



i.MX 6 Series Portfolio Overview

FTF-INS-F1207

AUG. 2015



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Agenda

- i.MX Series Introduction
 - i.MX Product Leadership
 - Target Markets
- Positioning with i.MX 6 Series Products
- Development with i.MX 6SoloX
 - Introduction to Heterogeneous Multicore Processing
- i.MX 6 Portfolio Expansion
 - Advantages of the low end i.MX 6UltraLite
 - Introduction to i.MX 6DualPlus and i.MX 6QuadPlus family



A Global Leader in Microcontrollers and Digital Networking Processors



>50 Year Legacy

>5,500 Engineers

>6,000 Patent

Families

Five Core Product Groups

Microcontrollers

Digital Networking

Automotive MCU

Analog & Sensors

RF

Four Primary Markets

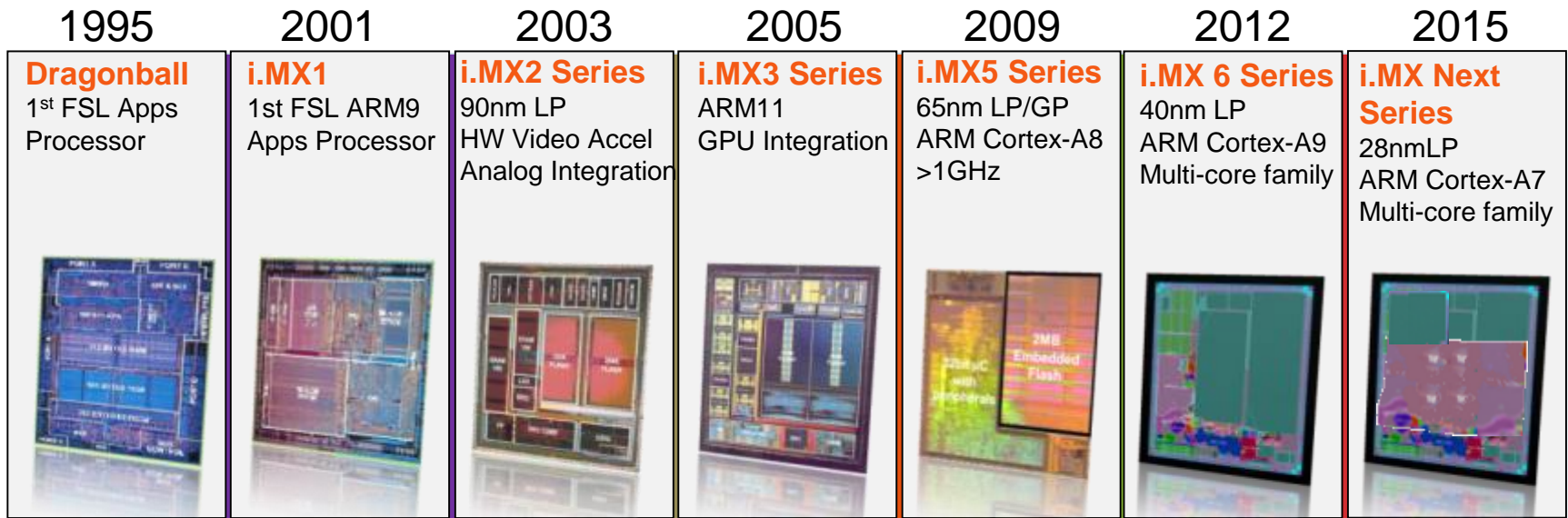
Automotive 

Networking 

Industrial 

Consumer 

Seven Generations of Application Processors



50+ Products
>200M Units

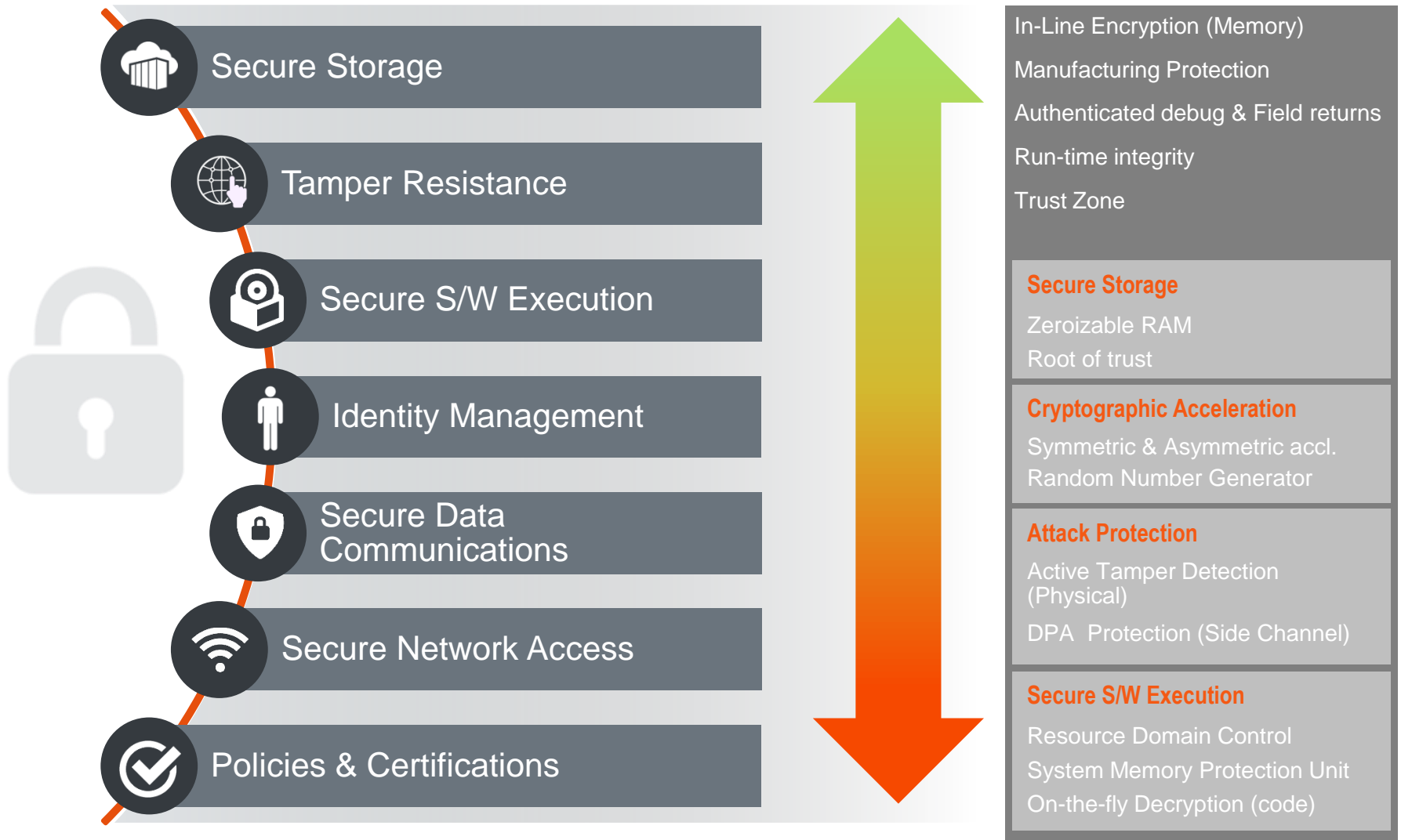
- **No.1** for eReader apps processors (IDC)
- **No. 2** in Auto Infotainment (Strategy Analytics)
- Freescale ARM SOC **Momentum**:
 - ARM based products (Kinetis, i.MX) >50% y/y
 - Strong growth in Auto Infotainment (i.MX > 50% y/y)
 - Industrial & consumer MCU's double-digit growth y/y
 - i.MX double-digit growth in all regions

i.MX Application Processors Core Values

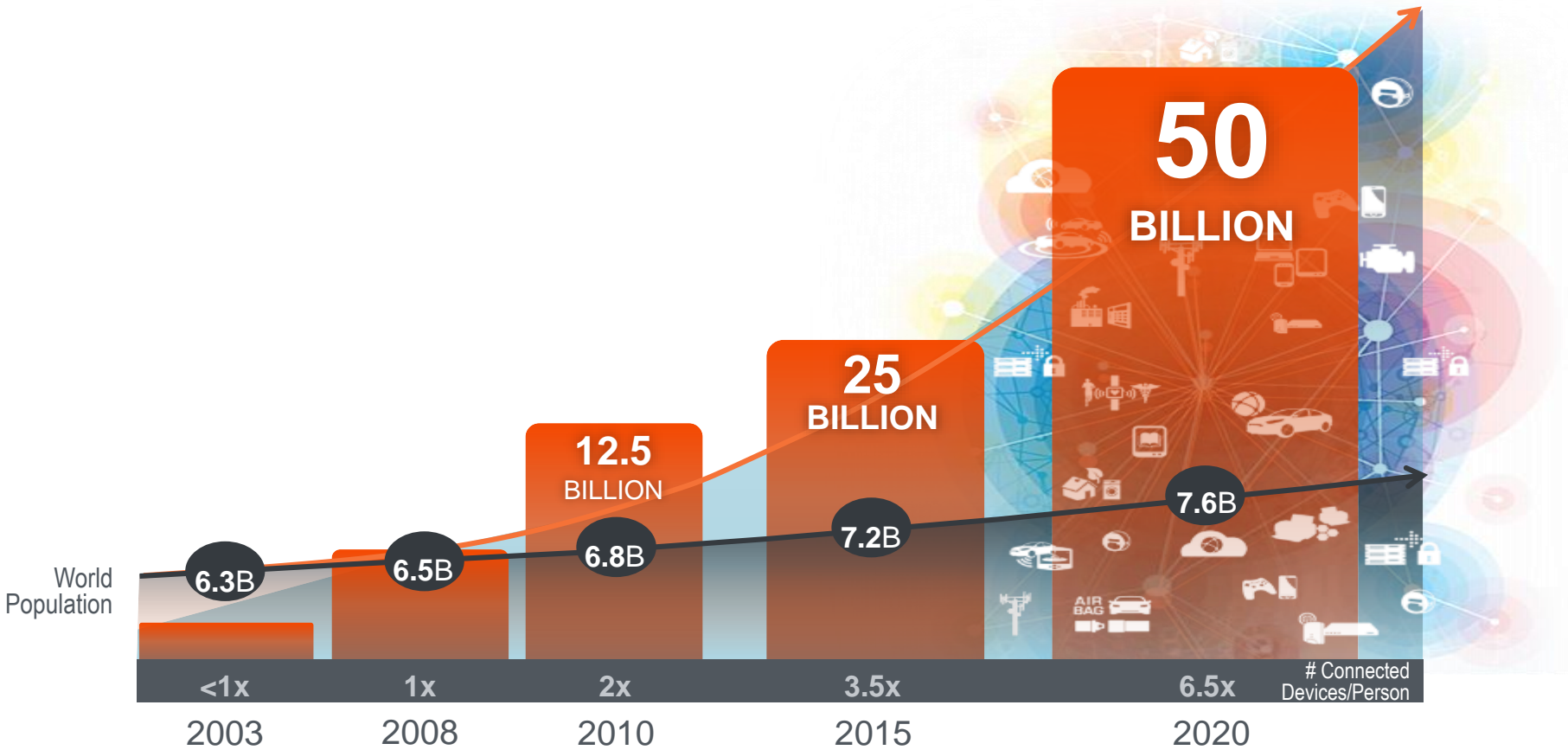
- **Scalability**
 - CPU (single/dual/quad, asymmetric), GPU, IO
 - Software: Linux, Android, QNX, Windows Embedded, RTOS
 - Industry Leading Ecosystem and Partnerships
- **Integration**
 - Automotive/Industrial/Consumer peripheral sets
 - Packaging to Meet Market Requirements
 - Qualifications: AEC-Q100, JEDEC Industrial and Consumer
- **Trust**
 - Longevity: Minimum of 10-15 years in all markets
 - Consistency of Supply, Accessibility
 - Quality, Robustness, Zero-defect methodology
 - Security and Safety
- **Ease of Adoption**
 - Communities, Innovation, Support
 - Design Collateral, Distribution
 - System Solutions: SoC, Sensors, PMIC, IoT Comms, SBC



Leadership Security – i.MX Hardware Enablement



The Internet of Things is Driving Explosive Growth in Connected Devices

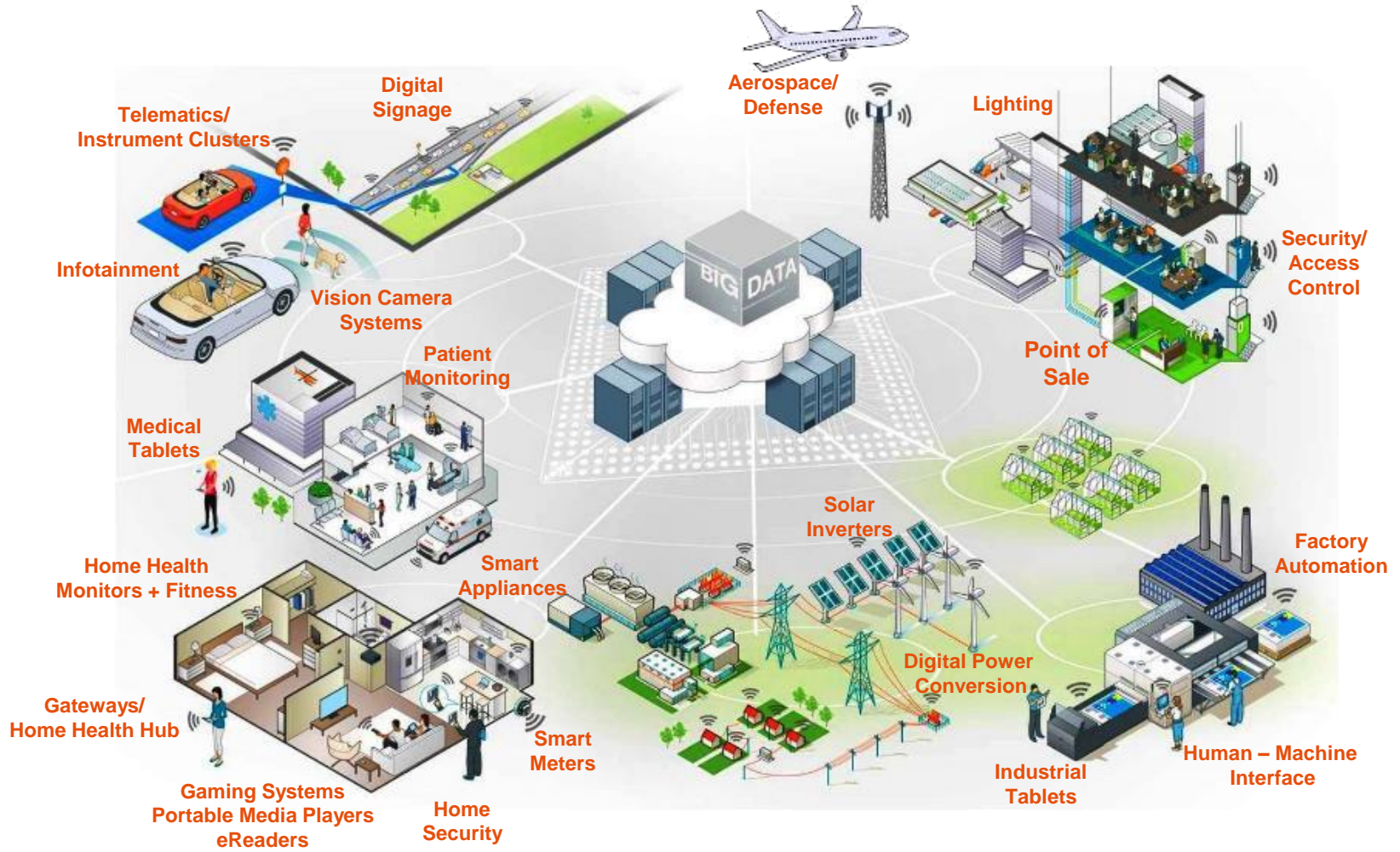


* Sources: Ericsson, February 2011; Cisco Internet Business Solutions Group (IBSG), April 2011



