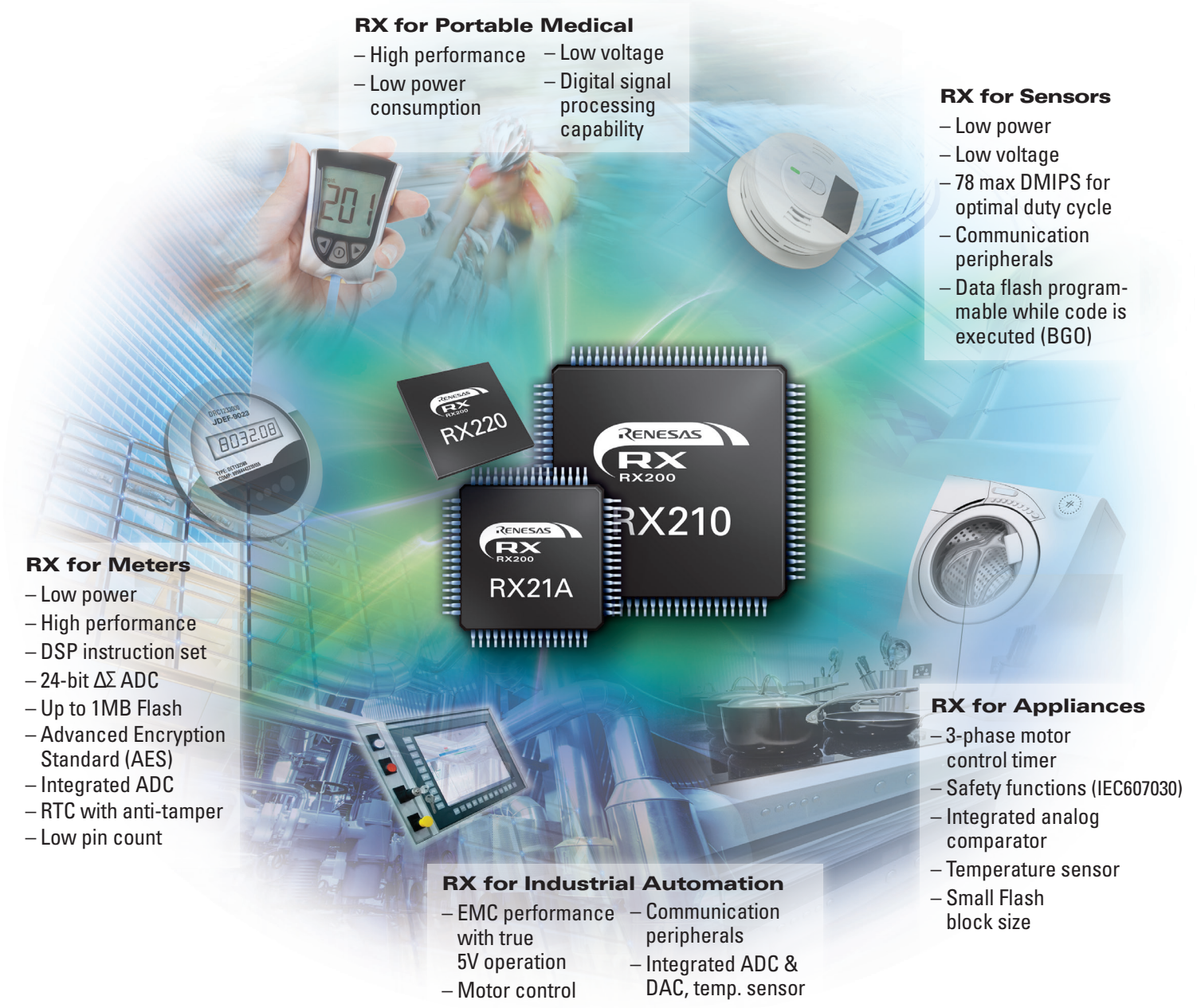
The Core Difference in Your Design

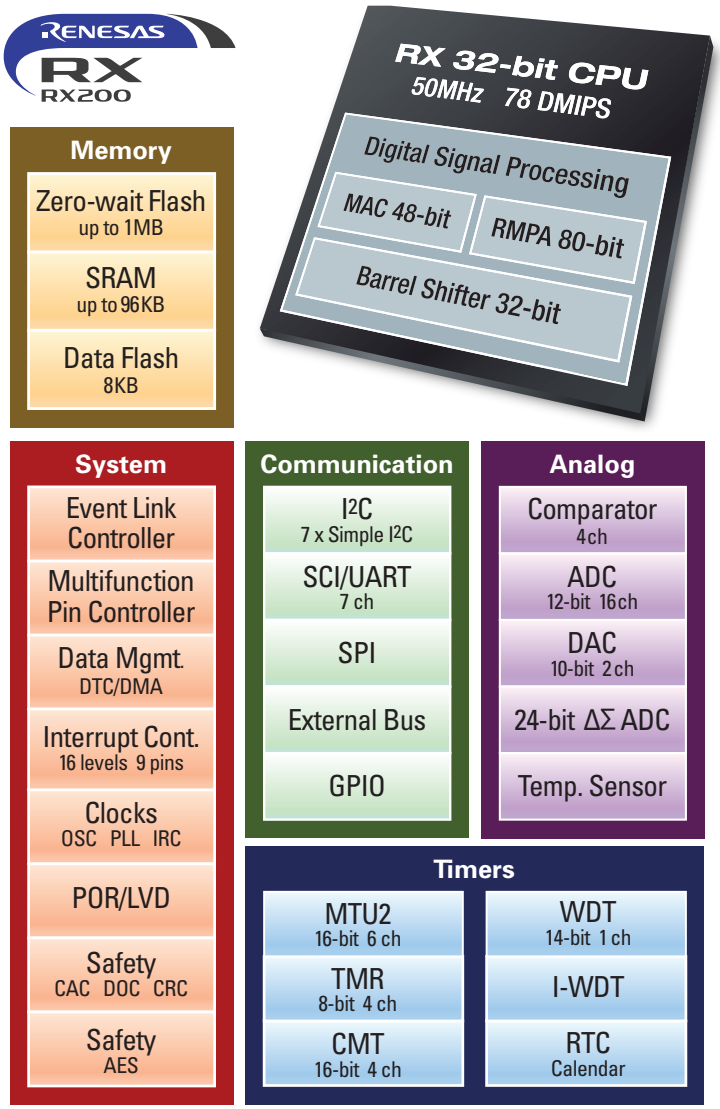
RX200 Microcontrollers

Renesas Electronics Singapore
sg.renesas.com

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.





Ultra-low voltage operation

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

High performance

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

Zero wait-state Flash

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

Low power consumption

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

Scalable

- 48-145 pins, QFP, LGA, QFN
- 32KB - 1MB
- 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 watch-dog 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

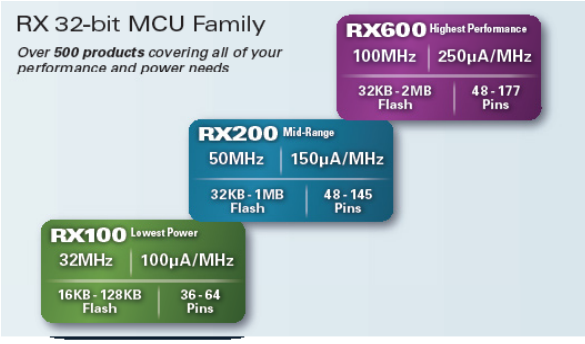
CAC: Clock frequency accuracy measurement circuit OCO: On-chip oscillator

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

RX Family Performance/Power Consumption Comparison

The RX family now contains three series of 32-bit MCUs that are optimized for a vast range of application requirements. The RX100, RX200 and RX600 series are CPU and peripheral compatible and share the same software tools and ecosystem.

MCUs in the top-level RX600 series are ideal for systems that require high-performance, excellent connectivity, LCD drive and motor control capability. By contrast, devices in the RX200 and RX100 series are optimized for ultra-low-power, portable applications, safety functionality and integrated analog interfaces.



