHED: October 1986 **NO. OF EMPLOYEES: 40**

BACKGROUND

HNC, Inc. (formerly Hecht-Nielsen Neurocomputers) was formed in October 1986 by Robert Hecht-Nielsen and Todd Gutschow with the goal of becoming the leader in developing neural network products and technology and applying them to practical problems. HNC develops, manufactures, and supplies a complete line of high-speed neural network hardware coprocessors and workstations and an extensive package of neural network software.

Neural networks, modeled loosely after the interconnected nerve cells of the human nervous system, represent an information-processing technology that is radically different from traditional sequentially programmed computers. Rather than relying upon an explicit algorithm to perform desired tasks, a neural network is trained by adapting to repeated examples. For this reason, programming is less complicated—which makes development time shorter.

HNC currently is shipping the ANZA family of neurocomputing systems, which consists of three general-purpose neurocomputing coprocessor boards. The boards are available for the IBM PC AT, the Sun 386i, and Sun-3 and Sun-4 workstations. More than 300 HNC neural network hardware systems have been installed worldwide. HNC currently is developing two CMOS VLSI neural chips that utilize RISC technology. The HNC 100X is a general-purpose neural chip that provides two orders of magnitude increase in performance over current processing techniques. The HNC 103X (patent pending) incorporates both vision and image processing capabilities for complex pattern recognition applications. Both chips will be available during the third quarter of 1990.

HNC is targeting commercial and defense/aerospace markets with its neural network technology. Customers include Fortune 500 companies with broad application ranges such as industrial inspection systems, financial credit scoring, EKG noise filtering, chemical plant process control, modeling, machinery diagnostics, and database analysis.

The Company markets its products in the United States to end users and OEMs through a direct sales force with offices in San Diego, California, and Falls Church, Virginia. An international network of distributors provides marketing and sales support throughout Europe, the Far East, India, and Australia.

BOARD
(Name and Affiliation)

Oliver Curme
Battery Ventures

Thomas Farb
Air Fund

Charles Hertzfeld
E.S. Jacobs

Burt McGillivary
Continental Illinois Ventures

Thomas Tranchina
San Diego Fire Supply

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Robert L. North
TRW, Gen Mgr, Elect Sys

VP, R&D
Michael Thiemann
Four-Pi Systems, VP, Marketing

VP, Mktg
Dave Shlager
Lucid, VP, Sales

Exec VP
Gerald Farmer
Gould, Dir R&D

Mkt Comm Mgr
Julie Hotz
Rohr Industries, Marketing Manager

FINANCING

October 1986
Seed
$635,000
Private

June 1987
Round 1
$2.6M
Battery Ventures

June 1988
Round 2
$3.4M
Battery Ventures, Continental, Illinois Ventures, Aetna, E.S. Jacobs, and Ramo Technology

ALLIANCES

The Fusion Group
September 1989
HNC announced a strategic partnership with The Fusion Group to market software utilities designed to integrate neural computing into financial applications. Under the terms of the agreement, HNC and Fusion will develop software interfaces between HNC's ANZA Plus neurocomputing system and both the Sybase Relational Database Manager and Fusion's Market Data Server (MDS).

MANUFACTURING

Technology

1-micron CMOS

Facilities

San Diego, CA
13,000 sq. ft.
R&D, marketing, headquarters, manufacturing, finance

Falls Church, VA
Regional office

PRODUCTS

ANZA
ANZA Plus
ANZA & ANZA Plus Neurocomputing Workstations
ANZA Plus/VME
AXON Neural Network Description Language
Neural Network Development Toolkit
ExploreNet Standalone Neural Network Software

OTHER INFORMATION

HNC's PR firm is Marcom Strategies.

Hualon Micro-Electronics Corporation

9th Floor, No. 61, Chung Shan N.
Road Sec. 2, Taipei, Taiwan R.O.C.
(02) 562-8813 Ext. 768
Fax: (02) 531-3241

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 400**

BACKGROUND

Hualon Micro-Electronics Corporation (HMC) was formed to offer telecommunications ICs, consumer ICs, microcomponents, and ASICs. Initially, the Company will use 2-micron CMOS technology to manufacture its products but has plans to develop CMOS technology to the 1-micron level.

Recently, HMC opened a new 269,097-square-foot fabrication facility in the Hsinchu Science-Based Park. The facility is capable of manufacturing 30,000 5-inch wafers per month. The Company plans to reach a capacity of 60,000 5-inch wafers per month by 1991.

HMC was financed by the Hualon Group for about U.S.$30 million. The Hualon Group's first venture into the IC business was an assembly plant set up in 1984. As its requirements for high-quality ICs that use advanced process technologies increased, the Hualon Group decided to invest in an IC fab.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Vice President
Andrew Oung

FINANCING

1987
Round 1
U.S. $30.0M
Hualon Textile

ALLIANCES

Not available

MANUFACTURING

Technology

5.0-micron metal-gate CMOS
2.0- and 3.5-micron silicon-gate CMOS
3.5-micron NMOS

Facilities

Hsinchu City, Taiwan
269,097 sq. ft.
Total space includes design and manufacturing.

39,900 sq. ft.
Class 1 and Class 10 clean rooms

Hualon announced that its second fab facility in Taiwan will open in September 1990.

PRODUCTS

Consumer IC Family

	Device	Description
Clock	HM 3200	Analog Clock
	HM 3203	3-1/2-Digit Alarm Clock
	HM 3204	World Time Clock

	Device	Description
Watch	HM 3201	3-1/2-Digit LCD Watch
	HM 3202	4-Digit LCD Watch
Home Electronics IC	HM 3701	Touch Dimmer
Calculator	HM 3401	Solar Calculator
Melody	HM 5801	64-Note Simple Melody
	HM 5802	128-Note Simple Melody
	HM 4801	512-Note Simple Melody
	H 66T	64-Note Simple Melody (3-Pin Package)
	H 67T	64-Note Simple Melody (4-Pin Package)
	H 68T	128-Note Doorbell
Voice IC	HM 2005	3-Second PCM
	HM 2005-1	1.5-Second PCM (Piezo)
	HM 2005-2	1.5-Second PCM
	HM 2006	LPC Processor
	HM 2007	Speech Recognition
Organ	HM 5601	Simple Mini-Organ
Microcomponent and Memory IC Family		
System	HM 6667/8	PC AT 16-MHz Zero-Wait Chip Set
Peripheral	HM 666A/B	RS 232x2, Printer Portx2
	HM 82C11	Printer Port
	HM 16450	PC AT Asynchronous Communications Element
	HM 8250	PC XT Asynchronous Communications Element
	HM 6818	PC AT Real-Time Clock
	HM 58167	PC XT Real-Time Clock
	HM 6845/A/B	CRT Controller
Memory	HM 2300/2301	Character Generator
	HM 2333	4Kx8 ROM
	HM 2366	8Kx8 ROM
	HM 23C256	32Kx8 ROM
	HM 6116	2Kx8 SRAM
	HM 6164	8Kx8 SRAM
Telecommunication IC Family		
Telephone Dialers	HM 9100	Pulse Dialer
	HM 9101/9102	Tone/Pulse Dialer
	HM 9105	5-Memory Tone/Pulse Dialer
	HM 9110	10-Memory Tone/Pulse Dialer
	HM 9113	14-Memory Tone/Pulse Dialer
	HM 9114	15-Memory Tone/Pulse Dialer
	HM 9115	Advanced 15-Memory Tone/Pulse Dialer+ARD
	HM 9120	Advanced 20-Memory Tone/Pulse Dialer+ARD
	HM 9187	Tone Dialer

	Device	Description
Peripheral	HM 2004	Voice Processor
	HM 9200	Call-Progress Tone Decoder
	HM 9202/9203/9204	DTMF Receiver Series

OTHER INFORMATION

Hualon does not employ a PR firm.

IC Sensors, Inc.

1701 McCarthy Blvd.
Milpitas, CA 95035
408/432-1800
Fax: 408/434-6687

ESTABLISHED: 1982 **NO. OF EMPLOYEES: 145**

BACKGROUND

IC Sensors, Inc., designs, develops, and manufactures both standard and custom pressure sensors. The Company developed its silicon sensor technology and applied it to design and manufacture a variety of pressure sensors, accelerometers, pressure switches, load sensors, valves and actuators, and other microstructures. The Company's products are used in medical, industrial, automotive, aerospace, and consumer applications.

IC Sensors was formed with funds provided by the founders. The Company received additional funds when it formed a strategic partnership with Borg-Warner. In December 1986, IC Sensors, Inc., and Transensory Devices, Inc., (TDI) completed a merger. TDI was founded in 1982 and developed a micromachining technology that is used to fabricate both custom and standard devices.

In September 1987, IC Sensors introduced a new technology called Silicon Micromachining, which applies semiconductor production techniques to mechanical devices. Micromachined sensors are produced by etching precise micromechanical structures in silicon. As a result, the structure that serves as a mechanical sensing device is also a semiconductor.

The basic elements of the microstructure technology include the photolithographic processes, oxidations, diffusions, thin-film processes, and metallizations common in the IC industry. A number of other processes are used as well, such as wet chemical and dry etch processes, etch stops, double-sided patterning, and multilayer structures.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

CEO
*Donald G. Lynam

President
Dr. James W. Knutti

VP, Marketing and Sales
Frank A. Perrino

VP, Engineering
Henry V. Allen

Chief Engineer
Edward J. Russell

VP, Operations
*Manuel G. Rossell

VP, Finance
Robert Regalia

*Founder

FINANCING

Not available

RECENT HIGHLIGHTS

June 1987
IC Sensors offered the 1210 and 1220—two piezoresistive sensors.

July 1987
IC Sensors offered the 2501, a miniature silicon pressure switch that eliminates the need for comparators, external voltage references, and potentiometers.

July 1987
IC Sensors offered the 410, a general-purpose piezoresistive sensor that is mountable on PC boards.

September 1987
IC Sensors introduced a new technology, silicon micromachining, that applies semiconductor production techniques to mechanical devices.

September 1987
IC Sensors introduced a silicon piezoresistive accelerometer, the Model 3021.

ALLIANCES

Borg-Warner Corp.
Borg-Warner does some manufacturing for IC Sensors, Inc.

PRODUCTS

Pressure Sensors
Accelerometers
Pressure Switches
Load Sensors
Valves and Actuators

OTHER INFORMATION

IC Sensors does not employ a PR firm.

MANUFACTURING

Technology

Not available

Facilities

Milpitas, CA
34,000 total sq. ft.
Headquarters, manufacturing

9,000 sq. ft.
Fabrication area

ICI Array Technology, Inc.

1297 Parkmoor Avenue
San Jose, CA 95126-3448
408/297-3333
Fax: 408/297-3763

ESTABLISHED: 1982 **NO. OF EMPLOYEES: 130**

BACKGROUND

ICI Array Technology offers a variety of technologies to support development and manufacturing of small-footprint subsystem products. The Company emphasizes designing for manufacturability. Subsystem design is supported with ASIC capability in CMOS gate arrays and cell-based-designed ICs. One of the Company's major strengths is surface-mount technology (SMT) and COB technology offered as part of a totally integrated system.

The Company was founded by William Robson, without venture capital, as Array Technology, Inc. In January 1986, the Company was acquired by Imperial Chemical Industries PLC (ICI), a large U.K. chemical company, and renamed ICI Array Technology. Prior to its acquisition, Array Technology funded all activities from its design and consulting fees.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

President
Bernie Aronson

VP, Marketing & Sales
Jack Hullman

Director of Finance
Erik Simonson

Director of Engineering
Dennis Morris

Director of Operations
Rich Frieberger

Program Manager
*Brian Tighd

*Founder

FINANCING

Not available

ALLIANCES

ICI
January 1986
Imperial Chemical Industries Plc (ICI), a large U.K. chemical company, acquired Array Technology.

National
March 1988
National Semiconductor and ICI Array Technology signed an agreement under which ICI Array will use National's design systems and process specifications to develop proprietary ASICs.

MANUFACTURING

Multiple offshore and U.S. sources provide CMOS silicon wafers.

Technology

1.0-, 1.5-, 2.0-, and 3.0-micron, double-layer metal, silicon-gate CMOS designs on Mentor tools

Facilities

San Jose, CA
50,000 sq. ft.
Administration, design, production

ICI Array Technology, Inc.

PRODUCTS

CMOS Gate Arrays

Process	Linewidth (micron)	Delay (ns)	Cells
Si-Gate	1.5, 2.0, 3.0	0.5 to 2.0	RAM, ROM

Digital Gate Arrays

150 to 20,000 gates

Linear Arrays

Semicustom Subsystems

OTHER INFORMATION

ICI Array Technology does not employ a PR firm.

Innovative Silicon Technology

Wholly Owned Subsidiary of SGS-Thomson
1310 Electronics Drive
Carrollton, TX 75006
214/466-6000
Fax: 214/466-6572

ESTABLISHED: May 1986 **NO. OF EMPLOYEES: 160**

BACKGROUND

Innovative Silicon Technology (IST) was formed by SGS-Thomson Microelectronics to meet the growing market demands for advanced ASICs. The Company was formed by Piero Martinotti and others from Motorola to concentrate on quick-turn R&D for the ASIC market. SGS-Thomson, which transferred the assets of its ASIC activities to IST, provides high-volume foundry services, allows access to its design centers by IST engineers and IST customers, and provides sales and marketing support. The assets transferred from SGS-Thomson to IST include technologies, CAD and production hardware and software, R&D capacity, a significant customer base, a consolidated product portfolio, and human resources.

IST conducts R&D, design, prototyping, low-volume production, assembly, and test, and uses 1.2- to 3.0-micron single-, double-, and triple-layer metal and direct-write e-beam technologies. The Company recently opened a new facility in Agrate, Italy, which serves as its worldwide headquarters and includes wafer fabrication and R&D facilities.

Innovative Silicon Technology's products include gate arrays with up to 50,000 gates and a cell-based library with 140 logic cells.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Chief Executive Officer
Pierangelo Martinotti

Director of Central Business
Mario Licciardello

Director of R&D
Roberto Fantechi

Europe/Asia Operating Unit Director
Pietro Palella

QC Director
Ignazio Salvemini

Finance Administration Director
Arrigo Gradi

Director of Human Relations
Marco Bartolozzi

FINANCING

May 1986
Innovative Silicon Technology is wholly owned by SGS-Thomson Microelectronics.

ALLIANCES

CDI
April 1987
IST and California Devices Inc. (CDI) agreed to a joint product development and second-source agreement covering two families of ASICs using channelless architectures. The first family is a 2-micron, double-metal CMOS with up to 24,000 gates. The second family is based on a 1.5-micron technology and will include more than 100,000 gates.

SDA Systems
May 1987
IST signed an agreement with SDA Systems to develop CAD systems based on SDA technology for use by IST customers.

Innovative Silicon Technology

SERVICES

Quick-turn R&D
Foundry

MANUFACTURING

Technology

1.2- to 3.0-micron, double- and triple-layer metal CMOS; 4-inch and 6-inch wafers

Facilities

Carrollton, TX, U.S.
22,500 sq. ft.
Wafer fab, test, marketing, customer support, sales

Agrate, Italy
13,500 sq. ft.
Worldwide headquarters, wafer fab, R&D

Innovative Silicon Technology employs SGS-Thomson design centers in France, Italy, Sweden, the United Kingdom, West Germany, Hong Kong, Singapore, South Korea, and Taiwan.

Assembly operations are conducted in SGS-Thomson facilities in Malaysia, Malta, and Singapore.

PRODUCTS

Gate Arrays

50,000 Gates; 1.2-Micron, Double-Layer Metal designed for Triple-Layer
10,000 Gates; 2.0-Micron, Double-Layer Metal
6,000 Gates; 3.0-Micron, Double-Layer Metal
2,500 Gates; 3.5-Micron, Single-Layer Metal

Cell-Based Library

140 Cells; 3.0- and 1.2-Micron, Double-Layer Metal; Fully Compatible with Gate Array Libraries

OTHER INFORMATION

Innovative Silicon Technology does not employ a PR firm.

Inova Microelectronics

2220 Martin Avenue
Santa Clara, CA 95050
408/980-0730
Fax: 408/980-1805

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 62**

BACKGROUND

Inova Microelectronics designs, manufactures, and markets ultralarge-scale integrated (ULSI) multichip ICs that use waferscale integration technology developed by the Company. Inova has developed a unique interconnect technology called Inroute. Initially, Inova is using Inroute to integrate multiple memory structures at the wafer level to produce a line of high-density SRAMs.

Inroute is based on an architecture of repeatable slices. (A slice is a row of memory structures.) Slices are repeated on the circuit, including spare slices to allow for defects. A second feature of the Inroute technology is the ability to isolate slices for testing. Working slices are identified and their addresses established by means of fuse-programmable logic. Nonfunctional slices are disconnected through a lacing of fuses so that a defect in a single device does not affect the functionality of the entire circuit. A third feature is the use of a universal second metal layer that can be used for all wafers because all nonfunctional circuits have been disconnected. The technology uses standard fabrication methods and equipment and is transportable to CMOS, BiCMOS, bipolar, GaAs, and VHSIC processes.

Inova's product line focuses on applications where the capability of the system to be integrated requires a large area of silicon. The products typically are characterized by having large repetitive sections of silicon, such as the Company's initial product offerings. In June 1988, Inova began volume shipment of the S128K8, a 1Mb CMOS SRAM. The device is built under a foundry agreement with Sharp, using a 1.2-micron, double-metal, double-poly process. The device, which is comprised of 40 base 4Kx8 slices, targets military accounts that previously have used 1Mb SRAM modules with four 256K parts. In addition to the S128K8, Inova currently is shipping the S32K8, a 256K SRAM. The S32K8 is built with the same 4Kx8 slice used in the 1Mb version. These products will be followed by a family of SRAMs that will be developed through different integrations of the base 4Kx8 slice.

Inova will be developing other ULSI products where a monolithic system solution is not possible with traditional design methods. Applications for these products may include telecommunications, systolic arrays, digital signal processing, and image processing. The Company's product lines serve military, commercial, and industrial markets. Inova has received a DESC Standard Military Drawing for its 70 to 120ns products. Future plans include a 25ns SRAM, available in mid-1990, and product lines containing cache controllers and neural network products. Inova also plans to introduce the first commercially available 4Mb SRAM.

In September 1988, Inova acquired LYNX Technology, a start-up company in the memory product business. LYNX becomes Inova's Colorado Springs division and is responsible for the development of SRAMs. The division in Colorado Springs and headquarters in Santa Clara share responsibility for process and technology development. Dr. Ron Bourassa, previously president and CEO of LYNX, is the vice president and general manager of the Colorado Springs division.

BOARD

(Name and Affiliation)

Vaemond Crane
Inova Microelectronics, President

Glenn Penisten
Alpha Partners

Dan Flamen
Comann, Howard & Flamen

Pete Thomas
Institutional Venture Partners

Blair Stewart
Wilson, Sonsini, Goodrich & Rosati

Gene Strull
Westinghouse Electric Corp.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Vaemond Crane
MIPS Computer Systems, President/CEO

VP Marketing
Doug Mitchell
Inmos, Dir Technical Marketing

VP Finance
David Garrett
Stanford Applied Engineering, CFO

VP Operations, Santa Clara
Howard Gopen
Intel, Wafer Fab Plant Manager

VP Operations, Colorado Springs
Ron Bourassa
LYNX Technology, President/CEO

FINANCING

1984
Seed
$2.0M
Alpha Partners

February 1986
Round 1
$5.3M
Alpha Partners, Asset Management, Bryan & Edwards, Glenwood Management, Jupiter Partners, Institutional Venture Partners, Paribus Technology, Ritter Partners, Technology Venture Investors

April 1987
Round 2
$2.5M
Westinghouse Electric Corporation

April 1988
Round 3
$5.0M
All previous investors

RECENT HIGHLIGHTS

June 1988
Inova began shipping the S128K8 1Mb CMOS SRAM.

September 1988
Inova acquired LYNX Technology, a start-up memory company in Colorado Springs, Colorado.

ALLIANCES

United Microelectronic Products
November 1985
Inova and UMP signed a five-year foundry agreement under which UMP will provide base wafers to Inova.

Westinghouse
June 1987
Westinghouse Electric Corporation invested $2.5 million in equity and $2.5 million in lease guarantees. Westinghouse also is working with Inova as part of its strategic long-term technology efforts. The efforts are sponsored by Westinghouse's Advanced Technology Division.

MANUFACTURING

Technology

1.2-micron CMOS

Facilities

Santa Clara, CA
12,000 sq. ft.
Design, test

Colorado Springs, CO
8,500 sq. ft.
Design, process development

PRODUCTS

Part No.	Device Type	Organization	Access Time
S128K8	1Mb SRAM	128Kx8	70 to 120ns
S32K8	256K SRAM	32Kx8	55 to 100ns

OTHER INFORMATION

Inova Microelectronics does not employ a PR firm.

Integrated CMOS Systems, Inc.

440 Oakmead Parkway
Sunnyvale, CA 94086
408/735-1550
Fax: 408/735-9808

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 65**

BACKGROUND

Integrated CMOS Systems (ICS) designs, manufactures, and markets system-level VLSI semiconductors for cost-effective design and production of customer-specific subsystems. ICS provides complete turnkey solutions from design definition to working multichip subsystems.

ICS developed a family of gate array masterslices; advanced, high-pin-count surface-mount packaging; and board-level technology for high-performance, midrange computer systems. The Company's design technology is integrated with a design automation system that can take a description of a system and transform it into an optimized and testable subsystem-level solution.

The Company's future plans include submicron processes, expanded gate array families, and advanced behavioral design implementation.

In March 1988, ICS and Apollo Computer Inc. introduced the series 10000, a new RISC-based workstation based on ICS' subsystem technology. The series 10000 achieves an execution rate of more than one instruction per cycle. The performance is achieved by parallelism among processors using 64-bit data paths and an efficiently coupled set of VLSI devices. ICS contributed system-level design and gate arrays that incorporate level-sensitive scan design (LSSD) test methodology to assure a testable product the first time.

The system uses 10 different 1.5-micron, double-level metal CMOS gate arrays with densities of 30,000+ gates from the ICS10000 Series Family. The implemented chips include a RISC-based integer processor, a floating-point register file, a memory manager, an I/O manager, and a high-speed system bus processor. The ICS10000 has up to 360 configurable I/O pads and comes in packages with up to 340 pins.

The Company's heritage is high-performance, large computer system design and development. ICS' founders came from Amdahl, IBM, and the STC Computer Research Corp., which was set up by Storage Technology.

BOARD

The Board consists of representatives from the following concerns:

DSV Partners
Hambrecht & Quist
Hambro International
Industrial Technology Research Institute (ITRI), Taiwan
Montgomery Securities
Venrock Associates

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Lin Wu
STC Computer Rsch Corp., Sr VP Opns/COO

Exec VP, Operations
Roy Thiels
National Semiconductor, Pro Dir CMOS, Gate Arrays

Chief Techn Officer
Larry Cooke
STC Computer Research Corporation, Dir Des Automation

VP Engineering
Jin Shyr
Daisy, Mgr Prod Tech Support

VP Strat Plan
Symon Chang
STC Computer Rsch Corp., Sr Eng Mgr

VP Mfg
Steve Margoslan
Interest Corporation, VP Engineering

VP Sales
Steve Stephansen
AMD, Director of Sales

VP Marketing
Robert G. Andrews
ZyMOS, Dir Corp Mktg

VP Finance
Michael J. DelGrosso
The Bottom Line, Consultant

FINANCING

1985
Round 1
$2.5M
Hambrecht & Quist, private individuals

May 1987
Round 2
$5.5M
DSV Partners, Hambro International Venture Fund, Montgomery Securities, Venrock Associates

October 1988
Round 3
$4.2M
DSV Partners; Hambrecht & Quist; Hambro International; ITRI, Taiwan; Montgomery Securities; Sequoia Capital; Venrock Associates

ALLIANCES

VLSI Technology, Toshiba
1985
Toshiba and VLSI began providing foundry services for ICS.

MANUFACTURING

ICS subcontracts wafer fabrication with Toshiba of Japan, Taiwan Semiconductor Cooperative (TSMC), and National Semiconductor in the United States.

Technology

1.5-micron and 1.0-micron, dual-metal CMOS

Facilities

Sunnyvale, CA
12,500 sq. ft.
Headquarters and design

Braintree, MA
Sales office

PRODUCTS

Gate Arrays

10,000 to 30,000 1.5-micron usable gate, gate arrays (ICS10000 Series)
10,000 up to 60,000 1.0-micron usable gate, gate arrays (ICS15000 Series)
15,000 to 50,000 1.0-micron usable sea-of-gate, gate arrays (IC20000 Series)

OTHER INFORMATION

Integrated CMOS Systems' PR firm is Thomas Associates.

Integrated Information Technology

2540 Mission College Blvd., Suite 105
Santa Clara, CA 95054
408/727-1885
Fax: (408) 292-1922

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 23**

BACKGROUND

Integrated Information Technology (IIT) was founded to develop high-performance compute engines for applications in personal computers and other information-processing hardware. IIT's objective is to enhance existing standards of compute engine-based silicon technology for personal computer platforms while embedding additional functionality that will evolve new standards to create new markets for existing and future products and increase information flow in the workplace. The Company was founded in April 1987 by two former Weitek employees, Chi-Shin Wang and Y.W. Sing. Dr. Wang also was a cofounder of Weitek.

The Company currently offers two math coprocessors—the IIT-2C87 and the IIT-3C87—and will begin shipment of its integrated graphics array (IGA) in late 1989. The single-chip IGA is fully compatible with VGA and is downward compatible with EGA, CGA, MGA, and Hercules. In the future, IIT plans to offer a 386 object code-compatible CPU family, a 32-bit controller, and a DSP device.

To date, IIT has received funding in two rounds of financing and has $2.7 million in current assets, which the Company believes to be significant capital to carry it to positive cash flow with a comfortable margin. Investors were Ascii, General Electronics, Mitsui, and Yamaha. Strategic relationships have also been established with Ascii, Mitsui, and Yamaha. Yamaha is conducting wafer fab operations for IIT; Mitsui and Yamaha serve as IIT's Japanese distribution agents. In addition to wafer fab, IIT subcontracts assembly and test operations; the Company conducts design, marketing, and QA in-house.

BOARD
(Name and Affiliation)

*Dr. Chi-Shin Wang
IIT, President

*Dr. Y.W. Sing
IIT, Executive VP

Dick Chang

Samuel Fang

Kazuhiko Nishi
Ascii, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Dr. Chi-Shin Wang
Weitek, VP of Engineering

Executive VP
*Dr. Y.W. Sing
Weitek, Manager, Advanced Product Development

VP Marketing & Sales
Gene Parrott
Cirrus Logic, VP Sales

VP Operations
Robert Shen
VTI, Director WW Manufacturing Operations

Manager Sales Operations
Karen Zelina
AMD, AT&T Program Manager

Manager, R&D
Jan Fandrianto
Weitek, Chief Design Engineer

*Founder

Integrated Information Technology

FINANCING

1987
Round 1
Undisclosed amount
General Electronics

1988
Round 2
Undisclosed amount
Ascii, Mitsui, Yamaha

ALLIANCES

Ascii
1989
IIT signed a distribution agreement with Ascii, making Ascii a regional distributor of IIT products in Japan.

Mitsui
1989
IIT signed a strategic alliance with Mitsui, giving Mitsui distribution rights for IIT products in Japan.

Yamaha
1989
IIT signed a foundry agreement with Yamaha, under which Yamaha will provide wafer fabrication services to IIT.

MANUFACTURING

Technology

1.2- and 1.0-micron CMOS

Facilities

IIT subcontracts all wafer fabrication, assembly, and test, while conducting design, marketing, and QA in its Santa Clara facility.

PRODUCTS

IIT-2C87 Math Coprocessor
IIT-3C87 Math Coprocessor
IGA

OTHER INFORMATION

IIT's PR firm is Joyce Lekas Public Relations.

Integrated Logic Systems, Inc.

4445 Northpark Drive, Suite 102
Colorado Springs, CO 80907
719/590-1588
Fax: 719/590-1373

ESTABLISHED: August 1983 **NO. OF EMPLOYEES: 15**

BACKGROUND

Integrated Logic Systems, Inc. (iLSi), was formed to design and develop a family of silicon-gate CMOS and software-based design aids.

iLSi introduced new gate array architectures that offer customers state-of-the-art capabilities. iLSi's product line is capable of implementing 45,000-gate designs that can include large complex functions such as ROM, RAM, PLA, PAL, and the 2900 family in a variety of package options.

The Company has licensing and foundry agreements with four major worldwide corporations.

BOARD

(Name and Affiliation)

Ted Orf, Chairman
Integrated Logic Systems, Inc.

*Frank Gasparik
Integrated Logic Systems, Inc.

James Shook
Consultant

Gordon Olinger
Consultant

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Frank Gasparik
Insouth, VP Engineering

Exec VP/CFO
Ted Orf
Attorney

VP Sales/Mktg
Bruce Grieshaber
Honeywell, Nat Sales Mgr

*Founder

FINANCING

January 1984
Round 1
$5.0M
OTC offering

RECENT HIGHLIGHTS

June 1989
Integrated Logic Systems introduced the Metal Programmed Gate Array (MPGA), which is designed to replace current PLDs and PGAs.

ALLIANCES

Motorola
June 1986
iLSi licensed its line of gate arrays to Motorola (inactive).

Sumitomo
December 1986
iLSi signed an agreement with Sumitomo Corporation and SC Hightech Center, a design center formed to carry out the agreement. Sumitomo licensed ASIC design technology from iLSi. In addition to gaining royalty payments, iLSi gained rights to use any foundries that Sumitomo uses.

Yamaha
December 1987
Yamaha Corporation purchased a license to manufacture and sell gate arrays based on iLSi technology for an undisclosed amount. Yamaha will pay royalties and provide foundry services.

Oki
April 1988
iLSi signed a technology purchase and licensing agreement with Oki Electric Industry Company, Ltd., for an undisclosed amount. Oki will manufacture and sell gate arrays based on iLSi technology and will provide foundry services.

Integrated Logic Systems, Inc.

MANUFACTURING

Technology

1.5-micron silicon-gate CMOS, double-level metal
1.2-micron silicon-gate CMOS, double-level metal under development

Facilities

Colorado Springs, CO
10,000 sq. ft.
Administration and design

Boulder, CO
CAD development

PRODUCTS

CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
CA-1500	Si-Gate	1.5	1.0	2,000 to 42,000
15GH	Si-Gate	1.5	1.0	2,500 to 110,000

OTHER INFORMATION

Integrated Logic Systems does not employ a PR firm.

Intergraph Advanced Processor Division

2400 Geng Road
Palo Alto, CA 94303
415/494-8800
Fax: 415/856-9224

ESTABLISHED: October 1987 **NO. OF EMPLOYEES: 140+**

BACKGROUND

The Intergraph Advanced Processor Division (APD) is a division of Intergraph Corporation and is the result of Intergraph Corporation's acquisition of the Fairchild Advanced Processor Division. The age of the two parent companies normally would exclude the Company from this directory. However, Dataquest believes that, although the division is not a start-up company per se, the operation is the result of a new focus at Fairchild (prior to the acquisition by National) on high-performance MPUs.

APD was acquired in October 1987 for $6.25 million. APD employs more than 140 people involved in the engineering, manufacturing, sales, and support of the merchant market CLIPPER 32-bit RISC microprocessor. APD was formed in 1982 to develop an advanced MPU based on RISC principles. Howard Sachs formed APD and built the division to bring the new CLIPPER microprocessor to market. The CLIPPER 32-bit MPU family was the first commercially available RISC microprocessor to ship in volume production.

The first-generation CLIPPER RISC MPU is the C200. The C200 operates at either 25 or 33 MHz. The second-generation CLIPPER microprocessor, the C300, delivers twice the performance of the C200 and operates at 40 or 50 MHz. All of the current CLIPPER products are implemented in CMOS process technology. Future CLIPPERs will be implemented in both CMOS and bipolar process technologies. Currently, all of APD's fabrication is contracted to Fujitsu. All assembly and testing is done in-house.

CLIPPER microprocessors are currently used in both interactive computer systems and embedded applications. Interactive systems applications include business systems, engineering and graphics workstations, and board-level products based on the PC AT bus, VMEbus, and NuBus. As an embedded processor, CLIPPER's primary use is in Raster Image Processing. CLIPPER is also used in a high-speed dedicated database engine.

At this time, APD is the only RISC vendor to offer a full range of binary-compatible CPUs in three formats: individual chips, chip sets, and prepackaged RISC modules.

BOARD (Intergraph Corporation)
(Name and Affiliation)

James Meadlock, Chairman
Intergraph Corp., CEO

Roland Brown

Larry Laster
Intergraph Corp., Executive VP

Nancy Meadlock
Intergraph Corp., Executive VP

Keith Schonrock

James Taylor
Intergraph Corp., Executive VP

Robert Thurber
Intergraph Corp., Executive VP

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

VP and General Manager
Howard Sachs
Fairchild, General Manager

Director Engineering
Tim Robinson
High Level Hardware

Director Marketing
Ralph Kaplan
B.I.T., VP of Marketing

Director Software Engineering
John Kellum
Fairchild

Director Manufacturing
Steve Rowles
Fairchild, Director of Manufacturing

Director QA
Thomas Wehman
Fairchild, Director of QA

FINANCING

October 1987
Acquisition
$6.25M
Intergraph Corporation acquisition of Fairchild Advanced Processor Division

ALLIANCES

Fujitsu
Early 1987
Intergraph established a foundry agreement with Fujitsu, under which Fujitsu provides wafer fabrication services to the Advanced Processor Division.

MANUFACTURING

Technology

1.5-micron CMOS, moving to submicron CMOS in 1990

Facilities

Palo Alto, CA
50,000 sq. ft.
Assembly, test, marketing, QA, administration

PRODUCTS

CLIPPER C200 RISC MPU, 25 or 33 MHz
CLIPPER C300 RISC MPU, 40 MHz
CLIPPER C300 RISC MPU, 50 MHz

OTHER INFORMATION

Intergraph does not employ a PR firm.

International CMOS Technology, Inc.

2125 Lundy Avenue
San Jose, CA 95131
408/434-0678
Fax: 408/434-0688

ESTABLISHED: October 1983 **NO. OF EMPLOYEES:** 50

BACKGROUND

International CMOS Technology, Inc., (ICT) designs, manufactures, and markets CMOS EEPROMs, EPROMs, and EEPLDs. ICT stated that, in 1984, the Company successfully combined the first 5V-only CMOS EEPROM (the 93C46) in volume production.

The Company's current product offerings include the programmable electrically erasable logic (PEEL) family of CMOS PLDs. The PEEL products use the Company's CMOS 1.25- and 2.0-micron EEPROM technology and feature a propagation delay as fast as 15ns. Additional ICT products include serial EEPROMs; a 40ns, 64K CMOS UV-erasable PROM; and a 35ns, 32K UV-erasable PROM that targets the bipolar 24-pin PROM market.

ICT also offers design and development tools. The Company enlisted John Birkner, the inventor of the PAL (a trademark of Monolithic Memories), to create a low-cost, easy-to-use developmental package consisting of design software and a PC-based, software-controlled programmer. ICT gives the software, free of charge, to any party interested in using PEEL devices.

ICT is developing a family of products that will address the high-density PLD and programmable gate array markets. The introduction of these devices will complete a PLD family ranging from 20-pin, 300-gate equivalent PLDs to 40-/68-/84-pin, 10,000-gate programmable gate arrays.

The Company is planning advances in its memory lines as well and is working on process and design shrinks to minimize the access times further and allow for the fabrication of 256K and larger devices.

The Company was founded by Drew Allen Osterman, Dr. Samuel T. Wang, Dhaval J. Brahmbhatt, and Donald E. Robinson, all of whom were formerly with National Semiconductor Corporation, and Lawrence A. Yaggi, Jr., formerly with Perkin-Elmer. In January 1988, Paul K. Forster joined ICT as its first vice president of sales and marketing.

ICT entered into technology development agreements with Gould Semiconductor and Hyundai Electronics to offset major start-up costs. These agreements provide ICT with operating capital and a significant share of production capacity. The agreements also provide ICT with additional technical support in the form of CAD services and prototype wafer fabrication.

BOARD
(Name and Affiliation)

*Drew Allen Osterman, Chairman of the Board CEO and President

Paul Reagan, Director

Lee Lunsford, Director

Ali Dad Farmanfarma, Director

*Dr. Samuel T. Wang, Director Vice President of Technology

C.S. Park, Director

*Lawrence A. Yaggi, Jr.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Drew A. Osterman
National Semiconductor, Mktg Mgr NV Mems

VP Technology
*Dr. Samuel T. Wang
National Semiconductor, Sr Process Eng Mgr

VP Sales/Mktg
Paul K. Forster
Signetics, Dir Dist Sales

VP Dsn Engr
*Dhaval J. Brahmbhatt
National Semiconductor, Engr Mgr

VP Operations
*Donald E. Robinson
National Semiconductor, Prod Mgr EPROMs

VP CFO
*Lawrence A. Yaggi, Jr.
Perkin-Elmer, Controller

*Founder

FINANCING

1984
Rounds 1 and 2
$5.0M
Hyundai Electronics Industries

June 1987
Round 3
$2.0M
Undisclosed institutional investors

February 1988
Round 4
$2.9M
Undisclosed institutional investors

June 1989
IPO
$3.6M
Initial public offering

RECENT HIGHLIGHTS

January 1987
Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

June 1987
ICT raised $2.0 million in third-round financing. The funds were used for additional capital equipment and personnel and for general working capital. ICT also announced a move to a new 31,000-square-foot facility adjacent to its current site in San Jose, California.

July 1987
ICT offered four new CMOS UV EPROMs with access times of 35ns, 45ns, and 55ns. The 27CX641 and 27CX642 are organized as 8Kx8, and the 27CX321 and 27CX322 are organized as 4Kx8. The products differ in packaging.

September 1987
ICT offered the PDS-1 development system for designing and programming PEEL devices. Designers can use either ICT's APEEL compiler or third-party development software. The system includes an editor, a logic assembler, a PLD-to-PEEL translator, a programmer, and a device tester.

December 1987
ICT offered four new CMOS PLD devices. The 20-pin PEEL153 and 24-pin PEEL173 are plug-in replacements for bipolar FPLA devices. The 20-pin PEEL253 and 24-pin PEEL273 offer architectural enhancements to the PEEL153 and PEEL253, respectively.

January 1988
ICT signed a nationwide distribution franchise agreement with Marshall Industries.

February 1988
ICT raised $2.9 million in fourth-round financing from undisclosed institutional investors.

June 1989
Initial public offering

ALLIANCES

Hyundai
October 1983
Hyundai and ICT signed a joint development agreement to develop and produce seven or eight devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs. Hyundai funded ICT's initial product development and allocated 30 percent of its wafer fab capacity for an equity interest in ICT.

IMP
July 1984
IMP and ICT codeveloped a CMOS EEPROM process (expired).

Gould
April 1986
ICT will transfer its CMOS EEPROM process semiconductor technology and products to Gould in exchange for foundry services and second-sourcing of PEEL and EEPROM devices. Gould will provide foundry services for ICT's new high-speed CMOS EEPROM family. Both companies will work on new product and technology development including work on PEEL products.

Asahi Chemical
January 1987
Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

AMD
July 1989
ICT and AMD signed an agreement for joint development of a 1Mb EPROM device with an access time of 55ns.

MANUFACTURING

Technology

1.25- and 2.00-micron CMOS EE process
1.0- and 0.8-micron CMOS EE process in the near future

Facilities

San Jose, CA
31,000 sq. ft.
Headquarters, design, test, marketing, and sales

PRODUCTS

Memory

Device	Description
93C46	1K Serial 5V Read/Write EEPROM
93C66	4K Serial 2.5V to 7.0V Read/Write EEPROM
27CX321/322	4Kx8 UV-Erasable PROM, 35ns, 40ns, 45ns
27CX641/642	8Kx8 UV-Erasable PROM, 40ns, 45ns, 55ns

PEEL Devices

Device	Delay (ns)	Pins	Programmable Array(s)
PEEL18CV8	15	20	AND
PEEL22CV10	25	24	AND
PEEL20CG10	25	24	AND
PEEL153	30	20	AND/OR
PEEL173	30	24	AND/OR
PEEL253	30	20	AND/OR
PEEL273	30	24	AND/OR
PA7024	25	24	Undisclosed
PA7040	25	40	Undisclosed

PDS-1 development system that allows design with either ICT's PEEL logic compiler or third-party software. The system includes editor, logic assembler, logic simulator, PLD-to-PEEL translator, programmer, and device tester.

OTHER INFORMATION

International CMOS Technology's PR firm is Hayes/Rothwell Public Relations.

International Microelectronic Products

2830 North First Street
San Jose, CA 95134
408/432-9100
Fax: 408/434-0335
TWX: 910 338 2274
Telex: 499-1041

ESTABLISHED: January 1981 **NO. OF EMPLOYEES: 500**

BACKGROUND

International Microelectronic Products (IMP) designs and manufactures mixed analog/digital and complex digital CMOS ASICs. The Company is a full-service vendor with in-house capability that includes cell-based design methods, advanced CAD tools, and high-performance CMOS processes. Products designed by IMP are used primarily in the microcomputer, computer peripherals, and communications markets. IMP's goal is to achieve sales of $150 million by the early 1990s.

The Company is composed of three business groups. The IMP-Designed IC (IDIC) group performs complete IC design for customers. The Customer-Designed IC (CDIC) group links customers with their own designs and IMP's prototyping and production manufacturing. The Customer Technology Assistance Program (CTAP) supports customers in their long-term ASIC technology development efforts by coordinating technology licensing and joint development efforts for IC development and/or manufacturing capabilities in partnership with IMP.

In May 1986, IMP formed an affiliate company, IMP Europe Limited, headquartered in Swindon, England. IMP Europe's initial activities include custom IC design and applications engineering services for the European market.

In June 1987, IMP completed an initial public offering of 4.5 million shares of common stock that raised $22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability to redeem Series-A preferred stock and for general corporate purposes.

One of IMP's goals is to maintain a process technology leadership position among ASIC suppliers. The Company's 2- and 3-micron CMOS processes have the capability to implement various combinations of polysilicon and metal interconnect in p-well or n-well technology. In May 1988, a new 1.2-micron CMOS process and accompanying 1.2-micron analog and digital cell libraries were announced. They are tailored for mixed analog and digital functions on the same chip. The Company's facility uses all-stepper photolithography, gas plasma dry etchers, ion implantation, computer-controlled diffusion, and a computer parameter test process.

The Company's R&D programs currently focus on developing complex analog and digital cells for use in the IMP Design System; semiconductor manufacturing processes and device structures; advanced design software; and advanced networking, communications, and information systems for use in engineering and manufacturing. IMP is working with Silicon Compiler Systems Inc. to develop analog compilation techniques, with a leading university to develop advanced analog cells, and with the Company's IMP Europe affiliate for advances in CAD.

BOARD

(Name and Affiliation)

*George W. Gray, Chairman
International Microelectronic Products

Barry Carrington, Director
International Microelectronic Products

*Zvi Grinfas, Director
International Microelectronic Products

Russell Carson, Director
Welsh, Carson, Anderson and Stowe

Richard Smith, Director
Sohio

DuBose Montgomery, Director
Menlo Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Barry Carrington*
AMI, Sr VP Mfg

Exec VP/CFO
Charles Isherwood
AMI, Sr VP Corp Svcs

Sr VP Ops
Larry Anderson
NEC, Mfg Manager

Sr VP Sales
Martin Landin
Gould AMI, VP Sales

VP Technology
Dr. Moiz Khambaty
AMI, CMOS Tech Dev

VP Materials
Paul Bolinger
Synertek, Project Manager

VP Sales
Bob Kromer
National Semiconductor, Regional Sales Mgr

*Founder

FINANCING

August 1981
Round 1
$8.8M
IMP management and individuals; Charles River Partnership; Citicorp Venture Capital; Continental Illinois Venture; Harvest Ventures; INCO Securities; Lambda; Menlo Ventures; Robertson, Colman, & Stephens; Vista Ventures; Welsh, Carson, Anderson and Stowe

1981
Lease
$13.0M
Bank of America, Orchard Properties

August 1982
Round 2
$7.4M
Initial investors (except IMP management and individuals); R.W. Allsop; Edinburgh Financial, U.K.; Foster Industries; Murray Johnstone, U.K.; Prudential Nominees, U.K.; Republic Ventures; Robinson Investments; Scottish Development Agency; Stewart Enterprises, U.K.; Toronto Dominion Bank; H.G. Usher, U.K.; Wilmark R&D (Ivory & Sime), U.K.

June 1983
Round 3
$14.2M
Same as round 2 (except Stewart Enterprises and Wilmark R&D); IMP management and individuals; Aiken Hume; Alex Brown & Sons; Citibank; Drayton Montagu; GE Pension Fund; Hillman Company; IBM Retirement Trust Fund; Kleinwort Benson; Latigo Ventures; Lombard Odier; Morgan, Grenfell & Co.; Morgan Stanley & Co.; Mutual Benefit Life; Pacific Technology Venture; Robert Fleming & Co.; Schulf, Woltman & Co.; Walter Scott & Partners

June 1984
Round 4
$3.0M
National Semiconductor

August 1984
$4.0M
Standard Oil of Ohio

June 1985
$6.2M
Northern Telecom, Standard Oil of Ohio

June 1986
£3.0M
CIN Investor Nominees Ltd.; Citicorp Venture Capital Ltd.; Pruventure, Syntech, Grosvenor Technology Fund

June 1987
$22.3M
Initial public offering

RECENT HIGHLIGHTS

September 1986
Barry Carrington, president, was promoted to CEO from COO. He succeeds George W. Gray, who remains as IMP's chairman of the board.

June 1987
IMP completed an initial public offering of 4.5 million shares of common stock, raising $22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability, to redeem Series-A preferred stock, and for general corporate purposes.

December 1987
IMP reported third-quarter revenue of $13.1 million for the period ending December 31, 1987. Net income for the period was $1.8 million, which was a 200 percent increase compared with the comparable quarter a year before.

May 1988
IMP announced a family of analog and digital 1.2-micron cell libraries and supporting CMOS processes. The ACL-1.2 and DCL-1.2 families can implement analog and digital functions on the same chip and can offer system speeds of 40 MHz. The digital CMOS process, called C1201, and the DCL-1.2 digital cell library became available in May 1988 in the United States and in Europe through IMP Europe. The analog CMOS process, C1202, and the ACL-1.2 analog cell library became available in January 1989.

ALLIANCES

Zoran
June 1983
IMP and Zoran codeveloped a CMOS PROM technology.

IXYS
November 1983
IMP codeveloped a high-voltage CMOS process with IXYS.

National Semiconductor
1984
IMP and National Semiconductor signed a five-year technology exchange and second-source agreement transferring IMP's standard cell designs in exchange for National's multiple-layer metal silicon-gate CMOS process, as well as future CMOS processes.

April 1985
IMP will second-source National's 2-micron gate arrays.

Micro Linear
June 1984
IMP and Micro Linear codeveloped a 10V CMOS process. IMP provides foundry services for Micro Linear.

Micro Linear/MBB
August 1986
IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

ICT
July 1984
IMP and ICT codeveloped a CMOS EEPROM process.

Iskra
April 1985
IMP and Iskra codeveloped a CMOS analog cell library for which IMP provides foundry services.

Lattice Logic
May 1986
Lattice Logic's CHIPSMITH Silicon compiler software became available with IMP's design rules.

Silicon Compilers
June 1986
SCI and IMP announced a strategic alliance to develop analog compilation capability for SCI's Genesil Silicon Development System. SCI will incorporate IMP's 3-micron, double-poly, double-metal process into the Genesil system.

Lasarray
August 1986
IMP and Lasarray agreed to cooperate on developing a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module. Initial wafers will contain a 2-micron, 2-layer metal CMOS 2,400-gate array with 1.5ns delay.

Electrolux
November 1987
IMP signed a five-year agreement with Electrolux of Sweden to develop ASIC devices that will be used in home appliances. IMP will also develop CAD tools for Electrolux and its component subsidiary, Electrolux Mecatronik. IMP will manufacture the devices in San Jose, California.

Mitel
March 1989
Mitel Corporation and International Microelectronic Products (IMP) announced a strategic alliance in communications chips including applications related to integrated services digital network (ISDN). Under the joint technology transfer agreement, Mitel will exchange four communications chip designs for IMP's MxCMOS 1.2 manufacturing process, ACL1.2-DCL1.2 cell libraries, and mixed analog/digital design methodology.

SERVICES

Foundry
Design
Prototyping

MANUFACTURING

Technology

3.0-, 2.0-, and 1.2-micron CMOS
P-well, double-metal, double-poly
5-inch wafers

Facilities

San Jose, CA
110,000 sq. ft.
Headquarters and manufacturing

16,000 sq. ft.
Class 10 clean room

PRODUCTS

CMOS Gate Array

Process	Linewidth	Delay	Gates
Si-Gate	2 Microns	1.0ns	800 to 6,000

CMOS Cell Library

Family	Process	Gate Length	Delay (ns)	Cells
ACL-3	Si-Gate	3.0 Microns	N/A	>40 Analog
DCL-3	Si-Gate	3.0 Microns	3.5	>0 Logic
DCL-2	Si-Gate	2.0 Microns	1.0	>0 Logic, RAM, ROM, PLA
ACL-2	Si-Gate	2.0 Microns	N/A	8 Analog
DCL-1.2	Si-Gate	1.2 Micron	0.3	70 Logic
ACL-1.2	Si-Gate	1.2 Micron	N/A	8

N/A = Not Applicable

Development Tools

Device	Description
IDS-II	Distributed Processing, Sun-Based Design System for Cell-Based and Full-Custom Products
UNT	Universal Netlist Translator (UNT) that Converts any Gate Array Netlist or Cell-Based Design to an IMP Cell-Based Design
SCF Compiler	Switched Capacitor Filter Compiler Software
SCIL	Standard Cell IC Layout System Software
BIL	Block IC Layout Software

OTHER INFORMATION

IMP's PR firm is Regis McKenna, Inc.

Isocom Limited

Prospect Way
Park View Industrial Est.
Brenda Road
Hartlepool, Cleveland, England
(0429) 221431

Isocom, Inc.

256 E. Hamilton Avenue, Suite H
Campbell, CA 95008
408/370-2212

ESTABLISHED: November 1982 **NO. OF EMPLOYEES:** 84

BACKGROUND

Isocom Limited was formed to design, manufacture, and market optocouplers with the goal of becoming a major participant in the $80 million military optocoupler market. Marketing efforts were concentrated in the European commercial and industrial markets for the first two years. In 1986, the Company began offering devices to the military market.

The Company's initial products included a range of optocouplers and interrupter switches in single-, dual-, and quad-package configurations. In 1984 and 1985, the product line expanded to include Hewlett-Packard-compatible, high-speed, high-gain optocouplers. Isocom's products, which currently include transistor-output, Darlington-output, AC-input, photo SCRs, TRIACs, and Schmitt Trigger optocouplers, are used in power supplies, telecommunications, instrumentation, and modems. In the second quarter of 1985, the Company became one of the first to offer a range of surface-mount devices.

Isocom was founded by several former Litronix managers and is headquartered in Hartlepool, England, with a U.S. sales and marketing office in Campbell, California. Design, manufacturing, and test are done at the 25,000-square-foot Hartlepool facility. Some assembly is contracted to companies in the Far East.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Colin Rees
Litronix, Mgr Europe Sales

Technical Dir
*Andrew Mann
Siemens, Prod Mgr Optocoupler Div

VP Isocom, Inc.
Sam Kaufman
Siemens, Director of Marketing

*Founder

FINANCING

Not available

MANUFACTURING

Technology

Silicon
GaAs
GaAlAs

Facilities

Hartlepool, England
25,000 sq. ft.
R&D, design, manufacturing, test

Campbell, CA
2,000 sq. ft.
Marketing and sales

Isocom Limited

PRODUCTS

Minicouplers
High-Speed/High-Gain Couplers
High-Isolation Optocouplers
High-Speed Tristate Optocouplers
High-Voltage Photo Transistor Couplers
Switches
Hybrids
Visible Lamps
Visible Displays
Integrated Displays

OTHER INFORMATION

Isocom does not employ a PR firm.

ISSI

680 Amador Lane
Sunnyvale, CA 94086
408/733-ISSI (4774)
Fax: 408/245-ISSI (4774)

ESTABLISHED: October 1988 | **NO. OF EMPLOYEES: N/A**

BACKGROUND

Integrated Silicon Solution, Inc., (ISSI) was founded in October 1988 by Jimmy Lee, K.Y. Han, and Fu Tseng to develop CMOS semiconductor products that provide superior system-level reliability, price, and performance.

The Company's initial focus is on high-performance SRAMs and cache memory products. First products will include 16K and 64K SRAMs and 16K and 64K cache data RAMs. ISSI will expand its product line to include SRAMs with densities up to 1Mb, cache controllers, and cache tag RAMs. The Company plans to develop BiCMOS TTL RAMs in mid-1990. In the future, ISSI plans to develop EE memories, EEPLDs, and Flash EEPROM devices. ISSI will begin taking bookings in December 1989, with volume production scheduled for mid-February 1990.

ISSI received funding from Wearnes Technology Corporation, the corporate venture capital investment office for the Wearnes Technology Group. The Wearnes Technology Group is a multinational computer and high-technology products manufacturer based in Singapore. The group has a high degree of vertical integration. ISSI will benefit from partnerships with sister companies in the Wearnes Group. Assembly, for instance, will be conducted by a sister company in Indonesia.

ISSI has entered manufacturing agreements with LSI Logic Corporation, Taiwan Semiconductor Manufacture Corporation, and United Microelectronics Corporation. All three of these companies will serve as foundries for ISSI. The Company has licensed technology to UMC and LSI. The Company will conduct R&D, design, test, and marketing operations at its Sunnyvale, California, facility.

BOARD

(Name and Affiliation)

*Jimmy Lee
ISSI, President

*K.Y. Han
ISSI, VP Engineering

*Dr. Fu H. Tseng
ISSI, VP Technology

Dr. Richard Yen
Wearnes Technology Corporation

Joe Liu
TechLink, President

George Liau
Audix

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Jimmy Lee
ICI, Engineering Manager

VP Technology
*Dr. Fu H. Tseng
Visic/VTI, Principal Process Staff

Dir Mktg
Richard Cimino
Wyle Dist. Grp., Area Sales Manager

VP Engineering
*K.Y. Han
Vitelic, Design Engineering Mgr

Dir Design Eng
Yun Hwang
MOSel, Engineering Director

*Founder

FINANCING

January 1989
Seed
$800,000
Private, Wearnes Technology Corp.

June 1989
Round 1
$1.5M
Private, Wearnes Technology Corp.

September 1989
Round 1
$0.5M
Private, Wearnes Technology Corp.

ALLIANCES

United Microelectronics Corporation
January 1989
ISSI signed a licensing and manufacturing agreement with UMC that covers ISSI's SRAM and cache product lines.

Taiwan Semiconductor Manufacturing Corporation
August 1989
ISSI signed a foundry agreement with TSMC.

LSI Logic
September 1989
ISSI signed a licensing and manufacturing agreement with LSI.

MANUFACTURING

Technology

1.2-, 1.0-micron single-poly, double-metal CMOS
0.8-micron CMOS available Q1 1990

Facilities

Sunnyvale, CA
10,000 sq. ft.
R&D, design, test, marketing

PRODUCTS

4Kx4 Sub-15ns (16K)
8Kx8 Sub-20ns (64K)
16Kx4 Sub-20ns (64K)
32Kx8 Sub-25ns (256K)
32Kx8 Low-Power Sub-70ns (256K)
128Kx8 Sub-35ns High-Performance (1Mb)
128Kx8 Low-Power Sub-70ns (1Mb)

OTHER INFORMATION

ISSI does not employ a PR firm.

IXYS Corporation

2355 Zanker Road
San Jose, CA 95131
408/435-1900

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 70**

BACKGROUND

IXYS designs, manufactures, and markets a specialized line of discrete power MOS devices, VLSI CMOS digital ICs, and CMOS analog ICs. The Company's products are designed for motion control applications in machinery, such as robots and home appliances, and in power conversion equipment, such as precision DC motors and high-voltage switches.

IXYS' smart power products include monolithic current sensing to simplify the design of current-mode switching power supplies. The Company plans to integrate a function that will monitor device junction temperature on the power chip.

IXYS also is working with NASA and other major aerospace companies to provide high-reliability space versions of the technology for all-electric aircraft and space station programs.

BOARD
(Name and Affiliation)

David Cooper, Chairman
IXYS Corporation, President/CEO

Jack Carsten, Director
U.S. Venture Partners

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
David Cooper
SGS-Thomson, WW Dir Power MOS

Exec VP
Nathan Zommer
GE Intersil, Mgr Pwr MOS R&D

Sr VP Power ICs
Dick Blanchard
Siliconix, VP Dsn & Tech

VP Worldwide Sales
Daniel Schwob
GE, Prod Mktg Mgr

VP Finance/Admin
Jim Wu
Siliconix, Controller

VP Marketing
Edward Day
Sprague Electric, Regional Sales Mgr

Ops Mgr
Tony DeCarlo
Intersil, Dir Custom Svc

Dir Operations
Walt Buchannan
G2, Dir Mktg

Chief Operating Officer
William T. Malanczuk
National Semiconductor, VP WW Waferfab and Technology

FINANCING

1983
Round 1
$0.8M
Fred Adler

October 1985
Round 2
$6.7M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership

August 1987
Round 3
$3.0M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Oak Investment Partners; U.S. Venture Partners

August 1988
Round 4
$6.2M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership First Boston; Bay Partners; John F. Shea

RECENT HIGHLIGHTS

January 1986
IXYS offered its first product, the IXSE501, a Shaft Encoder Peripheral Interface IC. The device is a CMOS monolithic two-channel PWM control processor for micro-stepping two-phase stepper motors and other applications.

June 1986
IXYS offered a line of MOS insulated-gate transistors (MOSIGTs) developed by Nathan Zommer, who originally developed IGTs while at GE Intersil. The new devices combine the IGT design with polysilicon gate CMOS technology.

March 1987
IXYS relocated into a new 53,000-square-foot facility in San Jose, California. The facility, which is six times larger than the Company's former facility, includes an automated line and has capability for custom packaging. IXYS plans to invest between $2 million and $3 million in the line over the next two years.

March 1987
IXYS offered the IXMS150, a CMOS two-channel PWM control processor.

August 1987
IXYS named David Cooper president and chief executive officer. Mr. Cooper takes over the position from Alan Hofstein. Mr. Cooper will focus on expanding the Company's development efforts in power chips, high-voltage ICs, and power modules, with various new product introductions. Before joining IXYS, Mr. Cooper was worldwide director of power and smart power operations for SGS-Thomson, a Milan, Italy-based chipmaker with annual sales of more than $1 billion.

August 1987
IXYS raised $3.0 million in third-round financing.

October 1987
Dick Blanchard joined IXYS as senior vice president and heads the Company's smart power IC design team. Mr. Blanchard was with Siliconix previously, most recently as vice president of design and advanced technology development. He reports to Mr. Cooper.

November 1987
IXYS began offering its power MOSFETs and MOSIGTs in military packages.

December 1987
IXYS introduced the MOSBLOC IGBT family of modules, which range from 25A to 200A in both 600V and 1000V versions. The devices are packaged in bipolar Darlington modules, as used by Japanese vendors. The product family is aimed at motor control and other industrial applications that are served by Japanese suppliers. IXYS expects this product family to become its major commercial product line and to account for as much as $30 million per year in revenue.

August 1989
IXYS acquired the ASEA Brown Boveri Power Semiconductor Group in Lampertheim, West Germany.

ALLIANCES

IMP
November 1983
IMP and IXYS codeveloped a high-voltage CMOS process.

Ricoh
1984
IXYS and Ricoh signed a technology exchange for Ricoh to provide wafers; IXYS is providing its power MOSFET HDMOS process (expired).

Samsung
January 1986
IXYS signed an agreement with Samsung Semiconductor and Telecommunications under which Samsung will receive IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas; the two companies will jointly manufacture IXYS' first smart power products.

ABB
May 1988
IXYS announced a joint venture agreement with ASEA Brown Boveri Corporation. The agreement is expected to strengthen the marketplace for industrial power control using ABB's patented copper substrate bonding technology and IXYS' advanced technology in smart power, IGBTs, and Mega MOS.

MANUFACTURING

Technology

1.2- to 4.0-micron CMOS HDMOS (high-performance DMOS)
5-inch wafers
4-inch wafers
6-inch wafers

Facilities

San Jose, CA
53,000 sq. ft.
Design, manufacturing, hi-rel assembly, test

PRODUCTS

PowerFETs

Device	Description
MegaMOS FETs	Large-Scale Monolithic Power MOSFETs
Power MOSFETs	High-Voltage n-Channel and p-Channel MOSFETs
MirrorFETs	Power MOSFET with Monolithic Current Sensing
LIMOFETs	Mega MOSFET with IC Drive Technology
HiPerFETs	Power MOSFET with High DV/DT Ruggedness
MOSIGBTs	Monolithic Power MOSFETs with Bipolar Devices
MOSBLOC Modules	Power MOSFETs or MOSIGBTs

Integrated Circuits

IXLD426-9	CMOS MOSFET Drivers
IXED0900/1500	CMOS Address Encoder/Decoder
IXMS150	CMOS Monolithic Two-Channel PWM Controller
IXPD610	Digital Pulse-Width Modulator (DPWM)
IXSE501	Shaft Encoder Peripheral Interface (SEPI)
IXSE510	16 Bit (SEPI)
IXBD4410	High Side/Low Side Driver

OTHER INFORMATION

IXYS' PR firm is Simon McGarry.

Krysalis Corporation

1135 Kern Avenue
Sunnyvale, CA 94086
408/749-7390
Fax: 408/739-5362

ESTABLISHED: 1985 **NO. OF EMPLOYEES: 12**

BACKGROUND

Krysalis was formed to develop and manufacture nonvolatile semiconductor memories, using a CMOS ferroelectric technology. Founders of the Company are Joseph T. Evans, formerly of the U.S. Air Force Weapons Laboratory, and William D. Miller, formerly of Signetics.

The Company plans to market 16K and derivative products as initial process vehicles. The products will feature an access time of 120ns and emphasize radiation-hardened and industrial applications.

Krysalis demonstrated the feasibility of manufacturing the devices with a 512-bit UniRAM memory part using a 3-micron process at Orbit Semiconductor. At this time, Krysalis is shipping a family of latch and register products, evaluation units, and a 4K serial RAM.

In October 1989, National Semiconductor Corporation acquired Krysalis' assets, including all rights to Krysalis' ferroelectric technology. National and Krysalis had previously entered into a technology agreement under which the companies agreed to share technology, product codevelopment, and manufacturing services.

The Company believes that its process can be applied to wide ranges of logic including ASICs, MPUs, and TTL-compatible logic. The ferroelectric technology also is said to be compatible with bipolar, CMOS, and GaAs processes.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Dr. James Harris
Akashic, Pres/CEO

VP Tech
*William D. Miller
Signetics, Process Dev

VP/CFO
Neil Hennessey
Gould NavCom, VP Finance

*Founder

FINANCING

May 1986
Seed
$1.0M
Columbine Venture Fund, Crosspoint Venture Partners, Meadows Ventures, OSCCO Ventures, Weeden Capital Partners

December 1986
Round 1
$3.2M
Initial investors

October 1989
Acquired by National Semiconductor Corporation

RECENT HIGHLIGHTS

1987
Krysalis set up a small, $3.0 million materials research laboratory in New Mexico.

December 1987
Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. (See "Alliances" for more details.)

Krysalis Corporation

ALLIANCES

National Semiconductor
December 1987

Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. National will provide product engineering, manufacturing, and marketing support. Initially, National will supply base wafers based on a 2-micron process. Krysalis will complete fabrication of the wafers through packaging, test, and burn-in. Krysalis will conduct its own marketing and sales.

PRODUCTS

Family of Latch and Register Products
Evaluation Units
4K Serial RAM

OTHER INFORMATION

Krysalis does not employ a PR firm.

MANUFACTURING

Technology

2- and 3-micron

Facilities

Sunnyvale, CA
Albuquerque, NM

Kyoto Semiconductor Corporation

418-3, Yodosaime-cho
Fushimi-ku Kyoto 613, Japan
075-631-8823
Fax: 075-631-8291

ESTABLISHED: April 1980 **NO. OF EMPLOYEES: 20**

BACKGROUND

Kyoto Semiconductor offers GaAs light-emitting diodes (LEDs), phototransistors, photosensors, and LED displays. The diodes offer twice the efficiency of available units. The heterostructured diodes feature a 23.6 percent light-emitting efficiency at peak wavelengths of 190nm. Four selections of wavelengths are available: 660, 750, 830, and 890.

Kyoto Semiconductor's major customers are Mitsubishi Electric and General Instrument. The Company contracts assembly to companies in Taiwan.

BOARD

Not available

PRODUCTS

High Bright LEDs
Infra LEDs
Photo TRs
Photosensors
LED Displays

OTHER INFORMATION

Kyoto Semiconductor does not employ a PR firm.

COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President
Jousuke Nakata
Mitsubishi

FINANCING

Capitalization: ¥62 million

MANUFACTURING

Not available

Facilities

Kyoto, Japan
Production

Lattice Semiconductor Corporation

555 N.E. Moore Court
Hillsboro, OR 97124
503/681-0118
Fax: 503/681-3037

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 110**

BACKGROUND

Lattice Semiconductor Corporation (LSC) designs, develops, manufactures, and markets high-performance PLDs using a proprietary EE CMOS technology. LSC has pioneered a line of high-speed PLDs called Generic Array Logic (GAL) as direct pin-for-pin replacements of bipolar PAL devices. The next generation, ispGAL devices, includes in-system programmability that makes logic configurable "on the fly" under software control for robotics and artificial intelligence applications.

LSC has established agreements with National Semiconductor and SGS in Milan, Italy. In exchange for the right to use certain GAL designs, the companies provide wafers and assembly services. The Company conducts all final testing, including quality and reliability testing, at the LSC facility in the United States.

In September 1986, Monolithic Memories, Inc. (MMI), filed a class action suit against LSC and Altera, charging patent infringement of the PAL architecture. LSC filed a $300 million countersuit charging MMI with abusing the Sherman Act, i.e., trying to destroy the competition. The MMI suit brought negotiations for additional financing, which were in progress, to a standstill. In December 1986, Rahul Sud, president; Jay McBride, general manager; S. Robert Brutbarth, and Kishan C. Sud resigned from LSC. As a result of these events, during 1987, LSC took aggressive actions to restructure the Company and filed a voluntary petition for protection under the Chapter 11 federal bankruptcy law.

On September 28, 1987, LSC's reorganization plan under federal bankruptcy law became effective, marking the Company's exit from Chapter 11. As a result of the restructuring, the Company raised $1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson. In November 1987, LSC relocated to a new headquarters in Hillsboro, Oregon, tripling its manufacturing space. Also in November, LSC and MMI settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents in PLDs.

In 1987, LSC signed Arrow Electronics as its authorized U.S. distributor and also signed Almex, in France; Alcom, in the Netherlands; Bacher GmbH, in the Federal Republic of Germany; and Henaco, in Norway. In addition, Lattice signed sales representatives in the United States and the United Kingdom.

BOARD
(Name and Affiliation)

C. Norman Winningstad, Chairman
Floating Point Systems, Chairman

Dan Hauer
S-MOS (Seiko-Epson), President

Harry A. Merlo
Louisiana Pacific Corp., Chairman/CEO

Roy Pollack
RCA (retired)

Ole Christian Sand
Elcon Partners; Oslo Norway

Douglas C. Strain
Electro Scientific Industries, Vice Chairman

Cyrus Tsui
Lattice Semiconductor Corp, CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Cyrus Tsui
AMD, VP PLD Div

VP Finance/Admin
Jan Johannessen
N/A

VP Sales
Paul Kollar
Signetics, Dir Natl Ops

Dir Marketing
Bill Wiley Smith
Silicon Systems, Dir Apps

VP/Operations
Daniel Hu
AMD, VP Calif Wafer Fab Op

FINANCING

1983
Round 1
$1.9M
Datavekst A/S, Norway; Floating Point Systems, Inc.; Louisiana-Pacific Corp.; Harry A. Merlo, C. Norman Winningstad, and other corporate stockholders

July 1984
Credit
$2.7M
Oregon Bank, U.S. National Bank

September 1987
Round 2
$1.6M
Previous investors

January 1988
Credit
$1.5M
First Interstate Bank

February 1988
Round 3
$2.5M
Institutional investors

April 1988
Round 4
$5.0M
Institutional investors

September 1989
IPO
$14.0M
Initial public offering

RECENT HIGHLIGHTS

September 1986
LSC adds Bell Industries of Los Angeles, California, as a distributor.

October 1986
LSC offers GAL16V8-25P and GAL20V8-25P "quarter-power" devices that are 25ns PLDs and operate with only 45 milliamperes. The GALs can be configured into any one of 21 PAL architectures.

October 1986
LSC offered Q11987, an 8Kx8, 64K CMOS SRAM with an access time of 25ns.

April 1987
LSC offered the GAL39V18, a programmable logic device using EE CMOS technology. Maximum delays are 30ns from input to output and 15ns from clock to output.

June 1987
LSC recalled its fast 64K EEPROM product line, which it began sampling in late 1986 due to engineering flaws.

July 1987
LSC filed a voluntary petition for protection under Chapter 11 federal bankruptcy law. The Company cut back on its SRAM development and laid off approximately 15 employees.

September 1987
LSC's reorganization plan under federal bankruptcy law became effective on September 28, 1987, and marked the Company's exit from Chapter 11. As result of the restructuring, the Company raised $1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson.

November 1987
LSC relocated to a new headquarters in Hillsboro, tripling its manufacturing space.

November 1987
LSC and Monolithic Memories, Inc., settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

December 1987
LSC announced a 33 percent reduction on the average selling price of its GAL devices.

January 1988
LSC, although a privately held company, reported product sales of $3.4 million for the third quarter ending January 3, 1988. The $3.4 million was a 93 percent increase over the third-quarter sales the year before. Second-quarter sales, for the period ending September 26, 1987, were $2.9 million. LSC also reported annual revenue exceeding $13.5 million.

ALLIANCES

Floating Point Systems
1983
LSC and Floating Point Systems agreed to exchange technology for LSC's UltraMOS technology and FPS' DSP and array processor technology. Floating Point Systems gained major equity participation as well as long-term purchasing agreements from LSC. (expired)

Synertek
July 1984
LSC and Synertek signed a cross-licensing and second-sourcing agreement allowing Synertek to use LSC's UltraMOS process to manufacture a 35ns, 64K SRAM in exchange for a portion of Synertek's production capacity in Santa Cruz, California. (expired)

VLSI Technology
September 1984LSC provided technology for CMOS EEPROMs and SRAMs to VLSI Technology in exchange for foundry services at VLSI. (expired)

Seiko-Epson/S-MOS
January 1986
LSC announced a manufacturing and second-sourcing agreement. Seiko-Epson acquired the license to LSC's 16Kx4 SRAM design and process technology; S-MOS acquired the rights to market the part in North America.

SGS
February 1987
LSC signed a technology agreement with SGS Semiconductor, giving SGS a license to second-source LSC's GAL products. SGS will manufacture the GAL products for LSC, and both companies will cooperate on the design of future PLD products.

National Semiconductor
May 1987
National Semiconductor made a minority capital investment in LSC and licensed its GAL technology. The five-year agreement includes co-development of denser architectures of both standard and in-system programmable GALs, as well as a new line of FPLAs and sequencer devices.

MMI
November 1987
LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

AMD
May 1989
Lattice signed a new cross-licensing agreement with AMD. Under the agreement, Lattice is licensed to manufacture AMD's industry-standard 22V10 programmable logic device and to use the 22V10 architecture in manufacturing GAL products. AMD is licensed to manufacture GAL devices using Lattice's architecture.

MANUFACTURING

Technology

1.1 to 0.9-micron CMOS
6-inch wafers

Facilities

Hillsboro, OR
44,000 sq. ft.
Design and test

Lattice Semiconductor Corporation

PRODUCTS

GAL Products

Device	Speed
GAL16V8	10 to 25ns
GAL16V8A	10ns
GAL20V8	10 to 25ns
GAL22V10	15ns
GAL6001	30ns
ispGAL 16Z8	15 to 25ns

Development Tools

All Devices	Third-Party Development Support from Leading PLD Systems, Both Hardware and Software

OTHER INFORMATION

LSC's PR firm is KVO, Inc.

Level One Communications Inc.

105 Lake Forest Way
Folsom, CA 95630
916/985-3670
Fax: 916/985-3512

ESTABLISHED: November 1985 **NO. OF EMPLOYEES: 39**

BACKGROUND

Level One Communications Inc. designs, manufactures, and markets system-specific transceivers (transmitters/receivers) and associated peripheral circuits for the twisted-pair, high-speed digital communications market. Products are designed for integrated voice, data, and video communications systems and networks at speeds from 19.2 Kbps to 16.0 Mbps.

Transceivers combine digital and analog circuitry to convert digital impulses into line code, a language that travels more efficiently on twisted-pair wire than nonencoded digital signals. The sending transceiver converts data according to a given line code and transmits it through twisted-pair wires. The transceiver at the receiving end of the line decodes the encoded signals to data.

Level One offers integrated analog and digital ASIC transceiver ICs that can be tailored to specific systems using a modular cell-based approach. To accelerate design time significantly, Level One has developed the LxLIB, a library of predefined mixed analog and digital ICs and functional blocks that can be assembled quickly. Level One also has developed proprietary CAD simulation tools dedicated to transceiver development. The CAD simulation and techniques model the physical-level communications systems and associated transmission lines. The line simulator also is used for automated component testing by providing analog input waveforms to the tester.

Level One's transceiver products are composed of front and back ends. The front end is the transceiver core and contains blocks of cells that perform the analog functions such as pulse shaping, encoding, and timing and data recovery. The back end is the system interface, which handles the digital functions and the interface to each customer's system.

The Level One design team has had extensive experience in PBX transceivers and ISDN devices at companies such as AMD, AT&T Bell Labs, Hitachi, Intel, Mitel, National Semiconductor, and Rockwell.

As of October 1988, the Company had completed four rounds of funding. The seed round was completed in December 1985, when Julian, Cole & Stein, a Los Angeles-based venture capital firm, purchased 38 percent of the Company for $800,000. In December 1986, Julian, Cole & Stein purchased an additional percentage of the company for $2 million. The third round brought investments of $5 million, with lead investors Warburg, Pincus Ventures Inc., and Julian, Cole & Stein. The fourth round of funding resulted from a private placement, arranged by Merrill Lynch Capital Markets, of convertible preferred stock for Julian, Cole & Stein's Strategic Technologies Portfolio. This funding brought an additional $6.25 million to Level One, which will be used for business expansion, new product development, and general working capital.

The Company leased a 21,000-square-foot facility in Folsom, California, where it conducts R&D and design. Level One has contracted International Microelectronic Products (IMP) and Mitel to manufacture its products. IMP will work closely with Level One to adapt its CMOS process to meet the specific analog and digital requirements of integrated transceivers.

BOARD:
(Name and Affiliation)

Charles R. Cole
Julian, Cole & Stein, Partner

James M. Julian
Julian, Cole & Stein, Partner

Dr. Henry Kressel
N/A

Dr. Robert S. Pepper
Level One Communications, President/CEO

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Dr. Robert Pepper
RCA, VP/GM Solid State Div

VP Mktg/Sales
J. Francois Crepin
LSI Logic, Dir WW Strat Plan

VP Finance/Admin
*Terry S. McCoy
American Continental, Dir Finance

VP Engineering
Cecil Aswell
Siemens, Dir Engr

*Founder

FINANCING

December 1985
Seed
$0.80M
Julian, Cole, & Stein

December 1986
Round 1
$2.00M
Julian, Cole, & Stein

September 1987
Round 2
$5.00M
Julian, Cole and Stein; Warburg, Pincus Ventures Inc

September 1988
Round 3
$6.25M
Merrill Lynch Capital Markets private placement for Julian, Cole, and Stein. Investors included Ameritech Pension Fund; Delaware State Employees Retirement Fund; The St. Paul Companies; Transamerica Occidental Life Insurance Company

ALLIANCES

LTX
1986
Level One was selected to codevelop and field test new ISDN platforms with LTX.

Mitel
May 1988
Level One and Mitel signed a 5-year joint development and second-source agreement that covers advanced transceivers for T-1 transmission and ISDN markets.

MANUFACTURING

Technology

3.0-micron double-poly, double-metal, 5V CMOS
2.0-micron double-poly, double-metal, 5V CMOS
1.5- and 1.2-micron planned
Level One contracts its foundry work to International Microelectronic Products of San Jose, California

Facilities

Folsom, CA
21,000 sq. ft.
Administration, design, R&D, and test

PRODUCTS

Device	Description
LXT200	ISDN STT Interface Transceiver
LXP302	T1/ESF Digital Trunk Interface Circuit
LXP303	CEPT/CRC Digital Trunk Interface Circuit
LXP600	Clock Adapter

Products under Development

LXT130	TCM Transceiver (3,000 feet)
LXT134	Quad TCM Transceiver (3,000 feet)
LXT131	TCM Transceiver (6,000 feet)
LXT135	Quad TCM Transceiver (6,000 feet)
LXT300	T1/CEPT Integrated Transceiver
LXT324	T1 Quad Receiver
LXT400	DDS Transceiver

OTHER INFORMATION

Level One's PR firm is Regis McKenna, Inc.

Linear Integrated Systems Inc.

47853 Warm Springs Boulevard
Fremont, CA 94539
415/659-1015
Fax: 415/659-1365

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 50**

BACKGROUND

Linear Integrated Systems Inc. (LIS) designs, manufactures, and markets standard and custom low-noise, precision, linear ICs and high-resolution A/D and D/A converter ICs. The Company's products are designed to serve data acquisition applications in the military, industrial, and medical market sectors. LIS provides ASIC design services using a cell-based design approach. The Company's cell-based library uses an advanced set of automated layout tools that combine cells, process, and software.

LIS began offering products in January 1988 and currently offers 18 products. Future plans include expanding the Company's high-resolution, high-speed, high-accuracy data conversion products; low-noise; high-precision linear ICs products; and additional cell-based designs in both the linear and digital areas. Developments will emphasize military applications with higher levels of radiation hardness.

The Company was founded by John Hall, who founded and served as president of Micro Power Systems. The Company conducts manufacturing and engineering in Fremont, California. Recently, a second facility was completed; it houses design and corporate offices.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*John Hall
Micro Power

General Manager
Bob Sabo
Micro Power

Dir Mktg
Richard Hall
Micro Power

*Founder

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

Bipolar linear
1.5- to 5.0-micron high-density CMOS
Both processes are offered with dielectric isolation and the capability to withstand high levels of nuclear radiation.

Facilities

Fremont, CA
10,000 sq. ft.
Administration, design, manufacturing, test

The Company has an additional 5,000 sq. ft. of dedicated capacity.

SERVICES

ASIC Design

Linear Integrated Systems Inc.

PRODUCTS

- Precision Low-Noise Linear ICs
- High-Resolution A/D and D/A Converter ICs
- Cell-Based Library of Linear/Digital Cells

OTHER INFORMATION

Linear Integrated does not employ a PR firm.

Linear Technology Corporation

1630 McCarthy Blvd.
Milpitas, CA 95035-7487
408/432-1900

ESTABLISHED: September 1981 **NO. OF EMPLOYEES: 450**

BACKGROUND

Linear Technology Corporation (LTC) designs, manufactures, and markets a broad line of standard high-performance linear ICs using silicon gate CMOS and bipolar technologies. The Company markets about 180 linear ICs, with temperature and packaging variations resulting in more than 1,800 device types, one-half of which are proprietary. Products focus on the instrumentation, process control, industrial, and military markets.

The Company specializes in precision products in the analog and analog-to-digital interface markets and also provides proprietary linear functions for its products, including data acquisition products. LTC supplies op amps, voltage regulators, references, data conversion devices, interface devices, monolithic filters, and special-function devices such as temperature sensors. In the future, LTC plans to increase its presence in the converter and interface markets. LTC benefits from the increasing prominence of its proprietary chips and from the absence of Japanese competition.

The Company has a strong presence in the military market, accounting for approximately 10 percent of worldwide sales and about 35 to 40 percent of North American sales. From its beginning, LTC followed a marketing strategy aimed at penetrat- ing the military market. In August 1984, LTC received DESC JAN Class-B qualification and, in 1987, also achieved certification to begin fabrication of JAN Class S-level linear devices for space applications. The first Class-S product is the LM108AH, an operational amplifier that was shipped in 1988.

Linear Technology was founded in 1981 by Robert H. Swanson, Jr., Robert C. Dobkin, Brian E. Hollins, Brent Welling, and Robert Widler from National Semiconductor's linear design group. In September 1982, the manufacturing team was in place and the Company had moved into its current facility in Milpitas, California. By January 1983, the Company had produced its first wafers.

In May 1986, LTC established a company in Tokyo, Japan, to provide technical services to its Japanese customers. The company, named Linear Technology K.K., is wholly owned by the U.S. parent.

In September 1986, LTC moved its headquarters and some of its operations to a new 43,000–square–foot building next to its current headquarters in Milpitas. The Company's previous headquarters were taken over by LTC's expanded design, engineering, and domestic high-reliability assembly and wafer fabrication operations already located in the building.

In 1987, LTC signed an agreement with Texas Instruments, providing the Company with TI's BiCMOS manufacturing, assembly, test, and CAD tools, and a credible second source.

LTC markets its products through a network of independent sales representatives and electronics distributors. The Company also has approximately 1,000 OEM customers, including Compaq, Fujitsu, Honeywell, HP, Hughes, Philips, Raytheon, Rockwell, and Siemens.

BOARD
(Name and Position)

*Robert H. Swanson, Jr.
Linear Technology Corporation, President, CEO

Regis McKenna
Regis McKenna, Inc., Chairman

Glenn M. Mueller
Mayfield Fund, General Partner

Thomas S. Volpe
Volpe & Company, Managing Partner

Linear Technology Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Robert H. Swanson
NSC, VP/GM Linear IC Ops

VP Operations
Dr. Clive B. Davies
NSC, Grp Dir Adv Tech

VP Engineering
*Robert C. Dobkin
NSC, Dir Adv Circuit Dev

VP Mktg/Sales
William A. Ehrsam
NSC, Grp Dir Mktg Commun

VP Finance/CFO
Paul Coghlan
GenRad, VP/GM Test Prod Div

*Founder

FINANCING

September 1981
Round 1
$5.0M
Capital Management Services; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Mayfield Fund; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors

May 1982
Round 2
$5.0M
Olivetti, Finance for Industry, and a Hong Kong investor

Lease
$9.0M
Greyhound Computer Corp.

April 1983
Round 3
$7.0M
Cowen and Company, Greivson Grant, Kemper Financial, Kleinwort Benson, Morgan Stanley, State Farm, Touche Remnant, and others

Lease
$9.0M
Greyhound Computer Corp.

May 1986
Initial public offering
$24.0M

RECENT HIGHLIGHTS

May 1986
LTC established a Japanese unit to strengthen its technical services to Japanese customers. The unit is Linear Technology K.K. and is wholly owned by LTC in the United States. Robert Swanson was appointed president and Atsushi Nakata, general manager.

September 1986
LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas.

December 1986
LTC announced voltage references and other devices in surface-mount packages.

February 1987
Linear introduced its XH series that includes five linear ICs guaranteed to operate at a temperature range from -125° to +200° centigrade.

April 1987
LTC offered the LT1030, a bipolar line driver. The quad, low-power, line driver is part of LTC's family of RS-232 driver/receiver circuits. It can be used as an interface, an RS-232 driver, or as a logic-level translator.

June 1987
LTC offered the LTC1090, a 10-bit CMOS data acquisition system. It includes a software-controlled 8-bit analog multiplexer with sample-and-hold and a 10-bit ADC. The device operates in a full-duplex mode, and a selection feature allows data to be transmitted either most-significant-bit (MSB) first or least-significant-bit (LSB) first.

July 1987
LTC received QPL Part-1 approvals from DESC for 10 of the company's BiFET and low-noise operational amplifiers and negative adjustable regulators. This brings the number of JAN QPL parts available to 30.

ALLIANCES

Silicon General
July 1982
LTC and Silicon General signed a technology exchange and second-source agreement under which Silicon General provides pulse width modulators and two additional circuits and second-sources several high-current series pass regulators developed by LTC; no masks are involved. (expired)

Teijin/Japan Macnics/Technology Trading
June 1983
LTC signed an agreement with Teijin Advanced Products, Japan Macnics, and Technology Trading for distribution in Japan.

Signetics
June 1984
LTC and Signetics signed a three-year agreement granting Signetics the right to purchase die in wafer form and manufacturing rights for three precision op amps and other unnamed products. Signetics provided LTC with certain small-outline packaging services. (expired)

Interdesign
July 1984
LTC and Interdesign entered into a three-year agreement granting Interdesign the right to design IC arrays, using up to three of LTC's processes. LTC also agreed to dedicate foundry capacity to manufacture the Interdesign arrays. (extended)

Motorola
January 1985
Motorola and LTC signed a seven-year agreement granting each other rights to several patents. LTC gained rights to several Motorola patents; Motorola gained rights to patents obtained and filed during the term of the agreement, which expires in 1991. LTC also will make specific lump-sum payments through 1991.

National
July 1986
National and LTC entered into a patent-licensing agreement granting LTC rights to products under two National BiFET patents. National was granted rights to LTC's BiFET-related patents, including those filed through 1992. LTC pays royalties.

TI
March 1987
LTC and Texas Instruments signed a five-year agreement allowing TI to select six of LTC's circuits every six months for the duration of the agreement. TI will pay LTC $500,000 every six months and pay royalties for a 10-year period on any LTC circuit that TI produces.

MANUFACTURING

Technology

Single-layer polysilicon bipolar
Single- and double-layer silicon-gate (LTCMOS)
4-inch wafers
5-inch wafers

Facilities

Milpitas, CA
40,600 sq. ft.
Administration and manufacturing

20,000 sq. ft.
Class 10 clean room

42,000 sq. ft.
Linear headquarters and test

Most commercial product assembly is subcontracted to companies in South Korea, Malaysia, Thailand, and Taiwan.

PRODUCTS

Regulators
Positive fixed and adjustable regulators ranging from 125mA to 5A.

Reference
Wide range of references from 1.2V to 10.0V.

Op Amps
LTC offers a complete line of Op Amps and more than 40 different chips.

Comparators
Dual, CMOS Dual, High-Speed and Window Comparators, and Voltage Regulator plus Comparator

Filters
Single, Dual and Triple Filters, Five-Pole, Maximally Flat, Low-Pass Filter, 8th Order, Quad 80-kHz Switched Cap Filter

Regulating Pulse-Width Modulators
Switching Regulator, Switching Regulator Controller, Switching Power Supply Circuit, Oscillator Accuracy

Interface Products
RS-232 Line Driver, Triple RS-232 Driver/Receiver, 5V Powered RS-232 Driver/Receivers, Programmable Power Hex Translator/Driver/Receiver

Data Acquisition Products
10-Bit Data Acquisition Systems, 10-Bit Serial I/O ADC with Reference Pin of 6-Channel MUX, 10-Bit Serial I/O with 8-Channel MUX

Other Products
Current Source, Voltage Converters, Power Buffer, Reference Diodes, Voltage Inverter, Cold-Junction Compensator Kit for Thermocouples, Sample-and-Hold Amplifier

OTHER INFORMATION

Linear Technology Corporation's PR firm is Tycer, Fultz, & Bellack.

Logic Devices Inc.

628 E. Evelyn Avenue
Sunnyvale, CA 94086
408/720-8630
Fax: 733/7690
Telex: 172387

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 55**

BACKGROUND

Logic Devices Inc. designs, manufactures, and markets very high performance semiconductors using 1.2-micron CMOS process technology. The Company's products address applications that require very high operating speeds and/or low-power operation.

The Company offers a line of high-performance 16K, 64K, and 256K SRAMs; a line of high-performance building block components for DSP applications; and a line of computer interface circuits that implement the SCSI standard. The products are used in military signal-processing systems (radar, sonar, and seeker systems), video and medical imaging systems, array processors and superminicomputers, engineering workstations, telephony systems, and personal computers.

Approximately 30 percent of the Company's sales are products produced in full compliance with MIL-STD-883 Rev. C. In addition, the Company produces a portfolio of custom circuits that address high-end military DSP applications (adaptive FIR filtering) and telecommunications problems such as echo canceling, ADPCM compression, and cross-point switching.

Company operations in Sunnyvale, California, include administration, sales and marketing, engineering, assembly, and high-reliability testing and screening. Commercial products are offered in plastic dual-in-line, leaded chip carriers, and SOIC packaging. Military products are available in leaded and leadless chip carriers, flat packs, and pin grid array packages. Manufacturing operation follows the requirements of MIL-STD-9858, -45662, and -883C. These operations have been audited and approved by many major military systems contractors.

Products are marketed through a network of domestic and international stocking distributors and manufacturers' representatives, with 103 locations worldwide. U.S. distributors include Cypress Electronics, Falcon, Future, and Milgray. The Company operates direct regional sales offices in Los Angeles, California and New York City, New York.

BOARD
(Name and Affiliation)

Howard L. Farkas
Farkas Realty, Chairman

William J. Volz
Logic Devices Inc., President

James McAllister
Logic Devices Inc., VP Operations

Burton W. Kantor
Walnut Capital Corp., COB

Albert Morrison
Caplan, Morrison, Brown & Company, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*William J. Volz
TI, Technical Staff

Sr VP Operations
James McAllister
Indy Electronics, Executive VP

CFO
Todd Ashford
W.R. Grace, Financial Analyst

VP Mktg/Sales
Joe Krouse
IDT, HQ Sales Mgr

Nat Sales Manager
Del Valek
ITT, Sales Manager

Dir QA/Rel
Don Taylor
Exar, QA Manager

VP Technology
Tony Bell
VLSI Design, Consultant

VP Strategic Bus
Gary Ater
Vitelic Assoc, N/A

Dir Prod Mktg
Joel Dedrick
Texas Instruments, N/A

*Founder

FINANCING

November 1988
IPO
$5.4M
Initial public offering

MANUFACTURING

Technology

1.2- and 1.5-micron CMOS
0.9 micron CMOS

Facilities

Sunnyvale, CA
12,500 sq. ft.
Administration, sales and marketing, engineering, assembly, high-reliability testing and screening

2,500 sq. ft.
Clean room

PRODUCTS

SRAMs

Device	Description	Speed
L6116	2Kx8	20ns
L7C161/162/164/165/166	16Kx4	20ns
L7C167	16Kx1	12ns
L7C168 through 172	4Kx4	15ns
L185/186	8Kx8	25ns
L7C187	64Kx1	15ns
Specialty Memory Circuits		
L10C11	18x8-Bit Variable Delay	
LRF07	Three Independent Port 8x8	35ns
LRF08	Five Independent 8x8	35ns
L29C520/521	8-Bit Multilevel Pipeline Registers	22ns
LPR520/521	16-Bit Multilevel Pipeline Registers	22ns
L29C524/525	16-Stage Pipeline Registers	
L29C818	Shadow Register	
Multipliers		
LMU08	8x8 Signed Parallel Multiplier	35ns
LMU8U	8x8 Unsigned Parallel Multiplier	35ns
LMU557/558	8x8 Mixed Parallel Multipliers	60ns
LMU12	12x12 Parallel Multipliers	35ns
LMU112	12x12 Reduced Pincount	50ns
LMU16/216	16x16 Parallel Multipliers	35ns
LMU17/217	16x16 Microprogrammable Multipliers	45ns
LMU18	16x16 Parallel Multiplier with Dedicated 32-Bit Output Port	35ns
LMS12	12x12 Video Multiplier with 26-Bit Adder	40ns

Multiplier/Accumulator Circuits

Device	Description	Speed
LMA1009	12x12 Multiplier/Accumulator	45ns
LMA1010/2010	16x16 Multiplier/Accumulators	45ns
Arithmetic Logic Units		
L29C101	16-Bit Slice (4x2901 & 2902)	35ns
L4C381	16-Bit Cascadable Adder/Subtractor (4x54S381)	26ns
LSH32	32-Bit Cascadable Barrel Shifter/Normalizer	32ns
L10C23	64x1 Digital Correlator	20ns
Communications Controllers		
L5380	Asynchronous SCSI Controller Chip	4Mbps
L53C80	SCSI Controller	4Mbps

OTHER INFORMATION

Logic Devices' PR firm is Faries and Associates.

Lytel

61 Chubb Way
P.O. Box 1300
Somerville, NJ 08876
201/685-2000
Fax: 201/685-1282

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 130**

BACKGROUND

Lytel was formed to design, develop, and manufacture InGaAsP technology-based electro-optic components for the telecommunications, data communications, and military markets. Products include semiconductor lasers, LEDs, and photodetectors using an indium phosphide materials technology.

Lytel's first products, introduced in January 1986, were InGaAsP high-power lasers for fiber-optic applications. The Company is focusing on quality, reliability, delivery, and performance.

Lytel occupies a 57,000-square-foot facility that includes a Class 1,000 clean room.

BOARD

Not Available

COMPANY EXECUTIVES
(Position and Name)

GM
Gerald Leehan

VP Engineering & Development
*Ron Nelson

Controller
Tim Bock

*Founder

PRODUCTS

InGaAsP High-Power Lasers
LEDs
Optical Data Links

OTHER INFORMATION

Lytel's PR firm is The Jason Group.

FINANCING

1984
Start-up
$20.0M
AMP

November 1988
N/A
Became a subsidiary of AMP

ALLIANCES

Not available

MANUFACTURING

Technology

InGaAsP
1.3-micron opto components

Facilities

Somerville, NJ
57,000 sq. ft.
Manufacturing, assembly, test

5,000 sq. ft.
Class 1,000 clean room

Matra-Harris Semiconducteur

La Chantrerie/Route Gachet
B.P. 942
44075 Nantes cedex/France
(40) 303030
Telex: MATHARI 711930 F

ESTABLISHED: 1979 **NO. OF EMPLOYEES: 1,000**

BACKGROUND

Matra-Harris Semiconducteur (MHS) designs, manufactures, and markets a broad range of ICs, using bipolar, CMOS, and NMOS process technologies. Its main product strategies center on ASICs, fast SRAMs, microprocessors, and telecommunications circuits.

MHS was formed in 1979 as a joint venture company by Matra of France and Harris Corporation of the United States. Prior to this formal link, Matra and Harris had made agreements for CMOS technology transfers. The agreement was extended in 1980 to include bipolar products.

The Company was supported by the French government in place at that time to develop high technology in France. A 12,000-square-foot factory was built near Nantes, France, and designated as an area for industrial development, which allowed MHS to gain government financial assistance. Initial wafer fabrication began in December 1980.

In 1982, Harris and MHS merged their European marketing operations outside France (Harris-MHS). The new operation was financed equally by the two partners. Under the 1979 agreement, MHS continues to have exclusive sales rights in France for the Harris line of semiconductors. Conversely, Harris represents MHS exclusively for sales in North America.

Today, Matra-Harris remains the only independent French semiconductor operation not absorbed into the Thomson Group.

The Company's ASIC capability includes a range of matrices with from 250 to 7,500-gates, using CMOS technology and integrated design tools based on the VAX or IBM PCs. Libraries are available on Daisy, Mentor, and Valid systems.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Chairman
Guy Dumas

Strategist
Jean-Claude Rentlet

Commercial Dir
Michael Thouvenan

FINANCING

1979
$40.0M
Matra S.A. and Harris Corp.

RECENT HIGHLIGHTS

December 1986
MHS unveiled eight new products at Wescon/86, including the HM65787, a 64Kx1 SRAM that is the first application of the 0.8-micron process licensed from Cypress Semiconductor.

June 1987
Intel and Matra-Harris dissolved their joint venture design facility, CIMATEL G.I.E. CIMATEL was formed in 1982 as an equal partnership to design standard VLSI devices for the telecommunications and computer graphics

markets. It was jointly owned by Intel and MHS S.A. The dissolution of CIMATEL is due to a reassessment by Intel of its long-range marketing plans. CIMATEL had been responsible for the design of the 82716 video controller, as well as the announced ISDN chip set, the 29C48 combo, and the 29C53 S-transceiver. CIMATEL was located in Paris, France, and employed 26 persons. MHS made employment offers to many CIMATEL employees.

ALLIANCES

Intel
March 1981
MHS and Intel signed an agreement covering NMOS circuits and establishing a joint design facility in Nantes called CIMATEL.

June 1987
Intel and MHS dissolved CIMATEL due to a change in Intel's long-range plans. CIMATEL employed 26 persons, many of whom were offered employment at MHS.

Cypress Semiconductor
October 1985
Cypress transferred masks for its 25ns 4K and 16K SRAMs and provided its 1.2-micron CMOS technology to Matra-Harris. Cypress will receive 2 percent of Matra-Harris stock for an undisclosed amount of cash. A similar deal for the Cypress 0.8-micron process and 64K SRAM is planned.

Weitek
March 1986
MHS and Weitek signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process in exchange for manufacturing a variety of Weitek's products. The companies will also codevelop complex, high-speed logic devices for DSP, telecommunications, and military markets.

Silicon Compilers
June 1986
MHS and Silicon Compilers Inc. (SCI) will integrate SCI's Genesil silicon design system with MHS' advanced 2-micron, dual-level, metal CMOS process. MHS will also offer prototyping services, volume production, and design services for Genesil users.

Cypress, Aspen
April 1988
MHS entered into an R&D agreement with Cypress Semicondoctor and Aspen Semiconductor. MHS will provide $4.57 million in contract funding for the development of ultrahigh-speed ECL circuits to be developed by Aspen.

MANUFACTURING

Technology

2.5-, 2.0-, 1.2-, and 0.8-micron CMOS
1- and 2-layer metal
5-inch wafers

Facilities

Nantes, France
72,000 sq. ft.
Design, manufacturing in Class 10 clean room, assembly, and test

PRODUCTS

CMOS SRAMs
MHS markets 4K, 16K, 64K,and 256K SRAMs in a wide range of configurations, available in I/O multiplexed or separated form.

Dual-Port SRAMs
CMOS 2Kx8 Synchronous
CMOS 2Kx8
CMOS Dual-Port RAM Controller

CMOS Linear Arrays
Available in 3-micron, 1-layer metal with 228-1139 gates or in 2-micron, 2-layer metal with 810 to 11,250 gates

Microcomponents

MPUs
- HMOS 16-Bit MPU; 5, 8 MHz
- CMOS 16-Bit MPU; 5, 8 MHz
- HMOS 8-, 16-Bit MPU; 5, 8 MHz
- CMOS 8-, 16-Bit MPU; 5, 8 MHz

MCUs
- HMOS 8-Bit MCU with 4K ROM
- CMOS 8-Bit MCU with 4K ROM
- HMOS 8-Bit MCU with 8K ROM
- CMOS 8-Bit MCU with 8K ROM
- 80C52 8-Bit with 16K ROM

MPRs
- Video Storage Display Device Interface

Telecommunications Circuits
- Serial PCM Codec-Filter Family
- CMOS Combo
- CMOS Digital Loop Controller
- X.21 Protocol Controller
- Monolithic CMOS Codec-Filter Serial Interface
- 300-Baud Modem

DSP
- 16x16 Parallel Multiplier/Accumulator 45ns
- 16x16 Parallel Multiplier 45ns

OTHER INFORMATION

Matra-Harris does not employ a PR firm.

Maxim Integrated Products, Inc.

120 San Gabriel Drive
Sunnyvale, CA 94086
408/737-7600

ESTABLISHED: May 1983 **NO. OF EMPLOYEES: 172**

BACKGROUND

Maxim Integrated Products, Inc., designs, manufactures, and markets a broad range of linear and mixed-signal ICs for the analog market. The Company's objective is to develop and market both industry-standard and proprietary linear ICs using a diversity of process technologies.

Currently, the Company offers 200 products that are available in a number of packaging options including surface-mounted package technology. Products are designed for computer and peripherals, instrumentation, process control, communications, military, factory automation, and medical applications.

The Company sees its primary competitors as Analog Devices and Intersil. The competition with Intersil is intense and is expected to intensify further as the result of a second-source agreement giving Intersil the right to select and license up to 10 circuits designed by the Company.

Maxim was founded by John F. Gifford, Frederick Beck, Dr. Steven Combs, and David J. Fullagar, all former employees of Intersil's Analog IC Product Division. Maxim purchased a 30,000-square-foot facility in Sunnyvale, California, from Si-Fab. In February 1988, the Company completed the sale of 2.3 million shares of common stock. Maxim is using the proceeds to prepay $3 million in long-term debt incurred when it purchased a new facility in October 1987. The remaining amount will be applied to equipment and other expenses for the new facility. The facility houses the Company's executive offices, engineering, and all services connected with its manufacturing.

The Company's products are sold worldwide through 63 sales representative organizations and electronics distributors. Domestic distributors are Anthem Electronics, Bell Industries, Hall-Mark Electronics, and Pioneer Electronics. In fiscal 1987, approximately 38 percent of sales were from the United States, 37 percent from Europe, 17 percent from Japan, and 8 percent from ROW. Among the Company OEM users are AT&T, Brown Boveri, GEC Card Technology (an affiliate of General Electric Company Plc), Hewlett-Packard, IBM, McDonnell Douglas, NEC, Siemens, and Tokyo Electric Co., Ltd.

BOARD
(Name and Affiliation)

John F. Gifford
Maxim Integrated Products, Inc., President

Paul Bancroft
Bessemer Venture Partners L.P., Limited Partner

B. Kipling Hagopian
Brentwood Associates, General Partner

Stephen L. Merrill
Merrill, Pickard, Anderson & Eyre, General Partner

James R. Bergman
DSV Associates

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*John F. Gifford
Intersil, President/CEO

VP Mktg/Sales
*Frederick Beck
Intersil, SR VP WW Sales/Mktg

VP Operations
*Dr. Steven Combs
GE, Mng Dir Process Tech

VP R&D
*David J. Fullagar
Intersil, VP Engineering

VP Finance/Admin
John H. Trollman
DEST Corp., VP Finance

*Founder

FINANCING

1983
Round 1
$4.9M
Bessemer Venture Partners; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Venad; overseas venture capital

February 1985
Round 2
$5.5M
Adler & Co.; Bessemer Venture Partners; Brown Boveri; Brentwood Associates; DSV Partners; De Monet Industries; Merrill, Pickard, Anderson & Eyre

Lease
$5.3M
Bank of America; Bank of the West

September 1985
Round 3
$6.4M
Bessemer Venture Partners; BNP Ventures; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Rothschild, Inc.

March 1986
R&D
$1.2M
Venture Technology Funding

February 1988
IPO
$7.0M
Initial public offering

RECENT HIGHLIGHTS

January 1987
Maxim offered a family of RS-232 components designed for specific uses such as digital PBX or modem interfaces. The devices are as follows:

- MAX230 and MAX231 digital PBX interfaces
- MAX232/233/235/236 general-purpose interfaces
- MAX234/237/239 modem interfaces

July 1987
Maxim offered an MPU supervisory circuit that tracks power levels to reset processor functions and switch over to battery backup. The device is designed for laptops and industrial control.

July 1987
Maxim offered the MAX452 family of CMOS video multiplexers/amplifiers.

February 1988
Maxim offered 1.7 million shares of common stock in an initial public offering. Maxim is using the proceeds to prepay $3 million in long-term debt incurred in the acquisition of its new facility, with the remaining amount going toward equipment and other expenses for the new facility.

ALLIANCES

Intersil
1984
Maxim and Intersil entered into an agreement that resolved legal proceedings between them. Under the agreement, Maxim granted Intersil the right to select, by July 1989, up to 10 circuits designed by Maxim for manufacture and sale on a royalty basis. Intersil granted Maxim certain rights to Intersil products, trade secrets, and patent rights. Intersil has selected three of Maxim's proprietary products.

April 1986
Maxim and Intersil signed a second-source agreement.

Brown Boveri
February 1985
Maxim agreed to design and manufacture devices for Brown Boveri.

Supertex
April 1988
Maxim and Supertex signed an agreement to jointly market the 690 family of MPU supervisory circuits.

MANUFACTURING

Technology

Metal-gate CMOS for 1.5 to 18.0V operation
Metal-gate CMOS for 5 to 40V operation

Silicon-gate CMOS-DMOS for up to 150V operation
High-density/low-noise, analog silicon-gate CMOS
Low-noise, precision linear bipolar for up to 44V operation

Facilities

Sunnyvale, CA
62,000 sq. ft.
Design and test

PRODUCTS

Multiplexers
RF-Video, Fault-Protected, Differential, and CMOS Analog Multiplexer

CMOS Analog Switches
Quad-SPST, Quad-DPST, Dual-DPST, Dual-SPST, Low-Power, Low-Charge, RF-Video, and TTL-Compatible Switches

A/D Converters
3.5- and 4.5-Digit Converters, High-Speed, Low-Power or Low-Noise Converters, Available with LED or LCD Drivers, 12-Bit Converter with Three-State Binary Output

Op AMPs/Buffers
Low-Power Single, Dual, Triple, and Quad OP Amps, Power Op Amp, Precision Op Amp, Fast and Very Fast Buffer Amp, High-Accuracy Fast Buffer, Superlow-Offset Op Amp, Chopper-Stabilized Op Amps

Display Drivers/Counters
4-, 5-, 8-, 10—Digit LCD Decoder/Drivers, 4.5-Digit LCD, High-Speed Counters/Decoders/Drivers

Interface
+5V Powered, Dual-RS-232 Transmitter and Receiver

Switched Capacitor Filter
Dual, Second-Order, Universal Switch Capacitor Filter

Timers/Counters
Programmable or fixed RC Timer/Counter, Low-Power, General-Purpose Timer or Dual Timer

Power Supply Circuits
AC/DC Regulators, Fixed/Adjustable Output, Step-Up Switching Regulator, Inverting Switching Regulator, Step-Down Switching Regulator, Positive or Negative Voltage Regulator, Voltage Converter, Under-/Overvoltage Detector MPU Watchdog Battery, Switchover/Reset Generators

Voltage References
+10.0V and -10.0V Precision Reference, 1.2V Voltage Reference, +10.0V Voltage Reference, +5.0V Precision Voltage Reference

OTHER INFORMATION

Maxim does not employ a PR firm.

MemTech Technology Corporation

3000 Oakmead Village Court
Santa Clara, CA 95051
408/970-8900
Fax: 408/986-0656

ESTABLISHED: December 1986 **NO. OF EMPLOYEES: 75**

BACKGROUND

MemTech Technology Corporation is dedicated to the manufacture of bubble memory devices and related products. The Company was formed to acquire the business, principal assets, technology, and R&D capability of Intel Corporation's Magnetic Operation. The Company's leveraged buyout was initiated by the two founders, Richard H. Loeffler and William H. Almond, as well as an additional equity partner, Golodetz Corporation.

The Company is concentrating primarily on military and industrial applications of bubble memory technology. Recently, MemTech won a contract from the Wright-Patterson Air Force Base Avionics Laboratory to conduct work on advanced bubble memory devices. MemTech also works closely with General Electric on the Milstar Satellite program.

MemTech is headquartered in Folsom, California. The Company occupies more than 65,000 square feet of manufacturing space for device manufacture and assembly in Folsom, Santa Clara, and Santa Rosa, California. In addition, MemTech has a network of sales and customer service support operations located throughout the world.

In April 1987, MemTech purchased the Crystal Division of Materials Progress Corporation, the only remaining U.S. supplier of gadolinium gallium garnet (GGG) substrates. GGG are the base materials essential for the manufacture of bubble memory devices.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
*Richard H. Loeffler
Helix Systems, Chairman/CEO

President/COO
*William H. Almond
Eaton, GM Microlithography Division

VP Sales/Mktg
Joseph J. Rutherford
Materials Progress, VP Mktg/Sales

VP Technology
Dr. Peter Silverman
Intel, FAB Manager

*Founder

FINANCING

Not available

ALLIANCES

Not available

Facilities

Santa Clara, CA
20,000 sq. ft.
Engineering, assembly, test, marketing, sales, component fabrication

Santa Rosa, CA
13,000 sq. ft.
Crystal products division Tenth-Wave Division

PRODUCTS

1Mb Device and Board-Level Products

Device	Description
BPK70AZ	1Mb (128KB), Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
BPK72AZ	1Mb Bubble Memory Prototype Kit
SBX251	Bubble Memory Board (128KB) Bubble Memory
SBC254	Bubble Memory Board (128KB to 512KB capacity)
BCK10	1Mb Bubble Cassette System with interchangeable 128KB Bubble Cassette Cartridges

4Mb Device and Board-Level Products

BPK74	4Mb Bubble Memory Subsystem (512KB) Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
SBX261	4Mb Bubble Memory Board SBX Bus Compatible (512KB Capacity)
SBC264	Bubble Memory Board (512KB to 2MB capacity)
PCB75/76	Bubble Memory Card (512KB to 1MB capacity), IBM PC, ST, AT Compatible, and other compatible systems
PCB74	Bubble Memory Expandable Memory Card (512KB to 4MB) IBM, PC, XT, AT Compatible or other compatible systems
BVME164/174	VMEbus Compatible Bubble Memory Boards. Expandible at system level up to 15MB
BCS74	1MB Bubble Memory Cassette System with Multiple Interfaces available, PC, SBX, SCS1, and STD (512KB to 1MB capacity)

OTHER INFORMATION

MemTech's PR firm is Matthews and Clark.

Micro Linear Corporation

2092 Concourse Drive
San Jose, CA 95131
408/433-5200
Fax: 408/432-0295
Telex: 275906

ESTABLISHED: October 1983 **NO. OF EMPLOYEES: 144**

BACKGROUND

Micro Linear Corporation designs, manufactures, and markets linear and mixed linear/digital ICs, including both proprietary and enhanced second-source products as well as ASICs.

Micro Linear offers standard and semicustom ASICs that use a bipolar process. In addition, Micro Linear offers standard products using a CMOS process. Products are designed primarily for computer peripherals, telecommunications, power supply controls, industrial, and military applications.

Micro Linear also offers a number of computer-aided design (CAD) tools and a portfolio of linear semicustom design methodologies—including mask-programmable analog arrays and standard cells—that simplify the development of both standard and ASIC products containing analog functions.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Art Stabenow
National, Sr VP/Analog Div

VP Marketing
Charles Gopen
Daisy Systems, GM IC Layout Div

VP Sales
Tim D. Cox
National, Dir Dist Sales

VP Engineering
*Dr. Jim McCreary
Intel, Program Mgr

VP Finance/Admin
*Al Castleman, Jr.
MCI/Quantel, VP Finance

VP Materials/Quality Ops
*Abe Korgav
SEEQ, Dir Test/Assembly

VP Mfg Operations
Micheal Morrione
National, Product Line Mgr-Linear Op

*Founder

FINANCING

October 1983
Round 1
$4.0M
Fairfield Ventures; Founders, Adler & Co.; Oak Investment Partners; Richard Reardon

Lease
$3.5M
California First Bank; Western Technology Investors

November 1985
Round 2
$12.0M
Round 1 investors, Accel Partners, Grace Ventures, Greenwood Funds, Harvest Ventures, Institutional Venture Partners, International Industrial Interests, Investors in Industry, Kyocera International, Montgomery Bridge Funds, Grine Ventures, International Tadiran, Xerox Venture Capital

Lease
$3.0M
Burnham Leasing Corp.; California First Bank

February 1986
Round 3
$15.0M
Round 1 and 2 investors, Aeneas Venture Corp., First Analysis Corp., GE Pension Fund, Kuwait & Middle East Financial Services, Northern Telecom, Schroeder Ventures, United Eastern Investments, U.S. Venture Partners

Lease
$3.2M
Burnham Leasing, Westinghouse Credit, Phoenix Leasing

August 1988
Round 4
$10.0M
Round 1, 2, and 3 investors, Concord Partners, Merrill Lynch Venture Capital, Sigma Partners

Lease
$2.6M
Pitney Bowes Credit, GATX Leasing, Phoenix Leasing

ALLIANCES

IMP
June 1984
IMP and Micro Linear codeveloped a 10V CMOS process; IMP provides foundry services for Micro Linear.

Rockwell
1985
Rockwell invested in Micro Linear ($1.8M cumulatively) and purchases products from Micro Linear.

Tadiran
1985
Tadiran invested in Micro Linear ($1.6M cumulatively) and purchases products from Micro Linear.

Kyocera
1985
Kyocera invested in Micro Linear ($1.5M cumulatively) and purchases products from Micro Linear.

Toko
October 1985
Toko began making bipolar devices for Micro Linear at its Saitama, Japan, plant.

Northern Telecom
1986
Northern Telecom invested in Micro Linear ($2.0M cumulatively) and purchases products from Micro Linear.

Analog Design Tools
July 1986
Micro Linear integrated both its micro- and macrocell libraries into Analog Design Tools' workbench CAE system.

Daisy Systems
August 1986
Daisy Systems agreed to port Micro Linear's FB300 and FB900 cell libraries to Daisy's workstations.

IMP/MBB
August 1986
IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

MANUFACTURING

Technology

Bipolar
20V, 300-MHz, single-layer metal
12V, 900-MHz, dual-layer metal
36V, 300-MHz, dual-layer metal
12V, 3-GHz, dual-layer metal (1989)
10V, 3.0-micron, dual-layer polysilicon CMOS
8V, 1.2-micron, dual-poly/dual-metal (1989)

Facilities

San Jose, CA
48,000 sq. ft.
Design, manufacturing, and test

PRODUCTS

Bipolar Analog Arrays

Family	Linewidth (Microns)	Interconnect
FB900	10.0	Single-Layer Metal
FB300	8.0	Dual-Layer Metal
FB3400	8.0	Dual-Layer Metal
FB3600	7.0	Dual-Layer Metal

Standard Linear Products

Device	Description
Disk Drives	Bipolar Standard and Semicustom ICs for Read/Write, Data Recovery, and Servo Actuator Control
Telecommunications	CMOS Products for Conditioning Analog Phone Lines; Programmable Attenuators, Equalizer, Loopback, and Tone Signaling
Data Converters	12-Bit and 8-Bit ADC with Serial and Parallel Interfaces

CAD

Micro Linear provides Libraries of Devices and Macro Models for its bipolar ASIC products. The Libraries run on industry-standard platforms such as ViewLogic, Analog Design Tools, and Daisy Workstations.

OTHER INFORMATION

Micro Linear Corporation's PR firm is Rigoli, Panthalon, Demeter.

Microwave Monolithics

465 East Easy Street
Simi Valley, CA 93065
805/584-6642

ESTABLISHED: April 1982 | **NO. OF EMPLOYEES: 17**

BACKGROUND

Microwave Monolithics specializes in GaAs monolithic microwave ICs (MMICs) for Department of Defense (DOD) microwave specialty circuits as well as custom GaAs circuits.

The Company is privately held by five partners and completed first-round financing in 1983 through private sources.

Microwave Monolithics did custom GaAs circuit design research and development work for government agencies and OEMs until financing was secured. The Company began producing GaAs MMICs by year-end 1984.

BOARD

Not available

PRODUCTS

MMICs

OTHER INFORMATION

Microwave Monolithics does not employ a PR firm.

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Daniel Ch'en
Rockwell, Mgr M/W Rsch

*Founder

ALLIANCES

Not available

MANUFACTURING

Technology

0.5-micron GaAs fine-line capability

Facilities

Simi Valley, CA
8,000 sq. ft.
Two Class 100 clean rooms

Microwave Technology, Inc.

4268 Solar Way
Fremont, CA 94538
415/651-6700
Fax: 415/651-2208

ESTABLISHED: May 1982 **NO. OF EMPLOYEES: 160**

BACKGROUND

Microwave Technology, Inc., (MwT) is a vertically integrated manufacturer of GaAs-based microwave components and subassemblies. MwT designs, manufactures, and markets GaAs epitaxial materials, GaAs FET devices, MMICs, hybrid MICs, and microwave components and subassemblies. The Company's products are designed for defense-related applications.

MwT produces both ultralow-noise and medium-power GaAs FETs and AlGaAs HEMT devices for applications ranging from 0.5 GHz to 40.0 GHz. The devices are produced with gate lengths from 0.1 to 0.25 micron. The Company is developing a family of high-performance MMIC products and has completed a series of 2- to 6-GHz MMIC amplifiers. Products in the 2- to 18-GHz and 6- to 16-GHz ranges are in development.

The Company also offers GaAs FET amplifiers from 0.5 to 26.5 GHz that use MMIC and hybrid MIC modules.

In 1987, MwT acquired Monolithic Microsystems, Inc. of Santa Cruz, California. Monolithic Microsystems makes detector log video amplifiers (DLVAs), log video amplifiers (LVAs), and threshold detectors based on proprietary monolithic LVA ICs. Products are used in various EW systems and other defense electronic applications. Monolithic Microsystems will operate as a wholly owned subsidiary of MwT and will continue manufacturing in its 8,200-square-foot Santa Cruz facility.

BOARD
(Name and Affiliation)

Thomas R. Baruch
Microwave Technology, Inc., Chairman

Dr. M. Omori
Microwave Technology, Inc., VP of Engineering

C.C. Bond
New Enterprises Associates

Irwin Federman
Advanced Micro Devices

Dr. P. Kaminski
Hambrecht & Quist

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Joseph Lee
Litton, President

VP Finance/CFO
J. Geyton
Avantek, Div Controller

VP Materials
A. Herbig
Avantek, Tech Staff

VP Engineering/R&D
Dr. Masa Omori
Avantek, Eng Mgr

VP Mktg/Sales
David Gray
EM Systems, Sales Mgr

VP Ops
John Sorci
Watkins-Johnson, Subsystems Div Mgr

FINANCING

August 1983
Round 1
$4.8M

Not available
Round 2
$4.3M

Microwave Technology, Inc.

June 1985
Round 3
$1.0M
Investors were the Allstate Insurance Company, Concord Partners, New Enterprise Associates, T. Rowe Price, Sequoia Capital, and U.S. Venture Partners.

ALLIANCES

Not available

MANUFACTURING

Technology

GaAs

Facilities

Fremont, CA
50,000 sq. ft.
Design, manufacturing
6,000 sq. ft.
Class 1,000 clean room

PRODUCTS

GaAs Epitaxial Materials
GaAs FET Amplifiers, 0.5 to 26.5 GHz
GaAs MMIC Amplifiers, 2 to 6 GHz
GaAs MIC Microwave Products
Thin-Film Hybrids
Log Amplifiers
Detector Log Video Amplifiers

OTHER INFORMATION

Microwave Technology, Inc. does not employ a PR firm.

Mietec N.V.

Westerring 15
9700 Oudenaardé, Belgium
055-33-2211
Fax: 055-318-112
Telex: 85739 MIETEC

ESTABLISHED: March 1983 **NO. OF EMPLOYEES: 280**

BACKGROUND

Mietec N.V. designs mixed analog and digital ASICs, using a cell-based library of digital and analog cells. The Company's ASIC products are split into two categories: user-specific ICs (USICs) and application-specific standard products (ASSPs) for dedicated uses.

The Company is capable of designing devices using CMOS (for low-power, high-density applications), BiMOS (for high-voltage applications, 70V), and SBiMOS (a multipurpose technology) processes. A proprietary development software support tool called Mietec Analog/Digital Engineering (MADE) allows the development and simulation of digital and analog functions simultaneously.

Mietec is a joint venture, 49.8 percent of which is owned by Alcatel Bell Telephone Company; 49.2 percent is owned by GIMV, a Flanders regional investment company; and 1.0 percent is owned by a private investment bank. Mietec is a major supplier of the ASIC products for the Alcatel System 12 and is working on the next generation of Alcatel exchanges based on ISDN.

BOARD

Jo Cornu, Chairman

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

General Manager/CEO
Jean-Pierre Liebaut
Matra-Harris

Business Development Manager
Eric Schutz
Motorola

Director, Marketing & Sales
Alain Gilot
Mostek

FINANCING

Investment in the Company totaled $48.2 million.

ALLIANCES

Sprague
1983
Mietec entered a cross-licensing agreement with Sprague for a BiMOS process.

STM
1987
Mietec, SGS-Thomson, and Alcatel agreed to the transfer of a 1.2-micron CMOS process.

MANUFACTURING

Technology

5.0-, 3.0-, and to 2.4-micron NMOS
3.0- and 2.4-micron CMOS
VMOS
BiCMOS
Single and double-layer metal

Facilities

Oudenaarde, Belgium
The manufacturing center is situated on a 40,000-square-meter site with 10,000 square meters of floor space. A wafer fab is equipped with more than 2,000 square meters of clean rooms, of which 400 square meters are Class 10. Potential capacity is 150,000 wafers per year. The fab is suitable for technologies of 1 micron or lower.

Brussels, Belgium
The customer design center includes VAX 8500, VAX 750, MICROVAX, Tektronix, GPX2, and Daisy equipment, in addition to VALID workstations.

OTHER INFORMATION

Mietec does not employ a PR firm.

Modular Semiconductor, Inc.

138 Kifer Court
Sunnyvale, CA 94086
408/733-5000
Fax: 408/733-0224

ESTABLISHED: September 1983 **NO. OF EMPLOYEES: 12**

BACKGROUND

Modular Semiconductor, Inc., was founded by individuals from Hewlett-Packard, Signetics, and Synertek to design, develop, manufacture, and market VLSI ICs using a 1.0-micron CMOS process technology.

The Company is focusing on data communications chips, memories, semicustom and custom designs, VMEbus chip sets, and telecommunications products. Modular Semiconductor began manufacturing with a 2-micron CMOS process and is now offering 1.5-micron technology, with plans to use a 1.0-micron process in the near future.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Arockiyaswami Venkidu
Faraday Electronics, Dir Engr

Dir Mfg
*Dr. Lenin Anne
Hewlett-Packard, Sr Engr

*Founder

FINANCING

Not available

ALLIANCES

Panatech/Ricoh
November 1984
Modular Semiconductor made a five-year, three-way agreement with Panatech and Ricoh of Japan. Modular provided Ricoh with its CMOS designs and process technology for 16K SRAMs and 256K DRAMs. Ricoh manufactured these devices in Japan and had the rights to market them in Japan. Panatech had the rights to market 16K memories only in North America. (expired)

MANUFACTURING

Technology

1.5-micron CMOS
2.0-micron CMOS

Facilities

Sunnyvale, CA
7,000 sq. ft.
Design

PRODUCTS

CMOS SRAM

Device	Description	Access Time (ns)
MS6168	4K x 4	55ns
MS616	16K x 1	55ns

Data Communication

Device	Description
MS16C450/82C50A	PC UART
MS16C451	PC UART with parallel port
MS16C452	PC DUAL UART with parallel port
MS16C453	PC DUAL UART
MS16C454	PC QUAD UART
MS16C550A	PS/2 FIFO UART
MS16C551	PS/2 FIFO UART with parallel port
MS16C552	PS/2 FIFO DUAL UART with parallel port
MS16C553	PS/2 FIFO UART
MS16C554	PS/2 FIFO QUAD UART
MS68/88C681	DUART
MS82C684	QUART

Bus Interface

MS68C153	VMEbus Interrupter Module
MS68C154	VMEbus Controller
MS68C155	VME Interrupt Generator

OTHER INFORMATION

Modular Semiconductor does not employ a PR firm.

Molecular Electronics Corporation

4030 Spencer Street MS108
Torrance, CA 90503-2417
213/214-1485
Fax: 213/542-1270

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 12**

BACKGROUND

Molecular Electronics Corporation (MEC) is developing technology for the formation, deposition, and commercial application of biomolecular membranes, or biomembranes, in the fields of electronics, optics, and biomedicine.

A biomembrane is a structural analog of the membrane that surrounds every living cell. MEC's proprietary technology enables the formation and deposition of highly ordered, perfectly uniform organic films onto a variety of substrate surfaces, with thickness control down to 10 angstroms. The Company's technology and know-how include a patented biomembrane production technology called MonoFab, and the molecular engineering and synthesis of biomembrane materials with the desired physical, electronic, optical, and biological properties.

MEC has developed several potential commercial applications of the core biomolecular membrane technology (BMT). The first is an ultrathin, uniform, high-resolution e-beam resist (MonoResist) that has a demonstrated resolution down to 1.0 micron. The second is an ultrathin anti-corrosive lubricant (MonoGuard) for rigid disk magnetic media. The third is a perfectly uniform antireflection coating (MonoArc) for pellicles.

The Company also has demonstrated a 20-angstrom biomembrane dielectric on GaAs devices. Outside of semiconductor applications, the Company has demonstrated unique biocompatible properties of biomembranes as coatings for medical implants, including intra-ocular lenses, and is developing drug delivery and surface-active (binding) sites applications (e.g., biosensors).

The MEC business plan calls for partnerships with corporations on both the electronic and medical applications of its technology. The Company believes that its technology will lead to new classes of organic/inorganic hybrid semiconductors and dielectric spacers for quantum devices in electronics and, ultimately, will represent the key enabling technology for bioelectronics including the biochip.

BOARD

*George Reynolds, Chairman
Dr. Vladimir Rodov
Dr. Paul Kaminski
Parker Dale
Roman Kupchynsky

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President, CEO
*Dr. Vladimir Rodov
TRW, N/A

VP Dir Medical Bus
David Gibson
Chiron Ophthalmics, Founder/Dir R&D

*Founder

FINANCING

Molecular Electronics has raised more than $5 million in three rounds of financing.

ALLIANCES

Alliances exist but information is not available.

MANUFACTURING

Currently on a pilot scale

Facilities

Torrance, CA
7,500 sq. ft.
Headquarters, R&D lab (including Class 10 clean room, surface analytic, electronics, and chemistry sections)

OTHER INFORMATION

Molecular Electronics Corp. does not employ a PR firm.

MOS Electronics Corporation

914 West Maud Avenue
Sunnyvale, CA 94086
408/733-4556
Fax: 408/773-8415

ESTABLISHED: September 1983 **NO. OF EMPLOYEES: 64**

BACKGROUND

MOS Electronics Corporation (MOSel) designs, manufactures, and markets CMOS SRAMs and a family of specialty memory products for the dual-port cache control and telecommunications markets. The Company is using its SRAMs to build a base that will enable it to design specialty memories including cache tag RAMs; video RAMs; and radiation-hardened, 6-transistor RAMs.

MOSel does front-end R&D and marketing at its headquarters in Sunnyvale, California. Hyundai, Sharp, Taiwan Semiconductor, and UMC Manufacturing Corporation provide foundry services. Assembly and test are also subcontracted.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Peter Chen
Fairchild, Semi Tech Mgr.

VP Technology
Nasa Tsai
Fairchild, Sr MTF

Dir Eng Design
Y.T. Loh
Saratoga Semiconductor, VP Technology

VP Sales/Mktg
Bruce Campbell
Intel, Mktg Mgr

VP Finance
George Sun
Delta 79, VP Finance

Dir of Sales
Eric Nagel
Intel, Dist Sales Mgr

Dir of Bus Dev
Jim Summers
AT&T, Dir of Product Planning

FINANCING

1983
Seed
$1.0M
Founders

1984
Round 1
$2.0M
Pacific Electric Wire & Cable (Taiwan)

1988
Round 2
$3.0M
Walson Lihwa Corp (Taiwan)

RECENT HIGHLIGHTS

January 1987
MOSel offered the MS6130, a 1Kx8 dual-port RAM for use in 32-bit parallel computer applications, offering a 55ns address access time and a 30ns output enable time for no-wait operation with 25-MHz MPUs.

March 1987
MOSel offered the MS7201 CMOS FIFO with access times of 50ns, 65ns, and 120ns.

January 1989

MOSel introduced a cache memory chip jointly developed with Chips & Technologies for 25-MHz 80386 cache memory applications.

ALLIANCES

Fuji Electric
September 1985
Fuji Electric and MOSel signed an agreement whereby Fuji Electric will supply 4-inch and 6-inch wafers using MOSel 1.5 and 2.0-micron process technology. The companies will jointly develop CMOS 16K and 64K SRAMs for MOSel under an OEM contract.

UMC
October 1985
MOSel licensed a 32Kx8 EPROM, a 16K SRAM, and a 1.2-micron process to UMC in Taiwan in exchange for fab capacity.

November 1985
Agreement extended to include 1.2-micron technology and 256K SRAM.

Hyundai
February 1986
MOSel provided 8Kx8 and 32Kx8 SRAMs and 1.2- and 1.5-micron CMOS process technologies to Hyundai in exchange for foundry capacity under a discounted OEM contract.

March 1988
Agreement extended to include 1MB SCRAM and submicron technology.

Sharp
June 1986
MOSel provided a 256K SRAM design based on a 1.2-micron CMOS process. Sharp provides foundry service under a favorable OEM contract.

MANUFACTURING

Technology

MOSel offers five high-performance CMOS (H-BiCMOS) processes and one BiCMOS process with minimum dimensions as follows:

Drawn (Microns)	Effective (Microns)
2.0	1.5
1.5	1.1
1.2	0.8
1.2 BiCMOS*	0.8
1.0*	0.8
0.8*	0.7

*Under development

Facilities

Sunnyvale, CA
10,000 sq. ft.
Design and test

Hsin-Chu, Taiwan
6,000 sq. ft.
Design

PRODUCTS

Bytewide SRAMs

Device	Description	Access Time (ns)
MS6516	2Kx8	45-100
MS6264	8Kx8	35-120
MS62256	32Kx8	25-85
MS88128	128Kx8	45-150*
MS88512	512Kx8	70-100*

*Under development

Specialty Memories

Device	Description	Access Time (ns)
MS7201	512Kx9 FIFO	50-120
MS6130	1Kx8 Dual Port	55-120
MS6132	2Kx8 Dual Port	55-120
MS82C308	Cache Memory	25 MHz
MS176	Video Color Palette	35, 50 MHz
MSVR35	Voice ROM	3 sec.
MSVR205	Voice ROM	20 sec.

OTHER INFORMATION

MOSel does not employ a PR firm.

MOSPEC Semiconductor Corp.

76 Chung Shan Rd, Hsin Shin
Tainan Taiwan R.O.C.
Taipei (2)755-6664
U.S. 213/802-7662
Fax: Taipei (2)755-6460
U.S. 213/802-7662

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 300**

BACKGROUND

MOSPEC Semiconductor Corporation is a subsidiary of President Enterprises Corporation, one of the largest companies (No. 7 in total sales) in Taiwan. The Company previously was a fully owned unit of President under the name PECOR. As a result of a joint venture with U.S. company MOSPOWER Technology, Inc., MOSPEC was formed in April 1987.

MOSPEC is the only manufacturer of power devices in Taiwan. Its product lines include bipolar power transistors, Darlingtons, power MOSFETs, Schottky rectifiers, and ultrafast and fast-recovery rectifiers. The Company currently is shipping all of these products. MOSPEC also provides wafer fab and assembly services to other manufacturers on a contract basis. MOSPEC offers 3-micron bipolar and MOSFET process technologies.

The Company's production facilities include an 80,000 square feet plant that houses headquarters, wafer fab, assembly, design, test, and R&D operations.

