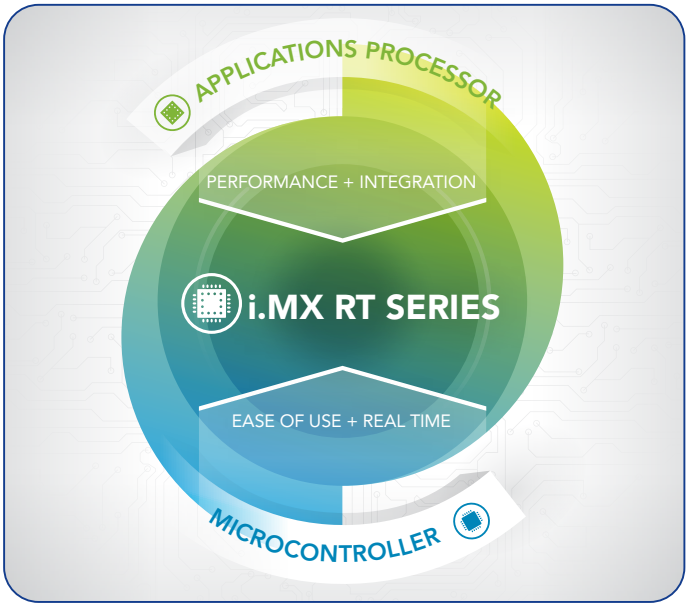
Delivering Processor Capabilities at MCU Prices

i.MX RT Series of Crossover MCUs

USHERING IN THE GHZ MCU ERA

NXP's crossover processors and MCUs marry the simplicity of MCUs with the complexity of applications processors into a hybrid device designed to address the growing consumer demand for enhanced user experiences in smart, secure, high-performance products. Included in this new class of product is the i.MX RT series of crossover MCUs that combines unprecedented performance with reliability and high levels of integration and security to propel industrial, IoT and automotive applications.



PORTFOLIO HIGHLIGHTS

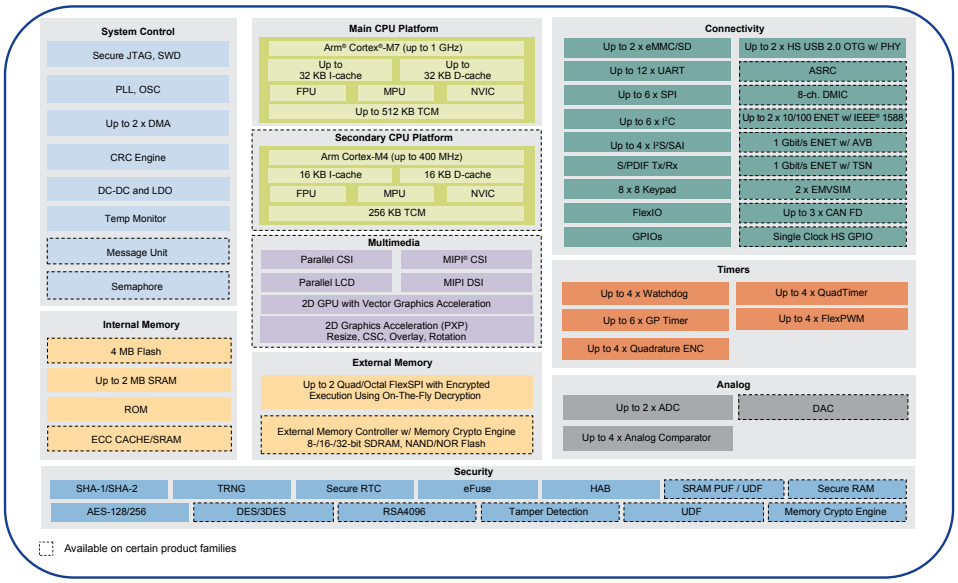
- High-performing Arm® Cortex®-M based device
  - Up to 6468 total CoreMarks with Cortex-M7 @ 1 GHz + Cortex-M4 @ 400 MHz
- Real-time, low-latency response
  - Up to 2 MB of SRAM
    - 512 KB of TCM with ECC for Cortex-M7
    - 256 KB of TCM with ECC for Cortex-M4
  - Fast real-time response with latency as low as 12 ns
- Low-power operation
  - Low dynamic power with integrated DC-DC converter
  - Low-power run modes at 24 MHz
- Highly integrated
  - Advanced multimedia for GUI and enhanced HMI
- Extensive memory interface options
  - Quad/Octal SPI and HyperFlash™/RAM, SDRAM, NAND Flash, NOR Flash, SD/eMMC
- Security
  - Hardware protected keys for secure boot
  - AES engine for data encryption
  - On-the-fly decryption for execute-in-place (XIP) from Quad/Octal SPI/HyperFlash