RX100

- The entry level RX100 series is the lowest cost product line in the RX Family. The RX111 group offers ultra-low-power operation, a fast wake-up time, USB connectivity, 8KB data Flash, a DAC, and communication channels. Pin counts in the RX100 series are as low as 36 pins, and the on-chip Flash memory is from 16KB up to 128KB, with a roadmap to 256KB.

RX200

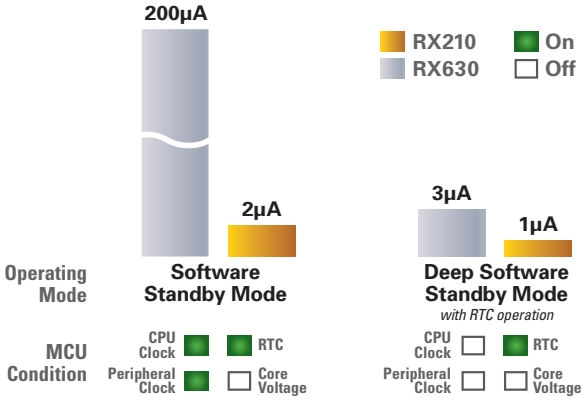
- RX210 MCUs feature memory sizes from 32KB to 1MB and provide an integrated 12-bit ADC, analog comparator and temperature sensor. RX220 MCUs aim at price-sensitive designs; they come in smaller packages with as few as 48 pins and offer additional options for smaller memory footprint applications. The RX21A group features advanced analog and security functions such as a 24-bit Delta-Sigma data converter and a Memory Protection Unit.

RX600

- RX62N and RX63N product groups are characterized by advanced connectivity with Ethernet, USB host function, and multiple CAN interfaces; those in the RX62T, RX63T and RX62G groups have features specifically intended for controlling motors and power inverters.

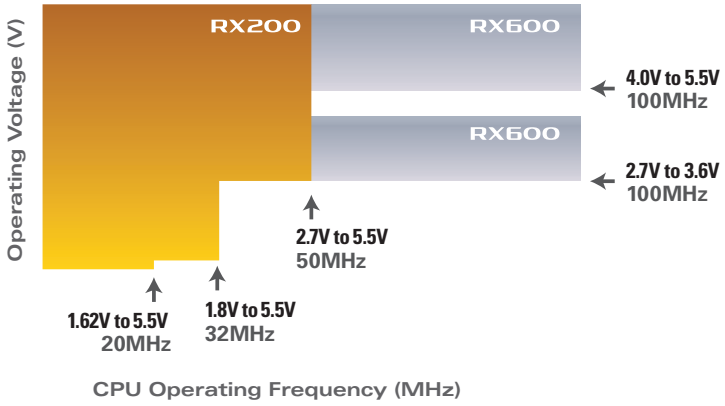
RX200 Series Features Lower Power Consumption

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



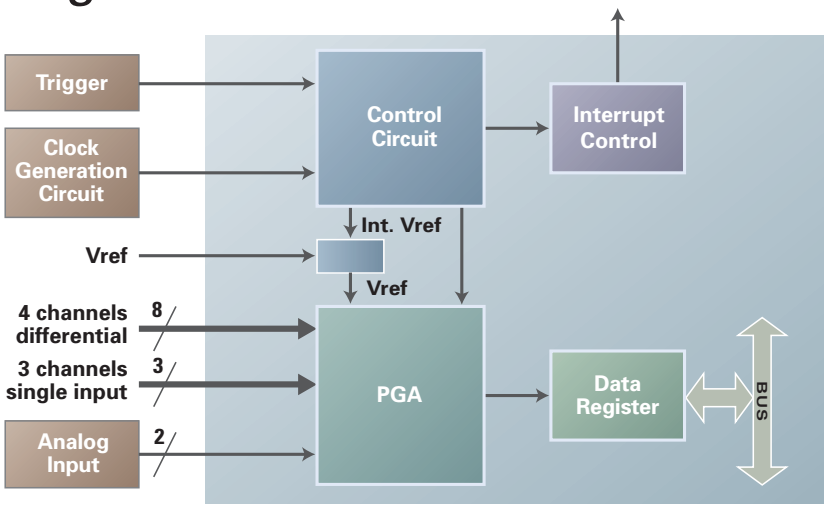
RX200 Series Provides Wider Voltage Range

