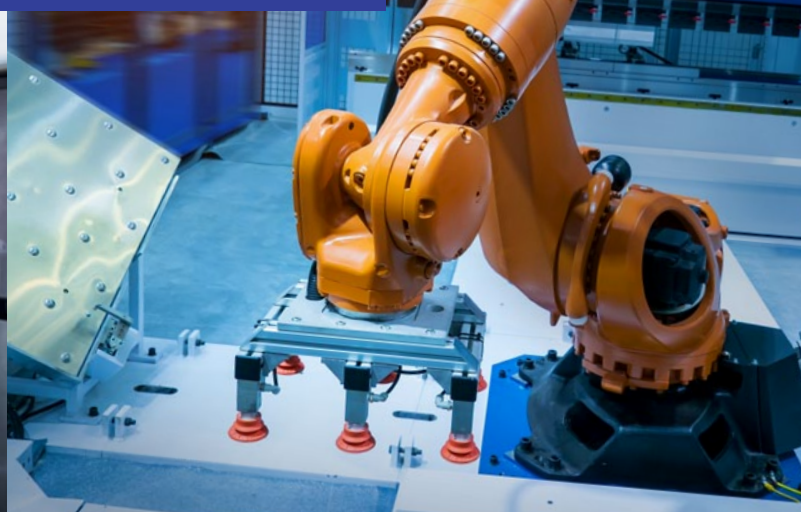
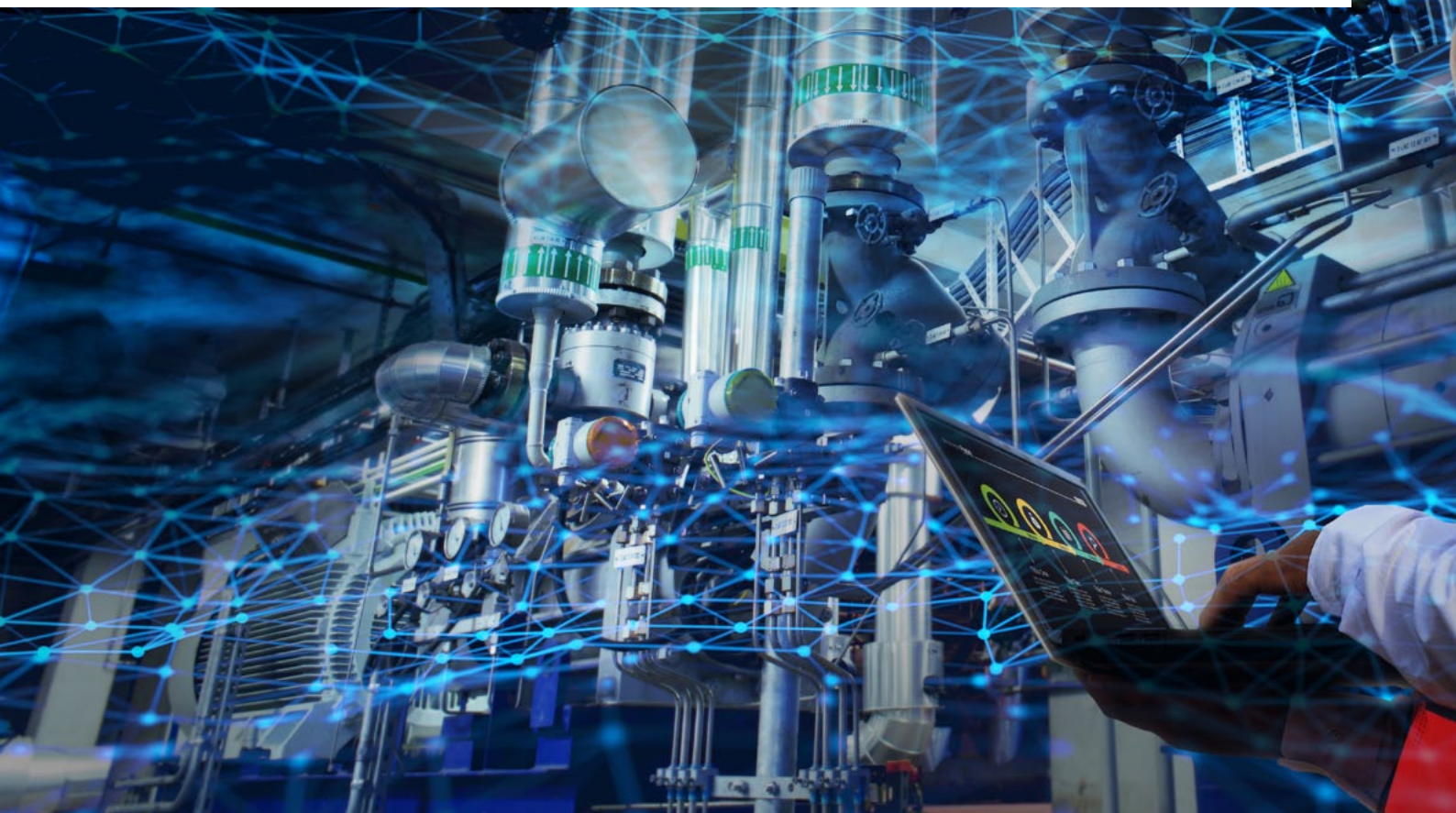


RX600/RX700 SERIES MICROCONTROLLERS

32-bit architecture with outstanding performance, power efficiency,
and connectivity, including sophisticated on-chip functionality



RX600/RX700 SERIES MICROCONTROLLERS FOR **PERFORMANCE WITHOUT SACRIFICE**



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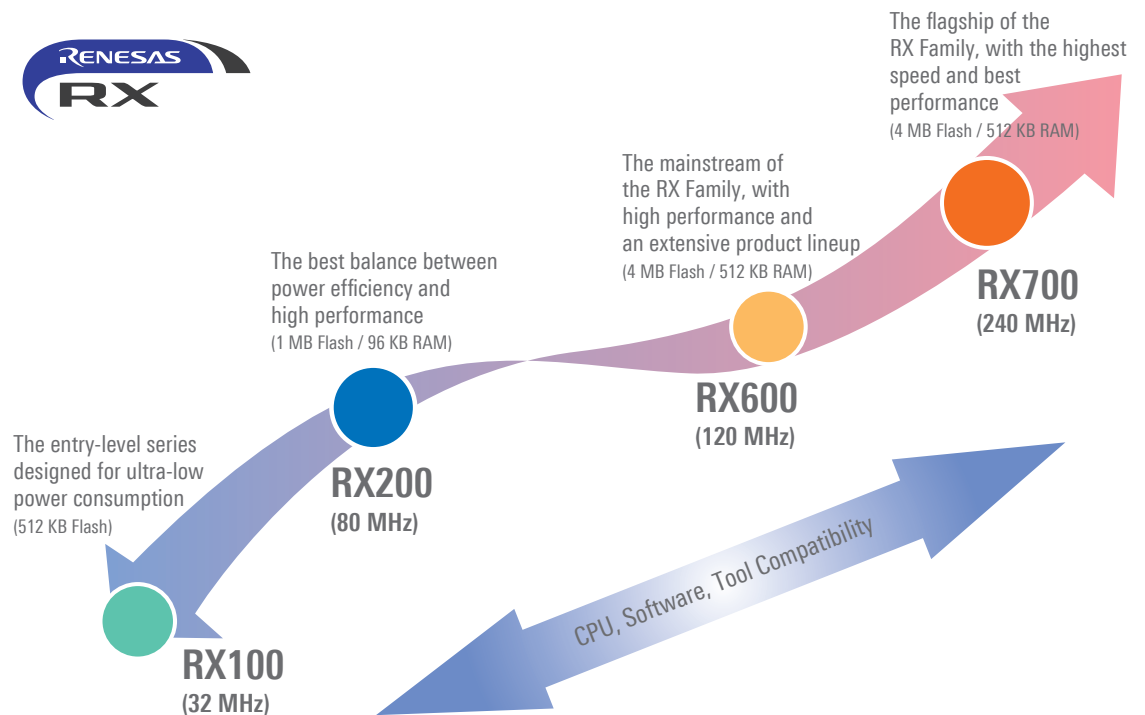
RX600/RX700 – THE HIGH-SPEED AND HIGH-PERFORMANCE SERIES MCUS

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.