Microcontrollers – Powering The Internet of Things

i.MX Applications Processors | Kinetis MCUs | DSCs

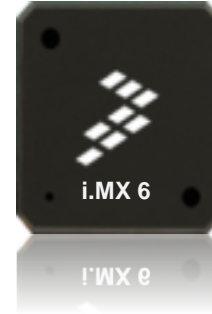
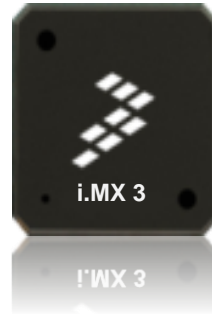
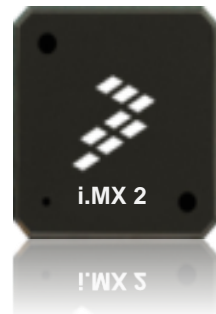


Leadership Software - i.MX Linux Enablement

- Silver Member of Linux Foundation
- AGL Working Group Bronze Member (in progress)



Over the past 15 years shipping i.MX application processors...



← 39,000+ Linux Downloads →

*Multiple i.MX 6 Series customer engagements are using GENIVI Solutions
Freescale has more compliant platforms than ANY semiconductor vendor*

Reference: <http://www.genivi.org/compliant-products>



i.MX Android Leadership



ANDROID



Commitment: 9 Android OS versions released over past 7 years

Broad Acceptance: 25,000+ downloads of BSP to date

Fast Development: ~4 months from development start to production release on multiple Android versions

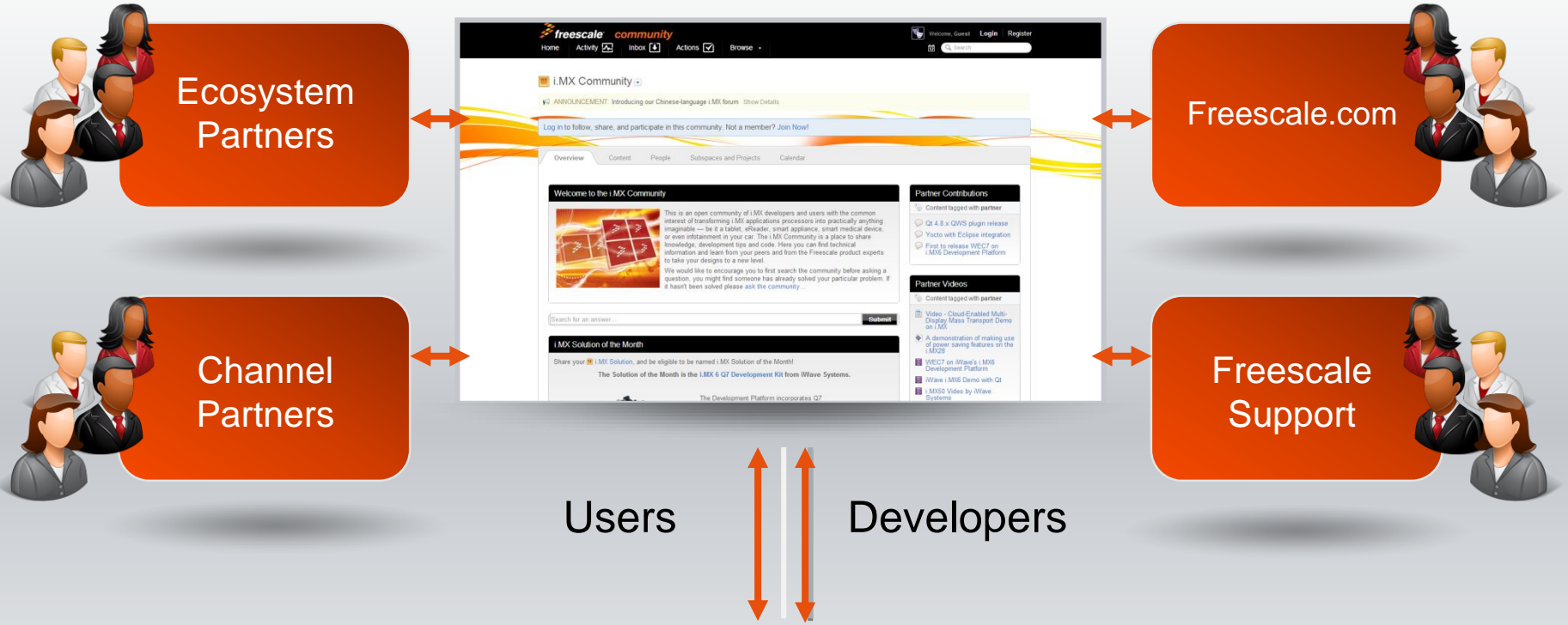
Cross Market Robustness: Automotive, Embedded/Industrial, Consumer

Continued Support: New OS releases for 2 years after silicon production qual

Leadership: i.MX – only Android system shipping in a top 5 OEM infotainment platform today



iMXCommunity.org – Connect. Collaborate. Share.



Users Developers

Greater than **4,000 members**

3500 **new content** added **every year**

Support and enablement for i.MX processors and software – **share** tips, **ask** questions, **spark ideas**
Federated **search capability** integrated with Freescale.com

Forums – Discussions – Groups – Blogs Posts – News – Multimedia Gallery – Training



i.MX Expanded 6 Series

Enhancements for performance, power efficiency and lower BOM



- Provide customers and partners with the **broadest range** of choices
- Reduce **development costs** and **improve** time to market
- **Performance scalability** is key to implement this strategy

i.MX 6 Series at a Glance

Red indicates change from column to the left

i.MX6UltraLite

- Single ARM® Cortex®-A7 up to 528 MHz
- 128 KB L2 cache, Neon, VFP, Trustzone
- X16 LPDDR2, DDR3/LV-DDR3
- 2X 10/100 Mb/s + IEEE 1588
- 2X 12-bit ADC (1 with resistance touch control)
- 10/100 Ethernet MAC



i.MX6SoloLite

- Single Cortex®-A9 up to 1.0 GHz
- 256 KB L2 cache, Neon, VFPv16 Trustzone
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400 MHz
- Integrated EPD controller
- 10/100 Ethernet MAC



i.MX6SoloX

- Single Cortex®-A9 up to 1.0 GHz
- Single Cortex®-M4 up to 200 MHz
- 256 KB L2 cache, Neon, VFP, Trustzone
- 3D and 2D graphics
- 32-bit DDR3 and LPDDR2 at 400 MHz
- Dual Gigabit Ethernet MAC w/ hardware AVB support
- PCIe controller plus PHY
- LVDS controller plus PHY
- Analog camera interface
- 8-channel, 12-bit ADC
- MLB and FlexCAN controllers



i.MX6Solo

- Single Cortex®-A9 up to 1.0 GHz
- 512 KB L2 cache, Neon, VFPv16 Trustzone
- 3D graphics with one shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400 MHz
- Gigabit Ethernet MAC
- Integrated EPD controller
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6DualLite

- Dual Cortex®-A9 up to 1.0 GHz
- 512 KB L2 cache, Neon, VFPv16 Trustzone
- 3D graphics with one shader
- 2D graphics
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 400 MHz
- Gigabit Ethernet MAC
- Integrated EPD controller
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6Dual

- Dual Cortex®-A9 up to 1.2 GHz
- 1 MB L2 cache, Neon, VFPv16 Trustzone
- 3D graphics with four shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Gigabit Ethernet MAC
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6DualPlus

- Dual Cortex®-A9 up to 1.2 GHz
- 1 MB L2 cache, Neon, VFPv16 Trustzone
- Enhanced 3D graphics with four shaders
- Enhanced Two 2D graphics engines
- Prefetch & Resolve Engine
- Gigabit Ethernet MAC
- Optimized 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6Quad

- Quad Cortex®-A9 up to 1.2 GHz
- 1 MB L2 cache, Neon, VFPv16 Trustzone
- 3D graphics with four shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Gigabit Ethernet MAC
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX6QuadPlus

- Quad Cortex®-A9 up to 1.2 GHz
- 1 MB L2 cache, Neon, VFPv16 Trustzone
- Enhanced 3D graphics with four shaders
- Enhanced Two 2D graphics engines
- Prefetch & Resolve Engine
- Gigabit Ethernet MAC
- Optimized 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz
- Integrated SATA-II
- HDMIV1.4 controller plus PHY
- LVDS controller plus PHY
- PCIe controller plus PHY
- MLB and FlexCAN controllers



i.MX 6 Series Automotive Momentum



**7 of top 10
Automotive OEMs**
Infotainment Systems



6 Top Luxury Brands
Reconfigurable LCD
Instrument Clusters



Rapid Expansion
Into Other Applications
Such as Telematics and
Driver Awareness



i.MX 6Quad
i.MX 6Dual
i.MX 6DualLite
i.MX 6Solo

Autoliv

ALPINE

BOSCH

Continental

DENSO

DELPHI

FOXCONN

HARMAN

**Johnson
Controls**

LG

**MAGNETI
MARELLI**

**NSI
N.S. INTERNATIONAL, LTD.**

Pioneer






TechniSat

Visteon

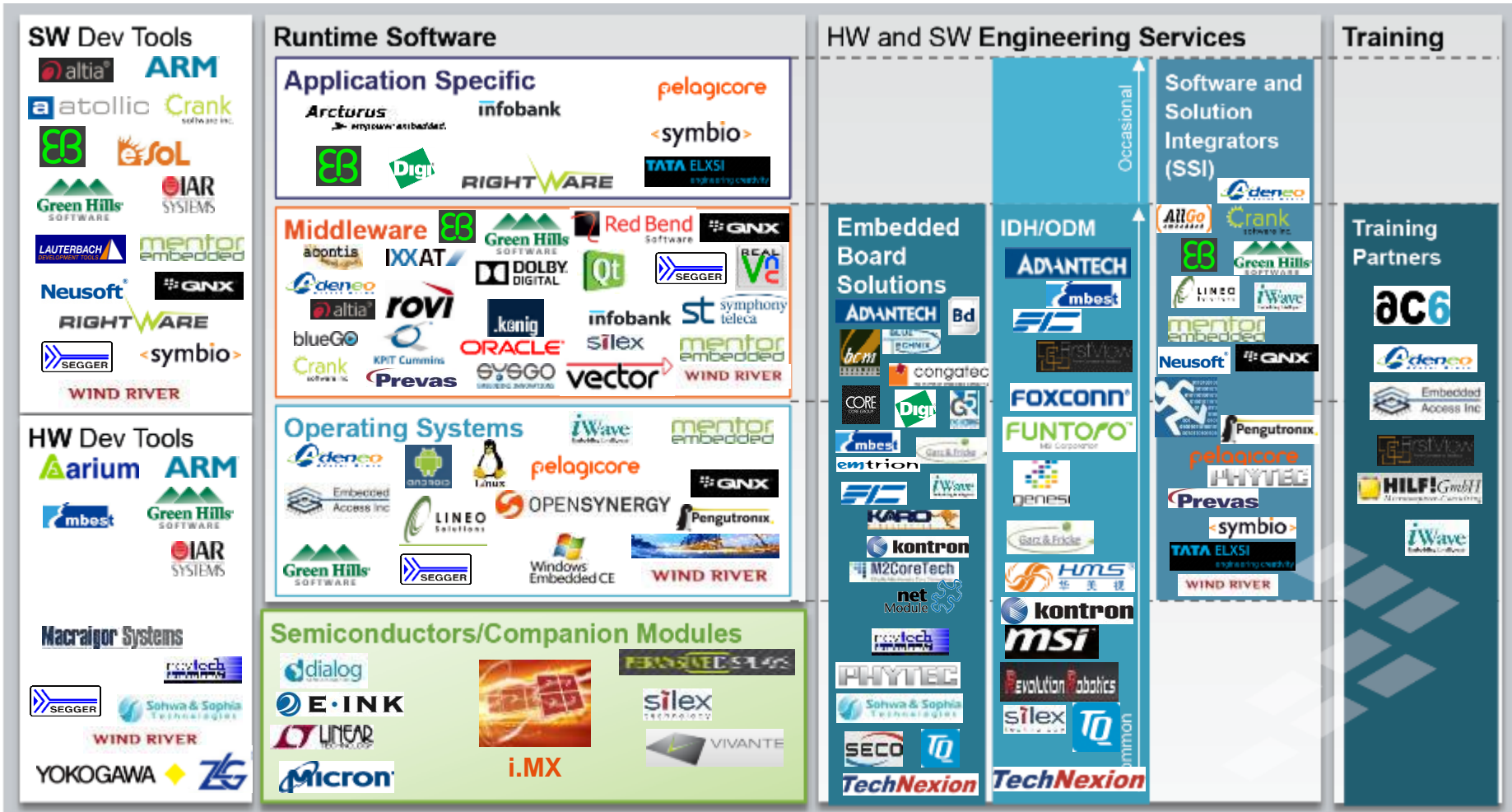
YAZAKI



Industrial Applications & Products

| | Factory Automation | Home Appliances | Smart Energy | Healthcare | Other Industrial |
|--------------|--|---|--|--|--|
| |  |  |  |  |  |
| Applications | <ul style="list-style-type: none"> • Factory Automation • Machine-to-Machine • Human-Machine Interface • Industrial Networking • Lighting Control • HVAC, Heating & Cooling Systems • Motor Control • Internet of Things | <ul style="list-style-type: none"> • Refrigerators • Dishwashers • Washing Machines & Dryers • Connected Appliances • Motor Control • Human-Machine Interface • Internet of Things | <ul style="list-style-type: none"> • Smart Meters • Smart Grid Infrastructure • Home Energy Control • Home Hub • Digital Power Conversion • Security & Home Monitoring • Internet of Things | <ul style="list-style-type: none"> • Diabetes Care • Cardiac Care • Health / Fitness • Remote Monitoring • Wireless Healthcare • Diagnostics & Therapy • Internet of Things | <ul style="list-style-type: none"> • Aerospace & Defense • Industrial Radar • ISM & Broadcast • Land Mobile Radio • Printing & Imaging • Next Gen Microwave Ovens • Video Analytics • Internet of Things |
| Products | <ul style="list-style-type: none"> • Microcontrollers • Microprocessors • Communications Processors • Applications Processors | <ul style="list-style-type: none"> • Sensors & Sensor Fusion • Digital Signal Controllers • ZigBee, Bluetooth Low Energy, Sub-1 GHz Wireless | <ul style="list-style-type: none"> • RF Power Amplifiers & Transistors • Analog Battery Management • Analog System Basis Chips • Network Transceivers | | |

EcoMAPS: i.MX Applications Processor Based on the ARM™ Core



Non-proven partners and non connect partners included

<https://community.freescale.com/community/imx>
 For more partner options, visit freescale.com/partners



Graphics Technology Engineering Center

Comprehensive Graphics Application Support for Freescale i.MX Products



AN ORGANIZED TEAM OF "CUSTOMER CENTRIC" GRAPHICS TECHNOLOGY EXPERTS FOCUSED ON OPTIMIZING GRAPHICS PERFORMANCE AND CUSTOMER EXPERIENCE AT THE STUDIO, APPLICATION AND SYSTEM LEVELS AS WELL AS ARCHITECTING ADVANCED, FORWARD THINKING SOLUTIONS FOR OUR NEXT GENERATION APPLICATION PROCESSOR PLATFORMS.