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



High-precision 24-bit Delta Sigma ADC

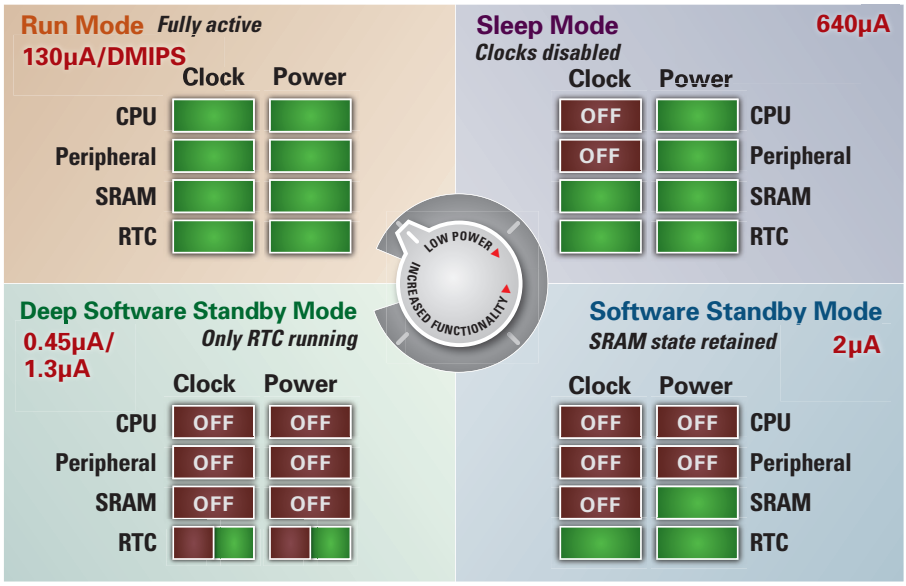
The RX21A features up to seven channels of 24-bit delta sigma, four of which are differential and three being single-end input. A Programmable Gain Amplifier is also included for signal amplification. Each channel is independent in terms of timing and interrupt generation. This module also has the ability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



Highly Effective Power Management

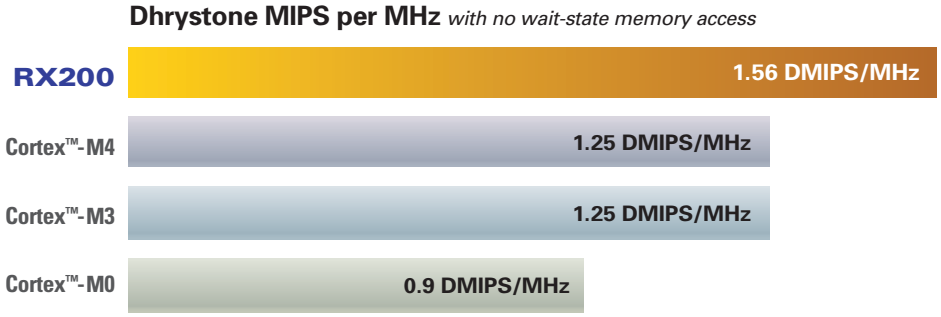
RX200 MCUs have a sophisticated power management system that can apply power to only those functions essential to the application at any point in time.

Four different major power modes are available – Run, Sleep, Software Standby and Deep Software Standby. Wake-up time from Sleep mode is only 0.2µs. 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 50MHz while consuming only 96µA/DMIPS. The RX200 strikes a perfect balance of performance and power consumption, making it suitable for battery operated applications.



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.

