Compact Flash Card Min.**16MB ~** Max.**512MB, ATA/IDE Interface Mode, Support 3 power save mode, 3.3V/5.0V Operating Part No**. **CFCxxxSx**

1.PRODUCT OVERVIEW

GENERAL DESCRIPTION

The CFCxxxSx series CompactFlash™ card is a flash technology based with ATA interface flash memory card. It is constructed with flash disk controller chip and NAND-type (Samsung) flash memory device. The CompactFlash™ card operates in both 3.3-Volt and 5.0-Volt power supplies. It comes in capacity of 16, 32, 64, 96, 128, 192, 256, 384 MB and up to 512 MB formatted for type-I card.

By optimizing flash memory management, the life of this card can be extended to its maximum level. Because the ECC function is included, the correctness of data transfer between the card and the mobile device can be guaranteed. The power down and sleep modes of the card can ensure longer life of the batteries in the mobile devices. It is a perfect choice of solid-state mass-storage cards for battery backup handheld devices such as Digital Camera, Audio Player, PDA, GPS, or the applications which require high environment tolerance with high performance sustained write speed.

FEATURES

- ATA / True IDE compatible host interface
- ATA command set compatible
- Very high performance, very low power consumption
- Automatic error correction
- Support 3 power save mode : stop/idle/active
- Support for CIS implemented with 256 bytes of attribute memory
- Support for 8 or 16 bit host transfers
- 3.3V/5.0V operation voltage
- Host data transfer rate : 20MB/s
- Flash data transfer rate : 10MB/s
- Host Interface bus width : 8/16 bit Access
- Flash Interface bus width : 8 bit Access
- Capacity : Min. 16MB ~ Max. 512MB
- MTBF : 1,000,000 hours, minimum 30,000 insertions
- Operating vibration : 15G peak to peak maximum
- Operating shock : 1,000G maximum

PRODUCT SPECIFICATIONS

Capacities :

16, 32, 48, 64, 96, 128, 192, 256, 384 and up to 512 MB (formatted)

System Compatibility :

Please refer to the compatibility list of index.

Performance :

Data Transfer Rates :	up to 4.2 MB/s in ATA PIO mode 4
To/from Flash memory :	up to 12.4 MB/s
To/from host :	up to 20MB/s
Sustained write :	up to 2.9MB/s in ATA PIO mode 4
Sustained read :	up to 5.62MB/s in ATA PIO mode 4

Operating Voltage : 3.3V / 5.0V ± 10%

Power consumption :

Read mode	30 mA (typ), 40 mA (Max)
Write mode	30 mA (typ), 40 mA (Max)
Stop mode	30 μA (typ)

Environment conditions :

Operating temperature	0°C to + 65°C
Storage temperature	- 20°C to + 70°C
Relative humidity	95%(Max)

Dimension :

Weight	Capacity dependent
Length	36.4 ± 0.15 mm (1.433 ± 0.006 in.)
Width	42.8 ± 0.10 mm (1.685 ± 0.004 in.)
Thickness	3.3 mm ± 0.10 mm (0.130 ± 0.004 in.)

ELECTRICAL SPECIFICATIONS

Table 1.1 Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DD}	Supply voltage	- 0.3 to + 7.0	V
V_{IN}	Input voltage	- 0.3 to + 7.0	V
I_{IN}	DC input current	- 10	mA
T_{STG}	Storage temperature	- 20 to + 85	°C

Table 1.2 Recommended Operating Conditions

Symbol	Parameter		Ratings	Unit
V_{DD}	DC Supply voltage	5V	4.75 to 5.25	V
		3.3V	3.0 to 3.6	V
T_a	Storage temperature		- 20 to +70	°C

Table 1.3 DC Characteristics

(Ta=0°C to 70°C, V_{DD}=3.0 to 5.3V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{DD}	Operating Current		30	70	mA
I_{ds}	Stop Current		50	150	μA
V_{DD}	High Level Output Voltage	2.4			V
V_{DD}	Low Level Output Voltage			0.4	V

