# i.MX 6 Series Portfolio Overview

## AMF-CON-T0060

**Pat Stilwell**
Product Marketing

August 2013

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# i.MX

## Your Interface to the World

**i.MX families** offer some of the most versatile platforms for multimedia and display applications, bringing personality and interactivity to a whole new world of products

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# 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



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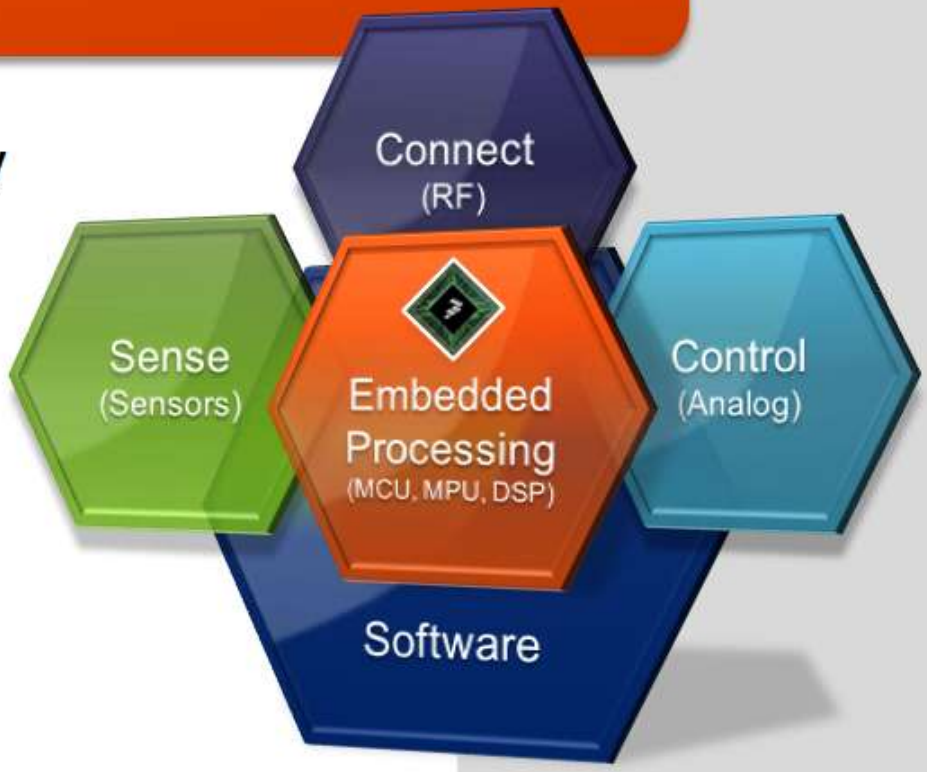
# A Global Leader of
# Embedded Processing Solutions

## 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

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# Six Generations of Application Processors

| 1995 | 2001 | 2003 | 2005 | 2009 | 2011 |
|---|---|---|---|---|---|
| **Dragonball**<br>1st FSL Apps Processor | **i.MX1**<br>1st FSL ARM9 Apps Processor | **i.MX2 Series**<br>90nm LP<br>HW Video Accel<br>Analog Integration | **i.MX3 Series**<br>ARM11<br>GPU Integration | **i.MX5 Series**<br>65nm LP/GP<br>ARM Cortex-A8<br>>1GHz | **i.MX 6 Series**<br>40nm LP<br>ARM Cortex-A9<br>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)

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# i.MX Smart Devices

Giant Waterproof Tablet – i.MX53

Honeywell Lynx Touch security panel with the i.MX25

Icephone, Medical Phone with i.MX31

Navico Marine Navigation i.MX51

Maxtrack tablet for Brazilian Police with i.MX51

Avaak Vue Personal Video Network With the i.MX25

Invoxia IP Phone - i.MX503

Gigaset DECT phone with i.MX233

Sophia systems' non-contact card Reader/Writer for DoCoMo with i.MX51

AMX 20.3" Modero X Series Panoramic Table Top Touch Panel with i.MX53

Televic in Belgium trams using MX51

Line6 "Stagescape" audio mixing system with i.MX51

i.MX233 based i'mWatch

Japanese Boarding Gate Pass Reader with i.MX27

Self service touch screen terminal

Sharp e-Dictionary with i.MX28

Harris military communication equipment with i.MX27

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# 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**

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# 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**

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

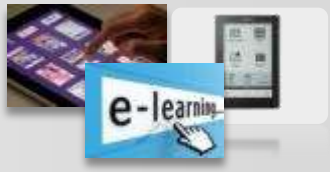
**Low-End**

**Single** Core

**High-End**

Smart Energy
eReaders
Entry Infotainment

**Low-End**

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# 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*

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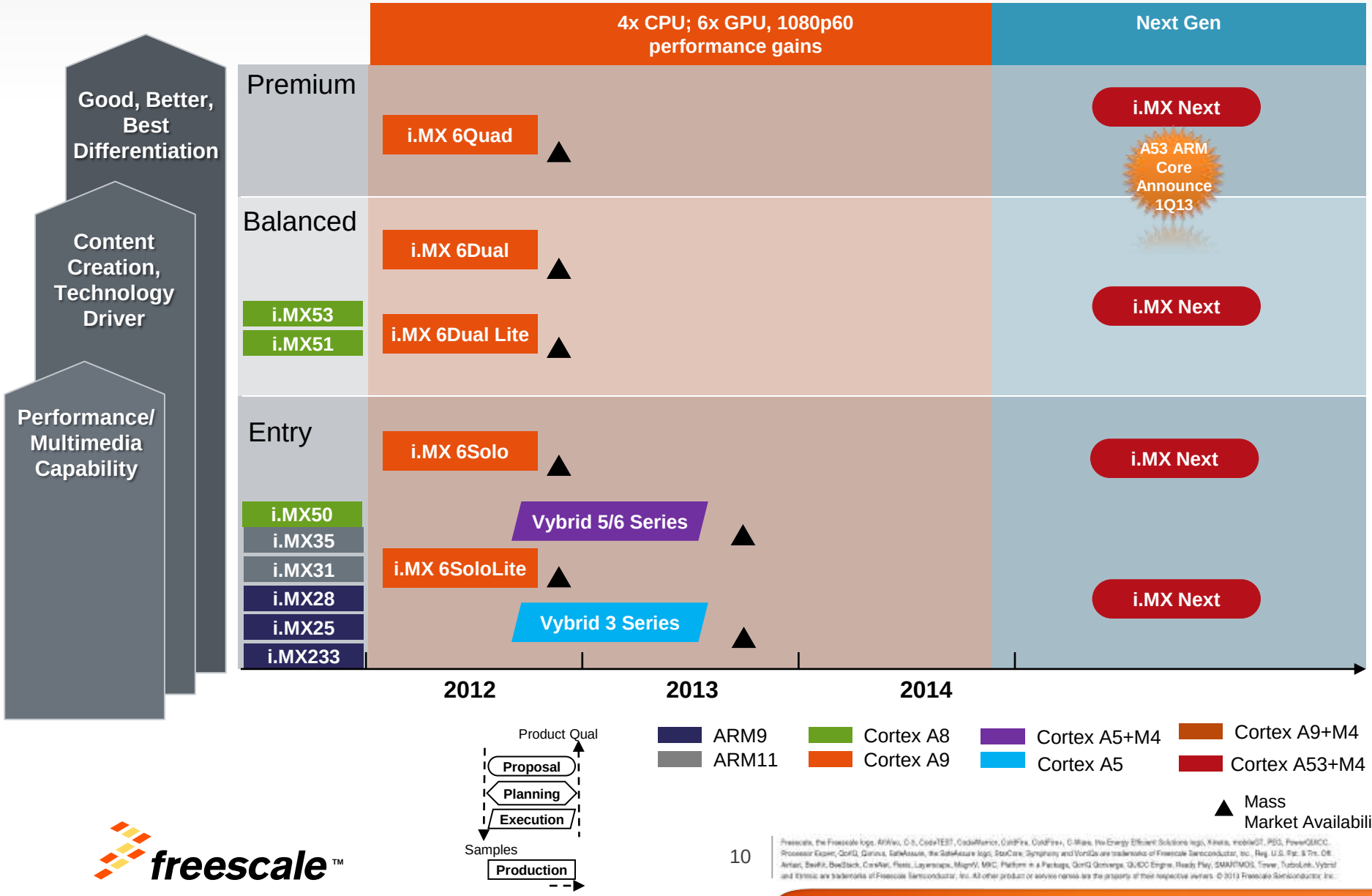
# Applications Processor Family Roadmap

