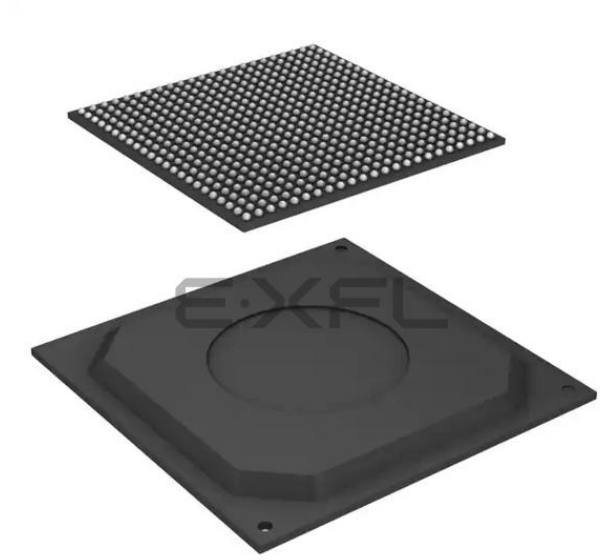


Welcome to E-XFL.COM

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	Active
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	LPDDR2, LVDDR3, DDR3
Graphics Acceleration	Yes
Display & Interface Controllers	Keypad, LCD, LVDS
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 (TA)
Security Features	A-HAB, ARM TZ, CAAM, CSU, SNVS, System JTAG, TVDECODE
Package / Case	529-LFBGA
Supplier Device Package	529-MAPBGA (19x19)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mcimx6x4cvm08ab

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, VFPvd16, 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, VFPvd16, 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, VFPvd16, 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, VFPvd16, 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, VFPvd16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II

