

# RX200 SERIES MICROCONTROLLERS

Exceptional 32-bit performance providing ultra-low power, low voltage, and a wide range of capabilities



# RX200 SERIES MICROCONTROLLERS FOR **HIGH PERFORMANCE & POWER EFFICIENCY**



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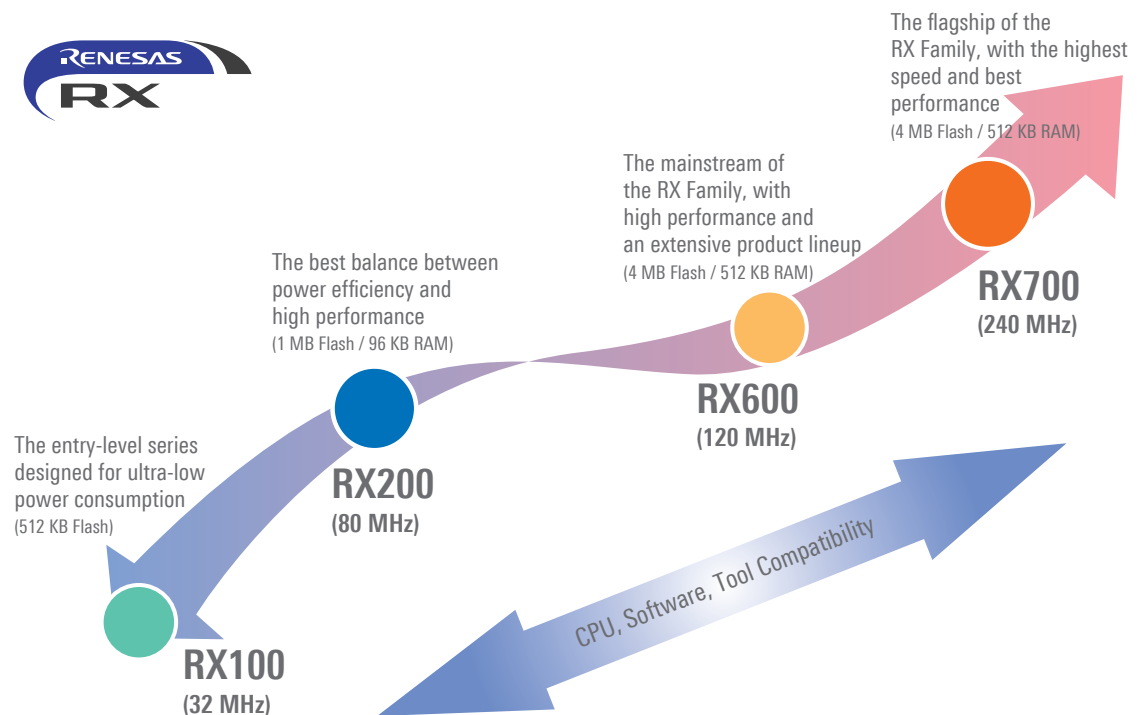
# RX200 – A PERFECT BALANCE OF PERFORMANCE AND POWER CONSUMPTION

The RX Family of MCUs features the revolutionary RX architecture and meets current and projected system design requirements in terms of memory size, power consumption, scalability, feature set, and price.

Devices in the RX200 Series emphasize mid-range performance combined with high power efficiency and ultra-low power, low voltage, and safety.

- All RX Family devices are CPU and peripheral compatible and share the same software tools and ecosystem.
- Many devices offer advanced connectivity with Ethernet, a USB host function, and multiple CAN interfaces and solutions for motors and power inverters.
- The RX200 Series offers memory sizes from 32 KB up to 1 MB.

## THE RX 32-BIT MICROCONTROLLER FAMILY



# RX200 SERIES AT-A-GLANCE

The RX200 Series of Flash MCUs brings new levels of capability and performance to ultra-low-power, low-voltage embedded system applications. Based on the fast 32-bit RX CPU core, the RX200 family of middle-range products delivers more performance on far less power than other MCUs, operates over wide voltage ranges, and offers huge power savings in standby.

- All RX200 Series MCUs offer a wide set of peripherals, including communication, ADC, and IEC60730 appliance safety standard support.
- RX231 Group is the primary option for most general-purpose mid-range designs.
- RX23T, RX24T, and RX24U are specifically targeted for motor control applications.

## RX200 SERIES FEATURES

<p><b>High-performance 32-bit RX CPU</b> Up to 4.33 CoreMark<sup>®</sup>/MHz</p> <p>DSP and FPU with improved processing capacity</p>	<p><b>Low power consumption</b> 0.12 mA/MHz (operation) 0.8 μA (standby)</p> <p>Superior power efficiency through intermittent operation</p>	<p><b>Numerous peripheral functions</b> Communication, touch, motors, analog, 5 V interface</p> <p>Simplified support for system control, motor control, and IoT</p>	<p><b>Safety functions</b> Security</p> <p>Simplified support for safety standards Protection against threats such as viruses</p>
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## MAIN APPLICATIONS OF RX200 SERIES

