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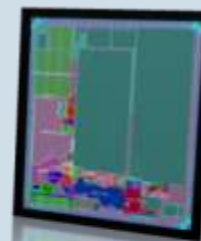


Agenda

- i.MX 6 Series
- Multi Core Advantages
- Graphics capabilities
- Video capabilities
- Development Platforms
- Summary

2011

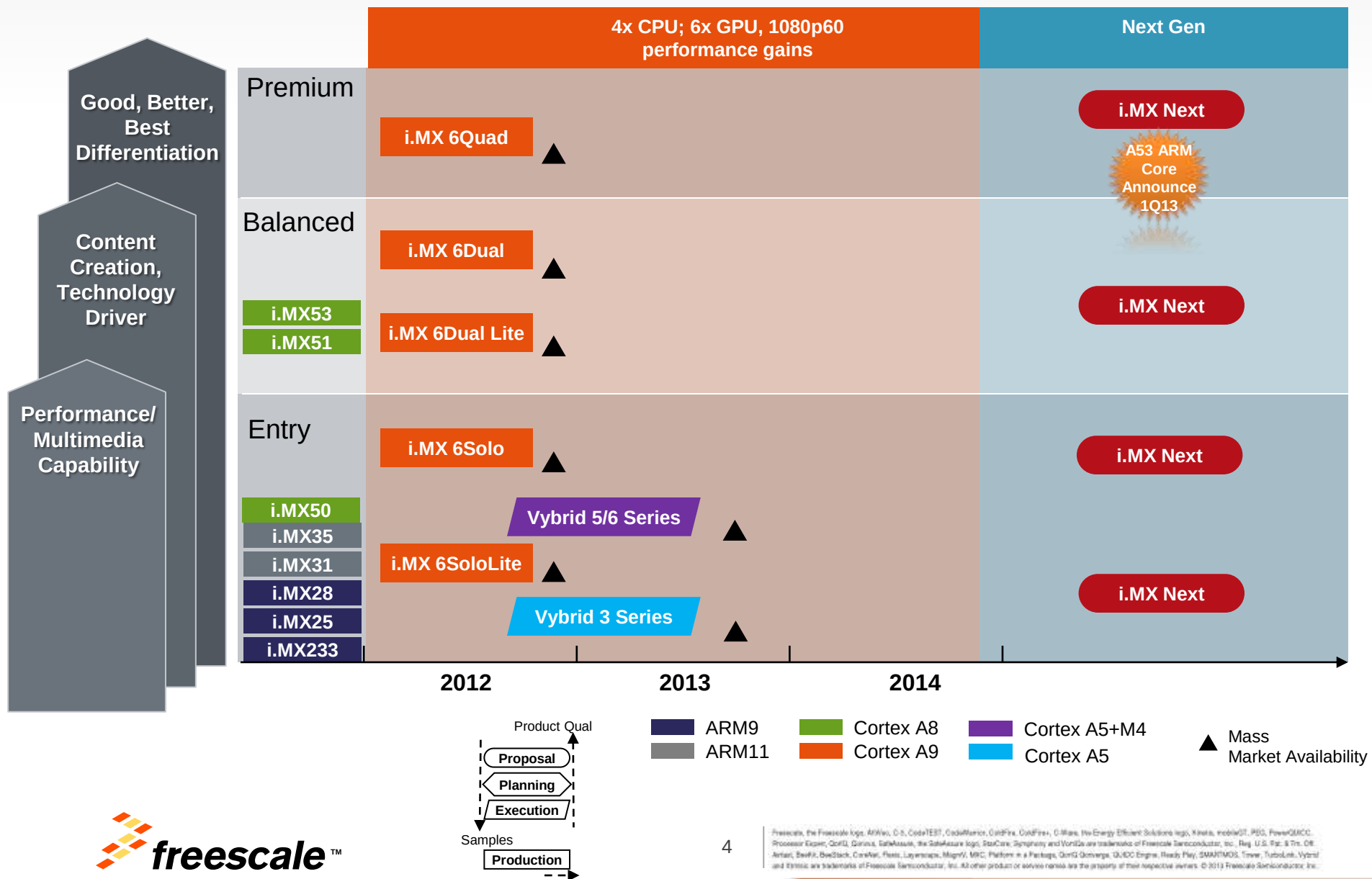
i.MX 6 Series
40nm LP
ARM Cortex-A9
Multi-core family



50+ Products
>150M Units

- **Clear market leader** for eReader apps processors (IDC)
- **No. 1** in Apps Processors (IDC 12/2011)
- **No. 2** in Auto Infotainment (Strategy Analytics)

Applications Processor Family Roadmap



ARM Cortex-A50 Series Partnership

Freescale and ARM Extend Relationship with Cortex-A50 Processor License for Future i.MX and QorIQ Products

Multiyear subscription license demonstrates Freescale's commitment to further expanding its extensive ARM Powered portfolio

NUREMBERG, Germany--(BUSINESS WIRE)--Feb. 26, 2013-- [Freescal Semiconductor](#) (NYSE: FSL) is licensing the ARM® Cortex™-A50 series of microprocessors (MPUs) for future versions of its [i.MX](#) applications processor and [QorIQ](#) communications processor product lines. This agreement is part of a new multiyear subscription license with [ARM](#) that demonstrates Freescale's commitment to the ARM architecture and its intent to further expand its ARM Powered® portfolio – one of the industry's broadest range of solutions built on ARM technology.