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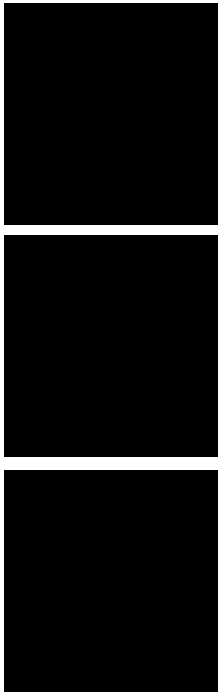
# Freescale i.MX 6: unmatched pin-compatibility

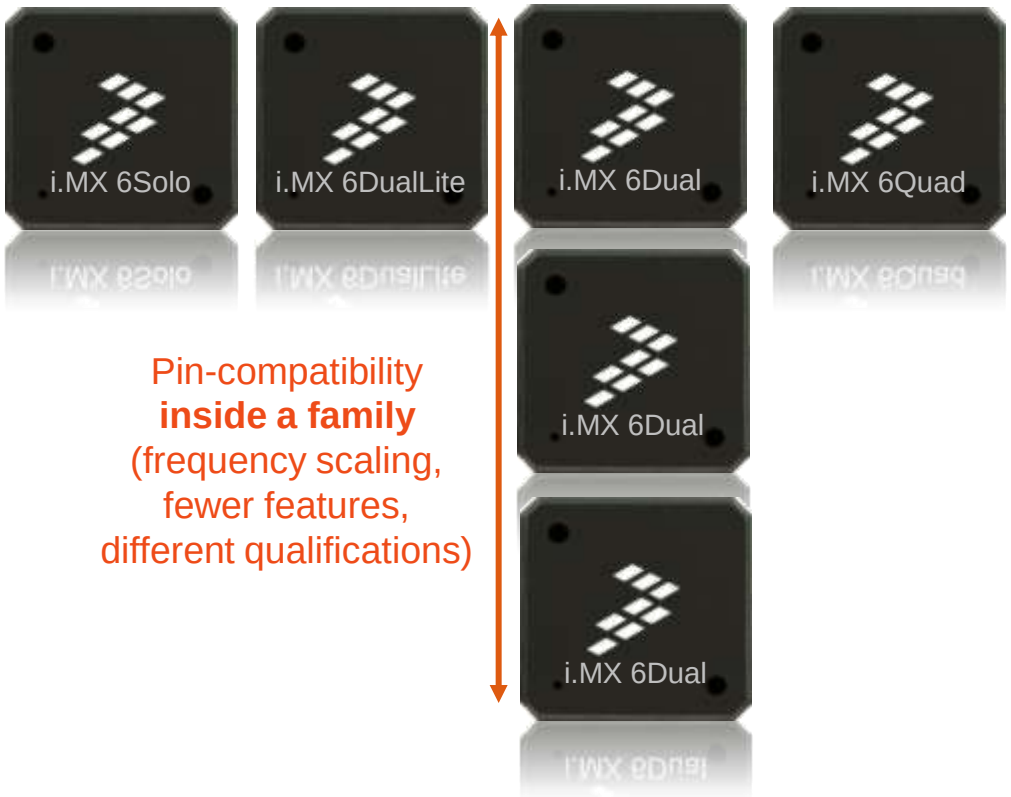
Competitors



Pin-compatibility
**inside a family**
(typically frequency scaling)

**Freescale**

Pin-compatibility
**between families**




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

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# 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



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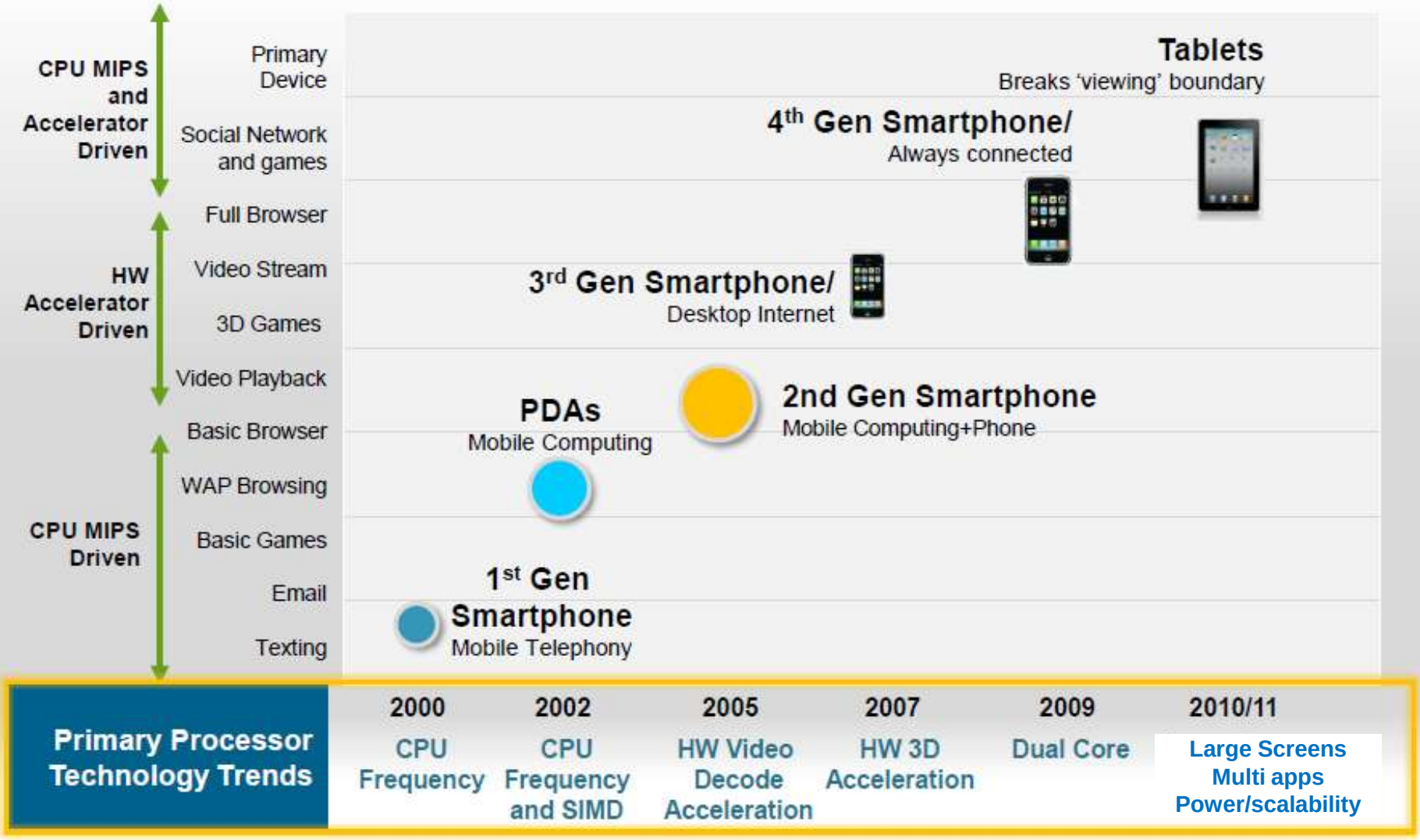
# Optimizing the Processor Platform