BOARD
(Name and Affiliation)

Dr. C.Y. Kao
President Enterprises Corporation

Dr. M.L. Tarng
MOSPEC Semiconductor Corporation, president

C.S. Ling
President Enterprises Corporation

Ming-Yuen Tang
Kao Chao Brokerage

COMPANY EXECUTIVES
(Position and Name)

President
M.L. Tarng

VP, Mktg.
Ming-Yuen Tang

VP, Finance
C.T. Chen

R&D Mgr
W.C. Hsu

P/MC Mgr
W.N. Teng

FINANCING

Round 1
$7.8M
Private Placement

Round 2
$4.0M
Private Placement and employees

ALLIANCES

Not available

SERVICES

Wafer fab, assembly

MANUFACTURING

Technology

3.0-micron bipolar and MOSFET technologies

Facilities

Tainan, Taiwan
80,000 sq. ft.R&D, manufacturing, assembly, marketing, finance, test

PRODUCTS

Bipolar Power Transistors
Power MOSFETs
Schottky, Ultrafast and Fast Recovery Rectifiers
Wafer Foundry
OEM Assembly

OTHER INFORMATION

MOSPEC does not employ a PR firm.

Multichip Technology Inc.

58 Daggett Drive
San Jose, CA 95134
408/432-7000
Fax: 408/432-7049

ESTABLISHED: February 1988 **NO. OF EMPLOYEES: 40**

BACKGROUND

Multichip Technology Inc. was formed in February 1988 to design, develop, and market multichip memory modules for Cypress Semiconductor. Financing was provided by Cypress, which owns 100 percent of the capital stock.

Multichip operates as a wholly owned subsidiary of Cypress Semiconductor Corporation and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Multichip-developed devices are fabricated by Cypress and sold through Cypress' sales organization.

Multichip Technology is engaging in a new approach to system design through multichip modules. Packing multiple chips into a single component reduces board space significantly. Modules create space by allowing chips to be stacked vertically or horizontally and in multiple layers, thus improving system density. By moving devices closer together, modules reduce interconnect capacitance, thus decreasing signal delays.

The Company offers high-performance SRAM modules, which began shipment in June 1988. Offerings include standard and custom products for both military and commercial applications. Multichip currently is developing products for RISC systems based on the SPARC microprocessor. Future multichip modules may integrate other Cypress advanced products such as PLDs, fast SRAMs, PROMs, FIFOs, and dual ports. The Company plans to offer denser and faster memory modules in the future, as well as application-specific modules (i.e., DSP, cache) and standard and custom products implemented using advanced packaging techniques.

BOARD
(Name and Affiliation)

T.J. Rodgers, Chairman
President, Cypress Semiconductor

Andy Paul
President

Lowell Turriff
VP, Mktg & Sales, Cypress Semiconductor

Roger Ross
President, Ross Technologies

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Andy Paul
IDT, Mktg Mgr

VP, R&D
Marcelo Martinez
IDT, Eng Dir

VP, Mktg
Tom Kadlec
IDT, Mktg Mgr

VP, Finance
John Green
AMD, Asst Controller

VP, Mfg
Jeff Michols
MET, VP Mfg

FINANCING

Round 1
February 1988
Cypress Semiconductor

Multichip Technology Inc.

ALLIANCES

Multichip is a wholly owned subsidiary of Cypress Semiconductor Corporation.

MANUFACTURING

Technology

Surface-mount components of ceramic and/or epoxy laminate substrates.

Facilities

San Jose, CA
18,000 sq. ft.
Design, marketing

PRODUCTS

High-performance SRAM modules (standard products and custom products; military and commercial)

OTHER INFORMATION

Multichip does not employ a PR firm.

nCHIP, Inc.

1971 North Capitol Avenue
San Jose, CA 95132
408/945-9991
Fax: 408/945-0151

ESTABLISHED: December 1987 **NO. OF EMPLOYEES: 20**

BACKGROUND

nCHIP was founded in December 1987 to address the performance bottleneck that is building up at the package level. The solution provided by nCHIP is multichip modules. The Company will design and/or manufacture silicon circuit boards, complete multichip modules, and module carriers for high-performance, high-density, and cost-sensitive applications.

nCHIP designs and manufactures custom high-performance, high-density silicon circuit boards (SiCBs) to be used for multichip modules, allowing faster, lighter, more compact, and more reliable systems to be built. Die are mounted directly on the SiCB, eliminating much of the typical package-related capacitances. nCHIP design rules enable dense placement of the ICs, approaching wafer-scale density in memory applications.

In addition to designing the silicon circuit board, nCHIP also provides complete multichip module design, fabrication, and assembly services to assist the systems designer in achieving the benefits of these technologies. The Company provides the module carrier, addresses power dissipation issues using proprietary technologies, and manufactures and delivers a complete, tested application-specific integrated module (ASIM) that is ready for system assembly.

The technology base was developed by nCHIP's founders at Lawrence Livermore National Laboratory (LLNL). While at LLNL, the founders produced functional models for use in a 1989 space mission. More than $25 million was invested in the development program since 1983.

In 1989, nCHIP selected strategic customers, completed the design of its initial products, and set up a 5-inch wafer production line. In 1990, nCHIP will begin volume production and increase its customer base. In late 1991, production capacity will be increased with the addition of an 8-inch manufacturing line.

BOARD
(Name and Affiliation)

Philip Dauber, CEO
nCHIP, Chairman/CEO

William Davidow
Mohr, Davidow Ventures, Partner

Bruce McWilliams
nCHIP, President/COO

F. Gibson Myers
Mayfield Fund

Richard Newton
University of California, Berkeley

Martin Titland
Fairchild Space Company

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
Philip Dauber
Key Computer, President

President/COO
Bruce McWilliams
LLNL, Program Leader

VP Operations
Luc Bauer
IDT, VP and General Manager

VP Technology
David Tuckerman
LLNL, Project Leader

VP Engineering
Kamran Malik
Key Computer, Dir. of Engineering

VP Finance
Kirk Flatow
Bain & Co., Senior Consultant

FINANCING

October 1987
Seed
Private investors

April 1989
Seed
Private investors

August 1989
Round 1
$4.2M
Mayfield Fund; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow Ventures

PRODUCTS

Circuit Boards
Multichip Modules

OHER INFORMATION

nCHIP does not employ a PR firm.

SERVICES

Design
Fabrication
Assembly

MANUFACTURING

Technology

CMOS
5-inch wafers
8-inch wafers in 1991

NMB Semiconductor Co. Ltd.

9730 Independence Avenue
Chatsworth, CA 91311
818/341-3355
Fax: 818/341-8207

ESTABLISHED: April 1984 **NO. OF EMPLOYEES: 75**

BACKGROUND

NMB Semiconductor designs, manufactures, and markets 256K and 1Mb DRAMs and also offers foundry services. The Company was Japan's first start-up to build a VLSI facility capable of fabricating products with submicron geometries. Designs and technology were acquired initially through licensing agreements and technology exchanges with Inmos and other U.S. companies to bring existing processes on-line quickly.

NMB Semiconductor is a Division of NMB Technologies, which is, in turn, a subsidiary of the multinational Minebea Co. Ltd. of Tokyo, Japan. NMB Technologies was formed in early 1988 and consolidates Minebea's U.S. activities, which consist of NMB Semiconductor, Hi-Tek Corp., IMC Components Corp., and NMB Audio Research Corp. NMB Technologies is organized into a Memory Division (NMB Semiconductor), a Keyboard Division (Hi-Tek), an axial fan division (IMC Components), and an Audio Research Division (NMB Audio Research). NMB Technologies conducts the marketing for all products manufactured by the subsidiaries including DRAMs, hybrid ICs, switching power supplies, keyboards, inductors, DC servo and step motors, and AC and DC tube axial cooling fans.

All manufacturing for NMB Semiconductor's DRAMs is conducted by Minebea in a $250 million, fully automated facility in Tateyama, Japan.

BOARD
(Name and Affiliation)

Takumi Tamura
  NMB Semiconductor

Masatomo Yuki
  Minebea

Takami Takahashi
  Minebea

Iwao Ishizuka
  Minebea

Goro Ogino
  Minebea

Hidisato Ishikawa
  Minebea

Sadahiko Oki
  Minebea

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Hidisato Ishikawa
  Minebea, Sr Mng Dir

Executive VP
William C. Connell
  NMB (USA), Vice President

Dir Mfg & R&D
Shosuke Shinoda
  Matsushita, Dir MOS Process

FINANCING

1984
Start-up
$11.11M
  Bank of Tokyo, Ltd.; Fuji Bank; Japan Associated Finance Co., Ltd.; K.K. Keiaisha; Kyowa Bank; Long Term Credit Bank of Japan; Minebea Co; Nippon Enterprises Development Corp.; Nippon Investment & Finance Co., Ltd.; Sumitomo Trust & Banking; Takami Takahashi; Takumi Tamura; Tokai Bank

1989
IPO
$460.0M
  Initial public offering

NMB Semiconductor Co. Ltd.

RECENT HIGHLIGHTS

March 1989
NMB acquired the Composite Recording Head Division of Seagate Technology.

ALLIANCES

Minebea Co.
1984
NMB is the subsidiary of and is financed by Minebea Co. Ltd. of Tokyo.

Inmos
June 1984
NMB obtained a five-year license to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the 256K DRAM output. The companies also planned to codevelop the technology for Inmos' 64K and 1Mb DRAMs.

Vitelic
November 1985
Vitelic granted a license to NMB Semiconductor for its 1Mb CMOS DRAM in exchange for one-third of NMB Semiconductor's plant capacity.

National
September 1986
National contracted NMB to manufacture fast SRAMs at the Tateyama fab. This agreement was canceled.

TI
November 1987
NMB agreed to supply Texas Instruments (TI) with TI-designed, 1Mb field RAMs. Initially, NMB shipped 100,000 units a month.

Alliance Semiconductor
December 1987
Alliance Semiconductor signed a five-year agreement with NMB Semiconductor, covering 256K and 1Mb DRAMs. NMB will manufacture and sell the devices worldwide.

SERVICES

Silicon Foundry

MANUFACTURING

Technology

1.0- to 2.0-micron CMOS
5-inch wafers

Facilities

Tateyama, Japan
200,000 sq. ft.
Total space
43,000 sq. ft.
Class 1 clean room

PRODUCTS

DRAMs

Device	Description	Speed
AAA2800	256Kx1 Static Column Mode	60 to 80ns
AAA2801	256Kx1 Page Mode	60 to 80ns
1M100	1Mb x 1 Fast Page Mode	100 to 200ns
1M101	1Mb x 1 Nibble Mode	100 to 200ns
1M102	1Mb x 1 Static Column Mode	100 to 200ns
1M104	256Kx4 Fast Page Mode	100 to 200ns
1M105	256Kx4 Static Column Mode	100 to 200ns
1M200	1Mb x 1 Fast Page Mode	60 to 80ns
1M201	1Mb x 1 Nibble Mode	60 to 80ns
1M202	1Mb x 1 Static Column Mode	60 to 80ns
1M204	256Kx4 Fast Page Mode	60 to 80ns
1M205	256Kx4 Static Column Mode	60 to 80ns

OTHER INFORMATION

NMB's PR firm is Capital Relations.

NovaSensor

1055 Mission Court
Fremont, CA 94539
415/490-9100
Fax: 415/770-0645
Telex: 990010

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 105**

BACKGROUND

NovaSensor was formed to develop, manufacture, and market the next generation of solid-state sensors and unique silicon-based mechanical microstructures. In the sensor field, the Company is focusing its design and development efforts on the physical parameters of pressure, acceleration, flow, and force. In the area of silicon-based mechanical microstructures, NovaSensor is focusing its efforts on the development of flow restrictors, programmable microvalves, microswitches, nozzles, fluidics components, and micropositioners.

The Company was formed by Janusz Bryzek, Joseph R. Mallon, and Kurt Peterson. The team was joined by Phil Barth, a sensor technologist from Stanford University.

The Company is housed in a 32,000-square-foot facility that became operational in the summer of 1987 and includes a 4-inch wafer-processing line, assembly, and test.

First packaged devices were the TO-5 and TO-8 piezoresistive pressure sensors compensated over the range of 0° to 70° centigrade.

In September 1987, IC Sensors filed a suit against NovaSensor, claiming that the firm misappropriated information and trade secrets. The suit also names Mr. Bryzek, NovaSensor's president and CEO, and the former vice president and director at IC Sensors.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Copresident/CEO
*Janusz Brysek
IC Sensors, Founder/President

Copresident/COO
*Joseph R. Mallon
Kulite Semiconductor, VP Engineering

Exec VP Tech
*Kurt Peterson
Transensory Devices, Founder/VP Tech

Dir Adv Sensor Dev
Phil Barth
Stanford University, Sr Rsch Assoc

Mgr of App Engr
Dilip Vyas
Sensym, Mgr QA

*Founder

FINANCING

NovaSensor was funded by Solarton Electronics Inc., a division of Schlumberger, for an undisclosed amount.

ALLIANCES

Not available

MANUFACTURING

Full-capability wafer fabrication for solid-state sensors, silicon microstructures, and transducer lines on 4-inch wafers. The facility is capable of producing more than 30 million sensors per year.

NovaSensor

Facilities

Fremont, CA
22,000 sq,. ft.
  Manufacturing

3,500 sq. ft.
  Class 1,000 clean room

PRODUCTS

- Low-Pressure Sensors (10 inches of water pressure) with High Output and Low Linearity
- High-Pressure Sensors (up to 10,000 psi)
- Acceleration Sensors
- Isolated Metal Diaphragm Transducers
- On-Chip Laser-Trimmable Pressure Transducers
- Low-Cost Mini-DIP Plastic Package Differential Pressure Sensor

OTHER INFORMATION

NovaSensor's PR firm is Roger Grace, Inc.

Novix Inc.

19925 Stevens Creek Blvd., Suite 280
Cupertino, CA 95015
408/255-2750

ESTABLISHED: March 1984 **NO. OF EMPLOYEES: 20**

BACKGROUND

Novix develops and markets MPUs and development tools that implement a FORTH-in-silicon architecture. In 1986, Novix introduced the NC Series of 16-bit MPUs, which are high-level language, direct-execution (no microcode) MPUs. The MPUs are manufactured using 1.25-micron HCMOS and typically perform in excess of 20 mips. Other products include CPU boards, the ND4000 development system, a C compiler, and a FORTH operating environment. The Company states that the approach can be implemented in HCMOS, ECL, and GaAs. A 3-micron CMOS gate array was designed using Novix-developed technology.

Novix designs products for the artificial intelligence, embedded controller, cryptographics, robotics, and machine vision markets. Future plans also include implementing gallium arsenide in its product lines. The Company subcontracts all production and assembly.

Novix founders included Charles Moore, who invented the FORTH language in 1969; John Peers; John Golden; and Robert Murphy. The Company, originally named Technology Industries, was formed when Sysorex Information System, Inc., offered approximately $1 million to develop devices based on the FORTH "language slice" computing. The combined Sysorex-Technology Industries R&D partnership was renamed Novix Inc.

In October 1986, Novix established an office in Belgium and signed nine European distributors.

In January 1987, John Golden and Robert Murphy formed a new company, named QSD, which applies the FORTH-in-silicon architecture to the military market.

BOARD
(Name and Affiliation)

John Peers
  Novix Inc.

Ed Mack
  Consultant

Ron Osborne
  Faultless Starch

Peter Johnson
  Not Available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
John Peers
  Technology Industries Inc., President

FINANCING

March 1984
Round 1
$1.0M
  Sysorex International Inc.; Technology Industries Inc.

RECENT HIGHLIGHTS

February 1987
  Novix put its 16-bit NC4016 MPU on an STD bus card measuring 4.5 x 6.5 inches. The NB4300 card supports 20-bit addressing and can be used as master or slave bus control.

April 1987
  Novix introduced the NS4100, a high-speed coprocessor/real-time controller board for IBM PCs or compatibles. The board is built with the Company's NC4016 MPU.

ALLIANCES

Sysorex
March 1984
  Sysorex International participated in first-round financing.

Harris
July 1986
Harris added the Novix FORTH language MPU to its ASIC library as part of a licensing agreement covering MPU and MCU products based on the FORTH engine.

Facilities

Cupertino, CA
6,000 sq. ft.
Design, test

MANUFACTURING

Technology

3- and 1.25-micron CMOS

PRODUCTS

Microprocessors

Device	Description	Features
NC4016	16-Bit	64K Words Direct and 128-Gigaword On-Chip Memory Addressing, 10 to 12 mips
NC5116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, 20 to 25 mips
NC6116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, plus UARTS, FIFO, CTC, SCSI, On-Chip Stacks, 20 to 25 mips

CPU Boards

Device	Description
NB4000	Novix Beta Board with 28K-word RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4100	IBM PC Add-In Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4200	Turbo Frame 4000 with 8K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4300	Novix STD Bus CPU Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH

Development Tools

Device	Description
ND4000	Standalone System with Disk Controller, 10MB Hard Disk, Power Supply/Case, 360KB Floppy Disk, and Breadboard Development Area
Novix Empress	Comprehensive Superset FORTH-83 Operating Environment
Novix C	Full K and R and ANSI

OTHER INFORMATION

Novix does not employ a PR firm.

NSI Logic, Inc.

Cedar Hill Business Park
257-B Cedar Hill Road
Marlboro, MA 01762

ESTABLISHED: November 1984 **NO. OF EMPLOYEES: N/A**

BACKGROUND

NSI Logic Incorporated designs, develops, and markets ASICs and video add-on boards that enhance graphics performance of new and existing IBM PC, PS/2, and compatible computer systems. The Company was founded in 1984 by Nandu Marketkar. Prior to founding NSI, Mr. Marketkar operated Custom Computer Systems.

NSI offers ASICs for the graphics and raster controller segments of the industry and will continue to develop turnkey solutions using state-of-the-art technology in related areas. The Company uses CMOS, MOS, and BiCMOS technologies in its ASIC development, which allows NSI to provide a platform for a broad line of high-performance products for applications in graphics and raster controllers. The Company's ASIC products are marketed to OEMs that build systems and video add-on boards. Primary markets for the Company's board products are owners and buyers of computer systems and value-added resellers (VARs).

BOARD
(Name and Affiliation)

*Nandu J. Marketkar, Chairman
NSI Logic, CEO

Jeff Schiebe
NSI Logic, President

Stephen A. Stecyk
Not Available

PRODUCTS

VLSI	Controllers
EVC215	EPIC EGA
EVC315	Smart EGA
EVC315CR	Smart EGA PLUS
EVC415A	Smart VGA/8
PS00004	VGA/8 and VGA/16

OTHER INFORMATION

NSI Logic does not employ a PR firm.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman & CEO
*Nandu J. Marketkar
Custom Computer Systems, President

President & COO
Jeff Schiebe
Masscomp

*Founder

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

Not Available

Facilities

Marlboro, MA
R&D, marketing

Oak Technology, Inc.

139 Kifer Court
Sunnyvale, CA 94086
408/737-0888
Fax: 408/737-3838

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Oak Technology, Inc., was founded in 1987 to provide system-level solutions in chip form to the personal computer market. The Company was founded by David Tsang, a founder and president of Data Technology Corporation from 1979 to 1987. Oak Technology provides total silicon solutions to specific application areas by designing, marketing, and supporting OEM customers in their efforts to design and manufacture high-performance systems. By focusing on key growth areas of the personal computer chip market, Oak seeks to become a dominant player in those market segments. In particular, the targeted segments are battery-powered laptops, high-performance 286/386SX desktops, and graphics controller chips.

By focusing exclusively on those areas that present potential for a high growth rate, Oak hopes to avoid direct head-to-head battles with the numerous other chip set companies. While it cannot compete with larger competitors in the breadth of its product offerings, the objective is to aim at one specific piece of the total market and achieve superiority by designing its products to fit that specific need. Oak believes that it can become a performance leader in the laptop market and the specialized desktop market.

Initially, Oak supplied a PS/2 Model 30-compatible chip set and a VGA/Super VGA graphics controller. In the fall of 1989, Oak began to focus on the introduction of a laptop PC chip set, the OakHorizon. A second area of concentration is the VGA graphics controller market. Future products will target high-performance PCs.

Oak's strongest area of expertise is in the design and marketing of its products. For this reason, it focuses its resources in these areas and uses external fabrication facilities both in the United States and in the Pacific Rim to provide high-volume manufacturing. In this way, Oak is able to take advantage of state-of-the-art manufacturing facilities without massive investment in manpower and capital.

BOARD

(Name and Affiliation)

*David Tsang
Oak Technology, Inc., President

Richard King
KBA Venture Partners, Partner

Wen Ko
Hewlett-Packard Taiwan, President

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*David Tsang
Qume, Vice Chairman

VP, Mktg
Sukkin Fong
Harmony Inc., President

Dir VLSI Design
Dr. Mou Yang
VLSI Technology, not available

Dir Sys Des
Lloyd Ebisu
Data Technology, Dir Eng

Dir Oak-Taiwan
Abel Lo
Convergent Technologies, not available

Dir Ops
James Ou
Data Tech Corp., Ops Res Mgr

*Founder

FINANCING

July 1987
Round 1
$1.5M
KBA Venture Partners, Eastpac, private

November 1988
Round 2
$4.5M
KBA Venture Partners, private

RECENT HIGHLIGHTS

September 1988
Oak announced a family of CMOS chips for the IBM PS-2 Model 30 that uses high-density VLSI devices for systems logic, data separation, and peripherals. The chip family includes the OTI-031 system controller, the OTI-032 I/O controller, the OTI-033 floppy disk controller, and the OTI-036 and OTI-037 graphics controllers.

ALLIANCES

Kanematsu Semiconductor—Oak's Japanese representative

MANUFACTURING

Technology

Proprietary Megacell Technology, CMOS

Facilities

Sunnyvale, CA
Design, marketing, test

PRODUCTS

OTI-030 Core Logic for 8088/8086
OTI-037 Super VGA Controller
OTI-050 OakHorizon for 286/386-SX

OTHER INFORMATION

Bailey Associates is Oak Technology's PR firm.

Opto Diode Corp.

750 Mitchell Road
Newbury Park, CA 91320
805/499-0335
Fax: 805/499-8108

ESTABLISHED: 1981 **NO. OF EMPLOYEES: 13**

BACKGROUND

Opto Diode Corp. (ODC) was formed in 1981 by James Kim, formerly with Rockwell's Collins division in Dallas, Texas. ODC offers semicustom high-reliability devices made to customer specifications. The Company is occupying a 10,000-square-foot facility in Newbury Park, California.

ODC had $1 million in sales in 1985 from GaAs infrared LEDs for solid-state relay and optoelectronics markets. Future plans are to penetrate the U.S. military market and European market.

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*James Kim
Rockwell, Sr Research Engr

*Founder

FINANCING

Not available

BOARD

Not available

ALLIANCES

Not available

PRODUCTS

Gallium Aluminum Infrared LEDs

OTHER INFORMATION

Opto Diode does not employ a PR firm.

Opto Tech Corp.

32 Industrial East 4th Road
Science-Based Industrial Park
Hsinchu, Taiwan
ROC
(035) 777-481/3
Telex: 31592 OPTO TECH

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 100**

BACKGROUND

Opto Tech is offering GaAs-based products, silicon wafers, and photoresistor and photodiode semiconductors. The Company plans to offer small-signal and transmitting transistors, junction FETs, microwave transistors, and fast-recovery and Schottky-barrier diodes. Production began in July 1984.

The Company spun off from Fine Microelectronics and is owned by local investors and the Bank of Communications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
James Chiu
Petrochemical Industry, President

Business Liaison
S. Shyu
Not available

FINANCING

$2.5M
Bank of Communications, Fortune Plastic Manufacturing Co., Opto Tech Corp.

ALLIANCES

None

MANUFACTURING

Technology

GaAs
Silicon

Facilities

Hsinchu, Taiwan
9,175 sq. ft.

PRODUCTS

- LED
- Transistors
- Photodiodes
- Phototransistors
- Infrared Devices

OTHER INFORMATION

Opto Tech does not employ a PR firm.

Orbit Semiconductor, Inc.

1230 Bordeaux Drive
Sunnyvale, CA 94086
408/744-1800
Fax: 408/747-1263

ESTABLISHED: November 1985 **NO. OF EMPLOYEES: 115**

BACKGROUND

Orbit Semiconductor, Inc., specializes in quick-turn, high-reliability foundry work with emphasis on 1.5-micron CMOS including either a double-poly or double-metal process. Other processes include 2.0- to 5.0-micron CMOS, HMOS, single- or double-poly, single- or double-metal, double-poly/double-metal, and multiple-layer poly.

Orbit guarantees single-poly and single-metal CMOS or HMOS in 10 working days or fewer and double-poly or double-metal CMOS in 15 working days or less.

The Company also offers computer-aided design services, which include layout from customer-provided logic drawings, design rule checking, data sizing, and conversion and Versatec plots. Orbit also acts as a prime contractor for providing photoplates.

In late 1979, Comdial Corporation, an Oregon firm that made subsystems for telephone dialing, started the firm as its engineering subsidiary. Comdial acquired an existing facility in 1979 and developed industry-compatible silicon-gate NMOS and CMOS processes. The Company, operating under the name Comdial Semiconductor, began offering foundry services in January 1980 and became the only guaranteed quick-turn fab in the business. One-half of the Company's resources were dedicated to quick-turn services and guaranteed parts within as few as 5 days for NMOS and 10 days for CMOS.

In November 1985, 80 percent of Comdial Semiconductor was acquired by Orbit Instruments, Inc., a supplier to Hughes and other military contractor companies. The management of Comdial Semiconductor retained 20 percent of the Company. In addition to continuing the previous services, Orbit is positioning itself to be a stronger supplier to high-reliability commercial and military-oriented users. In 1987, Orbit added specialized processing such as p-well radiation-hardened CMOS and CCD manufacturing. The 2-micron radiation-hardened CMOS offers a total dose of radiation up to 1 megarad.

Orbit's North American customers include Amber Engineering, Cardiac Pacemakers, Crystal Semiconductor, Dallas Semiconductor, General Electric, General Motors, Honeywell, Hughes, Intermedics, ITT, Johns Hopkins University, Lotus Designs, Macronix, Martin Marietta, Motorola, RCA, Rockwell, Silicon General, and VLSI Design Associates. The Company's overseas customers include British Petroleum, Tadiron, and Thomson CSF.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Gary Kennedy
Comdial Semiconductor, VP/GM

VP Finance
Joseph Wai
Comdial Semiconductor, Controller

VP Technology
*Steve Kam
Comdial Semiconductor, Dir Technology

VP Wafer Fab
Al Bettencourt
Comdial Semiconductor, Process Mgr

*Founder

FINANCING

Not available

RECENT HIGHLIGHTS

March 1988

Orbit ordered $1.4 million of 1:1 model 1100 lithography systems from General Signal's Ultratech Stepper unit. The order marks the first purchase of steppers by Orbit.

ALLIANCES

Not available

SERVICES

CAD
Foundry: HMOS, CMOS, Charge-Coupled Device Processing
Prototype Manufacturing
Volume Manufacturing
Assembly
Packaging
Test

MANUFACTURING

Technology

1.5-micron silicon-gate, double-poly, double-metal CMOS and HMOS
2.0- to 5.0-micron CMOS single- or double-poly, single- or double-metal
2.0- to 5.0-micron HMOS single- or double-poly, single- or double-metal
4-inch wafers

Facilities

Sunnyvale, CA
28,000 sq. ft.
Manufacturing

OTHER INFORMATION

Orbit does not employ a PR firm.

Oxford Computer, Inc.

39 Old Good Hill Road
Oxford, CT 06483
203/881-0891
Fax: 203/888-1146

ESTABLISHED: March 1987 | **NO. OF EMPLOYEES: 3**

BACKGROUND

Oxford Computer was founded to solve extremely demanding problems in pattern recognition. The initial technical approach was to build massive parallel analog chips that were inspired by neural networks. This approach proved infeasible, but basic lessons about placing processors within specially configured memory chips were learned. Oxford Computer's goal is to reduce the cost dramatically and expand the use of image processing, pattern recognition, and 3-D graphics devices.

A marketing communications campaign was launched in April 1988 that resulted in more than 50 newspaper and magazine articles about Oxford Computer and its technology during the 18 months following its start. As a result of many customer contracts, a family of application-specific, memory-plus-processor chips was defined and shown to be desired. Basic functions include matrix multiplication, convolution, and interpolation. Oxford calls these novel chips Intelligent Memory Chips.

Unlike ordinary memory chips that are limited to information storage, Oxford Computer's Intelligent Memory Chips both store and process information. In addition to their primary function as memory, Intelligent Memory Chips have multiple simple partial processors embedded within. Furthermore, unlike ordinary memory chips that handle only one or a few bits of information at a time, each Intelligent Memory Chip handles strings of hundreds of bits at a time. Although the idea of placing processors within memory chips is an old one, Oxford has devined a family of Intelligent Memory Chips with specific applications in digital signal processing, pattern recognition, and 3-D graphics.

Currently, two products are in development at Oxford Computer. The first is the Intelligent Pattern Recognition Memory Chip. The second product is the Intelligent Convolution Memory Chip, with samples due in spring 1990. Oxford subcontracts all manufacturing and assembly operations and most of its testing.

BOARD
(Name and Affiliation)

Michael Mulshine
Osprey Partners

Steven G. Morton
Oxford Computer

Jack Harding
Zycad Corporation

Howard Morgan
ARCA Group, Inc.

Earl Rogers
Formerly CEO of Precision Monolithics

COMPANY EXECUTIVES
(Position and Name)

President & Chief Technical Officer
Steven G. Morton

Corporate Secretary & Treasurer
Jack Harding

Assistant Secretary
Frank Marco

FINANCING

Seed stage from the founder and a private placement.

Start-up financing initiated in the fall of 1989.

Oxford Computer, Inc.

ALLIANCES

Not available

OTHER INFORMATION

Oxford Computer does not employ a PR firm.

Pacific Monolithics, Inc.

245 Santa Ana Court
Sunnyvale, CA 94086
408/732-8000
Fax: 408/732-3413

ESTABLISHED: March 1984 **NO. OF EMPLOYEES: 120**

BACKGROUND

Pacific Monolithics, Inc., designs and manufactures monolithic ICs (MMICs) based on GaAs, as well as microwave subsystems based on its GaAs MMICs. The Company offers more than 200 microwave macrocells (PM Cells) for semicustom IC design for consumer, communications, and defense applications. Company strengths include yield-tolerant design techniques, advanced packaging technology, a proprietary CAD/CAE system, and foundry services.

The Company participated as a team member on several contracts for the Department of Defense, including Phase 0 and Phase 1 of the Microwave/Millimeter-Wave IC (MIMIC) program. The contracts were in the areas of communication, radar, electronic warfare, and smart weapons for the army, navy, and air force.

Pacific Monolithics has developed a set of monolithic GaAs subsystem building blocks for microwave signal processing. The Company's ASIC cell library includes amplifiers, mixers, oscillators, couplers, combiners, switches, attenuators, phase shifters, modulators, and demodulators.

In April 1986, Pacific Monolithics introduced three MMIC devices that were offered in 5V, commercial grade, 8-lead, surface-mount packages. The devices were an 0.8- to 3.0-GHz converter, a 3.0- to 6.0-GHz converter, and a 5.0- to 6.0-GHz converter.

In March 1986, the Company relocated from a 10,000-square-foot facility to a 22,000-square-foot facility that can be expanded by an additional 13,000 square feet. Presently, Pacific Monolithics uses several foundry services, including TriQuint and COMSAT.

BOARD
(Name and Affiliation)

*Allen Podell, Chairman of the Board

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Donald A. Bond
Sanders, VP/GM Microwave

SR VP & Director
Allen Podell
A.F. Podell Assoc., President of Technology

VP Bus Dev
Frank Russell
Avantek, Sales Mgr

VP Engr
Pang Ho
Geotech, President

Dir Sys & Plan
*Doug Lockie
Strategic Technology, Consultant

*Founder

FINANCING

August 1985
Round 1
$5.0M
IAI Venture Partners, Sand Hill Financial Corp., Shaw Ventures, Vanguard Associates

September 1986
Round 2
$3.5M
Institutional Investment Partners, Oak Investment Partners

RECENT HIGHLIGHTS

November 1987
Pacific Monolithics and TriQuint became team members, with Ford as primary contractor, for contracts that cover smart weapons, radar, and electronic warfare.

November 1987
Pacific Monolithics and TriQuint became team members, with Allied Bendix as prime contractor, for two contracts that cover communications and radar.

ALLIANCES

Not available

PRODUCTS

Channelized Up/Down Converters
Converters
Amplifiers
Oscillators
Attenuators
Active Isolators
Phase Shifters
Switches
Synthesizers
TR Modules
Single-Chip Radars
Microwave Sensors
Expendable Countermeasure Subassemblies

OTHER INFORMATION

Pacific Monolithics does not employ a PR firm.

MANUFACTURING

Technology

GaAs

Facilities

Sunnyvale, CA
35,000 sq. ft.
Lab, manufacturing, administration

6,000 sq. ft.
Class 100 clean room

Paradigm Technology, Inc.

(Formerly GL Micro Devices)
71 Vista Montana
San Jose, CA 95134
408/954-0500

ESTABLISHED: February 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Paradigm Technology, Inc., was formed to develop high-performance advanced CMOS products and is in an R&D mode. Norman Godinho and Frank Lee, founders of Paradigm Technology, Inc., also are founders of Integrated Device Technology (IDT). Mr. Godinho served as vice president and general manager of IDT's digital signal processing (DSP) division, and Mr. Lee was codirector of IDT's corporate research and development group.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Terry Holdt
Linear Corp., Pres.

VP Technology
*Norman Godinho
IDT, VP/GM DSP Div

VP Prod Dev
*Frank Lee
IDT, Codirector Corp R&D

VP Mktg/Sales
Steve Taylor
IDT, NE Regional Mgr

VP Operations
James Doran
Intel, Plant Manager

VP Finance/CFO
Richard Henander
Sigma Circuits, VP Finance

*Founder

FINANCING

February 1987
Round 1
$2.4M
El Dorado Ventures, Glenwood Management

May 1989
Round 2
$9.6M
First-round investors, TA Associates, Chesapeake Ventures, Gateway Partners, Centennial Funds

RECENT HIGHLIGHTS

May 1989
Paradigm relocated from temporary facilities in Santa Clara, California, to its new 62,000-square-foot facility in San Jose. The new facility includes a wafer-fabrication facility dedicated to implementing Paradigm's proprietary design and process technology.

MANUFACTURING

Technology

CMOS

Facilities

San Jose, CA
62,000 sq. ft.
R&D, manufacturing, administration

PRODUCTS

A complete family of high-speed 256Kb SRAM chips, with 1Mb SRAMs expected in early 1990

OTHER INFORMATION

Paradigm's PR firm is Ulevich and Orrange, Inc.

Performance Semiconductor Corporation

610 East Weddell Drive
Sunnyvale, CA 94089
408/734-8200
Fax: 408/724-0258

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 330**

BACKGROUND

Performance Semiconductor Corporation designs, develops, manufactures, and markets high-speed SRAMs, MPUs, and logic devices for military, industrial, and telecommunications applications. The Company was founded by Dr. Thomas A. Longo, David Maxwell, and Gerald Herzog.

Performance Semiconductor is using an advanced single-CMOS process known as performance advanced CMOS engineered (PACE) technology. PACE uses 0.8-micron and 0.7-micron effective channel lengths to give 500ps loaded internal gate delays. PACE also includes two-level metal and epitaxial substrates.

The Company's products include CMOS SRAMs at levels of complexity of 1K to 64K; a 40-MHz, 16-bit MPU that executes the 1750A instruction set; and two support functions, the processor interface circuit (PIC) and MMU combination. In 1987, Performance offered an 8ns 1K SRAM organized as 256x4 and a new series of TTL I/O 16K SRAMs featuring an address access time of between 12ns and 15ns. In 1987, the Company also signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals.

In March 1985, Performance leased a 26,000-square-foot facility where it conducts research and development and all manufacturing. The Company has developed it into a Class 1 facility that uses 6-inch wafers. In 1987, Performance achieved military 883C compliance and shipped both 64K SRAMs and the 1750A processor compliant with the 883C.

In January 1988, Performance announced that it had signed a nationwide franchising agreement with Schweber Electronics, putting in place its North American distributor network. A nationwide franchise was previously signed with Zeus Components in July 1987.

BOARD
(Name and Affiliation)

*Dr. Thomas A. Longo, Chairman
Performance Semiconductor Corporation

Robert Zicarelli
Northwest Venture Partners

B. Kipling Hagopian
Brentwood Associates

William Bowes
U.S. Venture Partners

Dr. James Meindl
Rensselaer Polytechnic Institute

T.J. Connors
T.J. Connors Company

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Dr. Thomas A. Longo
Schlumberger

VP Ops
Gene Blanchette
Raytheon

VP Sales/Mktg
Les Welborne
Fairchild

VP Finance
George Wikle
Memorex

VP Human Resources
William Strickland
Fairchild

VP Product Development
Dr. Vir Dhaka
Xerox

VP Product Development
Dr. John E. Iwersen
Bell Labs

VP Reliability & QA
Rudy Konegan
U.S. Air Force

*Founder

FINANCING

October 1984
Round 1
$11.3M
Advanced Technology Ventures, Albion Ventures, Arbeit & Co,, Asset Mgmt., Brentwood Assoc., DSV Partners, IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital Mgmt., Rotan MOSel Technology Partners, Taylor & Turner, U.S. Venture Partners, Venwest Partners (Westinghouse Electric Corp.), Seymour Cray, Thomas Longo

Lease
$6.6M
Westinghouse Electric Corp.

November 1986
Round 2
$10.0M
Advanced Technology Ventures, Albion Ventures, Asset Mgmt., Brentwood Assoc., DSV Partners, Harvard Mgmt., IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital, Reynolds Creek Ltd. Partnership, L.F. Rothschild, Taylor & Turner, Unterberg Towbin, U.S. Venture Partners, Venwest Partners, Thomas Longo

August 1988
Round 3
$5.0M
Berkeley International, Brentwood Associates, Cowen and Co., and several officers of Performance Semiconductor Corporation

RECENT HIGHLIGHTS

September 1987
Performance offered the VSI chip, which incorporates bus interface features for intelligent controller applications. The device provides 32-bit VMEbus address decoding as well as interrupt and mailbox facilities.

November 1987
Performance presented information on its 40-MHz VHSIC-level PACE 1750A system at the GOMAC conference. The system is a CMOS three-chip set consisting of a CPU, a processor interface chip, and an MMU/combination support chip. The set is said to provide system performance greater than 2 mips.

March 1989
Performance introduced two static RAMs—the P3C3147 and the P3C3148—that use 3.3V rather than 5.0V.

ALLIANCES

Westinghouse
August 1986
Performance fabricated a VHSIC Phase-I, 11,000-gate array designed by the Westinghouse Defense and Electronics Center for the U.S. Air Force Wright Aeronautical Laboratories.

MIPS Computer Systems
November 1987
Performance signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals. Performance will also sell the MIPS software environment with the chips.

MANUFACTURING

Technology

1.25-micron CMOS PACE I (0.8-micron effective channel lengths)
1.00-micron CMOS PACE II (0.7-micron effective channel lengths); all wafers produced have been 6-inch double-metal, epi substrates since 1985.

Facilities

Sunnyvale, CA
44,000 sq. ft.
Manufacturing

8,000 sq. ft.
Class 1 clean room

PRODUCTS

CMOS SRAMs

Device	Density	Organization	Speed (ns)	Features
P4C422	1K	256x4	8	
P4C147	4K	4Kx1	10	
P4C148	4K	1Kx4	10	
P4C149	4K	1Kx4	10	Fast CS
P4C150	4K	1Kx4	10	Separate I/O, Reset
P4C151	4K	1Kx4	10	Comparator
P4C116	16K	2Kx8	15	300-Mil Package
P4C168	16K	4Kx4	12	
P4C169	16K	4Kx	12	Fast CS
P4C170	16K	4Kx4	12	Output Enable
P4C1682/1681	16K	4Kx4	15	Separate I/O
P4C164	64K	8Kx8	20	300-Mil Package
P4C187	64K	64Kx1	12	
P4C188	64K	16Kx4	20	
P4C198	64K	16Kx4	20	Output Enable
P4C1982/1981	64K	16Kx4	20	Separate I/O
P4C163	72K	8Kx9	20	300-Mil Package
P4C1257	256K	256Kx1	20	

Pace Logic CMOS Family

74PCT273/374 250-MHz Toggle Rates
74PCT373/533 Gated Latches
74PCT241/244 Bus Drivers
74PCT245/545/640/643/645 Transceivers
74PCT29818/29521 plus "A" versions of all logic parts

Microcomponents

PACE 1750A Family	16-Bit MPUs	20-, 30-, and 40-MHz; Includes 32-Bit and 48-Bit Floating-Point Arithmetic Processing
PACEMIPS	R2000A CPU (16-MHz) R2010 FPA (16-MHz) R3000 CPU (25-MHz) R3010 FPA (25-MHz)	

OTHER INFORMATION

Performance Semiconductor does not employ a PR firm.

Photonic Integration Research, Inc.

1357 Perry Street
Columbus, OH 43201
614/424-3313
Fax: 614/424-3320

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 6**

BACKGROUND

Photonic Integration Research, Inc., (PIRI) was formed to develop basic optical IC technology for commercial applications. The Company is the result of a joint venture between Nippon Telegraph and Telecommunications (NTT), Mitsubishi Electric Corporation of Japan, and the Batelle Memorial Institute. NTT owns 49 percent of the Company; Mitsubishi owns 41 percent; and Batelle owns 10 percent.

PIRI president, Dr. Tadashi Miyashita, was formerly head of the Optoelectronic Materials Section of the Electronics Materials Department at NTT's Ibaraki Electrical Communications Laboratories. Shigeki Sakaguchi and Shin Sumida also were previously at NTT's Ibaraki Telecommunications Laboratories, where the optical IC technology was invented.

In addition to developing commercial applications for optical waveguide technology, PIRI will also develop applied components that will be made available to equipment manufacturers for use in such end products as optical communications equipment, optical measuring equipment, automobiles, and airplanes. The Company expects advancement in the technology to lead to greater miniaturization and increased utilization of fiber optics.

PIRI is located in the Batelle Memorial Institute's Columbus, Ohio, facilities.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
Dr. Tadashi Miyashita
NTT

General Manager
Shigeki Sakaguchi
NTT

Chief Supervisor
Shin Sumida
NTT

FINANCING

July 1987
Round 1
$10.0M
Batelle Research Institute, Mitsubishi Electric Corporation, Nippon Telephone & Telegraph

PRODUCTS

Optoelectronic Devices
Custom-Design Optical Devices

OTHER INFORMATION

PIRI does not employ a PR firm.

Plus Logic

1255 Parkmoor Avenue
San Jose, CA 95126
408/293-7587
Fax: 408/298-7587

ESTABLISHED: 1988 **NO. OF EMPLOYEES: 27**

BACKGROUND

Plus Logic was incorporated in October 1987. The founding team, which consists of former National Semiconductor founder Roger Smullen and semiconductor industry executives Clayton Marr and Cecil Kaplinsky, was established in January 1988. Plus Logic was formed to solve the system performance, cost, and time-to-market limitations of existing "glue logic" devices. The Company's goal is to become a major player in the ASIC market, targeting the multibillion-dollar field-programmable gate array (FPGA) market with a range of innovative and easy-to-use products and software design tools.

Plus Logic's answer to the problems associated with conventional glue logic lies within its family of FPGAs based on Plus Logic's proprietary PLUS ARRAY architecture. The PLUS ARRAY family of FPGAs combines the flexibility and faster time to market of user configurability, along with the cost and performance required to implement high-speed glue logic.

The PLUS ARRAY architecture provides the high-performance system designer with a way of implementing glue logic that is high in performance (40-MHz system clock rate), integrated (1,000 to 6,000 gates per chip), fast and easy to design (uses standard design tools), predictable in timing (does not require multiple design iterations), and low in cost.

Plus Logic's first family of products is the FPGA2000 family. Three family member parts will be introduced by the end of 1990. Based on a CMOS EPROM technology, the devices are capable of implementing functions of up to 2,000 gates and will support a system clock rate of up to 40 MHz. Plus Logic subcontracts foundry and assembly services. In addition, the Company conducts in-house testing but also subcontracts a portion of this work.

BOARD

(Name and Affiliation)

Roger Smullen, Chairman
Plus Logic, President/CEO

Gordon Russel
Sequoia Capital, Partner

Jeff Pickard
Merrill, Pickard, Anderson & Eyre, Partner

Bernard J. Lacroute
Formerly with Sun Microsystems

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Roger Smullen
AMCC, CEO/Chairman

VP R&D
*Cecil Kaplinsky
Katus Technologies, Partner

VP Mktg
*Clayton Marr
Katus Technologies, Partner

VP Finance
Howard Bailey
MVI, Inc., Founder

VP Technology
George Simmons
Phillips/Signetics, CMOS Tec Dev Mgr

*Founder

FINANCING

October 1988
Seed
Not available
Chips & Technologies, Inc.; private investors

January 1989
Round 1
$5.0M
Sequoia Capital; Merrill, Pickard, Anderson & Eyre; Asset Mgmt Co.; Brentwood Associates; Hook Partners

ALLIANCES

Foundry agreements are in place and will be announced at a later date.

PRODUCTS

Silicon Device

FPGA 200 Family

2010	4 FBs
2020	8 FBs
2040	16 FBs

Field-Programmable Subsystem Logic Family

5110	4 FBs and dual-port memory
5210	4 FBs and finite state machine

OTHER INFORMATION

Plus Logic's PR firm is Maxtec.

MANUFACTURING

Technology

1.2-micron CMOS

Facilities:

San Jose, CA
28,000 sq. ft.
Engineering, development, test, marketing, administration

PLX Technology Corporation

625 Clyde Avenue
Mountain View, CA 94043
415/960-0448
Fax: 415/960-0479

ESTABLISHED: May 1986 | **NO. OF EMPLOYEES: N/A**

BACKGROUND

PLX Technology Corporation was formed to offer CMOS programmable interface devices for MPU-based systems. The Company's first product, introduced in May 1987, was the PLX 448—an erasable programmable logic device (EPLD). The device has electrical and architectural features that are geared specifically for bus interface appli1cations. The PLX 448 includes four 48mA drivers and four 24mA drivers that can drive VMEbus, Nubus, Micro Channel bus, proprietary buses, and memory buses directly. PLX is the only supplier that offers the high-drive capability. The device is fabricated using a 1.5-micron CMOS EPROM process and offers a propagation delay from input to high-drive-current output as low as 25ns.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Michael Salameh
Hewlett-Packard, Mktg Manager

VP R&D
Wei-Ti Liu
AMD, R&D

VP Prod Plan
D. James Guzy, Jr.
AMD, R&D

VP Sales
Don Etzbach
Virtual Micro-System, Mktg/Sales

Mgr Systems Eng
Arthur Chang
Wyse Technology, Hardware Eng Mgr

VP Marketing
Gaylord Galiher
Hewlett-Packard, Marketing Mgr

FINANCING

May 1986
Round 1
N/A
Arbor Financial Group; Draper Associates; and others

March 1988
Round 2
N/A
Initial investors; and others

August 1989
Round 3
$1.9M
Arbor Financial Group; Associated Venture Investors; Draper Associates

ALLIANCES

None

MANUFACTURING

Technology

1.5-micron CMOS
1.2-micron CMOS

PLX Technology Corporation

PRODUCTS

Device	Description
PLX 464	PLD with 64mA High-Drive Current
PLX 448	PLD with 24mA and 48mA High-Drive Current
VSB 1200	Master Module Interface Device with Single-Level Arbiter, Bus Requester, Bus Controller
VME 1200/1210/1220	VMEbus Master Controllers with Single-Level System Arbiter, Bus Requester, Driver
VME 2000	VMEbus Slave Module Interface Device
MCA 1200	Micro Channel Bus Controller and Local Arbiter
VSB 2000	VSB Slave Module Interface Device
VME 3000/3010	Interrupt Generators
VME 4000	Interrupt Handler
USB 1400	Multi-Master Bus Controller

Multibus I

MBI 8289A/8289B	MBI APX 86/88/186 Bus Arbitor iAPX

Multibus II

PSB 2000/2100	Reply agent controller and reply agent error generator
LBX 2000/2100	Reply agent controller/reply agent

OTHER INFORMATION

PLX's PR firm is Robin Eschler Associates.

Power Integrations Incorporated

411 Clyde Avenue
Mountain View, CA 94043
415/960-3572
Fax: 415/940-1226

ESTABLISHED: May 1988 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Power Integrations Incorporated was founded in May 1988 by Dr. Klas Eklund, Arthur Fury, and Steve Sharp to develop, manufacture, and market high-voltage power semiconductors. Using proprietary technology, Power Integrations developed a line of power ICs that integrate low 5-volt circuits with circuits that handle 200 to 400 volts. The Company's products bridge the gap between low-voltage control circuitry and high-voltage peripheral devices.

Power Integrations introduced its first products in June 1989. One is a universal power driver used to control high-voltage peripherals such as relays, solenoids, lamps, and motors from low-voltage control circuitry including CMOS and TTL digital logic and analog signals. The Company also introduced a high-voltage interface and a high-voltage n-channel array. Each of these devices is available with voltage rating of 200 or 300 volts. The n-channel array and the universal power driver are also available with a 400-volt handling capacity. Future products will have high voltage and current ratings.

All of Power Integrations' products are based on CMOS technology. Power Integrations conducts all testing in-house, but wafer fab and assembly operations are conducted by external sources.

BOARD
(Name and Affiliation)

Dr. William Davidow
Mohr, Davidow Ventures

Irwin Federman
Concord Partners

Floyd Kvamme
Kleiner, Perkins, Caufield & Byers

*Stephen Sharp
Not available

Dr. Ed Ross
Power Integrations

*Dr. Klas Eklund
Power Integrations

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Dr. Ed Ross
Signetics, Sr VP Prod Div Grp

VP R&D
*Dr. Klas Eklund
Data General, Product Manager

VP Mktg
*Art Fury
Micro Linear, VP Mktg & Sales

VP Mfg
Russ Anderson
Signetics, VP/Gen Cus Spec Prod Div

*Founder

FINANCING

May 1988
Round 1
$3.1M
Concord Partners; Data General Corporation; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow Ventures

August 1989
Round 2
$7.5M
Original investors; Hillman Ventures; Merrill, Pickard, Anderson & Eyre

Power Integrations Incorporated

RECENT HIGHLIGHTS

June 1989

Power Integrations, Inc., introduced its first family of products for the high-voltage power IC market. The products include the PWR-DRV1 universal power driver, the PWR-DRV451 through 4 high-voltage interface series, and the PWR-NCH801 high-voltage n-channel array.

ALLIANCES

None

PRODUCTS

Universal Power Driver
High-Voltage Interface
High-Voltage N-Channel Array

OTHER INFORMATION

Power Integration's PR firm is Rigoli, Pamphilon, Demeter.

MANUFACTURING

Technology

CMOS

Facilities

Mountain View, CA
10,400 sq. ft.
Design, test, marketing

Powerex, Inc.

Hillis Street
Youngwood, PA 15697
412/925-7272
Fax: 412/925-4393

ESTABLISHED: January 1986 **NO. OF EMPLOYEES: 500**

BACKGROUND

Powerex, Inc., manufactures and markets thyristors and rectifiers rated greater than 50 amperes. The Company also offers power transistors, Darlington, FETMOD, and MOSBIP modules. Powerex is a service-oriented company, providing just-in-time delivery, and has developed business partnership arrangements with many key customers. The Company has more than 100 accounts, including electric companies, railroads, and government agencies.

Powerex is the result of a joint venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corporation. The purpose of the joint venture was to form a company that would be a leading supplier of power semiconductors in the United States. To create the new entity, Westinghouse combined its semiconductor division with General Electric's high-power rectifier and thyristor business. Mitsubishi contributed working capital and technology for a 10 percent ownership.

The Company is developing high-power semiconductor devices and plans to supply intelligent-power hybrid circuits that combine a power element (e.g., power transistor) with a logic/control element.

BOARD

Not available

COMPANY EXECUTIVES
Position, Name, and Prior Company)

President/CEO
Ronald Whigham
Westinghouse Electric Corporation

VP Commercial Op
Stanley R. Hunt
Westinghouse Electric Corporation

CFO
J.A. Sibenac
Westinghouse Electric Corporation

VP Operations
Dave Gillott
Westinghouse Electric Corporation

FINANCING

Powerex received initial funding from Westinghouse Electric Corporation (45 percent), General Electric Company (45 percent), and Mitsubishi Electric America (10 percent) for an undisclosed amount.

1988
Financing changed to one-third ownership by previously mentioned companies

RECENT HIGHLIGHTS

January 1986
Powerex received licenses and technological know-how for Darlington transistor modules and GTOs from Mitsubishi; it received all thyristor and rectifier technology from Westinghouse, General Electric, and Mitsubishi.

August 1986
Powerex assumed exclusive sales responsibilities for Mitsubishi Darlington transistor modules in North America.

August 1986
Powerex reached an agreement with Mitsubishi to build a world-class automated assembly facility in France for isolated modules.

September 1987
Powerex purchased GE/RCA's low-power thyristor product line. The Company also signed a technology-licensing agreement with GE/RCA for MOSFET, IGBT, and MCT products and received exclusive sales rights for all MCTs rated greater than 100 amperes.

December 1987
Powerex started up a new wafer fab in Youngwood. The new fab is capable of producing complex geometry devices. Powerex also produced its first isolated modules for quality conformance testing in France.

MANUFACTURING

Technology

R&D
Design
Assembly
Test
Manufacturing

Facilities

Youngwood, PA
225,000 sq. ft.
Wafer fab

Auburn, NY
Wafer fab

Massey, France
Wafer fab, assembly

Puerto Rico
Assembly

Singapore
Assembly

PRODUCTS

Standard Rectifiers—High Power
Fast Recovery Rectifiers
Phase-Control Thyristors
Thyristors for Pulse Applications
Inverter-Grade SCRs
Reverse Conducting Thyristors
Gate Turn-Off (GTO) Thyristors
Triacs
Thyristor and Diode Modules
Power Transistor Modules
Darlington Modules
FETMOD Isolated MOSFET Modules
MOSBIP Hybrid Isolated Modules
IGBT Modules
Low-Power Product Line

OTHER INFORMATION

Powerex does not employ a PR firm.

PromTech

1885 Lundy Avenue, Suite 202
San Jose, CA 95131
408/434-9550
Fax: 408/434-7045

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 7**

BACKGROUND

PromTech was formed to combine the high-speed EPROM expertise of the founding members with custom and semicustom design. The Company has been working on contracts to design custom memory devices. PromTech also has developed a 1Mb and 4Mb EPROM in the 70ns access range.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Dr. Paul Ouyang
Universal Semi, Exec VP

*Founder

FINANCING

1984
Seed
$0.2M
Private

PRODUCTS

To be announced

OTHER INFORMATION

PromTech does not employ a PR firm.

ALLIANCES

1984
PromTech licensed technology to an unnamed Japanese company.

1987
PromTech licensed its EPROM technology to Yamaha Corp. Yamaha will develop a new ASIC standard chip that combines the EPROM technology with its own voice- and image-processing capabilities.

MANUFACTURING

Technology

1.2-, 1.5-, and 2.0-micron single-metal, double-poly CMOS

Facilities

San Jose, CA
2,000 sq. ft.
Administration, design, R&D

RAMAX Limited

Monash Business Park
Level 1, Building 11
Business Park Drive
Notting Hill VIC 3168
Australia
(03) 558 9900
Fax: (03) 558 9123

ESTABLISHED: 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

RAMAX Limited was formed in 1987 to commercialize and produce integrated circuits for global markets based on new nonvolatile memory (NVM) technology. Funding for the Company was provided solely by the Victoria State Government in the form of equity subscription. This funding has allowed RAMAX to acquire rights to this new technology and commence the pursuit of the business opportunities it has identified.

The Company recognizes that the demand for integrated circuits with higher density and higher speed is driving the semiconductor industry toward the use of optical techniques. These techniques are based primarily on active thin-film technologies, and RAMAX has chosen to specialize in this rapidly growing market area.

To realize its market opportunity, RAMAX will develop and commercialize a range of differentiated products based on active thin-film technologies; these products are thin-film ferroelectrics and compound semiconductor epi layers. RAMAX's long-term emphasis will be on compound semiconductor-based (specifically GaAs) integrated circuits—electronic and optoelectronic—that combine the advantages of both the GaAs and thin-film ferroelectric materials. However, market opportunities in silicon NVMs also will be pursued, particularly the replacement of current EEPROMs with ferroelectric versions that offer superior performance characteristics.

The Company formed a joint venture with Epi Materials Ltd. (EML) of the United Kingdom to enter the epi-treated wafer market in Asia. The product initially will be sourced from EML and primarily will be GaAs-based epi layers that use an enhanced, high-quality, high-yield metalorganic chemical vapor deposition (MOCVD) process developed by EML. Once sufficient sales volume has been generated, the product will be manufactured in Australia.

The silicon NVM market will be approached in two phases. In the first, RAMAX proposes to market the product from an existing European or North American manufacturer into Asia to build marketing capability and understand customer needs before entering the market with its own products. The second phase will be the launch of a new NVM product that offers significantly improved user benefits utilizing thin-film ferroelectrics. A foundry manufacturing strategy will be employed for production.

Initial entry to the GaAs market will be via an agency for products from an existing manufacturer. As with silicon NVMs, this method of entry will allow a marketing capability to be established and the building of customer relationships. The Company then proposes to establish a design facility for standard GaAs products and ultimately design GaAs NVM products utilizing the thin-film ferroelectric technology.

The Company's long-term entry to the optoelectronic IC market will result from the integration of the active thin-film technologies that will allow a new generation of OEICs to be developed.

RAMAX Limited

BOARD
(Name and Affiliation)

Vincent N. Schutze, Chairman
Dr. David G. Beanland, Director
Allan G. Tapley, Managing Director

COMPANY EXECUTIVES
(Position and Name)

Chief Executive Officer
Allan G. Tapley

Admin. Manager & Company Secretary
William D. Gleeson

Technology Manager
R. Bruce Godfrey

FINANCING

June 1987
Round 1
$8.0M
State Government of Victoria

ALLIANCES

Ramtron Corp.
June 1987
RAMAX licensed Ramtron's thin-film ferroelectric NVM technology. RAMAX has worldwide nonexclusive rights with sublicensing on silicon and worldwide exclusive rights with sublicensing on GaAs.

Epi Materials Ltd.
October 1989
An Australian joint venture was formed to market EML's epi-treated wafers into Asia and ultimately to manufacture epi-treated wafers in Australia.

SERVICES

Marketing
Manufacturing

PRODUCTS

MOCVD epi-treated wafers
Silicon- and GaAs-based NVM and standard products to be announced

OTHER INFORMATION

RAMAX does not employ a PR firm.

Ramtron Corporation

1873 Austin Bluffs Parkway
Colorado Springs, CO 80918
719/594-4455
Fax: 719/594-4939

ESTABLISHED: May 1984 **NO. OF EMPLOYEES: 53**

BACKGROUND

Ramtron Corporation is a technology research, development, and marketing organization founded in 1984 to develop a solution to the inherent problem of volatility in microelectronic circuits.

Ramtron's solution is ferroelectronics. Ferroelectronics merge the ferroelectric effect, known for its nonvolatile storage characteristics, with conventional integrated circuitry. Ferroelectronics produces the world's first true nonvolatile microelectronic memory. In 1987, Ramtron successfully integrated its proprietary lead zirconate titanate (PZT) with a conventional CMOS fabrication process and introduced the world's first ferroelectric random access memory (FRAM). The FRAM combines the benefits of existing memories in a single device: the speed and ease of use of SRAM, the high density and potential low cost of DRAM, and a nonvolatility that equals or exceeds that of EEPROM. FRAMs provide a common memory element that can be used throughout a system, replacing the diverse memory types currently required.

The Company licensed potassium nitrate technology from George Rohrer whose company, Technovation Corporation, owns a minority interest in Ramtron. Newtech Development Corporation of Australia negotiated an agreement with Mr. Rohrer for the patent and formed Ramtron to conduct R&D programs at the University of Colorado in a $5 million research lab.

Ramtron is actively pursuing strategic partnerships and agreements to accelerate ferroelectronic technology insertion in a broad range of applications. Initial markets for the FRAMs include industrial, military, and aerospace applications where nonvolatility is essential. These markets traditionally have used EEPROMs, ROMs, and memories with battery backup. The Company is developing several applications for its FRAMs, including smart sensors, smartcards, smart tags, smart watches, and smart toys.

BOARD
(Name and Affiliation)

Ross M. Lyndon-James, Chairman
 Ramtron Australia Ltd., Deputy Chairman

Brian L. Harcourt, Exec Director
 Ramtron Australia Ltd., Managing Director

Richard L. Horton, Exec Director
 Ramtron Corp., President

Hilton J. Nicholas, Director
 Ramtron Australia Ltd., Chairman

A. Geoffrey Lee, Director
 Ramtron Australia Ltd., Director

Glen R. Madland
 Integrated Circuit Engineering, Chairman

Dr. Steward S. Flaschen, Director
 Flaschen & Davies, Consultant

Charles W. Missler, Director
 Resdel Industries, Inc., Chairman & CEO

Sam Freeman, Director
 Rio Grand Industries, Consultant

Jack F. Moore, Director
 International Brotherhood of Electrical Workers, International Secretary

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Richard L. Horton
 Honeywell, Dir of Bus Dev

Exec VP/COO
*Dr. Fred Gnadinger
 INMOS, VP of R&D & Founder

VP Finance/Admin
Jerald Bollinger
 Elxsi, CFO

VP of Research & Development
S. Sheffield Eaton
INMOS, Project Leader & Founder

*Founder

FINANCING

May 1984
Round 1
$5M
Ramtron Australia Limited

May 1986
Round 2
$10M
Ramtron Australia Limited

March 1989
Round 3
$19.5M
National Electrical Contractors Association

ALLIANCES

RAMAX Limited
June 1987
RAMAX Limited, an Australian technology company, licensed Ramtron's FRAM technology.

ITT Semiconductor
June 1988
ITT and Ramtron have a codevelopment and licensing program to develop an advanced submicron ferroelectronic manufacturing process.

NMB Semiconductor
October 1988
NMB and Ramtron have a codevelopment and licensing program to develop a 4Mb DRAM process technology and products utilizing high dielectric materials.

TRW
November 1988
TRW and Ramtron have a codevelopment program to develop radiation-hardened nonvolatile memory for aerospace and defense applications.

Seiko-Epson Corp.
April 1989
Ramtron entered a strategic technology codevelopment alliance with Seiko-Epson. Seiko-Epson will provide Ramtron with manufacturing capacity for FRAM products and will receive sales and distribution rights for FRAM products in Japan and Southeast Asia.

Alcan Aluminum
June 1989
Ramtron and Alcan signed joint development and stock purchase agreements. The agreements include a 6.5 percent equity investment in Ramtron by Alcan and initiate a joint program focused on the development of advanced ferroelectric materials.

MANUFACTURING

Technology

3.0-micron CMOS
1.5-micron CMOS
1.2-micron CMOS (in development)
0.8-micron CMOS (in development)

Facilities

A 69,000-square-foot facility currently under construction in Colorado Springs, Colorado, will house the headquarters and R&D facility, including wafer fab. It is scheduled for completion in June 1990.

PRODUCTS

FM1008	128x8	Available
FM1108	256x8	Available
FM1208	512x8	Available
FM1408	2Kx8 FRAM	Q4 1989
FM1608	8Kx8 FRAM	Future Product
FM1808	32Kx8	Future Product
FM2008	128Kx8	Future Product

OTHER INFORMATION

Ramtron does not employ a PR firm.

S3, Incorporated

2933 Bunker Hill Lane, Suite 100
Santa Clara, CA 95054
408/986-8144
Fax: 408/986-1457

ESTABLISHED: January 1989 **NO. OF EMPLOYEES: 33**

BACKGROUND

S3, Incorporated, was founded in January 1989 by Diosdado Banatao and Ron Yara, two Chips & Technologies veterans. The Company plans to bring a workstation level of performance to PC compatibles by developing advanced silicon subsystems. S3 is currently in its design phase and is expected to introduce its first products in 1990.

In recent years, Dataquest has identified an industry-wide trend toward the "system on a chip." Of course, the ultimate expression of this trend would be a monolithic system chip that integrates logic and memory into the microprocessor. Although the industry has yet to reach this level of integration, the ASIC revolution allowed for the consolidation of logic through gate arrays and similar devices. More recently, many companies have chosen to optimize system performance by developing specialized logic chip sets. Companies that pursue this approach to increasing system performance have found value in design engineers who possess both IC logic and systems expertise.

S3's design methodology is an example of the application of systems expertise to silicon-based subsystem design. In developing its subsystems, S3 simulates system level operation and then partitions its design into chip-level subsystems. This approach to subsystem design allows high-performance integration while maintaining degrees of flexibility at multiple levels for the end-system designer.

The Company has adopted a strategy of using outside companies for its wafer fabrication needs. This strategy allows S3 the flexibility to choose the most economical process for each chip design. Without owning its own fab, S3 is not bound to one process technology and therefore can shop around for the best foundry to fit its needs.

BOARD
(Name and Affiliation)

*Diosdado P. Banatao
President & CEO, S3, Incorporated

Andrew S. Rachleff
Merrill, Pickard, Anderson & Eyre

L. John Doerr
Kleiner, Perkins, Caufield & Byers

Andrew R. Heller
Kleiner, Perkins, Caufield & Byers

William H. Davidow
Mohr, Davidow Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Diosdado P. Banatao
Chips & Technologies, VP/GM

VP, Mktg
*Ronald T. Yara
Chips & Technologies, VP

Dir, Finance
David K. Hanabusa
Ashtech, CFO

Dir, Eng
Robert C. Schopmeyer
Not available

*Founder

FINANCING

April 1989
Round 1
$6.0M
Merrill, Pickard, Anderson & Eyre; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow; Sequoia Capital; Mayfield Fund; AVI Management Partners

ALLIANCES

The Company has strategic alliances, but it is not yet in a position to identify them.

PRODUCTS

Silicon Subsystems

OTHER INFORMATION

S3 does not employ a PR firm.

MANUFACTURING

Technology

1.5-micron CMOS
1.0-micron CMOS

S3 will use foundries for manufacturing.

Samsung Semiconductor, Inc.

3725 North First Street
San Jose, CA 95134
408/980-1630

ESTABLISHED: 1983 | **NO. OF EMPLOYEES: 250**

BACKGROUND

Samsung Semiconductor, Inc., (formerly Tristar Semiconductor) designs, manufactures, and markets a broad range of products including NMOS and CMOS memories, logic devices, microprocessors and peripherals, and power MOSFETs. The Company began its operations as a DRAM supplier and, through strategic alliances, has licensed designs to expand its product portfolio quickly.

Building on its base of CMOS DRAM technology with the addition of a new 80,000-square-foot R&D facility in San Jose, California, Samsung is amassing a portfolio of proprietary products. In 1988, the Company introduced a 1Mb DRAM; 64K and 256K SRAMs with 70ns, 80ns, and 100ns access times; fast CMOS logic; and PLDs with speeds of 25ns and 35ns, followed later by a 15ns model. Later that year, Samsung introduced 64K EEPROMs and fast SRAMs with access times down to 20ns and densities of up to 256K, microperipherals running at 10 MHz, a DRAM controller, and AC/ACT CMOS standard logic. These products were developed at two Korean R&D facilities, as well as in Samsung's new San Jose R&D center. In addition, the Company will be producing PLD and DRAM controllers in the San Jose facility.

Samsung Semiconductor is a wholly owned subsidiary of Samsung Electronics Co. (SEC), of the Samsung Group, a Korean conglomerate. SST's investment in Samsung totals $550 million.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
S. Joon Lee
Honeywell, Manager

VP R&D
Ilbok Lee
NSC, Div Mgr

VP Mktg/Sales
C.H. Oh
SST, Sr VP

VP Finance
Won Yang
SST, GM

Dir Mktg
Orlando Gallegos
Zytrex, VP Mktg/Sales

Dir Sales
Mike Barthmen
Hitachi, Natl Sales Mgr

FINANCING

1983
Start-up
$6.0M
Samsung Semiconductor and Telecommunications Ltd. (SST)

1983
Lease
$7.0M
SST

RECENT HIGHLIGHTS

February 1987
Samsung formally opened its $36 million national headquarters in San Jose, California. The facility, which Samsung purchased for $5 million, houses administration, R&D operations, and a research fab. Included in the 80,000-square-foot facility is a 12,000-square-foot Class 1 fab with 6-inch wafer processing equipment. Currently, 50 percent of the Company's capacity of 10,000 wafer starts per month is devoted to R&D.

June 1987
Samsung Semiconductor, GoldStar Semiconductor Inc., and Hyundai Electrical Engineering Co. announced that they are preparing to launch full-scale production of a 1Mb DRAM chip jointly developed by the three South Korean firms in 1986.

June 1987
Samsung Semiconductor agreed to supply Intel with 64K, 256K, and 1Mb DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea will begin in July.

ALLIANCES

SST
1983
Samsung Semiconductor was set up as a U.S. subsidiary of Samsung Co. Ltd., of Korea.

Exel
1983
Exel granted Samsung a license to second-source its 16K EEPROMs.

May 1985
The agreement was extended to include 64K EEPROMs.

Micron Technology
June 1983
Samsung obtained a license to manufacture and market Micron's 64K DRAM design in exchange for cash. The agreement was later extended to include Micron's 256K DRAM.

Micron Technology
July 1986
Samsung acquired a 2.7 percent interest in Micron for $5 million as part of an out-of-court settlement of a suit brought against Samsung. Micron claimed that Samsung failed to pay for materials and provide certain technology according to a 64K DRAM exchange pact. Micron obtained rights to the Samsung SRAM and EEPROM technologies for a 1 percent royalty, if sales exceeded 1 million units. The prior agreement was terminated.

Intel
January 1985
Intel granted Samsung a license to second-source certain microcomponents.

June 1987
Samsung agreed to supply Intel with 64K and 256K DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea began in July.

Zytrex
June 1985
Zytrex and Samsung signed a three-year technology/fab agreement. Samsung second-sourced Zytrex's LSI logic devices; Zytrex provided its proprietary ICE-MOS process. Zytrex is no longer in business.

Mostek
1986
Mostek and Samsung signed an agreement covering Mostek's 256K DRAM technology.

IXYS
January 1986
IXYS and Samsung signed an agreement allowing Samsung to receive IXYS' power MOS technology in exchange for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas.

GoldStar/Hyundai
1986
GoldStar, Samsung, and Hyundai agreed to cooperate on a 1Mb DRAM.

NCR
January 1989
Samsung and NCR's Microelectronics Division signed a broad technology exchange and license agreement that gives Samsung ASIC capability and gives NCR SRAM capability.

Quadtree Software Corp.
February 1989
Samsung and Quadtree announced a contract and licensing agreement under which Quadtree is developing full-function software models of Samsung's high-performance DRAM controllers.

Zilog
June 1989
Samsung and Zilog signed two licensing agreements that permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 microcontrollers and the Z85C30 Serial Communications Controller.

MANUFACTURING

Technology

1.0- and 1.5-micron CMOS, NMOS, bipolar
4-, 5-, and 6-inch wafers

Facilities

San Jose, CA
80,000 sq. ft.
Administration, R&D, manufacturing

12,000 sq. ft.
Class 1 clean room

The facility has a capacity of 10,000 wafer starts per month.

PRODUCTS

Linear	Device	Description
Op Amps	LM324	Quad Op Amp
	LM358/1458/4558	Dual Op Amp
	LM741	Single Op Amp
	LM386	Low-Voltage Power Amp
Timers	NE555	Single Timer
	NE556	Dual Timer
	KS555	Single Timer
	KS555H	High-Speed Timer
	KS556	Dual Timer
Voltage Regulators	KA33	Precision Voltage Regulator
	LM72	Adjustable Precision
	MC78	Positive Voltage Regulator
	MC79	Negative Voltage Regulator
	KA78S40	Switching Regulator
	KA431	Programmable Precision
Reference		
Comparators	LM311	Single Comparator
	LM339	Quad Comparator
	LM393	Dual Comparator
Data Converters	KS5C02/25C03	8-Bit Successive Aprox Register
	KS25C04	12-Bit Successive Aprox Register
	KSV3100	8-Bit and 10-Bit Flash Converter
	KSV3310	8-, 9-, and 10-Bit DACs
Interface	MC1488/1489	Quad Line RS-232 Receiver
Other	KA2181/2182/2183	Remote Control Preamp
	KA2580/2588	8CH Source Driver
	KA2803	Ground Default Detector
	KA2804	Zero-Voltage Switch

Linear	Device	Description
Telecommunications	LM567	Tone Decoder
	KA2410/2411	Tone Ringer
	KA2412	Subset Amplifier
	KA2413/5805	DTMF
	MC3361	FM IF Amplifier
	KS5804/5805	Pulse Dialer
	KT3170	DTMF Receiver
	KS5820	Tone/Pulse Dialer w/Redial
	KS5822/5823	Repertory Dialers
Transistors	Power MOSFET	
	General-Purpose Transistors	
	Low-Noise Amplifier Transistors	
	High-Voltage Transistors	
	Darlington Transistors	
Logic	KS54/74AHCT Family of Advanced High-Speed CMOS	
	KS54/74HCTLS Family of High-Speed CMOS	
Memory	64K, 128K, 256K, and 1Mb DRAMs	
	16K, 64K, and 256K SRAMs	
	16K and 64K EEPROMs	
	4K and 8K FIFO dual-port buffer memories	

OTHER INFORMATION

Samsung's PR firm is Roy Twitty & Co.

Seattle Silicon Corporation

3075 112th Avenue NE
Bellevue, WA 98004
206/828-4422
Fax: 206/827-4224

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 90**

BACKGROUND

Seattle Silicon Technology, Inc., was founded during the heyday of ASIC start-ups in 1983. Its initial business strategy has three important points aimed at establishing a unique position in the market. One is to supply silicon compiler software to systems designers with little or no actual experience with integrated circuit design. A second cornerstone of the firm's strategy is to provide process-independent designs, thus making it one of the first ASIC suppliers to base its business on providing tools and support services rather than wafer processing from a captive manufacturing facility. This key point in the strategy allows its customers to establish second sources easily and migrate its designs to newer fabrication processes as they become available. The third point of the Company's strategy is to integrate its software compilers into the familiar design environments of the leading third-party CAE workstations such as those from Digital Equipment Corporation, Tektronix, and Valid.

With its early software product, called Concorde, Seattle Silicon was successful in establishing strategic partnerships with Fortune 100 companies such as Burroughs (now Unysis), General Dynamics, and General Motors. Concorde offered customers an integrated software compiler that allowed input in the form of high-level functional specifications such as block diagrams or Boolean expressions. Process and foundry independence are achieved by referencing a table of process parameters for each foundry. Seattle Silicon claims that its products give customers access to more fabrication processes than any other ASIC supplier.

As the worldwide ASIC business evolved, it fragmented into gate arrays, standard cells, and silicon compilation. The major market acceptance was primarily on gate arrays, with standard cells and silicon compilers well behind. In 1987, recognizing a need to broaden its business base, Seattle Silicon began adapting its strategy to the evolving ASIC market by building upon early successes. The company now targets selected high-end application segments of the electronics market such as military, high-performance ASICs and mixed analog/digital circuits. The Company learned that many potential customers were not willing to take full responsibility for a chip's performance, so it introduced its "First Silicon" service, where Seattle Silicon guarantees working ASICs from a variety of manufacturing processes.

The Company continues to add processing options to its software and now allows designers to take advantage of the most advanced CMOS, VHSIC, SOS, and GaAs processes. Seattle Silicon believes that in the future of the ASIC industry, companies without a dedicated fab will be the norm rather than the exception; it is among the vanguard in this trend.

BOARD

(Name and Affiliation)

Stewart Carrell
Diasonics, Inc., Chairman/CEO

Bill Hambrecht
Hambrecht & Quist, General Partner

Amaury Piedra
Seattle Silicon, President/CEO

Paul Kirby
Hill, Kirby, Washing & Carman, General Partner

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Amaury Piedra
Fairchild, VP Strategic Alliances

VP Marketing
Ed Fernandez
National Semiconductor, Fairchild Analog Division

VP Sales
Dick Braydon
Fairchild, Technology Marketing Manager

VP Finance
John Celms
Amary International, CFO

VP Design Tools Development Engineering
Robert V. Alessi
Eastman Kodak, Manager IC Design

VP First ASIC Operations
Fred Tsang
Supertex, VP/COO

VP Software Operations
Bill Moore
Silvar-Lisco Inc., Dir. R&D

FINANCING

February 1985
Round 1
$6.2M
Hill, Kirby & Washing; Canadian Enterprise Development Corp.; Hambrecht & Quist; Norwest Venture Capital Management; Paragon Partners; Olympic Venture Partners; TWB Investment Partnership; Rainier Venture Partners

November 1985
Round 2
$0.5M
Previous investors

Early 1986
R&D Financing
$5.0M
General Motors

August 1986
R&D Financing
$7.0M
Pru-Tech

August 1987
Round 3
$5.0M
Hill, Kirby & Washing; Hambrecht & Quist; Rainier Venture Partners; Norwest Venture Capital Management; Paragon Partners

August 1988
Round 4
$5.1M
Hill, Kirby & Washing; Hambrecht & Quist; Norwest Venture Capital Management

RECENT HIGHLIGHTS

February 1988
Seattle Silicon introduced ChipCrafter®, a software design tool that will provide fully automatic physical design for high-functionality ASICs and maintain manufacturing process independence.

August 1988
Seattle Silicon announced the first production shipments of ChipCrafter.

August 1988
Using Seattle Silicon's compiler-based ASIC design software, two University of Michigan engineering students won first prize in the industry-sponsored sixth annual Student VLSI Design contest. Four out of the top six designs were completed using Seattle Silicon's Concorde compiler tool.

ALLIANCES

Gould AMI Semiconductors
September 1986
Seattle Silicon and Gould AMI signed an agreement that provides systems manufacturers with a simplified means of designing ASICs and transferring final design data to Gould AMI for fabrication. By the agreement, Gould AMI provided Seattle Silicon with its proprietary geometric design rules and performance characteristics of selected fabrication processes.

Burroughs Corp.
August 1986
Seattle Silicon and Burroughs signed an agreement to jointly develop a "new-generation design system" for integrated circuits.

United Technologies Microelectronics Center (UTMC)
June 1987
Seattle Silicon and UTMC announced their intention to jointly design and fabricate ASICs used in tactical and strategic radiation environments.

National Semiconductor
October 1987
Seattle Silicon and National signed a foundry agreement to qualify National's 1.25- and 1.20-micron VHSIC CMOS processes for design with Concorde, Seattle Silicon's compiler for top-end ASIC designs.

Oki Electric
August 1988
Seattle Silicon and Oki announced an agreement to develop a compiler for a process-independent, five-port, high-speed (15ns) static RAM module.

GigaBit Logic
June 1989
Seattle Silicon and GigaBit Logic announced the formation of an alliance to develop the design automation industry's first comprehensive set of software tools specifically created for GaAs ASICs.

SERVICES

"First Silicon" production management

MANUFACTURING

Technology

1.2-micron CMOS

PRODUCTS

- ChipCrafter design software tool
  - ChipCrafter ASIC Expert
  - ChipCrafter IC Expert
- Concorde ASIC compiler tool
- User-configured ASICs

OTHER INFORMATION

Seattle Silicon's PR firm is Franson & Associates, Inc.

SEEQ Technology, Inc.

1849 Fortune Drive
San Jose, CA 95131
408/432-7400
Fax: 408/432-1550

ESTABLISHED: January 1981 **NO. OF EMPLOYEES: 530**

BACKGROUND

SEEQ Technology, Inc., designs, manufactures, and markets nonvolatile semiconductor memory devices used in defense electronics, industrial, and data processing applications. SEEQ specializes in EEPROM processes for applications that require both nonvolatility and in-circuit programmability.

SEEQ products are grouped strategically into three classifications: EEPROM products that support nonvolatile memory needs, EEPROM microprocessors, and telecommunication circuits. SEEQ's EEPROMs range in density from 4K to 256K and offer benefits such as page-mode writes, 1M cycle endurance, silicon signature, and DiTrace as standard features. The Company's flash EEPROMs combine in-circuit programmability and the density of UV EPROMs. The Company's 8-bit, single-chip MCUs feature on-board EEPROMs for applications that allow on-chip reprogramming of code and data. SEEQ also offers enhanced Ethernet data link controllers and CMOS Manchester coder/decoder circuits.

SEEQ Technology was founded by Gordon Campbell, Dr. Philip J. Salsbury, Larry T. Jordan, Maria Ligeti, and George Perlegos, all formerly employed by Intel Corporation, and Dan Barbato, who was previously employed by Synertek.

Four domestic and two international sales offices manage a network of sales representatives in the United States, Canada, Europe, and Japan. Three national and three regional distributors serve the United States and Canada.

BOARD
(Name and Affiliation)

J. Daniel McCranie, Chairman
SEEQ Technology, Inc.

E. Floyd Kvamme
Kleiner, Perkins, Caufield & Byers

John W. Larson
Brobeck, Phleger & Harrison

Philip Paul
Hillman Ventures

*Dr. Philip J. Salsbury
SEEQ Technology, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
J. Daniel McCranie
Harris, Grp VP Sales

VP Finance/CFO
Patrick Brennan
NSC, VP/Treasurer

VP Manufacturing
Michael Van Hoy
SGS-Thomson, VP Operations

VP/CTO
*Dr. Philip J. Salsbury
Intel, Div Dir EEPROMs

VP Strat Accounts
Tom Endicott
Signetics, Mgr Rel & QA

VP Worldwide Sales
Philip Ortiz
CDI, Dir Mktg/Sales

VP/GM Flash Div
Michael Villot
Motorola, Dir Mktg MPUs

VP/Business Development
Ralph Harms
Signetics, Controller

*Founder

FINANCING

March 1981
Initial
$15.0M
Kleiner, Perkins, Caufield & Byers; Hillman Ventures

September 1983
Initial public offering
$20.0M

March 1985
Private placement
$14.0M

October 1986
Private placement
$6.0M
Bridge Capital; GE Venture Capital; Hillman Ventures; John Hancock; Kleiner, Perkins, Caufield & Byers

November 1988
Private placement
$4.0M
Monolithic Memories

April 1988
Public offering
$19.5M

RECENT HIGHLIGHTS

February 1987
SEEQ reincorporated in Delaware.

April 1987
SEEQ announced the addition of its 27C256 EPROM to military drawing 86063. It was the first time SEEQ ever had parts listed for a military drawing, and it followed the 27C256's compliancy with MIL-STD-883 Rev C, Class B.

April 1987
SEEQ announced its successful demonstration to the Defense Electronics Supply Center (DESC) of SEEQ's compliance with the requirements of MIL-M-38510 and MIL-STD-976. DESC recognized SEEQ as having reached a level of manufacturing competence in which all phases of design, processing, and testing meet or exceed established standards by DESC.

April 1988
SEEQ introduced the 512K flash EEPROM, first of the generation of high-density flash-type electrically erasable programmable memories.

February 1989
SEEQ announced the industry's first 1Mb flash EEPROM at the 36th ISSCC in New York. The part offers twice the density of other currently available flash EEPROM devices. The 48F010 is available in commercial and military versions.

ALLIANCES

Amkor
1981
SEEQ signed Amkor to assemble its IC products.

Rockwell
July 1982
SEEQ signed an exclusive licensing agreement to provide its 16K EEPROM and 16K UV EPROM technology to Rockwell. In exchange, Rockwell paid SEEQ $5.0 million, leased $5.5 million of SEEQ's equipment, and agreed to pay a 3 percent royalty on sales of these products.

Texas Instruments
August 1982
SEEQ licensed its EEPROM technology to Texas Instruments in exchange for its TMS7000 8-bit MCU.

Silicon Compilers
1983
SEEQ announced that it would manufacture the Silicon Compiler, Inc., (SCI) Ethernet data link controller.

July 1985
SEEQ provided all of its EEPROM designs for integration into SCI's Genesil system. SEEQ will manufacture the EEPROM logic circuits using its 2-micron CMOS process.

Monolithic Memories
November 1986
Monolithic Memories Inc. (MMI) purchased a 16 percent equity in SEEQ for $4 million. The two firms also agreed to a joint product and technology program to codevelop four CMOS EEPROM-based PLDs.

Motorola
December 1986
SEEQ and Motorola signed an engineering development agreement to develop a high-performance EEPROM microcomputer.

National Semiconductor
October 1987
SEEQ and National Semiconductor signed a four-year exclusive technology licensing and manufacturing agreement. Under the agreement, the two companies share technology and marketing rights to SEEQ's 512K and 1Mb and to National's 256K flash EEPROMs. The agreement was extended October 1988.

June 1989
SEEQ and National scaled back their 1987 agreement to cover only current Flash technology. SEEQ will continue to develop the next generation of 0.8μ Flash chips alone.

Hamilton-Standard
October 1987
SEEQ signed a $1.4 million contract to supply CMOS 256K EEPROMs to Hamilton-Standard, a division of UTC. The EEPROMs, configured as 32Kx8, will be used in military flight tape recorders.

MANUFACTURING

Technology

2.0-micron, double-poly, floating-gate CMOS
1.25-micron, double-poly, floating-gate CMOS
5-inch wafers

Facilities

San Jose, CA
120,000 sq. ft.
Administration, design, manufacturing (The SEEQ fab has DESC certification to allow individual parts to achieve JAN qualifications.)

PRODUCTS

EEPROMs
16K Latched; 4K, 16K, and 64K Latched and Timed; 64K and 256K Page Mode; High-Speed CMOS 64K and 256K EEPROMs; Timer EEPROM

Flash
512K and 1024K CMOS Flash EPROMs, 512K and 1024K CMOS Flash EEPROMs

EPROMs
64K, 128K, 256K CMOS

Data Communications
Ethernet Data Link Controller, Manchester Code Converters, Advanced Ethernet Data Link Controller

EEPLD
Registered Asynchronous CMOS EEPLD, Versatile 28-pin CMOS EEPLD

MILITARY PRODUCTS

EEPROMs
16K and 64K Latched; 16K and 64K Latched and Timed; 64K and 256K Page Mode, Latched & Timed; High-Speed CMOS Bipolar PROM Replacement; High-Speed CMOS; High-Speed CMOS Bipolar PROM; 1,024K EEPROM

EPROMs

64K, 128K, and 256K EPROMs; 256K CMOS EPROM; DESC SMD-Compliant 64K, 128K, and 256K CMOS UV EPROMs

FLASH

512K and 1,024K CMOS Flash EEPROMs, 512K and 1,024K CMOS Flash EPROMs

OTHER INFORMATION

SEEQ Technology does not employ a PR firm.

Sensym, Inc.

1255 Reamwood Avenue
Sunnyvale, CA 94089
408/744-1500
Fax: 408/734-0407
Telex: 176376

ESTABLISHED: October 1982 **NO. OF EMPLOYEES: 120**

BACKGROUND

Sensym, Inc., designs, manufactures, and markets a complete line of IC accelerometers and IC pressure sensors and transducers including absolute, differential, and gauge types ranging from 0 to 1 psi to 0 to 5,000 psi. The Company provides devices with a variety of coatings, isolators, and special packages made specifically to handle various media, from dry air to hostile environments such as steam, water, freon, and high humidity. Products are used in many applications including energy management, avionics, medical diagnostics, agrionics, and industrial controls.

Sensym was founded when the principal management of National Semiconductor's transducer group initiated a leveraged buyout from the parent company, with the assistance of venture capital funding. The Company set up its operation in Sunnyvale, California, to provide only United States-built products and offers the National Semiconductor transducer product line as well as numerous product additions. Round two of financing, completed in 1984, assisted in the expansion of Sensym's manufacturing capacity.

In April 1989, Sensym was acquired by FASCO Sensors and Controls Group, a division of FASCO Industries. Sensym became the tenth member of the Sensors and Controls Group, a consortium of FASCO companies that provides temperature, pressure, and position-sensing technology as well as aerospace controls and subsystems.

BOARD

(Name and Affiliation)

Dennis Dauenhauer
  Sensym, Inc.

Roger J. Barry
  Crosspoint Venture Partners, Partner

Robert L. Cummings
  Robertson, Colman & Stephens, Partner

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO/COO
Dennis Dauenhauer
  National, Grp Dir Transducers

VP Mktg/Sales
W. Frederick Jones
  Varian Associates, Div Mgr

VP Hybrid & Semi
Fred Adamic
  National, Linear Prod Line Mgr Ops

FINANCING

October 1982
Round 1
$ 1.0M
  Crosspoint Venture Partners; Robertson, Colman & Stephens

Round 2
$ 1.5M
  Crosspoint Venture Partners; Med-Tec Ventures; National Semiconductor; Robertson, Colman & Stephens

August 1986
Round 3
$ 1.5M
  Becton & Dickinson

August 1989
Acquisition
$250.0M
  Sensym acquired by FASCO Sensors and Controls Group

RECENT HIGHLIGHTS

August 1987
Sensym leased 20,405 square feet of research and development space at 1244 Reamwood Avenue, Sunnyvale. The additional space will be used for the development and manufacture of digital electronic tire gauges.

April 1989
Sensym was acquired by FASCO Sensors and Controls Group.

ALLIANCES

Michelin
Sensym has a technology agreement with Michelin of France.

MANUFACTURING

Technology

CMOS capabilities
Bipolar
4-inch wafers
Solid-state sensors
Sensor-based systems

Facilities

Sunnyvale, CA
65,000 sq. ft.
Manufacturing, engineering, administration
20,405 sq. ft.
Corporate offices, R&D, marketing and sales
1,500 sq. ft.
Class 100 clean room

PRODUCTS AND SERVICES

Custom Pressure Sensors
Disposable Blood Pressure Sensors
Tape Tension Pressure Sensors
Energy Management Pressure Sensors
Medical Instrumentation Pressure Sensors
Barometric Pressure Sensors
Engine Diagnostic System Sensors
Accelerometers
Digital Tire Gauges
Digital Pressure Gauges
Sensor-Based Subsystems
Proprietary and Custom Solid State Sensors for Pressure and Acceleration

OTHER INFORMATION

Sensym does not employ a PR firm.

SID Microelectronics S.A.

Av. Brig. Faria Lima
1476 - 7. andar 01452
Sao Paulo, Brazil
011/210-4033

ESTABLISHED: April 1984 **NO. OF EMPLOYEES: 850**

BACKGROUND

SID Microelectronics S.A. designs, manufactures, and markets small and medium transistors and linear devices. The Company plans to introduce hybrid circuits, surface-mounted device technology, metallic-can transistors, ceramic and metal (cermet) ICs, and digital IC assembly. Additional product plans include MOS logic, custom/semicustom ICs, memories, microprocessors, TTL, LIC, and LSI devices. The Company plans to continue support of its design and research and development activities in CMOS.

SID succeeds the RCA-Ford semiconductor manufacturing joint venture in Brazil that closed in 1983. In 1984, SID purchased the IC fab from RCA to produce ICs for the merchant market. SID is the only South American semiconductor manufacturing company with all the manufacturing steps, including wafer production.

BOARD
(Name and Affiliation)

Matias Machline
Sharp S.A. Equipamentos Electronics

Jose B. Amorim
SID S.A. Servicos Tecnicos

Yuichi Tsukamoto
SHARP S.A. Equipamentos Electronics

Jose Papa, Jr.
FIESP

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
Matias Machline
Not available

VP R&D
Adalberto Machado
Ford-Brazil

VP Finance
Luis Paulo Rosenberg
Not available

Mng Director
Victor Blatt
CPQD-Telebras

Indus Director
Wilson L.M. Leal
Siemens

Planning Mgr
Luiz Mauge
Sharp

Mktg Mgr
Inacio Hatanaka
RCA

FINANCING

1984
Initial
$14.2M
Private investors

MANUFACTURING

Technology

3.0-micron bipolar

PRODUCTS

Small-Signal Transistors
Medium-Power Transistors
Linear ICs

OTHER INFORMATION

SID Microelectronics does not employ a PR firm.

Sierra Semiconductor Corporation

2075 North Capitol Avenue
San Jose, CA 95132
408/263-9300
Fax: 408/263-3337
Telex: 384467

ESTABLISHED: November 1983 **NO. OF EMPLOYEES: 350**

BACKGROUND

Sierra Semiconductor Corporation is a service-oriented supplier of CMOS ASICs with a complementary portfolio of standard products that include memory and linear digital ICs. The Company specializes in designs that combine analog, digital, and/or EEPROM memory technology on one chip. Products target telecommunications, data communications, computers and peripherals, and selected industrial applications.

The Company's proprietary Triple Technology makes the integration of analog, digital, and EEPROM memory on a single IC possible. Sierra's products are fabricated on 5-inch wafers using 1.5-, 2.0-, and 3.0-micron CMOS process technology. Currently, Sierra conducts its own manufacturing and test but occasionally also uses foundries to augment internal capability. A recent joint venture company established in Singapore ensures adequate manufacturing and test resources for the foreseeable future.

Sierra is considered to be strong in circuits combining analog and digital technology and is also considered to have a strong cell library. The Company has an EE cell library—only two other suppliers (NCR and National Semiconductor) have such a library. Sierra's initial strategy was to develop a portfolio of CMOS standard products that demonstrated Sierra's Triple Technology. Sierra's long-term strategy is to expand its custom and cell-based products to 70 percent of sales and identify new markets and applications that benefit from the combination of digital, analog, and EE nonvolatile memory. At the end of 1987, Sierra's sales were about evenly split between standard and custom products.

Sierra has established two joint ventures in the last few years. In June 1986, Sierra formed a corporation in the Netherlands, named Sierra Semiconductor B.V. The $9 million in equity funding for the venture came from the Netherlands-based MIP Equity Fund. The headquarters, which opened in October 1986, houses a design center, technical support and services, and marketing and sales for Sierra's standard and cell-based ICs. In January 1987, Dr. Stephen Forte was appointed president of the operation.

In November 1987, Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore named Chartered Semiconductor Pte. Ltd. The company is located at a 170,000-square-foot site in the Singapore Science Park. Initial capacity will be 5,000 6-inch wafers per month. This firm fabricates and tests CMOS wafers and ASIC devices primarily for Sierra and National.

Singapore Technology holds 74 percent of the joint venture company; Sierra holds 17 percent, and National holds the remaining 9 percent. Sierra will contribute its Triple Technology CMOS process and technical management, while National will provide CMOS process technology and technical support to construct the clean room facility. Singapore Technology Corporation also participated in Sierra's third round of financing.

Sierra sells its products through manufacturers' representatives and distributors in North America and Asia. In Europe, the Company sells its products through Sierra Semiconductor B.V., headquartered in the Netherlands, and also through manufacturers' representatives.

BOARD
(Name and Affiliation)

Donald T. Valentine, chairman
Sequoia Capital

Charlie C. Bass
Ungermann-Bass

James V. Diller
Sierra Semiconductor Corporation

Kheng-Nam Lee
Singapore Technology Corporation, Inc.

Robert J. Schreiner
Borg-Warner Electronics

Hans Severiens
MIP Equity Fund

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
James V. Diller
National, VP MOS Mem Ops

Pres/Sierra B.V.
Dr. Stephen Forte
AMI, VP WW Mktg/Sales

VP Mktg/Sales
John T. Reynolds
National, Group Mktg Dir

VP Design
Andrew G. Varadi
National, VP Technology

VP Opns
Edward Boleky
Intel, Mgr Mem Prod

VP Finance
C. Stephen Cordial
TI, Div Controller

Mng Dir Chartered Semi
John Hambridge
Fairchild, VP Logic Division

FINANCING

January 1984
Round 1
$ 7.7M
Arscott, Norton & Assoc.; Asset Mgmt.; Associated Venture Investors; Bay Partners; Borg-Warner Electronics; Investors in Industry; Mohr, Davidow Ventures; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors; Venrock Associates

April 1985
Round 2
$15.0M
Initial investors; Bryan and Edwards; Burr, Egan, Deleage & Co.; Litton Industries; Suez Technology Fund; Tellabs, Inc.

October 1986
Round 3
$18.4M
Asset Mgmt,; Associated Venture Investors; Bay Partners; Berkeley International; Borg-Warner Electronics; Churchill International; Hambrecht & Quist; Litton Fund; MIP Equity Fund; Mohr, Davidow Ventures; Sequoia Capital; Singapore Technology Corporation; Suez Technology Fund; Sutter Hill Ventures; Technology Venture Investors; Venrock Associates

September 1987
Round 4
$10.0M
Convertible debentures, Berkeley International

RECENT HIGHLIGHTS

June 1986
MIP Equity Fund invested $9 million in Sierra and Sierra Semiconductor B.V. The latter operates as a design and service center. Additional funding through government grants was assured. In January 1987, Dr. Forte joined Sierra as president of the subsidiary.

October 1986
Sierra completed third-round financing for $18.4 million. In addition to discussing an investment, Singapore Technology Corp. and Sierra discussed establishing a joint venture in Singapore for a design center and semiconductor manufacturing facility.

December 1986
Sierra introduced the SC11270 and SC11289 DTMF receivers.

December 1986
Sierra introduced the SC11401/11402/11403/11404 8-bit video DACs, which are compatible with RS-170 and RS-323 specifications.

December 1986
Sierra announced that its cell library is now supported on Mentor Graphics workstations.

January 1987
Sierra and National Semiconductor announced a jointly developed family of 8-bit CMOS MCUs. The first members in the family of flexible controllers are called SC44820, SC44821, and SC44822 by Sierra and COP820C, COP821C, and COP822C by National Semiconductor.

May 1987
Sierra sampled a CMOS 2,400-bps modem chip set based on its initial 1,200-bps modem chip set, which is second-sourced by VLSI Technology. The SC11006 is the 2,400-bps modem, and the SC11009 and SC11011 are companion controllers. The SC11009 is for parallel bus applications such as the PC XT, AT, or compatibles; and the SC11011 supports RS-232 applications.

September 1987
Sierra ported the MIXsim behavioral modeling tools to the Mentor Graphics Idea workstation.

November 1987
Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore and named it Chartered Semiconductor Pte. Ltd.

ALLIANCES

National Semiconductor
July 1984
Sierra and National signed a technology exchange agreement that covers selected advanced CMOS products and processes. Sierra leased a facility from National to develop its process and manufacture products using its own equipment and employees.

November 1987
Sierra, National, and Singapore Technology Corporation formed a joint venture company named Chartered Semiconductor Pte. Ltd. The new firm, located in the Singapore Science Park, will fabricate and test CMOS wafers and ASIC devices primarily for Sierra and National. Initial capacity will be 5,000 6-inch wafers per month. Sierra and National are providing process technology and technical assistance.

VLSI Technology
January 1985
Sierra and VLSI have an agreement that provides for the exchange of technical information and the mutual sharing of developments in ASIC software, design expertise, and products. VLSI is also a second source for Sierra's custom and analog standard products.

Mentor Graphics
December 1986
Sierra announced that its cell library is now supported on Mentor Graphics workstations.

September 1987
Sierra's MIXsim behavioral modeling tools are available on Mentor Graphics' Idea workstation.

MANUFACTURING

Technology

2.0-micron single- and double-poly, double-metal CMOS
3.0-micron single- and double-poly CMOS
1.5-micron
5-inch wafers
6-inch wafers available in third quarter 1989

Facilities

San Jose, CA
71,000 sq. ft.
Headquarters, administration, marketing, design, and test

Santa Clara, CA
16,000 sq. ft.
Engineering, wafer fabrication

Sierra Semiconductor Corporation

PRODUCTS

CMOS Cell Library

Process	Linewidth	Cells
Si-Gate CMOS	2.0-micron	280 Digital Cells, 50 Analog Cells, 25 EEPROM Cells, RAM, ROM, PLA, 2901, Multiplier
Si-Gate CMOS	1.5-micron	250 Digital Cells, 25 Analog Cells, 70-MHz PLL, Video DACs, 9 EEPROM Cells, RAM, ROM, PLA, Data Path, Multiplier

EEPROMs

Device	Description
SC22001/22002	CMOS 256-Bit Serial EEPROM
SC22011/22012	CMOS 1,024-Bit Serial EEPROM
SC22101	CMOS 128x8 Multiplexed EEPROM
SC22102	CMOS 256x8 Multiplexed EEPROM
SC22104	CMOS 512x8 Multiplexed EEPROM

Microcomponents

SC44820/44821/44822	8-Bit CMOS MCUs

Linear

Data Communication

SC11000/11001/11005	CMOS 1,200-Baud Modem Filters
SC11002/SC22003	CMOS 300-Baud Modem
SC11004/SC11014	CMOS 1,200-Baud Modem
SC11006	CMOS 2,400-Baud Modem
SC11007/SC11008	CMOS Modem Controller
SC11009	SC11006 Companion Controller for Parallel Bus
SC11011	SC11006 Companion Controller for RS-232
SC11015	CMOS 1,200-Baud Modem with Programmable Receiver Gain Amplifier

Telecommunications

SC11202/11203/11204/11270	DTMF Receiver
SC11270/11289	DTMF Receiver
SC11280/11289/11290	DTMF Transceiver
SC11301/11302	Codec Filter Combo

Computer/Peripheral

SC11401/11402/11403/11404	8-Bit Video DACs

Developmental Tools

MONTAGE - Systems Integration Software	Design system that permits schematic capture and simulation of mixed signal ASICs by the system's designer
SCDS	Custom Design System
MIXsim	Behavioral Modeling Tools

OTHER INFORMATION

Sierra Semiconductor does not employ a PR firm.

Si-Fab Corporation

27 Janis Way
Scotts Valley, CA 95066
408/438-6800
Fax: 408/438-6800, Ext. 107

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 15**

BACKGROUND

Si-Fab Corporation provides process design and engineering services as well as quick-turn CMOS foundry services. The Company filed for Chapter 11 protection during the economic downturn in the semiconductor industry and reorganized its management and systems. Consequently, Si-Fab's business outlook and sales have increased substantially.

BOARD

Not available

COMPANY EXECUTIVE
(Position and Name)

President
Leon B. Pearce

FINANCING

Private

PRODUCTS

- Aftermarket Technology
- Proprietary Products
- High-Speed SRAM 44-64U

OTHER INFORMATION

Si-Fab does not employ a PR firm.

ALLIANCES

Not available

SERVICES

- Custom IC design
- Thin-film coating services
- Metal gate and Si-gate CMOS foundry
- P-channel and n-channel foundry

MANUFACTURING

Technology

- 1.0- to 1.25-micron SOS, CMOS, NMOS, and PMOS
- 4-inch and 5-inch wafers

Facilities

Scotts Valley, CA
12,000 sq. ft.
Plant
5,000 sq. ft.
Clean rooms

SIMTEK Corporation

1465 Kelly Johnson Boulevard, Suite 301
Colorado Springs, CO 80902
719/531-9444
Fax: 719/531-9481

ESTABLISHED: May 1987 **NO. OF EMPLOYEES: 30**

BACKGROUND

SIMTEK Corporation designs, manufactures, and markets advanced nonvolatile memory products. SIMTEK is using proprietary nonvolatile integrated circuit technology, and its first two products are a 256K EPROM and a 64K NVSCRAM. SIMTEK began production of these products in early 1989 and expected its first revenue from them late in 1989.

SIMTEK is using advanced CMOS processes coupled with silicon nitride oxide semiconductor (SNOS) technology. This technology provides high-density, high-performance, reliable, and full-function nonvolatile products.

Initial capitalization was provided by Nippon Steel Corporation of Japan, which owns about 20 percent of the Company and has a seat on the board. Other financing was provided by the founders.

Dr. Richard Petritz, a founder of Mostek and Inmos, serves as chairman and CEO of the Company.

BOARD

Dr. Richard Petritz
Dr. Gary Derbenwick
Mr. Kazuo Takanashi

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
Dr. Richard Petritz
Inmos, Founder

COO
Dr. Gary Derbenwick
Inmos, Mgr Technology

VP Operations
Dr. Dennis Ryden
Inmos, Process Mgr

VP Engineering
Dr. Ralph Sokel
Inmos, CAD Development

VP Finance
William G. Skolout
RAMTRON, CFO

OTHER INFORMATION

SIMTEK does not employ a PR firm.

Solid State Optronics Inc.

442 Queens Lane
San Jose, CA 95112
408/436-1390
Fax: 408/436-1392

ESTABLISHED: June 1982 **NO. OF EMPLOYEES: 5**

BACKGROUND

Solid State Optronics, Inc., designs and manufactures solid-state relays, photoresistors, and thyristors. The Company was founded by Zag Kadah in 1982. Prior to founding the Company, Mr. Kadah was employed at Electro-Trol, Inc., as vice president in charge of the optoelectronics division. In 1979, Mr. Kadah founded Power Interface, a company that pioneered the development of an IC to drive back SCRs in solid-state relays.

The Company subcontracts manufacturing to a company in Asia; assembly is done in the Philippines.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Zag Kadah
Elec-Trol, Inc.

Marketing
Sid Kadah
UC Berkeley

Financial Officer
Fay Kadah
Magnex

*Founder

PRODUCTS

- Input/Output Modules
- Interrupters
- Photodiodes
- Photo Arrays
- Silicon Photo Detectors
- Solid-State Relays
- Hybrid Optoelectronic Modules

OTHER INFORMATION

Solid State Optronics' PR firm is QMI.

FINANCING

Zag Kadah holds 100 percent of the Company.

ALLIANCES

Not available

MANUFACTURING

Technology

- Bipolar
- Dielectric isolation
- DMOS
- GaAs and GaAlAs

Facilities

San Jose, CA
1,200 sq. ft.
R&D, design, engineering, and assembly

Spectrum Microdevices

5330A Spectrum Drive
Frederick, MD 21701
301/695-0868
Fax: 301/831-4032

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 21**

BACKGROUND

Spectrum Microdevices is a part of Fairchild Communications & Electronics Company, which, in turn, is part of Fairchild Industries. In 1983, Fairchild acquired a 51 percent share of Insouth, a company that makes large-scale ICs, hybrids, and gate arrays. Fairchild has since increased its holdings to 100 percent.

In 1986, Spectrum Microdevices, then known as Insouth Microsystems, moved from Auburn, Alabama, to Frederick, Maryland. Some members of the management and design group, including General Manager Marvin L. Harding, were transferred to coordinate component manufacturing more closely with Fairchild Communications & Electronics Company in Germantown, Maryland. Fairchild Communications & Electronics Company, Spectrum Microdevices' major customer, manufactures avionics and telecommunications equipment. The move was completed in September 1986, and the Company's name was changed in early 1987.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Director Operations
William K. Bowers

FINANCING

Not available

MANUFACTURING

Technology

2.0-micron CMOS

Facilities

Frederick, MD
2,500 sq. ft.
Administration

12,500 sq. ft.
Manufacturing, assembly, test

PRODUCTS

Military Hybrids/Custom Monolithic Assembly and Test
Surface Mount for Military

OTHER INFORMATION

Spectrum Microdevices does not employ a PR firm.

Synaptics, Inc.

2860 Zanker Road, Suite 105
San Jose, CA 95134
408/434-0110
Fax: 408/434-9819

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 7**

BACKGROUND

Synaptics, Inc., was formed to develop a family of neural network interpret circuits for use in intelligent sensors and pattern recognition applications. The Company is in a research stage and does not expect to introduce products for some time.

The Company hopes to develop a device with the ability to sense and process real-world signals in real time and to learn without prior knowledge embedded in its program.

The basic research is guided by a scientific advisory committee chaired by Carver Mead of California Institute of Technology. Professor Mead, a leading force in the development of silicon computer design methodology for VLSI, has been modeling neural networks with analog VLSI systems.

BOARD

Not available

OTHER INFORMATION

Synaptics does not employ a PR firm.

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Federico Faggin
Cygnet Communication, Founder

Chairman
Carver Mead
California Institute of Technology, Computer Science Professor

*Founder

FINANCING

May 1986
Seed
$0.6M
Avalon Ventures, Sprout Group, Technology Venture Investors

June 1987
Round 1
$1.5M
Kleiner, Perkins, Caufield & Byers; Sprout Group; Technology Venture Investors

Synergy Semiconductor Corporation

3450 Central Expressway
Santa Clara, CA 95051
408/730-1313
Fax: 408/737-0831

ESTABLISHED: 1987 **NO. OF EMPLOYEES: 48**

BACKGROUND

Synergy Semiconductor Corporation was formed to offer ultrahigh-performance bipolar ECL memory and logic products for the commercial and military markets. The Company is in its product development stage and plans to begin offering ECL bipolar products that will serve the needs of the high-performance computer and ATE markets in the second half of 1988. Its first product will be a 4K memory chip with an access time of less than 5ns.

Synergy was cofounded by Ralph O. Cognac, Larry J. Pollock, George W. Brown, Thomas S. Wong, and E. Marshall Wilder. All of the founders worked together at Advanced Micro Devices, where they developed the advanced bipolar technology called IMOX. Mr. Cognac and Mr. Pollock also played key roles at Integrated Device Technology, a leading supplier of high-speed CMOS memory and logic products.

Kenneth G. Wolf joined the Company as president and CEO in July 1987. Mr. Wolf was previously employed at Motorola for 22 years in management positions. At various times, he was responsible for the bipolar memory, bipolar logic, and ASIC divisions.

In January 1988, Synergy Semiconductor purchased Zoran Corporation's Santa Clara, California, wafer fabrication clean room and a portion of the 50,000-square-foot manufacturing and office facility.

BOARD
(Name and Affiliation)

Sven E. Simonson, chairman
  Sequoia Capital

*Ralph O. Cognac
  Synergy Semiconductor Corporation

William J. Harding
  J.H. Whitney & Company

Glenn M. Mueller
  Mayfield Fund

Kenneth G. Wolf
  Synergy Semiconductor Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Kenneth G. Wolf
  Motorola, VP/GM ASIC Div

VP Prod Ops
*George W. Brown
  AMD, Prod Mgr Bipolar RAMs

VP Mktg/Sales
*Ralph O. Cognac
  IDT, VP Mktg

VP Technology
*Larry J. Pollock
  IDT, VP Corp Engr

VP Prod Dev
*Thomas S. Wong
  AMD, Dsn Mgr Bip RAMs

VP Mfr Ops
*E. Marshall Wilder
  AMD, Mgr Dir MOS RAMs

*Founder

FINANCING

July 1987
Round 1
$3.9M
  Mayfield Fund, Sequoia Capital, Suez Technology Fund

Synergy Semiconductor Corporation

February 1988
Round 2
$ 9.0M
Broventure Capital Mgmt.; Matrix Partners; Mayfield Fund; Menlo Ventures; Merrill, Pickard, Anderson & Eyre; Oak Investment Partners; Stanford University Engineering; Sequoia Capital; J.H. Whitney

January 1989
$8.5M
Revolving Lease Line

ALLIANCES

Major strategic alliances are as yet unnamed.

MANUFACTURING

Technology

1.5-micron bipolar ECL
4-inch wafers

Facilities

Santa Clara, CA
30,000 sq. ft.
Administration and manufacturing

7,000 sq. ft.
Class 10 clean room

PRODUCTS

Synergy's first product is the industry's fastest 1Kx4 bipolar ECL RAM 3ns SY100474 and SY10474 offering 100K and 10K compatible logic levels. These parts feature balanced read/write, elimination of the traditional write recovery glitch, and standard or fast edge rates. They are designed for alpha particle immunity and are available in industry-standard DIP and Flatpack packages.

Synergy plans to offer a complete family of the industry's fastest 1K, 4K, and 16K ECL RAMs as well as several specialized ASM (application-specific RAMs) memories.

Synergy also plans a series of ultrafast logic products in the future.

OTHER INFORMATION

Synergy Semiconductor does not employ a PR firm.

Taiwan Semiconductor Manufacturing Company, Limited

1F No. 9, Industriale E. 4th Road
Science-Based Industrial Park
Hsinchu, Taiwan
(035) 961240
Fax: (035) 942616

North American Office
3150 Almaden Expressway, Suite 111
San Jose, CA 95118
408/978-1322
Fax: 408/978-1365

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 300**

BACKGROUND

Taiwan Semiconductor Manufacturing Company, Limited, (TSMC) was formed to provide one-stop semiconductor manufacturing services including wafer fabrication, probing test, packaging, final test, and burn-in for a wide variety of ICs.

Taiwan's Executive Yuan, or legislature, earmarked funds from its development fund for a 48.0 percent stake in the Company. N.V. Philips has a 27.5 percent share in the $150 million investment in TSMC and an option to purchase controlling interest in the Company. The remainder is held by other Taiwanese firms.

In 1987, Dr. Morris Chang, former president and chief executive officer of General Instrument Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan, was made chairman of TSMC. Dr. Chang is also chairman of United Microelectronics Corporation. Also in 1987, Jim Dykes joined TSMC as president and chief executive officer. Mr. Dykes had set up General Electric Company's Semiconductor Division. Stephen L. Pletcher, who had been vice president of sales and marketing for GE Semiconductor, was named director of a new North American and European marketing and sales operation of TSMC.

In early 1987, TSMC made its first wafer shipment from its facility, which is capable of producing 10,000 6-inch wafers per month. It is equipped to produce chips, using 1.5-, 2.0-, and 3.0-micron CMOS and NMOS processes. TSMC began volume production in early 1988.

In December 1987, TSMC received approval to build a second manufacturing facility in Taipei, Taiwan. The new facility, which is scheduled for completion by year-end 1989, will cost about $220 million and will nearly quadruple the Company's capacity. The planned 65,000-square-foot fab facility will have a production capacity of 30,000 6-inch wafers per month. It is designed for submicron processes; however, initial production will be done via a 1.2-micron process. In the future, TSMC plans to convert a portion of the capacity to 8-inch wafers and also to shrink its processes to the submicron level by 1990.

When the Company begins volume production, it expects approximately 25 percent of its production to be for Philips, 25 percent for Taiwanese firms, and the remainder for U.S. manufacturers.

BOARD

Dr. Morris Chang, Chairman

COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President/CEO
Klaus Wiemer
Texas Instruments

Taiwan Semiconductor Manufacturing Company, Limited

VP Operations
F.C. Tseng
ERSO

VP Marketing
John Luke
Monsanto Silicon, VP Sales

VP Finance
Mient Vinenga
Philips

VP Admin
Eddie Mou
Texas Instruments, Pacific Rim Sales

FINANCING

1986
Round 1
$48.0M
Executive Yuan Development Fund (48.3 percent), N.V. Philips (27.5 percent), China American Petrochemical, Formosa Chemicals & Fiber, Formosa Plastics, Nan Ya Plastics, Central Investment Holding Co., Asia Polymer Corp., China General Plastics, Mabuchi Taiwan, USI Far East Corp., Yao Hua Glass, ADI Corp., Tai Yuen Textile, Union Petrochemical

1988
Round 2
$29.0M
Original investors

1988
Round 3
$205.0M
Original investors

ALLIANCES

Philips
1986
N.V. Philips has a 27.5 percent share in the $150 million investment in TSMC, with the remainder held by the government and Taiwanese firms. Philips has an option to purchase controlling interest in the Company.

SERVICES

Foundry
Assembly
Packaging
Test
Burn-in

MANUFACTURING

Technology

3.0-micron silicon-gate NMOS and CMOS p-well
2.0-, 1.5-, and 1.25-micron silicon-gate CMOS n-well
6-inch wafers
Submicron processes and 8-inch wafer compatibility planned by 1990

Facilities

Taiwan
21,000 sq. ft.
Manufacturing, Class 1 and Class 10 clean rooms

A second $220 million 65,000-square-foot facility is planned for completion in late 1989. The facility will have a production capacity of 36,000 6-inch wafers per month.

OTHER INFORMATION

Taiwan Semiconductor's PR firm is Masto Dagastine.

Telcom Devices Corporation

914 Tourmaline Drive
Newbury Park, CA 91320
805/499-0335
Fax: 805/499-8018

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 6**

BACKGROUND

Telcom Devices Corporation was formed in early 1986 to offer indium gallium arsenide (InGaAs) photodiodes and indium gallium phosphide (InGaP) light-emitting diodes.

Founders James Kim, Ock-Ky Kim, and Larry Perillo are former Rockwell engineers. Telcom Devices is a subsidiary of Opto Diode Corp. (ODC) and is operating from ODC's facilities in Newbury Park, California. Both companies share clean room and manufacturing space.

Telcom Devices began volume production of its first products in May 1986. The products were InGaAs PIN photodiodes for fiber-optic applications and included the Planar 13PD100 and Planar 15PD100.

BOARD

Five members (James Kim is Chairman.)

COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President
*James Kim
Rockwell

VP Engr
*Ock-Ky Kim
Rockwell

Dir Opto Mtls
*Larry Perillo
Rockwell

*Founder

FINANCING

Not available

MANUFACTURING

Facilities

Newbury Park, CA
10,000 sq. ft.
Administration, manufacturing

PRODUCTS

InGaAs Photodiodes and Long-Wavelength LEDs

OTHER INFORMATION

Telecom Devices Corp. does not employ a PR firm.

Three-Five Systems, Inc.

10230 S. 50th Place
Phoenix, AZ 85044
602/496-0035
Fax: 602/496-0168

ESTABLISHED: April 1985 **NO. OF EMPLOYEES: 235**

BACKGROUND

Historically, Three-Five Systems, Inc., produced and marketed custom and semicustom products that combine silicon and GaAs technologies for the consumer, industrial, telecommunications, and computer markets. The Company's main product thrust now is custom user interface modules utilizing LED, LCD, and keyboard components.

The Company is headquartered in a 40,000-square-foot facility in Phoenix, Arizona. The facility houses all corporate functions as well as a quick-turn prototype manufacturing area. In 1987, Three-Five consolidated its domestic operations in Phoenix, Arizona, and eliminated a facility in Troy, New York.

The Company was formed via a leveraged buyout of National Semiconductor's Optoelectronics business unit and was named Three-Five Semiconductor. The Company's founders are Frank Shroff, John Gragg, Dennis Riccio, Joe Riccio, and Brent Fox. Three-Five received acquisition funding, which was completed in December 1985, from Continental Illinois Venture Corporation (Chicago, Illinois) and OptoVen of Phoenix, an investment company formed specifically to invest in Three-Five.

In 1987, the Company changed its name from Three-Five Semiconductor Corporation to Three-Five Systems to reflect a shift from a front-end semiconductor emphasis to a broader systems approach. The Company has reorganized into two groups. The optoelectronics group supplies all existing and future standard products, and the display group is responsible for Application-Specific Integrated Displays (ASIDs) as well as other technologies that may be added. In September 1987, Three-Five raised $5.5 million in second-round financing, which was used to expand its technical staff and facilities to support the Company's thrust into new opto product areas. In March 1988, Three-Five initiated a further round of financing to support the Company's thrust into LCDs.

Currently, 400 products that were developed by the Company while it was a division of National are offered by Three-Five and include infrared and custom devices. New products include custom LCDs. In the long term, the Company will focus on PLCDs and GaAs-based products, optoelectronics (standard and custom), and integrated optoelectronic ICs. The Company will also focus on display systems, such as LED and LCD, with a higher degree of electronic control.

BOARD

(Name and Affiliation)

David R. Buchanan
Chairman

Kenneth M. Julien
Vice President, Chief Financial Officer

Burt McGillivray
Vice President, Continental Illinois Venture Corporation

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
David R. Buchanan
Talos Systems (now Calcomp Digitizer Division), Founder/Chairman/CEO

VP Finance/CFO
Kenneth M. Julien
CerProbe, VP/CFO

VP Quality
*Joseph Riccio
Motorola, Area Sales Mgr

Dir Mktg/Sales
Norman E. Clarke
MCI Telecommunications, National Account Manager

Dir European Ops
Martin Woolfenden
National Semiconductor, Marketing Manager

Dir Manufacturing
Dr. Carl Derrington
Motorola, Prod Mgr, Sensors

Dir Materials and Process Technology
Dr. Joseph Morrissy
Alcatel Information Systems, Manufacturing Manager

Dir Engineering
Mike Petera
Alphasil, Elec Design Mgr

*Founder

FINANCING

September 1987
Round 2
$5.5M
Continental Illinois Venture Corporation, National Semiconductor Corp., OptoVen Partners

March 1988
Round 3
Sears Pension Trust

MANUFACTURING

Technology

Liquid Crystal
GaAs

Facilities

Phoenix, AZ
40,000 sq. ft.
Prototype laboratories, corporate headquarters

Manila, Philippines
Manufacturing, inventory

Swindon, United Kingdom
European headquarters

PRODUCTS

Application-Specific Integrated Displays(ASIDs)
Custom User Interface Modules (Displays and Keyboards)
LCD Modules—Standard and Custom
Integrated Displays
Integrated LED Bar Graphs
Infrared
LED Dot Matrix Displays
Visible Lamps and LED Digits
Multidigit LED Displays
Keyboards

OTHER INFORMATION

Three-Five Systems does not employ a PR firm.

Togai InfraLogic, Inc.

30 Corporate Park, Suite 107
Irvine, CA 92714
714/975-8522
Fax: 714/975-8524

ESTABLISHED: August 1987 **NO. OF EMPLOYEES: 14**

BACKGROUND

Togai InfraLogic, Inc., was founded in August 1987 for the sole purpose of developing fuzzy logic tools and applications. The Company was founded by Dr. Masaki Togai, Carl Perkins, and Rodney J. Corder. The Company is actively developing and marketing fuzzy logic development tools for the commercial market in Japan, North America, and Europe.

Fuzzy logic is a form of multivalued logic that makes it possible for computer-controlled products to make "shades of gray" decisions the way humans do, as opposed to the limited yes-or-no approach dictated by conventional computer logic. In August 1989, Togai InfraLogic introduced the FC110 Digital Fuzzy Processor, the world's first embedded AI processor. The FC110 is a flexible 10-mips RISC processor with a specialized instruction set for fuzzy logic processing targeted at real-time embedded applications such as color copiers and engine controllers. In September 1989, the Company introduced its AT Accelerator board for PC AT based on the FC110. The Company also offers two products designed to facilitate fuzzy logic expert system development—the Fuzzy-C Compiler and the TIL Shell. The latter is a graphical CASE tool for expert system development.

Togai's first major commercial project is a joint development program with Japan's Mitsubishi Heavy Industries to create the world's first fuzzy logic-controlled air conditioning system. The system is designed to outperform the existing PID control for heating/cooling time and overall stability. Designers also anticipate a significant savings in power use resulting from implementation of this system.

BOARD
(Name and Affiliation)

Professor Lotfi Zaheh
University of California, Berkeley

Frank Lundberg
Rockwell—retired

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Masaki Togai, PhD
Rockwell

VP, R&D
*Rodney J. Corder
Rockwell

VP, Mktg
*Carl Perkins
Rockwell

Dir, Software Dev
Jon Terchrow
N/A

*Founder

FINANCING

1987
Round 1
Less than $1M
Corporations and private individuals

RECENT HIGHLIGHTS

December 1988
Togai introduced its first fuzzy logic development product—the Fuzzy-C Compiler, a textural tool for developing fuzzy logic expert systems in portable C source code.

May 1989

Togai's first VLSI processor, rated at 160 million 16-bit operations per second, was released for image classification and sorting, the output of which is managed by fuzzy logic knowledge bases.

August 1989

Togai introduced the FC110 Digital Fuzzy Processor, a 10-mips RISC processor with a specialized instruction set for fuzzy logic processing.

September 1989

Togai introduced its AT accelerator board and its graphical CASE tool for fuzzy logic expert system development.

ALLIANCES

Mitsubishi Heavy Industries
September 1989

Togai and Mitsubishi Heavy Industries announced the joint development of an air conditioning system based on a fuzzy logic controller.

MANUFACTURING

Technology

Fuzzy logic; 1.5- and 1.0-micron CMOS

Facilities

Irvine, CA
5,000 sq. ft.
Design, marketing

PRODUCTS

Fuzzy-C Development System
TIL Shell Graphical Export System
Fuzzy Logic AT Accelerator Board (based on its VLSI fuzzy processor)

OTHER INFORMATION

Togai InfraLogic's PR firm is Bond Communications.

Topaz Semiconductor Inc.

1971 North Capitol Avenue
San Jose, CA 95132-3799
408/942-9100
Fax: 408/942-1174

ESTABLISHED: March 1985 **NO. OF EMPLOYEES: 37**

BACKGROUND

Topaz Semiconductor designs and manufactures advanced field-effect transistors (FETs) and CMOS/DMOS ICs. Topaz, a company representing a partial buyout of Semi-Processes, Inc. (SPI), was formed by Thomas Cauge and Bruce Watson. The purchase included DMOS transistor and certain IC designs, and wafer fabrication, test, and finishing equipment. Topaz later acquired the SPI facilities as the result of an agreement to be acquired by Hytek Microsystems, Inc., of Los Gatos, California.

Topaz Semiconductor operates as a wholly owned subsidiary of Hytek Microsystems. Hytek designs and manufactures thick-film hybrid microcircuits. In July 1985, Hytek purchased all the DMOS-related assets of SPI. Hytek's integration of the SPI assets with those of Topaz Semiconductor insures a continued source of SPI products, as well as contribution to the faster expansion of Topaz Semiconductor.

With the financial backing of Hytek, a significant number of new Topaz products has been added. These products include medium-power lateral DMOS discretes (high-voltage and ultralow-leakage n- and p-channel); vertical DMOS discrete products with 20-micron hex-to-hex spacing; and new CMOS/DMOS IC analog switch products for video switching applications. Topaz will focus on high-speed digital and precision analog switching applications for its lateral DMOS devices and on low- to medium-current relay-replacement applications for its vertical DMOS line. Topaz initially has integrated DMOS and CMOS on a single chip. Plans include integrating logic with both lateral and vertical DMOS to allow more user flexibility. Topaz also supplies standard and special high-reliability products that are tested to military requirements.

Topaz subcontracts assembly operations to companies in Thailand, Malaysia, and Taiwan.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Thomas Cauge
Semi-Processes Inc., VP Opns

Dir Marketing
*Bruce Watson
Semi-Processes Inc., Prod Mktg Mgr

Dir Engineering
Paul Denham
Semi-Processes Inc., Engr Mgr

Dir Sales
Robert Vosburgh
Marconi Instruments, Sales Mgr

*Founder

FINANCING

1985
Seed
$1.5M
Private

RECENT HIGHLIGHTS

March 1987
Topaz offered the CDG2214N, an analog switch with a CMOS-compatible control input. The device combines CMOS and DMOS processes and switches analog signals of ± 10V with CMOS logic levels.

April 1987
Topaz offered the CDG201B, a low-insertion-loss quad analog switch that is TTL-compatible and pin- and function-compatible with standard CMOS devices.

April 1987
Topaz offered the CDG211CJ, a quad single-pole, single-throw analog switch with TTL-compatible control input.

June 1987
Topaz offered the SD5400 series of DMOS analog switches in 14-lead, small-outline packages. Power dissipation is 546 milliwatts and the series operates from 0 to 70° centigrade.

June 1987
Topaz offered the SD1202, a 200V, n-channel enhancement-mode vertical D-MOSFET with a high gate standoff of 100V.

June 1987
Topaz offered the SD1500BD, a 600V enhancement-mode vertical D-MOSFET.

January 1988
Topaz offered the CDG4460J, a 6-bit digital-controlled attenuator for video frequencies of 10.7 to 30.0 MHz, with attenuation of 0.25dB per step.

February 1988
Topaz offered the SD220/SD221 series of 60V, 9-ohm/100V, 12-ohm n-channel enhancement-mode lateral D-MOSFETs for ultrahigh-speed display driver applications.

ALLIANCES

Hytek Microsystems
July 1985
Topaz was acquired by Hytek Microsystems and operates as a wholly owned subsidiary. Hytek and Topaz cooperate on development of precision, standard hybrid circuits.

MANUFACTURING

Technology

3.0-micron and 20.0-micron hex-to-hex spacing silicon-gate Vertical DMOS
5-inch wafers
Lateral DMOS (3-inch wafers)
3.0-micron CMOS

Facilities

San Jose, CA
30,000 sq. ft. total

20,000 sq. ft.
Design, wafer fab, and test

8,000 sq. ft.
Class 10 clean room (underhood)

PRODUCTS

Lateral DMOS FETs
DMOS Power FETs
DMOS FET Ultralow Leakage
High-Voltage DMOS Power FETs
Vertical DMOS FETs
Dual-Gate DMOS FETs

DMOS FET Switches
Ultrahigh-Speed, Low-Cost Switches
Quad Monolithic SPST CMOS/DMOS Analog Switches
Dual Monolithic SPST CMOS/DMOS T-Configuration Analog Switch

DMOS FETs 8-Channel Arrays
Quad DMOS Power FET Arrays
Quad DMOS FET Driver Arrays
Quad DMOS FET Analog Switch Arrays
FET Ultrahigh-Speed Dual Drivers
4:1 Monolithic CMOS/DMOS Analog Multiplexers

OTHER INFORMATION

Topaz does not employ a PR firm.

TranSwitch Corporation

8 Progress Drive
Shelton, CT 06484
203/929-8810
Fax: 203/926-9453

ESTABLISHED: April 1988 **NO. OF EMPLOYEES: 16**

BACKGROUND

TranSwitch was founded in April 1988 to develop telecommunication ICs. The Company will offer chip sets that facilitate synchronous optical network (SONET) multiplexing.

Multiplexing is a foundation of telecommunications data transmission. The purpose of multiplexing is to combine a number of signals into one higher-level signal to accelerate transmission speeds. For example, a T-1 line is the result of the combination of 24 voice channels. Twenty-eight T-1 signals may then be combined to form a T-3 line. Similarly, 24 voice channels are combined to form a DS-1 signal. Next, 28 DS-1 signals can be combined to form a DS-3 line. SONET uses DS-3 lines to build higher-level signals for transmission.

The Company is scheduled to introduce DS-3 VLSI devices in January 1990, followed by the introduction of SONET VLSI devices in April 1990. TranSwitch contracts outside firms for wafer fab and assembly operations. Devices are manufactured using a 1.5-micron CMOS process. TranSwitch has raised more than $3 million in venture capital financing through two rounds. During the next three years, the Company plans to acquire $4 million worth of capital equipment and expand its facilities to 20,000 square feet.

BOARD
(Name and Affiliation)

Dr. S. Flashen
Independent Consultant

Dr. S. Das
President, TranSwitch Corporation

Dr. A. Paladino
Partner, Advanced Tech. Ventures

Dr. C. Lee
Partner, ABACUS Ventures

I. Wolff
Partner, Rothschild Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Dr. S. Das
Spectrum Digital, President

Dir, R&D
D. Upp
ITT, Dir, Exploration Sys

VP, Mktg
J. Lane
Telco Systems, VP, Engineering

Dir, Finance
M. McCoy
ITT, Controller, ITT-ATC

Mgr, Ops
E. Linke
Black & Decker, Manager

FINANCING

December 1988
Round 1
$1.7M
Advanced Technology Ventures, Abacus Ventures, Transtech Ventures, Rothschild Ventures, Merrill Lynch Management Fund

July 1989
Round 2
$2.5M
Initial investors, Connecticut Seed Ventures

ALLIANCES

None

MANUFACTURING

Technology

1.5-micron CMOS, BiCMOS

Facilities

Shelton, CT
6,500 sq. ft.
Design, test, marketing

PRODUCTS

DS-3 VLSI Devices
SONET VLSI Devices

OTHER INFORMATION

TranSwitch Corporation does not employ a PR firm.

