

2008.01

Everywhere you imagine. **RENESAS**



Renesas MCU  
**M16C Family**  
(R32C/M32C/M16C/R8C)



**M16C Family** (R32C/M32C/M16C/R8C)  
**Powerful Processor**  
**Easy to Use**

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

# World's No. 1\* Flash MCUs !!

World's No. 1  
Flash MCUs  
Proof No. 1

**Total shipments of  
1,000,000,000 units!!**

Thanks to strong demand, total flash MCU shipments reached the 1 billion mark in March 2007. Renesas flash MCUs are used in a wide range of consumer, industrial and automotive applications.

World's No. 1  
Flash MCUs  
Proof No. 2

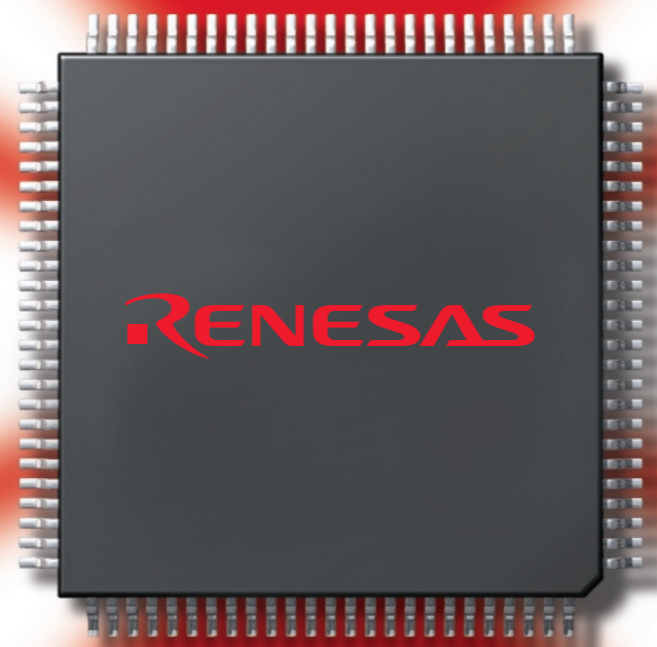
**No. 1 lineup of flash MCUs with  
over 300 products in 30 series!!**

Divided into high-end, middle, and low-end classes, the flash MCU lineup is built on the most advanced technology. Flexible support is provided for increasingly large and complex software.

World's No. 1  
Flash MCUs  
Proof No. 3

**High-speed flash memory supporting  
up to 100MHz operation!!**

Renesas flash technology provides direct memory access and no-wait-state operation at up to 100MHz to bring out the full capabilities of the MCU.



World's No. 1  
Flash MCUs  
Proof No. 4

**Rewriting possible during operation, and  
program/erase cycles increased to 100,000!**

E2dataFlash substantially improves the functionality and performance of data flash, allowing data to be rewritten independently while the MCU is operating. Guaranteed program/erase cycles have been increased to 100,000, and data save times are two orders of magnitude faster than external E2PROM. (E2dataFlash: E2PROM emulation data flash memory)

World's No. 1  
Flash MCUs  
Proof No. 5

**40μsec./byte high-speed flash  
programming!!**

Flash MCU technology supports high-speed programming at a rate of 512KB every 20 seconds (total time required for reprogramming, including erasing and programming).

World's No. 1  
Flash MCUs  
Proof No. 6

**Comprehensive support and  
service to assist developers!!**

Renesas delivers seamless integrated development environments and up-to-date technical information for 8-bit to 32-bit MCUs alongside a quick and responsive support system.