PHYSYCAL SPECIFICATION
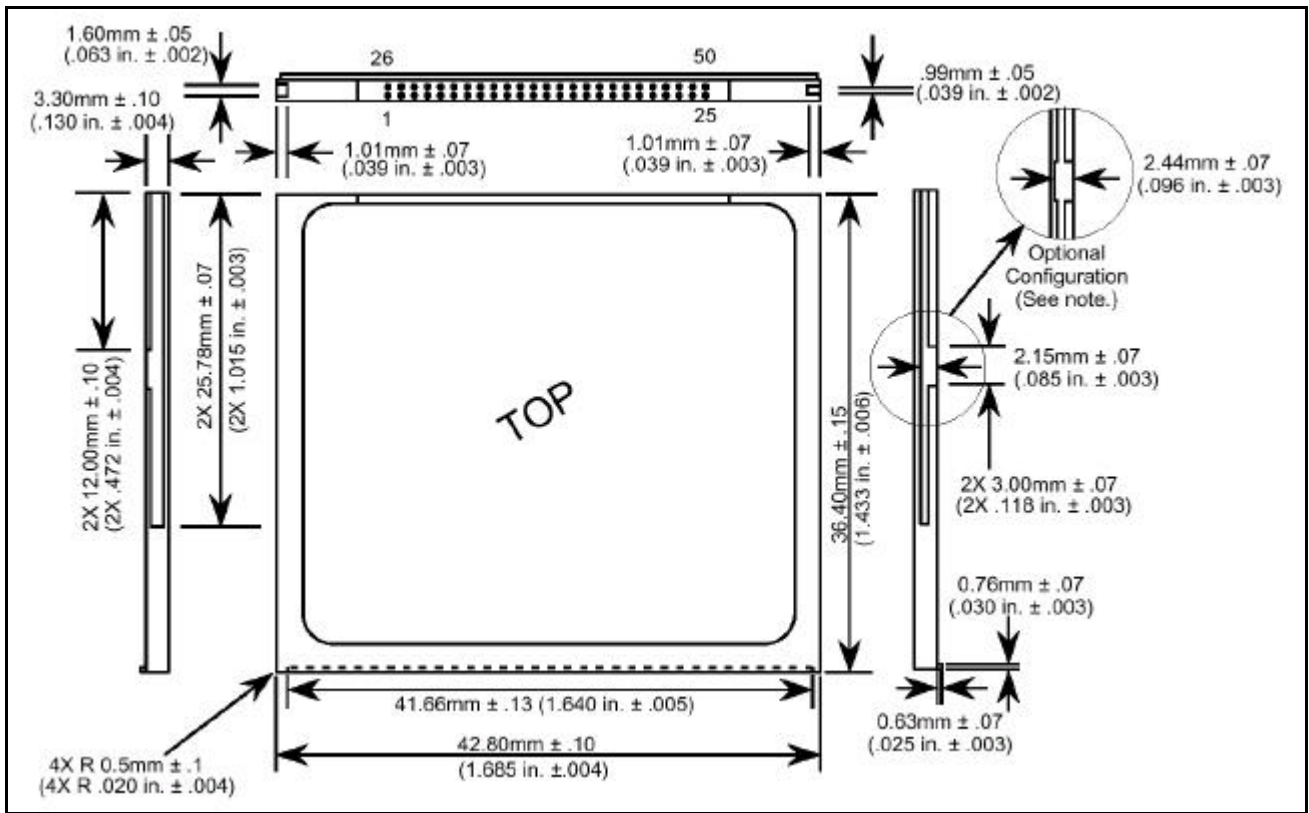
Note: The optional notched configuration was shown in the CF Specification
Rev. 1.0. In specification Rev. 1.2, the notch was removed for ease of tooling.
This optional configuration can be used but it is not recommended.

Figure 1.1 Type I CompactFlash Storage Card Dimensions

Electrical Interface

Physical Description

The host is connected to the CompactFlash Storage Card or CF+ Card using a standard 50-pin connector. The connector in the host consists of two rows of 25 male contacts each on 50 mil (1.27 mm) centers.

Pin Assignments and Pin Type

The signal/pin assignments are listed in Table 4. Low active signals have a "-" prefix. Pin types are Input, Output or Input/Output. Section 4.3 defines the DC characteristics for all input and output type structures.

Electrical Description

The CompactFlash Storage Card functions in three basic modes:

1) PC Card ATA using I/O Mode
2) PC Card ATA using Memory Mode
3) True IDE Mode

Which is compatible with most disk drives. CompactFlash Storage Cards are required to support all three modes. The CF Cards normally function in the first and second modes, however they can optionally function in True IDE mode. The configuration of the CompactFlash Card will be controlled using the standard PCMCIA configuration registers starting at address 200h in the Attribute Memory space of the storage card or for True IDE Mode, pin 9 being grounded. The configuration of the CF Card will be controlled using configuration registers starting at the address defined in the configuration Tuple (CISTPL_CONFIG) in the Attribute Memory space of the CF Card.

