

AN14570

Design with RT1040-EVK for RT104x Devices

Rev. 1.0 — 12 February 2025

Application note

Document information

Information	Content
Keywords	AN14570, RT1041, RT1042, RT1042, RT1046
Abstract	This application note helps to facilitate selection and development of RT1040 family.



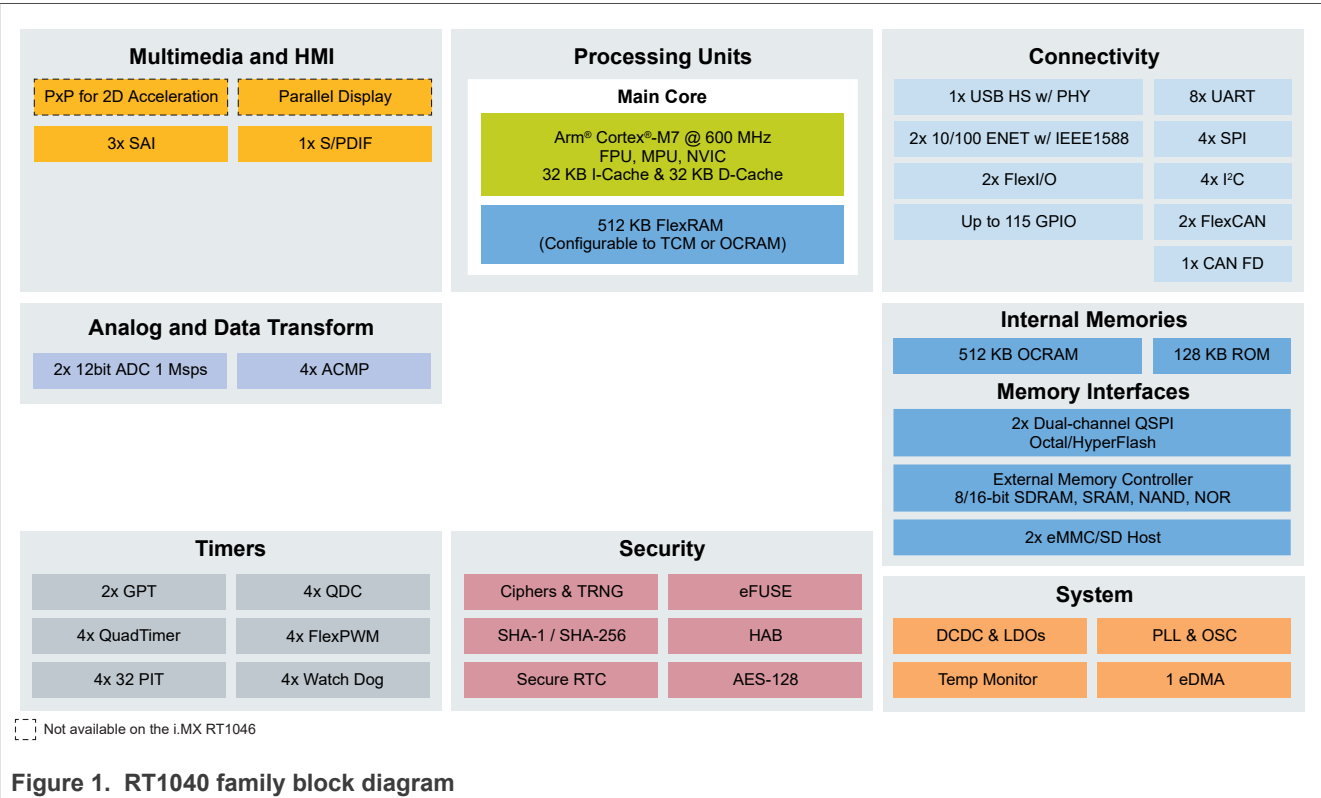
1 Introduction

i.MX RT1040 Crossover MCUs are based on the Arm Cortex-M7 core for real-time performance and high integration for Industrial and IoT applications.

The i.MX RT1040 Arm Cortex-M7 operates at up to 600 MHz with 1 MB on-chip RAM that can be configured as Tightly-Coupled Memory or general-purpose. The family offers various memory interfaces and a wide range of connectivity interfaces including UART, SPI, I²C, USB, and CAN. The new i.MX RT1046 provides additional flexibility with a 169 BGA compact package and an extended temperature range up to 125 °C.

Currently, there are four-part numbers in the RT1040 family: RT1041, RT042, RT1043, and RT1046. There are some minor differences between these parts, so this application note is written to facilitate selection and development.