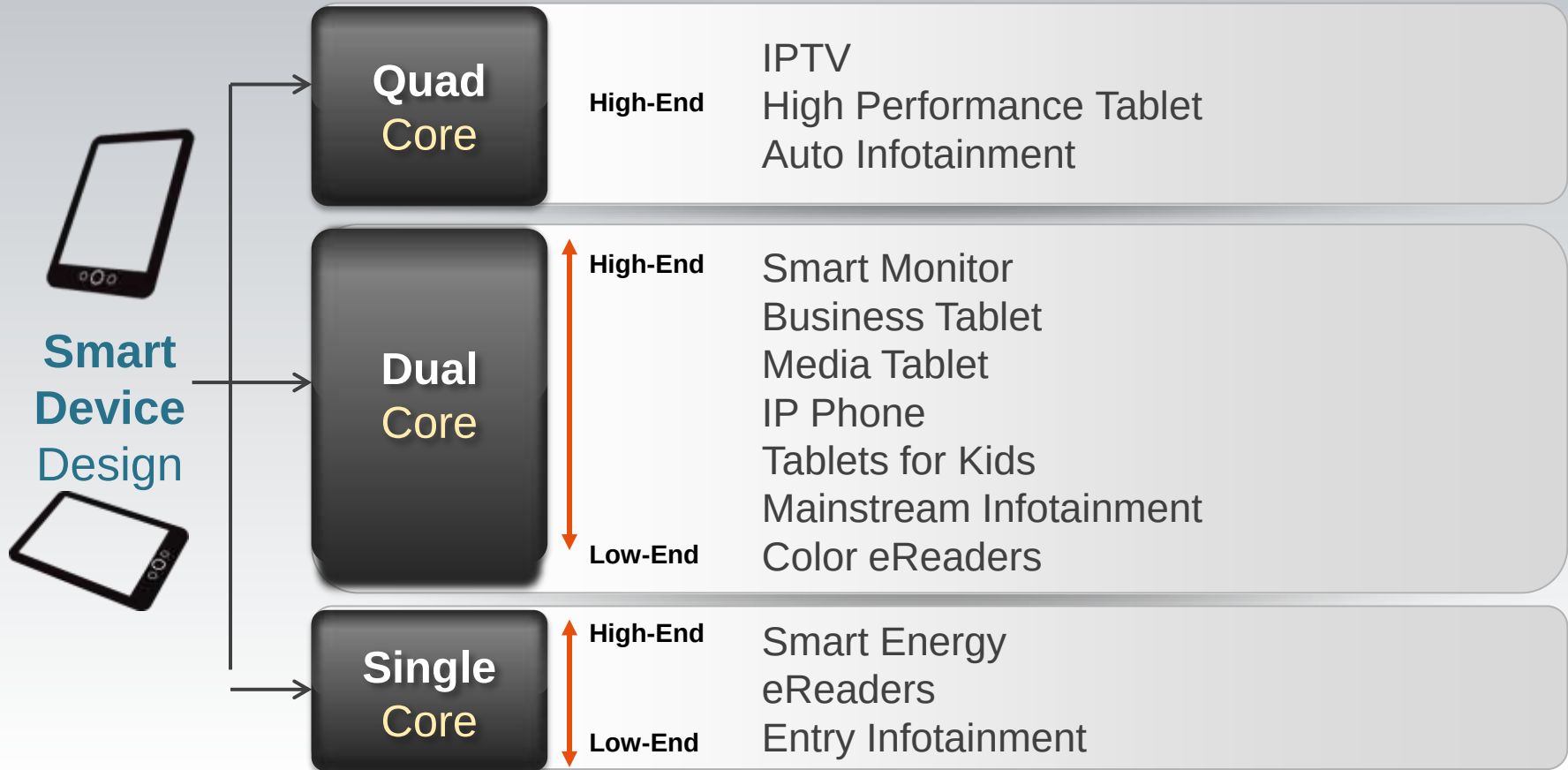
ARM recently announced the Cortex-A50 series which is based on the ARMv8 architecture and is capable of 64- and 32-bit execution. The series initially includes the Cortex-A57 and Cortex-A53 processors. The Cortex-A57 processor is ARM's most advanced high-performance processor, while the Cortex-A53 processor is the most power-efficient ARM applications processor, as well as the world's smallest 64-bit processor.

- The embedded market needs **long-term product support**
- Freescale has a longstanding track record of **providing long-term production support** for our products
- Freescale is pleased to introduce a **formal product longevity program** for the market segments we serve
 - For the automotive and medical segments, Freescale will make a broad range of program devices available for a minimum of **15 years**
 - For all other market segments in which Freescale participates, Freescale will make a broad range of devices available for a minimum of **10 years**
 - **Life cycles** begin at the time of launch
- A list of participating **Freescale products** is available at: www.freescale.com/productlongevity

[illegible]

i.MX 6: One Platform, Differentiated Products

Saves development costs and improves time to market.
Scalability with multiple cores is key to implement this strategy.



Supreme Scalability: One Design, Many Products

- **Scalable** series of five ARM Cortex A9-based SoC families



i.MX 6 Series At a Glance

Red indicates change from column to the left

i.MX 6SoloLite

- Single ARM® Cortex™-A9 at 1.0GHz
- 256KB L2 cache, Neon, VFPv16, Trustzone
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller



i.MX 6Solo

- Single ARM Cortex-A9 at 1.0GHz
- **512KB** L2 cache, Neon, VFPv4, Trustzone
- **3D graphics** with 1 shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller



i.MX 6DualLite

- **Dual** ARM Cortex-A9 at 1.0GHz
- 512KB L2 cache, Neon, VFPv16, Trustzone
- 3D graphics with 1 shader
- 2D graphics
- **64-bit** DDR3 and 2-channel 32-bit LPDDR2 at 400MHz
- Integrated EPD controller



i.MX 6Dual

- **Dual** ARM Cortex-A9 at 1/**1.2GHz**
- **1 MB** L2 cache, Neon, VFPv4, TrustZone
- 3D graphics with **4 shaders**
- **Two** 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at **533MHz**
- Integrated **SATA-II**



i.MX 6Quad

- **Quad** ARM Cortex-A9 at 1.2GHz
- 1 MB L2 cache, Neon, VFPv16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II



i.MX 6 Series Highlights

- ARM Cortex-A9 based solutions ranging up to 1.2GHz
- HD 1080p encode and decode (except 6SL)
- 3D video playback in High definition (except 6SL)
- Low power 1080p playback at 350mW Integrated IO's that include HDMI v1.4, MIPI and LVDS display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0 and PCI-Express
- SW support: Google Android™, Windows® Embedded CE, Ubuntu, Linux®, Skype™

Features vary by product family

Intelligent Integration of Multi-Media

i.MX 6Dual/6Quad VPU

- H.264 MVC1080p60 decode
- H.264 MVC 720p60 encode
- 350mW power consumption for single video!



