

# Driving Video, Audio and Voice Solutions with the i.MX 8M Family of Multimedia Applications Processors

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SECURE CONNECTIONS  
FOR A SMARTER WORLD

# Agenda

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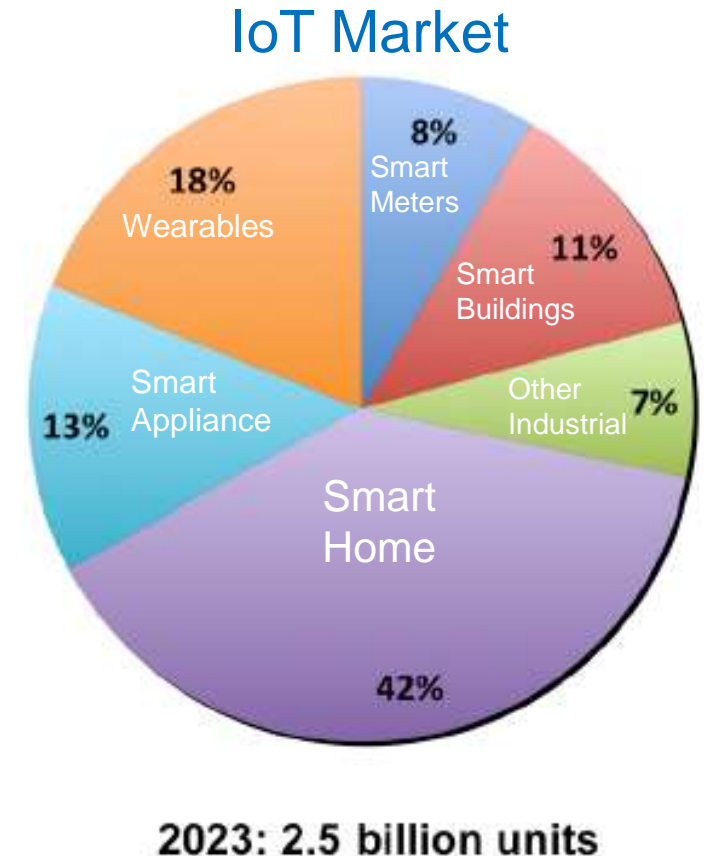
- Market Trends in IoT
- The i.MX 8 Series Roadmap
- The i.MX 8M Family Line-up
- Making It Easy for You
- Why You Should Choose NXP

# Market Trends in IoT



# IoT Shifts to Consumer\*

- As costs drop, consumer will dominate IoT
- Dependent on smart-home platforms:
  - Smart speakers provide entry point for IoT
  - Alexa going into alarms, appliances, door locks, lighting, thermostats and more
- In 2023, consumer totals 74% of market in connected appliances, smart home, wearables



Source: The Linley Group 2018

\* Consumer IoT excludes traditional connected devices such as media players, smart TVs, smartphones, and PCs

# Decora Voice™ Dimmer with Amazon Alexa Built-in

Powered by i.MX 8M Mini



Leviton Decora Voice™ Dimmer photo courtesy of Leviton

# Six Most Popular Smart Home Devices\*

- Networked cameras
- Video doorbells
  - 25% of U.S. broadband households plan to buy a video doorbell in 2019
- Smart door locks
- Smart thermostat
- Smart lightbulbs
- Smart garage door opener

Owners of smart speakers with voice assistants (Amazon Echo, Google Home) are **3x more likely to own a smart home device** than consumers who do not

Multiple IoT devices in home is becoming common— among consumers who own a connected entertainment or smart home device, **more than 60% have more than one**

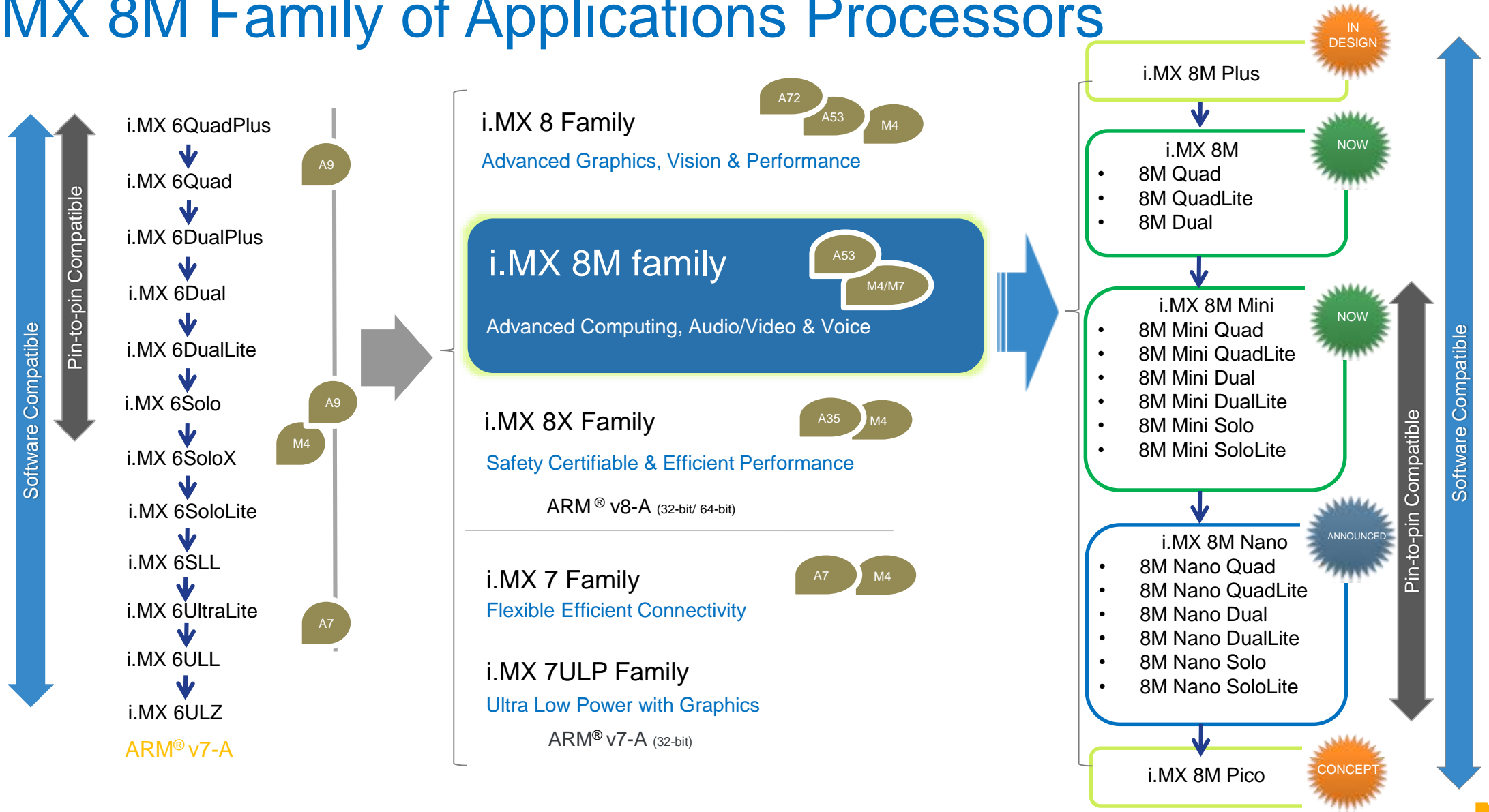
\* Found in 22% of U.S. broadband households

Source: Parks Associates 2019 Connected Home & Entertainment Trends

# The i.MX 8 Series Roadmap



# i.MX 8M Family of Applications Processors



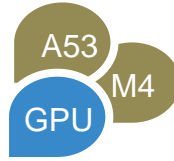


# i.MX 8 Series: Target Applications

Advanced graphics, video, image processing, vision, audio and voice

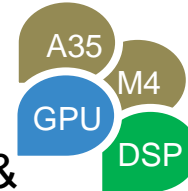
## i.MX 8M Family

Advanced Computing,  
Audio/Video & Voice



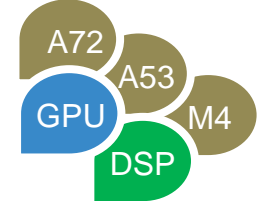
## i.MX 8X Family

Safety Certifiable &  
Efficient Performance



## i.MX 8 Family

Advanced Graphics,  
Vision & Performance



# i.MX 8M Family: Expanding Performance, Efficiency, Connectivity

Quad-A53 plus Cortex-M4 and Cortex-M7 for task offload and power optimizations

Immersive audio experience: 20+ channel high-fidelity audio, multi-room music, Dolby ATMOS certification

Up to 2 TOPS ML acceleration



9mW  
Sleep Mode



Support for new memory types: LPDDR4 (12GB/s), DDR4 plus DDR3L

New interfaces: USB 3.0, eDP, eARC

2X CPU  
Performance

Quad Cortex-A53 up to 1.8MHz plus Cortex-M4/M7 for task offload and power optimizations

Applications <2-3W

60% less power in run mode

Video  
4Kp60 decoder (HDR, Dolby Vision)  
1080p60 encoder



75% less power in deep sleep mode



Graphics  
OpenGL ES 3.1, Vulkan  
OpenCL 1.2

14LPC FinFET: more performance, better efficiency

Performance benchmark in Dhrystone with 6QP.

# The i.MX 8M Family Line-up



# i.MX 8M Family: Scalable Solutions for the Broad Market...

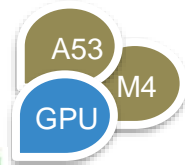
Scalable series of **three** Arm V8 64-bit (/32-bit) based SoC Families in **Production** (i.MX 8M Quad / i.MX 8M Mini) and **Announced** (i.MX 8M Nano)

## i.MX 8M Quad



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

i.MX 8M  
QuadLite

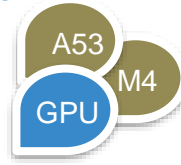


## i.MX 8M Mini



i.MX 8M Mini  
Quad/Dual/Solo

i.MX 8M Mini  
QuadLite/DualLite/  
SoloLite

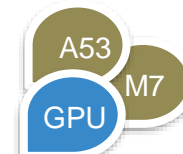


## i.MX 8M Nano



i.MX 8M Nano  
Quad/Dual/Solo

i.MX 8M Nano  
QuadLite/DualLite/  
SoloLite



Pin Compatible

- Advanced Audio, Voice
- 4K Video, HDR
- 3D GPU with OpenCL
- Multi-Display and Camera
- USB 3.0, Multiple PCIe

Pin Compatible 14x14 Package: Design Compatibility

- Advanced Audio, Voice
- 1080p Video Encode and Decode
- 3D GPU
- Single Display & Camera
- USB 2.0, PCIe
- Performance and Power-efficient

- Low Cost Audio, Voice
- Video on Cortex-A53
- 3D GPU with OpenCL
- Single Display & Camera
- USB 2.0
- Performance and Power Efficient

Software Compatible (including GPU Tools)

High-end (\$\$\$) => Mid-end (\$\$) => Low-end (\$)

# W.I.N.N.E.R.S.! – The Championship Line Up

## Important Information

### i.MX 8M wins Product of the Year 2019

Congratulations! The i.MX 8M is the winner of the Kategorie Active Devices and therefore Product of the Year 2019. And also our partner and customer Phytex won with the phyCORE-i.MX 8 Quad Max in the categorie Embedded Design.

