恩智浦新一代高性价比家庭娱乐及音视频会议系统解决方案

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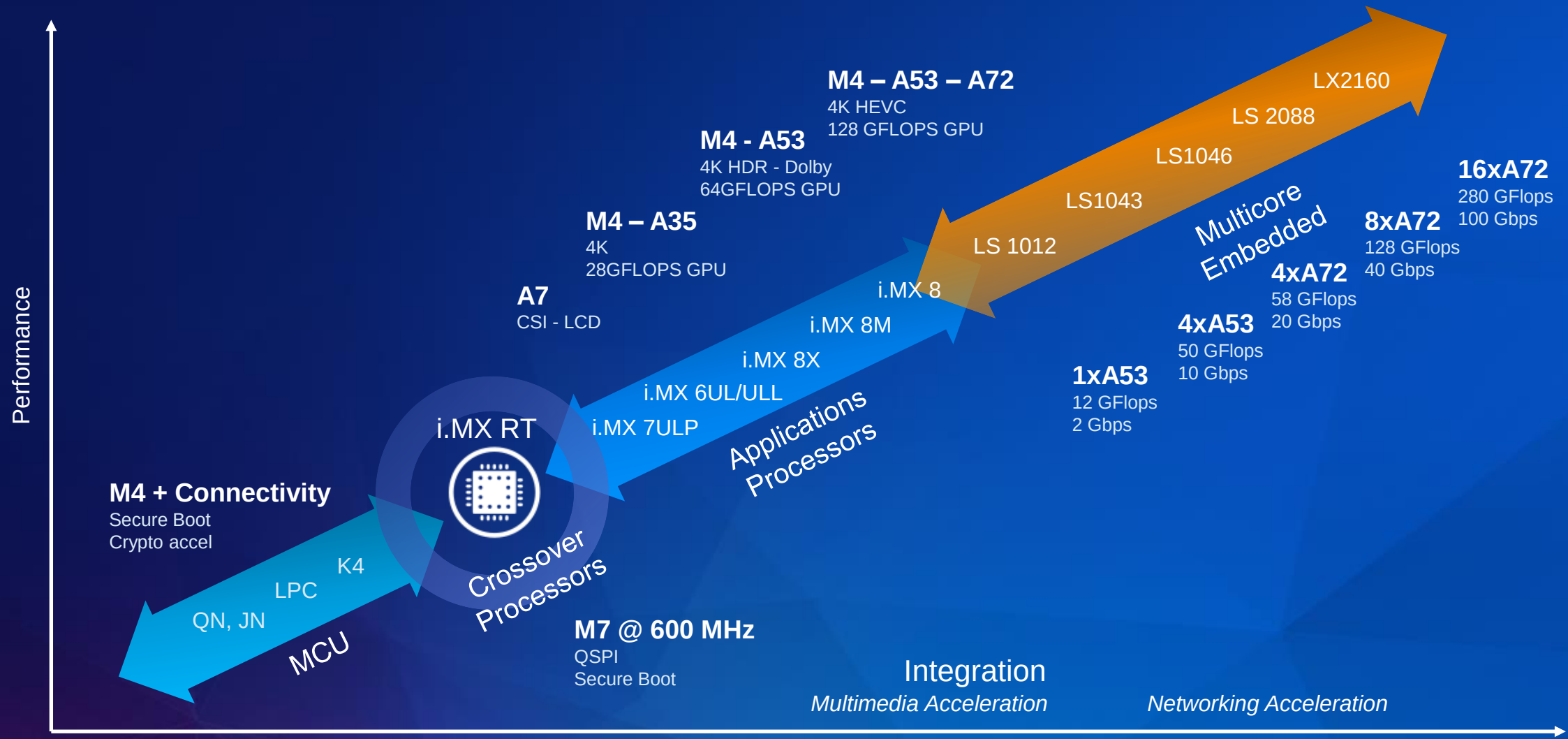
SECURE CONNECTIONS
FOR A SMARTER WORLD

BU EDGE PROCESSING PRODUCTS



Advanced Multimedia Capability, Dolby ATMOS, DTS:X, Voice Capability

Home Entertainment

(Soundbar, Smart Speaker, Wireless Headphones, Karaoke Systems)

Soundbar

- Immersive sound effect and high price
- Dolby and DTS certificate (better to have)

Smart Speaker

- Voice assistant and online streaming
- Cost-sensitive system solution

Professional Audio Devices

Mixer

(permanent, rack-mount)

Effector

(Reverb, Gates, Compressors, Limiters)

Studio Speakers, Touring Speakers, Power Amplifiers Electronic Musical Instrument

Conference System

AV Conference System

- Audio & video synchronization
- Full duplex for all attendees

Large-scale Conference System

- Super-low latency (1~2ms end to end)

NXP Solutions for Home Entertainment

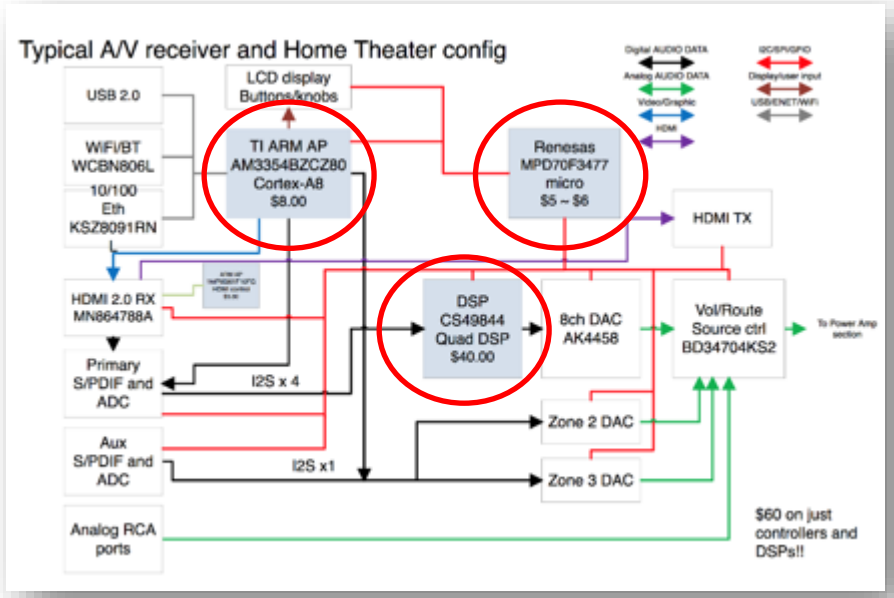
DOLBY ATMOS: WIDELY WELCOMED BY THE MARKET AND CUSTOMERS

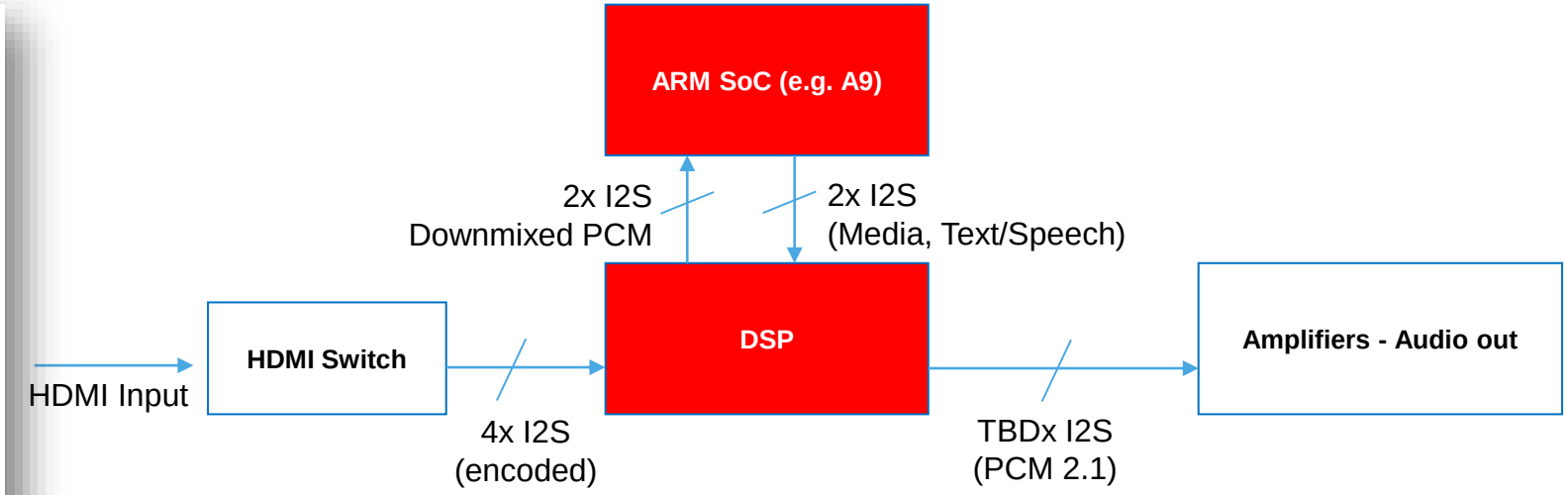
- Media Content
  - Movie
  - Game
  - Music
    - Universal Music Group (UMG)
    - EMI & Sony in discussion with Dolby
    - Amazon HD Streaming Service
- Devices
  - Soundbar/AVR
  - Gaming Console
    - PC/PlayStation/Xbox (key concern is ***low latency***)
  - Headset
  - Next Generation of Smart Speaker
    - Dolby ATMOS Speaker