The RX600/RX700 Series is high-speed and high-performance MCU family with RXv2 core, large-capacity RAM, and enhanced security, connectivity, and HMI.

- 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 RX700 Series products focus on industry-leading performance and rich peripherals.
- The RX600 Series are optimized for applications requiring high-performance, high-efficiency processors.

THE RX 32-BIT MICROCONTROLLER FAMILY



RX600/RX700 SERIES AT-A-GLANCE

The RX600/RX700 Series is optimized for high speed and excellent performance. In addition to the RXv2 core operating at up to 120 MHz (240 MHz for RX700), it is available with up to 4 MB of zero-wait access flash memory to realize the full performance potential of the CPU. It is provided with a single-precision FPU, 32-bit multiplier and divider, and 32-bit multiply-and-accumulate (MAC) unit. These enable the fast execution and real-time performance required for the filtering operation or motor feedback control. The extensive product lineup provides support for a broad range of applications.

- All RX600/RX700 Series MCUs offer a wide set of peripherals, including communication, ADC, and support for the IEC60730 appliance safety standard.
- RX65N and RX651 Group MCUs are the primary option for most general-purpose designs.
- RX62T and RX63T Group MCUs are specifically targeted for motor control applications.

RX600/RX700 SERIES FEATURES

<p>High-performance 32-bit RX CPU Up to 4.55 CoreMark/MHz</p> <p>The new RXv2 sets new standards in its class with a 4.55 CoreMark/MHz benchmark.</p>	<p>High-speed/large-capacity flash Max. 120 MHz flash access Max. 4 MB</p> <p>Ability to extract 100% of CPU's performance potential. Fewer components for reduced power consumption</p>	<p>Extensive lineup Ethernet, motor control, LCD, etc. Many product versions for a variety of applications</p> <p>Connectivity, motor control, LCD, etc. Functions suitable for many applications Numerous pin count and memory options</p>	<p>Safety functions Security</p> <p>Support for industrial safety standards Encryption functionality to protect communication Enhanced system safety</p>
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MAIN APPLICATIONS OF RX600/RX700 SERIES

Industrial					Office equipment	Electric home appliances
Robots, machine tools	General-purpose inverters	Meters	Building automation	Semiconductor fabrication equipment LCD panel manufacturing equipment	Copiers, Printers	Air conditioners, Refrigerators, Washing machines

General Purpose, HMI, Connectivity, Security	RX651/RX65N		Max. 120 MHz 640 KB SRAM, 2 MB Flash 2.7 V to 3.6 V	RXv2 core*1	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI
General Purpose, Connectivity, Security	RX71M		Max. 240 MHz 512 KB SRAM, 4 MB flash 2.7 V to 3.6 V	RXv2 core*1	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI
General Purpose, Connectivity, Security	RX64M		Max. 120 MHz 512 KB SRAM, 4 MB Flash 2.7 V to 3.6 V	RXv2 core*1	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI
Motor Control, Connectivity	RX63T		Max. 100 MHz 48 KB SRAM, 512 KB Flash 2.7 V to 3.6 V, 4.0 V to 5.5 V	RXv1 core	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI
Motor Control	RX62T		Max. 100 MHz 16 KB SRAM, 256 KB Flash 2.7 V to 3.6 V, 4.0 V to 5.5 V	RXv1 core	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI
Motor Control	RX62G		Max. 100 MHz 16 KB SRAM, 256 KB Flash 4.0 V to 5.5 V	RXv1 core	FPU	Safety functions	Ethernet	External bus	CAN	LIN
				USB Host/Func	SDHI	Motor control	Encryption	Power control	IEEE1588	Advanced HMI



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

BLOCK DIAGRAM



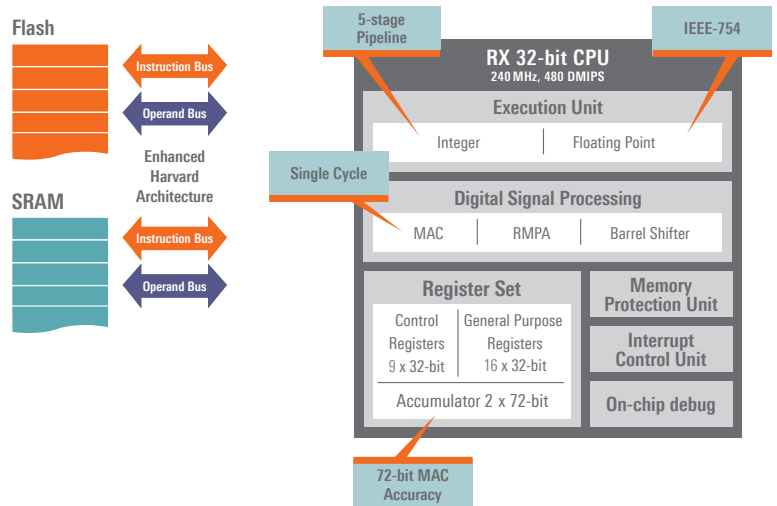
- Superior Architecture
 - RX CPU Core with FPU and DSP: up to 480 DMIPS, up to 240 MHz
 - Enhanced Harvard architecture and 5-stage pipeline
 - More than six internal busses
 - Multiple Direct Memory Access control
 - Rapid interrupt response
- Fast Flash
 - Industry's only 90 nm / 40 nm up to 120 MHz embedded Flash
 - CPU receives instructions with no delays
 - Mature and reliable silicon process
- Power Efficiency
 - 217 μ A/MHz, with all peripherals active
 - 0.6 μ A RTC Deep Standby
 - 34.6 CoreMark/ma
 - Extends battery life in portable applications
- Code Efficiency
 - Up to 28% code size savings compared to popular 32-bit RISC MCUs on the market
 - Variable-length CISC instructions
 - FPU, DSP and bit manipulation instructions

RX CORE FEATURES

As products gain added value and systems become more complex, customers demand ever higher performance from microcontrollers. At the same time, they require microcontrollers with low power consumption to improve energy efficiency and extend battery life. RXv2, the new RX core, incorporates advances designed to meet these needs.

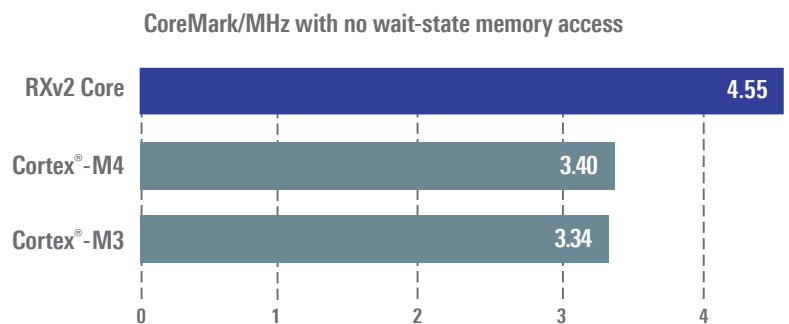
RXv2 CORE BENEFITS

The latest RXv2 core combines the speed of a RISC architecture with the flexibility and code efficiency of a CISC architecture. The CPU interacts with the Flash and SRAM through an enhanced Harvard design. The RXv2 core leverages the industry's fastest Flash memory, delivering up to 2.0 DMIPS/MHz and 4.55 CoreMark/MHz without wait states. Tightly coupled to the RX core are the FPU, MAC, and RMPA (Repeat Multiply Accumulate), which are efficiently driven by DSP and floating point instructions to meet the growing demand of DSC (Digital Signal Controller) type applications.



BEST-IN-CLASS PERFORMANCE – UP TO 4.55 COREMARK/MHz

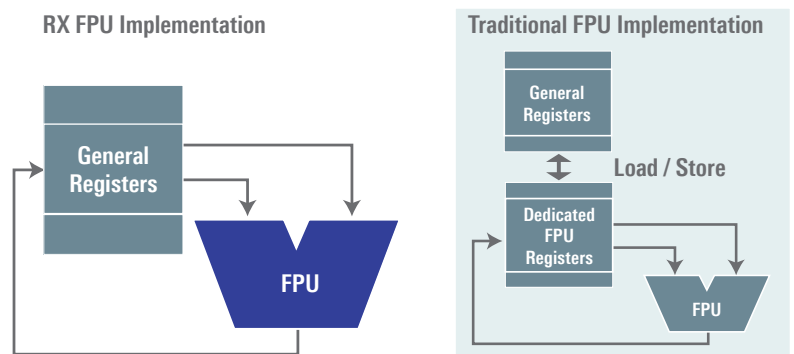
The new RXv2 sets new standards in its class with a 4.55 CoreMark/MHz benchmark. The results are being continually improved with new compiler releases. The Renesas RX compiler delivers the best RX benchmarks.