Feature	i.MX RT1010	i.MX RT1015	i.MX RT1020	i.MX RT1050	i.MX RT1060/RT1064	i.MX RT1170
Core/Speed	Cortex-M7 @ 500 MHz	Cortex-M7 @ 500 MHz	Cortex-M7 @ 500 MHz	Cortex-M7 @ 600 MHz	Cortex-M7 @ 600 MHz	Cortex-M7 @ 1GHz, Cortex-M4 @ 400 MHz
Cache	16 KB-I, 8 KB-D	16 KB-I, 16 KB-D	16 KB-I, 16 KB-D	32 KB-I, 32 KB-D	32 KB-I, 32 KB-D	32 KB-I, 32 KB-D
TCM	Up to 128 KB	Up to 128 KB	Up to 256 KB	Up to 512 KB	Up to 512 KB	Up to 512 KB
On-chip RAM	128 KB	128 KB	256 KB	512 KB	1 MB	2 MB
On-chip flash	-	-	-	-	Up to 4 MB	-
External memory	-	-	8-/16-bit interface for SDRAM, SRAM, NOR, NAND	8-/16-bit interface for SDRAM, SRAM, NOR, NAND	8-/16-bit interface for SDRAM, SRAM, NOR, NAND	8-/16-/32-bit interface for SDRAM, SRAM, NOR, NAND
Quad/Octal SPI/ HyperBus™	Dual-channel/ 8-bit	Dual-channel/ 8-bit	Dual-channel/ 8-bit	Dual-channel/ 8-bit	Up to 2 x dual-channel/ 8-bit	1 x dual-channel/8-bit 1 x dual-channel/ 16-bit
SDIO	-	-	SD 3.0/eMMC 4.5 x 2	SD 3.0/eMMC 4.5 x 2	SD 3.0/eMMC 4.5 x 2	SD 3.0/eMMC 5.0 x 2
Ethernet	-	-	10/100 Mbit/s x 1 w/ IEEE® 1588	10/100 Mbit/s x 1 w/ IEEE 1588	10/100 Mbit/s x 2 w/ IEEE 1588	1Gbit/s w/ AVB + 1Gbit/s w/ TSN + 10/100 Mbit/s w/ IEEE 1588
USB with PHY	OTG, HS/FS x 1	OTG, HS/FS x 1	OTG, HS/FS x 1	OTG, HS/FS x 2	OTG, HS/FS x 2	OTG, HS/FS x 2
CAN	-	-	FlexCAN x 2	FlexCAN x 2	FlexCAN x 2 + CAN FD x 1	CAN FD x 3
Graphics	-	-	-	PxP for 2D acceleration	PxP for 2D acceleration	PxP for 2D acceleration, 2D GPU with vector graphics acceleration
CSI	-	-	-	8-/10-/16-bit parallel	8-/10-/16-bit parallel	8-/10-/16- bit parallel, 2-lane MIPI CSI
LCD	-	-	-	8-/16-/18-/24-bit parallel	8-/16-/18-/24-bit parallel	8-/16-/18-/24-bit parallel, 2-lane MIPI DSI
Security	TRNG, AES-128, SHA, Secure Boot	TRNG, AES-128, SHA, Secure Boot	TRNG, AES-128, SHA, Secure Boot	TRNG, AES-128, SHA, Secure Boot	TRNG, AES-128, SHA, Secure Boot	TRNG,AES-128/256, SHA, Secure Boot, RSA4096, DES/3DES, Tamper Detection PUF, UDF, Secure RAM
UART/SPI/I²C/FlexIO	4/2/2/1	4/2/2/1	8/4/4/1	8/4/4/2	8/4/4/3	12/6/6/2
I²S/SPDIF	2/1	3/1	3/1	3/1	3/1	4/1
ADC	1M sample/s x 1	1M sample/s x 1	1M sample/s x 2	1M sample/s x 2	1M sample/s x 2	2M sample/s x 2
ACMP/DAC	-	-	4/-	4/-	4/-	4/1
FlexPWM/quad timer/quad ENC	1/0/0	1/1/1	2/2/2	4/4/4	4/4/4	4/4/4
GP timer/watchdog	3/4	6/4	6/4	6/4	6/4	6/4
Package	80 LQFP	100 LQFP	100 LQFP, 144 LQFP	196 BGA	196 BGA	289 BGA
Temperature (Tj)	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C	Consumer: 0 °C to 95 °C Industrial: -40 °C to 105 °C Automotive: -40 °C to 125 °C

