

# i.MX 8 SERIES OVERVIEW

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i.MX PRODUCT MARKETING  
MICROCONTROLLERS

AMF-CNS-T271 | JUNE 2017

[www.nxp.com/imx8](http://www.nxp.com/imx8)



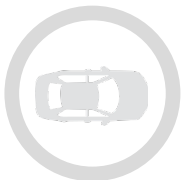
SECURE CONNECTIONS  
FOR A SMARTER WORLD

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# AGENDA

- Introduction
- i.MX 8 & 8X Overview
- i.MX 8M Overview
- Software
- Additional Information
- Q&A



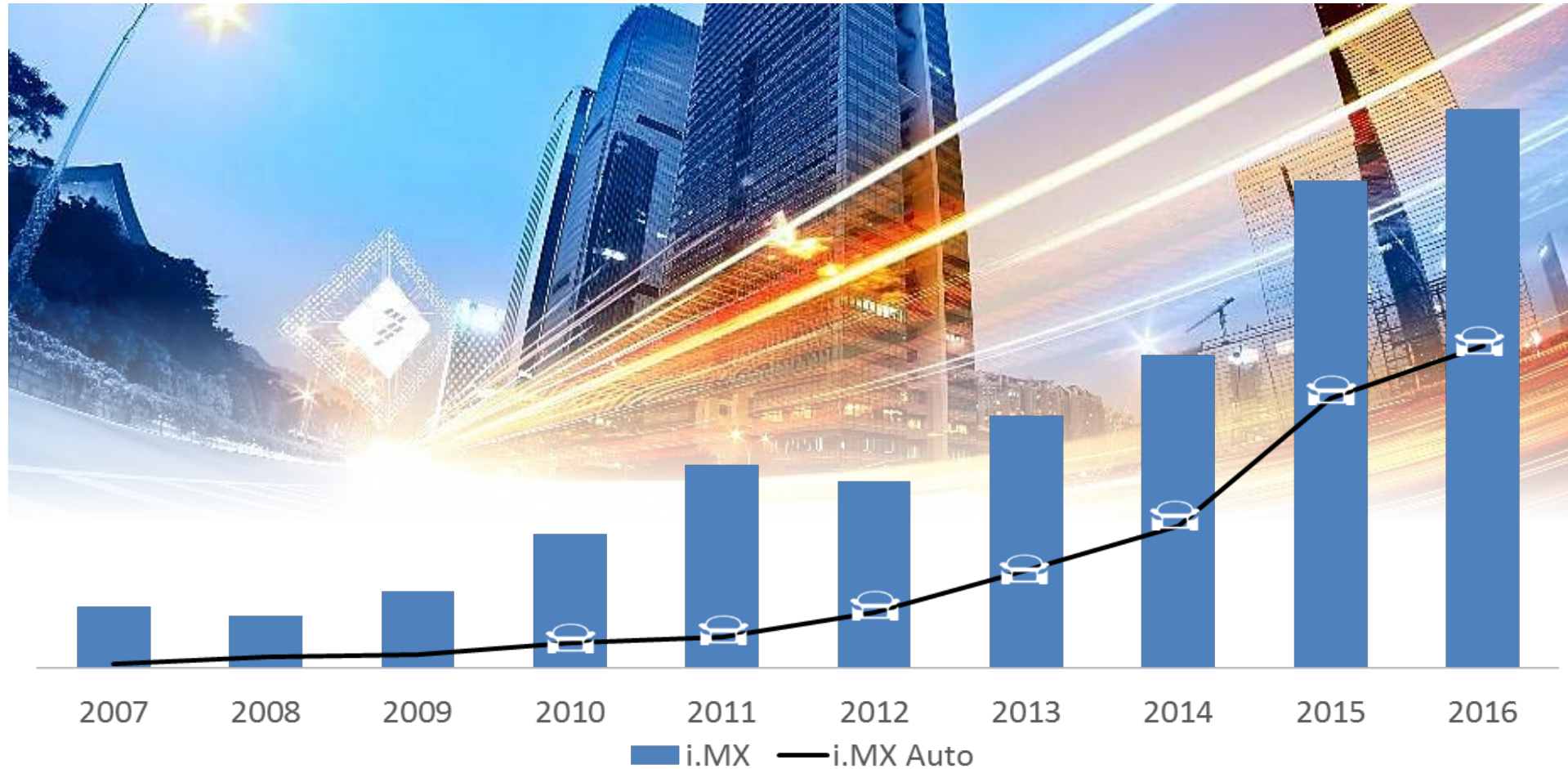


# 01.

## Introduction



# i.MX Driving Explosive Growth in Automotive and Smart Devices



Over **350M i.MX** SOCs shipped to date  
Over **92M vehicles** enabled with i.MX since 2007  
**#1** in eReaders, **#1** in Auto Infotainment Application Processors

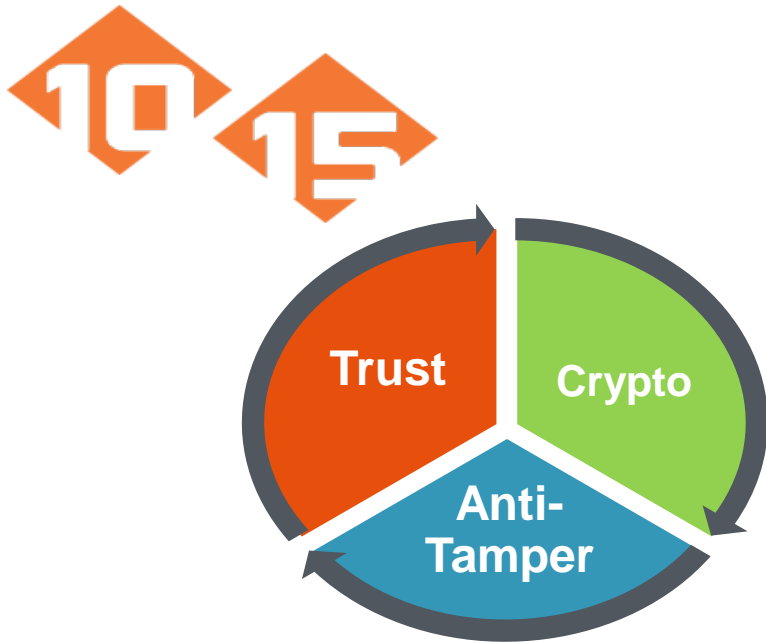
Source: Strategy Analytics Infotainment & Telematics Q1 2017

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# i.MX Applications Processor Values

## Product **Longevity**



- **Scalability**

- Pin compatibility and software portability
- CPU (single/dual/quad, asymmetric), GPU, IO
- Software: Linux, Android, Windows-embedded, RTOS

- **Trust**

- Longevity: minimum of 10-15 years in all markets
- Quality, robustness, zero-defect methodology
- Security and Safety
- Qualifications: AEC-Q100, JEDEC Industrial and Consumer

- **Ease of Use**

- Industry-leading ecosystem, partnerships and support
- Design collateral, distribution, communities
- System solutions: SoC, sensors, memory, PMIC, connectivity



# NXP Product Longevity Program

NXP formally offers many devices for a minimum of 10 or 15 years from the time of launch

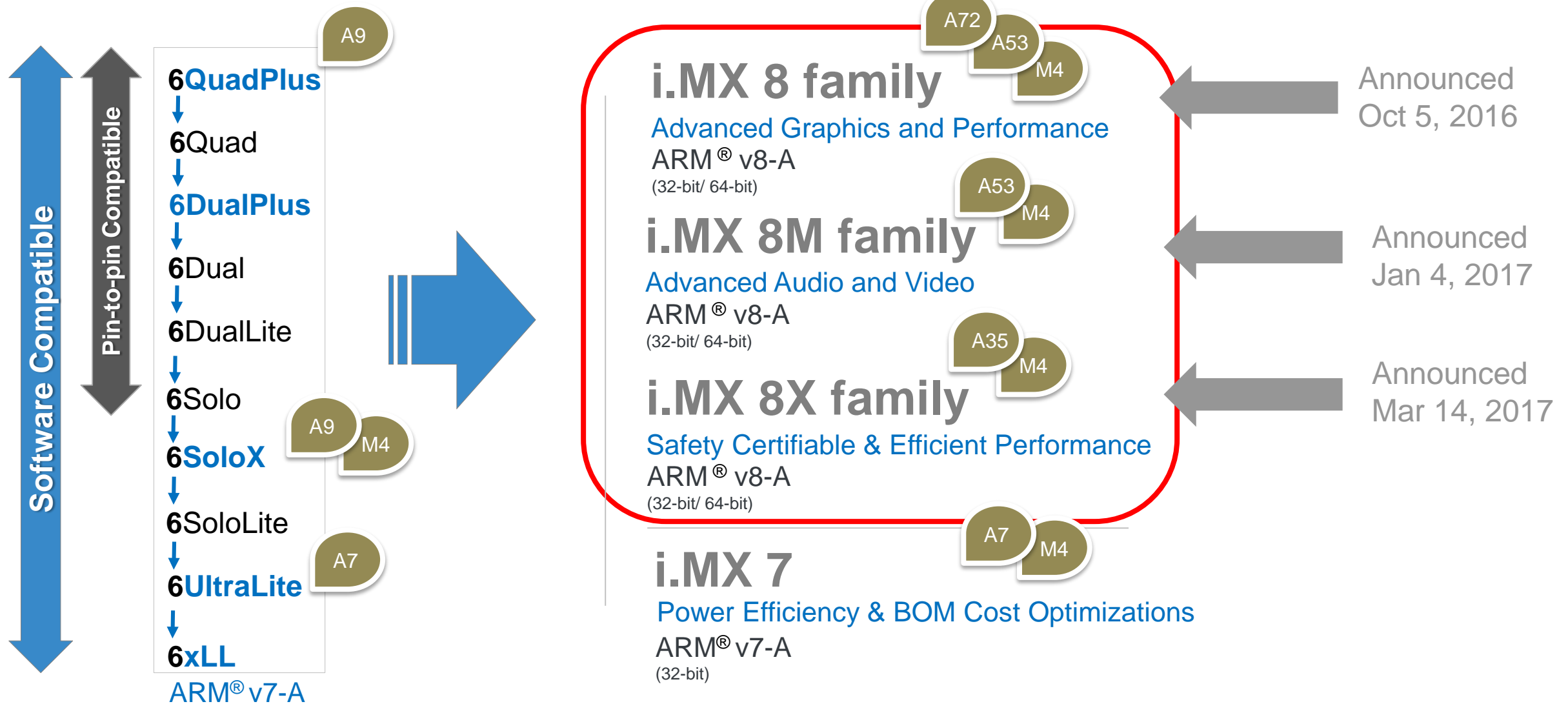
- Participating NXP products and program terms are listed at [www.nxp.com/productlongevity](http://www.nxp.com/productlongevity)

Recently updated to:

- Extend **i.MX 6 series industrial** parts for 15-year longevity
  - Industrial parts match automotive 15-years
  - Industrial i.MX 6Quad, 6Dual, 6DualLite, 6Solo extended until at least 2027
  - Industrial i.MX 6SoloX and 6UltraLite extended until at least 2030
  - Consumer and commercial remain at 10-years
- Add **i.MX 7Dual and 7Solo** with 10-year longevity
  - i.MX 7Dual and 7Solo expected to ship until at least 2026