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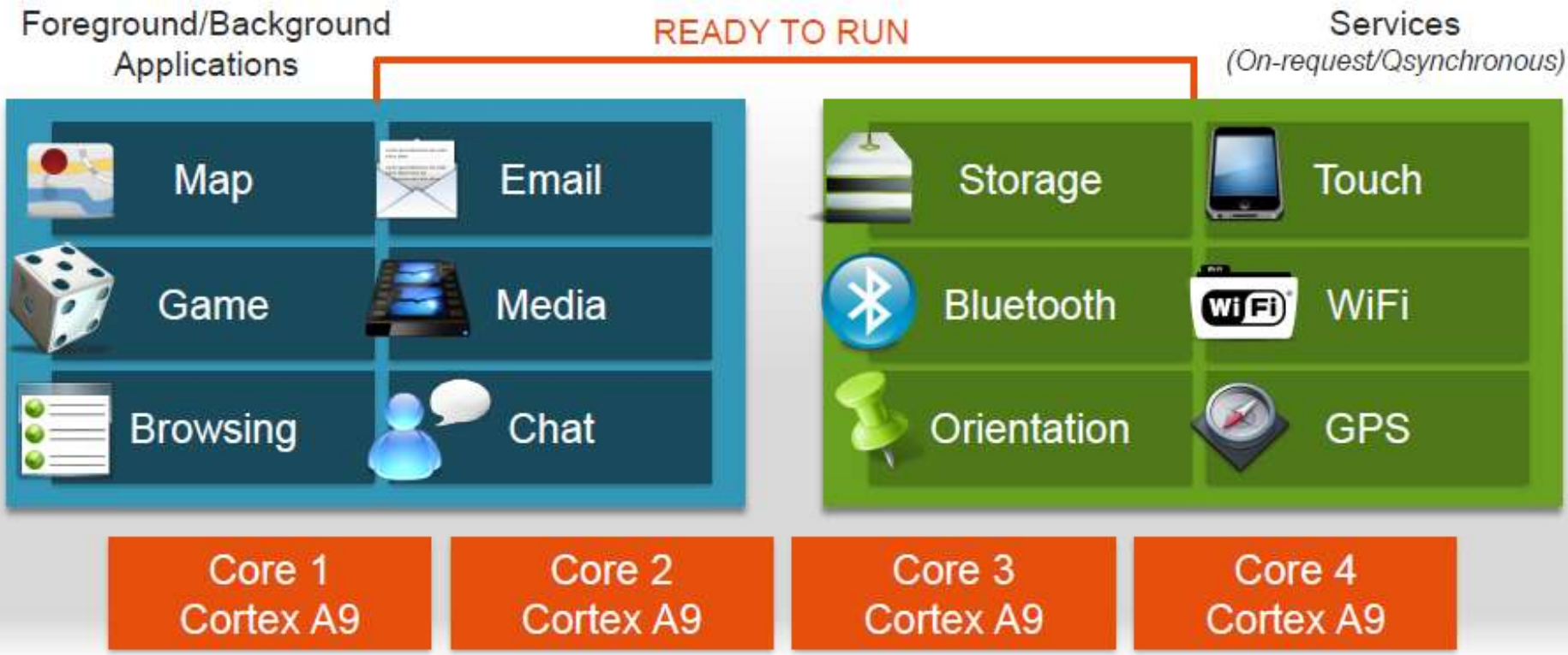
# Android Support Quad Core

## 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***



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# 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!

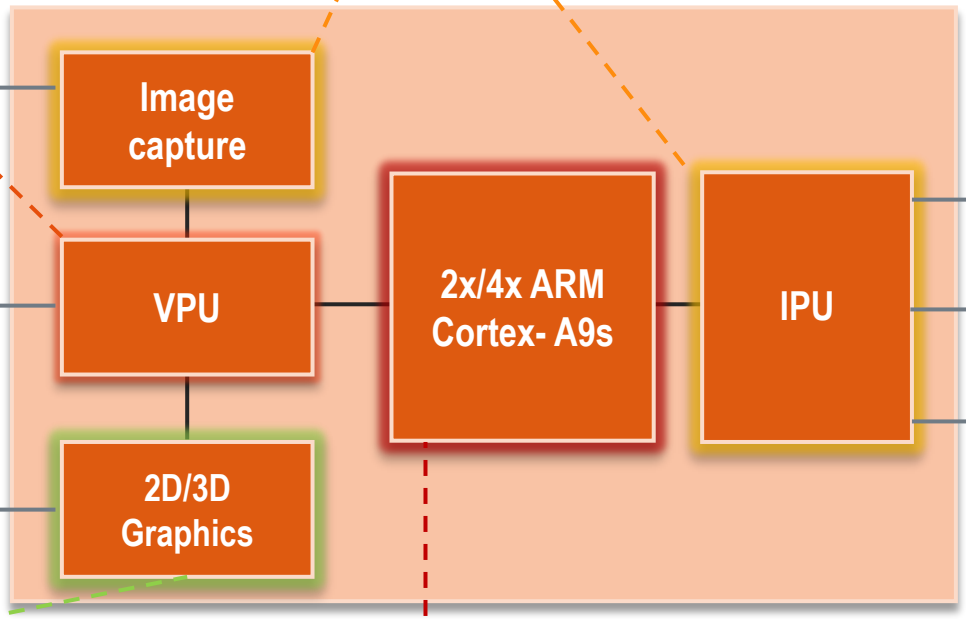
## i.MX 6Dual/6Quad IPU

- 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

Recording Video

Movie Content

Game Content



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'