GPU South

- Kernel Level Drivers
- API Level Libraries (GL ES, VG, etc.)
- Validate New SW from GPU IP Provider
- Debugging / Test
- Customer Support (as needed)

Graphics

- Graphics "Above" the API Level
- Benchmarking
- Testing
- Demonstration Applications
- Customer Support / Education

Compute

- OpenCL
- Compute Shaders
- Benchmarking
- Testing
- Customer Support / Education
- Demonstration Applications

Studio

- Conceptual Art
- 2D / 3D artwork creation
- Artwork Optimization
- Technical Art
- Tutorials
- Demos
- Benchmarks

Ecosystem

- Graphics Engines (2D / 3D)
- Debuggers
- Performance Analysis
- HMI Tooling
- OS Vendors

Architecture

- Customer Requirements
- System Architecture
- IP Evaluation / Recommendation
- Troubleshooting
- RTL Analysis / Simulation



Freescale's Product Longevity Program

- The automotive market requires **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 solutions available for a minimum of **15 years**
 - For all other market segments in which Freescale participates, Freescale will make a broad range of solutions available for a minimum of **10 years**
 - **Lifecycles** begin at the time of launch
- A list of participating products is available at: www.freescale.com/productlongevity



Freescale i.MX Family



i.MX25 Target Markets

Industrial



- HMI (Factory Automation & Building Control)
- Smart Meters
- General Embedded / Consumer

Point Of Sale

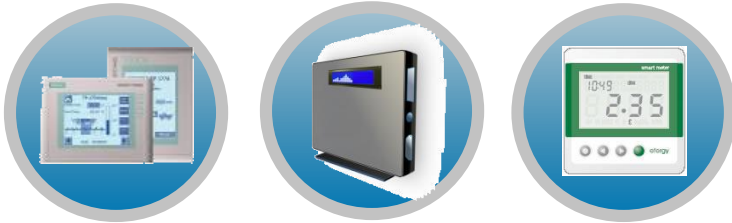


- Secure ePOS Terminals
- Data Acquisition (Scanners)
- Fixed and Handheld Printers

| Feature | Benefit |
|---|--|
| Integration and Connectivity – Ethernet, CAN, SDIO, Touchscreen Controller, DDR2, USB PHY, Camera I/F | Reduced system cost and complexity, greater product feature scalability |
| LCD Controller | Can drive high color VGA displays for information display and user interaction |
| Security | Robust, tamper-resistant devices for secure applications |
| Industrial qualification and product longevity | Supports the full life of the product in the field |
| Windows CE and Linux BSP's | Reuse software across i.MX platforms |
| Optimized performance and power consumption | Fanless automation, increased battery life for portable equipment |

i.MX28 Target Applications

Industrial



- Smart Energy – Gateways/Meters
- HMI – Factory Automation
- HMI – Building Control
- Industrial Control
- Fixed and Handheld Printers

Home and Office



- HMI (Appliances, Security Panels, Automation)
- Portable Medical
- Media Gateways/Accessories

Automotive



- Audio Connectivity
- CAN Gateways

i.MX53 Target Markets

Consumer



- Tablet
- Personal Navigation
- Mobile Internet Devices
- Video-enabled IP Phone
- Digital Photo Frame
- Connected TV
- Smart Monitor

Industrial



- Security and Surveillance
- Industrial HMI
- Digital Signage / Kiosks
- Barcode Scanners
- Printers

Automotive



- Connectivity and Telematics
- Digital Instrument Clusters
- Video and Navigation

Medical



- Patient Monitors
- Telehealth
- Infusion Pumps

Freescale i.MX 6SoloX



i.MX 6 Series at a Glance

Red indicates change from column to the left

| i.MX6UltraLite | i.MX6SoloLite | i.MX6SoloX | i.MX6Solo | i.MX6DualLite | i.MX6Dual | i.MX6DualPlus | i.MX6Quad | i.MX6QuadPlus |
|---|--|--|---|--|---|--|---|--|
| <ul style="list-style-type: none"> • Single ARM® Cortex®-A7 up to 528 MHz • 128 KB L2 cache, Neon, VFP, Trustzone • X16 LPDDR2, DDR3/LV-DDR3 • 2X 10/100 Mb/s + IEEE 1588 • 2X 12-bit ADC (1 with resistance touch control) • 10/100 Ethernet MAC | <ul style="list-style-type: none"> • Single Cortex®-A9 up to 1.0 GHz • 256 KB L2 cache, Neon, VFPv16 Trustzone • 2D graphics • 32-bit DDR3 and LPDDR2 at 400 MHz • Integrated EPD controller • 10/100 Ethernet MAC | <ul style="list-style-type: none"> • Single Cortex®-A9 up to 1.0 GHz • Single Cortex®-M4 up to 200 MHz • 256 KB L2 cache, Neon, VFP, Trustzone • 3D and 2D graphics • 32-bit DDR3 and LPDDR2 at 400 MHz • Dual Gigabit Ethernet MAC w/ hardware AVB support • PCIe controller plus PHY • LVDS controller plus PHY • Analog camera interface • 8-channel, 12-bit ADC • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Single Cortex®-A9 up to 1.0 GHz • 512 KB L2 cache, Neon, VFPv16 Trustzone • 3D graphics with one shader • 2D graphics • 32-bit DDR3 and LPDDR2 at 400 MHz • Gigabit Ethernet MAC • Integrated EPD controller • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Dual Cortex®-A9 up to 1.0 GHz • 512 KB L2 cache, Neon, VFPv16 Trustzone • 3D graphics with one shader • 2D graphics • 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 400 MHz • Gigabit Ethernet MAC • Integrated EPD controller • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Dual Cortex®-A9 up to 1.2 GHz • 1 MB L2 cache, Neon, VFPv16 Trustzone • 3D graphics with four shaders • Two 2D graphics engines • 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Gigabit Ethernet MAC • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Dual Cortex®-A9 up to 1.2 GHz • 1 MB L2 cache, Neon, VFPv16 Trustzone • Enhanced 3D graphics with four shaders • Enhanced Two 2D graphics engines • Prefetch & Resolve Engine • Gigabit Ethernet MAC • Optimized 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Quad Cortex®-A9 up to 1.2 GHz • 1 MB L2 cache, Neon, VFPv16 Trustzone • 3D graphics with four shaders • Two 2D graphics engines • 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Gigabit Ethernet MAC • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers | <ul style="list-style-type: none"> • Quad Cortex®-A9 up to 1.2 GHz • 1 MB L2 cache, Neon, VFPv16 Trustzone • Enhanced 3D graphics with four shaders • Enhanced Two 2D graphics engines • Prefetch & Resolve Engine • Gigabit Ethernet MAC • Optimized 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533 MHz • Integrated SATA-II • HDMIv1.4 controller plus PHY • LVDS controller plus PHY • PCIe controller plus PHY • MLB and FlexCAN controllers |

Requisite for Multiple Software Execution Environments

- A growing number of embedded use cases require concurrent execution of isolated software environments within the system
- Motivation for multiple software execution environments:
 - Real-time performance
 - Power consumption
 - Fast boot
 - System integrity
 - System security
 - Leverage hardened or certified software solutions
 - Reuse of legacy software

i.MX 6SoloX Target Applications



- XGA industrial HMI with basic UI
- Large or high-quality small appliance
- Industrial scanner or printer
- Vending machine with display and basic UI



- Access control (security) panel
- Surveillance monitoring
- Building control, e.g. elevator or automated door
- Kiosk with 2D display, e.g. gas pump



- Mobile patient care, e.g. infusion pump or respirator
- Blood pressure monitor
- Activity and wellness monitor
- Exercise equipment with display



- Wired and wireless audio streaming
- Energy management hub
- Industrial gateway
- VoIP



- Telematics
- Entry-level infotainment
- Industrial vehicle with control & HMI, e.g. tractor, train, ship, heavy equipment
- Service robot

i.MX 6SoloX vs. i.MX 6Solo/6SoloLite Key Differences

Blue indicates feature advantage

| Feature | i.MX 6SoloLite | i.MX 6SoloX | i.MX 6Solo |
|--------------------|--|---|--|
| CPU1 | 1GHz Cortex-A9 (2400 DMIPS) | 800MHz -1GHz Cortex-A9 (2400 DMIPS) | 800MH-1GHz Cortex-A9 (2400 DMIPS) |
| CPU2 | - | 166MHz-200MHz Cortex-M4 (208 DMIPS) | - |
| On-chip memory | 256KB L2 + 256KB SRAM | 256KB L2 + 128KB SRAM | 512KB L2 + 128KB SRAM |
| Serial Flash I/F | SPI | Dual DDR QuadSPI | SPI |
| Raw NAND Flash I/F | - | 8-bit NAND BCH60 | 8-bit NAND BCH40 |
| DRAM interface | 32-bit LPDDR2/DDR3 @400MHz | 32-bit LPDDR2/DDR3 @400MHz | 32-bit LPDDR2/DDR3 @400MHz |
| Ethernet | 1x 10/100 | 2x Gb AVB | 1x Gb + 1588 |
| PCIe | - | 1x PCIe 2.0 (x1 lane) *n/a on all packages | 1x PCIe 2.0 (x1 lane) |
| USB | 1x USB OTG HS w/PHY 1x USB Host HS w/PHY 1x HSIC | 1x USB OTG HS w/PHY 1x USB Host HS w/PHY 1x HSIC | 1x USB OTG HS w/PHY 1x USB Host HS w/PHY 2x HSIC |
| UART, SPI, I2C | 5, 4, 4 | 6 , 4, 4 | 5, 4, 4 |
| SD/MMC interface | 3x SD/MMC, 1x SDXC | 3x SD/MMC, 1x SDXC | 3x SD/MMC, 1x SDXC |
| 12-bit ADC | - | 2x 12-bit SAR *n/a on all packages | - |
| Camera Input | 16-bit parallel | 20-bit parallel *n/a on all packages 4x Composite *n/a on all packages | 20-bit parallel 1x MIPI CSI |
| GPU 2D | GC320 Composition (600Mpxl/s) *n/a on all devices | via GPU 3D (300Mpxl/s) *n/a on all devices | GC320 Composition (600Mpxl/s) *n/a on all devices |
| GPU 3D | - | GC400T Open GLES 2.0 *n/a on all devices 27M Tri/s, 133 Mpxl/s | GC880 Open GLES 2.0 *n/a on all devices 53M Tri/s, 266 Mpxl/s |
| Video Decode | via Software | via Software | 1080p30 + D1 |
| Display interface | 1x 24-bit RGB up to WXGA 1x EPDC | 1x 24-bit RGB up to WXGA 1x LVDS *n/a on all packages | 2x 24-bit RGB up to WXGA 1x LVDS, HDMI, MIPI DSI, EPDC |
| Package | 13x13, 0.5P | 17 x17, 0.8P or 19x19, 0.8P | 21 x 21, 0.8P |
| Qual. Tiers | Commercial | Commercial, Industrial, Automotive | Commercial, Industrial, Automotive |
| Availability | Now | Sampling – now (alpha) Production – 4Q14 | Now |