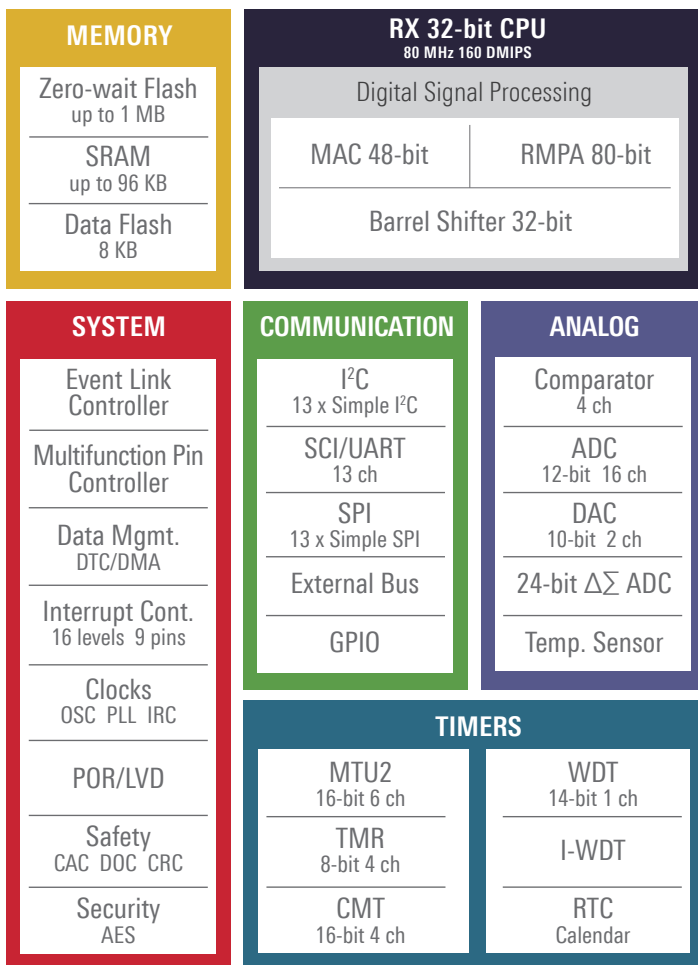
<p><b>Consumer devices (battery drive)</b></p> <p>Digital cameras Gadgets</p>	<p><b>Healthcare devices</b></p> <p>Wearable devices Blood sugar gauges</p>	<p><b>Industrial</b></p> <p>Power meters Pressure, Temperature, and flow volume meters, Inverters</p>	<p><b>Electric home appliances</b></p> <p>Air conditioners, Refrigerators Washing machines</p>
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Motor Control	<p><b>RX24U</b></p> <p>Max. 80 MHz 256 KB to 512 KB 2.7 V to 5.5 V</p>	<p>RXv2 core*1</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>
	<p><b>RX24T</b></p> <p>Max. 80 MHz 128 KB to 512 KB 2.7 V to 5.5 V</p>	<p>RXv2 core*1</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>
	<p><b>RX23T</b></p> <p>Max. 40 MHz 64 KB to 128 KB 2.7 V to 5.5 V</p>	<p>RXv2 core*1</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>
General Purpose, HMI, Connectivity, Security	<p><b>RX231</b></p> <p>Max. 54 MHz 128 KB to 512 KB 1.8 V to 5.5 V</p>	<p>RXv2 core*1</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>
	<p><b>RX230</b></p> <p>Max. 54 MHz 128 KB to 256 KB 1.8 V to 5.5 V</p>	<p>RXv2 core*1</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>
Meter/Measuring	<p><b>RX21A</b></p> <p>Max. 50 MHz 256 KB to 512 KB 1.8 V to 3.6 V</p>	<p>RXv1 core</p> <p>USB Host/Func</p>	<p>FPU</p> <p>SDHI</p>	<p>Safety functions</p> <p>Motor control</p>	<p>Touch</p> <p>Encryption</p>	<p>External bus</p> <p>ΔΣA/D</p>	<p>CAN</p>

Note 1: The RXv2 CPU core has advanced performance features such as a DSP.



# BLOCK DIAGRAM



- Ultra-low voltage operation
  - 1.62V operation @ up to 20 MHz, 31 DMIPS
- High performance
  - 2.00 DMIPS/MHz, 160 DMIPS @ 80 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 programmable while code is executed (BGO)
- Low power consumption
  - 96  $\mu$ A/DMIPS\* (run mode), 1.0  $\mu$ A with RTC on
  - 0.3  $\mu$ A 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

\*96  $\mu$ A/DMIPS applies to the RX210 MCU, Version B, high-speed operating mode, no peripherals operating

## 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. The 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. The ADC has disconnect-detection and self-diagnostic functions. The I/O pins can read back output values.

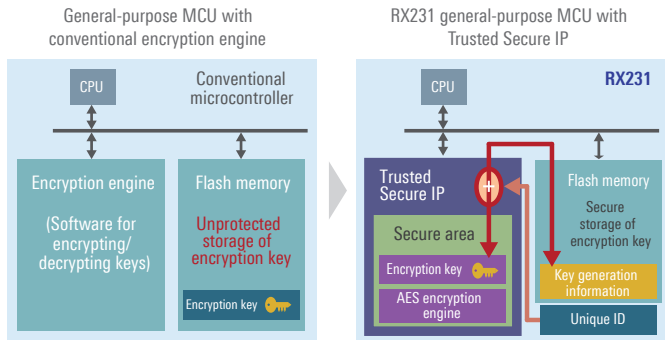
Clock	RAM	Serial Communication	OCO Dedicated for WDT	ADC
CAC Detects abnormal frequency	Data Operation Circuit Assists RAM failure check test	Cyclic Redundancy Check Detects serial communication data error	I-WDT Independent watchdog timer clock source from system clock	Disconnect Detection Detects disconnection 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

# KEY FEATURES

## ROBUST SECURITY WITH TRUSTED SECURE IP (TSIP)

The Trusted Secure IP creates a secure area inside the IP module by monitoring for unauthorized access attempts. It ensures that the encryption engine and encryption key can be utilized safely. The encryption key, the most important element in reliable and secure encryption, is linked to a unique ID and stored in the flash memory in a safe, undecipherable format.



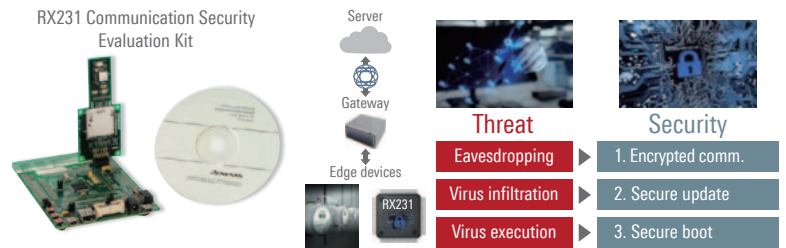
### Functions of AES\* encryption engine of Trusted Secure IP

- Key length: 128 bits/256 bits
- Encryption modes used:  
Encryption/decryption: ECB, CBC, GCM  
Tampering detection: CMAC

\* AES: Advanced Encryption Standard. An encryption method, established by the National Institute of Standards and Technology (NIST), that is the standard in the United States.

