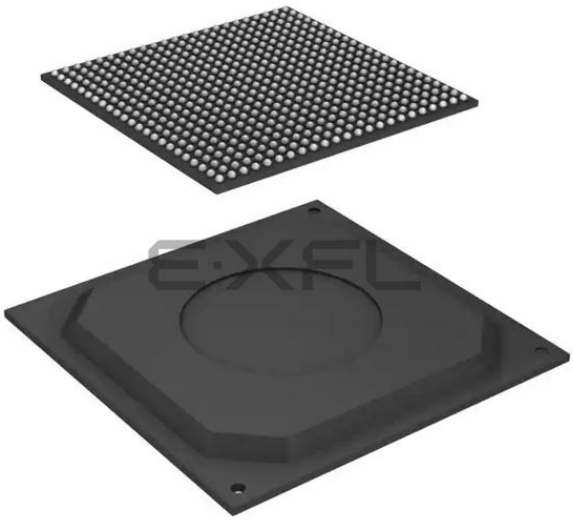

**Welcome to E-XFL.COM**

## 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 ~ 125°C (TJ) |
| 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/mcimx6x4avm08ab |

# 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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# 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

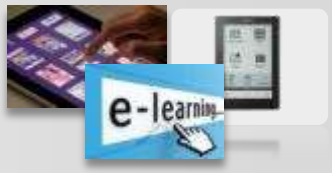
Smart Monitor
Business Tablet
Media Tablet
IP Phone
Tablets for Kids
Mainstream Infotainment
Color eReaders

**Single Core**

High-End

Low-End

Smart Energy
eReaders
Entry Infotainment



# i.MX 6 Series 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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# 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!

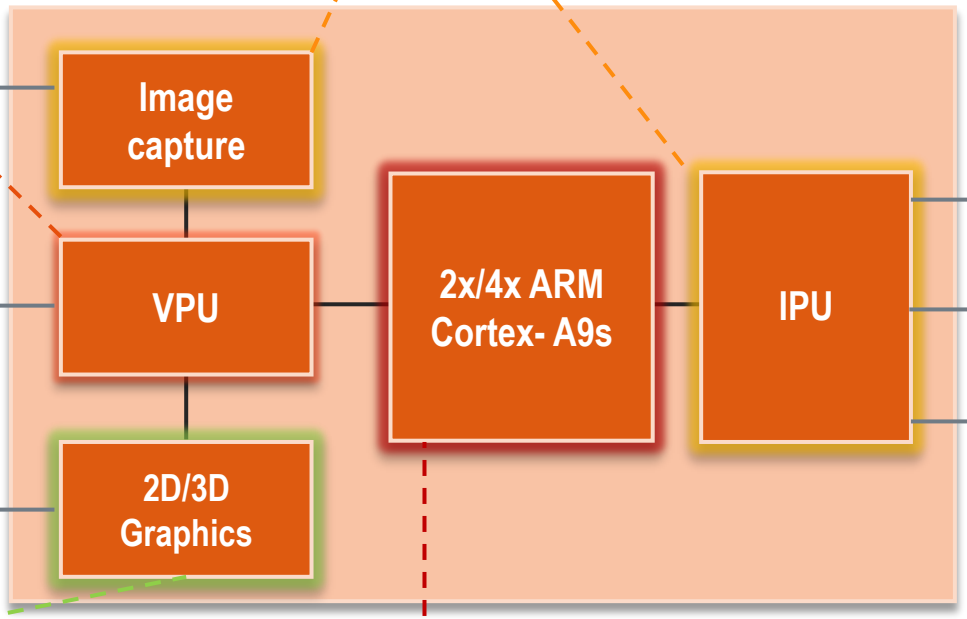
## i.MX 6Dual/6Quad IPU

- 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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# 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 |

