



i.MX 8 SERIES APPLICATIONS PROCESSORS

Powerful control and HMI solutions with optimized machine learning, graphics, vision, video, audio and voice

i.MX 8 SERIES APPLICATIONS PROCESSORS

**FOR ADVANCED GRAPHICS, IMAGING, MACHINE LEARNING,
MACHINE VISION, AUDIO, VOICE AND VIDEO APPLICATIONS**

One of the great strengths of the NXP i.MX 8 applications processor series is the breadth of market coverage – from IoT and consumer electronics, to Industrial Applications and Factory Automation to Automotive infotainment and telematics. The i.MX 8 series of applications processors is a key part of the EdgeVerse™ edge computing platform, built on a foundation of scalability, energy efficiency, machine learning, connectivity and robust security.

Built with advanced media processing capabilities, secure domain partitioning and innovative vision processing, the i.MX 8 series can support a wide array of applications including multiple automotive displays, vehicle to everything (V2X) communications, industrial automation systems, HMI solutions, machine vision, speech recognition and audio/video applications.

The i.MX 8 series provides a feature- and performance-scalable multicore platform that includes single-, dual- and quad-core families based on the Arm® Cortex® architecture including combinations of Cortex-A72 + Cortex-A53, Cortex-A35, Cortex-M4, Cortex M7 and Cortex M33-based processors. The series includes the i.MX 8, i.MX 8M, i.MX 8X and i.MX 8ULP families, many of which are software compatible and supported by Android™ Linux®, QNX, Green Hills, FreeRTOS and other third-party commercial operating systems.



i.MX 8M FAMILY

Higher end, highly scalable design options for machine learning and machine vision at the edge, consumer electronics, advanced audio and voice



i.MX 8XLITE FAMILY

Telematics with V2X acceleration, connectivity and optimized performance for building and industrial control



i.MX 8ULP FAMILY

Flexible heterogeneous domain computing architecture for accelerated graphics and low-power processing



i.MX 8 FAMILY

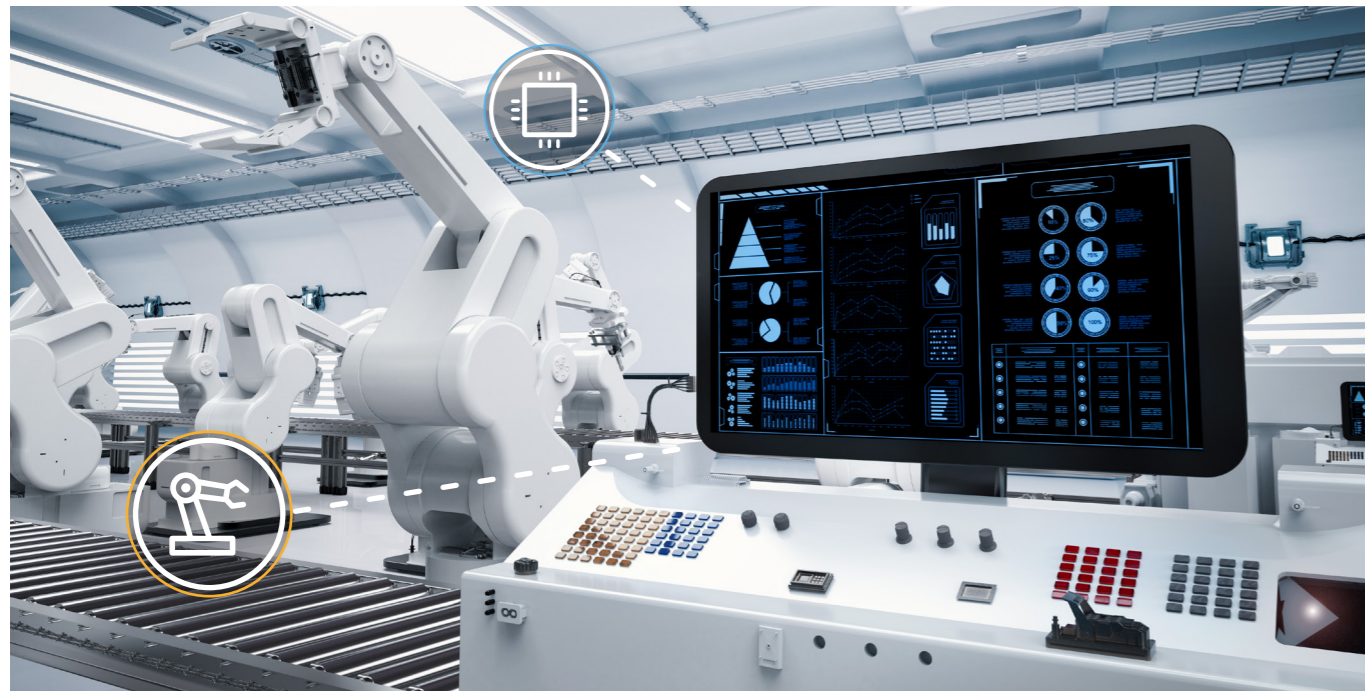
Designed for advanced graphics, vision and high-performance systems