Recording Video



Movie Content



Game Content

i.MX 6Dual/6Quad IPU

- Four Display support (2x MIPI-DSI, Parallel, HDMI v1.4a)
- Stereoscopic camera input
- Color adjustments and gamut mapping
- Gamma correction and contrast stretching
- Compensation for low-light conditions & backlight reduction



3D LCD



Publish



3D Television

i.MX 6Dual/6Quad Triple-Play Graphics

- 3 engines: 3D, OpenVG and BLT
- 200 MT/s, 4 shaders, 3 separate engines
- High quality 3D games optimized for mobile
- Augmented reality views (real world + 3D objects)
- Advanced 3D video formats (source/depth format)

i.MX 6Dual/6Quad– 2x/4x cores

- Create, transform, enhance, & publish multimedia fast!
- Intuitive User Interfaces for content viewing
- Scalability for 'the next big use case'



A stylized white geometric pattern, resembling a series of parallel lines or a stylized letter 'E', is set against a vibrant orange background. The pattern is composed of several white rectangular blocks arranged in a staggered, grid-like fashion. The background features a subtle, darker orange geometric pattern of overlapping triangles and quadrilaterals.

Android Support Quad Core

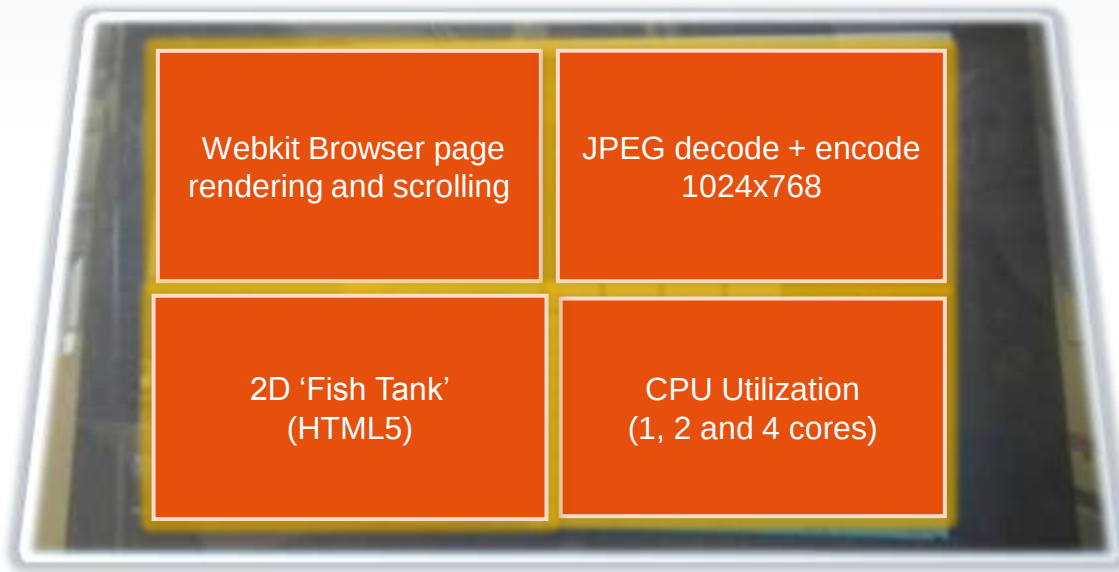
The Good News: Heavy Lifting Already Done

The work required to go from 1 to 2 cores was much greater than to go from 2 to 4 (or more) cores... Android 3.0 (Honeycomb) natively supported Quad core out of the box in June 2011

If you have 4 threads and 4 cores, Android will schedule a thread per core



Why Dual or Quad Core? Example 1



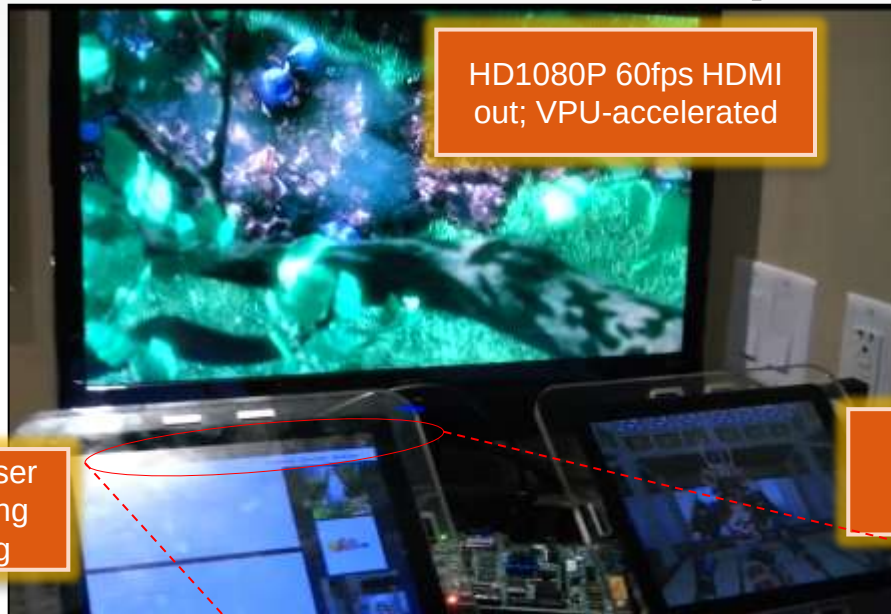
- All workloads implemented on CPU
- Does not use HW accelerators at all
- Done in order to test CPU capabilities

App	1 Core	2 Core	4 Core	Quad speedup vs Dual Core
JPEG	.2 fps	~1fps	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	15	>50% faster
Browser FPS	3.45	27.58	64.4	>2x higher
Fish Tank FPS	~14-20fps	~18-25fps	~22-30fps	~25% higher

Watch it live!