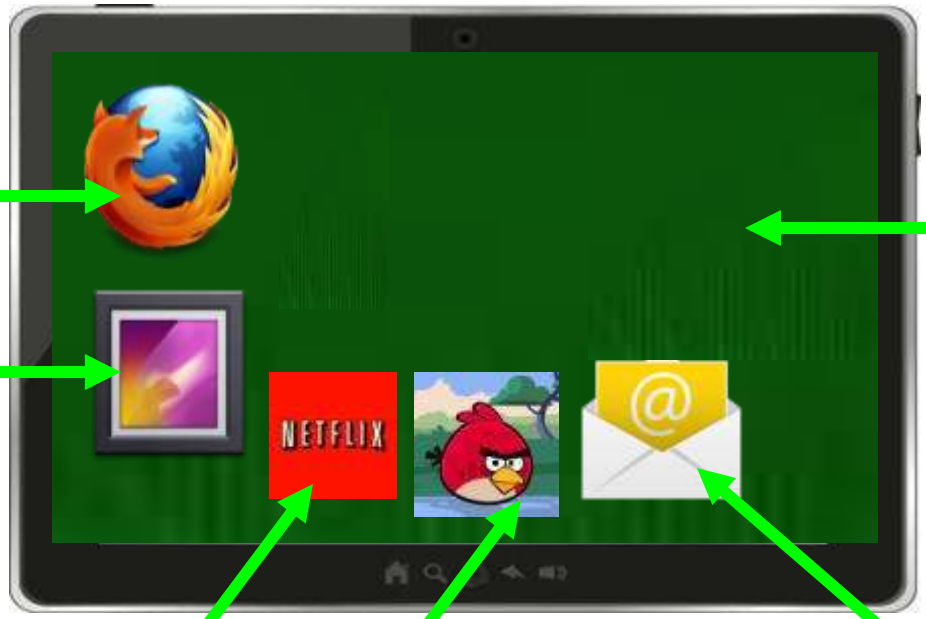
***Same GPU drivers for all i.MX 6 Processors***

# 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**

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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.**