# i.MX 8 Series: 3 families of parts with targeted features

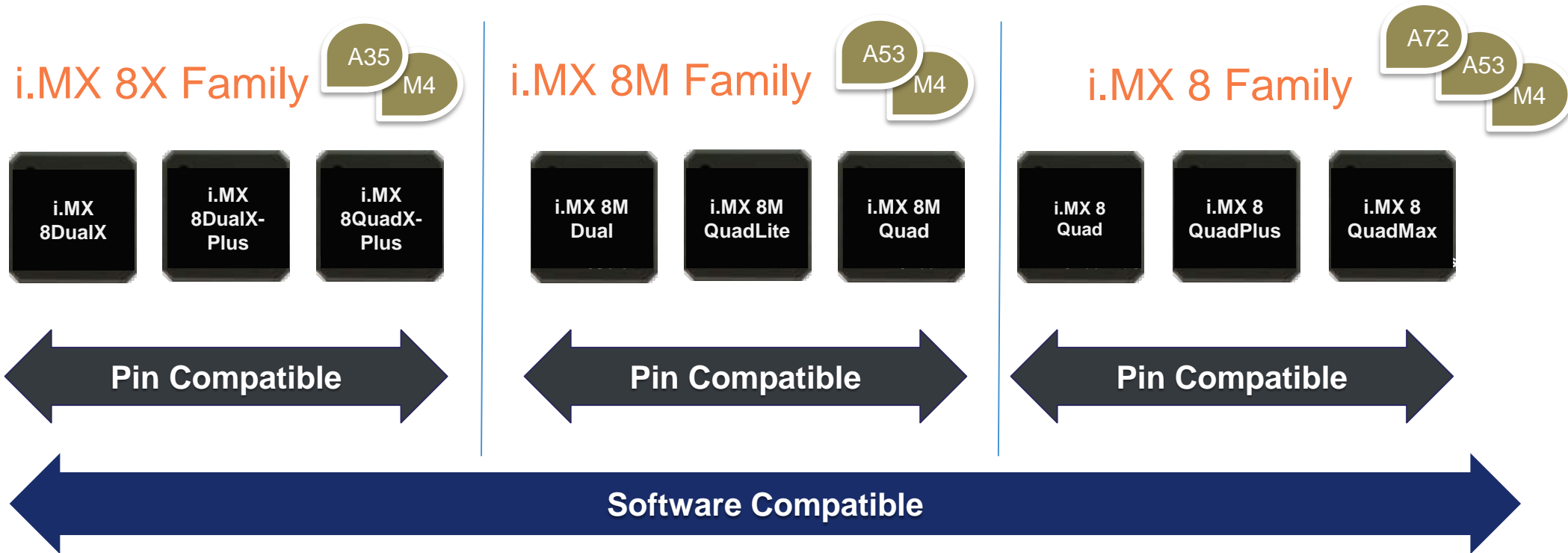




# i.MX 8 Series: Supreme Scalability and Flexibility



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



# Qualification Levels and Package Types

Qualification Level	Characteristics
<b>Commercial or Consumer</b> <ul style="list-style-type: none"><li>• Highest MHz</li></ul>	<b>5-year life, 50% on</b> Typically: <ul style="list-style-type: none"><li>• -20C (0C) to +105C Tj</li><li>• Highest CPU speed</li></ul>
<b>Automotive</b> <ul style="list-style-type: none"><li>• Widest temperature range</li></ul>	<b>15-year life, 10% on</b> Typically: <ul style="list-style-type: none"><li>• -40C to +125C Tj</li><li>• Medium CPU speed</li></ul>
<b>Industrial</b> <ul style="list-style-type: none"><li>• Longest operating life</li></ul>	<b>10-year life, 100% always on</b> Typically: <ul style="list-style-type: none"><li>• -40C to +105C Tj</li><li>• Lowest CPU speed</li></ul>

- Metal lid covers the die
- More robust for industrial or automotive environments
- Typically more costly

Lidded Package – Automotive or Industrial



Non-Lidded Package – Consumer or Industrial



- Back side of the die is exposed (flip-chip)
- Lower Z-height for space-constrained devices
- Easier to attach custom heat spreaders

# i.MX 8 SERIES AUTO PROCESSOR ROADMAP

32 - 64 bit OS compatibility from entry to premium segments



## i.MX 8

Advanced Graphics & Performance

ARM® v8-A Cortex-A53 / A72

Scalable family of products for advanced multi-display eCockpit systems with low virtualization software overhead

## i.MX 8X

Safety Certifiable & Efficient Performance

ARM® v8-A Cortex-A35



Scalable family of products for display audio infotainment, reconfigurable instrument clusters and telematics / V2X applications

**SAFE**  SAFE ASSURE  
by Processor

Advanced support for ASIL-B Display and Camera Applications

## SCALABLE

Common architecture with ~70% design reuse

ARM v8-A Compatibility to support common applications

## SECURE

Common security subsystem with advanced crypto and HSM support



# i.MX 8 Series Industrial Target Applications

## HMI, Voice and Vision for Harsh Environments



### Imaging and Scanning

- Portable platforms need faster response and battery life that exceeds a work shift (12 hours)
- Sensor module targets are now below 10 cubic millimeters
- Durable products operate more than 10 years in an unconditioned environment (-40C to +85C ambient)

### Human Machine Interface (HMI)



- Industrial workers expect to use rich graphics and video on higher resolution displays, similar to their personal devices
- Time is money – the HMI must respond accurately, and in milliseconds, to voice, touch screen and gesture inputs
- Efficient development leverages scalable performance and reusable software across multiple product platforms



### Building Automation

- Mobile and stationary machines want full access to cloud-based knowledge
- This demands increasingly faster and more reliable wired and wireless connectivity
- Security is at the forefront, to protect human privacy and commercial assets

### Machine Vision



- Machines “see” through multiple camera and sensor inputs
- Developers prefer to migrate away from DSPs and ASICs to leverage well-supported GPU and ARM technology
- Software tools and reference designs enable advanced math processors (GPU, ARM NEON) for faster image processing

# The i.MX 8M is a Game Changer

- **Industry-Leading Video and Audio**

- Video quality with full 4K UltraHD resolution and HDR
  - Dolby Vision, HDR10, and HLG
- Highest levels of pro audio fidelity

- **Performance and Versatility**

- Up to four 1.5 GHz Cortex-A53 processors
- Flexible memory options
- Newest high-speed interfaces for flexible connectivity

- **Advanced HMI Solutions**

- Industrial and consumer HMI
- Dual displays
- Enriched user experience
- Immersive Audio and Video processing
- Voice Solutions
- Interconnected Devices (smarter edge devices)

## Enhanced Video Clarity

SD → HD → 4K → 4K HDR



Pin Compatible  
Subsystem Compatible  
Software Compatible

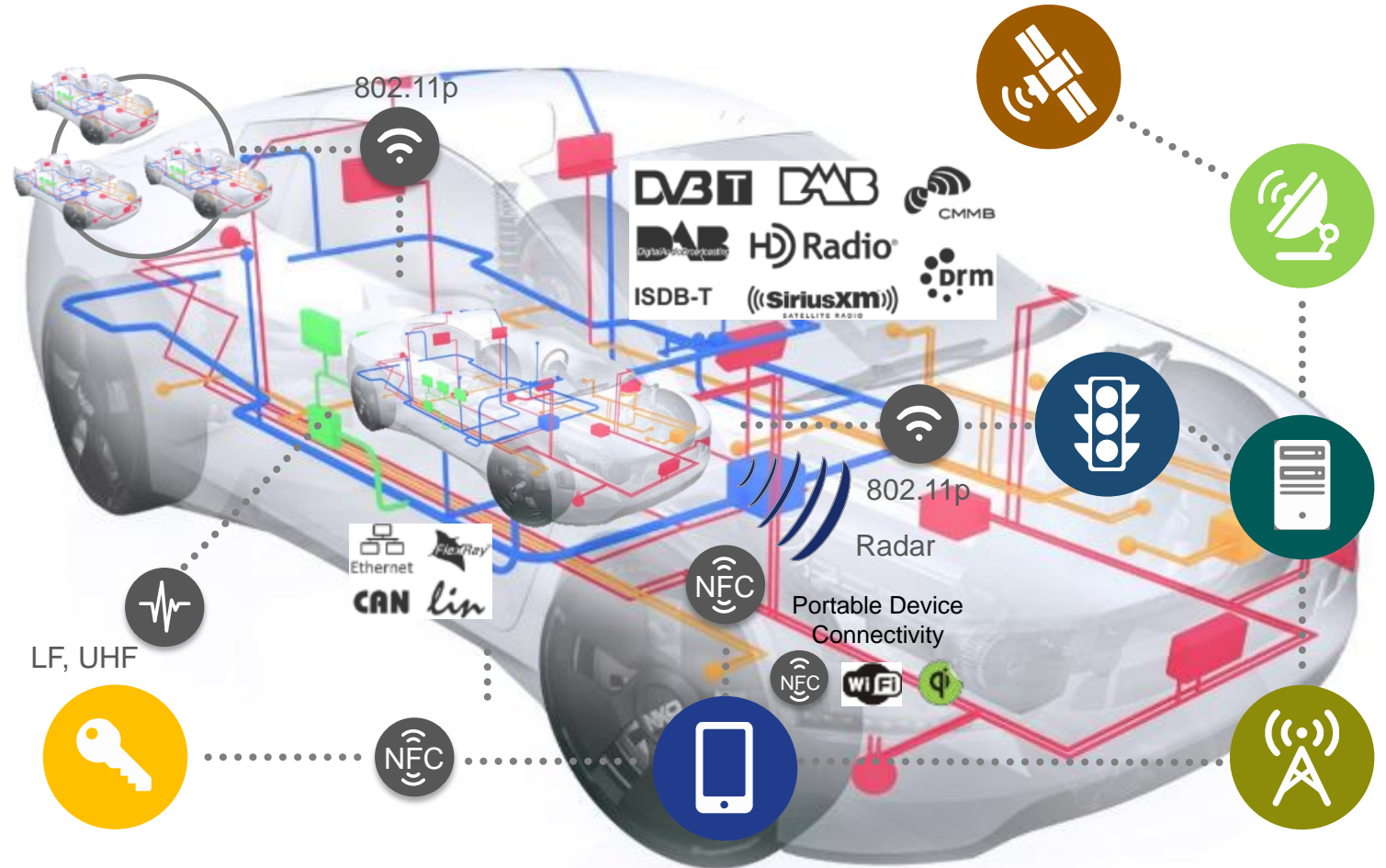
# The Clouds on the Ground

- **Smart Driving**

- up to 100 network points per car
- Multiple sensors (radar, NFC, WIFI, Sat)
- Safer driving via Smart control systems
- Vehicle to Vehicle/Infrastructure comms
- Smart route planning, accident avoidance
- Speech based control
- Your 2<sup>nd</sup> home....

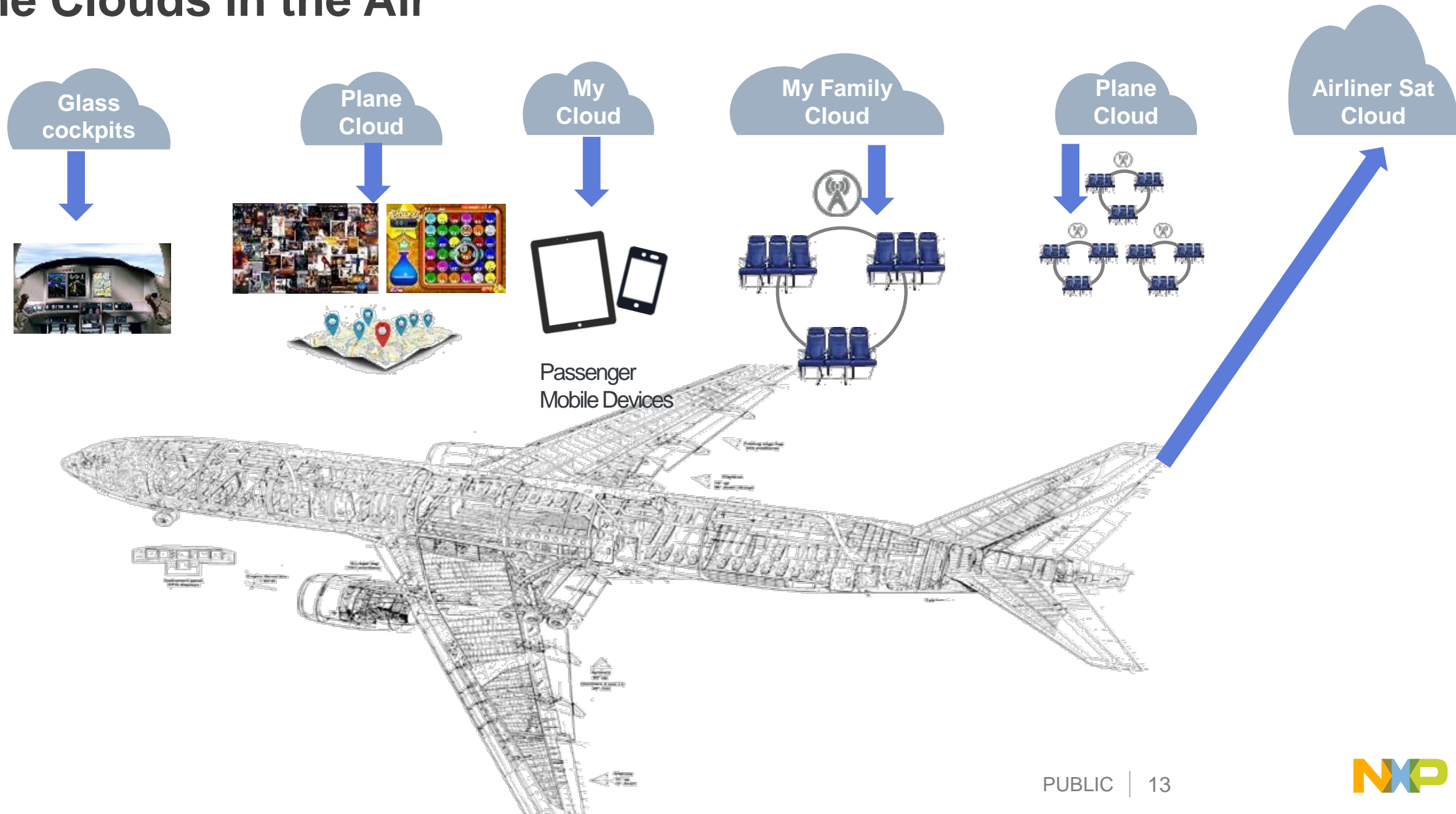
- **Increasingly connected to its environment**