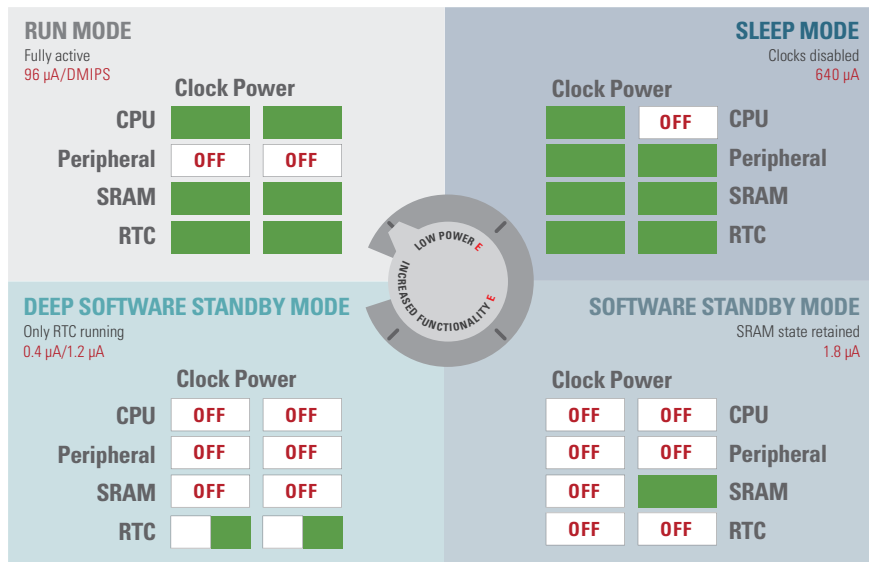
## Features of RX231 Communication Security Evaluation Kit

Protect IoT edge devices from eavesdropping and from the infiltration and execution of viruses. Start evaluating encrypted communication, secure boot, and secure update functionality in your wireless LAN and USB communication applications right away.



## HIGHLY EFFECTIVE POWER MANAGEMENT

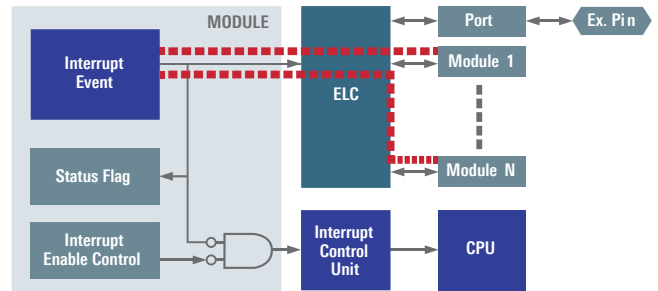
RX200 MCUs have a sophisticated power management system that can apply power to only those functions essential to the application at any point in time. Four different major power modes are available – Run, Sleep, Software Standby, and Deep Software Standby. Wake-up time from Sleep mode is only 0.2  $\mu$ 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.



## LOW POWER CONSUMPTION AND DESIGN FLEXIBILITY

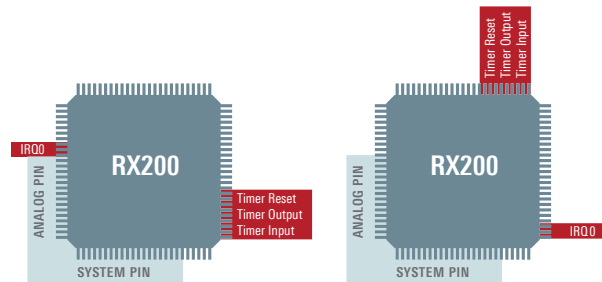
### Event Link Controller

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.



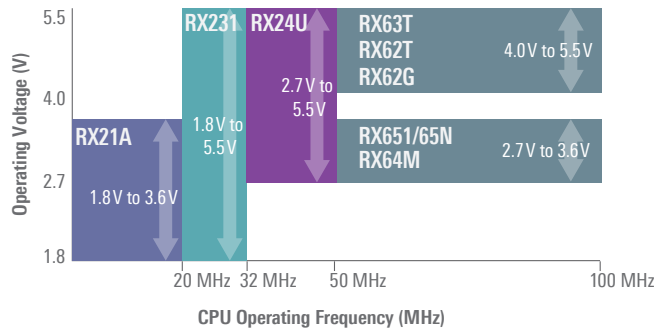
### Multifunction Pin Controller

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.



## WIDER VOLTAGE RANGE

The RX200 series provides a wider set of voltage operation as compared to the RX600 – from 1.8 V to 5.5 V.

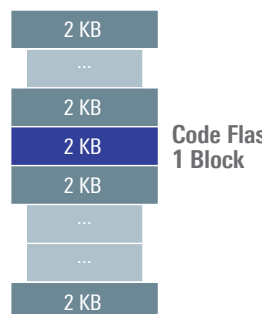


## INDUSTRY-LEADING FLASH TECHNOLOGY

Today Renesas uses a variety of advanced low power flash technologies to allow the RX MCUs to fetch instructions without delay and maintain the maximum levels of CPU 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 down to 1.62 V or 1.8 V on many RX200 devices, making it possible for battery operated devices to program them while running at minimum operating voltage.