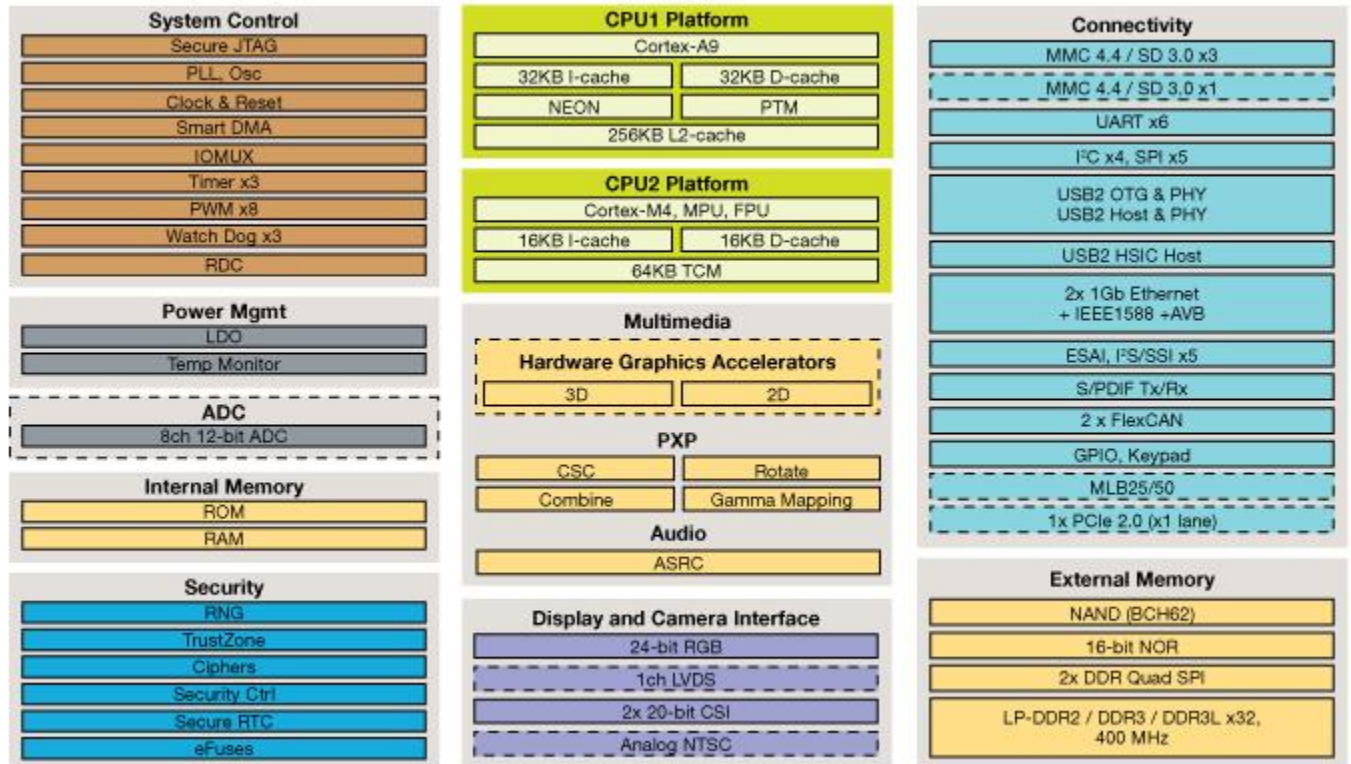
Package Options



| 14 x 14, 0.65p | 17 x 17 NP, 0.8p | 17 x 17 WP, 0.8p | 19 x 19, 0.8p |
|--|---|---|---|
| Optimized for smallest form-factor designs | Optimized for lowest cost board design w/o PCIe | Optimized for lowest cost board design w PCIe | Full-featured package for HMI based designs |
| 2D/3D GPU is optional | 2D/3D GPU is optional | 2D/3D GPU is optional | 2D/3D GPU is standard |
| No PCIe | No PCIe | PCIe is standard | PCIe is standard |
| Parallel LCD interface | Parallel LCD interface | Parallel LCD interface | Parallel and LVDS interfaces |
| ADC is standard | ADC is standard | No ADC | ADC is standard |
| Automotive, industrial and consumer parts | Automotive, industrial and consumer parts | Automotive, industrial and consumer parts | Automotive, industrial and consumer parts |

i.MX 6SoloX Block Diagram

- Heterogeneous Cortex-A9 plus Cortex-M4 architecture for applications processing with real-time control, security and low-power
- Dual Gb Ethernet with hardware AVB support provides fast and reliable communications
- PCIe for high-speed connectivity (e.g. Wi-Fi)
- Every device has a display option (LVDS or parallel)
- 2D and 3D hardware graphics acceleration for performance optimized UI
- Memory controller supports low-power LPDDR2 and cost-effective DDR3/DDR3L
- Versatile boot options
- Broad connectivity
- Smart analog integration simplifies system design
- Industrial, automotive and consumer temp ranges



□ Standard Feature □ Optional Feature



At A Glance: i.MX 6Dual/6Solo, i.MX 6SoloX

| | i.MX 6Dual/6Solo | i.MX 6SoloX | Notes |
|-----------------|------------------|-------------|---|
| 3D GPU | GC 880 | GC 400T | 400T Can support 3D and 2D contexts simultaneously. |
| 2D GPU | GC 320 | (GC400T) | 2 Layer 2D HW Composition Engine |
| Vector Graphics | GC 355 | N/A | Full OpenVG Compliant (Font Rendering / SVG Accel.) |
| Video | 1080p30FPS | None | Support up to H.264 / VP8 single stream |
| OpenCL | N/A | N/A | OpenCL support on A9 only w/ NEON |

Multiple Execution Environments – Automotive Use Case

- Use case details:
 - Automotive infotainment unit
 - Based on rich OS
 - Connected to vehicle bus (CAN)
 - Connected to rear camera

| Environment Requirement | Use Case Details |
|---------------------------------------|---|
| Fast boot | CAN bus response Activation of rear-view camera |
| System security | CAN bus access separated from rich OS |
| Leverage hardened/certified solutions | Certified CAN stack running in AUTOSAR-compliant environment |
| System integrity | Critical driver notifications available regardless of rich OS state |

Multiple Execution Environments – Industrial Use Case

- Use case details:
 - Industrial control system
 - Rich OS for user interface
 - Battery power or constrained power supply

| Environment Requirement | Use Case Details |
|--------------------------|---|
| Real-time performance | Connected to sensors/controls that require real-time response |
| Power consumption | Majority of active time spent aggregating data from sensors |
| Reuse of legacy software | Reuse legacy software from standalone MCU |

Multiple Execution Environments – Consumer Use Case

- Use case details:
 - Portable consumer device
 - Based on rich OS
 - Battery power
 - Low-power Bluetooth low energy (BLE) connection

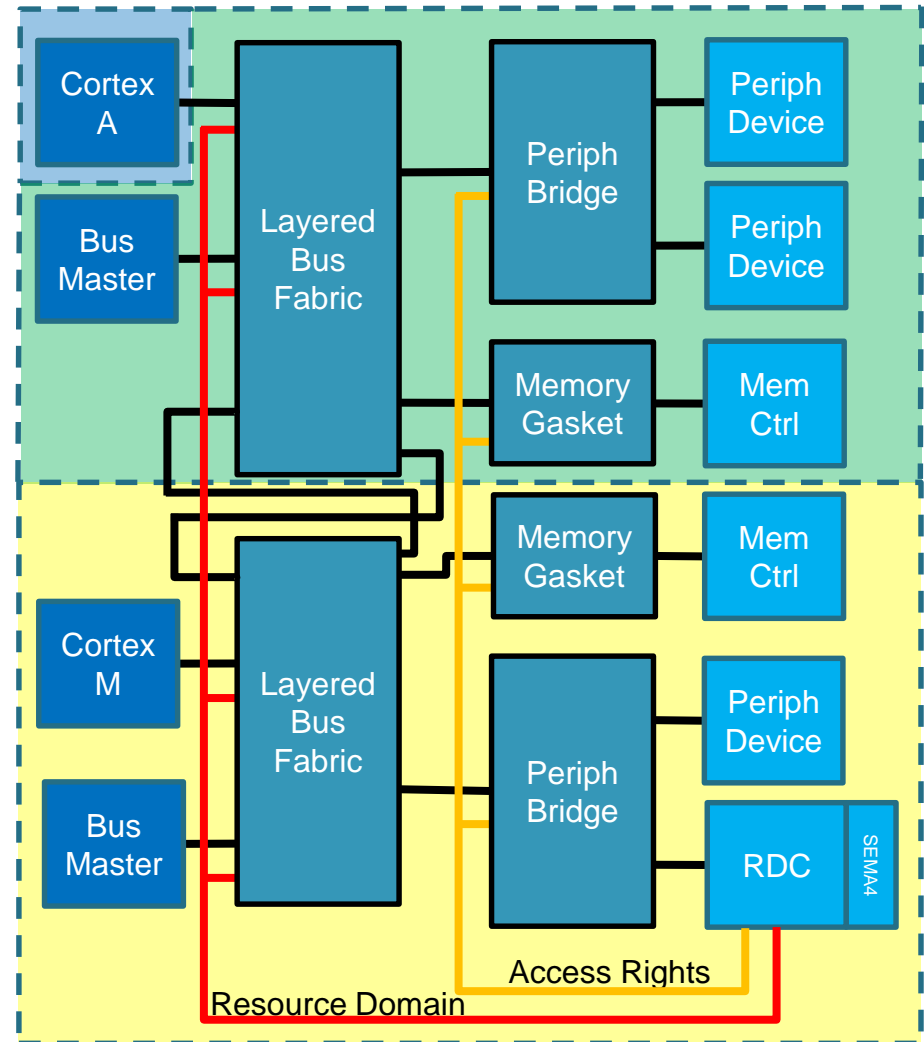
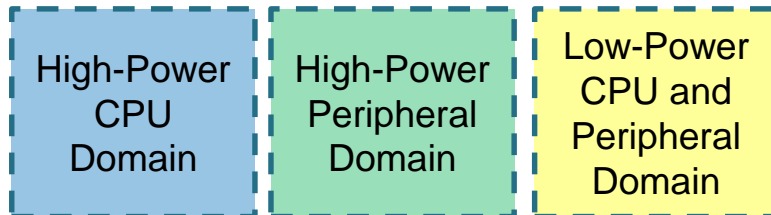
| Environment Requirement | Use Case Details |
|------------------------------|---|
| Leverage certified solutions | Leverage BLE solution certified on standalone MCU |
| Power consumption | Majority of active time spent maintaining BLE connection and monitoring sensors |

i.MX 6 Series and i.MX 6SoloX Security HW Comparison

| Feature | i.MX 6 Series | i.MX 6SoloX |
|----------------------------|---|--|
| Assurance Boot | Authenticated Boot + Encrypted boot (HABv4.1) | Same |
| Secure Storage | On-chip zeroizable 4x4kB Secure RAM Off-chip storage protected using unique HW master key (AES-256) (CAAM/SNVS) | On-chip zeroizable 8x4kB Secure RAM Remainder is the same |
| Cryptographic Accelerators | Symmetric: AES-128/256, DES, 3DES, ARC4 Hash & HMAC: MD5, SHA-1, SHA-224, SHA-256 HW Random Number Generator – follows NIST/BSI recommendations > 2015 (CAAM) | + Additional AES modes: CMAC, XCBC-MAC |
| Secure Real Time Clock | SNVS | SNVS |
| Hardware Firewalls | External memory (TZASC) On-chip peripherals (CSU) On-Chip Memory (CAAM, OCRAM) | Same |
| Resource Domain Separation | None | Separation between Cortex-A9 and Cortex-M4 peripherals and memory (RDC) |
| Secure JTAG | Full or Controlled Disable (3 modes) | Same |
| Physical Tamper Detection | Tamper Input GPIO Tamper Response (SNVS) | Same |
| Device Configuration | Open, Closed, Field Return | Same |
| TrustZone Support | Peripheral DMA access control (CSU) Memory DMA access control (ARM TZASC) Interrupt separation (ARM GIC) Secure storage separation (CAAM) OCRAM protected region (OCRAM, CSU) | Same |

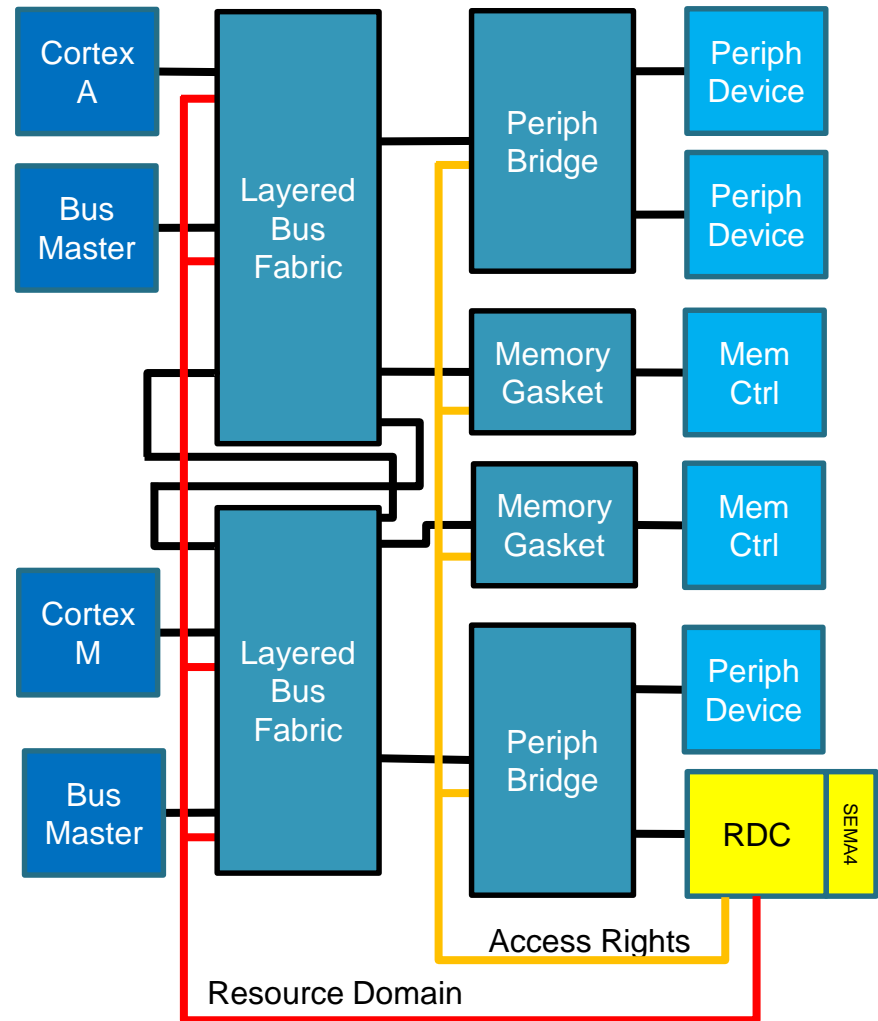
Power Domain Partitioning

- System resources are partitioned into multiple power domains
- Power domains with unused resources can be powered down under software control to save leakage
- Cortex-M and low-power peripherals are located in a separate low-leakage domain to enable low-power processing



Resource Domain Controller (RDC)