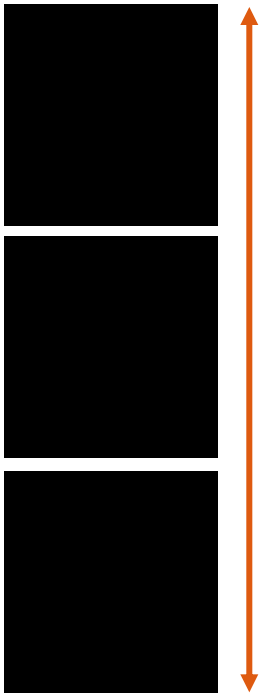
i.MX 6 Series Highlights

- 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

Freescale i.MX 6: unmatched pin-compatibility

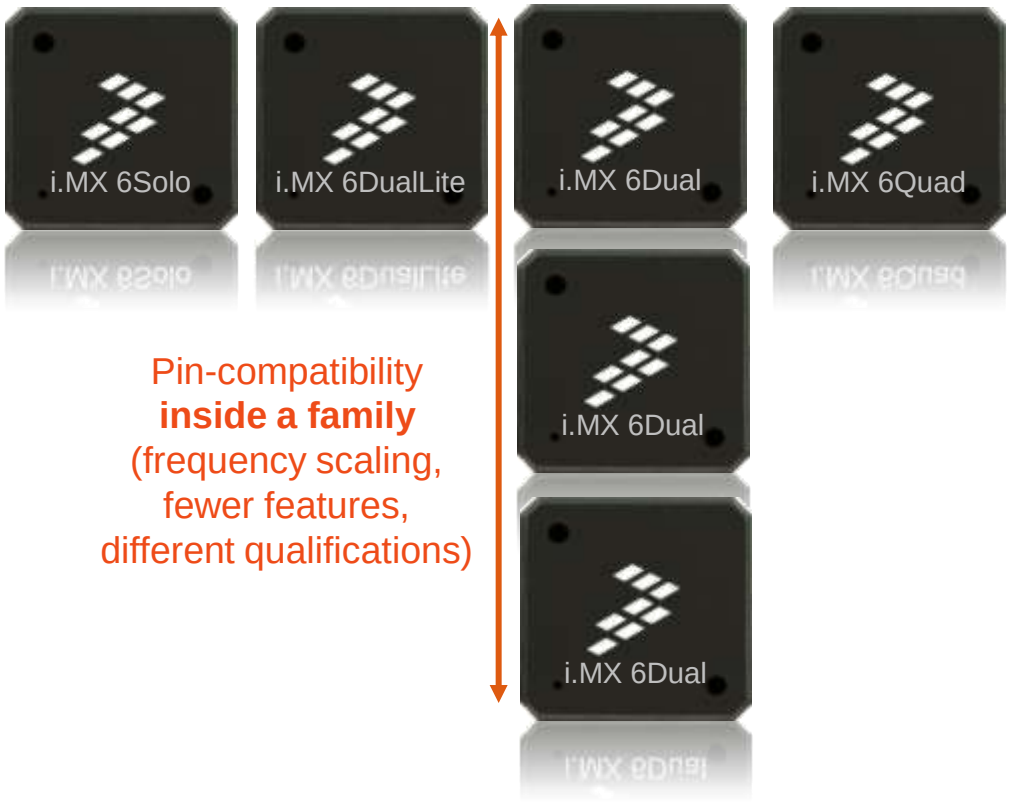
Competitors



Pin-compatibility
inside a family
(typically frequency scaling)

Freescale

Pin-compatibility
between families



Pin-compatibility
inside a family
(frequency scaling,
fewer features,
different qualifications)

i.MX 6 Series Overview

Scalable series of five ARM Cortex A9-based SoC families

i.MX 6SoloLite

- 1x 1GHz
- x32 400MHz DDR3
- No HW video accel.
- 2D graphics (2 GPUs)
- LCD, EPD

i.MX 6Solo

- 1x 1GHz
- x32 400MHz DDR3
- **HD1080p video**
- 2D+**3D** (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6DualLite

- **2x** 1GHz
- **x64** 400MHz DDR3
- HD1080p video
- 2D+3D (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6Dual

- 2x 1/**1.2GHz**
- x64 **533MHz** DDR3
- **Dual** HD1080p video
- 2D+3D (3 GPUs), **176 Mtri/s**
- LCD