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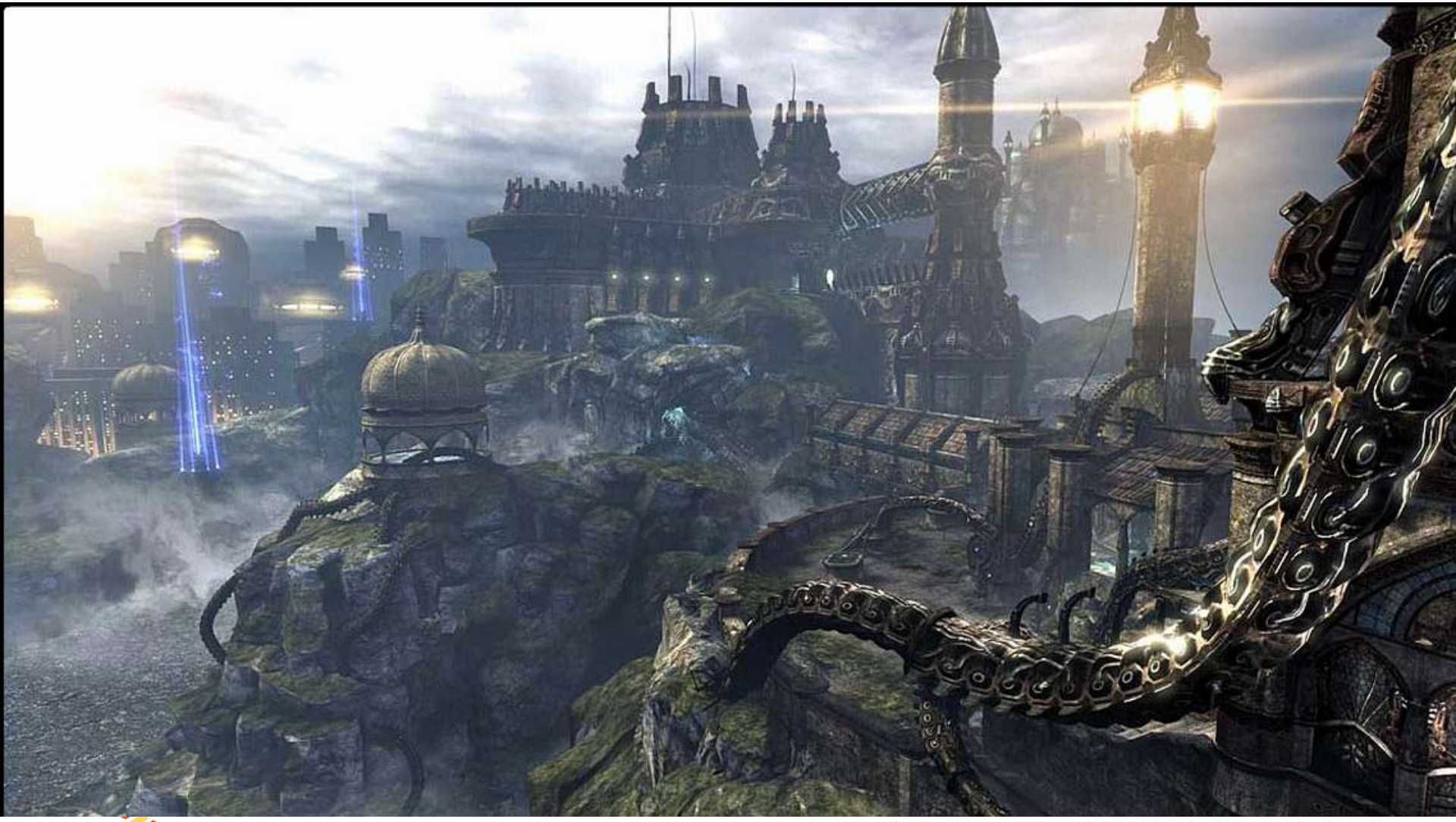
VIVANTE

# Vivante GC2000 Ultra-threaded GPU





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# i.MX 6 Series Triple-Play Graphics support

| i.MX 6Solo / i.MX 6DualLite | i.MX 6Dual | i.MX 6Quad |
|---|---|---|
| VIVANTE GC320 | VIVANTE GC320 | VIVANTE GC320 |
| Composition (2D BLIT) | Composition (2D BLIT) | Composition (2D BLIT) |
| | VIVANTE GC355 | VIVANTE GC355 |
| | Vector Graphics | Vector Graphics |
| VIVANTE GC880 | VIVANTE GC2000 | VIVANTE GC2000 |
| 3D + GP GPU<br>1 shader core | 3D + GP GPU<br>4 shader cores | 3D + GP GPU<br>4 shader cores |

***Same GPU drivers for all i.MX 6 Processors***



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# Why Dual or Quad Core?

Webkit Browser page rendering and scrolling

2D 'Fish Tank' (HTML5)

JPEG decode + encode 1024x768

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

CPU Utilization (1, 2 and 4 cores)

| Android Honeycomb Application | 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=JYFmBIk3itI#t=2m49s

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# 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**

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# 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

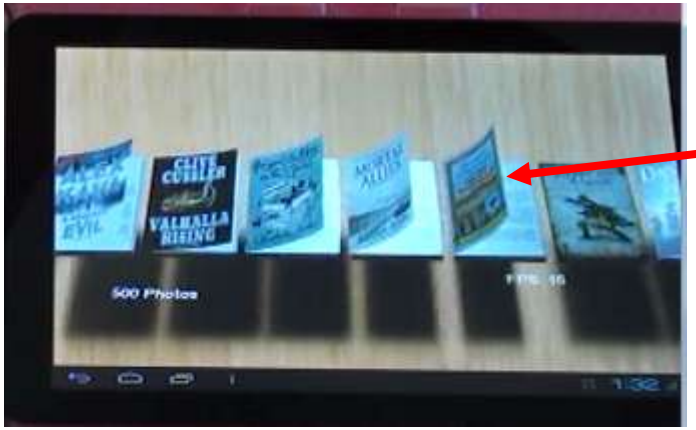
Recommend Dual Core + 64-bit Memory Bus

**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**

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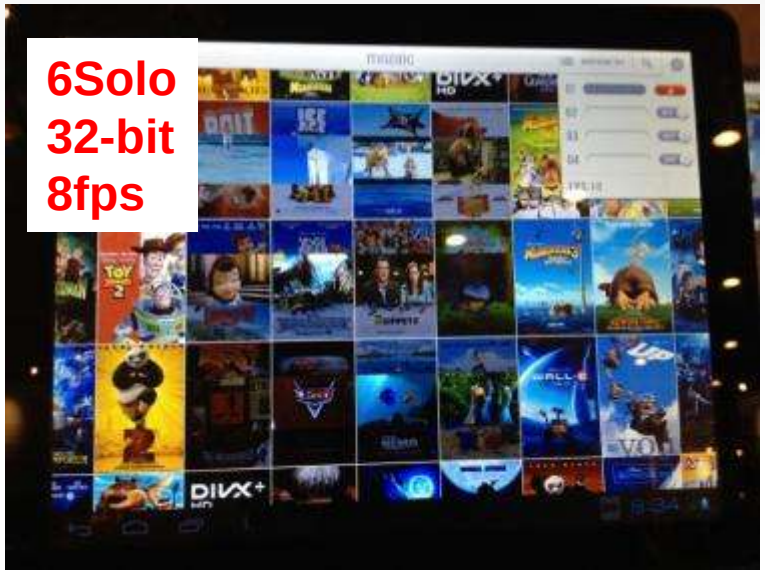
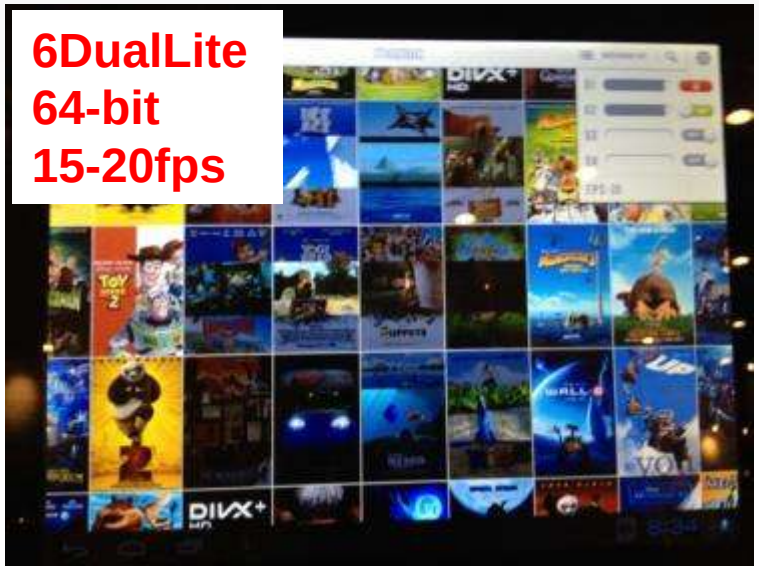
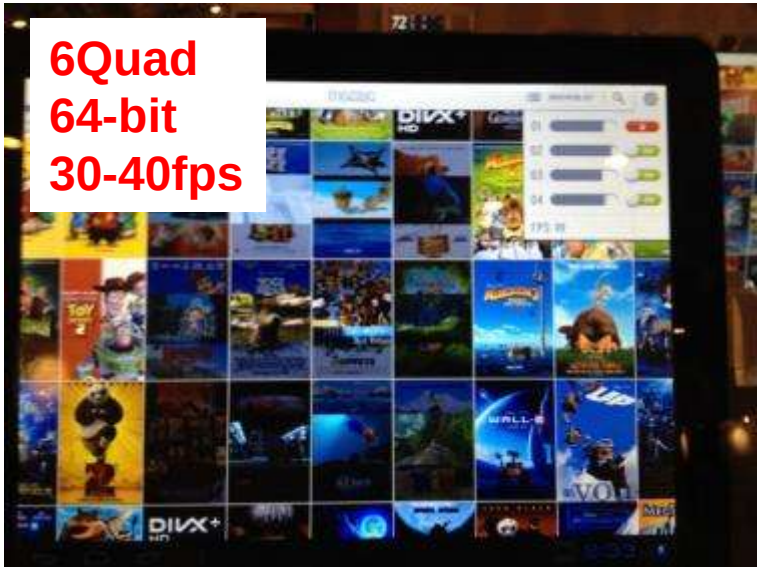
# User Interfaces in Action – Dual Core + 64-bit matters