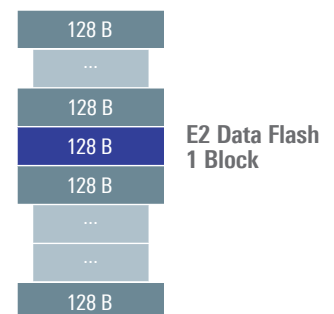
### Code Flash

- 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

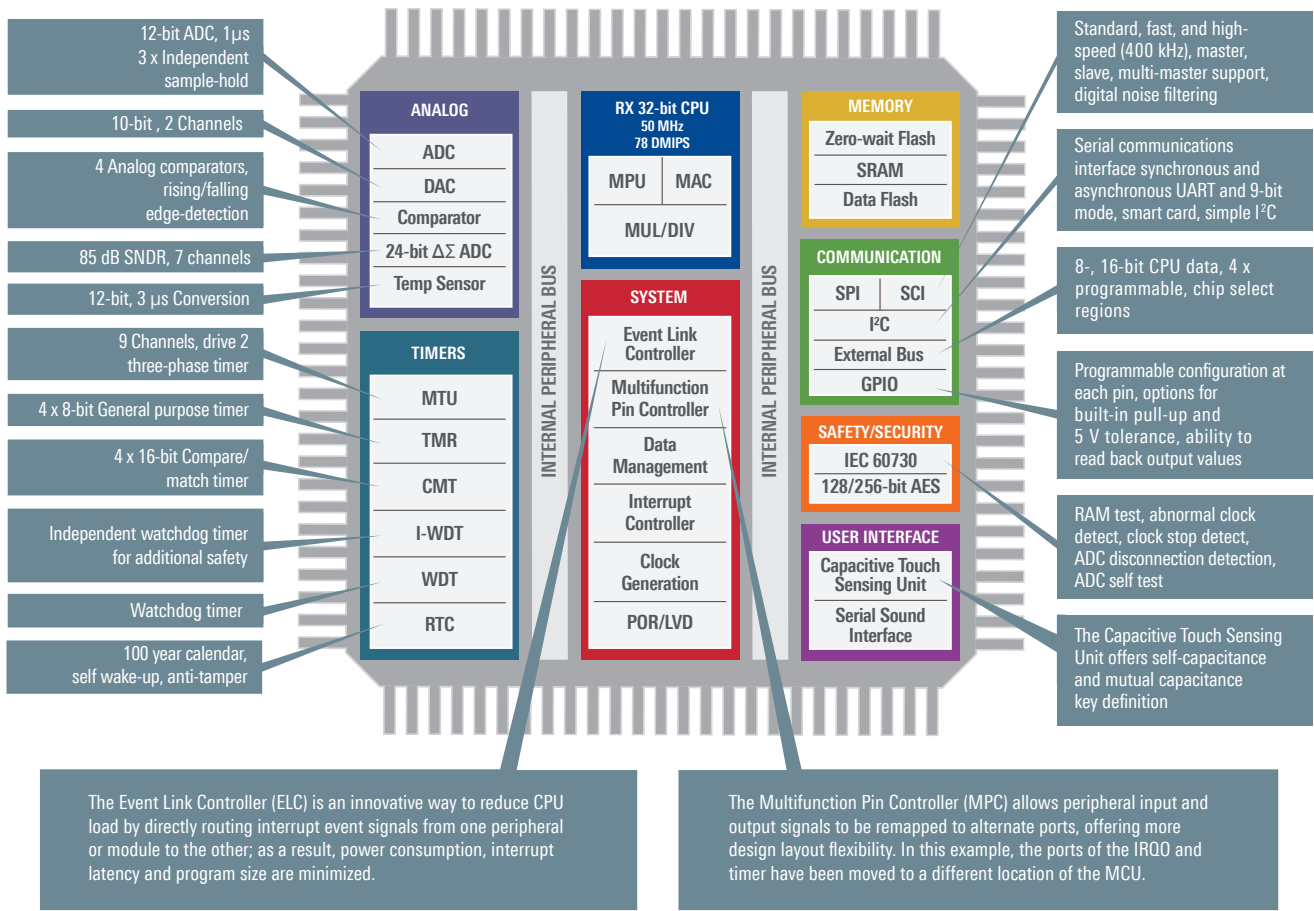
- Erase/write operation down to 1.62 V
- E2 Data Flash replaces external EEPROM
- 128 Bytes erase block size
- 100 K times erase cycle
- 2 Byte write/program
- BGO (programmable data flash while code is executed)



# COMPREHENSIVE ON-CHIP PERIPHERALS

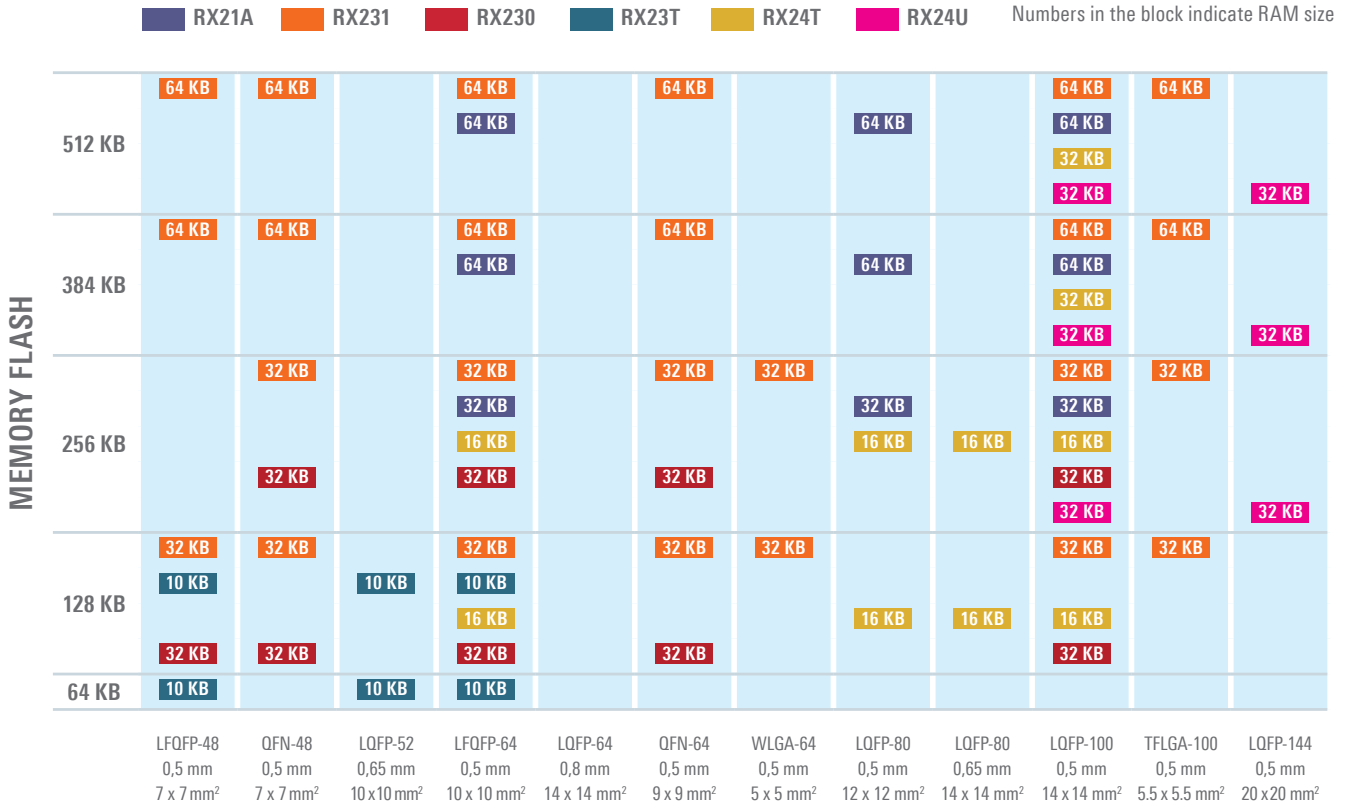
Many different combinations of on-chip analog, timer, communication, system, and other functions are built into RX200 MCUs to lower cost, simplify systems, and reduce total power consumption.