Signal description describes the I/O signals. Signals whose source is the host are designated as inputs while signals that the CompactFlash Storage Card sources are outputs. The CompactFlash Storage Card logic levels conform to those specified in the PCMCIA Release 2.1 specification. Each signal has three possible operating modes:

1) PC Card Memory mode
2) PC Card I/O mode
3) True IDE

True IDE mode is required for CompactFlash Storage cards. All outputs from the card are totem pole except the data bus signals that are bi-directional tri-state.

2.PIN INFORMATION

PIN ASSIGNMENTS AND PIN TYPE

Table 2.1 Pin Assignment and Pin type

PC Card Memory Mode				PC Card I/O Mode				True IDE Mode			
Pin	Signal	Pin Type	Function	Pin	Signal	Pin Type	Function	Pin	Signal	Pin Type	Function
1	GND	DC	Ground	1	GND	DC	Ground	1	GND	DC	Ground
2	D03	I/O	I1Z, OZ3	2	D03	I/O	I1Z, OZ3	2	D03	I/O	I1Z, OZ3
3	D04	I/O	I1Z, OZ3	3	D04	I/O	I1Z, OZ3	3	D04	I/O	I1Z, OZ3
4	D05	I/O	I1Z, OZ3	4	D05	I/O	I1Z, OZ3	4	D05	I/O	I1Z, OZ3
5	D06	I/O	I1Z, OZ3	5	D06	I/O	I1Z, OZ3	5	D06	I/O	I1Z, OZ3
6	D07	I/O	I1Z, OZ3	6	D07	I/O	I1Z, OZ3	6	D07	I/O	I1Z, OZ3
7	-CE1	I	I3U	7	-CE1	I	I3U	7	-CS0	I	I3U
8	A10	I	I1Z	8	A10	I	I1Z	8	A10	I	I1Z
9	-OE	I	I3U	9	-OE	I	I3U	9	-ATA SEL	I	I3U
10	A09	I	I1Z	10	A09	I	I1Z	10	A09[2]	I	I1Z
11	A08	I	I1Z	11	A08	I	I1Z	11	A08[2]	I	I1Z
12	A07	I	I1Z	12	A07	I	I1Z	12	A07[2]	I	I1Z
13	VCC	DC	Power	13	VCC	DC	Power	13	VCC	DC	Power
14	A06	I	I1Z	14	A06	I	I1Z	14	A06[2]	I	I1Z
15	A05	I	I1Z	15	A05	I	I1Z	15	A05[2]	I	I1Z
16	A04	I	I1Z	16	A04	I	I1Z	16	A04[2]	I	I1Z
17	A03	I	I1Z	17	A03	I	I1Z	17	A03[2]	I	I1Z
18	A02	I	I1Z	18	A02	I	I1Z	18	A02	I	I1Z
19	A01	I	I1Z	19	A01	I	I1Z	19	A01	I	I1Z
20	A00	I	I1Z	20	A00	I	I1Z	20	A00	I	I1Z
21	D00	I/O	I1Z, OZ3	21	D00	I/O	I1Z, OZ3	21	D00	I/O	I1Z, OZ3
22	D01	I/O	I1Z, OZ3	22	D01	I/O	I1Z, OZ3	22	D01	I/O	I1Z, OZ3
23	D02	I/O	I1Z, OZ3	23	D02	I/O	I1Z, OZ3	23	D02	I/O	I1Z, OZ3
24	WP	O	OT3	24	-IOIS16	O	OT3	24	-IOIS16	O	OT3
25	-CD2	O	Ground	25	-CD2	O	Ground	25	-CD2	O	Ground
26	-CD1	O	Ground	26	-CD1	O	Ground	26	-CD1	O	Ground
27	D11[1]	I/O	I1Z, OZ3	27	D11[1]	I/O	I1Z, OZ3	27	D11[1]	I/O	I1Z, OZ3
28	D12[1]	I/O	I1Z, OZ3	28	D12[1]	I/O	I1Z, OZ3	28	D12[1]	I/O	I1Z, OZ3
29	D13[1]	I/O	I1Z, OZ3	29	D13[1]	I/O	I1Z, OZ3	29	D13[1]	I/O	I1Z, OZ3
30	D14[1]	I/O	I1Z, OZ3	30	D14[1]	I/O	I1Z, OZ3	30	D14[1]	I/O	I1Z, OZ3
31	D15[1]	I/O	I1Z, OZ3	31	D15[1]	I/O	I1Z, OZ3	31	D15[1]	I/O	I1Z, OZ3
32	-CE2[1]	I	I3U	32	-CE2[1]	I	I3U	32	-CS1[1]	I	I3U
33	-VS1	O	Ground	33	-VS1	O	Ground	33	-VS1	O	Ground
34	-IORD	I	I3U	34	-IORD	I	I3U	34	-IORD	I	I3U
35	-IOWR	I	I3U	35	-IOWR	I	I3U	35	-IOWR	I	I3U
36	-WE	I	I3U	36	-WE	I	I3U	36	-WE[3]	I	I3U