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# 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 …



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# 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 |


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# Video Playback and Streaming

- **Video Playback or Streaming performance is highly dependent upon screen resolution**
  - 1080p playback on a 1024x768 screen takes less bandwidth than 1080p on a 1920x1080 LCD
- **Available Memory bandwidth on 32bit DDR is ~1600MB/s**
  - 64bit memory is up to 3200MB/s
  - This assumes 50% utilization of the interface (generous)
- **Total Memory B/W required for 1080p playback**
  - On 1024x768 screen: ~800MB/s
  - On 1920x1080 screen: ~1100MB/s
  - If performing parallel tasks, will add to memory bandwidth needs
  - System activity+screen size Can vary memory bandwidth by up to 500MBs

Recommend Dual Core + 64-bit Memory Bus for 1080p Playback



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# User Interfaces – Characteristics and Implications

- Screenshots of Unreal Citadel Running on i.MX 6Quad

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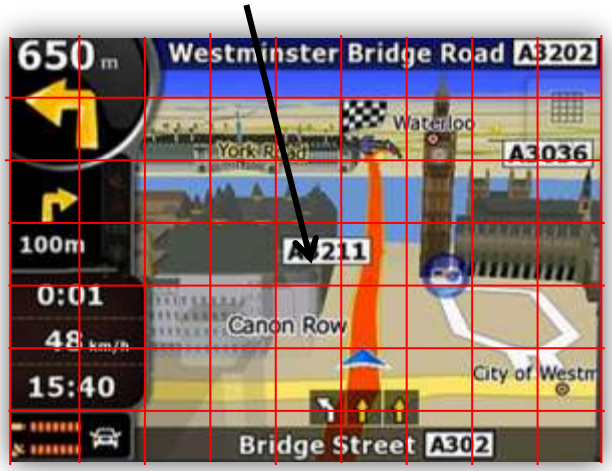
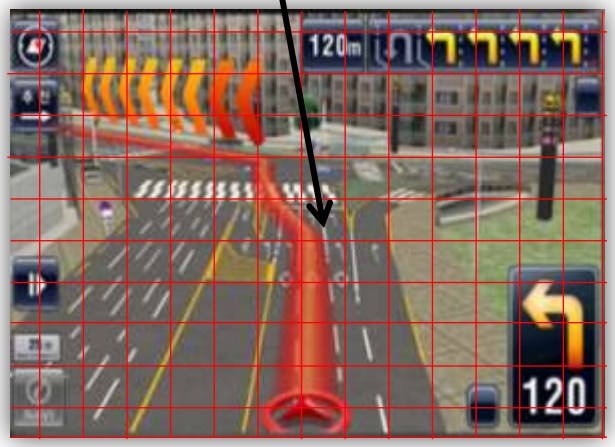
# Tile Based Rendering (Chunkers)

- Size of scene buffer unknown before rendering
  - Possible overflow if scene requires more data than expected
- Good rendering method for baseline GUI/3D Apps with smaller object count (less details)
  - More bandwidth efficient than FMR in simple (yesterday) use cases
- 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
  - PC Level Applications (Performance, Quality, Effects) → Tablets → Smartphones → Infotainment

Tile




Tile




Tile (Complex Scene)

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# 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**)<br>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<br>H.263-P0/P3 | 6 | 2 | -- | -- |



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# 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)<br>1 (**TBD** for 30fps) |

## *Full-duplex*

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



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# Software Completeness

Ecosystem

**Applications/ HMI**

UI | Games | Apps | Browser | Launcher

**Segment Specific**

**Auto infotainment**
- Fast boot
- Connectivity
- MARS, GenIVI

**eReaders**
- EPD optimizations
- Adobe PDF Reader

**Tablets**
- Flash AIR
- Skype
- Player tuning

**Middleware Layer**

- Optimized OpenGL/ES
- Codec parsers
- Power management hooks
- Flash10

Graphics Libraries | Media Framework | Power Management | Security / DRM

**OS Layer**

- Optimized drivers
- Codec bundle
- Common code base
- Latest kernels

Drivers | Accelerated Codecs | Bootloader | Kernel

**Hardware**

i.MX PLATFORM

Partners

Freescale focus



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# 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<br>i.MX 6Dual<br>i.MX 6DualLite<br>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<br>i.MX 6Dual<br>i.MX 6DualLite<br>i.MX 6Solo | 7/11/2013 |
| R13.4.1 | Android ICS 4.0.4 | 3.0.35 | i.MX 6Quad<br>i.MX 6Dual<br>i.MX 6DualLite<br>i.MX 6Solo | 12/12/12 |
| R13.5.0 | Android ICS 4.0.4 | 3.0.35 | i.MX 6SoloLite | 11/16/12 |


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# 21x21 FCBGA Mechanical structure

