

The Core Difference in Your Design

RX200 Microcontrollers



RX200 MCUs for High-performance, Power-efficient Applications

The RX200 Family of Flash MCUs bring new levels of capability and performance to ultra-low-power, low-voltage embedded-system applications. Based on the fast 32-bit RX CPU core, RX210 MCUs are the first members of the RX200 series of middle-range products. They deliver more performance on far less power than other MCUs, operate over wide voltage ranges, and offer huge power savings in standby. A wide set of peripherals are available, including communication, ADC and support for the IEC60730 appliance safety standard. MCUs in the RX220 Group will be more price sensitive, and have smaller package and memory size options. MCUs in the RX21A group will have advanced security features and a 24-bit Delta Sigma ADC.

RX for Portable Medical

- High performance
- Low power consumption
- Low voltage
- Digital signal processing capability

RX for Sensors

- Low power
- Low voltage
- 78 max DMIPS for optimal duty cycle
- Communication peripherals
- Data flash programmable while code is executed (BGO)

RX for Meters

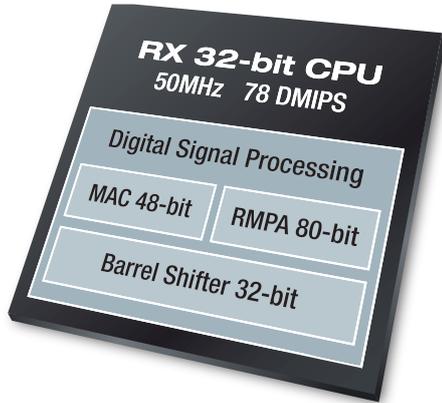
- Low power
- High performance
- DSP instruction set
- 24-bit $\Delta\Sigma$ ADC
- Up to 1 MB Flash
- Advanced Encryption Standard (AES)
- Integrated ADC
- RTC with anti-tamper
- Low pin count

RX for Industrial Automation

- EMC performance with true 5 V operation
- Motor control
- Communication peripherals
- Integrated ADC & DAC, temp. sensor

RX for Appliances

- 3-phase motor control timer
- Safety functions (IEC607030)
- Integrated analog comparator
- Temperature sensor
- Small Flash block size



Memory
Zero-wait Flash up to 1 MB
SRAM up to 96 KB
Data Flash 8 KB

System
Event Link Controller
Multifunction Pin Controller
Data Mgmt. DTC/DMA
Interrupt Cont. 16 levels 9 pins
Clocks OSC PLL IRC
POR/LVD
Safety CAC DOC CRC
Safety AES

Communication
I2C 7 x Simple I2C
SCI/UART 7 ch
SPI
External Bus
GPIO

Analog
Comparator 4 ch
ADC 12-bit 16 ch
DAC 10-bit 2 ch
24-bit ΔΣ ADC
Temp. Sensor

Timers	
MTU2 16-bit 6 ch	WDT 14-bit 1 ch
TMR 8-bit 4 ch	I-WDT
CMT 16-bit 4 ch	RTC Calendar

Ultra-low voltage operation

- > 1.62 V operation @ up to 20 MHz, 31 DMIPS

High performance

- > 1.56 DMIPS/MHz, 78 DMIPS @ 50 MHz, 2.7 V to 5.5 V

Zero wait-state Flash

- > 2 KB block size, Erase/Write operation down to 1.62 V
- > Programmable at 1.62 V
- > Data flash program-mable while code is executed (BGO)

Low power consumption

- > 96 μA/DMIPS* (run mode), 1.0 μA with RTC on
- > 0.3 μA with RTC off

Scalable

- > 48 – 145 pins, QFP, LGA, QFN
- > 32 KB – 1 MB
- > Multifunction pin controller

Integrated analog

- > Comparators
- > 24-bits delta sigma
- > Temperature sensor

Safety functions

RX200 MCUs provide six modular hardware subsystems that help products meet safety standards. Clock Accuracy Control checks that the clock frequency is within a predefined range. Oscillation Stop Detection switches the chip's main clock to an alternative source if the primary one fails. Data Operation Circuit continuously performs a SRAM failure test independently of the CPU. The Independent Watchdog Timer (I-WDT) uses a reliable internal clock source. ADC has disconnect-detection and self-diagnostic functions. I/O pins can read back output values.