PC Card Memory Mode				PC Card I/O Mode				True IDE Mode			
Pin	Signal	Pin Type	Function	Pin	Signal	Pin Type	Function	Pin	Signal	Pin Type	Function
37	RDY/BSY	O	OT1	37	IREQ	O	OT1	37	INTRQ	O	OZ1
38	VCC	DC	Power	38	VCC	DC	Power	38	VCC	DC	Power
39	-CSEL	I	I2Z	39	-CSEL	I	I2Z	39	-CSEL	I	I2U
40	-VS2	O	Open	40	-VS2	O	Open	40	-VS2	O	Open
41	RESET	I	I2Z	41	RESET	I	I2Z	41	-RESET	I	I2Z
42	-WAIT	O	OT1	42	-WAIT	O	OT1	42	IORDY	O	ON1
43	-INPACK	O	OT1	43	-INPACK	O	OT1	43	-INPACK	O	OZ1
44	-REG	I	I3U	44	-REG	I	I3U	44	-REG[3]	I	I3U
45	BVD2	I/O	I1U, OT1	45	-SPKR	I/O	I1U, OT1	45	-DASP	I/O	I1U, ON1
46	BVD1	I/O	I1U, OT1	46	-STSCHG	I/O	I1U, OT1	46	-PDIAG	I/O	I1U, ON1
47	D08[1]	I/O	I1Z, OZ3	47	D08[1]	I/O	I1Z, OZ3	47	D08[1]	I/O	I1Z, OZ3
48	D09[1]	I/O	I1Z, OZ3	48	D09[1]	I/O	I1Z, OZ3	48	D09[1]	I/O	I1Z, OZ3
49	D10[1]	I/O	I1Z, OZ3	49	D10[1]	I/O	I1Z, OZ3	49	D10[1]	I/O	I1Z, OZ3
50	GND	DC	Ground	50	GND	DC	Ground	50	GND	DC	Ground

Note : 1. These signals are required only for 16bit access and not required when
installed in 8-bit systems. Devices should allow for 3-state signals not to consume current.
2. Should be grounded by the host.
3. Should be tied to VCC by the host.
4. Optional required for PCMCIA Storage Cards.