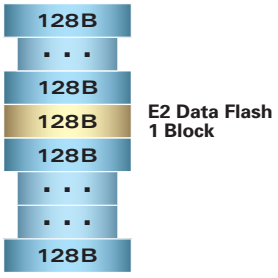
Two different types of Memory Flash are available in the RX200: Code Flash for application code, and Data Flash with BGO, which eliminates the need for external EEPROM or to store additional data tables or system data. The BGO (Background Operation) allows the Data Flash to be programmed while code is executed from the Flash. Both Data and Code Flash are programmable at 1.62V, 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 to1.62V
- Up to 1MB
- 2KB block size
- 1K times erase cycle

Data Flash with BGO

- Erase/write operation down to1.62V
- E2 Data Flash replaces external EEPROM
- 128Bytes erase block size ○
- 100K times erase cycle
- 2Byte 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	I²C	SCI	ExBus	SPI	IrDa
RX210	50	1MB	96KB	8KB	2	–	16	–	√	4	–	–	√	√	4	4	√	√	√	1	7	√	1	–
RX220	32	256KB	32KB	8KB	–	–	12	–	–	2	–	–	–	√	2	2	–	√	√	1	3	–	1	–
RX21A	50	512KB	64KB	8KB	2	7	–	4	√	4	√	√	√	√	4	4	√	√	√	2	5	–	2	5

12-bit ADC, 1µs 3 x Independent sample-hold

10-bit, 2 Channels

2 Analog comparators, rising/falling edge-detection

85dB SNDR, 7 channels

12-bit, 30µs Conversion

6 Channels, drive 2 three-phase motors

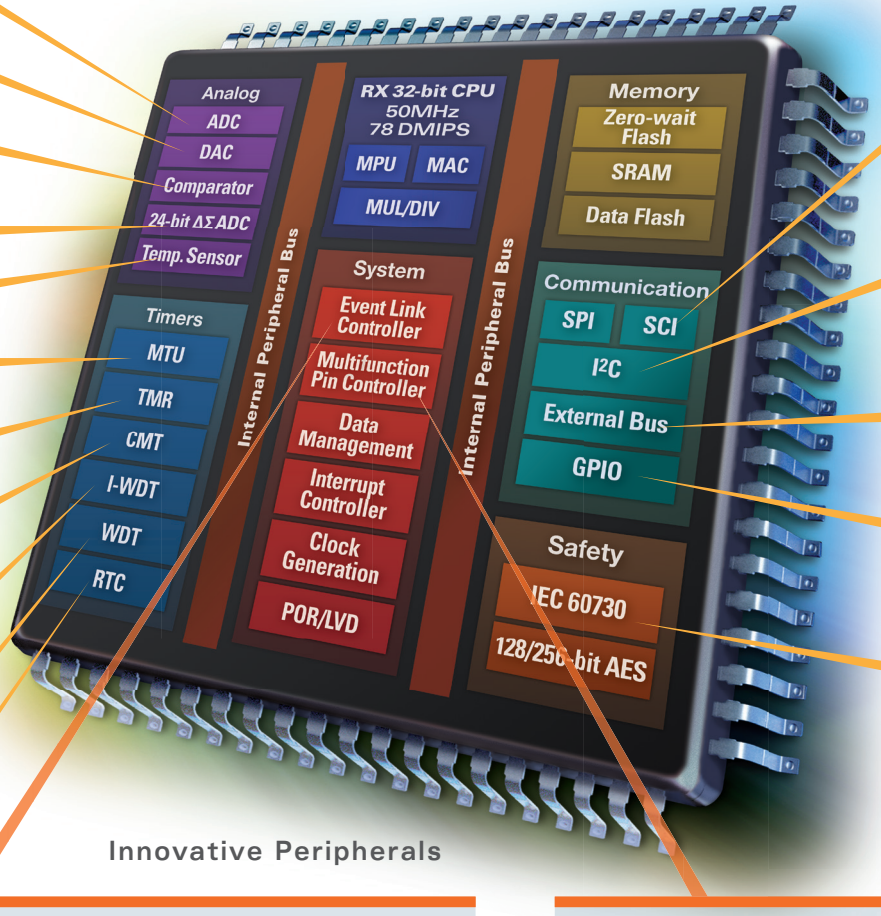
2 x 8-bit General purpose timer

2 x 16-bit Compare/ match timer

Independent watchdog timer for additional safety

Watchdog timer

100 year calendar, self wake-up, anti-tamper



Standard, fast, and high-speed (400KHz), master, slave, multi-master support, digital noise filtering

