Welcome to E-XFL.COM

Understanding Embedded - Microprocessors

Embedded microprocessors are specialized computing chips designed to perform specific tasks within an embedded system. Unlike general-purpose microprocessors found in personal computers, embedded microprocessors are tailored for dedicated functions within larger systems, offering optimized performance, efficiency, and reliability. These microprocessors are integral to the operation of countless electronic devices, providing the computational power necessary for controlling processes, handling data, and managing communications.

Applications of Embedded - Microprocessors

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Obsolete
Core Processor	ARM® Cortex®-A9, ARM® Cortex®-M4
Number of Cores/Bus Width	2 Core, 32-Bit
Speed	200MHz, 800MHz
Co-Processors/DSP	Multimedia; NEON™ MPE
RAM Controllers	DDR3, LPDDR2, LVDDR3
Graphics Acceleration	Yes
Display & Interface Controllers	Keypad, LCD
Ethernet	10/100/1000Mbps (2)
SATA	-
USB	USB 2.0 + PHY (1), USB 2.0 OTG + PHY (2)
Voltage - I/O	1.8V, 2.5V, 2.8V, 3.15V
Operating Temperature	-40°C ~ 105°C (TJ)
Security Features	A-HAB, ARM TZ, CAAM, CSU, SNVS, System JTAG, TVDECODE
Package / Case	400-LFBGA
Supplier Device Package	400-MAPBGA (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mcimx6x1cvk08ab

Objectives

- Learn about the Freescale i.MX 6 series of application processors' key features, capabilities, uses and market segment targets
- Learn about the Development Ecosystem available for the i.MX 6 Series family of processors
- Understand the power and performance advantages of the 6 Series family

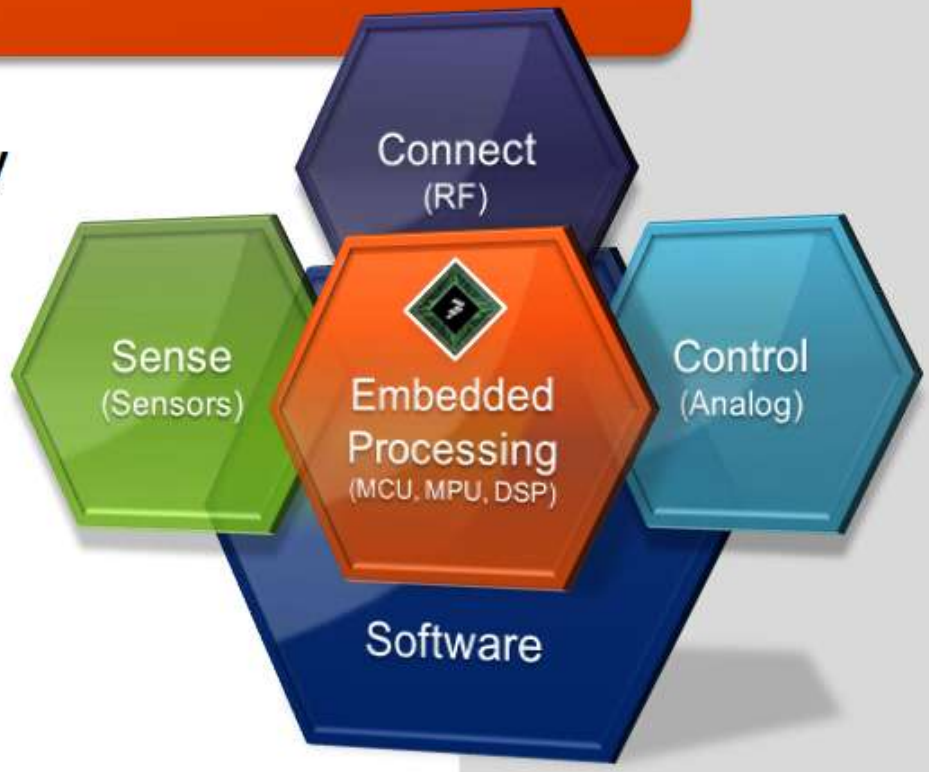
A Global Leader of
Embedded Processing Solutions