- to vehicles & infrastructure
- to user devices
- to cloud services

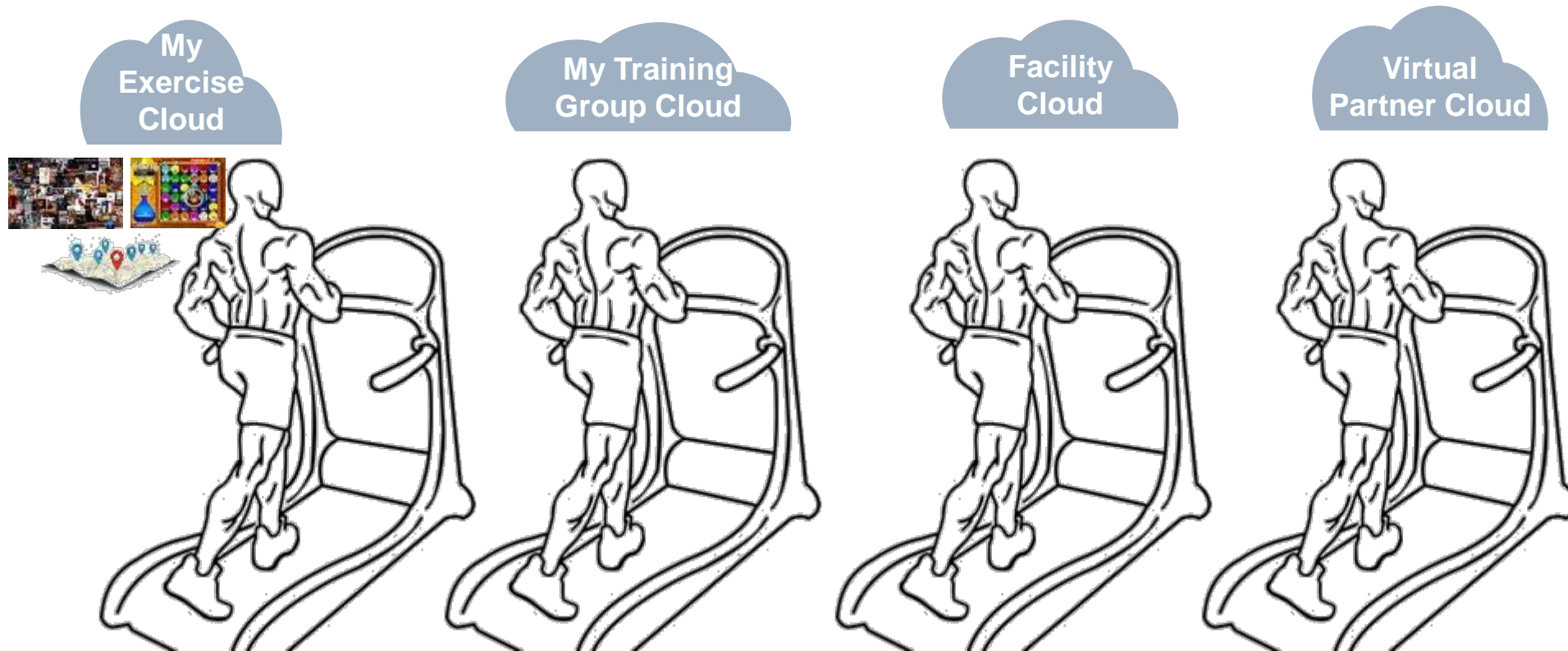




# The Clouds in the Air



# ...The Clouds in the Gym? What's the difference?




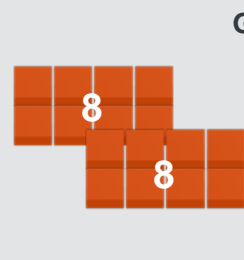


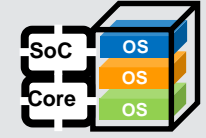

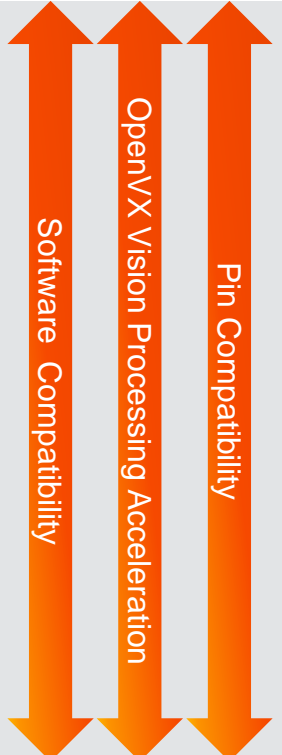




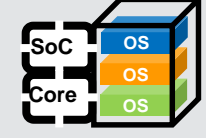


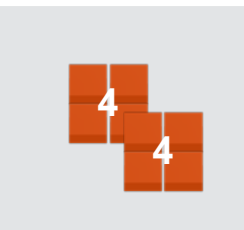


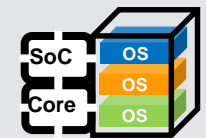

Nothing Really... Similar Needs, Similar Solutions



# 02.

## i.MX 8 & 8X Overview

# i.MX 8 Family of Application Processors

	GPU	Display	DSP	Virtualization	ARM CPU	
 <p><b>8QuadMax</b></p>	 <ul style="list-style-type: none"> <li>Dual Core GPU</li> <li>16 Vec4 Shaders</li> <li>64 execution units</li> <li>Tessellation/Geometry Shaders</li> </ul>	Up to 4 displays 	Audio DSP  <p>HiFi 4</p>	SoC Level 	Cortex-M4   Cortex-A53   Cortex-A72 	 <p>Software Compatibility</p> <p>OpenVX Vision Processing Acceleration</p> <p>Pin Compatibility</p>
 <p><b>8QuadPlus</b></p>	 <ul style="list-style-type: none"> <li>Dual Core GPU</li> <li>8 Vec4 Shaders</li> <li>32 execution units</li> <li>Tessellation/Geometry Shaders</li> </ul>	Up to 4 displays 	Audio DSP  <p>HiFi 4</p>	SoC Level 		
 <p><b>8Quad</b></p>	 <ul style="list-style-type: none"> <li>Dual Core GPU</li> <li>8 Vec4 Shaders</li> <li>32 execution units</li> <li>Tessellation/Geometry Shaders</li> </ul>	Up to 4 displays 	Audio DSP  <p>HiFi 4</p>	SoC Level 		

Family of Scalable Multimedia Processors




Industrial Grade Qualification

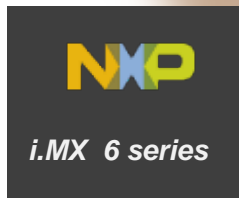
Automotive Qualification for high temp, duty cycled applications



# i.MX 8 Family

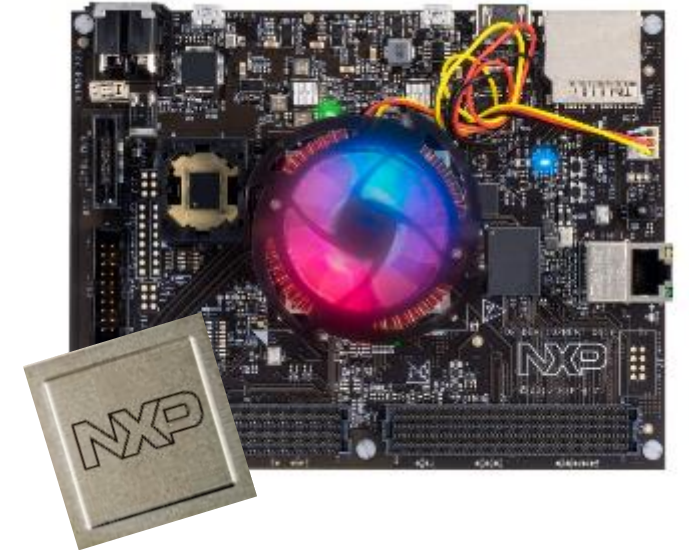
*Up and  
To The  
Right*

	CPU	GPU	Virtual	Vision	Display	VPU	DDR
	3.5x	8x	New	10x	4x	8x	3x
	2.5x	4x	New	5x	4x	8x	3x
	1.5x	4x	New	5x	4x	8x	3x



# i.MX 8 Family Key Features

- **Multiple Systems, One Processor**
  - Combine multiple systems into one, easily
  - Run-time system partitioning & isolation
  - Advanced, programmable security (e.g. Flashless SHE)
- **Multi-Display and Multi-Domain Functionality**
  - Four screens of independent content
  - Split Media Architecture: Rich Gfx, faster deployment
  - SafeAssure ASIL-B ready hardware
  - Failover capable display controller: keeps the LCD alive
- **Enabling the New World of Seamless Machine Interfaces**
  - Advanced vision-based HMI systems
  - View the world in 360° via multi-camera support & image stitching
  - Multi-domain voice-recognition and audio processing