Serial communications interface synchronous and asynchronous UART and 9-bit mode, smart card, simple I²C

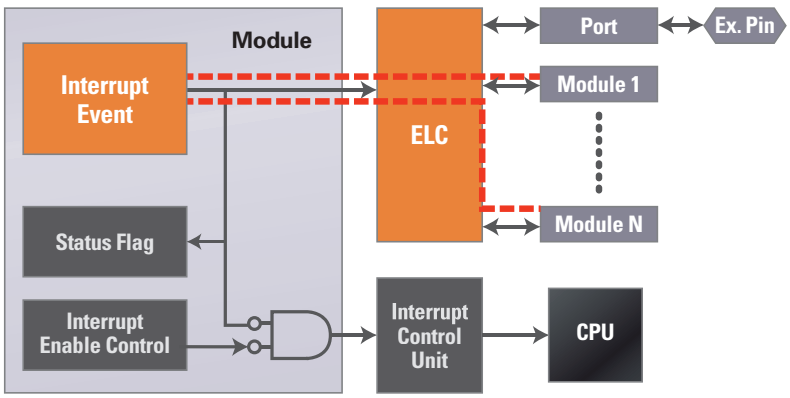
8-, 16-bit CPU data, 4 x programmable, chip select regions

Programmable configuration at each pin, options for built-in pull-up and 5V tolerance, ability to read back output values

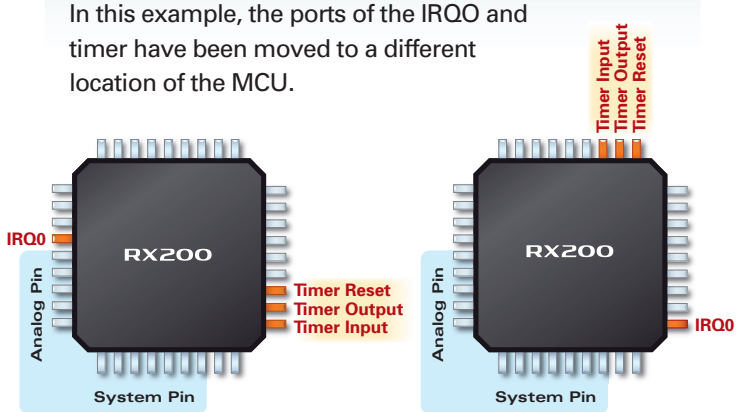
RAM test, clock abnormally detect, clock stop detect, ADC disconnection detection, ADC self test