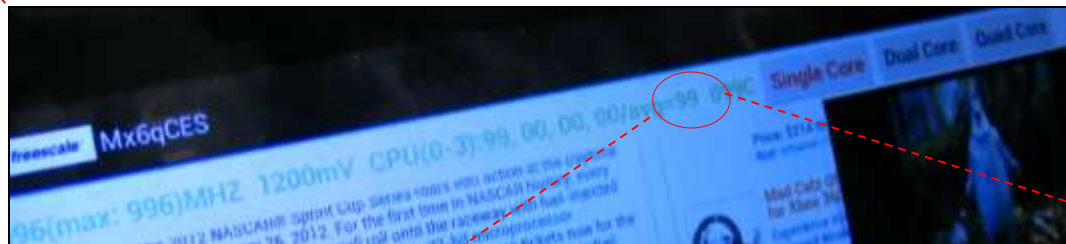
[http://www.youtube.com/watch?v=JYFmBlk3itI#t=2m49s ...](http://www.youtube.com/watch?v=JYFmBlk3itI#t=2m49s)

Quad core enables lower power than Dual core



Webkit Browser page rendering and scrolling

3D gaming;
GPU-accelerated



	1 Core	2 Core	4 Core
CPU utilization	99%	~55-67%	~33%

Watch it live!

<http://www.youtube.com/watch?v=dE5TlzOz9NI&list#t=7m07>



A stylized white geometric pattern, resembling a series of parallel lines or a stylized letter 'E', is centered on a vibrant orange background. The pattern is composed of several white rectangular blocks arranged in a staggered, grid-like fashion. The background has a subtle, darker orange geometric pattern, creating a layered effect.

i.MX 6 Dual/Quad: Triple-Play Graphics Solution

- GPUv4 @ 533MHz
- 200M triangles / sec
- 4 Shader Cores: 30 GFLOPS
- Halti support



Vector Graphics

- GPU-VG @ 500MHz
- 350M pixels/sec raw performance
- Native OpenVG™ 1.1 Khronos conformance with hardware tessellation