i.MX 8X FAMILY

High-end applications processors ideal for efficient performance for telematics and industrial automation





i.MX 8 SERIES

Performance, power, scalability, security and longevity

The i.MX 8 series builds on NXP's 15-year+ i.MX heritage of delivering leading-edge technology, robust security, advanced software and broad ecosystem support.

Everything in the series is designed to help developers find the right balance of performance and power efficiency while offering solutions that are scalable, feature rich and secure.

High-quality manufacturing and reliability testing of i.MX applications processors result in impressive product longevity at a minimum of 10 to 15 years.



Flexibility and Longevity

- The i.MX 8M families target a wide range of industrial and consumer applications, delivering a combination of high performance and low power based on the Arm Cortex®-A53 processor.
- Built to handle Machine Learning at the edge, across the industrial, consumer and automotive infotainment markets.
- The i.MX 8 and i.MX 8X families share common software and hardware architectures with 70% IP design reuse and pin compatibility.
- Comprehensive i.MX 8 development tools are widely available for evaluation and development using Linux® or Android Board Support Packages (BSP) and other platforms.

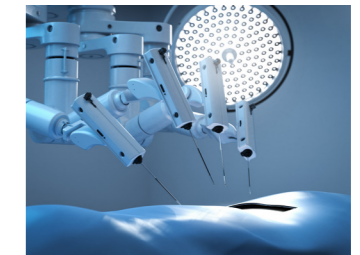
TARGET APPLICATIONS



Smart home IoT



Consumer electronics



Healthcare



Multimedia devices



Streaming audio and video



Voice assist/control



Telematics



Automotive cockpit and cluster



Industrial Automation

TECHNOLOGIES



ADVANCED SECURITY



AI, MACHINE LEARNING AND VISION



HUMAN-MACHINE INTERFACE

i.MX 8M PLUS APPLICATIONS PROCESSOR FAMILY

Dedicated Machine Learning and Vision

The i.MX 8M Plus family focuses on machine learning and vision, advanced multimedia, and industrial automation with high reliability. It is built to meet the needs of Smart Home, Building, City and Industry 4.0 applications.

Key Features



- Powerful quad or dual Arm® Cortex®-A53 processor with an integrated Neural Processing Unit (NPU) operating at up to 2.3 TOPS
- Dual image signal processors (ISP) and two camera inputs for effective advanced vision systems
- The multimedia capabilities include video encode (including h.265) and decode, 3D/2D graphic acceleration, and multiple audio and voice functionalities
- Real-time control with Cortex-M7. Robust control networks supported by dual CAN FD and dual Gigabit Ethernet with Time Sensitive Networking (TSN)
- High industrial reliability with DRAM inline ECC



i.MX 8M APPLICATIONS PROCESSOR FAMILY

Scalable, state-of-the-art audio, voice, vision and video processing

The i.MX 8M family is designed for high-performance computing, industry-leading audio, voice and video applications. The i.MX 8M processors offer up to 4K UltraHD video streaming with pro audio fidelity, voice assistance, machine vision and advanced machine learning capabilities, making them an ideal choice for a wide range of edge computing applications.

