Powering the next generation of portable HMI, ML/AI, voice and audio applications

i.MX RT500 and i.MX RT600 Crossover MCUs

The i.MX RT500 and i.MX RT600 families of secure and embedded crossover MCUs pair a high-performance DSP core with the real-time functionality of an Arm® Cortex®-M33 core to help unlock the potential of IoT edge applications.
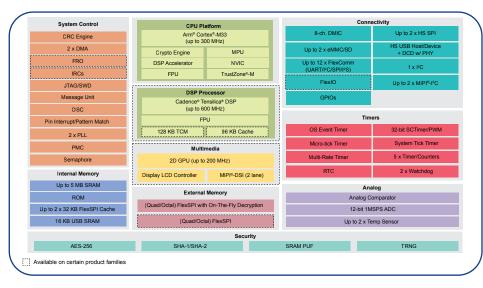
THE CROSSOVER MCU MARKET

Drawing on its expertise as a leading supplier of both applications processors and microcontrollers (MCUs), NXP's i.MX RT500 and i.MX RT600 MCUs offer the ideal balance of power optimization and high-performance capabilities.

▸ High-performance, real-time processing
▸ Low power
▸ Rich integration
▸ Advanced security

TARGET APPLICATIONS

▸ Wearables
▸ Smart home controls
▸ Personal health and fitness
▸ Handheld products
▸ Hearables
▸ Audio subsystem
▸ ML-based edge applications
▸ Voice-enabled IoT devices

i.MX RT500 AND i.MX RT600 CROSSOVER MCUs BLOCK DIAGRAM

System Control
- CRC Engine
- 2 x DMA
- FRO
- IRCs
- JTAG/SWD
- Message Unit
- OSC
- Pin Interrupt/Pattern Match
- 2 x PLL
- PMC
- Semaphore

Internal Memory
- Up to 5 MB SRAM
- ROM
- Up to 2 x 32 KB FlexSPI Cache
- 16 KB USB SRAM

CPU Platform
Arm® Cortex®-M33 (up to 300 MHz)
- Crypto Engine | MPU
- DSP Accelerator | NVIC
- FPU | TrustZone®-M

DSP Processor
Cadence® Tensilica® DSP (up to 600 MHz)
- FPU
- 128 KB TCM | 96 KB Cache

Multimedia
- 2D GPU (up to 200 MHz)
- Display LCD Controller | MIPI®-DSI (2 lane)

External Memory
- (Quad/Octal) FlexSPI with On-The-Fly Decryption
- (Quad/Octal) FlexSPI

Connectivity
- 8-ch. DMIC | Up to 2 x HS SPI
- Up to 2 x eMMC/SD | HS USB Host/Device + DCD w/ PHY
- Up to 12 x FlexComm (UART/I²C/SPI/I²S) | 1 x I²C
- FlexIO | Up to 2 x MIPI®-I²C
- GPIOs

Timers
- OS Event Timer | 32-bit SCTimer/PWM
- Micro-tick Timer | System Tick Timer
- Multi-Rate Timer | 5 x Timer/Counters
- RTC | 2 x Watchdog

Analog
- Analog Comparator
- 12-bit 1MSPS ADC
- Up to 2 x Temp Sensor

Security
- AES-256 | SHA-1/SHA-2 | SRAM PUF | TRNG

◌ Available on certain product families

MCU + DSP = UNLIMITED CAPABILITIES

Take advantage of the integrated DSP technology and enhance your design with audio features, voice capabilities and sensor processing, all while maintaining low power consumption.

The Cadence® Tensilica® HiFi 4 and Fusion DSPs provide the right level of high performance audio digital signal processing power and include algorithm-specific operations for a fully programmable approach that provides maximum flexibility. All Cadence Tensilica DSPs support multiple existing and developing standards, as well as specific algorithms.

VIVID GRAPHICS

The i.MX RT500 family modernizes HMI for the low-power market by providing vivid graphics with its integrated 2D GPU.

Graphics development is made easy with NXP software support, combined with an extensive list of partner solutions.

SOFTWARE AND TOOLS

i.MX RT500 and i.MX RT600 MCUs are supported by robust enablement, including a comprehensive offering of software and evaluation kits, to reduce development effort and speed time-to-market. Also, enjoy the ability to expand upon the feature-rich EVKs with compatible Arduino™ hardware shields.

Toolchains

▸ MCUXpresso software and tools
▸ IAR Embedded Workbench® IDE
▸ Keil® IDE
▸ Cadence Tensilica Xplorer IDE

Software

▸ MCUXpresso SDK with Amazon FreeRTOS™
▸ Cadence Tensilica Xplorer SDK
▸ NXP eIQ™ Machine Learning Software
  – TensorFlow Lite inference engine
  – Arm CMSIS-NN kernels
  – Glow neural network compiler

Libraries and Codecs

Libraries and codecs (binary form) are distributed and licensed for customer production use on specific NXP devices.