Clock	RAM	Serial Communication	OCO Dedicated for WDT	ADC
CAC Detects abnormal frequency	Data Operation Circuit Assists RAM failure check test	Cyclic Redundancy Check Detects serial communication data error	I-WDT Independent watchdog timer clock source from system clock	Disconnect Detection Detects disconnection of analog input
Oscillation Stop Detection Detects OSC stop Switch clock source to OCO			GPIO With read back ability	ADC Self-Diagnosis Detects ADC circuit failure

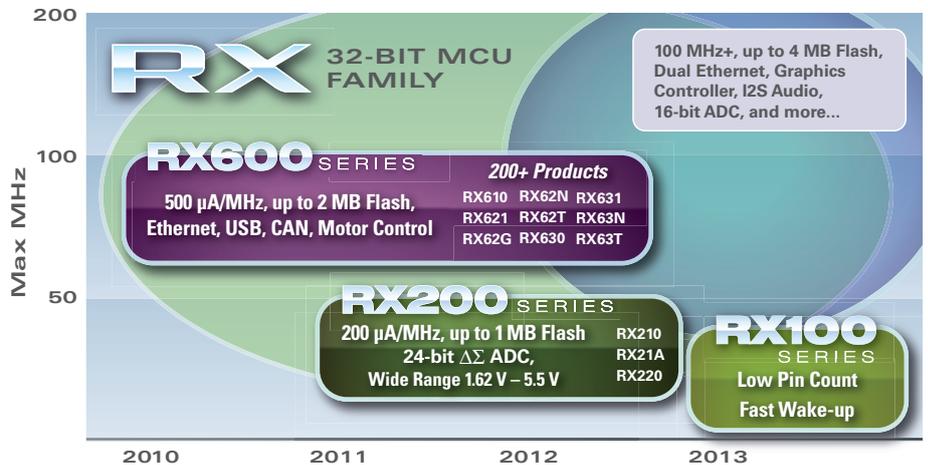
CAC: Clock frequency accuracy measurement circuit OCO: On-chip oscillator

*96 μA/DMIPS applies to the RX210 MCU version B, high-speed operating mode, no peripheral operating.

RX Family Performance/Power Consumption Comparison

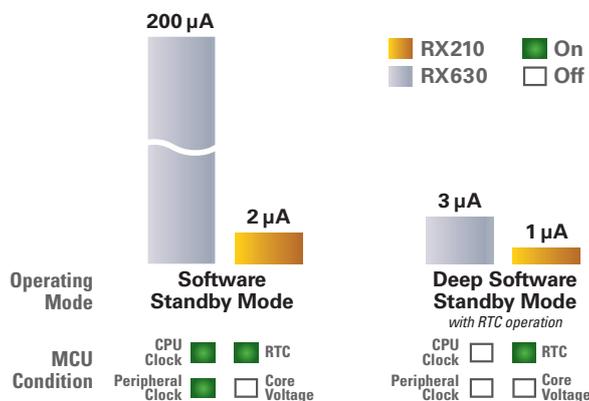
RX family MCUs feature the revolutionary RX architecture and meet current and projected system design requirements in terms of memory size, power consumption, scalability, feature sets and price. Devices in the new RX100 series emphasize performance and extremely power consumption; whereas, devices in the RX200 series emphasize ultra-low power, low voltage, and safety. The RX600 family is optimised for connectivity applications and extremely high performance and integration. All RX family devices are CPU and peripheral compatible and share the same software tools and ecosystem. Many devices offer advanced connectivity with Ethernet, USB host function, and multiple CAN interfaces and solutions for motors and power inverters. The RX210 MCUs feature memory sizes from 32 KB to 512 KB (with a roadmap up to 1 MB), integrated 12-bit ADC, analog comparator and temperature sensor.

The RX220 group is more price sensitive, with smaller packages (as few as 48 pins), and provides additional options for smaller memory footprint applications. MCUs in the RX21A group will have advanced analog and security features such as the 24-bit Delta Sigma and MPU (Memory Protection Unit).