Two Core Product Groups

- Automotive, Industrial & Multi-Market Solutions
  - Microcontrollers
  - Sensors
  - Analog
- Networking and Multimedia Solutions
  - Communications Processors
  - Applications Processors
  - RF Power

Four Primary Markets

- Automotive
- Industrial
- Networking
- Consumer



Platform-Level Solutions

>50 Year Legacy

>5,500 Engineers

>6,000 Patent Families

>18,000 Customers

freescale™

Freescale i.MX Applications Processors

i.MX 6Quad

High Performance Tablet

Media Box

Luxury Infotainment

Advanced HMI

i.MX 6Dual
i.MX 6DualLite

i.MX53

Color eReader

Business Tablet

Mainstream Infotainment

Medical

i.MX 6Solo
i.MX 6SoloLite

i.MX28, i.MX233, i.MX25, i.MX35, i.MX50

Monochrome eReader

Single Function Tablet

Connected Radio

Smart Energy Meter

Performance/ Multimedia Capability

Content Creation, Technology Driver

Good, Better, Best Differentiation

freescale™

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.

Smart Device Design

Quad Core

High-End

IPTV
High Performance Tablet
Auto Infotainment

Dual Core

High-End

Low-End

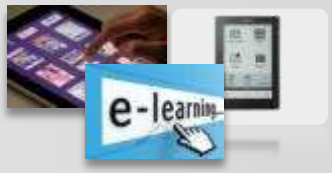
Smart Monitor
Business Tablet
Media Tablet
IP Phone
Tablets for Kids
Mainstream Infotainment
Color eReaders

Single Core

High-End

Low-End

Smart Energy
eReaders
Entry Infotainment



i.MX 6 Series Triple-Play Graphics support

i.MX 6Solo / i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
		
Composition (2D BLIT)	Composition (2D BLIT)	Composition (2D BLIT)
		
	Vector Graphics	Vector Graphics
		
3D + GP GPU 1 shader core	3D + GP GPU 4 shader cores	3D + GP GPU 4 shader cores

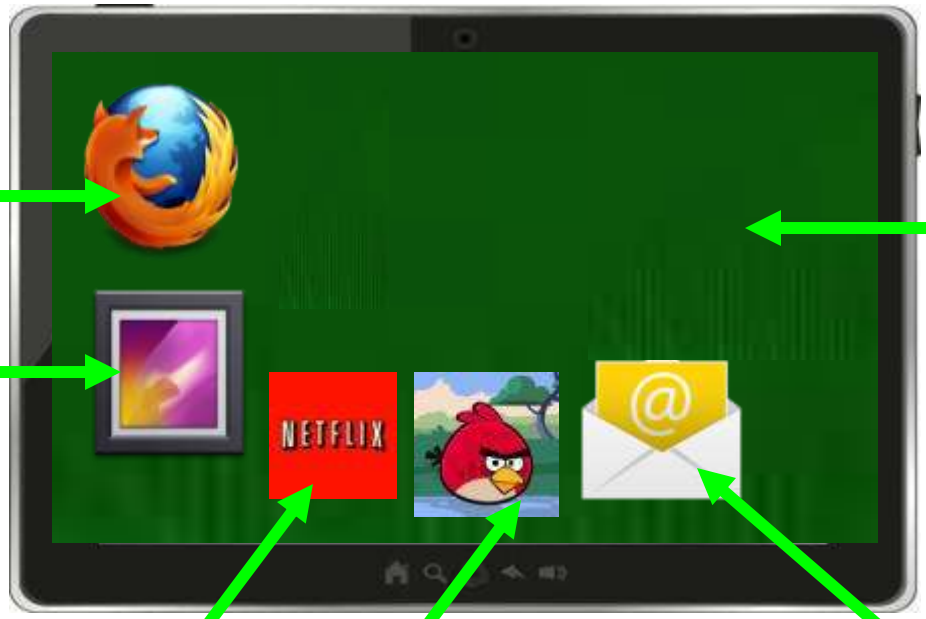
Same GPU drivers for all i.MX 6 Processors