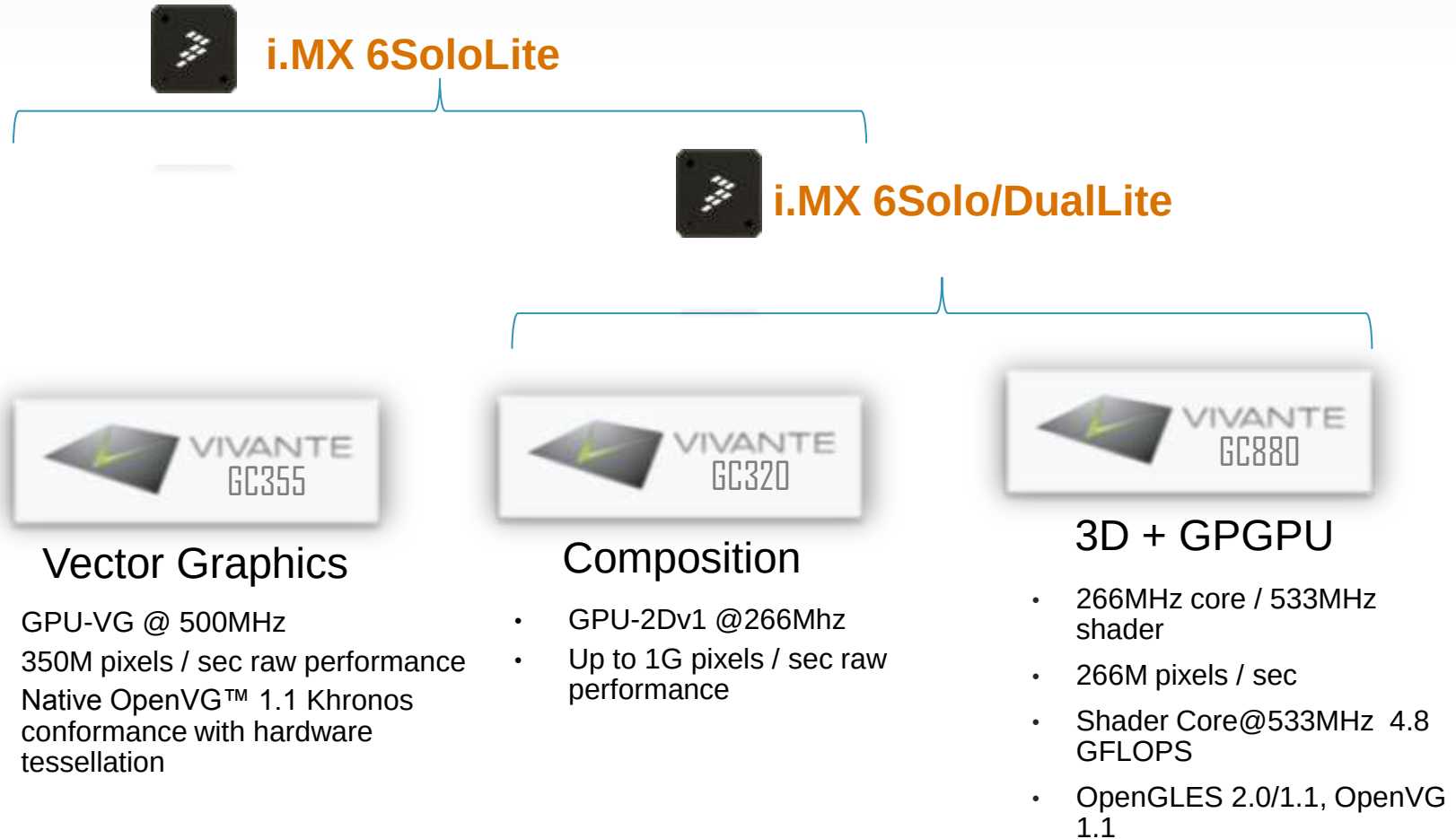
3D + GPGPU



Composition

- GPU-2Dv1 @500Mhz
- Up to 1G pixels / sec raw performance

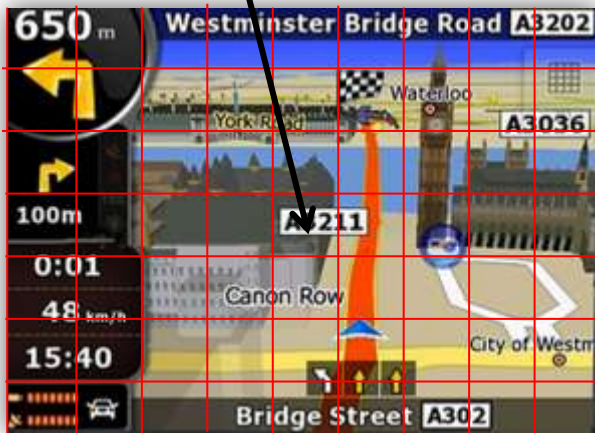
i.MX 6 Solo/DualLite&SoloLite: Graphics Solution



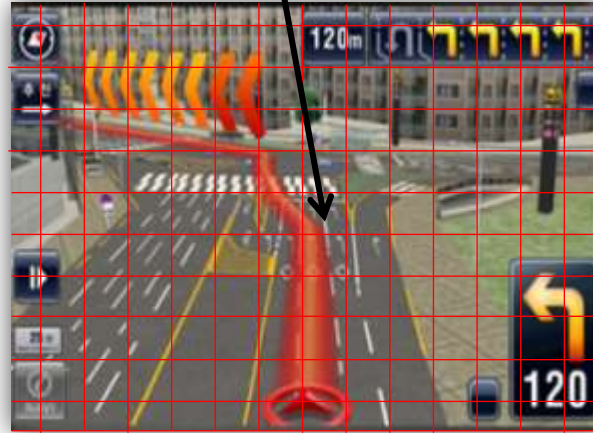
Tile Based Rendering (Chunkers)

- Size of scene buffer unknown before rendering
- Good rendering method for baseline GUI/3D Apps with smaller object count (less details)
- For next generation dynamic scenes in new and future applications with lots of objects, details and post-processing effects, tile based Chunkers require multi-pass memory access to constantly process changing 3D/scene data

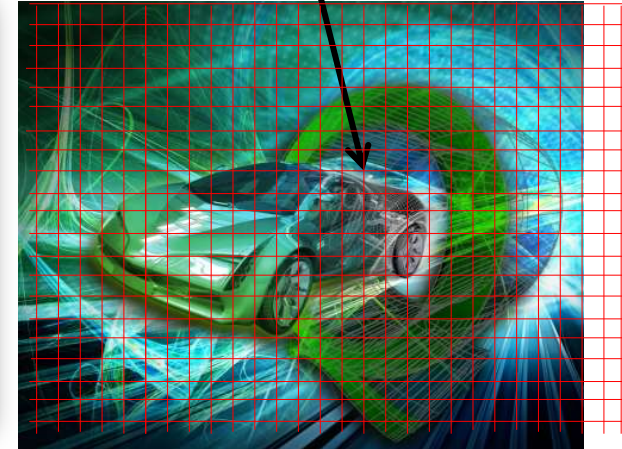
Tile



Tile

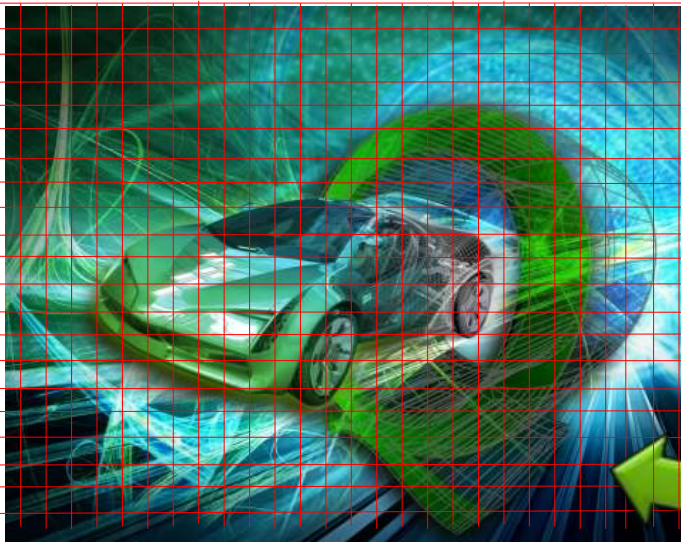
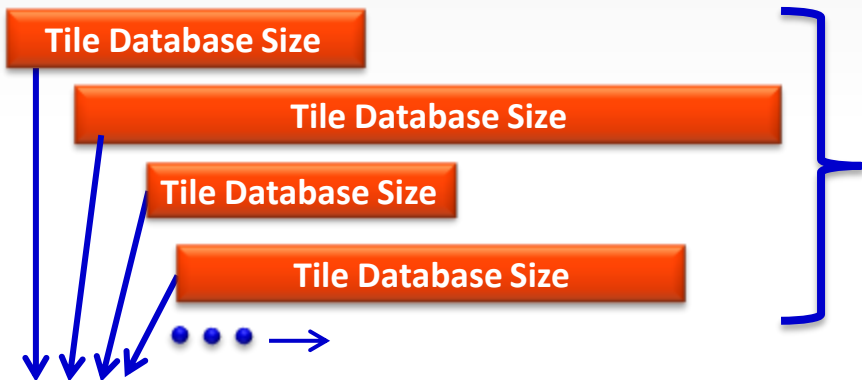