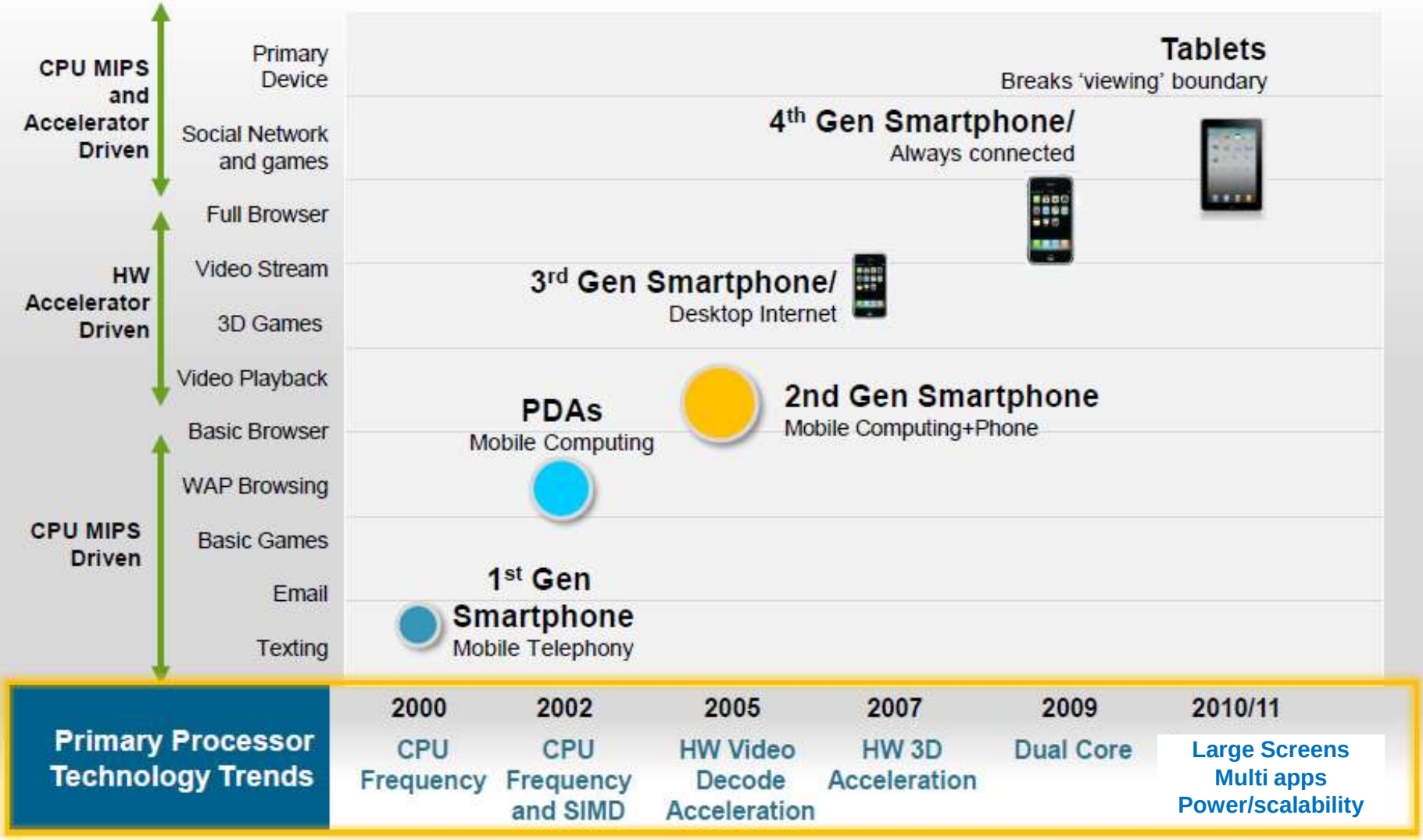
i.MX 6Quad

- **4x** 1/1.2GHz
- x64 533MHz DDR3
- Dual HD1080p video
- 2D+3D (3 GPUs), 176 Mtri/s
- LCD

Pin-to-pin Compatible

Software Compatible

Optimizing the Processor Platform



User Interfaces – Characteristics and Implications

- **UI content is inherently dynamic**
  - Unlike Games (which use pre-cached images/textures)
  - User content can/will change at any time
  - Therefore UI must refresh continuously in case new content emerges
  - Requires high speed (533Mhz) and wide (64-bit) memory bus to ensure high frame rates

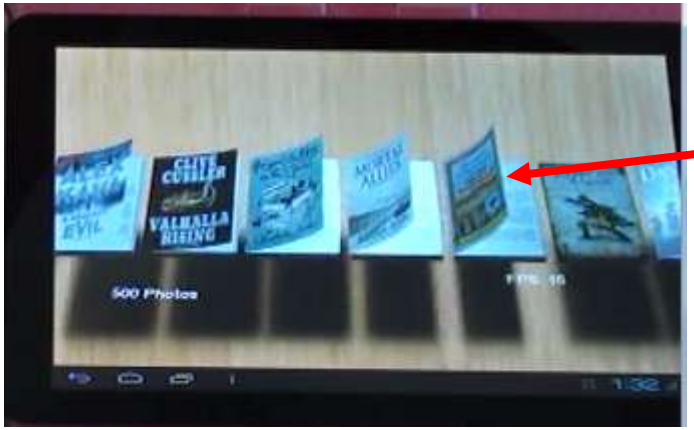
Recommend Dual Core + 64-bit Memory Bus

User Content is dynamic and (potentially) always changing. Especially true of streaming movies, YouTube, pictures, home moviews

User expects their 'latest' content to be instantly visible when scrolling (either touch or via remote with TV)
Thumbnails must be visible and smooth as they scroll left to right.