Key Features



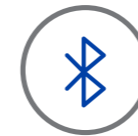
High performance at low power

- Advanced process technology node with much lower leakage than standard technologies
- Scalable power using mobile power architecture
- Single-, dual- or quad-core Arm Cortex-A53 cores up to 1.8 GHz
- Heterogeneous multicore processing with Arm Cortex-M4 running up to 400+ MHz to offload tasks, optimize power and enhance security
- Heterogeneous multicore processing with Arm Cortex-M4 or Cortex-M7 to offload tasks, optimize power and enhance security
- 2.3 TOPS NPU and Cadence® Tensilica® HiFi4 DSP up to 800 MHz



Impressive multimedia performance

- Up to 4K video decoding in h.265, h.264, VP9 with high dynamic range (HDR)
- Up to 1080p60 video encoding (H.264, VP8) using parallel VPU engine to enable video transcode applications (video calling)
- High-performance 3D graphic processing unit (GPU)
- Highest levels of pro audio fidelity with 32-bit @ 384 KHz, up to 32-ch. TDM and DSD512 support
- On-chip ISP supporting two cameras



NXP PMIC and NXP Wi-Fi®/Bluetooth® Solutions

- NXP PMIC and NXP Wi-Fi/Bluetooth drivers integrated into the Wi-Fi/Bluetooth BSP solutions



Multiple high-speed interfaces

- PCIe with L1 low power substrates enabling high-performance connectivity
- Gigabit Ethernet, USB 3.0 and multiple SDIO interfaces
- Display: HDMI 2.0a (up 4K), MIPI-DSI (4 lanes) (720p60)
- Vision: 2 x MIPI-CSI (4-lanes) supporting 1080p30, 720p60 and VGA at 60 fps

i.MX 8M MINI APPLICATIONS PROCESSOR FAMILY

The new HMI: video, voice, touch, machine vision, AI

Part of the EdgeVerse™ portfolio of industry-leading, scalable, embedded processing, security, and software solutions designed to accelerate edge computing, the i.MX 8M Mini is designed for general purpose human machine interface (HMI) solutions enabling, touch, voice, graphics, video, image analytics and vision. Built using advanced 14LPC FinFET process technology, the i.MX 8M Mini family provides more speed and improved power efficiency. With commercial and industrial level qualification, the devices are designed for general purpose industrial and IoT applications.

Key Features



- It features advanced implementation of a quad Arm® Cortex-A53 core, operating at speeds up to 1.6 GHz.
- A general purpose Cortex-M4 400 MHz core processor is integrated for low-power processing.
- The DRAM controller supports 32-bit/16-bit LPDDR4, DDR4, and DDR3L memory.
- A wide range of audio interfaces are available, including I2S, AC97, TDM, and S/PDIF.
- High-speed interfaces for flexible connectivity include:
 - Two USB 2.0 interfaces with PHY
 - Three SDIO interfaces provides boot source, expandable storage, and connectivity options
- PCIe interface with L1 substates for fast wakeup and low-power
 - MIPI-DSI (4-lane) display interface
 - MIPI-CSI (4-lane) camera interface
 - Gigabit Ethernet MAC with Audio Video Bridging (AVB) and IEEE capability

i.MX 8M NANO APPLICATIONS PROCESSOR FAMILY

Scalable, versatile, affordable.

The i.MX 8M Nano family of applications processors provide cost-effective integration and affordable performance for smart, connected, power-efficient devices requiring graphics, vision, voice control, intelligent sensing and general-purpose processing.

The i.MX 8M Nano family includes the i.MX 8M Nano UltraLite the i.MX 8M Nano Lite, and i.MX 8M Nano. Featuring up to 4x Arm® Cortex®-A53 cores and 1x Cortex-M7 core, the i.MX 8M Nano family of applications processors are a pin-compatible, scalable offering to the popular i.MX 8M Mini applications processors. With commercial and industrial level qualification the i.MX 8M Nano family may be used in general purpose industrial and IoT applications.

Key Features



Design once, scale your performance

- Quad-, dual- or single- core Arm® Cortex®-A53 offerings enables scalable processing in a pin-compatible package
- Optional 3D GPU for applications requiring higher levels of graphics performance for HMI
- Cortex-M7 for heterogenous multicore processing to enable MCU-like functions or low power processing
- Pin-compatible package enables you to build one hardware design that supports both the i.MX 8M Nano and i.MX 8M Mini applications processors add performance and features as products require