Innovative Peripherals

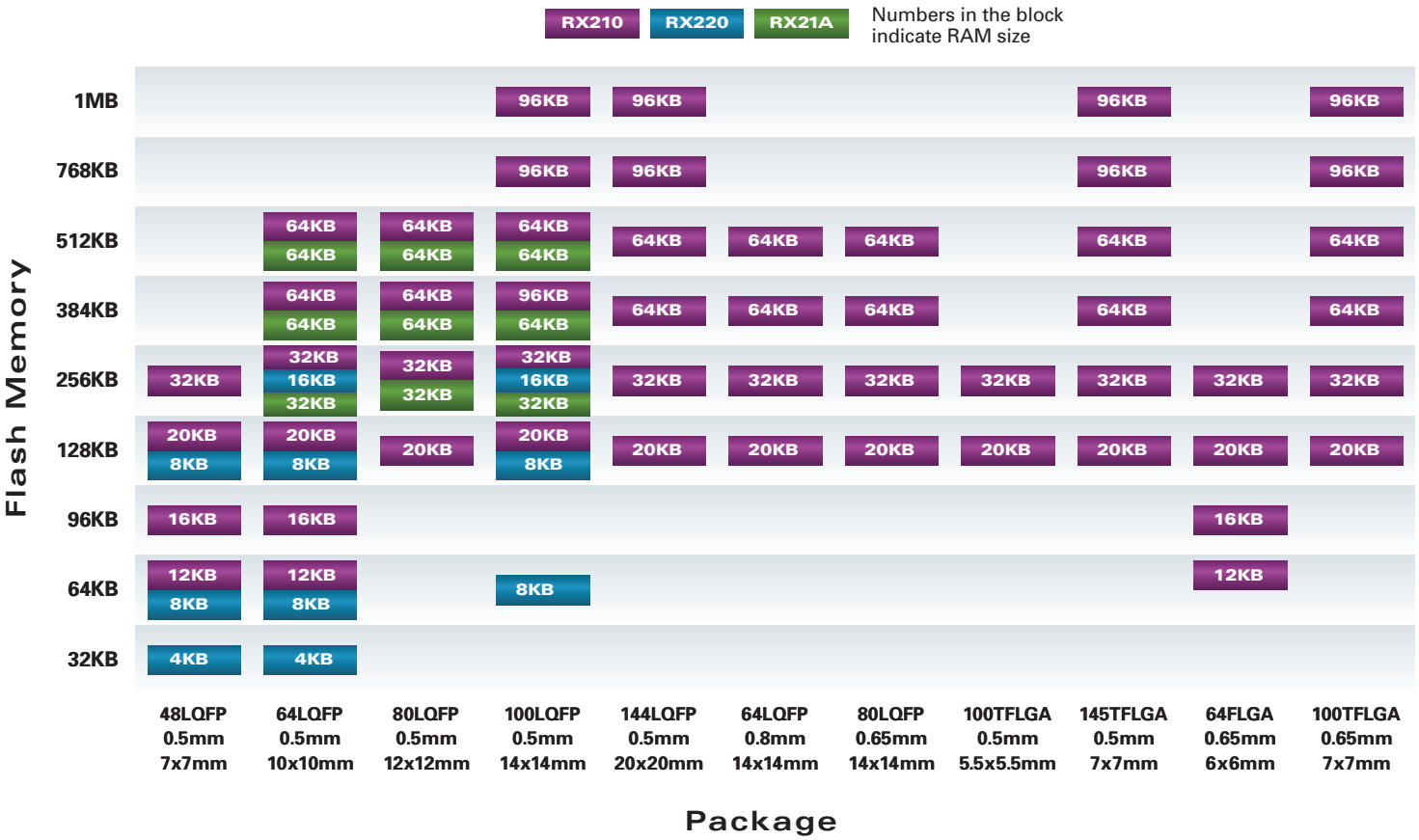
The **Event Link Controller (ELC)** is an innovative way to reduce CPU load by directly routing interrupt event signals from one peripheral or module to the other. As a result, power consumption, interrupt latency and program size are minimized.



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 IRQ0 and timer have been moved to a different location of the MCU.