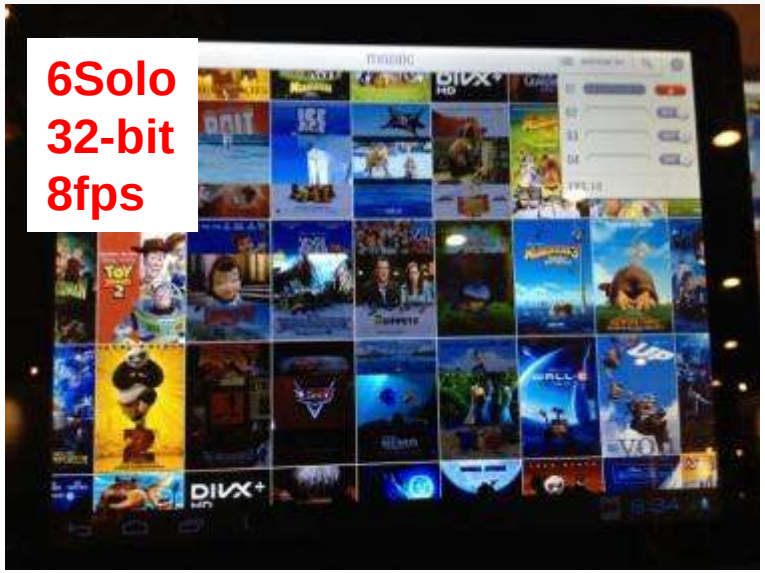
User Interfaces – Characteristics and Implications

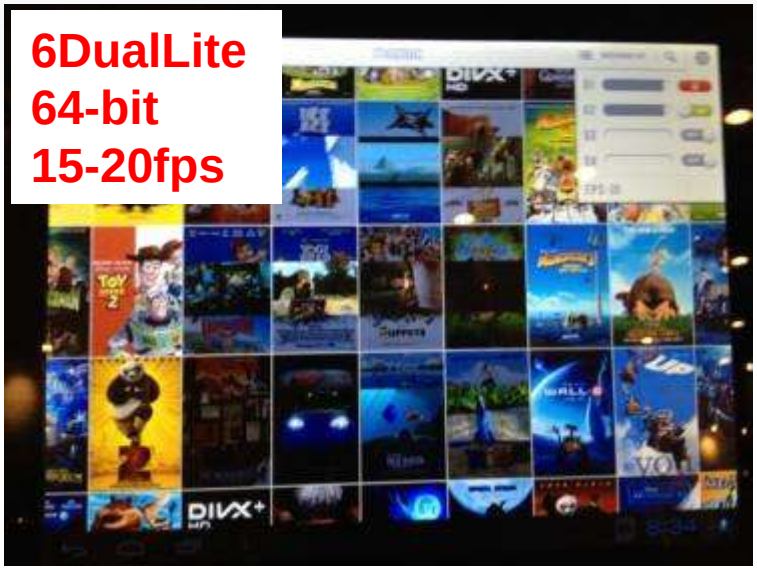
- **UI requires high resolution support → 1080p TV or LCD is now the norm**
  - 1080p30 fps content is becoming a standard offering from websites and streaming
  - 1080p60 is around the corner
  - Must be able to decode h.264 High Profile 1080p at high bitrates (for user content decode as well as for video streaming over the net)
  - Must be able to support newer 1080p TVs. Consumer devices starting to hit >1080p LCDs (iPAD HD) Requires large memory space, fast display capabilities, in hardware rotation/scaling
  - Advantage Freescale i.MX 6: up to 4XGA, dual display engines, 64bit memory space @ 533Mhz
- **Access to fast CPU MIPS → used for complicated transforms to augment visual experience**
  - CPU cores useful to add in additional transforms that don't map well to 3D unit
  - Morphing effects and some fluid dynamics for innovative UI effects
  - CPU cores can also be used to augment 3D unit and act as a 'secondary' 3D unit
  - Advantage Freescale i.MX 6: up to Quad core Cortex A9 at 1.2Ghz → nearly 5Ghz of CPU horsepower