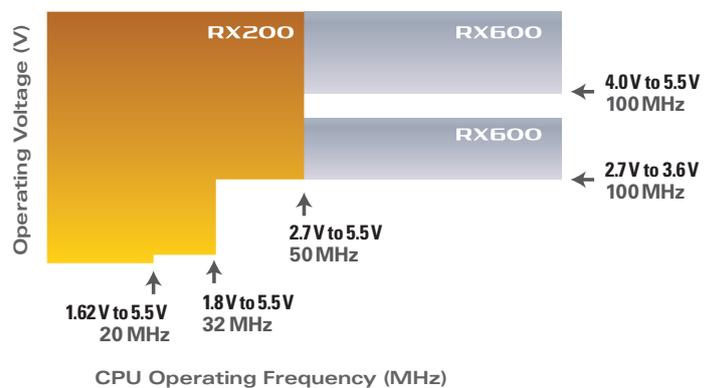
RX200 Series Features Lower Power Consumption

> The RX200 series reduces current consumption by **60% in Run Mode**, as compared to the RX600.



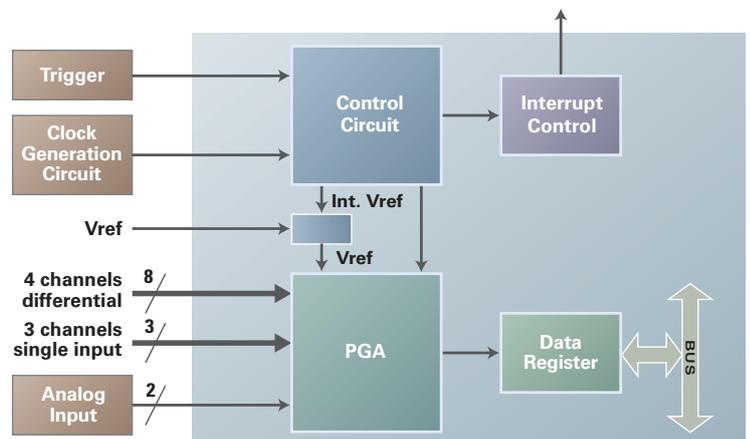
RX200 Series Provides Wider Voltage Range

> The RX200 series provides a wider set of voltage operation as compared to the RX600 – from 1.62 V to 5.5 V.



High-precision 24-bit Delta Sigma ADC

The RX21A features up to seven channels of 24-bit delta sigma, four of which are differential and three being single-end input. A Programmable Gain Amplifier is also included for signal amplification. Each channel is independent in terms of timing and interrupt generation. This module also has the ability to either utilize its own internal voltage reference or connect to an external source.

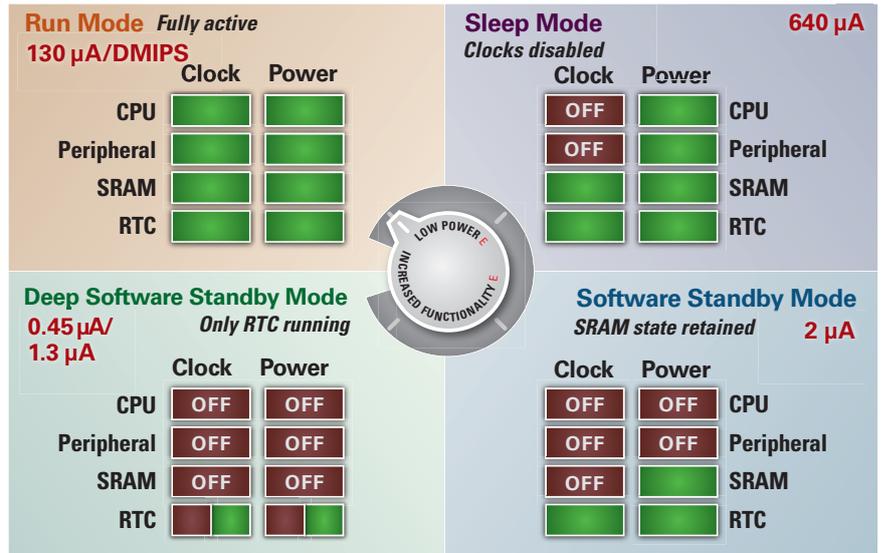


Highly Effective Power Management

RX200 MCUs have a sophisticated power management system that can apply power to only those functions essential to the application at any point in time.