Good tablet application performance requires a balanced processor architecture (CPU speed, Memory BW, HW Accelerators)

Application
-HW Dependency #1
-HW Dependency #2
-HW Dependency #3
-**User satisfaction 'metric'**

Browsing
-CPU speed (rendering)
-Video HW unit
-Memory bandwidth
-**Fast page draw**

Imaging
-JPEG HW dec
-Memory bandwidth
-2D perf (swipe)
-**Fast image viewing**



User Interface
- CPU speed (geometry)
- 3D HW unit
- Memory BW
-**Responsiveness**

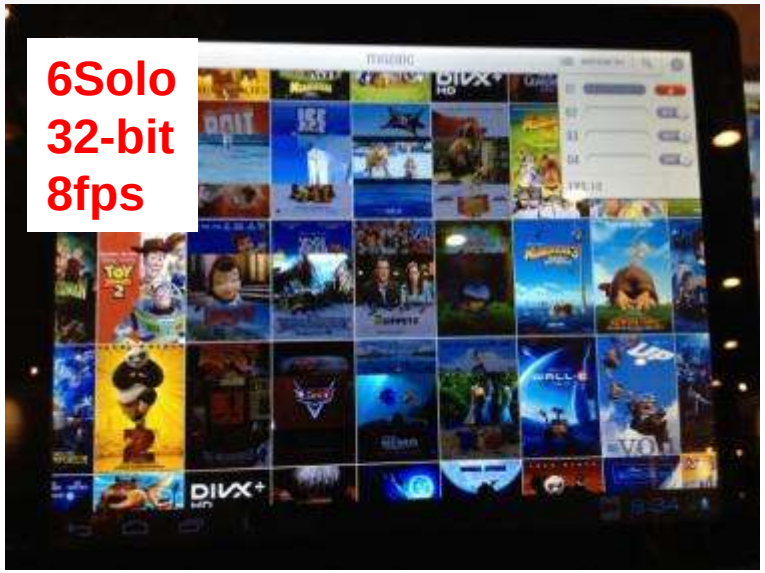
Video Playback/Streaming
-HW video unit
-Memory bandwidth
- **jitter-free video**

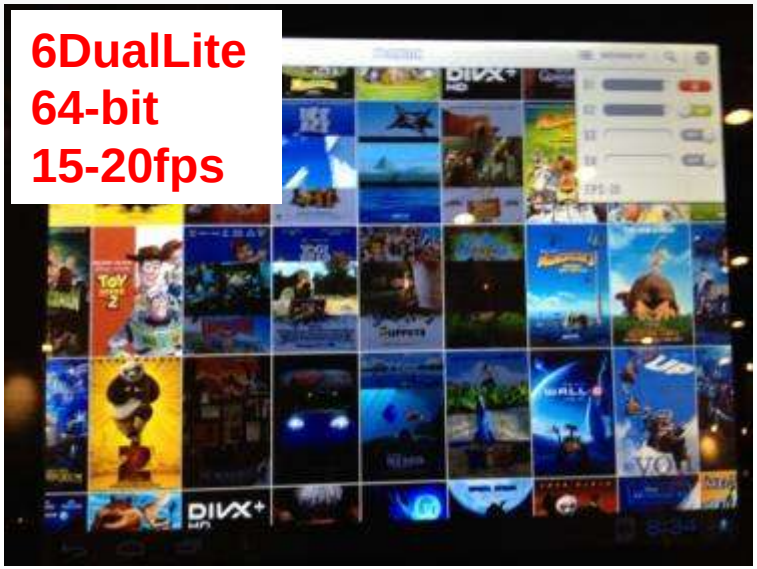
Games
-CPU speed (geometry)
-3D HW unit (TPS)
-Memory Bandwidth (complexity)
- **Richer graphics, no 'lag'**