Signal Descriptions

Table 2.2 Signal Descriptions

Signal Name	Dir.	Pin	Description
A10 - A0 (PC Card Memory Mode)	I	8,10,11,12,14,15,16, 17,18,19,20	These address lines along with the -REG signal are used to select the following: The I/O port address registers within the CompactFlash Storage Card or CF+ Card, the memory mapped port address registers within the CompactFlash Storage Card or CF+ Card, a byte in the card's information structure and its configuration control and status registers.
A10 - A0 (PC Card I/O Mode)			This signal is the same as the PC Card Memory Mode signal.
A2 - A0 (True IDE Mode)	I	18,19, 20	In True IDE Mode only A[2:0] are used to select the one of eight registers in the Task File, the remaining address lines should be grounded by the host.
BVD1 (PC Card Memory Mode)	I/O	46	This signal is asserted high as BVD1 is not supported.
-STSCHG (PC Card I/O Mode) Status Changed			This signal is asserted low to alert the host to changes in the RDY/-BSY and Write Protect states, while the I/O interface is configured. Its use is controlled by the Card Config and Status Register.
-PDIAG (True IDE Mode)			In the True IDE Mode, this input / output is the Pass Diagnostic signal in the Master / Slave handshake protocol.
BVD2 (PC Card Memory Mode)	I/O	45	This signal is asserted high as BVD2 is not supported.
-SPKR (PC Card I/O Mode)			This line is the Binary Audio output from the card. If the Card does not support the Binary Audio function, this line should be held negated.
-DASP (True IDE Mode)			In the True IDE Mode, this input/output is the Disk Active/Slave Present signal in the Master/Slave handshake protocol.
-CD1, -CD2 (PC Card Memory Mode)	O	26,25	These Card Detect pins are connected to ground on the CompactFlash Storage Card or CF+ Card. They are used by the host to determine that the CompactFlash Storage Card or CF+ Card is fully inserted into its socket.
-CD1, -CD2 (PC Card I/O Mode)			This signal is the same for all modes.
-CD1, -CD2 (True IDE Mode)			This signal is the same for all modes.
-CE1, -CE2 (PC Card Memory Mode) Card Enable	I	7,32	These input signals are used both to select the card and to indicate to the card whether a byte or a word operation is being performed. -CE2 always accesses the odd byte of the word. –CE1 accesses the even byte or the Odd byte of the word depending on A0 and -CE2. A multiplexing scheme based on A0, -CE1, -CE2 allows 8 bit hosts to access all data on D0-D7.
-CE1, -CE2 (PC Card I/O Mode) Card Enable			This signal is the same as the PC Card Memory Mode signal.
-CS0, -CS1 (True IDE Mode)			In the True IDE Mode CS0 is the chip select for the task file registers while CS2 is used to select the Alternate Status Register and the Device Control Register.
Signal Name	**Dir.**	**Pin**	**Description**
-CSEL (PC Card Memory Mode)	I	39	This signal is not used for this mode.
-CSEL (PC Card I/O Mode)			This signal is not used for this mode.
-CSEL			This internally pulled up signal is used to configure this device as a Master

Signal Name	Dir.	Pin	Description
(True IDE Mode)			or a Slave when configured in the True IDE Mode. When this pin is grounded, this device is configured as a Master. When the pin is open, this device is configured as a Slave.
D15 - D00 (PC Card Memory Mode)	I/O	31,30, 29,28, 27,49, 48,47, 6,5,4, 3,2, 23,22, 21	These lines carry the Data, Commands and Status information between the host and the controller. D00 is the LSB of the Even Byte of the Word. D08 is the LSB of the Odd Byte of the Word.
D15 - D00 (PC Card I/O Mode)			This signal is the same as the PC Card Memory Mode signal.
D15 - D00 (True IDE Mode)			In True IDE Mode, all Task File operations occur in byte mode on the low order bus D00-D07 while all data transfers are 16 bit using D00-D15.
GND (PC Card Memory Mode)	--	1,50	Ground.
GND (PC Card I/O Mode)			This signal is the same for all modes.
GND (True IDE Mode)			This signal is the same for all modes.
-INPACK (PC Card Memory Mode)	O	43	This signal is not used in this mode.
-INPACK (PC Card I/O Mode) Input Acknowledge			The Input Acknowledge signal is asserted by the CompactFlash Storage Card or CF+ Card when the card is selected and responding to an I/O read cycle at the address that is on the address bus. This signal is used by the host to control the enable of any input data buffers between the CompactFlash Storage Card or CF+ Card and the CPU.
-INPACK (True IDE Mode)			In True IDE Mode this output signal is not used and should not be connected at the host.
-IORD (PC Card Memory Mode)	I	34	This signal is not used in this mode.
-IORD (PC Card I/O Mode)			This is an I/O Read strobe generated by the host. This signal gates I/O data onto the bus from the CompactFlash Storage Card or CF+ Card when the card is configured to use the I/O interface.
-IORD (True IDE Mode)			In True IDE Mode, this signal has the same function as in PC Card I/O Mode.
-IOWR (PC Card Memory Mode)	I	35	This signal is not used in this mode.
-IOWR (PC Card I/O Mode)			The I/O Write strobe pulse is used to clock I/O data on the Card Data bus into the CompactFlash Storage Card or CF+ Card controller registers when the CompactFlash Storage Card or CF+ Card is configured to use the I/O interface. The clocking will occur on the negative to positive edge of the signal (trailing edge).
-IOWR (True IDE Mode)			In True IDE Mode, this signal has the same function as in PC Card I/O Mode.
Signal Name	**Dir.**	**Pin**	**Description**
-OE (PC Card Memory Mode)	I	9	This is an Output Enable strobe generated by the host interface. It is used to read data from the CompactFlash Storage Card or CF+ Card in Memory Mode and to read the CIS and configuration registers.
-OE (PC Card I/O Mode)			In PC Card I/O Mode, this signal is used to read the CIS and configuration registers.