Four different major power modes are available – Run, Sleep, Software Standby and Deep Software Standby. Wake-up time from Sleep mode is only 0.2 μ s.

In every mode, peripherals that aren't required can be completely shut down to minimize power consumption. Five different levels of operation are also available in "Run" mode: High speed, Middle speed A, Middle speed B, Low speed A and Low speed B.



RX200 Delivers Power Savings without Compromising Performance

> The RX200 delivers 1.56 DMIPS per MHz and achieves 78 DMIPS at 50 MHz while consuming only 96 μ A/DMIPS. The RX200 strikes a perfect balance of performance and power consumption, making it suitable for battery operated applications.

Dhrystone MIPS per MHz *with no wait-state memory access*



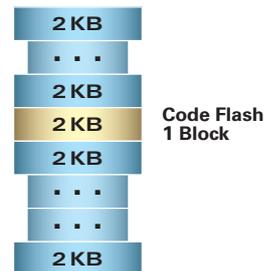
RX200 Leverages Industry-leading Flash Technology

Renesas' unique low-power, zero wait-state MONOS Flash technology allows RX MCUs to fetch instructions without delay and with minimum power consumption. Competing technology utilizes a high-voltage transistor for readout and hardware accelerators to compensate for a slower Memory Flash, resulting in higher power consumption and decreased performance.

Two different types of Memory Flash are available in the RX200: Code Flash for application code, and Data Flash with BGO, which eliminates the need for external EEPROM or to store additional data tables or system data. The BGO (Background Operation) allows the Data Flash to be programmed while code is executed from the Flash. Both Data and Code Flash are programmable at 1.62 V, making it possible for battery operated devices to program them while running at minimum operating voltage.

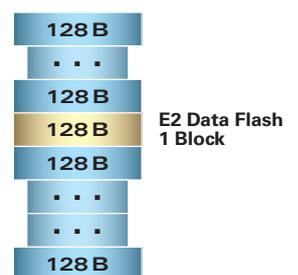
Code Flash

- > Each block individually erased/programmed
- > Erase/write operation down to 1.62 V
- > Up to 1 MB
- > 2 KB block size
- > 1 K times erase cycle



Data Flash with BGO

- > Erase/write operation down to 1.62 V
- > E2 Data Flash replaces external EEPROM
- > 128 Bytes erase block size
- > 100 K times erase cycle
- > 2 Byte write/program
- > BGO (programmable data flash while code is executed)