SUPERIOR FPU IMPLEMENTATION

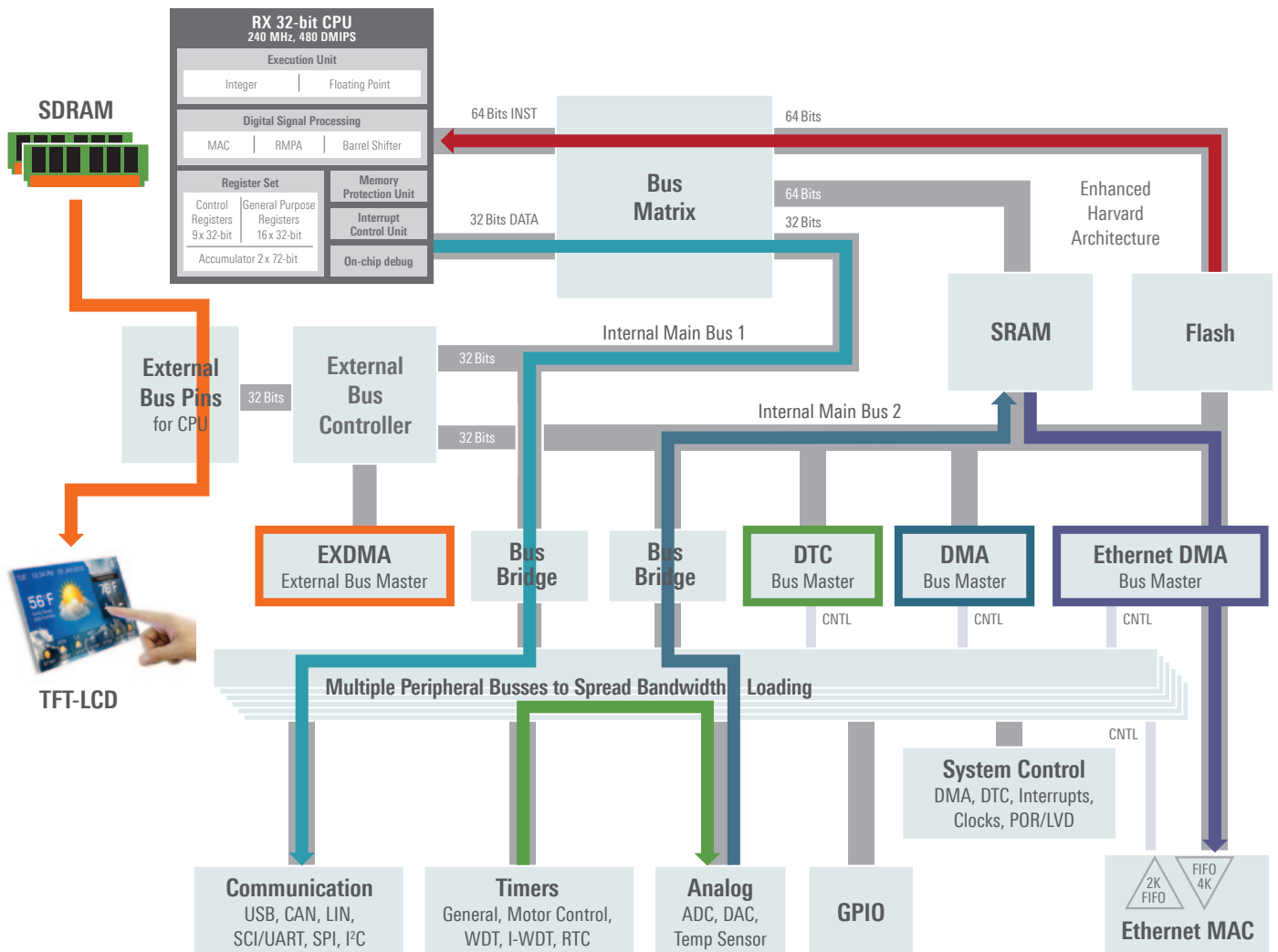
The RX FPU implementation allows direct access to general registers, resulting in faster execution and smaller code size. To speed up FPU operation further, the RXv2 core not only shortens latency, but also adapts to the pipelined FPU. The RXv2 core is respectably faster, performing most operations in one to three cycles and in single-cycle throughput.

- RX FPU eliminates the overhead of load/store operations
- Results in higher performance and smaller code size



SIMULTANEOUS DATA TRANSFERS

The RX Core uses a large number of parallel busses to handle simultaneous movement of data between the CPU core, Flash, SRAM, and peripherals. Six different peripheral busses enable a flexible distribution of slow and fast peripherals for optimized throughput. An external bus with an independent DMA can move data directly from one external device to another external device, such as a graphic frame buffer to a TFT-LCD panel.



Independent Data Transfers

- Fetch instructions
- Transmit USB data
- Move RGB data from external SDRAM to TFT-LCD

Interleaving Data Transfers

- Load ADC values into SRAM
- Move Ethernet data packets from internal SRAM
- Timer data written to DAC output

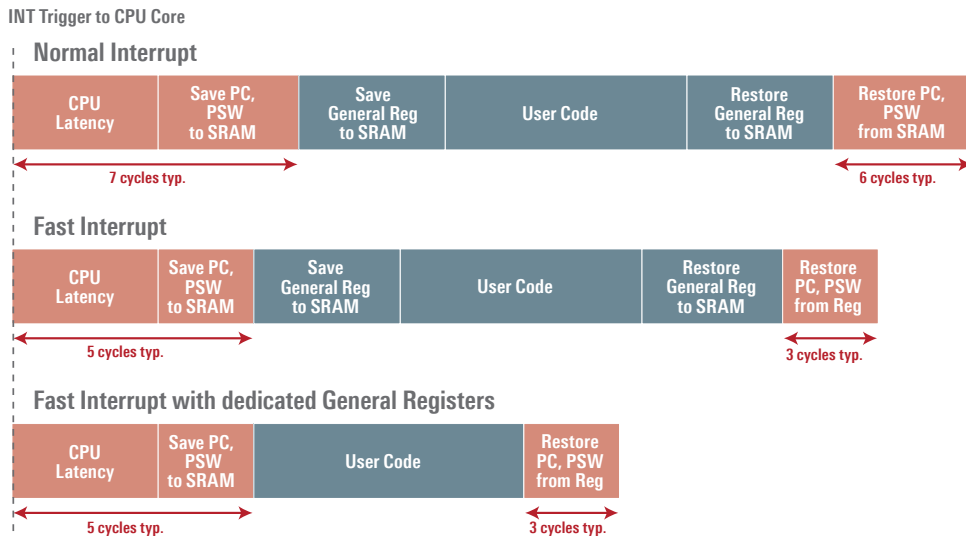
KEY FEATURES

EFFICIENT INTERRUPT HANDLING

There are flexible options to achieve minimum latency for various scenarios:

- Normal interrupt responds in as few as seven CPU clock cycles from the event until the firmware serves the interrupt.*
- Fast interrupt mode can be assigned dynamically to any interrupt source, responding in just five CPU clocks, using dedicated registers to save and restore the CPU state.
- All interrupt service routines can be shortened by dedicating up to four RX CPU general registers for use only by interrupts, eliminating the need to push and pop the registers to and from the stack.