Group	Flash (max)	SRAM (max)	Data Flash	ADC 24-bit	ADC 12-bit	ADC 10-bit	DAC	Temp. Sensor	Comparator	Encryption	MPU	MTU	TPU	TMR	CMT	Low Power Timer	WDT	i-WDT	RTC	USART	I <sup>2</sup> C	SPI	USB	CAN	Cap. Touch	IrDA
RX21A	512 KB	64 KB	8 KB	7 ch	-	7	2 ch 10-bit	✓	4	✓	✓	6	-	4	4	-	✓	✓	✓	5	✓	✓	-	-	-	✓
RX231	512 KB	64 KB	8 KB	-	24	-	2 ch 10-bit	✓	4	✓	✓	6	✓	4	4	✓	✓	✓	✓	7	✓	✓	✓	✓	✓	✓
RX230	256 KB	32 KB	8 KB	-	24	-	2 ch 10-bit	✓	4	-	✓	6	✓	4	4	✓	✓	✓	✓	7	✓	✓	✓	-	✓	✓
RX23T	128 KB	10 KB	-	-	10	-	1 ch 8-bit	-	3	-	✓	6	-	4	4	-	-	✓	-	2	✓	✓	-	✓	-	-
RX24T	256 KB	16 KB	8 KB	-	22	-	1 ch 8-bit	-	4	-	✓	9	-	8	4	-	-	✓	-	3	✓	✓	-	✓	-	-
RX24U	512 KB	32 KB	8 KB	-	22	-	2 ch 8-bit	-	4	-	✓	9	-	8	4	-	-	✓	-	6	✓	✓	-	✓	-	-





# RX200 MCU SERIES PORTFOLIO



# RX200 SERIES FOCUS DEVICES

Group	Device	Operating Speed MHz	Flash Size (KB)	Data Flash (KB)	V <sub>cc</sub> (V)	SRAM (KB)	External Data Bus	On Chip Oscillator	8-bit Timers	16-bit Timers	Motor Control Timer	RTC	Watchdog Timers	A/D 24-bit	A/D 12-bit	Comparator	DAC	DMA	DTC	SCI	SPI	I <sup>2</sup> C	GPIO	Package Type	Pin Pitch
RX231	R5F5231xyDFL	54	128, 256, 384, 512	8	1.8–5.5	32–64	–	3	4	16	✓	✓	2	–	8	4	–	4	✓	4	1	1	30	LQFP-48	0.5 mm
	R5F5231xyDNE	54	128, 256, 384, 512	8	1.8–5.5	32–64	–	3	4	16	✓	✓	2	–	8	4	–	4	✓	4	1	1	30	QFN-48	0.5 mm
	R5F5231xyDFM	54	128, 256, 384, 512	8	1.8–5.5	32–64	–	3	4	16	✓	✓	2	–	12	4	2	4	✓	5	1	1	44	LFQFP-64	0.5 mm
	R5F5231xyDND	54	128, 256, 384, 512	8	1.8–5.5	32–64	–	3	4	16	✓	✓	2	–	12	4	2	4	✓	5	1	1	44	QFN-64	0.5 mm
	R5F5231xyDLF	54	128, 256, 384, 512	8	1.8–5.5	32–64	–	3	4	16	✓	✓	2	–	12	4	2	4	✓	5	1	1	44	WLGA-64	0.5 mm
	R5F5231xyDFP	54	128, 256, 384, 512	8	1.8–5.5	32–64	✓	3	4	16	✓	✓	2	–	24	4	2	4	✓	7	1	1	80	LQFP-100	0.5 mm
	R5F5231xyDLA	54	128, 256, 384, 512	8	1.8–5.5	32–64	✓	3	4	16	✓	✓	2	–	24	4	2	4	✓	7	1	1	80	TFLGA-100	0.5 mm
RX230	R5F5230xADFL	54	128, 256	8	1.8–5.5	32	–	3	4	16	✓	✓	2	–	8	4	2	4	✓	4	1	1	30	LQFP-48	0.5 mm
	R5F5230xADNE	54	128, 256	8	1.8–5.5	32	–	3	4	16	✓	✓	2	–	8	4	2	4	✓	4	1	1	30	QFN-48	0.5 mm
	R5F5230xADFM	54	128, 256	8	1.8–5.5	32	–	3	4	16	✓	✓	2	–	12	4	2	4	✓	5	1	1	44	LFQFP-64	0.5 mm
	R5F5230xADND	54	128, 256	8	1.8–5.5	32	–	3	4	16	✓	✓	2	–	12	4	2	4	✓	5	1	1	44	QFN-64	0.5 mm
	R5F5230xADFP	54	128, 256	8	1.8–5.5	32	✓	3	4	16	✓	✓	2	–	24	4	2	4	✓	7	1	1	80	LQFP-100	0.5 mm
RX23T	R5F523TxADFL	40	64, 128	–	2.7–5.5	10	–	3	4	10	✓	–	1	–	10	3	–	–	✓	2	1	1	36	LQFP-48	0.5 mm
	R5F523TxADFD	40	64, 128	–	2.7–5.5	10	–	3	4	10	✓	–	1	–	10	3	–	–	✓	2	1	1	38	LQFP-52	0.65 mm
	R5F523TxADFM	40	64, 128	–	2.7–5.5	10	–	3	4	10	✓	–	1	–	10	3	–	–	✓	2	1	1	49	LFQFP-64	0.5 mm
RX24T	R5F524TxADFM	80	128, 256	8	2.7–5.5	16	–	3	8	13	✓	–	1	–	12	4	1	–	✓	3	1	1	49	LFQFP-64	0.5 mm
	R5F524TxADFN	80	128, 256	8	2.7–5.5	16	–	3	8	13	✓	–	1	–	17	4	1	–	✓	3	1	1	61	LFQFP-80	0.5 mm
	R5F524TxADFF	80	128, 256	8	2.7–5.5	16	–	3	8	13	✓	–	1	–	17	4	1	–	✓	3	1	1	61	LFQFP-80	0.65 mm
	R5F524TxADFP	80	128, 256	8	2.7–5.5	16	–	3	8	13	✓	–	1	–	22	4	1	–	✓	3	1	1	81	LFQFP-100	0.5 mm
	R5F524TxADFP	80	256, 384, 512	8	2.7–5.5	32	–	3	4	11	✓	–	1	–	22	4	2	–	✓	3	1	1	80	LFQFP-100	0.5 mm
RX24U	R5F524UxADFP	80	256, 384, 512	8	2.7–5.5	32	–	3	4	15	✓	–	1	–	20	4	2	–	✓	4	1	1	80	LFQFP-100	0.5 mm
	R5F524UxADFB	80	256, 384, 512	8	2.7–5.5	32	–	3	4	15	✓	–	1	–	22	4	2	–	✓	6	1	1	111	LFQFP-144	0.5 mm
RX21A	R5F521AxBDFP	50	256, 384, 512	8	1.8–3.6	32–64	–	3	4	10	✓	✓	2	7	7	4	2	4	✓	5	2	2	67	LQFP-100	0.5 mm
	R5F521AxBDFN	50	256, 384, 512	8	1.8–3.6	32–64	–	3	4	10	✓	✓	2	4	7	4	2	4	✓	5	2	2	52	LQFP-80	0.5 mm
	R5F521AxBDFM	50	256, 384, 512	8	1.8–3.6	32–64	–	3	4	10	✓	✓	2	3	4	3	–	4	✓	5	2	1	39	LQFP-64	0.5 mm