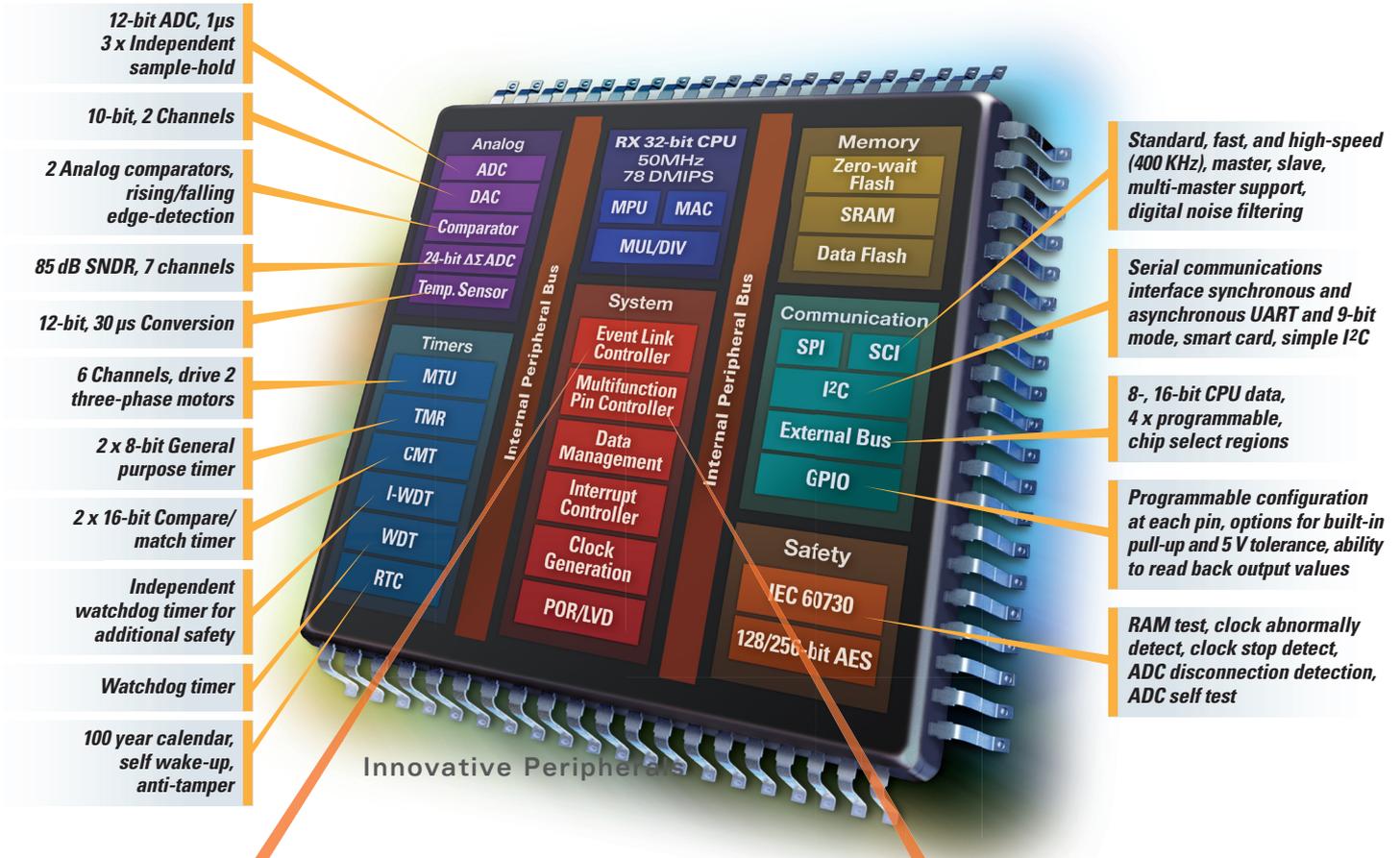


Comprehensive On-chip Peripherals

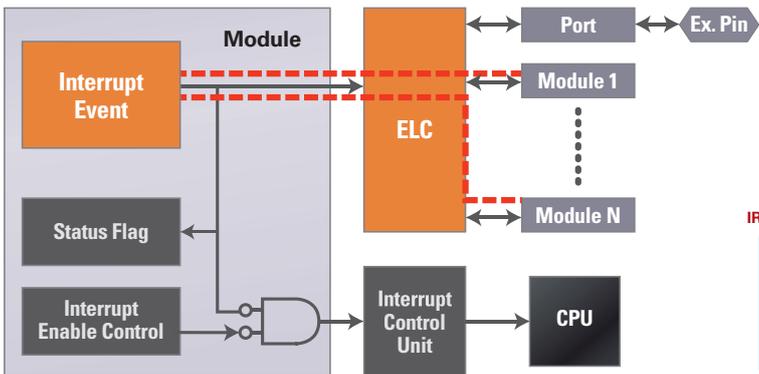
Many different combinations of on-chip analog, timer, communication, system and other functions are built into RX200 MCUs to save cost, simplify systems and reduce total power consumption.

The diverse functionality available within this product group enables the matching of MCU capabilities to system requirements.

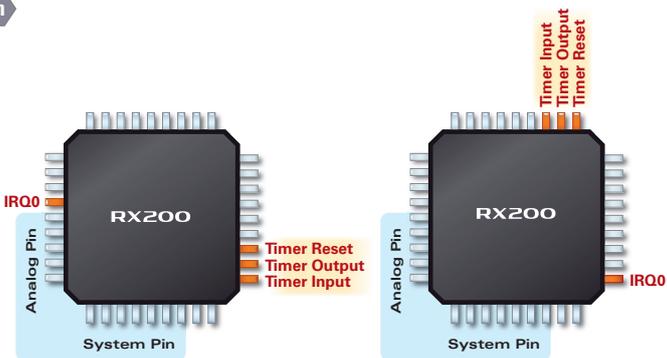
Group	CPU (MHz)	Flash (max)	SRAM (max)	Data Flash	DAC 10-bit	ADC 24-bit	ADC 12-bit	ADC 10-bit	Temp Sensor	Comparator	AES	MPU	Dp SW Stby	MTU2	TMR	CMT	WDT	I-WDT	RTC	I ² C	SCI	ExBus	SPI	IrDa
RX210	50	1 MB	96 KB	8 KB	2	-	16	-	✓	4	-	-	✓	✓	4	4	✓	✓	✓	1	7	✓	1	-
RX220	32	256 KB	32 KB	8 KB	-	-	12	-	-	2	-	-	-	✓	2	2	-	✓	✓	1	3	-	1	-
RX21A	50	512 KB	64 KB	8 KB	2	7	-	4	✓	4	✓	✓	✓	✓	4	4	✓	✓	✓	2	5	-	2	5