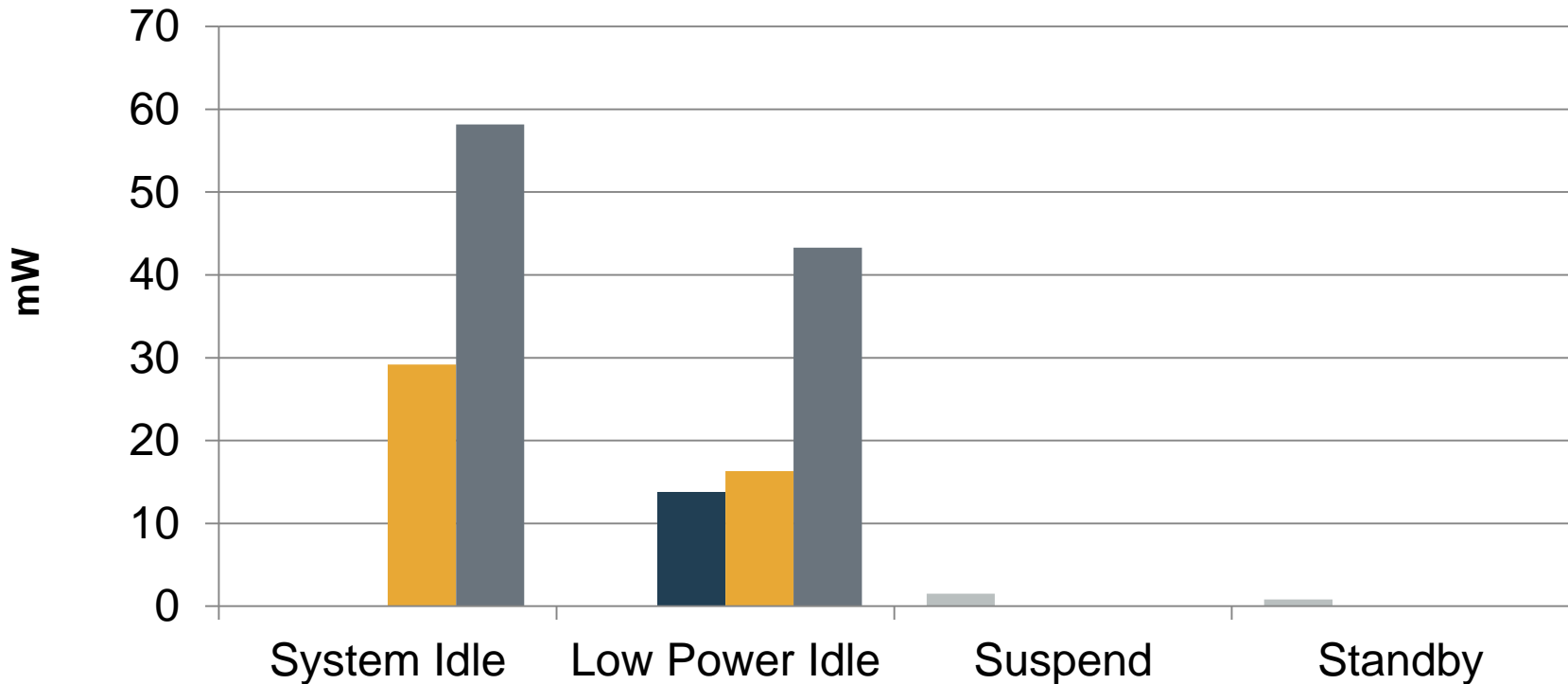
- Resource Domain Controller (RDC) is a new module integrated into next-gen i.MX devices
- RDC provides a centralized programming model to configure isolation and sharing of system resources
- **Key RDC features:**
 - Assignment of master resources (CPUs and bus mastering peripherals) to a **resource domain**
 - Configuration of read/write access for slave peripherals based on **resource domain**
 - Partitioning of memory into regions that can have separate domain access controls
 - Configuration of read/write access for memory regions based on **resource domain**
 - Integral semaphore hardware enables cooperative software to safely access peripherals with access by multiple domains
 - Optional enforcement of semaphore usage to reject accesses by master resources that have not obtained the semaphore lock



Cortex-M4 Enables New Low-Power Modes

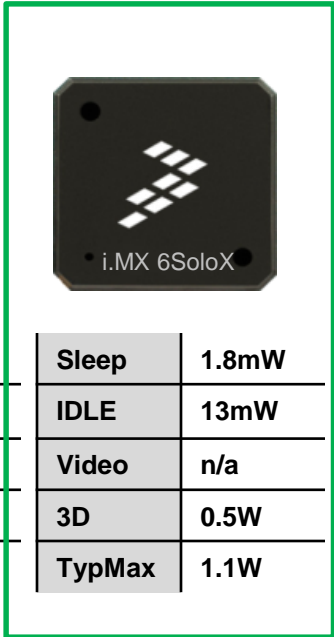
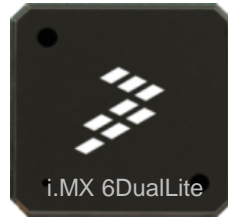
Low-Power Modes*

- Cortex-M4=Off
- Cortex-M4=4MHz
- Cortex-M4=24MHz
- Cortex-M4=Max



* Cortex-A9 is power gated in all low-power modes, Cortex-M4 is available for low-level processing

i.MX 6Series – Power Consumption Summary



| | | | | | | | | | | | |
|--------|-------|--------|--------|--------|-------|--------|-------|--------|-------|--------|--------|
| Sleep | 3.8mW | Sleep | 3.8mW | Sleep | 3.9mW | Sleep | 3.1mW | Sleep | 1.8mW | Sleep | 2.6mW |
| IDLE | 227mW | IDLE | 220mW* | IDLE | 151mW | IDLE | 143mW | IDLE | 13mW | IDLE | 14.5mW |
| Video | 867mW | Video | 867mW | Video | 772mW | Video | 695mW | Video | n/a | Video | n/a |
| 3D | 1.6W | 3D | 1.6W | 3D | 1.1W | 3D | 1.1W | 3D | 0.5W | 3D | n/a |
| TypMax | 3.8W | TypMax | n/a | TypMax | 2.4W | TypMax | 1.7W | TypMax | 1.1W | TypMax | n/a |

All results include power at the chip (cores, accelerators, peripherals, DDR I/O)

•i.MX 6Dual cores are estimated on i.MX 6Quad by clock gating two cores

•Results are based on typical silicon @ 25C

Case 1: Deep Sleep → lowest power mode available

Case 2: System IDLE mode → LCD off, system waiting on input

Case 3: 1080p30 video → Playback on 1080p TV, device LCD is off

Case 4: 3D Benchmark → Running 3DMobileMark ES 1.1 on device LCD

Case 5: "Typical" Max Power → heavy use case (1080p playback on TV, 3DMM06 on LCD, Dhrystone on all cores)

Scalable Performance and Power Consumption
'One Series fits all'

Summary of i.MX HMP Features

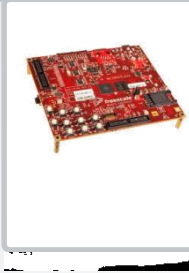
| Feature | HMP Benefits |
|---|--|
| Integration of Cortex-A and Cortex-M processors | <ul style="list-style-type: none">• Execute rich OS on Cortex-A and real-time software on Cortex-M• Cortex-M enhances low-power capability• Use Cortex-M to increase system integrity and security• Leverage proven Cortex-M software solutions |
| Shared Bus Topology | <ul style="list-style-type: none">• Efficient use of system resources• Flexibility to adapt to new use cases |
| Resource Domain Controller | <ul style="list-style-type: none">• Allows software to partition peripherals and memories into resource domains with assignable access permissions• Integrated hardware semaphore facilitates safe sharing of peripherals |
| Messaging Unit (MU) | Flexible interprocessor communication |
| Hardware Semaphore (SEMA4) | HMP synchronization to shared resources |
| Shared Memory | Efficient interprocessor communication |
| Power Domain Partitioning | Flexibility to enable low-power processing |

Enabling Faster Time to Market

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

i.MX 6SoloX SABRE SDB

- i.MX 6SoloX applications processor
 - 1GHz Cortex-A9 processor
 - 200MHz Cortex-M4 processor
 - 19x19 BGA, 0.8mm pitch
- OS: Linux and Android (Cortex-A9), MQX (Cortex-M4)
- 1GB total x16 DDR3-800
- Dual DDR Quad SPI
- Mini-PCIe
- 2x GbE PHYs and 2x Ethernet RJ45 connectors
- 1x Type A USB, 1x Micro-AB USB
- 1x CAN connector
- 3x Full-size SD slots (boot/storage/Wi-Fi)
- Stereo audio codec, microphone input
- Accessory boards (available separately): 10.1" capacitive multi-touch display (MCIMX-LVDS1), Wi-Fi
- Availability:
 - **Now**
 - **Part Number: MCIMX6SX-SDB**
 - **Price: \$399**



i.MX 6SoloX SABRE for Automotive Infotainment

- Available to Tier 1 automotive OEMs
- i.MX 6SoloX applications processor
 - 800MHz Cortex-A9 processor
 - 166MHz Cortex-M4 processor
 - 19x19 BGA, 0.8mm pitch
- OS: Linux and Android (Cortex-A9), MQX (Cortex-M4)
- 1GB total x16 DDR3-800
- Dual DDR Quad SPI
- 2x Ethernet connectors, mini/micro USB
- 2x Full-size SD slots (boot/storage/Wi-Fi)
- 2x CAN connectors, 1x MLB connector
- Analog video input
- 8ch audio codec, microphone input
- Support for terrestrial and satellite radio tuners, Wi-Fi, Bluetooth, GPS, cellular modem, iAP authentication modules, MOST vehicle networking, cameras and displays
- Accessory boards (available separately): 10.1" capacitive multi-touch display (MCIMX-LVDS1), Wi-Fi
- Available in Q32015



Preliminary, subject to change



Freescale i.MX 6UltraLite

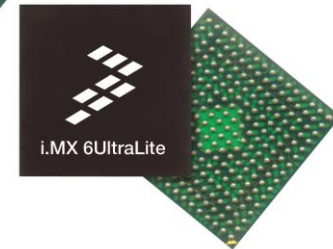
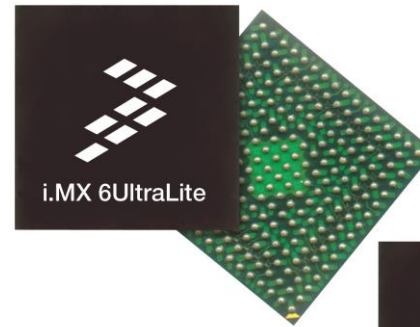


i.MX 6 Series Expansion

- Freescale announced the i.MX 6QuadPlus and i.MX 6DualPlus along with the i.MX 6UltraLite with a May 28, 2015 publication.

Freescale Extends i.MX 6 Family – *Business Wire*

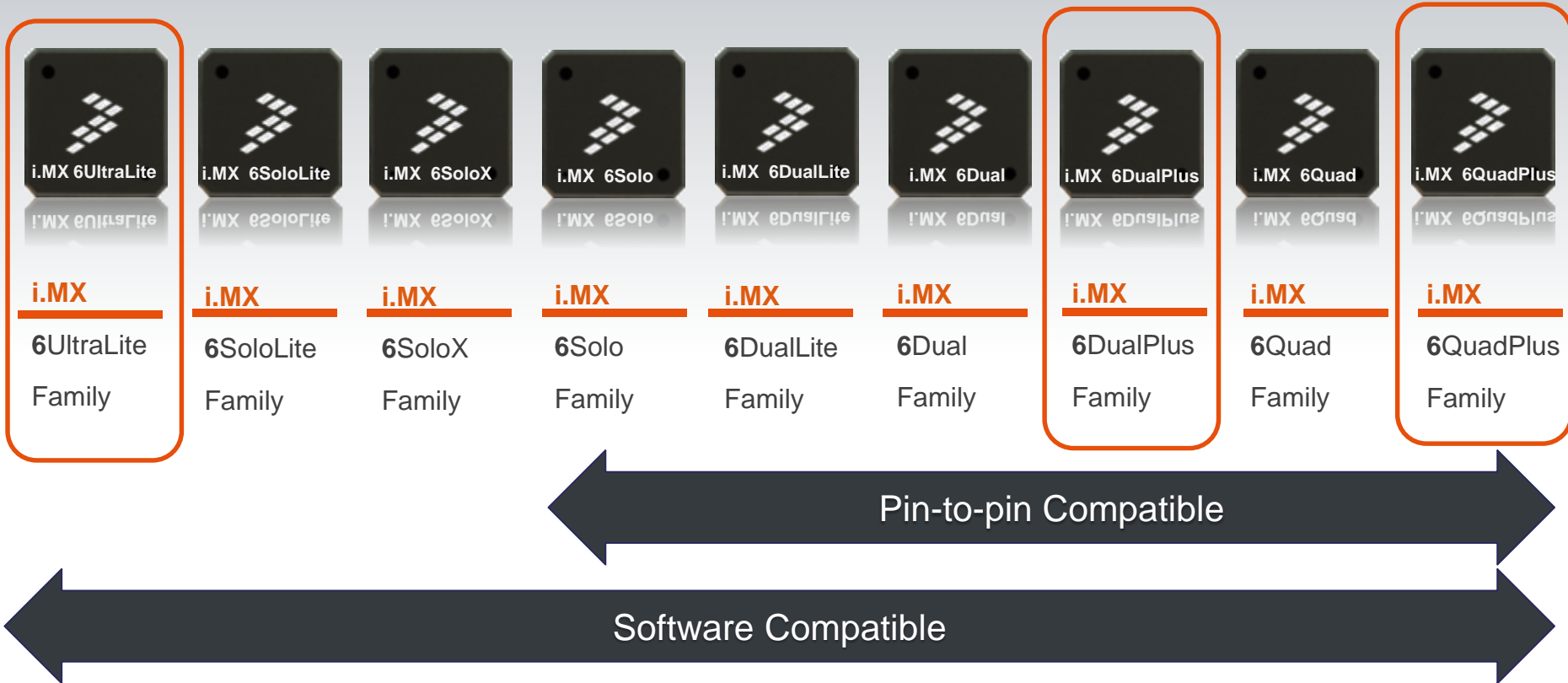
- The announcement discusses the broadening of the i.MX 6 product family at both the high end with the i.MX 6QuadPlus and i.MX 6DualPlus as well as at the low end with the i.MX 6UltraLite



i.MX 6 Series: Supreme Scalability and Flexibility

Leverage One Design Into Diverse Product Portfolio

Scalable series of **NINE** ARM-based SoC Families



i.MX 6UltraLite

The most power efficient, lowest cost and smallest i.MX6 member

Low-Power and High-Performance

ARM **Cortex-A7** @ 528 MHz
(**Neon** engine , FPU)



Advanced Security

TRNG, Crypto Engine
(AES/TDES/SHA/RSA with DPA),
HAB, Tamper Monitor, Secure
Boot, OTF DRAM Encryption



Longevity, Quality and Maturity

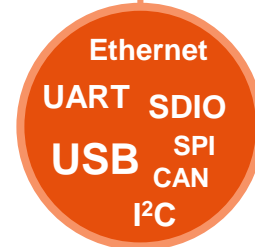
On the **longevity program** (15 years)
Industrial qualification (-40°C to 105°C)
Power-on for 10 years (24/7)

Same **mature Linux BSP** as other i.MX 6 devices



Connectivity

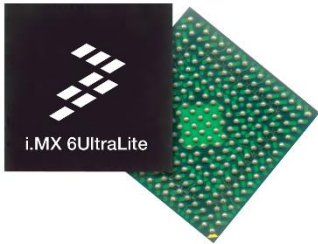
Optimized for industrial and IoT applications



i.MX 6UltraLite Advantages

- **Lowest cost and smallest i.MX 6 member**

- ARM Cortex-A7 @ 528 MHz



- The 14x14 289 MAPBGA with 0.8mm pitch for simple and low cost PCB design.