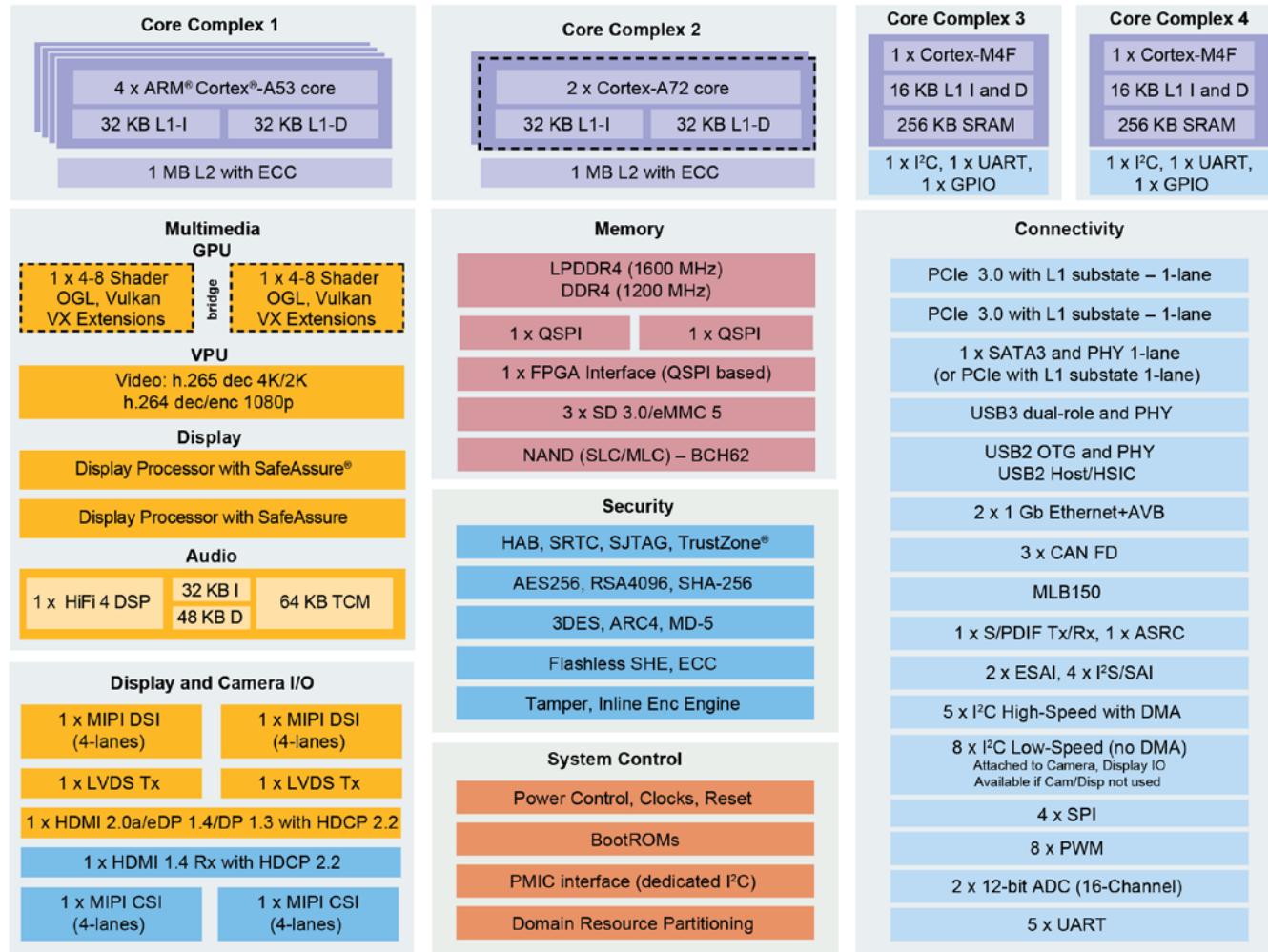
Pin Compatible  
Subsystem Compatible  
Software Compatible




# i.MX 8 Family - Multi-Domain Applications

- Automotive
  - full digital electronic cockpit (eCockpit)
    - Infotainment, instrument cluster, head unit, heads-up display (HUD), rear seat entertainment
  - Advanced industrial human machine interface (HMI) and control
- Computer Vision & Surround View
- Single-board computers
- Home/Building
- Autonomous robotic and industrial devices
- Multiple domain security systems




# i.MX 8 Family Block Diagram



	 <i>i.MX 8QuadMax</i>	 <i>i.MX 8QuadPlus</i>	 <i>i.MX 8Quad</i>
Feature			
ARM® Core	2 x ARM Cortex®-A72	1 x Cortex-A72	-
ARM® Core	4 x Cortex-A53	4 x Cortex-A53	4 x Cortex-A53
ARM® Core	2 x Cortex-M4F	2 x Cortex-M4F	2 x Cortex-M4F
DSP Core	Tensilica® HiFi 4 DSP	Tensilica HiFi 4 DSP	Tensilica HiFi 4 DSP
GPU	2 x GC7000XSVX	2 x GC7000Lite/XSVX	2 x GC7000Lite/XSVX
PCIe	1 x PCIe (2-lane)* + 1 x PCIe (1-lane)	1 x PCIe (1-lane)	1 x PCIe (1-lane)

\*2-lane PCIe can act as 2 x 1-lane PCIe

 Available on certain product families Note: Accessing muxable controller's full capabilities is dependent upon board component choices.



# i.MX8QuadMax – Full System

## Up to 8 Simultaneous camera inputs

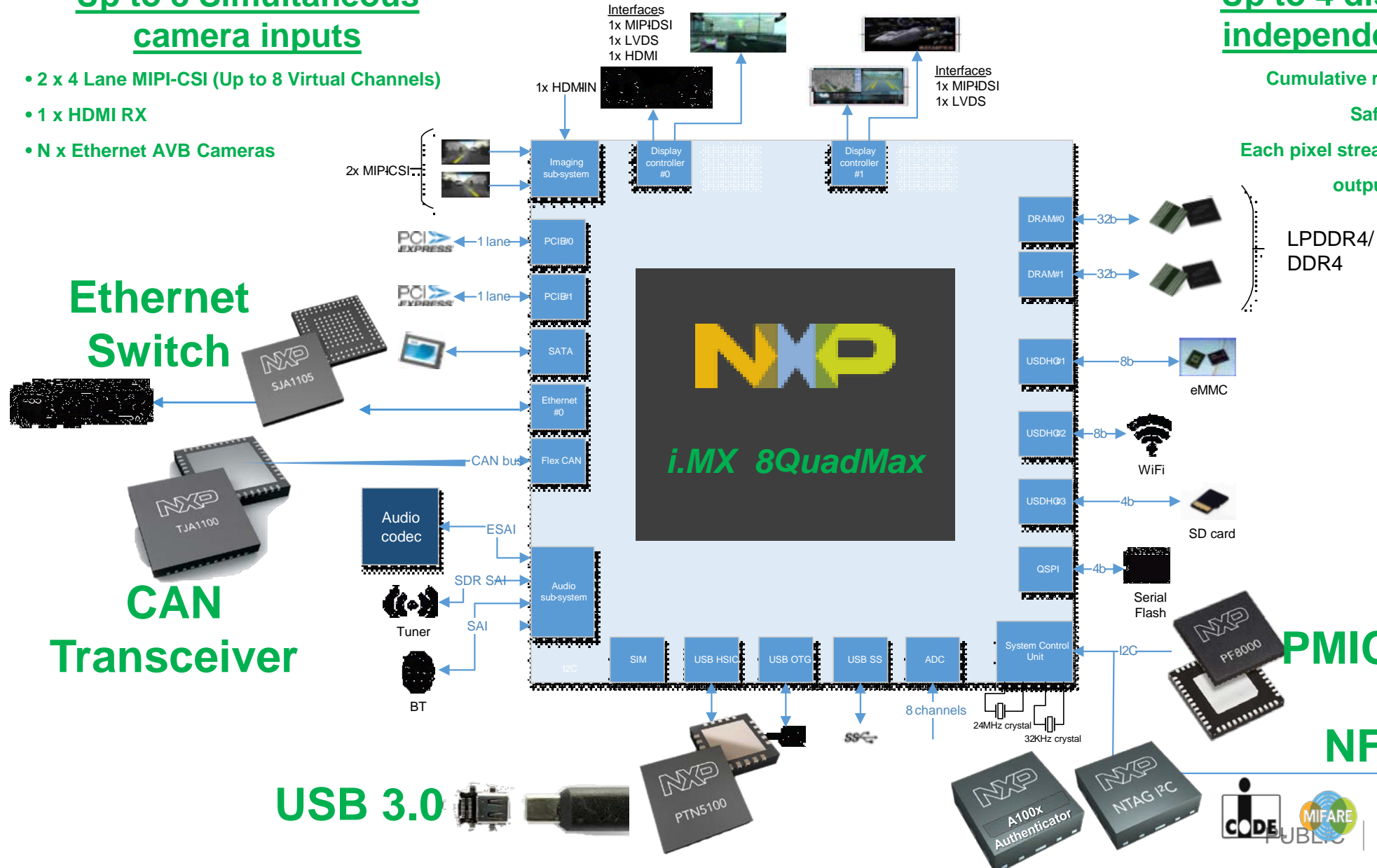
- 2 x 4 Lane MIPI-CSI (Up to 8 Virtual Channels)
- 1 x HDMI RX
- N x Ethernet AVB Cameras

## Up to 4 displays with independent content

Cumulative resolution up to 4K pixels (Ultra HD)

Safety layer, independent of main path

Each pixel stream can be directed to a selection of output PHYs: LVDS, MIPI-DSI, HDMI/eDP





















USB 3.0

NFC

PMIC



# i.MX 8X Family of Applications Processors

	GPU		Video	Displays	DSP	USB	DDR	ARM CPU
 <p><b>8QuadXPlus</b></p>		<ul style="list-style-type: none"> <li>• Single Core GPU</li> <li>• 4 Vec4 Shaders</li> <li>• 16 execution units</li> <li>• OpenGL ES 3.1</li> <li>• OpenCL Embedded</li> </ul>	 <p>+ Legacy</p>	<p>Up to 3</p> <p>2x 1080p 1x WVGA</p>	 <p>HiFi 4</p>		<p>x32</p> <p>DDR3L-1866 (ECC option)</p> <p>LP-DDR4-2400 (no ECC)</p>	<p>Cortex-A35 + M4</p> 
 <p><b>8DualXPlus</b></p>		<ul style="list-style-type: none"> <li>• Single Core GPU</li> <li>• 4 Vec4 Shaders</li> <li>• 16 execution units</li> <li>• OpenGL ES 3.1</li> <li>• OpenCL Embedded</li> </ul>	 <p>+ Legacy</p>	<p>Up to 3</p> <p>2x 1080p 1x WVGA</p>	 <p>HiFi 4</p>		<p>x32</p> <p>DDR3L-1866 (ECC option)</p> <p>LP-DDR4-2400 (no ECC)</p>	
 <p><b>8DualX</b></p>		<ul style="list-style-type: none"> <li>• Single Core GPU</li> <li>• 2 Vec4 Shaders</li> <li>• 8 execution units</li> <li>• OpenGL ES 3.0</li> </ul>	 <p>+ Legacy</p>	<p>Up to 3</p> <p>2x 1080p 1x WVGA</p>	 <p>HiFi 4</p>		<p>x16</p> <p>DDR3L-1866 (no ECC)</p> <p>LP-DDR4-2400 (no ECC)</p>	



Family of Scalable Multimedia Processors  
 Industrial Grade Qualification with ECC  
 Automotive Qualification for high temp, duty cycled applications

# i.MX 8X Family

*Natural extension of i.MX 6 series*



	CPU	GPU	M4	DSP	Display	VPU	DDR
i.MX 8QXP	1.2x i.MX6QP	1.2x	New	New	2.25x	4x	1.2x i.MX6QP
i.MX 8DXP	1.2x i.MX6D	1.2x	New	New	1.5x	4x	1.2x i.MX6D
i.MX 8DX	~2x i.MX6Solo	3x	New	New	1.5x	>>>	1.5x i.MX6Solo



# i.MX 8X Key Features

- **Safeguard Mission Critical Displays and Control Functions**
  - Increase system accuracy – ECC to support SIL 3
  - Ensure your display stays up and correct – SafeAssure® ASIL-B ready HW protects critical info with fail-over-capability
  - Advanced programmable security
  - Improved system reliability with FD-SOI
  - Offload time-critical tasks
- **Advanced Integration**
  - Multi-domain voice recognition: ARM core & DSP
  - Up to 3 screens of independent content
  - Flexible memory options
  - Unmatched range of cost-performance scaling with pin-compatible options and the highest level of software reuse
  - Audio partitioning flexibility between radio chip and apps processor
- **Low-power Optimized Performance**
  - Up to four 1.2 GHz Cortex-A35 processors
  - Multiple systems, one processor
  - Optimized power with the Cortex-M4 core for real-time processing





# i.MX 8X Family Target Applications

- Automotive
- Industrial vehicle
- Advanced industrial HMI & control
- Robotics
- Building control
- Healthcare
- Networking
- Mobile payment
- General purpose HMI solutions



# i.MX 8X Family of Applications Processors



### Core Complex 1

- 2-4 x ARM® Cortex®-A35
- 32 KB I-cache    32 KB D-cache
- 512 KB L2 cache with ECC