Read the article (in german)

<https://www.elektroniknet.de/elektronik/halbleiter/hier-kommen-die-sieger-163399.html>



More info: [NXP Blog](#)

- ✓ Enriched User Experience
- ✓ Performance and Versatility
- ✓ High Speed Interfaces



# i.MX 8M Family Target Applications

## Consumer & Pro Audio Systems

- Portable audio devices
- Wireless or networked speakers
- Surround sound and sound bars
- Audio/video receiver
- Public address systems
- Smart Remote Controls
- Voice>Music>Video Convergence



## Home & Building Automation

- Video doorbell
- Security and surveillance system
- Smart light control
- HVAC climate control
- IoT gateway
- Two-way video conferencing
- Smart appliances
- Control panel
- Digital sign



## Industrial HMI, Vision and Automation

- Barcode or image scanner
- Industrial printer
- Ruggedized HMI
- Kiosk
- Machine visual inspection
- Image analytics
- Factory automation
- Test and measurement
- Two-way radio
- Mobility and logistics
- High-speed i/f conversion



## Consumer, Healthcare, Other

- Smart appliance
- Service robot, e.g. vacuum, mower, cleaner
- Camera and LCD
- Mobile patient care, e.g. infusion pump, respirator
- Blood pressure monitor
- Activity/wellness monitor
- Exercise equipment
- IP phones



# The i.MX 8M Quad Family 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, up to 20 channels
- **Performance and Versatility**
  - 1x-4x Cortex-A53 processors at speeds of up to 1.5 GHz per core, 1x Cortex-M for task offload
  - Flexible memory options (speed, power, cost)
  - Newest high-speed interfaces for flexible connectivity
  - Configurations less than 2 to 3 Watts
- **Basic to Advanced HMI Solutions**
  - Industrial and consumer HMI
  - Dual displays and camera inputs
  - Immersive Audio and Video processing
  - Voice Solutions (local and cloud connected)
  - Interconnected Devices (smarter edge devices)






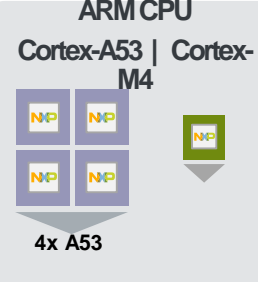
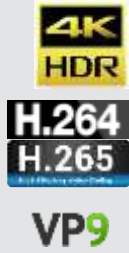


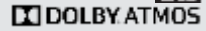




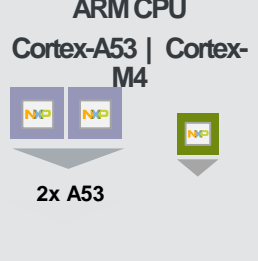
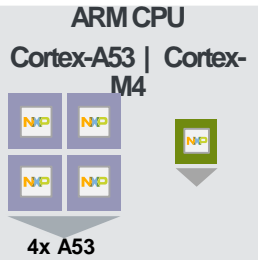
# i.MX 8M Quad Key Features

- **Scalable CPU Performance**
  - Dual, Quad Cortex-A53 up to 1.5 GHz
  - Cortex-M4 up to 266 MHz
    - Offload Tasks, Optimize Power, Increase Security
  - HW based resource isolation & safe sharing between Cortex-A and Cortex-M
  - Enables concurrent execution of multiple software environments to provide high performance with real time responsiveness
- **Best In Class Multimedia Performance**
  - Up to 4K video decoding in h.265, h.264, VP9
  - High Dynamic Range (HDR) support
  - High Performance 3D Graphics Acceleration
    - 32 GFLOPS
    - OpenGL ES 3.1, Vulkan, OpenCL 1.2, and Open VG support
  - 20+ audio channel inputs/outputs
  - 32-bit @ 384KHz interfaces (up to 768 KHz)
- **High Performance at Low power**
  - Scalable power using mobile power architecture
    - Independent power gate on each core
    - Multiple Power Islands / Flexible clock gating
    - DVFS support
  - Support Cortex-M4 running with A53 and high-speed modules power gated
  - DDR3L, DDR4 and LPDDR4 high performance / lower power memories
- **Multiple High-Speed Interfaces**
  - Enabling Vision: 2x MIPI-CSI (4-lanes)
    - Support 1080p30, 720p60, VGA at 60 fps
  - Display
    - HDMI 2.0a (up 4K), MIPI-DSI (4 lanes) (720p60)
  - Connectivity
    - 1x Gb Ethernet (MAC): AVB & IEEE 1588 for sync, and EEE for low power
    - 2x USB 3.0 Type C/dual role with PHY (works as USB 3.0 or USB 2.0), 5Gbps
    - 2x PCIe 2.0 (1-lane) with L1 substates (low power, fast wakeup)

# i.MX 8M Family – In Production Now

Applications Processors for Consumer and Industrial Applications

- Streaming Media
- Voice Assistants
- AI, Machine Learning
- Industrial IoT
- Edge Compute
- Machine Vision

 i.MX 8M Quad	Up to 13,800 DMIPS  ARM CPU Cortex-A53   Cortex-M4 4x A53	Video • Decode: 4Kp60 H.265, VP9 H.264, VP8 	3D GPU • Single core GPU • 4 Vec4 Shader • Up to 64 GFLOPS • OpenGL ES 3.0 • OpenCL 1.2 • 267 MTri / sec • 1.6 GPix / sec	Display/ Camera • HDMI  • MIPI-DSI 4-lane  • 2x MIPI-CSI 4-lane	Audio I/O • 20-channels • 32-bits @ 384KHz • DSD512, TDM • SPDIF Tx & Rx • HDMI ARC 	Connectivity I/O • 2x USB3.0 (Type C) • 2x PCIe • 2x SDIO • 1x GbE  Type-C	 Software Compatibility  Discrete Package Option  Pin Compatibility
	Up to 6,900 DMIPS  ARM CPU Cortex-A53   Cortex-M4 2x A53	Video SAME AS 8M Quad	3D GPU SAME AS 8M Quad	Display/ Camera SAME AS 8M Quad	Audio I/O SAME AS 8M Quad	Connectivity I/O SAME AS 8M Quad	
	Up to 13,800 DMIPS  ARM CPU Cortex-A53   Cortex-M4 4x A53	Video No Video acceleration	3D GPU SAME AS 8M Quad	Display/ Camera SAME AS 8M Quad	Audio I/O SAME AS 8M Quad	Connectivity I/O SAME AS 8M Quad	



# 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

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

**Qualification** for Consumer and Industrial applications

## Feature Highlights:

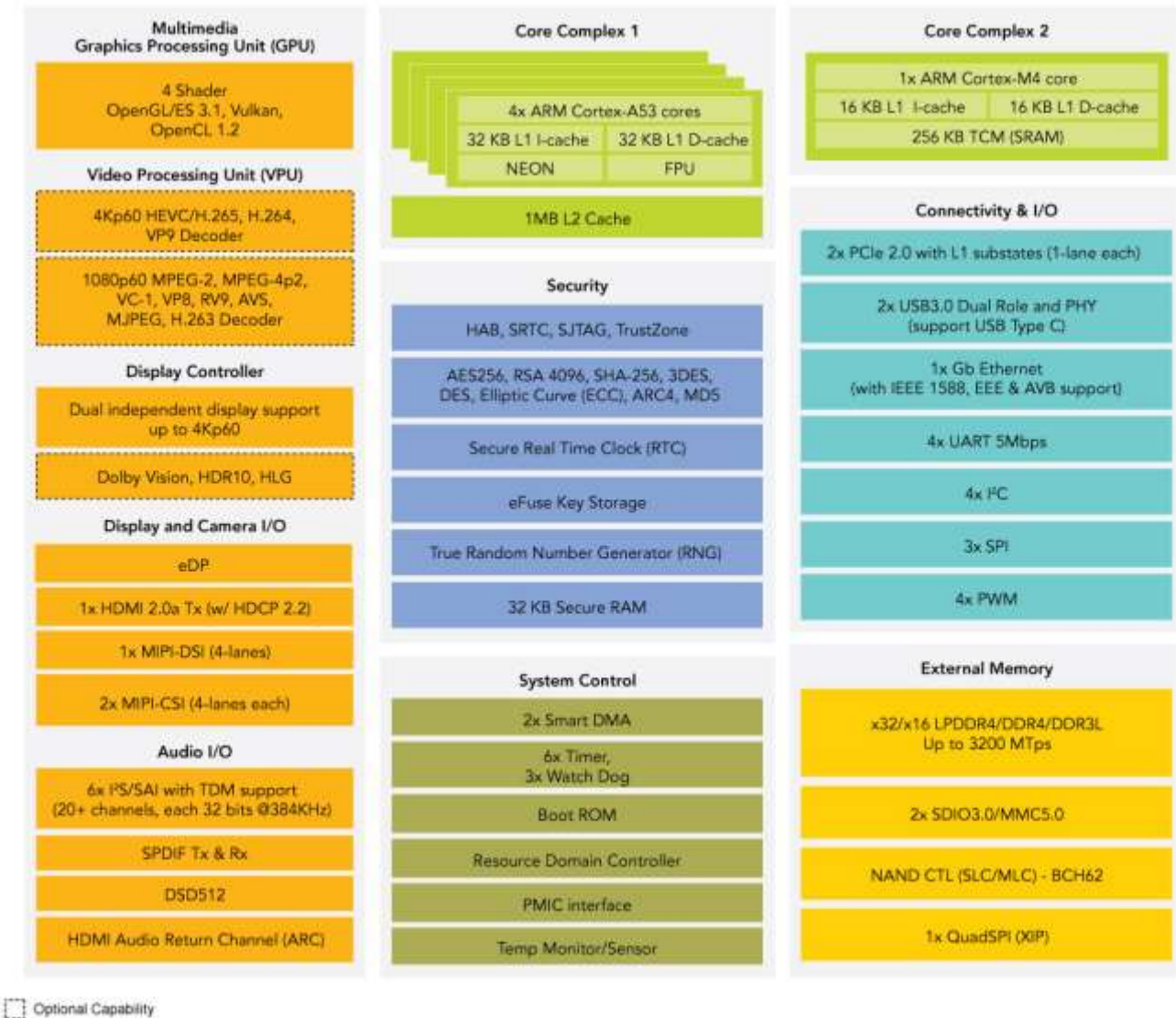
- Security: DRM support for RSA, AES, 3DES, DES
- **GC7000Lite 3D Graphics GPU** (OpenGL ES 1.0, 2.0, 3.0, 3.1, Vulkan, and OpenCL 1.2)
- **4Kp60 Main, Main10 H.265/HEVC and VP9, 4Kp30 H.264 decoder**
- High Dynamic Range Support: HDR10, Dolby Vision, HLG
- **1080p60 MPEG-2, MPEG-4p2, VC-1, VP8, RV9, 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)
- **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

## Connectivity

- 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

## Memory

- 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)



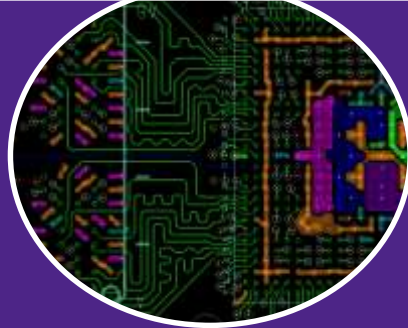
Planned to be added in the 10-year longevity program

## Extreme, Cost-Effective Scalability for Media and Industrial IoT



### Power Efficient and Scalable

- 14LPC FinFET: higher performance at lower power.
- Cortex-A53: 1x, 2x or 4x cores, up to 1.8 GHz, optional hardware video codecs.
- Cortex-M: heterogeneous processing for task offload and power optimizations.
- Pin-compatibility provides drop-in scalable product performance using the same hardware design and minimal software changes.