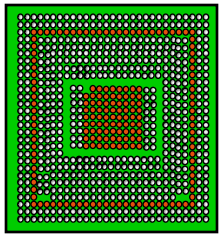
**The IMX6Q/D Design**

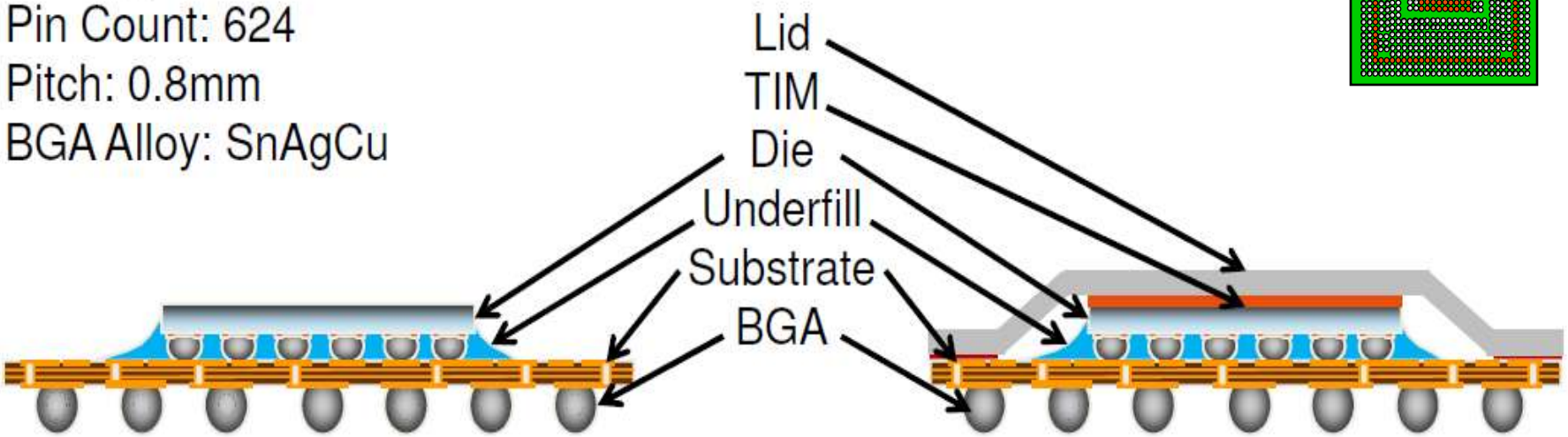
Package: 21x21mm FCPBGA

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** |

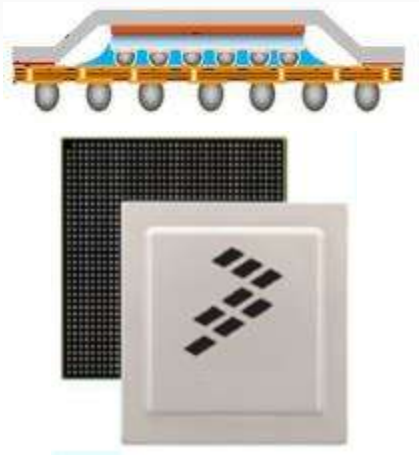
| Lidded, 0.4mm core | Min | Nominal | Max |
|---|---|---|---|
| Lid | 0.450 | 0.5 | 0.550 |
| Thermal interface Material (TIM) | 0.025 | 0.05 | 0.075 |
| Device | 0.280 | 0.305 | 0.330 |
| Gap height (UF thickness) | 0.070 | 0.080 | 0.090 |
| Substrate (2/2/2 0.4mm core) | 0.560 | 0.660 | 0.760 |
| 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

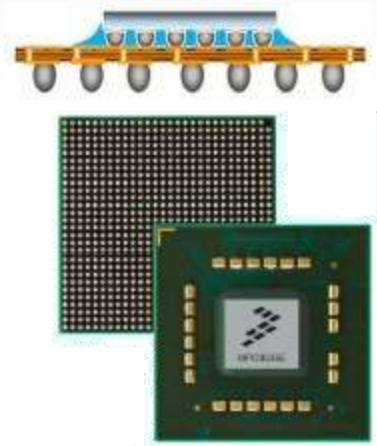
# Packaging and Qual levels – 21x21 FCBGA Package

- **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<br>•5 year life cycle @ 50% duty cycle<br>•Max of 1.2Ghz CPU speed |
| Automotive | •-40 to 125Deg Tj<br>•10 year life cycle @ 10% duty cycle<br>•Max of 1Ghz CPU speed |
| Industrial | •-40 to 105Deg Tj<br>•10 year life cycle @ 100% duty cycle<br>•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'**

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# 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 |

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# i.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<br>*** performance limited to 480Mbps** | 1x GbE* + IEEE1588<br>* performance limited to 480Mbps | 1x GbE*+ IEEE1588<br>* performance limited to 480Mbps | 1x GbE*+ I EEE1588<br>* performance limited to 480Mbps |
| **USB** | 3x USB2.0 HS<br>• 1x OTG + PHY<br>• 1x Host + PHY<br>• 1x Host HSIC | **4x** USB2.0 HS<br>• 1x OTG + PHY<br>• 1x Host + PHY<br>• **2x** Host HSIC | 4x USB2.0 HS<br>• 1x OTG + PHY<br>• 1x Host + PHY<br>• 2x Host HSIC | 4x USB2.0 HS<br>• 1x OTG + PHY<br>• 1x Host + PHY<br>• 2x Host HSIC | 4x USB2.0 HS<br>• 1x OTG + PHY<br>• 1x Host + PHY<br>• 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<br>1x SDXC | 3x SD/MMC 4.4<br>1x SDXC | 3x SD/MMC 4.4<br>1x SDXC | 3x SD/MMC 4.4<br>1x SDXC | 3x SD/MMC 4.4<br>1x SDXC |
| **MIPI** | - | **MIPI-CSI2**<br>**MIPI-DSI** | MIPI-CSI2<br>MIPI-DSI | MIPI-CSI2<br>MIPI-DSI<br>**MIPI-HSI** | MIPI-CSI2<br>MIPI-DSI<br>MIPI-HSI |
| **Camera Interface** | 1x Input<br>• 1x 16-bit Parallel | **2x** Inputs<br>• **2x** 20-bit Parallel<br>• **2x lane MIPI-CSI2** | 2x Inputs<br>• 2x 20-bit Parallel<br>• 2x lane MIPI-CSI2 | **3x** Inputs<br>• 2x 20-bit Parallel<br>• **4x** lane MIPI-CSI2 | 3x Inputs<br>• 2x 20-bit Parallel<br>• 4x lane MIPI-CSI2 |
| **HDD I/F** | - | - | - | **S-ATA II 3Gbps** | S-ATA II 3Gbps |
| **Audio Acc.** | - | **ASRC** | ASRC | ASRC | ASRC |
| **Audio** | 3x I2S<br>SPDIF Tx/Rx | 3x I2S<br>SPDIF Tx/Rx ESAI | 3x I2S<br>SPDIF Tx/Rx<br>ESAI | 3x I2S<br>SPDIF Tx/Rx<br>ESAI | 3x I2S<br>SPDIF Tx/Rx<br>ESAI |