### Core Complex 2

Cortex-M4F	1 x I <sup>2</sup> C
16 KB I-cache	1 x UART
16 KB D-cache	6 x GPIO
256 KB SRAM	1 x TPM Timer

### Connectivity

- 4 x UART
- 8 x I<sup>2</sup>C
- 4 x SPI
- 1 or 2 x 1 Gbit Ethernet AVB
- 1 x 10/100 Ethernet
- 3.3 V/1.8 V GPIO
- PCIe 3.0 with L1 Substate-1-lane
- 1 x USB3 OTG w/PHY
- 1 or 2 x USB2 OTG w/PHY
- 3 x CAN/CAN FD
- MOST 25/50
- 4 x 4 Keypad
- 4 x PWM
- 1 x 12-bit ADC
- 2 x ASRC, SPDIF
- 4 x SAI, ESAI, MQS

### Multimedia

#### GPU

1 x 2- or 4-Shader, OpenGL ES 3.0 or 3.1 3.1, Vulkan®

#### VPU

Video: h.265 dec 4K, h.264 enc/dec 1080p

#### Audio

##### DSP Core

Tensilica® HiFi 4	32 KB I	48 KB D	64 KB TCM
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512 KB SRAM

### Memory

- DDR3L @ 933 MHz (ECC option)/ LPDDR4 @ 1200 MHz (no ECC)
- 2 x SDIO3.0/eMMC5.1
- RAW NAND-BCH62
- 2 x Quad/1 x Octal SPI

### Security

- HAB, SRTC, SJTAG, TrustZone®
- AES256, RSA4096, SHA-256
- 3DES, ARC4, MD-5
- Flashless SHE, ECC
- Tamper, Inline Enc Engine

### Display and Camera I/O

- Display Processor with SafeAssure®
- 2 x MIPI-DSI/LVDS Combo PHY\*
- 1 x Parallel Display    1 x Parallel CSI
- 1 x MIPI CSI

### System Control

- Power Control, Clocks, Reset
- BootROMs
- PMIC interface (dedicated I<sup>2</sup>C)
- Domain Resource Partitioning

Feature	i.MX 8DualXPlus / i.MX 8QuadXPlus	i.MX 8DualX
ARM® Core	2 x Cortex-A35 (i.MX 8DualXPlus) 4 x Cortex-A35 (i.MX 8QuadXPlus)	2 x Cortex-A35
ARM® Core	1 x Cortex-M4F	1 x Cortex-M4F
DSP Core	Tensilica® HiFi 4 DSP	Tensilica HiFi 4 DSP
DRAM	32-bit DDR3L (ECC option)/ LPDDR4 (no ECC)	16-bit DDR3L (no ECC) LPDDR4 (no ECC)
GPU	1 x GC7000Lite	1 x GC7000UltraLite
VPU	4K h.265 dec, 1080p h.264 enc/dec	1080p h.264 enc/dec
Ethernet	2 x Gigabit with AVB	1 x Gigabit with AVB 1 x 10/100
USB with PHY	1 x USB 3.0 (can be used as USB 2.0) 1 x USB 2.0	2 x USB 2.0

\* Each single PHY can either be a 1x4 lane MIPI-DSI or a 1x1 channel LVDS interface for a total of 2 display interfaces. In combination, the two PHYs can be configured to be a single 2-channel LVDS interface.

Available on certain product families    Note: Accessing muxable controller's full capabilities is dependent upon board component choices.



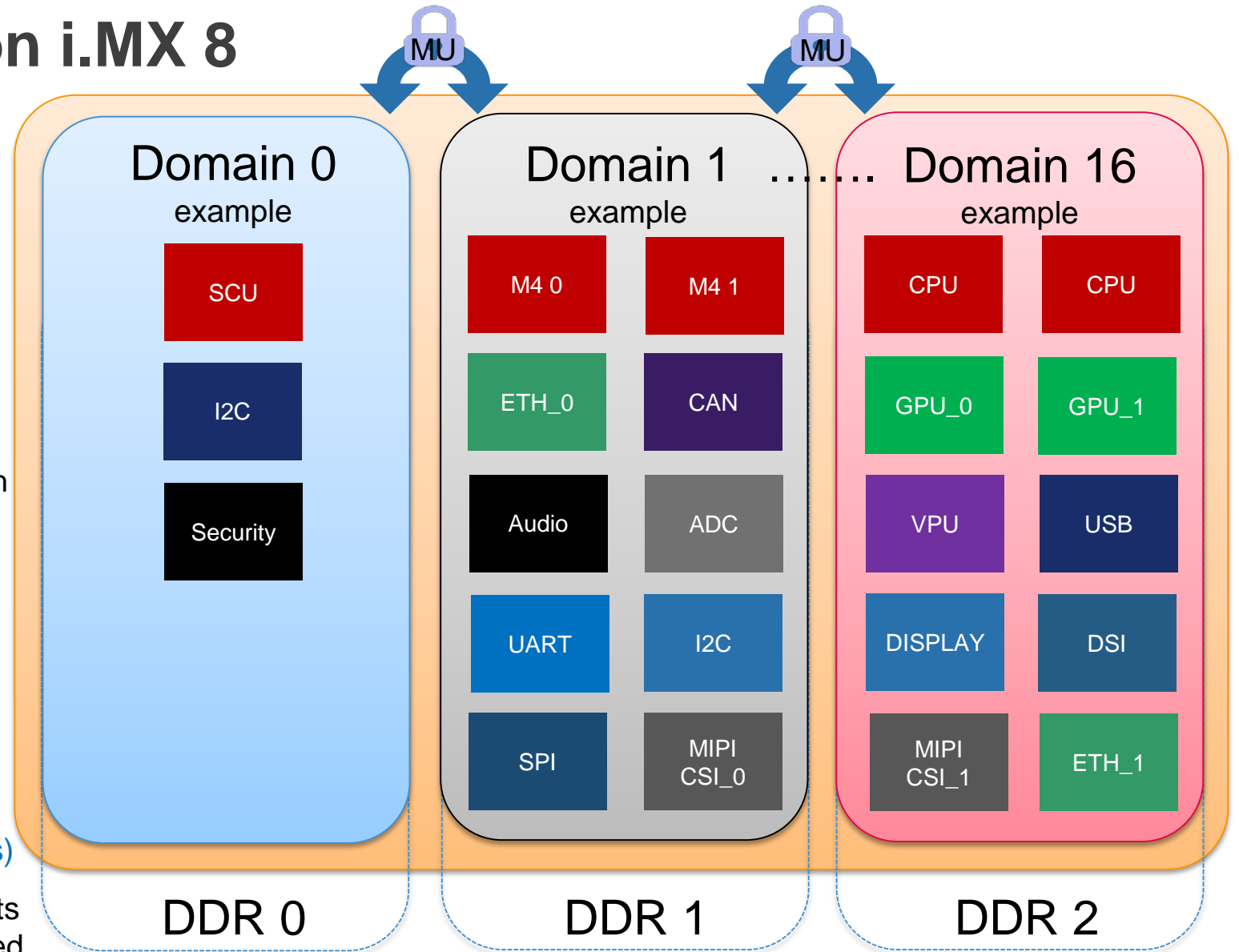
# Resource Partitioning on i.MX 8

## How Partitioning Works:

- The system controller commits peripherals and memory regions into a specific domains.  
(This is customer defined in the System Configuration Data)
- Any communication between domains are forced to use messaging protocols through Messaging Units (MU's)
- If a domain peripheral tries to access other domains illegally, a bus error will occur.

## Benefits of Partitioning:

- Reporting of immediate illegal accesses helps track down hard to find race conditions before they go to production. (AKA Sandbox Methods)
- Provides security on a finished product: protects system critical SoC peripherals from less trusted apps and intentional security breaches



# i.MX 8: GPU support

OpenGL ES 1.1, 2.0, 3.0, 3.1, 3.2

OpenGL 2.1 , 3.0

DirectX 11 9\_3

## OpenGL Vulkan

- low-level CPU like language that is more “hands-off” in terms of fixed functionality.
- Very efficient because it lets the user talk closer to the hardware.
- More dangerous... if the programmer doesn't know what they are doing.

## Tessellation Shading (-> OpenGL ES 3.2)

- GPU hardware function that increases the detail of given polygons via a shader program.
- Great for detailed maps (navigation), car or other 3D models.

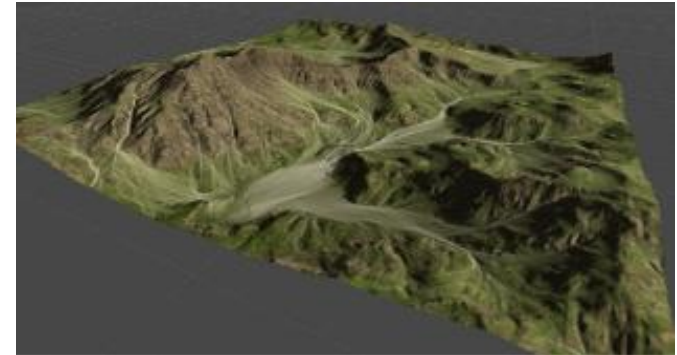
## Geometry Shading

- GPU hardware function that can modify existing 3D primitives or create NEW polygons programmatically.
- Unlimited use cases – usable for terrain generation in automotive mapping.

OpenCL 1.0, 1.1, 2.0

## OpenVX, OpenCV

- VX Hardware additions to GPU enable image processing use cases
- 40% increase in efficiency vs other GPU for OpenVX workloads



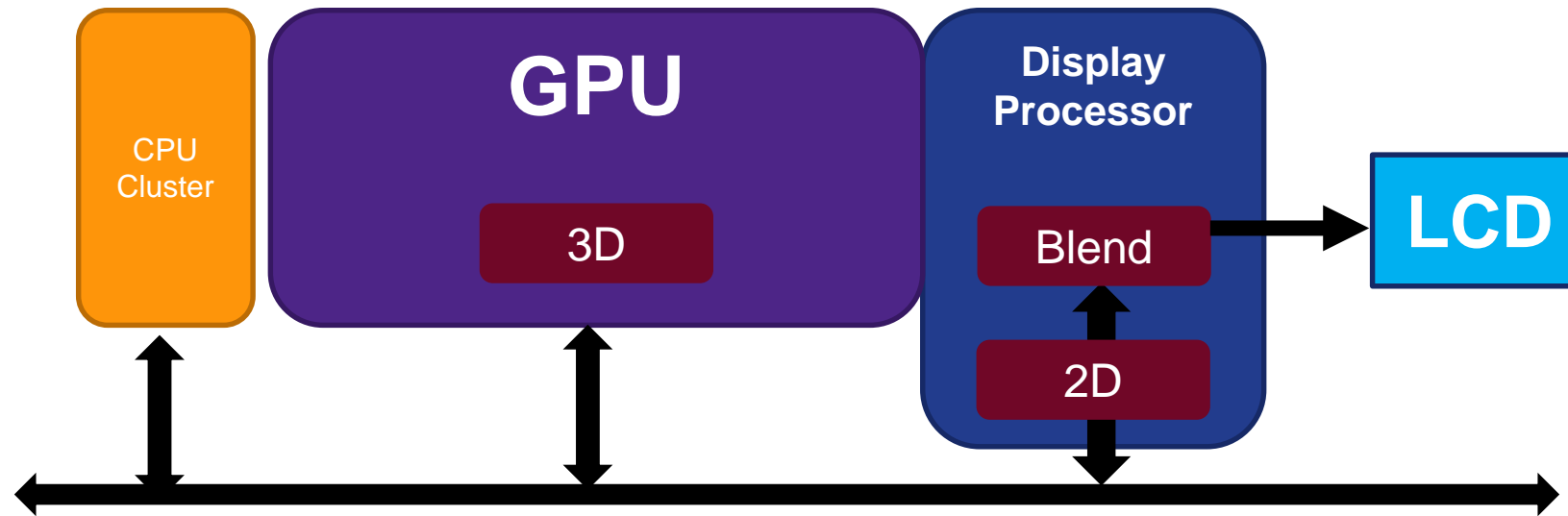


# i.MX 8QM & 8QXP Series Video

- Decode : HEVC + H264 + all legacy formats
  - up to 4K
- Encode : H264
  - up to 1080p
- Multi stream (up to 4 stream support)
- Transport stream on i.MX 8QM