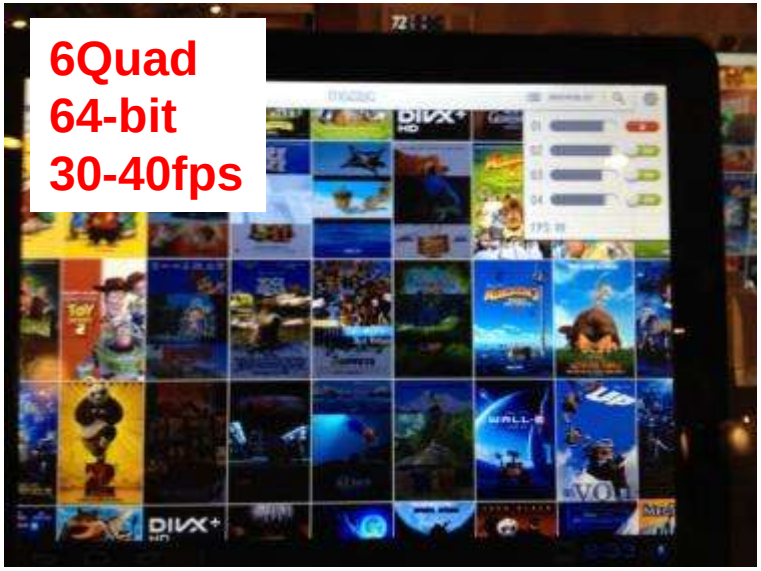
Email/IM
- CPU speed
- Memory Bandwidth
-**Responsiveness**

freescale™

User Interfaces in Action – Dual Core + 64-bit matters







Browsing and Image Viewing

Webkit Browser page rendering and scrolling

JPEG decode + encode 1024x768

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

App	1 Core	2 Core	Dual Core vs Single Core	4 Core	Quad Core vs Dual Core
JPEG	.2 fps	~1fps	5x faster	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	>87% faster	15	>50% faster
Browser FPS	3.45	27.58	8x higher	64.4	>2x higher

Watch it live!
http://www.youtube.com/watch?v=JYFmBIk3itI#t=2m49s …

Gaming Performance

- **Benchmarking 3D game performance is tricky**
  - Dependent upon the 3D HW, the CPU speed and memory BW
  - Must balance all three to get best performance
- **Review websites use generally available benchmarks to rate tablets**
  - Example: Basemark, NenaMark, Antutu, Quadrant

Taiji Girl (Basemark ES2)

NenaMark2 3D Benchmark

AnTuTu Benchmark

Quadrant Benchmark

	6Quad	6DualLite	6Solo	Tegra2
Taiji Girl	25.65 fps	9.2 fps	7.67 fps	6 fps
NenaMark	49.2	30.5	27.2	21
AnTuTu	9605	5583	4531	4904
Quadrant	4011	3005	2414	2559