# 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**

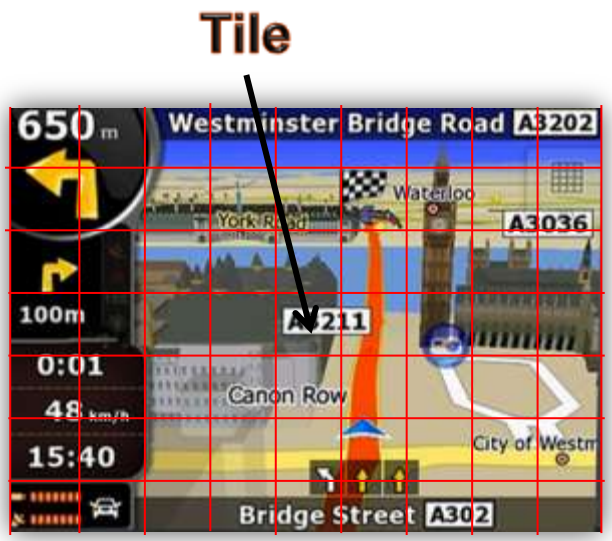
**AnTuTu Benchmark**

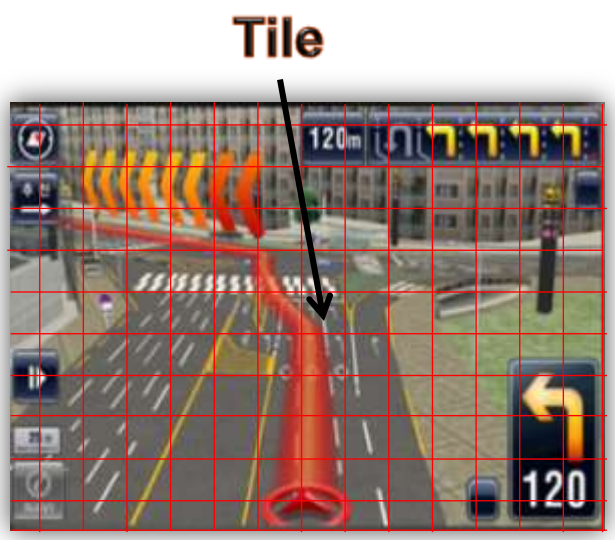

**Quadrant Benchmark**

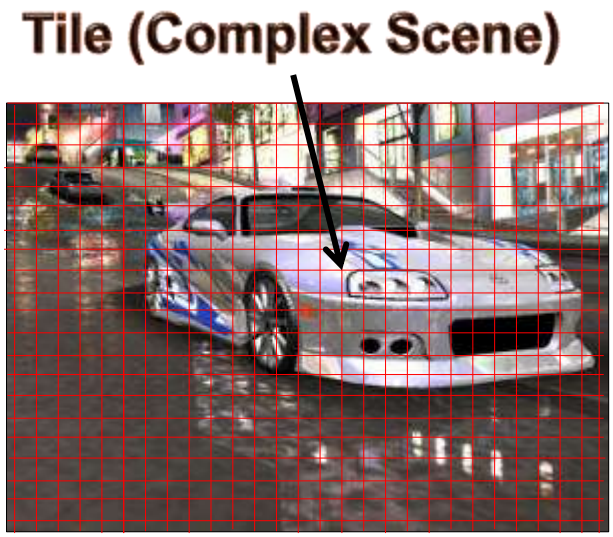
| | 6Quad | 6DualLite | 6Solo | Tegra2 |
|---|---|---|---|---|
| **Taiji Girl** | 25.65 fps | 9.2 fps | 7.67 fps | 6 fps |
| **NenaMark** | 49.2 | 30.5 | 27.2 | 21 |
| **AnTuTu** | 9605 | 5583 | 4531 | 4904 |
| **Quadrant** | 4011 | 3005 | 2414 | 2559 |

# 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



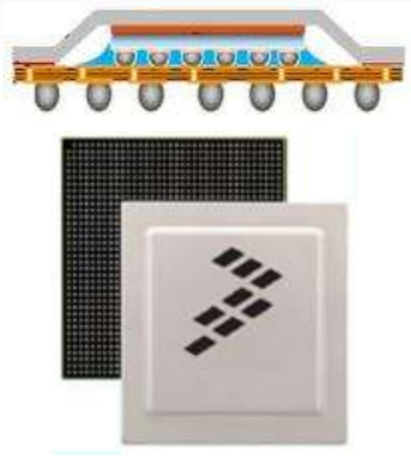
# i.MX 6 Series VPU: *Multi-streams*

| | 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 | -- | -- |

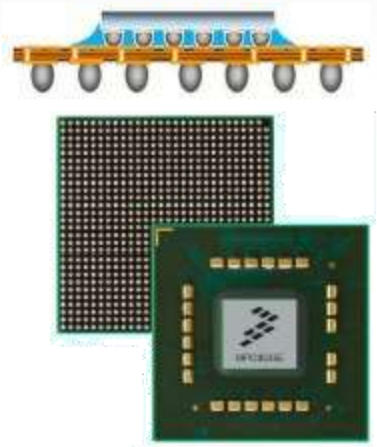
# Packaging and Qual levels – 21x21 FCBGA Package

- **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 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<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 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<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 |