### Cost-optimized System Design

- Full-featured packages with cost-effective PCB design references (6-8 layer board design and no microvias).
- LPDDR4 for highest performance and lowest power, or DDR3L and DDR4 for lowest system cost.
- Direct connection of PDM microphones (no CODEC).
- Linux/Android/FreeRTOS BSP and solutions software.



### Machine Learning, Multi-Media

- Cost-effective machine-learning & inference using Cortex-A53 or GPU.
- Up to 1080p60 video decoding (H.265, H.264, VP8/9) and 1080p60 video encoding (H.264, VP8).
- Integrated GPUs for 1080p media UI.
- 20+ audio channels and audio HW enhancements on some devices (e.g. ASRC).


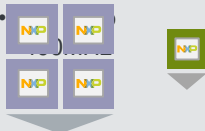




### Industrial Reliability, Supply

- -40C to 105C (junction) and Industrial-tier qualification (10yrs, continuous ON).
- Minimum 10 year supply longevity on commercial and industrial devices.
- Gigabit Ethernet with IEEE1588 and AVB support.
- Fanless design for reduced cost in high temperature environments.

# i.MX 8M Mini & 8M Nano Applications Processors

Power-optimized, scalable, multi-core applications processors built in advanced 14nm LPC FinFET process

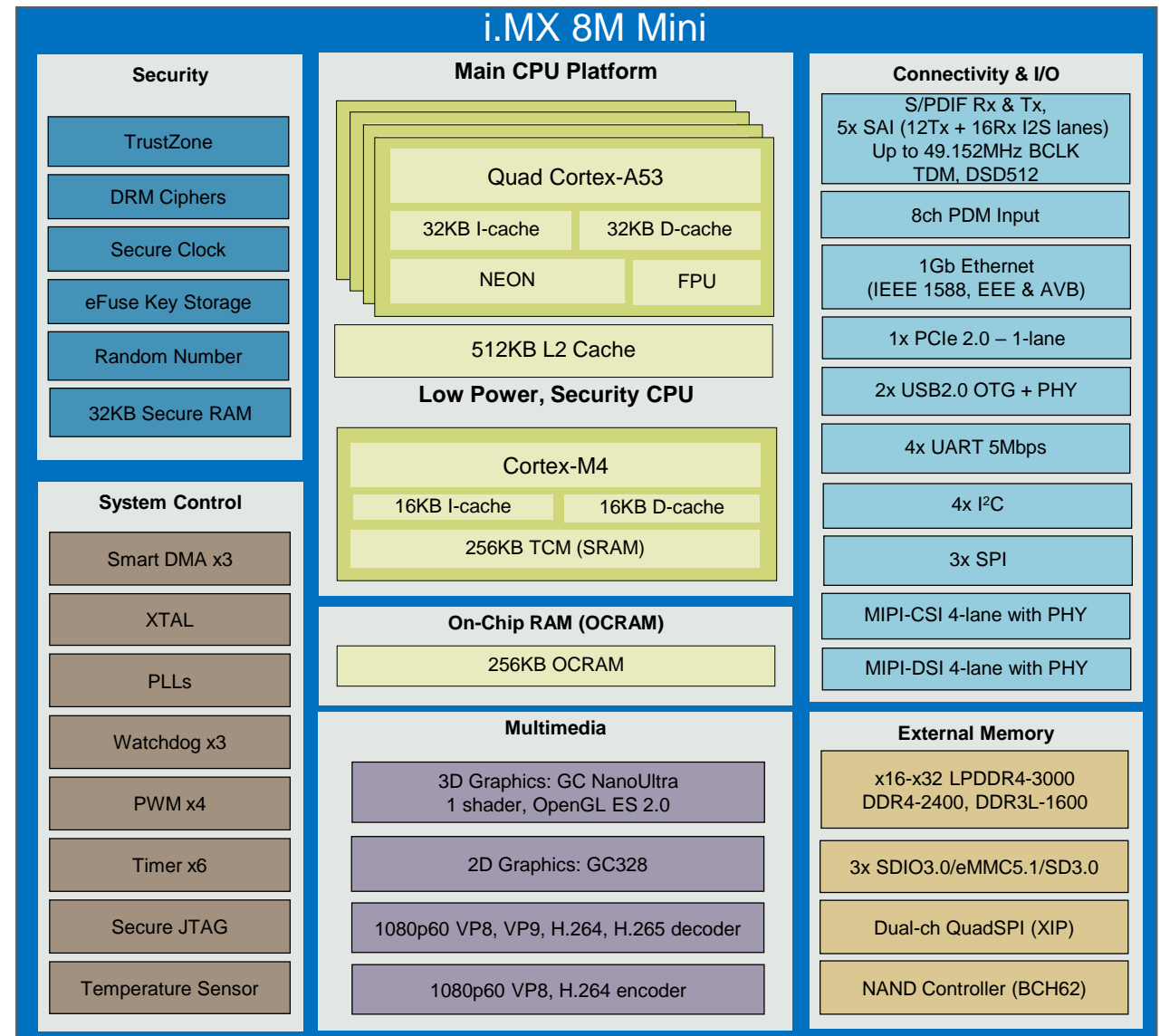
	Streaming Media	Voice Assistants	AI, Machine Learning	Industrial and IoT	Edge Compute	
 <ul style="list-style-type: none"> <li>i.MX 8M Mini Quad</li> <li>i.MX 8M Mini Dual</li> <li>i.MX 8M Mini Solo</li> <li>i.MX 8M Mini QuadLite</li> <li>i.MX 8M Mini DualLite</li> <li>i.MX 8M Mini SoloLite</li> </ul>	<p>Arm® CPU Cortex-A53   Cortex-M4</p> <ul style="list-style-type: none"> <li>A53 up to 1.8GHz</li> <li>Quad – 4x A53</li> <li>Dual – 2x A53</li> <li>Solo – 1x A53</li> </ul> 	<p>Video</p> <ul style="list-style-type: none"> <li>1080p60 Decode: H.265, VP9 H.264, VP8</li> <li>1080p60 Encode: H.264, VP8</li> </ul> <p><b>Lite - No HW video acceleration</b></p>	<p>2D+3D GPU</p> <ul style="list-style-type: none"> <li>1 Vec4 Shader</li> <li>OpenGL ES 2.0</li> <li>OpenVG 1.1</li> </ul>	<p>Display/ Camera</p> <ul style="list-style-type: none"> <li>MIPI-DSI 4-lane</li> <li>MIPI-CSI 4-lane</li> </ul>	<p>Audio I/O</p> <ul style="list-style-type: none"> <li>12Tx + 16Rx I²S up to 768kHz</li> <li>DSD512, TDM</li> <li>SPDIF Tx &amp; Rx</li> <li>8-ch PDM MIC</li> </ul>	<p>Connectivity I/O</p> <ul style="list-style-type: none"> <li>2x USB 2.0</li> <li>1x PCIe</li> <li>3x SDIO</li> <li>1x GbE</li> <li>x32 LPDDR4, x16 DDR4, x16 DDR3L</li> </ul>
 <ul style="list-style-type: none"> <li>i.MX 8M Nano Quad</li> <li>i.MX 8M Nano QuadLite</li> <li>i.MX 8M Nano Dual</li> <li>i.MX 8M Nano DualLite</li> <li>i.MX 8M Nano Solo</li> <li>i.MX 8M Nano SoloLite</li> </ul>	<p>Arm® CPU Cortex-A53   Cortex-M7</p> <ul style="list-style-type: none"> <li>A53 up to 1.5GHz</li> <li>Quad – 4x A53</li> <li>Dual – 2x A53</li> <li>Solo – 1x A53</li> <li>M7 up to 600MHz</li> </ul> 	<p>Video</p> <ul style="list-style-type: none"> <li>No HW video acceleration</li> </ul>	<p>3D GPU</p> <ul style="list-style-type: none"> <li>2 Vec4 Shader</li> <li>OpenGL ES 2.0/3.0/3.1</li> <li>OpenVG 1.1</li> <li>OpenCL 1.2</li> <li>Vulkan</li> </ul> <p><b>Lite - No HW GPU graphics acceleration</b></p>	<p>Display/ Camera</p> <ul style="list-style-type: none"> <li>MIPI-DSI 4-lane</li> <li>MIPI-CSI 4-lane</li> </ul>	<p>Audio I/O</p> <ul style="list-style-type: none"> <li>10Tx + 10Rx I²S up to 768kHz</li> <li>DSD512, TDM</li> <li>SPDIF Tx &amp; Rx</li> <li>8-ch PDM MIC</li> <li>ASRC</li> </ul>	<p>Connectivity I/O</p> <ul style="list-style-type: none"> <li>1x USB 2.0</li> <li>3x SDIO</li> <li>1x GbE</li> <li>x16 LPDDR4, DDR4, DDR3L</li> </ul>
						<p>Software Compatibility</p> <p>14x14 0.5nm</p> <p>Pin Compatibility</p>



# i.MX 8M Mini

## Feature Highlights:

- **Arm Cortex-A53 MPCore 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 OCRM**
- **External Memory Interface:**
  - 32/16-bit DRAM interfaces (LPDDR4-3000, 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 / SD3.0



Target Timeline: Production (14x14) 1Q'19

Package: FCBGA 14x14mm, 0.5mm pitch

Operating Systems: Linux OS, Android OS, FreeRTOS

Qualification: for consumer (0 to +95C) and industrial (-40C to +105C, 10yr 24/7) applications