TRADITIONAL SOLUTION FOR AVR/SOUNDBAR

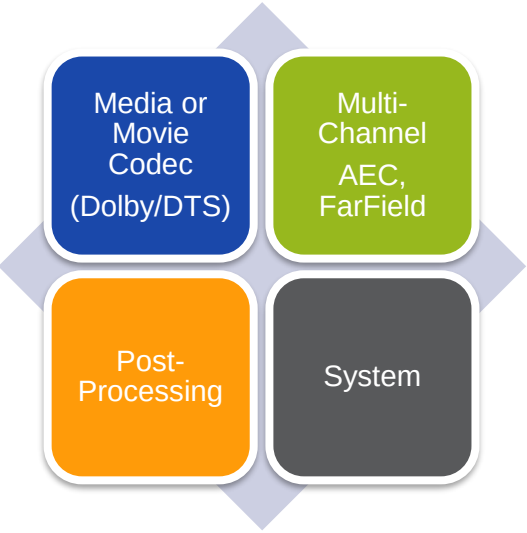
PROBLEM WITH TRADITIONAL TYPICAL ARCHITECTURE

- Typical architecture of A/V receivers or soundbars is a multichip DSP + lower-end Arm processor:
  - Cortex-A runs non-real time OS for non-real-time services
  - DSP runs audio codecs (e.g. Dolby ATMOS)
- Issues with this architecture:
  - ✘ Cost of DSPs can be high
  - ✘ Scale by addition of DSP cores
  - ✘ Cost of developing with DSP is high; difficult to add new features such as Dolby, DTS, or MPEG-H release
  - ✘ No clear way to add Voice or Digital Assistant



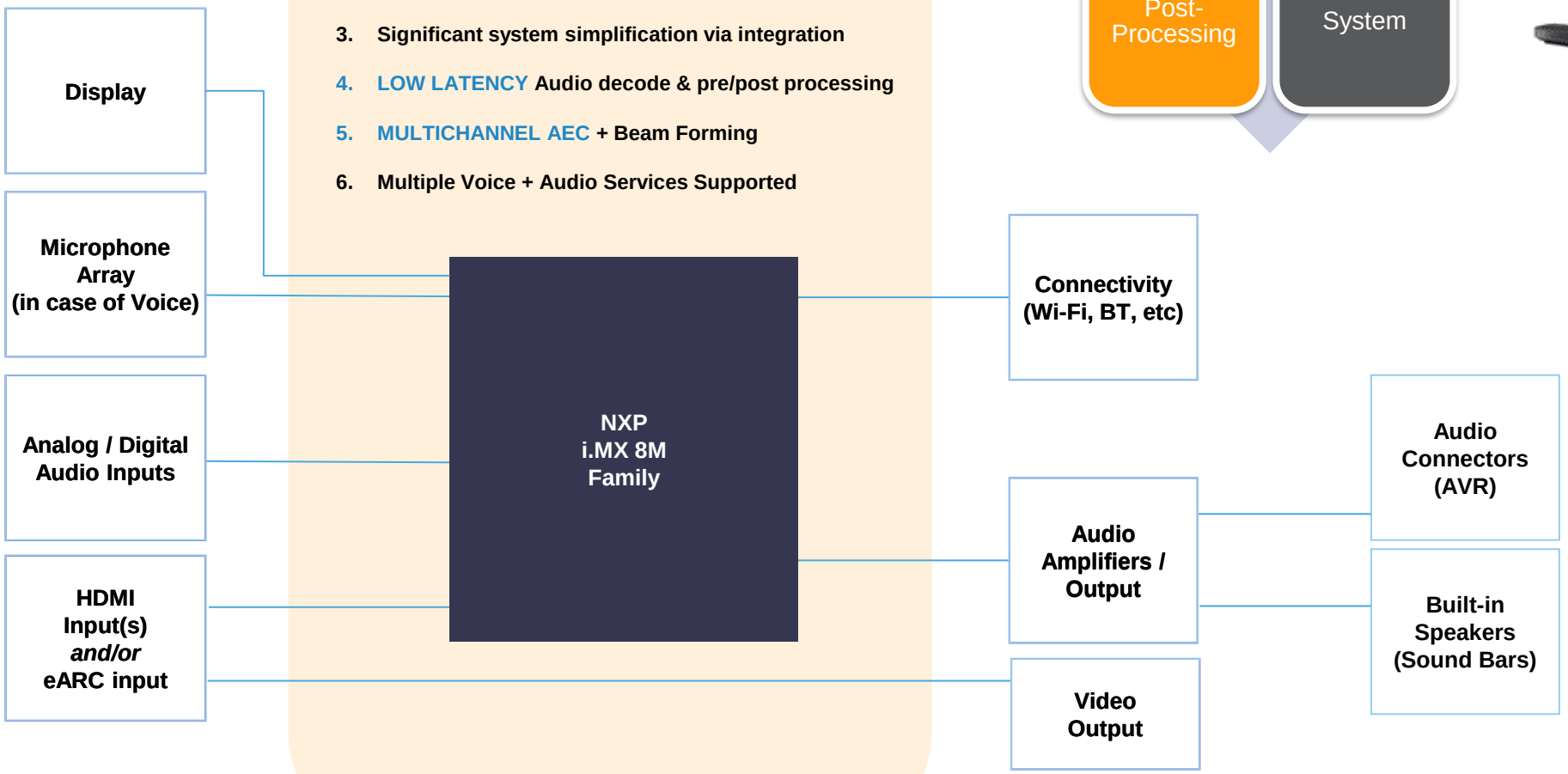


NEXT GENERATION SOLUTION FOR AVR/SOUNDBAR



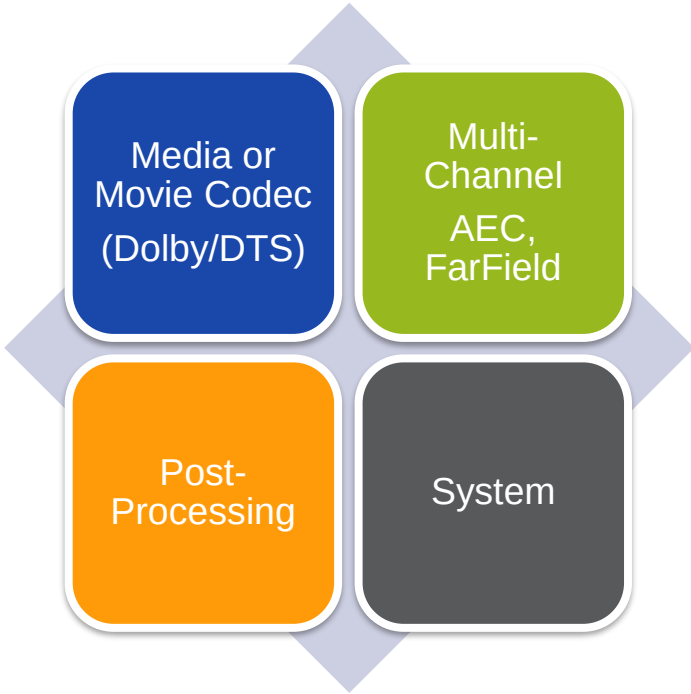
i.MX 8M and NXP Audio Framework

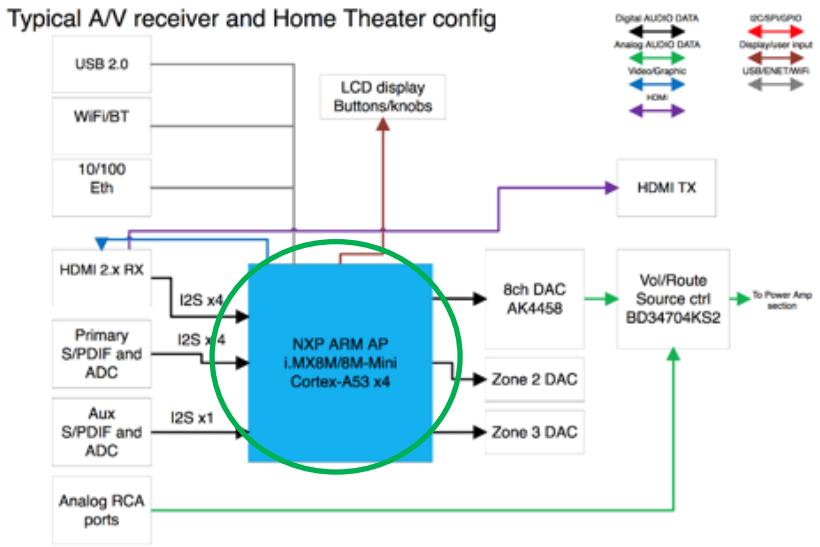
1. **1-chip Solution: All Audio Processing, Voice, etc.**
2. **Massive BOM Savings**
3. **Significant system simplification via integration**
4. **LOW LATENCY Audio decode & pre/post processing**
5. **MULTICHANNEL AEC + Beam Forming**
6. **Multiple Voice + Audio Services Supported**

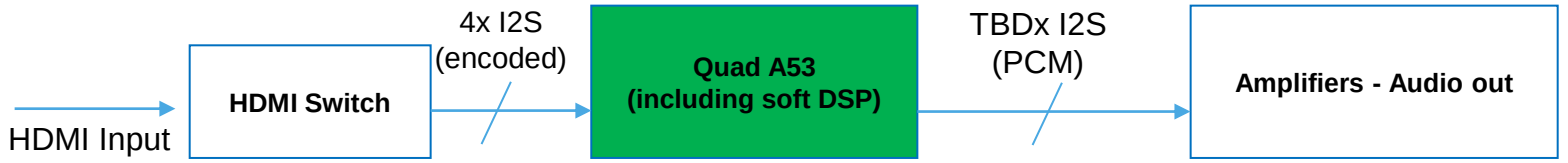


WHY IMMERSIV3D AUDIO FRAMEWORK?