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	--	--

21x21 FCBGA Mechanical structure

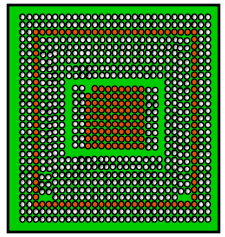
The IMX6Q/D Design

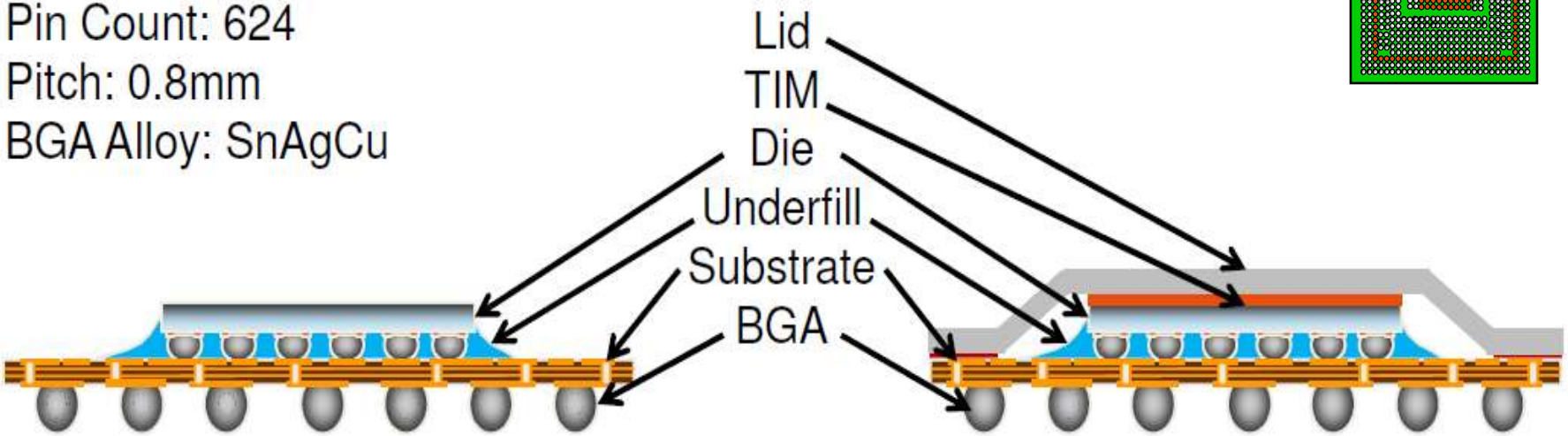
Package: 21x21mm FCPBGA

Pin Count: 624

Pitch: 0.8mm

BGA Alloy: SnAgCu





Stack-ups

Bare Die, 0.4mm core	Min	Nominal	Max
Device	0.280	0.305	0.330
Gap height (UF thickness)	0.070	0.080	0.090
Substrate (2/2/2 0.4mm core)	0.560	0.660	0.760
BGAs	0.300	0.400	0.500
TOTAL (sum of square tolerance)	1.301	1.445	1.589

Lidded, 0.4mm core	Min	Nominal	Max
Lid	0.450	0.5	0.550
Thermal interface Material (TIM)	0.025	0.05	0.075
Device	0.280	0.305	0.330
Gap height (UF thickness)	0.070	0.080	0.090
Substrate (2/2/2 0.4mm core)	0.560	0.660	0.760
BGAs	0.300	0.400	0.500
TOTAL (sum of square tolerance)	1.841	1.995	2.149

Full dimensions available in the i.MX 6 Consumer and Automotive Datasheets on the i.MX 6Quad/6Dual Extranet

i.MX 6Series – Power Consumption Summary

Sleep	**3.8mW**	**Sleep**	**3.8mW**	**Sleep**	**3.9mW**	**Sleep**	**3.1mW**	**Sleep**	**2.6mW**
IDLE	**227mW**	**IDLE**	**220mW***	**IDLE**	**151mW**	**IDLE**	**143mW**	**IDLE**	**14.5mW**
Video	**867mW**	**Video**	**867mW**	**Video**	**772mW**	**Video**	**695mW**	**Video**	**n/a**
3D	**1.6W**	**3D**	**1.6W**	**3D**	**1.1W**	**3D**	**1.1W**	**3D**	**n/a**
TypMax	**3.8W**	**TypMax**	**n/a**	**TypMax**	**2.4W**	**TypMax**	**1.7W**	**TypMax**	**n/a**

n/a = results pending release june 30th

*** 6Dual cores are estimated on 6Quad by clock gating two cores**

- All results include power at the chip (cores, accelerators, peripherals, DDR I/O) as well as the power consumption of the external DDR3 ICs.
- Power application notes listed in the presentation contain the full breakouts for the chip and DDR3. Note that use of LPDDR2 memory will substantially reduce memory IC power consumption

Scalable Performance and Power Consumption
'One Series fits all'

freescale™

i.MX 6 Series feature list (1/4)