Triad Semiconductors International

5575 Tech Center Drive
Colorado Springs, CO 80919
1-800/228-1874
Fax: 719/528-8875

ESTABLISHED: September 1988 **NO. OF EMPLOYEES: 25**

BACKGROUND

Triad Semiconductors International (Triad) designs, develops, and markets specialty memory ICs for use in high-performance data and algorithmic processors, digital telecommunications and video applications, image/voice synthesis and recognition and other artificial intelligence applications, and advanced industrial instrumentation and control systems. Triad's high-performance specialty memories are based on CMOS technology, but the Company plans to use other technologies if and when appropriate.

The Company has defined 24 products. Initial products include a monolithic 256-color graphics palette chip with RAM and DAC on-chip and a 2Kx9 and 4Kx9 FIFO, 64Kx4 Fast Industry Standard (FIS) latched and registered version. Future product introductions will include a writable control store chip, 1Kx48 CAM, 128Kx8 cached DRAM, and a second-generation monolithic color graphics chip.

The parent company of Triad is registered in the Netherlands. The Company conducts back-end services, such as testing in the Netherlands, and plans to add design activities to serve the EEC market. The Company has a joint venture with Rood Testhouse in Europe to guarantee engineering and test capacity in exchange for business committed by Triad. Operations are centralized in the United States and headquartered in Colorado Springs, Colorado.

Triad has adopted a strategy of developing a worldwide network of corporate alliances with industrial partners to obtain core product designs and then applying its expertise to add value-enhancing features. In October 1987, Triad negotiated an alliance with a Japanese semiconductor manufacturer, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D. Triad also has foundry alliances with AT&T and Seiko and plans additional alliances with a U.S. and a European company. Assembly is conducted by Lingsen in Taiwan and Swire in Hong Kong.

Applied Marketing Technology, based in the United Kingdom, has been signed as the Company's representatives in the EEC. Other representatives are being set up in the Far East and the United States.

BOARD
(Name and Affiliation)

Pieter Niessen, Chairman

Raymond Bullens
Henk Van der Kwast

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Michael Burton
Inmos, Mgr Commercial Ops

Sr VP Sales/Mktg
Bruce Threewitt
AMD, Dir Prod Dev

CFO
Jop Van der Wiel
Not available

***Founder**

FINANCING

1985
Initial
$8.0M
AMRO Bank, founders, The Limburg Investment Bank, private placement, grants and subsidies from the Dutch government

1986
Round 2
N/A
LIOS

1987
Round 3
N/A
Kempen Co.

ALLIANCES

Japanese Company
Triad negotiated an agreement with a Japanese semiconductor company, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D.

AT&T
Triad signed a foundry alliance with AT&T, which is manufacturing the fast latched/registered pipelined memories.

Seiko
Triad signed a foundry alliance with Seiko, which is manufacturing the monolithic color palette.

Rood Testhouse
Triad signed an agreement with Rood Testhouse in Europe, guaranteeing engineering and test capacity in exchange for business committed by Triad.

MANUFACTURING

Technology

1.2- and 1.5-micron CMOS
Double-metal, double-poly process
Double-metal, single-poly process

Facilities

Colorado Springs, CO
15,000 sq. ft.
Corporate headquarters, design

The Netherlands
25,000 sq. ft.
European headquarters

PRODUCTS

Product	Availability
256-Color Graphics Palette Chip	Q2 1988
16Kx4 Fast Industry Standard (FIS)	Q2 1989
64Kx4 FIS	Q3 1988
64Kx4 Latched and Registered Memory	Q4 1989
Writable Control Store	Q1 1989
1Kx48 LAN CAM	Q2 1990

OTHER INFORMATION

Triad's PR firm is Ad-Infinitum.

TriQuint Semiconductor, Inc.

Group 700
P.O. Box 4935
Beaverton, OR 97076
503/644-3535
Fax: 503/644-3198

ESTABLISHED: January 1984 **NO. OF EMPLOYEES: 135**

BACKGROUND

TriQuint designs, develops, manufactures, and markets microwave, linear, and GHz digital GaAs IC components. TriQuint also offers a broad range of foundry services. The Company's products are used in high-performance applications such as fiber-optic telephone communication, high-speed computer interfaces, instruments, and military systems.

The Company evolved from research on GaAs ICs that began in Tektronix Laboratories in 1978. Several of TriQuint's founders were leaders on the Tektronix research team. In 1984, TriQuint was formally established as a majority-owned subsidiary with the entrepreneurial freedom to establish a broad portfolio of long-term manufacturing contracts.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Alan D. Patz
Tektronix, GM GaAs ICs

Dir Mktg/Sales
Dennis C. Powers
Not available

Mgr QA
Richard Allen
Tektronix, Div Mfg Mgr

VP R&D
Dr. Richard Koyama
Tektronix, Technical Manager

Dir Finance/Admin
Richard Sasaki
Tektronix, Financial Mgr

VP Mfg
Dr. Gordon Roper
Tektronix, Principal Engr

VP Digital & Linear Products
Dr. Ajit Rode
Tektronix, IC Process Engr

VP Microwave Prod
Philips Snow
Not available

RECENT HIGHLIGHTS

November 1987
TriQuint offered the TQ3000, a 3,000-gate array that features 1,020 cells and 64 I/Os. The TQ3000, which can perform at up to 1 GHz, is produced with a 1-micron GaAs E- and D-MESFET process. The new array is supported by Daisy, Mentor, and Tek/CAE workstations.

October 1987
TriQuint introduced the TQ6330, an ultrafast pin driver, and the TQ6331 line receiver pair.

February 1988
TriQuint announced a radio-frequency/large-scale integration (RF/LSI) GaAs IC foundry service named the QED/A process.

March 1988
TriQuint introduced the QLSI cell-based library, a GHz LSI cell-based library that supports LSI applications of up to 6,000 equivalent gates and toggle rates of up to 2 GHz.

May 1988
TriQuint is the first GaAs foundry to manufacture microwave and digital ICs on 4-inch wafers.

May 1988
TriQuint announced an optimized 0.5-micron microwave foundry process.

July 1989
TriQuint announced the shipment of wafers and die screened to U.S. Department of Defense Class 5 requirements, the first commercial IC manufacturer to announce availability of this level of screening—permitting satellite systems applications.

ALLIANCES

Tektronix
January 1984
Tektronix spun off TriQuint, remaining the parent company and completing a sales agreement with the new subsidiary.

EEsof
May 1986
EEsof and TriQuint teamed up to incorporate TriQuint's GaAs custom MMIC foundry models into Touchstone, EEsof's minicomputer- and workstation-based MMIC CAD program. Jointly, they developed a GaAs MMIC element library that allows users to simulate microwave ICs, using MMIC components that model components available from TriQuint's custom MMIC foundry facility.

TRW
June 1987
TRW Components and TriQuint agreed jointly to develop and supply class-S level GaAs devices for space applications. TriQuint will provide microwave and digital GaAs technology in addition to foundry services.

MSC
March 1988
Microwave Semiconductor Corporation and TriQuint agreed to provide customers with GDS-II tape interchangeability and equivalent performance for GaAs analog and digital ICs and MMICs.

Hewlett-Packard
May 1988
TriQuint's MMIC Library of foundry design models are incorporated into Hewlett-Packard Company's microwave CAE design system.

Gazelle Microcircuits
May 1988
Gazelle Microcircuits signed foundry contract with TriQuint for 4-inch digital wafer production.

MANUFACTURING

Technology

1.0- and 0.5-micron gate length depletion mode MESFET processes capable of fabricating D-MESFETs VIAs
1.0- and 0.5-micron gate length enhancement/depletion mode MESFET processes capable of fabricating E- and D-MESFETs
3-inch wafers
4-inch wafers

Facilities

Beaverton, OR
35,000 sq. ft.
Administration, engineering, manufacturing
15,000 sq. ft.
Class 100 clean room

PRODUCTS

Foundry

1A/1D Process	1.0-Micron Gate Length Depletion Mode MESFET for D-MESFET, Schottky Diodes, Implanted Resistors, MIM Capacitors, and Airbridge Inductors
HA Process	0.5-Micron Gate Length Depletion Mode MESFET Process for Both 0.5- and 1.0-Micron D-MESFETs, Schottky Diodes, Implanted Resistors, Precision Nichrome Resistors, MIM Capacitors, and Airbridge Inductors

QED Process	1.0-Micron Gate Length Enhancement/Depletion Mode MESFET for E- and D-MESFETs, Schottky Diodes, Implanted Resistors, and Airbridge Inductors
QED/A Process	An Enhanced Version of the QED Process that Allows the Mixing of Low-Power Digital LSI Circuits and Precision Analog Circuits on a Single Die
3A Process	Optimized 0.5-micron microwave process

Gate Arrays

Family	Linewidth	Delay	Gates
QLSI	1.0	0.15	2,000; 3,000; 4,000

Cell-Based Library

Family	Cells
Q-Logic	1,000 Gates, Data Encoders/Decoders, MUX/DEMUX, Counters, Dividers, Prescalers
QLSI	8,000 Gates, ZFL Cells, SCFL Cell Family

MMICs (Die and Components)

TQ9111	1- to 8-GHz Amplifier
TQ9141	1- to 10-GHz Power Divider
TQ9152	1- to 10-GHz SPDT Switch
TQ9161	1- to 10-GHz Variable Attenuator
TQ9121	0.5 to 20.0-GHz 10w Noise Amplifier
TQ9131	0.5 to 20.0 GHz Active Combiner

Digital Products

TQ1131	Pgm 8:1, 16:1 MUX
TQ1132	Pgm 1:8, 1:16 DEMUX
TQ1133	4:1 MUX
TQ1134	1:4 DEMUX
TQ1135	12:1 MUX
TQ1136	12:1 DEMUX

Linear ICs

TQ6330	Pin Driver
TQ6331	Line Receiver
TQ6111-D	8-Bit DAC, 600 Ms/S, Die Form
TQ6111-M	8-Bit DAC, 600 Ms/S, Ceramic Package
TQ6111-BI	8-Bit DAC, 600 Ms/S, Board Module, Instrumentation Version
TQ6111-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
TQ6112-D	8-Bit DAC, 1,000 Ms/S, Die Form
TQ6112-M	8-Bit DAC, 1,000 Ms/S, Ceramic Package
TQ6112-BI	8-Bit DAC, 1,000 Ms/S, Board Module, Instrumentation Version
TQ6112-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
EK-TQ6101	GIGADAC Evaluation Kit

OTHER INFORMATION

TriQuint's PR firm is Hastings and Humble Public Relations.

United Microelectronics Corp.

#3 Industrial Road
Hsinchu City
Taipei, Taiwan
(035) 773131
Telex: 31476 UMCHSC
Fax: 035 774 767

ESTABLISHED: September 1979 **NO. OF EMPLOYEES: 950**

BACKGROUND

United Microelectronics Corp. (UMC) offers gate array and standard cell design services in addition to consumer, telecommunications, memory, and microprocessor ICs. The Company was formed to commercialize ERSO's IC technology and is Taiwan's largest wafer foundry. UMC provides foundry services to major U.S. and domestic IC design companies.

In 1983, UMC funded Unicorn Microelectronics, a design center, in San Jose, California. National Microelectronic Corporation is the U.S. sales and distribution arm for UMC's foundry services and products.

In December 1987, UMC started construction of a $170 million VLSI plant, with a planned capacity of 30,000 units of 6-inch wafers per month.

In 1987, UMC elected Dr. Morris Chang chairman. Dr. Chang is also the chairman of Taiwan Semiconductor Manufacturing Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan. Dr. Chang was a vice president at Texas Instruments and chief executive officer at General Instrument Corporation.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Robert H.C. Tsao
ERSO, VP Operations

VP Operations
Alex I.D. Liu
ERSO, Production Manager

VP Marketing
John Hsuan
ERSO, Marketing Manager

R&D Director
M.K. Tsai
ERSO, Design Manager

Plant Director
Hyley Huang
ERSO, Process Manager

FINANCING

1979
Round 1
$12.5M
Bank of Communications, China Development Corp., Kuang Hua Investment Co., Ministry of Economic Affairs, Orient Semiconductor, Sampo, Teco, Walsin-Lihwa Electric Wire & Cable, Yao Hua Glass Co.

July 1985
Round 2
$7.5M
Initial public offering

RECENT HIGHLIGHTS

November 1986
National Semiconductor filed a suit against UMC charging theft of trade secrets, fraud, breach of contract and fiduciary obligations, unfair competition, conversion, interference, and conspiracy. The suit concerns the marketing by UMC of a real-time clock part and

a UART, which National claims was based on designs received from National under a fab agreement. National is seeking $10 million in damages. UMC filed a countersuit against National in the United States, alleging that National has made false statements in an effort to interfere with UMC's economic relationships.

December 1987
UMC started construction of its $170 million VLSI plant II, with a planned capacity of 30,000 units of 6-inch wafers per month.

January 1988
UMC reported fiscal 1987 sales of $90 million.

ALLIANCES

ERSO
1979
ERSO granted UMC a license for design and process technology for 4-inch silicon wafers.

AMI
April 1983
Dialer ICs were produced in cooperation with AMI. UMC is also a second source for AMI's products and 5-micron silicon-gate CMOS in Asia.

Unicorn
January 1985
UMC funded Unicorn for $2.5 million.

June 1985
UMC and Unicorn agreed to jointly develop a standard cell library and to design cells for data path, memory, I/O, random logic, and complex logic.

Honeywell/Synertek
July 1985
UMC gained nonexclusive product licenses for 18 ICs formerly produced by Synertek and purchased some Synertek production equipment and inventory from Honeywell. Products covered in this agreement included 4K and 16K SRAMs and 8K, 16K, and 32K ROMs. Honeywell received $3 million plus royalties of 3 to 5 percent over the next three years.

MOSel
October 1985
MOSel transferred rights to a high-speed 2Kx8 SRAM and EEPROM to UMC, additionally providing 1.5- and 2.0-micron processes that were used to bring up the 2-micron CMOS process at UMC.

TRW
April 1986
UMC successfully developed 1.25-micron VLSI products with TRW.

SMC
June 1986
UMC signed a contract with SMC to coöperate on a computer IC.

SERVICES

Design—Gate arrays, standard cell, full custom
Foundry—CMOS
Prototype Manufacturing
Production Manufacturing

MANUFACTURING

Technology

5.0- and 2.0-micron silicon-gate NMOS
3.0- to 1.2-micron single/double metal/poly CMOS
5.0-micron silicon-/metal-gate CMOS
18V high-voltage CMOS
10V poly capacitor analog CMOS
2.0-micron CMOS EPROM
4-inch wafers

Facilities

Taiwan
92,000 sq. ft.
Total space

17,000 sq. ft.
Wafer fab

PRODUCTS

Memory
512x9 and 1,024x9 Parallel FIFOs, ROMs in 4Kx8, 8Kx8, 16Kx8, and 32Kx8 configurations, High-Speed SRAMs in 1Kx4, 2Kx8, 16Kx1, and 4Kx4 configurations, and a 1Kx4 SRAM

Consumer ICs
Melody Generators, CMOS Calculator, Timer, Clock, and Watch Chips, Voice Control IC, Speech Synthesizer, Encoder/Decoder, Dimmer

Microcomponents
8-Bit Single-Chip MCUs, 8-Bit MPU, CRT Controller, Video Attributes Controller, Disk Controller, Double-Row Buffer, Floppy Disk Separator, Bus Controllers, RTC, ACIA, VIA, PIA, RAM I/O Timer Array, DUART, EPCI IC, Programmable Interval Timer, Programmable Interrupt Controller, Programmable Peripheral Interface, Clock Generator and Driver, Capacitance Keyboard Encoder

New Microcomponent Products
System, I/O and FCD Support Chips for PS/2 Model 30, Single-Chip MCGA, Single-Chip FDC for PS/2 Model 30, Two Serial Ports and One Parallel Port, Advanced ACE, CMOS ACE, COS ACE, Single-Chip Monochrome Graphics Adapter, Single-Chip MGA and CGA, Micro Channel Interface Chip, SCSI Bus Controller

Data Converter ICs
3.5-Digit A/D Converter, Digit A/D Converter, CMOS DAC

Telecommunications
Simple Pulse Dialer, Repertory Pulse Dialer, Simple Tone Dialer, Tone/Pulse Dialer, T/P Redialer, Repertory T/P Dialer, Slave T/P Dialer, Direct Access Adapter, Crosspoint, DTMF Receiver

ASICs
Mask Programmable Logic Arrays

Gate Arrays
3-microns, 300 to 920 gates; 2-microns, 1,200 to 3,000 gates

Cell-Based Libraries
3.0-Micron, 1 Layer Poly, 1 Layer Metal
2.0-Micron, 1 Layer Poly, 1 Layer Metal
1.5-Micron Series, 1 Layer Poly, 2 Layers Metal

Silicon Compilers
Data Path Module, PLA Module, PAD Module, FIFO Module, RAM Module, ROM Module, Random Logic Module, and User-Specific Module

OTHER INFORMATION

UMC does not employ a PR firm.

United Silicon Structures

1971 Concourse Drive
San Jose, CA 95131
408/435-1366
Fax: 408/435-0504

ESTABLISHED: September 1987 **NO. OF EMPLOYEES: 25**

BACKGROUND

United Silicon Structures (US2) was founded in September 1987 by European Silicon Structures (ES2) to serve the U.S. ASIC market by delivering quick-turn, low-cost prototypes and low-volume production runs. US2 perceives the ASIC market as developing to the point where many customers require many different designs with low-volume requirements of each part type. The Company believes that market opportunity is being created for a new type of service-oriented company dedicated to manufacturing prototypes and small production series.

US2 utilizes an e-beam process for direct write production. Fabrication currently is conducted by US2's sister company, ES2, which operates two e-beam systems in a 100,000-square-foot plant in Rousset, France. The technology employed by US2 is compatible with the most popular CAE and CAD platforms, such as those of Mentor Graphics, Cadence Design Systems, and Silicon Compiler Systems. When volume production is required, the company makes use of its foundry contracts with Philips, Signetics, and TSMC.

First-round funding was provided by Advent International; Concord Partners; and Mohr, Davidow Ventures in the amount of $4.52 million. This venture capital investment represents a 30 percent equity investment in the Company. In addition, ES2 holds 40 percent of the equity stake, while the remaining 30 percent is reserved for US2's key employees.

Within the next three years, US2 will install a North American fab facility. The fab is designed to service the prototyping and low-volume marketplace. US2's new fab facility will also employ an e-beam write-on process.

BOARD
(Name and Affiliation)

Henri Jarrat
United Silicon Structures, President/CEO

William Davidow
Mohr, Davidow Ventures, General Partner

Irwin Federman
Dillon, Reed & Company, Managing Director

David Brown
Advent International, Senior Vice President

Jean-Luc Grand-Clement
European Silicon Structures, Chairman

Werner Koepf
European Silicon Structures, President/CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO/Chairman
Henri Jarrat
VTI, President

Executive VP
Jim Ellick
CAECO, President

VP Customer Eng
Ian Mackintosh
VTI, Dir West Coast Tech Centers

VP Mktg
Jacques Castaillac
European Silicon, VP Sales & Mktg Structures

Dir Customer Eng
Timothy O'Donnell
National Semiconductor, ASIC App Mgr

Dir R&D
Robert Heaton
European Silicon, Design Ctr Mgr Structures

FINANCING

March 1989
Initial
$4.5M
Advent International; Concord Partners; Mohr, Davidow Ventures

ALLIANCES

European Silicon Structures
European Silicon Structures is a sister company with which United Silicon Structures shares technology. Partnership agreements are with large volume silicon manufacturers such as National Semiconductor, Philips, Signetics, and TSMC.

PRODUCTS

Silicon Prototype Services
Low-Volume Silicon Production
Entry Level Design Software

OTHER INFORMATION

US2's PR firm is Miller Communications.

SERVICES

ASIC prototypes
Low-volume ASIC production

MANUFACTURING

Technology

CMOS, n-well, single poly, double metal
2.0 micron
1.5 micron
1.2 micron
1.0 micron (available in 1990)

Facilities

Rousset, France
100,000 sq. ft.
Manufacturing, test, assembly

Vadem

1885 Lundy Avenue, Suite 201
San Jose, CA 95131
408/943-9301
Fax: 408/943-9735

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 17**

BACKGROUND

Vadem, founded in 1983 by Chikok Shing and Henry Fung, designs, develops, and markets integrated circuits used in DOS-compatible systems. Vadem provides logic chip sets that offer PC XT compatibility, as well as application support chips that add to the core logic and enhance the use of the PC architecture in embedded control applications. Vadem targets the large class of products that incorporate a PC-compatible architecture in the control of computer-based equipment.

Vadem core logic chip sets focus on integrated processors from Intel and NEC, which typically serve the embedded control marketplace. Vadem offers a core logic chip set for the 80186/80C186 processor, which offers performance ranging from 8 to 16 MHz. Vadem's core logic chip sets for the NEC V-40 provide a very low cost PC XT solution at clock speeds of up to 10 MHz.

Vadem's application support chips focus on providing high levels of integration, which lower component count and reduce power consumption for products that use the PC architecture for embedded computer control. Applications that can make excellent use of the PC architecture for embedded controllers include portable or handheld terminals; market-specific terminals such as point-of-sale terminals, ATMs, and ticket and vending machines; PC-compatible intelligent terminals or network workstations; industrial and machine control systems; telecommunications; and home electronics.

Vadem also is involved in many design projects for major corporations. In 1984, Vadem designed the first battery-operated PC-DOS system for Morrow Designs. A modification of this design was licensed to Zenith and became the Z-171 laptop computer. Vadem has established design relationships with Sharp Electronics and Zenith Corporation in the PC area. Vadem currently is working on additional design projects that will result in new products such as a complete PC engine on a single chip.

BOARD
(Name and Affiliation)

*Chikok Shing
Vadem, Chairman/CEO

*Henry Fung
Vadem, Vice President of Engineering

Bob Dilworth
Metrocom, Inc., CEO

Samuel Fang
General Electronics, Inc., Hong Kong, Managing Director

JJ Guo
SIS, Taiwan, President

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

Chairman, CEO
*Chikok Shing
Osborne Computer Corp.

VP Eng
*Henry Fung
Intel Corporation

Dir Mktg
Barney Ichikawa
David Systems

Dir ASIC Dev
Siu Tsang
Intel Corporation

Dir Software Eng
Rich Peters
Seitor Corporation

NA Sales Manager
Howard James
Prolog Corporation

*Founder

FINANCING

Vadem is privately held and was funded initially by its founders; the founders and other employees own more than 80 percent of Vadem stock.

ALLIANCES

Intel
March 1988
Vadem and Intel signed an agreement in which Intel made a small up-front investment in an IBM Model 30 and PC XT-compatible chip set that Vadem is developing.

Intel
September 1988
Vadem and Intel signed a second strategic alliance focused on Vadem's Model 30 and PC XT-compatible chip set. Under the terms of the five-year agreement, Intel's sales force will refer customers to Vadem for the chip set. Vadem, meanwhile, will market the chip set independently.

MANUFACTURING

Technology

CMOS

Facilities

San Jose, CA
6,000 sq. ft.
R&D, test, marketing

PRODUCTS

Intel 80C186 Support Products
NEC V-40 Support Products
Application Support Chips

OTHER INFORMATION

Vadem does not employ a PR firm.

VIA Technologies, Inc.

(Formerly LOGICSTAR)
4160 B Technology Drive
Fremont, CA 94538
415/651-2796
Fax: 415/659-9057

ESTABLISHED: 1987 **NO. OF EMPLOYEES: 20**

BACKGROUND

VIA Technologies, Inc., was formed to design, manufacture, and market high-performance VLSI graphics and local area network (LAN) chips. The Company is addressing the PC AT market and is using a VLSI design methodology to bring products to market quickly.

The Company's initial products are a five-chip PC AT chip set that is pin-for-pin compatible with Chips & Technologies' chip set, a monographics controller, a memory mapper, a dual-channel NRZI encoder/decoder, and a Starlan interface chip. In April 1988, VIA Technologies, Inc., began volume shipments of its chip sets. Future products will include a VGA chip, 386 chip sets, additional disk communications chips, and disk controllers.

The Company has set up joint ventures for design with companies in Japan, Korea, and Taiwan. These agreements may be extended to include manufacturing and marketing at a future time. Foundry services are being provided by companies in the United States, Europe, and Japan.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman, CEO
Don Brooks
Fairchild, President

VP Oper/CFO
Mark Kaleem
OSM Computer, President

VP Engr
Idris Kothari
VLSI, N/A

VP Sales/Mktg
Peyton Cole
Fairchild, N/A

FINANCING

March 1989
Financing was provided by Fujitsu as part of the strategic alliance covering chip sets for Sun-compatible workstations.

ALLIANCES

Fujitsu
March 1989
VIA Technologies announced a strategic partnership with Fujitsu Microelectronics to codevelop peripheral chip sets for Sun-compatible workstations.

MANUFACTURING

Technology

1.3-micron, double-metal CMOS

Facilities

Fremont, CA
5,000 sq. ft.
Administration, design

PRODUCTS

Current Products

Device	Description
SL2002	Dual-Channel NRZI Encoder/Decoder
SL600X	80286-Based PC AT Chip Set
SL6001	PC AT System Controller
SL6002	PC AT Memory Decode
SL6003	PC AT System Buffer-1
SL6004	PC AT System Buffer-2
SL6005	PC AT System Buffer-3
SL6003C	PC AT System Buffer-1
SL6004C	PC AT System Buffer-2
SL6005C	PC AT System Buffer-3
SL6002A	PC AT Advanced Memory Controller
SL6012	PC AT Memory Mapper
SL5001	Parallel Printer Port
SL5002	Parallel Printer Port with Crystal Oscillator
SL7001	Monographic Controller
SL4000	Starlan Interface

New Products

SL9090	Universal AT Clock Chip
SL9091	Video Clock Chip
SL90XX	FlexSet, PC AT Core Logic (80286/80386SX/80386)
SL9010	System Controller
SL9020	Data Controller
SL9025	Address Controller
SL9030	Universal Peripheral Controller
SL9X5X	PC AT Memory Controllers
SL9150	80286-Based Page Mode
SL9155	80286-Based Cache-Based
SL9250	80386SX-Based Page Mode
SL9255	80386SX-Based Cache-Based
SL9350	80386-Based Page Mode
SL9355	80386-Based Cache-Based

OTHER INFORMATION

VIA Technologies does not employ a PR firm.

Vitelic Corporation

3910 North First Street
San Jose, CA 95134-1501
408/433-6000
Fax: 408/433-0331

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 180**

BACKGROUND

Vitelic designs, develops, manufactures, and markets high-performance specialty memory devices based on 1.2-micron CMOS manufacturing technology. The Company specializes in application- and customer-specific memory devices. Vitelic was founded by Alex Au, former director of VLSI research at Fairchild Camera and Instrument Corporation.

In 1987, Vitelic established a customer-specific memory business to serve the needs of board-level and system designers. The focus of this department is on supermini, supermicro, and high-performance workstations, as well as graphics and image-processing products.

Vitelic contracts all manufacturing to several Asian manufacturers through various licensing agreements.

BOARD

(Name and Affiliation)

Alex Au
  Vitelic Corporation, President/CEO

Teruaki Aoki
  Sony Corporation, Deputy Senior General Manager

Neill Brownstein
  Bessemer Venture Partners, L.P., General Partner

Kazuo Inamori
  Kyocera Corporation, Chairman

Harry Marshall
  J.H. Whitney & Company, General Partner

David Wang
  Syntek Design Tech Ltd., General Manager

Kunnan Lo
  Kunnan Enterprises Ltd., Founder

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Alex Au
  Fairchild, Dir Research

Exec VP
Will Kauffman
  Intel, VP Quality & Rel

VP Sales/Mktg
Gary Ater
  NMB, VP/GM US Ops

VP R&D
Michael Barry
  Fairchild, Dir CMOS/VLSI Lab

SR VP Sourcing Relationships
John Seto
  Hyundai, Dir Operations

SR VP/CFO
Arthur Wang
  Raychem, GM Malaysia and Thailand

SR VP VTC
Hsing Tuan
  Fairchild, N/A

SR VP/GM Taiwan Operations
Chun Ho
  Exel, Dir Tech Development

SR VP Corp Mktg
James Koo
  Synertech, Dir of Memory Products

VP Finance
Henry Shaw
  Talen Group, Mktg/Sales Director

VP General Counsel, Asst. Secretary
Martin Baker
  Wilson, Sonsini, Goodrich & Rosati, Counselor

VP GM SRAM Group
Raymond Wang
  Victory Computer, President/CEO

FINANCING

March 1984
Seed
$7.0M
Bessemer Venture Partners, INCO Securities Corp., Kyocera International, Oak Investment Partners, Oxford Venture Fund, Waverley Vencap, J.H. Whitney

August 1985
Round 1
$7.2M
Original investors, Pathfinders Chappell, Sony Corporation

August 1987
Round 2
$2.0M
Bessemer Venture Partners, INCO Venture Capital Management, Kyocera, Oak Investment Partners, Oxford Venture Fund, Sony, Waverley, J.H. Whitney

January 1989
Round 3
$39.0M
Western Digital Corp., Sigma Designs, Hambrecht & Quist Venture Partners, Genoa Systems Corp., Societe Nationale Elf Aquitaine, Mitsui & Co. Ltd., and others

RECENT HIGHLIGHTS

April 1989
Vitelic signed both Schweber Electronics and Almac Electronics as authorized Vitelic distributors. Almac is the major distributor in the Northwest and Schweber is the number three distributor in the United States.

May 1989
Vitelic introduced the V63C64, a high-speed 8Kx8 SRAM device with access times of 25ns and an output enable time of 9ns. The full CMOS part is designed for use in cache memory applications in high-end 80386-based PCs and workstations.

July 1989
Vitelic introduced the V53C261, a high-performance 64Kx4 video RAM that clocks 256 four-bit words at a serial rate of 33 MHz and has an access time of 80ns.

August 1989
Vitelic introduced the V63C329, an 8Kx16 cache data RAM designed for use in large-capacity cache memory applications from 64 Kbytes to 256 Kbytes, for high-performance PCs and workstations.

ALLIANCES

Kyocera
March 1984
Kyocera participated in the first-round financing of Vitelic.

ERSO
May 1984
ERSO and Vitelic agreed to codevelop EPROMs and 64K and 256K CMOS DRAMs.

Sony
June 1985
Vitelic and Sony signed an agreement giving Sony access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity.

NMB
July 1985
Vitelic granted a license for its 1Mb DRAM to NMB in exchange for one-third of NMB's plant capacity.

Hyundai
July 1985
Hyundai obtained a license to produce Vitelic memory products in exchange for manufacturing capacity. Vitelic memory products include 64K, 256K, and 1Mb CMOS DRAMs and 16K CMOS SRAMs.

Philips
March 1986
Philips and Vitelic agreed to a broad-ranging agreement that gave Vitelic access to Philips' process technology. In exchange, Vitelic would design a family of high-performance CMOS SRAMs for manufacture, use, license, and sale by both companies (expired).

Sanyo
October 1986
Sanyo and Vitelic would jointly develop a high-speed 64K SRAM family. Sanyo would manufacture the SRAMs, using 1-micron process technology. The agreement includes the manufacture of the products that Vitelic designs for Philips, using Philips' process developed by Tokyo Sanyo.

MANUFACTURING

Technology

2.0- to 1.0-micron CMOS (n-well)
VICMOS III

Facilities

San Jose, CA
33,000 sq. ft.
Headquarters and design

Taiwan
Under construction
Engineering and test

Japan
N/A
Sales location

PRODUCTS

	Device	Organization	Access Time
CMOS DRAM	V53C256/258	256Kx1	70-100ns
	V53C466/464	64Kx4	70-100ns
	V53C100/102	1Mbx1	80-100ns
	V53C104/105	256Kx4	80-100ns
CMOS SRAM	V63C64	8Kx8	25-45ns
	V61C16	2Kx8	35-70ns
	V61C68	4Kx4	35-55ns
	V61C6	16Kx1	35-55ns
Dual-Port RAM	V61C32	2Kx8	55-90ns
FIFO	V61C01	512x9	25-65ns
	V61C02/3	1Kx9	25-65ns
Video RAM	V53C261	64Kx4	80-100ns
Cache Data RAMs	V63C328	8Kx16	35ns
	V63C308	4Kx16	35ns

OTHER INFORMATION

Vitelic's PR firm is Thomas Mahon and Associates.

Vitesse Semiconductor Corporation

741 Calle Plano
Camarillo, CA 93010
805/388-3700
Fax: 408/433-0331

ESTABLISHED: July 1984 **NO. OF EMPLOYEES: 103**

BACKGROUND

Vitesse Semiconductor Corporation designs, manufactures, and markets cost-effective digital gallium arsenide (GaAs) large-scale ICs for the high-performance marketplace and offers foundry services on a contract basis. Products are manufactured using enhancement/depletion mode transistors and self-aligned gate technology according to silicon manufacturing techniques. The Company's first products were commercial versions of a family of GaAs ICs, including gate arrays, RAMs, and logic products.

Initially, the Company was organized into two divisions—the Integrated Circuits Division, which was responsible for GaAs IC designs, and the Digital Products Division, which was developing a minisupercomputer product. Early in 1987, the Integrated Circuits Division raised $10 million, establishing an independent company, and was renamed Vitesse Semiconductor Corporation. Dr. Louis Tomasetta, formerly president of the IC Division, is president and CEO of the new company. Dr. Tomasetta was director and program manager of the $40 million DARPA GaAs pilot program at Rockwell International.

Vitesse remains in the existing 45,000-square-foot facility and will use the additional funding raised in 1987 to develop additional products and expand into higher-volume production. The building is designed specifically for the production of LSI-level digital ICs in GaAs. Approximately 12,000 square feet have been designated as clean room area, and half of that area is a Class 10 clean room.

In March 1987, Pierre R. Lamond was elected chairman of the board. Mr. Lamond organized the $10 million financing of Vitesse Semiconductor and also serves on the boards of Convex Computer, Cypress Semiconductor, and several other private companies. In October 1987, Dr. T.J. Rodgers, president and CEO of Cypress Semiconductor Corporation, joined the board of Vitesse Semiconductor.

Vitesse has established a nationwide network of manufacturers' representatives to sell its foundry services and products. In June 1987, Vitesse signed Zeus as its first distributor to sell its 29G00 family of products.

BOARD
(Name and Affiliation)

Pierre R. Lamond, Chairman
Sequoia Capital, General Partner

Dr. T.J. Rodgers
Cypress Semiconductor Corp., President

Jim Cole
Spectra Enterprise Assoc., Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Dr. Louis Tomasetta
Rockwell, Dir R&D Center

Executive VP
*Patrick Hoffpauir
VLSI Technology, GM ASIC Ops

VP Marketing/Sales
David Mooring
Intel, Mktg Mgr

VP Sales
Neil Rappaport
AMCC, Ntl Sales Mgr

VP Engineering
*Ira Deyhimy
Rockwell, Mgr IC Engr

VP Operations
James Mikkelson
Hewlett-Packard, Mgr Process Dev

VP Finance/CFO
Michael A. Russell
Avicon Intl, VP Finance/CFO

*Founder

FINANCING

February 1987
Round 1
$10.0M
Bryan & Edwards; New Enterprises Assoc.; The Norton Company; Oxford Venture Corp.; Robertson, Colman & Stephens; Sequoia Capital; Spectra Enterprises; Walden Capital; J.H. Whitney

January 1988
Round 2
$8.1M
Previous investors; Hook Partners; Mohr, Davidow Ventures; Morgenthaler Ventures; Oak Investment Partners; Singapore Development Board

April 1989
Round 3
$7.3M
Previous investors, Aeneas Venture Corp., Security Pacific Capital Corp., Hughes Investment Management Co., New Venture Partners

RECENT HIGHLIGHTS

June 1987
Vitesse offered GaAs versions of the 2900 family of slice processors, produced through a licensing agreement with Advanced Micro Devices.

September 1987
Vitesse offered its first digital GaAs ICs fabricated with an E- and D-MESFET transistor process. They include a family of 1,500- and 4,500-gate arrays. The arrays are tailored for telecom fiber-optic MUX/DEMUX, computer, backplane, tester, and instrumentation applications.

Vitesse also offered the VS12G22E, a 256x4 SRAM with an access time of 3ns. The device is ECL RAM compatible, has 1.5-watt power dissipation, and is radiation hardened.

October 1987
Vitesse announced that Dr. T.J. Rodgers, President/CEO of Cypress Semiconductor, had joined the board of directors.

January 1988
Vitesse introduced the VS8001, a 1.25-GHz 12-to-1 multiplexer, and the VS8002 1-to-12 demultiplexer with ECL-compatible parallel I/O. The devices offer 12-bit parallel-to-serial and serial-to-parallel data conversion for communications applications. A unique feature is a self-test path designed to allow the devices to test each other.

March 1988
Vitesse announced that it has developed the VS8010, a MUX/DEMUX with control logic that meets the Synchronous Optical Network (SONET) standard at the 1.2-Gbit per second (Gbps) communications rate.

November 1988
Vitesse announced the world's first GaAs VLSI product, a 10,000-gate array, the VSC 10000.

January 1989
Vitesse announced a GaAs 22,000-gate array using standard cells.

August 1989
Vitesse announced shipment of its VSC10K GaAs gate array to E-Systems for that company's high-performance digital signal processor series.

ALLIANCES

Norton
July 1984
The initial investment of $30 million in Vitesse was provided by the Norton Company, a $1.3 billion company of Worcester, Massachusetts.

Advanced Micro Devices
November 1985
Vitesse and Advanced Micro Devices (AMD) agreed to develop and manufacture AMD's AM2900 family of MPUs in gallium arsenide.

TRW
December 1986
Vitesse signed a sales and marketing agreement with TRW Components International Inc. (TRWCI) covering logic, memory, and ASIC products. Vitesse will supply high-performance wafers, die, and packaged devices to TRWCI, which will assemble, test, qualify, and sell to the space-quality, Class-S level market. The companies will also cooperate to solve the radiation problems found in logic and memory products.

E-Systems
August 1987
Vitesse signed an agreement allowing E-Systems to use Vitesse's proprietary GaAs technology in its current and future programs. E-Systems also has an option to purchase design, packaging, and test technologies. The agreement allows Vitesse to participate in the EW systems market through E-Systems' military programs.

VLSI Technology
September 1987
Vitesse will develop a GaAs cell library for VLSI's design tools. VLSI will provide technical information and assist in the porting effort. When the library is completed, both companies will market the tools, which Vitesse will use internally. VLSI will extend the tools to its silicon compiler library; Vitesse will own the library and provide fabrication.

Ford Microelectronics
October 1987
Vitesse and Ford Microelectronics agreed to second-source each others' IC foundry services. The companies will develop common design rules.

Fujitsu
November 1989
Vitesse and Fujitsu Ltd. announced an alternate-source agreement with regard to Vitesse's FURY GaAs VLSI gate array family.

MANUFACTURING

Technology

GaAs E/D MESFET
0.8-1.25 microns
3-inch wafers

Facilities

Camarillo, CA
45,000 sq. ft.
Total space
10,000 sq. ft.
Class 10 clean room

PRODUCTS

Foundry

LSI Enhancement/Depletion Mode Process, 0.8-Micron Feature Size, Sub-100ps Gate Delays, 3-layer metal

	Device	Description
Gate Arrays	VSC1500	Structured Cell Array
	VSC4500	Gate Array
	VSC10K	Gate Array
	VSC15K	Gate Array
	VCB50K	Standard Cell
SRAMs	VS12G422E	256x4 SRAM, 3, 4, 5ns
	VS12G422T	256x4 SRAM, 4, 6, 8ns, TTL I/O
	VS126476	4Kx1 SRAM 2.5ns Self-Timed

	Device	Description
Microcomponents	VS29G01	4-Bit Slice Processor
	VS29G02	Look-Ahead Carry Generator
	VS29G10	Microcontroller
Standard Products	VS8001	12:1 MUX at 1.2 GHz
	VS8002	1:12 DEMUX at 1.2 GHz
	VS8010	SONET MUX/DEMUX
	VS8004	4:1 MUX at 2.5 Gbps
	VS8005	1:4 DEMUX at 2.5 Gbps

OTHER INFORMATION

Vitesse's PR firm is Capitol Relations, Inc.

VTC Incorporated

2401 East 86th Street
Bloomington, MN 55425-2702
612/851-5200
Fax: 612/851-5199
Telex: 857113

ESTABLISHED: May 1984 **NO. OF EMPLOYEES: 460**

BACKGROUND

VTC Incorporated designs, manufactures, and markets a broad line of high-performance linear and digital ICs, using bipolar and CMOS process technologies. The Company also offers a wide range of semicustom and custom ASICs, as well as a portfolio of standard products for the aerospace, telecommunications, and computer markets.

In the linear area, products include linear signal-processing (LSP) devices and mass storage devices. The signal-processing devices include very fast operational amplifiers, buffers, comparators, transconductance amplifiers, and sample/hold and data converters. These products are the highest-performance products in their respective classes, rivaling expensive hybrid circuits. In the mass storage area, the Company offers a full line of preamplifiers, data separators, channel devices, voltage-controlled oscillators, and tape drive servo controllers. These devices have speeds and features available from only a few suppliers and are aimed at the high-performance end of the market.

VTC is perceived to have very good cell-based libraries in bipolar and CMOS technologies. Products manufactured using the libraries are often modified and turned into standard parts. VTC also provides a complete set of CAD tools supporting its libraries.

The Company is also perceived to have a leadership position in the following linear areas: preamplifiers for disk drives and ultrahigh-speed op amps. VTC is expected to have 1988 sales of about $50 million and plans to be a $100 million company by 1990.

In the first quarter of 1986, VTC occupied an additional 170,000-square-foot facility. The facility includes a 30,000-square-foot Class 1/Class 10 clean room. The Company makes its own masks in a shop equipped with E-Beam technology. Its factories are designed for high-volume production with advanced manufacturing, in-house packaging, and test equipment.

In June 1987, VTC signed a merger agreement under which it became a wholly owned subsidiary of Control Data Corporation, its largest investor and major customer. Terms were not disclosed. Control Data has invested $56 million in VTC since it was founded and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock.

BOARD
(Name and Affiliation)

Larry Jodsaas
VTC Incorporated, CEO

Daniel Pennie
Control Data Corporation

Robert Lillestrand
Control Data Corporation

John Buckner, Chairman
Control Data Corporation

Donald Powers
Control Data Corporation

Allen Cuccio
Control Data Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Larry Jodsaas
Control Data, SR VP Quality

VP/CFO
J.R. Martin
Fairchild, Div Controller

VP Operations
E.M. Schnable
National, Operations Mgr

VP Engineering
D.A. Orton
Fairchild, Engr Mgr

VP Marketing
George Sanders
Micro Powersystem, Marketing Mgr

SR VP Sales
Daniel B. Griffith
Control Data, VP/GM

FINANCING

From 1984 through 1987, VTC financed its capital equipment and facility requirements with operating leases totaling about $75 million. In July 1987, employees of VTC, who collectively owned 51 percent of the Company, sold their ownership interest to Control Data Corporation (CDC), giving CDC 100 percent of VTC's common stock.

RECENT HIGHLIGHTS

April 1987
VTC was awarded a $7.5 million contract from the Control Data Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chip-types designed with VTC's 1-micron CMOS standard cell library.

May 1987
VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by Silicon Compilers Systems Inc. (SCS). VTC will also develop a radiation-hardened cell and other macrocells for the system.

May 1987
VTC offered the VL3000, a 6-GHz linear/digital bipolar cell library. It allows users to mix linear and digital circuits on the same chip, without redesigning at the transistor level. The library contains more than 100 predefined linear, digital, and memory functions.

June 1987
VTC became a wholly owned subsidiary of Control Data Corporation. Terms were not disclosed.

September 1987
VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

ALLIANCES

CDC
October 1984
Control Data Corporation invested $56 million in VTC and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock. The arrangement includes a fabrication technology license.

1987
VTC was awarded a $7.5 million contract from CDC's Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chips designed with VTC's 1-micron CMOS cell library.

Silicon Compilers
May 1986
VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by SCI. VTC will also develop a radiation-hardened cell for Genesil and additional macrocells for SCI's silicon compiler system.

IDT
January 1987
IDT agreed to allow VTC to second-source its FCT product line of TTL-compatible CMOS logic devices.

TRW
March 1987
TRW Components International and VTC signed a three-year agreement to cross sample space-quality, Class-S devices. VTC will supply TRW with unpackaged ICs that meet Class-S specs; TRW will assemble, test, qualify, and market the devices. They include radiation-hardened CMOS SRAMs, comparators, amps, and transceivers.

VME Technology Consortium
September 1987
VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

MANUFACTURING

Technology

3.0- and 2.0-micron bipolar linear
2.0-micron bipolar digital
1.2- and 1.0-micron two-layer metal CMOS

Facilities

Bloomington, MN
140,000 sq. ft.
Headquarters, manufacturing

30,000 sq. ft.
Class 1 and Class 10 clean rooms

20,000 sq. ft.
Manufacturing

PRODUCTS

Gate Arrays
CMOS and Bipolar/Linear Arrays

Cell Library
Bipolar cell libraries, 3.0-micron with 170 cells (100 digital, 70 analog), 2.0-micron with 88 cells; ECL or TTL I/O, 2.0-micron with 120 cells (90 digital, 30 analog)

Silicon Compiler
1.0- and 1.6-micron CMOS Compilers; RAM, ROM, FIFO, and PLA cells

Linear Signal Processing
Transconductance Amps and Dual-Transconductance Amps, each with or without buffer, 75-MHz Bandwidth

Video Amplifiers
Low-Noise 733 or 592 Video Amp

Op Amps
High-Speed, Dual High-Speed, and Quad High-Speed Precision and Fast-Setting Op Amps; Wideband High-Slew Rate, Dual High-Slew Rate, and Quad High-Slew Rate Op Amps; Sample and Hold Amp; Low-Voltage Amp

Data Converters
8-Bit Video DAC, 200 to 300 MHz; 12-Bit DAC, 125ns Settling Time

Comparators
Very Fast Comparator, Ultrafast Comparator, TTL Comparator, Ultrafast Dual Comparator, Dual TTL Comparator

Line Drivers
NTDS Driver/Receiver, Video Line Driver

Mass Storage
Disk Drive Read/Write Preamps: Ferrite Heads, Center-Tapped Thin-Film Heads, Thin-Film Heads, Vertical Heads; Servo Preamps: Ferrite Head, Low-Noise Ferrite Head, Thin-Film Head; Data Separator, Disk Drive Read Channel/Enhanced: Disk Drive Read/Write Channel, Tape Drive Clock Synchronizer; Tape Write Driver; Encoder/Decoder; Write/Servo Phase-Locked Oscillator

V54/74 FCT/ACT Interface Logic Family (Commercial & Mil Qualified)
Octal and 10-Bit Buffers and Line Drivers; Octal, 9-Bit, and 10-Bit Bus Transceivers; Octal, 9-Bit, and 10-Bit D-Type Transparent Latches: Octal, 9-Bit, and 10-Bit D-Type Edge-Triggered Flip-Flops; Dual 4-Bit D-Type Edge-Triggered Flip-Flops

OTHER INFORMATION

VTC Incorporated does not employ a PR firm.

WaferScale Integration, Inc.

47280 Kato Road
Fremont, CA 94538
415/656-5400
Fax: 415/657-5916

ESTABLISHED: August 1983 **NO. OF EMPLOYEES: 125**

BACKGROUND

WaferScale Integration, Inc., (WSI) founded by Eli Harari, Terry Leader, and Stephen Su, designs and manufactures high-performance CMOS reprogrammable ICs that incorporate advanced CMOS EPROM capability.

WSI offered an 8Kx8 RPROM (UV erasable reprogrammable PROM) in the first quarter of 1986. In mid-1987, WSI introduced two 256K CMOS EPROMs that use the Company's patented, self-aligned split-gate EPROM technology. The EPROMs feature an access time of 55ns and provide one- and two-chip program-store solutions for 16- and 32-bit MPU and DSP applications. WSI also supplies high-speed CMOS bit-slice processors and peripheral circuits.

In addition, the Company offers the capability to combine EPROM, SRAM, and complex system logic functions on a single IC in its CMOS macroblock cell library. The macroblock library provides VLSI EPROMs, SRAMs, and a family of high-performance bit-slice processor cells (from 4 bits to 32 bits). The library also contains bit-slice peripherals cells including microprogram controllers, variable pipelines, FIFOs, multipliers, bus registers, and register files.

WSI focuses on high-performance markets that include telecommunications, minicomputers, local area networking, digital signal processing, array processing, high-resolution color graphics, and military avionics and communication. WSI market involvement presently includes 55 percent office automation, 25 percent telecommunications, 15 percent military, and 5 percent other. The Company is directing efforts to balance office automation, telecommunications, and military to roughly 30 percent each by 1990.

WSI has leveraged its partnerships with Altera Corporation, GE Solid State, Intergraph Corporation, Kyocera Corporation, and Sharp Corporation to invest its capital into advancing its technology and realigning products to match market shifts.

Sharp and GE Solid State have invested in WSI through equity positions, and both companies hold WSI technology licenses. Altera and Intergraph are two additional strategic alliances involving either equity and/or technology. The Kyocera alliance involves equity and distribution of WSI products in Japan.

WSI's products are manufactured at Sharp Corporation's plant at Fukuyama, Japan. The facility produces 5-inch wafers with 1.2-micron CMOS VLSI circuits in a Class 1 clean room environment. In the United States, GE/RCA manufactures circuits for WSI in a Class 10 facility, using 1.0-micron CMOS on 5-inch wafers.

WSI's products are sold worldwide through a sales network that includes a combination of regional and direct sales managers, manufacturers' representative companies, and components distributors.

BOARD
(Name and Affiliation)

Irwin Federman, Chairman
WaferScale Integration, Inc., CEO

Harry Marshall
J.H. Whitney

James Swartz
Accel Partners

Donald K. Grierson
General Electric Corporation

Richard Santilli
RCA Corporation

Henry Kressel
Warburg Pincus Capital Partners

WaferScale Integration, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO/Acting
Irwin Federman
Concord Venture, Partner

VP Finance
Robert J. Barker
MMT, Mgr Finance

VP Systems Production
Zel A. Diel
GigaBit Logic, VP Prod Dev

VP Process Technology
Yale Ma
STC Computer, Mgr Wafer Fab Ops

VP Operations
Steve Sanghi
Intel, GM Prog Memory Ops

VP Device
Boaz Eitan
Intel, Mgr Device Physics

VP WW Sales
Thomas Branch
Micro Genesis, Principal

FINANCING

February 1984
Round 1
$16.1M
Accel Partners; Adler & Co.; Bessemer; Genevest (Switzerland); Intergraph; Oak Investment Partners; Robertson, Colman & Stephens; Smith Barney Venture Corp.; Tadiran (U.S.) Inc.; Venture Partners II; Warburg-Pincus; J.H. Whitney

Lease
Bank of America, Bateman Eichler Leasing Corp., Equitec

November 1984
Round 2
$8.5M
Original investors, Baillie Gifford & Co. (Scotland), Continental Illinois Venture Corp.

April 1986
Round 3
$13.0M
Original investors, Intergraph Corp., RCA Corporation, Sharp Corporation

July 1987
Round 4
$8.0M
Accel Partners; Adler; Bessemer Venture Partners; GE/RCA; Intergraph Corp.; Kyocera; Robertson, Colman & Stephens; Warburg Pincus; J.H. Whitney

RECENT HIGHLIGHTS

June 1987
WSI received a patent on its self-aligned, split-gate CMOS EPROM process.

July 1988
WSI introduced the WS57C51B, a 16Kx8-bit CMOS PROM, which is user-reprogrammable and consumes one-fourth the power of equivalent bipolar densities.

July 1988
WSI introduced its "L" series of low-power EPROMs, available in 128Kx8, 64Kx8, and 32Kx8 configurations.

July 1988
WSI introduced the MAP168 Mappable Memory Subsystem, which functionally integrates a memory subsystem into a single device.

October 1988
WSI announced the PAC1000, a high-performance, 16-bit microcontroller, the first of WSI's new class of user-configurable Programmable System Devices (PSD).

ALLIANCES

Sharp
December 1984
WSI agreed to allow Sharp to use its technology and produce a 64K CMOS EPROM. WSI received manufacturing capacity and royalties. Development and production of 256K CMOS EPROMs were planned.

October 1985
WSI and Sharp expanded the 1984 agreement to include WSI's 1.6-micron CMOS technology in exchange for royalties and foundry capacity.

GE/RCA and Sharp
March 1986
GE/RCA and Sharp signed a five-year agreement with WSI to develop an advanced cell library. WSI's library of LSI macrocells will be combined with cell libraries from GE/RCA and Sharp. The companies also jointly developed 1.0-micron cell libraries, advanced tools, packaging techniques, high-speed EPROMS, and other high-performance standard products. The alliance gives WSI alternative sources of chips and a springboard into the market in Japan.

July 1987
WSI and GE/RCA expanded the terms of their previous EPROM agreement to include U.S. manufacturing. Under a long-term foundry agreement, WSI will be guaranteed volume capacity at GE/RCA's new 5-inch wafer fab module in Findley, Ohio. WSI will transfer its 1.2-micron fast CMOS EPROM process to Findley. GE/RCA will use the process to manufacture ASIC circuits and second-source some of WSI's EPROM memory products.

Altera and Sharp
January 1987
Altera and WSI announced a five-year technology relationship to develop a new family of standalone microsequencer products with wafers manufactured by Sharp of Japan.

MANUFACTURING

Technology

SCMOS I: 2.0-micron, double-metal CMOS
SCMOS II: 1.0-micron, double-metal CMOS
4- and 5-inch wafers

Facilities

Fremont, CA
66,000 sq. ft.
Design, test, marketing, sales, administration

PRODUCTS

Memory

Device	Organization	Access Time
WS57C191/291	2Kx8 RPROM	45ns
WS57C43	4Kx8 RPROM	35, 55ns
WS57C49	8Kx8 RPROM	35, 55ns
WS57C51	16Kx8 RPROM	40, 70ns
WS27C64	8Kx8 Byte-Wide EPROM	55, 90ns
WS57C128	16Kx8 Byte-Wide EPROM	55, 90ns
WS57C256	32Kx8 Byte-Wide EPROM	55, 90ns
WS57C65	4Kx16 Word-Wide EPROM	55ns
WS57C257	16Kx16 Word-Wide EPROM	55ns

Microcomponents

WS5901	4-Bit Bit-Slice Processor	43 MHz
WS59016	16-Bit Bit-Slice Processor	432 MHz
WS59032	32-Bit Bit-Slice Processor	25 MHz
WS5910	Microprogram Controller	30 MHz
WS59520	Multilevel Pipeline Register	45 MHz
WS59510	16X16 Multiplier/Accumulator	30ns
WS59820	16-Bit Bidirectional Bus Interface Register	50 MHz

WaferScale Integration, Inc.

ASICs

Modular Cell Library	Combines EPROM and System Functions with 1.2-Micron Technology to Produce Devices with Sub-1.0ns Delay. Functions Include 4-Bit to 32-Bit Bit-Slice Processors, Microprogram Controllers, Variable Pipelines, FIFOs, Multipliers, Bus Registers, Register Files, ROM, RAM, PLD, 75 Gates, and 26 MSI.

OTHER INFORMATION

WSI's PR firm is Capithorne and Bellows.

Weitek Corporation

1060 East Arques Avenue
Sunnyvale, CA 94086
408/738-8400
Fax: 408/739-4374
Telex: 910-339-9545

ESTABLISHED: 1981 **NO. OF EMPLOYEES: 134**

BACKGROUND

Weitek designs, manufactures, and markets digital signal processing circuits for high-performance numerics-processing applications. The Company's goal is to make arithmetic-processing power available on a broad scale to systems developers. The Company's product strategy is to offer a complete range of products, including building blocks that achieve maximum system performance, attached processors for maximum price/performance, and coprocessors for the lowest system cost.

In March 1988, Weitek introduced three new products. The WTL2364 multiplier/WTL2365 ALU chip set is a double-precision vector floating-point processor chip set that implements the IBM 370 Basic Floating-Point Facility standard. It is capable of 32 million floating-point operations per second (mflops) for single-precision operations and up to 16 mflops for double-precision operations. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The floating-point processors each integrate a 64-bit multiplier, a 64-bit ALU, a divide/square-root unit, a 32-word by 64-bit six-port register file, and status and control logic on one chip.

Currently, the Company purchases wafers in the foundry market from VLSI Technology Inc. Long-term wafer processing is guaranteed under agreements with Cypress Semiconductor, Hewlett-Packard Company (HP), and Intel Corporation. Processes available to Weitek are 2.0-micron NMOS and 1.5-micron double-metal CMOS from Intel, 1.2-micron CMOS from HP, 1.2-micron double-metal CMOS from Cypress, and 1.5-micron NMOS and CMOS from VLSI Technology.

Weitek was founded in 1981 by Godfrey Fong, Dr. Edmund Sun, and Dr. Chi-Shin Wang and operated initially as a custom design house specializing in ROMs. In 1985, the Company began offering advanced circuit design semiconductors that use advanced concepts in numerics processing.

BOARD
(Name and Affiliation)

G. Leonard Baker
Sutter Hill Ventures

Arthur J. Collmeyer
Weitek Corporation

David House
Intel Corporation

Gerald Lodge
InnoVen Partners

Arthur Reidel
Alex Brown

James Patterson
Quantum Corporation

W. Frank King III
Lotus Development Corp.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Arthur Collmeyer
Calma, VP/GM Microelec Div

VP Sales
Robert T. Derby
Intel, Dir WW Sales/Mktg

VP Operations
Steven Farnow
Visic, Dir Ops

VP Marketing
John F. Rizzo
Apple, Mktg Mgr

VP Finance
A. Brooke Seawell
Southwall Tech, VP Finance/Admin

VP Admin
John Steinhart
Stanford Univ, Dir Sloan Program

VP IC R&D
John J. Barnes
SGS-Thomson, Dir Tech Dev

FINANCING

January 1981
Round 1
$1.0M
InnoVen

February 1982
Round 2
$1.3M
InnoVen, Sutter Hill Ventures

March 1983
Round 3
$2.2M
InnoVen; Institutional Venture Partners; Merrill, Pickard, Anderson & Eyre; Sutter Hill Ventures

January 1986
Round 4
$3.0M
All of the above, Alex Brown, Glynn Capital

September 1988
IPO
$8.4M
Initial public offering

RECENT HIGHLIGHTS

March 1988
Weitek introduced three new products. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The WTL2364 multiplier and WTL2365 ALU chip set is a double-precision vector floating-point processor chip that implements the IBM 370 Basic Floating-Point Facility standard.

April 1988
Weitek announced that the WTL1167 floating-point coprocessor is featured as an option in the new Sun 386 workstation family.

March 1989
Weitek announced the XL-8832 floating-point RISC processor, developed for Digital Equipment Corporation to deliver 3-D graphics performance to Digital's VAXstation 3520 and VAXstation 3540 midrange graphics workstations.

April 1989
Weitek announced the Abacus 3170 and Abacus 3171, the first single-chip floating-point coprocessors for the SPARC architecture, in speed grades ranging from 20 to 40 MHz.

May 1989
Weitek introduced the Abacus 4167, a floating-point coprocessor for the Intel 80486 microprocessor that completes math operations five to six times faster than the 486's on-chip floating-point unit.

ALLIANCES

Cypress
October 1985
Weitek and Cypress made an agreement to jointly develop a series of high-performance VLSI logic circuits designed by Weitek and manufactured using Cypress' 1.2-micron CMOS process. The circuits are designed for telecommunications, graphics, instrumentation, military, and CAD/CAM applications.

Intel
October 1985
Weitek agreed to develop an interface IC that Intel would second-source and for which Intel would provide foundry services on 6-inch NMOS and CMOS wafer-processing equipment.

NSC
October 1985
National Semiconductor announced that it would design, manufacture, and market an interface chip.

Step Engineering
March 1986
Step Engineering agreed to produce development tools for the debugging and microcoding of Weitek's floating-point integer processor designs.

Quadtree
April 1986
Weitek announced that Quadtree Software would develop behavioral simulators for the WTL2264/2265 chip sets.

Matra-Harris
May 1986
Weitek and MHS signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process.

Hewlett-Packard
May 1987
Hewlett-Packard would incorporate the Weitek model 2264/2265 chip set for high-performance, floating-point computation in current and future HP Precision Architecture computers. HP would manufacture the chip, using a 1.2-micron CMOS process.

Matsushita
November 1988
Weitek entered into a manufacturing agreement with Matsushita Electric Corporation, whereby Matsushita agreed to manufacture Weitek's higher volume processor and coprocessor products using its 1.2- and 1.5-micron CMOS process technologies. This agreement complements Weitek's existing manufacturing agreements, forged with Hewlett-Packard and VLSI Technology.

Toshiba
November 1988
Weitek signed an agreement with Toshiba wherein the two companies will cooperate in the development of high-performance numeric semiconductors. As part of the agreement, Weitek will receive manufacturing services from Toshiba's 1.0-micron CMOS and 1.5-micron BiCMOS production processes. Weitek will provide floating-point unit technology to Toshiba for use in certain Toshiba products.

MANUFACTURING

Technology

2.0- and 1.5-micron NMOS
1.2-micron, one-level metal CMOS
1.5-, 1.2-, 1.0-, 0.8-micron, two-level CMOS

Facilities

Sunnyvale, CA
50,000 sq. ft.
Administration, design, R&D

PRODUCTS

16-Bit Integer Family

Device	Description	Speed
WTL2516	16x16 Parallel Multiplier	38ns
WTL2517	16x16 Parallel Multiplier	38ns
WTL2010	16x16 Multiplier/Accumulator	45ns
WTL2245	16x16 Multiplier/Accumulator	45ns

32-Bit Floating-Point Family

WTL1232/1233	Multiplier/Adder	10 mflops
WTL3132	Data Path Unit	20 mflops
WTL3332	Data Path Unit	20 mflops

64-Bit Vector Floating-Point Family

Device	Description	Speed
WTL1264/1265	Multiplier/Adder	8 mflops
WTL2264/2265	Multiplier/ALU	20 mflops
WTL2364/2365	Multiplier/ALU, Double-Precision	32 mflops

64-Bit Floating-Point Coprocessor Family

WTL1167	80386 Coprocessor	3.5 mflops
WTL1164/1165	Multiplier/Adder/Divider	3.5 mflops
WTL3164	Data Path Unit	100ns, 20 mflops
WTL3364	Data Path Unit	100ns, 20 mflops
Abacus 3167	80386 Coprocessor	20, 25, 33 MHz
Abacus 3168	68020/030 Coprocessor	20, 25, 33 MHz
Abacus SPARC	SPARC Coprocessors	20, 25 MHz
Abacus 3171	SPARC Coprocessors	25, 33, 40 MHz

XL-Series Family

XL-8000	32-Bit Integer Processor	8 mips
XL-8032	32-Bit Single-Precision Processor	8 mips, 20 mflops
XL-8064	64-Bit Double-Precision Processor	7 mips, 20 mflops
XL-8136	Program Sequencing Unit	
XL-8137	Integer-Processing Unit	
XL-8200	32-Bit Hyperscript Processor	1 mflop
XL-8232	32-Bit Hyperscript Processor	20 mflops
XL-8832	32-Bit Single Precision Processor	20 mflops

Development Tools for the XL-Series Family

XL-Series C Compiler-Based Software Development Environment
XL-Series FORTRAN-Based Software Development Environment

PS-8000	XL-Series Prototyping System for the XL-8000
PS-8032	XL-Series Prototyping System for the XL-8032
PS-8064	XL-Series Prototyping System for the XL-8064

Functional Simulators for All Weitek Components

OTHER INFORMATION

Weitek's PR firm is Regis McKenna, Inc.

Wolfson Microelectronics Limited

Lutton Court,
20 Bernard Terrace
Edinburgh, EH8 9NX Scotland
031/667-9386
Fax: 031/667-5176
Telex: 727659

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 28**

BACKGROUND

Wolfson Microelectronics Limited designs, manufactures, and markets ASICs and specializes in the development of complex mixed analog and digital circuits. The Company offers IC design using semicustom and full-custom approaches including gate arrays with up to 20,000 gates; cell-based libraries in 3.0-, 2.0-, 1.5-, and 1.2-micron CMOS technology; and full-custom design using a range of CMOS and bipolar technologies.

Wolfson Microelectronics Limited evolved from the Wolfson Microelectronics Institute at Edinburgh University. The Company, although completely autonomous, retains its technological links with the academic research activities of the university.

The Company has developed an extensive CAD capability based on a network of Sun workstations to provide an integrated design environment for semicustom and structured custom design. The emphasis of its work has been signal processing. The Company has developed a 2-micron digital library of macro cells with variable parameters for digital designs and an extensive analog library of linear and nonlinear functions.

BOARD

Not available

COMPANY EXECUTIVES

(Position and Name)

Managing Director
David Milne

Technical Director
James Reid

Finance Manager
Neil Hattersley

FINANCING

Not available

ALLIANCES

Wolfson has manufacturing arrangements with AMS, Fujitsu, Mietec, and SGS-Thomson dating from 1985.

MANUFACTURING

Technology

All processes are for second-sourcing capability.

- 1.2-, 1.5-, 2.0-, 3.0-Micron SPSM/SPDM CMOS Digital Process
- 2.0-Micron SPDM BiMOS Analog Process
- 2.0-Micron SPDM CMOS Analog Process
- 3.0-Micron DPDM/DPSM CMOS Analog Process
- 4.0-Micron DPSM CCD Analog Process
- 5.0-Micron DPSM CMOS Analog Process

PRODUCTS

Current Products

Device	Description
WM 2020	Dual 15-Pt Tapped Delay Line
WM 2210	Dual 15-Pt Tapped Delay and Integrate
WM 2120	64-Pt Programmable Transversal Filter
WM 2130	256-Pt Programmable Transversal Filter
PWM 213	512-Pt Correlator Module
PWM 215	1,024-Pt VME Correlator Module

Future Products

WM 3201	Fifth Order, Low-Pass Elliptical Continuous Time Filter; Cutoff 5 KHz to 50 KHz
WM 33XX	Semicustom Switched Capacitor Family
WM 5110	128-Pt Complex Digital Programmable Transversal Filter
WM 5120	Digital Programmable Transversal Filter Controller

OTHER INFORMATION

Wolfson Microelectronics does not employ a PR firm.

Xilinx Incorporated

2100 Logic Dr.
San Jose, CA 95125
408/559-7778
Fax: 408/559-7114

ESTABLISHED: February 1984 **NO. OF EMPLOYEES: 150**

BACKGROUND

Xilinx Incorporated is a leading supplier of user-programmable gate arrays for the ASIC market. The Xilinx Logic Cell Array (LCA) uses specially designed static memory cells to store logic and interconnection configuration information generated by Xilinx design software.

The Company was founded by James Barnett, Ross Freeman, and Bernard Vonderschmitt, all formerly with Zilog. Xilinx introduced its first logic cell array, which consists of 1,000 to 1,500 equivalent two-input NAND gates, in November 1985. Since then, products with complexities of up to 9,000 gates have been added and are the largest available today. Designs are performed on PC ATs, and Apollo, Digital, and Sun workstations.

The Company has set up several barriers to entry, including patents, extensive development system software, advanced CMOS process technology, and alternative sources. Advanced Micro Devices is a second source of the Company's logic cell arrays and development system. Xilinx has a foundry arrangement with Seiko Epson, which produces the devices in the Suwa, Japan, plant.

The Company's devices and associated development systems are sold by a sales force that includes five sales offices in North America and one each in the United Kingdom and in Japan; 12 field-application engineers; 60 manufacturer's representatives worldwide; 54 North American distributor branches, including Hamilton-Avnet, Marshall, Insight, and Western Microtechnology; and 15 international distributor locations.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Bernard Vonderschmitt
Zilog, VP/GM IC Div

VP Admin
*James Barnett
Zilog, Prod Line Dir

VP Eng
*Ross Freeman
Zilog, Dir Eng

VP Sales
R. Scott Brown
Menlo Corp., VP Sales

VP Ops
Frank Myers
Exel, VP Ops

VP Mktg
Wes Patterson
VLSI, Dir Ops

VP Finance/CFO
Gordon Steel
Pyramid, VP Finance/Admin

*Founder

FINANCING

March 1984
Round 1
$2.8M
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; J.H. Whitney & Co.

December 1985
Round 2
$8.3M
Round 1 investors, Berry Cash Southwest Partnership, InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners

January 1987
Round 3
$6.4M
Round 1 investors; Fleming Ventures Ltd., InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners, Security Pacific, Monolithic Memories Inc.

August 1988
Round 4
$3.5M
Round 1 investors, others

RECENT HIGHLIGHTS

January 1987
Xilinx raised $3.4 million in third-round financing.

October 1987
Xilinx offered the XC3020, the first in a family of 1.2-micron, user-programmable gate arrays with 1,800 to 2,400 two-input NAND gates and a 40-MHz system clock rate.

November 1987
Xilinx introduced the XC3090, a 9,000-gate, user-programmable gate array.

November 1987
Xilinx's user-programmable gate arrays are available on Viewlogic Systems' Workview workstation. The support allows design and logic simulation on IBM PC ATs.

March 1989
Xilinx introduced the first user-programmable gate arrays to be fully compliant with MIL-STD 883, Class B.

PRODUCTS

Logic Cell Arrays (LCAs)

Device	Description
XC2064	1,200 gates
XC2018	1,800 gates
XC3020	2,000 gates
XC3030	3,000 gates
XC3042	4,200 gates
XC3064	6,400 gates
XC3090	9,000 gates

ALLIANCES

Seiko-Epson
December 1985
Xilinx and Seiko-Epson agreed to codevelop LCAs and development systems. Seiko-Epson will manufacture the LCAs, using Xilinx's proprietary technology. The companies also agreed on the joint development of Seiko-Epson's CMOS process. Seiko Epson gained nonexclusive marketing rights to the LCA product in Japan.

MMI/AMD
June 1986
Xilinx and MMI signed a three-year agreement allowing MMI to manufacture and market Xilinx's LCAs and development system. The first product transferred was the XC2064, a 1,200-gate device. Xilinx will supply future members of the LCA family to MMI as they become available. Xilinx also has given rights to market the XACT development system and the Xactor in-circuit emulator. The two companies will cooperate in extending software support for LCA products.

MANUFACTURING

Technology

1.2-micron double-metal silicon-gate CMOS
6-inch wafers

Facilities

San Jose, CA
100,000 sq. ft.
R&D, design, marketing, and test

XACT Gate Array Development System with In-Circuit Émulation
LCA Development System, Hardware and Software
XC2064, UART Design with Encryption/Decryption
Logic Synthesis Software

OTHER INFORMATION

Xilinx Inc.'s PR firm is Capithore and Bellows.

XTAR Corporation

9915 Business Park Avenue, Suite C
San Diego, CA 92131
619/271-4440

ESTABLISHED: September 1982 **NO. OF EMPLOYEES: 9**

BACKGROUND

XTAR electronics designs, develops, and manufactures graphics microprocessors, video shift registers, board-level products, and graphics systems. The Company concentrates on the design and development of new products.

XTAR funded the formation of the Company and development through its sales. It has developed a graphics microprocessor (GMP), a video shift register (VSR), and board-level products. Its GMP, a full-custom device, is designed to replace 400 devices with two chips. The VSR uses a standard-cell CMOS process technology. All of XTAR's products were sampled in September 1984, and production quantities were available in the fourth quarter of 1984. XTAR contracts wafer fabrication.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Anthony J. Miller
Universal Research Labs, Dir Engineering

VP Engr
Terrence Coleman
Universal Research Labs, Chief Engineer

Dir Mktg/Sales
Richard K. Thistle
Spectragraphics Corp, Product Mktg Manager

ALLIANCES

Fairchild
September 1986Fairchild and XTAR signed an alternate-source agreement for XTAR's X1000/X1002 Graphics MPU chip set, which Fairchild will redesign for manufacture using the FACT (Fairchild Advanced CMOS Technology) fabrication process.

MANUFACTURING

Technology

3.0-micron CMOS and NMOS
1.2-micron CMOS
4-inch wafers

Facilities

San Diego, CA
6,000 sq. ft.
Design

PRODUCTS

Device	Description
X1001/1002	Graphics MPU Chip Set
X1003	Video Shift Register
PG-2000	PC AT Graphics Board - Real-Time 3D Animation
AP-2000	20 MFLOPS 32-Bit Array Processor
Falcon-PC	PC AT Based Real-Time Graphics System —1024 x 1024 or 1024 x 768 —256 Colors from Palette of 4096 or 16.7M —Displays 30,000 Flat-Shaded Polygons/SEC —Fills Polygons AT 160 Million Pixels/SEC

OTHER INFORMATION

XTAR's PR firm is Nufter, Smith and Tucker.

Zoran Corporation

3450 Central Expressway
Santa Clara, CA 94051
408/720-0444
Fax: 408/720-9875

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 70**

BACKGROUND

Zoran Corporation designs, manufactures, and markets proprietary systems processors and programmable peripherals devices for the digital signal-processing (DSP) market. The Company is focusing on a unique systems design approach and combines VLSI and DSP to integrate DSP functions on single chips.

In June 1986, the Company offered two digital-filter processors (DFPs) and a vector signal processor (VSP) in addition to hardware support tools for the VSP. During 1987, Zoran offered new VSP devices, including a VLSI product that implements the IEEE 32-bit FFT algorithm and two 25-MHz and 30-MHz products. In addition, Zoran offered an image compression processor (ICP), which is a scaled-down version of the VSP.

To accelerate the implementation of its processors in end-user products, the Company has embedded algorithms and high-level instructions in the hardware. Zoran's integration of software algorithms and optimized hardware in its systems processors provides ease of design, high reliability, high performance, and optimized architectures.

Zoran, a privately held company, was cofounded by Dr. Levy Gerzberg and Yuval Almog. Prior to founding Zoran, Dr. Gerzberg was associate director of and senior research associate at the Stanford University Electronics Laboratory. Mr. Almog served in management positions at Raychem Corporation where he was responsible for military electronics marketing and resource planning. Zoran's systems approach to products is based on the research conducted by the cofounders.

In December 1987, Dale Williams joined Zoran as president and chief executive officer from Rockwell, replacing John Ekiss who resigned in May. Mr. Williams was formerly vice president and general manager of Rockwell International's Far East Operations, divisional manager with Intel, and founder of Monolithic Memories. Mr. Williams will be expanding the Company's marketing effort, particularly in Japan, and directing the Company's move into telecommunications and instrumentation products.

In December 1987, Zoran sold its fabrication facility to Synergy Semiconductor for $4 million in cash and notes. The Company stated that the fab, purchased at low cost from Storage Technology in late 1985, served its purpose of facilitating the rapid development of Zoran's first three product families to get to market quickly. In 1988, many of Zoran's customers entered production, a situation that outstripped the capacity of the R&D fab. The cost of expanding the fab's capacity and upgrading it to a more advanced process technology was not justified in light of the availability of existing foundries worldwide.

In April 1988, Zoran announced that it opened a Far Eastern headquarters facility in Tokyo, Japan. Heading the facility will be General Manager Noboru Iino, formerly Tokyo operational director at Rockwell Semiconductor. Under Mr. Iino's direction, the facility will provide local user-application engineering support, as well as marketing and sales direction. The Company hopes to capture a share of the DSP applications in the growing Japanese data compression market.

Zoran has a direct sales force with offices in Santa Clara and Los Angeles, California; Boston, Massachusetts; Chicago, Illinois; Tokyo, Japan; and Paris, France; and a worldwide network of manufacturers' sales representatives.

BOARD

Not available

Zoran Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Dr. Levy Gerzberg
Stanford Electronics Lab, Assoc Director

GM Far East Ops
Noboru Iino
Rockwell International, Tokyo Ops Dir

GM/European Ops
Jean-Pierre Garnier
Rockwell International, Euro Ops Dir

*Founder

FINANCING

August 1983
Round 1
$3.5M
Adler & Company; Elron Electronics Industries, Ltd., Israel

1984
Round 2
$1.5M
Previous investors

October 1985
Round 3
$22.0M
Previous investors; Concord Partners; Grace Ventures Corp.; Investment Advisors, Inc.; Kleiner, Perkins, Caufield & Byers; Mitsui & Co. Inc. (USA); Montgomery Securities; Vista Ventures; Welsh, Carson, Anderson & Stowe

April 1987
Round 4
$6.8M
Adler & Company; Concord Partners Elron Electronics Industries, Ltd.; Grace Ventures Corp.; Kleiner, Perkins, Caufield & Byers; Mitsui & Co. Inc.; Montgomery Securities; Vista Ventures; Welsh, Carson, Anderson & Stowe

May 1988
Harris Corporation bought 10 percent equity in Zoran Corporation.

RECENT HIGHLIGHTS

December 1986
Zoran offered a low-cost version of its VSP (VSP-10) and two personal computer development boards for the VSP. The VSP-10 is optimized for DSP applications and operates at 10 MHz versus 20 MHz for the VSP-20. The VSP-10 is aimed at instrumentation, medical imaging, and telecommunications applications.

To support the VSP chips, Zoran also introduced two development boards, the VSPX and VSPE, for use with an IBM PC XT or PC AT.

March 1987
Zoran introduced Support Tool Environment (STE), a development tool kit that addresses VSP and DFP. Zoran embedded the basic algorithms required in fixed, on-chip logic.

June 1987
Zoran offered an ICP, which is a scaled-down version of the VSP. The device is pin-compatible with the VSP-161, with its instruction set reduced for image applications. The device, which the Company says is the first in the marketplace, targets electronic publishing, satellite, electronic camera, picture data base, and broadcasting applications.

November 1987
Zoran offered the ZR33891-25, a 25-MHz digital filter processor; and ZR33891-30, a 30-MHz digital filter processor. The devices are upgraded digital filter processors designed for imaging, HDTV, and digital radio applications.

December 1987
Zoran sold its 50,000-square-foot fabrication facility for $4 million in cash and notes.

December 1987
Zoran offered the ZR34161 VSP in a 52-pin, ceramic J-leaded package. The device is available in 15-, 20-, and 25-MHz speeds.

April 1988
Zoran announced that it has opened a Far Eastern headquarters facility in Tokyo, Japan.

ALLIANCES

IMP
June 1983
IMP and Zoran codeveloped a CMOS PROM technology.

Toshiba
January 1988
Zoran and Toshiba agreed to a technology and manufacturing alliance.

SGS-Thomson
March 1988
Zoran and SGS-Thomson agreed to a technology and manufacturing alliance.

MANUFACTURING

Technology

1.0- to 2.0-micron, two-level metal CMOS
4-inch, 5-inch, and 6-inch wafers

Facilities

Santa Clara, CA
Headquarters, design

Haifa, Israel
Design center

Tokyo, Japan
Marketing/Sales

Paris, France
Marketing/Sales

PRODUCTS

Digital Filter Products

Device	Description
ZR33491	Four Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33881	Eight Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33891	Eight Cells; 9x9-Bit Arithmetic; 15, 20, 25, 30 MHz
ZR37381	16 Beat ALU Compatible with the LDI ALU
ZR33771	2D Converter 3x3 Symmetrical 40 MHz to 7x7 10 MHz Video rate

Vector Signal Processors

ZR34161	16-Bit Block Floating-Point DSP; 20, 25 MHz
ZR34325	32-Bit IEEE Floating-Point DSP; 25 MHz
ZR34322	32-Bit Block Floating-Point DSP; 20, 25, 30 MHz

Image Compression Processor

ZR36010	Discrete Cosine Transform Processor; 20, 25, 30 MHz

Development Tool Hardware

VSPX	ZR34161 Array Processor Board for IBM AT, 16K RAM, 10 MHz
VSPE	ZR34161 Array Processor Board for IBM XT, 16K RAM, 20 MHz
VSPD	ZR34161 Array Processor Board for IBM AT, 64K RAM, 20 MHz, I/O
DFPB	ZR39481/881 Digital Filter Board for IBM AT; 15, 20 MHz
ZRPD	ZR34325 Development System for the ZR34325 Floating-Point Processor

Development Tool Software

VSPS	ZR34161 Simulator
VSPA	ZR34161 Assembler
DFPS	Digital Filter Design Software
ZSPS	ZR34325 Software Tool Package

Zoran Corporation

Board/Subsystem

ZR73650	IEB (Image Engineering Board), AT-Compatible Board that supports development of imaging algorithms

OTHER INFORMATION

Zoran Corp. does not employ a PR firm.

Dataquest

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Dataquest Research and Sales Offices:

Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
Phone: (408) 437-8000
Telex: 171973
Fax: (408) 437-0292

Technology Products Group
Phone: (800) 624-3280

Dataquest Incorporated
Focus Research Division
10 Executive Drive
Farmington, Connecticut 06032
Phone: (203) 676-2200
Fax: (203) 676-1656

Dataquest Incorporated
Invitational Computer Conferences Division
3151 Airway Avenue, C-2
Costa Mesa, California 92626
Phone: (714) 957-0171
Telex: 5101002189 ICCDQ
Fax: (714) 957-0903

Dataquest Australia
Suite 1, Century Plaza
80 Berry Street
North Sydney, NSW 2060
Australia
Phone: (02) 959 4544
Telex: 25468
Fax: (02) 929 0635

Dataquest Boston
1740 Massachusetts Ave.
Boxborough, MA 01719-2209
Phone: (508) 264-4373
Telex: 171973
Fax: (508) 635-0183

Dataquest Europe GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089) 91 1064
Telex: 5218070
Fax: (089) 91 2189

Dataquest Hong Kong
Rm. 401, Connaught Comm. Bldg.
185 Wanchai Rd.
Wanchai, Hong Kong
Phone: 8387336
Telex: 80587
Fax: 5722375

Dataquest Israel
59 Mishmar Ha'yarden Street
Tel Aviv, Israel 69865
or
P.O. Box 18198
Tel Aviv, Israel
Phone: 52 913937
Telex: 341118
Fax: 52 32865

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03) 546-3191
Telex: 32768
Fax: (03) 546-3198

Dataquest Korea
Daeheung Bldg., Room 505
648-23 Yeoksam-dong
Kangnam-gu
Seoul, Korea 135
Phone: (02) 552-2332
Fax: (02) 552-2661

Dataquest Europe SA
Tour Gallieni 2
36, avenue Gallieni
93175 Bagnolet Cedex
France
Phone: (1) 48 97 31 00
Telex: 233 263
Fax: (1) 48 97 34 22

Dataquest Singapore
4012 Ang Mo Kio Industrial Park 1
Ave. 10, #03-10 to #03-12
Singapore 2056
Phone: 4597181
Telex: 38257
Fax: 4563129

Dataquest Taiwan
Room 801/8th Floor
Ever Spring Building
147, Sect. 2, Chien Kuo N. Rd.
Taipei, Taiwan R.O.C. 104
Phone: (02) 501-7960
Telex: 27459
Fax: (02) 505-4265

Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge, Middx UB9 5HP
England
Phone: 0895-835050
Telex: 266195
Fax: 0895 835260/1/2

Dataquest West Germany
In der Schneithohl 17
6242 Kronberg 2
West Germany
Phone: 06173/61685
Telex: 418089
Fax: 06173/67901

Ledgeway Group, Inc.
430 Bedford Street
Suite 340
Lexington, MA 02173
Phone: (617) 862-8500
Fax: (617) 862-8207

Dataquest

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The Dun & Bradstreet Corporation

A Decade of Semiconductor Start-Ups

Third Edition

A Strategic Analysis Report

Dataquest

A Decade of Semiconductor Start-Ups
Third Edition

Technology Products Group

Published by Dataquest Incorporated

Table of Contents

Table of Contents (Continued)

List of Tables

List of Tables (Continued)

List of Figures

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A Decade of Semiconductor Start-Ups

Introduction

During the last ten years, there has been an explosion of new activity in the semiconductor industry. Dataquest has identified 170 start-ups formed between 1979 and 1989. These start-ups are developing new niche markets and technologies that did not exist only a few years ago. Several new companies already have become $100 million operations. In the 1990s, some may well become $1 billion companies. Although several start-ups have failed, the ranks were quickly replenished by a host of newcomers. As new technologies and applications emerge, Dataquest expects to see many more start-ups in Europe, Asia, and the United States by the year 2000.

Dataquest believes that it is crucial to watch these swiftly moving start-ups—the industry's barometers of change—because they represent emerging new technologies, markets, and applications.

For our client's convenience, Dataquest has prepared *A Decade of Semiconductor Start-Ups—Third Edition*, a compendium of information about these start-ups. The information contained in this directory was gathered through surveys, telephone interviews, and publicly available material. Some of the text was integrated directly from background information provided by the companies. This report, updated regularly, provides the following information:

- Historical trends in start-up activity
- Key factors of successful start-ups
- Venture capital financing information
- Strategic alliances
- Technology trends (memory, microprocessors, digital signal processing (DSP), application-specific ICs (ASICs), GaAs, linear/analog, and others as they emerge)
- Company profiles

Definition of a Start-Up

Dataquest defines a start-up as a semiconductor manufacturer that designs and ships finished products in the merchant or captive sectors; they need not have in-house wafer fabrication facilities. Because of the high cost of state-of-the-art plants and equipment, we observe that most start-ups use silicon foundries to reduce up-front costs. The start-up completes the circuit designs, sends the masks to foundries for fabrication, and may or may not complete packaging in-house. Most start-ups conduct in-house testing.

Because a company must first ship a product to be considered a start-up, Dataquest does not include design houses in its definition of a start-up. However, Dataquest does include captive manufacturers under the start-up title, provided they have begun operations during the past 10 years. We also consider semiconductor operations of large corporations to be start-up activities if the corporation was not previously involved in semiconductor activity.

For purposes of this directory, a start-up's age will not exceed 10 years. After a company is 10 years old, Dataquest no longer considers it a start-up, and the company is dropped from the book. Also, many of the companies profiled in previous editions have become highly successful operations. For this reason, we have created the concept of the graduate—a company that has become too large to be considered a start-up. To become a graduate, a company must exceed $100 million in revenue *twice* in its lifetime. A list of graduates is shown in Table 2c.

Historical Trends

The semiconductor industry is a vibrant industry that has gone through numerous business cycles and technology developments during its 30-year history. Dataquest observes that the industry has had the following six distinct phases since the early 1950s:

- Establishment of the industry under Bell Labs and Schockley Transistor (1947 to 1957)
- Domination by Fairchild, National Semiconductor, Raytheon, Signetics, and other early start-ups (1957 to 1967)
- A boom in start-up companies such as AMD, Intel, and MMI that offered NMOS standard products (1968 to 1974)
- Consolidation of the industry through mergers and acquisitions (1975 to 1979)
- A boom in ASIC start-ups in 1982 and 1983; high-performance CMOS and GaAs start-ups in 1984; and HCMOS, DSP, ASICs, PC chip sets, and telecommunications IC start-ups (1985 to 1988)
- A second consolidation of the industry through mergers, acquisitions, and fab agreements

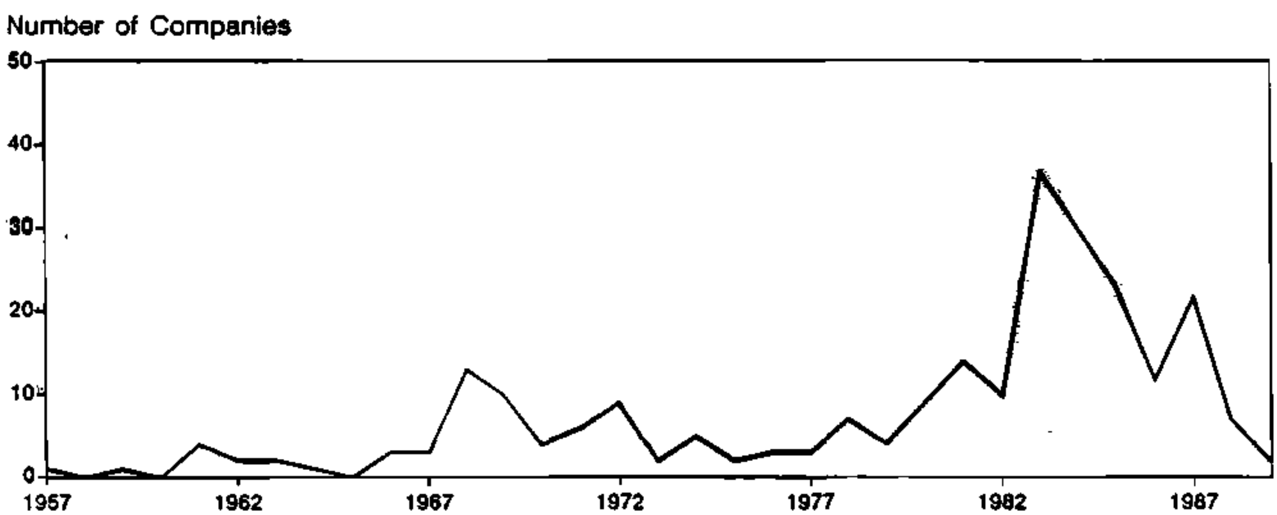
As shown in Figure 1, there have been three waves of semiconductor start-ups, each triggered by new process technologies. During the mid-1950s, companies such as Fairchild, Schockley Transistors, and Texas Instruments, all specializing in transistors and PMOS technology, rose to prominence. In the late 1960s, AMD, Intel, National, and others introduced NMOS technology. Since the late 1970s, a third wave of start-ups has developed next-generation technologies such as high-performance CMOS and GaAs processes; gate arrays, standard cells and silicon compilers for IC design; DSP, power transistors, and graphics and telecommunications ICs.

Historically, Dataquest has observed the following major trends in semiconductor start-up activity:

- A 12- to 15-year period between waves of start-ups, suggesting a technology life cycle that takes this amount of time to progress from initial research to commercialization and then to a gradual decline
- Technological and market leadership by key start-ups within a decade of existence
- Consolidation, acquisition, and a shakeout of start-ups following each peak of start-up activity
- A rapid loss of market share among older companies that are unable to compete with start-ups in emerging technologies
- Successively larger waves of start-up companies and increasing competition

Figure 1

Start-Up Activity by Year (1957-1989)



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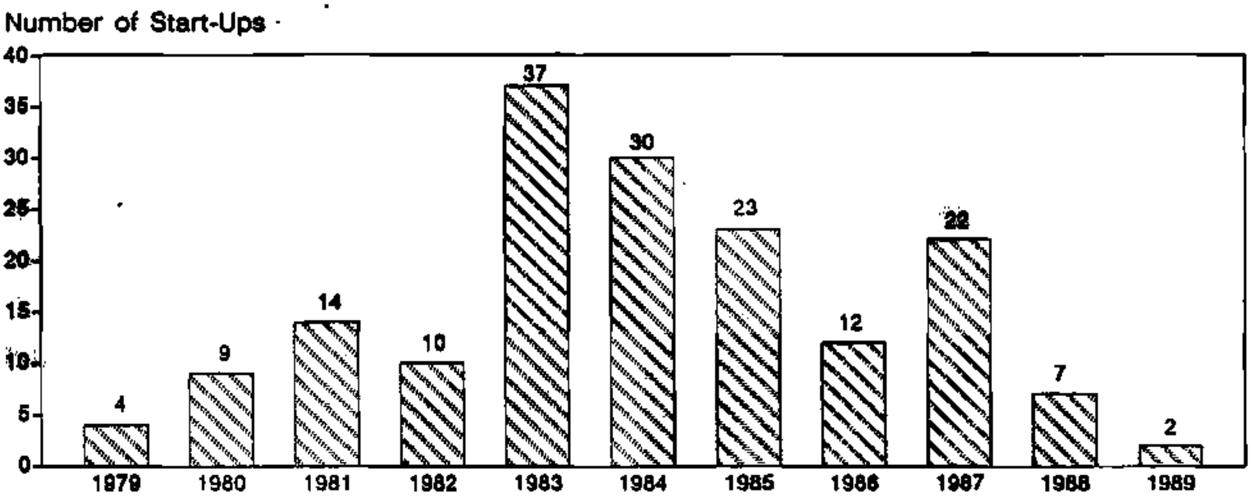
Source: Dataquest
January 1990

Figure 2

Semiconductor Start-Ups by Year
1979-1989



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Source: Dataquest
January 1990

- An emphasis on niche market strategies involving proprietary designs, CAD software, and excellent service

- Dispersion of start-up activity outside Silicon Valley due to the growing role of noncomputer applications, venture capital newcomers, and foreign government sponsorship

The latest wave of start-ups, which peaked in 1983, gradually is slowing down as existing start-ups commercialize their products and seek new rounds of financing. Figure 2 shows start-up activity for the 1979 through 1989 period. After a slow year in 1986, 1987 was strong, with the introduction of 22 new companies. Although the figures for 1988 have not been finalized, it appears at this time that 1988 will be a slower year than 1987 in terms of the number of start-ups. Dataquest believes that the industry has entered another phase of consolidations, mergers, and failures. This market shakeout occurs as niche markets become crowded and companies search for new directions in technology, products, and applications. In the mid-to-late 1990s, however, we anticipate a fourth wave of start-ups that will be involved with GaAs, optoelectronics, artificial intelligence (AI), parallel processors, three-dimensional ICs, voice recognition and synthesis, bioelectronics, and other emerging fields. These start-ups will become the major technology drivers as we enter the 21st century.

Start-Up Activity, 1988 and 1989

In 1988 and 1989, start-up activity in the semiconductor industry fell off quite substantially. In 1988, Cypress Semiconductor developed another satellite, Multichip Technology, which specializes in multichip memory modules. In 1989, Video Seven and G-2, two affiliates of LSI Logic, merged to form Headland Technology. Also in 1989, two executives from Chips and Technologies left to form S3, Inc., which will specialize in silicon subsystems. Overall, Dataquest identified only seven start-ups in 1988 and two so far in 1989. Because Dataquest does not identify a company as a viable entity until significant financing is secured or until a product is introduced, it is likely that the number of start-ups for 1988 and 1989 will increase as more companies meet Dataquest's definition of a start-up.

One of the main reasons for the decline in start-up activity is the lack of venture funding available for semiconductor start-ups. Beginning in 1987, the venture capital community has become increasingly disenchanted with the semiconductor industry. It is becoming extremely difficult for a new company to secure the venture financing necessary to bring a product to market. Without venture funding, many start-ups never get off the ground.

In addition, many of the niches that start-ups have recently pursued are becoming quite crowded. The markets for ASICs and fast SRAMs are especially so; start-up fatality rates are rising and entry rates are falling as a consequence. Start-ups, therefore, currently are searching for new niches to inhabit, and Dataquest expects start-up activity to be limited until a market with significant growth potential is uncovered.

Tables 1a through 1k list start-up activity by year.

Table 1a

Start-Up Activity by Year—1989 (2)

Company	Location	Product
Headland Technologies, Inc.	Fremont, CA	Micros
S3, Inc.	Santa Clara, CA	Micros

Source: Dataquest
January 1990

Table 1b

Start-Up Activity by Year—1988 (7)

Company	Location	Product
Advanced Hardware Architectures	Moscow, ID	Micros
ISSI	Sunnyvale, CA	Memory
Multichip Technology	San Jose, CA	Memory
Plus Logic	San Jose, CA	ASICs
Power Integrations	Mt. View, CA	Analog
The DSP Group	Emeryville, CA	DSP
TranSwitch	Shelton, CT	Telecom

Source: Dataquest
January 1990

Table 1c

Start-Up Activity by Year—1987 (22)

Company	Location	Product
ACC Microelectronics	Santa Clara, CA	Micros
Aspen Semiconductor	San Jose, CA	Memory, ASICs
Chartered Semiconductor	Singapore	ASICs, foundry
Cree Research	Durham, NC	Discretes
Genesis Microchip	Canada	ASICs
G-2 Incorporated (Merged into Headland)	Milpitas, CA	Micros
Hualon Micro-Electronics Corp.	Taiwan	Analog, ASICs, micros, telecom
Integrated Information Technology	Santa Clara, CA	Micros

(Continued)

Table 1c (Continued)

Start-Up Activity by Year—1987 (22)

Company	Location	Product
Intergraph Adv. Processor Div.	Palo Alto, CA	Micros
Linear Integrated Systems	Fremont, CA	Analog
MOSPEC Semiconductor	Taiwan	Discretes, foundry
nCHIP	San Jose, CA	Multichip modules
Oak Technology	Sunnyvale, CA	Micros
Oxford Computer	Oxford, CT	Memory
Paradigm Technology (formerly GL Micro Devices)	San Jose, CA	Memory
Photonic Integration Research	Columbus, OH	Opto
RAMAX	Australia	Memory
SIMTEK Corp.	Colorado Springs	Memory
Synergy Semiconductor	Santa Clara, CA	Memory
Togai InfraLogic	Irvine, CA	Fuzzy logic
US2	San Jose, CA	ASICs
VIA Technologies, Inc. (Formerly LOGICSTAR)	Fremont, CA	Micros

Source: Dataquest
January 1990

Table 1d

Start-Up Activity by Year—1986 (12)

Company	Location	Product
Advanced Microelectronic Products	San Jose, CA	Discretes
BKC International Electronics	Lawrence, MA	Discretes
Gazelle Microcircuits	Santa Clara, CA	GaAs
HNC, Inc.	San Diego, CA	Neural networks
Innovative Silicon Technology	Carrollton, TX	ASICs
MemTech Technology Corp.	Santa Clara, CA	Bubble memory
PLX Technology Corp.	Mt. View, CA	ASICs
Powerex, Inc.	Youngwood, PA	Discretes
Synaptics, Inc.	San Jose, CA	Neural networks
TSMC	Taiwan	Foundry
Telcom Devices Corp.	Newbury Park, CA	GaAs
Triad Semiconductors	Colorado Springs, CO	Memory

Source: Dataquest
January 1990

Table 1e

Start-Up Activity by Year—1985 (23)

Company	Location	Product
ABM Semiconductor[1]	San Jose, CA	GaAs opto
Actel Corp.	Sunnyvale, CA	ASICs
Acumos	San Jose, CA	ASICs
Advanced Linear	Sunnyvale, CA	Linear
Alliance Semiconductor	San Jose, CA	Memory
ANADIGICS	Warren, NJ	GaAs analog and digital
Catalyst Semiconductor	Santa Clara, CA	Memory
Chips & Technologies[2]	San Jose, CA	Micros
Dolphin Integration	France	ASICs
ES2	West Germany	ASICs
GAIN Electronics[1]	Somerville, NJ	GaAs ASICs
Hittite Microwave	Woburn, MA	GaAs MMICs
Intercept[1]	Sunnyvale, CA	ASICs
Krysalis[3]	Sunnyvale, CA	Ferroelectric memory
Level One Communications	Folsom, CA	Telecom
NovaSensor	Fremont, CA	IC sensors
Orbit Semiconductor	Sunnyvale, CA	Foundry
Sahni[4]	Sunnyvale, CA	ASICs
Saratoga Semiconductor[5]	Cupertino, CA	BiCMOS memory
Tachonics[1]	Plainsboro, NJ	GaAs
Three-Five Systems	Phoenix, AZ	GaAs opto
Topaz Semiconductor	San Jose, CA	Discrete, linear
Wolfson Microelectronics	Scotland	ASICs, DSP

[1]Inactive
[2]Graduate
[3]Acquired
[4]Closed
[5]Chapter 11

Source: Dataquest
January 1990

Table 1f

Start-Up Activity by Year—1984 (30)

Company	Location	Product
Advanced Power Technology	Bend, OR	Power MOSFETs
ATMEL	San Jose, CA	ASICs, memory, linear
Austek Microsystems	Australia	Micros
Celeritek	San Jose, CA	GaAs FETs, MMICs
Cirrus Logic	Milpitas, CA	Micros
Crystal Semiconductor	Austin, TX	Linear
Custom Arrays	Sunnyvale, CA	ASICs
Dallas Semiconductor	Dallas, TX	Memory, linear, micros
Edsun Laboratories	Waltham, MA	Micros
Epitaxx Inc.	Princeton, NJ	GaAs opto
Integrated CMOS Systems	Sunnyvale, CA	ASICs

(Continued)

Table 1f (Continued)

Start-Up Activity by Year—1984 (30)

Company	Location	Product
Integrated Power Semi[1]	Scotland	Linear
Lytel	Somerville, NJ	GaAs opto
Molecular Electronics	Torrance, CA	Bioelectronics
NMB Semiconductor	Chatsworth, CA	Memory, foundry
NSI Logic	Marlboro, MA	Micros
Novix	Cupertino, CA	Micros
Pacific Monolithics	Sunnyvale, CA	GaAs MMICs
Performance	Sunnyvale, CA	Memory, micros, logic
PromTech	San Jose, CA	Memory
Quasel Taiwan[2]	Taiwan	Memory
Ramtron	Colorado Springs, CO	Ferroelectric memory
SID Microelectronics	Brazil	Discretes, linear
Silicon Macrosystems[1]	San Jose, CA	Memory
TMMIC[3]	Mt. View, CA	GaAs MMIC
TriQuint Semiconductor	Beaverton, OR	GaAs analog/digital
Vitesse Semiconductor	Camarillo, CA	GaAs digital, foundry
VTC	Bloomington, MN	Linear, ASICs, foundry
Wafer Technology[4]	Rancho Palos Verdes, CA	Logic
Xilinx	San Jose, CA	ASICs

[1]Acquired
[2]Hybrid
[3]Removed
[4]Closed

Source: Dataquest
January 1990

Table 1g

Start-Up Activity by Year—1983 (37)

Company	Location	Product
Altera	Santa Clara, CA	ASICs
Asahi Kasei Microsystems	Japan	ASICs, linear, micros, memory
BIT	Beaverton, OR	DSP
Brooktree	San Diego, CA	Linear
Calmos Systems	Canada	ASICs, DSP, linear, memory
Calogic	Fremont, CA	Linear, ASICs
Custom Silicon	Lowell, MA	ASICs
Cypress Semiconductor[1]	San Jose, CA	Memory, ASICs, DSP
Elantec	Milpitas, CA	Linear
Electronic Technology	Ames, IA	ASICs
Exel Microelectronics	San Jose, CA	Memory, micros, ASICs
Hyundai America[2]	Santa Clara, CA	Memory
iLSi	Colorado Springs, CO	ASICs
ICT	San Jose, CA	Memory, ASICs
Inova	Santa Clara, CA	Memory

(Continued)

Table 1g (Continued)

Start-Up Activity by Year—1983 (37)

Company	Location	Product
Iridian[2]	Chatsworth, CA	GaAs FETs
IXYS	San Jose, CA	Power FETs, ICs
Laserpath[2]	Sunnyvale, CA	ASICs
Lattice Semiconductor	Hillsboro, OR	ASICs
Logic Devices	Sunnyvale, CA	Memory, DSP, micros
Maxim Integrated Products	Sunnyvale, CA	Linear
Micro Linear	San Jose, CA	ASICs, linear
Mietec N.V.	Belgium	ASICs
Modular Semiconductor	Santa Clara, CA	Memory, micros
MOS Electronics	Sunnyvale, CA	Memory
Opto Tech	Taiwan	GaAs opto
Samsung Semiconductor	San Jose, CA	Linear, discretes, logic, memory
Seattle Silicon	Bellevue, WA	ASICs
Sierra Semiconductor	San Jose, CA	ASICs, memory, micros, linear
S-MOS Systems[1]	San Jose, CA	Memory, micros, ASICs, linear
Texet[2]	Allen, TX	Discretes
Vadem	San Jose, CA	Micros
Vatic[3]	Mesa, AZ	ASICs
Visic[4]	San Jose, CA	Memory
Vitelic	San Jose, CA	Memory
WaferScale Integration	Fremont, CA	Memory, ASICs, micros
Zoran	Santa Clara, CA	DSP

[1]Graduate
[2]Closed
[3]Merged
[4]Acquired

Source: Dataquest
January 1990

Table 1h

Start-Up Activity by Year—1982 (10)

Company	Location	Product
Array Devices[1]	San Diego, CA	ASICs
Custom MOS Arrays[2]	Milpitas, CA	ASICs
IC Sensors	Milpitas, CA	Pressure sensors
ICI Array Technology	San Jose, CA	ASICs
Isocom	England	Opto
Microwave Monolithics	Simi Valley, CA	GaAs MMICs
Microwave Technology	Fremont, CA	GaAs FETs, MMICs
Sensym	Sunnyvale, CA	IC sensors
Solid State Optronics	San Jose, CA	Opto
XTAR	San Diego, CA	Micros

[1]Closed
[2]Merged

Source: Dataquest
January 1990

Table 1i

Start-Up Activity by Year—1981 (14)

Company	Location	Product
Adaptec	Milpitas, CA	Micros
Barvon Research[1]	Milpitas, CA	ASICs
GigaBit Logic	Newbury Park, CA	GaAs ASICs, logic, memory
IMP	San Jose, CA	ASICs
LTC	Milpitas, CA	Linear
LSI Logic[2]	Milpitas, CA	ASICs, DSP, micros
Opto Diode	Newbury Park, CA	GaAs LEDs
Panatech Semi[1]	Santa Clara, CA	ASICs
SEEQ Technology	San Jose, CA	Memory, micros
Signal Processor[1]	Salt Lake City, UT	DSP
Silicon Systems[1]	Tustin, CA	Linear, micros
Telmos[3]	Sunnyvale, CA	ASICs, linear, opto
Weitek	Sunnyvale, CA	DSP
Zytrex[3]	Sunnyvale, CA	Memory, logic

[1]Acquired
[2]Graduate
[3]Closed

Source: Dataquest
January 1990

Table 1j

Start-Up Activity by Year—1980 (9)

Company	Location	Product
California Micro Devices	Milpitas, CA	ASICs, linear
Comlinear	Ft. Collins, CO	Analog
Harris Microwave Semiconductor	Milpitas, CA	GaAs FETs, MMICs
IDT[1]	Santa Clara, CA	Memory, logic, DSP, micros
Kyoto Semiconductor	Japan	Optoelectronics
Si-Fab	Scotts Valley, CA	Foundry
Spectrum Microdevices	Frederick, MD	ASICs
Trilogy[2]	Cupertino, CA	Waferscale integration
VLSI Design Assoc.[3]	Campbell, CA	Micros

[1]Graduate
[2]Sold semiconductor operations
[3]Now Avasem

Source: Dataquest
January 1990

Table 1k

Start-Up Activity by Year—1979 (4)

Company	Location	Product
AMCC	San Diego, CA	ASICs
Matra-Harris	France	ASICs, memory, micros
United Microelectronics	Taiwan	Linear, micros, memory, foundry
VLSI Technology[1]	San Jose, CA	ASICs, memory, micros

[1]Graduate

Source: Dataquest January 1990

The Driving Factors

Why was there such a strong surge in semiconductor start-up activity in the late 1970s and early 1980s? Semiconductor start-ups faced increasingly expensive plant and equipment costs, growing competition from Asia, and a depressed market in 1981 and 1982. Yet a record number of semiconductor companies were started in 1983. Dataquest believes that the following factors drove this explosion of activity:

- The infusion of venture capital
- The strong start-up activity in computers, telecommunications, design workstations, and consumer electronics, all of which required state-of-the-art ICs
- The proliferation of specialized market niches that required fast turnaround times
- A growing number of experienced engineers and managers frustrated by the sluggishness of innovation within larger companies
- More user-friendly CAD systems and support software
- Worldwide fabrication facility overcapacity and silicon foundries that allowed start-up companies to defer fabrication investments
- The entry of U.S., Japanese, South Korean, and Taiwanese companies with sizeable financing
- The growing demand for higher-performance ICs with reduced power consumption (i.e., CMOS)

During the early 1980s, Dataquest observed a mismatch between U.S. and foreign vendors that specialized in NMOS processes and the growing demand for CMOS ASICs, memory, logic devices, and other new products. Start-ups were quickly able to fill these market gaps by emphasizing advanced process technologies, design, and focused marketing.

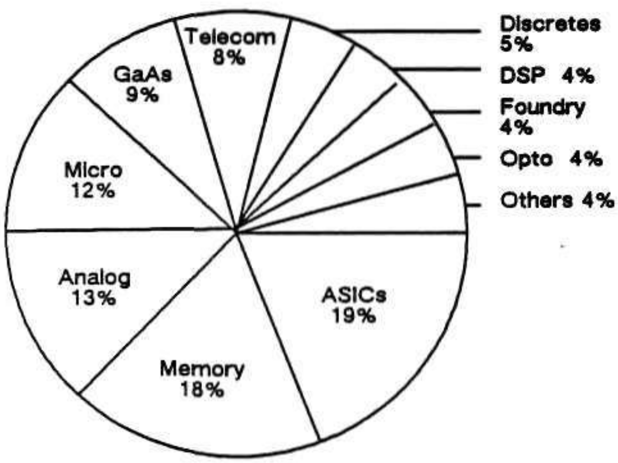
The Third Wave

The third wave of start-ups differs from previous start-up generations because of the sheer variety and number of companies, which makes generalizations difficult. However, Dataquest notes that the following several trends may have a major impact on the industry:

- More start-ups are being located outside Silicon Valley, especially in the Southwest and East Coast of the United States, and in Europe.
- Increasingly, start-ups are using silicon foundries as an alternative to building their own fabs, which shortens time to market and allows these companies the opportunity to focus on IC design, product development, and marketing.
- Increasingly, Asian silicon foundries are being used because of their high-quality wafers and an apparent lack of interest among U.S. vendors to compete.
- Numerous strategic alliances are occurring between start-ups and Asian companies to develop, manufacture, market, and distribute products jointly.

Figure 3

Semiconductor Start-Up Product Lines



0005344-3

Source: Dataquest January 1990

- More corporate investors and government backers throughout the world are participating in start-ups.
- Most start-ups have chosen to be niche players, where profit margins tend to be higher; and most are concentrated in fast-growing markets, such as ASICs, microcomponents (especially microperipherals), and telecommunications.

The third wave of start-up companies offers a wide variety of products, as shown in Figure 3. Application-specific ICs (ASICs) and high-performance CMOS memory and logic are attracting most of the attention. The microcomponent segment has grown substantially during the past two years; it currently represents 12 percent of semiconductor start-up product lines.

One of the fastest-growing product areas is the PC peripheral chip set market. The market for logic chip sets has attracted a host of new entrants in 1988 and 1989 and is approaching the saturation point. Dataquest expects a similar growth pattern in the other peripheral chip set markets (e.g., graphics, communication, mass storage, modem, and fax). Dataquest also expects significant growth in the market for telecommunications ICs.

Dataquest has recognized very little growth in the GaAs market segment. Two companies, GAIN Electronics and Tachonics, have failed, and we have not identified any new GaAs start-ups. The technology still is in its developmental stages, and it may be quite some time before it gains wide acceptance.

Keys to Success

The third wave of start-ups share many common characteristics. In general, the more successful companies tend to be as follows:

- Highly focused, flexible, and able to move quickly out of stagnant markets and into high-growth markets
- Willing to develop new markets and educate users about their products and design services
- Positioned at the leading edge because of their advanced process technologies and proprietary CAD software
- Resourceful in attracting venture capital from U.S. and foreign venture capitalists, corporate investors, and OEMs
- Aggressive in building strategic alliances to develop new applications jointly and secure wafer fab capacity, especially in Asia

Of course, not all recent start-ups fit this profile. Some companies are failing and are being acquired because of faulty management, weak finances, or poor product planning and marketing. Table 2a lists the companies that are no longer operating or have filed for Chapter 11 protection. Table 2b lists those companies that have been acquired by or merged with another company. Table 2c is a list of companies that have graduated from start-up status by achieving $100 million in annual sales twice in their lifetimes.

Table 2a

Companies That Are No Longer Operating

Company	Year Formed	Location	Product
ABM	1985	San Jose, CA	GaAs opto
Array Devices	1982	San Diego, CA	ASICs
GAIN Electronics	1985	Somerville, NJ	GaAs ASICs
Hyundai America	1983	Santa Clara, CA	Memory
Intercept Microelectronics	1985	Sunnyvale, CA	ASICs
Iridian	1983	Chatsworth, CA	GaAs FETs
Laserpath	1983	Sunnyvale, CA	ASICs
Sahni	1985	Sunnyvale, CA	ASICs
Saratoga Semiconductor	1985	Cupertino, CA	BiCMOS memory
Tachonics	1985	Plainsboro, NJ	GaAs
Telmos	1981	Sunnyvale, CA	ASICs, linear
Texet	1983	Allen, TX	Discretes
Trilogy	1980	Cupertino, CA	Waferscale
Wafer Tech	1984	Rancho Palos Verdes, CA	Logic
Zytrex	1981	Sunnyvale, CA	CMOS logic

Source: Dataquest
January 1990

Table 2b

Companies That Have Been Acquired or Merged

Company/Year Formed	Product	Acquired by	Year Acquired
Barvon Research (1981)	ASICs	Sipex	1988
Custom MOS Arrays (1982)	ASICs	CMD	1986
Exel Microelectronic (1983)	Memory, micros, ASICs	Exar	1986
G-2 Incorporated (1987)	Micros	Headland	1989
Integrated Power Semiconductor (1984)	Linear	Seagate	1987
Krysalis (1985)	NV memory	National	1989
Panatech (1981)	ASICs	Ricoh	1987
Signal Processor (1981)	DSP	Analog Devices	1983
Silicon Macrosystems (1984)	Memory	Austek	1986
Silicon Systems (1981)	Micros	TDK	1989
Vatic (1983)	ASICs	Thomson-Mostek	1986
Visic (1983)	Memory	VLSI Technology	1986
VTC (1984)	Linear, ASICs, foundry	Control Data	1987

Source: Dataquest
January 1990

Table 2c

Companies That Have "Graduated" from Start-Up Status

Company	Year Formed	Location	Product
Chips & Technologies	1985	San Jose, CA	Micros
Cypress Semiconductor	1983	San Jose, CA	Memory, ASICs, DSP
IDT	1980	Santa Clara, CA	Memory, logic, DSP, micros
LSI Logic	1981	Milpitas, CA	ASICs, DSP, micros
S-MOS Systems, Inc.	1983	San Jose, CA	Memory, micros, ASICs, linear
VLSI Technology	1979	San Jose, CA	ASICs, memory, micros

Source: Dataquest
January 1990

Table 3

Geographic Dispersion of Start-Up Companies

Silicon Valley	75
Southwest United States	21
Northwest United States	7
Midwest United States	3
Northeast United States	11
Southeast United States	2
ROW	18
Total	137

Source: Dataquest
January 1990

Geographic Dispersion of Start-Up Companies

Silicon Valley still leads with the number of semiconductor start-ups, but other areas are beginning to attract more start-ups. As shown in Table 3, 75 of the 137 companies identified in this book are located in Silicon Valley. This figure translates to 55 percent of these start-ups. In recent years, Dataquest has noticed a trend toward location outside Silicon Valley due to the increased availability of local financing and government support. Figure 4 shows the geographic concentration of start-ups in the United States.

Dataquest anticipates more worldwide start-up activity due to growing public and private interest in promoting venture capitalism and entrepreneurialism. In the future, we expect the following regions to become increasingly active:

- The East Coast of the United States, especially New Jersey ("Gallium Gulch"), Maryland ("Bioelectronics Center"), and North Carolina ("Research Triangle")
- The Southwest United States, especially Austin and Dallas, Texas
- Europe, especially Scotland, West Germany, and France
- Israel
- Asia, especially Taiwan, China, Singapore, Malaysia, and India

By the year 2000, we expect to see a semiconductor industry that is not so concentrated in existing areas, but is much more global in scope. The trend toward closer vendor/user ties will accelerate this global shift. Because of the grass roots nature of start-ups, they will have a significant impact on the direction of regional industries and economies.

Tables 4a through 4g list start-up companies by location and region.

Figure 4

Geographic Concentration of Start-Up Activity

0005344-4

Source: Dataquest
January 1990

Table 4a

Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
ACC Microelectronics	Santa Clara	1987
Actel Corp.	Sunnyvale	1985
Acumos	San Carlos	1985
Adaptec	Milpitas	1981
Advanced Linear Devices	Sunnyvale	1985
Advanced Microelectronic Products	San Jose	1986
Alliance Semiconductor	San Jose	1985
Altera Corporation	Santa Clara	1983
Aspen Semiconductors	San Jose	1987
ATMEL Corporation	San Jose	1984
Avasem Corporation	San Jose	1980
California Micro Devices	Milpitas	1980
Calogic Corp.	Fremont	1983
Catalyst Semiconductor	Santa Clara	1985
Celeritek	San Jose	1984
Cirrus Logic	Milpitas	1981
Custom Arrays Corp.	Sunnyvale	1984
The DSP Group	Emeryville	1988
Elantec	Milpitas	1983
Exel Microelectronics	San Jose	1983
Gazelle Microcircuits	Santa Clara	1986
Harris Microwave Semiconductor	Milpitas	1980
Headland Technologies, Inc.	Fremont	1989
IC Sensors	Milpitas	1982
ICI Array Technology	San Jose	1982
Inova Microelectronics Corp.	Santa Clara	1983
Integrated CMOS Systems	Sunnyvale	1984
Integrated Information Technology	Santa Clara	1987
Intergraph—Adv. Processor Div.	Palo Alto	1987
International CMOS Technology	San Jose	1983
IMP	San Jose	1981
Isocom Ltd.	Campbell	1982
ISSI	Sunnyvale	1988
IXYS Corp.	San Jose	1983
Krysalis Corp.	Sunnyvale	1985
Linear Integrated Systems	Fremont	1987
Linear Technology Corp.	Milpitas	1981
Logic Devices Inc.	Sunnyvale	1983
Maxim Integrated Products	Sunnyvale	1983
MemTech Technology Corp.	Santa Clara	1986
Micro Linear Corp.	San Jose	1983
Microwave Technology, Inc.	Fremont	1982
Modular Semiconductor	Sunnyvale	1983
MOS Electronics Corp.	Sunnyvale	1983
Multichip Technology	San Jose	1988
nCHIP, Inc.	San Jose	1987
NovaSensor	Fremont	1985
Novix	Cupertino	1984
Oak Technology, Inc.	Sunnyvale	1987

(Continued)

Table 4a (Continued)

Start-Ups in Silicon Valley (75)

Company	Location	Date Formed
Orbit Semiconductor	Sunnyvale	1985
Pacific Monolithics	Sunnyvale	1984
Paradigm Technology	San Jose	1987
Performance Semiconductor	Sunnyvale	1984
Plus Logic	San Jose	1988
PLX Technology Corp.	Mountain View	1986
Power Integrations	Mountain View	1988
PromTech	San Jose	1984
Samsung Semiconductor, Inc.	San Jose	1983
SEEQ Technology, Inc.	San Jose	1981
Sierra Semiconductor	San Jose	1984
Si-Fab Corp.	Scotts Valley	1981
Sensym, Inc.	Sunnyvale	1982
Solid State Optronics	San Jose	1982
S3	Santa Clara	1989
Synaptics, Inc.	San Jose	1986
Synergy Semiconductor Corp.	Santa Clara	1987
Topaz Semiconductor	San Jose	1985
US2	San Jose	1987
Vadem	San Jose	1983
VIA Technologies	Fremont	1987
Vitelic Corp.	San Jose	1983
WaferScale Integration	Fremont	1983
Weitek Corp.	Sunnyvale	1980
Xilinx Inc.	San Jose	1984
Zoran Corp.	Santa Clara	1983

Source: Dataquest
January 1990

Table 4b

Start-Ups in the Southwest (21)

Company	Location	Date Formed
AMCC	San Diego, CA	1979
Brooktree Corp.	San Diego, CA	1983
Comlinear Corp	Ft. Collins, CO	1980
Crystal Semiconductor	Austin, TX	1984
Dallas Semiconductor	Dallas, TX	1984
GigaBit Logic	Newbury Park, CA	1981
HNC	San Diego, CA	1986
Innovative Silicon Technology	Carrollton, TX	1986
Integrated Logic Systems	Colorado Springs, CO	1983
Microwave Monolithics	Simi Valley, CA	1982
Molecular Electronics Corp.	Torrance, CA	1984
NMB Technologies	Chatsworth, CA	1984

(Continued)

Table 4b (Continued)

Start-Ups in the Southwest (21)

Company	Location	Date Formed
Opto Diode Corp.	Newbury Park, CA	1981
Ramtron Corp.	Colorado Springs, CO	1984
SIMTEK Corp.	Colorado Springs, CO	1987
Telcom Devices Corp.	Newbury Park, CA	1986
Three-Five Systems, Inc.	Phoenix, AZ	1985
Togai InfraLogic	Irvine, CA	1987
Triad Semiconductors	Colorado Springs, CO	1986
Vitesse Semiconductor	Camarillo, CA	1984
XTAR Corp.	San Diego, CA	1982

Source: Dataquest
January 1990

Table 4c

Start-Ups in the Northwest (7)

Company	Location	Date Formed
Advanced Hardware Architectures	Moscow, ID	1988
Advanced Power Technology, Inc.	Bend, OR	1984
Bipolar Integrated Technology	Beaverton, OR	1983
Lattice Semiconductor	Hillsboro, OR	1983
Level One Communications	Folsom, CA	1985
Seattle Silicon Corp.	Bellevue, WA	1983
TriQuint Semiconductor	Beaverton, OR	1984

Source: Dataquest
January 1990

Table 4d

Start-Ups in the Midwest (3)

Company	Location	Date Formed
Electronic Technology Corp.	Ames, IA	1983
Photonic Integration Research	Columbus, OH	1987
VTC Inc.	Bloomington, MN	1984

Source: Dataquest
January 1990

Table 4e

Start-Ups in the Northeast (11)

Company	Location	Date Formed
ANADIGICS	Warren, NJ	1985
BKC International	Lawrence, MA	1986
Custom Silicon	Lowell, MA	1983
Edsun Laboratories	Waltham, MA	1984
Epitaxx Inc.	Princeton, NJ	1984
Hittite Microwave Corp.	Woburn, MA	1985
Lytel	Somerville, NJ	1984
NSI Logic	Marlboro, MA	1984
Oxford Computer	Oxford, CT	1987
Powerex	Youngwood, PA	1986
TranSwitch	Shelton, CT	1988

Source: Dataquest
January 1990

Table 4f

Start-Ups in the Southeast (2)

Company	Location	Date Formed
Cree Research	Durham, NC	1987
Spectrum Microdevices	Frederick, MD	1980

Source: Dataquest
January 1990

Table 4g

Start-Ups in the ROW Region (18)

Company	Location	Date Formed
Asahi Kasei Microsystems	Japan	1983
Austek Microsystems	Australia	1984
Calmos Systems	Canada	1983
Chartered Semiconductor	Singapore	1987
Dolphin Integration	France	1985
European Silicon Structures	West Germany	1985
Genesis Microchip	Canada	1987
Hualon Micro-Electronics Corp.	Taiwan	1987
Kyoto Semiconductor Corp.	Japan	1980
Matra-Harris Semiconducteur	France	1979
Mietec N.V.	Belgium	1983
MOSPEC Semiconductor Corp.	Taiwan	1987
Opto Tech Corp.	Taiwan	1983
RAMAX Ltd.	Australia	1987
SID Microelectronics	Brazil	1984
TSMC	Taiwan	1986
UMC	Japan	1979
Wolfson Microelectronics Ltd.	Scotland	1985

Source: Dataquest
January 1990

Success Factors

As competition intensifies in the semiconductor industry, building a successful start-up company will become increasingly difficult. What are the key factors that will distinguish the winners from the losers? Based on the track records of existing companies and our discussions with venture capitalists, Dataquest believes that the following factors are critical:

- Management
  - A strong management team, top-notch engineers, and excellent marketing managers
  - A unique business strategy with achievable goals including a clear definition of a customer's problem to be solved, rather than technology looking for an application
  - A stable source of financing that will allow sustained operation for five to eight years—maybe longer in a new market
- Product Development
  - Access to leading-edge processing expertise
  - Access to quality CAD software and support tools
  - Close relations with customer base
- Manufacturing
  - An experienced operations manager and strong in-house manufacturing knowledge
  - A silicon foundry agreement during initial years
  - A plan to ensure access to a state-of-the-art wafer fabrication facility
- Marketing
  - Global marketing perspective
  - Highly focused marketing plan
  - Asia monitoring capability (especially Japan)
  - A plan for overseas sales, marketing, and distribution agreements in the second or third year of production

Absolutely critical for success is the building of a strong management team. Successful new companies are those that attract talented and experienced personnel to fill positions in key areas including development, manufacturing, and international operations. Companies with only one or two of these positions filled with first-rate managers usually have trouble during the product commercialization phase. In general, the start-ups most likely to fail are those that are strong in technology but weak in marketing, manufacturing, and general management. Many companies are built around engineers who do not have the breadth of management and marketing experience required to run a company successfully.

The lack of marketing intelligence is another common pitfall. Most start-ups concentrate on the U.S. market and ignore overseas markets until they attain a certain sales volume. Unfortunately, these companies overlook significant sales opportunities and emerging foreign competitors. Dataquest believes that a global posture is critical for start-up companies, especially with the growing competition from European and Asian companies.

In evaluating start-up companies, we believe the following questions should be asked:

- What are the prior achievements of key officers and managers?
- Is the product line unique or a significant improvement over its competitors? Is it diversified enough to withstand fierce price competition?
- How much does the start-up invest in R&D?
- Does the start-up have plans to conduct joint research with universities and strategic partners?
- What is the start-up's marketing strategy? Is it domestic only or a global strategy?
- Is the start-up planning foundry agreements and/or plant construction? What is the timing?
- If the start-up has an agreement with an Asian company, is it giving away the store?
- Is the company prepared to respond to rapid technological innovation?

Financing

The start-ups in this directory have raised more than $2 billion in venture funding so far. In addition, public offerings have made up an additional $1.2 billion to start-up capital stock. The 1989 public offering totals are skewed by a $460 million public offering for NMB Semiconductor. Tables 5a and 5b contain information regarding public offerings by start-ups. Table 5a lists initial public offerings including company, date, and amount raised. Table 5b lists all public offerings by start-ups. Figure 5 shows start-up financing by year, highlighting monies raised by public offerings and those raised by other means. Table 6 contains to-date totals for funding by start-up and provides information regarding the source of funds for each company.