| Product | i.MX 8M Plus | i.MX 8M Quad / QuadLite | i.MX 8M Mini / Mini Lite | i.MX 8M Nano / Nano Lite | i.MX 8M Nano UltraLite |
|-------------------------|--|---|--|--|--|
| Main CPU | 2 x or 4 x A53 1.8 GHz, 512KB L2 | 2 x or 4 x A53 1.5 GHz, 1MB L2 | 1 x, 2 x or 4 x A53 1.8 GHz, 512KB L2 | 1 x, 2 x or 4 x A53 1.5 GHz, 512KB L2 | 1 x, 2 x or 4 x A53 1.4 GHz, 512KB L2 |
| MCU/DSP | M7 800 MHz, HiFi4 800 MHz | M4 266 MHz | M4 400 MHz | M7 up to 750 MHz | M7 up to 750 MHz |
| DDR | x 32 LPDDR4/DDR4 Inline ECC | x 16 or x 32 LPDDR4/DDR4/DDR3L | x 16 or x 32 LPDDR4/DDR4/DDR3L | x 16 LPDDR4/DDR4/DDR3L | x 16 LPDDR4/DDR4/DDR3L |
| GPU | 2D - GC520L 3D - GC7000 UltraLite (OpenGL® ES 2.1/3.0/3.1, OpenCL™ 1.2, Vulkan) | 3D - GC7000Lite (4 shaders) (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) | - |
| AI/ML | ML Accel 2+TOPS | A53, GPU (OpenCL) | A53 | A53, GPU (OpenCL) | A53 |
| SRAM | 768KiB + 32KiB | 128KiB + 32KiB | 256KiB + 32KiB | 512KiB + 32KiB | 512KiB + 32KiB |
| Camera | 2 x MIPI CSI (4-lane), 2x ISP (3-exposure HDR) | 2 x MIPI CSI (4-lane) | 1 x MIPI CSI (4-lane) | 1 x MIPI CSI (4-lane) | 1 x MIPI CSI (4-lane) |
| Display | HDMI 2.0a Tx (eARC), MIPI DSI (4-lane), 1 x LVDS (8-lane) | HDMI 2.0a Tx, MIPI DSI (4-lane), eDP | 1 x MIPI DSI (4-lane) | 1 x MIPI DSI (4-lane) | - |
| HDR | None | HDR10, HLG, Dolby Vision | None | None | None |
| Video Decode | 1080p60 H.265, H.264, VP9, VP8 | 4Kp60 HEVC, VP9, 4Kp30 H.264, legacy codecs | 1080p60 HEVC, H.264, VP9, VP8 | None | None |
| Video Encode | 1080p60 H.265, H.264 | No HW acceleration | 1080p60 H.264, VP8 | No HW acceleration | No HW acceleration |
| Audio | 18 x I2S TDM (32b @384 KHz), ASRC, 8ch PDM DMIC input), S/PDIF Tx+Rx | 20 x I2S TDM (32b @384 KHz), S/PDIF Tx+Rx | 20 x I2S TDM (32b @384 KHz), 8ch PDM DMIC input), S/PDIF Tx+Rx | 12 x I2S TDM (32b @384 KHz), ASRC, 8ch PDM DMIC input), S/PDIF Tx+Rx | 12 x I2S TDM (32b @384 KHz), ASRC, 8ch PDM DMIC input), S/PDIF Tx+Rx |
| Expansion I/O | 2 x USB 3.0 Type C, 1 x PCIe Gen 3 | 2 x USB3.0, 2 x PCIe Gen 2 | 2 x USB2.0, 1 x PCIe Gen 2 | 1 x USB2.0 | 1 x USB2.0 |
| Network, Storage | 1 x ENET, 1 x ENET with TSN, 2 x CAN-FD, 3 x SD/eMMC, MLC/SLC NAND | 1 x ENET, 2 x SD/eMMC, MLC/SLC NAND | 1 x ENET, 3 x SD/eMMC, MLC/SLC NAND | 1 x ENET, 3 x SD/eMMC, MLC/SLC NAND | 1 x ENET, 3 x SD/eMMC, MLC/SLC NAND |
| Package | 15 x 15 mm, 0.5p (depopulated array) | 17 x 17 mm, 0.65p (depopulated array) | 14 x 14 mm, 0.5p (depopulated array) | 14 x 14 mm, 0.5p (depopulated array) | 11 x 11 mm, 0.5p (depopulated array) |

i.MX 8XLITE APPLICATIONS PROCESSOR FAMILY

High reliability, low power consumption and efficient performance

The i.MX 8XLite family combines high-performance processing capabilities from the i.MX 8X processor with vehicle-to-everything (V2X) acceleration for next-generation telematics and industrial IoT applications. Extending the scalable cost-performance range of the i.MX 8 series, the i.MX 8XLite family includes the architecture and common subsystems of the higher-end i.MX 8X family, as well as high levels of software reuse. High reliability, low power consumption and efficient performance for next generation designs.