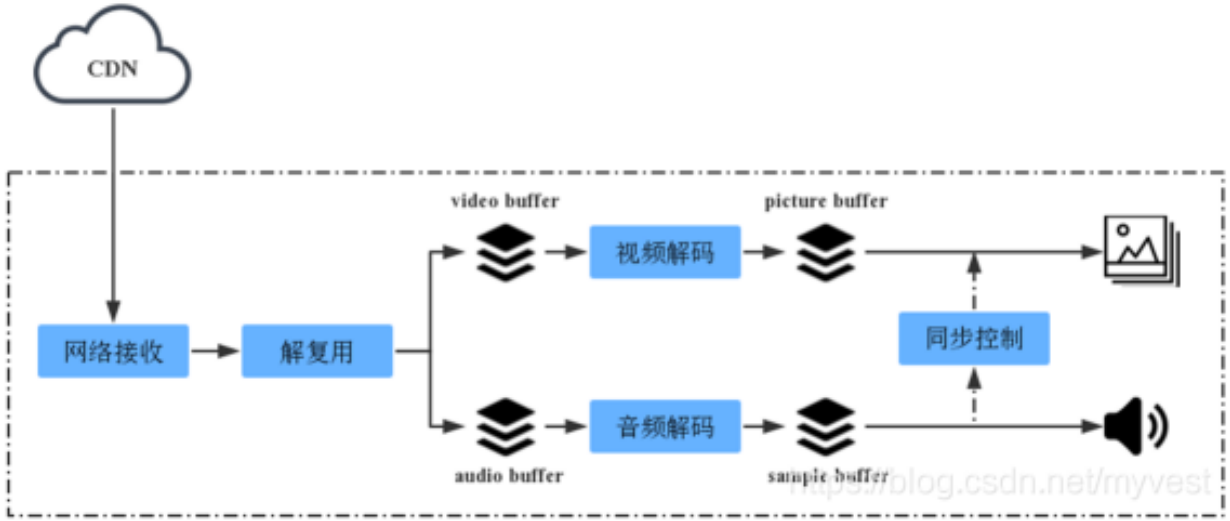
- I3D is a single chipset solution based on Arm using NXP advantage SoC
- Single architectures can achieve 2.1, 5.x.x, & 7.x.x configurations
- Configuration:
  - 2 Cores : Linux : AEC + Voice Assistant + Streaming
  - 2 Cores : RTOS : Decoder, CPP and Output Manager
- Value to our customers:
  - ✓ Low latency and deterministic architecture
  - ✓ High quality audio interfaces
  - ✓ Multiple audio interfaces
  - ✓ Reduce the BOM (no DSP cost)
  - ✓ Enable support for features such as Voice or Digital Assistant







VALUED PROPOSITION OF NXP SOLUTIONS – ULTRA LOW LATENCY



- Audio and video synchronization
  - For 4K TV, allows ~100ms video cache
  - For 8K TV, allows ~63ms video cache
- Tasks that need to be completed in 100ms
  - Audio Detection
  - Audio Decoding
  - Audio Post-processing
  - Wireless audio transmission (surround speakers + subwoofers)
- Difficulties
  - It's hard to manage delay in a non-realtime system.
  - How to deal with multi-audio source input?

i.MX 8M series products & Immersiv3D SDK can do help!

NXP Solutions for Conference System

SMART OFFICE APPLICATIONS

Desk / Portable Conference System

- Audio & video synchronization
- Full duplex for all attendees

Audio Conference Speaker

- Only audio
- Desk or portable

AV Conference Speaker

- Audio & video synchronization
- Desk or portable

AV Conference Soundbar

- Audio & video synchronization
- 4K is better
- Windows, Android, MacOS

Large-scale Conference System

Conference System in Hall

- Super-low latency (1~2ms end to end)
- LAN

Conference System in Meeting Room

- Audio & video synchronization
- WAN + LAN
- Enterprise orientation

CONFERENCE SPEAKER / SOUNDBAR

USB 2.0

USB Audio

Bluetooth

i.MX RT1xxx
i.MX RT600/500

HDMI

Windows, macOS, Android

USB 3.0/2.0

USB Audio / Audio + Video

USB2.0 audio: i.MX 8M Nano/Mini/Plus
USB3.0 audio: i.MX 8M Plus
1080p video: i.MX 8M Mini/Plus
4K video codec: i.MX 8QM/i.MX 9

AEC
Noise reduction
Directional audio extraction
Reverberation removal
ASIC + algorithm

Microphone Array (4~10 mics)

i.MX RT600/500
i.MX RT1xxx

RETUNE DSP IS NOW PART OF NXP

Retune DSP – one of the industry's best voice technologies in today's market – and its full portfolio of voice solutions – is now part of NXP Semiconductors.

Retune DSP brings extensive voice & speech software, including:

VoiceSeeker

a state-of-the-art multi-microphone voice control audio front-end DS solution offering high-performance beamforming and multi-channel acoustic echo cancellation deliver exceptional trigger word detection and payload accuracy.

VoiceSpot

a highly accurate wake-word engine leveraging Retune's proprietary ML-based pattern recognition technology

Conversa

a high-performance, multi-microphone, full-duplex voice processing software suite that provides total control of uplink and downlink audio

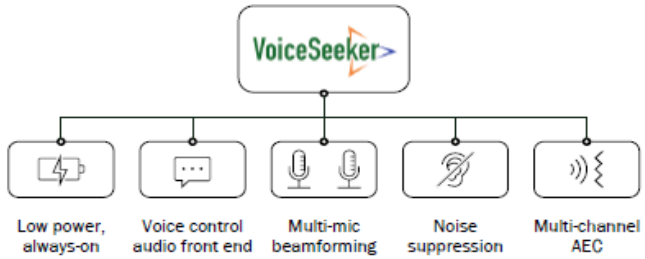
RETUNE DSP PRODUCTS: 3 VOICE SOLUTIONS

SYSTEM OVERVIEW | **APPLICATION AREAS**

VoiceSeeker

Voice UI audio front-end suite

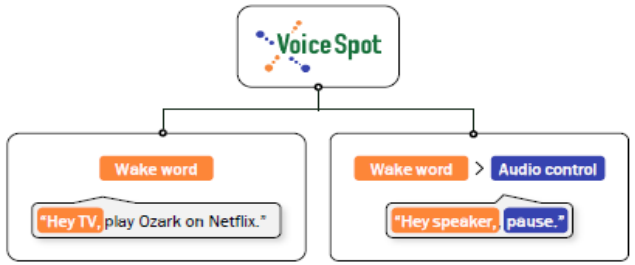
Voice control, multi-channel AEC, beamforming and ASR processing



VoiceSpot

ASR wake word engine

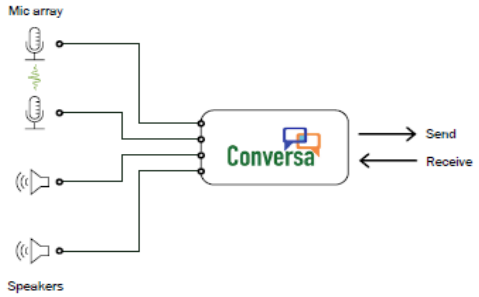
Ultra compact, high performance voice trigger solution and wake word engine



Conversa

Communication suite

Advanced full-duplex voice communication software suite



NXP Hardware Platform and Eco-system

i.MX 8M FAMILY: SCALABLE SOLUTIONS FOR THE BROAD MARKET… NOW

Software Compatible

Pin-to-pin Compatible

i.MX 6 QuadPlus
i.MX 6 Quad
i.MX 6 DualPlus
i.MX 6 Dual
i.MX 6 DualLite
i.MX 6 Solo
i.MX 6 SoloX
i.MX 6 SoloLite
i.MX 6SLL
i.MX 6 UltraLite
i.MX 6ULL
i.MX 6ULZ

A9 A9 M4 A7

Arm® v7-A

i.MX 8 family

A72 A53 M4

Advanced Graphics, Vision & Performance

i.MX 8M family

A53 M4/M7

Advanced Computing, Audio/Video & Voice

i.MX 8X family

A35 M4

Safety Certifiable & Efficient Performance

Arm® v8-A (32-bit/ 64-bit)

i.MX 7 family

A7 M4

Flexible Efficient Connectivity

i.MX 7ULP family

Ultra Low Power with Graphics

Arm® v7-A (32-bit)

i.MX 8M Plus
8M Plus Quad
8M Plus QuadLite
8M Plus Dual
(…)

i.MX 8M
8M Quad
8M QuadLite
8M Dual

i.MX 8M Mini
8M Mini Quad/QuadLite
8M Mini Dual/DualLite
8M Mini Solo/SoloLite

i.MX 8M Nano
8M Nano Quad
8M Nano QuadLite
8M Nano Dual
8M Nano DualLite
8M Nano Solo
8M Nano SoloLite

i.MX 8M Nano UltraLite
8M Nano UltraLite Quad
8M Nano UltraLite Dual
8M Nano UltraLite Solo

May '21

Pin-to-pin Compatible

Software Compatible

I.MX 8M PLUS TARGET APPLICATIONS

Machine Learning & Industrial Automation

- Machine Vision and Robot Controller
- Industrial Computer, Gateways, HMI
- Printers and Scanners
- Machine Visual Inspection
- Factory Automation