Table 5a

Initial Public Offerings by Start-Ups

Company	Date	Amount
VLSI Technology	February 1983	$ 53.0M
LSI Logic	May 1983	$160.0M
ZyMOS Corp.	July 1983	$ 46.9M
SEEQ	September 1983	$ 20.0M
Integrated Devices Technology	February 1984	$ 16.1M
United Microelectronics	July 1985	$ 7.5M
Linear Technology Corp.	May 1986	$ 24.0M
Cypress Semiconductor	June 1986	$ 72.0M
California Micro Devices	October 1986	$ 5.2M
Chips & Technologies	October 1986	$ 11.3M
IMP	June 1987	$ 22.3M
Dallas Semiconductor	September 1987	$ 35.1M
Maxim Integrated Products	February 1988	$ 7.0M
Altera Corp.	March 1988	$ 15.0M
Weitek Corp.	September 1988	$ 8.35M
Logic Devices	November 1988	$ 5.4M
NMB Semiconductor	September 1989	$460.0M
Cirrus Logic	June 1989	$ 24.0M
International CMOS Technology	June 1989	$ 3.6M
Lattice	November 1989	$ 14.0M

Source: Dataquest
January 1990

Table 5b

Public Offerings by Start-Ups

Company	Date	Amount
VLSI Technology	February 1983	$ 53.0M
LSI Logic	May 1983	$160.0M
ZyMOS Corp.	July 1983	$ 46.9M
SEEQ	September 1983	$ 20.0M
Integrated Logic Systems	January 1984	$ 5.0M
Integrated Device Technology	February 1984	$ 16.1M
Micron Technology	June 1984	$ 25.0M
Micron Technology	May 1985	$ 25.0M
United Microelectronics	July 1985	$ 7.5M
VLSI Technology	April 1986	$ 33.0M
Linear Technology Corp.	May 1986	$ 24.0M
Cypress Semiconductor	June 1986	$ 72.0M
Adaptec, Inc.	June 1986	$ 10.0M
Micron Technology	August 1986	$ 13.4M

(Continued)

Table 5b (Continued)

Public Offerings by Start-Ups

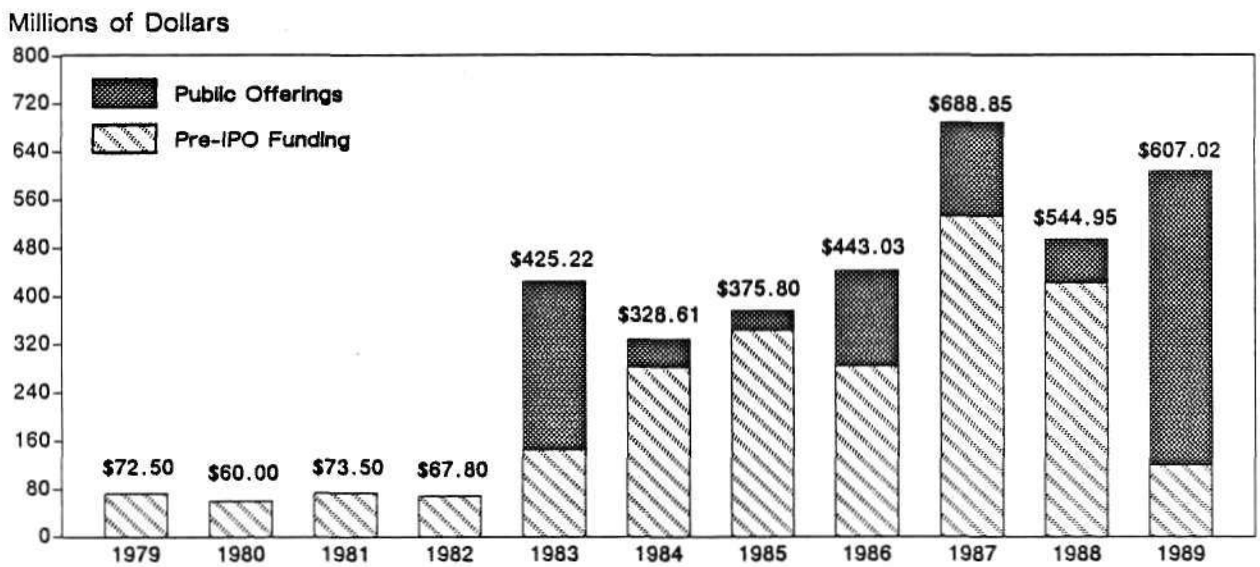
Company	Date	Amount
California Micro Devices	October 1986	$ 5.2M
Chips & Technologies	October 1986	$ 11.3M
LSI Logic	April 1987	$ 21.0M
Xicor	April 1987	$ 22.8M
Cypress Semiconductor	June 1987	$ 39.8M
IMP	June 1987	$ 22.3M
Chips & Technologies	July 1987	$ 15.5M
Dallas Semiconductor	September 1987	$ 35.1M
Maxim Integrated Products	February 1988	$ 7.0M
Xicor	March 1988	$ 17.0M
Altera Corp.	March 1988	$ 15.0M
SEEQ	April 1988	$ 19.5M
Weitek Corp.	September 1988	$ 8.35M
Logic Devices	November 1988	$ 5.4M
NMB Semiconductor	1989	$460.0M
International CMOS Technology	June 1989	$ 3.6M
Cirrus Logic	June 1989	$ 24.0M
Lattice	Filed September 1989	N/A

N/A = Not Available

Source: Dataquest
January 1990

Figure 5

Start-Up Financing by Year
1979-1989



0005344-5

Source: Dataquest
January 1990

Table 6

Capitalization by Company to Date
(Millions of Dollars)

Company	Amount	Sources
Actel Corp.	$ 19.70	Venture capital, private corporate
Advanced Power Technology	$ 13.80	Venture capital
Altera Corp.	$ 42.90	Lease, venture capital, public offering
ANADIGICS	$ 29.00	Venture capital, corporate
AMCC	$ 22.00	Venture capital, corporate
Aspen Semiconductor	$ 7.40	Corporate
ATMEL	$ 3.30	Venture capital
Austek Microsystems	$ 6.70	Venture capital
Bipolar Integrated Technology	$ 56.10	Lease, government, venture capital, corporate
BKC International	$ 2.52	Private, loan
Brooktree	$ 30.90	Venture capital, corporate
California Micro Devices	$ 5.20	Public offering
Calmos Systems	$ 5.50	Private
Calogic Corp.	$ 0.02	Private
Catalyst Semiconductor	$ 4.50	Private
Celeritek	$ 8.40	Venture capital
Chartered Semiconductor	$ 40.00	Corporate
Cirrus Logic	$ 51.60	Public offering, venture capital, corporate
Cree Research	$ 3.00	N/A
Crystal Semiconductor	$ 31.20	Venture capital, corporate
Custom Arrays	$ 2.35	Corporate, private
Dallas Semiconductor	$ 74.40	Public offering, bond, venture capital
Dolphin Integration	$ 0.60	Corporate, private
Elantec, Inc.	$ 23.40	Venture capital, corporate
Electronic Technology Corp.	$ 2.00	Venture capital, government
Epitaxx Inc.	$ 1.50	Venture capital
ES2	$ 44.00	Corporate, venture capital
Exel Microelectronics	$ 36.00	Private, corporate, venture capital
Gazelle Microcircuits	$ 17.20	Venture capital
GigaBit Logic	$ 46.30	Venture capital, corporate
HNC	$ 6.63	Private, venture capital
Hualon Micro-Electronics	$ 30.00	Corporate
IMP	$ 81.90	Public offering, venture capital, corporate, lease
Inmos	$100.00	Government, venture capital
Inova	$ 14.80	Venture capital, corporate
Integrated CMOS Systems	$ 12.20	Venture capital, private
Integrated Logic Systems	$ 5.00	Public offering
International CMOS Technology	$ 13.50	Venture capital, public offering, corporate
ISSI	$ 2.80	Corporate, private, venture capital
IXYS	$ 16.70	Venture capital, private
Krysalis	$ 4.20	Venture capital
Lattice	$ 15.20	Public offering, credit, private, venture capital
Level One Communications	$ 14.05	Venture capital, private
Logic Devices	$ 5.40	Public offering

(Continued)

Table 6 (Continued)

Capitalization by Company to Date
(Millions of Dollars)

Company	Amount	Sources
Linear Technology Corp.	$ 59.00	Lease, corporate, venture capital, public offering
Lytel	$ 20.00	Corporate
Matra-Harris Semiconducteur	$ 40.00	Corporate
Maxim Integrated Products	$ 30.30	Public offering, venture capital, lease, corporate
Micro Linear Corp.	$ 53.30	Lease, venture capital corporate
Micron Technology	$151.90	Private, public offerings
Microwave Technology	$ 10.10	Venture capital, corporate
MOSel	$ 6.00	Corporate, private
MOSPEC	$ 11.75	Private
nCHIP	$ 4.80	Venture capital, private
NMB	$471.11	Public offering, private
Novix Inc.	$ 1.00	Venture capital
Oak Technology	$ 6.00	Venture capital, private
Pacific Monolithics	$ 8.50	Venture capital
Paradigm Technology	$ 12.60	Venture capital
Performance Semiconductor	$ 32.90	Venture capital, private, lease
Photonic Integration Research	$ 10.00	Corporate, private
Plus Logic	$ 5.00	Venture capital
PLX Technology	$ 1.90	Venture capital
Power Integrations	$ 10.60	Venture capital, corporate
PromTech	$ 0.20	Private
RAMAX	$ 0.85	Government
Ramtron	$ 34.50	Corporate
S3	$ 6.00	Venture capital
Samsung Semiconductor	$ 13.00	Venture capital, corporate
Seattle Silicon	$ 28.80	Venture capital, corporate
SEEQ	$ 82.50	Public offerings, venture capital, corporate, private
Sensym	$ 14.20	Venture capital, corporate
SID Microelectronics	$ 14.20	Private
Sierra Semiconductor	$ 51.10	Venture capital, corporate
Synaptics	$ 2.10	Venture capital
Synergy Semiconductor	$ 12.90	Venture capital, private
TSMC	$282.00	Venture capital, corporate, government
Three-Five Systems	$ 5.50	Venture capital, corporate
Togai InfraLogic	$ 4.20	Venture capital
United Microelectronics	$ 20.00	Public offering, corporate, government
US2	$ 4.52	Venture capital
Vitelic	$ 55.20	Venture capital, corporate
Vitesse Semiconductor	$ 25.40	Venture capital, government
WaferScale Integration	$ 45.60	Venture capital, corporate
Weitek Corp.	$ 15.85	Public offering, venture capital
Xilinx	$ 21.00	Venture capital, corporate
Zoran	$ 33.80	Venture capital, corporate

N/A = Not Available

Source: Dataquest
January 1990

Venture Capital

Beginning in 1983, venture capital funding of semiconductor start-ups grew at a substantial rate. In 1986, funding slowed in the face of an industry recession. The industry recovered in 1987 and attracted new venture financing. Since that time, however, the venture capital community has shown declining interest in the semiconductor industry. The prevailing feeling among venture capital investors is that U.S. start-ups cannot compete with Japanese companies. In addition, the 1987 stock market crash has caused lower stock valuations industrywide, which is causing investors to think twice about floating their start-up companies on the stock market. Despite the fact that the stock market has recovered from the crash to post all-time highs, high-tech stocks remain in disfavor. Without a strong stock market as a means of recovering investment costs, many venture capitalists are choosing to stay out of this uncertain market.

Dataquest has identified a similar pattern among European investors as well. European investors are choosing to fund medium-size companies rather than start-ups. The venture capital industry is looking to back companies that want to acquire or buy stakes in small electronics companies. This method avoids the cost and risk of flotation and often provides a higher return on investment.

Japanese venture capitalists typically are more conservative than investors in the United States. Japanese companies rarely invest in start-ups; investors in Japan are more likely to invest in established companies. Japanese venture capitalists also tend not to fund high-tech companies and now are finding significant return in service industries, which support Japan's growing affection for leisure activities.

During the past few years, Dataquest has identified a general increase in total venture capital funding worldwide. Despite this fact, we are witnessing a growing disenchantment with the semiconductor industry among venture capitalists. This disenchantment is causing start-ups to seek new funding alternatives such as private placements or large loans. For this reason, Dataquest predicts a decline in start-up activity for the near future.

Venture Capital Companies

Of the 115 companies that released funding information to Dataquest, 61 companies reported the use of venture capital funding. This number may actually be much higher because, in many cases, profiled companies provided limited financial information. Dataquest identified 331 venture capital companies that provided funding to start-ups between 1979 and 1989. Thirty-four companies have been involved in five or more rounds of financing. Table 7 provides information about the 66 venture capitalists that were involved in three or more rounds of financing during this period.

Table 7

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (17)	VLSI Technology	December 1980
	LTC	September 1981
	Xilinx	March 1984
	Austek Microsystems	July 1984
	Exel Microelectronics	September 1984
	Crystal Semiconductor	October 1984
	Integrated CMOS Systems	1985
	Seattle Silicon	February 1985
	Exel Microelectronics	August 1985
	Gazelle Microcircuits	August 1986
	Sierra Semiconductor	October 1986
	Gazelle Microcircuits	April 1987
	Seattle Silicon	August 1987

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Hambrecht & Quist (Continued)	Seattle Silicon	August 1988
	Gazelle Microcircuits	September 1988
	Integrated CMOS Systems	October 1988
	Vitelic	January 1989
Kleiner, Perkins, Caufield & Byers (17)	VLSI Technology	December 1980
	LSI Logic	January 1981
	SEEQ	March 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Xilinx	March 1984
	Zoran Corp.	October 1985
	Crystal Semiconductor	February 1986
	Gazelle Microcircuits	August 1986
	SEEQ	October 1986
	Gazelle Microcircuits	April 1987
	Synaptics	June 1987
	Power Integrations	May 1988
	Gazelle Microcircuits	September 1988
	S3, Inc.	April 1989
	nCHIP	August 1989
	Power Integrations	August 1989
Merrill, Pickard, Anderson & Eyre (13)	LSI Logic	February 1982
	Maxim Integrated Products	1983
	Weitek Corporation	March 1983
	Cypress Semiconductor	April 1983
	Dallas Semiconductor	June 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Saratoga Semiconductor	May 1986
	Synergy Semiconductor	February 1988
	Gazelle Microcircuits	September 1988
	Plus Logic	January 1989
	S3	April 1989
	Power Integrations	August 1989
Sequoia Capital (12)	LTC	September 1981
	LSI Logic	February 1982
	Cypress Semiconductor	April 1983
	Microwave Technology	August 1983
	Sierra Semiconductor	January 1984
	Elantec, Inc.	December 1986
	Vitesse Semiconductor	February 1987
	Synergy Semiconductor	July 1987
	Elantec, Inc.	September 1988
	Integrated CMOS Systems	October 1988
	Plus Logic	January 1989
	S3	April 1989

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Adler & Company (11)	AMCC	April 1979
	IXYS Corp.	1983
	AMCC	March 1983
	Zoran Corp.	August 1983
	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Maxim Integrated Products	February 1985
	IXYS Corp.	October 1985
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
Oak Investment Partners (11)	Micro Linear Corp.	October 1983
	WaferScale Integration	February 1984
	Vitelic	March 1984
	Dallas Semiconductor	June 1984
	IXYS Corp.	October 1985
	Pacific Monolithics	September 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	Vitesse Semiconductor	January 1988
	Synergy Semiconductor	February 1988
	IXYS Corp.	August 1988
Robertson, Colman & Stephens (10)	IMP	August 1981
	Sensym	October 1982
	AMCC	March 1983
	WaferScale Integration	February 1984
	Cirrus Logic	March 1984
	Cypress Semiconductor	April 1984
	Sensym	May 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	AMCC	September 1987
U.S. Venture Partners (10)	AMCC	March 1983
	Microwave Technology	August 1983
	Performance Semiconductor	October 1984
	IXYS Corp.	October 1985
	Micro Linear Corp.	February 1986
	Elantec, Inc.	December 1986
	IXYS Corp.	August 1987
	AMCC	September 1987
	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
Brentwood Associates (9)	Maxim Integrated Products	1983
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Cirrus Logic	May 1985

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Brentwood Associates (Continued)	California Devices	August 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	June 1986
	Performance Semiconductor	August 1988
	Plus Logic	January 1989
Mayfield Fund (8)	LSI Logic	January 1981
	LTC	September 1981
	Cypress Semiconductor	April 1983
	Cypress Semiconductor	August 1985
	Celeritek, Inc.	August 1986
	Synergy Semiconductor	July 1987
	S3	April 1989
	nCHIP	August 1989
Mohr, Davidow Ventures (8)	Sierra Semiconductor	January 1984
	Actel Corp.	June 1986
	Vitesse Semiconductor	January 1988
	Power Integrations	May 1988
	US2	March 1989
	S3	April 1989
	nCHIP	August 1989
	Power Integrations	August 1989
Burr, Egan, Deleage & Co. (7)	Elantec, Inc.	August 1984
	Sierra Semiconductor	April 1985
	IXYS Corp.	October 1985
	Celeritek, Inc.	August 1986
	IXYS Corp.	August 1987
	IXYS Corp.	August 1988
	Elantec, Inc.	September 1988
DSV Partners (7)	Maxim Integrated Products	1983
	Epitaxx Inc.	March 1984
	Performance Semiconductor	October 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
	Integrated CMOS Systems	May 1987
	Integrated CMOS Systems	October 1988
New Enterprise Associates (7)	Microwave Technology, Inc.	August 1983
	Dallas Semiconductor	February 1984
	Cirrus Logic	May 1985
	Vitesse Semiconductor	February 1987
	Dallas Semiconductor	April 1987
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Technology Venture Investors (7)	LTC	September 1981
	Sierra Semiconductor	January 1984
	Altera Corp.	April 1984
	Cirrus Logic	May 1985

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Technology Venture Investors (Continued)	Inova	February 1986
	Synaptics	May 1986
	Synaptics	June 1987
Venrock Associates (7)	VLSI Technology	December 1980
	Sierra Semiconductor	January 1984
	Celeritek, Inc.	March 1985
	Gazelle Microcircuits	April 1987
	Integrated CMOS Systems	May 1987
	Gazelle Microcircuits	September 1988
	Integrated CMOS Systems	October 1988
Advanced Technology Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	Performance Semiconductor	October 1984
	Actel Corp.	October 1985
	Actel Corp.	June 1986
	Togai InfraLogic	December 1988
Alex Brown & Sons (6)	IMP	June 1983
	ANADIGICS	April 1985
	Weitek	January 1986
	Dallas Semiconductor	March 1986
	Dallas Semiconductor	April 1987
	ANADIGICS	January 1989
Concord Partners (6)	Microwave Technology	August 1983
	Zoran Corp.	October 1985
	Power Integrations	May 1988
	Micro Linear	August 1989
	US2	March 1989
	Power Integrations	August 1989
Crosspoint Venture Partners (6)	Sensym	October 1982
	Laserpath	June 1983
	Sensym	May 1984
	Laserpath	July 1985
	Krysalis	May 1986
	Krysalis	December 1986
Harvard Management (6)	Cypress	March 1985
	BIT	May 1986
	Performance Semiconductor	November 1986
	Elantec	December 1986
	Elantec	September 1988
	Gazelle Microcircuits	September 1988
J.H. Whitney (6)	Cypress	April 1983
	WaferScale	February 1984
	Vitelic	March 1984
	Xilinx	March 1984
	Vitesse	February 1987
	Synergy	February 1988

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Rothschild Ventures (6)	VLSI Technology	December 1980
	Austek Microsystems	July 1984
	ANADIGICS	April 1985
	Maxim Integrated Products	September 1985
	Actel Corp.	August 1988
	Togai InfraLogic	December 1988
Bessemer Venture Partners (5)	Maxim Integrated Products	1983
	WaferScale Integration	February 1984
	Vitelic	March 1984
	Maxim Integrated Products	February 1985
	Maxim Integrated Products	September 1985
Grace Ventures (5)	IXYS	October 1985
	Zoran Corp.	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Harvest Ventures (5)	IMP	August 1981
	IXYS	October 1985
	Micro Linear Corp.	November 1985
	IXYS	August 1987
	IXYS	August 1988
Hillman Ventures (5)	SEEQ	March 1981
	IMP	June 1983
	SEEQ	October 1986
	Actel Corp.	August 1988
	Power Integrations	August 1989
J.F. Shea & Company (5)	Advanced Power Technology	N/A
	Altera	April 1984
	Dallas Semiconductor	June 1984
	Exel Microelectronics	September 1984
	IXYS	August 1988
Matrix Partners (5)	AMCC	March 1983
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
	AMCC	September 1987
	Synergy Semiconductor	February 1988
Sutter Hill Ventures (5)	LSI Logic	January 1981
	LTC	September 1981
	Weitek Corp.	February 1982
	Sierra Semiconductor	January 1984
	Celeritek	March 1985
Accel Partners (4)	AMCC	March 1983
	WaferScale Integration	February 1984
	Micro Linear	November 1985
	AMCC	September 1987

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Associated Venture Investors (4)	Sierra Semiconductor	January 1984
	Elantec	August 1984
	Elantec	September 1988
	PLX Technology	August 1989
Bay Partners (4)	Sierra Semiconductor	January 1984
	Exel Microelectronics	September 1984
	California Devices	August 1985
	IXYS	August 1988
Continental Illinois Venture Corp. (4)	IMP	August 1981
	WaferScale Integration	November 1984
	Three-Five Systems	September 1987
	HNC	June 1988
John Hancock Venture Capital (4)	Dallas Semiconductor	June 1984
	California Devices	September 1986
	SEEQ	October 1986
	Saratoga Semiconductor	March 1987
Julian, Cole & Stein (4)	Advanced Power Technology	N/A
	Level One	December 1985
	Level One	December 1986
	Level One	September 1987
Norwest Venture Capital Management (4)	Seattle Silicon	February 1985
	Actel Corp.	June 1986
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
Republic Ventures (4)	IMP	August 1982
	Dallas Semiconductor	June 1984
	BIT	May 1986
	GigaBit Logic	September 1988
Riordan Venture Group (4)	GigaBit Logic	March 1982
	Exel Microelectronics	September 1984
	GigaBit Logic	April 1987
	GigaBit Logic	September 1988
Union Venture Corp. (4)	IDT	June 1983
	GigaBit Logic	February 1985
	BIT	May 1986
	GigaBit Logic	September 1988
Venture Growth Associates (4)	AMCC	March 1983
	Altera Corp.	April 1984
	Dallas Semiconductor	June 1984
	AMCC	September 1987
Alan Patricof Associates (3)	ANADIGICS	April 1985
	California Devices	August 1985
	ANADIGICS	January 1989

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
Alpha Partners (3)	Altera Corp.	June 1983
	Inova	1984
	Inova	February 1986
Arthur D. Little (3)	IXYS	October 1985
	ANADIGICS	November 1986
	IXYS	August 1988
Berkeley International (3)	Crystal Semiconductor	June 1987
	Sierra Semiconductor	September 1987
	Performance Semiconductor	August 1988
Berry Cash Southwest Partnership (3)	Crystal Semiconductor	October 1984
	Saratoga Semiconductor	November 1985
	Xilinx	December 1985
Bryan & Edwards (3)	Sierra Semiconductor	April 1985
	Inova	February 1986
	Vitesse	February 1987
Cowen & Company (3)	LTC	April 1983
	BIT	July 1987
	Performance Semiconductor	August 1988
Fairfield Venture Partners (3)	Micro Linear	October 1983
	ANADIGICS	April 1985
	BIT	July 1986
GE Venture Capital Corp. (3)	ANADIGICS	April 1985
	Laserpath	July 1985
	SEEQ	October 1986
Hambro International Venture Fund (3)	Integrated CMOS Systems	May 1987
	Edsun Labs	July 1988
	Integrated CMOS Systems	October 1988
Hill, Kirby & Washing (3)	Seattle Silicon	February 1985
	Seattle Silicon	August 1987
	Seattle Silicon	August 1988
HLM Partners (3)	Dallas Semiconductor	March 1986
	Saratoga Semiconductor	March 1987
	Dallas Semiconductor	April 1987
Hook Partners (3)	California Devices	October 1986
	Vitesse Semiconductor	January 1988
	Plus Logic	January 1989
InnoVen (3)	Weitek Corp.	January 1981
	Weitek Corp.	February 1982
	California Devices	August 1985
Merrill Lynch Venture Capital (3)	California Devices	August 1985
	Micro Linear	August 1988
	Elantec	September 1988

(Continued)

Table 7 (Continued)

Leading Venture Investors in Start-Ups

Venture Capital Firm	Company	Date
New Venture Partners (3)	Dallas Semiconductor	June 1984
	Cirrus Logic	June 1987
	Vitesse Semiconductor	April 1989
Rainier Venture Partners (3)	Seattle Silicon	February 1985
	Xilinx	December 1985
	Seattle Silicon	August 1987
Robert Fleming Investment Management (3)	AMCC	March 1983
	IMP	June 1983
	Cypress	April 1984
Shaw Venture Partners (3)	Pacific Monolithics	August 1985
	Actel Corp.	October 1985
	Actel Corp.	June 1986
Sprout Group (3)	Synaptics	May 1986
	Synaptics	June 1987
	Actel Corp.	August 1988
TA Associates (3)	Exel Microelectronics	September 1984
	Exel Microelectronics	August 1985
	Paradigm Technology	May 1989
Warburg, Pincus Ventures (3)	WaferScale Integration	February 1984
	Epitaxx Inc.	March 1984
	Level One	September 1987
Weeden Capital Partners (3)	Krysalis	May 1986
	Krysalis	December 1986
	BIT	April 1988
Welsh, Carson, Anderson & Stowe (3)	IMP	August 1981
	Altera Corp.	April 1984
	Zoran Corp.	October 1985

N/A = Not Available

Source: Dataquest
January 1990

Strategic Alliances

An important development in the start-up area is the proliferation of licensing and joint-development agreements with established companies. At a time when venture capital has become increasingly scarce, small companies often are under pressure for near-term funding. In addition to seeking funds, start-ups are entering strategic alliances for a variety of other reasons, such as the following:

- To avoid the prohibitive costs of a fab
- To increase production capacity
- To defray increasing product development costs
- To strengthen product portfolios
- To increase a worldwide presence
- To protect the start-up from the danger of obsolescence of a process technology by entering fab agreements

Strategic alliances can be valuable to both start-up companies and larger companies. Large companies often enter into alliances with technology-rich start-ups as a way of entering emerging markets. Through agreements with large companies, start-ups are able to take advantage of the manufac- turing, marketing, and financial power of large companies. Table 8 lists the advantages of strategic alliances to start-ups.

Until recently, companies that sought access to new technologies or markets often would resort to acquisition. Acquisition arrangements, however, can be ill-conceived, inefficient, and unsuccessful. Acquisitions frequently trigger a flight of top engineers and lower employee morale in the acquired company.

Corporate partners are seeking something more than mere dollar gains. Agreements include access to technology, designs, and guaranteed production.

To accomplish strategic objectives, companies are considering a broader range of limited and focused cooperative agreements, such as the following:

- Minority equity investments
- Technology licensing
- Joint marketing
- Joint ventures
- All or part of manufacturing

Figure 6 shows the number of start-up alliances per year for the period 1979 through 1989. Tables 9a through 9k list start-up alliances by year.

Table 8

Advantages of Start-Up Strategic Alliances

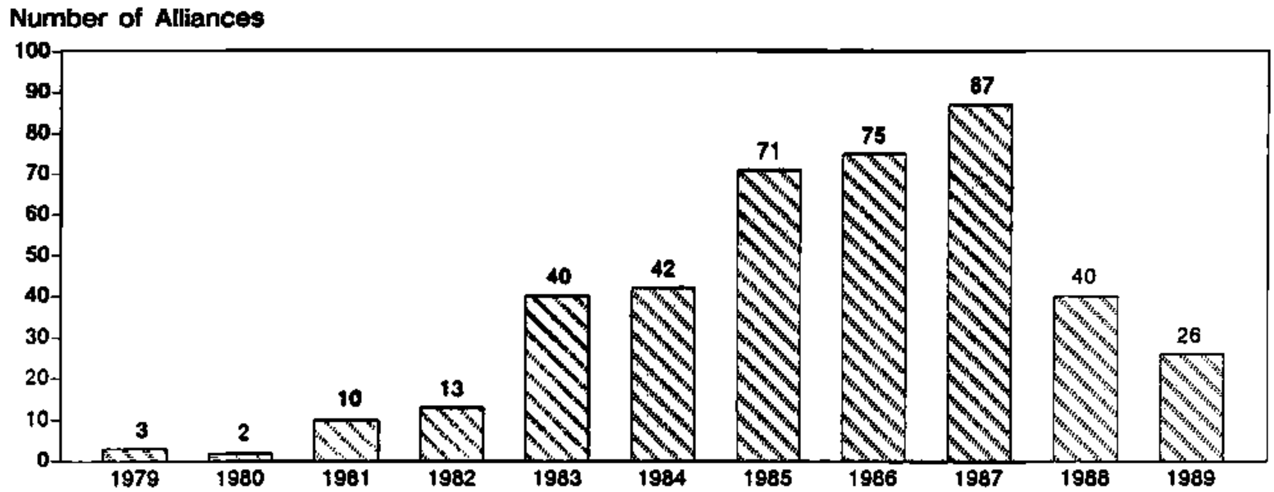
Offense	Defense
Secure technologies	Work with potential rivals
Gain access to markets	Keep out competitors
Rapid market entry	Monitor technology and market trends
Fill in product portfolios	Cut production costs
Foundry capacity	Financial viability
Cash infusions	
Greater product acceptance	
Ease trade frictions	

Pitfalls and Problems of Alliances
Management
Language and cultural differences
Management styles
Conflicting business goals
Unequal levels of commitment
Differing negotiating styles
Technology
Giving away the store
Receiving little in return
Stuck with a nonindustry standard
Market
Quarrels over territory
Loss of overseas expansion potential
Encroachment into U.S. market

Source: Dataquest
January 1990

Figure 6

Alliances by Year
1979-1989



0005344-6

Source: Dataquest
January 1990

Table 9a

1989 Alliances (26)

Companies	Description
ACC Microelectronics Motorola	April 1989—Motorola to second-source the ACC82020 and ACC82300 chip sets and cache controller and tag RAM to be introduced in late 1989
Crystal Semiconductor Analogic	June 1989—Analogic to become VAR of the Crystal ADC product line
HNC Fusion Group	September 1989—Partnership to market software utilities designed to integrate neural computing into financial applications
ICT AMD	July 1989—ICT and AMD to codevelop 1Mb EPROM with an access time of 55ns
IIT Ascii	1989—Ascii to distribute IIT products in Japan
IIT Mitsui	1989—Mitsui to distribute IIT products in Japan
IIT Yamaha	1989—Yamaha to provide wafer fab services to IIT
IMP Mitel	March 1989—Mitel to exchange four communications chip designs for IMP's 1.2-micron MxCMOS process, ACL1.2-DCL1.2 cell libraries, and mixed A/D design methodology

(Continued)

Table 9a (Continued)

1989 Alliances (26)

Companies	Description
ISSI UMC	January 1989—Licensing and manufacturing agreement with UMC, which will provide foundry services to ISSI
ISSI TSMC	August 1989—TSMC to provide foundry services to ISSI
ISSI LSI Logic	September 1989—Licensing and manufacturing agreement, LSI to provide foundry services to ISSI
Lattice AMD	May 1989—Cross-licensing agreement: Lattice gained rights to AMD's 22V10 PLD and the use of 22V10 architecture in manufacturing Generic Array Logic devices. AMD to manufacture GAL devices using Lattice's architecture
Oxford Computer Scan Graphics	September 1989—Joint development of image scanning devices using Oxford's "Intelligent Memory Chip" technology
RAMAX Epi Materials	October 1989—RAMAX to market EML's epi-treated wafers into Asia
Ramtron Seiko-Epson	April 1989—S-E to help finance FRAM basic development. Joint development of submicron CMOS FRAM production process
Ramtron Alcan Aluminum	June 1989—Ramtron and Alcan to codevelop advanced ferroelectric materials. Alcan made 6.5 percent equity investment in Ramtron
SEEQ National	June 1989—SEEQ and National scale back 1987 agreement to cover only current flash technology. SEEQ to continue to develop 0.8-micron flash chips alone
Samsung NCR	January 1989—Technology exchange and license agreement gives Samsung ASIC capability and NCR SRAM capability
Samsung Zilog	June 1989—Two licensing and marketing agreements permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 MCUs and the Z85C30 Serial Communications Controller
Samsung Quadtree Software	February 1989—Quadtree to develop full-function software models of Samsung's high-performance DRAM controllers
Seattle Silicon GigaBit Logic	June 1989—Seattle Silicon and GBL to develop comprehensive set of design software tools for GaAs ASICs
Togai InfraLogic Mitsubishi	September 1989—Togai and Mitsubishi Heavy Industries to codevelop air conditioning system based on fuzzy logic controller
VIA Technologies Fujitsu	March 1989—Partnership to codevelop peripheral chip sets for Sun-compatible workstations

Source: Dataquest
January 1990

Table 9b

1988 Alliances (40)

Companies	Description
Actel Corp. Texas Instruments	November 1988—TI to alternate source Actel's ACT 1 family of gate arrays and resell the Action Logic System, Actel's CAE system. Actel gains access to TI's EPIC 1 CMOS wafer processing technology and manufacturing capabilities
AMCC Plessey	January 1988—Jointly develop high-performance ECL gate arrays with up to 14,000 gates
Adaptec Chips & Technologies	October 1988—Joint introduction of a series of products for IBM PS/2 Models 50-, 60-, and 80-compatibles
Adaptec Chips & Technologies	January 1988—Adaptec and Chips to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80
BIT Arizona Microtek	July 1988—BIT and AZM to codevelop custom ICs using BIT's high-performance BIT-1 technology. AZM will serve as independent design house to develop LSI designs for BIT customers
Brooktree Analog Devices	January 1988—Analog Devices to second-source Brooktree's video DACs
Calmos Siltronics	February 1988—Calmos' acquisition of Siltronics' bipolar component business for $500,000
Catalyst Semiconductor Oki	November 1988—Oki to second-source the CAT35C102 and CAT35C202 serial EEPROMs
Cirrus Logic Award Software	July 1988—Award to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets
Cirrus Logic Phoenix Technologies	September 1988—Phoenix will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus
Cree General Instrument	August 1988—Cree and GI agreed to codevelop and manufacture silicon-based rectifiers
Custom Arrays Teledyne	February 1988—Custom and Teledyne to codevelop a new family of BiCMOS semicustom and cell-based libraries
ES2 Philips	February 1988—Philips to provide foundry services on its 1.5-micron CMOS line
ES2 US2	January 1988—ES2 establishes US2, a U.S.-based affiliate
GAIN Interface Tech	March 1988—GAIN to supply personalized versions of its GFL gate array product family
GBL Cray Research	January 1988—Cray placed $6.5 million foundry offer
Gazelle TriQuint	September 1988—TriQuint to manufacture GaAs devices for Gazelle; $16.9 million contract

(Continued)

Table 9b (Continued)

1988 Alliances (40)

Companies	Description
GigaBit Logic NKT (Denmark)	September 1988—GBL and NKT form GIGA to serve European and Israel markets for ICs
GigaBit Logic SC Hightech	December 1988—GBL to market SC Hightech's GaAs ICs worldwide, excluding Japan. Provides opportunity for codevelopment of GaAs ICs in the future. SC Hightech may provide foundry services to GBL
ICI Array National	March 1988—ICI Array Technology to use National Semiconductor's design systems and process specifications to develop proprietary ASICs
IXYS ABB	May 1988—IXYS and ASEA Brown Boveri form joint venture to strengthen industrial power control marketplace using ABB's patented copper substrate bonding technology and IXYS' smart power, IGBTs, and MegaMOS expertise
LSI Logic Sun	March 1988—LSI Logic to manufacture, market, modify, and enhance MPU-related components, software, and systems using Sun's SPARC
LSI Logic ITI	March 1988—Imaging Technology Inc. (ITI) to design a new generation of imaging products using LSI Logic's L64200 series of real-time image processing chips
Level One Mitel	May 1988—Joint development agreement
Matra-Harris Aspen Cypress	April 1988—R&D agreement. MHS to provide $4.57M in funding, and technical and design expertise for development of ultrahigh-speed ECL circuits to be developed by Aspen
Maxim Supertex	April 1988—Agreed to jointly develop 690 family of MPU supervisory circuits
Micron Intel	March 1988—Intel to market Micron DRAMs under Intel's label, beginning with 256K products
Micron SMC	April 1988—Micron's purchases 1.6 million shares of Standard Microsystems Corp. (SMC) common stock at $6.03 per share
Ramtron ITT Semiconductor	June 1988—Codevelopment program to develop submicron ferroelectric manufacturing process
Ramtron NMB Semiconductor	October 1988—Codevelopment and licensing program to develop 4Mb DRAM process technology and products utilizing Ramtron's ferroelectric materials
Ramtron TRW	November 1988—Codevelopment program to develop rad-hard NV memory for aerospace and defense applications
Seattle Silicon Oki	August 1988—Seattle Silicon and Oki to codevelop a compiler for a process-independent, five-port, high-speed SRAM module
TriQuint MSC	March 1988—Microwave Semiconductor Corporation (MSC) and TriQuint to provide interchangeable GDS-II tape with equivalent performance for GaAs analog and digital ICs and MMICs

(Continued)

Table 9b (Continued)

1988 Alliances (40)

Companies	Description
VLSI Technology Harris	April 1988—Codevelop a rad-hard gate array and future commercial and nonrad-hard military gate arrays
VLSI Technology Sanyo	April 1988—Sanyo to manufacture and market VLSI Technology's 32-bit ACORN RISC Machine IC family worldwide
Vadem Intel	March 1988—Intel invests in IBM Model 30 and PC XT-compatible chip set that Vadem is developing
Vadem Intel	September 1988—Intel to refer customers to Vadem for Vadem's PC chip set
Zoran Toshiba	January 1988—Technology and manufacturing alliance
Zoran SGS-Thomson	March 1988—Technology and manufacturing alliance
iLSi Oki	April 1988—Oki to manufacture and sell gate arrays based on iLSi technology and provide foundry service

Source: Dataquest
January 1990

Table 9c

1987 Alliances (87)

Companies	Description
ANADIGICS Bendix	June 1987—Contract from Bendix Aerospace to develop CAD tools for the DOD's MMIC program
ATMEL Sanyo Electric	1987—ATMEL and Sanyo signed a foundry contract to produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs
Adaptec SCO	October 1987—Adaptec and the Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system
Adaptec Conner Peripherals	October 1987—Adaptec to supply disk controller ICs to Conner Peripherals
Alcatel Mietec SGS-Thomson	1987—Alcatel, Mietec, SGS-Thomson—transfer of a 1.2-micron CMOS process
Alliance NMB	December 1987—Five-year agreement covering 256K and 1Mb DRAMs; NMB to manufacture and sell the devices worldwide
Altera WSI Sharp	January 1987—Codevelop a family of standalone microsequencer products with wafers manufactured by Sharp of Japan

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Altera Cypress	June 1987—Codevelop a family of CMOS EPLDs
Asahi Kasei Crystal Semi	January 1987—Asahi Chemical's acquisition of an 8 percent share in Crystal for approximately $4 million; Asahi Kasei to manufacture and market Crystal's devices for the far eastern market
Asahi Kasei ICT	January 1987—Asahi Kasei's receipt of a license to ICT's technology; Asahi Kasei to market ICT's EEPROMs
Aspen Cypress	December 1987—Cypress' guaranteed $7.4 million to Aspen, a wholly owned subsidiary of Cypress, which will fabricate and sell ECL devices
Austek ZyMOS	October 1987—ZyMOS licensed to make and sell the Austek Microcache as part of the POACH chip set
BIT Sun	July 1987—Sun's license of a bipolar 32-bit RISC MPU to BIT
Batelle Institute Photonic MEC NTT	July 1987—The Batelle Institute, Mitsubishi Electric Corporation (MEC), and NTT—formation of Photonic Integration
CDI IST	April 1987—Joint product development and second-source agreement covering two families of ASICs using channelless architectures
CMD Tachonics	March 1987—Tachonics to manufacture commercial and military GaAs ICs using CMD cell design and tools in the 1.0- to 0.5-micron range
CMD Telefonica	November 1987—Joint venture agreement to form a company named California Micro Devices SA in Spain
Calmos Samsung	January 1987—Calmos' license of its 8200 series of devices to Samsung in exchange for a foundry commitment
Catalyst Oki Electric	March 1987—Previous agreement extended to include a wide range of CMOS EEPROMs
Chartered National Sierra STC	October 1987—National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation established joint-venture company, Chartered Semiconductor Corporation
Cirrus Logic WDC	January 1987—Cirrus Logic's license of a custom Winchester disk drive controller IC to Western Digital Corporation
Cirrus Logic DIA-Semicon	October 1987—DIA-Semicon Systems to distribute new and existing products in Japan
Cirrus Logic Award Software	November 1987—Award Software to develop a VGA graphics BIOS and demonstration board for Cirus Logic's GD510/520 VGA chip set

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Cypress Sun	July 1987—Joint development of a CMOS RISC MPU product line based on Sun's SPARC
Cypress Matra-Harris	December 1987—Prior agreement extended to include manufacture and marketing of five Cypress 64K SRAMs
Dallas Xecom	May 1987—Three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families
Dallas AMP	August 1987—Dallas and AMP R&D partnership to develop interconnect techniques
ES2 Lattice Logic	1987—ES2's acquisition of Lattice Logic
ES2 Philips	February 1987—ES2, Philips, and TI joint agreement for the manufacture of the SystemCell; TI and Philips to supply volume parts, ES2 to provide prototypes and low-volume quantities
ES2 Mitsui & Co.	October 1987—ES2 and Mitsui & Co. joint purchase of a Japanese software and design company called Best, which will market ES2's products in Japan
Elantec Micro Power	November 1987—Micro Power to market Elantec's FET power buffers
G-2 LSI Logic	July 1987—LSI Logic's establishment of G-2 as a wholly owned subsidiary; LSI Logic to provide macrocells, megacells, and gate arrays
Genesis National	October 1987—Design center and manufacturing agreement
GigaBit Logic Tachonics	October 1987— Mutual second-sourcing of GaAs standard and ASIC products developed by each other
GigaBit Logic Cray Research	January 1987—Cray Research's $3.3 million foundry order
GigaBit Logic Cray Research	May 1987—Cray Research's January order increased from $3.2 million to $5.5 million
GigaBit Logic Seattle Silicon WTC	April 1987—GBL, Seattle Silicon, and the Washington Technology Center (WTC) to form a joint design project and fabricate a functional, compiler-based GaAs IC design
IDT VTC	January 1987—IDT to second-source VTC's FCT product line
IDT MIPS Computer	November 1987—IDT to manufacture MIPS Computer's complete line of 32-bit RISC MPUs
IMP Electrolux	November 1987—Five-year agreement with Electrolux to develop ASIC devices for home appliances

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
IST SDA Systems	May 1987—SDA Systems to develop CAD systems for use by Innovative Silicon Technology's (IST's) customers
Inova Westinghouse	June 1987—Westinghouse Advanced Technology Division to work with Inova in long-term strategic planning areas
Intergraph Fujitsu	Early 1987—Fujitsu to provide wafer fabrication services to Intergraph's Advanced Processor Division
Krysalis National	December 1987—Seven-year agreement with National Semiconductor to pursue UniRAM technology jointly
LSI Logic Stellar Computer	January 1987—LSI Logic to supply custom ASICs to Stellar Computer for use in a graphics supercomputer
LSI Logic Aida Corp.	January 1987—Aida Corp. to incorporate LSI Logic's gate array libraries into its design automation tools
LSI Logic ZyCAD Corp.	February 1987—LSI Logic's acquisition of the marketing rights to a customized version of ZyCAD's Logic Evaluator circuit design accelerators
LSI Logic Case Technology	March 1987—Joint development to allow LSI Logic's schematic libraries to be designed on Case Technology's workstations
LSI Logic Sun	April 1987—LSI Logic and Sun's joint establishment of an ASIC laboratory project at San Jose State University
LSI Logic Logic Automation	May 1987—Joint development to incorporate LSI Logic's channeled gate arrays on Logic Automation's Mentor Graphics workstations
LSI Logic Asix Systems	June 1987—LSI Logic's licensing of its ASIC design verification software to Asix Systems Corp.
LSI Logic Video Seven	July 1987—LSI Logic's acquisition of 20 percent of Video Seven for $7 million in cash
LSI Logic ACT	August 1987—Joint venture company named Inter-Act Corporation, which will develop and market software/hardware development system for the MIL-STD-1750 embedded system market
LSI Logic MIPS Computer	November 1987—LSI Logic to manufacture and market MIPS Computer Systems' entire family of circuits, including its 32-bit RISC MPU and floating point coprocessor
LTC TI	March 1987—Five-year agreement allowing TI to select six LTC circuits every six months; TI to pay royalties
Lattice SGS	February 1987— LSC's licensing of its GAL products to SGS Semiconductor; both companies to cooperate on future PLD products
Lattice National	April 1987—National Semiconductor's minority investment in LSC and licensing of its GAL technology
Lattice MMI	November 1987—LSC's licensing of MMI's patent; exchange of rights to worldwide patents in PLDs

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
Matra-Harris Intel	June 1987—CIMATEL dissolved by Intel
NMB TI	November 1987—NMB to manufacture and supply TI with TI-designed 1Mb field RAMs
Pacific Monolithics TriQuint Ford	November 1987—PM and TriQuint are team members with Ford for smart weapons, radar, electronic warfare contracts
Pacific Monolithics TriQuint Allied-Bendix	November 1987—PM and TriQuint are team members with Allied-Bendix for two communications and radar contracts
Performance MIPS Computer	November 1987—Performance to manufacture and market MIPS Computer Systems' 32-bit RISC MPU, floating-point coprocessor, and other peripherals
PromTech Yamaha	1987—PromTech's licensing of its EPROM technology to Yamaha Corp., which will combine it with voice- and image-processing capabilities
RAMAX Ramtron	June 1987—RAMAX's licensing of ferroelectric process technology from Ramtron
SEEQ National	October 1987—Four-year agreement to develop and market a new family of CMOS flash EEPROMs
SEEQ Hamilton-Standard	October 1987—SEEQ to supply 256K EEPROMs to Hamilton-Standard
Samsung Intel	June 1987—Samsung to supply Intel with 64K and 256K DRAMs, which Intel will sell under its own label
Seattle Semiconductor National	October 1987—National's 1.25-micron and 1.20-micron VHSIC CMOS processes qualified for design with Concorde, Seattle Silicon' ASIC compiler
Seattle Silicon UTMC	June 1987—Seattle Silicon and UTMC to jointly design and fabricate ASICs used in tactical and strategic radiation environments
Sierra Mentor Graphics	September 1987—Sierra's MIXsim behavioral modeling tools available on Mentor Graphics' Idea workstation
TriQuint TRW	June 1987—Jointly develop and supply Class-S level GaAs devices for space applications
VLSI Technology Visic	1987—VLSI's acquisition of Visic for approximately $525,000
VLSI Technology TCMC	March 1987—Agreement covering second-sourcing and product development for memory designs including FIFOs, dual-port RAMs, cache-tag RAMs, and SRAMs

(Continued)

Table 9c (Continued)

1987 Alliances (87)

Companies	Description
VLSI Technology Zilog	May 1987—VLSI to second-source Zilog's Super8 MCU and FIFOs
VLSI Technology GE Solid State	July 1987—GE to produce and market VLSI's VGT10 and VGT100 families of CMOS gate arrays
VLSI Technology Daisy Systems	November 1987—Gate array design kit offered for Daisy's CAE workstation
VLSI Technology Oak Technology	November 1987—Codevelop IBM PS/2 logic chips, using VLSI Technology's software tools
VTC Control Data	1987—VTC became a wholly owned subsidiary of Control Data (CDC); VTC's award of a $7.5 million contract from CDC's Government Systems Division to supply ASIC chips
VTC TRW	March 1987—TRW Components International and VTC to cross sample space-quality, Class-S devices including rad-hard CMOS SRAMs, comparators, amps, and transceivers
VTC VME Technology	September 1987—VTC's contract to design, develop, and manufacture a VMEbus interface IC (VMIC) for the VME Technology Consortium
Vitesse E-Systems	August 1987—E-systems to use Vitesse's GaAs technology in its current and future programs
Vitesse Ford	October 1987—Vitesse and Ford Microelectronics to mutually second-source each other's IC foundry services
Vitesse VLSI Technology	September 1987—Vitesse to develop a GaAs cell library for VLSI's design tools
WSI GE/RCA	July 1987—Prior agreement expanded to include EPROM manufacturing
Weitek HP	May 1987—Hewlett-Packard to manufacture and incorporate the Weitek model 2264/65 chip set in current and future HP Precision Architecture computers
Xicor Intel	June 1987—R&D agreement terminated; cross-licensing and royalty obligations remain in force
ZyMOS Intel	November 1987—Intel to market ZyMOS' POACH AT system logic set bundled with its 80286 MPU, which will be sold as 82X3X multifunctional peripherals
iLSi Yamaha	December 1987—Yamaha's purchase of a license for iLSi's gate arrays in exchange for royalties and foundry service

Source: Dataquest
January 1990

Table 9d

1986 Alliances (75)

Companies	Description
Actel Corp. Data General	June 1986—Joint development agreement covering gate arrays and a fab arrangement
Altera Data I/O FutureNet	May 1985—OEM marketing agreement with Data I/O's FutureNet for the DASH schematic capture packages
BIT Raytheon	July 1986—Joint development of ASICs
Brooktree Fairchild	April 1986—Broad-ranging partnership combining Brooktree's D/A conversion technology with Fairchild's manufacturing capability
CMD CMA	September 1986—Merger of CMD and Custom MOS Arrays (CMA)
CMD Fuji	November 1986—CMD's licensing of HCMOS gate array and cell-based design technology to Fuji Photo Film for $1 million
CSi Motorola	August 1986—CSi to act as the northwestern independent design center for Motorola
CSi NCR	September 1986—NCR's licensing of CSi's cell-based library
Catalyst Thomson-CSF	1986—Catalyst and Thomson to conduct R&D in France
Catalyst Oki Electric	July 1986—Long-term R&D of NVRAMs for ASICs, using CMOS EPROMs and EEPROMs
Chips National	November 1986—National Semiconductor to manufacture CMOS ICs for Chips & Technologies under fabrication agreement
Cirrus Logic Silicon Systems	October 1986—Cirrus Logic's and Silicon Systems' exchange of controller and buffer manager functions
Custom Array Teledyne	1986—Joint development agreement for a new family of BiCMOS semi-custom and cell-based libraries
Dallas Thomson-Mostek	January 1986—Thomson-Mostek's receipt of Dallas' multiport memory in exchange for laser production equipment and TCMC's MK4501 FIFO
ES2 British Aerospace	January 1986—British Aerospace investment of $5 million
ES2 SDA Systems	January 1986—ES2 to market SDA Systems' design systems throughout Europe and to use them in design centers
ES2 Philips TI	May 1986—ES2, Philips-Elcoma, and Texas Instruments—cooperation on the SystemCell cell-based library
Exel Microelectronics Exar	February 1986—Exar's completion of the $5.5 million acquisition of Exel
GAIN NTT	September 1986—Technology transfer giving GAIN access to NTT's self-aligned implantation for N+layer translator (SAINT) technology

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
ICI Array ICI	January 1986—Imperial Chemical Industries Plc—acquisition of Array Technology
ICT Gould Semiconductor	April 1986—ICT's transfer of its CMOS EEPROM technology and products in exchange for foundry service and second-sourcing of PEEL and EEPROM devices
IMP Lattice Logic	May 1986—Lattice Logic's CHIPSMITH Silicon complier software available with IMP's design rules
IMP Silicon Compilers	June 1986—SCI and IMP to develop analog compilation capability for SCI's Genesil Silicon Development
IMP Micro Linear MBB	August 1986—IMP and Micro Linear—agreement to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period
IMP Lasarray	August 1986—IMP and Lasarray to cooperate on a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module
IXYS Samsung	January 1986—Samsung's receipt of IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high current power MOS devices in Samsung facility
LSI Logic Raytheon	January 1986—Raytheon to second-source LSI Logic's LL700 Series of logic arrays; LSI Logic will provide its LDS software system to design and produce the logic arrays
LSI Logic Master Images	March 1986—LSI Logic's acquisition of a 20 percent equity interest in Master Images, a photomask supplier
LSI Logic Sun	April 1986—LSI Logic to sell and use internally Sun Microsystems' workstation and advanced schematic capture system
LSI Logic STC	May 1986—LSI Logic's acquisition of a majority stake in STC's semiconductor division
LTC National	July 1986—Patent licensing agreement Linear Technology Corp. (LTC) rights to products under two national BiFET patents; National was granted rights to LTC's BiFET-related patents
Lattice Seiko-Epson	January 1986—Seiko-Epson licensed to Lattice's high-speed 64K SRAM
MOSel Hyundai	February 1986—MOSel—8Kx8 and 1Mb SRAMs and 1.2- and 1.5-micron CMOS processes provided to Hyundai in exchange for a foundry commitment
MOSel Sharp	June 1986—MOSel—a 256K SRAM design based on a 1.2-micron CMOS process provided to Sharp, which provided 256K SRAMs
Matra-Harris Silicon Compilers	June 1986—MHS to integrate its 2-micron, double-metal CMOS process with Silicon Compilers' Genesil silicon design systems

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Matra-Harris Weitek	March 1986—Matra-Harris Semiconducteur's (MHS) receipt of Weitek's 16-bit integer multiplier product family; Weitek has preferred access to the MHS CMOS process in exchange for foundry services
Maxim Intersil	April 1986—Second-source agreement
Micro Linear Analog Design	July 1986—Micro Linear to integrate its micro and macrocell libraries into Analog Design tools' workbench CAE system
Micro Linear Daisy Systems	November 1986—Daisy Systems to port Micro Linear's cell libraries to its workstations
Micron Samsung	July 1986—Samsung's purchase of a 2.7 percent interest in Micron for $5 million as part of an out-of-court settlement; Micron received Samsung SRAM and EEPROM technologies for a 1.0 percent royalty
NMB National	September 1986—NMB to manufacture fast SRAMs; this agreement is no longer in effect
Novix Harris	July 1986—The Novix FORTH language MPU included in Harris' ASIC library
Performance Westinghouse	August 1986—Performance to fabricate a VHSIC Phase-I, 11,000-gate gate array designed by the Westinghouse Defense and Electronics Center
Powerex Westinghouse Mitsubishi	1986—Powerex formed by Westinghouse, GE, and Mitsubishi Electric; Powerex received licenses and technology from the companies
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems, using Seiko-Epson's CMOS process
SEEQ AMD/MMI	November 1986—Monolithic Memories acquisition of 16 percent of SEEQ for $4 million; jointly develop CMOS EEPROM-based PLDs
SEEQ Motorola	December 1986—Engineering development agreement to develop an EEPROM microcomputer
Samsung Mostek	1986—Agreement covering Mostek's 256K DRAM technology
Samsung Goldstar Hyundai	1986—Samsung, Goldstar, and Hyundai to cooperate on a 1Mb DRAM
Seattle Silicon Gould AMI	September 1986—Gould AMI provides Seattle Silicon with proprietary geometric design rules and performance characteristics of selected fab processes
Seattle Silicon Burroughs	August 1986—Seattle Silicon and Burroughs to jointly develop a new-generation design system for ICs
Sierra Mentor Graphics	December 1986—Sierra's cell library supported on Mentor Graphics' workstations

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Silicon Systems Ferranti	February 1986—SSi to second-source Ferranti's data conversion ICs in the United States
Silicon Systems Telmos Universal	August 1986—Universal's second-source agreement between Telmos and Silicon Systems acquired for the fabrication of analog/digital arrays
Silicon Systems RCA	February 1986—RCA to second-source SSi's monolithic modem ICs; RCA gained rights to SSi's analog CMOS process; SSi gained rights to RCA's digital 2-micron CMOS process; RCA also agreed to supply SSi with CMOS wafers over three years
Silicon Systems Oki Electric	September 1986—Oki to second-source SSi's K-series modems; Oki will pay royalties, furnish DSP chips, and provide foundry services
S-MOS Xilinx Seiko-Epson	1986—Development agreement with Xilinx, S-MOS, and Seiko-Epson for logic cell arrays and development systems using Seiko-Epson's CMOS process
TSMC Philips	1986—N.V. Philips' 27.5 percent interest in Taiwan Semiconductor Manufacturing Corp. and option to purchase controlling interest in the company
TriQuint EEsof	May 1986—EEsof to incorporate TriQuint's custom GaAs MMIC foundry models into Touchstone, a minicomputer and workstation-based MMIC CAD program
UMC TRW	April 1986—Joint development of 1.25-micron VLSI products
UMC SMC	June 1986—Contract to cooperate on computer ICs
VLSI Technology Mosaic Systems	1986—Joint agreement to build die and plug them together on the Mosaic process
VLSI Technology Intel	1986—Codeveloped a single-chip interface for the Intel-based Multibus II system bus architecture
VLSI Technology Acorn Computer	May 1986—Codeveloped a single chip, 32-bit RISC MPU, and associated controller chips
VTC Silicon Compilers	May 1986—VTC to provide its 1.6- and 1.0-micron two-layer metal CMOS processes to users of Genesil; VTC to develop a rad-hard cell for Genesil
Vitelic Philips	March 1986—Vitelic's access to Philips' process technology; Vitelic to design a family of high-performance CMOS SRAMs
Vitelic Sanyo	October 1986—Jointly develop a high-speed 64K SRAM family; Sanyo will manufacture the SRAMs

(Continued)

Table 9d (Continued)

1986 Alliances (75)

Companies	Description
Vitesse TRW	December 1986—Vitesse to supply TRW with high-performance wafers, die, and packaged devices, which TRW will assemble, test, qualify, and sell to the space quality, Class-S level market
WSI GE/RCA Sharp	March 1986—GE/RCA and Sharp have a five-year agreement with WSI to jointly develop an advanced cell library
Weitek Step Engineering	March 1986—Step Engineering to produce development tools for debugging and microcoding of Weitek's floating-point integer processor designs
Weitek Quadtree	April 1986—Quadtree Software to develop behavioral simulators for the WTL2264/2265 chip set
Weitek Matra-Harris	May 1986—Technology exchange and foundry agreement. MHS granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to MHS' CMOS process in exchange to manufacturing a variety of Weitek products
XTAR Fairchild	September 1986—Fairchild to alternate-source XTAR's X1000/X2000 graphics MPU chip set, which Fairchild will redesign and manufacture using its FACT fabrication process
Xilinx MMI/AMD	June 1986—MMI/AMD to manufacture and market Xilinx's Logic Cell Arrays and development system
ZyMOS Daewoo Corp.	April 1986—Controlling interest in ZyMOS acquired by Daewoo Corp.
iLSi Motorola	June 1986—iLsi's licensing of its line of gate arrays to Motorola
iLSi Sumitomo	December 1986—Sumitomo's licensing of ASIC design technology from iLSi exchange for royalty payments and foundry services

Source: Dataquest
January 1990

Table 9e

1985 Alliances (71)

Companies	Description
AMCC Sanders	February 1985—Sanders to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only
AMCC Seiko-Epson	May 1985—AMCC and Seiko-Epson entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process was merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
Altera Intel	June 1985—Extension of 1984 agreement with Intel for two years; includes additional products using Intel's CHMOS process and its evolutions
Altera P-CAD Systems	February 1985—Marketing agreement with P-CAD Systems
ATMEL General Instrument	March 1985—ATMEL technology provided to GI for fab capacity; this agreement is no longer in effect
Barvon Research Micron Technology	November 1985—Micron's acquisition of a 16 percent equity interest in Barvon to design ASICs for Micron
Brooktree Toshiba	1985—Brooktree's Technology licensed by Toshiba for consumer digital audio applications
CMD TRW	July 1985—TRW to manufacture HCMOS gate arrays in its JAN-qualified fab, using CMD/CMA's 1.2-micron design rules
CSi Viewlogic	October 1985—Custom Silicon's (CSi's) cell-based library offered on Viewlogic's Workview workstation
Catalyst Zilog	December 1985—Joint development and second-sourcing agreement; initial product will be a version of Zilog's Z8 MCU
Chips Toshiba Yamaha Fujitsu	November 1985—Foundry services from these companies subcontracted by Chips & Technologies
Cirrus Logic AMD	September 1985—Cirrus Logic's development of an MCU for AMD in exchange for foundry services
Cypress Matra-Harris	October 1985—Cypress masks for its SRAMs and 1.2-micron CMOS process transferred to MHS, which received 2 percent of Cypress' stock for $25 million
Cypress Weitek	October 1985—Joint development of a series of VLSI logic circuits designed by Weitek and manufactured by Cypress
ES2 Lattice Logic	1985—ES2 to market Lattice's logic compiler in Europe
ETC NCR	October 1985—Electronic Technology Corp. (ETC) to establish design centers and design cell-based ICs for NCR
Exel Microelectronics Samsung	May 1985—Prior agreement extended to include second-source Exel's 2Kx8 NMOS EEPROM
GAIN Mitsui	1985—Mitsui's acquisition of 30 percent interest in GAIN

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
ICS VLSI Technology Toshiba	1985—VLSI Technology and Toshiba to provide foundry services for Integrated CMOS Systems (ICS)
ICS Universal	1985—Cooperative gate array agreement to personalize wafers and designs supplied by ICS
IDT Internix	April 1985—Sales contract for Internix to sell IDT's products in Japan
IMP Iskra	April 1985—IMP's and Iskra's codevelopment of a CMOS analog cell library for which IMP provides foundry services
IMP National	April 1985—IMP to second-source National's 2-micron gate arrays
Inmos NMB/Minebea	March 1985—NMB/Minebea to ship 50 percent of its 256K DRAM output to Inmos
Inova UMP	November 1985—UMP to provide wafers to Inova
LSI Logic Toshiba	June 1985—Four-year joint venture to develop a 50,000-gate sea-of-gates array
LSI Logic C. Itoh	April 1985—C. Itoh to sell LSI Logic's products in Japan
LSI Logic Kawasaki Steel	August 1985—Formed joint-venture gate array company in Japan, Nihon Semiconductor
LTC Motorola	January 1985—Agreement granting each company rights to a number of patents
MOSel UMC	October 1985—MOSel's EEPROM, a 2Kx8 SRAM, and a 2-micron process transferred to UMC in exchange for fab capacity
MOSel Fuji Electric	September 1985—Fuji Electric supplied 4- and 6-inch wafers, using MOSel 1.5- and 2.0-micron processes; companies to jointly develop CMOS 16K and 64K SRAMs for MOSel
Maxim Brown Boveri	February 1985—Maxim to design and manufacture devices for Brown Boveri
Micro Linear Rockwell	1985—Rockwell's $1.2 million investment in Micro Linear and receipt of ASIC linear product technology; Rockwell provides wafers
Micro Linear Toko	October 1985—Toko to make bipolar devices for Micro Linear at its Saitama, Japan, plant
NMB Vitelic	November 1985—A 1Mb CMOS DRAM license granted to NMB's plant capacity

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
Quasel Taiwan ERSO	May 1985—Technology license
Ramtron General Motors	1985—Contract with General Motors to demonstrate ferroelectric feasibility in special applications such as space and automotive
S-MOS Siliconix	November 1985—Agreement allowing Siliconix to produce 1.5- and 2.0-micron gate arrays designed by Seiko-Epson and S-MOS
SEEQ Silicon Compilers	July 1985—All EEPROM designs provided by SEEQ for integration into SCI's Genesil System
Samsung Intel	January 1985—Samsung licensed to second-source certain Intel micros
Samsung Exel Microelectronics	May 1985—Prior agreement extended to include 64K EEPROMs
Samsung Zytrex	June 1985—LSI Logic devices and proprietary ICE-MOS process provided to Zytrex: Zytrex is no longer in business
Sierra VLSI Technology	January 1985—Sierra Semiconductor licensed by VLSI for IC software design tools in exchange for Sierra's cell-based designs
Silicon Systems Rogers	November 1985—Joint venture to design, manufacture, and market value-added intelligent flexible subsystems, called SMARTFLEX Systems
Tachonics Grumman	July 1985—Tachonics became a subsidiary of the Grumman Corporation
Topaz Hytek	July 1985—Topaz acquired by Hytek Microsystems; Hytek and Topaz cooperated on developing precision standard hybrid circuits
UMC Unicorn	January 1985—Unicorn, a design center based in Silicon Valley, funded by UMC for $2.5 million; joint development of a cell library
UMC Honeywell Synertek	July 1985—Nonexclusive product licenses gained by UMC for 18 ICs formerly produced by Synertek
Universal Edsun Laboratories	September 1985—Joint development with Edsun Laboratories for computer-related CMOS products
VLSI Technology Rockwell	1985—Jointly develop erasable programmable logic arrays
VLSI Technology Honeywell Synertek	April 1985—Rights to a CRT controller, interface circuits, 4O SRAMs, and a 16K ROM acquired by VLSI
VLSI Technology National	April 1985—National Semiconductor CMOS EPROM technology supplied to VLSI; VLSI manufactured the part and supplied wafers

(Continued)

Table 9e (Continued)

1985 Alliances (71)

Companies	Description
VLSI Technology Nihon Teksei	June 1985—Sales contract to sell mainly standard product LSIs into the Japanese market
VLSI Technology Daisy Systems	June 1985—VLSI's design tools and silicon compliers available on CHIPMASTER and SILICONMASTER workstations
VLSI Technology Zilog	June 1985—Zilog licensed to use VLSI's design software; cooperate to develop megacell versions of Zilog products
VLSI Technology Hewlett-Packard	October 185—Hewlett-Packard to use selected VLSI design tools on HP workstations
VLSI Technology MEM	1985—VLSI's process technology, which will be used by VLSI installed by Microelectronics-Marin (MEM)
VLSI Technology Olivetti	1985—Joint design center in Italy
VLSI Technology Bull Group	1985—VLSI's design technology licensed by Bull to develop computer products
VLSI Technology University of Louvain	1985—Agreement to install VLSI's IC design methodology to teach advanced IC design to students
Vitelic Sony	June 1985—Sony's access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity
Vitelic Hyundai	July 1985—Hyundai obtains license to Vitelic memory products in exchange for manufacturing capacity
Vitesse AMD	November 1985—Jointly develop and manufacture AMD's AM2900 family of MPUs in GaAs
WSI Sharp	October 1985—Prior agreement extended to include WSI's 1.6-micron CMOS technology
Weitek Intel	October 1985—Weitek to develop an interface IC that Intel will second-source; Intel to provide foundry services
Weitek National	October 1985—National to design, manufacture, and market an interface chip
Xicor Intel	August 1985—R&D technology exchange agreement to develop EEPROMs; both companies cross-licensed their EEPROM technology
Xilinx Seiko-Epson	December 1985—Codevelop logic cell arrays and development systems; Seiko-Epson to manufacture; jointly develop Seiko-Epson's CMOS process
ZyMOS General Instrument	April 1985—Extended agreement for an additional three years; covers cell library and foundry services
ZyMOS Source III	September 1985—ZyMOS to provide foundry services for Source III

Source: Dataquest
January 1990

Table 9f

1984 Alliances (42)

Companies	Description
AMCC Honeywell	August 1984—Honeywell to second-source AMCC's Q700 gate arrays and to alternative-source bipolar gate arrays
Altera Intel	August 1984—CHMOS EPROM fabrication technology and foundry services provided by Intel; Altera provided its EPLD design, test, and development support
Calogic Koki Company	December 1984—Koki to sell Calogic's CMOS data bus driver ICs in Japan
Custom Arrays ATAC-Diffusion	1984—ATAC to operate a design center and conduct marketing for Custom Arrays in Europe
Custom Arrays Ferranti-Interdesign	1984—The MM family is the result of a joint venture with Ferranti, which also acts as a second source
Custom Arrays Interdesign	1984—Jointly developed the MM family of linear arrays
Custom Silicon FutureNet	March 1984—CSi's cell-based design available on the FutureNet DASH design system
ETC Gould-AMI	1984—Agreement for 3- and 5-micron single-layer metal CMOS gate arrays; AMI provides foundry services
ICT IMP	July 1984—Codevelopment of a CMOS EEPROM process
IMP National	1984—Five-year technology exchanges and second-sourcing agreement covering IMP's cell-based designs and National's CMOS process
IMP Micro Linear	June 1984—Codevelopment of a 10V CMOS process; IMP provides foundry services
IXYS Ricoh	1984—Wafers provided by Ricoh; IXYS provided its power MOSFET HDMOS process
Inmos NMB	June 1984—NMB to produce the Inmos 256K CMOS DRAM for an initial sum and royalties; NMB will also cooperate on the Inmos 64K and 1Mb DRAMs
Inmos Thorn-EMI	1984—Thorn-EMI's acquisition of 76 percent of Inmos
Inmos Hyundai	December 1984—Hyundai—$6 million payment for the Inmos 256K DRAM technology
LSI Logic AMD	August 1984—Jointly develop CMOS standard cell definitions and a library for design of large-scale ICs
LSI Logic Intersil	February 1984—Agreement covering LSI Logic's HCMOS process logic arrays and Intersil's CMOS gate array family

(Continued)

Table 9f (Continued)

1984 Alliances (42)

Companies	Description
LTC Signetics	June 1984—Signetics to purchase die in wafer form and receive manufacturing rights for three precision op amps and other products; Signetics provided LTC with certain small outline packaging services
LTC Interdesign	July 1984—The right to design IC arrays, using up to three of LTC's processes, and dedicated foundry capacity to manufacture the Interdesign designs granted by LTC
Lattice Synertek	July 1984—Cross-licensing and second-sourcing agreement covering Lattice's UltraMOS process in exchange for Synertek's production capacity
Lattice VLSI Technology	September 1984—Lattice CMOS EEPROM and SRAM technology provided to VLSI in exchange for foundry services
Maxim Intersil	1984—Agreement to exchange products as part of a legal settlement
Micron National	November 1984—A license to manufacture and sell Micron's 64K DRAM purchased by National for about $5 million
Modular Ricoh	November 1984—Modular Semiconductor CMOS designs and processes for a 16K SRAM and 256K DRAM provided to Ricoh
NMB Minebea	1984—NMB is the subsidiary of and is financed by Minebea
NMB Inmos	June 1984—NMB to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the output
Novix Sysorex	March 1984—Sysorex International participant in first-round financing
PromTech Japanese Company	1984—PromTech licensed technology
S-MOS IMI	April 1984—Two-year agreement with International Microcircuits Inc. (IMI) to second-source 2-micron CMOS gate arrays and share cell-based libraries
Sierra National	July 1984—Technology exchange covering selected CMOS products and processes; Sierra leased a facility from National
TriQuint Tektronix	January 1984—TriQuint is a subsidiary of Tektronix
VLSI Technology Visic	February 1984—VLSI Technology and Visic to design and market CMOS 64Kx1 and 16Kx4 CMOS DRAMs
VLSI Technology Fairchild	May 1984—Joint development and second-source of Fairchild's 2-micron CMOS gate arrays

(Continued)

Table 9f (Continued)

1984 Alliances (42)

Companies	Description
VLSI Technology Silicon Compilers	October 1984—VLSI licensing of Silicon Compilers' RasterOp graphics processor chip in exchange for foundry services for customers who design circuits using SCI's design systems
VLSI Technology Western Digital	1984—Joint agreement to develop CMOS versions of propriety WD products and second-source several of WD's products; VLSI provides foundry support for three years
VTC CDC	October 1984—Control Data Corp. (CDC) invests $56 million in VTC; the arrangement includes a fabrication technology license
Vitelic Kyocera	March 1984—Kyocera participated in first-round financing
Vitelic ERSO	May 1984—ERSO and Vitelic to codevelop EPROMs and 64K and 256K CMOS DRAMs
Vitesse Norton Company	July 1984—The initial investment of $30 million provided by the Norton Company
WSI Sharp	December 1984—Sharp to produce a 64K CMOS EPROM for manufacturing capacity and royalties licensed by WSI
ZyMOS Intel	July 1984—ZyMOS ZyP design automation system provided for Intel's CHMOS II process; ZyMOS to manufacture Intel's 80C49 8-bit MCU

Source: Dataquest
January 1990

Table 9g

1983 Alliances (40)

Companies	Description
AMCC Signetics	September 1983—AMCC and Signetics to exchange future families of gate arrays and processes
AMCC Daisy Systems	February 1983—The Q-700 gate array family on Gatemaster supported by Daisy
Acrian Bharat	1983—Acrian technology transferred to Bharat Electronics Limited
Asahi Kasei Hitachi Limited	1983—Hitachi Limited's advanced CMOS process technology licensed by Asahi Kasei
BIT Analog Devices	1983—Equity investment
CDI Olympus Optical	January 1983—CDI gate array technology transferred to Olympus Optical Co.

(Continued)

Table 9g (Continued)

1983 Alliances (40)

Companies	Description
CDI Western Microtechnology	1983—CDI's gate arrays sold through Western Microtechnology's design center
CMD/CMA Ricoh	1983—Joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and cell-based ICs
CMD/CMA Micro Innovators	January 1983—Merge of CMD/CMA with Micro Innovators, a team of custom MOS/LSI designers
Custom Silicon NCR	November 1983—CSi to design and recall NCR's cell-based and gate array products in New England
Cypress MMI/AMD	June 1983—Cypress 1.2-micron CMOS process and warrants received by MMI/AMD in exchange for loan guarantees
ETC Exar	December 1983—Foundry services provided by Exar
Exel Microelectronics Samsung	1983—Samsung Semiconductor license to second-source its 16K EEPROMs granted by Exel
GBL Kidder, Peabody	December 1983—R&D partnership to develop four ultrahigh-speed GaAs SRAMs
ICT Hyundai	October 1983—International CMOS Technology (ICT) and Hyundai to jointly develop devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs; Hyundai allocated 30 percent of its wafer fab capacity for an equity interest in ICT
IMP Zoran	June 1983—Codevelopment of a CMOS PROM technology
IMP IXYS	November 1983—Codevelopment of a high-voltage CMOS process
Inmos General Instrument	October 1983—Inmos' 8Kx8 EEPROM licensed by General Instrument
Inmos Intel	December 1983—Intel and Inmos to develop consistent specifications on 64K and 256K CHMOS DRAMs
LSI Logic RCA	April 1983—RCA to second-source LSI Logic's 5000 Series
LSI Logic SGS	April 1983—SGS licensed by LSI as an LSI 500 Series and CAD software alternative source
LSI Logic Toshiba	June 1983—Jointly developed a channelless compacted array
LTC Teijin Japan Macnics Technology Trading	June 1983—Agreements for distribution in Japan

(Continued)

Table 9g (Continued)

1983 Alliances (40)

Companies	Description
Lattice Floating Point Systems	1983—Lattice UltraMOS technology provided in exchange for FSP's DSP and array processor technologies; FSP also made an equity investment
Micron ITT/STC	January 1983—ITT/STC granted a worldwide license by Micron to manufacture and sell 64K DRAMs
Micron Samsung	June 1983—Samsung granted a license by Micron to manufacture and market Micron's 64K and 256K DRAMs in exchange for cash
Micron Commodore	August 1983—Commodore licensed by Micron to produce a 64K DRAM; this agreement is no longer in effect
Mietec Sprague	1983—Cross-licensing agreement with Sprague for a BiMOS process
Samsung SST	1983—Samsung Semiconductor is the U.S. subsidiary of Samsung Semiconductor and Telecommunications (SST)
S-MOS Seiko-Epson	1983—S-MOS affiliated with Seiko-Epson, which holds 30 percent of S-MOS
SEEQ Silicon Compilers	1983—SEEQ to manufacture SCI's Ethernet data link controller
UMC AMI	April 1983—Dialer ICs produced in cooperation with AMI
Universal Siliconix	June 1983—Siliconix to set up a design center for Universal's gate arrays in Swansea, Wales
Universal Western Digital	August 1983—Western Digital to second-source Universal's CMOS gate arrays
VLSI Technology Ricoh	1983—Technology exchange for NMOS and CMOS mask ROMs
VLSI Technology KIET	1983—VLSI's 32K ROM technology licensed by KIET in exchange for foundry services
VLSI Technology Texas Instruments	July 1983—VLSI to second-source TI's TME4500A DRAM controller and developer of its 256K DRAM controller
VLSI Technology Wang Labs	November 1983—Wang purchased 15 percent of VLSI's stock for $34 million
ZyMOS Intel	January 1983—ZyMOS ZyP CAD system provided for Intel's CHMOS I process; codevelop a cell library
ZyMOS General Instrument	August 1983—GI to use ZyP software and Zy40000 to design the Zy4000 cell library

Source: Dataquest
January 1990

Table 9h

1982 Alliances (13)

Companies	Description
AMCC Sorep	January 1982—AMCC and Sorep to design, assemble, test, and market gate arrays in France
AMCC Thomson-CSF	July 1982—Thomson-CSF to alternate-source and develop AMCC's bipolar Q-700 series of gate arrays
Acrian Communications Transistor	1982—Acrian acquisition of Communications Transistors Corp.
CDI Telmos	1982—CDI's linear CMOS products licensed by Telmos
CDI Corintech	October 1982—Corintech, a thick-film manufacturer, to make and sell CDI gate arrays in Britain
CMD/CMA Ricoh	Ricoh wafers provided to CMD/CMA
CMD/CMA Racal	1982—CMD/CMA to manufacture and sell Racal's CMOS gate arrays in the United States
LSI Logic AMD	January 1982—A five-year license to manufacture the LCA 1200 Series of ECL macrocell arrays received by AMD
LSI Logic Fujitsu	1982—Agreement covering HCMOS gate arrays
LTC Silicon General	July 1982—Technology exchange and second-sourcing agreement; Silicon General provided PWMs and two additional circuits and second-sources several high-current series pass regulators developed by LTC
SEEQ Rockwell	July 1982—SEEQ 16K EEPROM and 16K UV EPROM technology provided to Rockwell for cash, a lease, and a royalty
SEEQ TI	August 1982—SEEQ EEPROM licensed to TI in exchange for TI's TMS7000 8-bit MCU
Universal Siliconix	December 1982—Second source for Universal's 5-micron ISO-5 and 3-micron ISO CMOS gate arrays
VLSI Technology Ricoh	1982—All wafers provided by Ricoh

Source: Dataquest
January 1990

Table 9i

1981 Alliances (10)

Companies	Description
Barvon Research Ricoh	1981—Foundry services provided by Ricoh
Barvon Research Goldstar	1981—Foundry services provided by Goldstar; joint development of an analog/digital CAD
CDI LSI Logic	July 1981—CDI's HC Series of gate arrays exchanged for LSI Logic's LDS1 CAD system

(Continued)

Table 9i (Continued)

1981 Alliances (10)

Companies	Description
CDI Giltspur	November 1981—A U.K. design center for CDI gate arrays established by Giltspur, a supplier of MPUs
Inmos TI	October 1981—Agreement for 64K DRAMs
LSI Logic Toshiba	August 1981—Joint development of a family of 1,000- to 10,000-gate CMOS arrays
Matra-Harris Intel	March 1981—Agreement covering NMOS circuits and a joint design facility, named Cimatel, in Nantes, France
SEEQ Amkor	1981—IC products assembled by Amkor
VLSI Technology Bendex	August 1981—Warrant guarantee for 14 percent of VLSI Technology preferred stock; $2 million R&D funding, $15 million equipment lease line
ZyMOS Intermedics	November 1981—Additional financing from Intermedics for $4 million

Source: Dataquest
January 1990

Table 9j

1980 Alliances (2)

Companies	Description
CDI AMI	1980—CDI HC series licensed to AMI
VLSI Technology Amkor	1980—Assembly for VLSI Technology's IC products provided by Amkor

Source: Dataquest
January 1990

Table 9k

1979 Alliances (3)

Companies	Description
AMCC Signetics	April 1979—Signetics to alternate-source the Q700 Quick-Chip series
UMC ERSO	1979—ERSO granted UMC a license for design and process technology for 4-inch silicon wafers
ZyMOS Intermedics	1979—Financing from Intermedics, Inc., for $10 million and lease guarantee for $5 million; ZyMOS supplied custom ICs

Source: Dataquest
January 1990

Start-Up Affiliations

In addition to strategic alliances, many start-ups have agreed to affiliations or acquisitions and have even acquired the assets of former companies. A number of companies in this directory are the result of joint ventures of other larger companies. Start-ups are a part of acquisitions and affiliations for the following reasons:

- To gain financial backing
- To exploit technologies developed at parent companies
- To gain mobility to enter new product markets
- To enlarge product lines
- To penetrate markets in other areas

Table 10 shows a list of start-up companies that either have been acquired, are affiliated with other companies, or have acquired other companies.

Table 10

Start-Up Company Affiliates or Subsidiaries of Larger Companies

Company	Affiliation
Aspen Semiconductor	Subsidiary of Cypress Semiconductor
Austek	Acquired Silicon Macrosystems (1986)
Chartered Semiconductor	Joint Venture among National Semiconductor, Singapore Technology Corp., and Sierra Semiconductor
Crystal Semiconductor	Acquired Texas Micro-Circuit (1984)
Custom Arrays	Subsidiary of ATAC
Electronic Technology Corp.	Subsidiary of J-TEC
Exel Microelectronics	Acquired by Rohm (1988)
Harris Microwave	Subsidiary of Harris Corp.
Headland Technology	Affiliate of LSI Logic
ICI Array Technology	Acquired by ICI Plc (1986)
Intergraph Advanced Processor Division	Division of Intergraph Corp., acquired via acquisition of Fairchild Advanced Processor Division (1987)
IXYS	Acquired ASEA Brown Boveri Power Semiconductor Group (1989)
Krysalis Corporation	Acquired by National Semiconductor (1989)
Matra-Harris Semiconducteur	Joint venture between Matra and Harris Corp.
MemTech Technology Corp.	Acquired Crystal Division of Materials Progress Corp. (1987)
Microwave Technology, Inc.	Acquired Monolithic Microsystems (1987)
MOSPEC Semiconductor	Subsidiary of President Enterprises Corp.
Multichip Technology	Subsidiary of Cypress Semiconductor
NMB Semiconductor	Division of NMB Technologies, which is a subsidiary of Minebea Co. Ltd. of Tokyo
NMB Semiconductor	Acquired Composite Recording Head Division of Seagate Technology
Orbit Semiconductor	Comdial was acquired by Orbit Instruments in 1985 and was renamed Orbit Semiconductor
Powerex, Inc.	Joint Venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corp.
Ramtron Corp.	Subsidiary of Newtech Development Corp.
Samsung Semiconductor	Subsidiary of Samsung Electronics Co., of the Samsung Group, a South Korean conglomerate
Sensym, Inc.	Acquired by Fasco Sensors & Controls (1989)
Spectrum Microdevices	Part of Fairchild Communications & Electronics

(Continued)

Table 10 (Continued)

Start-Up Company Affiliates or Subsidiaries of Larger Companies

Company	Affiliation
Telecom Devices	Subsidiary of Opto Diode Corp.
Three-Five Systems	Formed via leveraged buyout of National Semiconductor's Optoelectronics business unit (1985)
Topaz Semiconductor	Subsidiary of Hytek Microsystems
TriQuint Semiconductor	Subsidiary of Tektronix
United Silicon Structures	Affiliate of ES2
VTC Incorporated	Subsidiary of Control Data Corp.

Source: Dataquest
January 1990

Technology Trends

General Trends

Start-up companies in the United States historically have been at the leading edge of new product and process technology trends. The newest wave of start-up companies offer leading-edge process technologies, but many start-ups are subcontracting to external fabs. Many start-ups currently are planning products with submicron geometries, using advanced CMOS and BiCMOS technologies.

CMOS requires less power and generates less heat than bipolar and NMOS. Designers therefore can pack more circuits and functions onto a single chip, providing better price performance. Other advantages of CMOS that make it applicable for very large scale integration (VLSI) are broad operating temperature ranges, superior noise immunity, and improved electrostatic discharge protection. It also is a very versatile process technology that can be applied to both analog and digital circuits and can be combined with bipolar technologies to result in hybrid technologies such as BiCMOS. Most start-ups currently use a CMOS process technology.

Some other innovative technologies include bipolar ECL, BiCMOS, GaAs, and the Josephson Junction that IBM abandoned. Dataquest has identified many companies that are developing GaAs processes, and a few start-ups are beginning to explore BiCMOS. In fact, Aspen Semiconductor currently is offering BiCMOS ECL RAMs and PLDs.

Many of the companies also are taking a systems approach to designing ICs, an activity that mainline companies have not traditionally pursued. In recent years, Dataquest has identified a trend toward the "system on a chip." The ultimate expression of this idea would be a monolithic system chip that integrates logic and memory into the microprocessor. As companies pursue higher system performance through the use of ASICs and specialized peripheral chip sets, we have noticed that these companies find value in design engineers who possess both IC logic and systems expertise.

Current changes in the marketplace present the following challenges:

- Technology barriers as the industry approaches 0.5-micron design rules
- A demand for specialized chips with smaller overall markets
- Development costs of memory products that will reach as much as $100 million
- Rising costs for manufacturing equipment

To meet these challenges, companies are doing the following:

- Developing increasingly sophisticated computer and software tools
- Developing other technologies such as GaAs
- Focusing on end-use markets
- Emphasizing service

Table 11 lists the start-up companies alphabetically along with the product markets in which they participate.

Table 11

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
ACC						x	
Actel Corp.		x					
ANADIGICS				x			
ATMEL	x				x		Telecom
Acumos		x					
Adaptec						x	
AHA						x	
Advanced Linear	x						
AMP							Discrete
Advanced Power							Discrete
Alliance					x		
Altera		x					
AMCC		x					
Asahi Kasei	x	x			x	x	Telecom
Aspen		x			x		
Austek					x		
Avasem		x					
BKC							Discrete
BIT			x				
Brooktree	x						
CMD		x					
Calmos	x	x	x		x	x	Telecom
Calogic	x	x					
Catalyst					x	x	
Celeritek	x			x			Discrete
Chartered		x					Foundry
Cirrus Logic						x	
Comlinear	x						
Cree							Discrete
Crystal	x						Telecom
Custom Arrays	x						
Custom Silicon		x					
Dallas	x		x		x	x	Telecom
Dolphin		x					
DSP Group			x				
Exel Microelectronics		x			x		Telecom
Edsun						x	
Elantec	x						
ETC		x					
Epitaxx Inc.				x			Opto
ES2		x					
Gazelle				x			
Genesis		x					
GigaBit		x		x	x		Foundry
Harris				x			
Headland						x	

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Hecht-Nielson							Neural network
Hittite				x			
Hualon	x				x	x	Telecom
IC Sensors	x						
ICI Array		x					
ISSI					x		
IXYS							Discrete
IST		x					
Inova					x		
Integrated CMOS		x					
IIT						x	
Integrated Logic		x					
Intergraph APD						x	
ICT		x			x		
IMP		x					
Isocom							Opto
Krysalis					x		
Kyoto				x			Opto
Lattice		x					
Level One							Telecom
LIS	x						
LTC	x						
Logic Devices			x		x	x	
Lytel				x			Opto
Matra-Harris		x	x		x	x	Telecom
Maxim	x						
MemTech							Opto
Micro Linear	x	x					
M/W Monolithics			x				
M/W Technology	x			x			
Mietec		x					
Modular					x	x	Telecom
MOSel					x		
MOSPEC							Discrete, foundry
Multichip					x		
nCHIP							Multichip modules
NMB					x		Foundry
NovaSensor	x						
Novix						x	
NSI						x	
Oak Technology					x		
Opto Diode				x			Opto

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Opto Tech				x			Opto, discrete
Orbit							Foundry
Oxford					x		
PLX Technology	x						
Pacific Mono.				x			
Paradigm					x		
Performance					x	x	
Photonic Integration							Telecom
Plus Logic		x					
Power Integ.	x						
Powerex							Discrete
PromTech					x		
RAMAX					x		
Ramtron					x		
S3						x	
SEEQ					x		
SID	x						Discrete
SIMTEK					x		
Samsung	x				x		Discrete, telecom
Seattle Silicon		x					
Sensym	x						
Si-Fab							Foundry
Sierra	x	x			x		Telecom
Solid State							Discrete
Spectrum		x					
Synaptics							Neural network
Synergy					x		
TSMC							Foundry
Telcom Devices				x			Opto
Three-Five				x			
Togai							Fuzzy logic
Topaz							Discrete
TranSwitch							Telecom
TriQuint				x			
Triad					x		
UMC	x	x			x	x	Foundry, telecom
US2		x					
VIA Technologies						x	
VTC	x	x					
Vadem						x	
Vitelic					x		

(Continued)

Table 11 (Continued)

Alphabetical List of Start-Up Companies and Product Lines

Company	Analog	ASICs	DSP	GaAs	Memory	Micro	Others
Vitesse		x		x	x	x	
WaferScale		x			x		
Weitek			x				
Wolfson		x					
XTAR						x	
Xilinx		x					
Zoran			x				

Source: Dataquest
January 1990

Product Analysis

Emerging Technology Companies

Start-up companies in the United States historically have been at the leading edge of new trends in product and process technology. Many of the start-ups in this directory follow this same pattern. Table 12 lists some of the emerging technology companies and the areas in which they are developing.

ASICs

ASICs are transforming the electronics industry. System manufacturers are shifting their procurement content from standard ICs to ASICs. The functions of the standard ICs are being put into cell libraries used by system designers to incorporate a number of specific functions on one chip, thus providing a "single-chip system solution." This design methodology provides system manufacturers with a technique to accomplish the following:

- Reduce system size
- Reduce system cost
- Improve system security
- Reduce system development time
- Improve system performance
- Improve system reliability

Table 12

Emerging Technology Companies

Company	Technology/Product
Cree Research	Silicon carbide discretes
HNC	Neural network ICs
Krysalis	Ferroelectric memory
Molecular Electronics	Biomembranes (bioelectronics)
Photonic Integration	Optoelectronic ICs
RAMAX	Ferroelectric memory
Ramtron	Ferroelectric memory
Synaptics	Neural network ICs
Togai InfraLogic	Fuzzy logic processors

Source: Dataquest
January 1990

ASICs were a $7.4 billion market in 1988 and are projected to be a $17.8 billion market by 1994. More than 59 percent of all logic ICs consumed during 1988 were ASICs; the ASIC market consists of the following four product categories:

- Programmable logic devices (PLDs)
- Gate arrays
- Cell-based ICs (CBICs)
- Full-custom ICs

With the development of industry standards in the gate array segment, gate arrays have become a commodity product. As a result, companies with high-volume manufacturing capabilities, especially Japanese companies, now are dominating the market. More start-ups are entering the PLD market because there are no standards, it is a more fragmented market, and companies can protect their products with patented architectures. To survive, start-ups must avoid products that require large manufacturing muscle and develop strong ties with the customer. The key to success in this market is to provide a unique ASIC solution. This solution may take the form of a unique architecture or the development of cells for specific applications, such as telecommunications. Table 13 lists the companies that participate in the ASIC market.

Table 13

Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Actel Corp.	x				
Acumos	x				
Altera				x	
AMCC	x				
Asahi Kasei	x		x		
Aspen				x	
Avasem			x		
Calmos	x		x		
Calogic	x				
CMD	x		x		
Custom Arrays		x			
Custom Silicon	x				
Dolphin			x		
ETC		x			
ES2					x
Exel Microelectronics				x	
Genesis	x		x		
GigaBit			x		
ICI Array	x	x			
IST	x		x		
ICS	x				
iLSi	x				
ICT				x	
IMP	x		x		
Lattice				x	
Matra-Harris		x			
Micro Linear		x			
Mietec			x		
PLX				x	
Plus Logic				x	

(Continued)

Table 13 (Continued)

Companies That Offer ASIC Products

	Gate Array	Analog Array	Cell Library	PLD	Silicon Compilation
Seattle Silicon			x		x
Sierra			x		
Spectrum Micro	x				
UMC	x		x	x	x
US2					x
VTC	x		x		x
WaferScale			x		
Xilinx				x	

Source: Dataquest
January 1990

Analog ICs

The term "analog" defines electrical signals that have the property (or potential) of being continuously variable and that do not represent encoded numerical values. From 1988 through 1993, Dataquest predicts a compound annual growth rate (CAGR) of 12.4 percent for the analog IC market. Historically, analog ICs have grown well, between 16 and 20 percent in revenue during the last 10 years. The need to interface between the digital world and the real world has driven this growth. The need for accuracy, an easier means of design, and higher speed and precision also have been large factors. We expect these factors to continue to drive growth. Of great interest to the future growth of analog ICs, however, will be the development of analog ASIC circuitry, as employed in arrays and cell libraries.

Companies that offer analog products are concentrating on high-growth products, particularly analog ASICs, data converters, and telecom-specific products. A very specialized niche is the IC sensor segment. Three companies that offer sensor products are IC Sensors, NovaSensor, and Sensym.

Application-specific analog ICs, another analog approach, are expected to be a key area. Companies that can design cost-effective and reliable analog and digital circuits on a single chip will be able to provide a valuable service to the market. Companies that currently offer analog array design services are listed in the subsection entitled "ASICs."

Product segments in the analog marketplace include the following:

- Operational amplifiers
- Comparator products
- Consumer circuits
- Data conversion products
- Interface products
- Voltage regulators/voltage references
- Sensor products

Telecommunications ICs, which constitute an additional analog market segment, are listed separately in the subsection entitled "Telecommunications."

Dataquest believes that analog ASICs and telecom IC products will be the only areas that will show growth in 1989. In the long range (i.e., 1988 through 1993), Dataquest anticipates strong growth in the areas of analog ASICs, data converters, and telecom ICs. The CAGRs for each of these segments are 21.4 percent, 17.3 percent, and 16.2 percent, respectively. Major markets for analog ICs include data processing, communications, industrial, military, consumer, and transportation/automotive.

Table 14 lists the participants in the market for analog ICs.

Table 14

Companies That Offer Analog ICs

	Op Amps	Comparators	Consumer	Data Conv.	Interface	Regulators/ References	Sensors
ALD	x	x					
Asahi Kasei				x			
ATMEL				x	x		
Avasem				x			
Brooktree	x		x	x			
Calmos	x			x			
Calogic	x					x	
Celeritek	x						
Comlinear	x			x			
Crystal	x			x			
Dallas					x		
Elantec	x	x			x		
Hualon			x				
IC Sensors							x
LIS				x			
LTC	x	x		x	x	x	
Maxim	x			x	x	x	
Micro Linear				x	x		
Microwave Technology	x						
NovaSensor							x
Power Integrations				x			
Samsung	x	x		x	x	x	
Sensym							x
Sierra				x			
Topaz				x	x		
UMC			x	x			
VTC	x	x		x	x		

Source: Dataquest
January 1990

Digital Signal Processing

The digital signal processing (DSP) market is a fast-growing area with many niche market opportunities for innovative start-up companies. DSP applications have emerged as consumers of substantial numbers of ICs, particularly in the communications and military market segments, which currently represent approximately 75 percent of all DSP applications. However, technology and products are migrating quickly into mainstream commercial and consumer areas.

DSP products, as defined by Dataquest, comprise four categories: single-chip DSP microprocessors, microprogrammable devices, special-function circuits, and ASIC DSP products. DSP microprocessors are analogous to the MPUs used in the PC environment; the main difference is that their architectures are optimized to solve digital signal processing problems. Microprogrammable products are used to build customized architectures to solve high-performance problems and include multipliers, multipliers/accumulators, sequencers, and other traditional bit-slice products. Special-function devices include modems, codecs, filters, and speech- and image-processing devices. ASIC DSP products use a cell-based approach and are designed specifically for DSP applications.

Table 15 shows the companies that participate in the DSP market.

Table 15

Companies That Offer DSP Products

	DSP MPU	Microprogrammable	Special Function
BIT		x	
Calmos			x
Dallas	x		
The DSP Group			x
Logic Devices		x	
Matra-Harris		x	
Weitek		x	
Wolfson		x	
Zoran	x		x

Source: Dataquest
January 1990

Discrete Semiconductors

The term "discrete" refers to a packaged semiconductor device that has a single function, meaning that one or several functioning circuits are in the package. Technically, optoelectronic devices belong in this category, but for the purpose of this directory, we are treating them separately.

Dataquest divides the discrete market into seven separate categories: small signal and power transistors; small signal, power, and zener diodes; thyristors; and other discretes. Power field-effect transistors (FETs) are included as a separate category because many of the newer companies are concentrating in this area. FETs differ from most bipolar transistors in that they are voltage-controlled rather than current-controlled devices. FETs are available in two types: junction types (JFETs) and metal oxide types (MOSFETs).

The value of the discrete market was $7.5 billion in 1988. The discrete market grew at a CAGR of 13.4 percent from 1982 through 1987. We believe that the CAGR will be considerably less from 1988 through 1993, at 7 percent. The strongest product growth is expected to be in the power device and other discrete categories. Table 16 shows the companies that participate in the discrete semiconductor market.

Table 16

Companies That Offer Discrete Products

	Diodes	Transistors	Power FETs	Thyristors	Others
AMPi			x		
APT			x		
BKC International	x				
Celeritek		x			
Cree Research	x				
IXYS			x		x
MOSPEC		x	x		
Powerex	x			x	
SID		x			
Samsung		x	x		
Topaz			x		

Source: Dataquest
January 1990

Table 17

Companies That Offer Foundry Services

Company	Location
Chartered Semiconductor	Singapore
GigaBit Logic	United States
MOSPEC Semiconductor	Taiwan
NMB Semiconductor	Japan
Orbit Semiconductor	United States
Si-Fab Corporation	United States
Taiwan Semiconductor Manufacturing	Taiwan
UMC	Taiwan

Source: Dataquest
January 1990

Foundry

The companies listed in Table 17 offer semiconductor foundry services. GigaBit Logic, MOSPEC, and NMB also offer other products and services. The most recently formed company is Chartered Semiconductor Corporation, which was formed as a joint venture among National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation to establish a technology base in Singapore.

Gallium Arsenide

Gallium arsenide (GaAs) and other III-V compound semiconductors have made a slow transition from the laboratory to commercial applications. Users of supercomputers, telecommunications hardware, instrumentation, and consumer products are discovering major benefits in performance and improved functionality by taking advantage of this space-age technology. The worldwide market for GaAs semiconductors surpassed the $2.5 billion mark in 1988, up from 1987 shipments of an estimated $2.2 billion to more than $2.7 billion. The predominant devices were discrete optoelectronics; ICs make up less than 10 percent of these figures. GaAs is projected to exceed $4 billion by 1992; however, less than 30 percent of this value will be in ICs.

Advantages of GaAs over Silicon

The following are advantages that GaAs semiconductors have over silicon:

- Circuit switching 3 to 10 times faster
- Speed/power product 5 to 6 times more efficient
- Relative insensitivity to temperature and power supply variations
- Upper temperature limit of 350°C versus 175°C
- Superior levels of radiation tolerance
- Integrated optoelectronics on a single chip
- Wider range of resistivity due to semi-insulating substrates

Disadvantages of GaAs versus Silicon

The disadvantages of GaAs semiconductors compared with silicon are as follows:

- Higher wafer cost (typically 20 times or more)
- Lower level of digital circuit integration at a given point in time
- Lack of volume-production parametric test capability
- Design tasks more difficult; fewer expert engineers

GaAs has potentially wide-range applications in military, communications, and data processing market segments. Although GaAs is not likely to replace silicon in the foreseeable future as the workhorse semiconductor material, we do expect substantial growth in the GaAs market.

The following are potential GaAs IC applications:

- Telecommunications: opto and microwave electronics
- Computers and peripherals
- Instrumentation
- Consumer electronics
- Robotics
- Automotive
- Military/government

GaAs products are segmented into the following classifications:

- Analog ICs—MIC amps, MIC converters, frequency multipliers, ASICs
- Digital ICs—Logic, memory, ASIC, dividers, cost models
- Optoelectronics—LEDs, lasers, detectors, photovoltaic cells, isolators, couplers, integrated opto devices
- Discretes—Small-signal transistors, power FETs

Table 18 shows the participants in the gallium arsenide market.

Memory

Because it is very difficult for a start-up to compete in a commodity market such as DRAMs or slow SRAMs, most memory start-ups are entering niche markets. It is important for a start-up to enter a market that matches its abilities. For this reason, many new memory companies have chosen to enter the market for fast SRAMs. This market is well suited to start-up participants for the following reasons:

- It offers good margins.
- It requires a strong process technology.
- It requires strong technical support.
- It requires close customer contact, which is necessary to design products to fit client needs.
- It does not require a large fab.

Table 18

Companies That Offer GaAs Products

	Analog MMICs	Digital Linear	RAMs	ASICs	Std. Logic	Discretes	Opto
ANADIGICS	x	x					
Celeritek	x	x				x	
Epitaxx Inc.							x
Gazelle				x			
GigaBit		x	x	x	x		
HMS	x	x			x	x	
Hittite	x						
Isocom							x
Kyoto							x
Lytel							x
M/W Monolithics	x						
M/W Technology	x	x					
Opto Diode							x
Opto Tech						x	x
Pacific	x	x		x			
Telecom Devices							x
Three-Five							x
TriQuint	x	x		x	x		
Vitesse		x	x	x	x		

Source: Dataquest
January 1990

Most start-ups are well positioned to meet the success requirements in the fast SRAM market. U.S. companies have a particular advantage over Japanese companies in one crucial area: U.S. companies are able to establish much closer contact with their U.S. clients because of their domestic production capability. The goal of most start-ups is to become niche players. To sustain success with a niche strategy, however, the company must dominate the niche.

Other niches that start-ups are pursuing include the high-speed EPROM and EEPROM markets and other nonvolatile memory markets such as ferroelectric memory. In addition, a number of start-ups are positioning themselves in markets for specialty memories such as FIFO and dual-port devices.

Table 19 lists the participants in the memory product market.

Table 19

Companies That Offer Memory Products

	DRAM	SRAM	ROM	EPROM	EEPROM	FIFO	Others
Alliance	x	x					
Asahi Kasei		x	x				
Aspen		x					
ATMEL				x	x		x
Austek							x
Calmos		x					
Catalyst		x		x	x		
Dallas		x				x	x
Exel							x
GigaBit		x					
Hualon		x	x				
ISSI		x					
Inova		x					
ICT				x	x		
Krysalis							x
Logic Devices		x				x	x
Matra-Harris		x					x
Modular		x					
MOSel		x				x	x
Multichip		x					
NMB	x						
Oxford							x
Paradigm		x					
Performance			x				
PromTech				x			
RAMAX							x
Ramtron							x
Samsung	x	x			x		
SEEQ				x	x		
Sierra					x		
SIMTEK							x
Synergy		x					
Triad		x					x
UMC		x				x	
Vitelic	x	x				x	x
Vitesse		x					
WaferScale				x			

Source: Dataquest
January 1990

Microcomponents

Microcomponent products generally command higher ASPs than other ICs, frequently are sole-sourced, and have fostered the development of high-end niche markets. Start-up companies are offering graphics controllers, hard and floppy disk controllers, CRT controllers, and peripheral chip sets. A small number of start-ups are producing microprocessors, but the microprocessor market is dominated by larger companies such as Intel and Motorola.

During the past two years, the logic chip set market has been the fastest-growing segment of the microcomponent market. Worldwide, there were only 6 PC logic chip set vendors in 1987. In 1988, the number of vendors climbed to 13, a figure that continues to grow. Many of these new entrants are start-ups. Dataquest believes that the rapid increase in new entrants and capacity has carried this market to the point of saturation. We expect this saturation to lead to aggressive price competition, causing vendors to look for penetration of these products into new applications and markets. At this point, the growth rate of chip set shipments will be tied directly to the growth rate of PC shipments. The CAGR for chip set shipments from 1989 to 1993 is estimated to be only 12.2 percent. This growth level should attract fewer new entrants and cause some participants to exit the industry.

Dataquest believes that this rapid market saturation is bound to be repeated in each of the PC peripheral chip set markets—logic, graphics, communications, mass storage, modem, and fax—as established chip set and semiconductor companies follow one another into these most obvious product-line extensions. The graphics chip set market already is showing signs of saturation, marked by severe pricing pressure. At the same time, apparently low barriers to entry invite many new market participants.

Table 20 lists the companies that offer microcomponent products.

Table 20

Companies That Offer Microcomponent Products

	MPU	MCU	MPR Commun.	Mass Storage	Sys. Support	Key/Display
ACC Micro					x	
Adaptec				x		
Asahi Kasei		x				
Avasem					x	
Calmos	x			x	x	
Catalyst		x				
Cirrus Logic			x	x		x
Dallas		x			x	x
Edsun			x		x	x
Headland						x
Hualon			x		x	x
IIT	x					x
Intergraph APD	x					
Logic Devices			x		x	
Matra-Harris	x	x			x	x
Modular					x	
Novix	x					
NSI Logic						x
Oak Technology					x	x
Performance	x				x	
SEEQ	x				x	
S3					x	
UMC	x	x		x	x	x
XTAR						x

Source: Dataquest
January 1990

Optoelectronics

Optoelectronics is a field that combines the technologies of optics and electronics. Visible devices, including light-emitting device (LED) lamps and LED displays, are the market segments concerned with the interactions between light-emitting and filtering devices and electronics. LEDs are commodity products. Optocouplers and other opto areas are more customized products. Both of these products are growing at a faster pace than LEDs. Other opto areas include products such as photodiodes and phototransistors, solar cells, infrared lamps, lasers, and CCD sensors.

Dataquest divides the optoelectronics market into four separate categories: LED lamps, LED displays, optoelectronic couplers, and other optoelectronic devices. The total market for optoelectronics grew at a rate of 15.8 percent compounded annually from 1982 through 1987. Dataquest expects this growth rate to continue at the lesser rate of 11.4 percent compounded annually from 1988 through 1993. Price pressure in the industry is eroding dollar growth, although new technologies and applications continue. The optoelectronics segment is being fueled by the communications and computer industries, which use light as a medium for communication. Optoelectronics also are heavily used in the consumer market.

Table 21 lists the companies that offer optoelectronic products.

Telecommunications ICs

The telecommunication IC market is growing faster than the analog IC market, of which it is a segment. In fact, Dataquest predicts a CAGR of 16.2 percent for the telecom IC segment in the 1988 through 1993 period. One factor driving the growth of telecommunication ICs is the need to automate the office by linking personal computers. Another factor is the need to communicate faster, farther, and in a variety of ways, including satellites and facsimile machines. The demand for better and faster communication also is spurring the development of new devices such as line interfaces and switch arrays.

Table 22 lists the companies that offer telecommunications ICs.

Table 21

Companies That Offer Optoelectronic Products

	Light Emitting	Light Sensing	Others
Cree Research	x		
Epitaxx Inc.	x	x	
Isocom			Optocouplers
Kyoto	x	x	
Lytel	x		Lasers
Opto Diode	x		
Opto Tech	x		Photodiodes Phototransistors
Solid State	x	x	
Telcom Devices			Photodiodes

Source: Dataquest
January 1990

Table 22

Companies That Offer Telecommunications ICs

	Dialer	Modem	UART/ DUART	Line Interface	Codec/ Filter	Switch Array	Others
Asahi Kasei					x		
ATMEL					x		
CMD	x				x		
Calmos					x		x
Crystal	x	x		x			x
Dallas			x				
Exel			x				
Hualon	x						x
Level One				x			
Matra-Harris		x		x	x		
Modular			x				
Photonic							x
Samsung	x				x		x
Sierra	x	x			x		
Topaz						x	
TranSwitch							x
UMC	x		x				

Source: Dataquest
January 1990

Company Profiles

Dataquest has profiled 137 semiconductor start-ups in the following subsection. The data for these profiles were collected through personal and telephone interviews, surveys, and publicly available material. Some of the text was integrated verbatim from background information provided by the companies.

The 1990 edition contains some information not included in earlier editions of this directory. The asterisks (*) in the board of directors and company executives sections denote company founders. At the end of each profile, the name of the company's PR firm is listed if one exists.

ACC Microelectronics Corporation

3295 Scott Blvd., Suite #400
Santa Clara, CA 95054
408/980-0622
Fax: 408/980-0626

ESTABLISHED: February 1987 **NO. OF EMPLOYEES: 50**

BACKGROUND

ACC Microelectronics Corporation was established in February 1987 to design, produce, and market VLSI devices for advanced computer and communication products. The Company was founded by W.T. Chiang, a designer of the Intel 80386. ACC is concentrating on developing VLSI circuit device chip sets to be used as "gap bridging" solutions in several major application areas such as communications, computer systems controllers, and computer system board integration.

The Company has developed a full line of high-performance products, including nine chip sets and 15 individual chips. These products include a single-chip turbo-IBM PC XT-compatible peripheral controller, a single-chip floppy disk controller for XT, AT, PS/2 Model 30, and PS/2 Models 50, 60, 70, and 80-compatible computers, a 386 chip set, and a 386SX chip set. ACC's target markets include OEMs, distributors, and value-added integrators of computer and communication systems.

In April 1989, ACC announced a strategic alliance with Motorola's Semiconductor Products Sector. The agreement allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Previously, ACC and Motorola announced an alternate-source licensing agreement for the ACC3200 series of disk controllers.

In the future, ACC Microelectronics will offer a complete line of system-level VLSI chip set solutions for advanced computers and communications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*W.T. Chiang
Intel, Senior Manager

VP Eng
Mark Shieu
Amiga, Director

Dir Prod Mktg
Jack Yuan
Genoa, Prod Mktg Mgr

*Founder

FINANCING

ACC Microelectronics is privately financed.

RECENT HIGHLIGHTS

November 1989
ACC introduced a four-device chip set for IBM PC AT-compatible computer systems. The new ACC-82021 chip set operates at up to 20 MHz and supports Intel 80286 and 80386SX microprocessors.

November 1989
ACC announced its three-device ACC-82300 chip set for IBM PC AT-compatible computer systems. The new chip set operates at 20 or 25 MHz and supports the Intel 80386 microprocessor.

November 1989
ACC introduced the ACC-82030 single-chip AT controller. The new highly integrated controller chip is packaged in a unique 256-pin surface mount device developed by Motorola as part of ACC's earlier agreement with Motorola.

ALLIANCES

Motorola
April 1989
ACC and Motorola announced a strategic alliance that allows Motorola to second-source the ACC82020 and ACC82300 chip sets for PC AT-compatible computers and the ACC16C451 family of multifunction I/O controllers. Motorola also gained second-source rights to a cache controller and a tag RAM developed by ACC.

MANUFACTURING

Technology

1.5- and 1.0-micron CMOS

Facilities

Santa Clara, CA
Design, test

PRODUCTS

Single Chip XT—ACC1000
Single Floppy Disk Controller—ACC3201
386SX AT Chip Set—ACC82020
386 AT Chip Set—ACC82300

OTHER INFORMATION

ACC's PR firm is Shotwell Public Relations.

Actel Corporation

955 E. Arquez Avenue
Sunnyvale, CA 94086
408/739-1010
Fax: 408/739-1540

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 60**

BACKGROUND

Actel Corporation designs, manufactures, and markets user-configurable integrated solutions for the design and implementation of ICs in electronic systems.

The Company was founded by Amr Mohsen, a former Intel program manager of advanced technology development.

Actel has developed a CMOS gate array based on proprietary architecture and customer-configurable interconnect technologies. Customers can map applications instantly with Actel's design automation systems, which includes development software and system hardware.

In 1987, Actel received $750,000 in follow-on funding, bringing first-round financing to $9.1 million. In March 1988, William Davidow, an Intel veteran and well-known venture capitalist, was elected chairman of Actel.

BOARD
(Name and Affiliation)

William H. Davidow, Chairman
Mohr, Davidow Ventures

*Amr Mohsen
Actel Corporation

Carver Mead
California Institute of Technology

Jos Henkens
Advanced Technology Ventures

Vahe Sarkissian
Data General Corporation

Ed Zshau
Censtor Corporation

John East
Actel, President/CEO

Robert G. Spencer
Hillman Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
John East
AMD, VP Logic Products

VP Operations
Paul Franklin
MMI, GM-Memory, Digital & Logic Divisions

Sr VP Sales/Mktg
M. Douglas Rankin
Signetics, VP WW Sales

VP Finance
Richard S. Mora
HHB, VP Finance

VP Engineering
Jeff M. Schlageter
AMD, Managing Dir Peripheral Products

*Founder

FINANCING

October 1985
Initial
$0.5M
Private, Advanced Technology Capital, Shaw Venture Partners

June 1986
Round 1
$9.1M
Advanced Technology Ventures; Brentwood Associates; Mohr, Davidow Ventures; Norwest Venture Capital; Oak Associates; Shaw Venture Partners; Data General

August 1988
Round 2
$9.3M
Hillman Ventures, Sprout, DLJ Ventures, Rothschild Ventures, Equity Venture Capital, Hughes Aircraft

RECENT HIGHLIGHTS

February 1988
Actel introduced the ACT 1 family of FPGAs, which can be designed, programmed, and tested from a 386-based PC in a matter of hours.

July 1988
Actel disclosed technical details of its Programmable Low Impedance Circuit Element (PLICE) antifuse nonvolatile interconnect, a strategic technology important to the company's thrust into desktop-configurable products.

ALLIANCES

Data General
1986
Actel signed a three-year joint development agreement with Data General that allowed Data General to design and develop semiconductor products based on Actel's technology. In return, Data General supplied Actel with use of test equipment, wafer fabrication, and engineering facilities (expired).

Texas Instruments
November 1988
Actel and TI signed a seven-year technology and licensing agreement. Under the pact, TI will alternate-source the ACT 1 family of gate arrays and resell the Action Logic System (ALS)—Actel's fully-automatic CAE system. Actel will gain access to TI's advanced EPIC 1 CMOS wafer-processing technology and manufacturing capabilities.

MANUFACTURING

Technology

CMOS

Facilities

Sunnyvale, CA
30,000 sq. ft.
R&D, development, marketing, administration

PRODUCTS

A family of field-programmable Gate Arrays supported by a design automation system

Gate Arrays

Device	Description
Act 1010	1,200-gate FPA
Act 1020	2,000-gate FPA
Action Logic TM System	Development hardware and software

OTHER INFORMATION

Actel's PR firm is Tsantes and Associates.

Acumos, Inc.

1531 Industrial Road
San Carlos, CA 94070
415/591-1488
Fax: 415/591-1483

ESTABLISHED: 1985 **NO. OF EMPLOYEES: 15**

BACKGROUND

Acumos, Inc., specializes in analog-to-digital arrays, small-to-medium high-drive and high-voltage arrays, and analog switching arrays that incorporate both CMOS and DMOS switches. The Company offers both full-custom and standard cell devices.

In 1987, Acumos offered the A300 gate array that incorporates analog and digital functions. The device, which is a PLD replacement part, is designed for voice filtering, robotics, magnetic disk drive applications, and communications markets. The Company plans later introductions of specialty high-voltage products.

In 1985, the Company acquired Semi Processes Inc.'s gate array assets, including inventory, wafers, and test equipment. The Company is servicing SPI's customer base for low-density CMOS gate arrays in the 50- to 700-gate range.

Acumos subcontracts manufacturing and assembly with U.S. and offshore companies. The Company plans to sell into the Japanese and U.S. markets.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Man Shek Lee
GTE, Mgr IC Design

VP
*Chieh Chang
GTE, Sr Design Engr

*Founder

FINANCING

Not available

ALLIANCES

None

MANUFACTURING

Technology

3.0-, 4.0-, 5.0-micron silicon-gate CMOS

Facilities

San Carlos, CA
4,000 sq. ft.
Design and test

PRODUCTS

Gate Arrays

Device	Linewidth	Gates	Description
7001/7004/7005	4-micron	100 to 700	High 15V Output Drive Digital Gate Arrays, Typical 3ns Delay
D315-D3120 Series	3-micron	150 to 1,200	Typical 2ns Delay
A300	4-micron	300	Analog/Digital Array with Op Amps, Resistors, Capacitors, Comparators, 5ns-Internal Gate Delay
CD01/CD02		30-100	CMOS/DMOS Monolithic Gate Array

OTHER INFORMATION

Acumos does not employ a PR firm.

Adaptec, Inc.

691 S. Milpitas Boulevard
Milpitas, CA 95035
408/945-8600
Fax: 408/262-1845

ESTABLISHED: May 1981 **NO. OF EMPLOYEES: 567**

BACKGROUND

Adaptec, Inc., is one of the leading suppliers of high-performance input/output (I/O) solutions. Product offerings include proprietary VLSI circuits, a broad line of small computer systems interface (SCSI) host adapters and enhanced small device interface (ESDI) disk controller boards for personal computers, local area network (LAN) interface units, a family of SCSI test and development systems, and imaging systems controller products. Adaptec stock is traded over the counter under the NASDAQ symbol ADPT.

Adaptec designs full-custom, semicustom, and gate array circuits in NMOS, CMOS, and bipolar technologies in geometries ranging from 4.0- to 1.0-micron. Products are targeted to customers in three segments of the microcomputer market: the personal computer market; the multiuser systems, network file server, and engineering workstation market; and the supercomputer market for scientific and business applications. Adaptec also designs and manufactures host adapters and controller boards for the AT, Micro Channel and, soon, extended industry standard architecture (EISA) bus architecture microcomputers.

Adaptec is one of the leaders in the SCSI industry with chips, boards, test and development systems, software support, and communication products. The Company eventually will apply the interface to its laser printer controller boards. Adaptec's SCSI protocol chip has been incorporated into a host adapter made by IBM, and its controller chips have been selected by peripheral customers such as Conner, Hitachi, Quantum, Seagate, Seiko-Epson, and Sony. Adaptec has won contracts for its board products from microcomputer makers such as Nokia, Tandy, Unisys, and Zenith. Additionally, the Company's network interface unit, the Nodem, was "blessed" by Apple Computer and featured in the introduction of Apple's Macintosh Portable.

The Company subcontracts all IC production; however, it also performs final test on all products to maintain the quality and reliability of its devices. High-volume board products are assembled in Singapore by Adaptec's wholly owned manufacturing entity, Adaptec Manufacturing Singapore (AMS).

Adaptec markets and distributes controller boards and circuits to a broad spectrum of computer and disk drive manufacturers, a number of reseller channels, and domestic and international industrial distributors. The Company has 15 manufacturers' representative organizations, 5 industrial distributors, and 19 international distributors.

BOARD

(Name and Affiliation)

John G. Adler
Adaptec, Inc., President/CEO

Lawrence B. Boucher
Adaptec, Inc., Chairman

Robert J. Loarie
Lawrence, WPG Partners, General Partner

David F. Marquardt
Technology Venture Investors, General Partner

B. J. Moore
Outlook Technology Inc., President

W. Ferrell Sanders
Asset Management Co., Senior Associate

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
John G. Adler
Amdahl, VP Product Dev

VP Engineering
Larry Sasscer
Amdahl, Mgr Channel Dev

VP/GM
Jeffrey A. Miller
Intel, Mktg Mgr/MPU Ops

VP Finance/CFO
Paul Hansen
Raychem, Asst Controller

VP Systems
Bernard G. Nieman
Shugart, Project Manager

VP Sales
Roger McLean
Imagen Corp., VP OEM Sales/Mktg

VP Mfg
Gary J. Weitz
Finnigan, General Manager

VP Peripheral Products
G. Venkatesh
Commodore Int'l, Director of Mktg

FINANCING

June 1986
IPO
$10.0M
Initial public offering

RECENT HIGHLIGHTS

1979
Adaptec founders created SCSI.

1983
Adaptec introduced the industry's first programmable disk controller chips.

1984
Adaptec introduced the industry's first multitasking disk controllers/host adapters.

January 1987
Adaptec established a subsidiary in Singapore. The new company, called Adaptec Manufacturing Singapore, manufactures surface-mount controllers.

October 1987
Adaptec signed a $5 million contract to supply Conner Peripherals with disk controller ICs during 1988.

1988
Adaptec introduced the industry's first PS/2 Micro Channel disk controllers.

June 1988
Adaptec announced a major corporate restructuring. Under the new plan, the Company is organized into four major groups: Test and Development Systems, Chips, Boards, and Communications Products. Each group is nearly autonomous, with separate marketing, management, and profit-and-loss responsibility.

July 1989
Adaptec established a regional sales and support office in Singapore, headed by K.S. Yeo, regional sales manager.

ALLIANCES

SCO
October 1987
Adaptec signed an agreement with The Santa Cruz Operation (SCO) to jointly develop SCSI support for SCO's XENIX system V operating system.

Chips & Technologies
January 1988
Adaptec and Chips & Technologies aligned to introduce a series of hardware products that provide complete system solutions for producing desktop computers fully compatible with IBM PS/2 Models 50, 60, and 80.

MANUFACTURING

Technology

4.0- to 1.0-micron NMOS, CMOS, bipolar

Facilities

Milpitas, CA
100,000 sq. ft.
Administration, development

Singapore
45,000 sq. ft.
Manufacturing

PRODUCTS

Integrated Circuit Products

Device	Description
AIC-010F	10-Mbps Programmable Storage Controller
AIC-011F	15- and 24-Mbps Programmable Storage Controller
AIC-250F	MFM Encoder/Decoder
AIC-270F	2,7 RLL Encoder/Decoder
AIC-300F	Dual-Port Buffer Controller
AIC-301	Enhanced Dual-Port Buffer Controller
AIC-500	SCSI Interface Circuit
AIC-560	PC AT Interface Chip
AIC-610F	10-Mbps Integrated Programmable Storage Controller
AIC-6110	Single-Chip Synchronous SCSI Controller
AIC-6160	Single-Chip PC AT Mass Storage Controller
AIC-6190	Single-Chip Micro Channel Mass Storage Controller
AIC-6225	33-Mbps (1,7 RLL) Data Separator
AIC-6250	20MB Host Transfer with SCSI Protocol Circuit

Board Products

SCSI Host Adaptors

AHA-1540	PC AT-to-SCSI Host Adaptor
AHA-1542	PC AT-to-SCSI Host Adaptor
AHA-1640	Micro Channel-to-SCSI Host Adaptor

Hard Disk Controllers

ACB-231X	AT-to-ST412/506 MFM Hard Disk Controller, 5 Mbps
ACB-237X	AT-to-ST412/506 RLL Hard Disk Controller, 7.5 Mbps
ACB-232X	AT-to-ESDI NRZ Hard Disk Controller, 10 Mbps
ACB-232XB-8	AT-to-ESDI NRZ Hard Disk Controller, 15 Mbps
ACB-2610	Micro Channel-to-ST412/506 MFM Hard Disk Controller
ACB-2670	Micro Channel-to-ST412/506 RLL Hard Disk Controller
ACB-2620	Micro Channel-to-ESDI Hard Disk Controller

SCSI Test and Development Systems

SDS-1	SCSI Development System with Initiator Emulation
SDS-2	SCSI Development System with Target and Initiator Emulation
SDS-3	Synchronous SCSI Development System with Target and Initiator Emulation

SCSI-to-LAN Interface Unit

Nodem	Connects SCSI-based PCs to Ethernet

OTHER INFORMATION

Adaptec does not employ a PR firm.

Advanced Hardware Architectures, Inc.

P.O. Box 9669
Moscow, ID 83843
208/883-8000
Fax: 208/882-0105

ESTABLISHED: February 1988 **NO. OF EMPLOYEES: 25**

BACKGROUND

Advanced Hardware Architectures (AHA) was formed in 1988 to develop VLSI products based on a proprietary sorting and error-correction technologies developed by the Idaho Research Foundation. The Company's first products are a family of high-speed, single-chip Reed-Solomon encoder/decoder chips and a family of sorter coprocessor boards. AHA implements its patented sorting and error-correction technologies with very high speed hardware architectures.

AHA is the first commercial venture of the Idaho Research Foundation, the high-technology development arm of the University of Idaho. The Company is headed by John Overby, who joined AHA after holding the position of CEO with Advanced Input Devices.

The Company uses both CMOS and GaAs process technologies for its current product offerings and will use other technologies as the need arises. All of the Company's wafer fabrication operations are contracted to outside firms. AHA plans to set up a small fab of its own eventually. The Company currently operates two facilities in Moscow, Idaho, that total 10,000 square feet. AHA's future product focus will continue to be proprietary sorting and coding products. The Company plans to expand its capacity to allow for rapid product growth.

BOARD
(Name and Affiliation)

John Overby
Advanced Hardware Architectures, President

Dr. Richard Callahan
Idaho Research Foundation, Inc.

Dr. Gary Maki
UI/Microelectronics Research Center

Steve Shinn
Investor

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
John Overby
A.I.D., President and CEO

VP Finance
Gordon Scott
A.I.D., COO and CFO

VP Sorting Products
Dr. J. Shovic
University of Idaho/MRC, Research

VP Coding Products
Dr. Pat Owsley
University of Idaho/MRC, Research

FINANCING

Advanced Hardware Architectures has had three rounds of financing, which totaled more than $1 million.

ALLIANCES

None

MANUFACTURING

Technology

CMOS, GaAs, and others as needed

Facilities

Moscow, ID
Two locations that total 10,000 sq. ft.
R&D, marketing, test

Advanced Hardware Architectures, Inc.

PRODUCTS

PerFEC Series—Very High Speed, Single-Chip Reed-Solomon Encoder/Decoder Chips
Aha!Sort Series—Sorter Coprocessor Boards

OTHER INFORMATION

Advanced Hardware Architectures' PR firm is Hanna-Wheeler.

Advanced Linear Devices, Inc.

1180 F. Mariloma Way
Sunnyvale, CA 94086
408/720-8737
Fax: 408/720-8297

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 10**

BACKGROUND

Advanced Linear Devices, Inc., (ALD) designs, develops, manufactures, and markets linear ICs for low-power, low-voltage precision applications. Products are manufactured using a proprietary silicon-gate CMOS technology optimized for 5V operation. They are used for industrial control and electronic instrumentation, computer and peripheral equipment, medical instrumentation, telecommunications, aerospace, and military systems.

The Company offers two product lines. A series of about 25 standard products that include timers/oscillators, op amps, comparators, and n-channel and p-channel MOSFETs.

The second product line, which was offered in March 1988, is a Function-Specific Standard Cell Linear Program for the design of custom and semicustom ICs. The library includes timers/oscillators, op amps, comparators, and MOSFETs, as well as diodes, resistors, and capacitors. The program consists of a kit of 86 standard ICs of 20 different types and a design manual. Customers use the parts to bread board the desired circuit, then return the working design to ALD, which then designs the circuit.

ALD subcontracts wafer fabrication to two foundries in the United States and assembly to contractors in the Far East. ALD conducts all wafer probe, sort, and final test at its facility in Sunnyvale, California. In 1987, ALD put in place its U.S. and Canadian network of sales representatives and established a U.S. distributor network.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Robert Chao
Supertex, VP Product

VP Product Opns
*Larry Iverson
Supertex, Mgr Process Engr

VP Mktg/Sales
*Michael O'Neal
Micropower, VP Mktg/Sales

*Founder

FINANCING

Not available

RECENT HIGHLIGHTS

April 1986
ALD offered its first product, the ALD55 monolithic CMOS timer. It features 500ns monostable mode and 2-MHz astable mode operation.

August 1986
ALD offered the ALD2301 silicon-gate CMOS dual comparator with typical response time of 650ns.

November 1986
ALD offered the ALD1502/2502/4501 family of quad CMOS timers that operate on 2V to 12V supplies. The series is available in commercial and military grades.

March 1987
ALD offered the ALD2701 CMOS dual rail-to-rail op amp. The device operates from single or dual supplies and input and output signal levels both extended to the supply voltage rails.

March 1988
ALD offered the function-specific standard cell ASIC approach for linear ICs.

ALLIANCES

Not available

MANUFACTURING

Technology

3.0-, 5.0-micron silicon-gate CMOS

Facilities

Sunnyvale, CA
10,000 sq. ft.
Manufacturing
Design, test
Administration

PRODUCTS

Device	Description
ALD1701	CMOS, Rail-to-Rail, Micropower Amplifier
ALD1702	CMOS, Rail-to-Rail, Oscillation Resistant Amplifier
ALD1703	CMOS, Low-Cost Amplifier
ALD1704	CMOS, Low-Cost, JFET-Replacement Amplifier
ALD1706	CMOS, Rail-to-Rail, Very Low Power Amplifier
ALD2701	Dual, CMOS, Rail-to-Rail, Micropower Amplifier
ALD4701	Quad, CMOS, Rail-to-Rail, Micropower Amplifier
ALD2301	Dual, CMOS, Open Collector Output Comparator w/Drivers
ALD4302	Quad, CMOS, Push-Pull Outputs Comparator w/Drivers
ALD555/1502/1504	Single-Precision Timer/Oscillator
ALD2502/2504	Dual-Precision Timer/Oscillator
ALD4501/4503	Quad-Precision Timer/Oscillator
ALD1101	Dual N MOSFET Transistors
ALD1102	Dual P MOSFET Transistors
AlD555-1	One-volt Single Timer/Oscillator

OTHER INFORMATION

ALD does not employ a PR firm.

Advanced Microelectronic Products, Inc.

1/F #17 Industriale E. 2nd Road
Hsinchu, Taiwan

North American Headquarters
1887 O'Toole Avenue, Ste. C-111
San Jose, CA 95131
408/727-8880
Fax: 408/727-6320

ESTABLISHED: June 1986 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Advanced Microelectronic Products, Inc. (AMPi), was formed to design, manufacture, and market power MOSFETs. The Company is implementing a three-pronged strategy. Initially, the Company entered the market with standard, functional equivalents to International Rectifier's line of leading power MOSFETs. Concurrently, it designed value-added products from its standard product line. Future plans involve using proprietary technology to offer smart power devices.

In August 1986, the Company produced its first prototype product, the IRF450 power amplifier. By April 1987, the Company readied its line of International Rectifier-compatible products and opened its North American headquarters in Santa Clara.

AMPi has established relationships with ERSO (Taiwan), which will conduct manufacturing, and Lingsen (Taiwan) and New Era (Hong Kong), which will perform assembly for AMPi.

Sales representatives have been signed in the United States, Canada, and the Far East.

BOARD
(Name and Affiliation)

Bob Jih, Chairman of the Board
Advanced Microelectronic Products, CEO

COMPANY EXECUTIVES
(Position and Name)

President
James Yen

CEO
Bob Jih

CFO
H.K. Hu

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

3-micron MOS

Facilities

Santa Clara, CA
Design, marketing

Hsinchu, Taiwan
Headquarters, engineering, manufacturing, assembly, test

PRODUCTS

Device	Voltage	Drain Source (Amps)	Current Package
AM0610LL/AM2222LM	60	15.0, 19.0	TO-92
AM10KLM/AM2222LM	60	0.25, 0.3	TO-237
AM4000 Family	100 to 500	18.0 to 56.0	AMPAK-04
IRF100-400	60 to 500	12.0 to 33.0	TO-3
IRF500-800/BUZ	50 to 500	1.3 to 30.0	TO-220AB

OTHER INFORMATION

AMPi does not employ a PR firm.

Advanced Power Technology, Inc.

405 S.W. Columbia Street
Bend, OR 97702
503/382-8028
Fax: 503/388-0364

ESTABLISHED: June 1984 **NO. OF EMPLOYEES: 70**

BACKGROUND

Advanced Power Technology (APT) designs, manufactures, and markets low-cost, high-power MOSFETs for advanced electric power switching applications, such as data processing and telecommunications equipment, defense systems, and variable-speed electric motors.

APT has developed a family of large-die MOSFETs that match the power and price advantages of low-speed thyristors and bipolar transistors with equivalent switching speeds. The MOSFETs feature lower on resistance and lower input capacitance, achieved with a metal-gate and 6-micron feature sizes. APT has also reduced manufacturing costs by developing a simpler MOSFET design that reduces the number of masks required.

The Company's future plans include developing a line of hybrids and insulated gate bipolar transistors (IGBTs).

BOARD
(Name and Affiliation)

Charles Cole, Chairman
Julian, Cole & Stein, General Partner

Leib Orlanski
Freshman, Marantz, Orlanski, Cooper and Klein, Attorney, Partner

Patrick Sireta
Advanced Power Technology, Inc., President/CEO

Ed Snape
The Vista Group, General Partner

Dave Stein
Julian, Cole & Stein, General Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Patrick Sireta
TI, VP CMOS Div

VP Marketing
Barry Chenes
PowerTek, VP Sales

VP Operations
John Hess
SEEQ, Dir Operations

CFO
Robert M. Holburn
TI, Ctr WW MOS Mem

VP Engr
Dah Wen Tsang
Theta-J, Dir Research

Sales Manager
Terry Bowman
Micron, VP Sales/Mktg

FINANCING

1985
Seed
$0.4M

1985
Round 1
$2.5M

1986/1987
Round 2
$8.1M

1988
Round 3
$2.8M
Major investors include Julian, Cole & Stein; The Vista Group; Orien Ventures; 1st Chicago Investment Advisors; Sunwestern Ventures Company; J.F. Shea Company; and Mitsui & Company (U.S.A.), Inc.

RECENT HIGHLIGHTS

October 1986
First prototype MOSFETs produced.

March 1987
Internal wafer fabrication facility became fully operational.

June 1987
APT shipped its first sample MOSFETs for evaluation.

December 1987
First production MOSFETs were shipped to customers.

February 1989
APT introduced the world's most powerful MOSFET, Monster MOS. It can supply 10KW through a single full-bridge configuration.

ALLIANCES

Not available

MANUFACTURING

Technology

5-micron metal-gate MOS
4-inch wafers

Facilities

The Company conducts all manufacturing in its Bend, Oregon, facility. Assembly for military products is done in the United States; other assembly is conducted by companies overseas.

Bend, OR
31,750 sq. ft.
Total area

18,250 sq. ft.
Administration, assembly, test

13,500 sq. ft.
R&D, engineering, wafer fabrication (including 4,000 sq. ft. Class 10 clean room)

PRODUCTS

Device	Vds Volts	Id cont. Amps	Idm Amps	Available
AP35XX	350	7.5 to 183.0	30.0 to 732.0	Now
APT40XX	400	7.5 to 183.0	30.0 to 732.0	Now
APT45XX	450	6.5 to 152.0	26.0 to 608.0	Now
APT50XX	500	6.5 to 152.0	26.0 to 608.0	Now
APT55XX	550	5.3 to 122.0	10.6 to 488.0	Now
APT60XX	600	5.3 to 122.0	10.6 to 488.0	Now
APT75XX	750	4.O to 91.0	16.0 to 364.0	Now
APT80XX	800	4.0 to 91.0	16.0 to 364.0	Now
APT90XX	900	3.0 to 76.0	12.0 to 304.0	Now
APT100XX	1,000	3.0 to 76.0	12.0 to 304.0	Now

OTHER INFORMATION

APT does not employ a PR firm.

Alliance Semiconductor

1930 Zanker Road
San Jose, CA 95112
408/436-1860

ESTABLISHED: 1985 **NO. OF EMPLOYEES: 1,000**

BACKGROUND

Alliance Semiconductor was formed to design, manufacture, and market SRAMs and DRAMs. The Company is using a 1.2-micron CMOS planar process which, when combined with architectural innovations, produces value-added high-speed devices.

In December 1987, Alliance offered the AS4C188 16Kx4 SRAM that features access times of 25ns, 30ns, and 35ns. In 1988, the Company introduced a pair of 1Mb DRAMs in 1Mbx1 and 256Kx4 configurations. Products are designed for superminis, workstations, and other computing applications using 32-bit MPUs running at 20-MHz or better.

The Company's future plans are to offer FIFOs and other specialty memories, and to encourage designers to consider the high-speed DRAMs as complete replacements for cache memories.

Alliance has signed agreements to have some of its DRAMs manufactured by NMB Semiconductor in Japan, while the SRAMs are being manufactured by Goldstar in South Korea.

Alliance is now manufacturing 1Mb DRAMs in its new Lee's Summit, Missouri, facility.