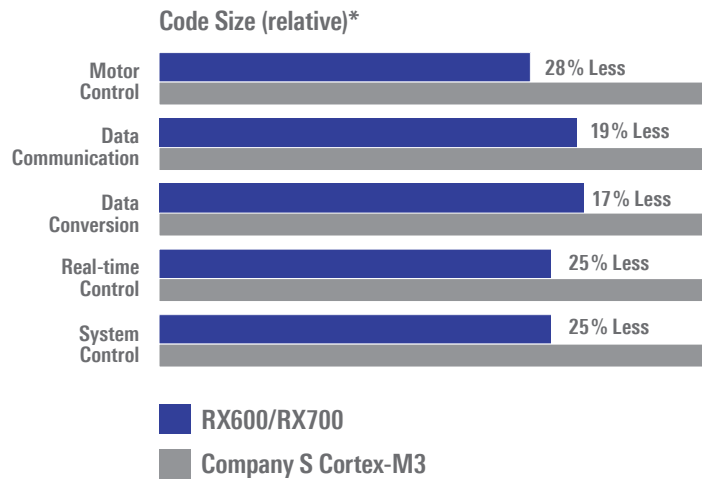
* Interrupt priority judgement cycles not included.



SUBSTANTIAL CODE SIZE REDUCTION

The RX CISC CPU architecture has inherent advantages over RISC CPUs in terms of code size, with the RX's variable length instructions ranging from 8 bits to 64 bits, allowing the compiler to select just the right instruction to do the job.

- Many RISC MCUs have only two instruction lengths, 16 bits and 32 bits, so the compiler must make compromises.
- RX CPU supports 10 addressing modes, which optimize manipulation and movement of data.
- Compiled RX code has been measured as much as 28% smaller than the same code compiled on a popular RISC MCU.



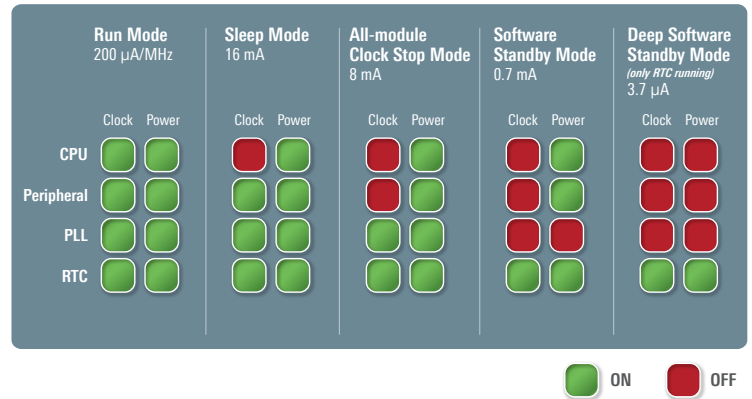
*Renesas internal testing

HIGHLY EFFECTIVE POWER MANAGEMENT

Strike an optimized balance of performance and power consumption with many low-power modes of operation enabled by these design techniques:

- Flexible system clocking and gating for each peripheral
- Selective power domain gating for unused sections of the device
- Low-power, high-voltage threshold transistors minimize leakage
- Five power modes to manage precious battery energy consumption without compromising performance

Five power modes to manage precious battery energy consumption without compromising performance

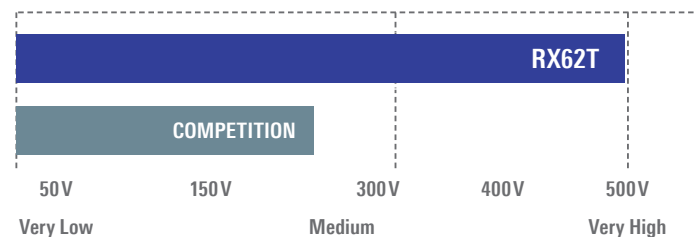


EMC ADVANTAGES – BUILT-IN TO ELIMINATE

Outstanding EMC performance of RX MCUs reduces system-integration problems, lowers development costs, and shortens design cycles. BOM costs drop, too, because external components can be eliminated.

- Strong electromagnetic immunity boosts system reliability
- Careful VCC and VSS layout
- Noise filters on input signals
- Advanced chip layout techniques

Immunity Level

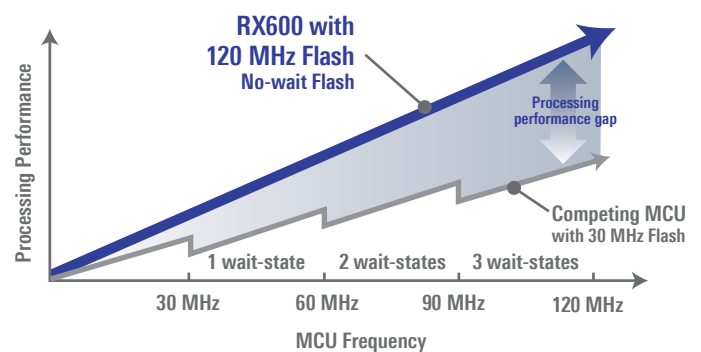


UP TO 4 MB OF 120 MHz ZERO-WAIT HIGH-SPEED FLASH MEMORY

The RX Family includes products utilizing the cutting-edge 40 nm ultrafine fabrication process and on-chip Flash memory employing MONOS*¹ technology. This allows for fast reading of data with zero-wait access at speeds up to 120 MHz, enabling maximum performance by the CPU. The ultrafine fabrication process allows up to 4MB of Flash memory to be integrated on-chip. RX Family products with on-chip Flash memory also include Flash memory for data storage. These two types of Flash memory support background operation (BGO), so a user's program can run while the Flash memory for data storage is being erased or programmed at the same time. This can provide a substantial boost to system performance.

Note 1: Metal Oxide Nitride Oxide Silicon

Industry's Only 120 MHz On-chip Flash



COMPREHENSIVE ON-CHIP PERIPHERALS

To lower costs, simplify system designs, reduce total system power consumption, and enable the implementation of value-added features, a wide range of on-chip peripheral functions is clustered around the powerful CPU core of RX MCUs. Broadly categorized into analog, timer, communication, and system functions, these numerous peripherals are proven designs delivering impressive performance. The many different types of RX MCUs offer diverse sets of functions, so chip capabilities and cost can be matched to application needs. The devices in the RX651/65N/64M/71M and RX62T/62G/63T product groups exemplify this diversity and optimization.

- RX65N/651 MCUs** have new security, Flash memory, and HMI features. The Trusted Secure IP provides not only a hardware crypto engine but also secure key management. The Flash memory can be split into two banks; users can erase or program the bank in the background while executing user code on another bank. Additionally, the area protection function protects the Flash memory against illegal deletion or program access by third parties. The combination of Trusted Secure IP and new Flash memory features enables secure boot and secure firmware updates. The Graphic LCD Controller and 2D Drawing Engine reduces the CPU load while the TFT-LCD displays.
- RX62T/63T MCUs** provide improved motor/ inverter control timers and enhanced analog peripherals for implementing very precise motor control and positioning applications. The MTU3 and GPT timer peripherals enable one MCU to control three motors simultaneously. An FPU and improved analog functions make these MCUs ideal for use with three-shunt or single-shunt vector-type motor control methods.
- RX64M/71M MCUs** have industry-leading Flash memory (4 MB, no-wait access at 120 MHz). They provide extensive communication peripherals with up to two Ethernet supporting the Precision Time Protocol (PTP) defined in IEEE 1588, and two USB-FS 2.0 (one USB-FS and one USB-HS on the RX71M), each operating as Host, Device, or OTG (On the Go). Additionally, they offer up to three CAN, thirteen SCI, two SPI, two I²C and two Serial Sound I/F. Among their other peripherals are analog I/F, timers, RTC and POR/LVD functions, and more.
- RX62G MCU** provides an improved high-resolution timer functionality base on the GPT Timer unit, enabling generation of a PWM signal with 312.5 psec/bit. An FPU and improved analog functions make these MCUs the ideal solution for Digital Power Supply designs, where a high-resolution timer is essential to bring the system design cost down.