RX200 MCU Series Portfolio



RX200 Series Devices

Group	Part	MHz	Flash Size	Data Flash (KB)	VCC (V)	RAM (KB)	External Data Bus	8-bit timers	16-bit timers	Watchdog Timers	A/D 24-bit	A/D 12-bit	A/D 10-bit	DAC	SCI	SPI	I2C	GPIO	Package Type	Pin Pitch
RX210	R5F52105ADFM	50	128	8	1.62-5.5	20	N	4	10	2	–	12	–	2	7	1	1	48	64-LQFP	0.5mm
	R5F52105ADFN	50	128	8	1.62-5.5	20	N	4	10	2	–	14	–	2	7	1	1	64	80-LQFP	0.5mm
	R5F52105ADFP	50	128	8	1.62-5.5	20	Y	4	10	2	–	16	–	2	7	1	1	84	100-LQFP	0.5mm
	R5F52105ADLJ	50	128	8	1.62-5.5	20	Y	4	10	2	–	16	–	2	7	1	1	84	100-LGA	0.65mm
	R5F52106ADFM	50	256	8	1.62-5.5	32	N	4	10	2	–	12	–	2	7	1	1	48	64-LQFP	0.5mm
	R5F52106ADFN	50	256	8	1.62-5.5	32	N	4	10	2	–	14	–	2	7	1	1	64	80-LQFP	0.5mm
	R5F52106ADFP	50	256	8	1.62-5.5	32	Y	4	10	2	–	16	–	2	7	1	1	84	100-LQFP	0.5mm
	R5F52106ADLJ	50	256	8	1.62-5.5	32	Y	4	10	2	–	16	–	2	7	1	1	84	100-LGA	0.65mm
	R5F52107ADFM	50	384	8	1.62-5.5	64	N	4	10	2	–	12	–	2	7	1	1	48	64-LQFP	0.5mm
	R5F52107ADFN	50	384	8	1.62-5.5	64	N	4	10	2	–	14	–	2	7	1	1	84	80-LQFP	0.5mm
	R5F52107ADFP	50	384	8	1.62-5.5	64	Y	4	10	2	–	16	–	2	7	1	1	84	100-LQFP	0.5mm
	R5F52107ADLJ	50	384	8	1.62-5.5	64	Y	4	10	2	–	16	–	2	7	1	1	84	100-LGA	0.65mm
	R5F52108ADFM	50	512	8	1.62-5.5	64	N	4	10	2	–	12	–	2	7	1	1	48	64-LQFP	0.5mm
	R5F52108ADFN	50	512	8	1.62-5.5	64	N	4	10	2	–	14	–	2	7	1	1	64	80-LQFP	0.5mm
	R5F52108ADFP	50	512	8	1.62-5.5	64	Y	4	10	2	–	16	–	2	7	1	1	84	100-LQFP	0.5mm
	R5F52108ADLJ	50	512	8	1.62-5.5	64	Y	4	10	2	–	16	–	2	7	1	1	84	100-LGA	0.65mm
RX220	R5F52201BDFL	32	32	8	1.62-5.5	4	N	4	10	1	–	8	–	–	4	1	1	35	48-LQFP	0.5mm
	R5F52203BDFL	32	64	8	1.62-5.5	8	N	4	10	1	–	8	–	–	4	1	1	35	48-LQFP	0.5mm
	R5F52205BDFP	32	128	8	1.62-5.5	8	N	4	10	1	–	16	–	–	5	1	1	85	100-LQFP	0.5mm
	R5F52206BDFP	32	256	8	1.62-5.5	16	N	4	10	1	–	16	–	–	5	1	1	85	100-LQFP	0.5mm
RX21A	R5F521A6BDFP	50	256	8	1.8-3.6	32	N	4	10	2	7	14	4	2	5	2	2	66	100-LQFP	0.5mm
	R5F521A7BDFM	50	384	8	1.8-3.6	64	N	4	10	2	3	7	2	–	5	2	1	38	64-LQFP	0.5mm
	R5F521A8BDFP	50	512	8	1.8-3.6	64	N	4	10	2	7	14	4	2	5	2	2	66	100-LQFP	0.5mm

Selected examples shown here.
Please check sg.renesas.com/rx200 for complete list of available devices.

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 128KB evaluation version, full GNU version)
- Quick-start guide, RX210 sample projects
- Shared firmware projects

RPB Part Number: YRPBRX210

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

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 – Run / Stop (Resume / Suspend) – Software breakpoints – Source step / disassembly step	– Variable and Expression views – Register view – Basic Memory view – Endian selection	– Renesas Debug view with Call Stack – I/O Registers view – Trace view – Eventpoints view	– Real-time Expression view – Real-time Memory view – Real-time Chart view
sg.renesas.com/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
R0E000010KCE00

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 Eclipse IDE and KPIT GNURX compiler
www.kpitgnutools.com

RTOS

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

CMX-RTX
www.cmx.com

FreeRTOS
www.freertos.org

embOS
www.segger.com

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

sg.renesas.com

Renesas Electronics Singapore Pte. Ltd. | Tel: +65 6213 0200
80 Bendemeer Road #06-02 Hyflux Innovation Centre, Singapore 339949.

Renesas Electronics Malaysia Sdn. Bhd. | Tel: +60 3 7955 9390
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, Petaling Jaya, 46050 Selangor, Malaysia.

Renesas Electronics Singapore Pte. Ltd. India Branch | Tel: +91 80 6720 8700
777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore 560038, India

Find us on Facebook
facebook.com/RenesasSingapore

YouTube
youtube.com/RenesasPresents

MyRenesas
sg.renesas.com/MyRenesas/

RenesasRulz.com
RenesasRulz.com

Renesas Interactive
RenesasInteractive.com