BOARD

(Name and Affiliation)

N.D. Reddy, Chairman
Alliance Semiconductor

C.N. Reddy
Alliance Semiconductor

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*N.D. Reddy
Modular Semiconductor, President

VP Sales/Mktg
Robert Reid
Oki Semiconductor, SR VP

VP Engineering
*C.N. Reddy
Cypress Texas Instruments, SRAM Dsn Mgr

*Founder

FINANCING

The Company has financed its developmental activity with private investment and seed funding from its offshore corporate partners.

March 1989
$1.2M
UtiliCorp United

$1.2M
Hallmark

$0.2M
Kansas City Valve & Fitting Co.

$0.2M
Black and Veatch

$0.1M
Dunn Industries

Tax credits, loan guarantees, grants
$2.27M
State of Missouri

Letter of credit
$3.0M
Private investor

RECENT HIGHLIGHTS

March 1989
Alliance agreed to lease manufacturing facilities outside Kansas City, Missouri, from AT&T.

ALLIANCES

NMB
December 1987
Alliance Semiconductor signed a five-year agreement with NMB Semiconductor covering 256K and 1Mb DRAMs. NMB will manufacture the devices and sell them worldwide.

MANUFACTURING

Technology

1.2- and 1.0-micron CMOS

Facilities

Kansas City, MO
120,000 total sq. ft.
Manufacturing

45,000 sq. ft.
Used for Class 10 clean room

PRODUCTS

Device	Description	Speed
AS4C188	16Kx4 SRAM	25, 30, 35ns
AS4C1000	1Mbx1 DRAM	60, 70, 80ns
AS44C256	256Kx4 DRAM	60, 70, 80ns

OTHER INFORMATION

Alliance does not employ a PR firm.

Altera Corporation

2610 Orchard Parkway
San Jose, CA 95134-2020
408/984-2800
Fax: 408/296-3140

ESTABLISHED: June 1983 **NO. OF EMPLOYEES: 225**

BACKGROUND

Altera Corporation designs, manufactures, and markets user-configurable EPROM-based ICs and associated CAE development systems and is focused entirely on developing this market. Altera invented and was the first company to ship electrically programmable logic devices (EPLDs).

The Company's products are specified for operation over commercial, industrial, and military operating ranges. The predominant users are manufacturers that supply equipment for the industrial, office automation, and telecommunications markets as well as military and aerospace contractors. Altera is qualified to supply devices to the requirements of MIL-STD-883 Revision C.

Altera's CAE tools and user-configurable devices allow design engineers to create custom logic functions on the IBM PC. Wafers using 1.0- and 0.8-micron CMOS technology are obtained through technology agreements. This strategy allows Altera to concentrate on architecture, circuit design, software, and service, which has earned the Company a reputation for providing excellent service and easy-to-use CAD software. The Company's goals are to achieve $100 million in annual sales in 1990 and to be recognized as the technology leader in the user-configurable IC market.

In March 1988, Altera amended its registration statement for an initial public offering of 4 million shares of common stock at $5.50 per share. Of the shares being offered, 1 million were sold by certain selling shareholders. The statement was originally filed in October 1987. Net proceeds will be used principally for working capital and for repayment of long-term debts.

In 1987, Altera began offering function-specific EPLDs. The StandAlone Microsequencer (SAM) family integrates 448 words of EPROM memory with a microcoded sequencer and pipelined register for microcoded state machines and sequencer applications. The Buster family of configurable bus interface peripheral devices combines a programmable bus interface, PLD, and storage elements in a single device.

In January 1988, Altera introduced three new products for the IBM PS/2 add-in board market. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface, the EPB2002 direct memory access (DMA) arbitration chip integrates the additional logic needed for DMA capability, and the MCMap provides software design support. The interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems. Add-in boards are licensed and encouraged by IBM and serve to add functions not included in the basic computers such as expanded memory, communications interfaces, peripheral equipment, and other functions as fax and voice mail.

The Company markets its products in North America, Europe, Australia, the Far East, and the Pacific Rim through direct sales offices and a network of distributors and sales representatives. Altera's distributors include Hall-Mark, Lionex, Pioneer, Quality Components, Schweber Electronics, and Wyle in the United States, and Future Electronics and Semad in Canada.

BOARD

Rodney Smith
Michael Ellison
Paul Newhagen
T. Peter Thomas

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Rodney Smith
Fairchild, GM/Linear Div

VP Marketing
David A. Laws
AMD, VP Bus Dev

VP Sales
John Duffy
Fairchild, VP Sales/Mktg

VP/IC Engr
*Robert F. Hartmann
Source III, President

VP Technology
*Dr. James Sansbury
Hewlett-Packard, Production Mgr

VP Finance
*Paul Newhagen
Source III, Controller/CFO

VP Operations
Bipin Shah
Fairchild, Operations Mgr

VP Software Engr
Clive McCarthy
Fairchild, Marketing Mgr

Mgr Human Res
John Waller
Zoran, Mgr Human Res

*Founder

FINANCING

June 1983
Round 1
$1.3M
Alpha Partners

April 1984
Round 2
$6.0M
Allstate Investments; Cable, Howse & Cozadd; F. Eberstadt & Company Inc.; John F. Shea; Technology Venture Investors; Welsh, Carson, Anderson & Stowe; Venture Growth Associates

Lease
$2.0M
Bank of America

March 1985
Round 3
$9.9M
Original investors; Analog Devices Ent.; Citibank N.A.; DeMuth, Folger, & Terhune Venture Capital; Institutional Venture Partners; Parker Drilling Company

Lease
$2.0M
Bank of America

May 1986
Round 4
$5.0M
European investors

Lease
$1.7M
Bank of America

March 1988
$15.0M
Initial public offering

RECENT HIGHLIGHTS

November 1986
Altera achieved full compliance to the Class B requirements of MIL-STD-883, Revision C for the EP310 and EP1210 devices. All other Altera devices in most package styles are available screened and environmentally tested to the MIL-STD specifications while compliancy requirements are being satisfied.

February 1987
Altera and Monolithic Memories, Inc., (MMI) settled the patent infringement suit brought against Altera by MMI. Altera agreed to the entry of a consent of judgment and the parties agreed to license each other under certain patents in the programmable logic field.

March 1987
Altera offered the StandAlone Microsequencer (SAM) family of EPLDs. The devices are user-configurable ICs designed for complex state machines and high-performance controller applications operating up to 30 MHz. These are the first products resulting from the Company's agreement with WaferScale Integration.

March 1987
Altera's LogiCaps now supports IBM's EGA and the Hercules graphics controllers. Altera also reduced the price of LogiCaps from $950 to $695.

October 1987
Altera introduced two families of function-specific EPLDs. SAM for complex state machines and high-performance controllers, and Buster for user-configurable MPU peripherals.

January 1988
Altera announced three new products for IBM PS/2 add-in boards. The EPB2001 is a single-chip user-configurable interface chip that replaces 14+ TTL PLDs needed to build the Micro Channel interface. The EPB2002 is a direct memory access (DMA) arbitration chip that integrates the additional logic needed for DMA capability. The MCMap provides software design support. The EPB2001 interface chip can be programmed to fit the requirements of any add-in board function including disk controller, laser printer controllers, graphics controllers, and modems.

March 1988
Altera amended its registration statement for an IPO of 4 million shares of common stock at $5.50 per share, originally filed in October 1987. Of the shares being offered, 1 million were being sold by certain shareholders. The net proceeds will be used principally for working capital and for repayment of long-term debt.

ALLIANCES

Intel
August 1984
Altera signed a five-year technology exchange agreement with Intel. Intel provided CHMOS EPROM fabrication technology and foundry services; Altera provided its EPLD design and test technology and software and hardware development support. Intel will be an alternate source for the CHMOS EPLDs. Both companies cooperate on developing support tools for EPLD development systems.

June 1985
The agreement with Intel was extended for two additional years and includes additional products using Intel's CHMOS process and its evolutions.

P-CAD Systems
February 1985
Altera entered a marketing agreement with Personal CAD Systems, Inc., which called for combining P-CAD's PC-CAPS, used for schematic capture, and PC-LOGs, a logic simulator, with Altera's A+PLUS and LogicMap software (expired).

Data I/O FutureNet
May 1985
Altera entered an OEM marketing agreement with Data I/O's FutureNet for the DASH series of schematic capture packages (expired).

Cypress
June 1987
Cypress Semiconductor and Altera signed a five-year agreement to develop a family of CMOS EPLDs. The 5,000-gate family is named MAX for Multiple Array Matrix. Altera is providing architecture, circuit design, and software support. Cypress is providing 0.8-micron CMOS EPROM process, manufacturing, and marketing support.

WSI
January 1987
Altera Corporation and WaferScale Integration, Inc., (WSI) announced a five-year technology agreement focused on the development of new, high-performance, user-configurable logic products. Altera will provide architecture, circuit design, and software support for the new family of products. WSI will contribute its strengths in high-speed CMOS process and EPROM memory device development. Wafers will be provided by Sharp of Japan.

Texas Instruments
July 1988
Altera Corporation and Texas Instruments (TI) announced the signing of a long-term agreement that encompasses a seven-year technology exchange and supply agreement for high-performance, high-density, user-configurable integrated circuits. Altera will provide architecture, circuit design, and software technology. TI will make available worldwide manufacturing capabilities and its high-voltage EPIC advanced CMOS process.

MANUFACTURING

Untested wafers are provided through technology exchange agreements with Intel, WaferScale/Sharp, Cypress Semiconductor, and other foundry relationships. Assembly operations are subcontracted to two vendors. Volume production assembly is conducted in the Far East; quick-turn and prototype assembly is performed locally. Assembled components are final tested, burned-in, marked, packed, and shipped at Altera.

Technology

1.2-micron CHMOS
0.8- and 1.0-micron CMOS EPROM

Facilities

Santa Clara, CA
52,000 sq. ft.
Administration, engineering, manufacturing, marketing

PRODUCTS

User-Configurable ICs

Part No.	Description	Speed
EP3XX	300-gate EPLD	35, 40 MHz
EP6XX	600-gate EPLD	26, 45 MHz
EP9XX	900-gate EPLD	26, 45 MHz
EP12XX	1,200-gate EPLD	28 MHz
EP18XX	2,100-gate EPLD	20 MHz
EPS448	StandAlone Microsequencer (SAM)	30 MHz
EPB1400	Configurable Peripheral (Buster)	25 MHz
EPB2001	Microchannel Interface Chip	
EPB2002	DMA Arbitration Chip	
EPM5032	32 Macrocell 88 MHz EPLD	88 MHz
EPM5128	128 Macrocell 50 MHz EPLD	50 MHz

Most of the above are available in commercial, military, and industrial temperature ranges in a variety of speed grades. The components are offered in both ceramic and plastic dip packages and J-lead surface-mount packages. Pin-grid array packages are also available.

Design Tools

Part No.	Description
PLDS2	Development System for EPSeries Devices
A+Plus	Software Logic Compilers for Programmable Logic
LogiCaps	Schematic Capture
PLSME	State Machine Software
PLFSIM	Simulation Software
PLSLIB	TTL Macrofunction Library
MCMap	IBM PS/2 Micro Channel Interface Software Support
PLDS-SAM	Development System for SAM Devices
SAM+PLUS	SAM Design Processor
Hardware	Hardware Programming Units and Package Adaptors
PLCAD-SUPREME	Development system for EPSeries Devices
PLCAD-ENCORE	Development system for EPSeries Devices and EPM Devices
PLDS-MAX	Development system for EPM Series Devices

Altera's development systems run on Daisy Systems Corporation's Personal LOGICIAN workstation, and on more than 18 personal computers including AT&T, COMPAQ Plus, COMPAQ Deskpro, Columbia, Columbia Portable, Corona, IBM PC/XT/AT, IBM Portable, ITT XTRA, Leading Edge, MAD 86186, Panasonic SR. Partner, Televideo, Sperry, ISI Model 5160, Zenith 100 and 151 PC, and Intersil System PC.

OTHER INFORMATION

Altera's PR firm is Paul Franson Associates.

ANADIGICS, Inc.

35 Technology Drive
Box 4915
Warren, NJ 07060
201/668-5000
Telex: 510-600-5741
Fax: 201/668-5068

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 70**

BACKGROUND

ANADIGICS, Inc., designs, manufactures, and markets gallium arsenide (GaAs) analog and digital ICs for the telecommunications, military, and instrumentation markets. The Company is currently offering RF microwave and signal conditioning amplifiers, A/D converters, dividers, and multiplexers/demultiplexers. In addition, ANADIGICS offers GaAs services and designs both catalog and custom GaAs ICs, as well as custom hybrid assemblies, including fiber-optic data links.

The founders are Ronald Rosenzweig and George Gilbert, who cofounded Microwave Semiconductor Corporation, and Dr. Charles Huang, who was director of GaAs R&D and wafer fabrication services at Avantek.

The Company's strategy is to establish its own niche in producing GaAs ICs for high-frequency analog and digital applications in the defense and communications markets.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Ronald Rosenzweig
Microwave Semiconductor Corporation, President

Exec VP/COO
*George Gilbert
Microwave Semiconductor Corporation, Exec VP Opns

VP Engr
*Dr. Charles Huang
Avantek, Dir GaAs R&D

Dir Sales/Mktg
Michael P. Gagnon
TRW LSI Products, Mgr Strat Plan

Dir Finance
John Lyons
General Electric, Dir Finance

*Founder

FINANCING

April 1985
Round 1
$10.0M
Alan Patricof Associates, NY; Alex Brown & Sons; Fairfield Ventures; General Electric Venture Capital; Orange Nassau; Rothschild Inc.; Smith Barney Venture Capital

Lease
$10.0M
GE Credit Corp., EQUITEC, and others

November 1986
Round 2
$10.0M
First-round investors; Arthur D. Little Co.; Century IV Fund; Englehard Corp.; Memorial Drive Fund; Metropolitan Life Insurance Co.

January 1989
Round 3
$9.0M
Thomson-C.S.F. Ventures; Canaan Venture Partners (formerly GE Venture); Philadelphia Ventures (formerly Century IV); Smith, Barney, Harris, Upham; Atlas Associates, Inc.; Alan Patricof Associates; Alex Brown and Sons; Metropolitan Life Insurance; Memorial Drive Trust

RECENT HIGHLIGHTS

January 1987
ANADIGICS offered the AOP3510 350-MHz unity gain stable GaAs op amp in commercial and military grades. The device has a bandwidth of 70 MHz and a settling time of 20ns.

March 1987
ANADIGICS offered the AWA20601 and ADA25001 wideband MMIC gain amplifiers. The Company also offered the ADV3040 4-to-1 divider.

June 1987
ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

July 1987
ANADIGICS offered the ACP10010 comparator for ATE and high-speed fiber-optic receivers.

September 1987
ANADIGICS offered the ATA30010, a 3-GHz transimpedance amplifier.

January 1988
ANADIGICS introduced the ALD30010, a 3-GHz laser driver.

February 1988
ANADIGICS was awarded a $500,000 contract from the navy to develop a chip set for X-band radars.

March 1988
ANADIGICS completed the first stage of a $4 million equity financing. Investors were ABS Ventures, Alan Patricof Associates Inc., Alex Brown Emerging Growth, Canaan Venture Limited Partnership, Century IV Partners, Fairfield Ventures, First Century Partnership III, Investments Orange Nassau, Memorial Drive Trust, Metropolitan Life, and Rothschild Inc.

April 1989
ANADIGICS introduced two new transimpedance amplifiers, the ATA03010 and the ATA30011.

ALLIANCES

Bendix
June 1987
ANADIGICS was awarded a contract by Bendix Aerospace to develop CAD tools for the DOD's MMIC program. Bendix will adapt the software tools for layout and simulation in the design of GaAs high-frequency broadband amplifiers and mixers.

SERVICES

GaAs IC design
GaAs foundry
Assembly
Test

MANUFACTURING

Technology

1.0m and 0.5m-GaAs MESFET

Low-power D-MESFET process technologies will be available in the future.

Facilities

Warren, NJ
55,000 sq. ft.
Design, test, manufacturing, administration

10,000 sq. ft.
Clean room

PRODUCTS

Device	Description
AOP1510	Op Amp, 150 MHz
AOP3510	Monolithic Op Amp, 350 MHz
AWA20601	10dB Gain Amplifier, 2 to 6 GHz
ACP10010	Comparator, 1.0ns Typical Delay
ADA25001/25002	25dB Gain Amplifier, 3 GHz
ADV3040	4-to-1 Divider
ALD30010	Laser Driver, 3 GHz
ATA30011	Transimpedance Amplifier, 3 GHz
APS30010	Phase Splitter, 3 GHz
ATA0310	Transimpedance 300-MHz Amplifier
ASW40010	DC—4-GHz Spdt switch
ASW80010	DC—8-GHz Spdt switch fiber optic receiver products
AAR10010	1-GHz, 1,330nm Analog Receiver
AAR10015	1-GHz, 800nm Analog Receiver
AAR10020	1-GHz, High-Output, 1,300nm Analog Receiver
AAR10025	1 GHz, High-Output, 800nm Analog Receiver
ADR16010	1.6-Gbps, 1,300nm Digital Receiver
ADR16015	1.6-Gbps, 800nm Digital Receiver
ADR16020	1.6-Gbps,ECL Output, 1,300nm Digital Receiver
ADR16025	1.6-Gbps, ECL Output, 800nm Digital Receiver
ADR16030	1.6-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR16035	1.6-Gbps, 800nm Digital Rcvr/Clock Recovery
ADR12030	1.2-Gbps, 1,300nm Digital Rcvr/Clock Recovery
ADR12035	1.2-Gbps, 800nm Digital Rcvr/Clock Recovery

OTHER INFORMATION

ANADIGICS' PR firm is Norm Fenichel.

Applied Micro Circuits Corporation

6195 Lusk Boulevard
San Diego, CA 92121
619/450-9333
Fax: 619/450-9885

ESTABLISHED: April 1979 **NO. OF EMPLOYEES: 225**

BACKGROUND

Applied Micro Circuits Corporation (AMCC) specializes in the design and manufacture of high-speed ECL gate arrays. In 1987, the Company began offering BiCMOS gate arrays. AMCC targets its products at OEMs that make industrial instruments, high-performance computers, electronic warfare systems, test equipment, graphics hardware, and telecommunications equipment.

AMCC is a privately held company that was formed by Howard Bobb and Joe Mingione, who had previously been American Microsystems Inc.'s chairman of the board and marketing manager, respectively. AMCC was founded in Cupertino, California, but later acquired Solitron Devices' 32,000-square-foot facility in San Diego. After converting it to run 4-inch wafers, AMCC's fab facility became operational late in 1981. Under the leadership of Roger Smullen, AMCC refocused its efforts in 1983 to the high-performance array marketplace. Mr. Smullen replaced the founders as president and CEO.

There are 29 sales representative organizations with more than 90 sales people that handle AMCC's gate arrays in North America, Europe, Israel, and the Far East.

BOARD
(Name and Affiliation)

Roger A. Smullen, Chairman
Plus Logic

William K. Bowes, Jr.
U.S. Venture Partners

F.K. Fluegel
Matrix Partners, L.P.

Franklin P. Johnson
Asset Management Corporation

Albert Martinez
Applied Micro Circuits Corp.

Gregorio Reyes
ASET

Arthur Stabenow
Micro Linear

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Albert Martinez
TRW, VP/GM LSI Products Div

VP Finance/Admin
Joel O. Holliday
Spin Physics, VP Finance

VP Mktg/Sales
A. C. D'Augustine
Inmos, Dir. Worldwide Sales

VP Operations
Don Schrock
Burr-Brown, VP/GM Data Products Div

VP Engineering
Ray Yuen
National Semiconductor, Design Manager

FINANCING

April 1979
Round 1
$5.0M
Fred Adler & Co., Ampersand Associates, International Industrial Investments Inc., Kimball Organ, Timex

March 1983
Round 2
$5.0M
Accel Capital; Adler & Co.; Asset Mgmt. Co.; Harrison Capital; International Industrial Investments (France); Kemper; Matrix Partners; Oak Investment Partners II; Prime Capital; Robert Fleming Ltd.; Robertson, Colman & Stephens; US Ventures; Venture Growth Associates

September 1987
Round 3
$12.0M
Accel Capital; Adler & Co.; Asset Mgmt. Co.; Eberstadt Fleming Venture Capital; Harrison Capital; International Industrial Investments (France); Jamieson & Co.; Kemper; Kimball Manufacturing; Matrix Partners; Oak Investment Partners; Olivetti; PaineWeber Ventures; PM Investment; Prime Capital; Robertson, Colman & Stephens; Time, Inc.; US Venture Partners; Venture Growth Associates

RECENT HIGHLIGHTS

May 1987
AMCC offered the Q5000 Series of bipolar products and entered the BiCMOS logic array market with its Q14000 series. The Q14000 is the result of a two-year joint development agreement with Seiko-Epson.

July 1987
AMCC named Albert Martinez president and chief executive officer, filling a vacancy that had existed since March 1987 when former presi- dent Jonathon K. Yu left the Company. Mr. Martinez was most recently vice president and general manager of TRW's LSI Product Division in La Jolla, California.

September 1987
AMCC completed a private sale of $12 million in convertible preferred stock. The funds are being used to reduce short-term borrowing and provide working capital for anticipated growth, including expansion into its recently completed facility in San Diego, California.

September 1987
AMCC moved into its new corporate facility in San Diego. The 100,000-square-foot building, on a 6.5-acre site, houses engineering, marketing, and administrative staff. The additional facility brings AMCC's total space to 121,000-square-feet, which includes a Class 10 fab and production facility.

January 1988
AMCC and Plessey signed an agreement to jointly develop a family of high-performance ECL gate arrays. The arrays, which range up to 18,000-gates, will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

June 1988
AMCC announced a major contract with Datatape, Inc., for seven logic array circuits. This contract is expected to be worth $3 million to $4 million over the next two years.

ALLIANCES

Signetics
April 1979
Signetics and AMCC agreed to allow Signetics to provide alternate sourcing of the Q700 Quick-Chip series. AMCC was licensed to market designs for Signetics' 8A-1200 gate array family.

September 1983
AMCC and Signetics signed an extension of the prior agreement that covers a technology transfer of future gate array families and junction-isolated and oxide-isolation processes.

Thomson-CSF
July 1982
AMCC signed an agreement with Thomson-CSF under which Thomson-CSF provided alternate sourcing and will develop AMCC's high-performance, bipolar Q-700 series of gate arrays. AMCC received $1 million over five years.

Daisy
February 1983
Daisy offered support for AMCC's Q-700 gate array family on its Gatemaster gate array development system; AMCC provided the design software.

Honeywell
August 1984
Honeywell signed an agreement to second source AMCC's Q700 series gate arrays and to alternate source AMCC's bipolar gate arrays.

Sanders
February 1985
Sanders agreed to develop prototype ECL gate arrays by customizing AMCC base wafers for in-house use only.

Seiko-Epson
May 1985
Seiko and AMCC entered into a BiCMOS joint development effort. Seiko's 1.5-micron CMOS process is merged with AMCC's bipolar process to produce a 1.5-micron BiCMOS process.

Plessey
January 1988
AMCC and Plessey agreed to jointly develop a family of high-performance ECL gate arrays up to 16,000 gates. It will be fabricated using Plessey's 1-micron triple-layer metal, HE1 bipolar process.

MANUFACTURING

Technology

2.0-, 3.0-, and 5.0-micron double-level-metal bipolar
1.5-micron BiCMOS
Three-level fine pitch metal
4-inch wafers

Facilities

San Diego, CA
116,000 sq. ft.
Administration, marketing, development, manufacturing

5,000 sq. ft.
Class 10 clean room

PRODUCTS

ECL Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
Q700	Bipolar	5.0	0.9	250 to 1,000
Q1500	Bipolar	5.0	0.9	1,500 to 1,700
Q3500	Bipolar	3.0	0.6	1,300 to 3,500
Q5000	Bipolar	2.0	0.3	1,300 to 5,000
Q20000	Bipolar	1.0	0.1	1,000 to 16,000
BiCMOS Gate Arrays				
Q14000	BiCMOS	1.5	0.7	2,160 to 13,440

Foundry

Process	Minimum Geometries	Number of Base Layers	Number of Metal Layers/Pitch	Wafer Size
Bipolar Junction Isolated	5.0-micron	7	2/10, 16	4"
Bipolar Oxide Isolated	3.0-micron	10	2/7, 10	4"
Bipolar Oxide Isolated	2.0-micron	10	3/5.5, 8.0, 15	4"
BiCMOS Oxide Isolated	1.5-micron	11	3/4.5, 6, 7	4"

OTHER INFORMATION

AMCC does not employ a PR firm.

Asahi Kasei Microsystems Co., Ltd.

Imperial Tower 1-1
Uchisaiwai-cho 1-chome
Chiyoda-ku, Tokyo, Japan
03/507-2371
Fax: 03/591-2567

ESTABLISHED: June 1983 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Asahi Kasei Microsystems Co., Ltd., manufactures and markets memory, application-specific ICs, linear, and microcontroller products. The Company was originally founded as Asahi Microsystems, Inc., by Asahi Chemical of Japan and American Microsystems Inc. (AMI) in June 1983. The Company focused on the design and marketing of custom and ASICs based on AMI technology.

In 1986, the Company became a wholly owned subsidiary of Asahi Chemical and changed its name to Asahi Kasei Microsystems. Asahi Kasei Microsystems has established an Electronics Research Laboratory in Atsugi, Japan, to develop new bipolar and CMOS process technologies and new applications, and plans to set up a manufacturing facility in two years.

The Company has established technical ties with Hitachi Ltd. for the acquisition of its advanced CMOS process technology. Asahi Kasei will manufacture and market Crystal's devices for the Far Eastern market, and International CMOS Technology (ICT) will market its EEPROMs.

AMI manufactures all the custom and standard products it develops and Hitachi manufactures its digital ICs. The Company manufactures new products developed through its tie-up with ICT on a small scale at an Atsugi plant.

BOARD

Not available

COMPANY EXECUTIVES

Not available

FINANCING

Not available

ALLIANCES

Hitachi
Asahi Kasei has licensed Hitachi Limited's advanced CMOS process technology.

Crystal Semiconductor
Asahi Kasei will manufacture and market Crystal's devices for the Far East market.

ICT
Asahi Kasei will market International CMOS Technology's (ICT) EEPROMs.

MANUFACTURING

Technology

2- and 3-micron CMOS

Facilities

Not available

Asahi Kasei Microsystems Co., Ltd.

PRODUCTS

SRAMs

Device	Description	Speed (ns)
AKM6264	64K 8Kx8	100, 120, 150
AKM6287	64K 64Kx1	45, 55, 70
AKM6288	64K 16Kx4 (In Development)	25, 35, 45
AKM62256	256K 32Kx8	85, 100, 120, 150
AKM6207	256K 256Kx1 (In Development)	35, 45
AKM6208	256K 64Kx4 (In Development)	35, 45
AKM66203	1Mb Module 128Kx8	100, 120, 150

ROMs

AKN623257/8	256K 32Kx8	150, 200
AKN62321	1Mb 128Kx8	150, 200
AKN62312	2Mb 256Kx8	200
AKN62412	2Mb 256Kx8/128Kx16	200
AKN62304	512Kx8	200
AKN62404	512Kx8/256Kx16	200

Gate Arrays

Family	Gates	Typical Internal Delay (ns)
AK61H	448 to 2,560	2.0
AK62B	4,032 to 7,136	1.8
AK62H	4,309 to 24,020	0.7

Cell-Based Library

Device	Description
Digital Cells	CPU/Peripheral Cells—Clock Generator, Bus Controller, DMA Controller, Programmable Counter/Timer, Multiplier Memory Cells—ROM, RAM
Analog Cells	Op Amps, A/D Converter, SCF Filters

Microcontrollers

AKMC4608	4-Bit Telephone Chip with DTMF Generator, LCD Driver, Real-Time Clock, 8Kx10 ROM, 1Kx4 RAM
AKMC4678	4-Bit Answering Machine Chip with DTMF Receiver, 8Kx10 ROM, 512x4 RAM
AKMC4919	4-Bit General-Purpose MCU with 1 microsecond of Instruction Time, 16Kx10 ROM, 992x4 RAM

Linear ICs

CS31412	A/D Converter
CS7008	Programmable Universal Filter

OTHER INFORMATION

Asahi Kasei Microsystems does not employ a PR firm.

Aspen Semiconductor Corporation

58 Daggett Drive
San Jose, CA 95134
408/432-7050
Fax: 408/943-2741

ESTABLISHED: December 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Aspen Semiconductor Corporation was formed in December 1987 to design and develop ultrahigh-speed ECL-compatible memory and PLD products with subthree nanosecond access times. The Company was formed and financed by Cypress Semiconductor Corporation and operates as a wholly owned subsidiary of Cypress.

Aspen is the brainchild of Cypress chief T.J. Rodgers, who has also established Multichip Technology and Ross Technology as Cypress subsidiaries. Rodgers' plan is to establish a number of small satellite companies under Cypress' control as an alternative to the large corporation. Hopefully, this type of organization will help maintain an aggressive start-up mentality within the corporation. Cypress provided the initial $7.4 million in financing and has an option to repurchase the Company at any time.

Aspen currently offers four ECL RAM products and four ECL PLDs. All of these devices are manufactured using a 0.8-micron BiCMOS process at Cypress' fabrication facilities. Aspen currently is shipping 1K and 4K SRAMs and plans to introduce a 64K device in Q1 1990. All Aspen-developed products are marketed by Cypress and sold under the Cypress logo. ECL RAMs and PLDs will be the basis of the Aspen product line in the future. New products currently are under development but no indication has been given as to the nature of these products.

BOARD
(Name and Affiliation)

Dr. T.J. Rodgers, Chairman
Cypress Semiconductor Corp., President/CEO

L.J. Sevin
Sevin-Rosen Management Company, President

Larry Sonsini
Wilson, Sonsini, Goodrich and Rosati, Partner

Robert C. Lutz
Aspen Semiconductor Corporation, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Robert C. Lutz
AMD, Director

Dir Marketing
David C. Ford
Actel, Director of Mktg

FINANCING

December 1987
Round 1
$7.4M
Cypress Semiconductor

ALLIANCES

Cypress
December 1987
Cypress provided initial funding in the amount of $7.4 million. Aspen operates as a wholly owned subsidiary of Cypress and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Aspen-developed devices will be fabricated by Cypress and sold through Cypress' sales organization.

MANUFACTURING

Technology

0.8-micron BiCMOS
1.0, 0.8-micron bipolar

Facilities

San Jose, CA
12,000 sq. ft.
Administrative, design, development, marketing

PRODUCTS

ECL RAMs

10/100E422	256x4	3ns
10/100E422L	256x4	5 to 7ns low power
10/100E474	1Kx4	3ns
10/100E474L	1Kx4	5 to 7ns low power

ECL PLDs

10/100E301	16P8	3, 4, 6ns
10/100E302	16P4	2.5, 4.0 6.0ns
10/100E301L	16P8	4, 6ns low power
10/100E302L	16P4	4, 6ns low power

OTHER INFORMATION

Aspen does not employ a PR firm.

ATMEL Corporation

2125 O'Nel Drive
San Jose, CA 95131
408/441-0311

ESTABLISHED: December 1984 **NO. OF EMPLOYEES: 152**

BACKGROUND

ATMEL (Advanced Technology-Memory & Logic) specializes in the design, manufacture, and marketing of high-speed EPROM, Flash EPROM, EEPROM, EPLD, and analog products. The Company's products are manufactured using a CMOS technology with geometries as low as 1-micron combined with two-layer metal and silicide processes.

ATMEL was founded by George Perlegos, Gust Perlegos, and T.C. Wu with private funds. Its first products were a CMOS 64K EEPROM at 120 to 450ns and a CMOS 256K EPROM operating at 120 to 250ns. They were followed by a CMOS 512K EPROM operating at 120 to 250ns. Currently, ATMEL offers additional EPROM, EEPROM, EPLD, 5-volt only Flash EPROM, and analog devices in a variety of organizations and densities.

In 1987, ATMEL introduced a line of linear products, including the AT76C10 programmable amplifier/delay equalizer, which is designed for use in modem and data communication equipment.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*George Perlegos
SEEQ, VP Engineering

VP Technology
*Dr. T.C. Wu
SEEQ, Process Dev Mgr

VP/General Manager
*Dr. Gust Perlegos
SEEQ, Engr Manager

VP Finance
Raymond Ostby
Intel, Ctlr Europe Ops

VP Sales
Jack Peckham
Semi Processes, Dir Sales/Mktg

VP Plan & Info Sys
Mikes Sisois
Qronos, VP Prod Dev

VP Marketing
B. Jeffrey Katz
Intel, Dir of Mktg

*Founder

FINANCING

December 1987
Round 2
$3.3M
Institutional Venture Partners

RECENT HIGHLIGHTS

June 1989
ATMEL agreed to purchase Honeywell's Solid State Electronics Division in Colorado Springs, Colorado. The facilities contain three wafer-fabrication areas, including a 6-inch facility, and related assembly, testing, and engineering facilities.

ALLIANCES

General Instrument
March 1985
ATMEL provided technology for its OTP EPROM, UV EPROM, and EEPROM in exchange for fab capacity at GI's plant in Chandler, Arizona (expired).

Sanyo Electric
1987
ATMEL and Sanyo signed a foundry contract under which Sanyo will produce high-speed 1Mb EPROMs for ATMEL. Sanyo and ATMEL will jointly develop 70ns EPROMs.

MANUFACTURING

Technology

1.25-micron two-level-metal CMOS
1.00-micron two-level-metal CMOS

Facilities

San Jose, CA
100,000 sq. ft.
Administration, engineering, design, test, sales and marketing

Colorado Springs, CO
250,000 sq. ft.
Fabrication, assembly, test, and engineering

PRODUCTS

High-Speed EPROM

Device	Density	Organization	Speed (ns)
27H64	64K	8Kx8	45-90
27HC256	256K	32Kx8	55-120
27HC1024	1Mb	64Kx16	55-120
EPROM			
27C128	128K	16Kx8	120-250
27C256	256K	32KX8	120-250
27C512	512K	64KX8	120-250
27C513	512K	4x16Kx8	150-250
27C1024	1Mb	64Kx16	150-250
27C010	1Mb	128Kx8	150-250
CMOS PROM			
28HC191/291	16K	2Kx8	35-90
27HC641/642	64K	8Kx8	35-90
EPROM (5-volt only Flash EPROM)			
29C256	256K	32Kx8	150-250
29C010	1Mb	128Kx8	150-250
High-Speed EEPROM			
28HC16	16K	2Kx8	45-120
28HC64	64K	8Kx8	55-120
28HC256	256K	32Kx8	70-120
EEPROM			
28C04	4K	512x8	150-350
28C16/17	16K	2Kx8	150-350
28C64	64K	8Kx8	150-350
28PC64	64K	8Kx8 Paged	150-350
28C256	256K	32Kx8	150-350
28C010	1Mb	128Kx8	150-350
28C1024	1Mb	64Kx16	120-250

EPLD

Device	Gates	Speed (ns)
22V10	500	15-40
V750	750	30-40
V2500	2,500	35-45
V5000	5,000	30-40

Linear

Device	Description
76C10	Programmable Telephone Line Delay Equalizer/Amplifier
76C171, 176	Triple 6-Bit color palette DAC; 50-65 MHz

OTHER INFORMATION

ATMEL does not employ a PR firm.

Austek Microsystems Pty. Inc.

2903 Bunker Hill Lane #201
Santa Clara, CA 95054
408/988-8556
Fax: 408/988-0818

Austek Microsystems Pty. Ltd.

Technology Park, Adelaide
South Australia 5095, Australia
8/260-0155
Fax: 8/260-8261

ESTABLISHED: July 1984 **NO. OF EMPLOYEES: 85**

BACKGROUND

Austek designs, manufactures, and markets VLSI components for the cache controller and digital signal processor markets. The Company was founded in 1984 as a design source and supplier of VLSI components. From 1984 to 1987, Austek developed custom products for Australian and U.S. customers. Through these programs, the Company gained considerable expertise in cache architectures, digital signal processing, and floating point processing. Austek has built on these experiences to establish itself as supplier of proprietary standard products to the high-performance cache memory and DSP markets.

The Company was the first to introduce integrated cache controllers for the 30386 (the A38152 in June 1987) and 80286 (the A28285 in November 1988). Its first DSP product, the A41102 frequency domain processor (FDP), was introduced in November 1988; the FDP implements the fast Fourier transform and is used in imaging and instrumentation applications.

Austek designs and fabricates system level design examples incorporating its products for customer evaluation purposes and to provide its customers with tools to reduce their product development cycle time.

Austek subcontracts wafer fabrication to Hewlett-Packard and VLSI Technology in the United States and Ricoh in Japan. High-volume assembly is subcontracted to Indy and Pantronix in the United States, Anam in Korea, and Seiko-Epson in Japan. Austek qualifies and tests each product in-house.

Austek is a privately held Delaware corporation and has two main facilities. One is in Santa Clara, California, where activities include corporate headquarters, marketing, sales, applications engineering, the cache products business unit, and manufacturing. The other, located in Adelaide, Australia, focuses on product development, CAD, the DAP products business unit, and advanced development.

BOARD
(Name and Affiliation)

A.C. Summers, Chairman
Bennett and Fisher Ltd.

Denis L. Redfern
Austek Microsystems, President and CEO

Dr. Ivan Sutherland
Evans & Sutherland, Cofounder

Roger Buckeridge
CP Ventures, Director

Jos Henkens
Advanced Technology Ventures, General Partner

Barry Hilson
Australia Industry Development Corporation

Dr. J. Craig Mudge
Austek Microsystems, Director Advanced Development

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President and CEO
Denis Redfern
Wormald Data Systems, Division Manager

VP Sales
George Adler
AMD, VP Sales—West

VP Marketing
Roger Fisher
TI, Strategic Marketing Manager

VP Engineering
Geoff Smith
CSIRO, Engineering Manager

VP Manufacturing
John Gloekler
NSC, Product Engineering Manager

CFO and VP Finance
Steve Pekarthy
Ultron Labs, VP F & A

Dir Advanced Development
Dr. J. Craig Mudge
DEC, Director VLSI

FINANCING

July 1984
Round 1
$6.7M
Advanced Technology Ventures, Hambrecht and Quist, Rothschild Ventures, Caznove Ltd., Newmarket Ltd., Australian Industry Development Corp., Bennett and Fisher, and other individual investors

November 1986
Round 2
$6.4M
Original investors

March 1988
Round 3
$3.2M
Original investors

September 1989
Round 4
$1.3M
Original investors

RECENT HIGHLIGHTS

August 1989
Austek offered the A38202 Microcache cache controller for systems using Intel's 80386.

September 1989
Austek offered the A38204 Burst Mode Memory Controller for systems using Intel's 80386 and Austek's A38202 Microcache. This device is a companion to the A38202.

November 1989
Austek and Western Digital signed a letter of intent whereby Western Digital will use Austek cache controllers in its system logic products.

December 1989
Austek offered the A38202SX Microcache, cache controller for systems using Intel's 80386SX.

ALLIANCES

ZyMOS
October 1987
Austek and ZyMOS cooperated in the marketing and sales of Austek's A38152 Microcache with the ZyMOS POACH chip set for Intel 80386-based systems.

SERVICES

VLSI and system design
VLSI manufacturing management
VLSI test

MANUFACTURING

Technology

1.0-, 1.2- and 1.5-micron double-metal CMOS

Facilities

Santa Clara, CA
10,000 sq. ft.

Adelaide, Australia
20,000 sq. ft.

PRODUCTS

Device	Description
A38152	Microcache cache controller for Intel 80386, 32Kb cache size, 16, 20, and 25 MHz
A29285	Microcache cache controller for Intel 80286, 32Kb and 64Kb cache sizes, 20 and 25 MHz
A38202	Microcache cache controller for Intel 80386, 32Kb, 64Kb, and 128Kb cache sizes, 25 and 33 MHz
A38204	Burst mode memory controller for Intel 80386 and Austek A30202 systems, implements burst fills and two-level write buffer, 25 and 33 MHz
A41102	Frequency domain processor, implementing the fast Fourier transform, 40 MHz

OTHER INFORMATION

Austek Microsystems employs Joyce Lekas Public Relations as its PR firm.

Avasem Corporation

(Formerly: VLSI Design Associates)
1271 Parkmoor Avenue
San Jose, CA 95126
408/297-1201
Fax: 408/925-9460

ESTABLISHED: May 1980 **NO. OF EMPLOYEES: 48**

BACKGROUND

Avasem Corporation was formed to provide application-specific IC design, prototyping, and production services for electronic systems OEMs. The Company specializes in mixed analog and digital devices. Products are developed using the Company's standard cells and automated design tools. Proprietary design rules allow for multi-source wafer fabrication. The Company has established strategic alliances with production foundries.

In 1984, the Company introduced its first standard IC product—the V3829 floppy disk separator. The offering was followed by the V8500, a SCSI bus interface device introduced in 1986, and the V8580, a SCSI bus host device introduced in 1987. In March 1988, the Company announced the VDA-176, the first product in a family of RAMDAC devices. The device features a 256x18 SRAM color look-up table with triple 6-bit D/A converters for use as a color palette in computer graphics systems. A pipeline design allows pixel rates of up to 80 MHz. A pixel word mask allows displayed colors to be changed in a single write cycle, rather than by modifying the look-up table.

BOARD

*Mark R. Guidry, Chairman, President, CFO
Carolyn C. Guidry, Secretary
Richard S. Miller, VP Analog Products
K. Venkateswaran, VP Digital Products

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CFO
*Mark Guidry
Fairchild Semiconductor, Manager

VP Analog Prod
Richard Miller
Fairchild Semiconductor, Manager

VP Digital Prod
K. Venkateswaran
Fairchild Semiconductor, Manager

CFO
Mike Cleland
ICT Array Technology, Manager

*Founder

FINANCING

Initial capital was provided by founders, receivable financing by Saratoga National Bank.

SERVICES

Design
Prototypes
High-Rel Processing
Test

MANUFACTURING

Technology

1.2- to 5.0-micron CMOS

Facilities

San Jose, CA
27,000 sq. ft.
Design and test

PRODUCTS

Device	Description
V3829	Floppy Disk Separator
V8500	SCSI Bus Interface Device
V8580	SCSI Bus Host Device
V3676	Color Palette RAMDAC
V2116	2Kx8 CMOS SRAM
V2102	256Kx8 CMOS SRAM
V8520	Winchester Disk Controller

OTHER INFORMATION

Avasem does not employ a PR firm.

Bipolar Integrated Technology

1050 Northwest Compton Drive
Beaverton, OR 97006
503/629-5490

ESTABLISHED: July 1983 **NO. OF EMPLOYEES: 165**

BACKGROUND

Bipolar Integrated Technology, Inc. (BIT), designs, manufactures, and markets high-performance bipolar VLSI computational building blocks for the high-end digital signal processing (DSP) and data processing markets.

The Company's founders include George Wilson, Kenneth Schlotzhauer, James Pickett, Kenneth Giles, and Les Soltesz. Steve Cooper recently joined BIT as president and chief executive officer. Mr. Cooper was most recently president and COO at Silicon Systems.

BIT has developed a VLSI bipolar process named BIT1. The process is based on 2-micron lithography and polysilicon self-aligning techniques. BIT1 density is said to be comparable to 1.5-micron CMOS and is five times denser than existing bipolar ECL.

The Company's ECL and TTL products include 16x16 integer multipliers, 16x16 multiplier-accumulators, five-port register files, and a floating-point multiplier/ALU 2-chip set. BIT has also developed ECL gate arrays with Raytheon and will produce a bipolar 32-bit RISC MPU as a result of an agreement with Sun Microsystems.

BIT has established a nationwide network of sales representatives and has opened sales offices in Norcross, Georgia, and in Saratoga and Costa Mesa, California.

BOARD
(Name and Affiliation)

*George Wilson, Chairman
Bipolar Integrated Technology, CTO

Stephen E. Cooper
Bipolar Integrated Technology, President & CEO

Larry Sullivan
Analog Devices Enterprises

Wayne Kingsley
InterVen Partners

Jeff Watts
Union Venture Corp.

Dr. William Lattin
Logic Automation, Pres/CEO

Randall R. Lunn
Fairfield Ventures, General Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CTO
*George Wilson
Tektronix, Sr Engr/Bip Div

President/CEO
Stephen E. Cooper
Silicon Systems, President/COO

VP Tech Dev
*Dr. Keneth Schlotzhauer
Tektronix, Sr Engr

VP Mktg
Chris DeMonico
TI, Strat Mktg Mgr VLSI Products

VP Finance
*Keneth Giles
Columbian Co., VP Finance

VP Engr
John Deignan
Intel, Design Mgr

VP Operations
Kevin Stewart
VTC, Operations Mgr

*Founder

FINANCING

1983
Seed
$0.3M
Analog Devices, Inc.

May 1984
Start-up
$3.7M
Analog Devices, Inc.; First Interstate Venture Capital; BancBoston Ventures

Lease
$3.4M
Bank of Boston

$4.1M
Oregon State Revenue Bond

May 1986
Round 1
$7.7M
Original investors, Harvard Mgmt. Co., Raytheon Company, Republic Ventures, Union Venture Corp.

July 1986
Round 2
$2.5M
Fairfield Venture Partners, InterVen

July 1987
Round 3
$10.0M
Round 1 & 2 investors, Cowen & Co., DFC Ventures, Manufacturers Hanover, Pell Rudman & Co.

April 1988
Round 4
$11.2M
Round 3 investors, Bancorp Hawaii, Sun Microsystems, Weeden Capital Mgmt.

June 1988
Round 5
$13.5M
Oxford Partners, New England Capital Corp., Analog Devices, Raytheon Co., InterVen Partners

RECENT HIGHLIGHTS

November 1986
BIT offered two 16x16 fixed-point multiplier/accumulators, the B3011 and B2011. The B3011 is an ECL version and the B2011 is a TTL version.

November 1986
BIT sampled the B3210 1K register file with a typical read-cycle time of 6ns.

February 1987
BIT offered a chip set that consists of a floating-point multiplier and a floating-point ALU and offers 60-mflop performance for nonpipelined 64-bit operations. The B3110 multiplier and B3210 ALU are ECL 10KH compatible. The B2110 multiplier and B2120 ALU are TTL versions.

July 1987
BIT signed an agreement with Sun Microsystems to produce a bipolar 32-bit RISC MPU.

October 1987
Stephen E. Cooper was elected chairman of the board and CEO of BIT.

January 1988
BIT was selected by *Electronic Business* magazine as one of the 38 "hot" electronics industry start-ups. The results were based on a poll of 125 leading venture capitalists.

ALLIANCES

Analog Devices
1983
Analog Devices participated in all rounds of BIT financing.

Raytheon
July 1986
Raytheon and BIT agreed to jointly develop VLSI ECL gate arrays and standard cell devices using the BIT1 process. Raytheon will use its CAD/CAE facilities, and BIT will perform wafer fabrication with Raytheon marketing the resulting products.

Sun Microsystems
July 1987
Sun Microsystems licensed BIT to produce a 32-bit bipolar RISC MPU using its BIT1 process. The part uses Sun's scalable processor architecture (SPARC) developed for workstation applications. BIT has full marketing rights including software support. BIT plans to offer a higher performance RISC SPARC chip in 1989 using its BIT2 process.

Arizona Microtek
July 1988
BIT and AZM agreed to develop custom ICs using BIT's high-performance BIT-1 technology. AZM will act as an independent design house providing complete capabilities to develop custom LSI designs for current and future BIT customers.

MANUFACTURING

Technology

1.2-micron bipolar

Facilities

Beaverton, OR
46,000 sq. ft.
Design and manufacturing

6,000 sq. ft.
Class 10 clean room

PRODUCTS

Device	Description	Clocked Multiply Time
B3018	ECL 16x16 Integer Multiplier	13ns
B2018	TTL 16x16 Integer Multiplier	19ns
B3011	ECL 16x16 Multiplier-Accumulator	15ns
B2011	TTL 16x16 Multiplier-Accumulator	16ns
B3210	ECL 64x18-bit Five-Port Register File	7ns
B2210	TTL 64x18-bit Five-Port Register File	16ns
B3110/2110	2-Chip Set Floating-Point Multiplier	50ns
B3120/2120	Floating-Point ALU 25ns	

OTHER INFORMATION

BIT's PR firm is KVO, Inc.

BKC International Electronics, Inc.

6 Lake Street
Lawrence, MA 01841
508/681-0392
Fax: (508) 681-9135

ESTABLISHED: January 1986 **NO. OF EMPLOYEES: 100**

BACKGROUND

BKC International Electronics was founded in 1985 by three former ITT Semiconductor Employees, who purchased the geranium diode line and hi-rel test lab from ITT in 1985 and began operations in 1986. The Company produces a wide range of high-reliability discrete semiconductors, including small signal switching diodes, zener diodes, rectifiers, and germanium diodes.

By February 1, 1986, BKC had received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types approved and manufactured by ITT. In November 1986, BKC announced the purchase of the silicon wafer fab facility from ITT. The purchase included all the equipment, process, and quality specifications and procedures necessary to produce JAN, JANTX, and JANTXV switching diodes and zener diodes. Final approval from DESC was granted April 29, 1987.

To date, the Company has raised $2.5 million in financing through bank loans and the private sale of common stock. BKC conducts operations in an 80,000 square foot plant in Lawrence, Massachusetts, which houses design, wafer fab, assembly and test operations. During the next three years, the Company plans to increase wafer fab capabilities to include mesa construction. In the future, BKC plans to add new discrete semiconductors such as 5W zeners, Schottky diodes and rectifiers, switching rectifiers, and transient suppressors to its product lines.

BOARD

Not Available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Gerald T. Billadeau
ITT, CFO

VP Marketing
*John L. Campbell
ITT, Sales

VP Operations
*William J. Kady
ITT

*Founder

FINANCING

1985-1989
Bank Loans
$2.0M Total
Comfed Savings Bank

1985, 1986, 1987
Multiple offerings
Private sale of common stock
$525,000
Private investors

RECENT HIGHLIGHTS

February 1986
BKC received certification from DESC to operate its MIL-S-19500 test lab and also was granted JAN qualification on the germanium device types previously approved and manufactured by ITT.

November 1986
BKC announced the purchase of the silicon wafer fab facility from ITT.

MANUFACTURING

Technology

BKC uses Planar, mesa, and germanium gold bonding process technologies.

Facilities

Lawrence, MA
80,000 sq. ft.
Headquarters, wafer fab, assembly, test, design

PRODUCTS

- Small Signal Switching Diodes
- Zener Diodes
- Rectifiers
- Germanium Diodes

OTHER INFORMATION

BKC does not employ a PR firm.

Brooktree Corporation

9950 Barnes Canyon Road
San Diego, CA 92121
619/452-7580
Fax: 619/452-1249
Telex: 383596

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 290**

BACKGROUND

Brooktree Corporation designs, develops, and markets high-performance data conversion devices. The Company currently offers a complete line of VIDEODACs, which are D/A converters designed for use in video applications; RAMDACs, which are a combination of VIDEODACs and a color look-up table on one chip; and other related products. Brooktree's products are based on the Brooktree Matrix, a proprietary design technology that allows the combination of analog and digital processes on a single chip. The Company uses standard CMOS or bipolar manufacturing processes.

One of the founders of Brooktree was Dr. Henry Katzenstein, who developed the Brooktree Matrix. The Matrix is a fundamental advance in data conversion architecture and was the initial impetus for the formation of the Company. James Bixby, president of the Company, previously was director of engineering at Spin Physics, a division of Eastman Kodak. While at Spin Physics, Mr. Bixby developed a high-speed motion analysis system.

In November 1987, Brooktree acquired Manx Engineering Corp., a small company that has developed specialized hardware for document compression/decompression. The acquisition gives Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

Brooktree also intends to broaden its customer base with the addition of a product line aimed at ATE and instrumentation applications. The Company is currently offering a series of timing vernier ICs for ATE use.

BOARD
(Name and Affiliation)

*Myron Eichen, Chairman
Brooktree Corporation

James Bixby
Brooktree Corporation

*Ellsworth Roston
Roston and Schwartz

Sid Webb
Titan Corporation

Jack Savidge
Venture Strategies

F. Duwaine Townsend
Ventana Corporation

Bill Mobratten
Independent

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
James Bixby
Spin Physics, Dir Engr

VP/Chief Scientist
*Henry Katzenstein
Quantrad, VP/Ch Scientist

VP/CFO
William Peavey
Monitor Labs, VP Finance/CFO

VP
Steve Ou
Rockwell, Dir Dev Engr

VP Distribution
Joseph Santen
Burr-Brown, GM Data Conv

VP/Sales
Richard Lee
Mostek, VP Sales

VP/GM Components
Charles Long
GE, VP/GM

VP Strat Plan
Stewart Kelly
Intel, Strat Bus Chrmn

VP Human Resources
Bob Zabaronick
Cipher Data Prod, P Human Rescs

VP/Dir Subsystems
Jeffrey Teza
Integrated Circuit Engineering, Mgr Custom Design

*Founder

FINANCING

January 1982
Start-up
$0.4M
Founders

Late 1982-Early 1983
Seed
$0.3M
Management, private investors

Summer 1983
Round 1
$0.7M
Management, private investors

Early 1985
Round 2
$5.0M
Institutional investor

Summer 1985
Round 3
$5.0M
Institutional investor

Early 1986
Round 4
$10.0M
Institutional investor, individual and foreign investors, Fairchild Semiconductor

Early 1987
Round 5
$5.0M
Institutional investor

Late 1987
Round 6
$5.0M
Shintech (a division of Shin-Etsu), individual and foreign investors

RECENT HIGHLIGHTS

July 1987
Brooktree offered radio-frequency identification (RF ID) chips that are being used to automate tool changing. The chips are a mix of on-chip logic, PROMs, and communication components that identify the right tool so the host computer can direct its attachment.

November 1987
Brooktree acquired Manx Engineering Corp., a small company that developed specialized hardware for document compression/ decompression. The acquisition gave Brooktree an opportunity to move into systems, specialized chips, and boards for document management.

January 1988
Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

ALLIANCES

Toshiba
1985
Toshiba signed a royalty-bearing licensing agreement to utilize Brooktree technology for consumer digital audio applications.

Fairchild
April 1986
Brooktree and Fairchild signed a broad-ranging partnership coupling Brooktree's D/A conversion technology with Fairchild's manufacturing capability. Fairchild made an equity investment and provides foundry services (expired April 1988).

Analog Devices
January 1988
Brooktree signed Analog Devices as a second source of the Bt471 and Bt478 video DACs, which are aimed at PS/2 and VGA add-in boards.

MANUFACTURING

Technology

3.0-, 2.0-, 1.2-micron Silicon-Gate Double-Metal CMOS
2.0-, 1.5-micron ECL bipolar

Facilities

San Diego, CA
73,000 sq. ft.
Headquarters, design, development, test

PRODUCTS

Video DACs

Device	Description	Clock Rate (MHz)
Bt101	Triple 8-Bit, Pipelined Operation	50, 30
Bt102	Single 8-Bit, 0, 7.5, or 10 IRE Pedestal	75
Bt103	Triple 4-Bit, Pipelined Operation	75, 30
Bt106	Single 8-Bit, Pipelined Operation	50, 30
Bt107	Single 8-Bit, 2:1 Multiplexed Pixel Inputs	400
Bt108	Single 8-Bit, Pipelined Operation	400, 300, 200
Bt109	Triple 8-Bit, Pin Compatible to TDC1318	250

Imaging

Device	Description	Conv. Rate (MHz)
Bt208	8-Bit Flash Video A/D Converter	15, 18
Bt251	Single-Channel 8-Bit Image Digitizer	15
Bt253	Triple-Channel 8-Bit Image Digitizer	15

RAMDACs

Bt450	Triple 4-Bit, 16x12 Dual-Port Color Palette RAM	70, 50, 30
Bt451	Triple 4-Bit, 256-Word Dual-Port Color Palette RAM	25, 110, 80
Bt453	Triple 4-Bit, 256-Word Color Palette RAM	66, 40
Bt454	Triple 4-Bit 16x12 Color Palette RAM	170, 110
Bt457	Single 8-Bit, 256x8 Dual-Port Color Palette RAM	125, 100, 80
Bt461	Single 8-Bit, Multiplexed TTL Pixel Ports	170, 110, 80
Bt471	Triple 6-Bit, 256x18 Color Palette RAM	80, 50, 35
Bt473	Triple 8-Bit True Color, 256-Word Palette	35, 50, 66, 80
Bt476	Triple 6-Bit, 256-Word Color Palette	35, 50, 66
Bt478	Triple 6/8-Bit, 256-Word Color Palette	35, 50, 66, 80
Bt459	Triple 8-Bit, 256-Word Color Palette with Cursor	80, 110, 135
Bt492	Single 8-Bit, 256-Word Palette, 100K ECL	360

Graphics Peripheral Devices

Device	Description	Conv. Rate (MHz)
Bt401-404	256x8 Pipelined SRAM, Optional 3x8 Overlay Registers, 10KH and 100K ECL Compatible	250
Bt424	40-Bit Multi-Tap Shift Register, 10KH ECL/TTL Compatible	250
Bt431	64x64 User Definable Cursor 35 MHz per 5 pixels	
Bt438	Clock Generator Chip for 125-MHz CMOS RAMDACs	250
Bt439	Clock Generator/Synchronizer Chip for Single Channel 125-MHz CMOS RAMDACs	150
Bt501/502	Octal ECL/TTL Bidirectional Transceiver/Translator, 10KH and 100K ECL Compatible	N/A

D/A Converters

Device	Description	Settling Time
Bt104	Monolithic Single 12-bit, Unlatched Data Inputs	40ns
Bt105	Monolithic Single 12-bit, Latched Version of Bt104	40ns
Bt110	Monolithic Octal 8-bit, Standard MPU Bus Interface	100ns

ATE Devices

Device	Description
Bt601	Dynamically Programmed Timing Edge Vernier, 10KH ECL Compatible
Bt602	Programmable Timing Edge Vernier, 20ps Resolution, 10KH ECL Compatible
Bt603	Programmable Timing Edge Delay, 20ns to 200ns span, 10KH ECL Compatible
Bt604	125-MHz 10KH ECL Compatible Dynamically Programmed Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt605	125-MHz 10KH ECL Compatible Programmable Timing Edge Vernier, 15ps Resolution, 4ns Span
Bt606	Programmable Timing Edge Delay, 20ns to 200ns Span
Bt687	Ultrafast ECL Dual Comparator

Military Devices

Bt101/883	MIL-STD-883C Version of Bt101 VIDEODAC, 30-MHz Clock Rate
Bt102/883	MIL-STD-883C Version of Bt102 VIDEODAC, 66-MHz Clock Rate
Bt453	MIL-STD-883C Version of Bt453 RAMDAC, 40-MHz Clock Rate, 40-Pin Ceramic Sidebrazed DIP Package
Bt458/883	MIL-STD-883C Version of Bt458 RAMDAC, 100-MHz Clock Rate, 84-Pin Ceramic PGA Package

OTHER INFORMATION

Brooktree's PR firm is Rigoli, Pamphilon, Demeter.

California Micro Devices Corporation

215 Topaz Street
Milpitas, CA 95035-2398
408/263-3214
Fax: 408/263-7846

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 300**

BACKGROUND

California Micro Devices Corporation (CMD) designs, manufactures, and markets a wide range of high-performance electronic components through its thin-film, ASIC, and microcircuits divisions. The components are marketed to military, aerospace, medical, computer, and communications customers.

CMD was formed originally in 1980 to acquire the assets of Capsco Sales, Inc., a thin-film company founded in 1976. In 1982, CMD established Custom MOS Arrays (CMA), which designed, manufactured, and marketed HCMOS cell-based ICs and gate arrays in the 200- to 2,000-gate range. In September 1986, CMD and CMA merged into one company. Dr. Handel H. Jones, formerly president of CMA, became president and COO of the new company.

CMA operates as the ASIC division of CMD and produces primarily gate array and cell-based ICs based on 2.5-, 2.0-, and 1.25-micron HCMOS technologies, with complexities of from 100 to 20,000 gates. The Company has adapted its cell-based designs to analog and digital products and has increased the level of integration by depositing precision thin film onto the ICs.

The thin-film division designs and manufactures precision resistive products including networks, capacitors, and metallized substrates for both hybrid and microwave applications. The division also produces nonimpact, high-density, color ink-jet printheads. In November 1985, the Company introduced its proprietary SX resistor chip materials for high-performance applications that require precision resistance and stability characteristics.

In August 1987, CMD acquired the assets of GTE Communication Systems' Microcircuits Division for $14.5 million. The acquisition covered all of Microcircuits' assets including inventory, receivables, trade payables, intellectual properties, five acres of land, silicon wafer foundry and test facilities, and personnel. In the transaction, GTE Communication Systems also granted a preferred vendor status to CMD and a license to proprietary technology in custom chips.

The division, which operates as the Microcircuits Division of CMD, offers custom telecommunications circuits, MPU and peripherals ICs, and gate arrays used in telecommunications systems. R&D efforts focus on products in the telecommunications arena. About 60 percent of sales is into the telecommunications market, 20 percent in the personal computer market, with the remainder from foundry business. The division provides about 50 percent of its production to support the internal requirements of GTE Communications Systems.

In January 1989, CMD formed the Vanguard Semiconductor Division, which will be run by former Aspen founder/president/CEO Narpat Bhandari.

BOARD
(Name and Affiliation)

*Chan M. Desaigoudar, Chairman
  California Micro Devices Corporation, CEO

James P. Burgess
  Cambur Company, President

Dr. C. Lester Hogan
  Fairchild Instruments, Former
  Vice Chairman, President & CEO

Dr. Handel H. Jones
  International Business Strategies, Chairman

Dr. Angel G. Jordan
  Carnegie-Mellon University, Provost

Stuart Schube
  Acorn Ventures, Inc., President

California Micro Devices Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Chan M. Desaigoudar
ITT Semiconductor, Far East Sales Dir

CFO/VP Finance, Asst Secretary
Steven J. Henke
Monsanto, Div Controller

VP/GM Microcircuits Div
Dr. Tarsaim L. Batra
Gould/AMI, Director Process Technology

VP Technology, Pres—Vanguard Semiconductor
Narpat Bhandari
Aspen Semiconductor (Div of Cypress Semiconductor), Founder, Pres and CEO

VP/GM Thin Film Division
Satish Kumar
United Supertek, Dir of Mktg

VP Sales and Tactical Mktg
Stephen R. Pass
Linear Technology, VP Sales

VP Foundry and Int'l Ops
Zia H. Malik
LSI Logic, Mgr Technical Liaison

*Founders

FINANCING

October 1986
$5.2 M
Initial public offering

RECENT HIGHLIGHTS

September 1986
CMD and Custom MOS Arrays merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

October 1986
CMD made an initial public offering of 1 million shares of common stock at $6 per share. The offering raised $5.2 million.

August 1987
CMD acquired the assets of GTE Microcircuits Division.

November 1987
CMD offered the G8870, a CMOS DTMF receiver that is a combination decoder and filter. The device is said to detect all 16 DTMF tone pairs and convert them into code.

August 1988
California Micro Devices announced that it entered into an agreement with Gould Inc. to acquire the assets and assume selected liabilities of American Microsystems Inc., a wholly owned subsidiary of Gould Inc., for approximately $70 million in cash.

January 1989
California Micro Devices announced the formation of Vanguard Semiconductor Division.

ALLIANCES

Ricoh
1982
Ricoh provided wafers to CMA.
1983
CMD signed a joint technology agreement with Ricoh covering CMOS silicon-gate and BiMOS gate arrays and standard cells.

Racal
January 1982
Racal agreed to allow CMA to design, manufacture, and sell Racal's new 5-micron silicon-gate CMOS gate arrays in the United States.

Micro Innovators
January 1983
CMA merged with Micro Innovators, Inc., to acquire a team of seasoned custom MOS/LSI designers and expand its product line to include standard cell and full-custom designs in silicon-gate CMOS at both 5- and 3-micron geometries.

TRW
July 1985
TRW agreed to manufacture HCMOS gate arrays of from 500 to 25,000 gates in its JAN-qualified fab, using CMA's 1.2-micron design rules. TRW will use the rules internally for its DSP products.

CMA
September 1986
CMD and CMA merged. The charter of the combined companies is to advance state-of-the-art thin-film technology and apply it to products in high-growth markets.

Fuji Photo Film
November 1986
CMD signed an agreement with Fuji Photo Film Co., Ltd., under which CMD will license its HCMOS gate array and cell-based design technology for $1 million. Fuji Photo Film will use the technology internally in image- and information-processing equipment.

Tachonics
March 1987
CMD signed an agreement with Tachonics Corporation that calls for Tachonics to manufacture commercial and military GaAs ICs at its foundry in New Jersey. CMD will provide cell design and tools in the 1.0- to 0.5-micron range. Initial products will be GaAs gate arrays in the 500- to 2,500-gate range and with radiation-hardened capability.

Telefonica
November 1987
CMD and Telefonica signed a joint venture agreement to form a company named California Micro Devices SA in Spain. CMD plans to invest about $2 million and will own approximately one-third of the company. CMD SA will offer thin-film passive components for hybrid assemblies, gate arrays, cell-based ICs, and nonimpact printhead substrates. CMD and Telefonica will also jointly develop ASICs. CMD will provide technology and training.

MANUFACTURING

Technology

1.25-, 1.5-, 2.0-, and 2.5-micron HCMO
Silicon-gate, single- and dual-layer metal
4-inch and 6-inch wafers

Facilities

Milpitas, CA
40,000 sq. ft.
Total space

15,000 sq. ft.
Class 1,000 clean room

Tempe, AZ
46,000 sq. ft.
Manufacturing, test—Class 1,000

20,000 sq. ft.
Clean room—Class 100 & 10

PRODUCTS

CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
C1000	Si-Gate	1.5	0.8	5,000 to 18,000
C2000	Si-Gate	2.0	2.0, 1.25	200 to 3,100
C3000	Si-Gate	2.5	2.5	1,500 to 10,500
C5000	Si-Gate	1.25	0.4	500 to 25,000

CMOS Cell Library

Process	Linewidth (Microns)	Delay (ns)	Cells
Si-Gate	1.25	0.25	120 gates, 200 MSI, RAM, ROM, PLA, 2901 Family, DMA Controllers, UART, USART
Si-Gate	2.0	1.2	Same as above
Si-Gate	2.5	2.5	Same as above

Linear

G8870	CMOS DTMF Receiver that Combines Decoder and Filter
G8912	PCM Filter

OTHER INFORMATION

California Micro Devices does not employ a PR firm.

Calmos Systems, Inc.

20 Edgewater Street
Kanata, Ontario, Canada K2L 1V8
613/836-1014
Fax: 613/831-1742
Telex: 053-4501

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 65**

BACKGROUND

Calmos Systems designs, develops, and markets a variety of devices, including VHSIC-level products that use CMOS and bipolar processes. The Company's CMOS products consist of the CA80C85B MPU and the 8000 series of peripherals, including SCSI and SCC devices. The bipolar product line is centered on a family of wireless components for cellular radio and pager applications. The Company also offers fast-turn prototyping and low-volume production runs that use e-beam technology.

In February 1988, Calmos acquired Siltronics' bipolar IC line. The acquisition adds about $2.5 million to Calmos' sales, which were $2 million in 1987. Calmos has purchased Siltronics' assets, especially the equipment for testing and assembly of the circuits.

Calmos hired about 24 of Siltronics' key employees, including founder and Vice President Gyles Panther, doubling the size of Calmos' work force.

The Siltronics product line consists of FM receiver chips for data and cellular radio applications, a delta codec chip based on an exponentially variable step-size algorithm, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

The Company participates in a EUREKA, a European consortium R&D project and is working with European Silicon Structures (ES2) to exploit the technology in ASIC design. Calmos, together with ES2, offers quick-turn prototyping using direct-write e-beam technology, which can implement several design projects on the same wafer.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Dr. Adam Chowaniec
Commodore, VP Technology

VP R&D
John Roberts
Mosaid, Dir Mktg

VP Sales/Mktg
William Woodley
Mosaid, VP/Bus Mgr

VP Finance/GM
D. Rosati
Cognos, Controller

VP Engineering and Technology
Andrew Herrington
Amiga, Dir Engineering

GM Manufacturing
S. Henthorn
Siltronics, Dir Mfg

FINANCING

Not available
Round 1
$1.0M
Private

Not available
Round 2
$0.4M
Private

Not available
Round 3
$3.6M
Private and grants

November 1987
Round 4
$0.5M
Private

RECENT HIGHLIGHTS

January 1987
Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

September 1987
Calmos announced that it has developed a prototype of a public-key data-encryption system implemented on a chip. The chip uses an algorithm developed at the University of Waterloo in Ontario that allows encryption by exponentiation at speeds of several hundred bits per second.

November 1987
Calmos received a federal contribution of more than $3 million from the Canadian DRIE to join the EUREKA program. The project involves the expansion of the Company's headquarters located in Kanata, Ontario, to include packaging and test facilities for semiconductor products and the expansion of its CAE system.

February 1988
Calmos acquired Siltronics' bipolar component business for $500,000. Siltronics' product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

ALLIANCES

Samsung
January 1987
Calmos licensed its 8200 series of devices to Samsung in exchange for a foundry commitment.

European Silicon Structures
February 1987
Calmos formed an alliance with ES2 to offer quick-turn prototyping.

Siltronics
February 1988
Calmos acquired Siltronics' bipolar component business for $500,000. The product line consists of FM receiver chips, a codec chip, DC-DC converter chips, a power supply monitor, and an MPU supervisory chip.

SERVICES

Prototyping
Low-Volume Production

MANUFACTURING

Technology

2.0- and 3.0-micron CMOS
0.9- to 1.5-micron CMOS VHSIC
3.0- and 5.0-micron bipolar

Facilities

Kanata, Ontario, Canada
20,000 sq. ft.
Manufacture, test, design

PRODUCTS

ASICs

Device	Description
CMOS Gate Arrays	228 to 1,000 Gates, 2ns Typical Delay
Structured Cell Library	80 Cells Including 4-Bit Adders Shift Registers
Macro Cell Library	RAM, ROM, Dual-Port RAM, 29C01, 80C85, and 8200 Series of Peripherals

Microcomponents

Device	Description	Speed
CA80C85B	8-Bit MPU with Extended Instruction Set	3 to 5 MHz
CA80C85S	CA80C85B with Static Operation (2Q88)	6 to 10 MHz
8000 Series Peripherals		
CA82C12	8-Bit MPU	8 to 10 MHz
CA82C37A	Static DMA Controller	5 to 10 MHz
CA82C54	Static Interval Timer	8 to 10 MHz
CA82C55A	Static Peripheral Interface	5 to 10 MHz
CA82C59A	Static Interrupt Controller	5 to 10 MHz
CA82C84A	Static Clock Generator/Driver	8 to 10 MHz
CA82C88	Static Bus Controller	5 to 10 MHz
CA53C80	Static SCSI Interface Controller	1.5 to 3.0 Mbps
CA34C168	Real-Time Data Encryption Processor	300 Kbps

DSP

CA29C128	Digital FIR Filter Controller	25 MHz
DFS001-P	PC Board with Programmable FIR Filter and with Software Interface	
FIRCALC-PC	FIR Filter CAD Program	

Memory

CA16C08	2Kx8 SRAM	25ns
CA16C09	2Kx9 SRAM	25ns
CA64C08	8Kx8 SRAM	35ns
CA64C09	8Kx9 SRAM	35ns

Bipolar IC Product Line

Communications Circuits

S422	FM Receiver
S412	Cellular Radio Receiver
S404/406	FM Receiver Two-Chip Set
S408/410	FM Receiver for Data
S2842	Delta Codec

Power Supply Circuits

S420/424	Low-Voltage DC-DC Converters
S2862	Power Supply Monitor

Specialty Circuits

S416	Programmable Monolithic Diode Matrix
S2854	MPU Control Circuit
S144	Triple Op Amp

OTHER INFORMATION

Calmos does not employ a PR firm.

Calogic Corporation

237 Whitney Place
Fremont, CA 94539
415/656-2900

ESTABLISHED: July 1983 **NO. OF EMPLOYEES:** 50

BACKGROUND

Calogic Corporation designs, develops, and manufactures DMOS analog products, CMOS and bipolar linear products, and gate arrays. The Company also builds fabrication facilities and markets semiconductor equipment.

The Company was founded without venture capital. From 1985 to 1987, it initially concentrated on foundry contracts and building mini fabrication facilities using its own facility as a model. Calogic has set up fabrication facilities for Data Linear, Microwave Device Modules, and other foreign companies.

In the first quarter of 1988, Calogic began ramping up its proprietary line of linear products, which includes op amps, reference, and regulators.

Calogic achieved a positive cash flow within its first year of operation. The Company is profitable, with sales of about $5 million and continues to grow at a rate of approximately 50 to 100 percent per year.

BOARD
(Name and Affiliation)

*Manny Del Arroz, Chairman

*Dr. Charlie Allen, Consultant

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Manny Del Arroz
Intel, Process Manager

*Founder

FINANCING

1983
Initial
$0.025M
Private

ALLIANCES

Koki Company
December 1984
Calogic and Koki reached an agreement regarding the sale of Calogic's CMOS data bus driver ICs by Koki in Japan. (expired)

MANUFACTURING

Technology

3-micron DMOS
5.0- to 3.0-micron metal-gate CMOS
3.0-micron bipolar linear with thin film
High-Speed Complementary Bipolar on DI

Facilities

Fremont, CA
30,000 sq. ft.
Design, manufacturing, and test

7,000 sq. ft.
Including a Class 100 clean room

PRODUCTS

- Op Amps
- Regulators
- References
- DMOS FET
- CMOS MPR
- DMOS Switching Arrays
- J Fet
- High-Speed Buffer Amplifiers
- Current Feedback Amplifiers
- Other Linear Analog Products

OTHER INFORMATION

Calogic does not employ a PR firm.

Catalyst Semiconductor, Inc.

2231 Calle De Luna
Santa Clara, CA 95054
408/748-7700
Fax: 408/980-8209
Telex: 5106017631

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 52**

BACKGROUND

Catalyst Semiconductor, Inc., was formed to design, develop, and manufacture leading-edge, nonvolatile memories as well as to provide this technology to application-specific and peripherals ICs. This design base is directed toward consumer, industrial, and military applications.

The Company was founded by B.K. Marya, previously the founder and CEO of Exel Microelectronics, Inc. Its long-term strategy is to gain ASIC leadership through the use of nonvolatile memory technology.

BOARD
(Name and Affiliation)

*B.K. Marya
Catalyst Semiconductor, president

George Pottorff
Pottorff, MacFarlane & Associates, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
B.K. Marya
Exel, President

Exec VP
Stephen Michael
GE Solid State, VP Custom ICs

VP Corp Dev
Hide Tanigami
Exel, Bus Dev/Japan

Dir European Sales
Barry Stanley
Mostek, Sales/Manager

Dir American Sales
Thomas Malgesini
Intel, Field Sales Engineer

Dir Tactical Mktg
Reggie Huff
Exar, Sales Mgr

Dir Strat Mktg
Nick Samaras
National, Mktg Mgr

*Founder

FINANCING

October 1985
Round 1
$4.5M
Private placement

RECENT HIGHLIGHTS

January 1987
Catalyst offered the CAT93C46 and CAT59C11, two CMOS 1K serial EEPROMs. The devices offer selectable serial memory organization and automatic write instruction.

March 1987
Catalyst and Oki Electric extended a previous agreement to include a wide range of CMOS EEPROMs. The agreement includes 1K serial EEPROMs; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs.

April 1987
Stephen Michael, formerly vice president of GE Semiconductor's Custom Integrated Circuit Department, joined Catalyst as executive vice president and COO. He has responsibility for all day-to-day operations.

June 1987
Catalyst offered the CAT62C580, a CMOS 8-bit MCU with 16K of EEPROM on-chip.

The device also includes 3 Kbytes of mask-programmable ROM and 128 bytes of data RAM.

June 1987
Catalyst offered the KASK 52580 program development and evaluation system for the CAT62C580 single-chip, 8-bit MCU. The system runs on the IBM PC AT or compatible MS-DOS machines.

July 1987
Catalyst offered its first CMOS SRAMs. The CAT71C256 and CAT71C256L are low-power 32Kx8 devices with an access/cycle time of 85ns. The CAT71C88 is a 16Kx4 SRAM with an access time of 45ns.

Sept. 1987
Catalyst sampled a 1Mb EPROM with an access time of 120nsCAT27010.

October 1987
Catalyst introduced the CAT28C16A and CAT28C17A, its first 16K EEPROMs. Both are organized as 2Kx8 and offer a 150ns access time.

1988 Developments

Catalyst introduced the CAT28C64A and CAT28C65A 64K EEPROMs.

Catalyst introduced the CAT35C102 and CAT35C202 2-Kbit serial EEPROMs.

Catalyst introduced the CAT35C104 and CAT35C204 4-Kbit serial EEPROMs.

Catalyst offered the CAT62C780, a CMOS 8-bit MCU with 8K of EEPROM on-chip. The device also includes 6Kbytes of mask-programmable ROM and 192 bytes of data RAM.

Catalyst introduced the CAT35C704 and CAT35C804 Secure Access Serial EEPROMs. These unique memories offer password-protected access to data and feature configuration.

Catalyst introduced its first military temperature device with the CAT27HC256. This is a 256-Kbit EPROM that provides 55ns access times. It also is available in industrial and commercial temperature grades as well as a low-power version, the CAT27HC256L.

Catalyst introduced a CMOS 1-Mbit EPROM, the CAT27C210, configured as 64Kx16 for 16- and 32-bit processor applications.

ALLIANCES

Zilog
December 1985
Catalyst and Zilog entered into a joint development and second-source agreement for user-programmable standard products. The Companies' initial effort will be a version of Zilog's Z8 microcontroller with on-chip, electrically alterable capabilities that use Zilog's 1.25-micron, n-well CMOS process.

Thomson CSF
1986
Catalyst and Thomson will conduct research and development in France.

Oki Electric
July 1986
Catalyst and Oki entered into an agreement that calls for long-term research and development of NVRAMs for ASICs using CMOS EPROMs and EEPROMs. Terms include a nonexclusive marketing agreement.

March 1987
Catalyst and Oki Electric extended the previous agreement to include a wide range of CMOS EEPROMs. The two companies planned a joint introduction of a 1K serial EEPROM; 256-bit and 512-bit serial EEPROMs; and 16K, 64K, and 256K EEPROMs by the end of 1987.

November 1988
Catalyst and Oki signed an agreement that gives Oki a second-source license to sell the Catalyst 2K CMOS serial EEPROM, the CAT35C102, and the CAT35C202 on a worldwide basis.

Seiko
February 1987
Catalyst and Seiko Instruments signed a technology exchange and foundry agreement.

MANUFACTURING

Technology

1.2-micron design rules
Double-metal, double-poly CMOS
Submicron technology in development

Facilities

Santa Clara, CA
20,000 sq. ft.
Offices, test

PRODUCTS

Device	Description
CMOS SRAM	
CAT71C256	32Kx8
CAT71C256L	32Kx8 (low-power version)
CMOS NVRAMs	
CAT22C10	64x4
CAT22C12	256x4
CAT24C44	16x16 Serial RAM
CMOS EPROMs	
CAT27HC256	32Kx8
CAT27HC256L	32Kx8 (low power)
CAT27C210	1 Mbit (64Kx16)
NMOS EPROMs	
CAT2764A	8Kx8 (OTP)
CAT27128A	16Kx8 (OTP)
CAT27256	32Kx8 (OTP)
CAT27512	64Kx8 (OTP)
CAT27010	1 Mbit (128Kx8) OTP and UV versions
Parallel CMOS EEPROMs	
CAT28C16A/28C17A	2Kx8
CAT28C64A/28C65A	8Kx8
CAT28C256	64Kx8
Serial CMOS EEPROMs	
CAT93C46/59C11	1K Serial
CAT35C102/CAT35C202	2K Serial
CAT35C104/CAT35C204	4K Serial
CAT35C704/CAT35C804	4K Secure Access Serial
Microcontrollers (SmartCard Chips)	
CAT62C580	8-Bit MCU, 16K of EEPROM on-chip, 3 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM
CAT62C780	8-bit MCU, 8K of EEPROM on-chip, 6 Kbytes of Mask-Programmable ROM, 128 bytes of data RAM
Development Tools	
EASE 62580	A Program Development and Evaluation System for the CAT62C580 Single-Chip, 8-Bit MCU

OTHER INFORMATION

Catalyst's PR firm is John Ranavicks.

Celeritek, Inc.

617 River Oaks Parkway
San Jose, CA 95134
408/433-0335
Fax: 408/433-0991

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 110**

BACKGROUND

Celeritek, Inc., designs, manufactures, and markets GaAs FETs, MMICs, and custom subsystems such as up/down converters for military and commercial applications.

The Company has developed a thin-film microwave amplifier technology and manufactures many of its low-noise and medium-power GaAs FETs in-house. All microwave amplifier thin-film circuits use a high-energy sputtering process for reliable and repeatable metal adhesion. The Company can also manufacture silicon MOS capacitors. Celeritek uses a family of standard amplifier modules that can be combined and aligned to achieve customer-specific specifications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Tamer Husseini
Granger Assoc., VP Operations

VP Amp Ops
*Gary Policky
Avantek, Mgr Adv Dev M/W

VP SC Ops
*Ross Anderson
Avantek, Mgr GaAs Dev

VP Finance
*John Beman
ROLM, Controller

VP Marketing
*Robert Jones
Avantek, Dir Marketing

*Founder

FINANCING

March 1985
Round 1
$3.2M
Greylock Management, Sutter Hill, Venrock Associates

August 1985
Follow-on
$1.0M
Original investors

August 1986
Round 2
$4.2M
Original investors; Burr, Egan, Deleage; Glynn Ventures; Mayfield Fund; Morgan Stanley

RECENT HIGHLIGHTS

July 1987
Celeritek leased 23,860 square feet of R&D space in San Jose, California.

December 1987
Avantek filed a suit against Celeritek and two of its founders, Tamer Husseini and Ross Anderson, charging theft of trade secrets.

ALLIANCES

None

MANUFACTURING

Technology

GaAs

Facilities

San Jose, CA
23,860 sq. ft.
Research and development and manufacturing

1,000 sq. ft.
Class 100 clean room

PRODUCTS

Low-Noise Amplifiers

Family	Frequency	Power Output
CMA Series	0.5 to 18.0 GHz	+18 dBm
CMT Series	2 to 18 GHz	+18 dBm
CMT Series	18 to 40 GHz	+10 dBm
Medium-Power Amplifiers		
CPA Series	6 to 18 GHz	+27 dBm
CPT Series	6 to 18 GHz	+30 dBm
Microsize Connectorless Amplifiers		
240/400 Series	2 to 18 GHz	
520 Series	0.5 to 4.0 GHz	
MMIC Chips		
CMM-2 Amp	2 to 6 GHz	
CMM-4 Amp	2 to 18 GHz	
CMS-12 Switch	DC to 18 GHz	
GaAs FETs		
CF004-02	2 to 40 GHz	+13 dBm
CF003-01	2 to 20 GHz	+22 dBm
CF010-01	2 to 18 GHz	+28 dBm

Integrated Assemblies

Frequency Converters
Switched Amplifiers
Log Amplifiers

OTHER INFORMATION

Celeritek does not employ a PR firm.

Chartered Semiconductor Pte Ltd.

3-Lim Teck Kim Road
STC Building 10-02
Singapore 0208
Phone: 65-320-7271

ESTABLISHED: October 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Chartered Semiconductor Pte Ltd. is a result of a joint venture among National Semiconductor Corporation, Singapore Technology Corporation, and Sierra Semiconductor Corporation. Singapore Technology holds 74 percent of the Company, Sierra holds 17 percent, and National holds the remaining 9 percent. Total initial investment in the facility and equipment was about $40 million.

The Company, which is located at a 170,000-square-foot site in the Singapore Science Park, will initially fabricate and test CMOS wafers and ASIC devices primarily for Sierra Semiconductor and National Semiconductor. Chartered Semiconductor began construction in October 1987 and began its first wafer starts in Q2 1989. The facility fabricates submicron devices in a Class 1 clean room with an initial capacity of 5,000 6-inch wafers per month. The facility will be capable of generating about $50 million in revenue per year.

Sierra is contributing its proprietary Triple Technology CMOS process, technical management, and training. National is providing CMOS process technology, technical training, and technical support in the construction and start-up of the clean-room facility. Singapore engineers have been training at Sierra's San Jose, California, facility for more than two years. Tom Klein, vice president and founder of Sierra, will supervise the facility construction and start-up of the manufacturing process. Sierra's Triple Technology is capable of integrating analog, digital, and EE memory on one chip.

BOARD
(Name and Affiliation)

Ming Seong Lim, chairman

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Managing Director
B. John Hambridge
Fairchild, VP Logic Division

FINANCING

Oct. 1987
Round 1
$40.0M
National Semiconductor Corporation; Sierra Semiconductor Corporation; Singapore Technology Corporation

ALLIANCES

National, Sierra, Singapore
Oct. 1987
National Semiconductor, Sierra Semiconductor, and the Singapore Technology Corporation cooperated in a joint venture to form Chartered Semiconductor.

SERVICES

Foundry
Manufacturing

MANUFACTURING

Technology

Submicron CMOS
6-inch wafers

Facilities

Singapore
170,000 sq. ft.
Manufacturing

The Company started wafer production in Q2 1989. The facility includes a Class 1 clean room and has an initial capacity of 5,000 wafers per month.

PRODUCTS (Planned)

CMOS Wafers
ASIC Devices

OTHER INFORMATION

Chartered Semiconductor does not employ a PR firm.

Cirrus Logic, Inc.

1463 Centre Pointe Drive
Milpitas, CA 95035
408/945-8300

ESTABLISHED: 1984 | **NO. OF EMPLOYEES: 175**

BACKGROUND

Cirrus Logic, Inc., designs, manufactures, and markets optimized mass storage controllers, communications controllers, and graphics controller chips for data communications, mass storage control, and display/graphics control applications. The Company's VLSI circuits use a proprietary silicon compilation technique and can be designed as standard products, as well as market- and customer-specific derivatives.

Cirrus Logic is the commercial follow-on to Patil Systems, a research laboratory founded in 1981. In 1984, financing was received from Nazem & Company of New York, and Cirrus Logic acquired Patil Systems.

Cirrus Logic developed a proprietary IC design method called Storage/Logic Array (S/LA) to design custom ICs in design times equivalent to those for standard cells with the density and performance of full-custom devices. Suhas Patil invented the S/LA concept, a type of silicon compilation technology with supporting CAD tools for logic design, simulation, and automatic layout.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Michael Hackworth
Signetics, Sr VP

Exec VP/Strat Ops
Kamran Elahian
CAE Systems, Founder/President

VP R&D
*Dr. Suhas Patil, Chairman
Patil Systems, Founder

VP Engineering
Kenyon Mei
Intel, GM OEM Comm

VP Manufacturing
Michael L. Canning
Teledyne, President/GM

VP Marketing
George Alexy
Intel, Mktg Mgr MPUs

VP Finance
Marilyn Guerrieri
Zitel, Dir Finance

VP Sales
Bill Caparelli
VLSI Technology, VP Sales/Mktg.

*Founder

FINANCING

March 1984
Seed
$1.6M
Nazem & Company; Robertson, Colman & Stephens

May 1985
Round 1
$7.5M
Brentwood Associates; Nazem & Company; New Enterprise Associates; Robertson, Colman & Stephens; Technology Venture Investors

May 1986
Round 2
$3.0M
Previous investors; Institutional Venture Partners

November 1986
Round 3
$4.5M
Previous investors; Kuwait & Middle East Financial; New York Life Insurance

June 1987
Round 4
$11.0M
Previous investors; Berkeley Development Capital; Evergreen Management Partners; New Venture Partners; T.R. Technology Investment; UNC Ventures

June 1989
IPO
$24.0M
Initial public offering

RECENT HIGHLIGHTS

June 1987
Cirrus Logic raised $11.0 million in funding. The funds were used to expand manufacturing and test capabilities, with the intent of doubling test capacity. Cirrus Logic also purchased $1.5 million worth of Sun Microsystems workstations for its design centers.

October 1987
Cirrus Logic offered the CL-GD510/520, a video graphics array device for the IBM PS/2-compatible market. A custom version of the device was developed in part with Video Seven.

November 1987
Cirrus Logic offered the CL-SH135 CMOS enhanced Winchester hard-disk formatter chip.

Cirrus Logic offered the CL-SH250, a CMOS single-chip SCSI disk controller that consists of a formatter, buffer manager, and SCSI bus interface.

December 1987
Cirrus Logic announced that it had begun volume production of the CL-GD510/520 chip set.

April 1988
Cirrus Logic offered the CL-SH260, a CMOS single-chip PC XT/AT-compatible disk controller that consists of a formatter, buffer manager, and PC XT/AT bus interface.

July 1988
Cirrus Logic announced a family of single-chip controllers, the RPX family, for raster printer acceleration. The first two chips in the RPX family are designed as coprocessors specifically to enhance the speed and reduce the systems costs of laser printers.

ALLIANCES

AMD
September 1985
Cirrus Logic and AMD agreed to a technology exchange wherein Cirrus Logic will use silicon-compiled, 1.6-micron, double-metal CMOS-processed wafers to develop an MCU for AMD. AMD provides foundry services. (completed)

Silicon Systems
October 1986
Cirrus Logic and Silicon Systems agreed to exchange controller and buffer manager functions and mutually second-source the devices. Both chips will be processed with a 2-micron CMOS technology. (completed)

WDC
January 1987
Cirrus Logic licensed a custom Winchester disk drive controller IC to WDC, which gained indirect access to the product when it acquired Adaptive Data Systems, Inc., a board manufacturer.

DIA-Semicon Systems
October 1987
Cirrus Logic signed an agreement with DIA-Semicon Systems in Japan to distribute new and existing products in Japan. Cirrus Logic began sales of its Winchester disk controller chip set in Japan. DIA-Semicon Systems was founded in 1986 and is 80 percent owned by Mitsubishi Electric Corporation.

Award Software
November 1987
Award Software, Inc., of Los Gatos, California, agreed to develop a VGA graphics Basic I/O System (BIOS) and demonstration board for Cirrus Logic's GD510/520 VGA chip set. The agreement includes a complete hardware and software solution for PS/2-compatible graphics.

July 1988
Award announced an agreement to provide VGA BIOS source code to Cirrus Logic for Cirrus' line of IBM PC and PS/2-compatible VGA chip sets.

Phoenix Technologies Ltd.
September 1988
Phoenix Technologies will offer an IBM PC-compatible BIOS product to support the new VGA chips from Cirrus Logic.

MANUFACTURING

Technology

3.0-micron NMOS and CMOS
1.2-, 1.5-, and 2.0-micron, double-metal CMOS

Facilities

Milpitas, CA
50,000 sq. ft.
Administration, engineering, design, and marketing

10,000 sq. ft.
Class 1,000 clean room (test facility)

PRODUCTS

Mass Storage Controllers

Device	Description
CL-SH120	CMOS Buffer Storage Manager
CL-SH130	CMOS Winchester Hard Disk Formatter
CL-SH135	CMOS Enhanced Winchester Hard-Disk Formatter
CL-SH250	SCSI Disk Controller with Formatter, Buffer Manager
CL-SH260	Disk Controller with Formatter, Buffer Manager, XT/AT Bus Interface

Display Controller

CL-GD510A/520A	Video Graphics Array—IBM New Generation
CL-GD610/620	Controller chips for laptop computers
CL-GD315	Laser printer coprocessors
CL-GD340	Laser printer coprocessors
CL-CD180	Multichannel communications controller (8 channel)

OTHER INFORMATION

Cirrus Logic does not employ a PR firm.

Comlinear Corporation

4800 Wheaton Drive
Fort Collins, CO 80525
303/226-0500
Fax: 303/226-0564

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 150**

BACKGROUND

Comlinear Corporation, located in Fort Collins, Colorado, was formed in 1980 by David Nelson, a former Hewlett-Packard employee. The original technical staff and management were drawn heavily from Hewlett-Packard. Comlinear is a manufacturer and supplier of high-performance analog signal processing components. Comlinear's amplifier products include high-speed hybrid and monolithic operational amplifiers, buffers, and clamping amplifiers. Converter products include track/hold amplifiers, A/D converters, and D/A converters. The corporate philosophy is to focus development on products that make a significant contribution toward solving customer problems.

Comlinear Corporation is housed in a custom-built facility, which is DESC certified to MIL-STD-1772. This facility houses the manufacturing, quality assurance, R&D, administration, and marketing operations for the Company.

Comlinear's proprietary signal processing components are sold worldwide to a diverse group of commercial, industrial, and military customers.

Application areas include communications (satellite systems, radar, fiber optics), avionics (electronic countermeasures, instrumentation), video (high-resolution displays, video processing, and distribution), and automatic test equipment.

BOARD
(Name and Affiliation)

David Nelson, Chairman
  Comlinear Corp., CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President, CFO
Barry Rowan
  Hewlett-Packard, Finance

VP R&D
John Farnbach
  Hewlett-Packard, R&D Manager

Executive VP Marketing
David Ford
  Hewlett-Packard, Product Manager

VP QA
Bob Vinton
  National Semiconductor, Quality Manager—Mil. Aero.

VP Manufacturing
Hal Chase
  Hewlett-Packard, Manager—Hybrid Products

CEO, Director Advanced Products
*David Nelson
  Hewlett-Packard

*Founder

FINANCING

Not available

ALLIANCES

TRW LSI
May 1988
  Comlinear and TRW LSI agreed to a joint development of high-resolution, high-speed data conversion products.

MANUFACTURING

Facilities

Ft. Collins, CO
50,000 sq. ft.
Design, manufacturing, test, administration

PRODUCTS

- Op Amps
- Unity Gain Buffer Amplifiers
- Linear (Video) Amplifiers
- Track & Hold Amplifiers
- Encased Amplifiers
- A/D Converters
- D/A Converters

OTHER INFORMATION

Comlinear's PR firm is Tallant/Yates.

Cree Research Inc.

2810 Meridian Parkway
Durham, NC 27713
919/361-5709
Fax: 919/361-4630

ESTABLISHED: 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Cree Research Inc. was formed to develop, design, manufacture, and market discrete devices using silicon carbide (SiC) technology developed at North Carolina State University (NCSU). Founders of the Company are Eric Hunter; Calvin H. Carter, Jr.; Neal Hunter; John A. Edmond; and John Palmour—all former research team members at the university. Cree Research has obtained exclusive worldwide rights on the university's 10 U.S. SiC patents and on any future filings.

Initially, the Company is focusing on simple devices—diodes and blue LEDs that have immediate benefit to customers in aircraft engine applications, deep well drilling, and digital color imaging. Prototypes were introduced in April 1988.

In November 1987, the Company raised $500,000 in financing to fund itself through the prototype stage. In March 1988, $2.5 million was raised in first-round financing. The funds are being used to establish an 8,200-square-foot manufacturing facility, which was completed in July 1988.

The Company has won contracts with the Department of Defense, has set up arrangements for assembly and test services, and is discussing arrangements with major semiconductor manufacturers.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Eric Hunter
MKS Instruments, District Sales Mgr

Dir Technology
Calvin H. Carter
NCSU, Assoc Professor

FINANCING

November 1986
Seed
$0.5M
Not available

March 1988
Round 1
$2.5M
Not available

ALLIANCES

GI
August 1988
Cree and GI entered into a joint-development program to develop and manufacture silicon-based rectifiers.

SERVICES

Assembly
Test

MANUFACTURING

Technology

MESFETs and MOSFETs on silicon carbide

Facilities

Durham, NC
10,000 sq. ft.
Development, design, manufacturing

PRODUCTS

Diodes

High-Temperature pn, 350° Centigrade with Reverse-Bias Leakage Current of less than 1 nanoamp at +125V

Blue LEDs

OTHER INFORMATION

Cree Research does not employ a PR firm.

Crystal Semiconductor Corp.

4210 South Industrial Road
P.O. Box 17847
Austin, TX 78760
512/445-7222
TWX: 910-874-1352
Fax: 512/445-7581

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 100**

BACKGROUND

Crystal Semiconductor Corp. develops, manufactures, and markets advanced smart analog ICs that combine analog and digital functions on a single CMOS device for the telecommunications/data communications, instrumentation, and industrial automation market segments.

Crystal is a privately held company founded by Michael J. Callahan and James H. Clardy. Crystal acquired the assets and technology of Texas Micro-Circuit Engineering, a company that Michael Callahan founded and served as president.

Crystal is developing three product lines for a variety of niche markets: telecommunications/data communications including PCM transceivers and data communications transceivers; digitally enhanced analog-to-digital and digital-to-analog data acquisition products; and signal-conditioning and application-specific filters.

In April 1986, Crystal Semiconductor announced its first product, the CSC8870B, a DTMF receiver. The circuit can be used in telephone-answering machines and credit card verification systems. In June 1986, the CSC7008 Universal Filter and Crystal-ICE Filter Development System was offered. The development system is a PC-based system that incorporates filter synthesis, coefficient-generation software, and an in-circuit emulator (ICE).

Crystal Semiconductor markets its products through the combined efforts of a direct sales force and a worldwide network of manufacturers' representatives and distributors.

BOARD
(Name and Affiliation)

H. Berry Cash, Chairman
Berry Cash Southwest Partnership

L.J. Sevin
Sevin, Rosen Management Company

*James H. Clardy
Crystal Semiconductor

*Michael J. Callahan
Crystal Semiconductor

*Dietrich R. Erdmann
Sevin, Rosen Management Company

Steven Sharp
Independent Venture Cap., Megatest
Power Integrations Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
James H. Clardy
Harris, VP WW Ops

VP Engineering
Michael J. Callahan
Texas Micro-Circuit, Founder/Pres

VP Marketing
Craig H. Ensley
Rockwell, Director Mktg

VP Technology
Eric J. Swanson
AT&T, Telecom Engr Mgr

VP Sales
Alan R. Schuele
Cypress Semiconductor, Regional Sales Mgr

*Founder

FINANCING

October 1984
Round 1
$4.5M
Berry Cash Southwest Partnership; Dietrich Erdmann; Hambrecht & Quist; The Hill Partnership; InterWest Partners; Republic Investment Co.; Sevin, Rosen Management Company

February 1986
Round 2
$6.7M
Original investors; Coronado Venture Fund; Crown Associates; Kleiner, Perkins, Caufield & Byers; Rho Management Company; Rust Ventures

January 1987
Equity
$15.0M
Asahi Chemical

June 1987
Round 3
$5.0M
Berkeley International

RECENT HIGHLIGHTS

January 1987
Asahi Chemical acquired an 8 percent share in Crystal for about $4 million. Asahi Kasei Microsystems, a subsidiary of Asahi Chemical, will manufacture and market Crystal's devices for the Far Eastern market. The agreement gives Crystal an aggregate financial package of $15 million.

April 1987
Crystal offered the CS61534 analog line interface, which combines the analog transmit and receive line interface functions for T1/CEPT applications. The device features a programmable line driver and on-chip data-and-timing recovery circuit.

April 1987
Crystal offered the CS5016 16-bit, self-calibrating D/A converter featuring conversion time of 16 microseconds, MPU interface, three-state output buffers, and digitally selectable unipolar or bipolar output ranges.

May 1987
Crystal offered the CSZ511X Series of 12-, 14-, and 16-bit successive approximation A/D converters for DSP systems.

September 1987
Crystal offered the CS7820 8-bit A/D self-contained converter with a 1.36-microsecond conversion time.

October 1987
Crystal offered the CS3112 self-calibrating, 12-bit, 1-microsecond track-and-hold amplifier.

December 1987
Crystal offered the CS5012-7 self-calibrating, 12-bit, 100-KHz sampling A/D converter with on-chip sample-and-hold amplifier.

January 1988
Crystal offered the CSZ5412 monolithic 12-bit, 1-MHz, self-calibrating A/D converter with on-chip track-and-hold amplifier, MPU interface, three-state output, and overrange output.

August 1989
Crystal reported its first quarterly profit since the company was founded in 1984.

ALLIANCES

Asahi Chemical
January 1987
Asahi Chemical acquired an 8 percent share in Crystal for about $4 million.

Analogic Corp.
June 1989
Crystal Semiconductor and Analogic Corp. signed a strategic alliance which established Analogic as a value-added re-seller of the Crystal ADC line.

MANUFACTURING

Technology

2.0-, 3.0-micron CMOS silicon-gate
2-layer poly structure, single layer of metal

Facilities

Austin, TX
25,000 sq. ft.
Design and test

Crystal is planning a production facility in 1990. Currently, Orbit Semiconductor and International Microelectronic Products in the United States, Mitel Semiconductor of Canada, and Asahi Chemical of Japan provide foundry services.

PRODUCTS

Jitter Attenuators
T1 1.5-MHz and CCITT 2.0-MHz Jitter Attenuators, 4.5- to 8.5-MHz Token-Ring Jitter Attenuators

DTMF Receivers

Fiber-Optic Transmitters/Receivers
Optimodems, Fiber-Optic T1 Transmitter/Receivers, LEDs

Analog Data Converters
Crystal offers a full line of 12-, 14-, 16-, and 20-Bit A/D converters, with varying speeds and operating frequencies.

Amplifiers
Quad, 1-microsecond Acquisition Time, Track and Hold
Single, 1-microsecond Acquisition Time, Track and Hold

Filters
Universal Digitally Programmable Switched-Capacitor Filter, ICE Development System

Evaluation Boards
Available for all product lines

ISDN Primary Rate Line Interfaces
T1 (1.544 MHz and PCM-30 (2.048 MHz) Line Interfaces, T1 Analog Interface

ISDN Primary Rate Transceiver
T1 Transceiver

Military Devices
12-, 14-, and 16-microsecond A/D Converters

OTHER INFORMATION

Crystal Semiconductor does not employ a PR firm.

Custom Arrays Corporation

525 Del Rey Avenue
Sunnyvale, CA 94086
408/749-1166
Fax: 408/749-1718
Telex: 510-600-5119

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 10**

BACKGROUND

Custom Arrays Corporation was formed to design and manufacture analog bipolar linear arrays that are supported by a CAE design software environment and run on MS-DOS on a PC AT hardware platform. The Company also offers quick-turn prototyping services.

The Company's founder is Pierre R. Irissou, who also serves as the Company president and the vice president of research and development. Mr. Irissou remains a board member of ATAC, which has exclusive marketing rights for Custom Arrays' products in France. In October 1987, the Company merged with a blind-pool public corporation and is listed on the pink sheets and traded OTC. The Company is incorporated in Nevada; however, all operations are conducted in Sunnyvale, California.

The Company's short-term strategy is to offer quick turnaround on prototypes based on its MM and MV families of bipolar arrays. The MM family consists of nine arrays with 2 to 28 macrocells. The MV family consists of five arrays with 4 to 20 macrocells. Both families are a result of a joint development venture with Ferranti-Interdesign, located in Scotts Valley, California.

The Company's long-term strategy is to expand its bipolar array offerings to include thin-film technology options, including laser-trim capability. Custom Arrays is developing new arrays based on a high-voltage BiCMOS process compatible with thin-film technology.

Custom Arrays has expanded its facilities to support in-house reticle and mask manufacture, direct-step-on-wafer (DSW) photolithography, wafer processing for metal patterning and top-glass passivation, dice-package assembly, and full-production testing at both the wafer and package level.

BOARD
(Name and Affiliation)

B. Bornette, Chairman
ELF Aquitaine, France

*Pierre R. Irissou
Custom Arrays Corporation

George Krautner
Custom Arrays Corporation

Emmanuel Celerier
SOFIPA, France

Herve Thiriez
Independent

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Pierre R. Irissou
ATAC Diffusion S.A., Managing Director

Exec VP
George Krautner
Ferranti-Interdesign, VP Mktg/Sales

VP Finance
William Hass
Ferranti-Interdesign, VP Finance

VP Corporate Development
Arun Pande
Not available

*Founder

FINANCING

October 1984
Seed
$300,000
ATAC Diffusion S.A. (division of ELF Aquitaine)

October 1986
Seed
$500,000
SOFIPA (investment division of ELF Aquitaine)

July 1987
Seed
$400,000
FINAXIA, private investors

October 1987
Seed
$145,000
Merger with Venture Nexus, Inc.

May 1988
Seed
$500,000
Societe Financiere Internationale de Participations

Gaz et Eaux
$500,000

ALLIANCES

ATAC-Diffusion
1984
ATAC operates a design center and conducts marketing for Custom Arrays in Europe.

Ferranti-Interdesign
1984
The MM family is the result of a joint development venture with Ferranti-Interdesign, Inc. Ferranti-Interdesign acts as a second source.

Teledyne
February 1988
Custom Arrays entered into a joint development agreement with Teledyne Semiconductor for a new family of BiCMOS semicustom and cell-based libraries. The technology will feature operating voltage levels of 18V.

SERVICES

Quick-turn prototyping

MANUFACTURING

Technology

Bipolar
BiCMOS

Facilities

Sunnyvale, CA
12,000 sq. ft.
Manufacture, assembly, test

PRODUCTS

Linear Arrays

MM Family of 20V Bipolar Analog Arrays with 2 to 28 Macrocells
MV Family of 40V Bipolar Analog Arrays with 4 to 20 Macrocells

Development Tools

B-SPICE	Circuit (SPICE) Simulator (PC 386)
LIBERTY	MM and MV Layout and Verification Software
PC-PG	Mask File Translator for Pattern Generation
LIKE	Cell-Based IC Design Software

OTHER INFORMATION

Custom Arrays Corporation's PR firm is Joyce Lekas Associates.

Custom Silicon Inc.

600 Suffolk Street
Lowell, MA 01854
617/454-4600
Fax: 617/458-4931

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 25**

BACKGROUND

Custom Silicon Inc. (CSi) was formed to serve the low-volume and high-complexity ASIC markets by acting as a "time-shared captive semiconductor division" to companies in regional markets. It acts as a value-added reseller of wafer fabrication capacity through its strategic relationships with major semiconductor manufacturers.

CSi's approach is one of extremely vertical marketing that focuses on applications. CSi offers 2- and 3-micron CMOS gate arrays and standard cells that are supported on Mentor, Daisy, FutureNet, and VIEWlogic workstations. CSi currently produces devices with up to 14,000 gates and planned to add a family of CMOS and bipolar linear arrays in the first quarter of 1987.

CSi is the ASIC distribution channel for NCR Corporation for both New England and the Pacific Northwest; it is also the northeastern independent design center for Motorola. In September 1986, WSI NCR licensed CSi's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSi's library was built from NCR's existing library.

CSi's sales strategy is to build a network of region- al operations to act as distribution channels for major manufacturers that serve the engineering-intensive segments of the ASIC market.

BOARD
(Name and Affiliation)

Albert P. Belle Isle
Custom Silicon Inc.

Richard A. Charpie
Paine Webber Ventures

David W. Guinther
Custom Silicon Inc.

Sumner Kaufman
Kaufman & Co.

Kenneth J. Revis
Turner Revis Associates

Henry R. Shean
Custom Silicon Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Albert P. Belle Isle
Wang, Vice President

VP R&D
Donald L. Gay
Wang, Program Mgr

VP Marketing
David W. Guinther
Wang, Program Dir

VP Finance
Henry R. Shean
Wang, Controller R&D

VP Sales
Robert J. Brown, Jr.
SGS, VP Sales

FINANCING

April 1983
Seed
$0.1M
Kaufman & Co.; private investors

February 1984
Round 1
$1.1M
Bank of New England; First Chicago; Turner Revis Associates

June 1985
Round 2
$2.8M
Original investors; Massachusetts Capital Resource Company; Paine Webber Ventures

ALLIANCES

NCR
November 1983
CSi and NCR entered into an exclusive technology licensing and sourcing agreement under which CSi will design and resell cell-based and gate array products in New England. The products use NCR's 3.0-micron CMOS and NMOS technologies. NCR provides manufacturing.

September 1986
NCR licensed CSi's standard cell library that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863 gates. CSi's library was built from NCR's existing library.

FutureNet
March 1984
CSi offered its standard cell library on the FutureNet DASH design system.

VIEWlogic
October 1985
CSi offered its standard cell library on VIEWlogic's Workview PC-based workstation. The library includes 165 digital primitives and 7,400 TTL macrocells.

Motorola
August 1986
CSi agreed to act as the northeastern independent design center for Motorola.

SERVICES

Wafer fabrication agent

MANUFACTURING

Technology

3.0-, 2.0-, and 1.5-micron CMOS and bipolar

Facilities

Lowell, MA
12,000 sq. ft.
Design

CSi has a long-term licensing and sourcing agreement with NCR, which provides preferred access to multiple manufacturing facilities.

PRODUCTS

CMOS Standard Cells

Device	Description
Micro Blocks Family	200 Cells Including Adders, ALUs, Multiplexers; Dual-Port RAMs; Multiplexers, Shift Registers; and Three-State Bus Drivers
TTL Macro Cells	Encoders, Decoders, Adders, Shift Registers, Multiplexers, Counters
Supercells	ROM, RAM, EEPROM, PLA, MPU, Timer, SCSI Controller
Analog Cells	General-Purpose Op Amp and Comparator, 8-Bit A/D and D/A Converter, Current-Bias Generator, Analog Switch, Oscillators

CMOS Gate Arrays

Family	Linewidth (Microns)	Delay (ns)	Gates
HCA 6200	2.0	1.9	2,430 to 4,860
HCA 6300	3.0	2.5	648 to 2,295
HCA 62A00	2.0	1.1	600 to 8,558

CMOS Standard Cells (Continued)

Bipolar Gate Arrays

Family	Technology	Delay (ns)	Gates
MCA ECL	ECL	0.5	652 to 2,500
MCA ALS	TTL	1.1	500 to 2,800
MCA ETL	Mixed ECL/TTL	1.1	2,950

OTHER INFORMATION

Custom Silicon does not employ a PR firm.

Dallas Semiconductor Corporation

4350 Beltwood Parkway
Dallas, TX 75244
214/450-0400
Fax: 214/450-0470

ESTABLISHED: February 1984 **NO. OF EMPLOYEES: 500**

BACKGROUND

Dallas Semiconductor Corporation designs, manufactures, and markets low-power CMOS memory, linear, and microcontroller circuits and subsystem products. The Company is an applications-oriented supplier that uses proprietary late-definition techniques to customize wafers after test and characterization. This flexibility, called soft silicon, is achieved through the use of lithium power sources, direct laser writing, high-energy ion implantation, and subsystem integration.

The resulting products offer OEMs the advantage of adding functionality without the redesign of existing systems. Some of the more innovative products are the Company's intelligent sockets, which add features such as nonvolatility and timekeeping ability; timekeeping circuits, which replace up to 20 discrete components in the IBM PC AT and PS/2-compatible computers; silicon timed circuits, which replace crystal and discrete components and feature-precise, system-signal timing; security products, which protect software from unauthorized use; teleservicing products that provide the capability to perform remote software upgrades and service equipment anywhere in the world over the telephone line; chips that provide the structure for two-way data transmission through the air, resulting in wireless, automatic identification; and a family of modular chip-laden subassemblies that snap into locking connectors for rapid construction of electronic systems.

In August 1984, Dallas purchased Commodore's Texas plant for $3.5 million. Until early 1987, the Company purchased all wafers and completed its late-definition technique at its plant in Texas. In 1987, Dallas completed construction of a $10 million wafer fabrication facility adjacent to its headquarters. The facility was expanded in 1988 to increase capacity. It includes a 10,420-square-foot, Class 1 clean room and has the capacity to produce 6-inch CMOS wafers with geometries down to 0.6-micron. Currently, Dallas processes about 90 percent of its wafer needs.

Dallas Semiconductor ships its wafers to assembly contractors in the Philippines and Korea for separation and packaging. It conducts burn-in and final testing on its devices and conducts its own subsystem assembly.

Dallas markets to OEMs in the United States, Canada, Europe, and Asia. The Company uses a direct sales force, worldwide distributors, and authorized manufacturers' representatives.

BOARD
(Name and Affiliation)

*C. Vin Prothro, Chairman
Dallas Semiconductor Corporation

*John Smith, Jr.
Dallas Semiconductor Corporation

Chao C. Mai
Dallas Semiconductor Corporation

M.D. Sampels
Worsham, Forsythe, Sampels, and Wooldridge

Richard L. King
Ventech Partners, L.P.

C. Richard Kramlich
New Enterprises Associates

Carmelo J. Santoro
Silicon System, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*John Smith, Jr.
Mostek, Facilities Dir

CEO
*C. Vin Prothro
Mostek, President, CEO, Chairman

VP Mfg
*Chao Mai
Mostek, VP R&D

VP Mktg & Prod
*Michael Bolan
Southwest Ent., Mgr Tech Planning Development

VP Sales
Sandy Scherpenberg
Mostek, Applications Engineer

Controller
Michael Pate
Arthur Young & Co., Senior Auditor

*Founder

FINANCING

February 1984
Seed
$2.0M
Abingworth Ltd., New Enterprises Associates, Southwest Enterprises Associates; Ventech Partners

June 1984
Round 1
$10.8M
Initial investors; Arscott, Norton & Assoc.; Crossroads Capital; First Source Capital Corp.; John Hancock Venture Capital Fund LP; Merrill, Pickard, Anderson & Eyre; New Venture Partners; Oak Investment Partners; Republic Venture Group; J.F. Shea & Company; Venture Growth Associates

Industrial Bond
$6.5M
Republic Bank, Dallas

March 1986
Round 2
$15.0M
Previous investors, British Petroleum Ventures, Alex Brown & Sons, Emerging Growth Stocks, HLM Partners, Merifin N.V.

April 1987
Round 3
$5.0M
Abingworth Ltd., Alex Brown & Sons, British Petroleum Ventures, Emerging Growth Stocks, HLM Partners, Merifin N.V., New Enterprise Associates, Southwest Enterprises Associates, T. Rowe Price, Threshold Fund, Ventech Partners

September 1987
$35.1M
Initial public offering

RECENT HIGHLIGHTS

Q1 1987
Dallas began producing wafers in a newly constructed, $10 million wafer fabrication facility adjacent to its headquarters.

February 1987
Dallas offered the DS2167 digital signal processor (DSP) said to double the link of full-duplex telephone transmission lines. The DS2167 combines a DSP with the adaptive differential pulse code modulation (ADPCM) standard.

March 1987
Dallas offered the DS5000 8-bit CMOS soft MCU, which features nonvolatile technology designed to preserve all information in the absence of power.

October 1987
Dallas offered 3.75 million shares of common stock at $9 per share in an initial offering and raised $36 million. The proceeds will be used for capital equipment and general corporate purposes.

October 1987
Dallas offered the DS1207 CMOS Timekey circuit designed to control access to PC software packages for specified periods of time.

May 1987
Dallas and Xecom signed a second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies will also cooperate on developing and manufacturing future modem-related products, the area of Xecom's expertise.

August 1987
Dallas and Amp, Inc., formed an R&D partnership to solve applications problems with semiconductor technology.

December 1987
Dallas filed a suit against Maxim Integrated Products. The suit was in response to warnings by Maxim that Dallas is violating certain receiver/transmitter patents held by Maxim.

December 1987
Dallas reported fourth-quarter revenue of $9.8 million and a net income of $1.5 million for the period ending December 31, 1987. Fiscal 1987 revenue was $30.7 million and net income was $2.6 million, which included an extraordinary benefit of $954,000.

ALLIANCES

Thomson-Mostek
January 1986
Thomson-Mostek (TCMC) was given royalty-free rights to second-source Dallas' multiport memory. In exchange for these rights, Dallas received an option to purchase a percentage of the products from Thomson. Dallas also received laser production equipment from Thomson and received technical information on TCMC's MK4501 FIFO.

Xecom
May 1987
Dallas and Xecom signed a three-year second-source agreement covering Xecom's modem products and development kits and Dallas' SmartSocket and SmartWatch families. The companies also agreed on the joint development of and manufacture of future modem-related products, the area of Xecom's expertise.

Amp
August 1987
Dallas and Amp, Inc., formed an R&D partnership that will develop innovative interconnect techniques.

MANUFACTURING

Technology

3.0- to 0.6-micron CMOS
6-inch wafers

Facilities

Dallas, TX
150,000 sq. ft.
Manufacturing area and a 10,420-square-foot Class 1 clean room

60,000 sq. ft.
Warehouse, offices

PRODUCTS

SRAMs
16K, 64K, 256K, and 1024K Nonvolatile SRAMs, and a 1024K Serial RAM

Multiport Memory Chips
512x9, 1024x9, 2048x9, and 4096x9 FIFOs and a quad-port Serial RAM

Microcontrollers
8-Bit Soft MCUs, 8-Bit Time MCUs, CMOS Microcontrollers, Evaluation Kits, Development Kits

Linear Telecommunications Circuits
Transceivers, Line Monitor and Line Interfaces, Network Interfaces, ADPCM Processors, Receiver Buffers

Timekeeping Devices
Clocks, Timekeepers, Clock plus NV SRAMs, Clock plus RAMs

Intelligent Sockets
Lithium-powered sockets—inserted CMOS RAMs become nonvolatile, some with timekeepers

Silicon Timed Circuits
- 5-Tap, 10-Tap, 3-in-1, and 7-in-1 Delay Lines

Security Products
- Electronic Security Devices, Encrypted Keys, Time Keys, Electronic Keys

User-Insertable Memory
- Memory Cartridges, Electronic Key Adaptors, Electronic Tags, PC Ports

Integrated Lithium Battery Backup
- Lithium-powered NV controllers, Power Packs, Power Monitors, NVRAM Controllers

Systems Extensions
- RS-232 Transceivers, Serial Ports, BankSwitches, Configurators, Micro Monitors, Micro Managers

SipStick Prefabs
- FIFO, SRAM, DRAM, DAA, ADPCM, SoftModem, and Micro Packaging Options

Wireless Products
- Proximity Key and Tags, Micro Power Receiver/Interpreters, Bytewide to Serial Converters, RF Communicators, Wireless SipSticks, Starter Kits

Teleservicing Components
- TeleIMicro Cartridges, Teleservicing Kits, 212A Modem Modules, Data Access Arrangements, Modem Evaluation Kits

OTHER INFORMATION

Dallas Semiconductor's PR firm is Simon McGarry.

Dolphin Integration SA

8, Chemin des Clos-ZIRST
38240 MEYLAN, France
33 (76) 41-10-96

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 20**

BACKGROUND

Dolphin Integration SA provides design, marketing, and fabrication subcontracting for selected niche market ICs and related software. The Company was launched as a design center and has developed a set of portable design rules for 2- to 1-micron CMOS technology. Dolphin's design rules adapt to any silicon foundry's process. Dolphin has enlarged its catalog of design rules to include analog technologies using double-poly from 3.0 to 1.5 micron. The Company has also developed signal-processing and protocol ICs.

BOARD
(Name and Affiliation)

Michael Depeyrot, Chairman
Dolphin Integration SA, President

Jean Gouliardon
SAGEM International

Michael Capart
EPICEA

Bernard Michelon
SOGINNOVE

Pierre Faurre
SAGEM, Chairman

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Michael Depeyrot
Thomson Semiconductors, VP Engr

PRODUCTS

Developmental Tools

VAX Network with Three Families
Tektronix X115, MicroVAX II, and COMPAQ 396
ECAD Software (ICAP and MASKAP)
LoF Cell Generator

OTHER INFORMATION

Dolphin Integration does not employ a PR firm.

FINANCING

1985
Initial
$600,000
EPICEA, SAGEM, SOGINNOVE, and founders

ALLIANCES

Dolphin has entered an agreement with a CAD/CAM group in California.

SERVICES

ASIC Design

MANUFACTURING

Technology

DIGIT—2.0- to 1.0-micron double-metal CMOS
DIANA—3.0- to 1.5-micron analog CMOS
DIXIE—Mixed high-power (BiMOS) and low-voltage CMOS

Facilities

Not available

The DSP Group Inc.

1900 Powell Street, Suite 1120
Emeryville, CA 94608
415/655-7311
Fax: 415/655-7537

ESTABLISHED: October 1988 **NO. OF EMPLOYEES: N/A**

BACKGROUND

The DSP Group Inc. was founded in October 1988 to develop technologies for a variety of applications, specializing in digital signal processing. The Company currently offers products in the telecommunications market. The DSP Group develops algorithms using digital signal processing as applied to voice/speech modification and enhancement.

The Company has a variety of technologies that it embeds in general-purpose digital signal processing chips. These chips are sold to OEMs, mostly high-volume consumer product manufacturers. DSP Group technologies, which can be used individually or in combinations, include noise reduction, voice-activated switching, voice compression, echo cancellation, voice recognition, and voice synthesis.

The DSP Group's current and future product offerings reflect these technologies. The Company currently is shipping telephone answering machine chip sets and cellular telephone chip sets. By the end of 1990, the company plans to have dictating equipment chip sets and integrated telephone/facsimile chip sets in volume production.

To date, the DSP Group has raised nearly $4.5 million in three rounds of financing, provided by private, corporate, and venture capital sources. All manufacturing is subcontracted; design and headquarters operations are located in the Company's Emeryville, California, facility. The DSP Group also has a subsidiary located in Israel.

BOARD
(Name and Affiliation)

Davibi Gilo
 The DSP Group, President

Donald Yost
 Dey Corporation/The DSP Group

Herman Fialkou
 PolyVenture

Shelton Wert
 Investor Group—Minneapolis

COMPANY EXECUTIVES
(Position and Name)

President
Davibi Gilo

VP R&D
Shabtai Albersberg

VP Mktg
Don Yost (Acting)

VP Finance
Gibi Bartak

GM Israel Operations
Zvi Slomimski

FINANCING

Round 1
$1.2M
 Davibi Gilo

Round 2
$750,000
 PolyVenture

Round 3
$750,000
 Minneapolis Group

Round 4
$1.8M
 Marubun-Japan

MANUFACTURING

Technology

DSP subcontracts all manufacturing.

Facilities

Emeryville, CA
Design, marketing, headquarters

Israel
R&D

PRODUCTS

Telephone Answering Machine Chip Sets
Cellular Telephone Chip Sets
Digitating Equipment Chip Sets
Integrate Telephone/Fax Chip Sets

OTHER INFORMATION

The DSP Group's PR firm is Paul Pease.

Edsun Laboratories, Inc.

564 Main Street
Waltham, MA 02154
617/647-9300

ESTABLISHED: 1984 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Edsun Laboratories was formed in 1984 by Steve Edelson. Edsun currently offers memory and modem controller chips as well as a chip used in PC accelerator boards. Edsun's flagship product, however, is the Continual Edge Graphics (CEG) color-palette DAC chip. The Company's mission is to enhance the graphics capability of PCs, workstations, and other display environments dramatically through its patented CEG technology.

Edsun's DAC chip is designed to improve the performance of VGA-based PC graphics dramatically. The Company claims that it will enhance the effective resolution of a 640 x 480-pixel screen to the equivalent of a 2,000 x 2,000-pixel screen. Edsun also claims that the chip will increase the effective number of colors in an 8-bit system from 256 to 700,000. It will smooth jagged PC graphics to the point where they rival those seen on high-resolution monitors used in engineering workstations or CAD/CAM systems. This new chip will allow existing graphics boards to be upgraded without modification or redesign. The circuit achieves high-resolution simulation by determining a shading value for the edge pixel and blending the shades to the new appropriately weighted color, giving the appearance of a perfectly smooth edge.

Edsun subcontracts all fab and assembly operations to outside companies. The Company conducts some test operations in-house. Although Edsun will continue to support its other existing products, the Company will focus on the development of a family of CEG products in the future. The Company plans to eventually offer CEG for PCs, laptops, and workstations.

BOARD
(Name and Affiliation)

*Steve Edelson, Chairman
Edsun Laboratories

Richard Simon
Edsun Laboratories, President

Ted Dintersmith
Aegis Funds, General Partner

Jerry Fishman
Analog Devices, Executive VP

Peter Santeusanlo
Hambro International Ventures Fund

COMPANY EXECUTIVES
(Position and Name)

President
Richard Simon

VP R&D
George Heron

*Founder

FINANCING

July 1988
Amount not available
Hambro International Ventures Fund, Aegis Venture Funds

ALLIANCES

Edsun has licensed its CEG technique to Dubner Computer Systems and Calcomp.

MANUFACTURING

Technology

Not available

Facilities

Waltham, MA
10,000 sq. ft.
Design, test, marketing

PRODUCTS

Edsun Continual-Edge graphics
Microchannel Memory Controller (EL2010)
Microchannel Modem Controller (EL2050)
Accelerator Board Chip (EL286-88)

OTHER INFORMATION

Edsun Laboratories does not employ a PR firm.

Elantec, Inc.

1996 Tarob Court
Milpitas, CA 95035
408/945-1323

ESTABLISHED: July 1983 **NO. OF EMPLOYEES: 155**

BACKGROUND

Elantec, Inc., designs, manufactures, and markets high-performance analog circuits using dielectric-isolation (DI) monolithic and hybrid technologies. The circuits are designed to be used in military and high-performance commercial applications. The Company supplies products to more than 25 military OEMs.

Elantec concentrates on high-performance analog IC and hybrid solutions and has identified a niche for very high speed operational amplifiers and buffers in video, page scanner, and fast radar systems. Advanced technologies are employed, including dielectric isolation, which allows very high speed npn and pnp transistors in the same chip.

Initially, Elantec offered alternatively sourced products for National Semiconductor's high-performance multichip amplifiers. In 1985, Elantec introduced its first proprietary monolithic IC that uses both dielectric- and junction-isolation processing techniques. Early in 1986, Elantec expanded into alternatively sourced versions of Harris Semiconductor's components that use a complementary bipolar dielectric-isolation process. Harris-sourced devices include op amps and buffers. Elantec also is developing proprietary devices such as a servo loop controller. In the long term, the Company is considering data acquisition circuits.

One of the key strengths of the Company has been its military program. Elantec's facilities have been qualified by more than 25 major military OEMs including General Dynamics, Hughes, IBM, and Lockheed. The Company's facilities comply with MIL-STD-M38510, MIL-STD-1772A, and MIL-STD-883, Revision C. Elantec was the fourth among approximately 20 companies in the world to be certified to produce hybrid devices to MIL-STD-1772A. Elantec also places a great deal of emphasis on reliability and has adopted a two-for-one guarantee under which a part that fails is replaced with two good devices.

In December 1987, Elantec announced that its wafer fabrication facility in Milpitas, California, is operational. The facility uses its proprietary dielectric-isolation process and is capable of producing 2,000 4-inch wafers per month. Initially, the facility will produce 3-inch wafers. Elantec manufactures all military products onshore, with some commercial assembly done in Southeast Asia.

European operations are managed from London, and Japanese sales are handled by Internix, a Japanese distributor. Marshall, Wyle, and Zeus are signed as North American distributors. Elantec also has regional sales offices in Dallas, Texas, and in Boston, Massachusetts.

BOARD
(Name and Affiliation)

Tom Winter
  Burr, Egan, Deleage

George Sarlo
  Walden Capital Corporation

Jim Diller
  Sierra Semiconductor

David O'Brien
  Elantec, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
David O'Brien
  PMI, President/CEO

VP Marketing
Dean Coleman
  National Semiconductor, Analog Mktg Mgr

VP Operations
Richard Corbin
PMI, VP Technology

VP Sales
Ralph Granchelli
Teledyne Semiconductor, Ntl Sales Mgr

VP Engineering Design
Barry Siegel
National Semiconductor, Std Hybrid

FINANCING

July 1983
Round 1
$2.7M
Venture capital

August 1984
Round 2
$3.1M
ALTA-Berkeley Eurofund; Associated Venture Investors; BNP Venture Capital Corporation; Burr, Egan, Deleage & Co.; International Industrial Interests; Murray Electronics; Pacific Technology Ventures; Paribaven; Thorn EMI Venture Fund; Walden Capital Corporation

August 1985
Round 3
$2.5M
Original investors, Jean Claude Asscher, Paribas Technology, Hytec Investment

December 1986
Round 4
$7.8M
Capital Riksa Trust, CEI, Cypress Fund, Harvard Management, Morgan-Holland, Sequoia Capital, St. James Venture Capital Fund, U.S. Venture Partners, and others

September 1988
Round 5
$7.3M
First Century Partners; Merrill Lynch Venture Capital; Inman & Bowman; Sequoia Capital; U.S. Venture Partners; Morgan-Holland; Burr, Egan, Deleage; Walden Associates; Associated Venture Investors; and Harvard Management

RECENT HIGHLIGHTS

March 1987
Elantec offered the EL2017J/883B monolithic closed-loop servo controller that features both precision linear and high-current switching modes of operation.

May 1987
Elantec offered the EL2020, a 50-MHz current-feedback amplifier that is optimized for video and other applications, with gains between -10 and +10.

September 1987
David O'Brien joined Elantec as president and chief executive officer, and Richard Corbin joined as vice president of operations. Mr. O'Brien replaced Al Vindasius, who left the Company to pursue other interests.

November 1987
Elantec signed an agreement allowing Micro Power to market Elantec's FET power buffers.

December 1987
Elantec announced that its wafer fabrication facility is operational.

ALLIANCES

Micro Power
November 1987
Elantec reached a joint agreement under which Micro Power will market Elantec's FET power buffers (expired).

MANUFACTURING

Technology

5-micron bipolar
4-inch wafers

Facilities

Milpitas, CA
30,000 total sq. ft.
Corporate offices and manufacturing

8,500 sq. ft.
Class 1,000 clean room

PRODUCTS

Device	Description
EL2003/2033	Video Line Driver
EL2004	350-MHz FET Buffer
EL2005	High-Accuracy Buffer
EL2006	Precision High-Speed FET Amplifier
EL2007	Precision Servo Driver
ED2015	350-MHz Quad PNP
EN2016	300-MHz Quad NPN
EL2017	Servo Controller
EL2018	Fast, High-Voltage Comparator with Latch
EL2019	Fast, High-Voltage Comparator with Master/Slave Flip-Flop
EL2020	50-MHz Current-Mode Feedback Amplifier
EL2022	165-MHz Current-Mode Feedback Amplifier
EL2039/2040	Very High Slew, Wideband Op Amp
EL2190	Wideband, Fast-Settling Op Amp
ELH0002	100mA Current Buffer
ELH0021	1A Power Op Amp
ELH0032	High-Speed FET Op Amp
ELH0033	High-Speed FET Buffer
ELH0041	200mA Power Amp
ELH101	2A Power Op Amp
EDH0006	Current Driver
EDH0008	High-Voltage, High-Current Driver
EHA2500	Precision, High-Slew-Rate Op Amps
EHA2520	Uncompensated, High-Slew-Rate Op Amps
EHA2539	Very High Slew, Wideband Op Amp
EHA2600	Wide-Bandwidth, High-Impedance Op Amp
EHA2620	Wide-Bandwidth, Uncompensated Op Amps
EHA2540	Very High Slew Rate Op Amp
EHA5190	Wideband, Fast-Settling Op Amp
EHOS100	125-MHz Buffer
EHOS200	200-MHz Buffer
EL2031	550-MHz Buffer
EHA2400	4-Channel Programmable Amplifier
EL2021	Monolithic Pin Driver

OTHER INFORMATION

Elantec's PR firm is Independent Public Relations Associates.