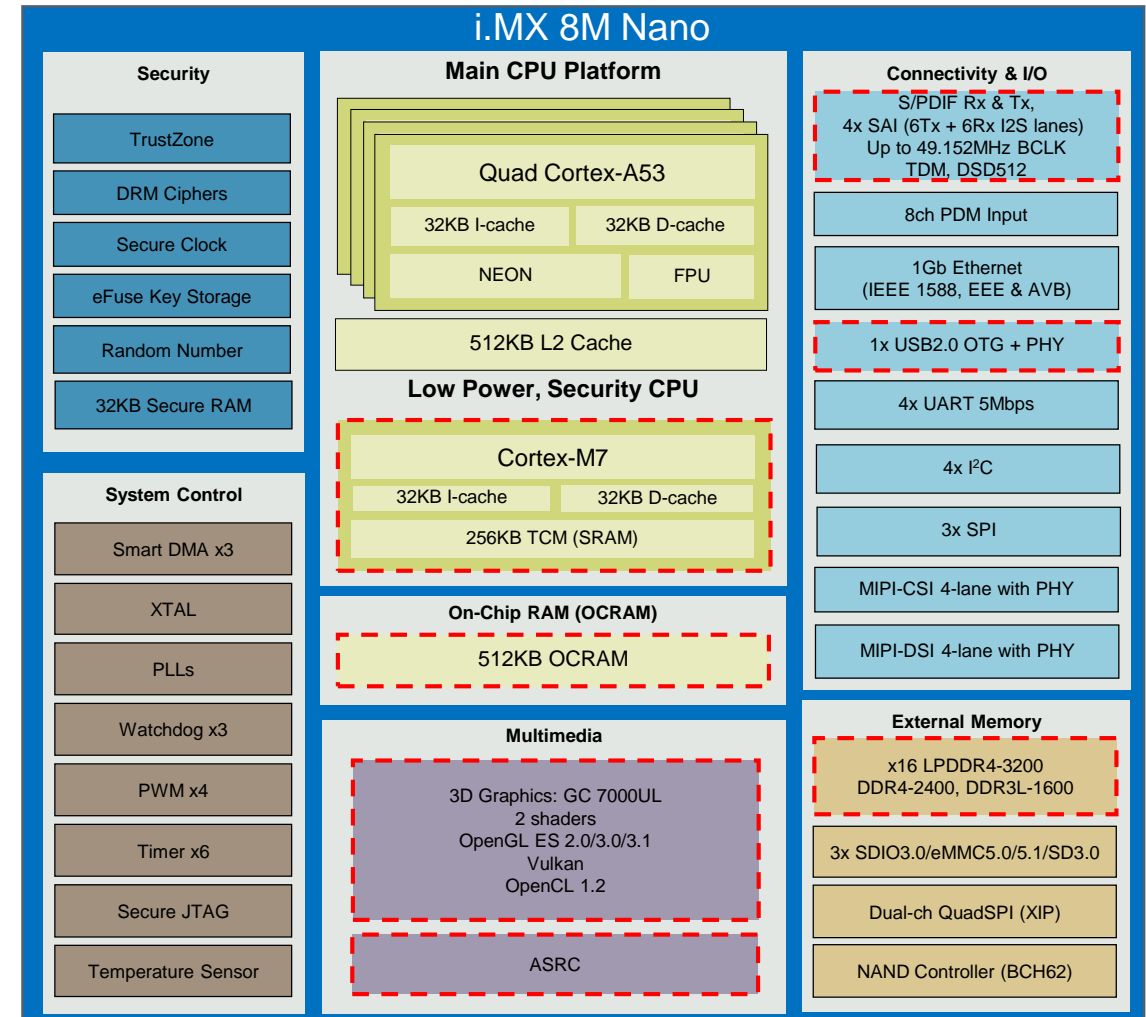
Longevity: 10yr longevity program

# i.MX 8M Nano

## Feature Highlights:

- **Arm Cortex-A53 MPCore 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:**
  - 600+ MHz
  - 32KB/32KB I/D cache, 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

Differences to i.MX 8M Mini



Target Timeline: Production target 4Q'19 (14x14)

Package: FCBGA 14x14mm, 0.5mm pitch de-pop array

Operating Systems: Linux OS, Android OS, FreeRTOS

Qualification: for consumer (0 to +85C) and industrial (-40C to +105C, 10yr 24/7) applications

Longevity: 10yr longevity program

# i.MX 8M Mini & 8M Nano 14x14 Package Design

Optimized for size and system cost

- 14 x 14 mm BGA, 0.5mm pin pitch, 486 pins

- Depopulated array for lower manufacturing cost

- Use low cost drilled vias; no high-cost laser microvias

- 3.2 mil trace and space escape

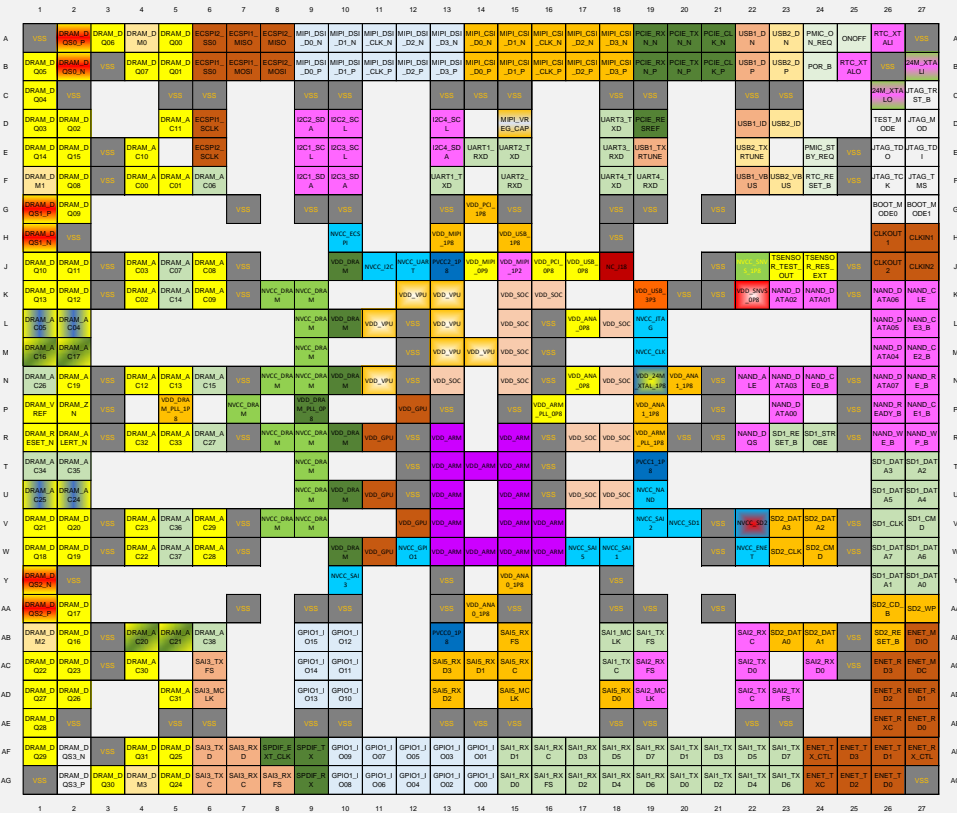
- Layout for 6 to 8 layer PCB

- Optimized for LPDDR4 routing

- LPDDR4 expects 10+ year product longevity to support wide adoption by automotive market

- Optimized power placement

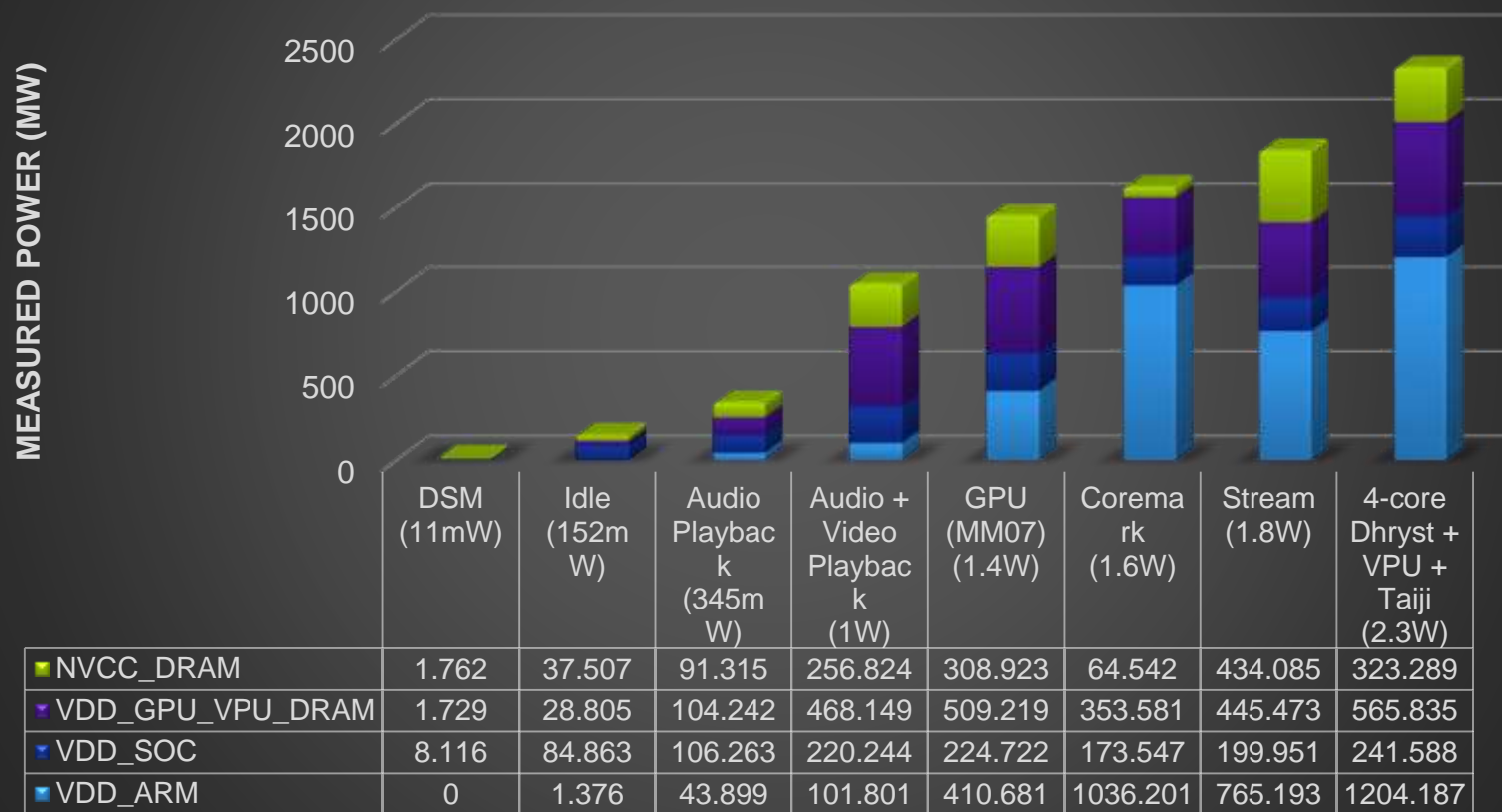
- Accommodates decouple caps under the BGA