Tile (Complex Scene)



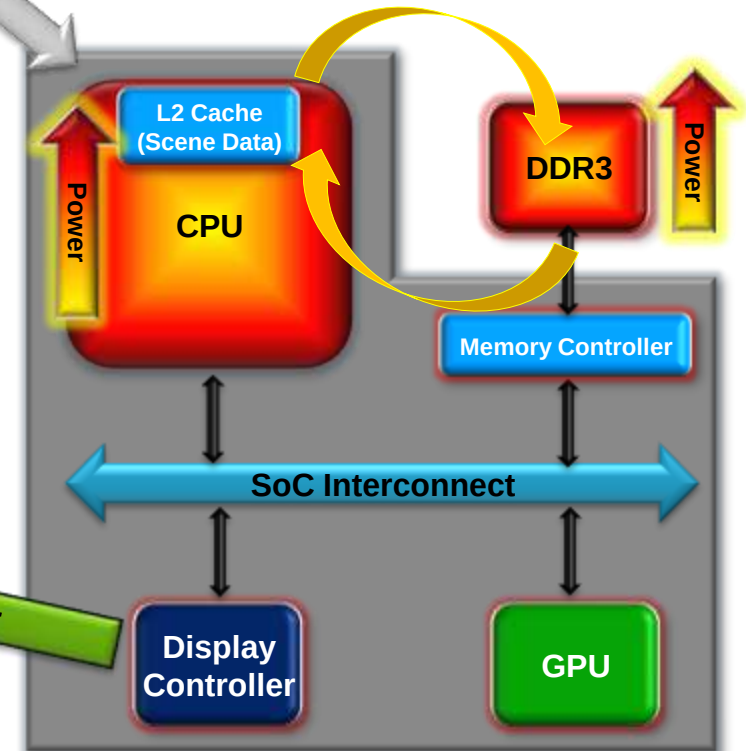
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Chunking Rendering Example

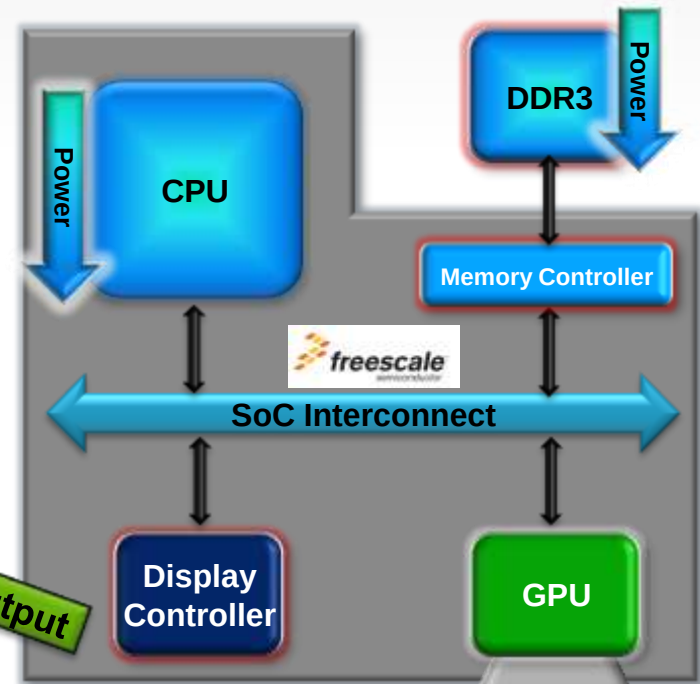


Overflow and Cache Miss:

- L2\$ → System Memory → L2\$
- L2\$ cannot hold entire tile database
- Textures need to be loaded into L2\$ due to high cache miss (thrashing)
- Constant off-chip memory access increases power consumption

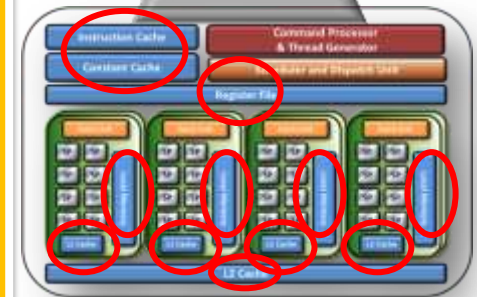


i.MX 6 Series Fast Mode Rendering



Heavy Use of Cache/ Local Storage

- **Distributed network of cache / local memory available for shaders and GPU core functions (minimal DDR transactions)**
- **Memory “burst building” architecture**
- **GPU merges multi-group transactions to DDR**
- **Intelligent banking architecture**
- **High level of data/texture compression**





Current Benchmark Results – GC2000 (i.MX 6Q/6D)

Benchmark	Framerate @ XGA
3DMarkMobile ES 1.1: Proxycon	108 FPS
3DMarkMobile ES 1.1: Samurai	103 FPS
3DMarkMobile ES 2.0: Taiji Girl	35 FPS
3DMarkMobile ES 2.0: Hover Jet	25 FPS