Group	Advanced Peripherals														Basic Peripheral Set																								
	Security (Option)					HMI				Connectivity				Advanced Motor	Memory			Analog				Timers					Communication												
	AES	TDES	SHA	RSA	TRNG	Trusted Secure IP	Graphic LCD Controller	2D Drawing Engine	CMOS Camera I/F (PDC)	Serial Sound I/F	Ethernet 10/100 MAC	USB 2.0 Host/Device/OTG	CAN 2.0B	SDHI	Advanced ADC 12-bit	MTU3	GPT	Flash (max)	SRAM (max)	Data Flash	ADC 10-bit	DAC 10-bit	ADC 12-bit	DAC 12-bit	Temperature Sensor	TPU	PPG	TMR	CMT	WDT	I-WDT	RTC	I ² C	SCI	ExBus	SPI	LIN	QSPI	
Connectivity	RX71M	Yes	Yes	Yes	-	Yes	-	-	-	Yes	2	2	2**	3	1	-	9	4	4 MB	512 KB	64 KB	-	-	29	2	1	6	8	4	4	1	1	1	2	13	8/16/32	2	1	1
	RX64M	Yes	Yes	Yes	-	Yes	-	-	-	Yes	2	2	2	3	1	-	9	4	4 MB	512 KB	64 KB	-	-	29	2	1	6	8	4	4	1	1	1	2	13	8/16/32	1	1	1
	RX65N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	1	1	2	1	-	9	-	2 MB	640 KB	32 KB	-	-	29	2	1	6	8	4	4	1	1	1	3	13	8/16/32	3	1	1
General	RX651	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	1	2	1	-	9	-	2 MB	640 KB	32 KB	-	-	29	2	1	6	8	4	4	1	1	1	3	13	8/16/32	3	1	1
Motor Control	RX63T	-	-	-	-	-	-	-	-	-	-	-	1	1	-	8	8	8	512 KB	48 KB	32 KB	20	2	-	-	-	-	-	-	4	1	1	-	2	5	8/16	2	1	-
	RX62T	-	-	-	-	-	-	-	-	-	-	-	1	-	8	8	4	256 KB	16 KB	8 KB	12	-	-	-	-	-	-	-	-	4	1	1	-	1	3	-	1	1	-
DPS*	RX62G	-	-	-	-	-	-	-	-	-	-	-	1	-	8	8	4**	256 KB	16 KB	8 KB	12	-	-	-	-	-	-	-	-	4	1	1	-	1	3	-	1	1	-

*Digital Power Supply **Incl. High Res. Timer ***1x USB Full Speed / 1x USB High Speed

RX600/RX700 SERIES FOCUS DEVICES

Group	Device		Memory			Package & I/O Ports			Operation			Communication I/F							
	Part Number		Code Flash [KB]	SRAM [KB]	Data Flash [KB]	Package	Dimension	I/O Ports	Max. Frequency [MHz]	Power Supply Voltage [V]	Operating Temperature [°C]	Ethernet	USB (Host/Device/OTG)	SD Host I/F	CAN	QSPI	SPI	I ² C	SCI
RX65N	R5F565NE****	2048	640	32	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	137	120	2.7 to 3.6	-40 to 85 or -40 to 105	1	1	1	2	1	3	3	13	
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch													
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch													
					145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112												
					144-in LFQFP	20 x 20 mm, 0.5 mm pitch													
					100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79												
	100-pin LFQFP	14 x 14 mm, 0.5 mm pitch																	
	R5F565NC****	1536	640	32	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	137												
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch													
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch													
					145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112												
					144-in LFQFP	20 x 20 mm, 0.5 mm pitch													
100-pin TFLGA					7 x 7 mm, 0.65 mm pitch	79													
100-pin LFQFP	14 x 14 mm, 0.5 mm pitch																		
R5F565N9****	1024	256	0	145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
R5F565N7****	768	256	0	100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
R5F565N4****	512	256	0	145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
RX651	R5F5651E****	2048	640	32	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	137	120	2.7 to 3.6	-40 to 85 or -40 to 105	0	1	1	2	1	3	3	13	
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch													
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch													
					145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112												
					144-in LFQFP	20 x 20 mm, 0.5 mm pitch													
					100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79												
	100-pin LFQFP	14 x 14 mm, 0.5 mm pitch																	
	R5F5651C****	1536	640	32	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	137												
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch													
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch													
					145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112												
					144-in LFQFP	20 x 20 mm, 0.5 mm pitch													
100-pin TFLGA					7 x 7 mm, 0.65 mm pitch	79													
100-pin LFQFP	14 x 14 mm, 0.5 mm pitch																		
R5F56519****	1024	256	0	145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
R5F56517****	768	256	0	100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
R5F56514****	512	256	0	145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														
				100-pin TFLGA	7 x 7 mm, 0.65 mm pitch	79													
				100-pin LFQFP	14 x 14 mm, 0.5 mm pitch														
				145-pin TFLGA	7 x 7 mm, 0.5 mm pitch	112													
				144-in LFQFP	20 x 20 mm, 0.5 mm pitch														

Timers						Analog				External Bus			DMA		Human Machine I/F				Security					
32-bit Timer	16-bit Timer	8-bit Timer	WDT	IWDT	RTC	12-bit ADC	10-bit ADC	12-bit DAC	10-bit DAC	Max. Data Bus Width [bit]	SDRAM Controller	EXDMAC	DMAC	DTC	Graphic LCD Controller	2D Drawing Engine	CMOS Camera I/F (PDC)	Serial Sound I/F	Trusted Secure IP	AES	TDES	RSA	SHA	TRNG
3	18	4	Yes	Yes	Yes	2 units 8+21	0	2	0	32	Yes	2	8	Yes	Yes	Yes	Yes	0	Yes	Yes	Yes	Yes	Yes	Yes
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
3	18	4	Yes	Yes	Yes	2 units 8+21	0	2	0	32	Yes	2	8	Yes	Yes	Yes	Yes	0	Yes	Yes	Yes	Yes	Yes	Yes
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							
						2 units 8+21		2			Yes						Yes							
						2 units 8+14		1			No						No							

RX600/RX700 SERIES FOCUS DEVICES (CONTINUED)

Group	Device		Memory			Package & I/O Ports			Operation			Communication I/F									
	Part Number		Code Flash [KB]	SRAM [KB]	Data Flash [KB]	Package	Dimension	I/O Ports	Max. Frequency [MHz]	Power Supply Voltage [V]	Operating Temperature [°C]	Ethernet	USB (Host/Device/OTG)	SD Host I/F	CAN	QSPI	SPI	I ² C	SCI		
RX64M	R5F564ML****	4096	512	64	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128	120	2.7 to 3.6	-40 to 85 or -40 to 105	2	2	1	1	1	1	2	2	13		
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F564MJ****	3072			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F564MG****	2560			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F564MF****	2048			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
RX71M	R5F571ML****	4096	512	64	177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128	240	2.7 to 3.6	-40 to 85 or -40 to 105	2	2	1	1	2	2	2	2	13		
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F571MJ****	3072			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F571MG****	2560			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9
	R5F571MF****	2048			177-pin TFLGA	8 x 8 mm, 0.5 mm pitch	128				2	2								3	13
					176-pin LFBGA	13 x 13 mm, 0.8 mm pitch	112				1	1								3	13
					176-pin LFQFP	24 x 24 mm, 0.5 mm pitch	79				1	1								2	9

Timers						Analog				External Bus			DMA		Human Machine I/F				Security					
32-bit Timer	16-bit Timer	8-bit Timer	WDT	IWDT	RTC	12-bit ADC	10-bit ADC	12-bit DAC	10-bit DAC	Max. Data Bus Width [bit]	SDRAM Controller	EXDMAC	DMAC	DTC	Graphic LCD Controller	2D Drawing Engine	CMOS Camera I/F (PDC)	Serial Sound I/F	Trusted Secure IP	AES	TDES	RSA	SHA	TRNG
3	22	4	Yes	Yes	Yes	2 units 8+21	0	2	0	32	Yes	2	8	Yes	No	No	Yes	2	No	Yes	Yes	No	Yes	Yes
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
3	22	4	Yes	Yes	Yes	2 units 8+21	0	2	0	32	Yes	2	8	Yes	No	No	Yes	2	No	Yes	Yes	No	Yes	Yes
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
						2 units 8+14		1		16	No						No							
						2 units 8+21		2		32	Yes						Yes							
						2 units 8+21		2		16	Yes						Yes							
2 units 8+14	1	16	No	No																				

RX600/RX700 SERIES FOCUS DEVICES (CONTINUED)