Smart Home, Building & City

- Safety, Security and Surveillance
- Fleet Analytics
- Traffic Monitor and Flow Optimization
- Vision Payment Systems
- Targeted Advertisement
- Service Drones
- Alarm and AI Server Hubs
- Home Patient and Elderly Monitor

Consumer & Pro Audio/Voice Systems

- Surround sound and sound bars
- Audio/video receiver
- Immersive Audio Products
- Wireless or networked smart speakers
- Personal Assistant
- Voice-assisted products

I.MX 8M PLUS – FEATURES / BENEFITS

	Capability	Feature	Benefits
Machine Learning	**Machine Learning**	• Neural Processing Unit (NPU) up to **2.3 TOPS**	• Edge Inference and intelligence • No cloud dependency, privacy, better user experience
	Vision System	• Up to 2 cameras (**2x MIPI-CSI**), 1080p60; • Image Signal Processor (**ISP**) up to 375MPix/s, HDR, de-warp	• 4K Vision / 1080p Stereo Vision. • HDR extracts the maximum image details in high contrast scenes • De-Warp: Fisheye lens correction reduce overall optical system cost
	Voice	• Low Power **Voice Accelerator**, • **8ch-PDM** digital microphone input.	• Voice systems processed at the edge. • Privacy, better user experience, no cloud dependency • Low noise and cost-effective microphone system
Advanced Multimedia	**HD Video**	• 1080p60 **video decoding**, **(H.265)** • 1080p60 **video encoding, (H.265)**	• High resolution video compression for cloud upload or local storage • H.265 compression is twice more effective than H.264
	3D/2D Graphics	• **2D and 3D GPU** - 1Gpix/s • OVG 1.1, OGLES 3.1, Vulkan, OCL 1.2 FP	• 3D and 2D graphics for rich HMI and user experience • Vulkan requirement for Android 10 onwards
	Advanced Audio	• 18x I2S TDM, DSD512, SP/DIF Tx + Rx, 8-ch PDM • HDMI 2.0b Tx + **eARC, ASRC**	• Latest audio technology including Immersive audio support • eARC for high-quality audio for cost-optimized soundbars
Industrial Network & Reliability	**Industrial Network**	• **2x Gigabit Ethernet** (1x w/ **TSN**) **2x CAN-FD**	• Low latency industrial network for precise control • robust industrial control network • Gateway application with dual Ethernet.
	Memory Reliability	• **ECC** in L2, **In-line ECC** on DDR bus • 14FF process	• High Industrial system reliability for Safety Industrial Level SIL3. • Low SER rates
	Real time Processing	• **Cortex-M7 @800MHz**	• High real-time processing power, Cortex-A complex off loading • Eliminating an external MCU
Performance & Connectivity	**High Performance Low power**	• **4x CortexA53 @1.8GHz,** • 14nm FinFET, Low Power, high performance	• Applications running <2.0W. Deep Sleep Mode < 20mW
	Display Interfaces	• **MIPI-DSI**, **HDMI** 2.0b, **LVDS** 4/8-lane, supports 2x1080p60 or 1x4kp30	• Multiple display interface options working simultaneously.
	High-Speed Interfaces	• **2xUSB 3.0** (5Gb/s each) **PCIe 3.0** • 3x SDIO 3.0 800Mb/s	• Fast connections to Wi-Fi, FPGAs, co-processors. • Fast data transfer, e.g., media files

I.MX 8M PLUS

Quad Arm® Cortex-A53 up to 1.8 GHz (up to 20,988 DMIPS)
- ARMv8 fully 64-bit capable, 512KB L2 cache (ECC)

Arm Cortex-M7 up to 800MHz with 512KB RAM (ECC)

Voice Acceleration co-processor:
HiFi4 DSP up to 800MHz with 256KB RAM (ECC)

Machine Learning (ML) accelerator: 2.3 TOPS performance

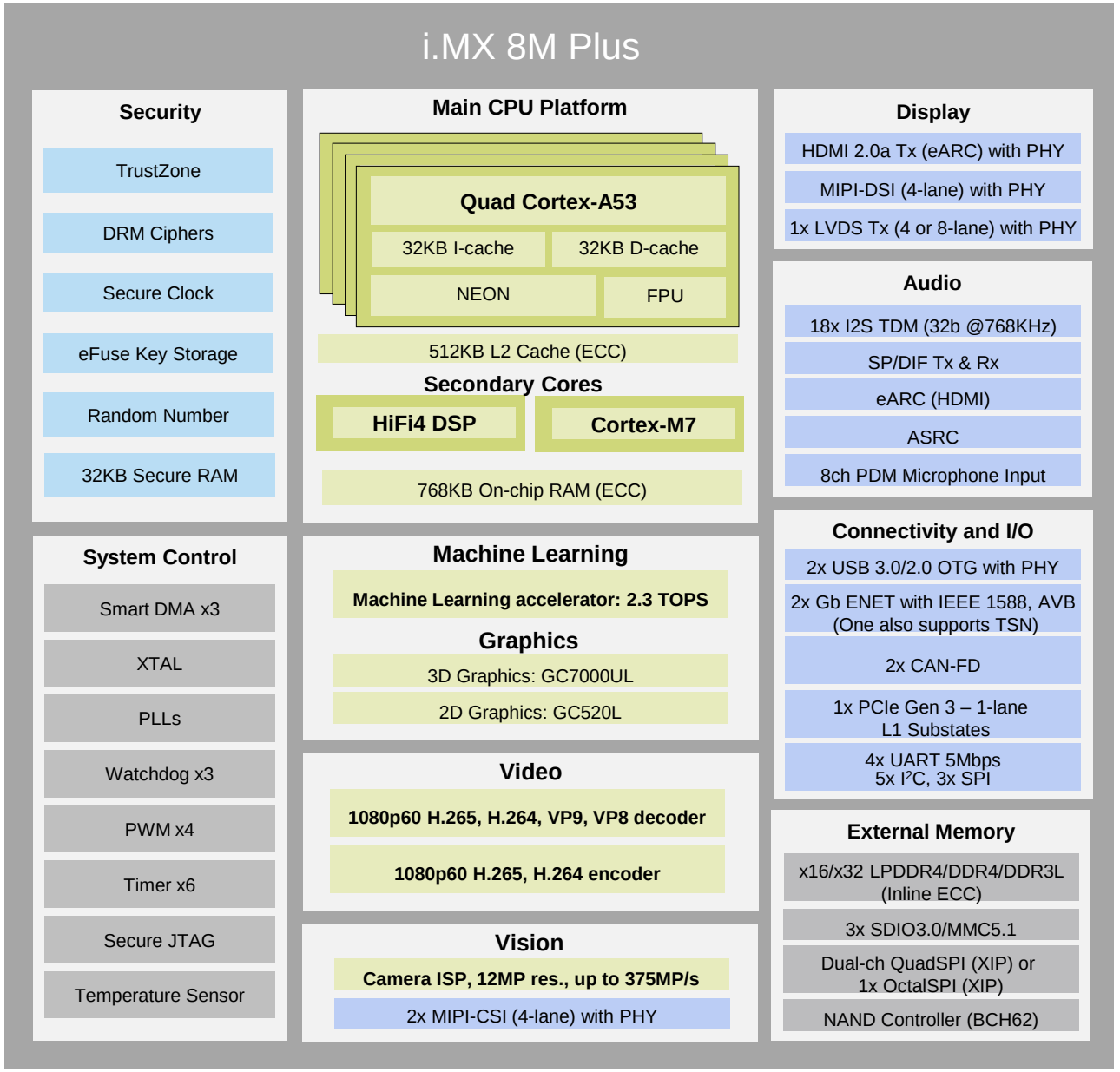
Package:
#1 FCBGA 15x15mm, 0.5mm pitch, depop (consumer and industrial)

Operating System targets: Linux OS, Android OS, HiFi4 SDK, FreeRTOS

Qualification: Consumer (0C to +95C); Industrial (-40C to +105C)

Feature Highlights:

- **External memory:** x32/x16 LPDDR4/DDR4/DDR3L (Inline ECC)
- 3x SDIO3.0/eMMC5.1
- Dual-channel QuadSPI (XIP) or 1x OctalSPI
- NAND Controller (BCH62)
- SPI NAND
- **Graphics processors:**
- GC7000UL (3D GPU, 2-shaders, OpenGL® ES 3.1, Vulkan®, Open CL™ 1.2 FP)
- GC520L (2D GPU, OpenVG™ 1.1)
- **Video processors:** 1080p60 H.265, H.264, VP9, VP8 decode
- 1080p60 **H.265**, H.264, VP8 encode
- **Display controllers (up to 3 simultaneous displays):**
- 1x HDMI 2.0a Tx (eARC) with PHY
- 1x LVDS Tx (4 or 8-lane) with PHY
- 1x MIPI-DSI (4-lane) with PHY
- **Camera (up to 2 cameras):** 2x MIPI-CSI (4-lane) with PHY
- **ISP 12MP resolution, 2x187MP or 1x375MP input rate, HDR, Dewarp**
- **Audio:** 18x I²S TDM (32-bit @ 768KHz), DSD512, SP/DIF Tx + Rx
- 8 channel PDM microphone input
- **eARC**, ASRC
- **2x USB** 3.0/2.0 Type C with PHY
- **1x PCIe Gen 3.0 (1 lane)** with L1 Substates for fast wake from low power mode
- **2x Gigabit Ethernet** with IEEE 1588, EEE and AVB (one with TSN, but no EEE)
- **2x CAN-FD**