Electronic Technology Corporation

Wholly Owned Subsidiary of J-TEC
ISU Research Park
2501 North Loop Drive
Ames, IA 50010-8284
515/296-7000
Fax: 515/296-7001

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 14**

BACKGROUND

Electronic Technology Corp. (ETC) provides linear and digital design with an emphasis on linear products. The Company also provides complete fabrication, packaging, and test services and guarantees that production units will be 100 percent compatible with prototypes.

ETC was funded initially by a midwestern consortium of venture organizations. ETC's primary customer base is in the midwestern corridor (extending from the eastern slopes of the Rockies to the Ohio Valley). The Company plans to become the midwest's major supplier and has a close working relationship with the Micro Electronics Research Center at Iowa State University in Ames.

ETC has agreements for foundry services with Exar and Gould Semiconductor. In October 1985, the Company signed an agreement with NCR to establish design centers for cell-based ICs.

BOARD
(Name and Affiliation)

Theodore Johnson, Chairman
J-TEC, President

Len A. van der Have
Electronic Technology Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Len A. van der Have
Datalinear, VP Marketing

Dir Technology
William A. Burkland
Micro Electronics Research Center, Associate Scientist

Dir Operations
Scott P. Yeager
NCR, Field Service Engineer

Dir Quality Assurance
Barbi Jo Cosgrove
Bournes, Inc., Quality Assurance Eng

Fin Mgr
Lynn A. Sackett
Clyde Industries, Accountant

FINANCING

1983
Initial
$2.0M
State and venture capital

ALLIANCES

Exar
December 1983
Exar provides foundry services for ETC.

AMI
1984
ETC and AMI signed agreements covering 3.0- and 5.0-micron, single-layer metal CMOS gate arrays. AMI provides foundry services.

NCR
October 1985
ETC agreed with NCR to establish design centers for standard cell ICs and to design standard cells for NCR (expired).

U.S. Government
March 1989
Prime contractor—federal government contract

SERVICES

Custom Design
Manufacturing
Packaging
Test
Military Standard Testing

PRODUCTS

Industry-Standard (20V) Array with 11 Arrays
High-Voltage (75V) Array with 1 Array
BiFET (36V) Arrays with 3 Arrays
Cellular (20V) Array with 1 Array
2.0-micron Bipolar Digital
5.0-micron Cell Custom Linear Digital/Bipolar
1.25 to 9.0-micron CMOS Digital
8.0-micron PMOS

OTHER INFORMATION

ETC does not employ a PR firm.

MANUFACTURING

Technology

2.0-, 5.0- and 9.5-micron CMOS
Bipolar

Facilities

Ames, IA
7,850 sq. ft.
Total space

500 sq. ft.
Class 100 clean room

Epitaxx Inc.

3490 U.S. Route One
Princeton, NJ 08540
609/452-1188
Fax: 609/452-0824

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 50**

BACKGROUND

Epitaxx Inc. produces indium gallium arsenide phosphide (InGaAsP) light-emitting diodes, lasers, and photodetectors for fiber-optic and infrared instrumentation applications. The Company also supplies InGaAsP using a proprietary crystal growth technique called vapor phase epitaxy (VPE), which allows the elements to be deposited from gases. Custom services include 2,000 and 2,500nm photodiodes, detector arrays, and pulsed laser diodes. Epitaxx sells its components to telecommunications vendors, such as GTE and ITT, and to fiber-optic companies such as Fibercom and Plantronics Wilcom.

In order to expand its products, Epitaxx conducts R&D sponsored by industry and the government. The following are some of the Company's development activities:

- InGaAs linear arrays for use in spectroscopy and imaging and airborne communication
- Extended-range sources and detectors for optical sensors and transoceanic communications applications
- InGaAs avalanche photodiodes for optical communications and sensors, range finding, and instrumentation applications
- 5mm InGaAs visible response (500 to 1,700nm) detectors for optical test and calibration and temperature sensors

The Company was founded by Dr. Gregory Olsen and Dr. Vladimir Ban, former research scientists at the RCA David Sarnoff Research Laboratories in Princeton, New Jersey. The founders developed the VPE applications while employed there.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Dr. Gregory Olsen
RCA, Scientist

Exec VP
*Dr. Vladimir Ban
RCA, Scientist

Marketing VP
Yves Dzialowski
General Optronic, Foreign Sales Manager

Finance VP
James Coleman
Lenox China, Account Exec

*Founder

FINANCING

March 1984
Round 1
$1.5M
DSV Partners, Warburg Pincus

RECENT HIGHLIGHTS

February 1988
Epitaxx announced that the Company was selected by the NASA Goddard Space Flight Center for a Phase-II Small Business Innovative Research (SBIR) contract to develop large-area InGaAs photodetectors for the 500 to 1,700nm spectral range.

March 1988
Epitaxx announced that the Company was awarded a $50,000, Phase-I SBIR contract by NASA's Goddard Space Flight Center to develop a linear array of InGaAs detectors. The array will have a minimum of 32 elements (30 x 30 microns each) and will be installed in a commercial multiplexer readout. Epitaxx plans to apply for a Phase-II program based on linear arrays of InGaAs detectors that are sensitive over the 0.8- through 2.2-micron spectral range.

April 1988
Epitaxx exhibited the following infrared components at CLEO '88:

- Edge-emitting LEDs (1,300 and 1,550nm) in a low-cost pigtailed package for local communication and optical instrumentation
- Large-area (0.5 to 3.0mm) InGaAs detectors for gyroscopes, gas sensors, space photography, SWIR detection, and fiber-optic test instrumentation
- High-speed, small-area, planar InGaAs PIN photodiodes for light-wave and range-finding receivers

ALLIANCES

Not available

MANUFACTURING

Technology

InGaAs

PRODUCTS

Device	Description
Epitaxx 1300	High-Power LEDs, 1,550 and 1,300nm
ETX60B	PIN InGaAs Photodetector, Low Capacitance and High Speed, 1,300 and 1,550nm
ETX75/100/300	InGaAs PIN Photodetectors, 900 to 1,700nm, with High Responsivity
ETX75F/100F	InGaAs Fibered Photodetectors with Low Dark Current and Capacitance, 1,300 and 1,550nm
ETX500/1000/2000	InGaAs Photodetectors, for Low Noise Measurements of Long Wavelengths (900 to 1,700nm)
ETX3000	Large-Area (3mm) InGaAs Photodetector for Low Noise Detection in the 0.8- to 1.7-Micron Spectral Range
ETX2550	InGaAs 2.5-micron
ETX-Array	256 element InGaAs Detector Array

OTHER INFORMATION

Epitaxx does not employ a PR firm.

European Silicon Structures

Headquarters
IndustriestraBe 17
8034 Germering, West Germany
089/8 49 39 0
Telex: 089/8 49 39 20

Hollybank House
Mount Lane
Bracknell, Berkshire
England
0344/525252
Fax: 0344/59412

72-78 Grande Rue
92310 Sevres, France
01/46264495
Fax: 01/45071423

ESTABLISHED: September 1985 **NO. OF EMPLOYEES: 150**

BACKGROUND

European Silicon Structures (ES2) was formed to design, develop, and offer quick-turn silicon prototyping and low-volume production (less than 50,000 units) of application-specific ICs for the European marketplace. The Company's objectives are to make ASIC design and production capability available to European systems manufacturers, generate a CAD product line, and offer fast turnaround with the use of e-beam technology.

The Company's Solo 1000 is based on Lattice Logic's Chipsmith system, and the Solo 2000 is based on the SDA Systems family of integrated CAD tools. Solo 1000 enables designers to produce full-custom and optimized designs and is available on PC AT-based hardware and UNIX-based workstations. Solo 2000 incorporates compiled macro blocks, which include RAM, ROM, PLA, ALU, and others. The Company's capability includes PLDs, optimized arrays, cell-based ICs, and handcrafted custom devices and circuits that will meet MIL-STD-38510 Class-B compliance.

In January 1987, ES2 introduced the ECDM20 CMOS, a process demonstrating subnanosecond gate delay performance. The n-well process features 5V digital CMOS; an epitaxial substrate for high latch-up immunity; and single-poly, two-layer metal using 10 masking steps. All processing is conducted using Perkin-Elmer Aeble 150 e-beam lithography equipment that is now operational.

ES2 is incorporated in Luxembourg and headquartered in Munich, West Germany. ES2's design automation technology is being developed by its software technology division located in Bracknell, England. The Company's manufacturing technology division is responsible for silicon manufacturing, which is conducted in Rousset, France, near Aix-en-Provence.

In November 1987, ES2 was granted a loan of $9 million by the Banque International and the European Investment Bank. The funds are being used to build ES2's production plant, called the Rousset Technology Center, at Rousset in southern France. The four-year loan is part of a larger financing package that could total $18 million. The manufacturing division also operates the Aeble 150 machine at the Exel Microelectronics plant in San Jose, California.

In 1987, ES2 acquired Lattice Logic and turned the Silicon Valley design arm of Lattice Logic into an ES2 design center named United Silicon Structures that serves the United States. Also in late 1987, ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

Through its own R&D and in conjunction with industrial partners and universities, ES2 is developing proprietary silicon compilation tools and is working to establish a set of standards for the European market.

BOARD
(Name and Affiliation)

Robert Wilmot, Cochairman
Wilmot Enterprises

Robert Heikes, Cochairman
Entrepreneur

Jean-Luc Grand-Clement
European Silicon Structures, CEO

Pierre Lesieur
European Silicon Structures, VP Finance

Viscount Etienne Davignon
Societe Generale de Belgique, Director

Albert Kloezen
EuroVenture, Benelux, Managing Director

Elserino Piol
Ing. C. Olivetti & Co., Executive Vice President

Klaus Volkholz
Philips International BV, Director of Corporate Planning

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO/Mng Dir
Jean-Luc Grand-Clement
Motorola, VP Europe Group

VP Fin/Admin
Pierre Lesieur
Motorola, Dir Finance

VP/Dir Ops
Rod Attwooll
TI, Mng Dir Bedford

VP/Mfg
Bernard Pruniaux
Thomson CSF, Dir Opns

VP/Dir S/W Tech
John Gray
Lattice Logic, Founder/Mng Dir

VP/Dir S. Europe
J.P. Demange
National Semiconductor, Dir Strat Mktg

VP/Dir Central Europe
H.P. Friedrich
N/A, Mng Dir

Wfr Fab Mgr
Francis Courreges
Sierra Semiconductor, Prod Eng Mgr

Dir Technology
Eric Demoulin
Thomson-CSF, Dir MOS Tech

FINANCING

1985
$5.0M
Advent, London; Techno-Venture Mgmt. Corp.

December 1985
$25.0M
Brown-Boveri and CIE (Switzerland), Ing. C. Olivetti & Co. (Italy), N.V. Philips (the Netherlands), Saab-Scandia AB (Sweden)

January 1986
$5.0M
British Aerospace

November 1986
$9.0M
Banque International a Luxembourg; European Investment Bank

ALLIANCES

Lattice Logic
1985
ES2 signed an agreement with Lattice Logic to market Lattice's logic compiler in Europe.

1987
ES2 acquired Lattice Logic. ES2 had been marketing Lattice Logic's compilers in Europe since 1985.

British Aerospace
January 1986
British Aerospace invested $5 million in ES2.

SDA Systems
January 1986
ES2 signed an agreement to market SDA Systems' design systems throughout Europe and to use them in a number of planned design centers.

Philips-Elcoma/Texas Instruments
May 1986
ES2, Philips-Elcoma, and Texas Instruments (TI) agreed to cooperate on the SystemCell standard cell library.

February 1987
ES2, Philips, and TI signed an agreement covering manufacturing of the SystemCell. TI and Philips would supply volume parts; ES2 would provide prototypes and low-volume quantities.

Philips
February 1988
ES2 and Philips announced an agreement that ensures rapid prototyping and high volumes of ASICs for customers worldwide implemented in Philips' standard 1.5u dual-layer metal CMOS process.

Mitsui & Co.
October 1987
ES2 formed a partnership with Mitsui & Co., Ltd., and purchased a software and design company in Japan called Best. The company is responsible for marketing ES2's products in Japan.

United Silicon Structures
January 1988
ES2 established US2, a U.S. partner.

SERVICES

Quick-turn ASIC prototyping
Low-volume production

MANUFACTURING

Technology

2.0-micron, double-metal CMOS
1.25-micron, double-metal (1988)
E-beam on 5-inch wafers

Facilities

Munich, West Germany
Headquarters

Bracknell, England
11,800 sq. ft.
Software products

Rousset, France
16,147 sq. ft.
Manufacturing, assembly, test

8,600 sq. ft.
Fab area

PRODUCTS

Development Tools

Device	Description
Solo 1000	A Low-Cost Development System with up to 5,000 Gates: Schematic Capture, Simulation, Layout, Back Annotation
Solo 2000	Advanced Software, Full-Custom Modules for ASICs with up to 150,000 Transistors: Structure Compiler, 250 Cells, Module Generators, Test Analyzer, Simulation, Automatic Place and Route

OTHER INFORMATION

ES2's PR firm is Bood and Partners.

Exel Microelectronics Inc.

2150 Commerce Drive
San Jose, CA 95131
408/432-0500
Fax: 408/432-8710

ESTABLISHED: February 1983 **NO. OF EMPLOYEES: 280**

BACKGROUND

Exel Microelectronics Inc. designs, develops, and manufactures nonvolatile memory and microcomponent devices for the EDP, industrial controls, automotive, telecommunications, military, and robotics markets.

The Company leveraged its proprietary EEPROM expertise into a broad base of EE technology-based, high-performance, low-power products including bipolar PROM replacements, UV-EPROM replacements, and PLDs. Exel was the first to offer high-density, 55ns CMOS, 16K EEPROMs and was one of the first to move into 6-inch wafer production. In the long term, Exel plans to develop microcomponent products with on-chip EEPROM memory.

In February 1986, Exel Microelectronics was acquired by Exar Integrated Circuits for $5.5 million. In August 1988, Rohm Co., Ltd., acquired 81 percent of Exel from Exar. Exel now is an operating unit of Rohm.

BOARD

Kozo Sato, Chairman of the Board
Kenichiro (Ken) Sato
Yoshiaki Odani
Takashi (Todd) Kobayashi
Edwin M.W. Chow

COMPANY EXECUTIVES
(Position and Name)

President/Secretary
Takashi Kobayashi

Vice President
Edwin M.W. Chow

CFO
Shigeru (Fred) Sasa

FINANCING

February 1983
Initial
$1.0M
Sirjan L. Tandon

July 1983
Round 1
$5.5M
Private Placement

Round 1
$5.5M
Lease Line

September 1984
Round 2
$10.5M
BancBoston Ventures; Bay Partners; CH Partners; Chase Manhattan; Crown Advisors, Ltd.; Hambrecht & Quist; Horsley Keogh & Assoc.; Hutton Venture; IBM Retirement Fund; Montgomery Securities; Orange Nassau; Paribas Technology; Prudential-Bache; Riordan Venture Mgmt; Rothschild, Unterberg & Towbin Ventures; J.F. Shea & Co.; TA Assoc.; 3i Ventures

August 1985
$13.5M
Cable, Howse, & Cozadd; Hambrecht & Quist; Horsley Keogh & Assoc.; TA Associates

February 1986
$5.5M
Acquired by Exar Corporation

August 1988
$40.0M
Rohm acquired 81 percent of Exel

June 1989
$6.5M
Remaining 19 percent of Exel acquired by Rohm.

Exel Microelectronics Inc.

RECENT HIGHLIGHTS

February 1986
Exar completed its $5 million acquisition of Exel.

October 1987
Exel's Class 10 CMOS fabrication facility met MIL-STD-883C specifications. The first devices to be compliant with this specification are the XL2864B 8Kx8 EEPROM and the XL78C800 EPLD.

November 1987
Exel offered the XL46HC64, a CMOS 64K EEPROM with a 35ns access time. The device can be erased in 10 milliseconds and reprogrammed and retested at least 10,000 times.

ALLIANCES

Samsung Semiconductor
1983
Samsung entered into a joint development project to act as a second source for Exel's forthcoming 16K EEPROMs (expired).
May 1985
The prior Samsung agreement was extended to include second-sourcing for 64K EEPROMs.

Paribas Technology
September 1984
Paribas took part in second-round financing.

Oki Electric
March 1985
Oki is a second source for Exel's 2Kx8 NMOS EEPROM and produces 64K EEPROMs.

Exar
February 1986
Exar completed its $5.5 million acquisition of Exel.

MANUFACTURING

Technology

NMOSE2	2.0-micron design rules
CMOSE2	1.5-micron design rules
EXCMOS3	1.5-micron, dual-metal
5-inch wafers	

Facilities

San Jose, CA
62,500 sq. ft.
12,000 sq. ft.
Class 10 clean room

PRODUCTS

EEPROM

Device	Organization	Process	Delay (ns)
XL2804A	512x8	NMOS	250
XL2816A	2Kx8	NMOS	250
XL2817A	2Kx8	NMOS	200
XL2864A	8Kx8	NMOS	200
XL2865A	8Kx8	NMOS	200

CMOS PROM

Device	Organization	Process	Delay (ns)
XL46C15	2Kx8	CMOS	55

Programmable Logic Device

78C800	CMOS ERASIC Family, 600 to 800 Gates
XL93C46	1K Serial CMOS EEPROM
XL26008	PLD development system (ERASIC family)
XL26002	PLD software—MultiMap/MultiSim

OTHER INFORMATION

Exel does not employ a PR firm.

Gazelle Microcircuits, Inc.

2300 Owen Street
Santa Clara, CA 95054
408/982-0900
Fax: 408/982-0222

ESTABLISHED: June 1986 **NO. OF EMPLOYEES: 53**

BACKGROUND

Gazelle Microcircuits, Inc., was founded to design and market high-performance, digital LSI and VLSI GaAs ICs for high-volume commercial applications such as computation, communication, and military/aerospace. The Company is concentrating on product design and marketing development and does not plan to invest in a wafer fabrication facility.

Gazelle's product strategy is to offer high-yielding, low-cost circuits of large-scale complexity, using existing GaAs fabrication processes. The Company will concentrate on developing unique circuit design approaches to differentiate its performance-oriented devices.

The Company was formed by ex-GigaBit Logic executives Andrew Graham and David MacMillan. In January 1987, Jerry Crowley left Oki Semiconductor, where he was vice chairman and founder, to head Gazelle. In March 1988, Thomas Andrade joined Gazelle as vice president of technology from Pacific Monolithics where he was manager of semiconductor development. Mr. Andrade is responsible for identifying and qualifying the foundries and processes used to fabricate Gazelle's circuits. Before joining Pacific Monolithics, he developed the first of Avantek's microwave IC process and transferred it into volume manufacturing. He was a member of the research staff at IBM, where he did basic research on GaAs fabrication processes and materials. He also did work on NMOS processes, much of which was funneled into the VHSIC project.

In February 1988, Gazelle moved into its new 22,000-square-foot headquarters in Santa Clara, California. The facility is used for engineering development, circuit design, product evaluation, and marketing operations. Gazelle also has an option on an adjoining 24,000-square-foot space.

Gazelle has signed pacts with several U.S. manufacturers to supply GaAs wafers to the firms and plans to offer TTL-replacement devices in 1988.

BOARD
(Name and Affiliation)

Jerry R. Crowley, Chairman
  Gazelle Microcircuits, Inc., President/CEO

*David MacMillan
  Gazelle Microcircuits, Inc., Vice President

E. Floyd Kvamme
  Kleiner, Perkins, Caufield & Byers, General Partner

Philip Young
  Dillon Read—Concord Partners, Managing Director

David Hathaway
  Venrock Associates, General Partner

Steve Sharp
  Power Integrations, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Jerry Crowley
  Oki Semiconductor, Vice Chairman

VP Marketing
David MacMillan
  GigaBit Logic, Product Manager

VP Engineering
*Andrew Graham
  GigaBit Logic, Dir of Memory Development

VP Technology
Thomas Andrade
  Pacific Monolithics, Mgr Semi Dev

VP Sales
John Randall
  Signetics, Dir Sales

VP Operations
George Schneer
Intel, VP Operations

*Founder

FINANCING

August 1986
Seed
$0.9M
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers

April 1987
Round 1
$5.5M
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates

August 1987
Lease Line
$1.5M
Comdisco, Ventures

April 1988
Lease Line
$2.5M
Comdisco Ventures

September 1988
Round 2
$6.8M
Dillon Read-Concord Partners; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Merrill, Pickard, Anderson & Eyre; Venrock Associates; Harvard Management Co. Inc.; JAFCO Ltd.

ALLIANCES

TriQuint
September 1988
Gazelle Microcircuits announced a two-year, $16.9 million gallium arsenide manufacturing contract with TriQuint Semiconductor, Inc., a subsidiary of Textronix.

MANUFACTURING

Technology

GaAs

Facilities

Santa Clara, CA
22,000 sq. ft.
Headquarters, engineering, design

The Company also has an option on an adjoining 24,000 square feet of space.

PRODUCTS

Part No.	Description
GA22VP10-7 GA22VP10-10	24-Pin PLD Superset with Improved Output Macrocells
GA22V10-7 GA22V10-10	24-Pin PLD Superset with Output Macrocells
GA23S8-7 GA23S8-10	20-Pin-Based Sequencer with Output Macrocells and six Buried Registers

OTHER INFORMATION

Gazelle's PR firm is Franson and Associates, Inc.

Genesis Microchip Inc.

2900 John Street
Markham, Ontario, Canada
L3R 5G3
416/470-2742
Fax: 416/470-2447

ESTABLISHED: January 1987 **NO. OF EMPLOYEES: 15**

BACKGROUND

Genesis Microchip Inc. was formed to be a supplier of design services, prototyping, and low-volume quantities of ASICs to the central North American market. Genesis offers gate array, cell-based ICs as well as full-custom design services. Products target the telecommunications, military, and industrial applications markets.

Initially, the Company operates as a Canadian design center for National Semiconductor's CMOS ASIC products under an agreement signed in October 1987. The agreement includes National's gate arrays and cell-based libraries, as well as the full range of design tools. National provides prototyping, volume manufacturing, and assembly and test of all CMOS ASIC devices designed by Genesis, using National's 2.0- and 1.5-micron technologies. National also provides manufacturing for Genesis customers that design custom cells not included in the National libraries.

BOARD
(Name and Affiliation)

W.L. Stapleton, Chairman
Corporate Systems Strategies Ltd.

*Paul M. Russo
Genesis Microchip Inc., President/CEO

*William H. White
Genesis Microchip Inc., Vice President

Jean-Claude Bonhomme
Investor

Marvin J. Singer
Armstrong, Schiralli & Dunne

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Paul M. Russo
GE, General Manager-MEC

Exec VP
William H. White
Harris Semi, Dir Engr Dig Prod

Comptroller
Peter W. Hawley
Consultant

*Founder

FINANCING

August 1987
Round 1
Undisclosed
Private investors

November 1987
Round 2
Undisclosed
Private investors

April 1988
Round 3
Undisclosed
Private investors

ALLIANCES

National
October 1987
National Semiconductor and Genesis signed a design center agreement that covers National's gate array and cell-based libraries and design tools. National provides prototyping and production for CMOS ASICs designed by Genesis using National's 2.0- and 1.5-micron technologies. Genesis operates as National's Canadian design center.

SERVICES

Design
ASIC prototyping
Low-volume production

MANUFACTURING

Technology

2.0- and 1.5-micron CMOS

Facilities

Genesis plans to build a 100,000-square-foot Canadian fabrication facility that features a Class 10 clean room. The facility will have the capacity for processing 1.5- and 1.0-micron CMOS double-level metal ASICs on 6-inch wafers. The facility will be optimized for quick-turn, low-volume manufacturing and will support MIL-STD-883 conformance.

Markham, Ontario
4,000 sq. ft.
Administration and design

Hull, Quebec
2,000 sq. ft.
Sales, design

PRODUCTS

Genesis offers the full range of National's CMOS gate array (2.0-, 1.5-, and 1.0-micron) and cell-based (2.0-micron) families, including analog, RAM/ROM, EEPROM, and MCU cells. In addition, Genesis can design special cells and full-custom ICs as customer-owned tooling designs for manufacture by National Semiconductor.

OTHER INFORMATION

Genesis Microchip does not employ a PR firm.

GigaBit Logic, Inc.

1908 Oak Terrace Lane
Newbury Park, CA 91320
805/499-0610
Fax: 805/499-2751
Telex: 6711358

ESTABLISHED: August 1981 **NO. OF EMPLOYEES: 120**

BACKGROUND

GigaBit Logic (GBL) designs, develops, manufactures, and markets GaAs standard and application-specific digital ICs capable of 1-GHz to 5-GHz operation. GBL was founded in 1981 by Fred A. Blum and Richard C. Eden. GBL's goal is to be the leader in the commercial digital GaAs IC market, and the company is targeting product segments in the military, mainframe computers, RF communication and instrumentation, and test equipment markets. GBL's strategy is to penetrate high-performance equipment markets by offering products that are five to ten times faster than silicon for comparable prices. GigaBit's sales goal for 1990 is $50 million.

GBL uses sales representatives, distributors, and a direct sales force to sell its products worldwide. Currently, GBL has sales representatives nationwide and franchised distributors in Japan, West Germany, Italy, France, the United Kingdom, Israel, Canada, Sweden, Denmark, Taiwan, Australia/New Zealand, and South Korea.

BOARD
(Name and Affiliation)

John D. Heightley, Chairman
GigaBit Logic, Inc., President, CEO

Heinrich F. Krabbe
Analog Devices, Inc.

Richard C. Eden
GigaBit Logic, Inc.

David B. Jones
Interven Partners, Inc.

Lawrence T. Sullivan
Analog Devices, Inc.

Mark C. Masur
O'Donnel & Masur

Greg Barnum
Cray Research

Ole Steen Anderson
NKT (Denmark)

Chris C. Ellison
DFC of New Zealand

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
John D. Heightley
Inmos, President

VP R&D
Richard C. Eden
Rockwell, Principal Scientist

VP Prod Dev
Frank S. Lee
Rockwell, Design Engr Mktg

VP Sales
James Brye
Vitesse, VP-Marketing/Sales

VP Marketing
Mike Pawlik
Fairchild, Marketing Mgr

VP Finance
Spencer Brown
CR Technology, VP-Finance/CEO

VP Mfg
Bryant M. Welch
Rockwell, Mgr GaAs Technology

FINANCING

March 1982
Seed
$1.0M
First Interstate Capital Corp., Riordan Venture Group, Wood River Capital

November 1982
Round 1
$8.1M
Analog Devices Enterprises, First Interstate Capital Corp., and others

December 1983
R&D Partnership
$6.1M
Kidder, Peabody & Company

February 1985
Round 2
$12.1M
Analog Devices Enterprises, GE Venture Corp., Interfirst Venture Corp., First Interstate Capital Corp., Standard Oil Co., Union Venture Corp.

April 1987
Recapitalization
$14.9M
Analog Devices Enterprises, Cray Research, Digital Equipment Corp., DFC New Zealand, FAIC Capital, Fairfield Equity, First Interstate Capital Corp., GE Venture Corp., Hanover Capital, Interfirst Venture, Interven Partners, New Enterprises Associates, Riordan Venture Group

September 1988
Round 3
$4.1M
Analog Devices Enterprises, DFC New Zealand, Interven Partners, Republic Venture, New Enterprises Associates, Union Venture Corp, Riordan, NKT (Denmark), Canaan Venture, Courtland Investment

RECENT HIGHLIGHTS

January 1987
GBL named its president and CEO, John Heightley, chairman of the board. Mr. Heightley takes over the chairman's post from Heinrich Krabbe, who remains a director. Mr. Krabbe is vice president of new business development for Analog Devices, an investor in GBL.

January 1987
Cray Research placed a $3.2 million foundry order.

April 1987
GBL completed a private placement of convertible preferred stock and raised $14.9 million. The funds were used to recapitalize the company.

April 1987
GBL, Seattle Silicon, and Washington Technology Center (WTC) announced that a joint design project resulted in the fabrication of a functional GaAs IC design that is compiler based (see "Alliances").

May 1987
GBL announced that Cray Research increased its January 1987 foundry order from $3.2 million to $5.5 million. Cray will use the logic and memory devices procured under this order to enter the next phase of development of a GaAs-based parallel processor supercomputer.

July 1987
Prisma Corp., a manufacturer of high-speed computers, is planning to build a GaAs-based, 32-bit, real-time computer using GigaBit's logic devices and other ECL-based memory. The machine will incorporate RISC, will implement Ada language, and will offer performance in the 100- to 200-mips range. The first machine is expected to be shipped by the end of 1989. Future systems are expected to use FORTRAN, C, and Lisp. Prisma is a spin-off from Cray Research and is capitalizing on Cray's research into implementing computers with GaAs.

October 1987
Tachonics and GBL agreed mutually to second-source GaAs standard and ASIC ICs and to codevelop cell libraries to support future GaAs technologies (see "Alliances").

October 1987
GBL achieved profitability.

January 1988
Cray placed a $6.8 million foundry order.

September 1988
GBL and NKT (Denmark) initiated a joint venture—named GIGA—to serve the Europe and Israel markets for ICs (see "Alliances").

November 1988
Cray placed a $29.3 million foundry order.

December 1988
GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo, Japan—signed a marketing and product development agreement. Under the pact, GigaBit Logic will market SC Hightech's GaAs IC products throughout the world, excluding Japan. The agreement also provides the opportunity for codevelopment of future generations of GaAs ICs to the two companies. In addition, SC Hightech may provide foundry services for certain high-volume segments of GigaBit Logic's standard product line.

ALLIANCES

Kidder, Peabody & Company
December 1983
GBL and Kidder, Peabody & Company formed a research and development partnership to develop four ultrahigh-speed GaAs SRAMs.

Cray Research
April 1987
Cray Research is a contributor in the $14.4 million recapitalization of GigaBit Logic. In return, GBL will provide foundry services for Cray in its development of a GaAs-based parallel processor supercomputer, the CRAY-3.

Seattle Silicon, Washington Technology Center
April 1987
GBL, Seattle Silicon, and the Washington Technology Center (WTC) announced that their joint design project had resulted in the fabrication of a functional GaAs IC design based on GBL's cell library; Seattle Silicon's compiler; and WTC's design, engineering support, packaging, and test.

Tachonics
October 1987
GBL and Tachonics agreed mutually to second-source GaAs standard ASIC ICs. GBL also will transfer databases, schematics, and test specs of the PicoLogic cell-based families to Tachonics. The companies will codevelop cell libraries to support future GaAs technologies.

NKT (Denmark)
September 1988
GBL and NKT initiated a joint venture (GIGA) to serve the Europe and Israel markets for ICs. GIGA will provide a full-support design center and management for GigaBit's distributor network for standard products in Europe. This alliance makes GBL the first U.S. GaAs company to have full ASIC development capability based in Europe.

SC Hightech Corporation
December 1988
GBL and SC Hightech Corp.—a division of Sumitomo Group, Tokyo—Japan, signed a marketing and product development agreement.

PRODUCTS

PicoLogic Digital and Analog GaAs ICs

Gates
Two and three Input NORs, two Input XOR/XNOR/Line Receivers, Dual AO/AOI

Drivers/Receivers/Comparators
2:1 Multiplexed Fanout Buffer, 1:4 Fanout Buffer Complementary Driver/Comparator

Flip-Flops and Registers
Dual-Precision D Flip-Flop, Quad D Flip-Flops with 2:1 MUXed or XOR Inputs, Octal Register/Shift Register and PN Code Generator

MUX/DEMUX/Crosspoint
Quad 2:1 MUX, 3:8 or Dual 2:4 Decoder/DEMUX, Quad 4:1 or Dual 8:1 MUX, 8x8x1 Expandable Crosspoint Switch, 16x16x1 Crosspoint Switch

Counters/Prescalers
2- and 7-Stage Ripple Counter/Dividers, 4-Bit Synchronous Programmable Counter, Variable Modulus Divider

Arithmetic Operations
Dual 9-Bit Parity Generator/Checker and 8-Bit Equivalence Checker, High-Speed 4-Bit Adder, Carry Lookahead Generator, 32-Bit DDS Phase Accumulator

Monolithic FET and Diode Arrays
15 mA Schottky Diode Array, Single Gate MESFET Array, Dual Gate MESFET Array

Fiber Communications Products
8:1 Time Division MUX, 8:1 Time Division DEMUX, Clock and Data Recovery Circuit, Low Power Clock and Data Recovery, 16G040 Demo Board, Transimpedance Amplifier, Laser Driver, LED Driver

Analog/ATE/Instrumentation Products
Phase/Frequency Comparator, Dual High-Speed Pin Driver

NANORAM and NANOROM Memory
256x4-Bit Registered, Self-Timed Static RAM, 1,024x4-Bit Latched Self-Timed Static RAM, 512x8-Bit Mask Programmable ROM

ASIC Products
SC5000 Standard Cell Library
SC10000 Standard Cell Library
GaAs Foundry Services

Prototyping and Support
Evaluation Boards for Transimpedance Amplifiers, Laser Drivers, and LED Drivers, Universal Prototyping Boards (for 36-, 40-, and 68-pin packages), High-Speed Sockets (for 40- and 68-pin leadless chip carriers)

OTHER INFORMATION

GigaBit Logic does not employ a PR firm.

Harris Microwave Semiconductor, Inc.

1530 McCarthy Blvd.
Milpitas, CA 95035
408/433-2222
Fax: 408/432-3268

ESTABLISHED: June 1980 **NO. OF EMPLOYEES: 65**

BACKGROUND

Harris Microwave Semiconductor (HMS), Inc., was formed to develop and manufacture GaAs-based FETs, MMICs, and digital ICs. In addition to offering standard products, the Company offers full and semicustom capabilities and provides foundry services. HMS is a vertically integrated operation of Harris Corporation's Semiconductor Sector. One hundred percent of the Company's funding has been provided by the Harris Corporation.

The Company has capabilities for manufacturing GaAs crystals and wafers as well as ICs, packaged products, and discrete devices. HMS is said to have the world's largest high-purity GaAs ingot-growing capacity, which produces single-crystal GaAs ingots of up to 7 inches in diameter.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

President/Chief Executive Officer
John T. Hartley

Vice President/General Manager
Dr. Joseph Barrera

Marketing and Sales Director
Vic Kovacevic

FINANCING

Not available

RECENT HIGHLIGHTS

July 1987
HMS offered the HMM-10610, a dual-stage, 2- to 6-GHz, 0.5-micron, medium-power monolithic amplifier in die form.

February 1988
HMS introduced the HMM-10620, a 2- to 6-GHz low-current, cascadable, broadband MMIC amplifier designed to meet the electronic warfare systems' low-current requirements.

May 1988
HMS introduced the HMM-11810, a 6- to 18-GHz low-current, cascadable broadband MMIC amplifier designed to meet the low current requirements of electronic warfare systems.

June 1989
HMS introduced the HMR-1100, a GaAs MMIC Pi Attenuator. The MMIC is a practical solution for slope and gain control in a variety of military components such as amplifiers.

ALLIANCES

Not available

SERVICES

Foundry

MANUFACTURING

Technology

1.0- to 0.5-micron GaAs MESFET
2-, 3-, and 4-inch wafers

Facilities

Milpitas, CA
37,000 sq. ft. total
15,000 sq. ft. manufacturing space

PRODUCTS

FETs (available in chip or packaged form)

Device	Description
HMF-0300	2-18 GHz, 125 mW Power
HMF-03100-100	2-20 GHz, Low Noise, Gain
HMF-03100-200	2-20 GHz, Gain/Drive
HMF-03100-300	2-20 GHz, Drive
HMF-0330	2-20 GHz, Low Noise, Low Current
HMF-0600	2-20 GHz, 250mW Power
HMF-0610	2-20 GHz, Gain
HMF-0620	2-14 GHz, High Transconductance
HMF-12000-100	2-16 GHz, 500mW Power
HMF-12000-200	2-16 GHz, 650mW Power
HMF-1210	2-20 GHz, Gain
HMF-24000-100	2-14 GHz, 800mW, Power
HMF-24000-200	2-14 GHz, 1.2W, Power

MMICs

HMR-11000	Pi Attenuator, DC-18 GHz
HMR-10502	Analog Amplifier, 0.5-5.0 GHz
HMR-10503	Analog Amplifier, 1-5 GHz
HMM-10610	Broadband Amplifier, 2-6 GHz
HMM-10620	Broadband Amplifier, 2-6 GHz, Low Current
HMM-11810	Broadband Amplifier, 6-18 GHz
HMM-11820	Broadband Amplifier, 6-18 GHz, Low Current

OTHER INFORMATION

Harris Microwave's PR firm is Ketchum Public Relations.

Headland Technology Incorporated

46221 Landing Parkway
Fremont, CA 94538
408/656-7800

ESTABLISHED: April 1989 **NO. OF EMPLOYEES: 200**

BACKGROUND

Headland Technology Inc. was formed in 1988, a result of the merger between G-2 Incorporated and Video Seven. In 1987, LSI Logic Corporation spun off G-2 to sell peripheral logic chip sets for the 80286 and 80386. LSI purchased 20 percent of Video Seven in 1988 and later increased its share to 80 percent. In July 1989, LSI merged G-2 and Video Seven to form Headland Technologies, an independent affiliate of LSI Logic Corporation. Headland maintains separate and independent marketing and engineering organizations. As an affiliate, Headland can draw upon LSI Logic's worldwide manufacturing facilities in the Far East, North America, and Europe. Headland also has access to LSI Logic's 24 design centers located throughout the world. Headland utilizes LSI Logic's HCMOS and BiCMOS process technology, which delivers submicron ICs in mass production.

Headland's initial focus is on the rapidly growing market for graphic and logic products for the IBM PC-compatible market. The G-2/Video Seven merger brings two product focuses under one roof. Video Seven, previously an independent graphics house, will provide Headland with video graphics expertise. In the graphics market, Headland currently offers VGA graphics cards, a single-chip EGA multimode graphics controller, and a VGA chip. Headland plans to offer an 8514A graphics chip set in early 1990 and will also introduce VGA chip sets for flat panel displays. The Company has an existing program with Sun Microsystems to produce a "virtual VGA" card for the 386i workstation. Headland expects to expand this product to other UNIX-based workstations.

Drawing from G-2's focus on PC chip sets, Headland offers a number of logic products. Headland's offerings include a PC AT chip set, a PS/2 Model 30/XT compatible chip, a 386 AT chip set, a 386 SX chip set, and a universal PS/2-compatible chip set. Headland expects to offer SPARC or MIPS chip sets in the near future.

Headland considers Chips & Technologies and Western Digital to be its two major competitors. Headland sells products to both OEM and retail customers. The Company's products will be sold through a mix of direct sales, independent representatives, and retail distribution. Headland has 8 national and 29 international distributors, as well as 2,100 authorized resellers that were acquired as part of the Video Seven holdings. Headland's strong retail sales channels should give the Company an advantage over its competitors, some of which have no retail distributors.

In 1988, G-2 raised approximately $19 million in revenue, and Video Seven reached the $50 million mark. By combining resources and taking advantage of economies of scale, LSI predicts that Headland's revenue could easily triple in 1989 and reach a rate of $200 million per year early in 1990.

In the future, Headland plans to support the new markets created by the integration of computers with all-digital communications and entertainment (i.e., ISDN, HDTV, interactive video), as well as the markets spurred by higher-performance graphics standards such as VGA and by the arrival of Presentation Manager's graphics environment.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

CEO
William J. O'Meara
G2, President

President
Paul Jain
USI International, President

VP, Manufacturing & Operations
Russ Faust
Ferix Corp.

Sr. VP, Research & Development
Don Bryson
Mouse Systems, VP Sales/Mktg

VP, Manufacturing & Operations
Bill Sams
Assisted Technology, VP Mktg

VP, OEM Sales
Fred Brown
LSI Logic, Sales

VP, Retail Sales
Michael Humphress
Mouse Systems, National Sales Mgr

VP, Systems Marketing
Greg Reznick
Mouse Systems, Prod Mgr

VP, Component Marketing
Elvet Moore
Kontron, President

VP, Research & Development
Steve Chan
LSI Logic, VP ASIC design

FINANCING

Not available

RECENT HIGHLIGHTS

April 1989
G-2 and Video Seven merged to form Headland Technologies, Incorporated.

July 1989
The Company's name was officially changed to Headland Technologies, Incorporated from Video Seven, Incorporated.

July 1989
Headland introduced the Video Seven VGA 1024i, a high-performance VGA adapter that enhances the industry-standard VGA.

ALLIANCES

Headland is an affiliate of LSI Logic Corporation.

MANUFACTURING

Facilities

Fremont, CA
Headquarters, marketing, test

Cupertino, CA
Engineering, R&D

PRODUCTS

VEGA Deluxe VGA Card
VEGA VGA Card
FastWrite VGA
V-RAM VGA
EGA Multimode Graphics Controller
Advanced VGA Chip

OTHER INFORMATION

Headland Technology's PR firm is Miller Communications.

Hittite Microwave Corporation

21 Cabot Road
Woburn, MA 01801
617/933-7267
Fax: 617/932-8903

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 12**

BACKGROUND

Hittite Microwave was formed to market custom and proprietary GaAs MMICs for military and commercial applications. The Hittite team has been involved in all aspects of design, development, and production of monolithic GaAs components, including participation in several Department of Defense GaAs technology development programs.

Hittite's expertise ranges from designing small, single-chip systems to 500-watt, continuous-wave, multichip components and subsystems. Hittite's facility is equipped to conduct design, layout, verification, packaging, and test of GaAs-based components. Wafer fabrication is conducted by foundries.

Hittite is part of the General Dynamics, Honeywell, TRW consortium that is addressing the critical technology, fabrication, and cost issues of inserting microwave/millimeter wave monolithic IC (MIMIC) technology into advanced tactical weapons systems. The team has targeted three main mission areas for MIMIC insertions—smart weapons, electronic warfare, and communications.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Pres/COO
Frank Paik
Raytheon, Business Dev Mgr

VP/CEO
*Yalcin Ayasli
Raytheon Research, Mgr R&D Monolithic ICs

CFO
Ronald Kaplan
Wang, Controller

*Founder

FINANCING

Private

ALLIANCES

Hittite is part of the General Dynamics, Honeywell, TRW consortium as part of the Department of Defense MIMIC program.

MANUFACTURING

Technology

0.5- and 1.0-micron GaAs MESFETs

Facilities

Woburn, MA
4,800 sq. ft. total
Offices, R&D, assembly, test

400 sq. ft.
Class 10 clean room

Hittite Microwave Corporation

PRODUCTS

Signal Control Components
Microwave Radar Ranging Systems
Other proprietary products

OTHER INFORMATION

Hittite Microwave does not employ a PR firm.

HNC, Inc.

5501 Oberlin Drive
San Diego, CA 92121
619/546-8877
Fax: 619/452-6524

ESTABLISHED: October 1986 **NO. OF EMPLOYEES: 40**

BACKGROUND

HNC, Inc. (formerly Hecht-Nielsen Neurocomputers) was formed in October 1986 by Robert Hecht-Nielsen and Todd Gutschow with the goal of becoming the leader in developing neural network products and technology and applying them to practical problems. HNC develops, manufactures, and supplies a complete line of high-speed neural network hardware coprocessors and workstations and an extensive package of neural network software.

Neural networks, modeled loosely after the interconnected nerve cells of the human nervous system, represent an information-processing technology that is radically different from traditional sequentially programmed computers. Rather than relying upon an explicit algorithm to perform desired tasks, a neural network is trained by adapting to repeated examples. For this reason, programming is less complicated—which makes development time shorter.

HNC currently is shipping the ANZA family of neurocomputing systems, which consists of three general-purpose neurocomputing coprocessor boards. The boards are available for the IBM PC AT, the Sun 386i, and Sun-3 and Sun-4 workstations. More than 300 HNC neural network hardware systems have been installed worldwide. HNC currently is developing two CMOS VLSI neural chips that utilize RISC technology. The HNC 100X is a general-purpose neural chip that provides two orders of magnitude increase in performance over current processing techniques. The HNC 103X (patent pending) incorporates both vision and image processing capabilities for complex pattern recognition applications. Both chips will be available during the third quarter of 1990.

HNC is targeting commercial and defense/aerospace markets with its neural network technology. Customers include Fortune 500 companies with broad application ranges such as industrial inspection systems, financial credit scoring, EKG noise filtering, chemical plant process control, modeling, machinery diagnostics, and database analysis.

The Company markets its products in the United States to end users and OEMs through a direct sales force with offices in San Diego, California, and Falls Church, Virginia. An international network of distributors provides marketing and sales support throughout Europe, the Far East, India, and Australia.

BOARD
(Name and Affiliation)

Oliver Curme
Battery Ventures

Thomas Farb
Air Fund

Charles Hertzfeld
E.S. Jacobs

Burt McGillivary
Continental Illinois Ventures

Thomas Tranchina
San Diego Fire Supply

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Robert L. North
TRW, Gen Mgr, Elect Sys

VP, R&D
Michael Thiemann
Four-Pi Systems, VP, Marketing

VP, Mktg
Dave Shlager
Lucid, VP, Sales

Exec VP
Gerald Farmer
Gould, Dir R&D

Mkt Comm Mgr
Julie Hotz
Rohr Industries, Marketing Manager

FINANCING

October 1986
Seed
$635,000
Private

June 1987
Round 1
$2.6M
Battery Ventures

June 1988
Round 2
$3.4M
Battery Ventures, Continental, Illinois Ventures, Aetna, E.S. Jacobs, and Ramo Technology

ALLIANCES

The Fusion Group
September 1989
HNC announced a strategic partnership with The Fusion Group to market software utilities designed to integrate neural computing into financial applications. Under the terms of the agreement, HNC and Fusion will develop software interfaces between HNC's ANZA Plus neurocomputing system and both the Sybase Relational Database Manager and Fusion's Market Data Server (MDS).

MANUFACTURING

Technology

1-micron CMOS

Facilities

San Diego, CA
13,000 sq. ft.
R&D, marketing, headquarters, manufacturing, finance

Falls Church, VA
Regional office

PRODUCTS

ANZA
ANZA Plus
ANZA & ANZA Plus Neurocomputing Workstations
ANZA Plus/VME
AXON Neural Network Description Language
Neural Network Development Toolkit
ExploreNet Standalone Neural Network Software

OTHER INFORMATION

HNC's PR firm is Marcom Strategies.

Hualon Micro-Electronics Corporation

9th Floor, No. 61, Chung Shan N.
Road Sec. 2, Taipei, Taiwan R.O.C.
(02) 562-8813 Ext. 768
Fax: (02) 531-3241

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 400**

BACKGROUND

Hualon Micro-Electronics Corporation (HMC) was formed to offer telecommunications ICs, consumer ICs, microcomponents, and ASICs. Initially, the Company will use 2-micron CMOS technology to manufacture its products but has plans to develop CMOS technology to the 1-micron level.

Recently, HMC opened a new 269,097-square-foot fabrication facility in the Hsinchu Science-Based Park. The facility is capable of manufacturing 30,000 5-inch wafers per month. The Company plans to reach a capacity of 60,000 5-inch wafers per month by 1991.

HMC was financed by the Hualon Group for about U.S.$30 million. The Hualon Group's first venture into the IC business was an assembly plant set up in 1984. As its requirements for high-quality ICs that use advanced process technologies increased, the Hualon Group decided to invest in an IC fab.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Vice President
Andrew Oung

FINANCING

1987
Round 1
U.S. $30.0M
Hualon Textile

ALLIANCES

Not available

MANUFACTURING

Technology

5.0-micron metal-gate CMOS
2.0- and 3.5-micron silicon-gate CMOS
3.5-micron NMOS

Facilities

Hsinchu City, Taiwan
269,097 sq. ft.
Total space includes design and manufacturing.

39,900 sq. ft.
Class 1 and Class 10 clean rooms

Hualon announced that its second fab facility in Taiwan will open in September 1990.

PRODUCTS

Consumer IC Family

	Device	Description
Clock	HM 3200	Analog Clock
	HM 3203	3-1/2-Digit Alarm Clock
	HM 3204	World Time Clock

	Device	Description
Watch	HM 3201	3-1/2-Digit LCD Watch
	HM 3202	4-Digit LCD Watch
Home Electronics IC	HM 3701	Touch Dimmer
Calculator	HM 3401	Solar Calculator
Melody	HM 5801	64-Note Simple Melody
	HM 5802	128-Note Simple Melody
	HM 4801	512-Note Simple Melody
	H 66T	64-Note Simple Melody (3-Pin Package)
	H 67T	64-Note Simple Melody (4-Pin Package)
	H 68T	128-Note Doorbell
Voice IC	HM 2005	3-Second PCM
	HM 2005-1	1.5-Second PCM (Piezo)
	HM 2005-2	1.5-Second PCM
	HM 2006	LPC Processor
	HM 2007	Speech Recognition
Organ	HM 5601	Simple Mini-Organ
Microcomponent and Memory IC Family		
System	HM 6667/8	PC AT 16-MHz Zero-Wait Chip Set
Peripheral	HM 666A/B	RS 232x2, Printer Portx2
	HM 82C11	Printer Port
	HM 16450	PC AT Asynchronous Communications Element
	HM 8250	PC XT Asynchronous Communications Element
	HM 6818	PC AT Real-Time Clock
	HM 58167	PC XT Real-Time Clock
	HM 6845/A/B	CRT Controller
Memory	HM 2300/2301	Character Generator
	HM 2333	4Kx8 ROM
	HM 2366	8Kx8 ROM
	HM 23C256	32Kx8 ROM
	HM 6116	2Kx8 SRAM
	HM 6164	8Kx8 SRAM
Telecommunication IC Family		
Telephone Dialers	HM 9100	Pulse Dialer
	HM 9101/9102	Tone/Pulse Dialer
	HM 9105	5-Memory Tone/Pulse Dialer
	HM 9110	10-Memory Tone/Pulse Dialer
	HM 9113	14-Memory Tone/Pulse Dialer
	HM 9114	15-Memory Tone/Pulse Dialer
	HM 9115	Advanced 15-Memory Tone/Pulse Dialer+ARD
	HM 9120	Advanced 20-Memory Tone/Pulse Dialer+ARD
	HM 9187	Tone Dialer

	Device	Description
Peripheral	HM 2004	Voice Processor
	HM 9200	Call-Progress Tone Decoder
	HM 9202/9203/9204	DTMF Receiver Series

OTHER INFORMATION

Hualon does not employ a PR firm.

IC Sensors, Inc.

1701 McCarthy Blvd.
Milpitas, CA 95035
408/432-1800
Fax: 408/434-6687

ESTABLISHED: 1982 **NO. OF EMPLOYEES: 145**

BACKGROUND

IC Sensors, Inc., designs, develops, and manufactures both standard and custom pressure sensors. The Company developed its silicon sensor technology and applied it to design and manufacture a variety of pressure sensors, accelerometers, pressure switches, load sensors, valves and actuators, and other microstructures. The Company's products are used in medical, industrial, automotive, aerospace, and consumer applications.

IC Sensors was formed with funds provided by the founders. The Company received additional funds when it formed a strategic partnership with Borg-Warner. In December 1986, IC Sensors, Inc., and Transensory Devices, Inc., (TDI) completed a merger. TDI was founded in 1982 and developed a micromachining technology that is used to fabricate both custom and standard devices.

In September 1987, IC Sensors introduced a new technology called Silicon Micromachining, which applies semiconductor production techniques to mechanical devices. Micromachined sensors are produced by etching precise micromechanical structures in silicon. As a result, the structure that serves as a mechanical sensing device is also a semiconductor.

The basic elements of the microstructure technology include the photolithographic processes, oxidations, diffusions, thin-film processes, and metallizations common in the IC industry. A number of other processes are used as well, such as wet chemical and dry etch processes, etch stops, double-sided patterning, and multilayer structures.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

CEO
*Donald G. Lynam

President
Dr. James W. Knutti

VP, Marketing and Sales
Frank A. Perrino

VP, Engineering
Henry V. Allen

Chief Engineer
Edward J. Russell

VP, Operations
*Manuel G. Rossell

VP, Finance
Robert Regalia

*Founder

FINANCING

Not available

RECENT HIGHLIGHTS

June 1987
IC Sensors offered the 1210 and 1220—two piezoresistive sensors.

July 1987
IC Sensors offered the 2501, a miniature silicon pressure switch that eliminates the need for comparators, external voltage references, and potentiometers.

July 1987
IC Sensors offered the 410, a general-purpose piezoresistive sensor that is mountable on PC boards.

September 1987
IC Sensors introduced a new technology, silicon micromachining, that applies semiconductor production techniques to mechanical devices.

September 1987
IC Sensors introduced a silicon piezoresistive accelerometer, the Model 3021.

ALLIANCES

Borg-Warner Corp.
Borg-Warner does some manufacturing for IC Sensors, Inc.

PRODUCTS

Pressure Sensors
Accelerometers
Pressure Switches
Load Sensors
Valves and Actuators

OTHER INFORMATION

IC Sensors does not employ a PR firm.

MANUFACTURING

Technology

Not available

Facilities

Milpitas, CA
34,000 total sq. ft.
Headquarters, manufacturing

9,000 sq. ft.
Fabrication area

ICI Array Technology, Inc.

1297 Parkmoor Avenue
San Jose, CA 95126-3448
408/297-3333
Fax: 408/297-3763

ESTABLISHED: 1982 **NO. OF EMPLOYEES: 130**

BACKGROUND

ICI Array Technology offers a variety of technologies to support development and manufacturing of small-footprint subsystem products. The Company emphasizes designing for manufacturability. Subsystem design is supported with ASIC capability in CMOS gate arrays and cell-based-designed ICs. One of the Company's major strengths is surface-mount technology (SMT) and COB technology offered as part of a totally integrated system.

The Company was founded by William Robson, without venture capital, as Array Technology, Inc. In January 1986, the Company was acquired by Imperial Chemical Industries PLC (ICI), a large U.K. chemical company, and renamed ICI Array Technology. Prior to its acquisition, Array Technology funded all activities from its design and consulting fees.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

President
Bernie Aronson

VP, Marketing & Sales
Jack Hullman

Director of Finance
Erik Simonson

Director of Engineering
Dennis Morris

Director of Operations
Rich Frieberger

Program Manager
*Brian Tighd

*Founder

FINANCING

Not available

ALLIANCES

ICI
January 1986
Imperial Chemical Industries Plc (ICI), a large U.K. chemical company, acquired Array Technology.

National
March 1988
National Semiconductor and ICI Array Technology signed an agreement under which ICI Array will use National's design systems and process specifications to develop proprietary ASICs.

MANUFACTURING

Multiple offshore and U.S. sources provide CMOS silicon wafers.

Technology

1.0-, 1.5-, 2.0-, and 3.0-micron, double-layer metal, silicon-gate CMOS designs on Mentor tools

Facilities

San Jose, CA
50,000 sq. ft.
Administration, design, production

ICI Array Technology, Inc.

PRODUCTS

CMOS Gate Arrays

Process	Linewidth (micron)	Delay (ns)	Cells
Si-Gate	1.5, 2.0, 3.0	0.5 to 2.0	RAM, ROM

Digital Gate Arrays

150 to 20,000 gates

Linear Arrays

Semicustom Subsystems

OTHER INFORMATION

ICI Array Technology does not employ a PR firm.

Innovative Silicon Technology

Wholly Owned Subsidiary of SGS-Thomson
1310 Electronics Drive
Carrollton, TX 75006
214/466-6000
Fax: 214/466-6572

ESTABLISHED: May 1986 **NO. OF EMPLOYEES: 160**

BACKGROUND

Innovative Silicon Technology (IST) was formed by SGS-Thomson Microelectronics to meet the growing market demands for advanced ASICs. The Company was formed by Piero Martinotti and others from Motorola to concentrate on quick-turn R&D for the ASIC market. SGS-Thomson, which transferred the assets of its ASIC activities to IST, provides high-volume foundry services, allows access to its design centers by IST engineers and IST customers, and provides sales and marketing support. The assets transferred from SGS-Thomson to IST include technologies, CAD and production hardware and software, R&D capacity, a significant customer base, a consolidated product portfolio, and human resources.

IST conducts R&D, design, prototyping, low-volume production, assembly, and test, and uses 1.2- to 3.0-micron single-, double-, and triple-layer metal and direct-write e-beam technologies. The Company recently opened a new facility in Agrate, Italy, which serves as its worldwide headquarters and includes wafer fabrication and R&D facilities.

Innovative Silicon Technology's products include gate arrays with up to 50,000 gates and a cell-based library with 140 logic cells.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Chief Executive Officer
Pierangelo Martinotti

Director of Central Business
Mario Licciardello

Director of R&D
Roberto Fantechi

Europe/Asia Operating Unit Director
Pietro Palella

QC Director
Ignazio Salvemini

Finance Administration Director
Arrigo Gradi

Director of Human Relations
Marco Bartolozzi

FINANCING

May 1986
Innovative Silicon Technology is wholly owned by SGS-Thomson Microelectronics.

ALLIANCES

CDI
April 1987
IST and California Devices Inc. (CDI) agreed to a joint product development and second-source agreement covering two families of ASICs using channelless architectures. The first family is a 2-micron, double-metal CMOS with up to 24,000 gates. The second family is based on a 1.5-micron technology and will include more than 100,000 gates.

SDA Systems
May 1987
IST signed an agreement with SDA Systems to develop CAD systems based on SDA technology for use by IST customers.

Innovative Silicon Technology

SERVICES

Quick-turn R&D
Foundry

MANUFACTURING

Technology

1.2- to 3.0-micron, double- and triple-layer metal CMOS; 4-inch and 6-inch wafers

Facilities

Carrollton, TX, U.S.
22,500 sq. ft.
Wafer fab, test, marketing, customer support, sales

Agrate, Italy
13,500 sq. ft.
Worldwide headquarters, wafer fab, R&D

Innovative Silicon Technology employs SGS-Thomson design centers in France, Italy, Sweden, the United Kingdom, West Germany, Hong Kong, Singapore, South Korea, and Taiwan.

Assembly operations are conducted in SGS-Thomson facilities in Malaysia, Malta, and Singapore.

PRODUCTS

Gate Arrays

50,000 Gates; 1.2-Micron, Double-Layer Metal designed for Triple-Layer
10,000 Gates; 2.0-Micron, Double-Layer Metal
6,000 Gates; 3.0-Micron, Double-Layer Metal
2,500 Gates; 3.5-Micron, Single-Layer Metal

Cell-Based Library

140 Cells; 3.0- and 1.2-Micron, Double-Layer Metal; Fully Compatible with Gate Array Libraries

OTHER INFORMATION

Innovative Silicon Technology does not employ a PR firm.

Inova Microelectronics

2220 Martin Avenue
Santa Clara, CA 95050
408/980-0730
Fax: 408/980-1805

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 62**

BACKGROUND

Inova Microelectronics designs, manufactures, and markets ultralarge-scale integrated (ULSI) multichip ICs that use waferscale integration technology developed by the Company. Inova has developed a unique interconnect technology called Inroute. Initially, Inova is using Inroute to integrate multiple memory structures at the wafer level to produce a line of high-density SRAMs.

Inroute is based on an architecture of repeatable slices. (A slice is a row of memory structures.) Slices are repeated on the circuit, including spare slices to allow for defects. A second feature of the Inroute technology is the ability to isolate slices for testing. Working slices are identified and their addresses established by means of fuse-programmable logic. Nonfunctional slices are disconnected through a lacing of fuses so that a defect in a single device does not affect the functionality of the entire circuit. A third feature is the use of a universal second metal layer that can be used for all wafers because all nonfunctional circuits have been disconnected. The technology uses standard fabrication methods and equipment and is transportable to CMOS, BiCMOS, bipolar, GaAs, and VHSIC processes.

Inova's product line focuses on applications where the capability of the system to be integrated requires a large area of silicon. The products typically are characterized by having large repetitive sections of silicon, such as the Company's initial product offerings. In June 1988, Inova began volume shipment of the S128K8, a 1Mb CMOS SRAM. The device is built under a foundry agreement with Sharp, using a 1.2-micron, double-metal, double-poly process. The device, which is comprised of 40 base 4Kx8 slices, targets military accounts that previously have used 1Mb SRAM modules with four 256K parts. In addition to the S128K8, Inova currently is shipping the S32K8, a 256K SRAM. The S32K8 is built with the same 4Kx8 slice used in the 1Mb version. These products will be followed by a family of SRAMs that will be developed through different integrations of the base 4Kx8 slice.

Inova will be developing other ULSI products where a monolithic system solution is not possible with traditional design methods. Applications for these products may include telecommunications, systolic arrays, digital signal processing, and image processing. The Company's product lines serve military, commercial, and industrial markets. Inova has received a DESC Standard Military Drawing for its 70 to 120ns products. Future plans include a 25ns SRAM, available in mid-1990, and product lines containing cache controllers and neural network products. Inova also plans to introduce the first commercially available 4Mb SRAM.

In September 1988, Inova acquired LYNX Technology, a start-up company in the memory product business. LYNX becomes Inova's Colorado Springs division and is responsible for the development of SRAMs. The division in Colorado Springs and headquarters in Santa Clara share responsibility for process and technology development. Dr. Ron Bourassa, previously president and CEO of LYNX, is the vice president and general manager of the Colorado Springs division.

BOARD

(Name and Affiliation)

Vaemond Crane
Inova Microelectronics, President

Glenn Penisten
Alpha Partners

Dan Flamen
Comann, Howard & Flamen

Pete Thomas
Institutional Venture Partners

Blair Stewart
Wilson, Sonsini, Goodrich & Rosati

Gene Strull
Westinghouse Electric Corp.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Vaemond Crane
MIPS Computer Systems, President/CEO

VP Marketing
Doug Mitchell
Inmos, Dir Technical Marketing

VP Finance
David Garrett
Stanford Applied Engineering, CFO

VP Operations, Santa Clara
Howard Gopen
Intel, Wafer Fab Plant Manager

VP Operations, Colorado Springs
Ron Bourassa
LYNX Technology, President/CEO

FINANCING

1984
Seed
$2.0M
Alpha Partners

February 1986
Round 1
$5.3M
Alpha Partners, Asset Management, Bryan & Edwards, Glenwood Management, Jupiter Partners, Institutional Venture Partners, Paribus Technology, Ritter Partners, Technology Venture Investors

April 1987
Round 2
$2.5M
Westinghouse Electric Corporation

April 1988
Round 3
$5.0M
All previous investors

RECENT HIGHLIGHTS

June 1988
Inova began shipping the S128K8 1Mb CMOS SRAM.

September 1988
Inova acquired LYNX Technology, a start-up memory company in Colorado Springs, Colorado.

ALLIANCES

United Microelectronic Products
November 1985
Inova and UMP signed a five-year foundry agreement under which UMP will provide base wafers to Inova.

Westinghouse
June 1987
Westinghouse Electric Corporation invested $2.5 million in equity and $2.5 million in lease guarantees. Westinghouse also is working with Inova as part of its strategic long-term technology efforts. The efforts are sponsored by Westinghouse's Advanced Technology Division.

MANUFACTURING

Technology

1.2-micron CMOS

Facilities

Santa Clara, CA
12,000 sq. ft.
Design, test

Colorado Springs, CO
8,500 sq. ft.
Design, process development

PRODUCTS

Part No.	Device Type	Organization	Access Time
S128K8	1Mb SRAM	128Kx8	70 to 120ns
S32K8	256K SRAM	32Kx8	55 to 100ns

OTHER INFORMATION

Inova Microelectronics does not employ a PR firm.

Integrated CMOS Systems, Inc.

440 Oakmead Parkway
Sunnyvale, CA 94086
408/735-1550
Fax: 408/735-9808

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 65**

BACKGROUND

Integrated CMOS Systems (ICS) designs, manufactures, and markets system-level VLSI semiconductors for cost-effective design and production of customer-specific subsystems. ICS provides complete turnkey solutions from design definition to working multichip subsystems.

ICS developed a family of gate array masterslices; advanced, high-pin-count surface-mount packaging; and board-level technology for high-performance, midrange computer systems. The Company's design technology is integrated with a design automation system that can take a description of a system and transform it into an optimized and testable subsystem-level solution.

The Company's future plans include submicron processes, expanded gate array families, and advanced behavioral design implementation.

In March 1988, ICS and Apollo Computer Inc. introduced the series 10000, a new RISC-based workstation based on ICS' subsystem technology. The series 10000 achieves an execution rate of more than one instruction per cycle. The performance is achieved by parallelism among processors using 64-bit data paths and an efficiently coupled set of VLSI devices. ICS contributed system-level design and gate arrays that incorporate level-sensitive scan design (LSSD) test methodology to assure a testable product the first time.

The system uses 10 different 1.5-micron, double-level metal CMOS gate arrays with densities of 30,000+ gates from the ICS10000 Series Family. The implemented chips include a RISC-based integer processor, a floating-point register file, a memory manager, an I/O manager, and a high-speed system bus processor. The ICS10000 has up to 360 configurable I/O pads and comes in packages with up to 340 pins.

The Company's heritage is high-performance, large computer system design and development. ICS' founders came from Amdahl, IBM, and the STC Computer Research Corp., which was set up by Storage Technology.

BOARD

The Board consists of representatives from the following concerns:

- DSV Partners
- Hambrecht & Quist
- Hambro International
- Industrial Technology Research Institute (ITRI), Taiwan
- Montgomery Securities
- Venrock Associates

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Lin Wu
STC Computer Rsch Corp., Sr VP Opns/COO

Exec VP, Operations
Roy Thiels
National Semiconductor, Pro Dir CMOS, Gate Arrays

Chief Techn Officer
Larry Cooke
STC Computer Research Corporation, Dir Des Automation

VP Engineering
Jin Shyr
Daisy, Mgr Prod Tech Support

VP Strat Plan
Symon Chang
STC Computer Rsch Corp., Sr Eng Mgr

VP Mfg
Steve Margoslan
Interest Corporation, VP Engineering

VP Sales
Steve Stephansen
AMD, Director of Sales

VP Marketing
Robert G. Andrews
ZyMOS, Dir Corp Mktg

VP Finance
Michael J. DelGrosso
The Bottom Line, Consultant

FINANCING

1985
Round 1
$2.5M
Hambrecht & Quist, private individuals

May 1987
Round 2
$5.5M
DSV Partners, Hambro International Venture Fund, Montgomery Securities, Venrock Associates

October 1988
Round 3
$4.2M
DSV Partners; Hambrecht & Quist; Hambro International; ITRI, Taiwan; Montgomery Securities; Sequoia Capital; Venrock Associates

ALLIANCES

VLSI Technology, Toshiba
1985
Toshiba and VLSI began providing foundry services for ICS.

MANUFACTURING

ICS subcontracts wafer fabrication with Toshiba of Japan, Taiwan Semiconductor Cooperative (TSMC), and National Semiconductor in the United States.

Technology

1.5-micron and 1.0-micron, dual-metal CMOS

Facilities

Sunnyvale, CA
12,500 sq. ft.
Headquarters and design

Braintree, MA
Sales office

PRODUCTS

Gate Arrays

10,000 to 30,000 1.5-micron usable gate, gate arrays (ICS10000 Series)
10,000 up to 60,000 1.0-micron usable gate, gate arrays (ICS15000 Series)
15,000 to 50,000 1.0-micron usable sea-of-gate, gate arrays (IC20000 Series)

OTHER INFORMATION

Integrated CMOS Systems' PR firm is Thomas Associates.

Integrated Information Technology

2540 Mission College Blvd., Suite 105
Santa Clara, CA 95054
408/727-1885
Fax: (408) 292-1922

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 23**

BACKGROUND

Integrated Information Technology (IIT) was founded to develop high-performance compute engines for applications in personal computers and other information-processing hardware. IIT's objective is to enhance existing standards of compute engine-based silicon technology for personal computer platforms while embedding additional functionality that will evolve new standards to create new markets for existing and future products and increase information flow in the workplace. The Company was founded in April 1987 by two former Weitek employees, Chi-Shin Wang and Y.W. Sing. Dr. Wang also was a cofounder of Weitek.

The Company currently offers two math coprocessors—the IIT-2C87 and the IIT-3C87—and will begin shipment of its integrated graphics array (IGA) in late 1989. The single-chip IGA is fully compatible with VGA and is downward compatible with EGA, CGA, MGA, and Hercules. In the future, IIT plans to offer a 386 object code-compatible CPU family, a 32-bit controller, and a DSP device.

To date, IIT has received funding in two rounds of financing and has $2.7 million in current assets, which the Company believes to be significant capital to carry it to positive cash flow with a comfortable margin. Investors were Ascii, General Electronics, Mitsui, and Yamaha. Strategic relationships have also been established with Ascii, Mitsui, and Yamaha. Yamaha is conducting wafer fab operations for IIT; Mitsui and Yamaha serve as IIT's Japanese distribution agents. In addition to wafer fab, IIT subcontracts assembly and test operations; the Company conducts design, marketing, and QA in-house.

BOARD
(Name and Affiliation)

*Dr. Chi-Shin Wang
IIT, President

*Dr. Y.W. Sing
IIT, Executive VP

Dick Chang

Samuel Fang

Kazuhiko Nishi
Ascii, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Dr. Chi-Shin Wang
Weitek, VP of Engineering

Executive VP
*Dr. Y.W. Sing
Weitek, Manager, Advanced Product Development

VP Marketing & Sales
Gene Parrott
Cirrus Logic, VP Sales

VP Operations
Robert Shen
VTI, Director WW Manufacturing Operations

Manager Sales Operations
Karen Zelina
AMD, AT&T Program Manager

Manager, R&D
Jan Fandrianto
Weitek, Chief Design Engineer

*Founder

FINANCING

1987
Round 1
Undisclosed amount
General Electronics

1988
Round 2
Undisclosed amount
Ascii, Mitsui, Yamaha

ALLIANCES

Ascii
1989
IIT signed a distribution agreement with Ascii, making Ascii a regional distributor of IIT products in Japan.

Mitsui
1989
IIT signed a strategic alliance with Mitsui, giving Mitsui distribution rights for IIT products in Japan.

Yamaha
1989
IIT signed a foundry agreement with Yamaha, under which Yamaha will provide wafer fabrication services to IIT.

MANUFACTURING

Technology

1.2- and 1.0-micron CMOS

Facilities

IIT subcontracts all wafer fabrication, assembly, and test, while conducting design, marketing, and QA in its Santa Clara facility.

PRODUCTS

IIT-2C87 Math Coprocessor
IIT-3C87 Math Coprocessor
IGA

OTHER INFORMATION

IIT's PR firm is Joyce Lekas Public Relations.

Integrated Logic Systems, Inc.

4445 Northpark Drive, Suite 102
Colorado Springs, CO 80907
719/590-1588
Fax: 719/590-1373

ESTABLISHED: August 1983 **NO. OF EMPLOYEES: 15**

BACKGROUND

Integrated Logic Systems, Inc. (iLSi), was formed to design and develop a family of silicon-gate CMOS and software-based design aids.

iLSi introduced new gate array architectures that offer customers state-of-the-art capabilities. iLSi's product line is capable of implementing 45,000-gate designs that can include large complex functions such as ROM, RAM, PLA, PAL, and the 2900 family in a variety of package options.

The Company has licensing and foundry agreements with four major worldwide corporations.

BOARD
(Name and Affiliation)

Ted Orf, Chairman
Integrated Logic Systems, Inc.

*Frank Gasparik
Integrated Logic Systems, Inc.

James Shook
Consultant

Gordon Olinger
Consultant

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Frank Gasparik
Insouth, VP Engineering

Exec VP/CFO
Ted Orf
Attorney

VP Sales/Mktg
Bruce Grieshaber
Honeywell, Nat Sales Mgr

*Founder

FINANCING

January 1984
Round 1
$5.0M
OTC offering

RECENT HIGHLIGHTS

June 1989
Integrated Logic Systems introduced the Metal Programmed Gate Array (MPGA), which is designed to replace current PLDs and PGAs.

ALLIANCES

Motorola
June 1986
iLSi licensed its line of gate arrays to Motorola (inactive).

Sumitomo
December 1986
iLSi signed an agreement with Sumitomo Corporation and SC Hightech Center, a design center formed to carry out the agreement. Sumitomo licensed ASIC design technology from iLSi. In addition to gaining royalty payments, iLSi gained rights to use any foundries that Sumitomo uses.

Yamaha
December 1987
Yamaha Corporation purchased a license to manufacture and sell gate arrays based on iLSi technology for an undisclosed amount. Yamaha will pay royalties and provide foundry services.

Oki
April 1988
iLSi signed a technology purchase and licensing agreement with Oki Electric Industry Company, Ltd., for an undisclosed amount. Oki will manufacture and sell gate arrays based on iLSi technology and will provide foundry services.

Integrated Logic Systems, Inc.

MANUFACTURING

Technology

1.5-micron silicon-gate CMOS, double-level metal
1.2-micron silicon-gate CMOS, double-level metal under development

Facilities

Colorado Springs, CO
10,000 sq. ft.
Administration and design

Boulder, CO
CAD development

PRODUCTS

CMOS Gate Arrays

Family	Process	Linewidth (Microns)	Delay (ns)	Gates
CA-1500	Si-Gate	1.5	1.0	2,000 to 42,000
15GH	Si-Gate	1.5	1.0	2,500 to 110,000

OTHER INFORMATION

Integrated Logic Systems does not employ a PR firm.

Intergraph Advanced Processor Division

2400 Geng Road
Palo Alto, CA 94303
415/494-8800
Fax: 415/856-9224

ESTABLISHED: October 1987 | **NO. OF EMPLOYEES: 140+**

BACKGROUND

The Intergraph Advanced Processor Division (APD) is a division of Intergraph Corporation and is the result of Intergraph Corporation's acquisition of the Fairchild Advanced Processor Division. The age of the two parent companies normally would exclude the Company from this directory. However, Dataquest believes that, although the division is not a start-up company per se, the operation is the result of a new focus at Fairchild (prior to the acquisition by National) on high-performance MPUs.

APD was acquired in October 1987 for $6.25 million. APD employs more than 140 people involved in the engineering, manufacturing, sales, and support of the merchant market CLIPPER 32-bit RISC microprocessor. APD was formed in 1982 to develop an advanced MPU based on RISC principles. Howard Sachs formed APD and built the division to bring the new CLIPPER microprocessor to market. The CLIPPER 32-bit MPU family was the first commercially available RISC microprocessor to ship in volume production.

The first-generation CLIPPER RISC MPU is the C200. The C200 operates at either 25 or 33 MHz. The second-generation CLIPPER microprocessor, the C300, delivers twice the performance of the C200 and operates at 40 or 50 MHz. All of the current CLIPPER products are implemented in CMOS process technology. Future CLIPPERs will be implemented in both CMOS and bipolar process technologies. Currently, all of APD's fabrication is contracted to Fujitsu. All assembly and testing is done in-house.

CLIPPER microprocessors are currently used in both interactive computer systems and embedded applications. Interactive systems applications include business systems, engineering and graphics workstations, and board-level products based on the PC AT bus, VMEbus, and NuBus. As an embedded processor, CLIPPER's primary use is in Raster Image Processing. CLIPPER is also used in a high-speed dedicated database engine.

At this time, APD is the only RISC vendor to offer a full range of binary-compatible CPUs in three formats: individual chips, chip sets, and prepackaged RISC modules.

BOARD (Intergraph Corporation)
(Name and Affiliation)

James Meadlock, Chairman
Intergraph Corp., CEO

Roland Brown

Larry Laster
Intergraph Corp., Executive VP

Nancy Meadlock
Intergraph Corp., Executive VP

Keith Schonrock

James Taylor
Intergraph Corp., Executive VP

Robert Thurber
Intergraph Corp., Executive VP

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

VP and General Manager
Howard Sachs
Fairchild, General Manager

Director Engineering
Tim Robinson
High Level Hardware

Director Marketing
Ralph Kaplan
B.I.T., VP of Marketing

Director Software Engineering
John Kellum
Fairchild

Director Manufacturing
Steve Rowles
Fairchild, Director of Manufacturing

Director QA
Thomas Wehman
Fairchild, Director of QA

FINANCING

October 1987
Acquisition
$6.25M
Intergraph Corporation acquisition of Fairchild Advanced Processor Division

ALLIANCES

Fujitsu
Early 1987
Intergraph established a foundry agreement with Fujitsu, under which Fujitsu provides wafer fabrication services to the Advanced Processor Division.

MANUFACTURING

Technology

1.5-micron CMOS, moving to submicron CMOS in 1990

Facilities

Palo Alto, CA
50,000 sq. ft.
Assembly, test, marketing, QA, administration

PRODUCTS

CLIPPER C200 RISC MPU, 25 or 33 MHz
CLIPPER C300 RISC MPU, 40 MHz
CLIPPER C300 RISC MPU, 50 MHz

OTHER INFORMATION

Intergraph does not employ a PR firm.

International CMOS Technology, Inc.

2125 Lundy Avenue
San Jose, CA 95131
408/434-0678
Fax: 408/434-0688

ESTABLISHED: October 1983 **NO. OF EMPLOYEES: 50**

BACKGROUND

International CMOS Technology, Inc., (ICT) designs, manufactures, and markets CMOS EEPROMs, EPROMs, and EEPLDs. ICT stated that, in 1984, the Company successfully combined the first 5V-only CMOS EEPROM (the 93C46) in volume production.

The Company's current product offerings include the programmable electrically erasable logic (PEEL) family of CMOS PLDs. The PEEL products use the Company's CMOS 1.25- and 2.0-micron EEPROM technology and feature a propagation delay as fast as 15ns. Additional ICT products include serial EEPROMs; a 40ns, 64K CMOS UV-erasable PROM; and a 35ns, 32K UV-erasable PROM that targets the bipolar 24-pin PROM market.

ICT also offers design and development tools. The Company enlisted John Birkner, the inventor of the PAL (a trademark of Monolithic Memories), to create a low-cost, easy-to-use developmental package consisting of design software and a PC-based, software-controlled programmer. ICT gives the software, free of charge, to any party interested in using PEEL devices.

ICT is developing a family of products that will address the high-density PLD and programmable gate array markets. The introduction of these devices will complete a PLD family ranging from 20-pin, 300-gate equivalent PLDs to 40-/68-/84-pin, 10,000-gate programmable gate arrays.

The Company is planning advances in its memory lines as well and is working on process and design shrinks to minimize the access times further and allow for the fabrication of 256K and larger devices.

The Company was founded by Drew Allen Osterman, Dr. Samuel T. Wang, Dhaval J. Brahmbhatt, and Donald E. Robinson, all of whom were formerly with National Semiconductor Corporation, and Lawrence A. Yaggi, Jr., formerly with Perkin-Elmer. In January 1988, Paul K. Forster joined ICT as its first vice president of sales and marketing.

ICT entered into technology development agreements with Gould Semiconductor and Hyundai Electronics to offset major start-up costs. These agreements provide ICT with operating capital and a significant share of production capacity. The agreements also provide ICT with additional technical support in the form of CAD services and prototype wafer fabrication.

BOARD
(Name and Affiliation)

*Drew Allen Osterman, Chairman of the Board
CEO and President

Paul Reagan, Director

Lee Lunsford, Director

Ali Dad Farmanfarma, Director

*Dr. Samuel T. Wang, Director
Vice President of Technology

C.S. Park, Director

*Lawrence A. Yaggi, Jr.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Drew A. Osterman
National Semiconductor, Mktg Mgr NV Mems

VP Technology
*Dr. Samuel T. Wang
National Semiconductor, Sr Process Eng Mgr

VP Sales/Mktg
Paul K. Forster
Signetics, Dir Dist Sales

VP Dsn Engr
*Dhaval J. Brahmbhatt
National Semiconductor, Engr Mgr

VP Operations
*Donald E. Robinson
National Semiconductor, Prod Mgr EPROMs

VP CFO
*Lawrence A. Yaggi, Jr.
Perkin-Elmer, Controller

*Founder

FINANCING

1984
Rounds 1 and 2
$5.0M
Hyundai Electronics Industries

June 1987
Round 3
$2.0M
Undisclosed institutional investors

February 1988
Round 4
$2.9M
Undisclosed institutional investors

June 1989
IPO
$3.6M
Initial public offering

RECENT HIGHLIGHTS

January 1987
Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

June 1987
ICT raised $2.0 million in third-round financing. The funds were used for additional capital equipment and personnel and for general working capital. ICT also announced a move to a new 31,000-square-foot facility adjacent to its current site in San Jose, California.

July 1987
ICT offered four new CMOS UV EPROMs with access times of 35ns, 45ns, and 55ns. The 27CX641 and 27CX642 are organized as 8Kx8, and the 27CX321 and 27CX322 are organized as 4Kx8. The products differ in packaging.

September 1987
ICT offered the PDS-1 development system for designing and programming PEEL devices. Designers can use either ICT's APEEL compiler or third-party development software. The system includes an editor, a logic assembler, a PLD-to-PEEL translator, a programmer, and a device tester.

December 1987
ICT offered four new CMOS PLD devices. The 20-pin PEEL153 and 24-pin PEEL173 are plug-in replacements for bipolar FPLA devices. The 20-pin PEEL253 and 24-pin PEEL273 offer architectural enhancements to the PEEL153 and PEEL253, respectively.

January 1988
ICT signed a nationwide distribution franchise agreement with Marshall Industries.

February 1988
ICT raised $2.9 million in fourth-round financing from undisclosed institutional investors.

June 1989
Initial public offering

ALLIANCES

Hyundai
October 1983
Hyundai and ICT signed a joint development agreement to develop and produce seven or eight devices including 1K CMOS EEPROMs, fast SRAMs, and 64K EPROMs. Hyundai funded ICT's initial product development and allocated 30 percent of its wafer fab capacity for an equity interest in ICT.

IMP
July 1984
IMP and ICT codeveloped a CMOS EEPROM process (expired).

Gould
April 1986
ICT will transfer its CMOS EEPROM process semiconductor technology and products to Gould in exchange for foundry services and second-sourcing of PEEL and EEPROM devices. Gould will provide foundry services for ICT's new high-speed CMOS EEPROM family. Both companies will work on new product and technology development including work on PEEL products.

Asahi Chemical
January 1987
Asahi Chemical Industry received a license to ICT's technology and will market ICT's EEPROMs.

AMD
July 1989
ICT and AMD signed an agreement for joint development of a 1Mb EPROM device with an access time of 55ns.

MANUFACTURING

Technology

1.25- and 2.00-micron CMOS EE process
1.0- and 0.8-micron CMOS EE process in the near future

Facilities

San Jose, CA
31,000 sq. ft.
Headquarters, design, test, marketing, and sales

PRODUCTS

Memory

Device	Description
93C46	1K Serial 5V Read/Write EEPROM
93C66	4K Serial 2.5V to 7.0V Read/Write EEPROM
27CX321/322	4Kx8 UV-Erasable PROM, 35ns, 40ns, 45ns
27CX641/642	8Kx8 UV-Erasable PROM, 40ns, 45ns, 55ns

PEEL Devices

Device	Delay (ns)	Pins	Programmable Array(s)
PEEL18CV8	15	20	AND
PEEL22CV10	25	24	AND
PEEL20CG10	25	24	AND
PEEL153	30	20	AND/OR
PEEL173	30	24	AND/OR
PEEL253	30	20	AND/OR
PEEL273	30	24	AND/OR
PA7024	25	24	Undisclosed
PA7040	25	40	Undisclosed

PDS-1 development system that allows design with either ICT's PEEL logic compiler or third-party software. The system includes editor, logic assembler, logic simulator, PLD-to-PEEL translator, programmer, and device tester.

OTHER INFORMATION

International CMOS Technology's PR firm is Hayes/Rothwell Public Relations.

International Microelectronic Products

2830 North First Street
San Jose, CA 95134
408/432-9100
Fax: 408/434-0335
TWX: 910 338 2274
Telex: 499-1041

ESTABLISHED: January 1981 **NO. OF EMPLOYEES: 500**

BACKGROUND

International Microelectronic Products (IMP) designs and manufactures mixed analog/digital and complex digital CMOS ASICs. The Company is a full-service vendor with in-house capability that includes cell-based design methods, advanced CAD tools, and high-performance CMOS processes. Products designed by IMP are used primarily in the microcomputer, computer peripherals, and communications markets. IMP's goal is to achieve sales of $150 million by the early 1990s.

The Company is composed of three business groups. The IMP-Designed IC (IDIC) group performs complete IC design for customers. The Customer-Designed IC (CDIC) group links customers with their own designs and IMP's prototyping and production manufacturing. The Customer Technology Assistance Program (CTAP) supports customers in their long-term ASIC technology development efforts by coordinating technology licensing and joint development efforts for IC development and/or manufacturing capabilities in partnership with IMP.

In May 1986, IMP formed an affiliate company, IMP Europe Limited, headquartered in Swindon, England. IMP Europe's initial activities include custom IC design and applications engineering services for the European market.

In June 1987, IMP completed an initial public offering of 4.5 million shares of common stock that raised $22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability to redeem Series-A preferred stock and for general corporate purposes.

One of IMP's goals is to maintain a process technology leadership position among ASIC suppliers. The Company's 2- and 3-micron CMOS processes have the capability to implement various combinations of polysilicon and metal interconnect in p-well or n-well technology. In May 1988, a new 1.2-micron CMOS process and accompanying 1.2-micron analog and digital cell libraries were announced. They are tailored for mixed analog and digital functions on the same chip. The Company's facility uses all-stepper photolithography, gas plasma dry etchers, ion implantation, computer-controlled diffusion, and a computer parameter test process.

The Company's R&D programs currently focus on developing complex analog and digital cells for use in the IMP Design System; semiconductor manufacturing processes and device structures; advanced design software; and advanced networking, communications, and information systems for use in engineering and manufacturing. IMP is working with Silicon Compiler Systems Inc. to develop analog compilation techniques, with a leading university to develop advanced analog cells, and with the Company's IMP Europe affiliate for advances in CAD.

BOARD
(Name and Affiliation)

*George W. Gray, Chairman
International Microelectronic Products

Barry Carrington, Director
International Microelectronic Products

*Zvi Grinfas, Director
International Microelectronic Products

Russell Carson, Director
Welsh, Carson, Anderson and Stowe

Richard Smith, Director
Sohio

DuBose Montgomery, Director
Menlo Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Barry Carrington
AMI, Sr VP Mfg

Exec VP/CFO
Charles Isherwood
AMI, Sr VP Corp Svcs

Sr VP Ops
Larry Anderson
NEC, Mfg Manager

***Sr VP Sales**
Martin Landin
Gould AMI, VP Sales

VP Technology
Dr. Moiz Khambaty
AMI, CMOS Tech Dev

VP Materials
Paul Bolinger
Synertek, Project Manager

VP Sales
Bob Kromer
National Semiconductor, Regional Sales Mgr

*Founder

FINANCING

August 1981
Round 1
$8.8M
IMP management and individuals; Charles River Partnership; Citicorp Venture Capital; Continental Illinois Venture; Harvest Ventures; INCO Securities; Lambda; Menlo Ventures; Robertson, Colman, & Stephens; Vista Ventures; Welsh, Carson, Anderson and Stowe

1981
Lease
$13.0M
Bank of America, Orchard Properties

August 1982
Round 2
$7.4M
Initial investors (except IMP management and individuals); R.W. Allsop; Edinburgh Financial, U.K.; Foster Industries; Murray Johnstone, U.K.; Prudential Nominees, U.K.; Republic Ventures; Robinson Investments; Scottish Development Agency; Stewart Enterprises, U.K.; Toronto Dominion Bank; H.G. Usher, U.K.; Wilmark R&D (Ivory & Sime), U.K.

June 1983
Round 3
$14.2M
Same as round 2 (except Stewart Enterprises and Wilmark R&D); IMP management and individuals; Aiken Hume; Alex Brown & Sons; Citibank; Drayton Montagu; GE Pension Fund; Hillman Company; IBM Retirement Trust Fund; Kleinwort Benson; Latigo Ventures; Lombard Odier; Morgan, Grenfell & Co.; Morgan Stanley & Co.; Mutual Benefit Life; Pacific Technology Venture; Robert Fleming & Co.; Schulf, Woltman & Co.; Walter Scott & Partners

June 1984
Round 4
$3.0M
National Semiconductor

August 1984
$4.0M
Standard Oil of Ohio

June 1985
$6.2M
Northern Telecom, Standard Oil of Ohio

June 1986
£3.0M
CIN Investor Nominees Ltd.; Citicorp Venture Capital Ltd.; Pruventure, Syntech, Grosvenor Technology Fund

June 1987
$22.3M
Initial public offering

RECENT HIGHLIGHTS

September 1986
Barry Carrington, president, was promoted to CEO from COO. He succeeds George W. Gray, who remains as IMP's chairman of the board.

June 1987
IMP completed an initial public offering of 4.5 million shares of common stock, raising $22.3 million. The Company is using proceeds to upgrade its internal fab lines and design capability, to redeem Series-A preferred stock, and for general corporate purposes.

December 1987
IMP reported third-quarter revenue of $13.1 million for the period ending December 31, 1987. Net income for the period was $1.8 million, which was a 200 percent increase compared with the comparable quarter a year before.

May 1988
IMP announced a family of analog and digital 1.2-micron cell libraries and supporting CMOS processes. The ACL-1.2 and DCL-1.2 families can implement analog and digital functions on the same chip and can offer system speeds of 40 MHz. The digital CMOS process, called C1201, and the DCL-1.2 digital cell library became available in May 1988 in the United States and in Europe through IMP Europe. The analog CMOS process, C1202, and the ACL-1.2 analog cell library became available in January 1989.

ALLIANCES

Zoran
June 1983
IMP and Zoran codeveloped a CMOS PROM technology.

IXYS
November 1983
IMP codeveloped a high-voltage CMOS process with IXYS.

National Semiconductor
1984
IMP and National Semiconductor signed a five-year technology exchange and second-source agreement transferring IMP's standard cell designs in exchange for National's multiple-layer metal silicon-gate CMOS process, as well as future CMOS processes.

April 1985
IMP will second-source National's 2-micron gate arrays.

Micro Linear
June 1984
IMP and Micro Linear codeveloped a 10V CMOS process. IMP provides foundry services for Micro Linear.

Micro Linear/MBB
August 1986
IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

ICT
July 1984
IMP and ICT codeveloped a CMOS EEPROM process.

Iskra
April 1985
IMP and Iskra codeveloped a CMOS analog cell library for which IMP provides foundry services.

Lattice Logic
May 1986
Lattice Logic's CHIPSMITH Silicon compiler software became available with IMP's design rules.

Silicon Compilers
June 1986
SCI and IMP announced a strategic alliance to develop analog compilation capability for SCI's Genesil Silicon Development System. SCI will incorporate IMP's 3-micron, double-poly, double-metal process into the Genesil system.

Lasarray
August 1986
IMP and Lasarray agreed to cooperate on developing a family of base wafers for personalization on Lasarray's turnkey design and manufacturing system module. Initial wafers will contain a 2-micron, 2-layer metal CMOS 2,400-gate array with 1.5ns delay.

Electrolux
November 1987
IMP signed a five-year agreement with Electrolux of Sweden to develop ASIC devices that will be used in home appliances. IMP will also develop CAD tools for Electrolux and its component subsidiary, Electrolux Mecatronik. IMP will manufacture the devices in San Jose, California.

Mitel
March 1989
Mitel Corporation and International Microelectronic Products (IMP) announced a strategic alliance in communications chips including applications related to integrated services digital network (ISDN). Under the joint technology transfer agreement, Mitel will exchange four communications chip designs for IMP's MxCMOS 1.2 manufacturing process, ACL1.2-DCL1.2 cell libraries, and mixed analog/digital design methodology.

SERVICES

Foundry
Design
Prototyping

MANUFACTURING

Technology

3.0-, 2.0-, and 1.2-micron CMOS
P-well, double-metal, double-poly
5-inch wafers

Facilities

San Jose, CA
110,000 sq. ft.
Headquarters and manufacturing

16,000 sq. ft.
Class 10 clean room

PRODUCTS

CMOS Gate Array

Process	Linewidth	Delay	Gates
Si-Gate	2 Microns	1.0ns	800 to 6,000

CMOS Cell Library

Family	Process	Gate Length	Delay (ns)	Cells
ACL-3	Si-Gate	3.0 Microns	N/A	>40 Analog
DCL-3	Si-Gate	3.0 Microns	3.5	>0 Logic
DCL-2	Si-Gate	2.0 Microns	1.0	>0 Logic, RAM, ROM, PLA
ACL-2	Si-Gate	2.0 Microns	N/A	8 Analog
DCL-1.2	Si-Gate	1.2 Micron	0.3	70 Logic
ACL-1.2	Si-Gate	1.2 Micron	N/A	8

N/A = Not Applicable

Development Tools

Device	Description
IDS-II	Distributed Processing, Sun-Based Design System for Cell-Based and Full-Custom Products
UNT	Universal Netlist Translator (UNT) that Converts any Gate Array Netlist or Cell-Based Design to an IMP Cell-Based Design
SCF Compiler	Switched Capacitor Filter Compiler Software
SCIL	Standard Cell IC Layout System Software
BIL	Block IC Layout Software

OTHER INFORMATION

IMP's PR firm is Regis McKenna, Inc.

Isocom Limited

Prospect Way
Park View Industrial Est.
Brenda Road
Hartlepool, Cleveland, England
(0429) 221431

Isocom, Inc.

256 E. Hamilton Avenue, Suite H
Campbell, CA 95008
408/370-2212

ESTABLISHED: November 1982 **NO. OF EMPLOYEES: 84**

BACKGROUND

Isocom Limited was formed to design, manufacture, and market optocouplers with the goal of becoming a major participant in the $80 million military optocoupler market. Marketing efforts were concentrated in the European commercial and industrial markets for the first two years. In 1986, the Company began offering devices to the military market.

The Company's initial products included a range of optocouplers and interrupter switches in single-, dual-, and quad-package configurations. In 1984 and 1985, the product line expanded to include Hewlett-Packard-compatible, high-speed, high-gain optocouplers. Isocom's products, which currently include transistor-output, Darlington-output, AC-input, photo SCRs, TRIACs, and Schmitt Trigger optocouplers, are used in power supplies, telecommunications, instrumentation, and modems. In the second quarter of 1985, the Company became one of the first to offer a range of surface-mount devices.

Isocom was founded by several former Litronix managers and is headquartered in Hartlepool, England, with a U.S. sales and marketing office in Campbell, California. Design, manufacturing, and test are done at the 25,000-square-foot Hartlepool facility. Some assembly is contracted to companies in the Far East.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Colin Rees
Litronix, Mgr Europe Sales

Technical Dir
*Andrew Mann
Siemens, Prod Mgr Optocoupler Div

VP Isocom, Inc.
Sam Kaufman
Siemens, Director of Marketing

*Founder

FINANCING

Not available

MANUFACTURING

Technology

Silicon
GaAs
GaAlAs

Facilities

Hartlepool, England
25,000 sq. ft.
R&D, design, manufacturing, test

Campbell, CA
2,000 sq. ft.
Marketing and sales

PRODUCTS

Minicouplers
High-Speed/High-Gain Couplers
High-Isolation Optocouplers
High-Speed Tristate Optocouplers
High-Voltage Photo Transistor Couplers
Switches
Hybrids
Visible Lamps
Visible Displays
Integrated Displays

OTHER INFORMATION

Isocom does not employ a PR firm.

ISSI

680 Amador Lane
Sunnyvale, CA 94086
408/733-ISSI (4774)
Fax: 408/245-ISSI (4774)

ESTABLISHED: October 1988 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Integrated Silicon Solution, Inc., (ISSI) was founded in October 1988 by Jimmy Lee, K.Y. Han, and Fu Tseng to develop CMOS semiconductor products that provide superior system-level reliability, price, and performance.

The Company's initial focus is on high-performance SRAMs and cache memory products. First products will include 16K and 64K SRAMs and 16K and 64K cache data RAMs. ISSI will expand its product line to include SRAMs with densities up to 1Mb, cache controllers, and cache tag RAMs. The Company plans to develop BiCMOS TTL RAMs in mid-1990. In the future, ISSI plans to develop EE memories, EEPLDs, and Flash EEPROM devices. ISSI will begin taking bookings in December 1989, with volume production scheduled for mid-February 1990.

ISSI received funding from Wearnes Technology Corporation, the corporate venture capital investment office for the Wearnes Technology Group. The Wearnes Technology Group is a multinational computer and high-technology products manufacturer based in Singapore. The group has a high degree of vertical integration. ISSI will benefit from partnerships with sister companies in the Wearnes Group. Assembly, for instance, will be conducted by a sister company in Indonesia.

ISSI has entered manufacturing agreements with LSI Logic Corporation, Taiwan Semiconductor Manufacture Corporation, and United Microelectronics Corporation. All three of these companies will serve as foundries for ISSI. The Company has licensed technology to UMC and LSI. The Company will conduct R&D, design, test, and marketing operations at its Sunnyvale, California, facility.

BOARD

(Name and Affiliation)

*Jimmy Lee
ISSI, President

*K.Y. Han
ISSI, VP Engineering

*Dr. Fu H. Tseng
ISSI, VP Technology

Dr. Richard Yen
Wearnes Technology Corporation

Joe Liu
TechLink, President

George Liau
Audix

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Jimmy Lee
ICI, Engineering Manager

VP Technology
*Dr. Fu H. Tseng
Visic/VTI, Principal Process Staff

Dir Mktg
Richard Cimino
Wyle Dist. Grp., Area Sales Manager

VP Engineering
*K.Y. Han
Vitelic, Design Engineering Mgr

Dir Design Eng
Yun Hwang
MOSel, Engineering Director

*Founder

FINANCING

January 1989
Seed
$800,000
Private, Wearnes Technology Corp.

June 1989
Round 1
$1.5M
Private, Wearnes Technology Corp.

September 1989
Round 1
$0.5M
Private, Wearnes Technology Corp.

ALLIANCES

United Microelectronics Corporation
January 1989
ISSI signed a licensing and manufacturing agreement with UMC that covers ISSI's SRAM and cache product lines..

Taiwan Semiconductor Manufacturing Corporation
August 1989
ISSI signed a foundry agreement with TSMC.

LSI Logic
September 1989
ISSI signed a licensing and manufacturing agreement with LSI.

MANUFACTURING

Technology

1.2-, 1.0-micron single-poly, double-metal CMOS
0.8-micron CMOS available Q1 1990

Facilities

Sunnyvale, CA
10,000 sq. ft.
R&D, design, test, marketing

PRODUCTS

4Kx4 Sub-15ns (16K)
8Kx8 Sub-20ns (64K)
16Kx4 Sub-20ns (64K)
32Kx8 Sub-25ns (256K)
32Kx8 Low-Power Sub-70ns (256K)
128Kx8 Sub-35ns High-Performance (1Mb)
128Kx8 Low-Power Sub-70ns (1Mb)

OTHER INFORMATION

ISSI does not employ a PR firm.

IXYS Corporation

2355 Zanker Road
San Jose, CA 95131
408/435-1900

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 70**

BACKGROUND

IXYS designs, manufactures, and markets a specialized line of discrete power MOS devices, VLSI CMOS digital ICs, and CMOS analog ICs. The Company's products are designed for motion control applications in machinery, such as robots and home appliances, and in power conversion equipment, such as precision DC motors and high-voltage switches.

IXYS' smart power products include monolithic current sensing to simplify the design of current-mode switching power supplies. The Company plans to integrate a function that will monitor device junction temperature on the power chip.

IXYS also is working with NASA and other major aerospace companies to provide high-reliability space versions of the technology for all-electric aircraft and space station programs.

BOARD
(Name and Affiliation)

David Cooper, Chairman
IXYS Corporation, President/CEO

Jack Carsten, Director
U.S. Venture Partners

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
David Cooper
SGS-Thomson, WW Dir Power MOS

Exec VP
Nathan Zommer
GE Intersil, Mgr Pwr MOS R&D

Sr VP Power ICs
Dick Blanchard
Siliconix, VP Dsn & Tech

VP Worldwide Sales
Daniel Schwob
GE, Prod Mktg Mgr

VP Finance/Admin
Jim Wu
Siliconix, Controller

VP Marketing
Edward Day
Sprague Electric, Regional Sales Mgr

Ops Mgr
Tony DeCarlo
Intersil, Dir Custom Svc

Dir Operations
Walt Buchannan
G2, Dir Mktg

Chief Operating Officer
William T. Malanczuk
National Semiconductor, VP WW Waferfab and Technology

FINANCING

1983
Round 1
$0.8M
Fred Adler

October 1985
Round 2
$6.7M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership

August 1987
Round 3
$3.0M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Oak Investment Partners; U.S. Venture Partners

August 1988
Round 4
$6.2M
Adler & Co.; Burr, Egan, Deleage; Grace Ventures; Harvest Ventures; Arthur D. Little; Oak Investment Partners; Stanford University; U.S. Venture Partners; Zimmerman Family Partnership First Boston; Bay Partners; John F. Shea

RECENT HIGHLIGHTS

January 1986
IXYS offered its first product, the IXSE501, a Shaft Encoder Peripheral Interface IC. The device is a CMOS monolithic two-channel PWM control processor for micro-stepping two-phase stepper motors and other applications.

June 1986
IXYS offered a line of MOS insulated-gate transistors (MOSIGTs) developed by Nathan Zommer, who originally developed IGTs while at GE Intersil. The new devices combine the IGT design with polysilicon gate CMOS technology.

March 1987
IXYS relocated into a new 53,000-square-foot facility in San Jose, California. The facility, which is six times larger than the Company's former facility, includes an automated line and has capability for custom packaging. IXYS plans to invest between $2 million and $3 million in the line over the next two years.

March 1987
IXYS offered the IXMS150, a CMOS two-channel PWM control processor.

August 1987
IXYS named David Cooper president and chief executive officer. Mr. Cooper takes over the position from Alan Hofstein. Mr. Cooper will focus on expanding the Company's development efforts in power chips, high-voltage ICs, and power modules, with various new product introductions. Before joining IXYS, Mr. Cooper was worldwide director of power and smart power operations for SGS-Thomson, a Milan, Italy-based chipmaker with annual sales of more than $1 billion.

August 1987
IXYS raised $3.0 million in third-round financing.

October 1987
Dick Blanchard joined IXYS as senior vice president and heads the Company's smart power IC design team. Mr. Blanchard was with Siliconix previously, most recently as vice president of design and advanced technology development. He reports to Mr. Cooper.

November 1987
IXYS began offering its power MOSFETs and MOSIGTs in military packages.

December 1987
IXYS introduced the MOSBLOC IGBT family of modules, which range from 25A to 200A in both 600V and 1000V versions. The devices are packaged in bipolar Darlington modules, as used by Japanese vendors. The product family is aimed at motor control and other industrial applications that are served by Japanese suppliers. IXYS expects this product family to become its major commercial product line and to account for as much as $30 million per year in revenue.

August 1989
IXYS acquired the ASEA Brown Boveri Power Semiconductor Group in Lampertheim, West Germany.

ALLIANCES

IMP
November 1983
IMP and IXYS codeveloped a high-voltage CMOS process.

Ricoh
1984
IXYS and Ricoh signed a technology exchange for Ricoh to provide wafers; IXYS is providing its power MOSFET HDMOS process (expired).

Samsung
January 1986
IXYS signed an agreement with Samsung Semiconductor and Telecommunications under which Samsung will receive IXYS' power MOS technology for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas; the two companies will jointly manufacture IXYS' first smart power products.

ABB
May 1988
IXYS announced a joint venture agreement with ASEA Brown Boveri Corporation. The agreement is expected to strengthen the marketplace for industrial power control using ABB's patented copper substrate bonding technology and IXYS' advanced technology in smart power, IGBTs, and Mega MOS.

MANUFACTURING

Technology

1.2- to 4.0-micron CMOS HDMOS (high-performance DMOS)
5-inch wafers
4-inch wafers
6-inch wafers

Facilities

San Jose, CA
53,000 sq. ft.
Design, manufacturing, hi-rel assembly, test

PRODUCTS

PowerFETs

Device	Description
MegaMOS FETs	Large-Scale Monolithic Power MOSFETs
Power MOSFETs	High-Voltage n-Channel and p-Channel MOSFETs
MirrorFETs	Power MOSFET with Monolithic Current Sensing
LIMOFETs	Mega MOSFET with IC Drive Technology
HiPerFETs	Power MOSFET with High DV/DT Ruggedness
MOSIGBTs	Monolithic Power MOSFETs with Bipolar Devices
MOSBLOC Modules	Power MOSFETs or MOSIGBTs

Integrated Circuits

IXLD426-9	CMOS MOSFET Drivers
IXED0900/1500	CMOS Address Encoder/Decoder
IXMS150	CMOS Monolithic Two-Channel PWM Controller
IXPD610	Digital Pulse-Width Modulator (DPWM)
IXSE501	Shaft Encoder Peripheral Interface (SEPI)
IXSE510	16 Bit (SEPI)
IXBD4410	High Side/Low Side Driver

OTHER INFORMATION

IXYS' PR firm is Simon McGarry.

Krysalis Corporation

1135 Kern Avenue
Sunnyvale, CA 94086
408/749-7390
Fax: 408/739-5362

ESTABLISHED: 1985 **NO. OF EMPLOYEES: 12**

BACKGROUND

Krysalis was formed to develop and manufacture nonvolatile semiconductor memories, using a CMOS ferroelectric technology. Founders of the Company are Joseph T. Evans, formerly of the U.S. Air Force Weapons Laboratory, and William D. Miller, formerly of Signetics.

The Company plans to market 16K and derivative products as initial process vehicles. The products will feature an access time of 120ns and emphasize radiation-hardened and industrial applications.

Krysalis demonstrated the feasibility of manufacturing the devices with a 512-bit UniRAM memory part using a 3-micron process at Orbit Semiconductor. At this time, Krysalis is shipping a family of latch and register products, evaluation units, and a 4K serial RAM.

In October 1989, National Semiconductor Corporation acquired Krysalis' assets, including all rights to Krysalis' ferroelectric technology. National and Krysalis had previously entered into a technology agreement under which the companies agreed to share technology, product codevelopment, and manufacturing services.

The Company believes that its process can be applied to wide ranges of logic including ASICs, MPUs, and TTL-compatible logic. The ferroelectric technology also is said to be compatible with bipolar, CMOS, and GaAs processes.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Dr. James Harris
Akashic, Pres/CEO

VP Tech
*William D. Miller
Signetics, Process Dev

VP/CFO
Neil Hennessey
Gould NavCom, VP Finance

*Founder

FINANCING

May 1986
Seed
$1.0M
Columbine Venture Fund, Crosspoint Venture Partners, Meadows Ventures, OSCCO Ventures, Weeden Capital Partners

December 1986
Round 1
$3.2M
Initial investors

October 1989
Acquired by National Semiconductor Corporation

RECENT HIGHLIGHTS

1987
Krysalis set up a small, $3.0 million materials research laboratory in New Mexico.

December 1987
Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. (See "Alliances" for more details.)

ALLIANCES

National Semiconductor
December 1987

Krysalis signed a seven-year agreement with National Semiconductor for the joint pursuit of UniRAM technology. National will provide product engineering, manufacturing, and marketing support. Initially, National will supply base wafers based on a 2-micron process. Krysalis will complete fabrication of the wafers through packaging, test, and burn-in. Krysalis will conduct its own marketing and sales.

PRODUCTS

Family of Latch and Register Products
Evaluation Units
4K Serial RAM

OTHER INFORMATION

Krysalis does not employ a PR firm.

MANUFACTURING

Technology

2- and 3-micron

Facilities

Sunnyvale, CA
Albuquerque, NM

Kyoto Semiconductor Corporation

418-3, Yodosaime-cho
Fushimi-ku Kyoto 613, Japan
075-631-8823
Fax: 075-631-8291

ESTABLISHED: April 1980 **NO. OF EMPLOYEES: 20**

BACKGROUND

Kyoto Semiconductor offers GaAs light-emitting diodes (LEDs), phototransistors, photosensors, and LED displays. The diodes offer twice the efficiency of available units. The heterostructured diodes feature a 23.6 percent light-emitting efficiency at peak wavelengths of 190nm. Four selections of wavelengths are available: 660, 750, 830, and 890.

Kyoto Semiconductor's major customers are Mitsubishi Electric and General Instrument. The Company contracts assembly to companies in Taiwan.

BOARD

Not available

PRODUCTS

High Bright LEDs
Infra LEDs
Photo TRs
Photosensors
LED Displays

OTHER INFORMATION

Kyoto Semiconductor does not employ a PR firm.

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
Jousuke Nakata
Mitsubishi

FINANCING

Capitalization: ¥62 million

MANUFACTURING

Not available

Facilities

Kyoto, Japan
Production

Lattice Semiconductor Corporation

555 N.E. Moore Court
Hillsboro, OR 97124
503/681-0118
Fax: 503/681-3037

ESTABLISHED: April 1983 **NO. OF EMPLOYEES: 110**

BACKGROUND

Lattice Semiconductor Corporation (LSC) designs, develops, manufactures, and markets high-performance PLDs using a proprietary EE CMOS technology. LSC has pioneered a line of high-speed PLDs called Generic Array Logic (GAL) as direct pin-for-pin replacements of bipolar PAL devices. The next generation, ispGAL devices, includes in-system programmability that makes logic configurable "on the fly" under software control for robotics and artificial intelligence applications.

LSC has established agreements with National Semiconductor and SGS in Milan, Italy. In exchange for the right to use certain GAL designs, the companies provide wafers and assembly services. The Company conducts all final testing, including quality and reliability testing, at the LSC facility in the United States.

In September 1986, Monolithic Memories, Inc. (MMI), filed a class action suit against LSC and Altera, charging patent infringement of the PAL architecture. LSC filed a $300 million countersuit charging MMI with abusing the Sherman Act, i.e., trying to destroy the competition. The MMI suit brought negotiations for additional financing, which were in progress, to a standstill. In December 1986, Rahul Sud, president; Jay McBride, general manager; S. Robert Brutbarth, and Kishan C. Sud resigned from LSC. As a result of these events, during 1987, LSC took aggressive actions to restructure the Company and filed a voluntary petition for protection under the Chapter 11 federal bankruptcy law.

On September 28, 1987, LSC's reorganization plan under federal bankruptcy law became effective, marking the Company's exit from Chapter 11. As a result of the restructuring, the Company raised $1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson. In November 1987, LSC relocated to a new headquarters in Hillsboro, Oregon, tripling its manufacturing space. Also in November, LSC and MMI settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents in PLDs.

In 1987, LSC signed Arrow Electronics as its authorized U.S. distributor and also signed Almex, in France; Alcom, in the Netherlands; Bacher GmbH, in the Federal Republic of Germany; and Henaco, in Norway. In addition, Lattice signed sales representatives in the United States and the United Kingdom.

BOARD
(Name and Affiliation)

C. Norman Winningstad, Chairman
Floating Point Systems, Chairman

Dan Hauer
S-MOS (Seiko-Epson), President

Harry A. Merlo
Louisiana Pacific Corp., Chairman/CEO

Roy Pollack
RCA (retired)

Ole Christian Sand
Elcon Partners; Oslo Norway

Douglas C. Strain
Electro Scientific Industries, Vice Chairman

Cyrus Tsui
Lattice Semiconductor Corp, CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Cyrus Tsui
AMD, VP PLD Div

VP Finance/Admin
Jan Johannessen
N/A

VP Sales
Paul Kollar
Signetics, Dir Natl Ops

Dir Marketing
Bill Wiley Smith
Silicon Systems, Dir Apps

VP/Operations
Daniel Hu
AMD, VP Calif Wafer Fab Op

FINANCING

1983
Round 1
$1.9M
Datavekst A/S, Norway; Floating Point Systems, Inc.; Louisiana-Pacific Corp.; Harry A. Merlo, C. Norman Winningstad, and other corporate stockholders

July 1984
Credit
$2.7M
Oregon Bank, U.S. National Bank

September 1987
Round 2
$1.6M
Previous investors

January 1988
Credit
$1.5M
First Interstate Bank

February 1988
Round 3
$2.5M
Institutional investors

April 1988
Round 4
$5.0M
Institutional investors

September 1989
IPO
$14.0M
Initial public offering

RECENT HIGHLIGHTS

September 1986
LSC adds Bell Industries of Los Angeles, California, as a distributor.

October 1986
LSC offers GAL16V8-25P and GAL20V8-25P "quarter-power" devices that are 25ns PLDs and operate with only 45 milliamperes. The GALs can be configured into any one of 21 PAL architectures.

October 1986
LSC offered Q11987, an 8Kx8, 64K CMOS SRAM with an access time of 25ns.

April 1987
LSC offered the GAL39V18, a programmable logic device using EE CMOS technology. Maximum delays are 30ns from input to output and 15ns from clock to output.

June 1987
LSC recalled its fast 64K EEPROM product line, which it began sampling in late 1986 due to engineering flaws.

July 1987
LSC filed a voluntary petition for protection under Chapter 11 federal bankruptcy law. The Company cut back on its SRAM development and laid off approximately 15 employees.

September 1987
LSC's reorganization plan under federal bankruptcy law became effective on September 28, 1987, and marked the Company's exit from Chapter 11. As result of the restructuring, the Company raised $1.6 million in cash, giving the Company a positive net worth. The plan received unanimous approval and strong support from the creditors' committee, which includes representatives of S-MOS and its parent company Seiko-Epson.

November 1987
LSC relocated to a new headquarters in Hillsboro, tripling its manufacturing space.

November 1987
LSC and Monolithic Memories, Inc., settled the lawsuits filed against each other. LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

December 1987
LSC announced a 33 percent reduction on the average selling price of its GAL devices.

January 1988
LSC, although a privately held company, reported product sales of $3.4 million for the third quarter ending January 3, 1988. The $3.4 million was a 93 percent increase over the third-quarter sales the year before. Second-quarter sales, for the period ending September 26, 1987, were $2.9 million. LSC also reported annual revenue exceeding $13.5 million.

ALLIANCES

Floating Point Systems
1983
LSC and Floating Point Systems agreed to exchange technology for LSC's UltraMOS technology and FPS' DSP and array processor technology. Floating Point Systems gained major equity participation as well as long-term purchasing agreements from LSC. (expired)

Synertek
July 1984
LSC and Synertek signed a cross-licensing and second-sourcing agreement allowing Synertek to use LSC's UltraMOS process to manufacture a 35ns, 64K SRAM in exchange for a portion of Synertek's production capacity in Santa Cruz, California. (expired)

VLSI Technology
September 1984LSC provided technology for CMOS EEPROMs and SRAMs to VLSI Technology in exchange for foundry services at VLSI. (expired)

Seiko-Epson/S-MOS
January 1986
LSC announced a manufacturing and second-sourcing agreement. Seiko-Epson acquired the license to LSC's 16Kx4 SRAM design and process technology; S-MOS acquired the rights to market the part in North America.

SGS
February 1987
LSC signed a technology agreement with SGS Semiconductor, giving SGS a license to second-source LSC's GAL products. SGS will manufacture the GAL products for LSC, and both companies will cooperate on the design of future PLD products.

National Semiconductor
May 1987
National Semiconductor made a minority capital investment in LSC and licensed its GAL technology. The five-year agreement includes co-development of denser architectures of both standard and in-system programmable GALs, as well as a new line of FPLAs and sequencer devices.

MMI
November 1987
LSC licensed MMI's patent, and both companies exchanged rights to their worldwide patents on PLDs.

AMD
May 1989
Lattice signed a new cross-licensing agreement with AMD. Under the agreement, Lattice is licensed to manufacture AMD's industry-standard 22V10 programmable logic device and to use the 22V10 architecture in manufacturing GAL products. AMD is licensed to manufacture GAL devices using Lattice's architecture.

MANUFACTURING

Technology

1.1 to 0.9-micron CMOS
6-inch wafers

Facilities

Hillsboro, OR
44,000 sq. ft.
Design and test

PRODUCTS

GAL Products

Device	Speed
GAL16V8	10 to 25ns
GAL16V8A	10ns
GAL20V8	10 to 25ns
GAL22V10	15ns
GAL6001	30ns
ispGAL 16Z8	15 to 25ns

Development Tools

All Devices	Third-Party Development Support from Leading PLD Systems, Both Hardware and Software

OTHER INFORMATION

LSC's PR firm is KVO, Inc.

Level One Communications Inc.

105 Lake Forest Way
Folsom, CA 95630
916/985-3670
Fax: 916/985-3512

ESTABLISHED: November 1985 **NO. OF EMPLOYEES: 39**

BACKGROUND

Level One Communications Inc. designs, manufactures, and markets system-specific transceivers (transmitters/receivers) and associated peripheral circuits for the twisted-pair, high-speed digital communications market. Products are designed for integrated voice, data, and video communications systems and networks at speeds from 19.2 Kbps to 16.0 Mbps.

Transceivers combine digital and analog circuitry to convert digital impulses into line code, a language that travels more efficiently on twisted-pair wire than nonencoded digital signals. The sending transceiver converts data according to a given line code and transmits it through twisted-pair wires. The transceiver at the receiving end of the line decodes the encoded signals to data.

Level One offers integrated analog and digital ASIC transceiver ICs that can be tailored to specific systems using a modular cell-based approach. To accelerate design time significantly, Level One has developed the LxLIB, a library of predefined mixed analog and digital ICs and functional blocks that can be assembled quickly. Level One also has developed proprietary CAD simulation tools dedicated to transceiver development. The CAD simulation and techniques model the physical-level communications systems and associated transmission lines. The line simulator also is used for automated component testing by providing analog input waveforms to the tester.

Level One's transceiver products are composed of front and back ends. The front end is the transceiver core and contains blocks of cells that perform the analog functions such as pulse shaping, encoding, and timing and data recovery. The back end is the system interface, which handles the digital functions and the interface to each customer's system.

The Level One design team has had extensive experience in PBX transceivers and ISDN devices at companies such as AMD, AT&T Bell Labs, Hitachi, Intel, Mitel, National Semiconductor, and Rockwell.

As of October 1988, the Company had completed four rounds of funding. The seed round was completed in December 1985, when Julian, Cole & Stein, a Los Angeles-based venture capital firm, purchased 38 percent of the Company for $800,000. In December 1986, Julian, Cole & Stein purchased an additional percentage of the company for $2 million. The third round brought investments of $5 million, with lead investors Warburg, Pincus Ventures Inc., and Julian, Cole & Stein. The fourth round of funding resulted from a private placement, arranged by Merrill Lynch Capital Markets, of convertible preferred stock for Julian, Cole & Stein's Strategic Technologies Portfolio. This funding brought an additional $6.25 million to Level One, which will be used for business expansion, new product development, and general working capital.

The Company leased a 21,000-square-foot facility in Folsom, California, where it conducts R&D and design. Level One has contracted International Microelectronic Products (IMP) and Mitel to manufacture its products. IMP will work closely with Level One to adapt its CMOS process to meet the specific analog and digital requirements of integrated transceivers.

BOARD:
(Name and Affiliation)

Charles R. Cole
Julian, Cole & Stein, Partner

James M. Julian
Julian, Cole & Stein, Partner

Dr. Henry Kressel
N/A

Dr. Robert S. Pepper
Level One Communications, President/CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Dr. Robert Pepper
RCA, VP/GM Solid State Div

VP Mktg/Sales
J. Francois Crepin
LSI Logic, Dir WW Strat Plan

VP Finance/Admin
*Terry S. McCoy
American Continental, Dir Finance

VP Engineering
Cecil Aswell
Siemens, Dir Engr

*Founder

FINANCING

December 1985
Seed
$0.80M
Julian, Cole, & Stein

December 1986
Round 1
$2.00M
Julian, Cole, & Stein

September 1987
Round 2
$5.00M
Julian, Cole and Stein; Warburg, Pincus Ventures Inc

September 1988
Round 3
$6.25M
Merrill Lynch Capital Markets private placement for Julian, Cole, and Stein. Investors included Ameritech Pension Fund; Delaware State Employees Retirement Fund; The St. Paul Companies; Transamerica Occidental Life Insurance Company

ALLIANCES

LTX
1986
Level One was selected to codevelop and field test new ISDN platforms with LTX.

Mitel
May 1988
Level One and Mitel signed a 5-year joint development and second-source agreement that covers advanced transceivers for T-1 transmission and ISDN markets.

MANUFACTURING

Technology

3.0-micron double-poly, double-metal, 5V CMOS
2.0-micron double-poly, double-metal, 5V CMOS
1.5- and 1.2-micron planned
Level One contracts its foundry work to International Microelectronic Products of San Jose, California

Facilities

Folsom, CA
21,000 sq. ft.
Administration, design, R&D, and test

PRODUCTS

Device	Description
LXT200	ISDN STT Interface Transceiver
LXP302	T1/ESF Digital Trunk Interface Circuit
LXP303	CEPT/CRC Digital Trunk Interface Circuit
LXP600	Clock Adapter

Products under Development

LXT130	TCM Transceiver (3,000 feet)
LXT134	Quad TCM Transceiver (3,000 feet)
LXT131	TCM Transceiver (6,000 feet)
LXT135	Quad TCM Transceiver (6,000 feet)
LXT300	T1/CEPT Integrated Transceiver
LXT324	T1 Quad Receiver
LXT400	DDS Transceiver

OTHER INFORMATION

Level One's PR firm is Regis McKenna, Inc.

Linear Integrated Systems Inc.

47853 Warm Springs Boulevard
Fremont, CA 94539
415/659-1015
Fax: 415/659-1365

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 50**

BACKGROUND

Linear Integrated Systems Inc. (LIS) designs, manufactures, and markets standard and custom low-noise, precision, linear ICs and high-resolution A/D and D/A converter ICs. The Company's products are designed to serve data acquisition applications in the military, industrial, and medical market sectors. LIS provides ASIC design services using a cell-based design approach. The Company's cell-based library uses an advanced set of automated layout tools that combine cells, process, and software.

LIS began offering products in January 1988 and currently offers 18 products. Future plans include expanding the Company's high-resolution, high-speed, high-accuracy data conversion products; low-noise, high-precision linear ICs products; and additional cell-based designs in both the linear and digital areas. Developments will emphasize military applications with higher levels of radiation hardness.

The Company was founded by John Hall, who founded and served as president of Micro Power Systems. The Company conducts manufacturing and engineering in Fremont, California. Recently, a second facility was completed; it houses design and corporate offices.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*John Hall
Micro Power

General Manager
Bob Sabo
Micro Power

Dir Mktg
Richard Hall
Micro Power

*Founder

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

Bipolar linear
1.5- to 5.0-micron high-density CMOS
Both processes are offered with dielectric isolation and the capability to withstand high levels of nuclear radiation.

Facilities

Fremont, CA
10,000 sq. ft.
Administration, design, manufacturing, test

The Company has an additional 5,000 sq. ft. of dedicated capacity.

SERVICES

ASIC Design

Linear Integrated Systems Inc.

PRODUCTS

Precision Low-Noise Linear ICs
High-Resolution A/D and D/A Converter ICs
Cell-Based Library of Linear/Digital Cells

OTHER INFORMATION

Linear Integrated does not employ a PR firm.

Linear Technology Corporation

1630 McCarthy Blvd.
Milpitas, CA 95035-7487
408/432-1900

ESTABLISHED: September 1981 **NO. OF EMPLOYEES: 450**

BACKGROUND

Linear Technology Corporation (LTC) designs, manufactures, and markets a broad line of standard high-performance linear ICs using silicon gate CMOS and bipolar technologies. The Company markets about 180 linear ICs, with temperature and packaging variations resulting in more than 1,800 device types, one-half of which are proprietary. Products focus on the instrumentation, process control, industrial, and military markets.

The Company specializes in precision products in the analog and analog-to-digital interface markets and also provides proprietary linear functions for its products, including data acquisition products. LTC supplies op amps, voltage regulators, references, data conversion devices, interface devices, monolithic filters, and special-function devices such as temperature sensors. In the future, LTC plans to increase its presence in the converter and interface markets. LTC benefits from the increasing prominence of its proprietary chips and from the absence of Japanese competition.

The Company has a strong presence in the military market, accounting for approximately 10 percent of worldwide sales and about 35 to 40 percent of North American sales. From its beginning, LTC followed a marketing strategy aimed at penetrat- ing the military market. In August 1984, LTC received DESC JAN Class-B qualification and, in 1987, also achieved certification to begin fabrication of JAN Class S-level linear devices for space applications. The first Class-S product is the LM108AH, an operational amplifier that was shipped in 1988.

Linear Technology was founded in 1981 by Robert H. Swanson, Jr., Robert C. Dobkin, Brian E. Hollins, Brent Welling, and Robert Widler from National Semiconductor's linear design group. In September 1982, the manufacturing team was in place and the Company had moved into its current facility in Milpitas, California. By January 1983, the Company had produced its first wafers.

In May 1986, LTC established a company in Tokyo, Japan, to provide technical services to its Japanese customers. The company, named Linear Technology K.K., is wholly owned by the U.S. parent.

In September 1986, LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas. The Company's previous headquarters were taken over by LTC's expanded design, engineering, and domestic high-reliability assembly and wafer fabrication operations already located in the building.

In 1987, LTC signed an agreement with Texas Instruments, providing the Company with TI's BiCMOS manufacturing, assembly, test, and CAD tools, and a credible second source.

LTC markets its products through a network of independent sales representatives and electronics distributors. The Company also has approximately 1,000 OEM customers, including Compaq, Fujitsu, Honeywell, HP, Hughes, Philips, Raytheon, Rockwell, and Siemens.

BOARD
(Name and Position)

*Robert H. Swanson, Jr.
Linear Technology Corporation, President, CEO

Regis McKenna
Regis McKenna, Inc., Chairman

Glenn M. Mueller
Mayfield Fund, General Partner

Thomas S. Volpe
Volpe & Company, Managing Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Robert H. Swanson
NSC, VP/GM Linear IC Ops

VP Operations
Dr. Clive B. Davies
NSC, Grp Dir Adv Tech

VP Engineering
*Robert C. Dobkin
NSC, Dir Adv Circuit Dev

VP Mktg/Sales
William A. Ehrsam
NSC, Grp Dir Mktg Commun

VP Finance/CFO
Paul Coghlan
GenRad, VP/GM Test Prod Div

*Founder

FINANCING

September 1981
Round 1
$5.0M
Capital Management Services; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Mayfield Fund; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors

May 1982
Round 2
$5.0M
Olivetti, Finance for Industry, and a Hong Kong investor

Lease
$9.0M
Greyhound Computer Corp.

April 1983
Round 3
$7.0M
Cowen and Company, Greivson Grant, Kemper Financial, Kleinwort Benson, Morgan Stanley, State Farm, Touche Remnant, and others

Lease
$9.0M
Greyhound Computer Corp.

May 1986
Initial public offering
$24.0M

RECENT HIGHLIGHTS

May 1986
LTC established a Japanese unit to strengthen its technical services to Japanese customers. The unit is Linear Technology K.K. and is wholly owned by LTC in the United States. Robert Swanson was appointed president and Atsushi Nakata, general manager.

September 1986
LTC moved its headquarters and some of its operations to a new 43,000-square-foot building next to its current headquarters in Milpitas.

December 1986
LTC announced voltage references and other devices in surface-mount packages.

February 1987
Linear introduced its XH series that includes five linear ICs guaranteed to operate at a temperature range from -125° to +200° centigrade.

April 1987
LTC offered the LT1030, a bipolar line driver. The quad, low-power, line driver is part of LTC's family of RS-232 driver/receiver circuits. It can be used as an interface, an RS-232 driver, or as a logic-level translator.

June 1987
LTC offered the LTC1090, a 10-bit CMOS data acquisition system. It includes a software-controlled 8-bit analog multiplexer with sample-and-hold and a 10-bit ADC. The device operates in a full-duplex mode, and a selection feature allows data to be transmitted either most-significant-bit (MSB) first or least-significant-bit (LSB) first.

July 1987
LTC received QPL Part-1 approvals from DESC for 10 of the company's BiFET and low-noise operational amplifiers and negative adjustable regulators. This brings the number of JAN QPL parts available to 30.

ALLIANCES

Silicon General
July 1982
LTC and Silicon General signed a technology exchange and second-source agreement under which Silicon General provides pulse width modulators and two additional circuits and second-sources several high-current series pass regulators developed by LTC; no masks are involved. (expired)

Teijin/Japan Macnics/Technology Trading
June 1983
LTC signed an agreement with Teijin Advanced Products, Japan Macnics, and Technology Trading for distribution in Japan.

Signetics
June 1984
LTC and Signetics signed a three-year agreement granting Signetics the right to purchase die in wafer form and manufacturing rights for three precision op amps and other unnamed products. Signetics provided LTC with certain small-outline packaging services. (expired)

Interdesign
July 1984
LTC and Interdesign entered into a three-year agreement granting Interdesign the right to design IC arrays, using up to three of LTC's processes. LTC also agreed to dedicate foundry capacity to manufacture the Interdesign arrays. (extended)

Motorola
January 1985
Motorola and LTC signed a seven-year agreement granting each other rights to several patents. LTC gained rights to several Motorola patents; Motorola gained rights to patents obtained and filed during the term of the agreement, which expires in 1991. LTC also will make specific lump-sum payments through 1991.

National
July 1986
National and LTC entered into a patent-licensing agreement granting LTC rights to products under two National BiFET patents. National was granted rights to LTC's BiFET-related patents, including those filed through 1992. LTC pays royalties.

TI
March 1987
LTC and Texas Instruments signed a five-year agreement allowing TI to select six of LTC's circuits every six months for the duration of the agreement. TI will pay LTC $500,000 every six months and pay royalties for a 10-year period on any LTC circuit that TI produces.

MANUFACTURING

Technology

Single-layer polysilicon bipolar
Single- and double-layer silicon-gate (LTCMOS)
4-inch wafers
5-inch wafers

Facilities

Milpitas, CA
40,600 sq. ft.
Administration and manufacturing

20,000 sq. ft.
Class 10 clean room

42,000 sq. ft.
Linear headquarters and test

Most commercial product assembly is subcontracted to companies in South Korea, Malaysia, Thailand, and Taiwan.

PRODUCTS

Regulators
Positive fixed and adjustable regulators ranging from 125mA to 5A.

Reference
Wide range of references from 1.2V to 10.0V.

Op Amps
LTC offers a complete line of Op Amps and more than 40 different chips.

Comparators
Dual, CMOS Dual, High-Speed and Window Comparators, and Voltage Regulator plus Comparator

Filters
Single, Dual and Triple Filters, Five-Pole, Maximally Flat, Low-Pass Filter, 8th Order, Quad 80-kHz Switched Cap Filter

Regulating Pulse-Width Modulators
Switching Regulator, Switching Regulator Controller, Switching Power Supply Circuit, Oscillator Accuracy

Interface Products
RS-232 Line Driver, Triple RS-232 Driver/Receiver, 5V Powered RS-232 Driver/Receivers, Programmable Power Hex Translator/Driver/Receiver

Data Acquisition Products
10-Bit Data Acquisition Systems, 10-Bit Serial I/O ADC with Reference Pin of 6-Channel MUX, 10-Bit Serial I/O with 8-Channel MUX

Other Products
Current Source, Voltage Converters, Power Buffer, Reference Diodes, Voltage Inverter, Cold-Junction Compensator Kit for Thermocouples, Sample-and-Hold Amplifier

OTHER INFORMATION

Linear Technology Corporation's PR firm is Tycer, Fultz, & Bellack.