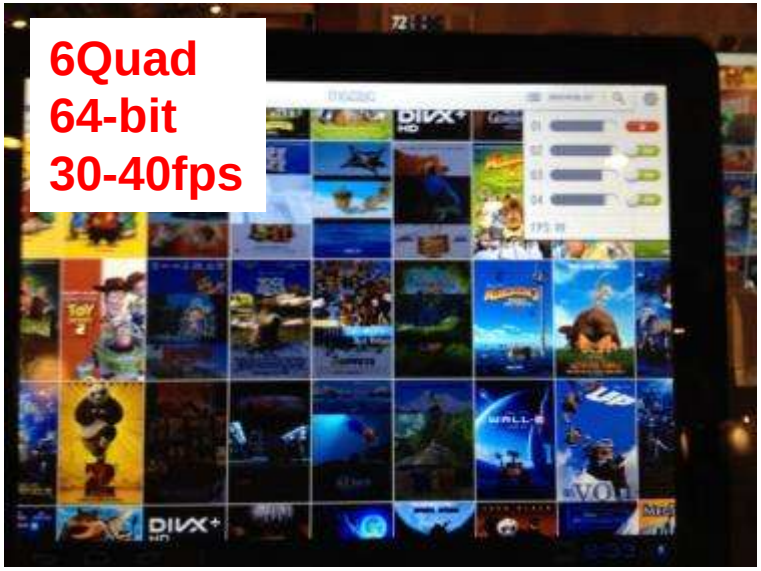


Book cover icon "blowing in the wind" when scrolling fast to visually indicate speed. Can use CPU power to calculate

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 Software – Current BSP Releases

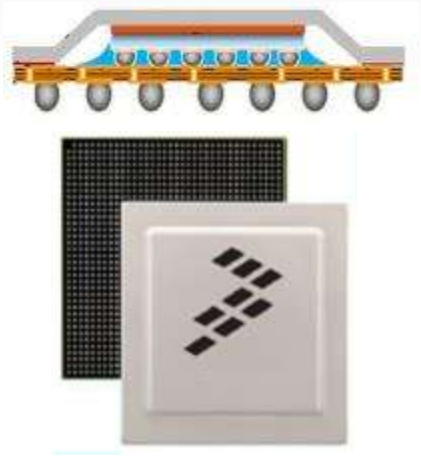
- All public software releases are available at www.freescale.com/imx6tools
- Future releases will support Linux 3.10 kernel and Android JB 4.3

BSP	Distribution	Kernel	SoC Supported	Release Date
L3.0.35_4.0.0	LTIB	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	5/13/2013
L3.0.35_2.1.0	LTIB	3.0.35	i.MX 6SoloLite	6/4/2013
JB4.2.2_1.1.0	Android JB 4.2.2	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	7/11/2013
R13.4.1	Android ICS 4.0.4	3.0.35	i.MX 6Quad i.MX 6Dual i.MX 6DualLite i.MX 6Solo	12/12/12
R13.5.0	Android ICS 4.0.4	3.0.35	i.MX 6SoloLite	11/16/12

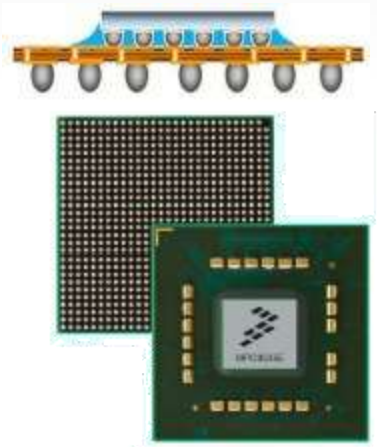
Packaging and Qual levels – 21x21 FCBGA Package

- **Lidded – Auto and Industrial**
  - Contains a metal lid covering the processor
  - More robust for industrial or automotive environments
- **Non-Lidded – Consumer**
  - Exposes the back side of the die (flipchip)
  - Lower Z-height for space constrained devices
  - Easier to attach custom heat spreaders
- **Three types of Qual for i.MX 6Series**
  - Consumer→ Highest Frequency
  - Automotive→ Maximum environmental support
  - Industrial→ Longest duration (“always on”)
- **Only Non-Lidded packaging will be available in Consumer Temp**