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# 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<br>(WXGA=1366x768) | **2x** WXGA | 2x WXGA | **2x 4XGA or**<br>**2x [1080p + WXGA]**<br>(4XGA=2048x1536) | 2x 4XGA or<br>2x [1080p + WXGA] |
| **Display Interfaces** | 2x Outputs<br>• 1x Parallel<br>• EPDC | 2x Outputs<br>• **2x** Parallel<br>• **2x** LVDS<br>• **HDMI**<br>• **MIPI-DSI**<br>• EPDC | 2x Outputs<br>• 2x Parallel<br>• 2x LVDS<br>• HDMI<br>• MIPI-DSI<br>• EPDC | **4x** Outputs<br>• 2x Parallel<br>• 2x LVDS<br>• HDMI<br>• MIPI-DSI | 4x Outputs<br>• 2x Parallel<br>• 2x LVDS<br>• HDMI<br>• MIPI-DSI |
| **GPU 3D** | - | **Vivante GC880**<br>• **53Mtri/s**<br>• **266Mpxl/s**<br>• **OpenGL ES 1.1/2.0/3.0** | Vivante GC880<br>• 53Mtri/s<br>• 266Mpxl/s<br>• OpenGL ES 1.1/2.0/3.0 | **Vivante GC2000**<br>• **176Mtri/s**<br>• **1000Mpxl/s**<br>• OpenGL ES 1.1/2.0/3.0<br>• **OpenCL 1.1 EP** | Vivante GC2000<br>• 176Mtri/s<br>• 1000Mpxl/s<br>• OpenGL ES 1.1/2.0/3.0<br>• OpenCL 1.1 EP |
| **GPU 2D (Vector Graphics)** | Vivante GC355<br>• 300Mpxl/s<br>• OpenVG 1.1 | via GPU 3D<br>• OpenVG 1.1 | via GPU 3D<br>• OpenVG 1.1 | **Vivante GC355**<br>• **300Mpxl/s**<br>• OpenVG 1.1 | Vivante GC355<br>• 300Mpxl/s<br>• OpenVG 1.1 |
| **GPU 2D (BLIT)** | Vivante GC320<br>• 600Mpxl/s | Vivante GC320<br>• 600Mpxl/s | Vivante GC320<br>• 600Mpxl/s | Vivante GC320<br>• 600Mpxl/s | Vivante GC320<br>• 600Mpxl/s |
| **Video Dec** | SW Only | **1080p30 + D1**<br>**MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8** | 1080p30 + D1<br>MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8 | **1080p60** + D1<br>**2x** 1080p30<br>MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8 | 1080p60 + D1<br>2x 1080p30<br>MPEG-2, H.264 MVC, VC1, MPEG-4/Xvid, DivX 6, H.263, MJPEG, VP6 / WebM VP8 |
| **Video Enc** | - | **1080p30**<br>**2x 720p**<br>H.264, H.263, MPEG-4, MPEG-2, MJPEG | 1080p30<br>2x 720p<br>H.264, H.263, MPEG-4, MPEG-2, MJPEG | 1080p30<br>2x 720p<br>H.264, H.263, MPEG-4, MPEG-2, MJPEG | 1080p30<br>2x 720p<br>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,<br>4x SPI<br>4x I2C | 4x SPI<br>5x UART<br>4x I2C | 4x SPI<br>5x UART<br>4x I2C | **5x** SPI<br>5x UART<br>**3x** I2C | 5x SPI<br>5x UART<br>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<br>Pin compatible with i.MX 6Dual/Quad** | | **21x21 0.8P FCBGA<br>Pin compatible with i.MX 6DualLite/Solo** | |

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# 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

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# 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

# i.MX 6 Quad SABRE Lite Board (TO1.0 Silicon)

## http://boundarydevices.com/products/sabre-lite-imx6-sbc/

**Low Cost Community Board**

- 1GByte of 64-bit wide DDR3 @ 532MHz
- Three display ports (24-bit RGB, LVDS, HDMI)
- Two camera ports (1xParallel, 1xMIPI)
- Serial ATA (SATA)
- Dual SDHC card slots (1 std, 1 micro)
- PCI express port
- Analog (headphone/mic) and Digital (HDMI) audio
- Compact size (3¼"x3¼")
- 10/100/1G Ethernet
- 10-pin JTAG interface
- 3 High speed USB ports (2xHost, 1xOTG)
- CAN port
- UART debug port
- I2C

- Purchase directly from Boundary Devices
  - PO, Credit Card or PayPal placed directly with Boundary Devices
  - Schematics and user manual available on Boundary website
- Additional supply partners available in Q3

**SABRE-Lite will not be stocked, sold, or supported by Freescale**
**All support from Boundary Devices, partners or IMXCommunity.org**



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# Freescale EcoMAPS for i.MX Architectures

## Dev Tools

ARM
IAR SYSTEMS
LAUTERBACH
Macraigor Systems
Complete JTAG Debug Support
mentor embedded
SEGGER
www.segger.com
timesys

## Customer Application

### Application Specific

Adobe
IXXAT
fast boot

### Middleware

Inflexion
Green Hills SOFTWARE
Security
Qt

### Operating Systems

Android
Windows CE
Linux
QNX SOFTWARE SYSTEMS
ubuntu

### i.MX Processors

ARM
Chips&Media
E INK
VIVANTE

## HW & SW Engineering Services

### EBS

Advantech
Boundary Devices
Congatec
Digi International
iWave
Kontron
NovTech
SECO
TQ

### IDH ODM

Compal
FIC
Foxconn
HMS
Letou
Netronix

### SSI

Adeneo
AllGo embedded
CANONICAL
Green Hills SOFTWARE
INTRINSYC
iWave Embedding Intelligence
QNX SOFTWARE SYSTEMS

Archermind
Pengutronix
Thundersoft

## Training

### Training Partners

Acsys
Adeneo
iWave

Freescale EcoMAPS

More Standard ← → More Custom

**IDE:** Integrated Development Environment
**BDM:** Background Debug Module

**EBS**: Embedded Board Solutions

**IDH**: Independent Design House
**ODM** Original Design Manufacturer

**SSI**: Software & Solution Integrators

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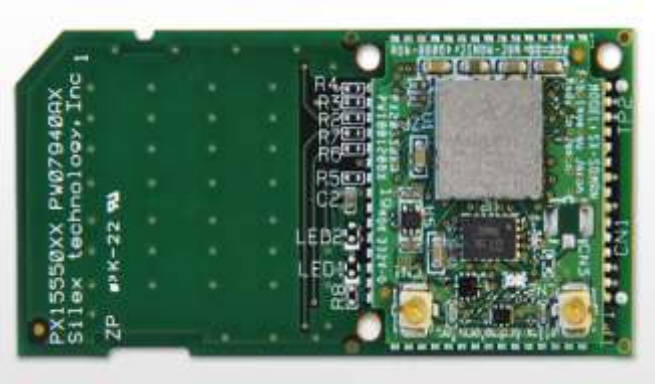
# SILEX Wi-FI SOLUTIONS

- 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

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## 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



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# i.MX 6 Series Triple-Play Graphics support

| i.MX 6Solo / i.MX 6DualLite | i.MX 6Dual | i.MX 6Quad |
|---|---|---|
| VIVANTE GC320 | VIVANTE GC320 | VIVANTE GC320 |
| Composition (2D BLIT) | Composition (2D BLIT) | Composition (2D BLIT) |
| | VIVANTE GC355 | VIVANTE GC355 |
| | Vector Graphics | Vector Graphics |
| VIVANTE GC880 | VIVANTE GC2000 | VIVANTE GC2000 |
| 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***

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# i.MX 6 Reference Designs (with Production Silicon)

- All Boards FSL designed
- All Boards FSL supported
- Each board designed for 6Q/6D/6DL/6S except for 6SL EVK
- Common set of boards for 6Q/D/DL/S
- SoloLite will have its own EVK

| | i.MX 6Quad<br>• Dual DDR | i.MX 6Dual<br>• Dual DDR | i.MX 6Dual Lite<br>• Dual DDR | i.MX 6Solo<br>• Single DDR<br>• EPD | i.MX 6SoloLite<br>• Single DDR<br>• EPD |
|---|---|---|---|---|---|
| SABRE–AI for Auto ($1499) | ✓ | | | ✓ | |
| SABRE Platform for Smart Devices ($999) | ✓ | | ✓ | | |
| SABRE Board for Smart Devices ($399) | ✓ | | | | |
| i.MX 6SLEVK ($599) | | | | | ✓ |

i.MX 6 maximizes use of reference boards across derivative parts

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# 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