Selected examples shown here. Please check [www.renesas.com/rx](http://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.

“y” represents the peripheral mix, indicated support of SHDI interface, and advanced security support (see RX231 hardware manual)

Note: Support for 105°C operation available on many devices.

Please check with Renesas.

# RX FAMILY DEVELOPMENT TOOLS

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.



## RX200 Renesas Starter Kit (RSK)

These complete RX200-based hardware/software platforms for in-depth application design include the E1 Debugger, e<sup>2</sup> studio, demonstration firmware, and a trial version of the Renesas RX compiler.



- RX231 RSK**  
P/N: YR0K505231S000BE
  - RX24U RSK**  
P/N: YRTK500524US00000BE
  - RX24T RSK**  
P/N: YRTK500524TS00000BE
  - RX23T RSK**  
P/N: YRTK500523TS00000BE
- [www.renesas.com/RSK](http://www.renesas.com/RSK)

## RX200 Target Board

The RX200 target board provides an entry point to evaluation, prototyping, and developing for the RX MCU family. It incorporates an emulator circuit so you can use it for your own application design without the need for further tool investments.



**RTK5RX2310C00000BR**  
[www.renesas.com/rxtb](http://www.renesas.com/rxtb)



## e<sup>2</sup> studio – the Eclipse-based Integrated Development Environment (IDE)

The Renesas e<sup>2</sup> studio IDE is a complete development and debug environment based on the popular Eclipse platform 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.com/e2studio](http://www.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 E2 Lite and E2 debuggers offer thorough CPU control and visibility.



**Renesas E2 Lite**  
P/N: RTE0T0002LKCE00000R



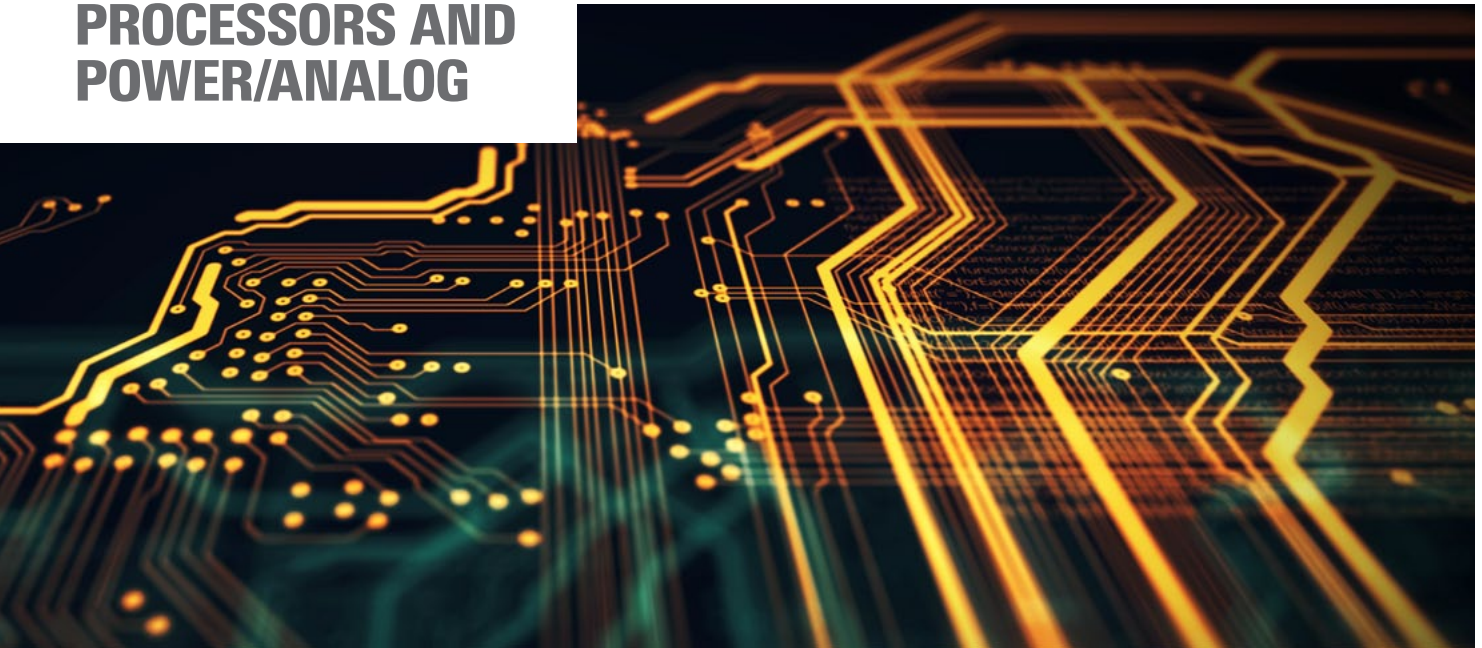
**Renesas E2**  
P/N: RTE0T0002KCE00000R