## index

Roadmap
CPU Architecture
Concepts
Product Lineup
Development Tools
Development Tools from Renesas Partners
Middleware/Demo Sets
Functions/Application Fields
Memory Capacity
Product No. Table
Support System

## Exceeding expectations for flash MCUs— FLASH & FLEXIBLE.

MCUs with embedded flash memory are now the main focus of MCU system development. Since its introduction, Flash MCUs from Renesas has been the industry leader in this product category. Over 300 individual products in 30 series are available, with processors ranging from 8 to 32 bits. Total shipments reached 1,000 million units in March 2007, making Renesas MCU the world's No. 1 flash MCU. With a wide selection of development tools from Renesas and our partner companies as well as comprehensive Web based support, it is now easier than ever to develop products around Flash MCU, and new advances are being made continuously.

\*No.1 in total units shipped as of June 2007 (Renesas statistics)

The M16C Family is a complete development platform in all respects. It provides total support for the customer's system.



The M16C Family overcomes most of the design issues that traditionally affect MCUs, while still reducing total system costs and supporting a wide range of applications.



# Roadmap

## Overall Roadmap



### Series Overview

Increased Functionality  
Better Performance

Under Development

**R32C/100**

- 4G space
- 100MHz
- 32-bit multiplier
- 32-bit barrel shifter
- On-chip FPU

**M32C/90**

- 16M space
- Up to 64MHz

**M32C/80**

- 16M space
- Up to 32MHz
- Enhanced 32-bit operation instructions
- Barrel shifter
- 4-channel DMA + DMA II

**M16C/80**

- 16M space
- Up to 20MHz
- 16-bit multiplier
- High-speed interrupts
- 2 to 4-channel DMA