I.MX 8M MINI/NANO TARGET APPLICATIONS

Consumer Audio, Video & Voice

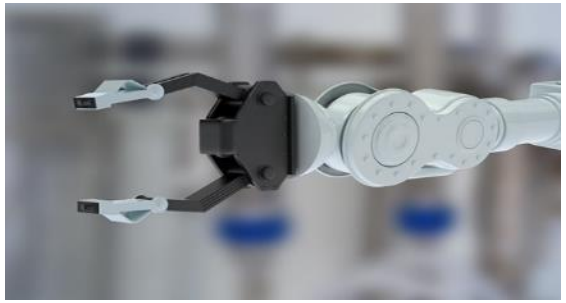
- Portable audio devices
- Networked speakers
- Wireless speakers
- Voice assistance
- Soundbars
- Audio/video receiver
- Public address systems

Home & Building Automation

- Smart appliances
- Video doorbell
- Smart lighting control
- HVAC climate control
- IoT gateway
- Two-way video calling
- Service robot, e.g. vacuum, mower, cleaner
- Elevator control panel

Industrial & Machine Vision

- Barcode or image scanner
- Industrial printer
- Ruggedized HMI
- Machine visual inspection
- Factory automation
- Test and measurement
- Mobility and logistics



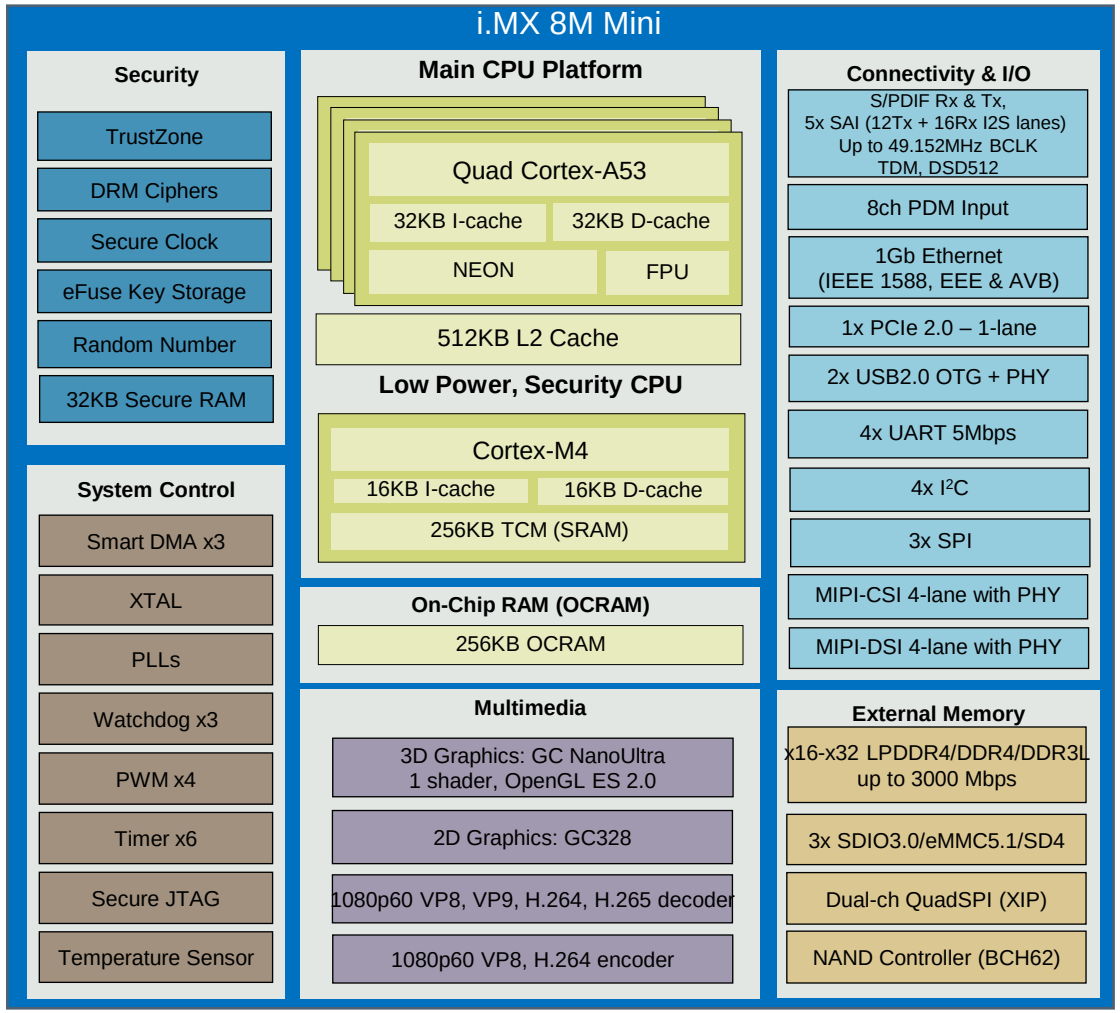
Consumer & Healthcare

- IP phones
- Conferencing systems
- Mobile patient care, e.g. infusion pump, respirator
- Blood pressure monitor
- Activity/wellness monitor
- Exercise equipment w/ display and video

I.MX 8M MINI QUAD

Feature Highlights:

- **Arm Cortex-A53 platform:**
  - Quad/Dual/Solo 1.6-1.8GHz
  - 32KB/32KB I/D cache, 512KB L2 cache with ECC
  - Media Processing Engine (MPE) with NEON
  - Floating Point Unit (FPU) supports VFPv4-D16 architecture
  - 64-bit Armv8-A architecture
- **Arm Cortex-M4 platform:**
  - Up to 400MHz
  - 16KB/16KB I/D cache, 256KB TCM
- **On-Chip RAM:** 256KB OCRAM
- **External Memory Interface:**
  - 32/16-bit DRAM interfaces (LPDDR4 up to 1.5GHz, DDR4-2400, DDR3L-1600)
  - 8-bit NAND Flash supports raw MLC/SLC (BCH62, ONFi3.2)
  - eMMC 5.1 Flash, SPI NOR Flash, FlexSPI with support for XIP
- **Multimedia:**
  - 1080p60 VP9 Profile 0,2 (10-bit) decoder, HEVC/H.265 decoder, AVC/H.264 Baseline, Main High decoder, VP8 decoder
  - 1080p60 AVC/H.264 encoder, VP8 encoder
  - GC NanoUltra 3D GPU, 1x shader, OpenGL ES 2.0
  - GC328 2D GPU
  - LCDIF display controller supports up to 2 layers of overlay, 1080p60
  - Display: 1x MIPI DSI (4-lane) with PHY
  - Camera: 1x MIPI CSI (4-lane each) with PHY
  - Audio: Supports over 20 channels of audio. 5x SAI (12Tx + 16Rx external I2S lanes); 4Tx + 4Rx support 49.152MHz BCLK for 768KHz audio, all others 24.576MHz BCLK (32-bit, 2-ch 384KHz, up to 32-ch TDM); DSD512
- **Security:**
  - DRM support for RSA, AES, 3DES, DES
- **Connectivity:**
  - 1x Gb Ethernet (MAC): AVB & IEEE 1588 for sync, and EEE for low power
  - 1x PCIe 2.0 (1-lane) with L1 substates (low power, fast wakeup)
  - 2x USB 2.0 OTG with PHY
  - 4x UART, 4x I2C, 3x SPI
  - 3x SDIO3.0 / eMMC5.1 / SD4