Video Processing Unit



	Standard	Profile	Performance (2D or 3D)		Bitrate
HW Decoder	MPEG-2	Main-High	2D	1080i/p+720p@30fps Dual 720p @30fps Dual 1080i/p @30ps	50Mbps
	H.264	BP/MP/HP-L4.1			50Mbps
	VC1	SP/MP/AP-L3			45Mbps
	MPEG4	SP/ASP			40Mbps
	DivX/XviD	3/4/5/6			40Mbps
	AVS	Jizhun			40Mbps
	H.263	P0/P3	1080p+720p@30fps Dual 720p @30fps Dual 1080p @30fps	20Mbps	
	MJPEG	Baseline	8k x 8k	120Mpel/s	
	On2 VP8	--	720p@30fps 1080p@30fps for iMX6 Q/D (TBD) 1080p@30fps for iMX6 D/S	20Mbps	
	H.264-MVC for 3D (FW/HW)	H.264-MVC SHP	3D	720p@30fps each view 1080p@24fps each view 1080p@30fps each view (TBD)	40Mbps
	Simulcast for 3D	Two independent streams		720p@30fps each view 1080i/p@24fps each view 1080i/p@30fps each view (TBD)	50Mbps
Frame-packing for 3D	Combine two frames into one	1080p@30fps decode → 1080p@30fps each view playback		50Mbps	
HW Post-proc	Rotation, mirror, deblocking/deringing				

i.MX 6 Series VPU: *Encoder*

	Standard	Profile	Performance (2D or 3D)		Bitrate
HW Encoder	H.264	BP	2D	1080p@30fps 720p@60fps	20Mbps
	MJPEG	Baseline		8k x 8k	160Mpel/s
	MPEG4	Simple		720p@30fps	15Mbps
	H.263	P0/P3		720p@30fps	15Mbps
	H.264-MVC for 3D	Stereo HP (no interview prediction)	3D	720p@30fps each view 1080p@24fps each view (TBD)	20Mbps
	Simulcast for 3D	Any VPU encoder supported profiles		720p@30fps each view 1080p@24fps each view (TBD)	20Mbps
	Frame-packing	Any VPU encoder supported profiles		1080p@30fps encoding → 1080p@30fps each view capture	20Mbps

i.MX 6 Series VPU: *Multi-streams*

	Standard	Profile	Max # Streams			
			D1@ 30fps	720p@ 30fps	1080p@ 24fps	1080p@ 30fps
HW Decoder	H.264	BP/MP/HP	8	3	2	1
	On2 VP8	--	4	2	1	1 (iMX6Q/D, TBD) 1 (iMX6D/S)
	VC1	SP/MP/AP	8	3	2	1
	MPEG4	SP/ASP	8	3	2	1
	H.263	P0/P3	8	3	2	1
HW Encoder	H.264	BP	6	2	2 (TBD)	1
	MPEG4-SP/H.263	MPEG4-SP H.263-P0/P3	6	2	--	--

i.MX 6 Series VPU: *Transcoding & Full-duplex* *On-fly-transcoding*

Source Resolution (decoded stream)	Max # Streams @ 30fps Target Resolution (encoded stream)		
	SD (720x480)	HD720p (1280x720)	HD1080p (1920x1080)
SD	4	--	--
HD720p	2	2 (24fps, TBD))	--
HD1080p	1	1	1 (24fps) 1 (TBD for 30fps)

Full-duplex

	Standard	Profile	Performance	
Full-duplex HW Codec	H.264	BP	720p@30fps, 1080p@24fps	20Mbps
			1080p@30fps (TBD) Dual 720p@30fps (TBD) <i>(TBD, current VPU standalone testing shows 29fps for bitrate less than 5Mbps, but see room for encoder optimization)</i>	5Mbps
	MPEG4	Simple	720p@30fps	15Mbps
	H.263	P0/P3	720p@30fps	15Mbps



Development System



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- **i.MX 6SoloLite**
- Single DDR
- EPD

1150

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11/11/2011



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Freescal e i.MX 6 series Development Systems

SABRE Board for Smart Devices



P/N: MCIMX6Q-SDB

- **Cost-effective** open source development platform
- Designed to **simplify product evaluation**

SABRE Platform for Smart Devices



**P/N: MCIMX6Q-SDP
MCIMX6DL-SDP**

- Smart Device Market-focused
- Form-factor ready to **accelerate design** & time to market

SABRE Platform for Automotive Infotainment



**P/N: MCIMXABASEV1
MCIMX6SAICPU1
MCIMX6QAICPU1**

- Automotive Market-focused
- Standard base board and adaptable CPU card system

SABRE Board for Smart Devices (SDB)

i.MX 6Quad 1Ghz Cortex-A9 Processor

- Can be configured as i.MX 6Dual
- Freescale MMPF0100 PMIC
- 1 GB DDR3 memory (non terminated)
- 3" x 7" 8-layer PCB

Display connectors

- 2x LVDS connectors
- Connector for 24 bit 4.3" 800x480 WVGA with 4-wire touch screen
- HDMI Connector

Audio

- Wolfson Audio Codec
- Microphone and headphone jacks

Expansion Connector

- Camera CSI port signals
- I2C, SSI, SPI signals

Part Numbers: MCIMX6Q-SDB

MCIMX6Q-SDB

Display (9.7"): MCIMX-LVDS1

MCIMX-LVDS1

Display (4.3"): MCIMX28LCD

MCIMX28LCD



Connectivity

- 2x Full-size SD/MMC card slot
- 22-pin SATA connector
- 10/100/1000 Ethernet port
- 1x high-speed USB OTG port
- mPCI-e connector

Debug

- JTAG connector
- Serial to USB connector

Additional Features

- 3-axis Freescale accel
- eCompass
- Power supply
- No battery charger

OS Support

- Linux and Android IceCream Sandwich from Freescale;
- Others: support by 3rd parties