# i.MX 8M Mini Preliminary Power Measurements


## i.MX 8M Mini Power Consumption (Preliminary)



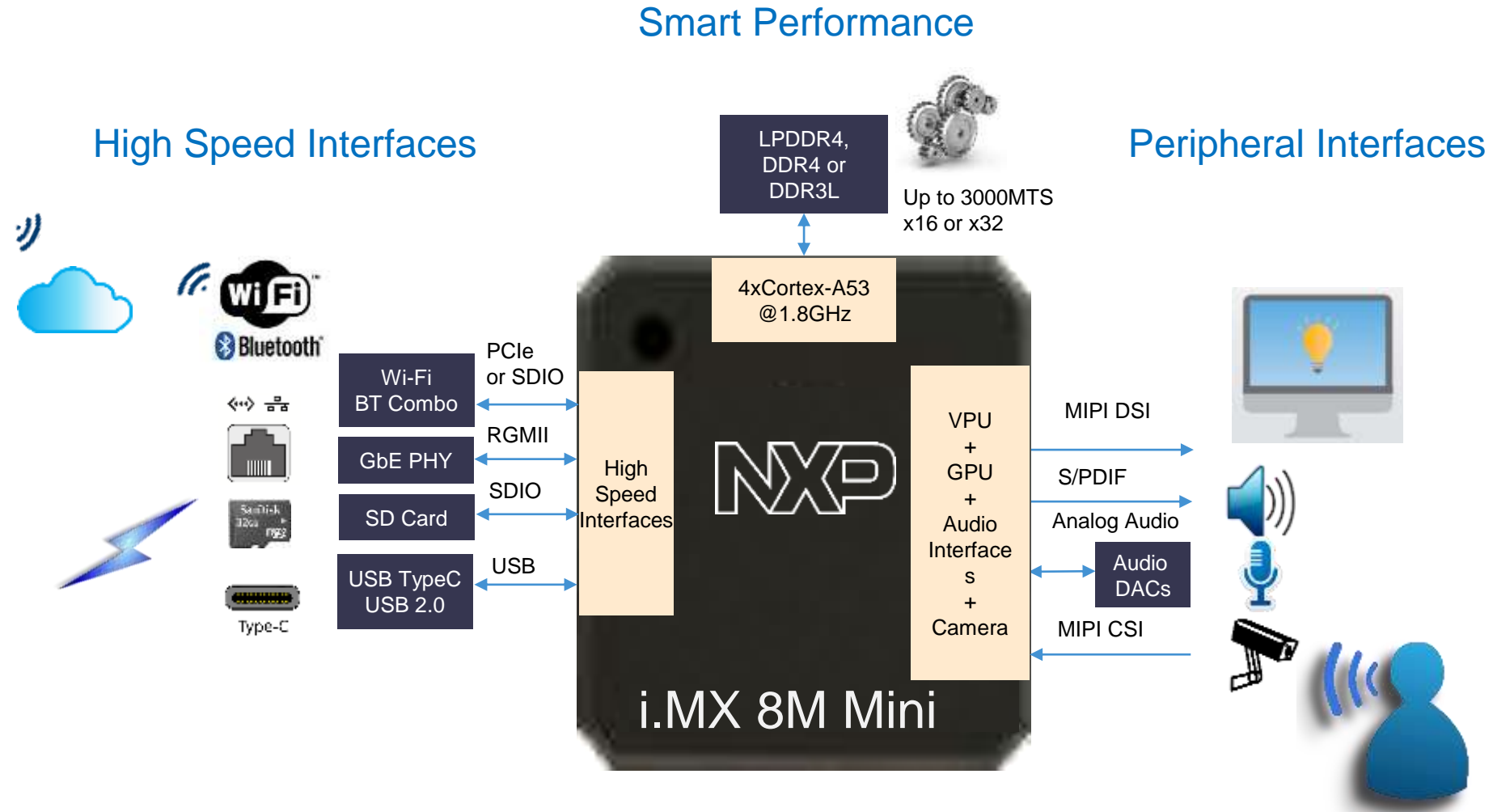
### Assumptions

- Power consumption use cases have been measured using 4.9 GA Linux kernel.
- Further power optimizations will be made with 4.14 GA Linux kernel.
- Measurements have been taken on the EVK, but require re-work if the customer wishes to reproduce the results.
- All power measurements have been taken on typical process silicon at room temperature 26C.
- Details on the use cases can be found in the preliminary application note posted on the i.MX 8M Mini Alpha SharePoint.

# i.MX 8M Family for Industrial and Media IoT

Family Name	i.MX 8M Quad/QuadLite i.MX 8M Dual	i.MX 8M Mini Quad/QuadLite i.MX 8M Mini Dual/DualLite i.MX 8M Mini Solo/SoloLite	 i.MX 8M Nano Quad/QuadLite i.MX 8M Nano Dual/DualLite i.MX 8M Nano Solo/SoloLite
Sample / Production	In Production – <a href="http://www.nxp.com/imx8m">www.nxp.com/imx8m</a>	In Production – <a href="http://www.nxp.com/imx8mmini">www.nxp.com/imx8mmini</a>	Announced – Sample Q2-19 / Production Q4-19
Main CPU	2x or 4x Cortex-A53 @ 1.5 GHz, 1MB L2	1x, 2x or 4x A53 @ 1.6-1.8 GHz, 512KB L2	1x, 2x or 4x A53 @ 1.2-1.5 GHz, 512KB L2
MCU	Cortex-M4 266MHz, 256KB TCM	Cortex-M4 400MHz, 256KB TCM	Cortex-M7 600+MHz, 256KB TCM
DDR	x16/x32 LPDDR4/DDR4/DDR3L	x16/x32 LPDDR4/DDR4/DDR3L	x16 LPDDR4/DDR4/DDR3L
GPU	GC7000Lite (4 shaders) OpenGL ES 2.0/3.0/3.1, Vulkan, OpenCL 1.2	GC NanoUltra 3D (1 shader) + GC320 2D OpenGL ES 2.0	GC7000UL (2 shaders) (*) OpenGL ES 2.0/3.0/3.1, Vulkan, OpenCL 1.2
Security	CAAM, RDC, TrustZone	CAAM, RDC, TrustZone	CAAM, RDC, TrustZone
AI/ML	OpenCL CPU: 32 GOPS	A53	OpenCL CPU, GPU: 32 GOPS
SRAM	128KiB + 32KiB	256KiB + 32KiB	512KiB + 32KiB
Display Features	4K HDR, DCSS, LCDIF	LCDIF	LCDIF
Display Interfaces	1x MIPI-DSI, HDMI 2.0a Tx (ARC) + eDP	1x MIPI-DSI	1x MIPI-DSI
HDR	HDR10, HLG, Dolby Vision	-	-
Camera Interface	2x MIPI-CSI (4-lanes each)	1x MIPI-CSI (4-lanes)	1x MIPI-CSI (4-lanes)
Video Decode	4Kp60 HEVC H.265, VP9, H.264 (*), legacy	1080p60 HEVC H.265, VP9, H.264, VP8 (*)	-
Video Encode	-	1080p60 H.264, VP8 (*)	-
Connectivity	External Module Options for Wi-Fi/BT		
Audio Interface	20 I2S TDM (32b @ 384kHz), S/PDIF Tx+Rx	20 I2S TDM (32b @ 384kHz), S/PDIF Tx+Rx, 8ch PDM DMIC input	12 I2S TDM (32b @ 384kHz), S/PDIF Tx+Rx, 8ch PDM DMIC input, ASRC
Expansion IO	2x USB3.0 Type C, 2x PCIe Gen2	2x USB 2.0, 1x PCIe Gen2	1x USB2.0
Network/Storage	1x GbE, 2x SDIO/eMMC, Raw NAND, QSPI	1x GbE, 3x SDIO/eMMC, Raw NAND, QSPI	1x GbE, 3x SDIO/eMMC, Raw NAND, QSPI
Process Technology	TSMC 28HPC	Samsung 14LPC FinFET	Samsung 14LPC FinFET
Qualification	Commercial, Industrial	Commercial, Industrial	Commercial, Industrial
Packages	17x17mm, 0.65p	14x14mm 0.5p (no microvias) *pin-compatible with i.MX 8M Nano	14x14mm 0.5p (no microvias) *pin-compatible with i.MX 8M Mini

# Smart IoT Home Blocks



# Making It Easy for You



# i.MX 8M Mini & 8M Nano Evaluation Kit

In Production

2 FLAVORS

**Part Numbers:**

- |                                       |  |       |
|---------------------------------------|--|-------|
| 1. Config 1: 8MMINILPD4-EVK           | <b>LPDDR4</b> / eMMC / Type1PJ (QCA9377) | \$399 |
| 2. Config 2: 8MMINID4-EVK <b>DDR4</b> | / NAND / Type1MW (CYW43455)              | \$399 |
| 3. Config 3: 8MNANOD4-EVK             | <b>DDR4</b> / eMMC / Type1MW (CYW43455)  |       |

(Now)  
 (Availability in Q219)  
 \$399 (Availability in Q419)

## Base Kit: Compute Module + Base Board

**Kit Contents**

- i.MX 8M Mini/Nano Board (two board stack comprising a compute module plus base board). Compute module not orderable separately.
- MIPI-DSI to HDMI cable.
- USB 3.0 to Type C cable.
- USB Type C power supply.