The **Event Link Controller (ELC)** is an innovative way to reduce CPU load by directly routing interrupt event signals from one peripheral or module to the other. As a result, power consumption, interrupt latency and program size are minimized.



The **Multifunction Pin Controller (MPC)** allows peripheral input and output signals to be remapped to alternate ports, offering more design layout flexibility. In this example, the ports of the IRQO and timer have been moved to a different location of the MCU.



RX200 MCU Series Portfolio



RX200 Series Devices

Group	Device	MHz	Flash Size	Data Flash (KB)	VCC (V)	SRAM (KB)	External Data Bus	8-bit Timers	16-bit Timers	Watchdog Timers	A/D 24-bit	A/D 12-bit	DAC	SCI	SPI	I ² C	GPIO	Package Type	Pin Pitch
RX210	R5F210xBDFB	50	128, 256, 384, 512, 768, 1024	8	1.62 – 5.5	20 – 96	Y	4	16	2	–	16	2	7	1	1	123	LQFP-64	0.5 mm
	R5F210xBDLK	50	128, 256, 384, 512, 768, 1024	8	1.62 – 5.5	20 – 96	Y	4	16	2	–	16	2	7	1	1	123	LQFP-80	0.5 mm
	R5F210xBDFP	50	128, 256, 768, 1024	8	1.62 – 5.5	20 – 96	Y	4	10	2	–	16	2	7	1	1	85	LQFP-100	0.5 mm
	R5F210xBDLJ	50	128, 256, 768, 1024	8	1.62 – 5.5	20 – 96	Y	4	10	2	–	16	2	7	1	1	85	LGA-100	0.65 mm
	R5F210xBDLA	50	128, 256	8	1.62 – 5.5	20 – 32	Y	4	10	2	–	16	2	7	1	1	85	LQFP-64	0.5 mm
	R5F210xBDFN	50	128, 256	8	1.62 – 5.5	20 – 32	N	4	10	2	–	14	2	7	1	1	65	LQFP-80	0.5 mm
	R5F210xBDFE	50	64, 96, 128, 256	8	1.62 – 5.5	12 – 32	N	4	10	2	–	14	2	7	1	1	65	LQFP-100	0.65 mm
	R5F210xBDFM	50	64, 96, 128, 256	8	1.62 – 5.5	12 – 32	N	4	10	2	–	12	2	7	1	1	49	LGA-100	0.5 mm
	R5F210xBDFK	50	128, 256	8	1.62 – 5.5	20 – 32	N	4	10	2	–	12	2	7	1	1	49	LQFP-64	0.8 mm
	R5F210xBDFL	50	64, 96, 128, 256	8	1.62 – 5.5	12 – 32	N	4	10	2	–	8	–	7	1	1	35	LQFP-80	0.5 mm
	R5F210xCDFP	50	384, 512	8	1.62 – 5.5	64	Y	4	10	2	–	16	2	7	1	1	85	LQFP-100	0.5 mm
	R5F210xCDLJ	50	384, 512	8	1.62 – 5.5	64	Y	4	10	2	–	16	2	7	1	1	85	LGA-100	0.65 mm
	R5F210xCDFN	50	384, 512	8	1.62 – 5.5	64	N	4	10	2	–	14	2	7	1	1	65	LQFP-64	0.5 mm
	R5F210xCDFE	50	384, 512	8	1.62 – 5.5	64	N	4	10	2	–	14	2	7	1	1	65	LQFP-80	0.65 mm
	R5F210xCDFM	50	384, 512	8	1.62 – 5.5	64	N	4	10	2	–	12	2	7	1	1	49	LQFP-100	0.5 mm
	R5F210xCDFK	50	384, 512	8	1.62 – 5.5	64	N	4	10	2	–	12	2	7	1	1	49	LGA-100	0.8 mm
RX220	R5F5220xBDFP	32	64, 128, 256	8	1.62 – 5.5	8 – 16	N	4	10	1	–	16	–	4	1	1	85	LQFP-48	0.5 mm
	R5F5220xBDFM	32	32, 64, 128, 256	8	1.62 – 5.5	4 – 16	N	4	10	1	–	12	–	4	1	1	49	LQFP-48	0.5 mm
	R5F5220xBDFL	32	32, 64, 128, 256	8	1.62 – 5.5	4 – 16	N	4	10	1	–	8	–	5	1	1	35	LQFP-100	0.5 mm
RX21A	R5F521AxBDFP	50	256, 384, 512	8	1.8 – 3.6	32 – 64	N	4	10	2	7	7	2	5	2	2	67	LQFP-100	0.5 mm
	R5F521AxBDFM	50	256, 384, 512	8	1.8 – 3.6	32 – 64	N	4	10	2	4	7	2	5	2	2	52	LQFP-64	0.5 mm
	R5F521AxBDFL	50	256, 384, 512	8	1.8 – 3.6	32 – 64	N	4	10	2	3	4	–	5	2	1	39	LQFP-100	0.5 mm