Supported by an expansive software ecosystem and dedicated hardware security modules, i.MX 8XLite processors are a good fit for vehicle telematics solutions, V2X and road infrastructure connectivity, industrial equipment and building control. OrangeBox Automotive Connectivity Domain Controller Development Platform is built upon an i.MX 8XLite dual core SoC. Using the 8XLite family as a communications platform, Tier 1 OEMs can combine telematics and V2X functions into a single integrated solution, reducing overall BOM cost and design complexity.

The i.MX 8XLite is available as a single- or dual-core device containing 1-2 Arm® Cortex®-A35 cores plus an Arm Cortex-M4F core for real-time processing, providing a cost-effective integration path with minimal BOM cost for applications that combine telematics and V2X.

| Feature | i.MX 8DualXLite | i.MX 8SoloXLite |
|-----------------|------------------------|------------------------|
| Arm® Core | 2 x Cortex-A35 | 1 x Cortex-A35 |
| Arm® Core | 1 x Cortex-M4F | 1 x Cortex-M4F |
| DDR | LPDDR4, DDR3L with ECC | LPDDR4, DDR3L with ECC |
| V2X Accelerator | Yes | Yes |
| CAN | 3 x CAN-FD | 3 x CAN-FD |
| ENET | 2 x Gb AVB + TSN | 2 x Gb AVB + TSN |
| USB | 2 x USB2 OTG with PHY | 2 x USB2 OTG with PHY |

Key Features



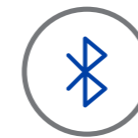
Optimized low-power performance

- Up to two 1.2 GHz Arm Cortex-A35 processors
- Multiple systems with one processor
- Optimized power efficiency with Arm Cortex-M4 core for real-time processing



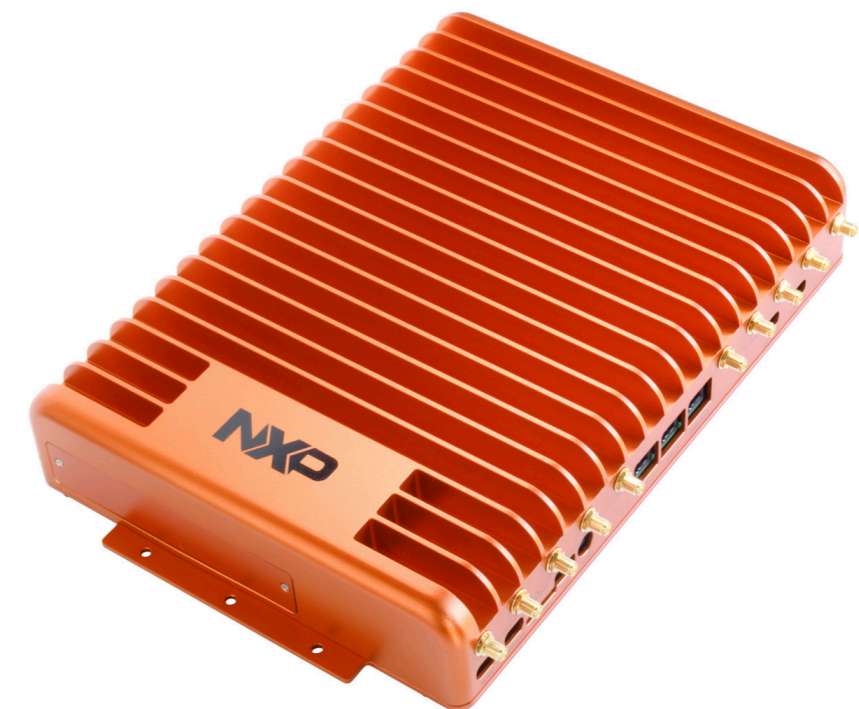
Flexible memory and high-speed interfaces

- Supports multiple DDR interfaces, such as LPDDR4 and DDR3L with Inline ECC support
- Fast boot from SPI NOR flash, Quad SPI
- Support for SD 3.0, eMMC 5.1 and RAW NAND
- Gigabit Ethernet TSN +AVB, USB 3.0 and CAN-FD



NXP PMIC, Wi-Fi®/Bluetooth®, and V2X solutions

- Custom-fit NXP PF7100 PMIC
- NXP Wi-Fi/Bluetooth drivers integrated into BSP
- V2X companion board available for EVK