- The 9x9 289 MAPBGA with 0.5mm pitch for space constrained applications.

- **Most Power efficient Applications Processor**

- Integrated power management module that reduces the complexity of external power supply and simplifies power sequencing.



"It provides up to 20% more single thread performance than the Cortex-A5 and provides similar performance to mainstream Cortex-A9 based smartphones in 2012 while consuming less power."

www.arm.com/products/processors/cortex-a/cortex-a7.php

- **Connectivity optimized for Industrial and IoT applications**

- 2x high-speed USB on-the-go with PHY
- Multiple expansion card ports (high-speed)
- 2x 12-bit ADC modules (up to 10 input channels)
- 2x smart card interfaces compatible with EMV Standard v4.3 and a variety of other popular interfaces
- 2x CAN ports



- **Advanced Security**

- Hardware-enabled security features that enable secure e-commerce, digital rights management (DRM), information encryption, On-The-Fly DRAM encryption, secure boot and secure software downloads



i.MX 6UltraLite Target Applications



Industrial HMI

- XGA industrial HMI with basic UI
- Large or high-quality small appliance
- Industrial scanner or printer
- Vending machine with display and basic UI



Building Control

- Access control (security) panel
- Surveillance monitoring
- Building control, e.g. elevator or automated door



Medical

- Mobile patient care, e.g. infusion pump or respirator
- Blood pressure monitor
- Activity and wellness monitor
- Exercise equipment with display



Integrated Connectivity

- Wired and wireless audio streaming
- Energy management hub
- Industrial gateway
- VoIP



Financial Payment

- Point-of-Sales
- Financial payment system

i.MX 6UltraLite Device Options

| Feature | 6UL-0 | 6UL-1 | 6UL-2 | 6UL-3 |
|--------------------|----------------------------|--|---|---|
| Sub Family | 6UL Base | 6UL General Purpose 1 | 6UL General Purpose 2 | 6UL Security |
| Core | ARM Cortex-A7 | ARM Cortex-A7 | ARM Cortex-A7 | ARM Cortex-A7 |
| Speed | 528 MHz | 528 MHz | 528 MHz | 528 MHz |
| Cache | 32 KB-I, 32KB-D | 32 KB-I, 32KB-D 128 KB L2 | 32 KB-I, 32KB-D 128 KB L2 | 32 KB-I, 32KB-D 128 KB L2 |
| OCRAM | 128 KB | 128 KB | 128 KB | 128 KB |
| DRAM | 16-bit LP-DDR2, DDR3/DDR3L | 16-bit LP-DDR2, DDR3/DDR3L | 16-bit LP-DDR2, DDR3/DDR3L | 16-bit LP-DDR2, DDR3/DDR3L |
| eFuse for Customer | 512-bit | 1024-bit | 1536-bit | 2048-bit |
| NAND (BCH40) | Yes | Yes | Yes | Yes |
| Parallel Nor/EBI | Yes | Yes | Yes | Yes |
| Ethernet | 10/100 MB x 1 | 10/100 MB x 1 | 10/100 MB x 2 | 10/100 MB x 2 |
| USB with PHY | OTG, HS/FS x 1 | OTG, HS/FS x 2 | OTG, HS/FS x 2 | OTG, HS/FS x 2 |
| CAN | 0 | 1 | 2 | 2 |
| Security | None | TRNG, Crypto Engine (AES/TDES/SHA), Secure Boot | TRNG, Crypto Engine (AES/TDES/SHA), Secure Boot | TRNG, Crypto Engine (AES/TDES/SHA/ RSA with DPA), Secure Boot, Tamper Monitor, PCI4.0 pre-certification, OTF DRAM Encryption |
| Graphic | None | None | PxP | PxP |
| CSI | None | None | 16-bit Parallel CSI | 16-bit Parallel CSI |
| LCD | None | None | 24-bit Parallel LCD | 24-bit Parallel LCD |
| QSPI | 1 | 1 | 1 | 1 |
| SDIO | 2 | 2 | 2 | 2 |
| UART | 4 | 8 | 8 | 8 |
| ISO7816-3 | 0 | 2 | 2 | 2 |
| IIC | 2 | 4 | 4 | 4 |
| SPI | 2 | 4 | 4 | 4 |
| I2S/SAI | 1 | 3 | 3 | 3 |
| S/PDIF | 1 | 1 | 1 | 1 |
| Timer/PWM | Timer x2, PWM x4 | Timer x4 , PWM x8 | Timer x4, PWM x8 | Timer x4, PWM x8 |
| 12-bit ADC | 1x8ch | 1x8ch | 2x8ch | 2x8ch |
| Keyboard (8x8) | Yes | Yes | Yes | Yes |
| Temperature | 0C to 70C (Tj) | -40C to 105C (Tj) | -40C to 105C (Tj) | -40C to 105C (Tj) |

VFxxx vs. i.MX 6SoloX vs. i.MX 6SL vs. i.MX 6UL: Key Differences

| Feature | VFxxx BGA324 | i.MX 6SoloX | i.MX 6SoloLite | i.MX 6UL-3 |
|------------------|--|--|--|------------------------------------|
| CPU1 | 400 – 500MHz Cortex-A5 628 DMIPS | 800MHz – 1GHz Cortex-A9 2000 - 2500 DMIPS | 1GHz Cortex-A9 2500 DMIPS | 528MHz Cortex-A7 930 DMIPS |
| CPU2 | 133 – 166MHz Cortex-M4 166 - 208 DMIPS | 200MHz Cortex-M4 208 DMIPS | - | - |
| On-chip memory | Option 1: 1.5MB (512KB ECC) Option 2: 1MB & 512KB L2 cache | 256KB L2 + 128KB SRAM | 256KB L2 + 128KB SRAM | 128KB L2 + 128KB SRAM |
| Serial Flash I/F | Dual DDR QuadSPI | Dual DDR QuadSPI | - | Dual DDR QuadSPI |
| NAND/NOR Flash | 16-bit NAND 16/32-bit NOR | 8-bit NAND 16-bit NOR | 16-bit NOR | 8-bit NAND 16-bit NOR |
| DRAM interface | 16-bit LPDDR2/DDR3 400MHz | 32-bit LPDDR2/DDR3/DDR3L 400MHz | 32-bit LPDDR2/DDR3 400MHz | 16-bit LPDDR2/DDR3/DDR3L 400MHz |
| Ethernet | 2x 10/100 + 1588 | 2x Gb AVB | 1x 10/100 | 2x 10/100 + 1588 |
| USB | 2x USB OTG HS w/PHY | 1x USB OTG HS w/PHY 1x USB Host HS w/PHY 1x HSIC | 1x USB OTG HS w/PHY 1x USB Host HS w/PHY 1x HSIC | 2x USB OTG HS w/PHY |
| UART, SPI, I2C | 6, 4, 4 | 6, 4, 4 | 5, 4, 4 | 8, 4, 4 |
| SD/MMC interface | 2 | 4 | 4 | 2 |
| CAN | 2x FlexCAN | 2x FlexCAN | - | 2x FlexCAN |
| MOST | MLB 25/50 | MLB 25/50 | - | - |
| PCIe | - | 1x PCIe 2.0 (x1 lane)* *not available on all packages | - | - |

VFxxx vs. i.MX 6SoloX vs. i.MX 6SL vs. i.MX 6UL: Key Differences

| Feature | VFxxx BGA324 | i.MX 6SoloX | i.MX 6SoloLite | i.MX 6UL |
|-------------------|--|---|---|--|
| 12-bit ADC | x2 | x2* *not available on all packages | - | x2 |
| 12-bit DAC | x2 | - | - | - |
| Camera Input | 18-bit parallel 4x Composite | 20-bit parallel 4x Composite* *not available on all packages | 16-bit parallel | 16-bit parallel |
| Audio interface | I2S x4 ESAI x1 (2 Tx, 4 Tx or Rx) ASRC | I2S x5 ESAI x1 (2 Tx, 4 Tx or Rx) SPDIF Tx/Rx ASRC | I2S x3 SPDIF Tx/Rx | I2S x3 SPDIF Tx/Rx ASRC |
| GPU 2D | GC355 OpenVG 1.1 300M pxl/s 2D ACE Composition | via GPU 3D | <ul style="list-style-type: none"> • GPU2Dv2—2D Graphics Processing Unit (BitBlt)* • GPUVG—OpenVG 1.1 Graphics Processing Unit* *optional feature | - |
| GPU 3D | - | GC400T Open GLES 2.0 / VG 1.1* 17M Tri/s 133 Mpxl/s *optional feature | - | - |
| Display interface | 2x 24-bit RGB up to WXGA | 1x 24-bit RGB up to WXGA 1x LVDS* up to WXGA *not available on all packages | 1x 24-bit RGB up to WXGA EPDC | 1x 24-bit RGB up to WXGA |
| Package | 17 x17, 0.8mm pitch | 14x14, 0.65mm pitch (two options) 17x17, 0.8mm pitch (two options) 19x19, 0.8mm pitch | 13 X 13. 0.5mm pitch | 14x14, 0.8mm pitch 9x9, 0.5mm pitch |

i.MX287 vs. i.MX 6UL

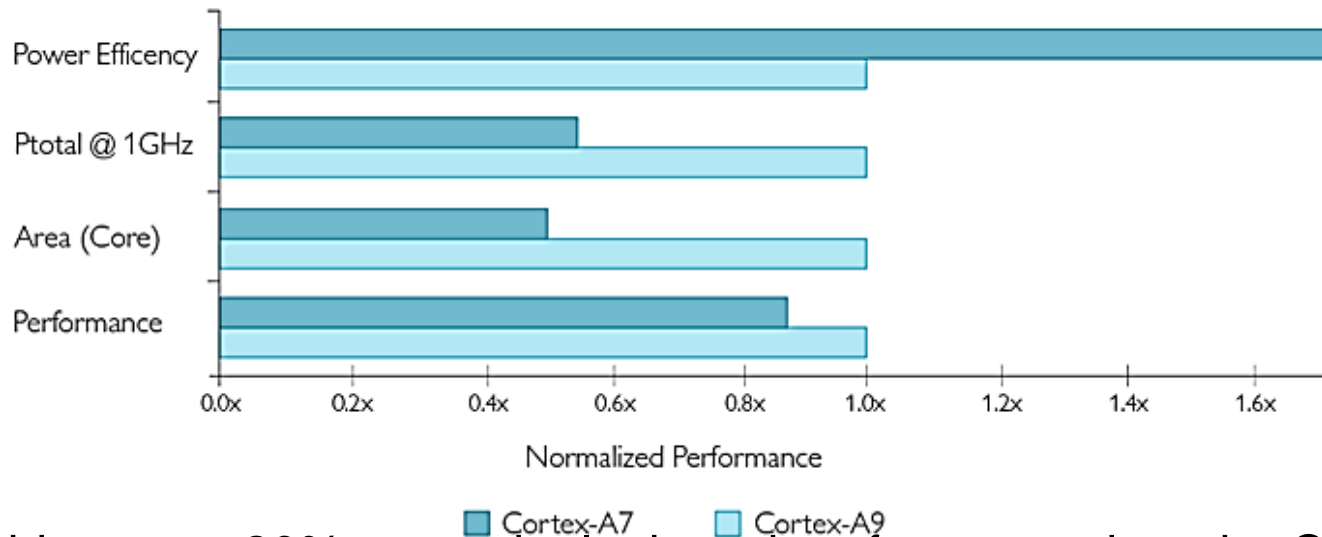
| | i.MX287 | i.MX6UL |
|-------------|--|---|
| Core | ARM926EJ-S | Cortex-A7 |
| Speed | 454MHz | 528MHz |
| Temp | -40 to 85°C | -40 to 105C |
| Package | MAPBGA289, 14x14, 0.8mm | MAPBGA289 14x14 0.8mm / 9x9 0.5mm |
| Cache | 16kB-I/32kB-D | 32KB-I/32KB-D |
| L2 Cache | N/A | 128KB |
| RAM | 128KB | 128KB |
| ROM | 128KB | 96KB |
| DRAM | 200MHz, 16-bit mDDR/DDR2/LV-DDR2 | 400MHz, 16-bit LP-DDR2/DDR3/DDR3L |
| NAND | 8-bit, up to 20bit ECC | 8-bit, up to 40bit ECC |
| NOR | N/A | 16-bit Parallel NOR FLASH / PSRAM |
| UART | 6 | 8 |
| I2C | 2 | 4 |
| SPI | 4 | 4 |
| I2S | 2 | 3 |
| SDIO/SD/MMC | 4 | 2 |
| CAN | 2 | 2 |
| ETH | 10/100M with 1588 x 2, L2 switch | 10/100M with 1588 x2 |
| USB HS 2.0 | HS USB with PHY x2 | OTG x2 |
| Security | AES-128/SHA-2 | TRNG, Crypto Engine (AES/TDES/SHA/RSA with DPA), HAB, Tamper Monitor, Secure Boot, OTF DRAM Encryption |
| Timer/PWM | Timer x4; PWMx8 | Timer x4, PWM x8 |
| ADC | 12bit ADC x8; 2Msps ADC x 1 | 2x 12-bit ADC, 10-ch, with TSC up to 5- wire |
| Display | 24bit RGB w/ touch | 24-bit LCD (work with dedicated pixel process engine, up to 150Mpixel/s) |
| Camera | N/A | 8/10/16/24-bit CSI, ITU-601/656 |
| Others | SPDIF TX | SPDIF TX/RX, QSPI, FlexIO |
| Ecosystem | Linux; WinCE6.0 | Linux, WinCE |
| PMIC | Full PMIC integration, including DC/DC 4.2V, LDOx4, battery charger | Partial PMU Integrated |



Cortex-A7

Most Power efficient Applications Processor

Cortex-A7 Power Efficiency Relative to Cortex-A9

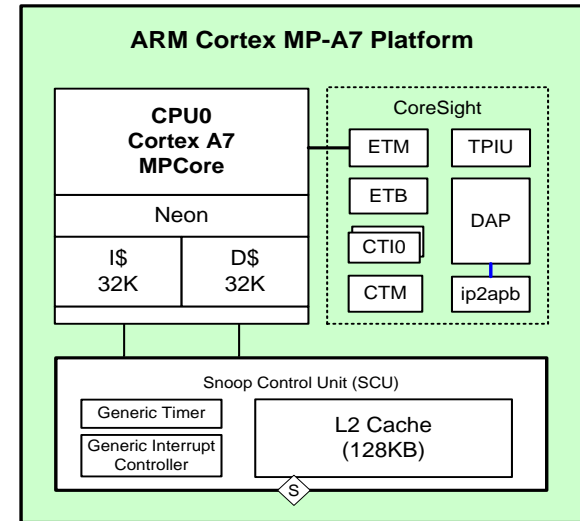


- “It provides up to 20% more single thread performance than the Cortex-A5 and provides similar performance to mainstream Cortex-A9 based smartphones in 2012 while consuming less power.”
- www.arm.com/products/processors/cortex-a/cortex-a7.php