**M16C/60**

- 1M space
- 16 to 32MHz
- 16-bit multiplier
- 2 to 4-channel DMA

**M16C/Tiny**

- Small package (42 to 85 pins)
- 10 to 24MHz
- Single chip only

**R8C/Tiny**

- Small package (20 to 80 pins)
- 16 to 20MHz
- Single chip only

Reduced Functionality,  
Lower Pin Count

Upward Compatibility at  
Assembly Language Level

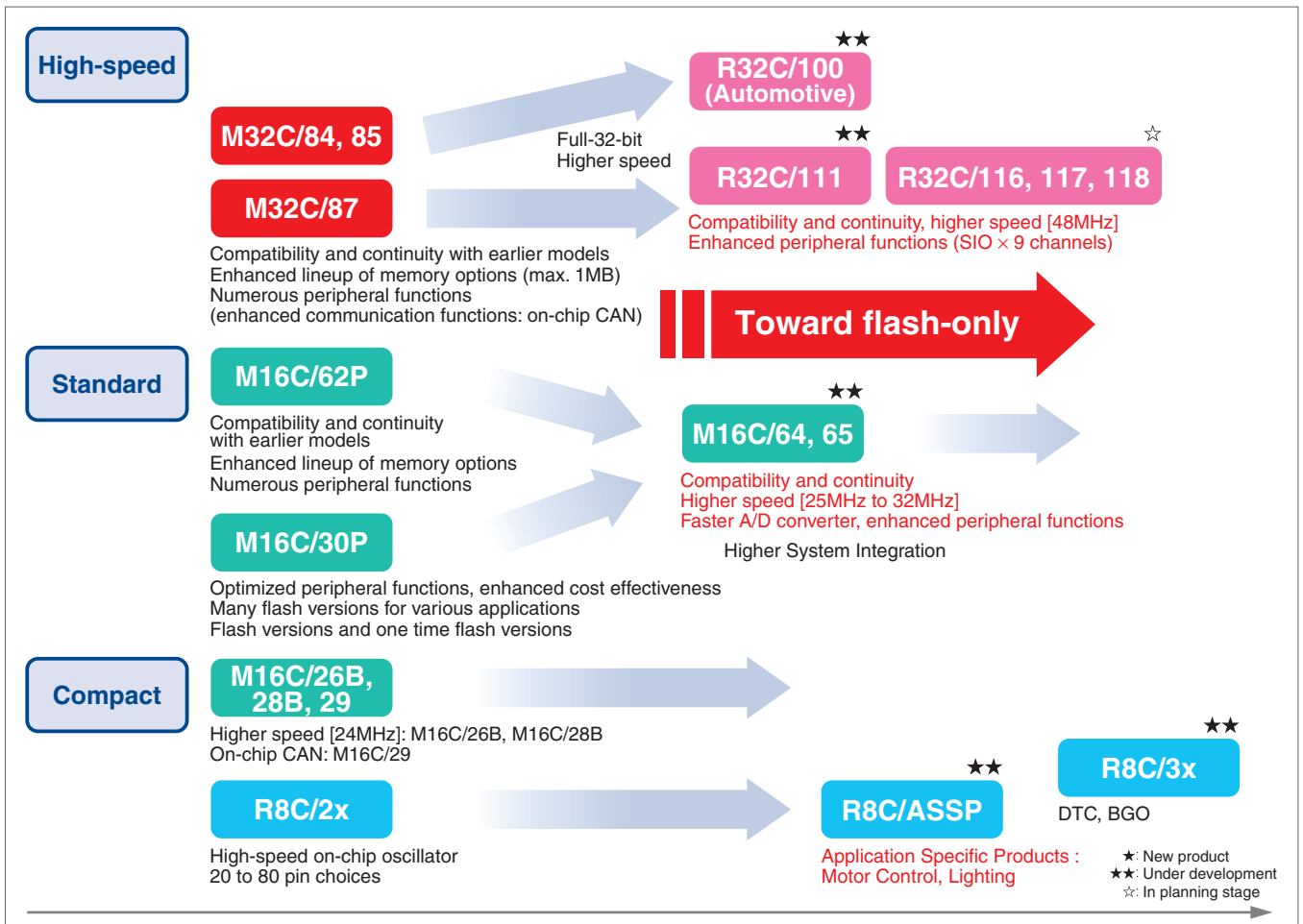
Same CPU for  
Binary Compatibility

Note: Series names beginning with R were developed following the establishment of Renesas Technology Corp.

## Series Comparison

CPU Core	R8C		M16C/60		M16C/80		M32C/80		R32C/100		
Address Space	1MB				16MB				4GB		
DMA	No	2 to 4ch			4ch						
DMA II	No				Yes						
Operation Instructions	16-Bit Operation Instructions				32-Bit Operation Instructions						
Barrel Shifter	No				Yes						
Series	R8C/Tiny	M16C/Tiny	M16C/6X	M16C/80	M32C/8X	M32C/9X	R32C/1XX				
Max. Operating Frequency	20MHz	24MHz	24 to 32MHz	20MHz	32MHz	64MHz	64MHz				
Max. On-Chip Memory	128KB	128KB	512KB	256KB	1MB	512KB	1MB				
External Bus Extension	No			Yes							
Other	8bit I/O	8bit + 16bit I/O			Intelligent I/O		FPU				