**Compute Module: Overview**

- NXP i.MX 8M Mini/Nano Quad
- Murata **Wi-Fi** Type 1PJ (QCA9377) or 1MW (CYW43455)
- PMIC Rohm BD71847AMWV
- **2GB** LPDDR4 or DDR4
- **16GB** eMMC 5.1 or NAND
- **64MB** QSPI Flash
- 8-layer PCB, No HDI
- Size 2"x2"

**OS Support**

- Linux, Android and FreeRTOS BSPs from NXP
- Others: 3<sup>rd</sup> parties



i.MX 8M Mini Board



MIPI-DSI to HDMI

**Base Board: Overview**

- Display Connector: 1x mini-SAS MIPI-DSI
- Camera connector: 1x mini-SAS MIPI-CSI
- Audio DAC (WM8524)
- Microphone/headphone jacks
- 1x full-size SD/MMC card slot
- 10/100/1000 Ethernet port (AR8031 Gigabit PHY)
- 1x USB 3.0 Type C
- Connectivity expansion connector:
  - M.2 connector (PCIe)
- Audio expansion connector:
  - FPC 0.5mm pitch 60pin ZIF
  - UART, I2S
- General purpose expansion connector (RPI-like):
  - UART, I2S
  - NXP PN7150RPI board supported via this interface
- Size 4.2"x4.2"

## Connectivity

- Murata Type 1PJ (QCA9377)
  - Dual band 2.4G/5G
  - 802.11a/b/g/n/ac (1x1)
  - BT/BLE 4.1
- Murata Type 1MW (CYW43455)
  - Dual band 2.5G/5G
  - 802.11a/b/g/n/ac (1x1)
  - BT/BLE 5.0

## Optional Add-ons



OV5640 5Mpix MIPI CSI Board  
 miniSAS based  
**MINISASTOCSI**



OLED MIPI DSI Board  
 miniSAS based  
 5.5", 1920 x 1080  
**MX8-DSI-OLED1**



# Enabling Audio & Voice Processing at the Edge <sup>1,2,3</sup>

“Voice control front end to grow at 29% CAGR ('17-'22) in the Smart Home”

NXP Enabled  
Smart Speakers



## Google Voice Assist



## Alexa Voice Services



NXP i.MX 7D  
2-Mic Dev Kit for Amazon AVS

## Voice Solutions for China



NXP i.MX 8M  
Largest Voice Solution  
provider for Mandarin

1. Source: Google Android Things developer website
2. Amazon AVS developer website
3. Source: ABI Research

# NXP i.MX8M Development Kit for Amazon Alexa Voice Service



## Kit focus

- 1) Easy out of box hardware set up
- 2) Detailed User Guide
- 3) Software set up simplified by scripts to automatically install 3<sup>rd</sup> party libraries at runtime

Kit Hardware	Software
SOM + Baseboard: Pico-Pi i.MX8M	Yocto 4.14 Linux
Mic Array: 2 Mic Voice HAT	Alexa Device SDK & Wake Word
Antennae, Speakers + cables	Audio Front End: SW based

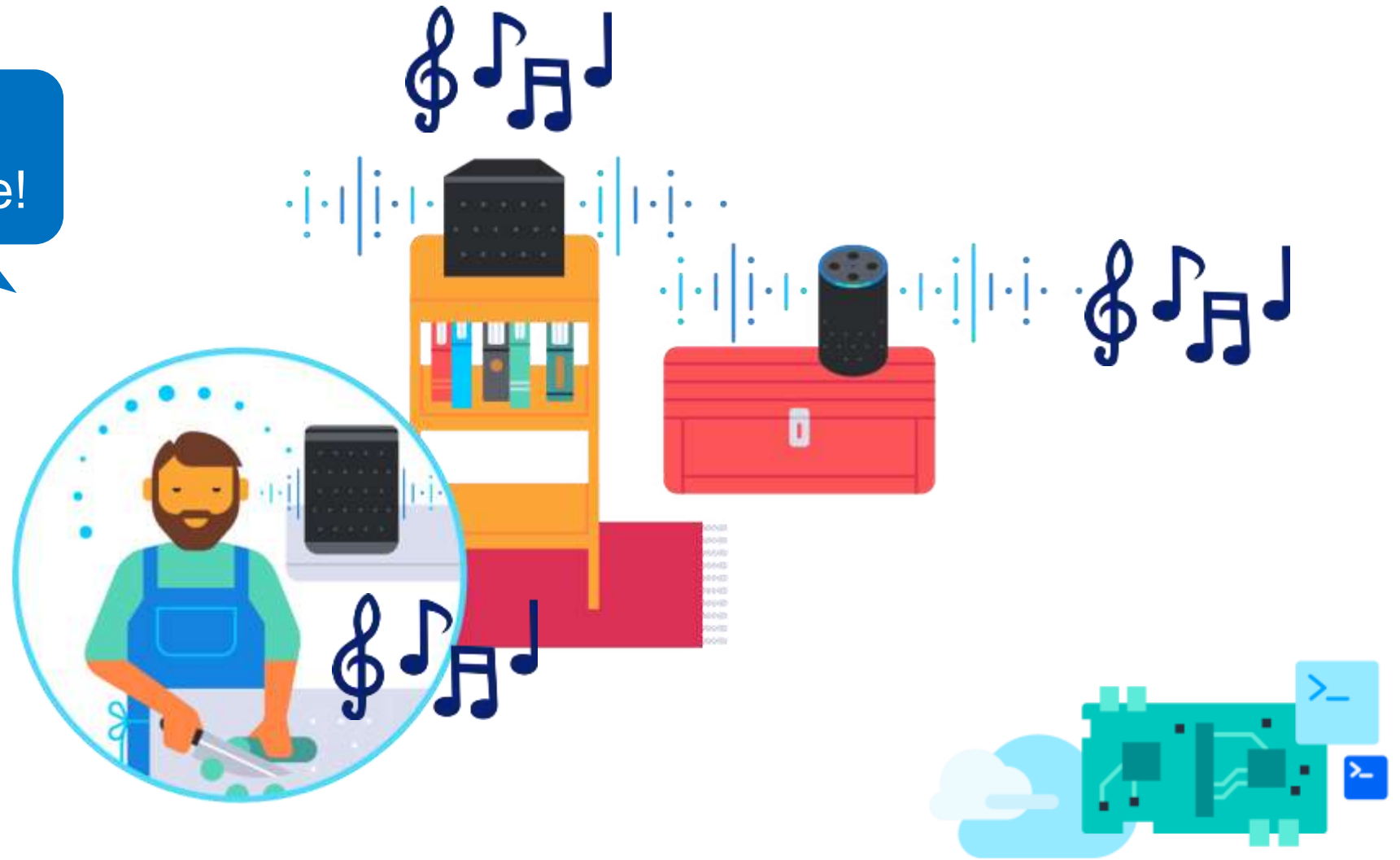
# Alexa Multi-Room Music





# What is Alexa Multi-Room Music? (MRM)

Alexa, play jazz music everywhere!



# Why is MRM Important?

Customers love whole-home music experiences – they may expect your product to have MRM when they purchase it, and could experience frustration if it doesn't.

★☆☆☆☆ **Not worth it.**

September 9, 2018

Style: [REDACTED] | **Verified Purchase**

The [REDACTED] will not connect to Alexa everywhere for music. Just know that before you spend \$200 on one of these.

★☆☆☆☆ **Doesn't play music simultaneously with other alexa devices.**

August 25, 2018

Style: [REDACTED] | **Verified Purchase**

It doesnt sync up with other alexa devices to play music. Whats the point of having Alexa and a speaker if you can't play music simultaneously with similar devices. If I didn't already pay to get it installed I'd return it.

★☆☆☆☆ **Can't play music in Multiroom with Alexa devices.**

January 13, 2019

Style: [REDACTED] | **Verified Purchase**

can not play music simultaneously with the Amazon dot and it is difficult to keep connected I am very frustrated with this product and I buy 2 and do not even sound together this sucks.