The MCUXpresso SDK for i.MX RT500 and i.MX RT600 MCUs contain the following libraries and codec binaries and docs:

▸ Xtensa Audio Framework (XAF)
▸ NatureDSP Library
▸ CMSIS DSP Library (Arm Cortex-M33)
▸ RPMsg Lite
▸ AAC decoder
▸ MP3 decoder
▸ Opus codec (encoder/decoder)
▸ SRC/ASRC
▸ SBC decoder
▸ SBC encoder
▸ Ogg/Vorbis decoder (i.MX RT600 only)

i.MX RT500 and i.MX RT600 MCU FEATURES

Feature	i.MX RT500	i.MX RT600
Core/Speed	Arm Cortex-M33 @ 200 MHz + Cadence Tensilica Fusion F1 DSP* @ 200 MHz	Arm Cortex-M33 @ 300 MHz + Cadence Tensilica HiFi 4 DSP @ 600 MHz
Cache	2 x 32 KB (FlexSPI)	32 KB (FlexSPI), 96 KB (DSP)
SRAM	Up to 5 MB	4.5 MB
Quad/Octal SPI HyperBus	2 x Dual Channel, on-the-fly decryption (on 1 x FlexSPI)	1 x Dual Channel, on-the-fly decryption
SDIO	2 x eMMC 5.0/SD 3.0	2 x eMMC 5.0/SD 3.0
USB with PHY	1 x HS/FS	1 x HS/FS
Graphics*	2D GPU with Vector Graphics Acceleration	-
CSI	8/10/16-bit Parallel (FlexIO)	-
LCD	8/10/16/18/24-bit Parallel (FlexIO) + LCD Interface + MIPI DSI	-
Security	AES-256, SHA, Secure Boot, SRAM PUF, TRNG	AES-256, SHA, Secure Boot, SRAM PUF, TRNG
UART/SPI/I²C/I³C/I²S/FlexIO	Up to 12 x FlexComm (config. as I²C/UART/SPI/I²S) + 1 x FlexIO + 2 x HS SPI + 2 x I³C + 1 x I²C	Up to 8 x FlexComm (config. as I²C/UART/SPI/I²S) + 1 x HS SPI + 1 x I³C + 1 x I²C
I²S/SPDIF/MQS/ASRC	X8	X8
ADC	1M sample/s	1M sample/s
Analog Comparator	1	1
PWM	10 GP/PWM outputs + 8 GP inputs	10 GP/PWM outputs + 8 GP inputs
DMIC	8-ch.	8-ch.
GP Timer/WDOG	5/2	5/2
GPIOs	Up to 136	Up to 147
Packages	249 FOWLP	249 FOWLP, 176 BGA, 114 CSP
Temperature (Tj)	Commercial: -20°C to 70°C	Commercial: -20°C to 70°C

*Product variants without integrated DSP and/or graphics are also available.

i.MX RT500 and i.MX RT600 EVALUATION KIT FEATURES

Features	i.MX RT500 EVK	i.MX RT600 EVK
Part Number	MIMXRT595-EVK	MIMXRT685-EVK
Processor	MIMXRT595SFFOB	MIMXRT685SFVKB
Memory	• 512 MB Macronix Octal SPI Flash • 4.5 MB AP memory PSRAM • 16 GB SanDisk eMMC	• 512 MB Macronix Octal SPI Flash • 4.5 MB AP memory PSRAM
Display	MIPI-DSI connector	N/A
Audio	• DMIC header • Dual knowles SPH0641lM4H digital microphone • Stereo audio codec with audio line in/out • Dual-class D amplifiers with speaker connectors	• DMIC header • Dual knowles SPH0641lM4H digital microphone • Stereo audio codec with audio line in/out • Dual-class D amplifiers with speaker connectors
Connectivity	• HS/FS USB port with micro-A/B connector • SD card slot	• HS/FS USB port with micro-A/B connector • SD card slot
Debug	• 10-pin and 20-pin JTAG/SWD connectors • On-board debug probe, with VCOM and CMSIS-DAP or J-link firmware options	• 10-pin and 20-pin JTAG/SWD connectors • On-board debug probe, with VCOM and CMSIS-DAP or J-link firmware options
Sensor	• 6-axis e-compass sensor • NXP FXOS8700CQ	• 6-axis e-compass sensor • NXP FXOS8700CQ
Display	• RK055HDMIPI4M* (MIPI I/F) - 5.5", 720 x 1280 • G1120B0MIPI* (MIPI I/F) -1.2", 390 x 390 • MIKROE-2406** (FlexIO I/F) - 5", 800 x 480, Capacitive Touch	N/A

* Purchased separately from NXP
** Purchased separately from third party