## Family Evolution

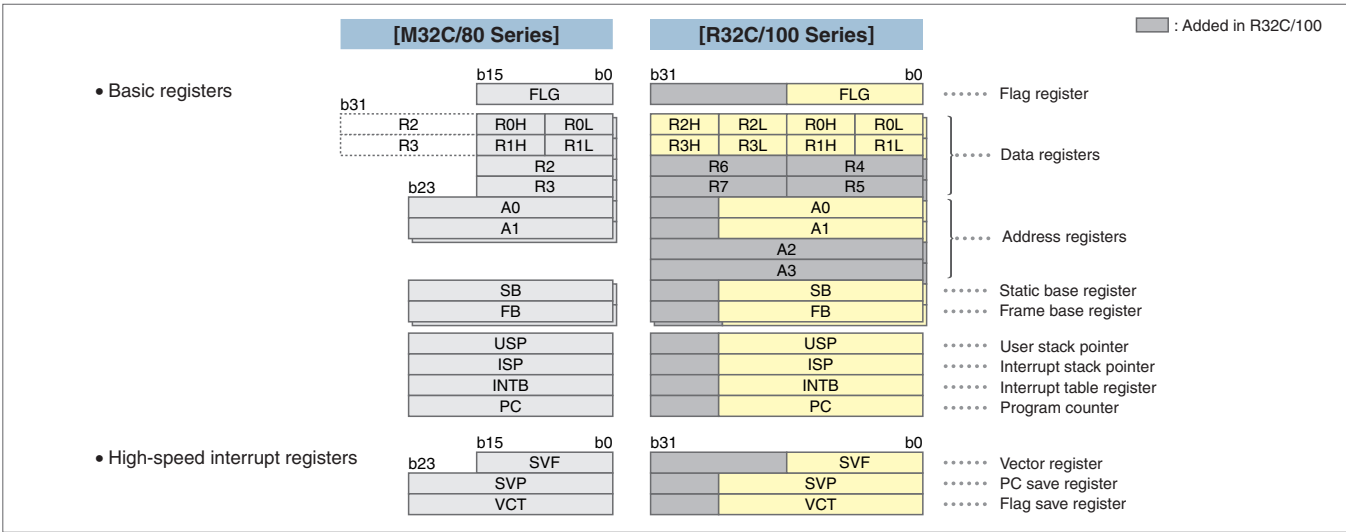




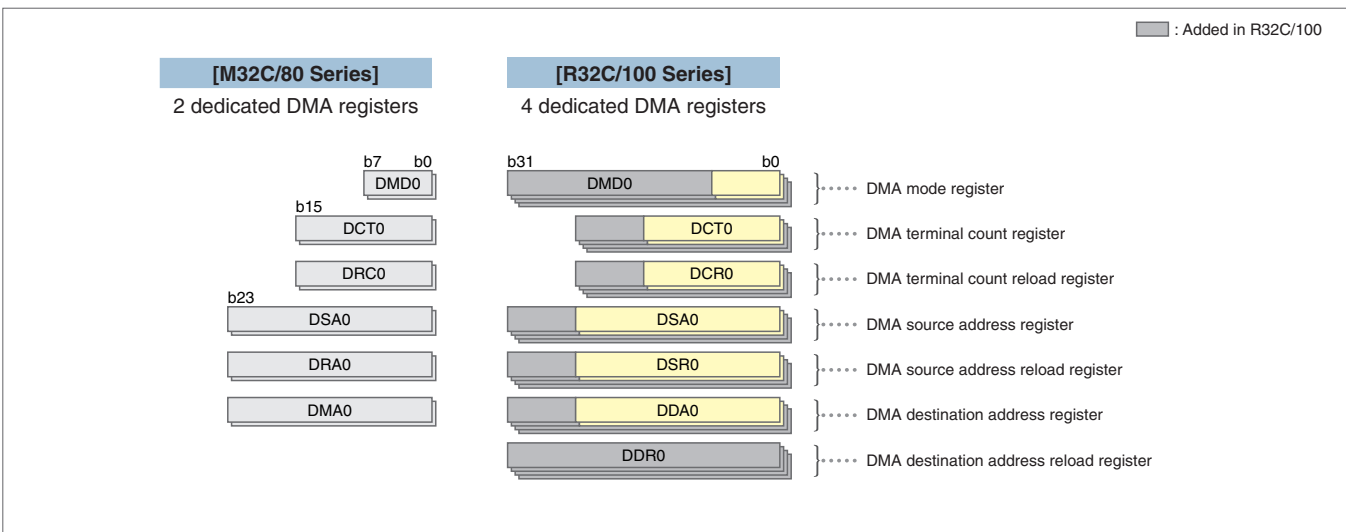
# CPU Architecture

The register layout and addressing of the M16C Family are optimized for embedded applications. Naturally, development using high-level languages (C, C++) is supported.