# i.MX 8 Display Processor: Let the GPU be a GPU!!

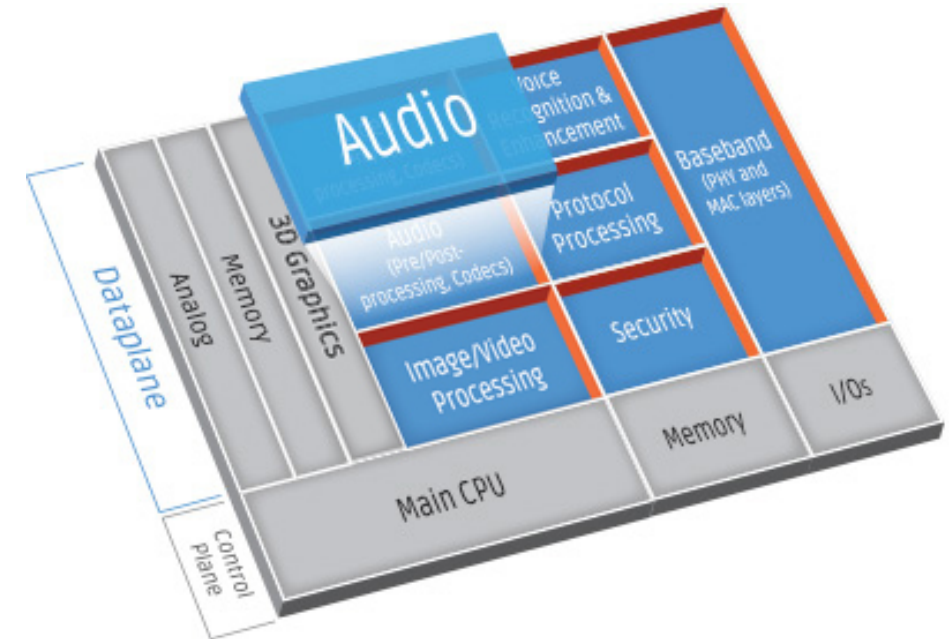


- **i.MX 8 Display Processor:**

- Runs independently of the GPU
- Turn the GPU off... SDC can drive 4x screens by itself
- Blends up to 20 unique planes of content inline without hitting DDR
- Has Warp/DeWarp, Video, Gfx planes (lots of 'em)
- Has SafeAssure: keep displaying something even if processor is crashed

# HiFi4 DSP Features

- **High Performance, DSP architecture**
  - Utilizes standard HiFi4 toolchains
  - End customer programmable
  - Tuned for audio, voice and music
  - Expandable to customer-specific algorithms
- **Large ecosystem of software from 3<sup>rd</sup> parties**
  - License from wide variety of 3<sup>rd</sup> party supplier
  - 175+ 3<sup>rd</sup> party codecs and audio/voice enhancements
- **Reuse across i.MX 8 and 8X**
  - Same DSP, same TCM, same software



# i.MX 8QM - CONNECTIVITY

**DDR4**

~~DDR3L~~

**LPDDR4**

**OctoSPI**

**HDMI**  
HIGH-DEFINITION MULTIMEDIA INTERFACE  
**2.0**

**((HDCP))**  
**2.2**

**MIPI**  
*DSI*

**MIPI**  
*CSI*

PCI **3.0**  
EXPRESS™

SERIAL  
**ATA** **3**

**USB2OTG**

**USB 3.0**

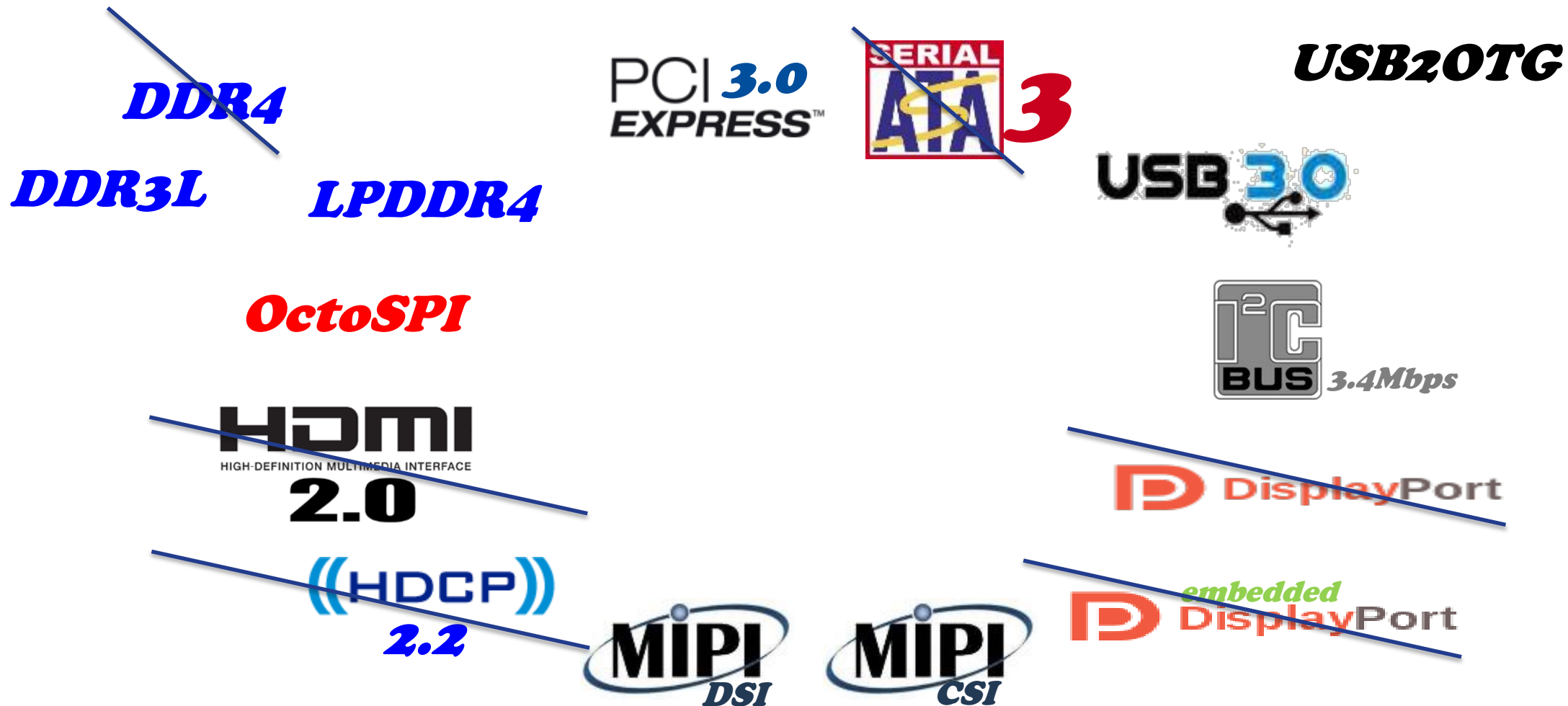
**I<sup>2</sup>C**  
BUS *3.4Mbps*

**DisplayPort**

**embedded**  
**DisplayPort**

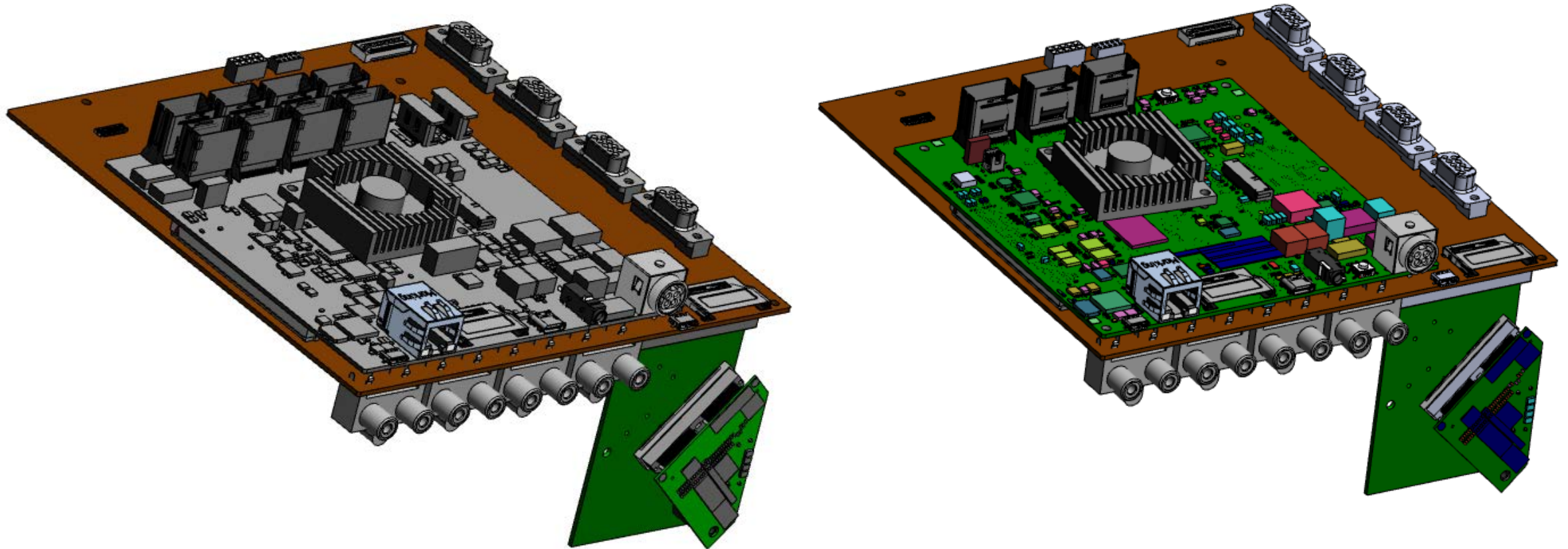


# i.MX 8QXP- CONNECTIVITY



# i.MX 8QuadMax / 8QuadXPlus MEK Preview

## Multisensory Enablement Kit



Plus multiple accessory board options

# PF8100/PF8200 Automotive PMIC



## Differentiating Points

- **High Power, High Efficiency** up to 10 A Core supply and > 19A total output power with **tight accuracy** and advanced thermal management
- **Proven & Robust** solution co-developed with MCU. BSP and reference designs provided.
- **Scalable** supply for MCU family with OTP configurability options
- **Minimize EMC with** Spread spectrum, frequency tuning, frequency synchronization and multi-phase operation
- **Optimized Size** through advanced architecture, < 200mm<sup>2</sup> component area
- Fit for for **ASIL-B** Application (PF8200)