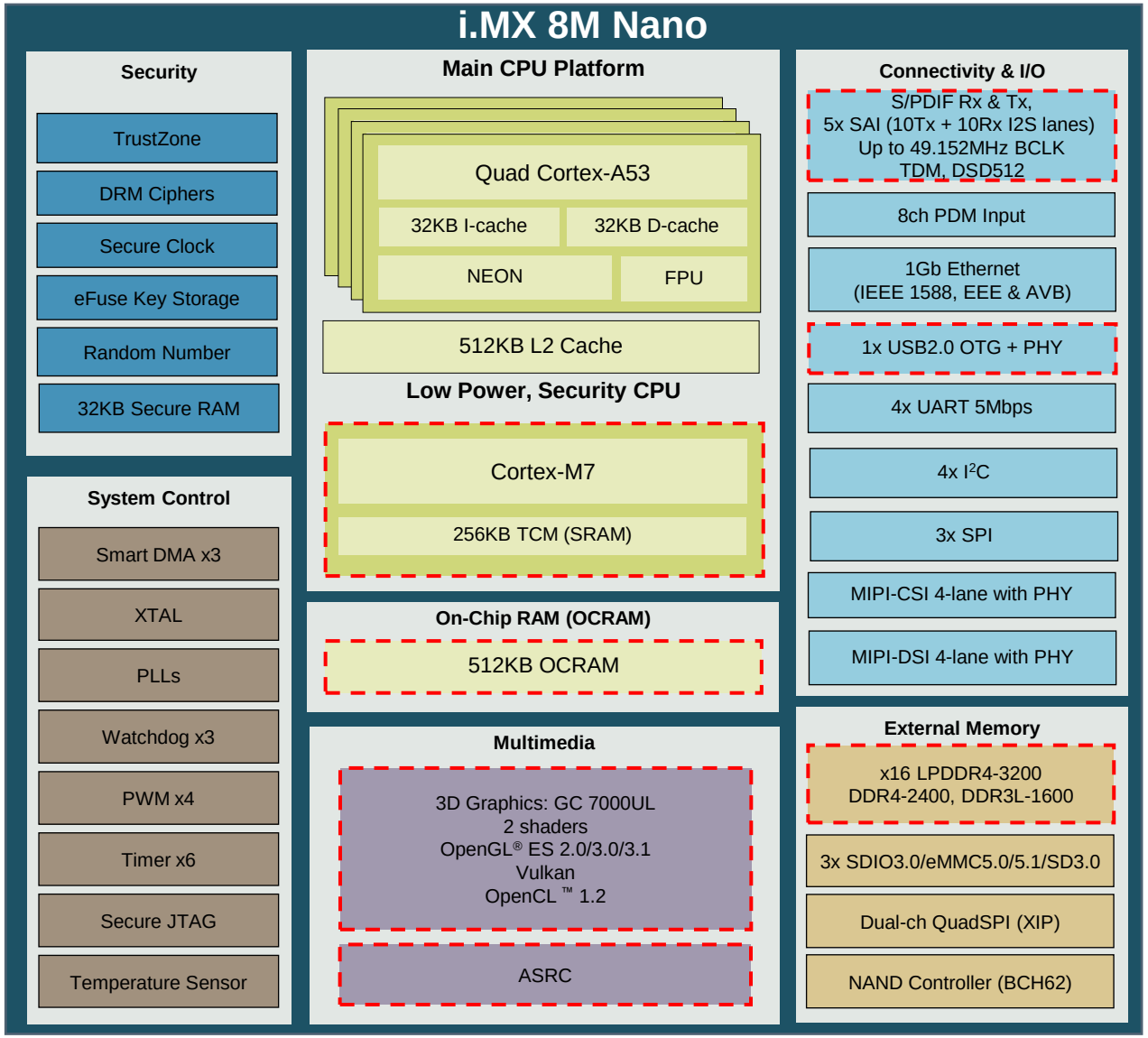
Target Timeline: Mass Production
Package: FCBGA 14x14mm, 0.5mm pitch
Operating Systems: Linux OS, Android OS, FreeRTOS (M4)
Qualification: for consumer (0 to +95C) and industrial (-40C to +105C, 10yr 24/7) applications
Longevity: 15 yr longevity program

I.MX 8M NANO QUAD

Differences to i.MX 8M Mini

Feature Highlights:

- **Arm Cortex-A53 platform:**
  - Quad/Dual/Solo 1.2-1.5GHz
  - 32KB/32KB I/D cache, 512KB L2 cache with ECC
  - Media Processing Engine (MPE) with NEON
  - Floating Point Unit (FPU) supports VFPv4-D16 architecture
  - 64-bit Armv8-A architecture
- **Arm Cortex-M7 platform:**
  - Up to 750 MHz
  - 256KB TCM
- **On-Chip RAM:** 512KB OCRAM
- **External Memory Interface:**
  - 16-bit DRAM interfaces (LPDDR4-3200, DDR4-2400, DDR3L-1600)
  - 8-bit NAND Flash supports raw MLC/SLC (BCH62, ONFi3.2)
  - eMMC 5.0/5.1 Flash, SPI NOR Flash, FlexSPI with support for XIP
- **Multimedia:**
  - GC 7000UL 3D Graphics GPU, 2 shader core, OpenGL® ES 3.1, Vulkan, OpenCL™ 1.2
  - LCDIF display controller supports up to 2 layers of overlay, 1080p60
  - Display: 1x MIPI DSI (4-lane) with PHY
  - Camera: 1x MIPI CSI (4-lane each) with PHY
  - Audio: Supports over 20 channels of audio. 5x SAI (10Tx + 10Rx external I2S lanes); up to 49.152MHz BCLK for 768KHz audio (32-bit, 2-ch 768KHz, up to 32-ch TDM); DSD512
  - ASRC: 32 channels of very high quality, asynchronous audio sample rate conversion
- **Security:**
  - DRM support for RSA, AES, 3DES, DES
- **Connectivity:**
  - 1x USB 2.0 OTG with PHY
  - 1x Gb Ethernet (MAC): AVB & IEEE 1588 for sync, and EEE for low power
  - 4x UART, 4x I2C, 3x SPI
  - 3x SDIO3.0 / eMMC5.1 / SD3.0



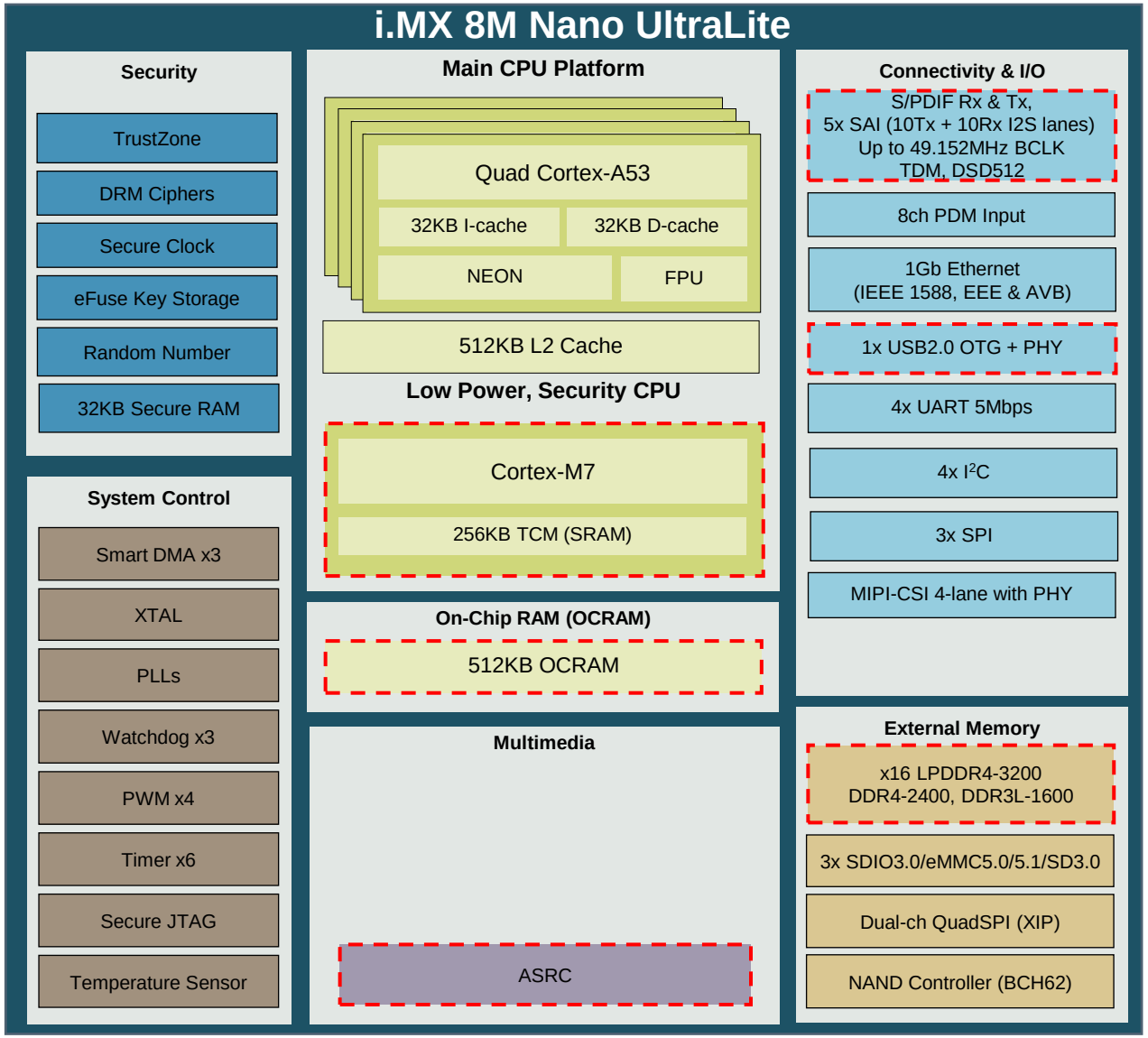
Target Timeline: Mass Production
Package: FCBGA 14x14mm, 0.5mm pitch de-pop array
Operating Systems: Linux OS, Android OS, FreeRTOS (M7)
Qualification: for consumer (0 to +85C) and industrial (-40C to +105C, 10yr 24/7) applications
Longevity: 15yr longevity program

I.MX 8M NANO QUAD ULTRALITE

Differences to i.MX 8M Mini

Feature Highlights:

- **Arm Cortex-A53 platform:**
  - Quad/Dual/Solo 1.2-1.4GHz
  - 32KB/32KB I/D cache, 512KB L2 cache with ECC
  - Media Processing Engine (MPE) with NEON
  - Floating Point Unit (FPU) supports VFPv4-D16 architecture
  - 64-bit Armv8-A architecture
- **Arm Cortex-M7 platform:**
  - Up to 750 MHz
  - 256KB TCM
- **On-Chip RAM:** 512KB OCRAM
- **External Memory Interface:**
  - 16-bit DRAM interfaces (LPDDR4-3200, DDR4-2400, DDR3L-1600)
  - 8-bit NAND Flash supports raw MLC/SLC (BCH62, ONFi3.2)
  - eMMC 5.0/5.1 Flash, SPI NOR Flash, FlexSPI with support for XIP
- **Multimedia:**
  - Camera: 1x MIPI CSI (4-lane each) with PHY
  - Audio: Supports over 20 channels of audio. 5x SAI (10Tx + 10Rx external I2S lanes); up to 49.152MHz BCLK for 768KHz audio (32-bit, 2-ch 768KHz, up to 32-ch TDM); DSD512
  - ASRC: 32 channels of very high quality, asynchronous audio sample rate conversion
- **Security:**
  - DRM support for RSA, AES, 3DES, DES
- **Connectivity:**
  - 1x USB 2.0 OTG with PHY
  - 1x Gb Ethernet (MAC): AVB & IEEE 1588 for sync, and EEE for low power
  - 4x UART, 4x I2C, 3x SPI
  - 3x SDIO3.0 / eMMC5.1 / SD3.0