2 Chip overview and key points



About the performance, all commercial parts can run at 600 MHz and the industrial parts can achieve 528 MHz. All parts support up to 512 KB TCM which guarantees fixed low-latency memory access for performance-critical applications. Therefore, the performance of the CPU is consistent, and the main differences are reflected in the number of peripherals, the size of the SRAM storage space, and the package type.

[Table 1](#) briefly describes the differences between the devices.

Table 1. Differences between RT1040 devices

	RT1041	RT1042	RT1043	RT1046
ADC	12 ch	12 ch	12 ch	15 ch
FlexRAM	512 KB	512 KB	512 KB	512 KB

Table 1. Differences between RT1040 devices...continued

	RT1041	RT1042	RT1043	RT1046
OCRAM	0	0	512 KB	512 KB
ENET	x1	x1	x1	x2
LPSPi	x3	x3	x3	x4
LCD/PXP	N	Y	Y	N
T _j (Commercial)	0 to +95	0 to +95	0 to +95	0 to +95
T _j (Industrial)	-40 to +125	-40 to +125	-40 to +125	-40 to +125
Package	9 × 9 mm, 0.65 mm, BGA169	9 × 9 mm, 0.65 mm, BGA169	9 × 9 mm, 0.65 mm, BGA169	7 × 7 mm, 0.5 mm, BGA169
	11 × 11 mm, 0.8 mm, BGA169	11 × 11 mm, 0.8 mm, BGA169		
Note: The ball maps for RT1041/RT1042 9 × 9 and 11 × 11 mm are different.				

Based on [Table 1](#) and common questions from customers, here are some key points:

- The ball maps for RT1041/RT1042 9 × 9 and 11 × 11 mm are different.
- The ball maps are different for 7 × 7, 9 × 9, and 11 × 11 mm in the RT1040 family.
- RT1043 = RT1042 + 512 KB OCRAM, but RT1043 only has a 9 × 9 mm package.
- In the same package, RT1041, RT1042, and RT1043 are pin-compatible.

3 Development and design reference materials

3.1 Hardware

For RT1041, RT1042, and RT1043, there are EVK design files for reference: [RT1040_EVK_Design_Files](#).

Note: The RT1040_EVK design is based on the chip with 11 × 11 mm, 0.8 mm, and BGA169 package. For RT1041/RT1042/RT1043 devices with 9 × 9 mm, 0.65 mm pitch, its ballmap is different from the one on RT1040_EVK and customer should refer to the symbol package information in the RT1040 datasheet.

For RT1046, there are RT1046 EVK design files for reference: [RT1046_EVK_Design_Files](#).

3.2 Software

For RT1041 and RT1042, customer can use the RT1040 SDK directly.

For RT1043, it has 512 KB FlexRAM and 512 KB OCRAM, which is bigger than RT1042. Based on this, customer can use the RT1040 SDK with the RT1060 linker file. Or, customer can use the RT1060 SDK.

For RT1046, suggest using the RT1060 SDK.

4 Revision history

[Table 2](#) summarizes the revisions to this document.

Table 2. Revision history

Document ID	Release date	Description
AN14570 v1.0	12 February 2025	Initial public release

Legal information

Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <https://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Suitability for use in non-automotive qualified products — Unless this document expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

HTML publications — An HTML version, if available, of this document is provided as a courtesy. Definitive information is contained in the applicable document in PDF format. If there is a discrepancy between the HTML document and the PDF document, the PDF document has priority.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately.

Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP B.V. — NXP B.V. is not an operating company and it does not distribute or sell products.

Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

NXP — wordmark and logo are trademarks of NXP B.V.

AMBA, Arm, Arm7, Arm7TDMI, Arm9, Arm11, Artisan, big.LITTLE, Cordio, CoreLink, CoreSight, Cortex, DesignStart, DynamIQ, Jazelle, Keil, Mali, Mbed, Mbed Enabled, NEON, POP, RealView, SecurCore, Socrates, Thumb, TrustZone, ULINK, ULINK2, ULINK-ME, ULINK-PLUS, ULINKpro, μ Vision, Versatile — are trademarks and/or registered trademarks of Arm Limited (or its subsidiaries or affiliates) 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.

Microsoft, Azure, and ThreadX — are trademarks of the Microsoft group of companies.

Contents

1 Introduction2

2 Chip overview and key points2

3 Development and design reference materials3

3.1 Hardware3

3.2 Software3

4 Revision history4

Legal information5

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.