Lidded



Non Lidded



Type	Characteristics
Consumer	•-20 to 105Deg Tj •5 year life cycle @ 50% duty cycle •Max of 1.2Ghz CPU speed
Automotive	•-40 to 125Deg Tj •10 year life cycle @ 10% duty cycle •Max of 1Ghz CPU speed
Industrial	•-40 to 105Deg Tj •10 year life cycle @ 100% duty cycle •Max of 800Mhz CPU speed

FC-BGA Manufacturing App note (Lid and non-Lid) Available on freescale.com

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

SABRE Platforms: Enabling Faster Time to Market

i.MX 6 series development tools are **Freescale designed** and **Freescale supported**

SABRE Platform for Smart Devices

- i.MX 6Quad/6DualLite 1 GHz ARM Cortex-A9
- Multiple connectivity options: Wi-Fi®, Bluetooth®, GPS, Ethernet, SD, parallel/serial interfaces, SATA (i.MX 6Quad only), PCIe and MIPI CSI
- SABRE Board plus:
  - 10.1" capacitive multi-touch display
  - Battery charging ICs
  - The SPI NOR Flash
  - MIPI display and MIPI camera connectors
  - 2x MIPI camera sensors
  - Digital microphones
  - Ambient light sensor, GPS
  - EPDC connector (i.MX 6DualLite only)

SABRE for Auto Infotainment

- Available to Tier 1 automotive OEMs
- i.MX 6Quad or i.MX6DualLite CPU card and i.MX 6 series base board
- Support for terrestrial and satellite radio tuners, Wi-Fi, Bluetooth, GPS, cellular modem, iAP authentication modules, MOST vehicle networking, cameras and displays
- Processor capability ranges from single ARM Cortex-A9 core at 800 MHz up to a quad core at up to 1 GHz

SABRE Board for Smart Devices

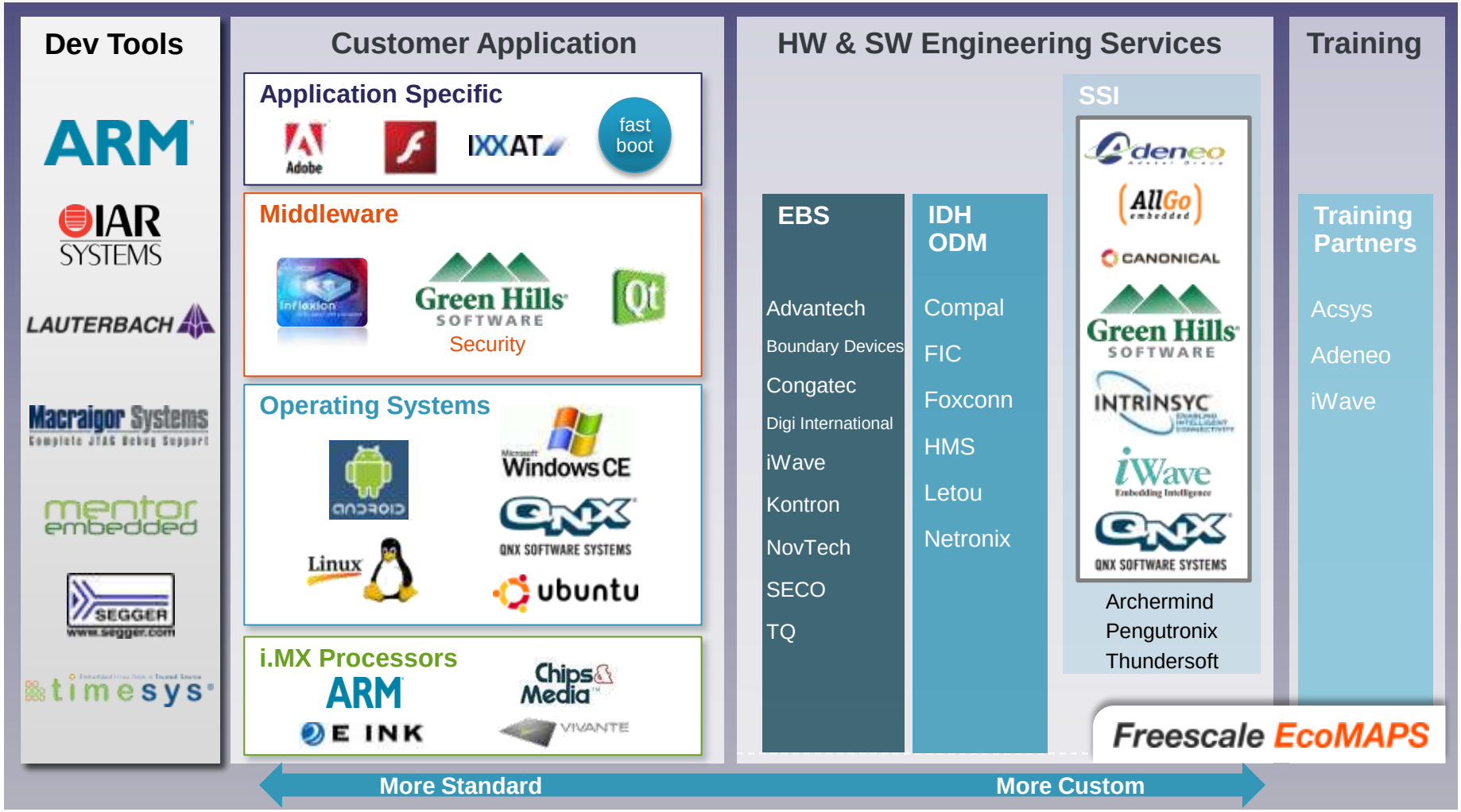
- i.MX 6Quad 1 GHz ARM Cortex-A9
- Intelligently designed with connectors on only two sides of board to eliminate 'octopus effect' on lab tables
- Evaluate the smartly integrated features of the i.MX 6Quad processor including an LVDS controller, USB PHYs, HDMI PHYs, SATA, PCI Express®, on-board power management and Ethernet

