The Core Difference in Your Design
RX200 Microcontrollers

Renesas Electronics Singapore
sg.renesas.com
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.

### RX200 MCUs for High-performance, Power-efficient Applications

<table>
<thead>
<tr>
<th>RX for Portable Medical</th>
<th>RX for Sensors</th>
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</thead>
<tbody>
<tr>
<td>- High performance</td>
<td>- Low power</td>
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<td>- 78 max DMIPS for optimal duty cycle</td>
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**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 Portable Medical**
- High performance
- Low voltage
- Digital signal processing capability

**RX for Meters**
- Low power
- High performance
- DSP instruction set
- 24-bit ΔΣ ADC
- Up to 1MB Flash
- Advanced Encryption Standard (AES)
- Integrated ADC
- RTC with anti-tamper
- Low pin count

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

**RX for Industrial Automation**
- EMC performance with true 5V operation
- Motor control
- Communication peripherals
- Integrated ADC & DAC, temp. 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
- CAC: Detects abnormal frequency
- Oscillation Stop Detection: Detects OSC stop and switch clock source to OCO

RAM
- Data Operation Circuit: Assists RAM failure check test

Serial Communication
- Cyclic Redundancy Check: Detects serial communication data error

OCO Dedicated for WDT
- I-WDT: Independent watchdog timer clock source from system clock

ADC
- Disconnect Detection: Detects disconnection of analog input
- 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.

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.

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**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.

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**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.

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

**Data Flash with BGO**
- Erase/write operation down to 1.62V
- 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.

<table>
<thead>
<tr>
<th>Group</th>
<th>CPU (MHz)</th>
<th>Flash (max)</th>
<th>SRAM (max)</th>
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<th>SRAM (max)</th>
<th>ADC 10-bit</th>
<th>ADC 12-bit</th>
<th>ADC 16-bit</th>
<th>Temp Sensor</th>
<th>Comparator</th>
<th>EAS</th>
<th>MPU</th>
<th>MART</th>
<th>MTU</th>
<th>WDT</th>
<th>RTC</th>
<th>SCI</th>
<th>SCI Bus</th>
<th>SPI</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX210</td>
<td>32</td>
<td>2MB</td>
<td>96KB</td>
<td>8KB</td>
<td>2</td>
<td>16</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>4</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>1</td>
<td>7</td>
<td>√</td>
</tr>
<tr>
<td>RX220</td>
<td>32</td>
<td>256KB</td>
<td>32KB</td>
<td>8KB</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>√</td>
<td>–</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>RX21A</td>
<td>50</td>
<td>512KB</td>
<td>64KB</td>
<td>8KB</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>4</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>4</td>
<td>√</td>
<td>√</td>
<td>2</td>
<td>5</td>
<td>–</td>
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</table>

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

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

RX210

RX220

RX21A

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 (CTD) project.

<table>
<thead>
<tr>
<th>Basic Features</th>
<th>Advanced Debug Features</th>
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</thead>
<tbody>
<tr>
<td>– Connect / Disconnect</td>
<td>– Renesas Debug view with Call Stack</td>
</tr>
<tr>
<td>– Run / Stop (Resume / Suspend)</td>
<td>– Real-time Expression view</td>
</tr>
<tr>
<td>– Software breakpoints</td>
<td>– Real-time Memory view</td>
</tr>
<tr>
<td>– Source step / disassembly step</td>
<td>– Real-time Chart view</td>
</tr>
<tr>
<td>– Variable and Expression views</td>
<td>– Endian selection</td>
</tr>
<tr>
<td>– Register view</td>
<td>– Basic Memory view</td>
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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.

Third-party Compilers and RTOS

<table>
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<tr>
<th>Compilers</th>
<th>RTOS</th>
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<tr>
<td>IAR SYSTEMS</td>
<td>Micrium</td>
</tr>
<tr>
<td>IAR Embedded Workbench, with full C and C++ support, MISRA C compliance checker</td>
<td>µC/OS-II and µC/OS-III</td>
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<tr>
<td><a href="http://www.iar.com/ewrx">www.iar.com/ewrx</a></td>
<td><a href="http://www.micrium.com">www.micrium.com</a></td>
</tr>
<tr>
<td>KPI Cummins Infosystems Limited</td>
<td>CMX SYSTEMS</td>
</tr>
<tr>
<td>KPI Eclipse IDE and KPI GNURX compiler</td>
<td>CMX-RTX</td>
</tr>
<tr>
<td><a href="http://www.kpitgnutools.com">www.kpitgnutools.com</a></td>
<td><a href="http://www.cmx.com">www.cmx.com</a></td>
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<td>sg.renesas.com/e2studio</td>
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Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.