MEMORY EXPANSION WITH i.MX RT

i.MX RT crossover MCUs shed the burden of on-chip flash, which helps reduce the cost and helps enable higher frequency operation for increased performance. In turn, it helps you boost capabilities, increase efficiency and add more features. The i.MX RT FlexSPI interface provides memory expansion for external memories such as serial flash/PSRAM, quad or octal data lines. This offers increased design flexibility and helps to ensure a high level of performance and security. The i.MX RT series integrates high densities of SRAM, which is further configured within the crossover design architecture to function as TCM with "zero-wait" single-cycle access to dramatically increase system performance. This key design feature enables the crossover processor's effective performance to be better than the traditional MCU counterpart.

i.MX RT CROSSOVER MCUs | PORTFOLIO BLOCK DIAGRAM



TARGET APPLICATIONS

- Audio subsystem
- Consumer products
- Home and building automation
- Industrial computing designs
- Motor Control and power conversion
- Automotive

NEXT-GENERATION HMI DESIGN

The i.MX RT10xx portfolio includes scalable solutions for HMI applications with features such as parallel camera interface, dedicated LCD controllers and the PXP for 2D graphics acceleration. The PXP is a high-performance pixel processor for operations, such as color-space conversion, alpha blending and rotation, and it supports traditional pixel/frame processing paths for still-image and video processing applications. For more advanced HMI designs, the i.MX RT1170 offers additional features including MIPI CSI, MIPI DSI and a 2D GPU with vector graphics acceleration. Additionally, NXP has partnered with several third parties to deliver embedded graphics software as part of the MCUXpresso SDK.

ACHIEVING END-TO-END SECURITY

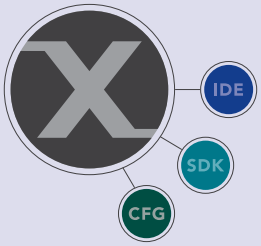
Secure development with the i.MX RT leverages years of experience gained from its applications processor lineage. The ROM firmware on the devices, as well as the tools used in the development and manufacturing processes, have been used and tested. With the i.MX RT and its associated software and tools for secure boot, the foundation for meeting today's security requirements can be achieved.

MAXIMUM FLEXIBILITY WITH FlexIO

FlexIO is a highly configurable module providing a wide range of functionality including emulation of a variety of communication protocols such as UART, I²C, SPI and I²S. This means that you have the flexibility in your design in your design to add more of the peripherals you need. Additionally, the FlexIO module consists of a flexible 16-bit timer with support for a variety of trigger, reset, enable and disable conditions.

i.MX RT CROSSOVER MCUs | SOFTWARE AND TOOLS

NXP's **MCUXpresso software and tools** offer comprehensive development solutions designed to optimize, ease and accelerate embedded system development of applications based on Cortex-M core devices, including Kinetis® and LPC microcontrollers, and i.MX RT crossover MCUs.



NXP eIQ™ Machine Learning Software Development Environment

The NXP eIQ ("edge intelligence") ML software environment provides the key ingredients to do inference with neural network (NN) artificial intelligence (AI) models on embedded systems. eIQ software deploys various ML algorithms on NXP microprocessors and microcontrollers for edge nodes. It includes inference engines, NN compilers, libraries, and hardware abstraction layers that support Google TensorFlow Lite, Arm NN, Arm® CMSIS-NN, and OpenCV.

GET STARTED NOW

Take advantage of the robust enablement to reduce development effort and speed time-to-market with a comprehensive offering of software and development tools.

The i.MX RT evaluation kits (EVKs) help you take your design to the next level by reducing complexity and accelerating time to market. You can also enjoy the ability to expand upon this feature-rich EVK with compatible Arduino™ hardware shields.