Target Timeline: Q4'2020 (samples)
Package: FCBGA 11x11mm, 0.5mm pitch de-pop array
Operating Systems: Linux OS, FreeRTOS (M7)
Qualification: for consumer (0 to +85C) and industrial (-40C to +105C, 10yr 24/7) applications
Longevity: 15yr longevity program

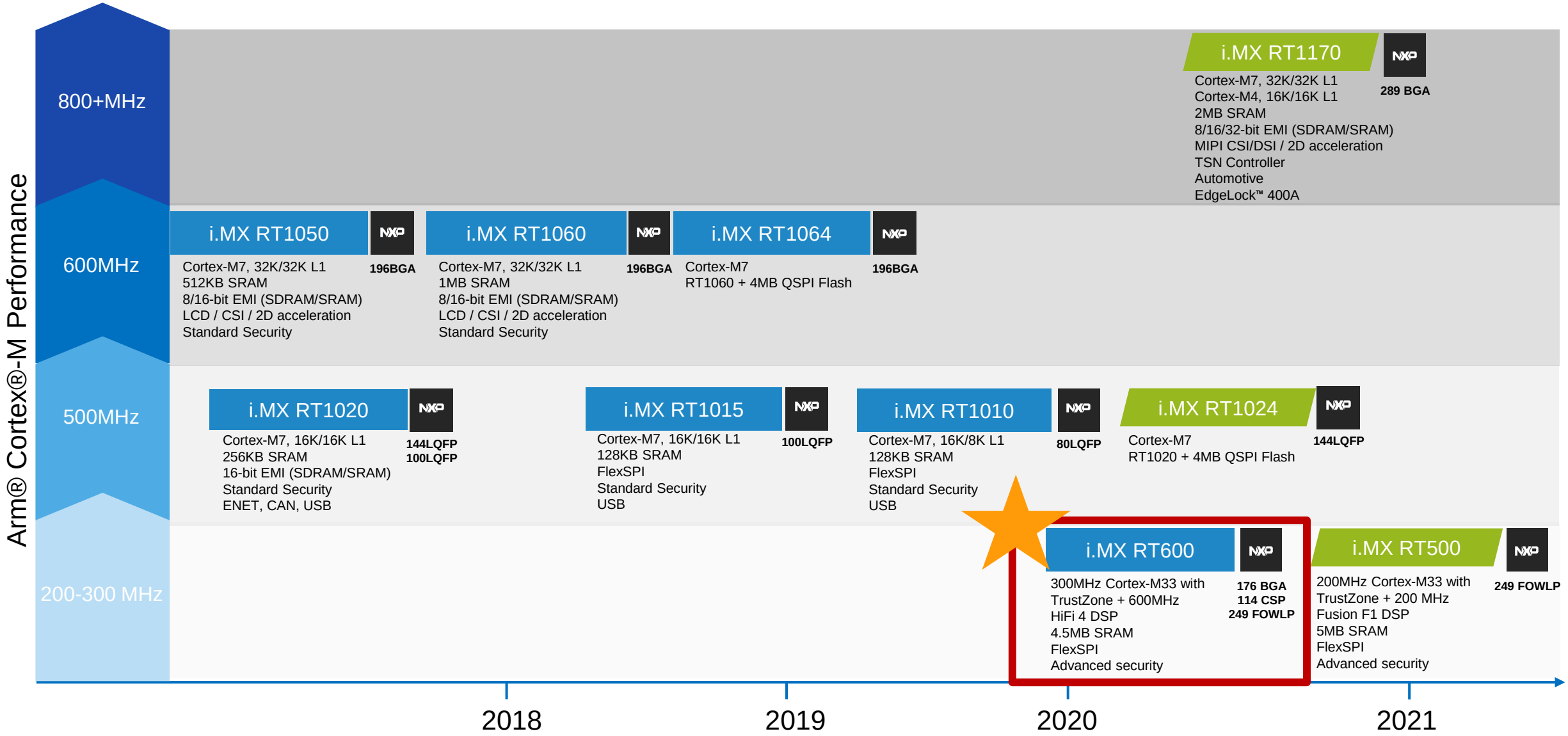
I.MX 8M FAMILY COMPARISON CHART

Product	i.MX 8M Quad / Quad Lite	i.MX 8M Mini / Mini Lite	i.MX 8M Nano / Nano Lite	i.MX 8M Nano UltraLite	i.MX 8M Plus
Production Status	Mass Production	Mass Production	Mass Production	1Q2021	1Q2021
Main CPU	2-4xA53 1.5GHz, 1MB L2	**1-4xA53 1.8GHz, 512KB L2**	1-4xA53 1.5GHz, 512KB L2	1-4xA53 1.4GHz, 512KB L2	**2-4xA53 1.8GHz, 512KB L2**
MCU/DSP	M4 266MHz	M4 400MHz	M7 up to 750MHz	M7 up to 750MHz	**M7 800MHz, HiF i4 800 MHz**
DDR	x16 or x32 LPDDR4/DDR4/DDR3L	x16 or x32 LPDDR4/DDR4/DDR3L	x16 LPDDR4/DDR4/DDR3L	x16 LPDDR4/DDR4/DDR3L	**x32 LPDDR4/DDR4 Inline ECC**
GPU	3D – GC7000L (OpenGL® ES 2.1/3.0/3.1, OpenCL™ 1.2, Vulkan®)	2D – GC320 3D – GC NanoULTRA (OpenGL ES 2.1)	GC7000UL (OpenGL ES 2.1/3.0/3.1, OpenCL 1.2, Vulkan)	-	2D - GC520L 3D – GC7000UL (OpenGL ES 2.1/3.0/3.1, OpenCL 1.2, Vulkan)
Security	CAAM, RDC, Arm® TrustZone®	CAAM, RDC, Arm TrustZone	CAAM, RDC, Arm TrustZone	CAAM, RDC, Arm TrustZone	CAAM, RDC, Arm TrustZone
AI/ML	OpenCL CPU: 32 GOPS	A53	OpenCL CPU, GPU: 32 GOPS	A53	**ML Accel 2+ TOPS**
SRAM	128KiB + 32KiB	256KiB + 32KiB	512KiB + 32KiB	512KiB + 32KiB	768KiB + 32KiB
Camera	2x MIPI CSI (4-lane)	1x MIPI CSI (4-lane)	1x MIPI CSI (4-lane)	1x MIPI CSI (4-lane)	**2x MIPI CSI (4-lane), 2 ISPs (3-exposure HDR)**
Display	**HDMI 2.0a Tx, MIPI DSI (4-lane), eDP; HDR10, HLG, Dolby Vision**	1x MIPI DSI (4-lane)	1x MIPI DSI (4-lane)	-	**HDMI 2.0a Tx (eARC), MIPI DSI (4-lane), 1x LVDS (8-lane)**
OSD Overlay	**4Kp60**	1080p60	1080p60	-	**4Kp30**
Video Decode	**4Kp60 HEVC, VP9, 4Kp30 H.264, legacy codecs**	**1080p60 HEVC, H.264, VP9, VP8**	None	None	**1080p60 H.265, H.264, VP9, VP8**
Video Encode	None	1080p60 H.264, VP8	None	None	1080p60 H.265, H.264
Connectivity	**PCIe, SDIO, USB**	**PCIe, SDIO, USB**	SDIO, USB	SDIO, USB	**PCIe, SDIO, USB**
Audio	20x I2S TDM (32b @384KHz), S/PDIF Tx+Rx	20x I2S TDM (32b @384KHz), 8ch PDM DMIC input, S/PDIF Tx+Rx	**12x I2S TDM (32b @384KHz), ASRC, 8ch PDM DMIC input, S/PDIF Tx+Rx**	**12x I2S TDM (32b @384KHz), ASRC, 8ch PDM DMIC input, S/PDIF Tx+Rx**	**18x I2S TDM (32b @384KHz), ASRC, 8ch PDM DMIC input), S/PDIF Tx+Rx**
Expansion I/O	**2x USB3.0, 2x PCIe Gen 2**	**2x USB2.0, 1xPCIe Gen 2**	1x USB2.0	1x USB2.0	**2x USB 3.0, 1x PCIe Gen 3**
Network, Storage	1x GbE, 2x SD/eMMC, MLC/SLC NAND	1x GbE, 3xSD/eMMC, MLC/SLC NAND	1x GbE, 3xSD/eMMC, MLC/SLC NAND	1x GbE, 3x SD/eMMC, MLC/SLC NAND	**2x GbE (1x TSN), 2x CAN-FD, 3x SD/eMMC, MLC/SLC NAND**
Process	28nm	**14nm FinFET**	**14nm FinFET**	**14nm FinFET**	**14nm FinFET**
Package	17x17mm, 0.65mm	**14x14mm, 0.5mm de-pop**	**14x14mm, 0.5mm de-pop**	11x11mm, 0.5mm de-pop	15x15mm, 0.5mm de-pop