Logic Devices Inc.

628 E. Evelyn Avenue
Sunnyvale, CA 94086
408/720-8630
Fax: 733/7690
Telex: 172387

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 55**

BACKGROUND

Logic Devices Inc. designs, manufactures, and markets very high performance semiconductors using 1.2-micron CMOS process technology. The Company's products address applications that require very high operating speeds and/or low-power operation.

The Company offers a line of high-performance 16K, 64K, and 256K SRAMs; a line of high-performance building block components for DSP applications; and a line of computer interface circuits that implement the SCSI standard. The products are used in military signal-processing systems (radar, sonar, and seeker systems), video and medical imaging systems, array processors and superminicomputers, engineering workstations, telephony systems, and personal computers.

Approximately 30 percent of the Company's sales are products produced in full compliance with MIL-STD-883 Rev. C. In addition, the Company produces a portfolio of custom circuits that address high-end military DSP applications (adaptive FIR filtering) and telecommunications problems such as echo canceling, ADPCM compression, and cross-point switching.

Company operations in Sunnyvale, California, include administration, sales and marketing, engineering, assembly, and high-reliability testing and screening. Commercial products are offered in plastic dual-in-line, leaded chip carriers, and SOIC packaging. Military products are available in leaded and leadless chip carriers, flat packs, and pin grid array packages. Manufacturing operation follows the requirements of MIL-STD-9858, -45662, and -883C. These operations have been audited and approved by many major military systems contractors.

Products are marketed through a network of domestic and international stocking distributors and manufacturers' representatives, with 103 locations worldwide. U.S. distributors include Cypress Electronics, Falcon, Future, and Milgray. The Company operates direct regional sales offices in Los Angeles, California and New York City, New York.

BOARD
(Name and Affiliation)

Howard L. Farkas
Farkas Realty, Chairman

William J. Volz
Logic Devices Inc., President

James McAllister
Logic Devices Inc., VP Operations

Burton W. Kantor
Walnut Capital Corp., COB

Albert Morrison
Caplan, Morrison, Brown & Company, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*William J. Volz
TI, Technical Staff

Sr VP Operations
James McAllister
Indy Electronics, Executive VP

CFO
Todd Ashford
W.R. Grace, Financial Analyst

VP Mktg/Sales
Joe Krouse
IDT, HQ Sales Mgr

Nat Sales Manager
Del Valek
ITT, Sales Manager

Dir QA/Rel
Don Taylor
Exar, QA Manager

VP Technology
Tony Bell
VLSI Design, Consultant

VP Strategic Bus
Gary Ater
Vitelic Assoc, N/A

Dir Prod Mktg
Joel Dedrick
Texas Instruments, N/A

*Founder

FINANCING

November 1988
IPO
$5.4M
Initial public offering

MANUFACTURING

Technology

1.2- and 1.5-micron CMOS
0.9 micron CMOS

Facilities

Sunnyvale, CA
12,500 sq. ft.
Administration, sales and marketing, engineering, assembly, high-reliability testing and screening

2,500 sq. ft.
Clean room

PRODUCTS

SRAMs

Device	Description	Speed
L6116	2Kx8	20ns
L7C161/162/164/165/166	16Kx4	20ns
L7C167	16Kx1	12ns
L7C168 through 172	4Kx4	15ns
L185/186	8Kx8	25ns
L7C187	64Kx1	15ns
Specialty Memory Circuits		
L10C11	18x8-Bit Variable Delay	
LRF07	Three Independent Port 8x8	35ns
LRF08	Five Independent 8x8	35ns
L29C520/521	8-Bit Multilevel Pipeline Registers	22ns
LPR520/521	16-Bit Multilevel Pipeline Registers	22ns
L29C524/525	16-Stage Pipeline Registers	
L29C818	Shadow Register	
Multipliers		
LMU08	8x8 Signed Parallel Multiplier	35ns
LMU8U	8x8 Unsigned Parallel Multiplier	35ns
LMU557/558	8x8 Mixed Parallel Multipliers	60ns
LMU12	12x12 Parallel Multipliers	35ns
LMU112	12x12 Reduced Pincount	50ns
LMU16/216	16x16 Parallel Multipliers	35ns
LMU17/217	16x16 Microprogrammable Multipliers	45ns
LMU18	16x16 Parallel Multiplier with Dedicated 32-Bit Output Port	35ns
LMS12	12x12 Video Multiplier with 26-Bit Adder	40ns

Multiplier/Accumulator Circuits

Device	Description	Speed
LMA1009	12x12 Multiplier/Accumulator	45ns
LMA1010/2010	16x16 Multiplier/Accumulators	45ns
Arithmetic Logic Units		
L29C101	16-Bit Slice (4x2901 & 2902)	35ns
L4C381	16-Bit Cascadable Adder/Subtractor (4x54S381)	26ns
LSH32	32-Bit Cascadable Barrel Shifter/Normalizer	32ns
L10C23	64x1 Digital Correlator	20ns
Communications Controllers		
L5380	Asynchronous SCSI Controller Chip	4Mbps
L53C80	SCSI Controller	4Mbps

OTHER INFORMATION

Logic Devices' PR firm is Faries and Associates.

Lytel

61 Chubb Way
P.O. Box 1300
Somerville, NJ 08876
201/685-2000
Fax: 201/685-1282

ESTABLISHED: October 1984 **NO. OF EMPLOYEES: 130**

BACKGROUND

Lytel was formed to design, develop, and manufacture InGaAsP technology-based electro-optic components for the telecommunications, data communications, and military markets. Products include semiconductor lasers, LEDs, and photodetectors using an indium phosphide materials technology.

Lytel's first products, introduced in January 1986, were InGaAsP high-power lasers for fiber-optic applications. The Company is focusing on quality, reliability, delivery, and performance.

Lytel occupies a 57,000-square-foot facility that includes a Class 1,000 clean room.

BOARD

Not Available

COMPANY EXECUTIVES
(Position and Name)

GM
Gerald Leehan

VP Engineering & Development
*Ron Nelson

Controller
Tim Bock

*Founder

FINANCING

1984
Start-up
$20.0M
AMP

November 1988
N/A
Became a subsidiary of AMP

ALLIANCES

Not available

MANUFACTURING

Technology

InGaAsP
1.3-micron opto components

Facilities

Somerville, NJ
57,000 sq. ft.
Manufacturing, assembly, test

5,000 sq. ft.
Class 1,000 clean room

PRODUCTS

InGaAsP High-Power Lasers
LEDs
Optical Data Links

OTHER INFORMATION

Lytel's PR firm is The Jason Group.

Matra-Harris Semiconducteur

La Chantrerie/Route Gachet
B.P. 942
44075 Nantes cedex/France
(40) 303030
Telex: MATHARI 711930 F

ESTABLISHED: 1979 **NO. OF EMPLOYEES: 1,000**

BACKGROUND

Matra-Harris Semiconducteur (MHS) designs, manufactures, and markets a broad range of ICs, using bipolar, CMOS, and NMOS process technologies. Its main product strategies center on ASICs, fast SRAMs, microprocessors, and telecommunications circuits.

MHS was formed in 1979 as a joint venture company by Matra of France and Harris Corporation of the United States. Prior to this formal link, Matra and Harris had made agreements for CMOS technology transfers. The agreement was extended in 1980 to include bipolar products.

The Company was supported by the French government in place at that time to develop high technology in France. A 12,000-square-foot factory was built near Nantes, France, and designated as an area for industrial development, which allowed MHS to gain government financial assistance. Initial wafer fabrication began in December 1980.

In 1982, Harris and MHS merged their European marketing operations outside France (Harris-MHS). The new operation was financed equally by the two partners. Under the 1979 agreement, MHS continues to have exclusive sales rights in France for the Harris line of semiconductors. Conversely, Harris represents MHS exclusively for sales in North America.

Today, Matra-Harris remains the only independent French semiconductor operation not absorbed into the Thomson Group.

The Company's ASIC capability includes a range of matrices with from 250 to 7,500-gates, using CMOS technology and integrated design tools based on the VAX or IBM PCs. Libraries are available on Daisy, Mentor, and Valid systems.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Chairman
Guy Dumas

Strategist
Jean-Claude Rentlet

Commercial Dir
Michael Thouvenan

FINANCING

1979
$40.0M
Matra S.A. and Harris Corp.

RECENT HIGHLIGHTS

December 1986
MHS unveiled eight new products at Wescon/86, including the HM65787, a 64Kx1 SRAM that is the first application of the 0.8-micron process licensed from Cypress Semiconductor.

June 1987
Intel and Matra-Harris dissolved their joint venture design facility, CIMATEL G.I.E. CIMATEL was formed in 1982 as an equal partnership to design standard VLSI devices for the telecommunications and computer graphics

markets. It was jointly owned by Intel and MHS S.A. The dissolution of CIMATEL is due to a reassessment by Intel of its long-range marketing plans. CIMATEL had been responsible for the design of the 82716 video controller, as well as the announced ISDN chip set, the 29C48 combo, and the 29C53 S-transceiver. CIMATEL was located in Paris, France, and employed 26 persons. MHS made employment offers to many CIMATEL employees.

ALLIANCES

Intel

March 1981

MHS and Intel signed an agreement covering NMOS circuits and establishing a joint design facility in Nantes called CIMATEL.

June 1987

Intel and MHS dissolved CIMATEL due to a change in Intel's long-range plans. CIMATEL employed 26 persons, many of whom were offered employment at MHS.

Cypress Semiconductor

October 1985

Cypress transferred masks for its 25ns 4K and 16K SRAMs and provided its 1.2-micron CMOS technology to Matra-Harris. Cypress will receive 2 percent of Matra-Harris stock for an undisclosed amount of cash. A similar deal for the Cypress 0.8-micron process and 64K SRAM is planned.

Weitek

March 1986

MHS and Weitek signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process in exchange for manufacturing a variety of Weitek's products. The companies will also codevelop complex, high-speed logic devices for DSP, telecommunications, and military markets.

Silicon Compilers

June 1986

MHS and Silicon Compilers Inc. (SCI) will integrate SCI's Genesil silicon design system with MHS' advanced 2-micron, dual-level, metal CMOS process. MHS will also offer prototyping services, volume production, and design services for Genesil users.

Cypress, Aspen

April 1988

MHS entered into an R&D agreement with Cypress Semicondoctor and Aspen Semiconductor. MHS will provide $4.57 million in contract funding for the development of ultrahigh-speed ECL circuits to be developed by Aspen.

MANUFACTURING

Technology

2.5-, 2.0-, 1.2-, and 0.8-micron CMOS
1- and 2-layer metal
5-inch wafers

Facilities

Nantes, France
72,000 sq. ft.
Design, manufacturing in Class 10 clean room, assembly, and test

PRODUCTS

CMOS SRAMs

MHS markets 4K, 16K, 64K,and 256K SRAMs in a wide range of configurations, available in I/O multiplexed or separated form.

Dual-Port SRAMs

CMOS 2Kx8 Synchronous
CMOS 2Kx8
CMOS Dual-Port RAM Controller

CMOS Linear Arrays
  Available in 3-micron, 1-layer metal with 228-1139 gates or in 2-micron, 2-layer metal with 810 to 11,250 gates

Microcomponents

- MPUs
  - HMOS 16-Bit MPU; 5, 8 MHz
  - CMOS 16-Bit MPU; 5, 8 MHz
  - HMOS 8-, 16-Bit MPU; 5, 8 MHz
  - CMOS 8-, 16-Bit MPU; 5, 8 MHz
- MCUs
  - HMOS 8-Bit MCU with 4K ROM
  - CMOS 8-Bit MCU with 4K ROM
  - HMOS 8-Bit MCU with 8K ROM
  - CMOS 8-Bit MCU with 8K ROM
  - 80C52 8-Bit with 16K ROM
- MPRs
  - Video Storage Display Device
  - Interface

Telecommunications Circuits

- Serial PCM Codec-Filter Family
- CMOS Combo
- CMOS Digital Loop Controller
- X.21 Protocol Controller
- Monolithic CMOS Codec-Filter Serial Interface
- 300-Baud Modem

DSP

- 16x16 Parallel Multiplier/Accumulator 45ns
- 16x16 Parallel Multiplier 45ns

OTHER INFORMATION

Matra-Harris does not employ a PR firm.

Maxim Integrated Products, Inc.

120 San Gabriel Drive
Sunnyvale, CA 94086
408/737-7600

ESTABLISHED: May 1983 **NO. OF EMPLOYEES: 172**

BACKGROUND

Maxim Integrated Products, Inc., designs, manufactures, and markets a broad range of linear and mixed-signal ICs for the analog market. The Company's objective is to develop and market both industry-standard and proprietary linear ICs using a diversity of process technologies.

Currently, the Company offers 200 products that are available in a number of packaging options including surface-mounted package technology. Products are designed for computer and peripherals, instrumentation, process control, communications, military, factory automation, and medical applications.

The Company sees its primary competitors as Analog Devices and Intersil. The competition with Intersil is intense and is expected to intensify further as the result of a second-source agreement giving Intersil the right to select and license up to 10 circuits designed by the Company.

Maxim was founded by John F. Gifford, Frederick Beck, Dr. Steven Combs, and David J. Fullagar, all former employees of Intersil's Analog IC Product Division. Maxim purchased a 30,000-square-foot facility in Sunnyvale, California, from Si-Fab. In February 1988, the Company completed the sale of 2.3 million shares of common stock. Maxim is using the proceeds to prepay $3 million in long-term debt incurred when it purchased a new facility in October 1987. The remaining amount will be applied to equipment and other expenses for the new facility. The facility houses the Company's executive offices, engineering, and all services connected with its manufacturing.

The Company's products are sold worldwide through 63 sales representative organizations and electronics distributors. Domestic distributors are Anthem Electronics, Bell Industries, Hall-Mark Electronics, and Pioneer Electronics. In fiscal 1987, approximately 38 percent of sales were from the United States, 37 percent from Europe, 17 percent from Japan, and 8 percent from ROW. Among the Company OEM users are AT&T, Brown Boveri, GEC Card Technology (an affiliate of General Electric Company Plc), Hewlett-Packard, IBM, McDonnell Douglas, NEC, Siemens, and Tokyo Electric Co., Ltd.

BOARD

(Name and Affiliation)

John F. Gifford
Maxim Integrated Products, Inc., President

Paul Bancroft
Bessemer Venture Partners L.P., Limited Partner

B. Kipling Hagopian
Brentwood Associates, General Partner

Stephen L. Merrill
Merrill, Pickard, Anderson & Eyre, General Partner

James R. Bergman
DSV Associates

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*John F. Gifford
Intersil, President/CEO

VP Mktg/Sales
*Frederick Beck
Intersil, SR VP WW Sales/Mktg

VP Operations
*Dr. Steven Combs
GE, Mng Dir Process Tech

VP R&D
*David J. Fullagar
Intersil, VP Engineering

VP Finance/Admin
John H. Trollman
DEST Corp., VP Finance

*Founder

FINANCING

1983
Round 1
$4.9M
Bessemer Venture Partners; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Venad; overseas venture capital

February 1985
Round 2
$5.5M
Adler & Co.; Bessemer Venture Partners; Brown Boveri; Brentwood Associates; DSV Partners; De Monet Industries; Merrill, Pickard, Anderson & Eyre

Lease
$5.3M
Bank of America; Bank of the West

September 1985
Round 3
$6.4M
Bessemer Venture Partners; BNP Ventures; Brentwood Associates; DSV Partners; Merrill, Pickard, Anderson & Eyre; Rothschild, Inc.

March 1986
R&D
$1.2M
Venture Technology Funding

February 1988
IPO
$7.0M
Initial public offering

RECENT HIGHLIGHTS

January 1987
Maxim offered a family of RS-232 components designed for specific uses such as digital PBX or modem interfaces. The devices are as follows:

- MAX230 and MAX231 digital PBX interfaces
- MAX232/233/235/236 general-purpose interfaces
- MAX234/237/239 modem interfaces

July 1987
Maxim offered an MPU supervisory circuit that tracks power levels to reset processor functions and switch over to battery backup. The device is designed for laptops and industrial control.

July 1987
Maxim offered the MAX452 family of CMOS video multiplexers/amplifiers.

February 1988
Maxim offered 1.7 million shares of common stock in an initial public offering. Maxim is using the proceeds to prepay $3 million in long-term debt incurred in the acquisition of its new facility, with the remaining amount going toward equipment and other expenses for the new facility.

ALLIANCES

Intersil
1984
Maxim and Intersil entered into an agreement that resolved legal proceedings between them. Under the agreement, Maxim granted Intersil the right to select, by July 1989, up to 10 circuits designed by Maxim for manufacture and sale on a royalty basis. Intersil granted Maxim certain rights to Intersil products, trade secrets, and patent rights. Intersil has selected three of Maxim's proprietary products.

April 1986
Maxim and Intersil signed a second-source agreement.

Brown Boveri
February 1985
Maxim agreed to design and manufacture devices for Brown Boveri.

Supertex
April 1988
Maxim and Supertex signed an agreement to jointly market the 690 family of MPU supervisory circuits.

MANUFACTURING

Technology

Metal-gate CMOS for 1.5 to 18.0V operation
Metal-gate CMOS for 5 to 40V operation

Silicon-gate CMOS-DMOS for up to 150V operation
High-density/low-noise, analog silicon-gate CMOS
Low-noise, precision linear bipolar for up to 44V operation

Facilities

Sunnyvale, CA
62,000 sq. ft.
Design and test

PRODUCTS

Multiplexers
RF-Video, Fault-Protected, Differential, and CMOS Analog Multiplexer

CMOS Analog Switches
Quad-SPST, Quad-DPST, Dual-DPST, Dual-SPST, Low-Power, Low-Charge, RF-Video, and TTL-Compatible Switches

A/D Converters
3.5- and 4.5-Digit Converters, High-Speed, Low-Power or Low-Noise Converters, Available with LED or LCD Drivers, 12-Bit Converter with Three-State Binary Output

Op AMPs/Buffers
Low-Power Single, Dual, Triple, and Quad OP Amps, Power Op Amp, Precision Op Amp, Fast and Very Fast Buffer Amp, High-Accuracy Fast Buffer, Superlow-Offset Op Amp, Chopper-Stabilized Op Amps

Display Drivers/Counters
4-, 5-, 8-, 10—Digit LCD Decoder/Drivers, 4.5-Digit LCD, High-Speed Counters/Decoders/Drivers

Interface
+5V Powered, Dual-RS-232 Transmitter and Receiver

Switched Capacitor Filter
Dual, Second-Order, Universal Switch Capacitor Filter

Timers/Counters
Programmable or fixed RC Timer/Counter, Low-Power, General-Purpose Timer or Dual Timer

Power Supply Circuits
AC/DC Regulators, Fixed/Adjustable Output, Step-Up Switching Regulator, Inverting Switching Regulator, Step-Down Switching Regulator, Positive or Negative Voltage Regulator, Voltage Converter, Under-/Overvoltage Detector MPU Watchdog Battery, Switchover/Reset Generators

Voltage References
+10.0V and -10.0V Precision Reference, 1.2V Voltage Reference, +10.0V Voltage Reference, +5.0V Precision Voltage Reference

OTHER INFORMATION

Maxim does not employ a PR firm.

MemTech Technology Corporation

3000 Oakmead Village Court
Santa Clara, CA 95051
408/970-8900
Fax: 408/986-0656

ESTABLISHED: December 1986 **NO. OF EMPLOYEES: 75**

BACKGROUND

MemTech Technology Corporation is dedicated to the manufacture of bubble memory devices and related products. The Company was formed to acquire the business, principal assets, technology, and R&D capability of Intel Corporation's Magnetic Operation. The Company's leveraged buyout was initiated by the two founders, Richard H. Loeffler and William H. Almond, as well as an additional equity partner, Golodetz Corporation.

The Company is concentrating primarily on military and industrial applications of bubble memory technology. Recently, MemTech won a contract from the Wright-Patterson Air Force Base Avionics Laboratory to conduct work on advanced bubble memory devices. MemTech also works closely with General Electric on the Milstar Satellite program.

MemTech is headquartered in Folsom, California. The Company occupies more than 65,000 square feet of manufacturing space for device manufacture and assembly in Folsom, Santa Clara, and Santa Rosa, California. In addition, MemTech has a network of sales and customer service support operations located throughout the world.

In April 1987, MemTech purchased the Crystal Division of Materials Progress Corporation, the only remaining U.S. supplier of gadolinium gallium garnet (GGG) substrates. GGG are the base materials essential for the manufacture of bubble memory devices.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
*Richard H. Loeffler
Helix Systems, Chairman/CEO

President/COO
*William H. Almond
Eaton, GM Microlithography Division

VP Sales/Mktg
Joseph J. Rutherford
Materials Progress, VP Mktg/Sales

VP Technology
Dr. Peter Silverman
Intel, FAB Manager

*Founder

FINANCING

Not available

ALLIANCES

Not available

Facilities

Santa Clara, CA
20,000 sq. ft.
Engineering, assembly, test, marketing, sales, component fabrication

Santa Rosa, CA
13,000 sq. ft.
Crystal products division Tenth-Wave Division

PRODUCTS

1Mb Device and Board-Level Products

Device	Description
BPK70AZ	1Mb (128KB), Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
BPK72AZ	1Mb Bubble Memory Prototype Kit
SBX251	Bubble Memory Board (128KB) Bubble Memory
SBC254	Bubble Memory Board (128KB to 512KB capacity)
BCK10	1Mb Bubble Cassette System with interchangeable 128KB Bubble Cassette Cartridges

4Mb Device and Board-Level Products

BPK74	4Mb Bubble Memory Subsystem (512KB) Nonvolatile, Solid State, Read/Write Bubble Memory Subsystem
SBX261	4Mb Bubble Memory Board SBX Bus Compatible (512KB Capacity)
SBC264	Bubble Memory Board (512KB to 2MB capacity)
PCB75/76	Bubble Memory Card (512KB to 1MB capacity), IBM PC, ST, AT Compatible, and other compatible systems
PCB74	Bubble Memory Expandable Memory Card (512KB to 4MB) IBM, PC, XT, AT Compatible or other compatible systems
BVME164/174	VMEbus Compatible Bubble Memory Boards. Expandible at system level up to 15MB
BCS74	1MB Bubble Memory Cassette System with Multiple Interfaces available, PC, SBX, SCS1, and STD (512KB to 1MB capacity)

OTHER INFORMATION

MemTech's PR firm is Matthews and Clark.

Micro Linear Corporation

2092 Concourse Drive
San Jose, CA 95131
408/433-5200
Fax: 408/432-0295
Telex: 275906

ESTABLISHED: October 1983 **NO. OF EMPLOYEES: 144**

BACKGROUND

Micro Linear Corporation designs, manufactures, and markets linear and mixed linear/digital ICs, including both proprietary and enhanced second-source products as well as ASICs.

Micro Linear offers standard and semicustom ASICs that use a bipolar process. In addition, Micro Linear offers standard products using a CMOS process. Products are designed primarily for computer peripherals, telecommunications, power supply controls, industrial, and military applications.

Micro Linear also offers a number of computer-aided design (CAD) tools and a portfolio of linear semicustom design methodologies—including mask-programmable analog arrays and standard cells—that simplify the development of both standard and ASIC products containing analog functions.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Art Stabenow
National, Sr VP/Analog Div

VP Marketing
Charles Gopen
Daisy Systems, GM IC Layout Div

VP Sales
Tim D. Cox
National, Dir Dist Sales

VP Engineering
*Dr. Jim McCreary
Intel, Program Mgr

VP Finance/Admin
*Al Castleman, Jr.
MCI/Quantel, VP Finance

VP Materials/Quality Ops
*Abe Korgav
SEEQ, Dir Test/Assembly

VP Mfg Operations
Micheal Morrione
National, Product Line Mgr-Linear Op

*Founder

FINANCING

October 1983
Round 1
$4.0M
Fairfield Ventures; Founders, Adler & Co.; Oak Investment Partners; Richard Reardon

Lease
$3.5M
California First Bank; Western Technology Investors

November 1985
Round 2
$12.0M
Round 1 investors, Accel Partners, Grace Ventures, Greenwood Funds, Harvest Ventures, Institutional Venture Partners, International Industrial Interests, Investors in Industry, Kyocera International, Montgomery Bridge Funds, Grine Ventures, International Tadiran, Xerox Venture Capital

Lease
$3.0M
Burnham Leasing Corp.; California First Bank

February 1986
Round 3
$15.0M
Round 1 and 2 investors, Aeneas Venture Corp., First Analysis Corp., GE Pension Fund, Kuwait & Middle East Financial Services, Northern Telecom, Schroeder Ventures, United Eastern Investments, U.S. Venture Partners

Lease
$3.2M
Burnham Leasing, Westinghouse Credit, Phoenix Leasing

August 1988
Round 4
$10.0M
Round 1, 2, and 3 investors, Concord Partners, Merrill Lynch Venture Capital, Sigma Partners

Lease
$2.6M
Pitney Bowes Credit, GATX Leasing, Phoenix Leasing

ALLIANCES

IMP
June 1984
IMP and Micro Linear codeveloped a 10V CMOS process; IMP provides foundry services for Micro Linear.

Rockwell
1985
Rockwell invested in Micro Linear ($1.8M cumulatively) and purchases products from Micro Linear.

Tadiran
1985
Tadiran invested in Micro Linear ($1.6M cumulatively) and purchases products from Micro Linear.

Kyocera
1985
Kyocera invested in Micro Linear ($1.5M cumulatively) and purchases products from Micro Linear.

Toko
October 1985
Toko began making bipolar devices for Micro Linear at its Saitama, Japan, plant.

Northern Telecom
1986
Northern Telecom invested in Micro Linear ($2.0M cumulatively) and purchases products from Micro Linear.

Analog Design Tools
July 1986
Micro Linear integrated both its micro- and macrocell libraries into Analog Design Tools' workbench CAE system.

Daisy Systems
August 1986
Daisy Systems agreed to port Micro Linear's FB300 and FB900 cell libraries to Daisy's workstations.

IMP/MBB
August 1986
IMP and Micro Linear agreed to transfer ASIC design know-how to Messerschmitt Bolkow Blohm (MBB) over a three-year period.

MANUFACTURING

Technology

Bipolar
20V, 300-MHz, single-layer metal
12V, 900-MHz, dual-layer metal
36V, 300-MHz, dual-layer metal
12V, 3-GHz, dual-layer metal (1989)
10V, 3.0-micron, dual-layer polysilicon CMOS
8V, 1.2-micron, dual-poly/dual-metal (1989)

Facilities

San Jose, CA
48,000 sq. ft.
Design, manufacturing, and test

PRODUCTS

Bipolar Analog Arrays

Family	Linewidth (Microns)	Interconnect
FB900	10.0	Single-Layer Metal
FB300	8.0	Dual-Layer Metal
FB3400	8.0	Dual-Layer Metal
FB3600	7.0	Dual-Layer Metal

Standard Linear Products

Device	Description
Disk Drives	Bipolar Standard and Semicustom ICs for Read/Write, Data Recovery, and Servo Actuator Control
Telecommunications	CMOS Products for Conditioning Analog Phone Lines; Programmable Attenuators, Equalizer, Loopback, and Tone Signaling
Data Converters	12-Bit and 8-Bit ADC with Serial and Parallel Interfaces

CAD

Micro Linear provides Libraries of Devices and Macro Models for its bipolar ASIC products. The Libraries run on industry-standard platforms such as ViewLogic, Analog Design Tools, and Daisy Workstations.

OTHER INFORMATION

Micro Linear Corporation's PR firm is Rigoli, Panthalon, Demeter.

Microwave Monolithics

465 East Easy Street
Simi Valley, CA 93065
805/584-6642

ESTABLISHED: April 1982 **NO. OF EMPLOYEES: 17**

BACKGROUND

Microwave Monolithics specializes in GaAs monolithic microwave ICs (MMICs) for Department of Defense (DOD) microwave specialty circuits as well as custom GaAs circuits.

The Company is privately held by five partners and completed first-round financing in 1983 through private sources.

Microwave Monolithics did custom GaAs circuit design research and development work for government agencies and OEMs until financing was secured. The Company began producing GaAs MMICs by year-end 1984.

BOARD

Not available

PRODUCTS

MMICs

OTHER INFORMATION

Microwave Monolithics does not employ a PR firm.

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Daniel Ch'en
Rockwell, Mgr M/W Rsch

*Founder

ALLIANCES

Not available

MANUFACTURING

Technology

0.5-micron GaAs fine-line capability

Facilities

Simi Valley, CA
8,000 sq. ft.
Two Class 100 clean rooms

Microwave Technology, Inc.

4268 Solar Way
Fremont, CA 94538
415/651-6700
Fax: 415/651-2208

ESTABLISHED: May 1982 **NO. OF EMPLOYEES: 160**

BACKGROUND

Microwave Technology, Inc., (MwT) is a vertically integrated manufacturer of GaAs-based microwave components and subassemblies. MwT designs, manufactures, and markets GaAs epitaxial materials, GaAs FET devices, MMICs, hybrid MICs, and microwave components and subassemblies. The Company's products are designed for defense-related applications.

MwT produces both ultralow-noise and medium-power GaAs FETs and AlGaAs HEMT devices for applications ranging from 0.5 GHz to 40.0 GHz. The devices are produced with gate lengths from 0.1 to 0.25 micron. The Company is developing a family of high-performance MMIC products and has completed a series of 2- to 6-GHz MMIC amplifiers. Products in the 2- to 18-GHz and 6- to 16-GHz ranges are in development.

The Company also offers GaAs FET amplifiers from 0.5 to 26.5 GHz that use MMIC and hybrid MIC modules.

In 1987, MwT acquired Monolithic Microsystems, Inc. of Santa Cruz, California. Monolithic Microsystems makes detector log video amplifiers (DLVAs), log video amplifiers (LVAs), and threshold detectors based on proprietary monolithic LVA ICs. Products are used in various EW systems and other defense electronic applications. Monolithic Microsystems will operate as a wholly owned subsidiary of MwT and will continue manufacturing in its 8,200-square-foot Santa Cruz facility.

BOARD
(Name and Affiliation)

Thomas R. Baruch
Microwave Technology, Inc., Chairman

Dr. M. Omori
Microwave Technology, Inc., VP of Engineering

C.C. Bond
New Enterprises Associates

Irwin Federman
Advanced Micro Devices

Dr. P. Kaminski
Hambrecht & Quist

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Joseph Lee
Litton, President

VP Finance/CFO
J. Geyton
Avantek, Div Controller

VP Materials
A. Herbig
Avantek, Tech Staff

VP Engineering/R&D
Dr. Masa Omori
Avantek, Eng Mgr

VP Mktg/Sales
David Gray
EM Systems, Sales Mgr

VP Ops
John Sorci
Watkins-Johnson, Subsystems Div Mgr

FINANCING

August 1983
Round 1
$4.8M

Not available
Round 2
$4.3M

June 1985
Round 3
$1.0M
Investors were the Allstate Insurance Company, Concord Partners, New Enterprise Associates, T. Rowe Price, Sequoia Capital, and U.S. Venture Partners.

ALLIANCES

Not available

MANUFACTURING

Technology

GaAs

Facilities

Fremont, CA
50,000 sq. ft.
Design, manufacturing
6,000 sq. ft.
Class 1,000 clean room

PRODUCTS

GaAs Epitaxial Materials
GaAs FET Amplifiers, 0.5 to 26.5 GHz
GaAs MMIC Amplifiers, 2 to 6 GHz
GaAs MIC Microwave Products
Thin-Film Hybrids
Log Amplifiers
Detector Log Video Amplifiers

OTHER INFORMATION

Microwave Technology, Inc. does not employ a PR firm.

Mietec N.V.

Westerring 15
9700 Oudenaarde, Belgium
055-33-2211
Fax: 055-318-112
Telex: 85739 MIETEC

ESTABLISHED: March 1983 **NO. OF EMPLOYEES: 280**

BACKGROUND

Mietec N.V. designs mixed analog and digital ASICs, using a cell-based library of digital and analog cells. The Company's ASIC products are split into two categories: user-specific ICs (USICs) and application-specific standard products (ASSPs) for dedicated uses.

The Company is capable of designing devices using CMOS (for low-power, high-density applications), BiMOS (for high-voltage applications, 70V), and SBiMOS (a multipurpose technology) processes. A proprietary development software support tool called Mietec Analog/Digital Engineering (MADE) allows the development and simulation of digital and analog functions simultaneously.

Mietec is a joint venture, 49.8 percent of which is owned by Alcatel Bell Telephone Company; 49.2 percent is owned by GIMV, a Flanders regional investment company; and 1.0 percent is owned by a private investment bank. Mietec is a major supplier of the ASIC products for the Alcatel System 12 and is working on the next generation of Alcatel exchanges based on ISDN.

BOARD

Jo Cornu, Chairman

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

General Manager/CEO
Jean-Pierre Liebaut
Matra-Harris

Business Development Manager
Eric Schutz
Motorola

Director, Marketing & Sales
Alain Gilot
Mostek

FINANCING

Investment in the Company totaled $48.2 million.

ALLIANCES

Sprague
1983
Mietec entered a cross-licensing agreement with Sprague for a BiMOS process.

STM
1987
Mietec, SGS-Thomson, and Alcatel agreed to the transfer of a 1.2-micron CMOS process.

MANUFACTURING

Technology

5.0-, 3.0-, and to 2.4-micron NMOS
3.0- and 2.4-micron CMOS
VMOS
BiCMOS
Single and double-layer metal

Facilities

Oudenaarde, Belgium
The manufacturing center is situated on a 40,000-square-meter site with 10,000 square meters of floor space. A wafer fab is equipped with more than 2,000 square meters of clean rooms, of which 400 square meters are Class 10. Potential capacity is 150,000 wafers per year. The fab is suitable for technologies of 1 micron or lower.

Brussels, Belgium
The customer design center includes VAX 8500, VAX 750, MICROVAX, Tektronix, GPX2, and Daisy equipment, in addition to VALID workstations.

OTHER INFORMATION

Mietec does not employ a PR firm.

Modular Semiconductor, Inc.

138 Kifer Court
Sunnyvale, CA 94086
408/733-5000
Fax: 408/733-0224

ESTABLISHED: September 1983 **NO. OF EMPLOYEES: 12**

BACKGROUND

Modular Semiconductor, Inc., was founded by individuals from Hewlett-Packard, Signetics, and Synertek to design, develop, manufacture, and market VLSI ICs using a 1.0-micron CMOS process technology.

The Company is focusing on data communications chips, memories, semicustom and custom designs, VMEbus chip sets, and telecommunications products. Modular Semiconductor began manufacturing with a 2-micron CMOS process and is now offering 1.5-micron technology, with plans to use a 1.0-micron process in the near future.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Arockiyaswami Venkidu
Faraday Electronics, Dir Engr

Dir Mfg
*Dr. Lenin Anne
Hewlett-Packard, Sr Engr

*Founder

FINANCING

Not available

ALLIANCES

Panatech/Ricoh
November 1984
Modular Semiconductor made a five-year, three-way agreement with Panatech and Ricoh of Japan. Modular provided Ricoh with its CMOS designs and process technology for 16K SRAMs and 256K DRAMs. Ricoh manufactured these devices in Japan and had the rights to market them in Japan. Panatech had the rights to market 16K memories only in North America. (expired)

MANUFACTURING

Technology

1.5-micron CMOS
2.0-micron CMOS

Facilities

Sunnyvale, CA
7,000 sq. ft.
Design

PRODUCTS

CMOS SRAM

Device	Description	Access Time (ns)
MS6168	4K x 4	55ns
MS616	16K x 1	55ns

Data Communication

Device	Description
MS16C450/82C50A	PC UART
MS16C451	PC UART with parallel port
MS16C452	PC DUAL UART with parallel port
MS16C453	PC DUAL UART
MS16C454	PC QUAD UART
MS16C550A	PS/2 FIFO UART
MS16C551	PS/2 FIFO UART with parallel port
MS16C552	PS/2 FIFO DUAL UART with parallel port
MS16C553	PS/2 FIFO UART
MS16C554	PS/2 FIFO QUAD UART
MS68/88C681	DUART
MS82C684	QUART

Bus Interface

MS68C153	VMEbus Interrupter Module
MS68C154	VMEbus Controller
MS68C155	VME Interrupt Generator

OTHER INFORMATION

Modular Semiconductor does not employ a PR firm.

Molecular Electronics Corporation

4030 Spencer Street MS108
Torrance, CA 90503-2417
213/214-1485
Fax: 213/542-1270

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 12**

BACKGROUND

Molecular Electronics Corporation (MEC) is developing technology for the formation, deposition, and commercial application of biomolecular membranes, or biomembranes, in the fields of electronics, optics, and biomedicine.

A biomembrane is a structural analog of the membrane that surrounds every living cell. MEC's proprietary technology enables the formation and deposition of highly ordered, perfectly uniform organic films onto a variety of substrate surfaces, with thickness control down to 10 angstroms. The Company's technology and know-how include a patented biomembrane production technology called MonoFab, and the molecular engineering and synthesis of biomembrane materials with the desired physical, electronic, optical, and biological properties.

MEC has developed several potential commercial applications of the core biomolecular membrane technology (BMT). The first is an ultrathin, uniform, high-resolution e-beam resist (MonoResist) that has a demonstrated resolution down to 1.0 micron. The second is an ultrathin anticorrosive lubricant (MonoGuard) for rigid disk magnetic media. The third is a perfectly uniform antireflection coating (MonoArc) for pellicles.

The Company also has demonstrated a 20-angstrom biomembrane dielectric on GaAs devices. Outside of semiconductor applications, the Company has demonstrated unique biocompatible properties of biomembranes as coatings for medical implants, including intra-ocular lenses, and is developing drug delivery and surface-active (binding) sites applications (e.g., biosensors).

The MEC business plan calls for partnerships with corporations on both the electronic and medical applications of its technology. The Company believes that its technology will lead to new classes of organic/inorganic hybrid semiconductors and dielectric spacers for quantum devices in electronics and, ultimately, will represent the key enabling technology for bioelectronics including the biochip.

BOARD

*George Reynolds, Chairman
Dr. Vladimir Rodov
Dr. Paul Kaminski
Parker Dale
Roman Kupchynsky

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President, CEO
*Dr. Vladimir Rodov
TRW, N/A

VP Dir Medical Bus
David Gibson
Chiron Ophthalmics, Founder/Dir R&D

*Founder

FINANCING

Molecular Electronics has raised more than $5 million in three rounds of financing.

ALLIANCES

Alliances exist but information is not available.

Molecular Electronics Corporation

MANUFACTURING

Currently on a pilot scale

Facilities

Torrance, CA
7,500 sq. ft.
Headquarters, R&D lab (including Class 10 clean room, surface analytic, electronics, and chemistry sections)

OTHER INFORMATION

Molecular Electronics Corp. does not employ a PR firm.

MOS Electronics Corporation

914 West Maud Avenue
Sunnyvale, CA 94086
408/733-4556
Fax: 408/773-8415

ESTABLISHED: September 1983 **NO. OF EMPLOYEES: 64**

BACKGROUND

MOS Electronics Corporation (MOSel) designs, manufactures, and markets CMOS SRAMs and a family of specialty memory products for the dual-port cache control and telecommunications markets. The Company is using its SRAMs to build a base that will enable it to design specialty memories including cache tag RAMs; video RAMs; and radiation-hardened, 6-transistor RAMs.

MOSel does front-end R&D and marketing at its headquarters in Sunnyvale, California. Hyundai, Sharp, Taiwan Semiconductor, and UMC Manufacturing Corporation provide foundry services. Assembly and test are also subcontracted.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Peter Chen
Fairchild, Semi Tech Mgr.

VP Technology
Nasa Tsai
Fairchild, Sr MTF

Dir Eng Design
Y.T. Loh
Saratoga Semiconductor, VP Technology

VP Sales/Mktg
Bruce Campbell
Intel, Mktg Mgr

VP Finance
George Sun
Delta 79, VP Finance

Dir of Sales
Eric Nagel
Intel, Dist Sales Mgr

Dir of Bus Dev
Jim Summers
AT&T, Dir of Product Planning

FINANCING

1983
Seed
$1.0M
Founders

1984
Round 1
$2.0M
Pacific Electric Wire & Cable (Taiwan)

1988
Round 2
$3.0M
Walson Lihwa Corp (Taiwan)

RECENT HIGHLIGHTS

January 1987
MOSel offered the MS6130, a 1Kx8 dual-port RAM for use in 32-bit parallel computer applications, offering a 55ns address access time and a 30ns output enable time for no-wait operation with 25-MHz MPUs.

March 1987
MOSel offered the MS7201 CMOS FIFO with access times of 50ns, 65ns, and 120ns.

January 1989
MOSel introduced a cache memory chip jointly developed with Chips & Technologies for 25-MHz 80386 cache memory applications.

ALLIANCES

Fuji Electric
September 1985
Fuji Electric and MOSel signed an agreement whereby Fuji Electric will supply 4-inch and 6-inch wafers using MOSel 1.5 and 2.0-micron process technology. The companies will jointly develop CMOS 16K and 64K SRAMs for MOSel under an OEM contract.

UMC
October 1985
MOSel licensed a 32Kx8 EPROM, a 16K SRAM, and a 1.2-micron process to UMC in Taiwan in exchange for fab capacity.

November 1985
Agreement extended to include 1.2-micron technology and 256K SRAM.

Hyundai
February 1986
MOSel provided 8Kx8 and 32Kx8 SRAMs and 1.2- and 1.5-micron CMOS process technologies to Hyundai in exchange for foundry capacity under a discounted OEM contract.

March 1988
Agreement extended to include 1MB SCRAM and submicron technology.

Sharp
June 1986
MOSel provided a 256K SRAM design based on a 1.2-micron CMOS process. Sharp provides foundry service under a favorable OEM contract.

MANUFACTURING

Technology

MOSel offers five high-performance CMOS (H-BiCMOS) processes and one BiCMOS process with minimum dimensions as follows:

Drawn (Microns)	Effective (Microns)
2.0	1.5
1.5	1.1
1.2	0.8
1.2 BiCMOS*	0.8
1.0*	0.8
0.8*	0.7

*Under development

Facilities

Sunnyvale, CA
10,000 sq. ft.
Design and test

Hsin-Chu, Taiwan
6,000 sq. ft.
Design

PRODUCTS

Bytewide SRAMs

Device	Description	Access Time (ns)
MS6516	2Kx8	45-100
MS6264	8Kx8	35-120
MS62256	32Kx8	25-85
MS88128	128Kx8	45-150*
MS88512	512Kx8	70-100*

*Under development

Specialty Memories

Device	Description	Access Time (ns)
MS7201	512Kx9 FIFO	50-120
MS6130	1Kx8 Dual Port	55-120
MS6132	2Kx8 Dual Port	55-120
MS82C308	Cache Memory	25 MHz
MS176	Video Color Palette	35, 50 MHz
MSVR35	Voice ROM	3 sec.
MSVR205	Voice ROM	20 sec.

OTHER INFORMATION

MOSel does not employ a PR firm.

MOSPEC Semiconductor Corp.

76 Chung Shan Rd, Hsin Shin
Tainan Taiwan R.O.C.
Taipei (2)755-6664
U.S. 213/802-7662
Fax: Taipei (2)755-6460
U.S. 213/802-7662

ESTABLISHED: April 1987 **NO. OF EMPLOYEES: 300**

BACKGROUND

MOSPEC Semiconductor Corporation is a subsidiary of President Enterprises Corporation, one of the largest companies (No. 7 in total sales) in Taiwan. The Company previously was a fully owned unit of President under the name PECOR. As a result of a joint venture with U.S. company MOSPOWER Technology, Inc., MOSPEC was formed in April 1987.

MOSPEC is the only manufacturer of power devices in Taiwan. Its product lines include bipolar power transistors, Darlingtons, power MOSFETs, Schottky rectifiers, and ultrafast and fast-recovery rectifiers. The Company currently is shipping all of these products. MOSPEC also provides wafer fab and assembly services to other manufacturers on a contract basis. MOSPEC offers 3-micron bipolar and MOSFET process technologies.

The Company's production facilities include an 80,000 square feet plant that houses headquarters, wafer fab, assembly, design, test, and R&D operations.

BOARD
(Name and Affiliation)

Dr. C.Y. Kao
President Enterprises Corporation

Dr. M.L. Tarng
MOSPEC Semiconductor Corporation, president

C.S. Ling
President Enterprises Corporation

Ming-Yuen Tang
Kao Chao Brokerage

COMPANY EXECUTIVES
(Position and Name)

President
M.L. Tarng

VP, Mktg.
Ming-Yuen Tang

VP, Finance
C.T. Chen

R&D Mgr
W.C. Hsu

P/MC Mgr
W.N. Teng

FINANCING

Round 1
$7.8M
Private Placement

Round 2
$4.0M
Private Placement and employees

ALLIANCES

Not available

SERVICES

Wafer fab, assembly

MANUFACTURING

Technology

3.0-micron bipolar and MOSFET technologies

Facilities

Tainan, Taiwan
80,000 sq. ft.R&D, manufacturing, assembly, marketing, finance, test

PRODUCTS

Bipolar Power Transistors
Power MOSFETs
Schottky, Ultrafast and Fast Recovery Rectifiers
Wafer Foundry
OEM Assembly

OTHER INFORMATION

MOSPEC does not employ a PR firm.

Multichip Technology Inc.

58 Daggett Drive
San Jose, CA 95134
408/432-7000
Fax: 408/432-7049

ESTABLISHED: February 1988 **NO. OF EMPLOYEES: 40**

BACKGROUND

Multichip Technology Inc. was formed in February 1988 to design, develop, and market multichip memory modules for Cypress Semiconductor. Financing was provided by Cypress, which owns 100 percent of the capital stock.

Multichip operates as a wholly owned subsidiary of Cypress Semiconductor Corporation and gains access to Cypress' 0.8-micron wafer fabrication facilities. All Multichip-developed devices are fabricated by Cypress and sold through Cypress' sales organization.

Multichip Technology is engaging in a new approach to system design through multichip modules. Packing multiple chips into a single component reduces board space significantly. Modules create space by allowing chips to be stacked vertically or horizontally and in multiple layers, thus improving system density. By moving devices closer together, modules reduce interconnect capacitance, thus decreasing signal delays.

The Company offers high-performance SRAM modules, which began shipment in June 1988. Offerings include standard and custom products for both military and commercial applications. Multichip currently is developing products for RISC systems based on the SPARC microprocessor. Future multichip modules may integrate other Cypress advanced products such as PLDs, fast SRAMs, PROMs, FIFOs, and dual ports. The Company plans to offer denser and faster memory modules in the future, as well as application-specific modules (i.e., DSP, cache) and standard and custom products implemented using advanced packaging techniques.

BOARD
(Name and Affiliation)

T.J. Rodgers, Chairman
President, Cypress Semiconductor

Andy Paul
President

Lowell Turriff
VP, Mktg & Sales, Cypress Semiconductor

Roger Ross
President, Ross Technologies

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Andy Paul
IDT, Mktg Mgr

VP, R&D
Marcelo Martinez
IDT, Eng Dir

VP, Mktg
Tom Kadlec
IDT, Mktg Mgr

VP, Finance
John Green
AMD, Asst Controller

VP, Mfg
Jeff Michols
MET, VP Mfg

FINANCING

Round 1
February 1988
Cypress Semiconductor

ALLIANCES

Multichip is a wholly owned subsidiary of Cypress Semiconductor Corporation.

MANUFACTURING

Technology

Surface-mount components of ceramic and/or epoxy laminate substrates.

Facilities

San Jose, CA
18,000 sq. ft.
Design, marketing

PRODUCTS

High-performance SRAM modules (standard products and custom products; military and commercial)

OTHER INFORMATION

Multichip does not employ a PR firm.

nCHIP, Inc.

1971 North Capitol Avenue
San Jose, CA 95132
408/945-9991
Fax: 408/945-0151

ESTABLISHED: December 1987 **NO. OF EMPLOYEES: 20**

BACKGROUND

nCHIP was founded in December 1987 to address the performance bottleneck that is building up at the package level. The solution provided by nCHIP is multichip modules. The Company will design and/or manufacture silicon circuit boards, complete multichip modules, and module carriers for high-performance, high-density, and cost-sensitive applications.

nCHIP designs and manufactures custom high-performance, high-density silicon circuit boards (SiCBs) to be used for multichip modules, allowing faster, lighter, more compact, and more reliable systems to be built. Die are mounted directly on the SiCB, eliminating much of the typical package-related capacitances. nCHIP design rules enable dense placement of the ICs, approaching wafer-scale density in memory applications.

In addition to designing the silicon circuit board, nCHIP also provides complete multichip module design, fabrication, and assembly services to assist the systems designer in achieving the benefits of these technologies. The Company provides the module carrier, addresses power dissipation issues using proprietary technologies, and manufactures and delivers a complete, tested application-specific integrated module (ASIM) that is ready for system assembly.

The technology base was developed by nCHIP's founders at Lawrence Livermore National Laboratory (LLNL). While at LLNL, the founders produced functional models for use in a 1989 space mission. More than $25 million was invested in the development program since 1983.

In 1989, nCHIP selected strategic customers, completed the design of its initial products, and set up a 5-inch wafer production line. In 1990, nCHIP will begin volume production and increase its customer base. In late 1991, production capacity will be increased with the addition of an 8-inch manufacturing line.

BOARD
(Name and Affiliation)

Philip Dauber, CEO
nCHIP, Chairman/CEO

William Davidow
Mohr, Davidow Ventures, Partner

Bruce McWilliams
nCHIP, President/COO

F. Gibson Myers
Mayfield Fund

Richard Newton
University of California, Berkeley

Martin Titland
Fairchild Space Company

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
Philip Dauber
Key Computer, President

President/COO
Bruce McWilliams
LLNL, Program Leader

VP Operations
Luc Bauer
IDT, VP and General Manager

VP Technology
David Tuckerman
LLNL, Project Leader

VP Engineering
Kamran Malik
Key Computer, Dir. of Engineering

VP Finance
Kirk Flatow
Bain & Co., Senior Consultant

FINANCING

October 1987
Seed
Private investors

April 1989
Seed
Private investors

August 1989
Round 1
$4.2M
Mayfield Fund; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow Ventures

PRODUCTS

Circuit Boards
Multichip Modules

OHER INFORMATION

nCHIP does not employ a PR firm.

SERVICES

Design
Fabrication
Assembly

MANUFACTURING

Technology

CMOS
5-inch wafers
8-inch wafers in 1991

NMB Semiconductor Co. Ltd.

9730 Independence Avenue
Chatsworth, CA 91311
818/341-3355
Fax: 818/341-8207

ESTABLISHED: April 1984 **NO. OF EMPLOYEES: 75**

BACKGROUND

NMB Semiconductor designs, manufactures, and markets 256K and 1Mb DRAMs and also offers foundry services. The Company was Japan's first start-up to build a VLSI facility capable of fabricating products with submicron geometries. Designs and technology were acquired initially through licensing agreements and technology exchanges with Inmos and other U.S. companies to bring existing processes on-line quickly.

NMB Semiconductor is a Division of NMB Technologies, which is, in turn, a subsidiary of the multinational Minebea Co. Ltd. of Tokyo, Japan. NMB Technologies was formed in early 1988 and consolidates Minebea's U.S. activities, which consist of NMB Semiconductor, Hi-Tek Corp., IMC Components Corp., and NMB Audio Research Corp. NMB Technologies is organized into a Memory Division (NMB Semiconductor), a Keyboard Division (Hi-Tek), an axial fan division (IMC Components), and an Audio Research Division (NMB Audio Research). NMB Technologies conducts the marketing for all products manufactured by the subsidiaries including DRAMs, hybrid ICs, switching power supplies, keyboards, inductors, DC servo and step motors, and AC and DC tube axial cooling fans.

All manufacturing for NMB Semiconductor's DRAMs is conducted by Minebea in a $250 million, fully automated facility in Tateyama, Japan.

BOARD
(Name and Affiliation)

Takumi Tamura
  NMB Semiconductor

Masatomo Yuki
  Minebea

Takami Takahashi
  Minebea

Iwao Ishizuka
  Minebea

Goro Ogino
  Minebea

Hidisato Ishikawa
  Minebea

Sadahiko Oki
  Minebea

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Hidisato Ishikawa
  Minebea, Sr Mng Dir

Executive VP
William C. Connell
  NMB (USA), Vice President

Dir Mfg & R&D
Shosuke Shinoda
  Matsushita, Dir MOS Process

FINANCING

1984
Start-up
$11.11M
  Bank of Tokyo, Ltd.; Fuji Bank; Japan Associated Finance Co., Ltd.; K.K. Keiaisha; Kyowa Bank; Long Term Credit Bank of Japan; Minebea Co; Nippon Enterprises Development Corp.; Nippon Investment & Finance Co., Ltd.; Sumitomo Trust & Banking; Takami Takahashi; Takumi Tamura; Tokai Bank

1989
IPO
$460.0M
  Initial public offering

NMB Semiconductor Co. Ltd.

RECENT HIGHLIGHTS

March 1989
NMB acquired the Composite Recording Head Division of Seagate Technology.

ALLIANCES

Minebea Co.
1984
NMB is the subsidiary of and is financed by Minebea Co. Ltd. of Tokyo.

Inmos
June 1984
NMB obtained a five-year license to produce Inmos' 256K CMOS DRAM in exchange for cash, royalties, and 50 percent of the 256K DRAM output. The companies also planned to codevelop the technology for Inmos' 64K and 1Mb DRAMs.

Vitelic
November 1985
Vitelic granted a license to NMB Semiconductor for its 1Mb CMOS DRAM in exchange for one-third of NMB Semiconductor's plant capacity.

National
September 1986
National contracted NMB to manufacture fast SRAMs at the Tateyama fab. This agreement was canceled.

TI
November 1987
NMB agreed to supply Texas Instruments (TI) with TI-designed, 1Mb field RAMs. Initially, NMB shipped 100,000 units a month.

Alliance Semiconductor
December 1987
Alliance Semiconductor signed a five-year agreement with NMB Semiconductor, covering 256K and 1Mb DRAMs. NMB will manufacture and sell the devices worldwide.

SERVICES

Silicon Foundry

MANUFACTURING

Technology

1.0- to 2.0-micron CMOS
5-inch wafers

Facilities

Tateyama, Japan
200,000 sq. ft.
Total space
43,000 sq. ft.
Class 1 clean room

PRODUCTS

DRAMs

Device	Description	Speed
AAA2800	256Kx1 Static Column Mode	60 to 80ns
AAA2801	256Kx1 Page Mode	60 to 80ns
1M100	1Mb x 1 Fast Page Mode	100 to 200ns
1M101	1Mb x 1 Nibble Mode	100 to 200ns
1M102	1Mb x 1 Static Column Mode	100 to 200ns
1M104	256Kx4 Fast Page Mode	100 to 200ns
1M105	256Kx4 Static Column Mode	100 to 200ns
1M200	1Mb x 1 Fast Page Mode	60 to 80ns
1M201	1Mb x 1 Nibble Mode	60 to 80ns
1M202	1Mb x 1 Static Column Mode	60 to 80ns
1M204	256Kx4 Fast Page Mode	60 to 80ns
1M205	256Kx4 Static Column Mode	60 to 80ns

OTHER INFORMATION

NMB's PR firm is Capital Relations.

NovaSensor

1055 Mission Court
Fremont, CA 94539
415/490-9100
Fax: 415/770-0645
Telex: 990010

ESTABLISHED: October 1985 **NO. OF EMPLOYEES: 105**

BACKGROUND

NovaSensor was formed to develop, manufacture, and market the next generation of solid-state sensors and unique silicon-based mechanical microstructures. In the sensor field, the Company is focusing its design and development efforts on the physical parameters of pressure, acceleration, flow, and force. In the area of silicon-based mechanical microstructures, NovaSensor is focusing its efforts on the development of flow restrictors, programmable microvalves, microswitches, nozzles, fluidics components, and micropositioners.

The Company was formed by Janusz Bryzek, Joseph R. Mallon, and Kurt Peterson. The team was joined by Phil Barth, a sensor technologist from Stanford University.

The Company is housed in a 32,000-square-foot facility that became operational in the summer of 1987 and includes a 4-inch wafer-processing line, assembly, and test.

First packaged devices were the TO-5 and TO-8 piezoresistive pressure sensors compensated over the range of 0° to 70° centigrade.

In September 1987, IC Sensors filed a suit against NovaSensor, claiming that the firm misappropriated information and trade secrets. The suit also names Mr. Bryzek, NovaSensor's president and CEO, and the former vice president and director at IC Sensors.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Copresident/CEO
*Janusz Brysek
IC Sensors, Founder/President

Copresident/COO
*Joseph R. Mallon
Kulite Semiconductor, VP Engineering

Exec VP Tech
*Kurt Peterson
Transensory Devices, Founder/VP Tech

Dir Adv Sensor Dev
Phil Barth
Stanford University, Sr Rsch Assoc

Mgr of App Engr
Dilip Vyas
Sensym, Mgr QA

*Founder

FINANCING

NovaSensor was funded by Solarton Electronics Inc., a division of Schlumberger, for an undisclosed amount.

ALLIANCES

Not available

MANUFACTURING

Full-capability wafer fabrication for solid-state sensors, silicon microstructures, and transducer lines on 4-inch wafers. The facility is capable of producing more than 30 million sensors per year.

NovaSensor

Facilities

Fremont, CA
22,000 sq,. ft.
  Manufacturing

3,500 sq. ft.
  Class 1,000 clean room

PRODUCTS

Low-Pressure Sensors (10 inches of water pressure) with High Output and Low Linearity
High-Pressure Sensors (up to 10,000 psi)
Acceleration Sensors
Isolated Metal Diaphragm Transducers
On-Chip Laser-Trimmable Pressure Transducers
Low-Cost Mini-DIP Plastic Package Differential Pressure Sensor

OTHER INFORMATION

NovaSensor's PR firm is Roger Grace, Inc.

Novix Inc.

19925 Stevens Creek Blvd., Suite 280
Cupertino, CA 95015
408/255-2750

ESTABLISHED: March 1984 **NO. OF EMPLOYEES: 20**

BACKGROUND

Novix develops and markets MPUs and development tools that implement a FORTH-in-silicon architecture. In 1986, Novix introduced the NC Series of 16-bit MPUs, which are high-level language, direct-execution (no microcode) MPUs. The MPUs are manufactured using 1.25-micron HCMOS and typically perform in excess of 20 mips. Other products include CPU boards, the ND4000 development system, a C compiler, and a FORTH operating environment. The Company states that the approach can be implemented in HCMOS, ECL, and GaAs. A 3-micron CMOS gate array was designed using Novix-developed technology.

Novix designs products for the artificial intelligence, embedded controller, cryptographics, robotics, and machine vision markets. Future plans also include implementing gallium arsenide in its product lines. The Company subcontracts all production and assembly.

Novix founders included Charles Moore, who invented the FORTH language in 1969; John Peers; John Golden; and Robert Murphy. The Company, originally named Technology Industries, was formed when Sysorex Information System, Inc., offered approximately $1 million to develop devices based on the FORTH "language slice" computing. The combined Sysorex-Technology Industries R&D partnership was renamed Novix Inc.

In October 1986, Novix established an office in Belgium and signed nine European distributors.

In January 1987, John Golden and Robert Murphy formed a new company, named QSD, which applies the FORTH-in-silicon architecture to the military market.

BOARD
(Name and Affiliation)

John Peers
  Novix Inc.

Ed Mack
  Consultant

Ron Osborne
  Faultless Starch

Peter Johnson
  Not Available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
John Peers
  Technology Industries Inc., President

FINANCING

March 1984
Round 1
$1.0M
  Sysorex International Inc.; Technology Industries Inc.

RECENT HIGHLIGHTS

February 1987
Novix put its 16-bit NC4016 MPU on an STD bus card measuring 4.5 x 6.5 inches. The NB4300 card supports 20-bit addressing and can be used as master or slave bus control.

April 1987
Novix introduced the NS4100, a high-speed coprocessor/real-time controller board for IBM PCs or compatibles. The board is built with the Company's NC4016 MPU.

ALLIANCES

Sysorex
March 1984
  Sysorex International participated in first-round financing.

Harris
July 1986
Harris added the Novix FORTH language MPU to its ASIC library as part of a licensing agreement covering MPU and MCU products based on the FORTH engine.

Facilities

Cupertino, CA
6,000 sq. ft.
Design, test

MANUFACTURING

Technology

3- and 1.25-micron CMOS

PRODUCTS

Microprocessors

Device	Description	Features
NC4016	16-Bit	64K Words Direct and 128-Gigaword On-Chip Memory Addressing, 10 to 12 mips
NC5116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, 20 to 25 mips
NC6116	16-Bit	2-Megaword Direct and 128-Gigaword On-Chip Memory Addressing, plus UARTS, FIFO, CTC, SCSI, On-Chip Stacks, 20 to 25 mips

CPU Boards

Device	Description
NB4000	Novix Beta Board with 28K-word RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4100	IBM PC Add-In Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4200	Turbo Frame 4000 with 8K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH
NB4300	Novix STD Bus CPU Board with 64K-words RAM, 8 mips, CPU, Program and Data Memory, I/O, Memory Interface, FORTH

Development Tools

Device	Description
ND4000	Standalone System with Disk Controller, 10MB Hard Disk, Power Supply/Case, 360KB Floppy Disk, and Breadboard Development Area
Novix Empress	Comprehensive Superset FORTH-83 Operating Environment
Novix C	Full K and R and ANSI

OTHER INFORMATION

Novix does not employ a PR firm.

NSI Logic, Inc.

Cedar Hill Business Park
257-B Cedar Hill Road
Marlboro, MA 01762

ESTABLISHED: November 1984 **NO. OF EMPLOYEES: N/A**

BACKGROUND

NSI Logic Incorporated designs, develops, and markets ASICs and video add-on boards that enhance graphics performance of new and existing IBM PC, PS/2, and compatible computer systems. The Company was founded in 1984 by Nandu Marketkar. Prior to founding NSI, Mr. Marketkar operated Custom Computer Systems.

NSI offers ASICs for the graphics and raster controller segments of the industry and will continue to develop turnkey solutions using state-of-the-art technology in related areas. The Company uses CMOS, MOS, and BiCMOS technologies in its ASIC development, which allows NSI to provide a platform for a broad line of high-performance products for applications in graphics and raster controllers. The Company's ASIC products are marketed to OEMs that build systems and video add-on boards. Primary markets for the Company's board products are owners and buyers of computer systems and value-added resellers (VARs).

BOARD
(Name and Affiliation)

*Nandu J. Marketkar, Chairman
NSI Logic, CEO

Jeff Schiebe
NSI Logic, President

PRODUCTS

VLSI	Controllers
EVC215	EPIC EGA
EVC315	Smart EGA
EVC315CR	Smart EGA PLUS
EVC415A	Smart VGA/8
PS00004	VGA/8 and VGA/16

OTHER INFORMATION

NSI Logic does not employ a PR firm.

Stephen A. Stecyk
Not Available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman & CEO
*Nandu J. Marketkar
Custom Computer Systems, President

President & COO
Jeff Schiebe
Masscomp

*Founder

FINANCING

Not available

ALLIANCES

Not available

MANUFACTURING

Technology

Not Available

Facilities

Marlboro, MA
R&D, marketing

Oak Technology, Inc.

139 Kifer Court
Sunnyvale, CA 94086
408/737-0888
Fax: 408/737-3838

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Oak Technology, Inc., was founded in 1987 to provide system-level solutions in chip form to the personal computer market. The Company was founded by David Tsang, a founder and president of Data Technology Corporation from 1979 to 1987. Oak Technology provides total silicon solutions to specific application areas by designing, marketing, and supporting OEM customers in their efforts to design and manufacture high-performance systems. By focusing on key growth areas of the personal computer chip market, Oak seeks to become a dominant player in those market segments. In particular, the targeted segments are battery-powered laptops, high-performance 286/386SX desktops, and graphics controller chips.

By focusing exclusively on those areas that present potential for a high growth rate, Oak hopes to avoid direct head-to-head battles with the numerous other chip set companies. While it cannot compete with larger competitors in the breadth of its product offerings, the objective is to aim at one specific piece of the total market and achieve superiority by designing its products to fit that specific need. Oak believes that it can become a performance leader in the laptop market and the specialized desktop market.

Initially, Oak supplied a PS/2 Model 30-compatible chip set and a VGA/Super VGA graphics controller. In the fall of 1989, Oak began to focus on the introduction of a laptop PC chip set, the OakHorizon. A second area of concentration is the VGA graphics controller market. Future products will target high-performance PCs.

Oak's strongest area of expertise is in the design and marketing of its products. For this reason, it focuses its resources in these areas and uses external fabrication facilities both in the United States and in the Pacific Rim to provide high-volume manufacturing. In this way, Oak is able to take advantage of state-of-the-art manufacturing facilities without massive investment in manpower and capital.

BOARD
(Name and Affiliation)

*David Tsang
Oak Technology, Inc., President

Richard King
KBA Venture Partners, Partner

Wen Ko
Hewlett-Packard Taiwan, President

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*David Tsang
Qume, Vice Chairman

VP, Mktg
Sukkin Fong
Harmony Inc., President

Dir VLSI Design
Dr. Mou Yang
VLSI Technology, not available

Dir Sys Des
Lloyd Ebisu
Data Technology, Dir Eng

Dir Oak-Taiwan
Abel Lo
Convergent Technologies, not available

Dir Ops
James Ou
Data Tech Corp., Ops Res Mgr

*Founder

FINANCING

July 1987
Round 1
$1.5M
KBA Venture Partners, Eastpac, private

November 1988
Round 2
$4.5M
KBA Venture Partners, private

RECENT HIGHLIGHTS

September 1988
Oak announced a family of CMOS chips for the IBM PS-2 Model 30 that uses high-density VLSI devices for systems logic, data separation, and peripherals. The chip family includes the OTI-031 system controller, the OTI-032 I/O controller, the OTI-033 floppy disk controller, and the OTI-036 and OTI-037 graphics controllers.

ALLIANCES

Kanematsu Semiconductor—Oak's Japanese representative

MANUFACTURING

Technology

Proprietary Megacell Technology, CMOS

Facilities

Sunnyvale, CA
Design, marketing, test

PRODUCTS

OTI-030 Core Logic for 8088/8086
OTI-037 Super VGA Controller
OTI-050 OakHorizon for 286/386-SX

OTHER INFORMATION

Bailey Associates is Oak Technology's PR firm.

Opto Diode Corp.

750 Mitchell Road
Newbury Park, CA 91320
805/499-0335
Fax: 805/499-8108

ESTABLISHED: 1981 | **NO. OF EMPLOYEES: 13**

BACKGROUND

Opto Diode Corp. (ODC) was formed in 1981 by James Kim, formerly with Rockwell's Collins division in Dallas, Texas. ODC offers semicustom high-reliability devices made to customer specifications. The Company is occupying a 10,000-square-foot facility in Newbury Park, California.

ODC had $1 million in sales in 1985 from GaAs infrared LEDs for solid-state relay and optoelectronics markets. Future plans are to penetrate the U.S. military market and European market.

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*James Kim
Rockwell, Sr Research Engr

*Founder

FINANCING

Not available

BOARD

Not available

ALLIANCES

Not available

PRODUCTS

Gallium Aluminum Infrared LEDs

OTHER INFORMATION

Opto Diode does not employ a PR firm.

Opto Tech Corp.

32 Industrial East 4th Road
Science-Based Industrial Park
Hsinchu, Taiwan
ROC
(035) 777-481/3
Telex: 31592 OPTO TECH

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 100**

BACKGROUND

Opto Tech is offering GaAs-based products, silicon wafers, and photoresistor and photodiode semiconductors. The Company plans to offer small-signal and transmitting transistors, junction FETs, microwave transistors, and fast-recovery and Schottky-barrier diodes. Production began in July 1984.

The Company spun off from Fine Microelectronics and is owned by local investors and the Bank of Communications.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
James Chiu
Petrochemical Industry, President

Business Liaison
S. Shyu
Not available

FINANCING

$2.5M
Bank of Communications, Fortune Plastic Manufacturing Co., Opto Tech Corp.

ALLIANCES

None

MANUFACTURING

Technology

GaAs
Silicon

Facilities

Hsinchu, Taiwan
9,175 sq. ft.

PRODUCTS

LED
Transistors
Photodiodes
Phototransistors
Infrared Devices

OTHER INFORMATION

Opto Tech does not employ a PR firm.

Orbit Semiconductor, Inc.

1230 Bordeaux Drive
Sunnyvale, CA 94086
408/744-1800
Fax: 408/747-1263

ESTABLISHED: November 1985 **NO. OF EMPLOYEES: 115**

BACKGROUND

Orbit Semiconductor, Inc., specializes in quick-turn, high-reliability foundry work with emphasis on 1.5-micron CMOS including either a double-poly or double-metal process. Other processes include 2.0- to 5.0-micron CMOS, HMOS, single- or double-poly, single- or double-metal, double-poly/double-metal, and multiple-layer poly.

Orbit guarantees single-poly and single-metal CMOS or HMOS in 10 working days or fewer and double-poly or double-metal CMOS in 15 working days or less.

The Company also offers computer-aided design services, which include layout from customer-provided logic drawings, design rule checking, data sizing, and conversion and Versatec plots. Orbit also acts as a prime contractor for providing photoplates.

In late 1979, Comdial Corporation, an Oregon firm that made subsystems for telephone dialing, started the firm as its engineering subsidiary. Comdial acquired an existing facility in 1979 and developed industry-compatible silicon-gate NMOS and CMOS processes. The Company, operating under the name Comdial Semiconductor, began offering foundry services in January 1980 and became the only guaranteed quick-turn fab in the business. One-half of the Company's resources were dedicated to quick-turn services and guaranteed parts within as few as 5 days for NMOS and 10 days for CMOS.

In November 1985, 80 percent of Comdial Semiconductor was acquired by Orbit Instruments, Inc., a supplier to Hughes and other military contractor companies. The management of Comdial Semiconductor retained 20 percent of the Company. In addition to continuing the previous services, Orbit is positioning itself to be a stronger supplier to high-reliability commercial and military-oriented users. In 1987, Orbit added specialized processing such as p-well radiation-hardened CMOS and CCD manufacturing. The 2-micron radiation-hardened CMOS offers a total dose of radiation up to 1 megarad.

Orbit's North American customers include Amber Engineering, Cardiac Pacemakers, Crystal Semiconductor, Dallas Semiconductor, General Electric, General Motors, Honeywell, Hughes, Intermedics, ITT, Johns Hopkins University, Lotus Designs, Macronix, Martin Marietta, Motorola, RCA, Rockwell, Silicon General, and VLSI Design Associates. The Company's overseas customers include British Petroleum, Tadiron, and Thomson CSF.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Gary Kennedy
Comdial Semiconductor, VP/GM

VP Finance
Joseph Wai
Comdial Semiconductor, Controller

VP Technology
*Steve Kam
Comdial Semiconductor, Dir Technology

VP Wafer Fab
Al Bettencourt
Comdial Semiconductor, Process Mgr

*Founder

Orbit Semiconductor, Inc.

FINANCING

Not available

RECENT HIGHLIGHTS

March 1988
Orbit ordered $1.4 million of 1:1 model 1100 lithography systems from General Signal's Ultratech Stepper unit. The order marks the first purchase of steppers by Orbit.

ALLIANCES

Not available

SERVICES

- CAD
- Foundry: HMOS, CMOS, Charge-Coupled Device Processing
- Prototype Manufacturing
- Volume Manufacturing
- Assembly
- Packaging
- Test

MANUFACTURING

Technology

- 1.5-micron silicon-gate, double-poly, double-metal CMOS and HMOS
- 2.0- to 5.0-micron CMOS single- or double-poly, single- or double-metal
- 2.0- to 5.0-micron HMOS single- or double-poly, single- or double-metal
- 4-inch wafers

Facilities

Sunnyvale, CA
28,000 sq. ft.
Manufacturing

OTHER INFORMATION

Orbit does not employ a PR firm.

Oxford Computer, Inc.

39 Old Good Hill Road
Oxford, CT 06483
203/881-0891
Fax: 203/888-1146

ESTABLISHED: March 1987 **NO. OF EMPLOYEES: 3**

BACKGROUND

Oxford Computer was founded to solve extremely demanding problems in pattern recognition. The initial technical approach was to build massive parallel analog chips that were inspired by neural networks. This approach proved infeasible, but basic lessons about placing processors within specially configured memory chips were learned. Oxford Computer's goal is to reduce the cost dramatically and expand the use of image processing, pattern recognition, and 3-D graphics devices.

A marketing communications campaign was launched in April 1988 that resulted in more than 50 newspaper and magazine articles about Oxford Computer and its technology during the 18 months following its start. As a result of many customer contracts, a family of application-specific, memory-plus-processor chips was defined and shown to be desired. Basic functions include matrix multiplication, convolution, and interpolation. Oxford calls these novel chips Intelligent Memory Chips.

Unlike ordinary memory chips that are limited to information storage, Oxford Computer's Intelligent Memory Chips both store and process information. In addition to their primary function as memory, Intelligent Memory Chips have multiple simple partial processors embedded within. Furthermore, unlike ordinary memory chips that handle only one or a few bits of information at a time, each Intelligent Memory Chip handles strings of hundreds of bits at a time. Although the idea of placing processors within memory chips is an old one, Oxford has devined a family of Intelligent Memory Chips with specific applications in digital signal processing, pattern recognition, and 3-D graphics.

Currently, two products are in development at Oxford Computer. The first is the Intelligent Pattern Recognition Memory Chip. The second product is the Intelligent Convolution Memory Chip, with samples due in spring 1990. Oxford subcontracts all manufacturing and assembly operations and most of its testing.

BOARD
(Name and Affiliation)

Michael Mulshine
Osprey Partners

Steven G. Morton
Oxford Computer

Jack Harding
Zycad Corporation

Howard Morgan
ARCA Group, Inc.

Earl Rogers
Formerly CEO of Precision Monolithics

COMPANY EXECUTIVES
(Position and Name)

President & Chief Technical Officer
Steven G. Morton

Corporate Secretary & Treasurer
Jack Harding

Assistant Secretary
Frank Marco

FINANCING

Seed stage from the founder and a private placement.

Start-up financing initiated in the fall of 1989.

ALLIANCES

Not available

OTHER INFORMATION

Oxford Computer does not employ a PR firm.

Pacific Monolithics, Inc.

245 Santa Ana Court
Sunnyvale, CA 94086
408/732-8000
Fax: 408/732-3413

ESTABLISHED: March 1984 **NO. OF EMPLOYEES: 120**

BACKGROUND

Pacific Monolithics, Inc., designs and manufactures monolithic ICs (MMICs) based on GaAs, as well as microwave subsystems based on its GaAs MMICs. The Company offers more than 200 microwave macrocells (PM Cells) for semicustom IC design for consumer, communications, and defense applications. Company strengths include yield-tolerant design techniques, advanced packaging technology, a proprietary CAD/CAE system, and foundry services.

The Company participated as a team member on several contracts for the Department of Defense, including Phase 0 and Phase 1 of the Microwave/Millimeter-Wave IC (MIMIC) program. The contracts were in the areas of communication, radar, electronic warfare, and smart weapons for the army, navy, and air force.

Pacific Monolithics has developed a set of monolithic GaAs subsystem building blocks for microwave signal processing. The Company's ASIC cell library includes amplifiers, mixers, oscillators, couplers, combiners, switches, attenuators, phase shifters, modulators, and demodulators.

In April 1986, Pacific Monolithics introduced three MMIC devices that were offered in 5V, commercial grade, 8-lead, surface-mount packages. The devices were an 0.8- to 3.0-GHz converter, a 3.0- to 6.0-GHz converter, and a 5.0- to 6.0-GHz converter.

In March 1986, the Company relocated from a 10,000-square-foot facility to a 22,000-square-foot facility that can be expanded by an additional 13,000 square feet. Presently, Pacific Monolithics uses several foundry services, including TriQuint and COMSAT.

BOARD
(Name and Affiliation)

*Allen Podell, Chairman of the Board

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Donald A. Bond
Sanders, VP/GM Microwave

SR VP & Director
Allen Podell
A.F. Podell Assoc., President of Technology

VP Bus Dev
Frank Russell
Avantek, Sales Mgr

VP Engr
Pang Ho
Geotech, President

Dir Sys & Plan
*Doug Lockie
Strategic Technology, Consultant

*Founder

FINANCING

August 1985
Round 1
$5.0M
IAI Venture Partners, Sand Hill Financial Corp., Shaw Ventures, Vanguard Associates

September 1986
Round 2
$3.5M
Institutional Investment Partners, Oak Investment Partners

Pacific Monolithics, Inc.

RECENT HIGHLIGHTS

November 1987
Pacific Monolithics and TriQuint became team members, with Ford as primary contractor, for contracts that cover smart weapons, radar, and electronic warfare.

November 1987
Pacific Monolithics and TriQuint became team members, with Allied Bendix as prime contractor, for two contracts that cover communications and radar.

ALLIANCES

Not available

PRODUCTS

Channelized Up/Down Converters
Converters
Amplifiers
Oscillators
Attenuators
Active Isolators
Phase Shifters
Switches
Synthesizers
TR Modules
Single-Chip Radars
Microwave Sensors
Expendable Countermeasure Subassemblies

OTHER INFORMATION

Pacific Monolithics does not employ a PR firm.

MANUFACTURING

Technology

GaAs

Facilities

Sunnyvale, CA
35,000 sq. ft.
Lab, manufacturing, administration

6,000 sq. ft.
Class 100 clean room

Paradigm Technology, Inc.

(Formerly GL Micro Devices)
71 Vista Montana
San Jose, CA 95134
408/954-0500

ESTABLISHED: February 1987 **NO. OF EMPLOYEES: 35**

BACKGROUND

Paradigm Technology, Inc., was formed to develop high-performance advanced CMOS products and is in an R&D mode. Norman Godinho and Frank Lee, founders of Paradigm Technology, Inc., also are founders of Integrated Device Technology (IDT). Mr. Godinho served as vice president and general manager of IDT's digital signal processing (DSP) division, and Mr. Lee was codirector of IDT's corporate research and development group.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Terry Holdt
Linear Corp., Pres.

VP Technology
*Norman Godinho
IDT, VP/GM DSP Div

VP Prod Dev
*Frank Lee
IDT, Codirector Corp R&D

VP Mktg/Sales
Steve Taylor
IDT, NE Regional Mgr

VP Operations
James Doran
Intel, Plant Manager

VP Finance/CFO
Richard Henander
Sigma Circuits, VP Finance

*Founder

FINANCING

February 1987
Round 1
$2.4M
El Dorado Ventures, Glenwood Management

May 1989
Round 2
$9.6M
First-round investors, TA Associates, Chesapeake Ventures, Gateway Partners, Centennial Funds

RECENT HIGHLIGHTS

May 1989
Paradigm relocated from temporary facilities in Santa Clara, California, to its new 62,000-square-foot facility in San Jose. The new facility includes a wafer-fabrication facility dedicated to implementing Paradigm's proprietary design and process technology.

MANUFACTURING

Technology

CMOS

Facilities

San Jose, CA
62,000 sq. ft.
R&D, manufacturing, administration

Paradigm Technology, Inc.

PRODUCTS

A complete family of high-speed 256Kb SRAM chips, with 1Mb SRAMs expected in early 1990

OTHER INFORMATION

Paradigm's PR firm is Ulevich and Orrange, Inc.

Performance Semiconductor Corporation

610 East Weddell Drive
Sunnyvale, CA 94089
408/734-8200
Fax: 408/724-0258

ESTABLISHED: 1984 **NO. OF EMPLOYEES: 330**

BACKGROUND

Performance Semiconductor Corporation designs, develops, manufactures, and markets high-speed SRAMs, MPUs, and logic devices for military, industrial, and telecommunications applications. The Company was founded by Dr. Thomas A. Longo, David Maxwell, and Gerald Herzog.

Performance Semiconductor is using an advanced single-CMOS process known as performance advanced CMOS engineered (PACE) technology. PACE uses 0.8-micron and 0.7-micron effective channel lengths to give 500ps loaded internal gate delays. PACE also includes two-level metal and epitaxial substrates.

The Company's products include CMOS SRAMs at levels of complexity of 1K to 64K; a 40-MHz, 16-bit MPU that executes the 1750A instruction set; and two support functions, the processor interface circuit (PIC) and MMU combination. In 1987, Performance offered an 8ns 1K SRAM organized as 256x4 and a new series of TTL I/O 16K SRAMs featuring an address access time of between 12ns and 15ns. In 1987, the Company also signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals.

In March 1985, Performance leased a 26,000-square-foot facility where it conducts research and development and all manufacturing. The Company has developed it into a Class 1 facility that uses 6-inch wafers. In 1987, Performance achieved military 883C compliance and shipped both 64K SRAMs and the 1750A processor compliant with the 883C.

In January 1988, Performance announced that it had signed a nationwide franchising agreement with Schweber Electronics, putting in place its North American distributor network. A nationwide franchise was previously signed with Zeus Components in July 1987.

BOARD
(Name and Affiliation)

*Dr. Thomas A. Longo, Chairman
Performance Semiconductor Corporation

Robert Zicarelli
Northwest Venture Partners

B. Kipling Hagopian
Brentwood Associates

William Bowes
U.S. Venture Partners

Dr. James Meindl
Rensselaer Polytechnic Institute

T.J. Connors
T.J. Connors Company

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Dr. Thomas A. Longo
Schlumberger

VP Ops
Gene Blanchette
Raytheon

VP Sales/Mktg
Les Welborne
Fairchild

VP Finance
George Wikle
Memorex

VP Human Resources
William Strickland
Fairchild

VP Product Development
Dr. Vir Dhaka
Xerox

VP Product Development
Dr. John E. Iwersen
Bell Labs

VP Reliability & QA
Rudy Konegan
U.S. Air Force

*Founder

FINANCING

October 1984
Round 1
$11.3M
Advanced Technology Ventures, Albion Ventures, Arbeit & Co,, Asset Mgmt., Brentwood Assoc., DSV Partners, IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital Mgmt., Rotan MOSel Technology Partners, Taylor & Turner, U.S. Venture Partners, Venwest Partners (Westinghouse Electric Corp.), Seymour Cray, Thomas Longo

Lease
$6.6M
Westinghouse Electric Corp.

November 1986
Round 2
$10.0M
Advanced Technology Ventures, Albion Ventures, Asset Mgmt., Brentwood Assoc., DSV Partners, Harvard Mgmt., IAI Venture Partners, NorthStar Ventures, Northwest Venture Capital, Reynolds Creek Ltd. Partnership, L.F. Rothschild, Taylor & Turner, Unterberg Towbin, U.S. Venture Partners, Venwest Partners, Thomas Longo

August 1988
Round 3
$5.0M
Berkeley International, Brentwood Associates, Cowen and Co., and several officers of Performance Semiconductor Corporation

RECENT HIGHLIGHTS

September 1987
Performance offered the VSI chip, which incorporates bus interface features for intelligent controller applications. The device provides 32-bit VMEbus address decoding as well as interrupt and mailbox facilities.

November 1987
Performance presented information on its 40-MHz VHSIC-level PACE 1750A system at the GOMAC conference. The system is a CMOS three-chip set consisting of a CPU, a processor interface chip, and an MMU/combination support chip. The set is said to provide system performance greater than 2 mips.

March 1989
.Performance introduced two static RAMs—the P3C3147 and the P3C3148—that use 3.3V rather than 5.0V.

ALLIANCES

Westinghouse
August 1986
Performance fabricated a VHSIC Phase-I, 11,000-gate array designed by the Westinghouse Defense and Electronics Center for the U.S. Air Force Wright Aeronautical Laboratories.

MIPS Computer Systems
November 1987
Performance signed an agreement with MIPS Computer Systems, allowing Performance to manufacture and market MIPS' 32-bit RISC MPU, floating-point coprocessor, and other peripherals. Performance will also sell the MIPS software environment with the chips.

MANUFACTURING

Technology

1.25-micron CMOS PACE I (0.8-micron effective channel lengths)
1.00-micron CMOS PACE II (0.7-micron effective channel lengths); all wafers produced have been 6-inch double-metal, epi substrates since 1985.

Facilities

Sunnyvale, CA
44,000 sq. ft.
Manufacturing

8,000 sq. ft.
Class 1 clean room

PRODUCTS

CMOS SRAMs

Device	Density	Organization	Speed (ns)	Features
P4C422	1K	256x4	8	
P4C147	4K	4Kx1	10	
P4C148	4K	1Kx4	10	
P4C149	4K	1Kx4	10	Fast CS
P4C150	4K	1Kx4	10	Separate I/O, Reset
P4C151	4K	1Kx4	10	Comparator
P4C116	16K	2Kx8	15	300-Mil Package
P4C168	16K	4Kx4	12	
P4C169	16K	4Kx	12	Fast CS
P4C170	16K	4Kx4	12	Output Enable
P4C1682/1681	16K	4Kx4	15	Separate I/O
P4C164	64K	8Kx8	20	300-Mil Package
P4C187	64K	64Kx1	12	
P4C188	64K	16Kx4	20	
P4C198	64K	16Kx4	20	Output Enable
P4C1982/1981	64K	16Kx4	20	Separate I/O
P4C163	72K	8Kx9	20	300-Mil Package
P4C1257	256K	256Kx1	20	

Pace Logic CMOS Family

74PCT273/374 250-MHz Toggle Rates
74PCT373/533 Gated Latches
74PCT241/244 Bus Drivers
74PCT245/545/640/643/645 Transceivers
74PCT29818/29521 plus "A" versions of all logic parts

Microcomponents

PACE 1750A Family	16-Bit MPUs	20-, 30-, and 40-MHz; Includes 32-Bit and 48-Bit Floating-Point Arithmetic Processing
PACEMIPS	R2000A CPU (16-MHz) R2010 FPA (16-MHz) R3000 CPU (25-MHz) R3010 FPA (25-MHz)	

OTHER INFORMATION

Performance Semiconductor does not employ a PR firm.

Photonic Integration Research, Inc.

1357 Perry Street
Columbus, OH 43201
614/424-3313
Fax: 614/424-3320

ESTABLISHED: July 1987 **NO. OF EMPLOYEES: 6**

BACKGROUND

Photonic Integration Research, Inc., (PIRI) was formed to develop basic optical IC technology for commercial applications. The Company is the result of a joint venture between Nippon Telegraph and Telecommunications (NTT), Mitsubishi Electric Corporation of Japan, and the Batelle Memorial Institute. NTT owns 49 percent of the Company; Mitsubishi owns 41 percent; and Batelle owns 10 percent.

PIRI president, Dr. Tadashi Miyashita, was formerly head of the Optoelectronic Materials Section of the Electronics Materials Department at NTT's Ibaraki Electrical Communications Laboratories. Shigeki Sakaguchi and Shin Sumida also were previously at NTT's Ibaraki Telecommunications Laboratories, where the optical IC technology was invented.

In addition to developing commercial applications for optical waveguide technology, PIRI will also develop applied components that will be made available to equipment manufacturers for use in such end products as optical communications equipment, optical measuring equipment, automobiles, and airplanes. The Company expects advancement in the technology to lead to greater miniaturization and increased utilization of fiber optics.

PIRI is located in the Batelle Memorial Institute's Columbus, Ohio, facilities.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
Dr. Tadashi Miyashita
NTT

General Manager
Shigeki Sakaguchi
NTT

Chief Supervisor
Shin Sumida
NTT

FINANCING

July 1987
Round 1
$10.0M
Batelle Research Institute, Mitsubishi Electric Corporation, Nippon Telephone & Telegraph

PRODUCTS

Optoelectronic Devices
Custom-Design Optical Devices

OTHER INFORMATION

PIRI does not employ a PR firm.

Plus Logic

1255 Parkmoor Avenue
San Jose, CA 95126
408/293-7587
Fax: 408/298-7587

ESTABLISHED: 1988 **NO. OF EMPLOYEES: 27**

BACKGROUND

Plus Logic was incorporated in October 1987. The founding team, which consists of former National Semiconductor founder Roger Smullen and semiconductor industry executives Clayton Marr and Cecil Kaplinsky, was established in January 1988. Plus Logic was formed to solve the system performance, cost, and time-to-market limitations of existing "glue logic" devices. The Company's goal is to become a major player in the ASIC market, targeting the multibillion-dollar field-programmable gate array (FPGA) market with a range of innovative and easy-to-use products and software design tools.

Plus Logic's answer to the problems associated with conventional glue logic lies within its family of FPGAs based on Plus Logic's proprietary PLUS ARRAY architecture. The PLUS ARRAY family of FPGAs combines the flexibility and faster time to market of user configurability, along with the cost and performance required to implement high-speed glue logic.

The PLUS ARRAY architecture provides the high-performance system designer with a way of implementing glue logic that is high in performance (40-MHz system clock rate), integrated (1,000 to 6,000 gates per chip), fast and easy to design (uses standard design tools), predictable in timing (does not require multiple design iterations), and low in cost.

Plus Logic's first family of products is the FPGA2000 family. Three family member parts will be introduced by the end of 1990. Based on a CMOS EPROM technology, the devices are capable of implementing functions of up to 2,000 gates and will support a system clock rate of up to 40 MHz. Plus Logic subcontracts foundry and assembly services. In addition, the Company conducts in-house testing but also subcontracts a portion of this work.

BOARD
(Name and Affiliation)

Roger Smullen, Chairman
Plus Logic, President/CEO

Gordon Russel
Sequoia Capital, Partner

Jeff Pickard
Merrill, Pickard, Anderson & Eyre, Partner

Bernard J. Lacroute
Formerly with Sun Microsystems

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Roger Smullen
AMCC, CEO/Chairman

VP R&D
*Cecil Kaplinsky
Katus Technologies, Partner

VP Mktg
*Clayton Marr
Katus Technologies, Partner

VP Finance
Howard Bailey
MVI, Inc., Founder

VP Technology
George Simmons
Phillips/Signetics, CMOS Tec Dev Mgr

*Founder

FINANCING

October 1988
Seed
Not available
Chips & Technologies, Inc.; private investors

January 1989
Round 1
$5.0M
Sequoia Capital; Merrill, Pickard, Anderson & Eyre; Asset Mgmt Co.; Brentwood Associates; Hook Partners

ALLIANCES

Foundry agreements are in place and will be announced at a later date.

PRODUCTS

Silicon Device

FPGA 200 Family

2010	4 FBs
2020	8 FBs
2040	16 FBs

Field-Programmable Subsystem Logic Family

5110	4 FBs and dual-port memory
5210	4 FBs and finite state machine

OTHER INFORMATION

Plus Logic's PR firm is Maxtec.

MANUFACTURING

Technology

1.2-micron CMOS

Facilities:

San Jose, CA
28,000 sq. ft.
Engineering, development, test, marketing, administration

PLX Technology Corporation

625 Clyde Avenue
Mountain View, CA 94043
415/960-0448
Fax: 415/960-0479

ESTABLISHED: May 1986 **NO. OF EMPLOYEES: N/A**

BACKGROUND

PLX Technology Corporation was formed to offer CMOS programmable interface devices for MPU-based systems. The Company's first product, introduced in May 1987, was the PLX 448—an erasable programmable logic device (EPLD). The device has electrical and architectural features that are geared specifically for bus interface applilcations. The PLX 448 includes four 48mA drivers and four 24mA drivers that can drive VMEbus, Nubus, Micro Channel bus, proprietary buses, and memory buses directly. PLX is the only supplier that offers the high-drive capability. The device is fabricated using a 1.5-micron CMOS EPROM process and offers a propagation delay from input to high-drive-current output as low as 25ns.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Michael Salameh
Hewlett-Packard, Mktg Manager

VP R&D
Wei-Ti Liu
AMD, R&D

VP Prod Plan
D. James Guzy, Jr.
AMD, R&D

VP Sales
Don Etzbach
Virtual Micro-System, Mktg/Sales

Mgr Systems Eng
Arthur Chang
Wyse Technology, Hardware Eng Mgr

VP Marketing
Gaylord Galiher
Hewlett-Packard, Marketing Mgr

FINANCING

May 1986
Round 1
N/A
Arbor Financial Group; Draper Associates; and others

March 1988
Round 2
N/A
Initial investors; and others

August 1989
Round 3
$1.9M
Arbor Financial Group; Associated Venture Investors; Draper Associates

ALLIANCES

None

MANUFACTURING

Technology

1.5-micron CMOS
1.2-micron CMOS

PRODUCTS

Device	Description
PLX 464	PLD with 64mA High-Drive Current
PLX 448	PLD with 24mA and 48mA High-Drive Current
VSB 1200	Master Module Interface Device with Single-Level Arbiter, Bus Requester, Bus Controller
VME 1200/1210/1220	VMEbus Master Controllers with Single-Level System Arbiter, Bus Requester, Driver
VME 2000	VMEbus Slave Module Interface Device
MCA 1200	Micro Channel Bus Controller and Local Arbiter
VSB 2000	VSB Slave Module Interface Device
VME 3000/3010	Interrupt Generators
VME 4000	Interrupt Handler
USB 1400	Multi-Master Bus Controller

Multibus I

MBI 8289A/8289B	MBI APX 86/88/186 Bus Arbitor iAPX

Multibus II

PSB 2000/2100	Reply agent controller and reply agent error generator
LBX 2000/2100	Reply agent controller/reply agent

OTHER INFORMATION

PLX's PR firm is Robin Eschler Associates.

Power Integrations Incorporated

411 Clyde Avenue
Mountain View, CA 94043
415/960-3572
Fax: 415/940-1226

ESTABLISHED: May 1988 **NO. OF EMPLOYEES: N/A**

BACKGROUND

Power Integrations Incorporated was founded in May 1988 by Dr. Klas Eklund, Arthur Fury, and Steve Sharp to develop, manufacture, and market high-voltage power semiconductors. Using proprietary technology, Power Integrations developed a line of power ICs that integrate low 5-volt circuits with circuits that handle 200 to 400 volts. The Company's products bridge the gap between low-voltage control circuitry and high-voltage peripheral devices.

Power Integrations introduced its first products in June 1989. One is a universal power driver used to control high-voltage peripherals such as relays, solenoids, lamps, and motors from low-voltage control circuitry including CMOS and TTL digital logic and analog signals. The Company also introduced a high-voltage interface and a high-voltage n-channel array. Each of these devices is available with voltage rating of 200 or 300 volts. The n-channel array and the universal power driver are also available with a 400-volt handling capacity. Future products will have high voltage and current ratings.

All of Power Integrations' products are based on CMOS technology. Power Integrations conducts all testing in-house, but wafer fab and assembly operations are conducted by external sources.

BOARD
(Name and Affiliation)

Dr. William Davidow
  Mohr, Davidow Ventures

Irwin Federman
  Concord Partners

Floyd Kvamme
  Kleiner, Perkins, Caufield & Byers

*Stephen Sharp
  Not available

Dr. Ed Ross
  Power Integrations

*Dr. Klas Eklund
  Power Integrations

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Dr. Ed Ross
  Signetics, Sr VP Prod Div Grp

VP R&D
*Dr. Klas Eklund
  Data General, Product Manager

VP Mktg
*Art Fury
  Micro Linear, VP Mktg & Sales

VP Mfg
Russ Anderson
  Signetics, VP/Gen Cus Spec Prod Div

*Founder

FINANCING

May 1988
Round 1
$3.1M
  Concord Partners; Data General Corporation; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow Ventures

August 1989
Round 2
$7.5M
  Original investors; Hillman Ventures; Merrill, Pickard, Anderson & Eyre

Power Integrations Incorporated

RECENT HIGHLIGHTS

June 1989
Power Integrations, Inc., introduced its first family of products for the high-voltage power IC market. The products include the PWR-DRV1 universal power driver, the PWR-DRV451 through 4 high-voltage interface series, and the PWR-NCH801 high-voltage n-channel array.

ALLIANCES

None

MANUFACTURING

Technology

CMOS

Facilities

Mountain View, CA
10,400 sq. ft.
Design, test, marketing

PRODUCTS

Universal Power Driver
High-Voltage Interface
High-Voltage N-Channel Array

OTHER INFORMATION

Power Integration's PR firm is Rigoli, Pamphilon, Demeter.

Powerex, Inc.

Hillis Street
Youngwood, PA 15697
412/925-7272
Fax: 412/925-4393

ESTABLISHED: January 1986 **NO. OF EMPLOYEES: 500**

BACKGROUND

Powerex, Inc., manufactures and markets thyristors and rectifiers rated greater than 50 amperes. The Company also offers power transistors, Darlington, FETMOD, and MOSBIP modules. Powerex is a service-oriented company, providing just-in-time delivery, and has developed business partnership arrangements with many key customers. The Company has more than 100 accounts, including electric companies, railroads, and government agencies.

Powerex is the result of a joint venture among Westinghouse Electric, General Electric, and the U.S. subsidiary of Mitsubishi Electric Corporation. The purpose of the joint venture was to form a company that would be a leading supplier of power semiconductors in the United States. To create the new entity, Westinghouse combined its semiconductor division with General Electric's high-power rectifier and thyristor business. Mitsubishi contributed working capital and technology for a 10 percent ownership.

The Company is developing high-power semiconductor devices and plans to supply intelligent-power hybrid circuits that combine a power element (e.g., power transistor) with a logic/control element.

BOARD

Not available

COMPANY EXECUTIVES

Position, Name, and Prior Company)

President/CEO
Ronald Whigham
Westinghouse Electric Corporation

VP Commercial Op
Stanley R. Hunt
Westinghouse Electric Corporation

CFO
J.A. Sibenac
Westinghouse Electric Corporation

VP Operations
Dave Gillott
Westinghouse Electric Corporation

FINANCING

Powerex received initial funding from Westinghouse Electric Corporation (45 percent), General Electric Company (45 percent), and Mitsubishi Electric America (10 percent) for an undisclosed amount.

1988
Financing changed to one-third ownership by previously mentioned companies

RECENT HIGHLIGHTS

January 1986
Powerex received licenses and technological know-how for Darlington transistor modules and GTOs from Mitsubishi; it received all thyristor and rectifier technology from Westinghouse, General Electric, and Mitsubishi.

August 1986
Powerex assumed exclusive sales responsibilities for Mitsubishi Darlington transistor modules in North America.

August 1986
Powerex reached an agreement with Mitsubishi to build a world-class automated assembly facility in France for isolated modules.

September 1987
Powerex purchased GE/RCA's low-power thyristor product line. The Company also signed a technology-licensing agreement with GE/RCA for MOSFET, IGBT, and MCT products and received exclusive sales rights for all MCTs rated greater than 100 amperes.

December 1987
Powerex started up a new wafer fab in Youngwood. The new fab is capable of producing complex geometry devices. Powerex also produced its first isolated modules for quality conformance testing in France.

MANUFACTURING

Technology

R&D
Design
Assembly
Test
Manufacturing

Facilities

Youngwood, PA
225,000 sq. ft.
Wafer fab

Auburn, NY
Wafer fab

Massey, France
Wafer fab, assembly

Puerto Rico
Assembly

Singapore
Assembly

PRODUCTS

Standard Rectifiers—High Power
Fast Recovery Rectifiers
Phase-Control Thyristors
Thyristors for Pulse Applications
Inverter-Grade SCRs
Reverse Conducting Thyristors
Gate Turn-Off (GTO) Thyristors
Triacs
Thyristor and Diode Modules
Power Transistor Modules
Darlington Modules
FETMOD Isolated MOSFET Modules
MOSBIP Hybrid Isolated Modules
IGBT Modules
Low-Power Product Line

OTHER INFORMATION

Powerex does not employ a PR firm.

PromTech

1885 Lundy Avenue, Suite 202
San Jose, CA 95131
408/434-9550
Fax: 408/434-7045

ESTABLISHED: 1984 | **NO. OF EMPLOYEES: 7**

BACKGROUND

PromTech was formed to combine the high-speed EPROM expertise of the founding members with custom and semicustom design. The Company has been working on contracts to design custom memory devices. PromTech also has developed a 1Mb and 4Mb EPROM in the 70ns access range.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Dr. Paul Ouyang
Universal Semi, Exec VP

*Founder

FINANCING

1984
Seed
$0.2M
Private

PRODUCTS

To be announced

OTHER INFORMATION

PromTech does not employ a PR firm.

ALLIANCES

1984
PromTech licensed technology to an unnamed Japanese company.

1987
PromTech licensed its EPROM technology to Yamaha Corp. Yamaha will develop a new ASIC standard chip that combines the EPROM technology with its own voice- and image-processing capabilities.

MANUFACTURING

Technology

1.2-, 1.5-, and 2.0-micron single-metal, double-poly CMOS

Facilities

San Jose, CA
2,000 sq. ft.
Administration, design, R&D

RAMAX Limited

Monash Business Park
Level 1, Building 11
Business Park Drive
Notting Hill VIC 3168
Australia
(03) 558 9900
Fax: (03) 558 9123

ESTABLISHED: 1987 **NO. OF EMPLOYEES: N/A**

BACKGROUND

RAMAX Limited was formed in 1987 to commercialize and produce integrated circuits for global markets based on new nonvolatile memory (NVM) technology. Funding for the Company was provided solely by the Victoria State Government in the form of equity subscription. This funding has allowed RAMAX to acquire rights to this new technology and commence the pursuit of the business opportunities it has identified.

The Company recognizes that the demand for integrated circuits with higher density and higher speed is driving the semiconductor industry toward the use of optical techniques. These techniques are based primarily on active thin-film technologies, and RAMAX has chosen to specialize in this rapidly growing market area.

To realize its market opportunity, RAMAX will develop and commercialize a range of differentiated products based on active thin-film technologies; these products are thin-film ferroelectrics and compound semiconductor epi layers. RAMAX's long-term emphasis will be on compound semiconductor-based (specifically GaAs) integrated circuits—electronic and optoelectronic—that combine the advantages of both the GaAs and thin-film ferroelectric materials. However, market opportunities in silicon NVMs also will be pursued, particularly the replacement of current EEPROMs with ferroelectric versions that offer superior performance characteristics.

The Company formed a joint venture with Epi Materials Ltd. (EML) of the United Kingdom to enter the epi-treated wafer market in Asia. The product initially will be sourced from EML and primarily will be GaAs-based epi layers that use an enhanced, high-quality, high-yield metalorganic chemical vapor deposition (MOCVD) process developed by EML. Once sufficient sales volume has been generated, the product will be manufactured in Australia.

The silicon NVM market will be approached in two phases. In the first, RAMAX proposes to market the product from an existing European or North American manufacturer into Asia to build marketing capability and understand customer needs before entering the market with its own products. The second phase will be the launch of a new NVM product that offers significantly improved user benefits utilizing thin-film ferroelectrics. A foundry manufacturing strategy will be employed for production.

Initial entry to the GaAs market will be via an agency for products from an existing manufacturer. As with silicon NVMs, this method of entry will allow a marketing capability to be established and the building of customer relationships. The Company then proposes to establish a design facility for standard GaAs products and ultimately design GaAs NVM products utilizing the thin-film ferroelectric technology.

The Company's long-term entry to the optoelectronic IC market will result from the integration of the active thin-film technologies that will allow a new generation of OEICs to be developed.

RAMAX Limited

BOARD
(Name and Affiliation)

Vincent N. Schutze, Chairman
Dr. David G. Beanland, Director
Allan G. Tapley, Managing Director

COMPANY EXECUTIVES
(Position and Name)

Chief Executive Officer
Allan G. Tapley

Admin. Manager & Company Secretary
William D. Gleeson

Technology Manager
R. Bruce Godfrey

FINANCING

June 1987
Round 1
$8.0M
State Government of Victoria

ALLIANCES

Ramtron Corp.
June 1987
RAMAX licensed Ramtron's thin-film ferroelectric NVM technology. RAMAX has worldwide nonexclusive rights with sublicensing on silicon and worldwide exclusive rights with sublicensing on GaAs.

Epi Materials Ltd.
October 1989
An Australian joint venture was formed to market EML's epi-treated wafers into Asia and ultimately to manufacture epi-treated wafers in Australia.

SERVICES

Marketing
Manufacturing

PRODUCTS

MOCVD epi-treated wafers
Silicon- and GaAs-based NVM and standard products to be announced

OTHER INFORMATION

RAMAX does not employ a PR firm.

Ramtron Corporation

1873 Austin Bluffs Parkway
Colorado Springs, CO 80918
719/594-4455
Fax: 719/594-4939

ESTABLISHED: May 1984 **NO. OF EMPLOYEES: 53**

BACKGROUND

Ramtron Corporation is a technology research, development, and marketing organization founded in 1984 to develop a solution to the inherent problem of volatility in microelectronic circuits.

Ramtron's solution is ferroelectronics. Ferroelectronics merge the ferroelectric effect, known for its nonvolatile storage characteristics, with conventional integrated circuitry. Ferroelectronics produces the world's first true nonvolatile microelectronic memory. In 1987, Ramtron successfully integrated its proprietary lead zirconate titanate (PZT) with a conventional CMOS fabrication process and introduced the world's first ferroelectric random access memory (FRAM). The FRAM combines the benefits of existing memories in a single device: the speed and ease of use of SRAM, the high density and potential low cost of DRAM, and a nonvolatility that equals or exceeds that of EEPROM. FRAMs provide a common memory element that can be used throughout a system, replacing the diverse memory types currently required.

The Company licensed potassium nitrate technology from George Rohrer whose company, Technovation Corporation, owns a minority interest in Ramtron. Newtech Development Corporation of Australia negotiated an agreement with Mr. Rohrer for the patent and formed Ramtron to conduct R&D programs at the University of Colorado in a $5 million research lab.

Ramtron is actively pursuing strategic partnerships and agreements to accelerate ferroelectronic technology insertion in a broad range of applications. Initial markets for the FRAMs include industrial, military, and aerospace applications where nonvolatility is essential. These markets traditionally have used EEPROMs, ROMs, and memories with battery backup. The Company is developing several applications for its FRAMs, including smart sensors, smartcards, smart tags, smart watches, and smart toys.

BOARD
(Name and Affiliation)

Ross M. Lyndon-James, Chairman
Ramtron Australia Ltd., Deputy Chairman

Brian L. Harcourt, Exec Director
Ramtron Australia Ltd., Managing Director

Richard L. Horton, Exec Director
Ramtron Corp., President

Hilton J. Nicholas, Director
Ramtron Australia Ltd., Chairman

A. Geoffrey Lee, Director
Ramtron Australia Ltd., Director

Glen R. Madland
Integrated Circuit Engineering, Chairman

Dr. Steward S. Flaschen, Director
Flaschen & Davies, Consultant

Charles W. Missler, Director
Resdel Industries, Inc., Chairman & CEO

Sam Freeman, Director
Rio Grand Industries, Consultant

Jack F. Moore, Director
International Brotherhood of Electrical Workers, International Secretary

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Richard L. Horton
Honeywell, Dir of Bus Dev

Exec VP/COO
*Dr. Fred Gnadinger
INMOS, VP of R&D & Founder

VP Finance/Admin
Jerald Bollinger
Elxsi, CFO

VP of Research & Development
S. Sheffield Eaton
INMOS, Project Leader & Founder
*Founder

FINANCING

May 1984
Round 1
$5M
Ramtron Australia Limited

May 1986
Round 2
$10M
Ramtron Australia Limited

March 1989
Round 3
$19.5M
National Electrical Contractors Association

ALLIANCES

RAMAX Limited
June 1987
RAMAX Limited, an Australian technology company, licensed Ramtron's FRAM technology.

ITT Semiconductor
June 1988
ITT and Ramtron have a codevelopment and licensing program to develop an advanced submicron ferroelectronic manufacturing process.

NMB Semiconductor
October 1988
NMB and Ramtron have a codevelopment and licensing program to develop a 4Mb DRAM process technology and products utilizing high dielectric materials.

TRW
November 1988
TRW and Ramtron have a codevelopment program to develop radiation-hardened nonvolatile memory for aerospace and defense applications.

Seiko-Epson Corp.
April 1989
Ramtron entered a strategic technology codevelopment alliance with Seiko-Epson. Seiko-Epson will provide Ramtron with manufacturing capacity for FRAM products and will receive sales and distribution rights for FRAM products in Japan and Southeast Asia.

Alcan Aluminum
June 1989
Ramtron and Alcan signed joint development and stock purchase agreements. The agreements include a 6.5 percent equity investment in Ramtron by Alcan and initiate a joint program focused on the development of advanced ferroelectric materials.

MANUFACTURING

Technology

3.0-micron CMOS
1.5-micron CMOS
1.2-micron CMOS (in development)
0.8-micron CMOS (in development)

Facilities

A 69,000-square-foot facility currently under construction in Colorado Springs, Colorado, will house the headquarters and R&D facility, including wafer fab. It is scheduled for completion in June 1990.

PRODUCTS

FM1008	128x8	Available
FM1108	256x8	Available
FM1208	512x8	Available
FM1408	2Kx8 FRAM	Q4 1989
FM1608	8Kx8 FRAM	Future Product
FM1808	32Kx8	Future Product
FM2008	128Kx8	Future Product

OTHER INFORMATION

Ramtron does not employ a PR firm.

S3, Incorporated

2933 Bunker Hill Lane, Suite 100
Santa Clara, CA 95054
408/986-8144
Fax: 408/986-1457

ESTABLISHED: January 1989 **NO. OF EMPLOYEES: 33**

BACKGROUND

S3, Incorporated, was founded in January 1989 by Diosdado Banatao and Ron Yara, two Chips & Technologies veterans. The Company plans to bring a workstation level of performance to PC compatibles by developing advanced silicon subsystems. S3 is currently in its design phase and is expected to introduce its first products in 1990.

In recent years, Dataquest has identified an industry-wide trend toward the "system on a chip." Of course, the ultimate expression of this trend would be a monolithic system chip that integrates logic and memory into the microprocessor. Although the industry has yet to reach this level of integration, the ASIC revolution allowed for the consolidation of logic through gate arrays and similar devices. More recently, many companies have chosen to optimize system performance by developing specialized logic chip sets. Companies that pursue this approach to increasing system performance have found value in design engineers who possess both IC logic and systems expertise.

S3's design methodology is an example of the application of systems expertise to silicon-based subsystem design. In developing its subsystems, S3 simulates system level operation and then partitions its design into chip-level subsystems. This approach to subsystem design allows high-performance integration while maintaining degrees of flexibility at multiple levels for the end-system designer.

The Company has adopted a strategy of using outside companies for its wafer fabrication needs. This strategy allows S3 the flexibility to choose the most economical process for each chip design. Without owning its own fab, S3 is not bound to one process technology and therefore can shop around for the best foundry to fit its needs.

BOARD
(Name and Affiliation)

*Diosdado P. Banatao
President & CEO, S3, Incorporated

Andrew S. Rachleff
Merrill, Pickard, Anderson & Eyre

L. John Doerr
Kleiner, Perkins, Caufield & Byers

Andrew R. Heller
Kleiner, Perkins, Caufield & Byers

William H. Davidow
Mohr, Davidow Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
*Diosdado P. Banatao
Chips & Technologies, VP/GM

VP, Mktg
*Ronald T. Yara
Chips & Technologies, VP

Dir, Finance
David K. Hanabusa
Ashtech, CFO

Dir, Eng
Robert C. Schopmeyer
Not available

*Founder

FINANCING

April 1989
Round 1
$6.0M
Merrill, Pickard, Anderson & Eyre; Kleiner, Perkins, Caufield & Byers; Mohr, Davidow; Sequoia Capital; Mayfield Fund; AVI Management Partners

ALLIANCES

The Company has strategic alliances, but it is not yet in a position to identify them.

PRODUCTS

Silicon Subsystems

OTHER INFORMATION

S3 does not employ a PR firm.

MANUFACTURING

Technology

1.5-micron CMOS
1.0-micron CMOS

S3 will use foundries for manufacturing.

Samsung Semiconductor, Inc.

3725 North First Street
San Jose, CA 95134
408/980-1630

ESTABLISHED: 1983 | **NO. OF EMPLOYEES: 250**

BACKGROUND

Samsung Semiconductor, Inc., (formerly Tristar Semiconductor) designs, manufactures, and markets a broad range of products including NMOS and CMOS memories, logic devices, microprocessors and peripherals, and power MOSFETs. The Company began its operations as a DRAM supplier and, through strategic alliances, has licensed designs to expand its product portfolio quickly.

Building on its base of CMOS DRAM technology with the addition of a new 80,000-square-foot R&D facility in San Jose, California, Samsung is amassing a portfolio of proprietary products. In 1988, the Company introduced a 1Mb DRAM; 64K and 256K SRAMs with 70ns, 80ns, and 100ns access times; fast CMOS logic; and PLDs with speeds of 25ns and 35ns, followed later by a 15ns model. Later that year, Samsung introduced 64K EEPROMs and fast SRAMs with access times down to 20ns and densities of up to 256K, microperipherals running at 10 MHz, a DRAM controller, and AC/ACT CMOS standard logic. These products were developed at two Korean R&D facilities, as well as in Samsung's new San Jose R&D center. In addition, the Company will be producing PLD and DRAM controllers in the San Jose facility.

Samsung Semiconductor is a wholly owned subsidiary of Samsung Electronics Co. (SEC), of the Samsung Group, a Korean conglomerate. SST's investment in Samsung totals $550 million.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
S. Joon Lee
Honeywell, Manager

VP R&D
Ilbok Lee
NSC, Div Mgr

VP Mktg/Sales
C.H. Oh
SST, Sr VP

VP Finance
Won Yang
SST, GM

Dir Mktg
Orlando Gallegos
Zytrex, VP Mktg/Sales

Dir Sales
Mike Barthmen
Hitachi, Natl Sales Mgr

FINANCING

1983
Start-up
$6.0M
Samsung Semiconductor and Telecommunications Ltd. (SST)

1983
Lease
$7.0M
SST

RECENT HIGHLIGHTS

February 1987
Samsung formally opened its $36 million national headquarters in San Jose, California. The facility, which Samsung purchased for $5 million, houses administration, R&D operations, and a research fab. Included in the 80,000-square-foot facility is a 12,000-square-foot Class 1 fab with 6-inch wafer processing equipment. Currently, 50 percent of the Company's capacity of 10,000 wafer starts per month is devoted to R&D.

June 1987
Samsung Semiconductor, GoldStar Semiconductor Inc., and Hyundai Electrical Engineering Co. announced that they are preparing to launch full-scale production of a 1Mb DRAM chip jointly developed by the three South Korean firms in 1986.

June 1987
Samsung Semiconductor agreed to supply Intel with 64K, 256K, and 1Mb DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea will begin in July.

ALLIANCES

SST
1983
Samsung Semiconductor was set up as a U.S. subsidiary of Samsung Co. Ltd., of Korea.

Exel
1983
Exel granted Samsung a license to second-source its 16K EEPROMs.

May 1985
The agreement was extended to include 64K EEPROMs.

Micron Technology
June 1983
Samsung obtained a license to manufacture and market Micron's 64K DRAM design in exchange for cash. The agreement was later extended to include Micron's 256K DRAM.

Micron Technology
July 1986
Samsung acquired a 2.7 percent interest in Micron for $5 million as part of an out-of-court settlement of a suit brought against Samsung. Micron claimed that Samsung failed to pay for materials and provide certain technology according to a 64K DRAM exchange pact. Micron obtained rights to the Samsung SRAM and EEPROM technologies for a 1 percent royalty, if sales exceeded 1 million units. The prior agreement was terminated.

Intel
January 1985
Intel granted Samsung a license to second-source certain microcomponents.

June 1987
Samsung agreed to supply Intel with 64K and 256K DRAMs, which Intel will sell to its customers in the United States. Shipments from Korea began in July.

Zytrex
June 1985
Zytrex and Samsung signed a three-year technology/fab agreement. Samsung second-sourced Zytrex's LSI logic devices; Zytrex provided its proprietary ICE-MOS process. Zytrex is no longer in business.

Mostek
1986
Mostek and Samsung signed an agreement covering Mostek's 256K DRAM technology.

IXYS
January 1986
IXYS and Samsung signed an agreement allowing Samsung to receive IXYS' power MOS technology in exchange for low- and medium-range power devices; IXYS will manufacture its high-current power MOS devices in Samsung's facility overseas.

GoldStar/Hyundai
1986
GoldStar, Samsung, and Hyundai agreed to cooperate on a 1Mb DRAM.

NCR
January 1989
Samsung and NCR's Microelectronics Division signed a broad technology exchange and license agreement that gives Samsung ASIC capability and gives NCR SRAM capability.

Quadtree Software Corp.
February 1989
Samsung and Quadtree announced a contract and licensing agreement under which Quadtree is developing full-function software models of Samsung's high-performance DRAM controllers.

Zilog
June 1989
Samsung and Zilog signed two licensing agreements that permit Samsung to manufacture and market IC products compatible with Zilog's family of Super-8 microcontrollers and the Z85C30 Serial Communications Controller.

MANUFACTURING

Technology

1.0- and 1.5-micron CMOS, NMOS, bipolar
4-, 5-, and 6-inch wafers

Facilities

San Jose, CA
80,000 sq. ft.
Administration, R&D, manufacturing

12,000 sq. ft.
Class 1 clean room

The facility has a capacity of 10,000 wafer starts per month.

PRODUCTS

Linear	Device	Description
Op Amps	LM324	Quad Op Amp
	LM358/1458/4558	Dual Op Amp
	LM741	Single Op Amp
	LM386	Low-Voltage Power Amp
Timers	NE555	Single Timer
	NE556	Dual Timer
	KS555	Single Timer
	KS555H	High-Speed Timer
	KS556	Dual Timer
Voltage Regulators	KA33	Precision Voltage Regulator
	LM72	Adjustable Precision
	MC78	Positive Voltage Regulator
	MC79	Negative Voltage Regulator
	KA78S40	Switching Regulator
	KA431	Programmable Precision
Reference		
Comparators	LM311	Single Comparator
	LM339	Quad Comparator
	LM393	Dual Comparator
Data Converters	KS5C02/25C03	8-Bit Successive Aprox Register
	KS25C04	12-Bit Successive Aprox Register
	KSV3100	8-Bit and 10-Bit Flash Converter
	KSV3310	8-, 9-, and 10-Bit DACs
Interface	MC1488/1489	Quad Line RS-232 Receiver
Other	KA2181/2182/2183	Remote Control Preamp
	KA2580/2588	8CH Source Driver
	KA2803	Ground Default Detector
	KA2804	Zero-Voltage Switch

Linear	Device	Description
Telecommunications	LM567	Tone Decoder
	KA2410/2411	Tone Ringer
	KA2412	Subset Amplifier
	KA2413/5805	DTMF
	MC3361	FM IF Amplifier
	KS5804/5805	Pulse Dialer
	KT3170	DTMF Receiver
	KS5820	Tone/Pulse Dialer w/Redial
	KS5822/5823	Repertory Dialers
Transistors	Power MOSFET	
	General-Purpose Transistors	
	Low-Noise Amplifier Transistors	
	High-Voltage Transistors	
	Darlington Transistors	
Logic	KS54/74AHCT Family of Advanced High-Speed CMOS	
	KS54/74HCTLS Family of High-Speed CMOS	
Memory	64K, 128K, 256K, and 1Mb DRAMs	
	16K, 64K, and 256K SRAMs	
	16K and 64K EEPROMs	
	4K and 8K FIFO dual-port buffer memories	

OTHER INFORMATION

Samsung's PR firm is Roy Twitty & Co.

Seattle Silicon Corporation

3075 112th Avenue NE
Bellevue, WA 98004
206/828-4422
Fax: 206/827-4224

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 90**

BACKGROUND

Seattle Silicon Technology, Inc., was founded during the heyday of ASIC start-ups in 1983. Its initial business strategy has three important points aimed at establishing a unique position in the market. One is to supply silicon compiler software to systems designers with little or no actual experience with integrated circuit design. A second cornerstone of the firm's strategy is to provide process-independent designs, thus making it one of the first ASIC suppliers to base its business on providing tools and support services rather than wafer processing from a captive manufacturing facility. This key point in the strategy allows its customers to establish second sources easily and migrate its designs to newer fabrication processes as they become available. The third point of the Company's strategy is to integrate its software compilers into the familiar design environments of the leading third-party CAE workstations such as those from Digital Equipment Corporation, Tektronix, and Valid.

With its early software product, called Concorde, Seattle Silicon was successful in establishing strategic partnerships with Fortune 100 companies such as Burroughs (now Unysis), General Dynamics, and General Motors. Concorde offered customers an integrated software compiler that allowed input in the form of high-level functional specifications such as block diagrams or Boolean expressions. Process and foundry independence are achieved by referencing a table of process parameters for each foundry. Seattle Silicon claims that its products give customers access to more fabrication processes than any other ASIC supplier.

As the worldwide ASIC business evolved, it fragmented into gate arrays, standard cells, and silicon compilation. The major market acceptance was primarily on gate arrays, with standard cells and silicon compilers well behind. In 1987, recognizing a need to broaden its business base, Seattle Silicon began adapting its strategy to the evolving ASIC market by building upon early successes. The company now targets selected high-end application segments of the electronics market such as military, high-performance ASICs and mixed analog/digital circuits. The Company learned that many potential customers were not willing to take full responsibility for a chip's performance, so it introduced its "First Silicon" service, where Seattle Silicon guarantees working ASICs from a variety of manufacturing processes.

The Company continues to add processing options to its software and now allows designers to take advantage of the most advanced CMOS, VHSIC, SOS, and GaAs processes. Seattle Silicon believes that in the future of the ASIC industry, companies without a dedicated fab will be the norm rather than the exception; it is among the vanguard in this trend.

BOARD

(Name and Affiliation)

Stewart Carrell
Diasonics, Inc., Chairman/CEO

Bill Hambrecht
Hambrecht & Quist, General Partner

Amaury Piedra
Seattle Silicon, President/CEO

Paul Kirby
Hill, Kirby, Washing & Carman, General Partner

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Amaury Piedra
Fairchild, VP Strategic Alliances

VP Marketing
Ed Fernandez
National Semiconductor, Fairchild Analog Division

VP Sales
Dick Braydon
Fairchild, Technology Marketing Manager

VP Finance
John Celms
Amary International, CFO

VP Design Tools Development Engineering
Robert V. Alessi
Eastman Kodak, Manager IC Design

VP First ASIC Operations
Fred Tsang
Supertex, VP/COO

VP Software Operations
Bill Moore
Silvar-Lisco Inc., Dir. R&D

FINANCING

February 1985
Round 1
$6.2M
Hill, Kirby & Washing; Canadian Enterprise Development Corp.; Hambrecht & Quist; Norwest Venture Capital Management; Paragon Partners; Olympic Venture Partners; TWB Investment Partnership; Rainier Venture Partners

November 1985
Round 2
$0.5M
Previous investors

Early 1986
R&D Financing
$5.0M
General Motors

August 1986
R&D Financing
$7.0M
Pru-Tech

August 1987
Round 3
$5.0M
Hill, Kirby & Washing; Hambrecht & Quist; Rainier Venture Partners; Norwest Venture Capital Management; Paragon Partners

August 1988
Round 4
$5.1M
Hill, Kirby & Washing; Hambrecht & Quist; Norwest Venture Capital Management

RECENT HIGHLIGHTS

February 1988
Seattle Silicon introduced ChipCrafter®, a software design tool that will provide fully automatic physical design for high-functionality ASICs and maintain manufacturing process independence.

August 1988
Seattle Silicon announced the first production shipments of ChipCrafter.

August 1988
Using Seattle Silicon's compiler-based ASIC design software, two University of Michigan engineering students won first prize in the industry-sponsored sixth annual Student VLSI Design contest. Four out of the top six designs were completed using Seattle Silicon's Concorde compiler tool.

ALLIANCES

Gould AMI Semiconductors
September 1986
Seattle Silicon and Gould AMI signed an agreement that provides systems manufacturers with a simplified means of designing ASICs and transferring final design data to Gould AMI for fabrication. By the agreement, Gould AMI provided Seattle Silicon with its proprietary geometric design rules and performance characteristics of selected fabrication processes.

Burroughs Corp.
August 1986
Seattle Silicon and Burroughs signed an agreement to jointly develop a "new-generation design system" for integrated circuits.

United Technologies Microelectronics Center (UTMC)
June 1987
Seattle Silicon and UTMC announced their intention to jointly design and fabricate ASICs used in tactical and strategic radiation environments.

National Semiconductor
October 1987
Seattle Silicon and National signed a foundry agreement to qualify National's 1.25- and 1.20-micron VHSIC CMOS processes for design with Concorde, Seattle Silicon's compiler for top-end ASIC designs.

Oki Electric
August 1988
Seattle Silicon and Oki announced an agreement to develop a compiler for a process-independent, five-port, high-speed (15ns) static RAM module.

GigaBit Logic
June 1989
Seattle Silicon and GigaBit Logic announced the formation of an alliance to develop the design automation industry's first comprehensive set of software tools specifically created for GaAs ASICs.

SERVICES

"First Silicon" production management

MANUFACTURING

Technology

1.2-micron CMOS

PRODUCTS

- ChipCrafter design software tool
  - ChipCrafter ASIC Expert
  - ChipCrafter IC Expert
- Concorde ASIC compiler tool
- User-configured ASICs

OTHER INFORMATION

Seattle Silicon's PR firm is Franson & Associates, Inc.

SEEQ Technology, Inc.

1849 Fortune Drive
San Jose, CA 95131
408/432-7400
Fax: 408/432-1550

ESTABLISHED: January 1981 **NO. OF EMPLOYEES: 530**

BACKGROUND

SEEQ Technology, Inc., designs, manufactures, and markets nonvolatile semiconductor memory devices used in defense electronics, industrial, and data processing applications. SEEQ specializes in EEPROM processes for applications that require both nonvolatility and in-circuit programmability.

SEEQ products are grouped strategically into three classifications: EEPROM products that support nonvolatile memory needs, EEPROM microprocessors, and telecommunication circuits. SEEQ's EEPROMs range in density from 4K to 256K and offer benefits such as page-mode writes, 1M cycle endurance, silicon signature, and DiTrace as standard features. The Company's flash EEPROMs combine in-circuit programmability and the density of UV EPROMs. The Company's 8-bit, single-chip MCUs feature on-board EEPROMs for applications that allow on-chip reprogramming of code and data. SEEQ also offers enhanced Ethernet data link controllers and CMOS Manchester coder/decoder circuits.

SEEQ Technology was founded by Gordon Campbell, Dr. Philip J. Salsbury, Larry T. Jordan, Maria Ligeti, and George Perlegos, all formerly employed by Intel Corporation, and Dan Barbato, who was previously employed by Synertek.

Four domestic and two international sales offices manage a network of sales representatives in the United States, Canada, Europe, and Japan. Three national and three regional distributors serve the United States and Canada.

BOARD
(Name and Affiliation)

J. Daniel McCranie, Chairman
SEEQ Technology, Inc.

E. Floyd Kvamme
Kleiner, Perkins, Caufield & Byers

John W. Larson
Brobeck, Phleger & Harrison

Philip Paul
Hillman Ventures

*Dr. Philip J. Salsbury
SEEQ Technology, Inc.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
J. Daniel McCranie
Harris, Grp VP Sales

VP Finance/CFO
Patrick Brennan
NSC, VP/Treasurer

VP Manufacturing
Michael Van Hoy
SGS-Thomson, VP Operations

VP/CTO
*Dr. Philip J. Salsbury
Intel, Div Dir EEPROMs

VP Strat Accounts
Tom Endicott
Signetics, Mgr Rel & QA

VP Worldwide Sales
Philip Ortiz
CDI, Dir Mktg/Sales

VP/GM Flash Div
Michael Villot
Motorola, Dir Mktg MPUs

VP/Business Development
Ralph Harms
Signetics, Controller

*Founder

FINANCING

March 1981
Initial
$15.0M
Kleiner, Perkins, Caufield & Byers; Hillman Ventures

September 1983
Initial public offering
$20.0M

March 1985
Private placement
$14.0M

October 1986
Private placement
$6.0M
Bridge Capital; GE Venture Capital; Hillman Ventures; John Hancock; Kleiner, Perkins, Caufield & Byers

November 1988
Private placement
$4.0M
Monolithic Memories

April 1988
Public offering
$19.5M

RECENT HIGHLIGHTS

February 1987
SEEQ reincorporated in Delaware.

April 1987
SEEQ announced the addition of its 27C256 EPROM to military drawing 86063. It was the first time SEEQ ever had parts listed for a military drawing, and it followed the 27C256's compliancy with MIL-STD-883 Rev C, Class B.

April 1987
SEEQ announced its successful demonstration to the Defense Electronics Supply Center (DESC) of SEEQ's compliance with the requirements of MIL-M-38510 and MIL-STD-976. DESC recognized SEEQ as having reached a level of manufacturing competence in which all phases of design, processing, and testing meet or exceed established standards by DESC.

April 1988
SEEQ introduced the 512K flash EEPROM, first of the generation of high-density flash-type electrically erasable programmable memories.

February 1989
SEEQ announced the industry's first 1Mb flash EEPROM at the 36th ISSCC in New York. The part offers twice the density of other currently available flash EEPROM devices. The 48F010 is available in commercial and military versions.

ALLIANCES

Amkor
1981
SEEQ signed Amkor to assemble its IC products.

Rockwell
July 1982
SEEQ signed an exclusive licensing agreement to provide its 16K EEPROM and 16K UV EPROM technology to Rockwell. In exchange, Rockwell paid SEEQ $5.0 million, leased $5.5 million of SEEQ's equipment, and agreed to pay a 3 percent royalty on sales of these products.

Texas Instruments
August 1982
SEEQ licensed its EEPROM technology to Texas Instruments in exchange for its TMS7000 8-bit MCU.

Silicon Compilers
1983
SEEQ announced that it would manufacture the Silicon Compiler, Inc., (SCI) Ethernet data link controller.

July 1985
SEEQ provided all of its EEPROM designs for integration into SCI's Genesil system. SEEQ will manufacture the EEPROM logic circuits using its 2-micron CMOS process.

Monolithic Memories
November 1986
Monolithic Memories Inc. (MMI) purchased a 16 percent equity in SEEQ for $4 million. The two firms also agreed to a joint product and technology program to codevelop four CMOS EEPROM-based PLDs.

Motorola
December 1986
SEEQ and Motorola signed an engineering development agreement to develop a high-performance EEPROM microcomputer.

National Semiconductor
October 1987
SEEQ and National Semiconductor signed a four-year exclusive technology licensing and manufacturing agreement. Under the agreement, the two companies share technology and marketing rights to SEEQ's 512K and 1Mb and to National's 256K flash EEPROMs. The agreement was extended October 1988.

June 1989
SEEQ and National scaled back their 1987 agreement to cover only current Flash technology. SEEQ will continue to develop the next generation of 0.8μ Flash chips alone.

Hamilton-Standard
October 1987
SEEQ signed a $1.4 million contract to supply CMOS 256K EEPROMs to Hamilton-Standard, a division of UTC. The EEPROMs, configured as 32Kx8, will be used in military flight tape recorders.

MANUFACTURING

Technology

2.0-micron, double-poly, floating-gate CMOS
1.25-micron, double-poly, floating-gate CMOS
5-inch wafers

Facilities

San Jose, CA
120,000 sq. ft.
Administration, design, manufacturing (The SEEQ fab has DESC certification to allow individual parts to achieve JAN qualifications.)