Tools Support

- Lauterbach, ARM (DS-5), Macraigor debug/IDE tool chain

SABRE Platform for Smart Devices (SDP)

i.MX 6Quad 1GHz Cortex-A9 Processor
i.MX 6DualLite 1GHz Cortex-A9 Processor

- Freescale MMPF0100 PMIC
- 1 GB DDR3 memory (non terminated)
- 3" x 7" 8-layer PCB

Display connectors

- Native 1024x768 LVDS display (comes with kit)
- 2nd LVDS connector
- Connector for 24 bit 4.3" 800x480 WVGA with 4-wire touch screen
- HDMI Connector
- MIPI DSI connector

Audio

- Wolfson Audio Codec
- Microphone and headphone jacks
- Dual 1W Speakers

Expansion Connector

- Enables parallel LCD or HDMI output
- Camera CSI port signals
- I2C, SSI, SPI signals

Part Numbers:

MCIMX6Q-SDP
MCIMX6DL-SDP

Display (4.3"):
WiFi:

MCIMX28LCD
SX-SDCAN-2830BT



Connectivity

- 2x Full-size SD/MMC card slot
- 22-pin SATA connector
- 10/100/1000 Ethernet port
- 1x high-speed USB OTG port
- mPCI-e connector

Debug

- JTAG connector
- Serial to USB connector

Additional Features

- 3-axis Freescale accel
- GPS receiver
- Ambient Light Sensor
- eCompass
- Dual 5MP Cameras
- Power supply
- Battery Charger
- Battery connectors

OS Support

- Linux and Android IceCream Sandwich from Freescale;
- Others: support by 3rd parties

Tools Support

- Lauterbach, ARM (DS-5), Macraigor debug/IDE tool chain

- **Power and Memory**
- Freescale MMPF0100 PMIC
- 2 GB DDR3 memory (i.MX 6Dual/Quad)
- 1GB DDR3 memory (i.MX 6Solo)
- 32GB Parallel NOR Flash
- NAND Socket

- LVDS connector
 - compatible with MCIMX-LVDS1
- Parallel RGB display interface
- HDMI output connector

- JTAG connector
- Debug UART connector

- SD Card Slot
- High Speed USB OTG
- Ethernet
- SATA
- MIPI CSI
- PCIe
- MLB150 INIC connector
- 281-pin MXM card edge connector for main board expansion

SABRE AI boards will only be supported at automotive customers

Base Board: MCIMXABASEV1
CPU Cards: MCIMX6SAICPU1
 MCIMX6QAICPU1
Display: MCIMX-LVDS1

Can be reused from i.MX53 SABRE AI Connectivity and Expansion

- SD card slot (WiFi module or SD)
- Bluetooth or Bluetooth+WiFi header
- AM/FM tuner header
- Sirius XM Module header (de-pop'd)
- GPS (UART) module connector
- 2x CAN
- Dual High Speed USB Host connectors
- MLB 25/50 INIC connector
- SPI NOR flash

- LVDS connector
 - compatible with MCIMX-LVDS1
- Analog Video Input
- LVDS Input

- Cirrus multichannel audio codec
 - Up to 8 outputs
 - Dual microphone inputs
 - Stereo Line Level Input
- SPDIF receiver

- Linux
- Others: future support by 3rd parties



i.MX 6SL Development Platform Key Features

Processor

- Freescale i.MX 6SL 1 GHz ARM® Cortex™-A9 CPU
- Freescale PF0100 PMIC

Memory

- 512 MB Double Data Rate2 Mobile (LPDDR2) DRAM memory
- Footprint for Managed NAND (eMMC/eSD)
- SPI Flash
- Three Secure Digital (SD)/multimedia card (MMC) sockets

Display

- HDMI Daughter Card available
- Parallel WVGA LCD add-on card via expansion connector
- EPD add-on card via expansion connector

Audio

- Audio HP Jack
- External speaker connection
- Microphone

Connectivity

- USB Host connectors
- Micro USB OTG connector
- Ethernet (10/100T) connector
- SIM Card Socket
- Mini PCIe connector

Debug

- JTAG connector
- One console UART

Other

- MMA8450QT three-axis digital accelerometer (SABRE)

Tools & OS Support

- VMware player to bring up image on a Windows PC
- Linux® and Android™ BSPs from Freescale
- LTIB



Qualified Wi-Fi Solutions for i.MX 6 Series

- **802.11a/b/g/n WLAN SDIO card based on Qualcomm Atheros AR6003 technology**
- **Wi-Fi-driver readily integrated with various i.MX 6 development systems**
- **Low power design ideal for portable battery operated device applications**

Key Features:

- High performance, single stream (1x1), 2.4GHz/5GHz dual-band WiFi module
- SDIO card form factor
- 2 x U.FL external antenna connector
 - Optional TX/RX antenna diversity
- **Family of production “ready” hardware available**
 - SiP (System-in-Package)
 - Surface mount type
 - Board-Board connector type

Order at:

http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=i.MX6Q&fpp=1&tab=Design Tools Tab

Part Number: SX-SDCAN-2830BT



SPECIFICATIONS:

Product Name	SX-SDCAN-2830BT
Chipset	Qualcomm Atheros AR6233
Wireless	IEEE 802.11a/b/g/n
Host Interface	SDIO v2.0
Operating Voltage	3.30VDC +/- 5%
OperatingTemperature	-10 to + 70 degrees C
Regulatory Approvals	FCC/IC (US/Canada) R&TTE (EU), TELEC (Japan)
Solution Partner	Silex Technology (US/Japan)

Summary



- i.MX 6 Series Advantages

- 

www.imxcommunity.org

A Freescale supported open web community of developers sharing common interest in transforming i.MX applications processors into practically anything imaginable.

Community Facts at a Glance

- Over 3,800 members and over 200 Freescale engineers and marketers interacting with you
- Support and enablement for i.MX processors and software
- Forums, Groups and Blogs Posts
- News, Photos and Videos
- Training, Events and Promotions