Selected examples shown here. Please check www.renesas.com/rx for complete list of available devices.
 “x” represents the memory size; 1 = 32 k, 3 = 64 k, 4 = 96 k, 5 = 128 k, 6 = 256 k, 7 = 384 k, 8 = 512 k, A = 768 k, B = 1 Mbyte.

Note: Support for 105°C available

Get up and running with the RX Ecosystem

Renesas makes it easy to launch new system designs. Our comprehensive hardware and software tools – including very low cost and free products – help swiftly advance the product development process from concept stage to final RX-based design.

RX210 Renesas Promotion Board (RPB)

- > RX Family C/C++ toolchains (Renesas 128 KB evaluation version, full GNU version)
- > Quick-start guide, RX210 sample projects
- > Shared firmware projects



RPB Part Number: YRPBRX210
renesas.com/RPBRX210

RX210 Renesas Starter Kit (RSK)

This complete RX210-based hardware/software platform for in-depth application design includes the E1 Debugger, a trial version of the HEW IDE and Renesas RX compiler and demonstration firmware.



RSK Part Number: R0K505210S000BE
renesas.com/RSKRX210

e2studio – the new Eclipse-based Integrated Development Environment (IDE) from Renesas

Complete development and debug environment based on the popular Eclipse platform (v3.6 – Helios) and the associated C/C++ Development Tooling (CDT) project.

Basic Features		Advanced Debug Features	
– Connect / Disconnect	– Variable and Expression views	– Renesas Debug view with Call Stack	– Real-time Expression view
– Run / Stop (Resume / Suspend)	– Register view	– I/O Registers view	– Real-time Memory view
– Software breakpoints	– Basic Memory view	– Trace view	– Real-time Chart view
– Source step / disassembly step	– Endian selection	– Eventpoints view	

www.renesas.eu/e2studio

Complete Debugging, Emulation, and Programming

On-chip debugging of an RX-based application is performed via a debug connection to the target and USB connection to the Windows-based IDE. The Renesas E1 and E20 debuggers offer thorough CPU control and visibility.



Renesas E1
YR0E00010KCE00-EE

Renesas E20
R0E000200KCT00

Third-party Compilers and RTOS

Compilers



IAR Embedded Workbench, with full C and C++ support, MISRA C compliance checker
www.iar.com/ewrx



KPIT Cummins Infosystems Limited

KPIT Eclipse IDE and KPIT GNURX compiler
www.kpitgnu tools.com



embOS
www.segger.com



CMX-RTX
www.cmx.com

RTOS



FreeRTOS
www.freertos.org



µC/OS-II and µC/OS-III
www.micrium.com

Renesas MCU Ecosystem



> Consultant and tool vendor network
www.renesas.eu/alliance



> University program
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www.renesas.interactive.com

Software Library – Free SW
www.renesas.eu/swlibrary

Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