OrangeBox Automotive CDC Development Platform

i.MX 8ULP APPLICATIONS PROCESSOR FAMILY

Flexible, accelerated processing with ultra-low power consumption and advanced security

The i.MX 8ULP family implements our innovative Energy Flex technology and the EdgeLock® secure enclave. It features a heterogeneous domain computing (HDC) architecture that supports independent applications processor and real-time domains with a separate low-power multimedia domain. By separating these domains (i.e., Power, bus, and clocks), the HDC architecture's flexibility significantly enhances overall power efficiency. Additional power-saving design techniques and unique features of NXP's implementation using 28 nm FD-SOI process technology further extend battery life, a valued feature for today's consumer and industrial wearable and other portable devices.

The i.MX 8ULP family features NXP's advanced implementation of the Arm® Cortex®-A35 processor and an Arm Cortex-M33 core. Purposefully designed for a more intuitive, secure and useful edge, the processors integrate Cadence® Tensilica® HiFi4 and Fusion DSPs for low-power AI/ML, voice and sensor hub processing. The i.MX 8ULP applications processor family is supported by NXP's companion power management IC (PMIC). The processors target a wide range of consumer, industrial edge and IoT applications:



Smart home controls



Wearable and portable devices



Building automation



Access controllers



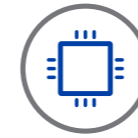
EV charging



Systems control

| Feature | i.MX 8ULP Dual | i.MX 8ULP Solo |
|-----------|--|--|
| Arm® Core | 2 x Cortex -A35 | 1 x Cortex -A35 |
| MCU | 1 x Cortex M33 | 1 x Cortex M33 |
| DSP | 1 x Tensilica® HiFi 4 1 x Tensilica® Fusion | 1 x Tensilica® HiFi 4 1 x Tensilica® Fusion |
| DDR | LPDDR3, LPDDR4/4x | LPDDR3, LPDDR4/4x |
| GPU | 3D GPU includes: Open GL® ES 3.1, OpenCL™, Vulkan® | 3D GPU includes: Open GL® ES 3.1, OpenCL™, Vulkan® |
| GPU | 2D GPU | 2D GPU |
| Display | 1 x MIPI DSI (4-lane) with PHY | 1 x MIPI DSI (4-lane) with PHY |
| CAN | 1 x CAN-FD | 1 x CAN-FD |
| ENET | 1 x Ethernet | 1 x Ethernet |
| USB | 2 x USB2 OTG with PHY | 2 x USB2 OTG with PHY |

Key Features



Arm Cortex-A35

- The Arm Cortex-A35 core enhances the capabilities of portable, connected devices by fulfilling the ever-increasing power efficiency needs of operating systems and applications.
- Heterogeneous domain computing architecture



EdgeLock® secure enclave

- The i.MX 8ULP processors feature NXP's EdgeLock™ secure enclave, an on-die security subsystem that eases the complexity of implementing robust, device-wide security intelligence through autonomous management of critical security functions such as root of trust, run-time attestation, trust provisioning, secure boot, key management and cryptographic services.



Multi-level memory system

- The Cortex-A35 processor's multi-level memory system is based on the L1 instruction and data caches, L2 cache, and internal and external memory.
- The processor supports many types of external memory devices including LPDDR4, LPDDR4x, up to OctalSPI and managed NAND including eMMC rev. 5.0.



Flexible Display interface

- MIPI DSI and parallel RGB interfaces
- MIPI CSI 2-lane interface
- Camera interface
- Interface options: USB on-the-go, 12-bit ADC/DACs, I2S audio, UART, I2C and more.



i.MX 8 FAMILY WITH DUAL A72 CORES, DUAL GPUs

High performance up to 1.6 GHz with dual Arm Cortex-A72 cores and dual GPUs

The i.MX 8 family supports advanced media processing and can run processing-intensive machine learning algorithms.

Built with powerful media processing capabilities, secure domain partitioning and innovative vision processing, the i.MX 8 applications processor family is designed to revolutionize the development of multiple-display automotive applications, industrial automation systems, vision applications, human-machine interfaces (HMI) and single-board computers.