Pin Compatible

Highlighted Feature

i.MX RT MCU SERIES PORTFOLIO



i.MX RT600 MCU FAMILY | HIGHLIGHTS

→ Combining high performance DSP processing with ultra low-power MCU functionality

High Performance, Real-time Processing

- Arm Cortex-M33 running up to 300 MHz with ultra-fast, real-time responsiveness
- Cadence® Tensilica® HiFi 4 DSP running up to 600MHz with Quad 32x32 MAC
- Cryptography and Math Accelerators for security and complex algorithms
- Up to 4.5 MB on-chip SRAM with zero wait-state access for critical code and data

Low Power

- 28nm FD-SOI process optimized for both active and leakage power

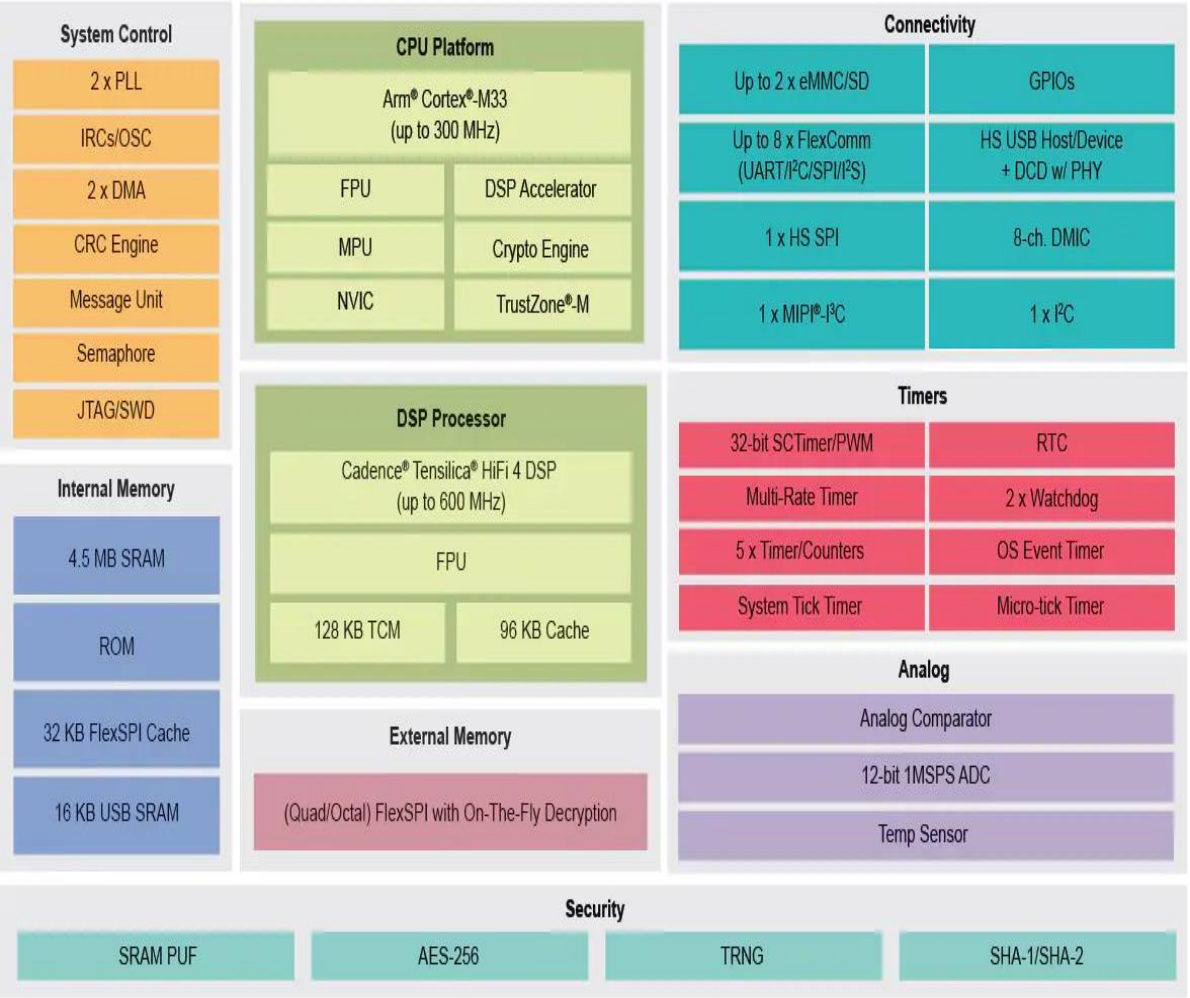
Rich Integration

- Quad/Octal SPI Flash & PSRAM memory interface with on-the-fly memory decryption
- USB 2.0 High-speed Host & Device interface with PHY
- Up to 8x Flexcomms – configurable to SPI, I2C, UART and/or I2S interfaces
- Up to 2x SD/eMMC memory card interfaces
- Digital microphone interface supporting up to 8 channels

Advanced Security

- Secure boot with immutable hardware ‘root-of-trust’
- SRAM Physically Unclonable Function (PUF) based unique key storage
- Acceleration for symmetric (AES-256 & SHA2-256) and asymmetric cryptography (ECC & RSA)
- Optional fuse-based root key storage mechanism

NXP 32-BIT ARM BASED MCUS – HIGH PERFORMANCE I.MX RT600: BLOCK DIAGRAM



Core Platform
- Up to 300MHz Cortex-M33
  - TrustZone, MPU, FPU, SIMD
- 600MHz Hifi4 DSP
- Coprocessors
  - DSP Accelerator
  - Crypto Engine

Memory
- 4.5 MB SRAM
- 128KB DSP TCM
- 96KB DSP Cache (32kI 64kD)

Timers
- 5 x 32b Timers
- SCTimer/PWM
- Multi-Rate Timer
- 2 x Windowed Watchdog Timer
- RTC
- Micro Timer

Interfaces
- USB High-speed (H/D) w/ on-chip HS PHY
- USB Full-speed (H/D), Crystal-less
- 2 x SDIO, 1 supports HS400
- 1 x High-Speed SPI up to 50MHz
- 8 x Flexcomms support up to 8x SPI, 8x I2C, 8x UART, 4x I²S channels (total 8 instances)
- I3C Master and Slave
- 8ch DMICs

Security
- SRAM PUF
- AES256
- SHA-2
- RNG

Analog
- ACMP
- ADC
- 1MHz LP Osc
- 16MHz IRC
- 48/60MHz IRC
- 32KHz RTC Osc
- PLLs

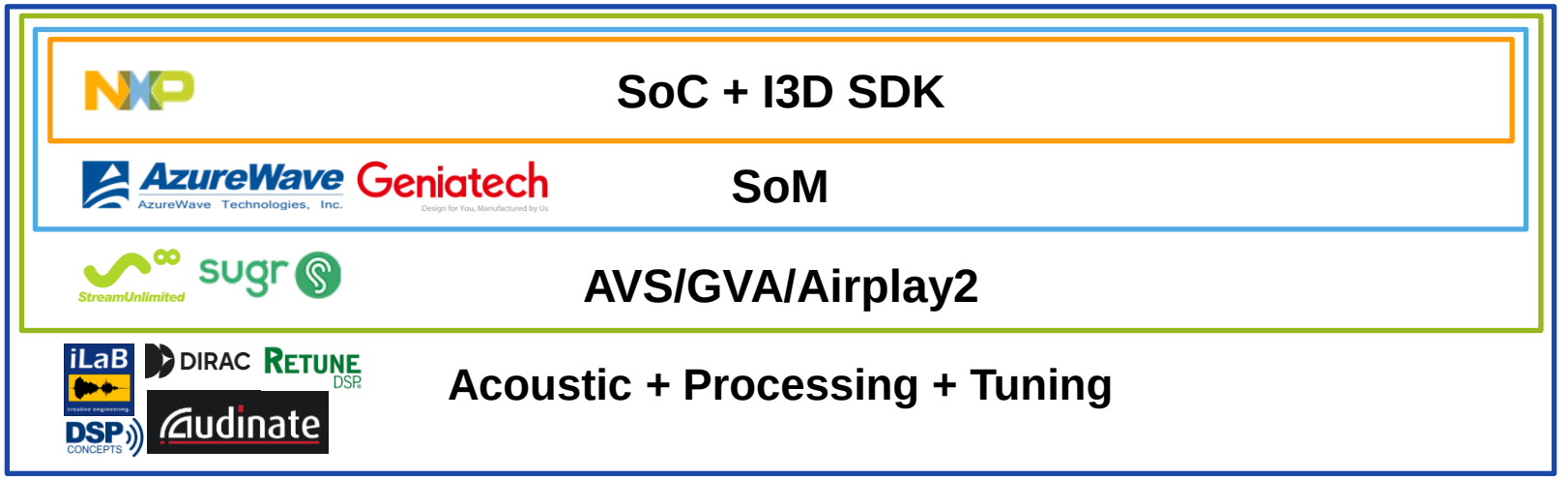
Power Supply
- 1.71V-3.6V

Package
- 9x9 BGA, 0.5mm pitch
- CSP
- FOWLP

NXP AUDIO ECO-PARTNER SUMMARY

- Audinate – Dante professional AV networking solution
- AzureWave – SoM provider
- Dirac – Audio post processing
- DSP Concepts – Audio Front End for voice input, and Audio post processing
- Geniatech – SoM provider
- iLaB – Acoustic architecture design
- StreamUnlimited – AVS,GVA, Airplay2, and streaming audio System Integrator
- Sugr – AVS System Integrator, and local voice control

** In alphabetical order*



SECURE CONNECTIONS
FOR A SMARTER WORLD