[www.renesas.com/tools](http://www.renesas.com/tools)

## Third-party Solutions

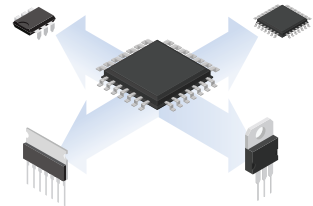
Compilers	IAR SYSTEMS	RoweBots	expresslogic	freeRTOS	SEGGER
	 <a href="http://www.iar.com/ewrx">www.iar.com/ewrx</a>	 <a href="http://www.rowebots.com">www.rowebots.com</a>	 <a href="http://www.expresslogic.com">www.expresslogic.com</a>	 <a href="http://www.freertos.org">www.freertos.org</a>	 <a href="http://www.segger.com">www.segger.com</a>
	IAR Embedded Workbench, with full C and C++ support, MISRA C compliance checker	Eclipse IDE and GNU RX compiler		KPIT GNURX compiler	
RTOS	µC/OS-III	Unison	ThreadX	FreeRTOS	embOS
USB	✓	✓	✓	✓	✓

# PROCESSORS AND POWER/ANALOG



## COMPLETE SYSTEM SOLUTIONS AT YOUR FINGERTIPS

In today's fast paced technology environment, designers need to be innovative without compromising time to market. Thinking at the system level is crucial to being able to address design challenges upfront. By offering quality solutions for the two most critical parts of your design, processors and power, Renesas accelerates your development and enables differentiation, while bringing predictability to your application. Whatever your product field – industrial, home electronics, office automation, or information communication technology – Renesas is the partner you can rely on from design to production.



A top-to-bottom, front-to-back product offering will help speed design and bring quality, compatibility, and predictability to your applications.

### Power Management and Precision Analog Products

Power Management	Amplifiers & Buffers	Audio & Video	Data Converters	Switches & Multiplexers	Optoelectronics	Timing & Digital
<ul style="list-style-type: none"> <li>■ Discrete DC/DC Converters</li> <li>■ Battery Management Systems (BMS)</li> <li>■ Computing Power VRM/IMVP</li> <li>■ Digital Power</li> <li>■ Display Power and Backlighting</li> <li>■ Hot Swap &amp; ORing</li> <li>■ Isolated Power Supply</li> <li>■ LED Drivers</li> <li>■ LNB Regulators</li> <li>■ Low Dropout Regulator ICs</li> <li>■ MOSFET Drivers</li> <li>■ PMIC</li> <li>■ Power Modules</li> </ul>	<ul style="list-style-type: none"> <li>■ Buffers</li> <li>■ Comparators</li> <li>■ Current Sense</li> <li>■ Differential Amplifiers</li> <li>■ Display Amplifiers and Buffers</li> <li>■ Gain Blocks</li> <li>■ High-Speed Op Amps</li> <li>■ Instrumentation Amplifiers</li> <li>■ Line Drivers</li> <li>■ Precision Op Amps</li> <li>■ Sample and Hold Amplifiers</li> <li>■ Transistor Arrays</li> </ul>	<ul style="list-style-type: none"> <li>■ Switches</li> <li>■ Security Surveillance</li> <li>■ Buffered Video MUXs</li> <li>■ Audio Processor</li> <li>■ DVI/HDMI</li> <li>■ Display ICs</li> <li>■ HD Video Analog Front End (AFEs)</li> <li>■ Surveillance ICs</li> <li>■ Video Decoders/Encoders</li> <li>■ Video ICs</li> </ul>	<ul style="list-style-type: none"> <li>■ D/A Converters</li> <li>■ Digital Potentiometers (DCPs)</li> <li>■ High-Speed A/D Converters</li> <li>■ Precision A/D Converters</li> <li>■ Voltage References</li> </ul>	<ul style="list-style-type: none"> <li>■ High Voltage</li> <li>■ Low Voltage</li> <li>■ Medium Voltage</li> <li>■ USB</li> <li>■ High-Speed</li> <li>■ High-Speed plus 2ch Stereo Audio</li> <li>■ High-Speed UART Dual 3-1 MUX</li> </ul>	<ul style="list-style-type: none"> <li>■ Ambient Light Sensors</li> <li>■ Ambient Light and Proximity Sensors</li> <li>■ Laser Diode Drivers (LDD)</li> <li>■ Proximity Sensors</li> </ul>	<ul style="list-style-type: none"> <li>■ Clock Generators</li> <li>■ Counters/Time Base ICs</li> <li>■ DSP</li> <li>■ Memory</li> <li>■ Microprocessors and Peripherals</li> <li>■ Real Time Clocks</li> </ul>
					<b>Interface</b> <ul style="list-style-type: none"> <li>■ RS-485 &amp; RS-422</li> <li>■ RS-232</li> <li>■ 2-Wire Bus Buffers</li> <li>■ Signal Integrity</li> </ul>	<b>Space &amp; Harsh Environment</b> <ul style="list-style-type: none"> <li>■ Radiation Hardened</li> <li>■ Defense &amp; Hi-Reliability</li> </ul>