Group	Device Part Number	Memory			Package & I/O Ports			Operation			Communication I/F																																		
		Code Flash [KB]	SRAM [KB]	Data Flash [KB]	Package	Dimension	I/O Ports	Max. Frequency [MHz]	Power Supply Voltage [V]	Operating Temperature [°C]	Ethernet	USB (Host/Device/OTG)	SD Host I/F	CAN	QSPI	SPI	I ² C	SCI																											
RX63T	R5F563TE****	512	48	32	144-pin LQFP	20 x 20 mm, 0.5 mm pitch	110	100	2.7 to 3.6 or 4 to 5.5	-40 to 85 or -40 to 105	0	1	0	1	0	2	2	5																											
					120-pin LQFP	16 x 16 mm, 0.5 mm pitch	93					1					2	5																											
					112-pin LQFP	20 x 20 mm, 0.65 mm pitch	90					0					1	5																											
					100-pin LQFP	14 x 14 mm, 0.5 mm pitch	78					0					1	4																											
	R5F563TC****	384	32		32	144-pin LQFP	20 x 20 mm, 0.5 mm pitch					110					100	2.7 to 3.6 or 4 to 5.5	-40 to 85 or -40 to 105	0	1	0	0	2	2	5																			
						120-pin LQFP	16 x 16 mm, 0.5 mm pitch					93									1				2	5																			
						112-pin LQFP	20 x 20 mm, 0.65 mm pitch					90									0				1	5																			
						100-pin LQFP	14 x 14 mm, 0.5 mm pitch					78									0				1	4																			
	R5F563TB****	256	24		32	144-pin LQFP	20 x 20 mm, 0.5 mm pitch					110									100				2.7 to 3.6 or 4 to 5.5	-40 to 85 or -40 to 105	0	1	0	0	2	2	5												
						120-pin LQFP	16 x 16 mm, 0.5 mm pitch					93																1				2	5												
						112-pin LQFP	20 x 20 mm, 0.65 mm pitch					90																0				1	5												
						100-pin LQFP	14 x 14 mm, 0.5 mm pitch					78																0				1	4												
	R5F563T6****	64	8	8	64-pin LQFP	10 x 10 mm, 0.5 mm pitch	48	100	2.7 to 3.6	-40 to 85 or -40 to 105	0	0	0	1	1	3																													
					48-pin LQFP	7 x 7 mm, 0.5 mm pitch	32																																						
	R5F563T5****	48			8	8	64-pin LQFP																					10 x 10 mm, 0.5 mm pitch				48	100	2.7 to 3.6	-40 to 85 or -40 to 105	0	0	1	1	3					
							48-pin LQFP																					7 x 7 mm, 0.5 mm pitch				32													
	R5F563T4****	32					8										8	64-pin LQFP	10 x 10 mm, 0.5 mm pitch	48		100	2.7 to 3.6	-40 to 85 or -40 to 105				0				0									1	1	3		
																		48-pin LQFP	7 x 7 mm, 0.5 mm pitch	32																									

Timers					Analog				External Bus			DMA		Human Machine I/F				Security							
32-bit Timer	16-bit Timer	8-bit Timer	WDT	IWDT	RTC	12-bit ADC	10-bit ADC	12-bit DAC	10-bit DAC	Max. Data Bus Width [bit]	SDRAM Controller	EXDMAC	DMAC	DTC	Graphic LCD Controller	2D Drawing Engine	CMOS Camera I/F (PDC)	Serial Sound I/F	Trusted Secure IP	AES	TDES	RSA	SHA	TRNG	
0	20	0	Yes	Yes	No	2 units 4+4	20	0	2	16	No	0	4	Yes	No	No	No	No	No	No	No	No	No	No	No
							12																		
							12																		
							12																		
							20																		
							12																		
	12																								
	20																								
	12																								
	12																								
	12																								
	12																								
16	0	0	Yes	Yes	No	8	0	0	No	No	0	4	Yes	No	No	No	No	No	No	No	No	No	No	No	No
						6																			
						8																			
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						6																			

DESIGN POTENTIAL OF THE RX FAMILY

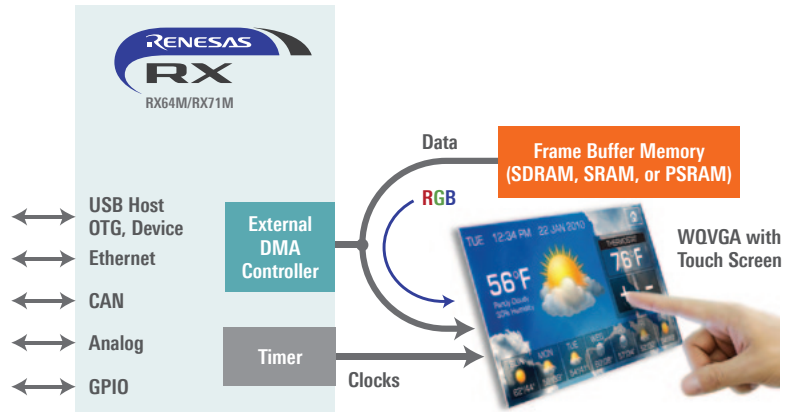
System design versatility, application capability, and economic sensibility are built into the many microcontrollers in the RX Family. Driven by a technology roadmap that anticipates more sophisticated applications in the next decade that demand cost effectiveness, RX devices offer abundant core performance and extensive peripheral functions.

RX FOR TFT-LCD APPLICATIONS

External DMA Controller

The external DMA controller integrated into RX devices can drive a TFT-LCD panel directly, greatly reducing the load on the MCU's CPU, thus maximizing the performance of application software.

- Directly drives a TFT-LCD panel
- RGB pixel data moves directly from frame buffer to the TFT-LCD and never enters the RX MCU
- RX CPU is loaded only 5%, while refreshing at 60 Hz
- Plenty of CPU bandwidth remains to run the application, communication channels, and create moderate animation on the TFT-LCD

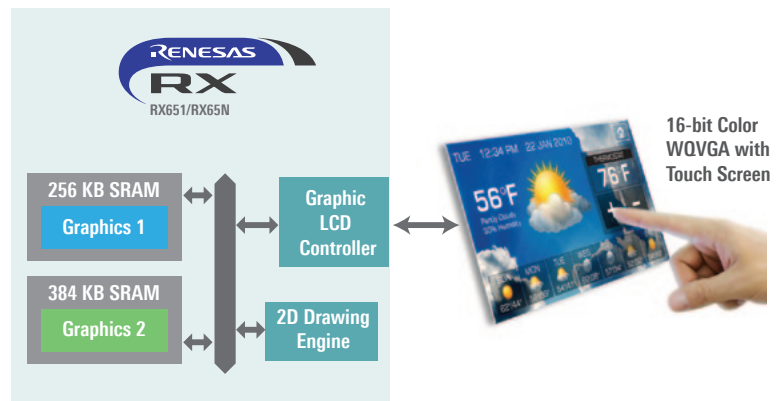


Graphic LCD Controller

- Bus master function: Reduces CPU load for graphics data access
- Alpha blending: Overlays three layers (Solid color background, Graphics 1 and Graphics 2)
- Supports various pixel data formats

2D Drawing Engine

- Bus master function: Reduces CPU load for graphics data access
- Vector drawing engines; Extended rendering primitives supported by hardware
 - Lines, polygons, circles, ellipses, quadratic Béziers, and texture mapping
- BitBLT function: seven types of BitBLT operations
 - Fill, copy, stretch BitBLT, rotate, scale, alpha blending, bilinear filtering, and color conversion



RX FOR CONNECTIVITY

RX MCUs provide built-in hardware for implementing efficient communications with external peripherals, systems, test equipment, and networks such as the Internet. The Ethernet, USB, and CAN connectivity modules are well-proven, reliable designs.