Red indicates change from column to the left

	i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
Cortex-A9	1x 1GHz Cortex-A9 2400 DMIPS	1x 800MHz-1GHz Cortex-A9 2400 DMIPS	**2x** 800MHz-1GHz Cortex-A9 **4800 DMIPS**	2x 800MHz-1.2GHz Cortex-A9 **5700 DMIPS**	**4x** 800MHz-1.2GHz Cortex-A9 **11500 DMIPS**
Cortex-M4	-	-	-	-	-
On-Chip Memory	256KB L2 + 32K+32K I/D L1 + 256KB SRAM	**512KB L2** + 32K+32K I/D L1 + 128KB SRAM	512KB L2 & 32K+32K I/D L1 + 128KB SRAM	**1MB L2** + 32K+32K I/D L1 + **256KB** SRAM	1MB L2 + 32K+32K I/D L1 + 256KB SRAM
Process Tech	40nm, LP	40nm, LP	40nm, LP	40nm, LP	40nm, LP
DRAM Interface	Up to 2GB 1x32 LP-DDR2, 1chx32 DDR3 or DDR3L	Up to **4GB** 1x32 LP-DDR2, 1chx32 DDR3 or DDR3L	Up to 4GB **2x32** LP-DDR2, **1chx64** DDR3 or DDR3L	Up to 4GB 2x32 LP-DDR2, 1chx64 DDR3 or DDR3L	Up to 4GB 2x32 LP-DDR2, 1chx64 DDR3 or DDR3L
Max DDR Speed	400MHz (800MT/s)	400MHz (800MT/s)	400MHz (800MT/s)	**533MHz (1066MT/s)**	533MHz (1066MT/s)
External Flash Support	-	**8-bit SLC/MLC NAND, 40-bit ECC, ONFI2.2**	8-bit SLC/MLC NAND, 40-bit ECC, ONFI2.2	8-bit SLC/MLC NAND, 40-bit ECC, ONFI2.2	8-bit SLC/MLC NAND, 40-bit ECC, ONFI2.2
	16/32-bit NOR	16/32-bit NOR	16/32-bit NOR	16/32-bit NOR	16/32-bit NOR
	eMMC 4.4	eMMC 4.4	eMMC 4.4	eMMC 4.4	eMMC 4.4
	-	-	-	-	-
	4x SPI	4x SPI	4x SPI	**5x** SPI	5x SPI

…MX 6 Series feature list (2/4)

Red indicates change from column to the left

	i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
Ethernet	1x 10/100	**1x GbE*** + IEEE1588 *** performance limited to 480Mbps**	1x GbE* + IEEE1588 * performance limited to 480Mbps	1x GbE*+ IEEE1588 * performance limited to 480Mbps	1x GbE*+ I EEE1588 * performance limited to 480Mbps
USB	3x USB2.0 HS • 1x OTG + PHY • 1x Host + PHY • 1x Host HSIC	**4x** USB2.0 HS • 1x OTG + PHY • 1x Host + PHY • **2x** Host HSIC	4x USB2.0 HS • 1x OTG + PHY • 1x Host + PHY • 2x Host HSIC	4x USB2.0 HS • 1x OTG + PHY • 1x Host + PHY • 2x Host HSIC	4x USB2.0 HS • 1x OTG + PHY • 1x Host + PHY • 2x Host HSIC
CAN	-	**2x FlexCAN**	2x FlexCAN	2x FlexCAN	2x FlexCAN
MLB	-	**MLB 25/50/150**	MLB 25/50/150	MLB 25/50/150	MLB 25/50/150
PCIe	-	**1x PCIe 2.0 (x1 lane)**	1x PCIe 2.0 (x1 lane)	1x PCIe 2.0 (x1 lane)	1x PCIe 2.0 (x1 lane)
SD/MMC	3x SD/MMC 4.4 1x SDXC	3x SD/MMC 4.4 1x SDXC	3x SD/MMC 4.4 1x SDXC	3x SD/MMC 4.4 1x SDXC	3x SD/MMC 4.4 1x SDXC
MIPI	-	**MIPI-CSI2** **MIPI-DSI**	MIPI-CSI2 MIPI-DSI	MIPI-CSI2 MIPI-DSI **MIPI-HSI**	MIPI-CSI2 MIPI-DSI MIPI-HSI
Camera Interface	1x Input • 1x 16-bit Parallel	**2x** Inputs • **2x** 20-bit Parallel • **2x lane MIPI-CSI2**	2x Inputs • 2x 20-bit Parallel • 2x lane MIPI-CSI2	**3x** Inputs • 2x 20-bit Parallel • **4x** lane MIPI-CSI2	3x Inputs • 2x 20-bit Parallel • 4x lane MIPI-CSI2
HDD I/F	-	-	-	**S-ATA II 3Gbps**	S-ATA II 3Gbps
Audio Acc.	-	**ASRC**	ASRC	ASRC	ASRC
Audio	3x I2S SPDIF Tx/Rx	3x I2S SPDIF Tx/Rx ESAI	3x I2S SPDIF Tx/Rx ESAI	3x I2S SPDIF Tx/Rx ESAI	3x I2S SPDIF Tx/Rx ESAI