# Options for Multi-Room Music (MRM)

For Speakers, Soundbars, AVRs and Home Theater Systems



*Alexa Multi-Room Music*

Interoperate with Echo Family of Devices and other MRM-enabled Alexa Devices

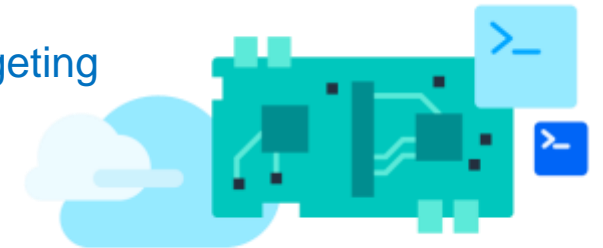
Direct interaction



Cloud-Controlled Speakers  
*Proprietary Multi-Room Music*

Connect your cloud to Alexa using Connected Speaker API skill

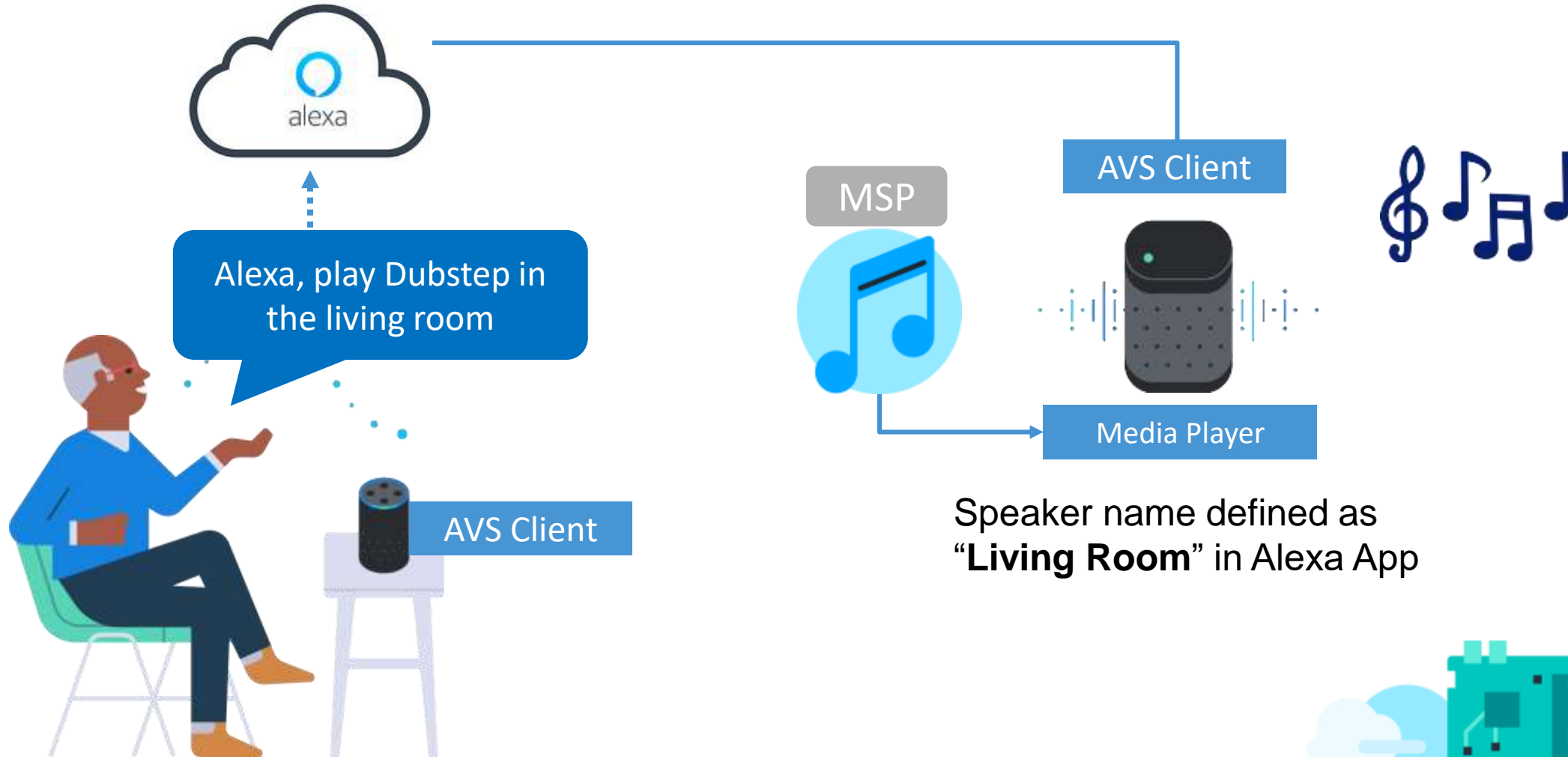
Implicit and explicit targeting



# Typical Device Interaction

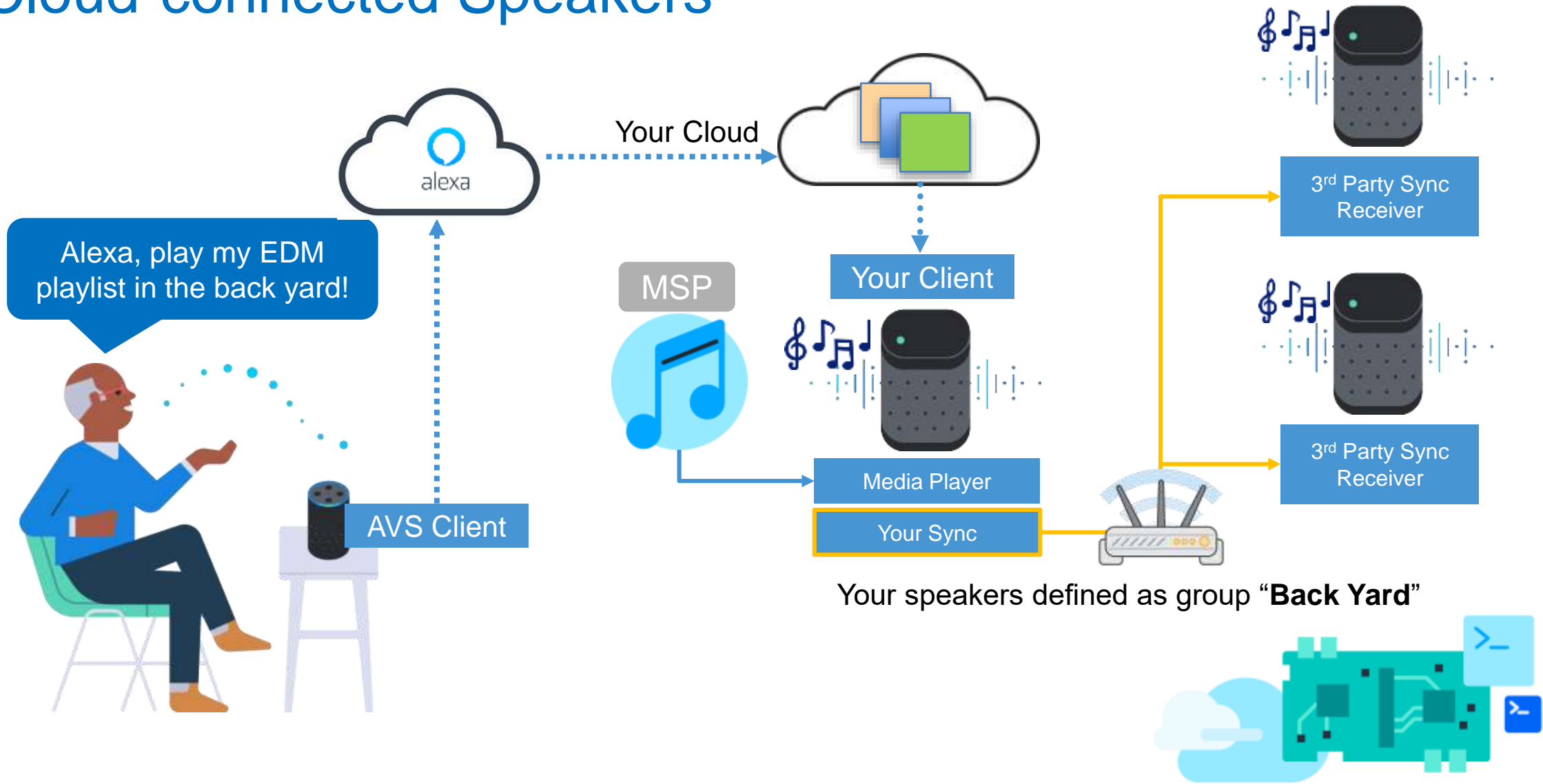


# Alexa Targeted Music Playback





# Cloud-connected Speakers



# Platform Considerations for MRM

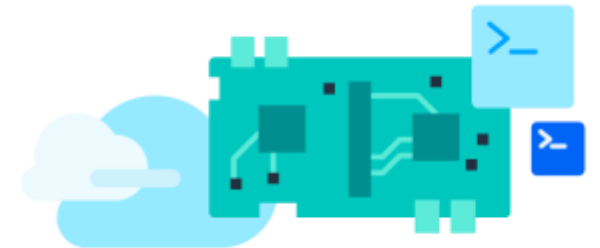
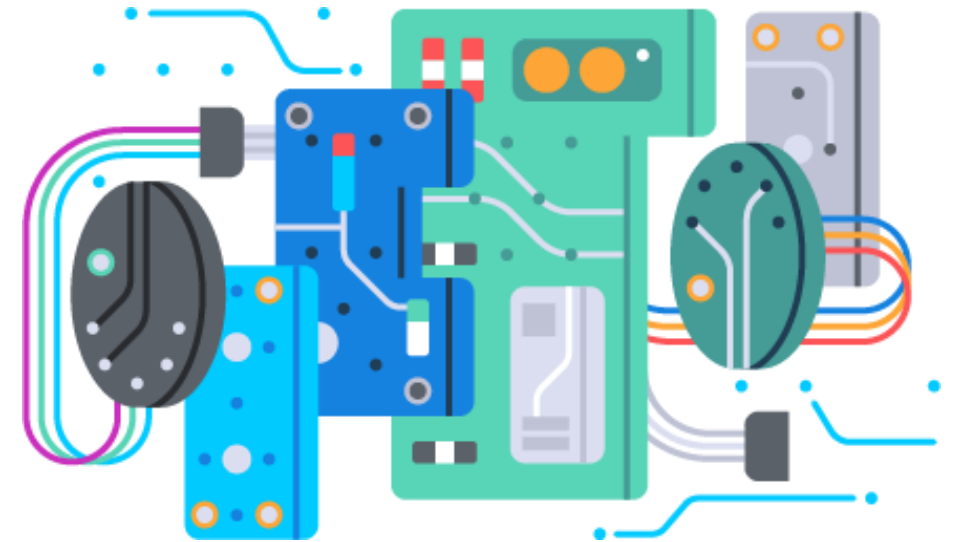
Linux OS

ARM v7+ Processor +450 DMIPS

+40 MB RAM and +30 MB Flash

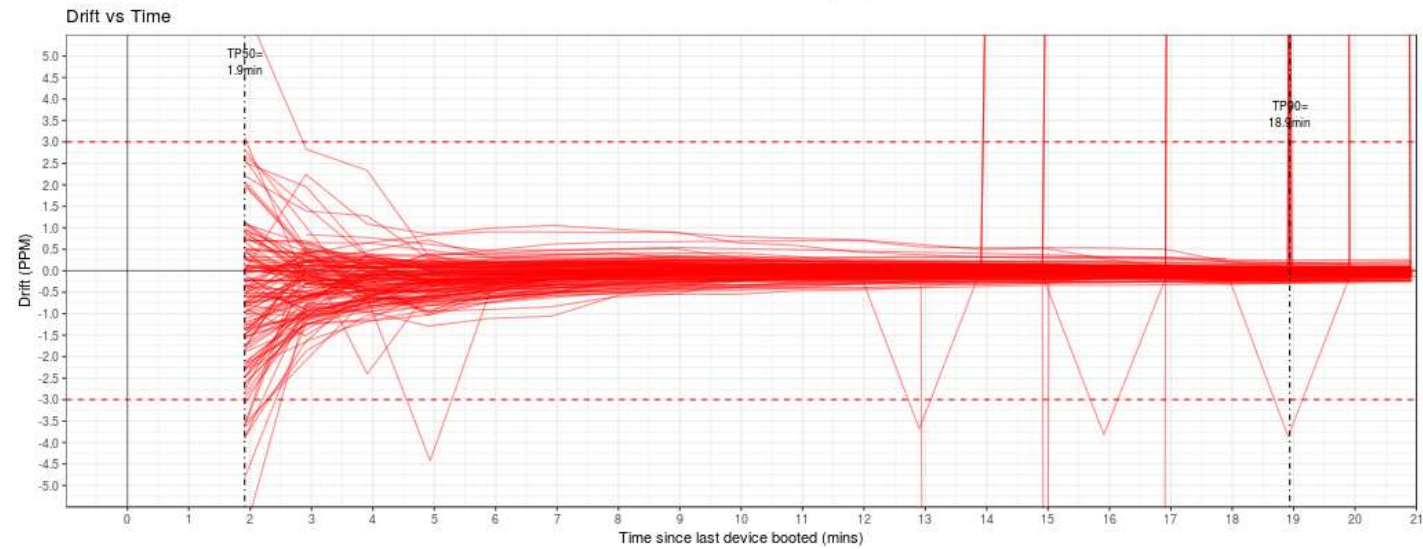
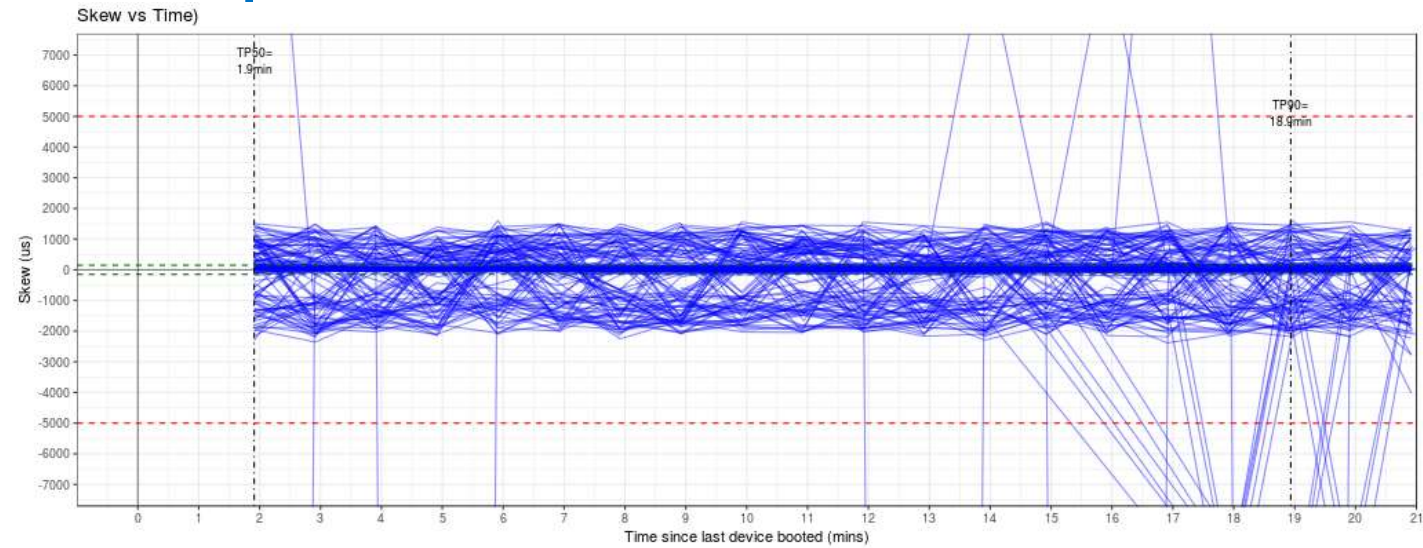
DAC sync'd to host processor clock