## POWERING AN MCU

### Buck-Boost Converter

ISL9120, ISL91107, ISL91128

- Current Range: 400 mA – 2.4 A
- Low Iq ~ 20  $\mu$ A
- Input Voltage: 0.6 V – 5.5 V
- Output Voltage: 2.5 V – 5.25 V

### Buck Converters

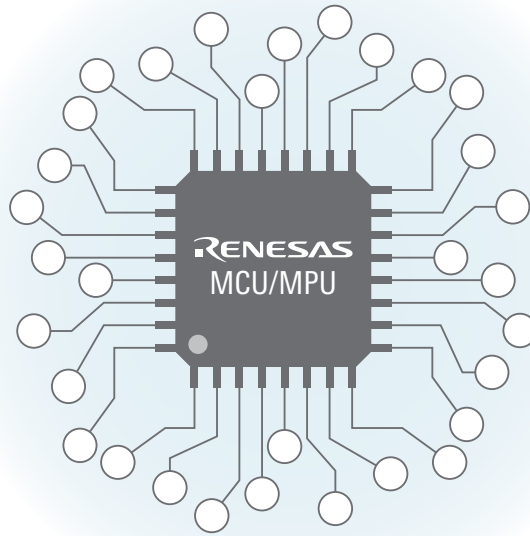
ISL9103/A, ISL9107/A, ISL9307

- Current Range: 500 mA – 1.5 A
- Low Iq ~ 17  $\mu$ A
- Input Voltage: 2.7 V – 6 V
- Output Voltage: 0.8 V -  $V_{IN}$

### Boost Converters

ISL9111, ISL9113, ISL91133

- Current Range: 400 mA – 2.3 A
- Low Iq ~ 20  $\mu$ A
- Input Voltage: 0.6 V – 5.4 V
- Output Voltage: 2.5 V – 5.25 V



### Linear Regulators

ISL9007, ISL9021A, ISL9016

- Current Range: 150 mA – 400 mA
- Low Iq ~ 25  $\mu$ A
- Input Voltage: 1.5 V – 6.5 V
- Output Voltage: 0.9 V – 3.3 V

### Bi-Directional Buck-Boost Conv.

ISL95338

- Current Range: <10 A
- $V_{IN}$ : 3.2 V – 23.5 V;  $V_{OUT}$ : 2.4 V – 20 V

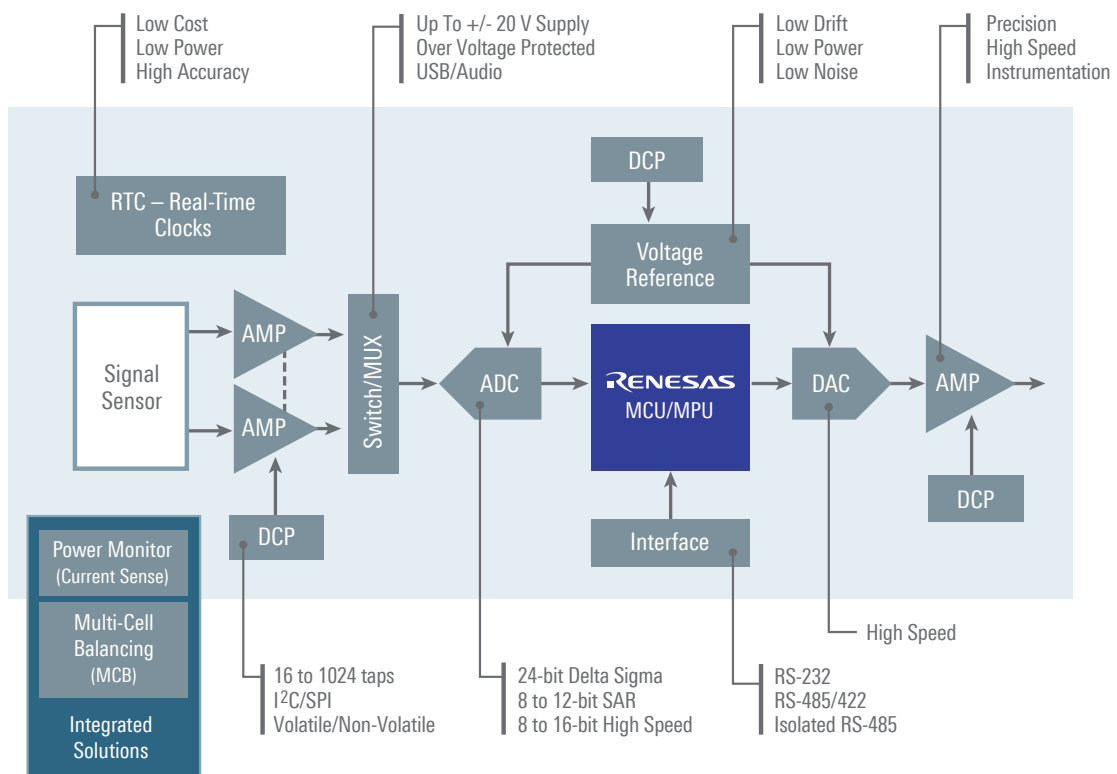
### Battery Chargers

ISL6294, ISL9230, ISL9220

- Dual power source (USB & Wireless Charging + Power Path)
- Current Range: 300 mA – 1.5 A
- 30 V Input Compliant

## COMPLETE SIGNAL CHAIN SOLUTIONS

Renesas' broad precision analog portfolio provides a wide range of next-gen precision instrumentation, medical, communication, and industrial process control applications where innovation, reliability, and dependability is central to the analog designs.







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