i.MX 6SoloLite Evaluation Kit

- i.MX 6SoloLite 1 GHz ARM Cortex-A9
- Integrated E Ink® display controller
- Enables EPD and/or LCD or HDMI display, touch control and audio playback, and the ability to add WLAN, a 3G modem or Bluetooth technology
- E Ink display available separately

freescale™

Freescale EcoMAPS for i.MX Architectures



IDE: Integrated Development Environment
BDM: Background Debug Module

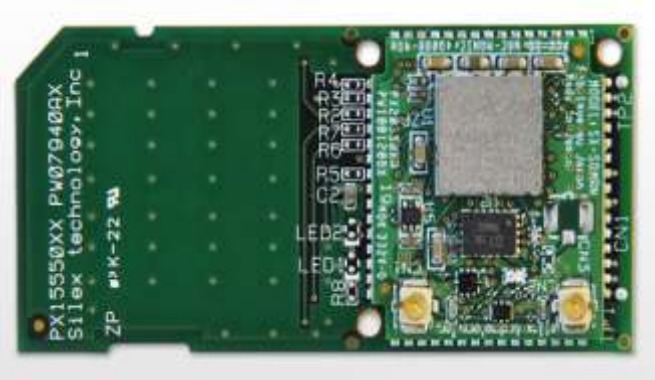
EBS: Embedded Board Solutions

IDH: Independent Design House
ODM Original Design Manufacturer

SSI: Software & Solution Integrators

SILEX Wi-FI SOLUTIONS

- 802.11a/b/g/n low power SDIO cad based on Qualcomm Atheros AR6003
- Wi-Fi driver software integrated with Freescale i.MX 6 platform
- Family of hardware solutions available
  - System-in-Package (SiP)
  - Radio Module
  - SD Card Form Factor



Freescale Product Longevity Program

- 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

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

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 ($399)

Display (9.7”): MCIMX-LVDS1 ($499)
Display (4.3”): MCIMX28LCD ($199)

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
- eCompass
- Power supply
- No battery charger

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

Linux Roadmap