i.MX 6 Series feature list (3/4)

Red indicates change from column to the left

	i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
Display Resolution (@60Hz)	WXGA (WXGA=1366x768)	**2x** WXGA	2x WXGA	**2x 4XGA or 2x [1080p + WXGA]** (4XGA=2048x1536)	2x 4XGA or 2x [1080p + WXGA]
Display Interfaces	2x Outputs • 1x Parallel • EPDC	2x Outputs • **2x** Parallel • **2x** LVDS • **HDMI** • **MIPI-DSI** • EPDC	2x Outputs • 2x Parallel • 2x LVDS • HDMI • MIPI-DSI • EPDC	**4x** Outputs • 2x Parallel • 2x LVDS • HDMI • MIPI-DSI	4x Outputs • 2x Parallel • 2x LVDS • HDMI • MIPI-DSI
GPU 3D	-	**Vivante GC880** • **53Mtri/s** • **266Mpxl/s** • **OpenGL ES 1.1/2.0/3.0**	Vivante GC880 • 53Mtri/s • 266Mpxl/s • OpenGL ES 1.1/2.0/3.0	**Vivante GC2000** • **176Mtri/s** • **1000Mpxl/s** • OpenGL ES 1.1/2.0/3.0 • **OpenCL 1.1 EP**	Vivante GC2000 • 176Mtri/s • 1000Mpxl/s • OpenGL ES 1.1/2.0/3.0 • OpenCL 1.1 EP
GPU 2D (Vector Graphics)	Vivante GC355 • 300Mpxl/s • OpenVG 1.1	via GPU 3D • OpenVG 1.1	via GPU 3D • OpenVG 1.1	**Vivante GC355** • **300Mpxl/s** • OpenVG 1.1	Vivante GC355 • 300Mpxl/s • OpenVG 1.1
GPU 2D (BLIT)	Vivante GC320 • 600Mpxl/s	Vivante GC320 • 600Mpxl/s	Vivante GC320 • 600Mpxl/s	Vivante GC320 • 600Mpxl/s	Vivante GC320 • 600Mpxl/s
Video Dec	SW Only	**1080p30 + D1 MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8**	1080p30 + D1 MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8	**1080p60** + D1 **2x** 1080p30 MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8	1080p60 + D1 2x 1080p30 MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8
Video Enc	-	**1080p30** **2x 720p** H.264, H.263, MPEG-4, MPEG-2, MJPEG	1080p30 2x 720p H.264, H.263, MPEG-4, MPEG-2, MJPEG	1080p30 2x 720p H.264, H.263, MPEG-4, MPEG-2, MJPEG	1080p30 2x 720p H.264, H.263, MPEG-4, MPEG-2, MJPEG

i.MX 6 Series feature list (4/4)