Ethernet MAC

- 10/100 Mbps
- 2 KB TX FIFO
- 4 KB RX FIFO
- MII, RMII connection to PHY
- Wake on LAN

USB

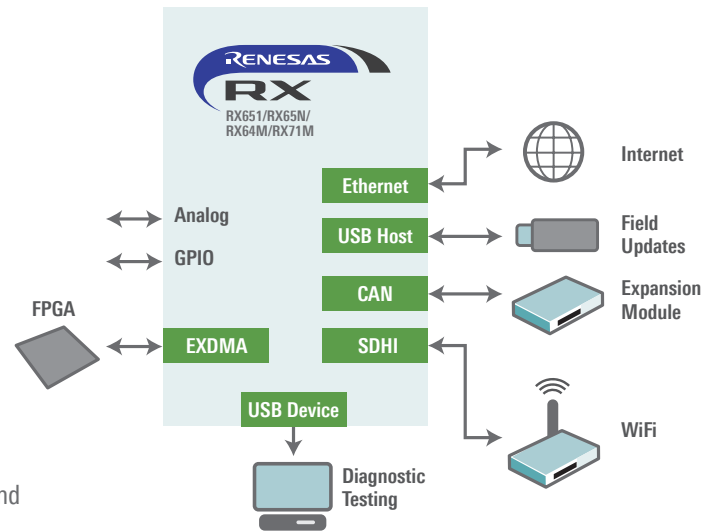
- Host/Device/OTG
- 12 Mbps
- Up to 2 ports
- 10 Endpoints
- 2 KB FIFO

CAN

- ISO11898-1
- 1 Mbps
- 32 Mailboxes

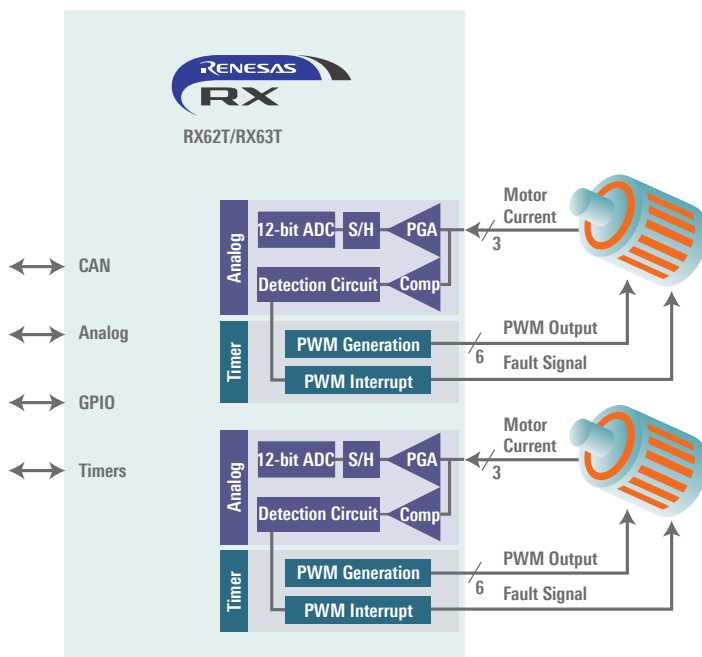
SDHI

- Up to 25 MB/s (4-bit bus, 50 MHz)
- Support SD, SDHC and SDXC memory card



RX62T/RX63T FOR MOTOR CONTROL

High-performance CPU and FPU capability, and advanced analog and timer peripherals, make the RX62T/RX63T an ideal solution for inverter and motor control applications. Renesas can help you develop your motor control solution with kits and firmware that support many kinds of motor control, including ultra-quiet, energy-efficient, and high-precision three-phase sensorless vector control. In the home appliance example shown here, the RX62T/RX63T is driving two three-phase motors simultaneously using its advanced PWM timers. These timers are well suited for Brushless DC three-phase motors by having complimentary PWM outputs with automatic dead-time insertion, an emergency “Shut-down” (stop) input, and quadrature encoder inputs for speed and direction feedback. The RX62T/RX63T’s advanced analog subsystem with multiple sample-and-hold circuits enables sampling of three simultaneous current measurements. It also offers programmable operational amplifiers and integrated window comparators to eliminate external components. The 12-bit ADCs have a fast 1 μ sec conversion time, can be triggered by the PWM timers, and provide self-diagnostic capability.



Advanced Analog

- Two 12-bit ADC units, each with 4 input channels, 1 μ sec conversion time, and self-diagnostic capability
- Each 12-bit ADC unit has
 - 3 x independent sample-and-hold circuits
 - 3 x programmable op amps
 - 3 x analog window comparators
 - 3 trigger sources (PWM timers, external and software)

Advanced Timers

- 100 MHz, 16-bit Multifunction Timer Unit (MTU3)
- 100 MHz, 16-bit General Purpose Timer Unit (GPT)
- Complimentary PWM and Reset-Synchronous outputs
- Dead-time insertion
- Quadrature encoder inputs
- Emergency motor “Shut-down” (stop) input

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.

Introduction

Development

Mass production

RENESAS STARTER KIT (RSK)

These complete RX600/RX700-based hardware/software platforms for in-depth application design include the E1 or E2 Lite Debugger, e2 studio, demonstration firmware, and a trial version of the Renesas RX compiler.

- The RSKs are specifically designed to be both an evaluation and development system. The kit includes everything that an engineer needs to be up and running within only a few minutes.



RX65N - 1 MB

P/N: YRTK500565NS0000BE

RX62T

P/N: R0K5562T0S000BE

RX65N - 2 MB

(w/o Trusted Secure IP)

P/N: YRTK50565N2S0000BE

RX63T

(64-pin)

P/N: R0K50563TS000BE

RX65N - 2 MB

(with Trusted Secure IP)

P/N: YRTK50565N2S00010BE

RX63T

(144-pin)

P/N: R0K5563THS000BE

RX71M

P/N: YR0K50571MS000BE

RX62G

P/N: R0K50562GS000BE

RX64M

P/N: YR0K50564MS000BE

www.renesas.com/RSK

EVALUATION/SOLUTION KITS

RX65N Envision Kit

A reference solution makes it easy to develop a user interface for industry, OA, and home appliances.

- Pre-installed software provides the demonstration on new features of the RX65N
 - Easy firmware update by dual-bank Flash and BGO (Background Operation)
 - Smooth 2D drawing on WQVGA TFT-LCD
- Included on-chip debugging can be used for own development



P/N: RTK5RX65N2C0000BR

www.renesas.com/envision

Motor Control Solutions Using the RX MCU

A solid evaluation and development platform for motor control.

Features

- Auto tune and calibrate
- Sensor/sensorless
- Ability to drive 2 motors
- Royalty free source code
- BLAC motor up to 48V
- PC control GUI
- Full schematics
- Tune and calibrate tutorial



P/N: YROTATE-IT-RX62T

www.renesas.com/tools

Renesas RX71M Revelation Kit

The RX71M Revelation Kit allows quick and easy evaluation of RX700 Series microcontrollers and development tools.

The Revelation Kit hardware includes:

- RX71M MCU with 4 MB Flash and 552 KB RAM
- QVGA TFT-LCD with touch screen
- USB Host/Function port
- Several Pmod™ interfaces
- E2-lite on-chip debug circuit



P/N: YRPBRX71M

(Contact your sales channel for availability)

Target Board for RX65N

Excellent choice for basic evaluation and development of RX65N.

- Full access to all MCU pins by provided header through-hole connections
- Included on-chip debugging can be used for own development
- USB connector to power and debug the MCU (no USB cable included)



P/N: RTK5RX65N0C0000BR

www.renesas.com/rxtb

Introduction

Development

Mass production

DEVELOPMENT TOOLS

e² studio – the Eclipse-based Integrated Development Environment (IDE)

The Renesas e² 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

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: RTE0T00020KCE00000R

www.renesas.com/tools

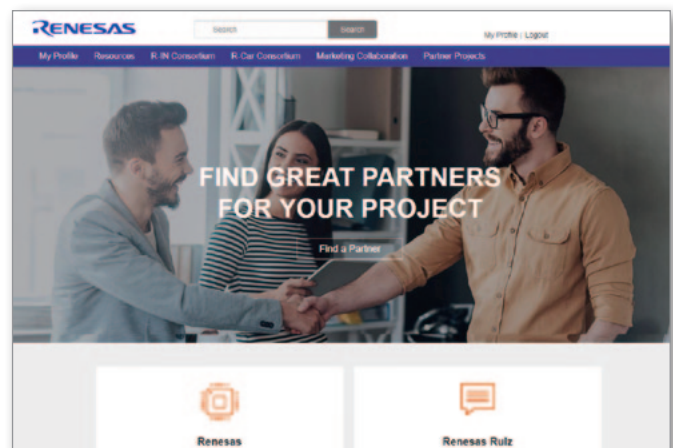
THIRD-PARTY SOLUTIONS

Compilers	 www.iar.com/ewrx IAR Embedded Workbench, with full C and C++ support, MISRA C compliance checker		 www.gcc-renesas.com Eclipse IDE and GNU RX compiler		 www.kpitgnu2tools.com KPIT GNURX compiler	
	 www.micrium.com		 www.cmx.com		 www.rowebots.com	
RTOS	µC/OS-III	CMX-RTX	Unison	ThreadX	FreeRTOS	embOS
USB	√	√	√	√	√	√