Cortex-A7 CPU

CPU Configuration

- 32 KB L1 Instruction Cache
- 32 KB L1 Data Cache
- 128 KB Unified L2 Cache
- Media Processing Engine (MPE) with NEON technology supporting the Advanced Single Instruction Multiple Data version 2 (SIMDv2) architecture
- Floating Point Unit (FPU) with support of the VFPv4-D16 architecture
- Integrated Global Interrupt Controller (GIC)
- Generic timer
- Interconnect using a single 128-bit wide bus AMBA AXI bus
- ARMv7.1 ARM debug architecture that complies with the Coresight debug/trace architecture
- Security extensions for enhanced security
- Virtualization extensions



| Parameter | Configuration |
|------------------|---------------|
| NUM_CPUS | 1 |
| L1_DCACHE_SIZE | 32KB |
| L1_ICACHE_SIZE | 32KB |
| L2_CACHE_PRESENT | TRUE |
| L2_CACHE_SIZE | 128KB |
| L2_CACHE_LATENCY | 2 |
| NEON | TRUE |
| FPU | TRUE |
| GIC_PRESENT | TRUE |
| NUM_SPIS | 128 |
| AXI_RATIO | 2 |
| APB_RATIO | 2 |
| ETM_PRESENT | TRUE |



Connectivity Highlights – General Purpose Connectivity

- **eCSPI**
 - 4x eCSPI support, up to 66MHz
- **I2C**
 - 4x I2C ports compatible with I2C specifications v2.1 (all up to 400Kb/s)
- **Keypad**
 - 8x8 matrix supported. (6 x 6 – “maim” configuration, but all pads are shared with other interfaces).
- **UART**
 - 8x UART interface support
 - High speed (up to 4MHz) – covers TIA/EIA-232-F Standard
 - IrDA 1.0
 - SIR protocol support (115.2kbps or lower)
 - 32 bytes FIFOs for transmitter and receiver, autobaud.
 - 9 bit mode supported
 - RS-485 mode supported
- **SDMA**
 - 2x external SDMA events
- **GPT**
 - 2x general purpose timers, each of them is a 32-bit “free-running” or “set and forget” mode timer.
 - External/Internal clock selectable
 - External/Internal event interval capturing
 - Programmable output logic, external output signal, ARM interrupt.
- **PWM**
 - 8x pulse-width modulators: 16-bit resolution with a 4x16 data FIFO
- **SIMv2 / EMVSIM**
 - 2x smart card interface, EMV2000 complaint
- **GPIO:**
 - All multifunctional digital pads have the GPIO functionality – Total number of GPIOs is 129
 - The GPIO supports up to 32 interrupts: programmable active interrupt edges/level of external signal
 - Most of GPIO capable pads are of UHVIO type - 1.65 ... 3.6 V operational range with automated voltage range selection



Connectivity Highlights – General Purpose Connectivity

- **USB**

- 2x High Speed (HS) USB 2.0 OTG (Up to 480 Mbps), with integrated HS USB PHY
- Support High-Speed/Full-Speed/Low-Speed
- Support High Speed, Full Speed and Low Speed operation in Host mode
- Support High Speed, and Full Speed operation in Peripheral mode
- Hardware support for OTG signaling, session request protocol, and host negotiation protocol
- Up to 8 bidirectional endpoints
- Support charger detection
- Low-power mode with local and remote wake-up capability
- Serial PHY interfaces configurable for bidirectional/unidirectional and differential/single ended
- Embedded DMA controller

- **Ethernet**






- 2x Ethernet MAC interface
- Support both MII and RMII interfaces to external PHY
- Dual speed 10/100 Mbit/s Ethernet MAC compliant with the IEEE802.3-2002 standard.
- The MAC layer provides compatibility with half- or full-duplex 10/100 Mbit/s Ethernet LANs.
- Integrated time-stamping module to support IEEE 1588 standard, provides accurate clock synchronization for distributed control nodes for industrial automation applications.

- **CAN**

- 2x FlexCAN module (New version) is a full implementation of the CAN protocol specification, Version 2.0 B, which supports both standard and extended message frames. A flexible number of Message Buffers (16, 32 or 64) is also supported. The Message Buffers are stored in an embedded RAM dedicated to the FlexCAN module.
- Programmable bit rate up to 1 Mb/sec
- Content-related addressing
- Flexible Message Buffers (up to 64) of zero to eight bytes data length
- Each MB configurable as Rx or Tx, all supporting standard and extended messages



Product Application Mapping

| | |  Traditional POS |  Telephone POS |  mPOS |  PINPAD |  3 rd -Gen UKey |
|---|--------------------|---|---|--|--|---|
| FSL Security MCU/MPU | | i.MX258 i.MX6UL-3 | i.MX258 K21F, K81 | K21D, K21F K81, , KL81 | K21D, K21F K81, KL81 | KL81 |
| Supported Band Card Types | Magnetic | √(EOL 2015) | √(EOL 2015) | √(EOL 2015) | √(EOL 2015) | √(EOL 2015) |
| | IC | √ | √ | √ | √ | √ |
| | Contactless | √ | √ | √ | √ | √ |
| Pin-Pad | | √ | √ | √ | √ | √ |
| Display | | Graphic/Segment | Segment | Segment | Segment | Segment |
| Interface to smart devices(mobile phone, tablet, PC) | | N/A | N/A | Audio Jack, USB, Bluetooth | N/A | USB |
| Security Certification | PCI-PTS | √ | √ | Optional in China | √ | √ |
| | PBOC | Must in China | Must in China | Must in China | Must in China | Must in China |
| | EMV | √ | √ | √ | √ | √ |
| Printer | | Mandatory and Integrated | Mandatory and Integrated | Optional, may be extended through BT | N/A | N/A |
| Applications running location | | Natively | Natively | Smart phone/tablet/PC | Natively | PC |

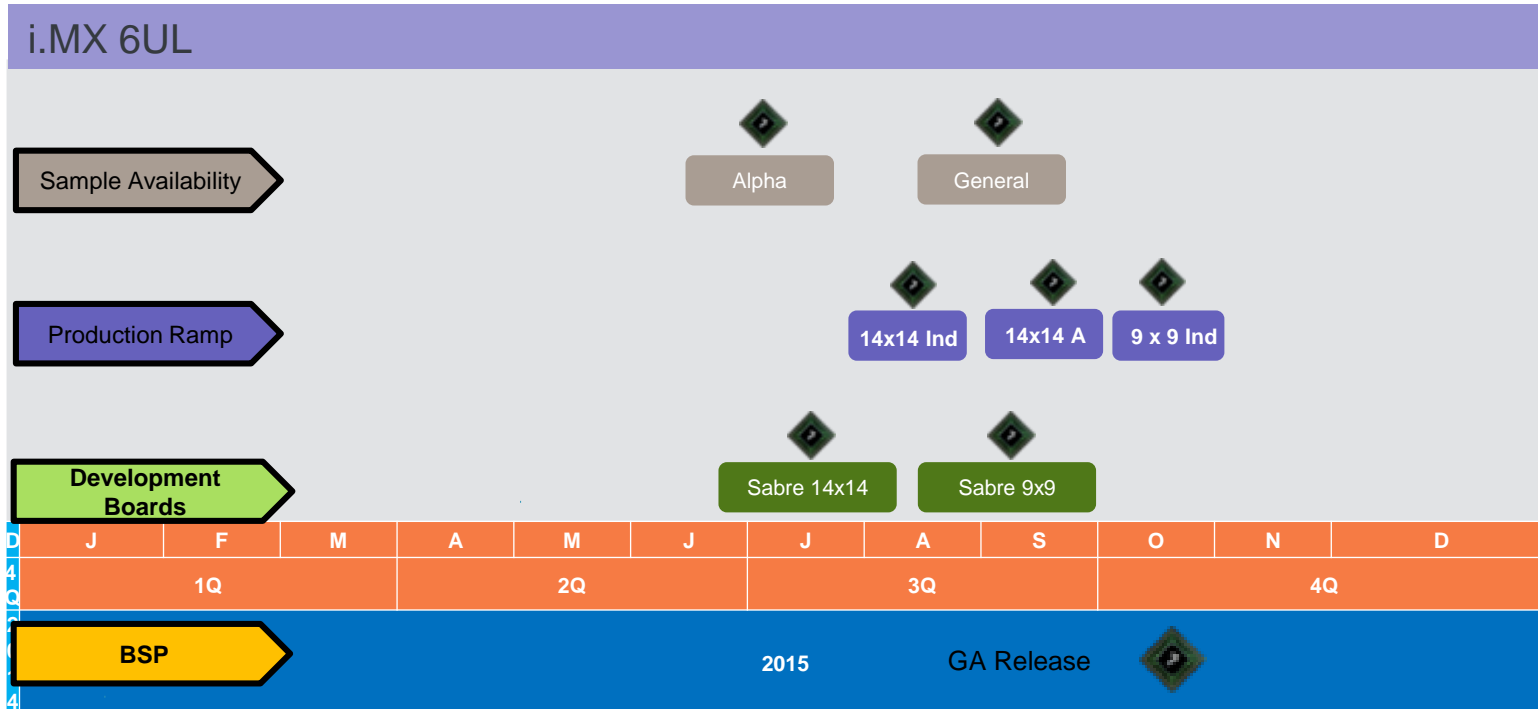
Freescale MPU Security Product Line Feature List

| Feature | i.MX258 | i.MX6UL-3 Security |
|----------------------------|--|---|
| Trusted Execution | TrustZone, (ARM926) Peripheral access control (CSU) | TrustZone, (ARM Cortex-A7) Peripheral access control (CSU) Memory access control (ARM TZASC) Interrupt separation (ARM GIC) Secure storage separation (CAAM/SNVS) Cryptographic separation (CAAM) |
| High Assurance Boot | HABv3 Based Secure Boot | HABv4.2 Based Secure Boot |
| Tamper Detection | Tamper Input GPIO x2 Wire-mesh Tamper Detect | Dedicated Tamper Inputs both passive and active for wire mesh (10 passive pins / 5 active pairs). |
| Encrypted boot | None | Authenticated + Encrypted Boot |
| Secure Storage | On-chip zeroizable 2kB Secure RAM | On-chip zeroizable 8x4kB Secure RAM Off-chip key/data blobs AES-256 master key |
| True Random Number Gen | Yes (RNGB) | Yes. Designed to be compliant with NIST SP800-90A and includes a hardware entropy source. NIST/BSI >2015 |
| Cryptographic Accelerators | SHA-1, SHA-256, 3DES | Asymmetric: RSA, ECDSA (up to 4096) Symmetric: AES-128/256 , DES, 3DES, ARC4, Hash & HMAC: MD5, SHA-1, SHA-224/256. 256-bit security (CAAM) |
| DRAM Encryption | None | Yes |
| DPA Protection | DPA Protection on 3DES | DPA Protection for DES/3DES and AES |
| Real Time Monitoring | RTIC, DryIce (Voltage, Temp, Freq Monitoring) | RTIC, DryIce (Voltage, Temp, Freq Monitoring) |
| Secure Clock | Secure RTC | SNVS |
| Secure Debug | Full or Controlled Disable (3 modes) | Full or Controlled Disable (3 modes) |
| EMV Compatible | Software word around | EMV Compatible SIM V2 or EMVSIM |

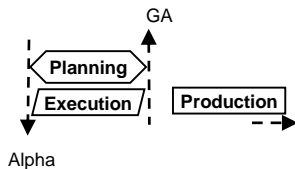




i.MX 6UltraLite Enablement Roadmap



Release Schedule



Linux 3.14.x



Freescal*e* i.MX 6DualPlus/6QuadPlus

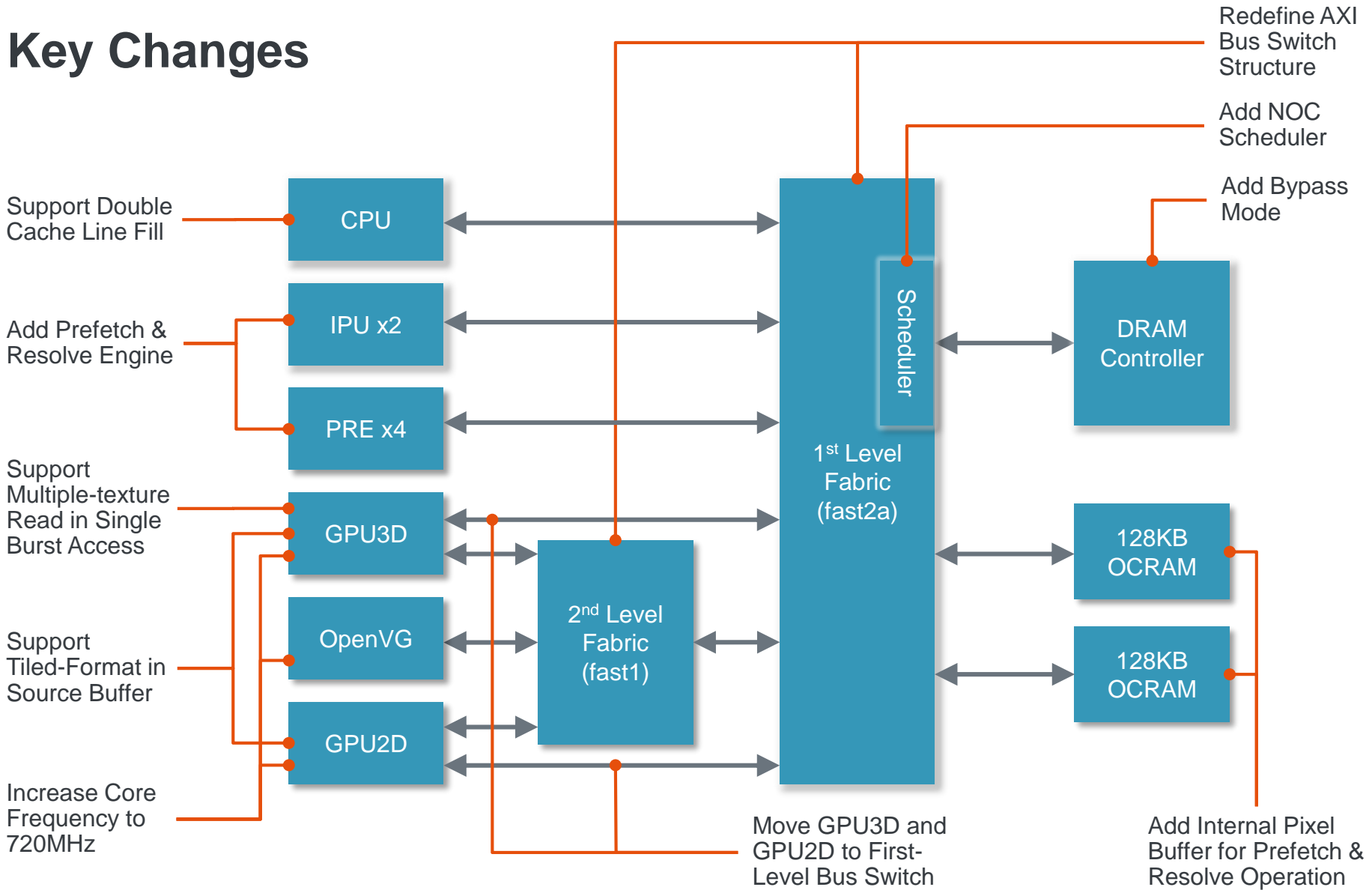


i.MX 6DualPlus/QuadPlus Design Goal

- Dramatic graphics performance with enhanced versions of 3D, 2D and composition GPUs and memory bandwidth utilization
- Improve the system performance of i.MX 6 class systems by dramatically increasing the memory bandwidth utilization without significant impact to Software or Hardware designs.
- Improvement of the internal bus interconnect to more efficiently transport and order memory requests to the DDR controller. (bus width 64b => 128b, Outstanding Transactions(OT) 4 => 8, frequency 264MHz => 528MHz)
- Significantly upgraded the capabilities of the graphic and display subsystems to generate more efficient memory requests, resulting in further bandwidth improvements. (interchangeable tiled buffer, pre-fetch / resolve modules, larger OCRAM)