Red indicates change from column to the left

	i.MX 6SoloLite	i.MX 6Solo	i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
UART SPI I2C	5x UART, 4x SPI 4x I2C	4x SPI 5x UART 4x I2C	4x SPI 5x UART 4x I2C	**5x** SPI 5x UART **3x** I2C	5x SPI 5x UART 3x I2C
ADC	-	-	-	-	-
Temp. Monitor	Yes	Yes	Yes	Yes	Yes
PMU	Partial PMU integration	Partial PMU integration	Partial PMU integration	Partial PMU integration	Partial PMU integration
Security	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG	HAB, Secure RAM, Crypto Acc., TrustZone, NIST approved RNG
Commercial Qual.	Available	Available	Available	Available	Available
Automotive Qual. AEC-Q100	-	Available	Available	Available	Available
Industrial Qual.	-	Available	Available	Available	Available
Package	13x13 0.5P BGA	**21x21 0.8P BGA Pin compatible with i.MX 6Dual/Quad**		**21x21 0.8P FCBGA Pin compatible with i.MX 6DualLite/Solo**	

Freescale i.MX 6 series Development Systems

SABRE Board for Smart Devices

P/N: MCIMX6Q-SDB

- **Cost-effective ($399)**, 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 ($999)

SABRE Platform for Automotive Infotainment

P/N: MCIMXABASEV1
MCIMX6SAICPU1
MCIMX6QAICPU1

- Automotive Market-focused
- Standard base board ($699) and adaptable CPU card ($799) system

freescale™

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

Part Numbers: MCIMX6Q-SDP ($999)
MCIMX6DL-SDP ($999)

Display (4.3”): MCIMX28LCD ($199)
WiFi: Silex WiFi module

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

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

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

SABRE Platform for Automotive Infotainment (AI)

CPU Card Details

- **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

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

Debug
- JTAG connector
- Debug UART connector

Connectivity and Expansion
- 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

Part Numbers

Base Board: MCIMXABASEV1 ($699)
CPU Cards: MCIMX6SAICPU1 ($799)
MCIMX6QAICPU1 ($799)
Display: MCIMX-LVDS1 ($499)

Expansion Modules from 3rd party planned availability in Q4 2012

SABRE AI boards will only be supported at automotive customers

Base Board Details

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

Display I/O
- LVDS connector
  - compatible with MCIMX-LVDS1
- Analog Video Input
- LVDS Input

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

OS Support
- Linux
- Others: future support by 3rd parties

History of Android Development

Android	Google Release	First Freescale Release
Cupcake	Android 1.0 (September 2008) Android 1.1 (February 9, 2009) **Android 1.5 (April 2009)**	**R3 (June 2009)**
Donut	**Android 1.6 (September 2009)**	**R5 (September 2009)**
Eclair	Android 2.0 (October 2009) Android 2.0.1 (December 2009) **Android 2.1 (January 2010)**	**R7 (January 2010)**
Froyo	Android 2.2 (May 2010) Android 2.2.1 (January 2011) Android 2.2.2 (January 2011) Android 2.2.3 (November 2011)	**R9 (August 2010)**
Gingerbread	Android 2.3 (December 2010) **Android 2.3.3 (February 2011)** Android 2.3.4 (April 2011) Android 2.3.5 (July 2011) Android 2.3.6 (September 2011) Android 2.3.7 (September 2011)	**R10 (January 2011)**
Honeycomb	Android 3.2 (July 2011) **Android 3.2.1 (September 2011)** Android 3.2.2 (August 2011) Android 3.2.4 (December 2011) Android 3.2.6 (February 2012)	**R11 (September 2011 – i.MX53)** **R12 (September 2011 – i.MX 6D/Q)**
Ice Cream Sandwich	Android 4.0.1 (October 2011) Android 4.0.2 (November 2011) Android 4.0.3 (December 2011) **Android 4.0.4 (March 2012)**	R13 (December 2011) R13.1 (January 2012) R13.3 (June 2012) R13.4 GA (September 2012) *to align to 6Series launch
JellyBean	Android 4.1 (September 2012) Android 4.2 (December 2012)	JB 4.1 GA candidate – Dec 2012 JB 4.2 Beta Feb 2013 JB 4.2 GA – April 2013