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

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

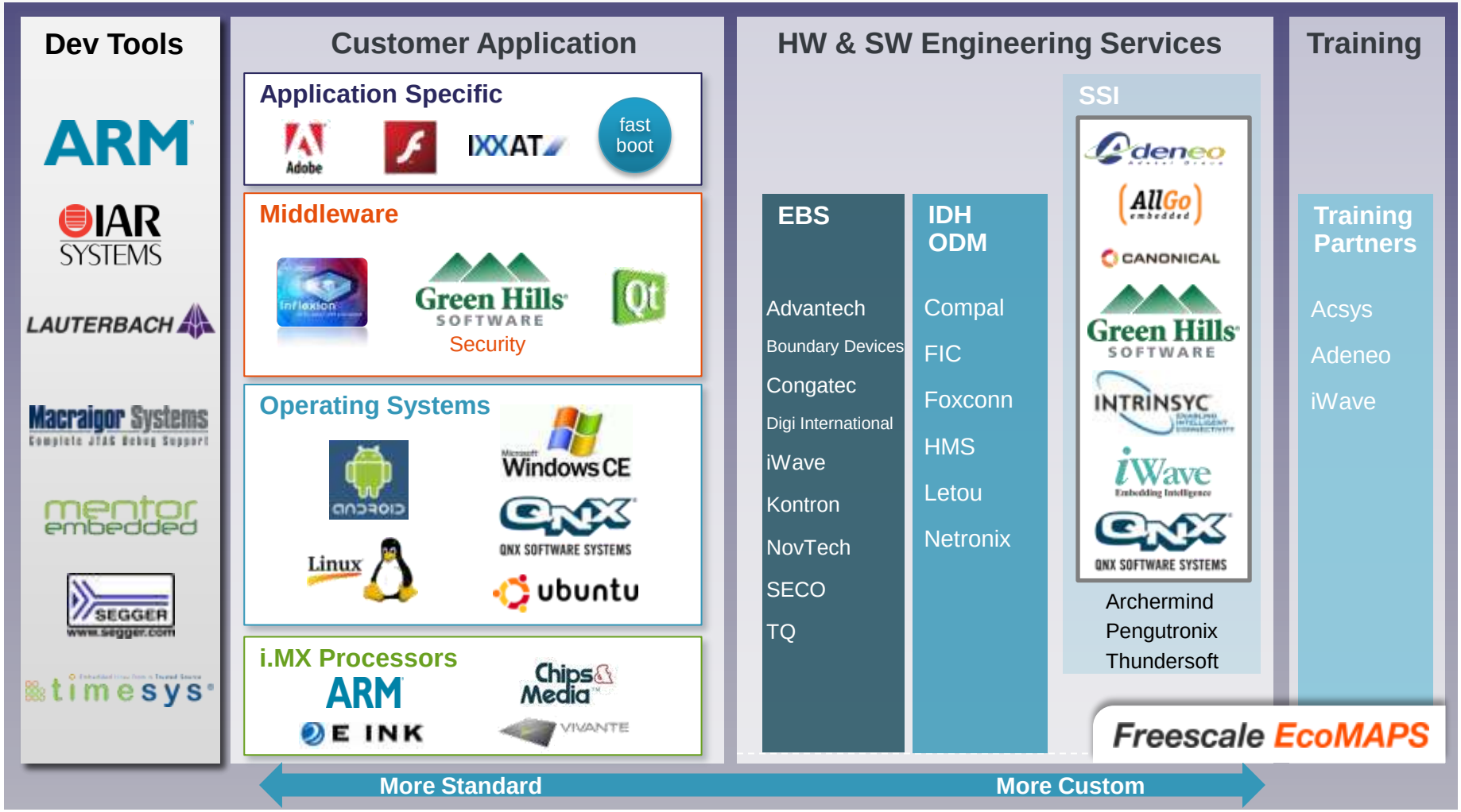
**Low Cost Community Board**

- 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**

# Freescale EcoMAPS for i.MX Architectures




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

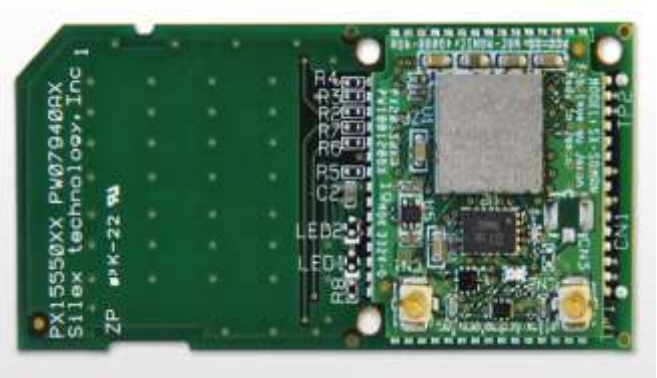
**EBS**: Embedded Board Solutions

**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



# 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***

# 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**
- Dual DDR