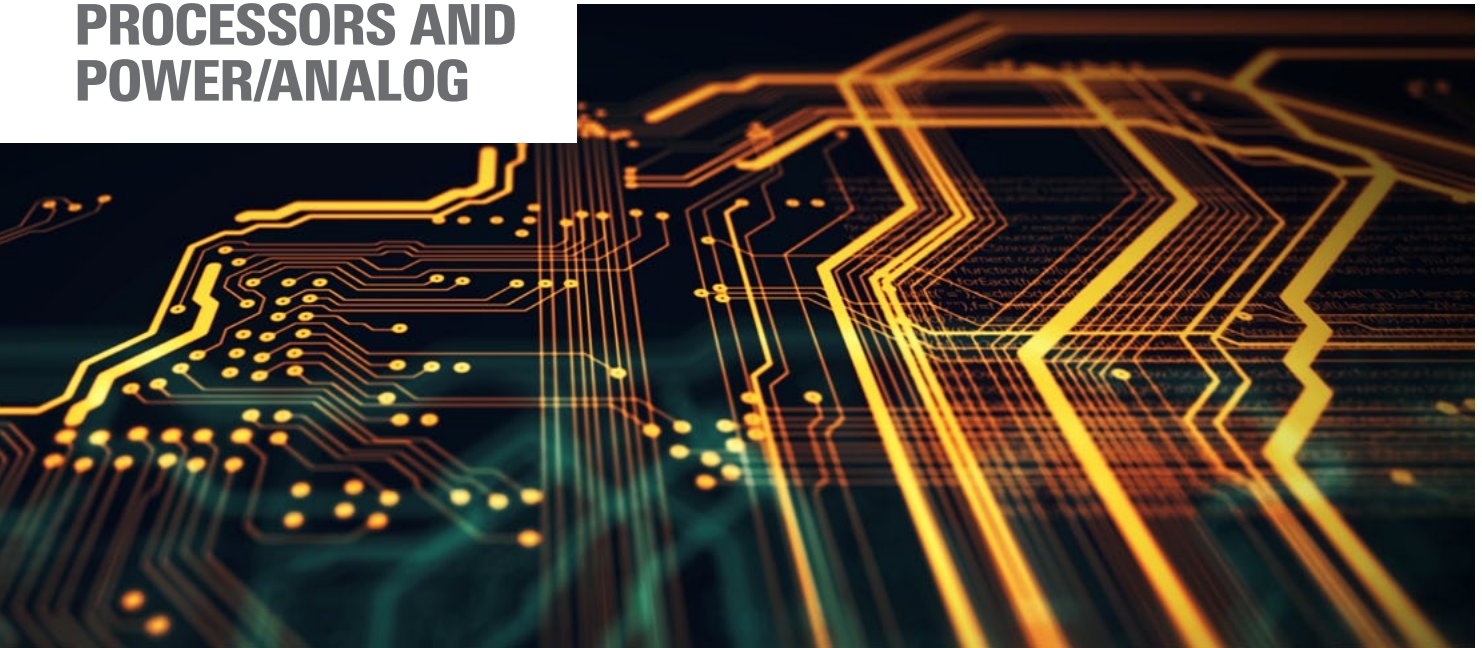
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Visit the following page to search for partner companies and their products, register as a new partner, or log in if your company is already a partner.

www.renesaspartners.com

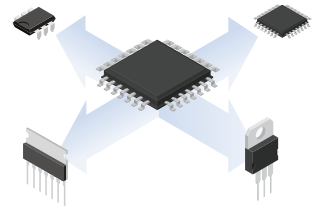


PROCESSORS AND POWER/ANALOG



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

POWERING AN MCU

Buck-Boost Converter

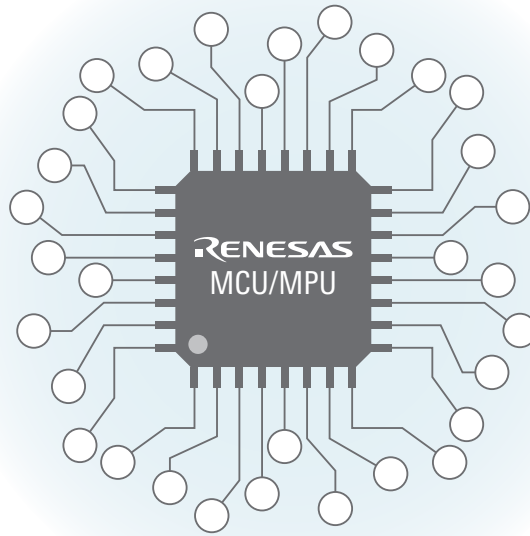
- ISL9120, ISL91107, ISL91128
- Current Range: 400 mA – 2.4 A
 - Low Iq ~ 20 μ A
 - Input Voltage: 0.6 V – 5.5 V
 - Output Voltage: 2.5 V – 5.25 V

Buck Converters

- ISL9103/A, ISL9107/A, ISL9307
- Current Range: 500 mA – 1.5 A
 - Low Iq ~ 17 μ 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 μ 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 μ A
 - Input Voltage: 1.5 V – 6.5 V
 - Output Voltage: 0.9 V – 3.3 V

Bi-Directional Buck-Boost Conv.

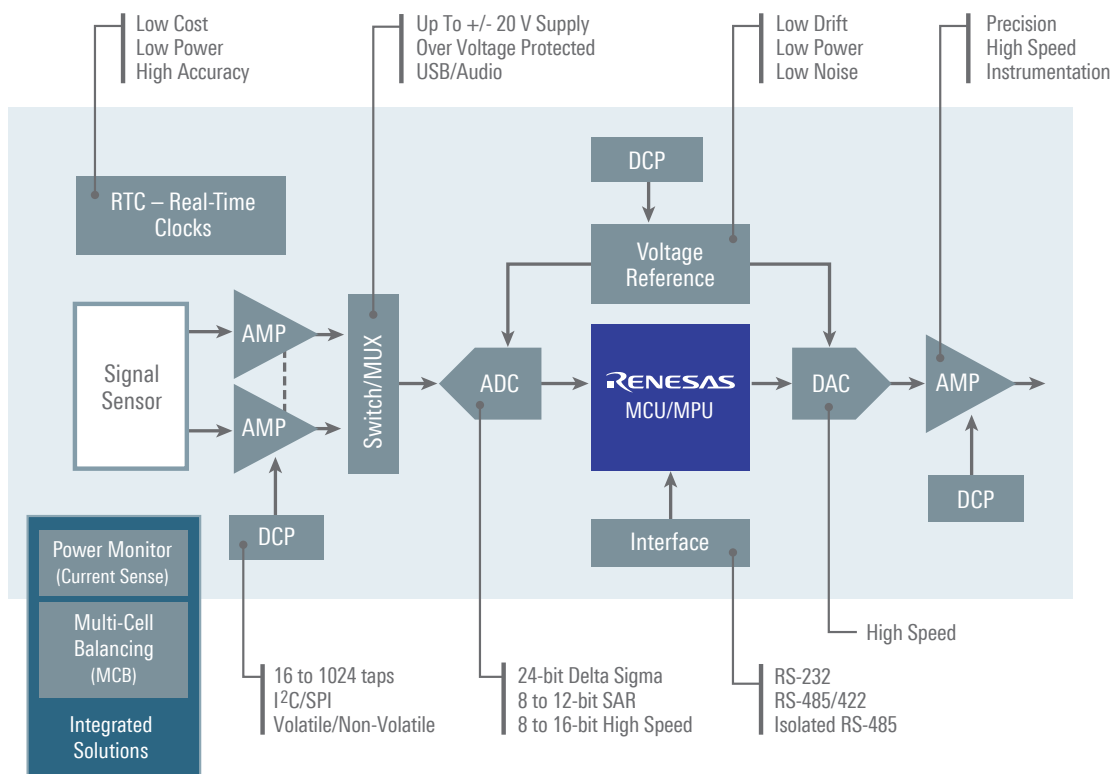
- ISL95338
- Current Range: <10 A
 - V_{IN} : 3.2 V – 23.5 V; V_{OUT} : 2.4 V – 20 V

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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