Advanced media processing



Secure domain partitioning



Dedicated vision processing engine

| Feature | i.MX 8QuadMax | i.MX 8QuadPlus |
|-----------|--------------------|---------------------|
| Arm® Core | 2 x Cortex-A72 | 1 x Cortex-A72 |
| Arm® Core | 4 x Cortex-A53 | 4 x Cortex-A53 |
| Arm® Core | 2 x Cortex-M4F | 2 x Cortex-M4F |
| DSP Core | Tensilica® HiFi 4 | Tensilica HiFi 4 |
| DDR | LPDDR4 | LPDDR4 |
| GPU | 2 x GC7000XSVX | 2 x GC7000Lite/XSVX |
| PCIe® 3.0 | 1 x PCIe (2-lane)* | 1 x PCIe (1-lane)* |

* 2-lane PCIe 3.0 capable and can act as 2 x 1-lane PCIe

Key Features



Multiple systems, one processor

- Build diverse platforms enabling hypervisor options to drive multiple operating systems on a single i.MX 8 processor
- Create independent GPU displays and functionality with resource partitioning
- Deliver advanced, end-to-end security solutions



Multi-display and multi-domain functionality

- Drive up to four independent screens or a single 4K screen
- Deliver rich graphics and faster deployment with a split media architecture
- Offload real-time tasks by using the dual Arm Cortex-M4 cores



Enable a new world of seamless machine interfaces

- Add multi-domain voice recognition and audio processing
- Create advanced vision-based HMI systems including gesture and object recognition



i.MX 8X APPLICATIONS PROCESSOR FAMILY

High reliability, low power consumption and efficient performance

i.MX 8X applications processors offer common subsystems and an advanced architecture from the higher end of the i.MX 8 family. This functionality gives designers an unmatched range of cost-performance scaling with pin-compatible device options along with an exceptional level of software reuse to reduce development cost.

High-level integration supports a wide range of graphics, video, image processing, audio and voice functions.

The i.MX 8X family includes the i.MX 8QuadXPlus and i.MX 8DualXPlus processors.

| Feature | i.MX 8DualXPlus/ i.MX 8QuadXPlus |
|---------------|--|
| Arm® Core | 2 x Cortex-A35 (i.MX 8DualXPlus) 4 x Cortex-A35 (i.MX 8QuadXPlus) |
| Arm® Core | 1 x Cortex-M4F |
| DSP Core | Tensilica® HiFi 4 |
| DDR interface | 32-bit DDR3L (ECC option)/ 32-bit LPDDR4 (no ECC) |
| GPU | 1 x GC7000Lite Performance Optimized |
| VPU | 4k h.265 dec, 1080p h.264 enc/dec |
| Ethernet | 2 x Gigabit with AVB |
| USB with PHY | 1 x USB 3.0 (can be used as USB 2.0) 1 x USB 2.0 |

Key Features



Optimized low-power performance

- Up to four 1.2 GHz Arm Cortex-A35 processors
- Multiple systems with one processor
- Optimized power efficiency with Arm Cortex-M4 core for real-time processing



Advanced integration

- Multi-domain voice recognition
- Up to three screens of independent content
- Flexible memory options
- Flexible audio partitioning between the radio and applications processor



Safeguard mission-critical displays and control functions

- Increased system accuracy
- Displays stay up and running and correct
- Advanced programmable security



How to Reach Us:

Home Page: www.nxp.com

Web Support: www.nxp.com/support

USA/Europe or Locations Not Listed:

NXP Semiconductors USA, Inc.

Technical Information Center, EL516

2100 East Elliot Road

Tempe, Arizona 85284

+1-800-521-6274 or +1-480-768-2130

www.nxp.com/support

Europe, Middle East and Africa:

NXP Semiconductors Germany GmbH

Technical Information Center

Schatzbogen 7

81829 Muenchen, Germany

+44 1296 380 456 (English)

+46 8 52200080 (English)

+49 89 92103 599 (German)

+33 1 69 35 48 48 (French)

www.nxp.com/support

Japan:

NXP Japan Ltd.

Yebisu Garden Place Tower 24F

4-20-3 Ebisu, Shibuya-ku,

Tokyo 150-6024, Japan

0120-950-032 (Domestic Toll Free)

www.nxp.com/jp/support/

Asia/Pacific:

NXP Semiconductors Hong Kong Ltd.

Technical Information Center

2 Dai King Street

Tai Po Industrial Estate

Tai Po, N.T., Hong Kong

+800 2666 8080

support.asia@nxp.com

i.MX 8 Series:

For more information please visit

www.nxp.com/imx8

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