Toolchains

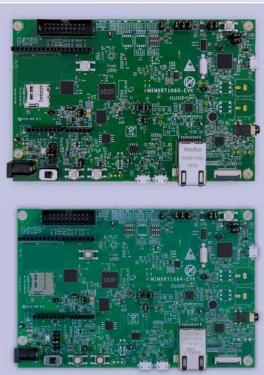
- MCUXpresso software and tools
- IAR Embedded Workbench® IDE
- Keil® IDE

Software

- MCUXpresso SDK with Amazon FreeRTOS™
- Zephyr® Operating System
- Arm® Mbed™ and the global Arm ecosystem

i.MX RT1010, i.MX RT1015 and i.MX RT1020 EVKs are two-layer through-hole PCBs enabled with a six-axis e-compass sensor, multiple audio features and debug options.

i.MX RT1050, i.MX RT1060 and i.MX RT1064 EVKs are four-layer through-hole PCBs that also offer additional features, including camera and LCD support.

EVK	i.MX RT1010	i.MX RT1015	i.MX RT1020	i.MX RT1050	i.MX RT1060/RT1064
Processor	• MIMXRT1011DAE5A	• MIMXRT1015DAF5A	• MIMXRT1021DAG5A	• MIMXRT1052DVL6B	• MIMXRT1062DVL6A/ MIMXRT1064DVL6A
Memory	• 128 Mbit QSPI flash	• 128 Mbit QSPI flash	• 256 Mbit SDRAM memory • 64 Mbit QSPI Flash • TF socket for SD card	• 256 Mbit SDRAM memory • 512 Mbit HyperFlash™ • 64 Mbit QSPI flash • TF socket for SD card	• 256 Mbit SDRAM memory • 512 Mbit HyperFlash • 64 Mbit QSPI flash • TF socket for SD card
Display	N/A	N/A	N/A	• Parallel LCD connector • Camera connector	• Parallel LCD connector • Camera sensor module
Audio	• Audio codec • 4-pole audio headphone jack • External speaker connection • Microphone	• Audio codec • 4-pole audio headphone jack • External speaker connection • Microphone	• Audio codec • 4-pole audio headphone jack • External speaker connection • Microphone	• Audio codec • 4-pole audio headphone jack • External speaker connection • Microphone • SPDIF connector	• Audio codec • 4-pole audio headphone jack • External speaker connection • Microphone • SPDIF connector
Connectivity	• Micro USB OTG connector • Arduino® interface	• Micro USB OTG connector • Arduino® interface	• Micro USB host connector • Micro USB OTG connector • Ethernet (10/100T) connector • CAN transceivers • Arduino® interface	• Micro USB host connector • Micro USB OTG connector • Ethernet (10/100T) connector • CAN transceivers • Arduino® interface	• Micro USB host connector • Micro USB OTG connector • Ethernet (10/100T) connector • CAN transceivers • Arduino® interface
Debug	• JTAG connector • Onboard DAP-link debugger	• JTAG connector • Onboard DAP-link debugger	• JTAG connector • Onboard DAP-link debugger	• JTAG connector • Onboard DAP-link debugger	• JTAG connector • Onboard DAP-link debugger
Sensor	• 6-axis e-compass (3-axis magnetometer, 3-axis accelerometer) sensor FXOS8700CQ	• 6-axis e-compass (3-axis magnetometer, 3-axis accelerometer) sensor FXOS8700CQ	• 6-axis e-compass (3-axis magnetometer, 3-axis accelerometer) sensor FXOS8700CQ	• 6-axis e-compass (3-axis magnetometer, 3-axis accelerometer) sensor FXOS8700CQ	• 6-axis e-compass (3-axis magnetometer, 3-axis accelerometer) sensor FXOS8700CQ
Part Number	MIMXRT1010-EVK	MIMXRT1015-EVK	MIMXRT1020-EVK	IMXRT1050-EVKB	MIMXRT1060-EVK/ MIMXRT1064-EVK
Camera Sensor	N/A	N/A	N/A	N/A	MT9M114 image sensor (included)
Display	N/A	N/A	N/A	RK043FN02H-CT 4.3" (purchased separately)	RK043FN02H-CT 4.3" (purchased separately)
	i.MX RT1010	i.MX RT1015	i.MX RT1020	i.MX RT1050	 i.MX RT1060/RT1064

nxp.com/iMXRT and community.nxp.com/community/iMXRT

NXP, the NXP logo, Kinetis and eIQ are trademarks of NXP B.V. All other product or service names are the property of their respective owners. TensorFlow, the TensorFlow logo and any related marks are trademarks of Google Inc. Arm, Cortex, Keil and Mbed are trademarks or registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere. The related technology may be protected by any or all of patents, copyrights, designs and trade secrets. All rights reserved. © 2020 NXP B.V.

Document Number: IMXRTPORTFS REV 3

10 15 Product Longevity