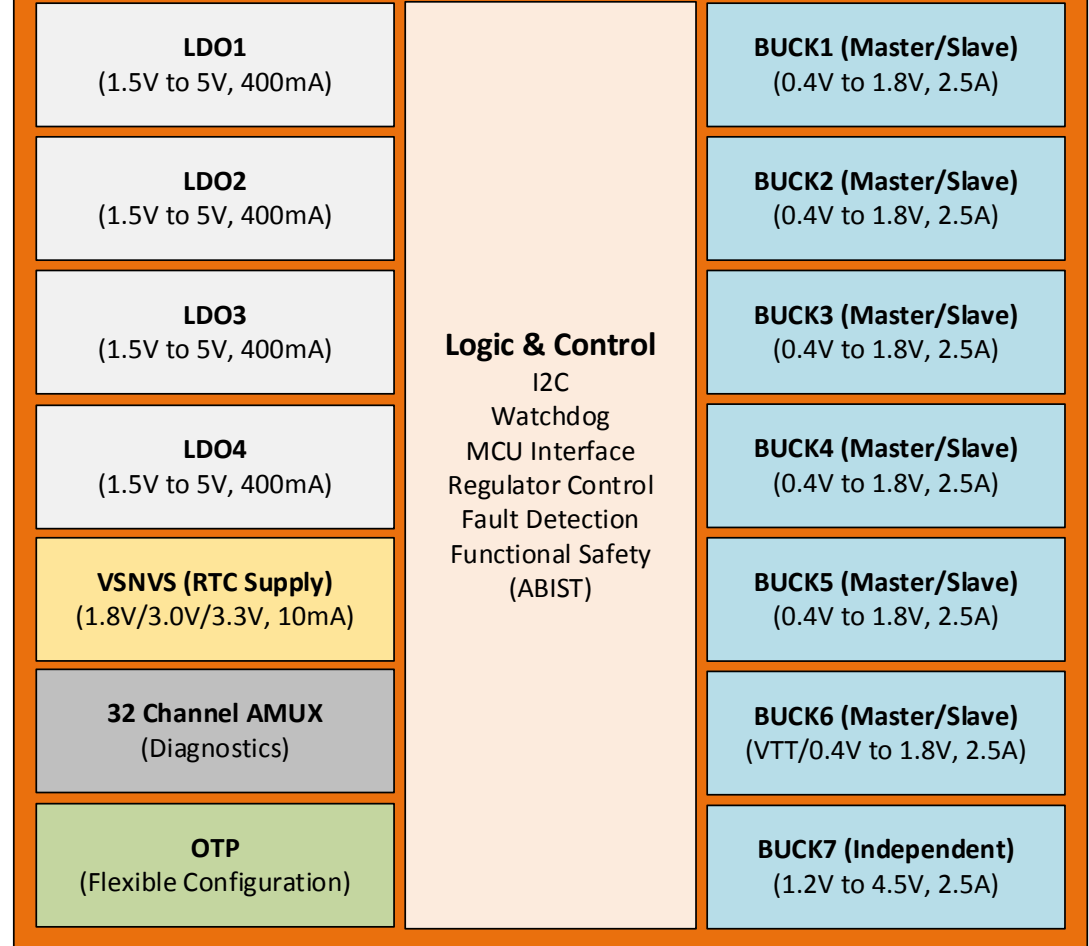
## Product Features

- Vin 2.7 – 5.5 V
- 6 Buck 0.4- 1.8 V, 2.5A Master/Slave;1 Buck 1.2- 4.5V Independent
- 4 LDO 1.5 - 5 V
- -40°C to 105°C Operating Ambient Temperature (150°C Tj)
- Prog Freq, Dynamic Freq Spread Spectrum , Ext Clock Synch
- 32 Channel AMUX, OV,UV
- Qualified for QM level (PF8100) or ASIL-B Safety Level (PF8200)
- 8x8mm 56-LD QFN-EP
- Consumer, Industrial, and Automotive grades available

## Applications

- Infotainment / Cluster
- Driver Awareness
- Vision
- Cable/Internet Stream Boxes
- Industrial/Consumer

## PF8200 Functional Block Diagram





# 03.

## i.MX 8M Overview



# i.MX 8M Family of Applications Processors

**+ HW Video Decode Engine**

	ARM CPU Cortex-A53   Cortex-M4	GPU	Display	Audio I/O	Modern I/O
<b>8M Quad</b> 13,800 DMIPS		<b>4</b> • Single Core GPU • 4 Vec4 Shaders • Up to 64 GFLOPS • 267 MTri / sec • 1.6 GPix / sec • OpenGL ES 3.0 • Vulkan • OpenCL Embedded	<b>Up to 2 displays</b> 	• 20-channels • 32-bits @ 384KHz • DSD512 • SPDIF Tx & Rx • HDMI ARC 	• 2x USB 3.0 (TypeC) • 2x PCIe • 2x SDIO 
<b>8M Dual</b> 6,900 DMIPS		<b>4</b> • Single Core GPU • 4 Vec4 Shaders • Up to 64 GFLOPS • 267 MTri / sec • 1.6 GPix / sec • OpenGL ES 3.0 • Vulkan • OpenCL Embedded	<b>Up to 2 displays</b> 	• 20-channels • 32-bits @ 384KHz • DSD512 • SPDIF Tx & Rx • HDMI ARC 	• 2x USB 3.0 (TypeC) • 2x PCIe • 2x SDIO 
<b>8M QuadLite</b> 13,800 DMIPS		<b>4</b> • Single Core GPU • 4 Vec4 Shaders • Up to 64 GFLOPS • 267 MTri / sec • 1.6 GPix / sec • OpenGL ES 3.0 • Vulkan • OpenCL Embedded	<b>Up to 2 displays</b> Resolution up to: 	• 20-channels • 32-bits @ 384KHz • DSD512 • SPDIF Tx & Rx • HDMI ARC 	• 2x USB 3.0 (TypeC) • 2x PCIe • 2x SDIO 

Software Compatibility

POP or Discrete Package Option

Pin Compatibility

Superset HDR w/ High Perf

HDR @ budget

UNIQUE High Perf Low Cost

## Family of Scalable Consumer and Industrial Media Processors

Human Machine Interface (HMI), Streaming Media Clients, Building Control,  
 Wireless/Networked Speakers, Soundbars, AV Receivers,  
 Consumer, Industrial and General Embedded Clients

# i.MX 8M Key Features



## • Best In Class Video Performance

- Up to 4K video decoding in h.265, h.264, VP9
- High Dynamic Range (HDR) support
  - Dolby Vision, HDR10 and HLG formats
- HDMI 2.0a with HDCP 2.2, MIPI-DSI (4 lanes)
- High Performance 3D Graphics Acceleration
  - OpenGL ES 3.1, Vulkan, OpenCL 1.2, and Open VG support



## • Scalable Next Generation CPU Performance

- Single, Dual, Quad Cortex-A53 up to 1.5 GHz
- Cortex-M4 up to 266 MHz
  - Offload Tasks, Optimize Power, Increase Security
- High Speed Interfaces (PCIe with L1 low power substates, USB3.0 with TypeC, etc.)

## • Best in Class Audio Interfaces

- 20+ audio channel inputs/outputs
- 32-bit @ 384KHz interfaces (some up to 768 KHz)
- DSD512 Support
- S/PDIF Tx and Rx
- HDMI Audio Return Channel (ARC)



## • High Performance at Low power

- Scalable power using mobile power architecture
  - Configurable to 1x, 2x, 3x, 4x Cortex-A53 cores
  - Multiple Power Islands
- HMP Cortex-A53 and Cortex-M4
- DDR3L, DDR4, and LPDDR4 Support



# i.MX 8M Quad

**Quad ARM Cortex-A53 @ 1.5+ GHz** (13,800 DMIPS)

- ARM v8 Fully 64-bit capable

**ARM Cortex-M4 @ 266 MHz** for Low Power, Security

**Package:** FCBGA 17x17mm, 0.65mm pitch (primary)

FCBGA 15x15mm, 0.65mm pitch, x32 PoP (secondary)

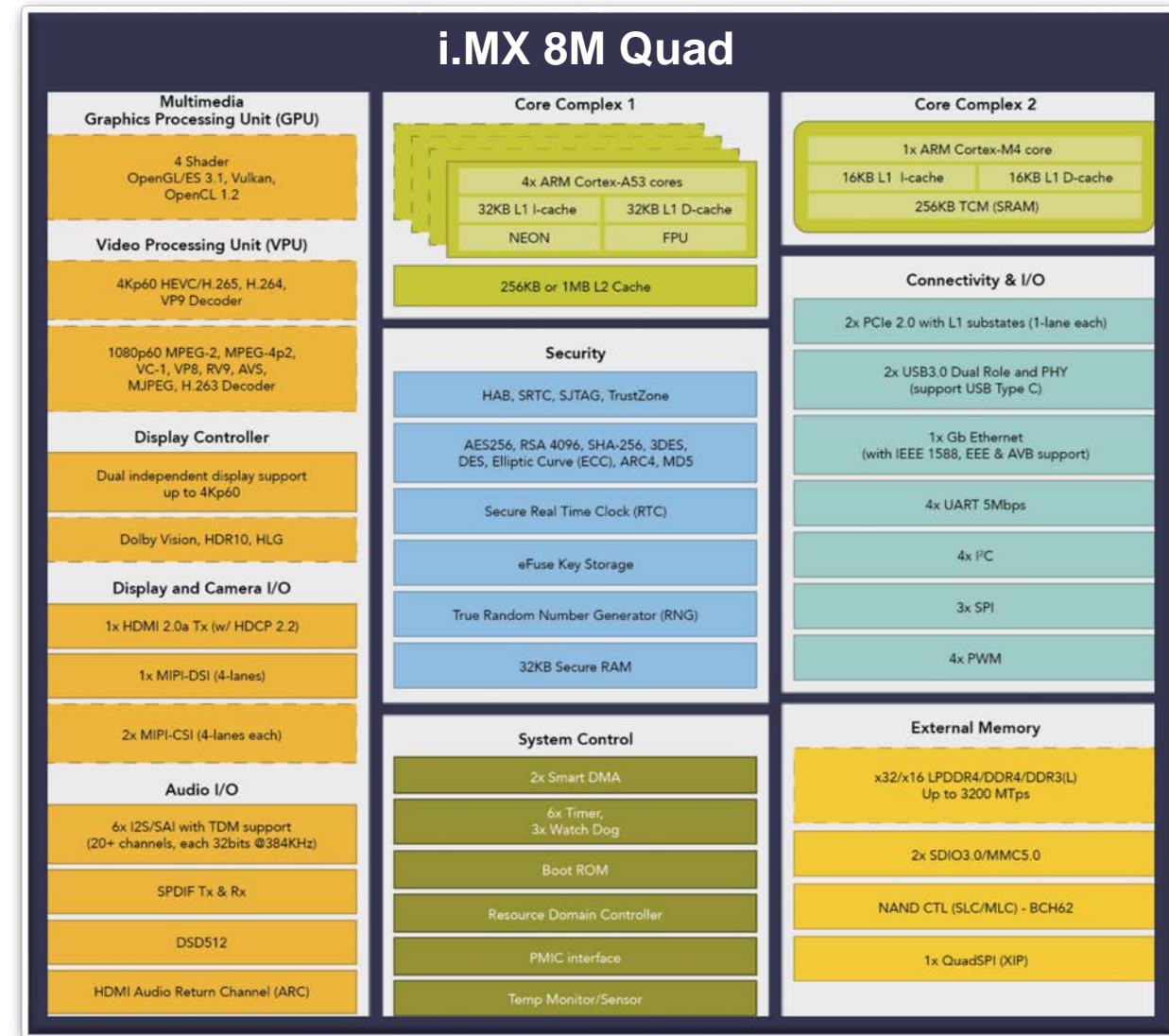
**Operating System targets:** Linux OS, Android OS, FreeRTOS

**Qualification** for Consumer and Industrial applications

## Feature Highlights:

- **GC7000Lite 3D Graphics GPU** (OpenGL ES 1.0, 2.0, 3.0, 3.1, Vulkan, and OpenCL 1.2)
- **4Kp60 Main, Main10 H.265/HEVC and VP9 (~2W including Memory)**
- 4Kp30 H.264 decoder
- **High Dynamic Range Support: HDR10, Dolby Vision, HLG**
- 1080p60 MPEG-2, MPEG-4p2, VC-1, VP8, RV9, AVS/AVS+, MJPEG, H.263 decoder
- High quality image resizing and graphics overlay
- **Audio: S/PDIF Rx & Tx, 6x I2S/SAI (up to 20ch 32bit @ 384Khz support) (reduced config - pinout)**
- **Display Interfaces:** 1x MIPI DSI (4-lane); 1x HDMI 2.0a Output with HDCP 2.2
- **Camera Interfaces:** 2x MIPI CSI2 input (4-lane each) with PHY
- 2x USB 3.0 Type C/dual role with PHY (works as USB 3.0 or USB 2.0)
- 1x Gb Ethernet (MAC): AVB & IEEE 1588 for sync, and EEE for low power
- **2x** PCIe 2.0 (1-lane) with L1 substates (low power, fast wakeup)
- 4x UART, 4x I2C, 3x SPI
- x16, x32 LPDDR4/DDR4/DDR3(L) (up to 3200 Mtps)
- 2x SDIO3.0 / eMMC5.0 / SD 4
- Raw NAND controller (BCH62)
- Quad-SPI for fast boot from SPI NOR; with Execute in Place (XIP)

**Preliminary, subject to change**



# i.MX8M Consumer Target Applications: Media IOT

## Video, Voice, and Audio for Connected Devices



### Video Streaming

- By 2018 IP video will represent 79% percent of all global traffic (source: Cisco)
- Cord cutting momentum shifts markets from traditional STB to OTT (over-the-top IP based video on demand)
- 4K and HDR driving need for updated equipment

### Voice



- 25-30% of ALL internet searches today are initiated by voice commands, and this number is growing rapidly (source: Google)
- Industry partnerships with major players such as Google, Amazon, Apple Homekit drive consumer adoption.
- Developer reference platforms to speed time-to-market.