# 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 ($999)
MCIMX6DL-SDP ($999)

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

**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


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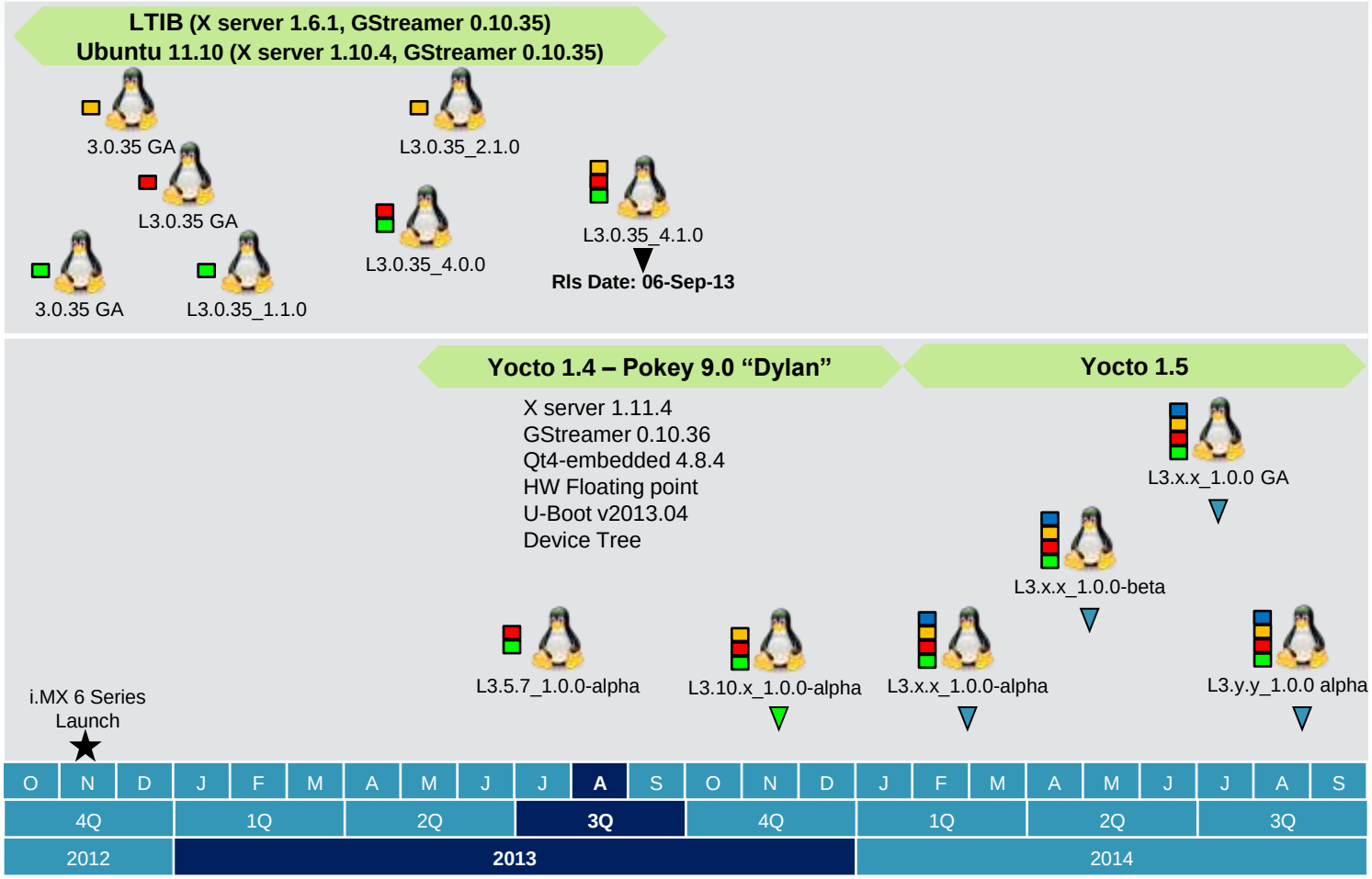
# Linux Roadmap




- Execution
- Planning
- Proposed

- i.MX6Q/i.MX6D SabreSDB/SDP, SabreAI
- i.MX6DL/i.MX6S SabreSDP, SabreAI
- i.MX6SL EVK
- i.MX6SoloX SabreSDP

**GA – Support for 1 year**
**Alpha & Beta – Support until next release**

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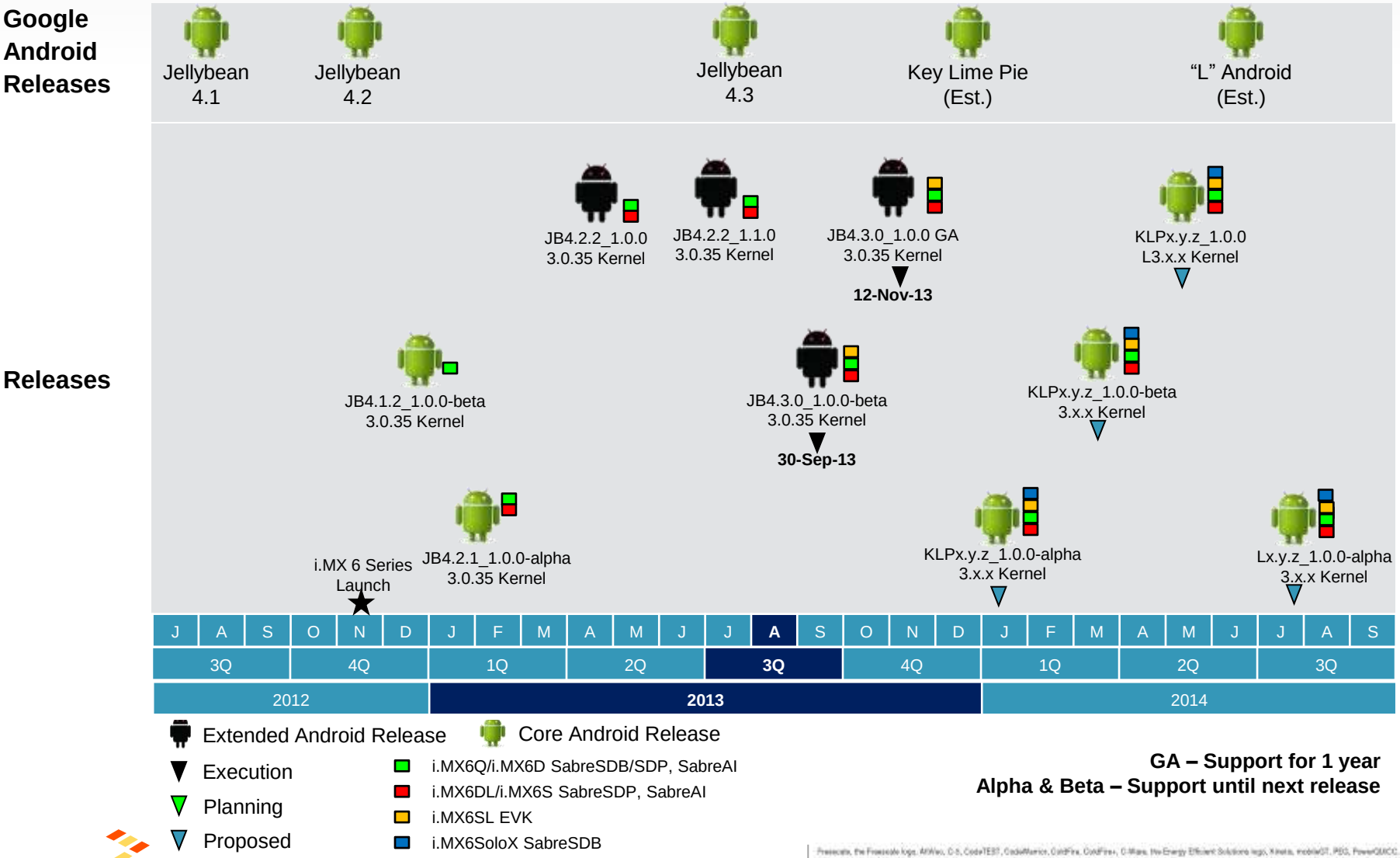
# Android Roadmap




**GA – Support for 1 year**
**Alpha & Beta – Support until next release**

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# History of Android Development

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

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