Low drift oscillator

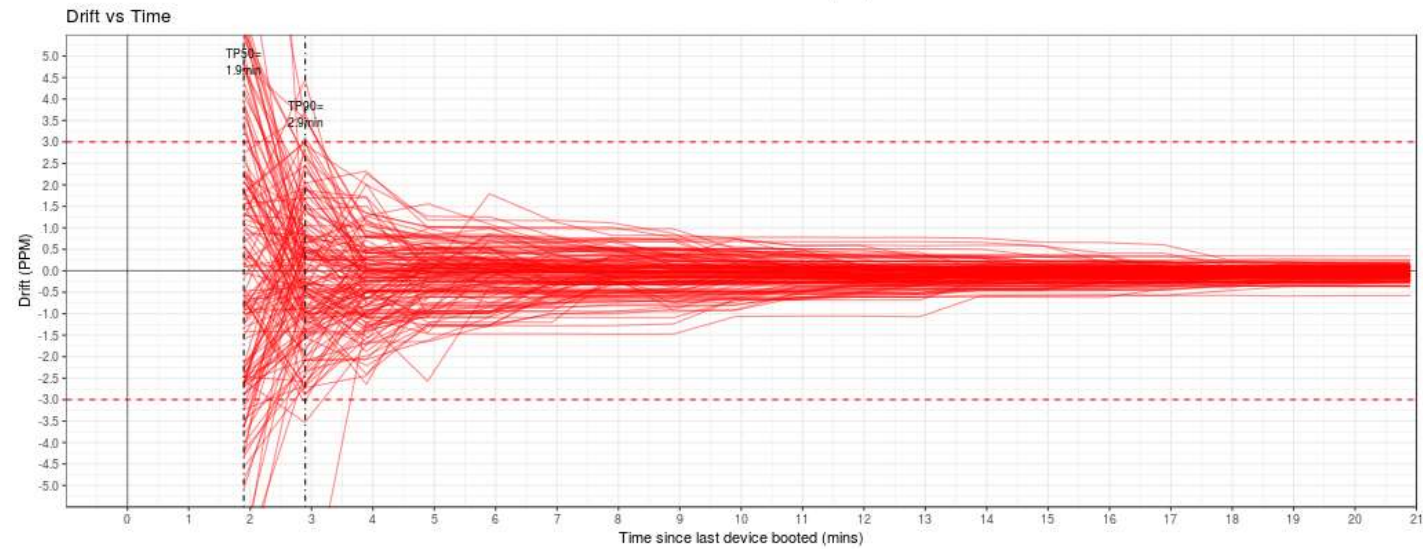
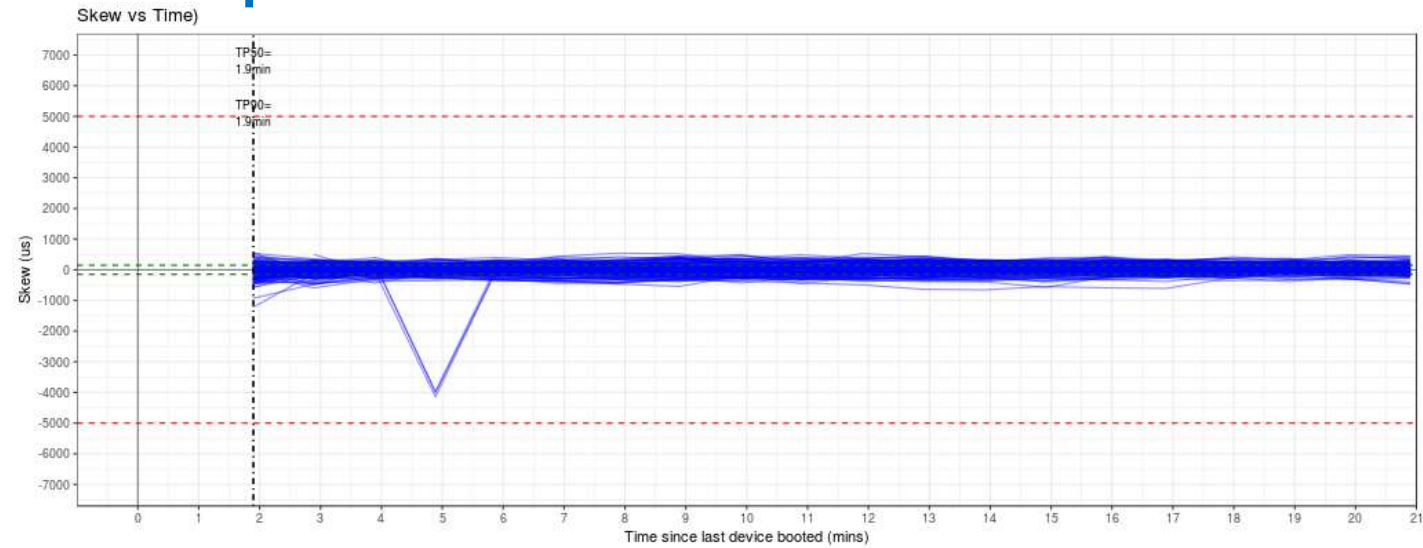




# MRM KPI – Group 2 Fail




# MRM KPI – Group 1 Pass Room Level



# Spotlight – Polk Audio Command Bar

Polk Audio added MRM with an OTA update and customers were delighted!

 [Redacted Name]

★★★★☆ **Works with Alexa multi-room audio**

March 9, 2019

Style: Command Bar w/ Subwoofer | **Verified Purchase**



★★★★☆ **Almost 5 stars!**

January 18, 2019

Style: Command Bar w/ Subwoofer | **Verified Purchase**

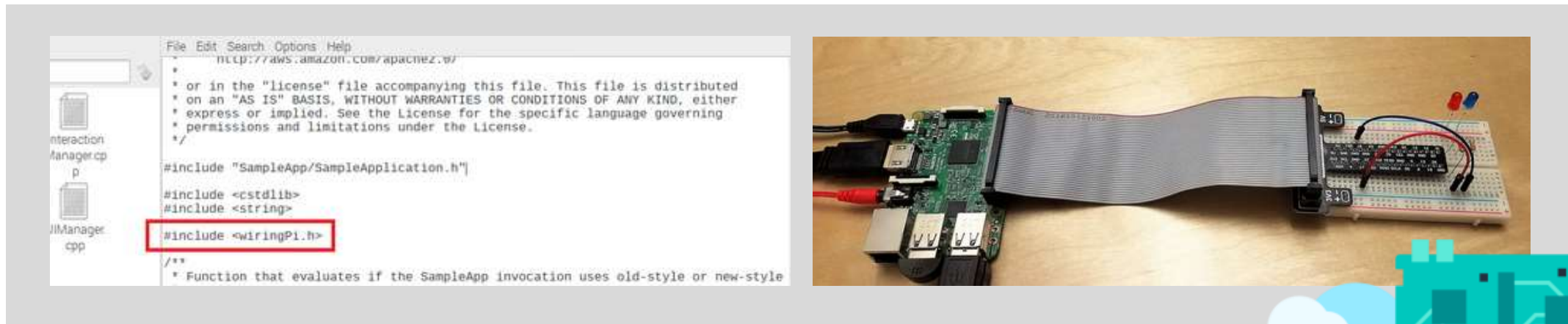
Likes

3. With Alexa like any of your other devices it auto updates and the latest update just allowed this to work on your every wear group now!

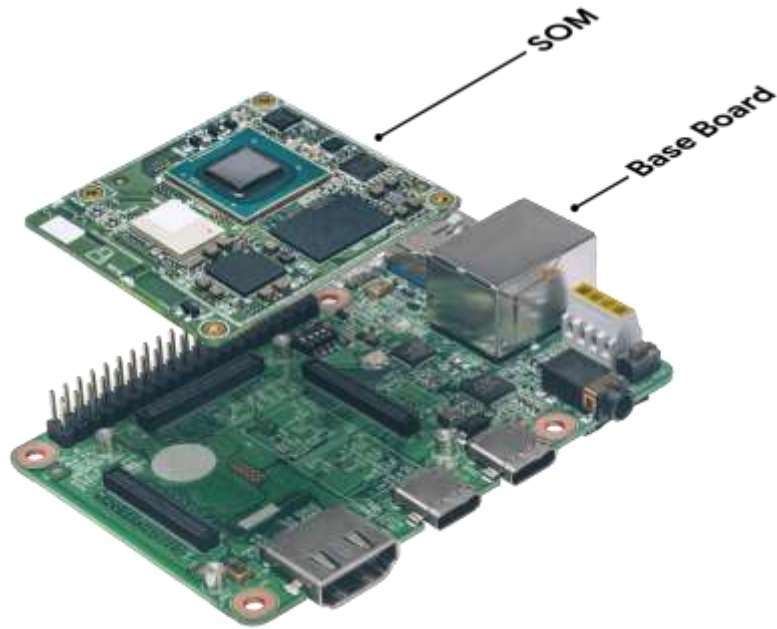


# Next Steps – MRM Links and Resources

- Contact solution providers with MRM experience – [alexandesign.com/SP](http://alexandesign.com/SP)
- Experiment with MRM qualified development kits – [alexandesign.com/devkits](http://alexandesign.com/devkits)
- Ask your Amazon Point of Content for access to MRM resources
- Learn more at [alexandesign.com/speakers](http://alexandesign.com/speakers) and [alexandesign.com/MRM](http://alexandesign.com/MRM)
- New to AVS? Build your first prototype at [alexandesign.com/avstutorials](http://alexandesign.com/avstutorials)



# Google Coral Dev Kit



- Object Recognition
- Facial Recognition
- Gaming & Learning

# TPU + i.MX 8M

- **Full System on Board:** SOC + ML + Connectivity all on the board, running a derivative of Debian Linux (Mendel), so you can run your favorite Linux tools with it.
- **Direct ML Model Support:** TFLite models can be compiled and run on the Coral Dev. Board.
- **Scale from Prototype to Production:** The SOM can be removed from the baseboard, ordered in bulk and integrated into production hardware.





**SECURE CONNECTIONS  
FOR A SMARTER WORLD**