Signal Name	Dir.	Pin	Description
-ATA SEL (True IDE Mode)			To enable True IDE Mode this input should be grounded by the host.
RDY/-BSY (PC Card Memory Mode) -IREQ (PC Card I/O Mode) INTRQ (True IDE Mode)	O	37	In Memory Mode this signal is set high when the CompactFlash Storage Card or CF+ Card is ready to accept a new data transfer operation and held low when the card is busy. The Host memory card socket must provide a pull-up resistor. At power up and at Reset, the RDY/-BSY signal is held low(busy) until the CompactFlash Storage Card or CF+ Card has completed its power up or reset function. No access of any type should be made to the CompactFlash Storage Card or CF+ Card during this time. The RDY/-BSY signal is held high (disabled from being busy) whenever the following condition is true: The CompactFlash Storage Card or CF+ Card has been powered up with +RESET continuously disconnected or asserted. I/O Operation – After the CompactFlash Storage Card or CF+ Card has been configured for I/O operation, this signal is used as -Interrupt Request. This line is strobed low to generate a pulse mode interrupt or held low for a level mode interrupt. In True IDE Mode signal is the active high Interrupt Request to the host.
-REG (PC Card Memory mode) Attribute Memory Select -REG (PC Card I/O Mode) -REG (True IDE Mode)	I	44	This signal is used during Memory Cycles to distinguish between Common Memory and Register (Attribute) Memory accesses. High for Common Memory, Low for Attribute Memory. The signal must also be active (low) during I/O Cycles when the I/O address is on the Bus. In True IDE Mode this input signal is not used and should be connected to VCC by the host.
RESET (PC Card Memory Mode) RESET (PC Card I/O Mode) -RESET (True IDE Mode)	I	41	When the pin is high, this signal Resets the CompactFlash Storage Card or CF+ Card. The CompactFlash Storage Card or CF+ Card is Reset only at power up if this pin is left high or open from power-up. The CompactFlash Storage Card or CF+ Card is also Reset when the Soft Reset bit in the Card Configuration Option Register is set. This signal is the same as the PC Card Memory Mode signal. In the True IDE Mode this input pin is the active low hardware reset from the host.
VCC (PC Card Memory Mode) VCC (PC Card I/O Mode) VCC (True IDE Mode)	--	13,38	+5 V, +3.3 V power. This signal is the same for all modes. This signal is the same for all modes.
Signal Name	**Dir.**	**Pin**	**Description**
-VS1 -VS2 (PC Card Memory Mode) -VS1 -VS2	O	33,40	Voltage Sense Signals. -VS1 is grounded so that the CompactFlash Storage Card or CF+ Card CIS can be read at 3.3 volts and -VS2 is reserved by PCMCIA for a secondary voltage. This signal is the same for all modes.

	I/O	Pin	Description
(PC Card I/O Mode) -VS1 -VS2 (True IDE Mode)			This signal is the same for all modes.
-WAIT (PC Card Memory Mode) -WAIT (PC Card I/O Mode) IORDY (True IDE Mode)	O	42	The -WAIT signal is driven low by the CompactFlash Storage Card or CF+ Card to signal the host to delay completion of a memory or I/O cycle that is in progress. This signal is the same as the PC Card Memory Mode signal. In True IDE Mode this output signal may be used as IORDY.
-WE (PC Card Memory Mode) -WE (PC Card I/O Mode) -WE (True IDE Mode)	I	36	This is a signal driven by the host and used for strobing memory write data to the registers of the CompactFlash Storage Card or CF+ Card when the card is configured in the memory interface mode. It is also used for writing the configuration registers. In PC Card I/O Mode, this signal is used for writing the configuration registers. In True IDE Mode this input signal is not used and should be connected to VCC by the host.
WP (PC Card Memory Mode) Write Protect -IOIS16 (PC Card I/O Mode) -IOIS16 (True IDE Mode)	O	24	Memory Mode - The CompactFlash Storage Card or CF+ Card does not have a write protect switch. This signal is held low after the completion of the reset initialization sequence. I/O Operation - When the CompactFlash Storage Card or CF+ Card is configured for I/O Operation Pin 24 is used for the -I/O Selected is 16 Bit Port (-IOIS16) function. A Low signal indicates that a 16 bit or odd byte only operation can be performed at the addressed port. In True IDE Mode this output signal is asserted low when this device is expecting a word data transfer cycle.