PRODUCTS

EEPROMs
16K Latched; 4K, 16K, and 64K Latched and Timed; 64K and 256K Page Mode; High-Speed CMOS 64K and 256K EEPROMs; Timer EEPROM

Flash
512K and 1024K CMOS Flash EPROMs, 512K and 1024K CMOS Flash EEPROMs

EPROMs
64K, 128K, 256K CMOS

Data Communications
Ethernet Data Link Controller, Manchester Code Converters, Advanced Ethernet Data Link Controller

EEPLD
Registered Asynchronous CMOS EEPLD, Versatile 28-pin CMOS EEPLD

MILITARY PRODUCTS

EEPROMs
16K and 64K Latched; 16K and 64K Latched and Timed; 64K and 256K Page Mode, Latched & Timed; High-Speed CMOS Bipolar PROM Replacement; High-Speed CMOS; High-Speed CMOS Bipolar PROM; 1,024K EEPROM

EPROMs
64K, 128K, and 256K EPROMs; 256K CMOS EPROM; DESC SMD-Compliant 64K, 128K, and 256K CMOS UV EPROMs

FLASH
512K and 1,024K CMOS Flash EEPROMs, 512K and 1,024K CMOS Flash EPROMs

OTHER INFORMATION

SEEQ Technology does not employ a PR firm.

Sensym, Inc.

1255 Reamwood Avenue
Sunnyvale, CA 94089
408/744-1500
Fax: 408/734-0407
Telex: 176376

ESTABLISHED: October 1982 **NO. OF EMPLOYEES: 120**

BACKGROUND

Sensym, Inc., designs, manufactures, and markets a complete line of IC accelerometers and IC pressure sensors and transducers including absolute, differential, and gauge types ranging from 0 to 1 psi to 0 to 5,000 psi. The Company provides devices with a variety of coatings, isolators, and special packages made specifically to handle various media, from dry air to hostile environments such as steam, water, freon, and high humidity. Products are used in many applications including energy management, avionics, medical diagnostics, agrionics, and industrial controls.

Sensym was founded when the principal management of National Semiconductor's transducer group initiated a leveraged buyout from the parent company, with the assistance of venture capital funding. The Company set up its operation in Sunnyvale, California, to provide only United States-built products and offers the National Semiconductor transducer product line as well as numerous product additions. Round two of financing, completed in 1984, assisted in the expansion of Sensym's manufacturing capacity.

In April 1989, Sensym was acquired by FASCO Sensors and Controls Group, a division of FASCO Industries. Sensym became the tenth member of the Sensors and Controls Group, a consortium of FASCO companies that provides temperature, pressure, and position-sensing technology as well as aerospace controls and subsystems.

BOARD

(Name and Affiliation)

Dennis Dauenhauer
  Sensym, Inc.

Roger J. Barry
  Crosspoint Venture Partners, Partner

Robert L. Cummings
  Robertson, Colman & Stephens, Partner

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO/COO
Dennis Dauenhauer
  National, Grp Dir Transducers

VP Mktg/Sales
W. Frederick Jones
  Varian Associates, Div Mgr

VP Hybrid & Semi
Fred Adamic
  National, Linear Prod Line Mgr Ops

FINANCING

October 1982
Round 1
$ 1.0M
  Crosspoint Venture Partners; Robertson, Colman & Stephens

Round 2
$ 1.5M
  Crosspoint Venture Partners; Med-Tec Ventures; National Semiconductor; Robertson, Colman & Stephens

August 1986
Round 3
$ 1.5M
  Becton & Dickinson

August 1989
Acquisition
$250.0M
  Sensym acquired by FASCO Sensors and Controls Group

RECENT HIGHLIGHTS

August 1987
Sensym leased 20,405 square feet of research and development space at 1244 Reamwood Avenue, Sunnyvale. The additional space will be used for the development and manufacture of digital electronic tire gauges.

April 1989
Sensym was acquired by FASCO Sensors and Controls Group.

ALLIANCES

Michelin
Sensym has a technology agreement with Michelin of France.

MANUFACTURING

Technology

CMOS capabilities
Bipolar
4-inch wafers
Solid-state sensors
Sensor-based systems

Facilities

Sunnyvale, CA
65,000 sq. ft.
Manufacturing, engineering, administration

20,405 sq. ft.
Corporate offices, R&D, marketing and sales

1,500 sq. ft.
Class 100 clean room

PRODUCTS AND SERVICES

Custom Pressure Sensors
Disposable Blood Pressure Sensors
Tape Tension Pressure Sensors
Energy Management Pressure Sensors
Medical Instrumentation Pressure Sensors
Barometric Pressure Sensors
Engine Diagnostic System Sensors
Accelerometers
Digital Tire Gauges
Digital Pressure Gauges
Sensor-Based Subsystems
Proprietary and Custom Solid State Sensors for Pressure and Acceleration

OTHER INFORMATION

Sensym does not employ a PR firm.

SID Microelectronics S.A.

Av. Brig. Faria Lima
1476 - 7. andar 01452
Sao Paulo, Brazil
011/210-4033

ESTABLISHED: April 1984 **NO. OF EMPLOYEES: 850**

BACKGROUND

SID Microelectronics S.A. designs, manufactures, and markets small and medium transistors and linear devices. The Company plans to introduce hybrid circuits, surface-mounted device technology, metallic-can transistors, ceramic and metal (cermet) ICs, and digital IC assembly. Additional product plans include MOS logic, custom/semicustom ICs, memories, microprocessors, TTL, LIC, and LSI devices. The Company plans to continue support of its design and research and development activities in CMOS.

SID succeeds the RCA-Ford semiconductor manufacturing joint venture in Brazil that closed in 1983. In 1984, SID purchased the IC fab from RCA to produce ICs for the merchant market. SID is the only South American semiconductor manufacturing company with all the manufacturing steps, including wafer production.

BOARD
(Name and Affiliation)

Matias Machline
Sharp S.A. Equipamentos Electronics

Jose B. Amorim
SID S.A. Servicos Tecnicos

Yuichi Tsukamoto
SHARP S.A. Equipamentos Electronics

Jose Papa, Jr.
FIESP

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
Matias Machline
Not available

VP R&D
Adalberto Machado
Ford-Brazil

VP Finance
Luis Paulo Rosenberg
Not available

Mng Director
Victor Blatt
CPQD-Telebras

Indus Director
Wilson L.M. Leal
Siemens

Planning Mgr
Luiz Mauge
Sharp

Mktg Mgr
Inacio Hatanaka
RCA

FINANCING

1984
Initial
$14.2M
Private investors

MANUFACTURING

Technology

3.0-micron bipolar

SID Microelectronics S.A.

PRODUCTS

Small-Signal Transistors
Medium-Power Transistors
Linear ICs

OTHER INFORMATION

SID Microelectronics does not employ a PR firm.

Sierra Semiconductor Corporation

2075 North Capitol Avenue
San Jose, CA 95132
408/263-9300
Fax: 408/263-3337
Telex: 384467

ESTABLISHED: November 1983 **NO. OF EMPLOYEES: 350**

BACKGROUND

Sierra Semiconductor Corporation is a service-oriented supplier of CMOS ASICs with a complementary portfolio of standard products that include memory and linear digital ICs. The Company specializes in designs that combine analog, digital, and/or EEPROM memory technology on one chip. Products target telecommunications, data communications, computers and peripherals, and selected industrial applications.

The Company's proprietary Triple Technology makes the integration of analog, digital, and EEPROM memory on a single IC possible. Sierra's products are fabricated on 5-inch wafers using 1.5-, 2.0-, and 3.0-micron CMOS process technology. Currently, Sierra conducts its own manufacturing and test but occasionally also uses foundries to augment internal capability. A recent joint venture company established in Singapore ensures adequate manufacturing and test resources for the foreseeable future.

Sierra is considered to be strong in circuits combining analog and digital technology and is also considered to have a strong cell library. The Company has an EE cell library—only two other suppliers (NCR and National Semiconductor) have such a library. Sierra's initial strategy was to develop a portfolio of CMOS standard products that demonstrated Sierra's Triple Technology. Sierra's long-term strategy is to expand its custom and cell-based products to 70 percent of sales and identify new markets and applications that benefit from the combination of digital, analog, and EE nonvolatile memory. At the end of 1987, Sierra's sales were about evenly split between standard and custom products.

Sierra has established two joint ventures in the last few years. In June 1986, Sierra formed a corporation in the Netherlands, named Sierra Semiconductor B.V. The $9 million in equity funding for the venture came from the Netherlands-based MIP Equity Fund. The headquarters, which opened in October 1986, houses a design center, technical support and services, and marketing and sales for Sierra's standard and cell-based ICs. In January 1987, Dr. Stephen Forte was appointed president of the operation.

In November 1987, Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore named Chartered Semiconductor Pte. Ltd. The company is located at a 170,000-square-foot site in the Singapore Science Park. Initial capacity will be 5,000 6-inch wafers per month. This firm fabricates and tests CMOS wafers and ASIC devices primarily for Sierra and National.

Singapore Technology holds 74 percent of the joint venture company; Sierra holds 17 percent, and National holds the remaining 9 percent. Sierra will contribute its Triple Technology CMOS process and technical management, while National will provide CMOS process technology and technical support to construct the clean room facility. Singapore Technology Corporation also participated in Sierra's third round of financing.

Sierra sells its products through manufacturers' representatives and distributors in North America and Asia. In Europe, the Company sells its products through Sierra Semiconductor B.V., headquartered in the Netherlands, and also through manufacturers' representatives.

BOARD
(Name and Affiliation)

Donald T. Valentine, chairman
Sequoia Capital

Charlie C. Bass
Ungermann-Bass

James V. Diller
Sierra Semiconductor Corporation

Kheng-Nam Lee
Singapore Technology Corporation, Inc.

Robert J. Schreiner
Borg-Warner Electronics

Hans Severiens
MIP Equity Fund

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
James V. Diller
National, VP MOS Mem Ops

Pres/Sierra B.V.
Dr. Stephen Forte
AMI, VP WW Mktg/Sales

VP Mktg/Sales
John T. Reynolds
National, Group Mktg Dir

VP Design
Andrew G. Varadi
National, VP Technology

VP Opns
Edward Boleky
Intel, Mgr Mem Prod

VP Finance
C. Stephen Cordial
TI, Div Controller

Mng Dir Chartered Semi
John Hambridge
Fairchild, VP Logic Division

FINANCING

January 1984
Round 1
$ 7.7M
Arscott, Norton & Assoc.; Asset Mgmt.; Associated Venture Investors; Bay Partners; Borg-Warner Electronics; Investors in Industry; Mohr, Davidow Ventures; Sequoia Capital; Sutter Hill Ventures; Technology Venture Investors; Venrock Associates

April 1985
Round 2
$15.0M
Initial investors; Bryan and Edwards; Burr, Egan, Deleage & Co.; Litton Industries; Suez Technology Fund; Tellabs, Inc.

October 1986
Round 3
$18.4M
Asset Mgmt,; Associated Venture Investors; Bay Partners; Berkeley International; Borg-Warner Electronics; Churchill International; Hambrecht & Quist; Litton Fund; MIP Equity Fund; Mohr, Davidow Ventures; Sequoia Capital; Singapore Technology Corporation; Suez Technology Fund; Sutter Hill Ventures; Technology Venture Investors; Venrock Associates

September 1987
Round 4
$10.0M
Convertible debentures, Berkeley International

RECENT HIGHLIGHTS

June 1986
MIP Equity Fund invested $9 million in Sierra and Sierra Semiconductor B.V. The latter operates as a design and service center. Additional funding through government grants was assured. In January 1987, Dr. Forte joined Sierra as president of the subsidiary.

October 1986
Sierra completed third-round financing for $18.4 million. In addition to discussing an investment, Singapore Technology Corp. and Sierra discussed establishing a joint venture in Singapore for a design center and semiconductor manufacturing facility.

December 1986
Sierra introduced the SC11270 and SC11289 DTMF receivers.

December 1986
Sierra introduced the SC11401/11402/11403/11404 8-bit video DACs, which are compatible with RS-170 and RS-323 specifications.

December 1986
Sierra announced that its cell library is now supported on Mentor Graphics workstations.

January 1987
Sierra and National Semiconductor announced a jointly developed family of 8-bit CMOS MCUs. The first members in the family of flexible controllers are called SC44820, SC44821, and SC44822 by Sierra and COP820C, COP821C, and COP822C by National Semiconductor.

May 1987
Sierra sampled a CMOS 2,400-bps modem chip set based on its initial 1,200-bps modem chip set, which is second-sourced by VLSI Technology. The SC11006 is the 2,400-bps modem, and the SC11009 and SC11011 are companion controllers. The SC11009 is for parallel bus applications such as the PC XT, AT, or compatibles; and the SC11011 supports RS-232 applications.

September 1987
Sierra ported the MIXsim behavioral modeling tools to the Mentor Graphics Idea workstation.

November 1987
Sierra, National Semiconductor, and Singapore Technology Corporation formed a joint venture company in Singapore and named it Chartered Semiconductor Pte. Ltd.

ALLIANCES

National Semiconductor
July 1984
Sierra and National signed a technology exchange agreement that covers selected advanced CMOS products and processes. Sierra leased a facility from National to develop its process and manufacture products using its own equipment and employees.

November 1987
Sierra, National, and Singapore Technology Corporation formed a joint venture company named Chartered Semiconductor Pte. Ltd. The new firm, located in the Singapore Science Park, will fabricate and test CMOS wafers and ASIC devices primarily for Sierra and National. Initial capacity will be 5,000 6-inch wafers per month. Sierra and National are providing process technology and technical assistance.

VLSI Technology
January 1985
Sierra and VLSI have an agreement that provides for the exchange of technical information and the mutual sharing of developments in ASIC software, design expertise, and products. VLSI is also a second source for Sierra's custom and analog standard products.

Mentor Graphics
December 1986
Sierra announced that its cell library is now supported on Mentor Graphics workstations.

September 1987
Sierra's MIXsim behavioral modeling tools are available on Mentor Graphics' Idea workstation.

MANUFACTURING

Technology

2.0-micron single- and double-poly, double-metal CMOS
3.0-micron single- and double-poly CMOS
1.5-micron
5-inch wafers
6-inch wafers available in third quarter 1989

Facilities

San Jose, CA
71,000 sq. ft.
Headquarters, administration, marketing, design, and test

Santa Clara, CA
16,000 sq. ft.
Engineering, wafer fabrication

PRODUCTS

CMOS Cell Library

Process	Linewidth	Cells
Si-Gate CMOS	2.0-micron	280 Digital Cells, 50 Analog Cells, 25 EEPROM Cells, RAM, ROM, PLA, 2901, Multiplier
Si-Gate CMOS	1.5-micron	250 Digital Cells, 25 Analog Cells, 70-MHz PLL, Video DACs, 9 EEPROM Cells, RAM, ROM, PLA, Data Path, Multiplier

EEPROMs

Device	Description
SC22001/22002	CMOS 256-Bit Serial EEPROM
SC22011/22012	CMOS 1,024-Bit Serial EEPROM
SC22101	CMOS 128x8 Multiplexed EEPROM
SC22102	CMOS 256x8 Multiplexed EEPROM
SC22104	CMOS 512x8 Multiplexed EEPROM

Microcomponents

SC44820/44821/44822	8-Bit CMOS MCUs

Linear

Data Communication

SC11000/11001/11005	CMOS 1,200-Baud Modem Filters
SC11002/SC22003	CMOS 300-Baud Modem
SC11004/SC11014	CMOS 1,200-Baud Modem
SC11006	CMOS 2,400-Baud Modem
SC11007/SC11008	CMOS Modem Controller
SC11009	SC11006 Companion Controller for Parallel Bus
SC11011	SC11006 Companion Controller for RS-232
SC11015	CMOS 1,200-Baud Modem with Programmable Receiver Gain Amplifier

Telecommunications

SC11202/11203/11204/11270	DTMF Receiver
SC11270/11289	DTMF Receiver
SC11280/11289/11290	DTMF Transceiver
SC11301/11302	Codec Filter Combo

Computer/Peripheral

SC11401/11402/11403/11404	8-Bit Video DACs

Developmental Tools

MONTAGE - Systems Integration Software	Design system that permits schematic capture and simulation of mixed signal ASICs by the system's designer
SCDS	Custom Design System
MIXsim	Behavioral Modeling Tools

OTHER INFORMATION

Sierra Semiconductor does not employ a PR firm.

Si-Fab Corporation

27 Janis Way
Scotts Valley, CA 95066
408/438-6800
Fax: 408/438-6800, Ext. 107

ESTABLISHED: 1980 | **NO. OF EMPLOYEES: 15**

BACKGROUND

Si-Fab Corporation provides process design and engineering services as well as quick-turn CMOS foundry services. The Company filed for Chapter 11 protection during the economic downturn in the semiconductor industry and reorganized its management and systems. Consequently, Si-Fab's business outlook and sales have increased substantially.

BOARD

Not available

COMPANY EXECUTIVE
(Position and Name)

President
Leon B. Pearce

FINANCING

Private

PRODUCTS

- Aftermarket Technology
- Proprietary Products
- High-Speed SRAM 44-64U

OTHER INFORMATION

Si-Fab does not employ a PR firm.

ALLIANCES

Not available

SERVICES

- Custom IC design
- Thin-film coating services
- Metal gate and Si-gate CMOS foundry
- P-channel and n-channel foundry

MANUFACTURING

Technology

- 1.0- to 1.25-micron SOS, CMOS, NMOS, and PMOS
- 4-inch and 5-inch wafers

Facilities

Scotts Valley, CA
12,000 sq. ft.
  Plant
5,000 sq. ft.
  Clean rooms

SIMTEK Corporation

1465 Kelly Johnson Boulevard, Suite 301
Colorado Springs, CO 80902
719/531-9444
Fax: 719/531-9481

ESTABLISHED: May 1987 **NO. OF EMPLOYEES: 30**

BACKGROUND

SIMTEK Corporation designs, manufactures, and markets advanced nonvolatile memory products. SIMTEK is using proprietary nonvolatile integrated circuit technology, and its first two products are a 256K EPROM and a 64K NVSCRAM. SIMTEK began production of these products in early 1989 and expected its first revenue from them late in 1989.

SIMTEK is using advanced CMOS processes coupled with silicon nitride oxide semiconductor (SNOS) technology. This technology provides high-density, high-performance, reliable, and full-function nonvolatile products.

Initial capitalization was provided by Nippon Steel Corporation of Japan, which owns about 20 percent of the Company and has a seat on the board. Other financing was provided by the founders.

Dr. Richard Petritz, a founder of Mostek and Inmos, serves as chairman and CEO of the Company.

BOARD

Dr. Richard Petritz
Dr. Gary Derbenwick
Mr. Kazuo Takanashi

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman/CEO
Dr. Richard Petritz
Inmos, Founder

COO
Dr. Gary Derbenwick
Inmos, Mgr Technology

VP Operations
Dr. Dennis Ryden
Inmos, Process Mgr

VP Engineering
Dr. Ralph Sokel
Inmos, CAD Development

VP Finance
William G. Skolout
RAMTRON, CFO

OTHER INFORMATION

SIMTEK does not employ a PR firm.

Solid State Optronics Inc.

442 Queens Lane
San Jose, CA 95112
408/436-1390
Fax: 408/436-1392

ESTABLISHED: June 1982 **NO. OF EMPLOYEES: 5**

BACKGROUND

Solid State Optronics, Inc., designs and manufactures solid-state relays, photoresistors, and thyristors. The Company was founded by Zag Kadah in 1982. Prior to founding the Company, Mr. Kadah was employed at Electro-Trol, Inc., as vice president in charge of the optoelectronics division. In 1979, Mr. Kadah founded Power Interface, a company that pioneered the development of an IC to drive back SCRs in solid-state relays.

The Company subcontracts manufacturing to a company in Asia; assembly is done in the Philippines.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Zag Kadah
Elec-Trol, Inc.

Marketing
Sid Kadah
UC Berkeley

Financial Officer
Fay Kadah
Magnex

*Founder

PRODUCTS

- Input/Output Modules
- Interrupters
- Photodiodes
- Photo Arrays
- Silicon Photo Detectors
- Solid-State Relays
- Hybrid Optoelectronic Modules

OTHER INFORMATION

Solid State Optronics' PR firm is QMI.

FINANCING

Zag Kadah holds 100 percent of the Company.

ALLIANCES

Not available

MANUFACTURING

Technology

- Bipolar
- Dielectric isolation
- DMOS
- GaAs and GaAlAs

Facilities

San Jose, CA
1,200 sq. ft.
R&D, design, engineering, and assembly

Spectrum Microdevices

5330A Spectrum Drive
Frederick, MD 21701
301/695-0868
Fax: 301/831-4032

ESTABLISHED: 1980 **NO. OF EMPLOYEES: 21**

BACKGROUND

Spectrum Microdevices is a part of Fairchild Communications & Electronics Company, which, in turn, is part of Fairchild Industries. In 1983, Fairchild acquired a 51 percent share of Insouth, a company that makes large-scale ICs, hybrids, and gate arrays. Fairchild has since increased its holdings to 100 percent.

In 1986, Spectrum Microdevices, then known as Insouth Microsystems, moved from Auburn, Alabama, to Frederick, Maryland. Some members of the management and design group, including General Manager Marvin L. Harding, were transferred to coordinate component manufacturing more closely with Fairchild Communications & Electronics Company in Germantown, Maryland. Fairchild Communications & Electronics Company, Spectrum Microdevices' major customer, manufactures avionics and telecommunications equipment. The move was completed in September 1986, and the Company's name was changed in early 1987.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Director Operations
William K. Bowers

FINANCING

Not available

MANUFACTURING

Technology

2.0-micron CMOS

Facilities

Frederick, MD
2,500 sq. ft.
Administration

12,500 sq. ft.
Manufacturing, assembly, test

PRODUCTS

Military Hybrids/Custom Monolithic Assembly and Test
Surface Mount for Military

OTHER INFORMATION

Spectrum Microdevices does not employ a PR firm.

Synaptics, Inc.

2860 Zanker Road, Suite 105
San Jose, CA 95134
408/434-0110
Fax: 408/434-9819

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 7**

BACKGROUND

Synaptics, Inc., was formed to develop a family of neural network interpret circuits for use in intelligent sensors and pattern recognition applications. The Company is in a research stage and does not expect to introduce products for some time.

The Company hopes to develop a device with the ability to sense and process real-world signals in real time and to learn without prior knowledge embedded in its program.

The basic research is guided by a scientific advisory committee chaired by Carver Mead of California Institute of Technology. Professor Mead, a leading force in the development of silicon computer design methodology for VLSI, has been modeling neural networks with analog VLSI systems.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Federico Faggin
Cygnet Communication, Founder

Chairman
Carver Mead
California Institute of Technology, Computer Science Professor

*Founder

FINANCING

May 1986
Seed
$0.6M
Avalon Ventures, Sprout Group, Technology Venture Investors

June 1987
Round 1
$1.5M
Kleiner, Perkins, Caufield & Byers; Sprout Group; Technology Venture Investors

OTHER INFORMATION

Synaptics does not employ a PR firm.

Synergy Semiconductor Corporation

3450 Central Expressway
Santa Clara, CA 95051
408/730-1313
Fax: 408/737-0831

ESTABLISHED: 1987 **NO. OF EMPLOYEES: 48**

BACKGROUND

Synergy Semiconductor Corporation was formed to offer ultrahigh-performance bipolar ECL memory and logic products for the commercial and military markets. The Company is in its product development stage and plans to begin offering ECL bipolar products that will serve the needs of the high-performance computer and ATE markets in the second half of 1988. Its first product will be a 4K memory chip with an access time of less than 5ns.

Synergy was cofounded by Ralph O. Cognac, Larry J. Pollock, George W. Brown, Thomas S. Wong, and E. Marshall Wilder. All of the founders worked together at Advanced Micro Devices, where they developed the advanced bipolar technology called IMOX. Mr. Cognac and Mr. Pollock also played key roles at Integrated Device Technology, a leading supplier of high-speed CMOS memory and logic products.

Kenneth G. Wolf joined the Company as president and CEO in July 1987. Mr. Wolf was previously employed at Motorola for 22 years in management positions. At various times, he was responsible for the bipolar memory, bipolar logic, and ASIC divisions.

In January 1988, Synergy Semiconductor purchased Zoran Corporation's Santa Clara, California, wafer fabrication clean room and a portion of the 50,000-square-foot manufacturing and office facility.

BOARD
(Name and Affiliation)

Sven E. Simonson, chairman
Sequoia Capital

*Ralph O. Cognac
Synergy Semiconductor Corporation

William J. Harding
J.H. Whitney & Company

Glenn M. Mueller
Mayfield Fund

Kenneth G. Wolf
Synergy Semiconductor Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
Kenneth G. Wolf
Motorola, VP/GM ASIC Div

VP Prod Ops
*George W. Brown
AMD, Prod Mgr Bipolar RAMs

VP Mktg/Sales
*Ralph O. Cognac
IDT, VP Mktg

VP Technology
*Larry J. Pollock
IDT, VP Corp Engr

VP Prod Dev
*Thomas S. Wong
AMD, Dsn Mgr Bip RAMs

VP Mfr Ops
*E. Marshall Wilder
AMD, Mgr Dir MOS RAMs

*Founder

FINANCING

July 1987
Round 1
$3.9M
Mayfield Fund, Sequoia Capital, Suez Technology Fund

Synergy Semiconductor Corporation

February 1988
Round 2
$ 9.0M
Broventure Capital Mgmt.; Matrix Partners; Mayfield Fund; Menlo Ventures; Merrill, Pickard, Anderson & Eyre; Oak Investment Partners; Stanford University Engineering; Sequoia Capital; J.H. Whitney

January 1989
$8.5M
Revolving Lease Line

ALLIANCES

Major strategic alliances are as yet unnamed.

MANUFACTURING

Technology

1.5-micron bipolar ECL
4-inch wafers

Facilities

Santa Clara, CA
30,000 sq. ft.
Administration and manufacturing

7,000 sq. ft.
Class 10 clean room

PRODUCTS

Synergy's first product is the industry's fastest 1Kx4 bipolar ECL RAM 3ns SY100474 and SY10474 offering 100K and 10K compatible logic levels. These parts feature balanced read/write, elimination of the traditional write recovery glitch, and standard or fast edge rates. They are designed for alpha particle immunity and are available in industry-standard DIP and Flatpack packages.

Synergy plans to offer a complete family of the industry's fastest 1K, 4K, and 16K ECL RAMs as well as several specialized ASM (application-specific RAMs) memories.

Synergy also plans a series of ultrafast logic products in the future.

OTHER INFORMATION

Synergy Semiconductor does not employ a PR firm.

Taiwan Semiconductor Manufacturing Company, Limited

1F No. 9, Industriale E. 4th Road
Science-Based Industrial Park
Hsinchu, Taiwan
(035) 961240
Fax: (035) 942616

North American Office
3150 Almaden Expressway, Suite 111
San Jose, CA 95118
408/978-1322
Fax: 408/978-1365

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 300**

BACKGROUND

Taiwan Semiconductor Manufacturing Company, Limited, (TSMC) was formed to provide one-stop semiconductor manufacturing services including wafer fabrication, probing test, packaging, final test, and burn-in for a wide variety of ICs.

Taiwan's Executive Yuan, or legislature, earmarked funds from its development fund for a 48.0 percent stake in the Company. N.V. Philips has a 27.5 percent share in the $150 million investment in TSMC and an option to purchase controlling interest in the Company. The remainder is held by other Taiwanese firms.

In 1987, Dr. Morris Chang, former president and chief executive officer of General Instrument Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan, was made chairman of TSMC. Dr. Chang is also chairman of United Microelectronics Corporation. Also in 1987, Jim Dykes joined TSMC as president and chief executive officer. Mr. Dykes had set up General Electric Company's Semiconductor Division. Stephen L. Pletcher, who had been vice president of sales and marketing for GE Semiconductor, was named director of a new North American and European marketing and sales operation of TSMC.

In early 1987, TSMC made its first wafer shipment from its facility, which is capable of producing 10,000 6-inch wafers per month. It is equipped to produce chips, using 1.5-, 2.0-, and 3.0-micron CMOS and NMOS processes. TSMC began volume production in early 1988.

In December 1987, TSMC received approval to build a second manufacturing facility in Taipei, Taiwan. The new facility, which is scheduled for completion by year-end 1989, will cost about $220 million and will nearly quadruple the Company's capacity. The planned 65,000-square-foot fab facility will have a production capacity of 30,000 6-inch wafers per month. It is designed for submicron processes; however, initial production will be done via a 1.2-micron process. In the future, TSMC plans to convert a portion of the capacity to 8-inch wafers and also to shrink its processes to the submicron level by 1990.

When the Company begins volume production, it expects approximately 25 percent of its production to be for Philips, 25 percent for Taiwanese firms, and the remainder for U.S. manufacturers.

BOARD

Dr. Morris Chang, Chairman

COMPANY EXECUTIVES

(Position, Name, and Prior Company)

President/CEO
Klaus Wiemer
Texas Instruments

VP Operations
F.C. Tseng
ERSO

VP Marketing
John Luke
Monsanto Silicon, VP Sales

VP Finance
Mient Vinenga
Philips

VP Admin
Eddie Mou
Texas Instruments, Pacific Rim Sales

FINANCING

1986
Round 1
$48.0M
Executive Yuan Development Fund (48.3 percent), N.V. Philips (27.5 percent), China American Petrochemical, Formosa Chemicals & Fiber, Formosa Plastics, Nan Ya Plastics, Central Investment Holding Co., Asia Polymer Corp., China General Plastics, Mabuchi Taiwan, USI Far East Corp., Yao Hua Glass, ADI Corp., Tai Yuen Textile, Union Petrochemical

1988
Round 2
$29.0M
Original investors

1988
Round 3
$205.0M
Original investors

ALLIANCES

Philips
1986
N.V. Philips has a 27.5 percent share in the $150 million investment in TSMC, with the remainder held by the government and Taiwanese firms. Philips has an option to purchase controlling interest in the Company.

SERVICES

Foundry
Assembly
Packaging
Test
Burn-in

MANUFACTURING

Technology

3.0-micron silicon-gate NMOS and CMOS p-well
2.0-, 1.5-, and 1.25-micron silicon-gate CMOS n-well
6-inch wafers
Submicron processes and 8-inch wafer compatibility planned by 1990

Facilities

Taiwan
21,000 sq. ft.
Manufacturing, Class 1 and Class 10 clean rooms

A second $220 million 65,000-square-foot facility is planned for completion in late 1989. The facility will have a production capacity of 36,000 6-inch wafers per month.

OTHER INFORMATION

Taiwan Semiconductor's PR firm is Masto Dagastine.

Telcom Devices Corporation

914 Tourmaline Drive
Newbury Park, CA 91320
805/499-0335
Fax: 805/499-8018

ESTABLISHED: 1986 **NO. OF EMPLOYEES: 6**

BACKGROUND

Telcom Devices Corporation was formed in early 1986 to offer indium gallium arsenide (InGaAs) photodiodes and indium gallium phosphide (InGaP) light-emitting diodes.

Founders James Kim, Ock-Ky Kim, and Larry Perillo are former Rockwell engineers. Telcom Devices is a subsidiary of Opto Diode Corp. (ODC) and is operating from ODC's facilities in Newbury Park, California. Both companies share clean room and manufacturing space.

Telcom Devices began volume production of its first products in May 1986. The products were InGaAs PIN photodiodes for fiber-optic applications and included the Planar 13PD100 and Planar 15PD100.

BOARD

Five members (James Kim is Chairman.)

PRODUCTS

InGaAs Photodiodes and Long-Wavelength LEDs

OTHER INFORMATION

Telecom Devices Corp. does not employ a PR firm.

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*James Kim
Rockwell

VP Engr
*Ock-Ky Kim
Rockwell

Dir Opto Mtls
*Larry Perillo
Rockwell

*Founder

FINANCING

Not available

MANUFACTURING

Facilities

Newbury Park, CA
10,000 sq. ft.
Administration, manufacturing

Three-Five Systems, Inc.

10230 S. 50th Place
Phoenix, AZ 85044
602/496-0035
Fax: 602/496-0168

ESTABLISHED: April 1985 **NO. OF EMPLOYEES: 235**

BACKGROUND

Historically, Three-Five Systems, Inc., produced and marketed custom and semicustom products that combine silicon and GaAs technologies for the consumer, industrial, telecommunications, and computer markets. The Company's main product thrust now is custom user interface modules utilizing LED, LCD, and keyboard components.

The Company is headquartered in a 40,000-square-foot facility in Phoenix, Arizona. The facility houses all corporate functions as well as a quick-turn prototype manufacturing area. In 1987, Three-Five consolidated its domestic operations in Phoenix, Arizona, and eliminated a facility in Troy, New York.

The Company was formed via a leveraged buyout of National Semiconductor's Optoelectronics business unit and was named Three-Five Semiconductor. The Company's founders are Frank Shroff, John Gragg, Dennis Riccio, Joe Riccio, and Brent Fox. Three-Five received acquisition funding, which was completed in December 1985, from Continental Illinois Venture Corporation (Chicago, Illinois) and OptoVen of Phoenix, an investment company formed specifically to invest in Three-Five.

In 1987, the Company changed its name from Three-Five Semiconductor Corporation to Three-Five Systems to reflect a shift from a front-end semiconductor emphasis to a broader systems approach. The Company has reorganized into two groups. The optoelectronics group supplies all existing and future standard products, and the display group is responsible for Application-Specific Integrated Displays (ASIDs) as well as other technologies that may be added. In September 1987, Three-Five raised $5.5 million in second-round financing, which was used to expand its technical staff and facilities to support the Company's thrust into new opto product areas. In March 1988, Three-Five initiated a further round of financing to support the Company's thrust into LCDs.

Currently, 400 products that were developed by the Company while it was a division of National are offered by Three-Five and include infrared and custom devices. New products include custom LCDs. In the long term, the Company will focus on PLCDs and GaAs-based products, optoelectronics (standard and custom), and integrated optoelectronic ICs. The Company will also focus on display systems, such as LED and LCD, with a higher degree of electronic control.

BOARD
(Name and Affiliation)

David R. Buchanan
Chairman

Kenneth M. Julien
Vice President, Chief Financial Officer

Burt McGillivray
Vice President, Continental Illinois Venture Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
David R. Buchanan
Talos Systems (now Calcomp Digitizer Division), Founder/Chairman/CEO

VP Finance/CFO
Kenneth M. Julien
CerProbe, VP/CFO

VP Quality
*Joseph Riccio
Motorola, Area Sales Mgr

Dir Mktg/Sales
Norman E. Clarke
MCI Telecommunications, National Account Manager

Dir European Ops
Martin Woolfenden
National Semiconductor, Marketing Manager

Dir Manufacturing
Dr. Carl Derrington
Motorola, Prod Mgr, Sensors

Dir Materials and Process Technology
Dr. Joseph Morrissy
Alcatel Information Systems, Manufacturing Manager

Dir Engineering
Mike Petera
Alphasil, Elec Design Mgr

*Founder

FINANCING

September 1987
Round 2
$5.5M
Continental Illinois Venture Corporation, National Semiconductor Corp., OptoVen Partners

March 1988
Round 3
Sears Pension Trust

MANUFACTURING

Technology

Liquid Crystal
GaAs

Facilities

Phoenix, AZ
40,000 sq. ft.
Prototype laboratories, corporate headquarters

Manila, Philippines
Manufacturing, inventory

Swindon, United Kingdom
European headquarters

PRODUCTS

- Application-Specific Integrated Displays(ASIDs)
- Custom User Interface Modules (Displays and Keyboards)
- LCD Modules—Standard and Custom
- Integrated Displays
- Integrated LED Bar Graphs
- Infrared
- LED Dot Matrix Displays
- Visible Lamps and LED Digits
- Multidigit LED Displays
- Keyboards

OTHER INFORMATION

Three-Five Systems does not employ a PR firm.

Togai InfraLogic, Inc.

30 Corporate Park, Suite 107
Irvine, CA 92714
714/975-8522
Fax: 714/975-8524

ESTABLISHED: August 1987 **NO. OF EMPLOYEES: 14**

BACKGROUND

Togai InfraLogic, Inc., was founded in August 1987 for the sole purpose of developing fuzzy logic tools and applications. The Company was founded by Dr. Masaki Togai, Carl Perkins, and Rodney J. Corder. The Company is actively developing and marketing fuzzy logic development tools for the commercial market in Japan, North America, and Europe.

Fuzzy logic is a form of multivalued logic that makes it possible for computer-controlled products to make "shades of gray" decisions the way humans do, as opposed to the limited yes-or-no approach dictated by conventional computer logic. In August 1989, Togai InfraLogic introduced the FC110 Digital Fuzzy Processor, the world's first embedded AI processor. The FC110 is a flexible 10-mips RISC processor with a specialized instruction set for fuzzy logic processing targeted at real-time embedded applications such as color copiers and engine controllers. In September 1989, the Company introduced its AT Accelerator board for PC AT based on the FC110. The Company also offers two products designed to facilitate fuzzy logic expert system development—the Fuzzy-C Compiler and the TIL Shell. The latter is a graphical CASE tool for expert system development.

Togai's first major commercial project is a joint development program with Japan's Mitsubishi Heavy Industries to create the world's first fuzzy logic-controlled air conditioning system. The system is designed to outperform the existing PID control for heating/cooling time and overall stability. Designers also anticipate a significant savings in power use resulting from implementation of this system.

BOARD
(Name and Affiliation)

Professor Lotfi Zaheh
University of California, Berkeley

Frank Lundberg
Rockwell—retired

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

President
*Masaki Togai, PhD
Rockwell

VP, R&D
*Rodney J. Corder
Rockwell

VP, Mktg
*Carl Perkins
Rockwell

Dir, Software Dev
Jon Terchrow
N/A

*Founder

FINANCING

1987
Round 1
Less than $1M
Corporations and private individuals

RECENT HIGHLIGHTS

December 1988
Togai introduced its first fuzzy logic development product—the Fuzzy-C Compiler, a textural tool for developing fuzzy logic expert systems in portable C source code.

May 1989
Togai's first VLSI processor, rated at 160 million 16-bit operations per second, was released for image classification and sorting, the output of which is managed by fuzzy logic knowledge bases.

August 1989
Togai introduced the FC110 Digital Fuzzy Processor, a 10-mips RISC processor with a specialized instruction set for fuzzy logic processing.

September 1989
Togai introduced its AT accelerator board and its graphical CASE tool for fuzzy logic expert system development.

ALLIANCES

Mitsubishi Heavy Industries
September 1989
Togai and Mitsubishi Heavy Industries announced the joint development of an air conditioning system based on a fuzzy logic controller.

MANUFACTURING

Technology

Fuzzy logic; 1.5- and 1.0-micron CMOS

Facilities

Irvine, CA
5,000 sq. ft.
Design, marketing

PRODUCTS

Fuzzy-C Development System
TIL Shell Graphical Export System
Fuzzy Logic AT Accelerator Board (based on its VLSI fuzzy processor)

OTHER INFORMATION

Togai InfraLogic's PR firm is Bond Communications.

Topaz Semiconductor Inc.

1971 North Capitol Avenue
San Jose, CA 95132-3799
408/942-9100
Fax: 408/942-1174

ESTABLISHED: March 1985 | **NO. OF EMPLOYEES: 37**

BACKGROUND

Topaz Semiconductor designs and manufactures advanced field-effect transistors (FETs) and CMOS/DMOS ICs. Topaz, a company representing a partial buyout of Semi-Processes, Inc. (SPI), was formed by Thomas Cauge and Bruce Watson. The purchase included DMOS transistor and certain IC designs, and wafer fabrication, test, and finishing equipment. Topaz later acquired the SPI facilities as the result of an agreement to be acquired by Hytek Microsystems, Inc., of Los Gatos, California.

Topaz Semiconductor operates as a wholly owned subsidiary of Hytek Microsystems. Hytek designs and manufactures thick-film hybrid microcircuits. In July 1985, Hytek purchased all the DMOS-related assets of SPI. Hytek's integration of the SPI assets with those of Topaz Semiconductor insures a continued source of SPI products, as well as contribution to the faster expansion of Topaz Semiconductor.

With the financial backing of Hytek, a significant number of new Topaz products has been added. These products include medium-power lateral DMOS discretes (high-voltage and ultralow-leakage n- and p-channel); vertical DMOS discrete products with 20-micron hex-to-hex spacing; and new CMOS/DMOS IC analog switch products for video switching applications. Topaz will focus on high-speed digital and precision analog switching applications for its lateral DMOS devices and on low- to medium-current relay-replacement applications for its vertical DMOS line. Topaz initially has integrated DMOS and CMOS on a single chip. Plans include integrating logic with both lateral and vertical DMOS to allow more user flexibility. Topaz also supplies standard and special high-reliability products that are tested to military requirements.

Topaz subcontracts assembly operations to companies in Thailand, Malaysia, and Taiwan.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Thomas Cauge
Semi-Processes Inc., VP Opns

Dir Marketing
*Bruce Watson
Semi-Processes Inc., Prod Mktg Mgr

Dir Engineering
Paul Denham
Semi-Processes Inc., Engr Mgr

Dir Sales
Robert Vosburgh
Marconi Instruments, Sales Mgr

*Founder

FINANCING

1985
Seed
$1.5M
Private

RECENT HIGHLIGHTS

March 1987
Topaz offered the CDG2214N, an analog switch with a CMOS-compatible control input. The device combines CMOS and DMOS processes and switches analog signals of ± 10V with CMOS logic levels.

April 1987
Topaz offered the CDG201B, a low-insertion-loss quad analog switch that is TTL-compatible and pin- and function-compatible with standard CMOS devices.

April 1987
Topaz offered the CDG211CJ, a quad single-pole, single-throw analog switch with TTL-compatible control input.

June 1987
Topaz offered the SD5400 series of DMOS analog switches in 14-lead, small-outline packages. Power dissipation is 546 milliwatts and the series operates from 0 to 70° centigrade.

June 1987
Topaz offered the SD1202, a 200V, n-channel enhancement-mode vertical D-MOSFET with a high gate standoff of 100V.

June 1987
Topaz offered the SD1500BD, a 600V enhancement-mode vertical D-MOSFET.

January 1988
Topaz offered the CDG4460J, a 6-bit digital-controlled attenuator for video frequencies of 10.7 to 30.0 MHz, with attenuation of 0.25dB per step.

February 1988
Topaz offered the SD220/SD221 series of 60V, 9-ohm/100V, 12-ohm n-channel enhancement-mode lateral D-MOSFETs for ultrahigh-speed display driver applications.

ALLIANCES

Hytek Microsystems
July 1985
Topaz was acquired by Hytek Microsystems and operates as a wholly owned subsidiary. Hytek and Topaz cooperate on development of precision, standard hybrid circuits.

MANUFACTURING

Technology

3.0-micron and 20.0-micron hex-to-hex spacing silicon-gate Vertical DMOS
5-inch wafers
Lateral DMOS (3-inch wafers)
3.0-micron CMOS

Facilities

San Jose, CA
30,000 sq. ft. total

20,000 sq. ft.
Design, wafer fab, and test

8,000 sq. ft.
Class 10 clean room (underhood)

PRODUCTS

Lateral DMOS FETs
DMOS Power FETs
DMOS FET Ultralow Leakage
High-Voltage DMOS Power FETs
Vertical DMOS FETs
Dual-Gate DMOS FETs

DMOS FET Switches
Ultrahigh-Speed, Low-Cost Switches
Quad Monolithic SPST CMOS/DMOS Analog Switches
Dual Monolithic SPST CMOS/DMOS T-Configuration Analog Switch

DMOS FETs 8-Channel Arrays
Quad DMOS Power FET Arrays
Quad DMOS FET Driver Arrays
Quad DMOS FET Analog Switch Arrays
FET Ultrahigh-Speed Dual Drivers
4:1 Monolithic CMOS/DMOS Analog Multiplexers

OTHER INFORMATION

Topaz does not employ a PR firm.

TranSwitch Corporation

8 Progress Drive
Shelton, CT 06484
203/929-8810
Fax: 203/926-9453

ESTABLISHED: April 1988 | **NO. OF EMPLOYEES: 16**

BACKGROUND

TranSwitch was founded in April 1988 to develop telecommunication ICs. The Company will offer chip sets that facilitate synchronous optical network (SONET) multiplexing.

Multiplexing is a foundation of telecommunications data transmission. The purpose of multiplexing is to combine a number of signals into one higher-level signal to accelerate transmission speeds. For example, a T-1 line is the result of the combination of 24 voice channels. Twenty-eight T-1 signals may then be combined to form a T-3 line. Similarly, 24 voice channels are combined to form a DS-1 signal. Next, 28 DS-1 signals can be combined to form a DS-3 line. SONET uses DS-3 lines to build higher-level signals for transmission.

The Company is scheduled to introduce DS-3 VLSI devices in January 1990, followed by the introduction of SONET VLSI devices in April 1990. TranSwitch contracts outside firms for wafer fab and assembly operations. Devices are manufactured using a 1.5-micron CMOS process. TranSwitch has raised more than $3 million in venture capital financing through two rounds. During the next three years, the Company plans to acquire $4 million worth of capital equipment and expand its facilities to 20,000 square feet.

BOARD
(Name and Affiliation)

Dr. S. Flashen
Independent Consultant

Dr. S. Das
President, TranSwitch Corporation

Dr. A. Paladino
Partner, Advanced Tech. Ventures

Dr. C. Lee
Partner, ABACUS Ventures

I. Wolff
Partner, Rothschild Ventures

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Dr. S. Das
Spectrum Digital, President

Dir, R&D
D. Upp
ITT, Dir, Exploration Sys

VP, Mktg
J. Lane
Telco Systems, VP, Engineering

Dir, Finance
M. McCoy
ITT, Controller, ITT-ATC

Mgr, Ops
E. Linke
Black & Decker, Manager

FINANCING

December 1988
Round 1
$1.7M
Advanced Technology Ventures, Abacus Ventures, Transtech Ventures, Rothschild Ventures, Merrill Lynch Management Fund

July 1989
Round 2
$2.5M
Initial investors, Connecticut Seed Ventures

ALLIANCES

None

MANUFACTURING

Technology

1.5-micron CMOS, BiCMOS

Facilities

Shelton, CT
6,500 sq. ft.
Design, test, marketing

PRODUCTS

DS-3 VLSI Devices
SONET VLSI Devices

OTHER INFORMATION

TranSwitch Corporation does not employ a PR firm.

Triad Semiconductors International

5575 Tech Center Drive
Colorado Springs, CO 80919
1-800/228-1874
Fax: 719/528-8875

ESTABLISHED: September 1988 **NO. OF EMPLOYEES: 25**

BACKGROUND

Triad Semiconductors International (Triad) designs, develops, and markets specialty memory ICs for use in high-performance data and algorithmic processors, digital telecommunications and video applications, image/voice synthesis and recognition and other artificial intelligence applications, and advanced industrial instrumentation and control systems. Triad's high-performance specialty memories are based on CMOS technology, but the Company plans to use other technologies if and when appropriate.

The Company has defined 24 products. Initial products include a monolithic 256-color graphics palette chip with RAM and DAC on-chip and a 2Kx9 and 4Kx9 FIFO, 64Kx4 Fast Industry Standard (FIS) latched and registered version. Future product introductions will include a writable control store chip, 1Kx48 CAM, 128Kx8 cached DRAM, and a second-generation monolithic color graphics chip.

The parent company of Triad is registered in the Netherlands. The Company conducts back-end services, such as testing in the Netherlands, and plans to add design activities to serve the EEC market. The Company has a joint venture with Rood Testhouse in Europe to guarantee engineering and test capacity in exchange for business committed by Triad. Operations are centralized in the United States and headquartered in Colorado Springs, Colorado.

Triad has adopted a strategy of developing a worldwide network of corporate alliances with industrial partners to obtain core product designs and then applying its expertise to add value-enhancing features. In October 1987, Triad negotiated an alliance with a Japanese semiconductor manufacturer, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D. Triad also has foundry alliances with AT&T and Seiko and plans additional alliances with a U.S. and a European company. Assembly is conducted by Lingsen in Taiwan and Swire in Hong Kong.

Applied Marketing Technology, based in the United Kingdom, has been signed as the Company's representatives in the EEC. Other representatives are being set up in the Far East and the United States.

BOARD

(Name and Affiliation)

Pieter Niessen, Chairman

Raymond Bullens
Henk Van der Kwast

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
*Michael Burton
Inmos, Mgr Commercial Ops

Sr VP Sales/Mktg
Bruce Threewitt
AMD, Dir Prod Dev

CFO
Jop Van der Wiel
Not available

*Founder

FINANCING

1985
Initial
$8.0M
AMRO Bank, founders, The Limburg Investment Bank, private placement, grants and subsidies from the Dutch government

1986
Round 2
N/A
LIOS

1987
Round 3
N/A
Kempen Co.

ALLIANCES

Japanese Company
Triad negotiated an agreement with a Japanese semiconductor company, giving Triad access to advanced process technologies, fabrication capacity, a second source, and joint R&D.

AT&T
Triad signed a foundry alliance with AT&T, which is manufacturing the fast latched/registered pipelined memories.

Seiko
Triad signed a foundry alliance with Seiko, which is manufacturing the monolithic color palette.

Rood Testhouse
Triad signed an agreement with Rood Testhouse in Europe, guaranteeing engineering and test capacity in exchange for business committed by Triad.

MANUFACTURING

Technology

1.2- and 1.5-micron CMOS
Double-metal, double-poly process
Double-metal, single-poly process

Facilities

Colorado Springs, CO
15,000 sq. ft.
Corporate headquarters, design

The Netherlands
25,000 sq. ft.
European headquarters

PRODUCTS

Product	Availability
256-Color Graphics Palette Chip	Q2 1988
16Kx4 Fast Industry Standard (FIS)	Q2 1989
64Kx4 FIS	Q3 1988
64Kx4 Latched and Registered Memory	Q4 1989
Writable Control Store	Q1 1989
1Kx48 LAN CAM	Q2 1990

OTHER INFORMATION

Triad's PR firm is Ad-Infinitum.

TriQuint Semiconductor, Inc.

Group 700
P.O. Box 4935
Beaverton, OR 97076
503/644-3535
Fax: 503/644-3198

ESTABLISHED: January 1984 **NO. OF EMPLOYEES: 135**

BACKGROUND

TriQuint designs, develops, manufactures, and markets microwave, linear, and GHz digital GaAs IC components. TriQuint also offers a broad range of foundry services. The Company's products are used in high-performance applications such as fiber-optic telephone communication, high-speed computer interfaces, instruments, and military systems.

The Company evolved from research on GaAs ICs that began in Tektronix Laboratories in 1978. Several of TriQuint's founders were leaders on the Tektronix research team. In 1984, TriQuint was formally established as a majority-owned subsidiary with the entrepreneurial freedom to establish a broad portfolio of long-term manufacturing contracts.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President/CEO
Alan D. Patz
Tektronix, GM GaAs ICs

Dir Mktg/Sales
Dennis C. Powers
Not available

Mgr QA
Richard Allen
Tektronix, Div Mfg Mgr

VP R&D
Dr. Richard Koyama
Tektronix, Technical Manager

Dir Finance/Admin
Richard Sasaki
Tektronix, Financial Mgr

VP Mfg
Dr. Gordon Roper
Tektronix, Principal Engr

VP Digital & Linear Products
Dr. Ajit Rode
Tektronix, IC Process Engr

VP Microwave Prod
Philips Snow
Not available

RECENT HIGHLIGHTS

November 1987
TriQuint offered the TQ3000, a 3,000-gate array that features 1,020 cells and 64 I/Os. The TQ3000, which can perform at up to 1 GHz, is produced with a 1-micron GaAs E- and D-MESFET process. The new array is supported by Daisy, Mentor, and Tek/CAE workstations.

October 1987
TriQuint introduced the TQ6330, an ultrafast pin driver, and the TQ6331 line receiver pair.

February 1988
TriQuint announced a radio-frequency/large-scale integration (RF/LSI) GaAs IC foundry service named the QED/A process.

March 1988
TriQuint introduced the QLSI cell-based library, a GHz LSI cell-based library that supports LSI applications of up to 6,000 equivalent gates and toggle rates of up to 2 GHz.

May 1988
TriQuint is the first GaAs foundry to manufacture microwave and digital ICs on 4-inch wafers.

May 1988
TriQuint announced an optimized 0.5-micron microwave foundry process.

July 1989
TriQuint announced the shipment of wafers and die screened to U.S. Department of Defense Class 5 requirements, the first commercial IC manufacturer to announce availability of this level of screening—permitting satellite systems applications.

ALLIANCES

Tektronix
January 1984
Tektronix spun off TriQuint, remaining the parent company and completing a sales agreement with the new subsidiary.

EEsof
May 1986
EEsof and TriQuint teamed up to incorporate TriQuint's GaAs custom MMIC foundry models into Touchstone, EEsof's minicomputer- and workstation-based MMIC CAD program. Jointly, they developed a GaAs MMIC element library that allows users to simulate microwave ICs, using MMIC components that model components available from TriQuint's custom MMIC foundry facility.

TRW
June 1987
TRW Components and TriQuint agreed jointly to develop and supply class-S level GaAs devices for space applications. TriQuint will provide microwave and digital GaAs technology in addition to foundry services.

MSC
March 1988
Microwave Semiconductor Corporation and TriQuint agreed to provide customers with GDS-II tape interchangeability and equivalent performance for GaAs analog and digital ICs and MMICs.

Hewlett-Packard
May 1988
TriQuint's MMIC Library of foundry design models are incorporated into Hewlett-Packard Company's microwave CAE design system.

Gazelle Microcircuits
May 1988
Gazelle Microcircuits signed foundry contract with TriQuint for 4-inch digital wafer production.

MANUFACTURING

Technology

1.0- and 0.5-micron gate length depletion mode MESFET processes capable of fabricating D-MESFETs VIAs
1.0- and 0.5-micron gate length enhancement/depletion mode MESFET processes capable of fabricating E- and D-MESFETs
3-inch wafers
4-inch wafers

Facilities

Beaverton, OR
35,000 sq. ft.
Administration, engineering, manufacturing
15,000 sq. ft.
Class 100 clean room

PRODUCTS

Foundry

1A/1D Process	1.0-Micron Gate Length Depletion Mode MESFET for D-MESFET, Schottky Diodes, Implanted Resistors, MIM Capacitors, and Airbridge Inductors
HA Process	0.5-Micron Gate Length Depletion Mode MESFET Process for Both 0.5- and 1.0-Micron D-MESFETs, Schottky Diodes, Implanted Resistors, Precision Nichrome Resistors, MIM Capacitors, and Airbridge Inductors

QED Process	1.0-Micron Gate Length Enhancement/Depletion Mode MESFET for E- and D-MESFETs, Schottky Diodes, Implanted Resistors, and Airbridge Inductors
QED/A Process	An Enhanced Version of the QED Process that Allows the Mixing of Low-Power Digital LSI Circuits and Precision Analog Circuits on a Single Die
3A Process	Optimized 0.5-micron microwave process

Gate Arrays

Family	Linewidth	Delay	Gates
QLSI	1.0	0.15	2,000; 3,000; 4,000

Cell-Based Library

Family	Cells
Q-Logic	1,000 Gates, Data Encoders/Decoders, MUX/DEMUX, Counters, Dividers, Prescalers
QLSI	8,000 Gates, ZFL Cells, SCFL Cell Family

MMICs (Die and Components)

TQ9111	1- to 8-GHz Amplifier
TQ9141	1- to 10-GHz Power Divider
TQ9152	1- to 10-GHz SPDT Switch
TQ9161	1- to 10-GHz Variable Attenuator
TQ9121	0.5 to 20.0-GHz 10w Noise Amplifier
TQ9131	0.5 to 20.0 GHz Active Combiner

Digital Products

TQ1131	Pgm 8:1, 16:1 MUX
TQ1132	Pgm 1:8, 1:16 DEMUX
TQ1133	4:1 MUX
TQ1134	1:4 DEMUX
TQ1135	12:1 MUX
TQ1136	12:1 DEMUX

Linear ICs

TQ6330	Pin Driver
TQ6331	Line Receiver
TQ6111-D	8-Bit DAC, 600 Ms/S, Die Form
TQ6111-M	8-Bit DAC, 600 Ms/S, Ceramic Package
TQ6111-BI	8-Bit DAC, 600 Ms/S, Board Module, Instrumentation Version
TQ6111-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
TQ6112-D	8-Bit DAC, 1,000 Ms/S, Die Form
TQ6112-M	8-Bit DAC, 1,000 Ms/S, Ceramic Package
TQ6112-BI	8-Bit DAC, 1,000 Ms/S, Board Module, Instrumentation Version
TQ6112-BV	8-Bit DAC, 600 Ms/S, Board Module, Video Version
EK-TQ6101	GIGADAC Evaluation Kit

OTHER INFORMATION

TriQuint's PR firm is Hastings and Humble Public Relations.

United Microelectronics Corp.

#3 Industrial Road
Hsinchu City
Taipei, Taiwan
(035) 773131
Telex: 31476 UMCHSC
Fax: 035 774 767

ESTABLISHED: September 1979 **NO. OF EMPLOYEES: 950**

BACKGROUND

United Microelectronics Corp. (UMC) offers gate array and standard cell design services in addition to consumer, telecommunications, memory, and microprocessor ICs. The Company was formed to commercialize ERSO's IC technology and is Taiwan's largest wafer foundry. UMC provides foundry services to major U.S. and domestic IC design companies.

In 1983, UMC funded Unicorn Microelectronics, a design center, in San Jose, California. National Microelectronic Corporation is the U.S. sales and distribution arm for UMC's foundry services and products.

In December 1987, UMC started construction of a $170 million VLSI plant, with a planned capacity of 30,000 units of 6-inch wafers per month.

In 1987, UMC elected Dr. Morris Chang chairman. Dr. Chang is also the chairman of Taiwan Semiconductor Manufacturing Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, Taiwan. Dr. Chang was a vice president at Texas Instruments and chief executive officer at General Instrument Corporation.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Robert H.C. Tsao
ERSO, VP Operations

VP Operations
Alex I.D. Liu
ERSO, Production Manager

VP Marketing
John Hsuan
ERSO, Marketing Manager

R&D Director
M.K. Tsai
ERSO, Design Manager

Plant Director
Hyley Huang
ERSO, Process Manager

FINANCING

1979
Round 1
$12.5M
Bank of Communications, China Development Corp., Kuang Hua Investment Co., Ministry of Economic Affairs, Orient Semiconductor, Sampo, Teco, Walsin-Lihwa Electric Wire & Cable, Yao Hua Glass Co.

July 1985
Round 2
$7.5M
Initial public offering

RECENT HIGHLIGHTS

November 1986
National Semiconductor filed a suit against UMC charging theft of trade secrets, fraud, breach of contract and fiduciary obligations, unfair competition, conversion, interference, and conspiracy. The suit concerns the marketing by UMC of a real-time clock part and

a UART, which National claims was based on designs received from National under a fab agreement. National is seeking $10 million in damages. UMC filed a countersuit against National in the United States, alleging that National has made false statements in an effort to interfere with UMC's economic relationships.

December 1987
UMC started construction of its $170 million VLSI plant II, with a planned capacity of 30,000 units of 6-inch wafers per month.

January 1988
UMC reported fiscal 1987 sales of $90 million.

ALLIANCES

ERSO
1979
ERSO granted UMC a license for design and process technology for 4-inch silicon wafers.

AMI
April 1983
Dialer ICs were produced in cooperation with AMI. UMC is also a second source for AMI's products and 5-micron silicon-gate CMOS in Asia.

Unicorn
January 1985
UMC funded Unicorn for $2.5 million.

June 1985
UMC and Unicorn agreed to jointly develop a standard cell library and to design cells for data path, memory, I/O, random logic, and complex logic.

Honeywell/Synertek
July 1985
UMC gained nonexclusive product licenses for 18 ICs formerly produced by Synertek and purchased some Synertek production equipment and inventory from Honeywell. Products covered in this agreement included 4K and 16K SRAMs and 8K, 16K, and 32K ROMs. Honeywell received $3 million plus royalties of 3 to 5 percent over the next three years.

MOSel
October 1985
MOSel transferred rights to a high-speed 2Kx8 SRAM and EEPROM to UMC, additionally providing 1.5- and 2.0-micron processes that were used to bring up the 2-micron CMOS process at UMC.

TRW
April 1986
UMC successfully developed 1.25-micron VLSI products with TRW.

SMC
June 1986
UMC signed a contract with SMC to cooperate on a computer IC.

SERVICES

Design—Gate arrays, standard cell, full custom
Foundry—CMOS
Prototype Manufacturing
Production Manufacturing

MANUFACTURING

Technology

5.0- and 2.0-micron silicon-gate NMOS
3.0- to 1.2-micron single/double metal/poly CMOS
5.0-micron silicon-/metal-gate CMOS
18V high-voltage CMOS
10V poly capacitor analog CMOS
2.0-micron CMOS EPROM
4-inch wafers

Facilities

Taiwan
92,000 sq. ft.
Total space
17,000 sq. ft.
Wafer fab

PRODUCTS

Memory
512x9 and 1,024x9 Parallel FIFOs, ROMs in 4Kx8, 8Kx8, 16Kx8, and 32Kx8 configurations, High-Speed SRAMs in 1Kx4, 2Kx8, 16Kx1, and 4Kx4 configurations, and a 1Kx4 SRAM

Consumer ICs
Melody Generators, CMOS Calculator, Timer, Clock, and Watch Chips, Voice Control IC, Speech Synthesizer, Encoder/Decoder, Dimmer

Microcomponents
8-Bit Single-Chip MCUs, 8-Bit MPU, CRT Controller, Video Attributes Controller, Disk Controller, Double-Row Buffer, Floppy Disk Separator, Bus Controllers, RTC, ACIA, VIA, PIA, RAM I/O Timer Array, DUART, EPCI IC, Programmable Interval Timer, Programmable Interrupt Controller, Programmable Peripheral Interface, Clock Generator and Driver, Capacitance Keyboard Encoder

New Microcomponent Products
System, I/O and FCD Support Chips for PS/2 Model 30, Single-Chip MCGA, Single-Chip FDC for PS/2 Model 30, Two Serial Ports and One Parallel Port, Advanced ACE, CMOS ACE, COS ACE, Single-Chip Monochrome Graphics Adapter, Single-Chip MGA and CGA, Micro Channel Interface Chip, SCSI Bus Controller

Data Converter ICs
3.5-Digit A/D Converter, Digit A/D Converter, CMOS DAC

Telecommunications
Simple Pulse Dialer, Repertory Pulse Dialer, Simple Tone Dialer, Tone/Pulse Dialer, T/P Redialer, Repertory T/P Dialer, Slave T/P Dialer, Direct Access Adapter, Crosspoint, DTMF Receiver

ASICs
Mask Programmable Logic Arrays

Gate Arrays
3-microns, 300 to 920 gates; 2-microns, 1,200 to 3,000 gates

Cell-Based Libraries
3.0-Micron, 1 Layer Poly, 1 Layer Metal
2.0-Micron, 1 Layer Poly, 1 Layer Metal
1.5-Micron Series, 1 Layer Poly, 2 Layers Metal

Silicon Compilers
Data Path Module, PLA Module, PAD Module, FIFO Module, RAM Module, ROM Module, Random Logic Module, and User-Specific Module

OTHER INFORMATION

UMC does not employ a PR firm.

United Silicon Structures

1971 Concourse Drive
San Jose, CA 95131
408/435-1366
Fax: 408/435-0504

ESTABLISHED: September 1987 **NO. OF EMPLOYEES: 25**

BACKGROUND

United Silicon Structures (US2) was founded in September 1987 by European Silicon Structures (ES2) to serve the U.S. ASIC market by delivering quick-turn, low-cost prototypes and low-volume production runs. US2 perceives the ASIC market as developing to the point where many customers require many different designs with low-volume requirements of each part type. The Company believes that market opportunity is being created for a new type of service-oriented company dedicated to manufacturing prototypes and small production series.

US2 utilizes an e-beam process for direct write production. Fabrication currently is conducted by US2's sister company, ES2, which operates two e-beam systems in a 100,000-square-foot plant in Rousset, France. The technology employed by US2 is compatible with the most popular CAE and CAD platforms, such as those of Mentor Graphics, Cadence Design Systems, and Silicon Compiler Systems. When volume production is required, the company makes use of its foundry contracts with Philips, Signetics, and TSMC.

First-round funding was provided by Advent International; Concord Partners; and Mohr, Davidow Ventures in the amount of $4.52 million. This venture capital investment represents a 30 percent equity investment in the Company. In addition, ES2 holds 40 percent of the equity stake, while the remaining 30 percent is reserved for US2's key employees.

Within the next three years, US2 will install a North American fab facility. The fab is designed to service the prototyping and low-volume marketplace. US2's new fab facility will also employ an e-beam write-on process.

BOARD
(Name and Affiliation)

Henri Jarrat
United Silicon Structures, President/CEO

William Davidow
Mohr, Davidow Ventures, General Partner

Irwin Federman
Dillon, Reed & Company, Managing Director

David Brown
Advent International, Senior Vice President

Jean-Luc Grand-Clement
European Silicon Structures, Chairman

Werner Koepf
European Silicon Structures, President/CEO

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO/Chairman
Henri Jarrat
VTI, President

Executive VP
Jim Ellick
CAECO, President

VP Customer Eng
Ian Mackintosh
VTI, Dir West Coast Tech Centers

VP Mktg
Jacques Castaillac
European Silicon, VP Sales & Mktg Structures

Dir Customer Eng
Timothy O'Donnell
National Semiconductor, ASIC App Mgr

Dir R&D
Robert Heaton
European Silicon, Design Ctr Mgr Structures

FINANCING

March 1989
Initial
$4.5M
Advent International; Concord Partners; Mohr, Davidow Ventures

ALLIANCES

European Silicon Structures
European Silicon Structures is a sister company with which United Silicon Structures shares technology. Partnership agreements are with large volume silicon manufacturers such as National Semiconductor, Philips, Signetics, and TSMC.

PRODUCTS

Silicon Prototype Services
Low-Volume Silicon Production
Entry Level Design Software

OTHER INFORMATION

US2's PR firm is Miller Communications.

SERVICES

ASIC prototypes
Low-volume ASIC production

MANUFACTURING

Technology

CMOS, n-well, single poly, double metal
2.0 micron
1.5 micron
1.2 micron
1.0 micron (available in 1990)

Facilities

Rousset, France
100,000 sq. ft.
Manufacturing, test, assembly

Vadem

1885 Lundy Avenue, Suite 201
San Jose, CA 95131
408/943-9301
Fax: 408/943-9735

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 17**

BACKGROUND

Vadem, founded in 1983 by Chikok Shing and Henry Fung, designs, develops, and markets integrated circuits used in DOS-compatible systems. Vadem provides logic chip sets that offer PC XT compatibility, as well as application support chips that add to the core logic and enhance the use of the PC architecture in embedded control applications. Vadem targets the large class of products that incorporate a PC-compatible architecture in the control of computer-based equipment.

Vadem core logic chip sets focus on integrated processors from Intel and NEC, which typically serve the embedded control marketplace. Vadem offers a core logic chip set for the 80186/80C186 processor, which offers performance ranging from 8 to 16 MHz. Vadem's core logic chip sets for the NEC V-40 provide a very low cost PC XT solution at clock speeds of up to 10 MHz.

Vadem's application support chips focus on providing high levels of integration, which lower component count and reduce power consumption for products that use the PC architecture for embedded computer control. Applications that can make excellent use of the PC architecture for embedded controllers include portable or hand-held terminals; market-specific terminals such as point-of-sale terminals, ATMs, and ticket and vending machines; PC-compatible intelligent terminals or network workstations; industrial and machine control systems; telecommunications; and home electronics.

Vadem also is involved in many design projects for major corporations. In 1984, Vadem designed the first battery-operated PC-DOS system for Morrow Designs. A modification of this design was licensed to Zenith and became the Z-171 laptop computer. Vadem has established design relationships with Sharp Electronics and Zenith Corporation in the PC area. Vadem currently is working on additional design projects that will result in new products such as a complete PC engine on a single chip.

BOARD
(Name and Affiliation)

*Chikok Shing
Vadem, Chairman/CEO

*Henry Fung
Vadem, Vice President of Engineering

Bob Dilworth
Metrocom, Inc., CEO

Samuel Fang
General Electronics, Inc., Hong Kong, Managing Director

JJ Guo
SIS, Taiwan, President

COMPANY EXECUTIVES
(Position, Name, and Prior Company)

Chairman, CEO
*Chikok Shing
Osborne Computer Corp.

VP Eng
*Henry Fung
Intel Corporation

Dir Mktg
Barney Ichikawa
David Systems

Dir ASIC Dev
Siu Tsang
Intel Corporation

Dir Software Eng
Rich Peters
Seitor Corporation

NA Sales Manager
Howard James
Prolog Corporation

*Founder

FINANCING

Vadem is privately held and was funded initially by its founders; the founders and other employees own more than 80 percent of Vadem stock.

ALLIANCES

Intel
March 1988
Vadem and Intel signed an agreement in which Intel made a small up-front investment in an IBM Model 30 and PC XT-compatible chip set that Vadem is developing.

Intel
September 1988
Vadem and Intel signed a second strategic alliance focused on Vadem's Model 30 and PC XT-compatible chip set. Under the terms of the five-year agreement, Intel's sales force will refer customers to Vadem for the chip set. Vadem, meanwhile, will market the chip set independently.

MANUFACTURING

Technology

CMOS

Facilities

San Jose, CA
6,000 sq. ft.
R&D, test, marketing

PRODUCTS

Intel 80C186 Support Products
NEC V-40 Support Products
Application Support Chips

OTHER INFORMATION

Vadem does not employ a PR firm.

VIA Technologies, Inc.

(Formerly LOGICSTAR)
4160 B Technology Drive
Fremont, CA 94538
415/651-2796
Fax: 415/659-9057

ESTABLISHED: 1987 **NO. OF EMPLOYEES: 20**

BACKGROUND

VIA Technologies, Inc., was formed to design, manufacture, and market high-performance VLSI graphics and local area network (LAN) chips. The Company is addressing the PC AT market and is using a VLSI design methodology to bring products to market quickly.

The Company's initial products are a five-chip PC AT chip set that is pin-for-pin compatible with Chips & Technologies' chip set, a monographics controller, a memory mapper, a dual-channel NRZI encoder/decoder, and a Starlan interface chip. In April 1988, VIA Technologies, Inc., began volume shipments of its chip sets. Future products will include a VGA chip, 386 chip sets, additional disk communications chips, and disk controllers.

The Company has set up joint ventures for design with companies in Japan, Korea, and Taiwan. These agreements may be extended to include manufacturing and marketing at a future time. Foundry services are being provided by companies in the United States, Europe, and Japan.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

Chairman, CEO
Don Brooks
Fairchild, President

VP Oper/CFO
Mark Kaleem
OSM Computer, President

VP Engr
Idris Kothari
VLSI, N/A

VP Sales/Mktg
Peyton Cole
Fairchild, N/A

FINANCING

March 1989
Financing was provided by Fujitsu as part of the strategic alliance covering chip sets for Sun-compatible workstations.

ALLIANCES

Fujitsu
March 1989
VIA Technologies announced a strategic partnership with Fujitsu Microelectronics to codevelop peripheral chip sets for Sun-compatible workstations.

MANUFACTURING

Technology

1.3-micron, double-metal CMOS

Facilities

Fremont, CA
5,000 sq. ft.
Administration, design

PRODUCTS

Current Products

Device	Description
SL2002	Dual-Channel NRZI Encoder/Decoder
SL600X	80286-Based PC AT Chip Set
SL6001	PC AT System Controller
SL6002	PC AT Memory Decode
SL6003	PC AT System Buffer-1
SL6004	PC AT System Buffer-2
SL6005	PC AT System Buffer-3
SL6003C	PC AT System Buffer-1
SL6004C	PC AT System Buffer-2
SL6005C	PC AT System Buffer-3
SL6002A	PC AT Advanced Memory Controller
SL6012	PC AT Memory Mapper
SL5001	Parallel Printer Port
SL5002	Parallel Printer Port with Crystal Oscillator
SL7001	Monographic Controller
SL4000	Starlan Interface

New Products

SL9090	Universal AT Clock Chip
SL9091	Video Clock Chip
SL90XX	FlexSet, PC AT Core Logic (80286/80386SX/80386)
SL9010	System Controller
SL9020	Data Controller
SL9025	Address Controller
SL9030	Universal Peripheral Controller
SL9X5X	PC AT Memory Controllers
SL9150	80286-Based Page Mode
SL9155	80286-Based Cache-Based
SL9250	80386SX-Based Page Mode
SL9255	80386SX-Based Cache-Based
SL9350	80386-Based Page Mode
SL9355	80386-Based Cache-Based

OTHER INFORMATION

VIA Technologies does not employ a PR firm.

Vitelic Corporation

3910 North First Street
San Jose, CA 95134-1501
408/433-6000
Fax: 408/433-0331

ESTABLISHED: December 1983 **NO. OF EMPLOYEES: 180**

BACKGROUND

Vitelic designs, develops, manufactures, and markets high-performance specialty memory devices based on 1.2-micron CMOS manufacturing technology. The Company specializes in application- and customer-specific memory devices. Vitelic was founded by Alex Au, former director of VLSI research at Fairchild Camera and Instrument Corporation.

In 1987, Vitelic established a customer-specific memory business to serve the needs of board-level and system designers. The focus of this department is on supermini, supermicro, and high-performance workstations, as well as graphics and image-processing products.

Vitelic contracts all manufacturing to several Asian manufacturers through various licensing agreements.

BOARD
(Name and Affiliation)

Alex Au
  Vitelic Corporation, President/CEO

Teruaki Aoki
  Sony Corporation, Deputy Senior General Manager

Neill Brownstein
  Bessemer Venture Partners, L.P., General Partner

Kazuo Inamori
  Kyocera Corporation, Chairman

Harry Marshall
  J.H. Whitney & Company, General Partner

David Wang
  Syntek Design Tech Ltd., General Manager

Kunnan Lo
  Kunnan Enterprises Ltd., Founder

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Alex Au
  Fairchild, Dir Research

Exec VP
Will Kauffman
  Intel, VP Quality & Rel

VP Sales/Mktg
Gary Ater
  NMB, VP/GM US Ops

VP R&D
Michael Barry
  Fairchild, Dir CMOS/VLSI Lab

SR VP Sourcing Relationships
John Seto
  Hyundai, Dir Operations

SR VP/CFO
Arthur Wang
  Raychem, GM Malaysia and Thailand

SR VP VTC
Hsing Tuan
  Fairchild, N/A

SR VP/GM Taiwan Operations
Chun Ho
  Exel, Dir Tech Development

SR VP Corp Mktg
James Koo
  Synertech, Dir of Memory Products

VP Finance
Henry Shaw
  Talen Group, Mktg/Sales Director

VP General Counsel. Asst. Secretary
Martin Baker
  Wilson, Sonsini, Goodrich & Rosati, Counselor

VP GM SRAM Group
Raymond Wang
  Victory Computer, President/CEO

FINANCING

March 1984
Seed
$7.0M
Bessemer Venture Partners, INCO Securities Corp., Kyocera International, Oak Investment Partners, Oxford Venture Fund, Waverley Vencap, J.H. Whitney

August 1985
Round 1
$7.2M
Original investors, Pathfinders Chappell, Sony Corporation

August 1987
Round 2
$2.0M
Bessemer Venture Partners, INCO Venture Capital Management, Kyocera, Oak Investment Partners, Oxford Venture Fund, Sony, Waverley, J.H. Whitney

January 1989
Round 3
$39.0M
Western Digital Corp., Sigma Designs, Hambrecht & Quist Venture Partners, Genoa Systems Corp., Societe Nationale Elf Aquitaine, Mitsui & Co. Ltd., and others

RECENT HIGHLIGHTS

April 1989
Vitelic signed both Schweber Electronics and Almac Electronics as authorized Vitelic distributors. Almac is the major distributor in the Northwest and Schweber is the number three distributor in the United States.

May 1989
Vitelic introduced the V63C64, a high-speed 8Kx8 SRAM device with access times of 25ns and an output enable time of 9ns. The full CMOS part is designed for use in cache memory applications in high-end 80386-based PCs and workstations.

July 1989
Vitelic introduced the V53C261, a high-performance 64Kx4 video RAM that clocks 256 four-bit words at a serial rate of 33 MHz and has an access time of 80ns.

August 1989
Vitelic introduced the V63C329, an 8Kx16 cache data RAM designed for use in large-capacity cache memory applications from 64 Kbytes to 256 Kbytes, for high-performance PCs and workstations.

ALLIANCES

Kyocera
March 1984
Kyocera participated in the first-round financing of Vitelic.

ERSO
May 1984
ERSO and Vitelic agreed to codevelop EPROMs and 64K and 256K CMOS DRAMs.

Sony
June 1985
Vitelic and Sony signed an agreement giving Sony access to Vitelic's 256K CMOS DRAM and 64K SRAM technologies in exchange for fab capacity.

NMB
July 1985
Vitelic granted a license for its 1Mb DRAM to NMB in exchange for one-third of NMB's plant capacity.

Hyundai
July 1985
Hyundai obtained a license to produce Vitelic memory products in exchange for manufacturing capacity. Vitelic memory products include 64K, 256K, and 1Mb CMOS DRAMs and 16K CMOS SRAMs.

Philips
March 1986
Philips and Vitelic agreed to a broad-ranging agreement that gave Vitelic access to Philips' process technology. In exchange, Vitelic would design a family of high-performance CMOS SRAMs for manufacture, use, license, and sale by both companies (expired).

Sanyo
October 1986
Sanyo and Vitelic would jointly develop a high-speed 64K SRAM family. Sanyo would manufacture the SRAMs, using 1-micron process technology. The agreement includes the manufacture of the products that Vitelic designs for Philips, using Philips' process developed by Tokyo Sanyo.

MANUFACTURING

Technology

2.0- to 1.0-micron CMOS (n-well)
VICMOS III

Facilities

San Jose, CA
33,000 sq. ft.
Headquarters and design

Taiwan
Under construction
Engineering and test

Japan
N/A
Sales location

PRODUCTS

	Device	Organization	Access Time
CMOS DRAM	V53C256/258	256Kx1	70-100ns
	V53C466/464	64Kx4	70-100ns
	V53C100/102	1Mbx1	80-100ns
	V53C104/105	256Kx4	80-100ns
CMOS SRAM	V63C64	8Kx8	25-45ns
	V61C16	2Kx8	35-70ns
	V61C68	4Kx4	35-55ns
	V61C6	16Kx1	35-55ns
Dual-Port RAM	V61C32	2Kx8	55-90ns
FIFO	V61C01	512x9	25-65ns
	V61C02/3	1Kx9	25-65ns
Video RAM	V53C261	64Kx4	80-100ns
Cache Data RAMs	V63C328	8Kx16	35ns
	V63C308	4Kx16	35ns

OTHER INFORMATION

Vitelic's PR firm is Thomas Mahon and Associates.

Vitesse Semiconductor Corporation

741 Calle Plano
Camarillo, CA 93010
805/388-3700
Fax: 408/433-0331

ESTABLISHED: July 1984 **NO. OF EMPLOYEES: 103**

BACKGROUND

Vitesse Semiconductor Corporation designs, manufactures, and markets cost-effective digital gallium arsenide (GaAs) large-scale ICs for the high-performance marketplace and offers foundry services on a contract basis. Products are manufactured using enhancement/depletion mode transistors and self-aligned gate technology according to silicon manufacturing techniques. The Company's first products were commercial versions of a family of GaAs ICs, including gate arrays, RAMs, and logic products.

Initially, the Company was organized into two divisions—the Integrated Circuits Division, which was responsible for GaAs IC designs, and the Digital Products Division, which was developing a minisupercomputer product. Early in 1987, the Integrated Circuits Division raised $10 million, establishing an independent company, and was renamed Vitesse Semiconductor Corporation. Dr. Louis Tomasetta, formerly president of the IC Division, is president and CEO of the new company. Dr. Tomasetta was director and program manager of the $40 million DARPA GaAs pilot program at Rockwell International.

Vitesse remains in the existing 45,000-square-foot facility and will use the additional funding raised in 1987 to develop additional products and expand into higher-volume production. The building is designed specifically for the production of LSI-level digital ICs in GaAs. Approximately 12,000 square feet have been designated as clean room area, and half of that area is a Class 10 clean room.

In March 1987, Pierre R. Lamond was elected chairman of the board. Mr. Lamond organized the $10 million financing of Vitesse Semiconductor and also serves on the boards of Convex Computer, Cypress Semiconductor, and several other private companies. In October 1987, Dr. T.J. Rodgers, president and CEO of Cypress Semiconductor Corporation, joined the board of Vitesse Semiconductor.

Vitesse has established a nationwide network of manufacturers' representatives to sell its foundry services and products. In June 1987, Vitesse signed Zeus as its first distributor to sell its 29G00 family of products.

BOARD
(Name and Affiliation)

Pierre R. Lamond, Chairman
Sequoia Capital, General Partner

Dr. T.J. Rodgers
Cypress Semiconductor Corp., President

Jim Cole
Spectra Enterprise Assoc., Partner

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Dr. Louis Tomasetta
Rockwell, Dir R&D Center

Executive VP
*Patrick Hoffpauir
VLSI Technology, GM ASIC Ops

VP Marketing/Sales
David Mooring
Intel, Mktg Mgr

VP Sales
Neil Rappaport
AMCC, Ntl Sales Mgr

VP Engineering
*Ira Deyhimy
Rockwell, Mgr IC Engr

VP Operations
James Mikkelson
Hewlett-Packard, Mgr Process Dev

VP Finance/CFO
Michael A. Russell
Avicon Intl, VP Finance/CFO

*Founder

FINANCING

February 1987
Round 1
$10.0M
Bryan & Edwards; New Enterprises Assoc.; The Norton Company; Oxford Venture Corp.; Robertson, Colman & Stephens; Sequoia Capital; Spectra Enterprises; Walden Capital; J.H. Whitney

January 1988
Round 2
$8.1M
Previous investors; Hook Partners; Mohr, Davidow Ventures; Morgenthaler Ventures; Oak Investment Partners; Singapore Development Board

April 1989
Round 3
$7.3M
Previous investors, Aeneas Venture Corp., Security Pacific Capital Corp., Hughes Investment Management Co., New Venture Partners

RECENT HIGHLIGHTS

June 1987
Vitesse offered GaAs versions of the 2900 family of slice processors, produced through a licensing agreement with Advanced Micro Devices.

September 1987
Vitesse offered its first digital GaAs ICs fabricated with an E- and D-MESFET transistor process. They include a family of 1,500- and 4,500-gate arrays. The arrays are tailored for telecom fiber-optic MUX/DEMUX, computer, backplane, tester, and instrumentation applications.

Vitesse also offered the VS12G22E, a 256x4 SRAM with an access time of 3ns. The device is ECL RAM compatible, has 1.5-watt power dissipation, and is radiation hardened.

October 1987
Vitesse announced that Dr. T.J. Rodgers, President/CEO of Cypress Semiconductor, had joined the board of directors.

January 1988
Vitesse introduced the VS8001, a 1.25-GHz 12-to-1 multiplexer, and the VS8002 1-to-12 demultiplexer with ECL-compatible parallel I/O. The devices offer 12-bit parallel-to-serial and serial-to-parallel data conversion for communications applications. A unique feature is a self-test path designed to allow the devices to test each other.

March 1988
Vitesse announced that it has developed the VS8010, a MUX/DEMUX with control logic that meets the Synchronous Optical Network (SONET) standard at the 1.2-Gbit per second (Gbps) communications rate.

November 1988
Vitesse announced the world's first GaAs VLSI product, a 10,000-gate array, the VSC 10000.

January 1989
Vitesse announced a GaAs 22,000-gate array using standard cells.

August 1989
Vitesse announced shipment of its VSC10K GaAs gate array to E-Systems for that company's high-performance digital signal processor series.

ALLIANCES

Norton
July 1984
The initial investment of $30 million in Vitesse was provided by the Norton Company, a $1.3 billion company of Worcester, Massachusetts.

Advanced Micro Devices
November 1985
Vitesse and Advanced Micro Devices (AMD) agreed to develop and manufacture AMD's AM2900 family of MPUs in gallium arsenide.

TRW
December 1986
Vitesse signed a sales and marketing agreement with TRW Components International Inc. (TRWCI) covering logic, memory, and ASIC products. Vitesse will supply high-performance wafers, die, and packaged devices to TRWCI, which will assemble, test, qualify, and sell to the space-quality, Class-S level market. The companies will also cooperate to solve the radiation problems found in logic and memory products.

E-Systems
August 1987
Vitesse signed an agreement allowing E-Systems to use Vitesse's proprietary GaAs technology in its current and future programs. E-Systems also has an option to purchase design, packaging, and test technologies. The agreement allows Vitesse to participate in the EW systems market through E-Systems' military programs.

VLSI Technology
September 1987
Vitesse will develop a GaAs cell library for VLSI's design tools. VLSI will provide technical information and assist in the porting effort. When the library is completed, both companies will market the tools, which Vitesse will use internally. VLSI will extend the tools to its silicon compiler library; Vitesse will own the library and provide fabrication.

Ford Microelectronics
October 1987
Vitesse and Ford Microelectronics agreed to second-source each others' IC foundry services. The companies will develop common design rules.

Fujitsu
November 1989
Vitesse and Fujitsu Ltd. announced an alternate-source agreement with regard to Vitesse's FURY GaAs VLSI gate array family.

MANUFACTURING

Technology

GaAs E/D MESFET
0.8-1.25 microns
3-inch wafers

Facilities

Camarillo, CA
45,000 sq. ft.
Total space
10,000 sq. ft.
Class 10 clean room

PRODUCTS

Foundry

LSI Enhancement/Depletion Mode Process, 0.8-Micron Feature Size, Sub-100ps Gate Delays, 3-layer metal

	Device	Description
Gate Arrays	VSC1500	Structured Cell Array
	VSC4500	Gate Array
	VSC10K	Gate Array
	VSC15K	Gate Array
	VCB50K	Standard Cell
SRAMs	VS12G422E	256x4 SRAM, 3, 4, 5ns
	VS12G422T	256x4 SRAM, 4, 6, 8ns, TTL I/O
	VS126476	4Kx1 SRAM 2.5ns Self-Timed

	Device	Description
Microcomponents	VS29G01	4-Bit Slice Processor
	VS29G02	Look-Ahead Carry Generator
	VS29G10	Microcontroller
Standard Products	VS8001	12:1 MUX at 1.2 GHz
	VS8002	1:12 DEMUX at 1.2 GHz
	VS8010	SONET MUX/DEMUX
	VS8004	4:1 MUX at 2.5 Gbps
	VS8005	1:4 DEMUX at 2.5 Gbps

OTHER INFORMATION

Vitesse's PR firm is Capitol Relations, Inc.

VTC Incorporated

2401 East 86th Street
Bloomington, MN 55425-2702
612/851-5200
Fax: 612/851-5199
Telex: 857113

ESTABLISHED: May 1984 **NO. OF EMPLOYEES: 460**

BACKGROUND

VTC Incorporated designs, manufactures, and markets a broad line of high-performance linear and digital ICs, using bipolar and CMOS process technologies. The Company also offers a wide range of semicustom and custom ASICs, as well as a portfolio of standard products for the aerospace, telecommunications, and computer markets.

In the linear area, products include linear signal-processing (LSP) devices and mass storage devices. The signal-processing devices include very fast operational amplifiers, buffers, comparators, transconductance amplifiers, and sample/hold and data converters. These products are the highest-performance products in their respective classes, rivaling expensive hybrid circuits. In the mass storage area, the Company offers a full line of preamplifiers, data separators, channel devices, voltage-controlled oscillators, and tape drive servo controllers. These devices have speeds and features available from only a few suppliers and are aimed at the high-performance end of the market.

VTC is perceived to have very good cell-based libraries in bipolar and CMOS technologies. Products manufactured using the libraries are often modified and turned into standard parts. VTC also provides a complete set of CAD tools supporting its libraries.

The Company is also perceived to have a leadership position in the following linear areas: preamplifiers for disk drives and ultrahigh-speed op amps. VTC is expected to have 1988 sales of about $50 million and plans to be a $100 million company by 1990.

In the first quarter of 1986, VTC occupied an additional 170,000-square-foot facility. The facility includes a 30,000-square-foot Class 1/Class 10 clean room. The Company makes its own masks in a shop equipped with E-Beam technology. Its factories are designed for high-volume production with advanced manufacturing, in-house packaging, and test equipment.

In June 1987, VTC signed a merger agreement under which it became a wholly owned subsidiary of Control Data Corporation, its largest investor and major customer. Terms were not disclosed. Control Data has invested $56 million in VTC since it was founded and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock.

BOARD
(Name and Affiliation)

Larry Jodsaas
VTC Incorporated, CEO

Daniel Pennie
Control Data Corporation

Robert Lillestrand
Control Data Corporation

John Buckner, Chairman
Control Data Corporation

Donald Powers
Control Data Corporation

Allen Cuccio
Control Data Corporation

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO
Larry Jodsaas
Control Data, SR VP Quality

VP/CFO
J.R. Martin
Fairchild, Div Controller

VP Operations
E.M. Schnable
National, Operations Mgr

VP Engineering
D.A. Orton
Fairchild, Engr Mgr

VP Marketing
George Sanders
Micro Powersystem, Marketing Mgr

SR VP Sales
Daniel B. Griffith
Control Data, VP/GM

FINANCING

From 1984 through 1987, VTC financed its capital equipment and facility requirements with operating leases totaling about $75 million. In July 1987, employees of VTC, who collectively owned 51 percent of the Company, sold their ownership interest to Control Data Corporation (CDC), giving CDC 100 percent of VTC's common stock.

RECENT HIGHLIGHTS

April 1987
VTC was awarded a $7.5 million contract from the Control Data Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chip-types designed with VTC's 1-micron CMOS standard cell library.

May 1987
VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by Silicon Compilers Systems Inc. (SCS). VTC will also develop a radiation-hardened cell and other macrocells for the system.

May 1987
VTC offered the VL3000, a 6-GHz linear/digital bipolar cell library. It allows users to mix linear and digital circuits on the same chip, without redesigning at the transistor level. The library contains more than 100 predefined linear, digital, and memory functions.

June 1987
VTC became a wholly owned subsidiary of Control Data Corporation. Terms were not disclosed.

September 1987
VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

ALLIANCES

CDC
October 1984
Control Data Corporation invested $56 million in VTC and holds nonvoting preferred shares convertible to 49 percent of the Company's voting stock. The arrangement includes a fabrication technology license.

1987
VTC was awarded a $7.5 million contract from CDC's Government Systems Division to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chips designed with VTC's 1-micron CMOS cell library.

Silicon Compilers
May 1986
VTC agreed to provide its 1.6- and 1.0-micron two-layer metal CMOS process to users of Genesil, the silicon development system offered by SCI. VTC will also develop a radiation-hardened cell for Genesil and additional macrocells for SCI's silicon compiler system.

IDT
January 1987
IDT agreed to allow VTC to second-source its FCT product line of TTL-compatible CMOS logic devices.

TRW
March 1987
TRW Components International and VTC signed a three-year agreement to cross sample space-quality, Class-S devices. VTC will supply TRW with unpackaged ICs that meet Class-S specs; TRW will assemble, test, qualify, and market the devices. They include radiation-hardened CMOS SRAMs, comparators, amps, and transceivers.

VME Technology Consortium
September 1987
VTC won a contract to design, develop, and manufacture a VME bus interface IC (VMIC) for the VME Technology Consortium. The VMIC combines interface, bus arbitration, and interrupt-handling components and will use a 1-micron CMOS cell-based process with embedded PLA.

MANUFACTURING

Technology

3.0- and 2.0-micron bipolar linear
2.0-micron bipolar digital
1.2- and 1.0-micron two-layer metal CMOS

Facilities

Bloomington, MN
140,000 sq. ft.
Headquarters, manufacturing

30,000 sq. ft.
Class 1 and Class 10 clean rooms

20,000 sq. ft.
Manufacturing

PRODUCTS

Gate Arrays
CMOS and Bipolar/Linear Arrays

Cell Library
Bipolar cell libraries, 3.0-micron with 170 cells (100 digital, 70 analog), 2.0-micron with 88 cells; ECL or TTL I/O, 2.0-micron with 120 cells (90 digital, 30 analog)

Silicon Compiler
1.0- and 1.6-micron CMOS Compilers; RAM, ROM, FIFO, and PLA cells

Linear Signal Processing
Transconductance Amps and Dual-Transconductance Amps, each with or without buffer, 75-MHz Bandwidth

Video Amplifiers
Low-Noise 733 or 592 Video Amp

Op Amps
High-Speed, Dual High-Speed, and Quad High-Speed Precision and Fast-Setting Op Amps; Wideband High-Slew Rate, Dual High-Slew Rate, and Quad High-Slew Rate Op Amps; Sample and Hold Amp; Low-Voltage Amp

Data Converters
8-Bit Video DAC, 200 to 300 MHz; 12-Bit DAC, 125ns Settling Time

Comparators
Very Fast Comparator, Ultrafast Comparator, TTL Comparator, Ultrafast Dual Comparator, Dual TTL Comparator

Line Drivers
NTDS Driver/Receiver, Video Line Driver

Mass Storage

Disk Drive Read/Write Preamps: Ferrite Heads, Center-Tapped Thin-Film Heads, Thin-Film Heads, Vertical Heads; Servo Preamps: Ferrite Head, Low-Noise Ferrite Head, Thin-Film Head; Data Separator, Disk Drive Read Channel/Enhanced: Disk Drive Read/Write Channel, Tape Drive Clock Synchronizer; Tape Write Driver; Encoder/Decoder; Write/Servo Phase-Locked Oscillator

V54/74 FCT/ACT Interface Logic Family (Commercial & Mil Qualified)

Octal and 10-Bit Buffers and Line Drivers; Octal, 9-Bit, and 10-Bit Bus Transceivers; Octal, 9-Bit, and 10-Bit D-Type Transparent Latches: Octal, 9-Bit, and 10-Bit D-Type Edge-Triggered Flip-Flops; Dual 4-Bit D-Type Edge-Triggered Flip-Flops

OTHER INFORMATION

VTC Incorporated does not employ a PR firm.

WaferScale Integration, Inc.

47280 Kato Road
Fremont, CA 94538
415/656-5400
Fax: 415/657-5916

ESTABLISHED: August 1983 **NO. OF EMPLOYEES: 125**

BACKGROUND

WaferScale Integration, Inc., (WSI) founded by Eli Harari, Terry Leader, and Stephen Su, designs and manufactures high-performance CMOS reprogrammable ICs that incorporate advanced CMOS EPROM capability.

WSI offered an 8Kx8 RPROM (UV erasable reprogrammable PROM) in the first quarter of 1986. In mid-1987, WSI introduced two 256K CMOS EPROMs that use the Company's patented, self-aligned split-gate EPROM technology. The EPROMs feature an access time of 55ns and provide one- and two-chip program-store solutions for 16- and 32-bit MPU and DSP applications. WSI also supplies high-speed CMOS bit-slice processors and peripheral circuits.

In addition, the Company offers the capability to combine EPROM, SRAM, and complex system logic functions on a single IC in its CMOS macroblock cell library. The macroblock library provides VLSI EPROMs, SRAMs, and a family of high-performance bit-slice processor cells (from 4 bits to 32 bits). The library also contains bit-slice peripherals cells including microprogram controllers, variable pipelines, FIFOs, multipliers, bus registers, and register files.

WSI focuses on high-performance markets that include telecommunications, minicomputers, local area networking, digital signal processing, array processing, high-resolution color graphics, and military avionics and communication. WSI market involvement presently includes 55 percent office automation, 25 percent telecommunications, 15 percent military, and 5 percent other. The Company is directing efforts to balance office automation, telecommunications, and military to roughly 30 percent each by 1990.

WSI has leveraged its partnerships with Altera Corporation, GE Solid State, Intergraph Corporation, Kyocera Corporation, and Sharp Corporation to invest its capital into advancing its technology and realigning products to match market shifts.

Sharp and GE Solid State have invested in WSI through equity positions, and both companies hold WSI technology licenses. Altera and Intergraph are two additional strategic alliances involving either equity and/or technology. The Kyocera alliance involves equity and distribution of WSI products in Japan.

WSI's products are manufactured at Sharp Corporation's plant at Fukuyama, Japan. The facility produces 5-inch wafers with 1.2-micron CMOS VLSI circuits in a Class 1 clean room environment. In the United States, GE/RCA manufactures circuits for WSI in a Class 10 facility, using 1.0-micron CMOS on 5-inch wafers.

WSI's products are sold worldwide through a sales network that includes a combination of regional and direct sales managers, manufacturers' representative companies, and components distributors.

BOARD

(Name and Affiliation)

Irwin Federman, Chairman
WaferScale Integration, Inc., CEO

Harry Marshall
J.H. Whitney

James Swartz
Accel Partners

Donald K. Grierson
General Electric Corporation

Richard Santilli
RCA Corporation

Henry Kressel
Warburg Pincus Capital Partners

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

CEO/Acting
Irwin Federman
Concord Venture, Partner

VP Finance
Robert J. Barker
MMT, Mgr Finance

VP Systems Production
Zel A. Diel
GigaBit Logic, VP Prod Dev

VP Process Technology
Yale Ma
STC Computer, Mgr Wafer Fab Ops

VP Operations
Steve Sanghi
Intel, GM Prog Memory Ops

VP Device
Boaz Eitan
Intel, Mgr Device Physics

VP WW Sales
Thomas Branch
Micro Genesis, Principal

FINANCING

February 1984
Round 1
$16.1M
Accel Partners; Adler & Co.; Bessemer; Genevest (Switzerland); Intergraph; Oak Investment Partners; Robertson, Colman & Stephens; Smith Barney Venture Corp.; Tadiran (U.S.) Inc.; Venture Partners II; Warburg-Pincus; J.H. Whitney

Lease
Bank of America, Bateman Eichler Leasing Corp., Equitec

November 1984
Round 2
$8.5M
Original investors, Baillie Gifford & Co. (Scotland), Continental Illinois Venture Corp.

April 1986
Round 3
$13.0M
Original investors, Intergraph Corp., RCA Corporation, Sharp Corporation

July 1987
Round 4
$8.0M
Accel Partners; Adler; Bessemer Venture Partners; GE/RCA; Intergraph Corp.; Kyocera; Robertson, Colman & Stephens; Warburg Pincus; J.H. Whitney

RECENT HIGHLIGHTS

June 1987
WSI received a patent on its self-aligned, split-gate CMOS EPROM process.

July 1988
WSI introduced the WS57C51B, a 16Kx8-bit CMOS PROM, which is user-reprogrammable and consumes one-fourth the power of equivalent bipolar densities.

July 1988
WSI introduced its "L" series of low-power EPROMs, available in 128Kx8, 64Kx8, and 32Kx8 configurations.

July 1988
WSI introduced the MAP168 Mappable Memory Subsystem, which functionally integrates a memory subsystem into a single device.

October 1988
WSI announced the PAC1000, a high-performance, 16-bit microcontroller, the first of WSI's new class of user-configurable Programmable System Devices (PSD).

ALLIANCES

Sharp
December 1984
WSI agreed to allow Sharp to use its technology and produce a 64K CMOS EPROM. WSI received manufacturing capacity and royalties. Development and production of 256K CMOS EPROMs were planned.

October 1985
WSI and Sharp expanded the 1984 agreement to include WSI's 1.6-micron CMOS technology in exchange for royalties and foundry capacity.

GE/RCA and Sharp
March 1986
GE/RCA and Sharp signed a five-year agreement with WSI to develop an advanced cell library. WSI's library of LSI macrocells will be combined with cell libraries from GE/RCA and Sharp. The companies also jointly developed 1.0-micron cell libraries, advanced tools, packaging techniques, high-speed EPROMS, and other high-performance standard products. The alliance gives WSI alternative sources of chips and a springboard into the market in Japan.

July 1987
WSI and GE/RCA expanded the terms of their previous EPROM agreement to include U.S. manufacturing. Under a long-term foundry agreement, WSI will be guaranteed volume capacity at GE/RCA's new 5-inch wafer fab module in Findley, Ohio. WSI will transfer its 1.2-micron fast CMOS EPROM process to Findley. GE/RCA will use the process to manufacture ASIC circuits and second-source some of WSI's EPROM memory products.

Altera and Sharp
January 1987
Altera and WSI announced a five-year technology relationship to develop a new family of standalone microsequencer products with wafers manufactured by Sharp of Japan.

MANUFACTURING

Technology

SCMOS I: 2.0-micron, double-metal CMOS
SCMOS II: 1.0-micron, double-metal CMOS
4- and 5-inch wafers

Facilities

Fremont, CA
66,000 sq. ft.
Design, test, marketing, sales, administration

PRODUCTS

Memory

Device	Organization	Access Time
WS57C191/291	2Kx8 RPROM	45ns
WS57C43	4Kx8 RPROM	35, 55ns
WS57C49	8Kx8 RPROM	35, 55ns
WS57C51	16Kx8 RPROM	40, 70ns
WS27C64	8Kx8 Byte-Wide EPROM	55, 90ns
WS57C128	16Kx8 Byte-Wide EPROM	55, 90ns
WS57C256	32Kx8 Byte-Wide EPROM	55, 90ns
WS57C65	4Kx16 Word-Wide EPROM	55ns
WS57C257	16Kx16 Word-Wide EPROM	55ns

Microcomponents

WS5901	4-Bit Bit-Slice Processor	43 MHz
WS59016	16-Bit Bit-Slice Processor	432 MHz
WS59032	32-Bit Bit-Slice Processor	25 MHz
WS5910	Microprogram Controller	30 MHz
WS59520	Multilevel Pipeline Register	45 MHz
WS59510	16X16 Multiplier/Accumulator	30ns
WS59820	16-Bit Bidirectional Bus Interface Register	50 MHz

ASICs

Modular Cell Library	Combines EPROM and System Functions with 1.2-Micron Technology to Produce Devices with Sub-1.0ns Delay. Functions Include 4-Bit to 32-Bit Bit-Slice Processors, Microprogram Controllers, Variable Pipelines, FIFOs, Multipliers, Bus Registers, Register Files, ROM, RAM, PLD, 75 Gates, and 26 MSI.

OTHER INFORMATION

WSI's PR firm is Capithorne and Bellows.

Weitek Corporation

1060 East Arques Avenue
Sunnyvale, CA 94086
408/738-8400
Fax: 408/739-4374
Telex: 910-339-9545

ESTABLISHED: 1981 **NO. OF EMPLOYEES: 134**

BACKGROUND

Weitek designs, manufactures, and markets digital signal processing circuits for high-performance numerics-processing applications. The Company's goal is to make arithmetic-processing power available on a broad scale to systems developers. The Company's product strategy is to offer a complete range of products, including building blocks that achieve maximum system performance, attached processors for maximum price/performance, and coprocessors for the lowest system cost.

In March 1988, Weitek introduced three new products. The WTL2364 multiplier/WTL2365 ALU chip set is a double-precision vector floating-point processor chip set that implements the IBM 370 Basic Floating-Point Facility standard. It is capable of 32 million floating-point operations per second (mflops) for single-precision operations and up to 16 mflops for double-precision operations. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The floating-point processors each integrate a 64-bit multiplier, a 64-bit ALU, a divide/square-root unit, a 32-word by 64-bit six-port register file, and status and control logic on one chip.

Currently, the Company purchases wafers in the foundry market from VLSI Technology Inc. Long-term wafer processing is guaranteed under agreements with Cypress Semiconductor, Hewlett-Packard Company (HP), and Intel Corporation. Processes available to Weitek are 2.0-micron NMOS and 1.5-micron double-metal CMOS from Intel, 1.2-micron CMOS from HP, 1.2-micron double-metal CMOS from Cypress, and 1.5-micron NMOS and CMOS from VLSI Technology.

Weitek was founded in 1981 by Godfrey Fong, Dr. Edmund Sun, and Dr. Chi-Shin Wang and operated initially as a custom design house specializing in ROMs. In 1985, the Company began offering advanced circuit design semiconductors that use advanced concepts in numerics processing.

BOARD
(Name and Affiliation)

G. Leonard Baker
Sutter Hill Ventures

Arthur J. Collmeyer
Weitek Corporation

David House
Intel Corporation

Gerald Lodge
InnoVen Partners

Arthur Reidel
Alex Brown

James Patterson
Quantum Corporation

W. Frank King III
Lotus Development Corp.

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President
Arthur Collmeyer
Calma, VP/GM Microelec Div

VP Sales
Robert T. Derby
Intel, Dir WW Sales/Mktg

VP Operations
Steven Farnow
Visic, Dir Ops

VP Marketing
John F. Rizzo
Apple, Mktg Mgr

VP Finance
A. Brooke Seawell
Southwall Tech, VP Finance/Admin

VP Admin
John Steinhart
Stanford Univ, Dir Sloan Program

VP IC R&D
John J. Barnes
SGS-Thomson, Dir Tech Dev

FINANCING

January 1981
Round 1
$1.0M
InnoVen

February 1982
Round 2
$1.3M
InnoVen, Sutter Hill Ventures

March 1983
Round 3
$2.2M
InnoVen; Institutional Venture Partners; Merrill, Pickard, Anderson & Eyre; Sutter Hill Ventures

January 1986
Round 4
$3.0M
All of the above, Alex Brown, Glynn Capital

September 1988
IPO
$8.4M
Initial public offering

RECENT HIGHLIGHTS

March 1988
Weitek introduced three new products. The WTL3364 and WTL3164 are two 64-bit floating-point processors that operate at a peak rate of 20 mflops for the 100ns speed grade. The WTL2364 multiplier and WTL2365 ALU chip set is a double-precision vector floating-point processor chip that implements the IBM 370 Basic Floating-Point Facility standard.

April 1988
Weitek announced that the WTL1167 floating-point coprocessor is featured as an option in the new Sun 386 workstation family.

March 1989
Weitek announced the XL-8832 floating-point RISC processor, developed for Digital Equipment Corporation to deliver 3-D graphics performance to Digital's VAXstation 3520 and VAXstation 3540 midrange graphics workstations.

April 1989
Weitek announced the Abacus 3170 and Abacus 3171, the first single-chip floating-point coprocessors for the SPARC architecture, in speed grades ranging from 20 to 40 MHz.

May 1989
Weitek introduced the Abacus 4167, a floating-point coprocessor for the Intel 80486 microprocessor that completes math operations five to six times faster than the 486's on-chip floating-point unit.

ALLIANCES

Cypress
October 1985
Weitek and Cypress made an agreement to jointly develop a series of high-performance VLSI logic circuits designed by Weitek and manufactured using Cypress' 1.2-micron CMOS process. The circuits are designed for telecommunications, graphics, instrumentation, military, and CAD/CAM applications.

Intel
October 1985
Weitek agreed to develop an interface IC that Intel would second-source and for which Intel would provide foundry services on 6-inch NMOS and CMOS wafer-processing equipment.

NSC
October 1985
National Semiconductor announced that it would design, manufacture, and market an interface chip.

Step Engineering
March 1986
Step Engineering agreed to produce development tools for the debugging and microcoding of Weitek's floating-point integer processor designs.

Quadtree
April 1986
Weitek announced that Quadtree Software would develop behavioral simulators for the WTL2264/2265 chip sets.

Matra-Harris
May 1986
Weitek and MHS signed a technology exchange and foundry agreement. MHS was granted Weitek's 16-bit integer multiplier product family. Weitek has preferred access to the MHS CMOS process.

Hewlett-Packard
May 1987
Hewlett-Packard would incorporate the Weitek model 2264/2265 chip set for high-performance, floating-point computation in current and future HP Precision Architecture computers. HP would manufacture the chip, using a 1.2-micron CMOS process.

Matsushita
November 1988
Weitek entered into a manufacturing agreement with Matsushita Electric Corporation, whereby Matsushita agreed to manufacture Weitek's higher volume processor and coprocessor products using its 1.2- and 1.5-micron CMOS process technologies. This agreement complements Weitek's existing manufacturing agreements, forged with Hewlett-Packard and VLSI Technology.

Toshiba
November 1988
Weitek signed an agreement with Toshiba wherein the two companies will cooperate in the development of high-performance numeric semiconductors. As part of the agreement, Weitek will receive manufacturing services from Toshiba's 1.0-micron CMOS and 1.5-micron BiCMOS production processes. Weitek will provide floating-point unit technology to Toshiba for use in certain Toshiba products.

MANUFACTURING

Technology

2.0- and 1.5-micron NMOS
1.2-micron, one-level metal CMOS
1.5-, 1.2-, 1.0-, 0.8-micron, two-level CMOS

Facilities

Sunnyvale, CA
50,000 sq. ft.
Administration, design, R&D

PRODUCTS

16-Bit Integer Family

Device	Description	Speed
WTL2516	16x16 Parallel Multiplier	38ns
WTL2517	16x16 Parallel Multiplier	38ns
WTL2010	16x16 Multiplier/Accumulator	45ns
WTL2245	16x16 Multiplier/Accumulator	45ns

32-Bit Floating-Point Family

WTL1232/1233	Multiplier/Adder	10 mflops
WTL3132	Data Path Unit	20 mflops
WTL3332	Data Path Unit	20 mflops

64-Bit Vector Floating-Point Family

Device	Description	Speed
WTL1264/1265	Multiplier/Adder	8 mflops
WTL2264/2265	Multiplier/ALU	20 mflops
WTL2364/2365	Multiplier/ALU, Double-Precision	32 mflops

64-Bit Floating-Point Coprocessor Family

WTL1167	80386 Coprocessor	3.5 mflops
WTL1164/1165	Multiplier/Adder/Divider	3.5 mflops
WTL3164	Data Path Unit	100ns, 20 mflops
WTL3364	Data Path Unit	100ns, 20 mflops
Abacus 3167	80386 Coprocessor	20, 25, 33 MHz
Abacus 3168	68020/030 Coprocessor	20, 25, 33 MHz
Abacus SPARC	SPARC Coprocessors	20, 25 MHz
Abacus 3171	SPARC Coprocessors	25, 33, 40 MHz

XL-Series Family

XL-8000	32-Bit Integer Processor	8 mips
XL-8032	32-Bit Single-Precision Processor	8 mips, 20 mflops
XL-8064	64-Bit Double-Precision Processor	7 mips, 20 mflops
XL-8136	Program Sequencing Unit	
XL-8137	Integer-Processing Unit	
XL-8200	32-Bit Hyperscript Processor	1 mflop
XL-8232	32-Bit Hyperscript Processor	20 mflops
XL-8832	32-Bit Single Precision Processor	20 mflops

Development Tools for the XL-Series Family

XL-Series C Compiler-Based Software Development Environment
XL-Series FORTRAN-Based Software Development Environment

PS-8000	XL-Series Prototyping System for the XL-8000
PS-8032	XL-Series Prototyping System for the XL-8032
PS-8064	XL-Series Prototyping System for the XL-8064

Functional Simulators for All Weitek Components

OTHER INFORMATION

Weitek's PR firm is Regis McKenna, Inc.

Wolfson Microelectronics Limited

Lutton Court,
20 Bernard Terrace
Edinburgh, EH8 9NX Scotland
031/667-9386
Fax: 031/667-5176
Telex: 727659

ESTABLISHED: January 1985 **NO. OF EMPLOYEES: 28**

BACKGROUND

Wolfson Microelectronics Limited designs, manufactures, and markets ASICs and specializes in the development of complex mixed analog and digital circuits. The Company offers IC design using semicustom and full-custom approaches including gate arrays with up to 20,000 gates; cell-based libraries in 3.0-, 2.0-, 1.5-, and 1.2-micron CMOS technology; and full-custom design using a range of CMOS and bipolar technologies.

Wolfson Microelectronics Limited evolved from the Wolfson Microelectronics Institute at Edinburgh University. The Company, although completely autonomous, retains its technological links with the academic research activities of the university.

The Company has developed an extensive CAD capability based on a network of Sun workstations to provide an integrated design environment for semicustom and structured custom design. The emphasis of its work has been signal processing. The Company has developed a 2-micron digital library of macro cells with variable parameters for digital designs and an extensive analog library of linear and nonlinear functions.

BOARD

Not available

COMPANY EXECUTIVES
(Position and Name)

Managing Director
David Milne

Technical Director
James Reid

Finance Manager
Neil Hattersley

FINANCING

Not available

ALLIANCES

Wolfson has manufacturing arrangements with AMS, Fujitsu, Mietec, and SGS-Thomson dating from 1985.

MANUFACTURING

Technology

All processes are for second-sourcing capability.

- 1.2-, 1.5-, 2.0-, 3.0-Micron SPSM/SPDM CMOS Digital Process
- 2.0-Micron SPDM BiMOS Analog Process
- 2.0-Micron SPDM CMOS Analog Process
- 3.0-Micron DPDM/DPSM CMOS Analog Process
- 4.0-Micron DPSM CCD Analog Process
- 5.0-Micron DPSM CMOS Analog Process

Wolfson Microelectronics Limited

PRODUCTS

Current Products

Device	Description
WM 2020	Dual 15-Pt Tapped Delay Line
WM 2210	Dual 15-Pt Tapped Delay and Integrate
WM 2120	64-Pt Programmable Transversal Filter
WM 2130	256-Pt Programmable Transversal Filter
PWM 213	512-Pt Correlator Module
PWM 215	1,024-Pt VME Correlator Module

Future Products

WM 3201	Fifth Order, Low-Pass Elliptical Continuous Time Filter; Cutoff 5 KHz to 50 KHz
WM 33XX	Semicustom Switched Capacitor Family
WM 5110	128-Pt Complex Digital Programmable Transversal Filter
WM 5120	Digital Programmable Transversal Filter Controller

OTHER INFORMATION

Wolfson Microelectronics does not employ a PR firm.

Xilinx Incorporated

2100 Logic Dr.
San Jose, CA 95125
408/559-7778
Fax: 408/559-7114

ESTABLISHED: February 1984 **NO. OF EMPLOYEES: 150**

BACKGROUND

Xilinx Incorporated is a leading supplier of user-programmable gate arrays for the ASIC market. The Xilinx Logic Cell Array (LCA) uses specially designed static memory cells to store logic and interconnection configuration information generated by Xilinx design software.

The Company was founded by James Barnett, Ross Freeman, and Bernard Vonderschmitt, all formerly with Zilog. Xilinx introduced its first logic cell array, which consists of 1,000 to 1,500 equivalent two-input NAND gates, in November 1985. Since then, products with complexities of up to 9,000 gates have been added and are the largest available today. Designs are performed on PC ATs, and Apollo, Digital, and Sun workstations.

The Company has set up several barriers to entry, including patents, extensive development system software, advanced CMOS process technology, and alternative sources. Advanced Micro Devices is a second source of the Company's logic cell arrays and development system. Xilinx has a foundry arrangement with Seiko Epson, which produces the devices in the Suwa, Japan, plant.

The Company's devices and associated development systems are sold by a sales force that includes five sales offices in North America and one each in the United Kingdom and in Japan; 12 field-application engineers; 60 manufacturer's representatives worldwide; 54 North American distributor branches, including Hamilton-Avnet, Marshall, Insight, and Western Microtechnology; and 15 international distributor locations.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
*Bernard Vonderschmitt
Zilog, VP/GM IC Div

VP Admin
*James Barnett
Zilog, Prod Line Dir

VP Eng
*Ross Freeman
Zilog, Dir Eng

VP Sales
R. Scott Brown
Menlo Corp., VP Sales

VP Ops
Frank Myers
Exel, VP Ops

VP Mktg
Wes Patterson
VLSI, Dir Ops

VP Finance/CFO
Gordon Steel
Pyramid, VP Finance/Admin

*Founder

FINANCING

March 1984
Round 1
$2.8M
Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; J.H. Whitney & Co.

December 1985
Round 2
$8.3M
Round 1 investors, Berry Cash Southwest Partnership, InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners

January 1987
Round 3
$6.4M
Round 1 investors; Fleming Ventures Ltd., InterFirst Venture Co., Interwest Partners, Matrix Partners, Morgan Stanley, Rainier Venture Partners, Security Pacific, Monolithic Memories Inc.

August 1988
Round 4
$3.5M
Round 1 investors, others

RECENT HIGHLIGHTS

January 1987
Xilinx raised $3.4 million in third-round financing.

October 1987
Xilinx offered the XC3020, the first in a family of 1.2-micron, user-programmable gate arrays with 1,800 to 2,400 two-input NAND gates and a 40-MHz system clock rate.

November 1987
Xilinx introduced the XC3090, a 9,000-gate, user-programmable gate array.

November 1987
Xilinx's user-programmable gate arrays are available on Viewlogic Systems' Workview workstation. The support allows design and logic simulation on IBM PC ATs.

March 1989
Xilinx introduced the first user-programmable gate arrays to be fully compliant with MIL-STD 883, Class B.

PRODUCTS

Logic Cell Arrays (LCAs)

Device	Description
XC2064	1,200 gates
XC2018	1,800 gates
XC3020	2,000 gates
XC3030	3,000 gates
XC3042	4,200 gates
XC3064	6,400 gates
XC3090	9,000 gates

ALLIANCES

Seiko-Epson
December 1985
Xilinx and Seiko-Epson agreed to codevelop LCAs and development systems. Seiko-Epson will manufacture the LCAs, using Xilinx's proprietary technology. The companies also agreed on the joint development of Seiko-Epson's CMOS process. Seiko Epson gained nonexclusive marketing rights to the LCA product in Japan.

MMI/AMD
June 1986
Xilinx and MMI signed a three-year agreement allowing MMI to manufacture and market Xilinx's LCAs and development system. The first product transferred was the XC2064, a 1,200-gate device. Xilinx will supply future members of the LCA family to MMI as they become available. Xilinx also has given rights to market the XACT development system and the Xactor in-circuit emulator. The two companies will cooperate in extending software support for LCA products.

MANUFACTURING

Technology

1.2-micron double-metal silicon-gate CMOS
6-inch wafers

Facilities

San Jose, CA
100,000 sq. ft.
R&D, design, marketing, and test

XACT Gate Array Development System with In-Circuit Émulation
LCA Development System, Hardware and Software
XC2064, UART Design with Encryption/Decryption
Logic Synthesis Software

OTHER INFORMATION

Xilinx Inc.'s PR firm is Capithore and Bellows.

XTAR Corporation

9915 Business Park Avenue, Suite C
San Diego, CA 92131
619/271-4440

ESTABLISHED: September 1982 | **NO. OF EMPLOYEES: 9**

BACKGROUND

XTAR electronics designs, develops, and manufactures graphics microprocessors, video shift registers, board-level products, and graphics systems. The Company concentrates on the design and development of new products.

XTAR funded the formation of the Company and development through its sales. It has developed a graphics microprocessor (GMP), a video shift register (VSR), and board-level products. Its GMP, a full-custom device, is designed to replace 400 devices with two chips. The VSR uses a standard-cell CMOS process technology. All of XTAR's products were sampled in September 1984, and production quantities were available in the fourth quarter of 1984. XTAR contracts wafer fabrication.

BOARD

Not available

COMPANY EXECUTIVES

(Position, Name, Prior Company, and Prior Position)

President
Anthony J. Miller
Universal Research Labs, Dir Engineering

VP Engr
Terrence Coleman
Universal Research Labs, Chief Engineer

Dir Mktg/Sales
Richard K. Thistle
Spectragraphics Corp, Product Mktg Manager

ALLIANCES

Fairchild

September 1986Fairchild and XTAR signed an alternate-source agreement for XTAR's X1000/X1002 Graphics MPU chip set, which Fairchild will redesign for manufacture using the FACT (Fairchild Advanced CMOS Technology) fabrication process.

MANUFACTURING

Technology

3.0-micron CMOS and NMOS
1.2-micron CMOS
4-inch wafers

Facilities

San Diego, CA
6,000 sq. ft.
Design

PRODUCTS

Device	Description
X1001/1002	Graphics MPU Chip Set
X1003	Video Shift Register
PG-2000	PC AT Graphics Board - Real-Time 3D Animation
AP-2000	20 MFLOPS 32-Bit Array Processor
Falcon-PC	PC AT Based Real-Time Graphics System —1024 x 1024 or 1024 x 768 —256 Colors from Palette of 4096 or 16.7M —Displays 30,000 Flat-Shaded Polygons/SEC —Fills Polygons AT 160 Million Pixels/SEC

OTHER INFORMATION

XTAR's PR firm is Nufter, Smith and Tucker.

Zoran Corporation

3450 Central Expressway
Santa Clara, CA 94051
408/720-0444
Fax: 408/720-9875

ESTABLISHED: 1983 **NO. OF EMPLOYEES: 70**

BACKGROUND

Zoran Corporation designs, manufactures, and markets proprietary systems processors and programmable peripherals devices for the digital signal-processing (DSP) market. The Company is focusing on a unique systems design approach and combines VLSI and DSP to integrate DSP functions on single chips.

In June 1986, the Company offered two digital-filter processors (DFPs) and a vector signal processor (VSP) in addition to hardware support tools for the VSP. During 1987, Zoran offered new VSP devices, including a VLSI product that implements the IEEE 32-bit FFT algorithm and two 25-MHz and 30-MHz products. In addition, Zoran offered an image compression processor (ICP), which is a scaled-down version of the VSP.

To accelerate the implementation of its processors in end-user products, the Company has embedded algorithms and high-level instructions in the hardware. Zoran's integration of software algorithms and optimized hardware in its systems processors provides ease of design, high reliability, high performance, and optimized architectures.

Zoran, a privately held company, was cofounded by Dr. Levy Gerzberg and Yuval Almog. Prior to founding Zoran, Dr. Gerzberg was associate director of and senior research associate at the Stanford University Electronics Laboratory. Mr. Almog served in management positions at Raychem Corporation where he was responsible for military electronics marketing and resource planning. Zoran's systems approach to products is based on the research conducted by the cofounders.

In December 1987, Dale Williams joined Zoran as president and chief executive officer from Rockwell, replacing John Ekiss who resigned in May. Mr. Williams was formerly vice president and general manager of Rockwell International's Far East Operations, divisional manager with Intel, and founder of Monolithic Memories. Mr. Williams will be expanding the Company's marketing effort, particularly in Japan, and directing the Company's move into telecommunications and instrumentation products.

In December 1987, Zoran sold its fabrication facility to Synergy Semiconductor for $4 million in cash and notes. The Company stated that the fab, purchased at low cost from Storage Technology in late 1985, served its purpose of facilitating the rapid development of Zoran's first three product families to get to market quickly. In 1988, many of Zoran's customers entered production, a situation that outstripped the capacity of the R&D fab. The cost of expanding the fab's capacity and upgrading it to a more advanced process technology was not justified in light of the availability of existing foundries worldwide.

In April 1988, Zoran announced that it opened a Far Eastern headquarters facility in Tokyo, Japan. Heading the facility will be General Manager Noboru Iino, formerly Tokyo operational director at Rockwell Semiconductor. Under Mr. Iino's direction, the facility will provide local user-application engineering support, as well as marketing and sales direction. The Company hopes to capture a share of the DSP applications in the growing Japanese data compression market.

Zoran has a direct sales force with offices in Santa Clara and Los Angeles, California; Boston, Massachusetts; Chicago, Illinois; Tokyo, Japan; and Paris, France; and a worldwide network of manufacturers' sales representatives.

BOARD

Not available

COMPANY EXECUTIVES
(Position, Name, Prior Company, and Prior Position)

President/CEO
*Dr. Levy Gerzberg
Stanford Electronics Lab, Assoc Director

GM Far East Ops
Noboru Iino
Rockwell International, Tokyo Ops Dir

GM/European Ops
Jean-Pierre Garnier
Rockwell International, Euro Ops Dir

*Founder

FINANCING

August 1983
Round 1
$3.5M
Adler & Company; Elron Electronics Industries, Ltd., Israel

1984
Round 2
$1.5M
Previous investors

October 1985
Round 3
$22.0M
Previous investors; Concord Partners; Grace Ventures Corp.; Investment Advisors, Inc.; Kleiner, Perkins, Caufield & Byers; Mitsui & Co. Inc. (USA); Montgomery Securities; Vista Ventures; Welsh, Carson, Anderson & Stowe

April 1987
Round 4
$6.8M
Adler & Company; Concord Partners Elron Electronics Industries, Ltd.; Grace Ventures Corp.; Kleiner, Perkins, Caufield & Byers; Mitsui & Co. Inc.; Montgomery Securities; Vista Ventures; Welsh, Carson, Anderson & Stowe

May 1988
Harris Corporation bought 10 percent equity in Zoran Corporation.

RECENT HIGHLIGHTS

December 1986
Zoran offered a low-cost version of its VSP (VSP-10) and two personal computer development boards for the VSP. The VSP-10 is optimized for DSP applications and operates at 10 MHz versus 20 MHz for the VSP-20. The VSP-10 is aimed at instrumentation, medical imaging, and telecommunications applications.

To support the VSP chips, Zoran also introduced two development boards, the VSPX and VSPE, for use with an IBM PC XT or PC AT.

March 1987
Zoran introduced Support Tool Environment (STE), a development tool kit that addresses VSP and DFP. Zoran embedded the basic algorithms required in fixed, on-chip logic.

June 1987
Zoran offered an ICP, which is a scaled-down version of the VSP. The device is pin-compatible with the VSP-161, with its instruction set reduced for image applications. The device, which the Company says is the first in the marketplace, targets electronic publishing, satellite, electronic camera, picture data base, and broadcasting applications.

November 1987
Zoran offered the ZR33891-25, a 25-MHz digital filter processor; and ZR33891-30, a 30-MHz digital filter processor. The devices are upgraded digital filter processors designed for imaging, HDTV, and digital radio applications.

December 1987
Zoran sold its 50,000-square-foot fabrication facility for $4 million in cash and notes.

December 1987
Zoran offered the ZR34161 VSP in a 52-pin, ceramic J-leaded package. The device is available in 15-, 20-, and 25-MHz speeds.

April 1988
Zoran announced that it has opened a Far Eastern headquarters facility in Tokyo, Japan.

ALLIANCES

IMP
June 1983
IMP and Zoran codeveloped a CMOS PROM technology.

Toshiba
January 1988
Zoran and Toshiba agreed to a technology and manufacturing alliance.

SGS-Thomson
March 1988
Zoran and SGS-Thomson agreed to a technology and manufacturing alliance.

MANUFACTURING

Technology

1.0- to 2.0-micron, two-level metal CMOS
4-inch, 5-inch, and 6-inch wafers

Facilities

Santa Clara, CA
Headquarters, design

Haifa, Israel
Design center

Tokyo, Japan
Marketing/Sales

Paris, France
Marketing/Sales

PRODUCTS

Digital Filter Products

Device	Description
ZR33491	Four Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33881	Eight Cells; 8x8-Bit Arithmetic; 15, 20 MHz
ZR33891	Eight Cells; 9x9-Bit Arithmetic; 15, 20, 25, 30 MHz
ZR37381	16 Beat ALU Compatible with the LDI ALU
ZR33771	2D Converter 3x3 Symmetrical 40 MHz to 7x7 10 MHz Video rate

Vector Signal Processors

ZR34161	16-Bit Block Floating-Point DSP; 20, 25 MHz
ZR34325	32-Bit IEEE Floating-Point DSP; 25 MHz
ZR34322	32-Bit Block Floating-Point DSP; 20, 25, 30 MHz

Image Compression Processor

ZR36010	Discrete Cosine Transform Processor; 20, 25, 30 MHz

Development Tool Hardware

VSPX	ZR34161 Array Processor Board for IBM AT, 16K RAM, 10 MHz
VSPE	ZR34161 Array Processor Board for IBM XT, 16K RAM, 20 MHz
VSPD	ZR34161 Array Processor Board for IBM AT, 64K RAM, 20 MHz, I/O
DFPB	ZR39481/881 Digital Filter Board for IBM AT; 15, 20 MHz
ZRPD	ZR34325 Development System for the ZR34325 Floating-Point Processor

Development Tool Software

VSPS	ZR34161 Simulator
VSPA	ZR34161 Assembler
DFPS	Digital Filter Design Software
ZSPS	ZR34325 Software Tool Package

Zoran Corporation

Board/Subsystem

ZR73650	IEB (Image Engineering Board), AT-Compatible Board that supports development of imaging algorithms

OTHER INFORMATION

Zoran Corp. does not employ a PR firm.

Dataquest

a company of
The Dun & Bradstreet Corporation

Dataquest Research and Sales Offices:

Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
Phone: (408) 437-8000
Telex: 171973
Fax: (408) 437-0292

Technology Products Group
Phone: (800) 624-3280

Dataquest Incorporated
Focus Research Division
10 Executive Drive
Farmington, Connecticut 06032
Phone: (203) 676-2200
Fax: (203) 676-1656

Dataquest Incorporated
Invitational Computer Conferences Division
3151 Airway Avenue, C-2
Costa Mesa, California 92626
Phone: (714) 957-0171
Telex: 5101002189 ICCDQ
Fax: (714) 957-0903

Dataquest Australia
Suite 1, Century Plaza
80 Berry Street
North Sydney, NSW 2060
Australia
Phone: (02) 959 4544
Telex: 25468
Fax: (02) 929 0635

Dataquest Boston
1740 Massachusetts Ave.
Boxborough, MA 01719-2209
Phone: (508) 264-4373
Telex: 171973
Fax: (508) 635-0183

Dataquest Europe GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089) 91 1064
Telex: 5218070
Fax: (089) 91 2189

Dataquest Hong Kong
Rm. 401, Connaught Comm. Bldg.
185 Wanchai Rd.
Wanchai, Hong Kong
Phone: 8387336
Telex: 80587
Fax: 5722375

Dataquest Israel
59 Mishmar Ha'yarden Street
Tel Aviv, Israel 69865
or
P.O. Box 18198
Tel Aviv, Israel
Phone: 52 913937
Telex: 341118
Fax: 52 32865

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03) 546-3191
Telex: 32768
Fax: (03) 546-3198

Dataquest Korea
Daeheung Bldg., Room 505
648-23 Yeoksam-dong
Kangnam-gu
Seoul, Korea 135
Phone: (02) 552-2332
Fax: (02) 552-2661

Dataquest Europe SA
Tour Gallieni 2
36, avenue Gallieni
93175 Bagnolet Cedex
France
Phone: (1) 48 97 31 00
Telex: 233 263
Fax: (1) 48 97 34 22

Dataquest Singapore
4012 Ang Mo Kio Industrial Park 1
Ave. 10, #03-10 to #03-12
Singapore 2056
Phone: 4597181
Telex: 38257
Fax: 4563129

Dataquest Taiwan
Room 801/8th Floor
Ever Spring Building
147, Sect. 2, Chien Kuo N. Rd.
Taipei, Taiwan R.O.C. 104
Phone: (02) 501-7960
Telex: 27459
Fax: (02) 505-4265

Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge, Middx UB9 5HP
England
Phone: 0895-835050
Telex: 266195
Fax: 0895 835260/1/2

Dataquest West Germany
In der Schneithohl 17
6242 Kronberg 2
West Germany
Phone: 06173/61685
Telex: 418089
Fax: 06173/67901

Ledgeway Group, Inc.
430 Bedford Street
Suite 340
Lexington, MA 02173
Phone: (617) 862-8500
Fax: (617) 862-8207