### Audio Streaming & Immersive Audio

- With TV Panels are getting slimmer, audio is being separated into separate sound bars.
- Also, DSP migration to ARM driving system architecture change for immersive audio.
- Fast migration of Bluetooth speakers to Networked Wifi Speakers with the advent of voice control (always connected, always ready to answer).

### Smart Home



- Surge of IOT and voice control are revolutionizing the smart home. Machine learning and Artificial Intelligence (AI) to drive this market even higher.
- Major ecosystems to drive all the growth.
- Many home appliances are adding voice or other smart controls



# i.MX 8M Industrial Target Applications

## HMI, Voice and Vision for Harsh Environments



### Imaging and Scanning

- Portable platforms need faster response and battery life that exceeds a work shift (12 hours)
- Sensor module targets are now below 10 cubic millimeters
- Durable products operate more than 10 years in an unconditioned environment (-40C to +85C ambient)

### Human Machine Interface (HMI)



- Industrial workers expect to use rich graphics and video on higher resolution displays, similar to their personal devices
- Time is money – the HMI must respond accurately, and in milliseconds, to voice, touch screen and gesture inputs



### Building Automation

- Mobile and stationary machines want full access to cloud-based knowledge
- Security to protect human privacy and commercial assets

### Machine Vision



- Machines “see” through multiple camera and sensor inputs
- Developers prefer to migrate away from DSPs and ASICs to leverage well-supported GPU and ARM technology

# 4K HDR Example



# i.MX 8M Family: Seeing is Believing

Note the difference in image quality when HDR technology is used

*Regular (Non-HDR) Content*

*HDR (Dolby Vision) Content*



Note the difference in brightness and color depth.

Images look more real... Your brain gains some depth perception.

# i.MX 8M Best in Class Audio Playback Performance

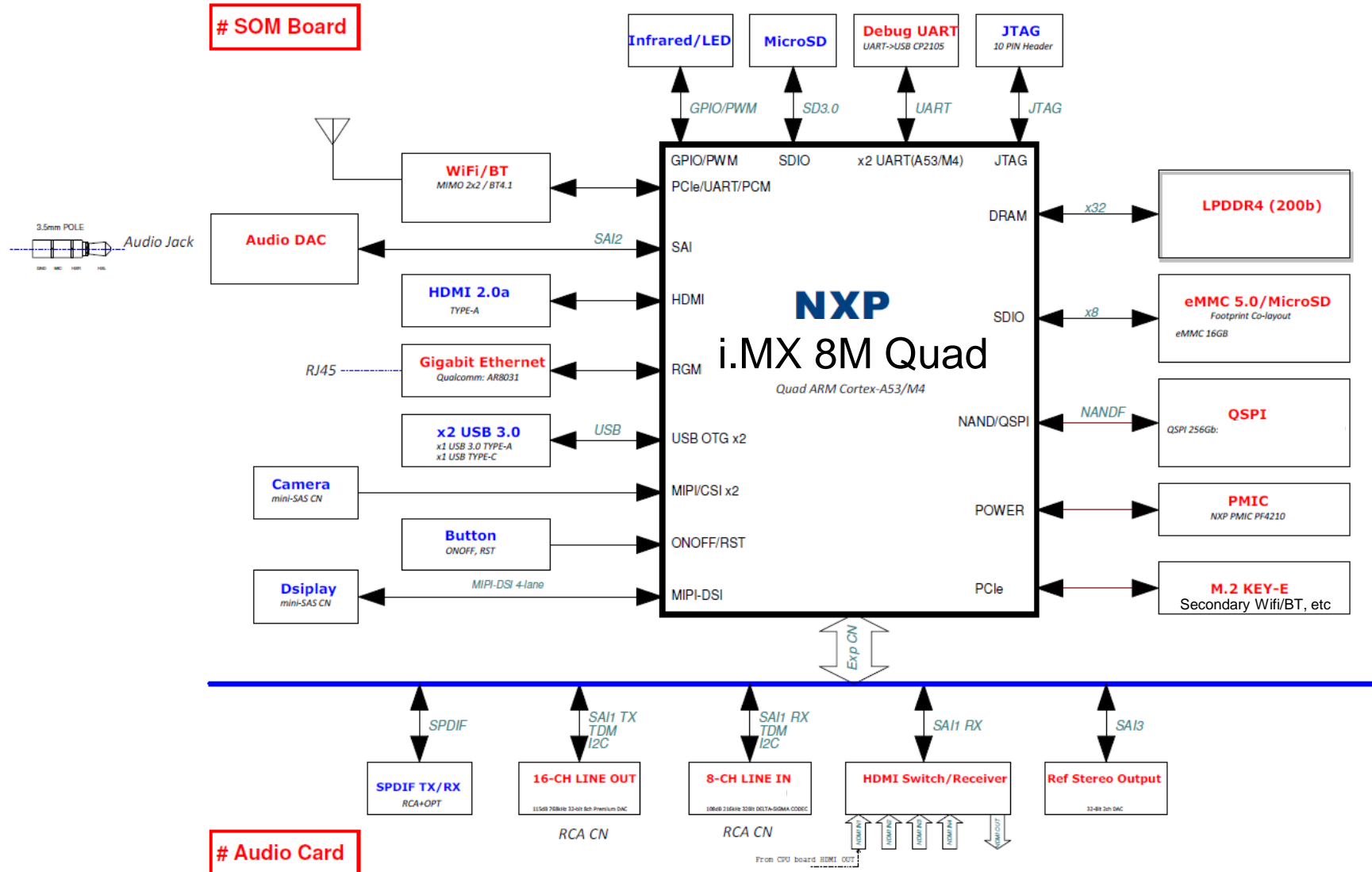
- Audio today FACTS:
  - Today most high end music is encoded using 16bits or 24bits.
  - Sampling rates are 44KHz (CDs), 48KHz (multichannel movie), 96KHz (multichannel), 192KHz (stereo)
  - Med-High performance Audio/Video Receivers (AVR) claim to use 32bits/384KHz audio processing.

## - i.MX8M's redesigned audio block:

- Supports 20 channels in/out all at 32bit 384KHz, and
- Could even support 768KHz on a smaller number of channels
- 6 external ports (6 SAI) asynchronous multi-format ports
- SPDIF Tx and Rx
- HDMI Audio Return Channel (ARC)
- DSD support for up to DSD512 5.1 channels
- Enough performance on the Cortex-A53 NEON to decode even the most complex streams (like Dolby Atmos, DTS:X, etc)



# i.MX 8M EVK board





# 04.

## Software

# Leadership Software – i.MX Linux Enablement



- Silver Member of Linux Foundation
- AGL Working Group Bronze Member
- Over the past 15 years shipping i.MX applications processors, there have been 39,000+ Linux downloads



- *Multiple i.MX 6 series customer engagements are using GENIVI solutions*
- *NXP has more compliant platforms than ANY semiconductor vendor*



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

# i.MX Android Enablement



- **Commitment:** **12** Android OS versions released over past 9 years
- **Broad Acceptance:** **35,000+** 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 **min. 2 years** after silicon production
- **Leadership:** i.MX – only Android system shipping in a **top 5 OEM infotainment platform** today



2008



2009



2010



2011



2011



2012



2012



2013



2014



2015



2016



2017

# Free RTOS

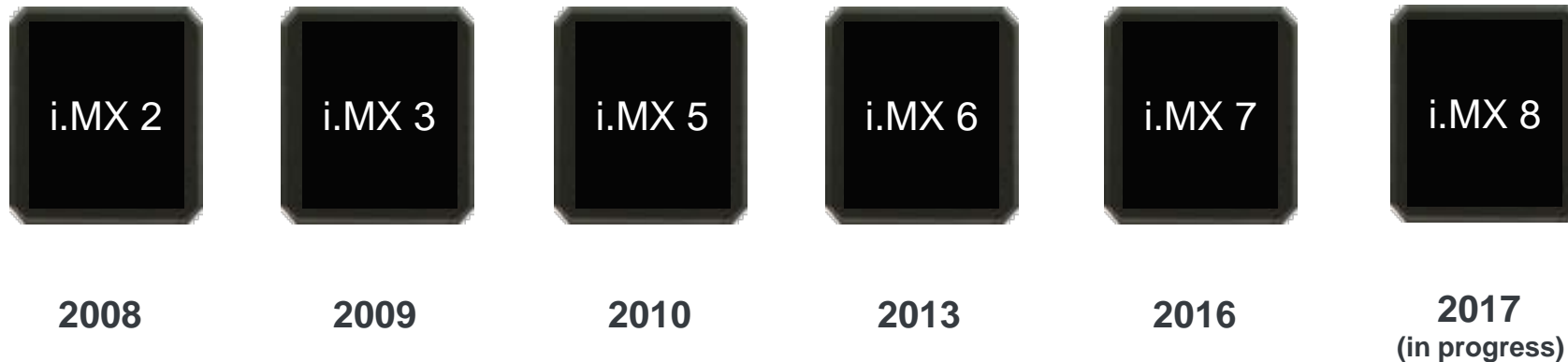
- Real-Time Operating System kernel with Minimal ROM, RAM and processing overhead.
- Distributed under the GPL
- Professionally developed, strictly quality controlled, robust, supported, free to use in commercial products
- <http://www.freertos.org>





# i.MX – QNX Collaboration

- **Commitment:** Partnering with QNX on i.MX since 2008
- **Customer Driven:** QNX works directly with customers to provide the BSP
- **Cross Market Robustness:** Automotive, Embedded/Industrial
- **Continued Support:** Strong relationship and partnering between QNX and NXP. Graphics support provided directly from NXP to QNX



# NXP i.MX 8 AUTOSAR Solution

NXP provides software products where in-depth hardware knowledge is crucial – value-add software products such as AUTOSAR MCAL, Custom Complex Drivers, OS, Custom Self Test, application-specific libraries to address unique hardware features





# 05.

## Additional Information

# i.MX 8 Family Showcase and i.MX 8X Announcement

- i.MX 8X announced at March 14-16 at Embedded World Nuremburg, Germany
- i.MX 8 Family Demos:
  - eCockpit + SurroundView (i.MX 8QuadMax)
    - 20+ NXP automotive products. Highlights i.MX 8DV + PFuse PMICs + i.MX 6SoloX that controls the Mercury AM/FM/Digital Radio tuner and BAP3 Digital Amplifier product over NXP's automotive Ethernet AVB switch and PHY components. New surround view demo added.
  - Neural Networks
    - i.MX 8 detects road signs, defective items, fruits and can tell the difference between a raw turkey and cooked. Targets Auto, industrial and home appliances.
  - Vulkan
    - Advanced Vulkan rendering techniques for i.MX8. Showcases how Vulkan can be used to increase performance and balances the CPU/GPU usage while maintaining a low overhead. Automotive HMI.



E-cockpit Demo

# i.MX 8 series Links

- Product Pages: [www.nxp.com/imx8](http://www.nxp.com/imx8)
  - Block Diagram
  - Features
  - Fact Sheets
  - Demo Videos
- Power Management IC –
  - PF8100 for i.MX 8 & 8X
  - PF4210 for i.MX 8M





# 06.

## Q & A



SECURE CONNECTIONS  
FOR A SMARTER WORLD