Key Changes



Graphics GC2000Plus and GC320 enhancements

- GC2000Plus is now capable of reading and writing a tiled or super tiled buffer which is interchangeable with the GC320. This results in:
 - Optimized data flow to reduce memory access
 - Optimized data access to improve DRAM efficiency
 - Increased graphic engines target frequencies
- GC320 is now capable of performing 8 layer overlay as well reading and writing a tiled or super tiled buffer.
- Dedicated graphics engines to provide the ultimate video experience

| Name | Clock | i.MX6DualQuad | i.MX6DualQuadPlus |
|--------------------|---------------------|--------------------------|--------------------------|
| GC2000(Plus)/GC355 | AXI / Core / Shader | 264MHz / 528MHz / 594MHz | 528MHz / 594MHz / 720MHz |
| GC320 | AX I/ Clk2x | 264MHz / 480MHz | 528MHz / 720MHz |

Display Improvements

- New **pre-fetch and resolve (PRE)** modules have been added to the existing IPU block on the **Plus** processors, to provide:
 - **Pre-fetch** reads the display frame buffer ahead of time, stores into a double buffer in OGRAM, which the IPU uses to display pixels, helps prevent under-run in high load conditions
 - **Resolve** if the frame buffer is a **GC2000+** render target, the **PRE** will resolve it from a tiled to linear buffer format and store in OGRAM, allowing the IPU to display the buffer directly, saving additional **GC2000+** operations and DRAM bandwidth
- The **pre-fetch and resolve gasket (PRG)** provides the handshake logic between the **PRE**, IPU and double buffers inside the **OGRAM**
- Each buffer is only 4/8/16 lines, **PRE** fills and generates a ready signal, IPU reads and generates a done signal



On-Chip Memories – OCRAM x2

- Two new 128 Kbyte OCRAM blocks and associated controllers have been added to the i.MX 6DQ**Plus** processors
- They are primarily intended to provide pixel pipeline buffers for the new Pre-fetch and Resolve modules
- Implemented as two 128 Kbyte blocks, known as **OCRAM_2** and **OCRAM_3** in order to provide higher throughput
- Can be used as general purpose RAM when not in use by the Pre-fetch and Resolve modules
- Provides a continuous 512 Kbyte block of OCRAM when combined with the existing 256 Kbyte
- The existing OCRAM controller was updated to match the new controllers support for simultaneous read/write access

Benchmarking

- Multi-master use case shows dramatic increase in memory bandwidth utilization => i.MX 6DQPlus silicon ~2x DRAM utilization vs. i.MX 6DQ

Test case description

IPU fetches 2x 1080p 32bit @60Hz images for display. PRE pre-fetch is enabled in i.MXDQPlus
GPU3D off screen loop "3D read_write_render" case
GPU2D off screen loop 1080p 2D bitblit case
CPU doing memory copy

- Graphics benchmarks prove dramatic increase in 3D performance

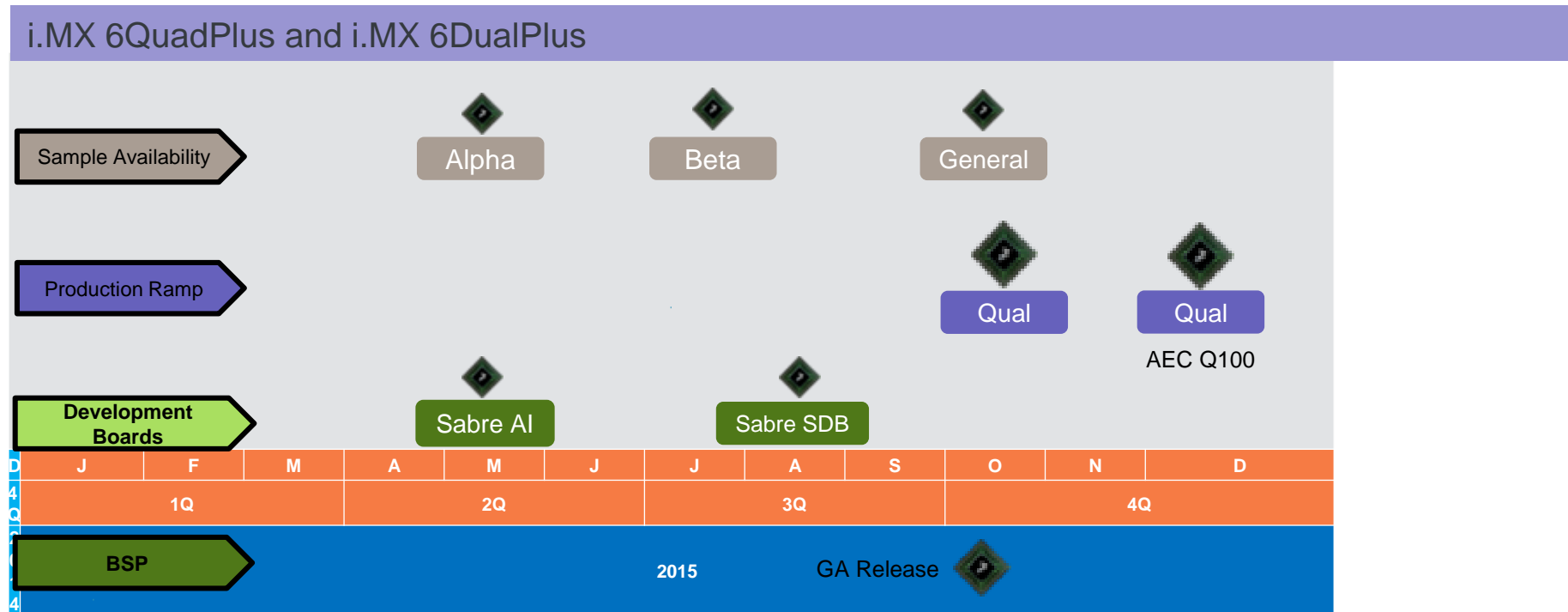
| 3.14.28 kernel Driver 5.0.11P6 | Unit | MX 6Dual/Quad | i.MX 6DQPlus |
|--------------------------------------|------|---------------|--------------|
| WebGL Aquarium Test | FPS | 8-10 | 23-26 |
| GLBenchmark 2.5 Egypt HD ETC1 C24Z16 | FPS | 25 | 40 |

i.MX 6DualPlus/QuadPlus Errata Fixes

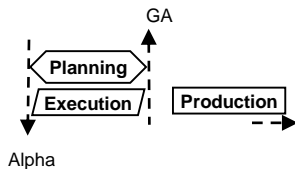
- Clock Controller – IPU Pixel clock glitch and any other clock control issue found as a result of analysis
- Supply Level Optimization – facilitate any design changes required to permit VDD_HIGH and VDD_SNVS have the same voltage rail specification.
- Analog LDO ESR Optimization – facilitate any design changes required to ensure the integrated LDO's can function without oscillation using a commercially viable external circuitry.
- 24MHz Xtal Optimization – facilitate any design changes required to ensure the 24MHz Xtal can function using a commercially viable external circuitry.
- Digital LDO Default Voltage – change default voltage level for integrated digital LDO's to 1.15V
- Boot Clock Source – modify ROM to use a more accurate boot clock source than the 32K RC-OSC
- 32K Xtal Status Bit – add status bit to monitor crystal status
- PCIe Power Down – fix issue which prevents PCIe from supporting L2 power down mode without a reset
- ROM Errata – update ROM to eliminate secondary Boot image issue
- ENET Interrupt – collect all interrupts from ENET module to support expanded wake-up from WAIT mode
- BCH Status Bit – fix issue related to incorrect erased page status flag
- SATA Phy Suspend/Resume – fix issue related to SATA module suspend and resume operation



i.MX 6DualPlus/QuadPlus Enablement Roadmap



Release Schedule



Linux 3.14.x
Android L5.1.x

i.MX 6QP/i.MX6DP



i.MX 6Dual/Quad Plus Marketing

- The i.MX 6DQPlus will be sold at a price premium over i.MX 6DQ
- Complementary PMIC is MMPF0100: 14 Channel Configurable PMIC

| Part Number | Quad/Dual | CPU Options | Speed | Temperature Grade | Package |
|-----------------|----------------|---------------|--------|---------------------------------|----------------|
| MCIMX6QP5EYM1AA | i.MX 6QuadPlus | VPU, GPU | 1GHz | Consumer Extended: -20 to + 105 | 21x21 0.8P BGA |
| MCIMX6QP7CVT8AA | i.MX 6QuadPlus | VPU, GPU | 800MHz | Industrial: -40 to +105 | 21x21 0.8P BGA |
| MCIMX6QP4AVT8AA | i.MX 6QuadPlus | GPU, MLB | 850MHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6QP6AVT8AA | i.MX 6QuadPlus | MLB, VPU, GPU | 850MHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6QP4AVT1AA | i.MX 6QuadPlus | GPU, MLB | 1GHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6QP6AVT1AA | i.MX 6QuadPlus | MLB, VPU, GPU | 1GHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6DP5EYM1AA | i.MX 6DualPlus | VPU, GPU | 1GHz | Consumer Extended: -20 to + 105 | 21x21 0.8P BGA |
| MCIMX6DP7CVT8AA | i.MX 6DualPlus | VPU, GPU | 800MHz | Industrial: -40 to +105 | 21x21 0.8P BGA |
| MCIMX6DP4AVT8AA | i.MX 6DualPlus | GPU, MLB | 850MHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6DP6AVT8AA | i.MX 6DualPlus | MLB, VPU, GPU | 850MHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6DP4AVT1AA | i.MX 6DualPlus | GPU, MLB | 1GHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |
| MCIMX6DP6AVT1AA | i.MX 6DualPlus | MLB, VPU, GPU | 1GHz | Automotive: -40 to + 125 | 21x21 0.8P BGA |



MMPF0100: 14 Channel Configurable PMIC

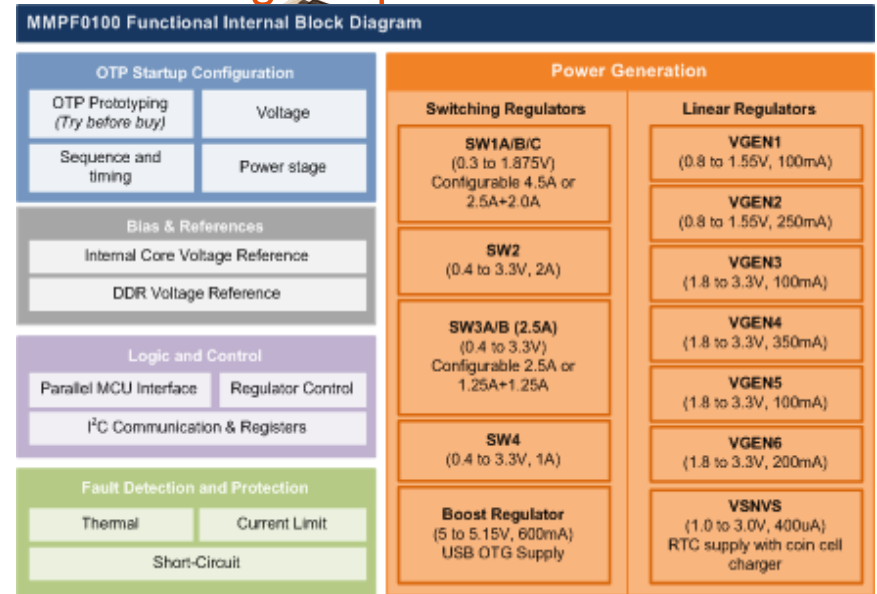
Unique Configurable/ programmable architecture enables the PF0100 to power complete system solutions based around a wide range of processors

Differentiating Points

- Proven compatibility with i.MX6 processor applications. Proven BSPs.
- Boost regulator to 5.0 V out for USB
- OTP (One Time Programmable) memory to configure the device for field programming
- Custom pre-programmed output voltages, sequencing, and timing available
- Power control logic with processor interface and event detection

Product Features

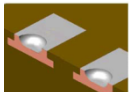
- Vin 2.8V to 4.5V Supply
- 4 to 6 Channel configurable buck converters**
- 6 User programmable LDO
- Forced PWM or automatic PSM operation
- Boost regulator, Coin cell charger, DDR reference
- Programmable output voltage, current limit, soft-start, Fsw, OTP fault interrupt
- High power 8x8 mm, 56 E-QFN or WF-QFN



**MMPF0200 has 3/4 buck regulators instead of 5/6

APPLICATIONS

- Tablets, eReaders, Smartbooks, Navigation
- IPTV, IP Phone
- Automotive infotainment
- Human-machine interface, Home Automation
- Portable Medical



Production : now
10k price : starting 2.54\$



i.MX 6 Overview Summary

- i.MX Product Leadership Offerings
- Positioning with i.MX 6 Series Product
 - i.MX 6 Product Expansion
 - i.MX 6SoloX
 - i.MX 6QuadPlus
 - i.MX 6DualPlus
 - i.MX 6Ultralite
- Product Support Pages Information



i.MX Product Pages

- [i.MX Product Family](#)
- [i.MX 6SoloX](#)
- [i.MX 6QuadPlus](#)
- [i.MX 6DualPlus](#)
- [i.MX 6UltraLite](#)





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