**i.MX 6Dual**
- Dual DDR


**i.MX 6Dual Lite**
- Dual DDR


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


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

# 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

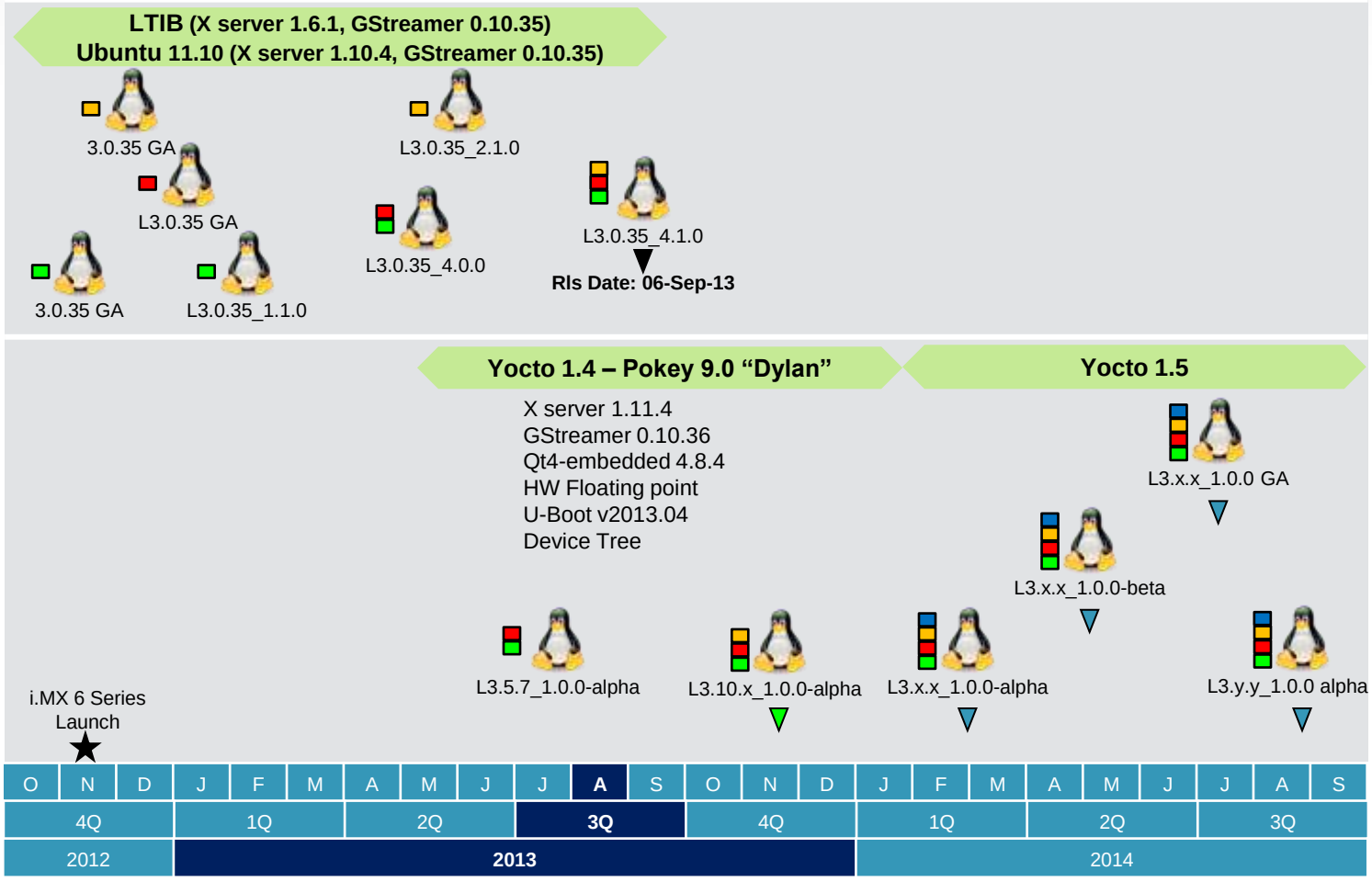
**Connectivity**
- 2x Full-size SD/MMC card slot
- 22-pin SATA connector
- 10/100/1000 Ethernet port
- 1x high-speed USB OTG port
- mPCI-e connector

**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

# 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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