## R32C/M32C Register Model

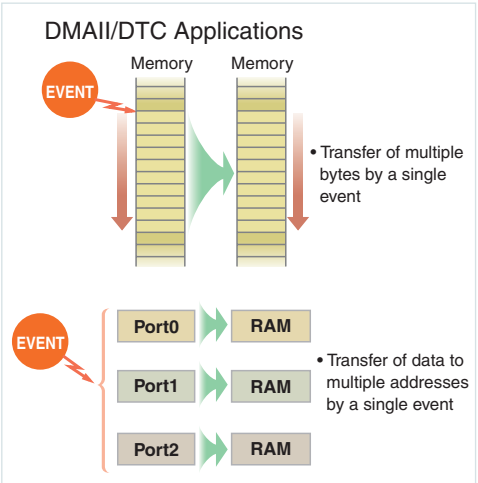
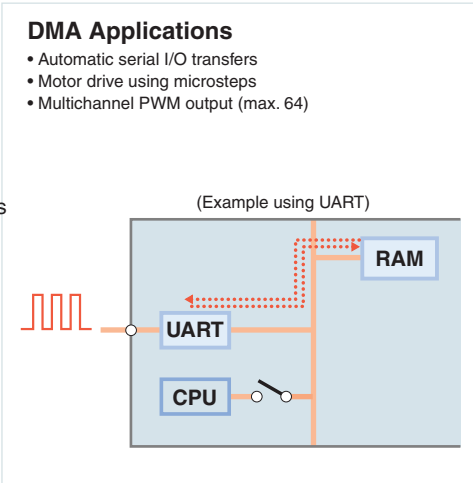


## R32C/M32C Register Model (DMA Related)



## DMA Function

DMA, which transfers data without CPU intervention, supports up to four channels. The DMAII/DTC function provides many other memory transfer capabilities, such as transfer of multiple bytes by a single event and transfer of data to multiple addresses by a single event (M32C/80 core, R32C/100 core).



## Basic Instructions

Frequently used instructions are executed in one cycle.

List of Instructions with 1-Cycle Execution Addressing (36 of 108 Total Instructions in the M32C/80)

Type	Instruction	Function	Type	Instruction	Function	
Arithmetic	ABS	Absolute value	Bit manipulation	BCLR	Clear bit	
	ADC	Add with carry		BNOT	Invert bit	
	ADCF	Add carry flag		BNTST	Test inverted bit	
	ADD	Add without carry		BSET	Set bit	
	CMP	Compare	BTST	Test bit		
	DEC	Decrement	Shift	ROL	Rotate left with carry	
	EXTS	Extend sign		RORC	Rotate right with carry	
	EXTZ	Extend zero		ROT	Rotate	
	INC	Increment	1-bit shift	SHA	Shift arithmetic	
	NEG	Two's complement		SHL	Shift logical	
	Logic	SBB	Subtract with borrow	Other	FCLR	Clear flag register bit
		SBU	Subtract without borrow		FSET	Set flag register bit
AND		Logical AND	INDEX		Index	
NOT		Invert all bits	INTO		Interrupt on overflow	
OR		Logical OR	Jcnd		Jump on condition	
Transfer	TST	Test	LDC		Transfer to control register	
	XOR	Exclusive OR	NOP		No operation	
	MOV	Transfer	PUSHC		Save control register	
	PUSH	Save	SCcnd		Store on condition	
	PUSHM	Save multiple registers				

## Advanced Instructions (Enhanced 32-Bit Instructions - R32C/100)

The R32C/100 CPU core features enhanced 32-bit instructions and many instructions with advanced functionality.

Category	Instruction	Description
Arithmetic instructions	ADSF	Sign flag add
	EDIV	Signed divide (64 ÷ 32 → 32-bit)
	EDIVU	Unsigned divide (64 ÷ 32 → 32-bit)
	EDIVX	Signed divide (32 ÷ 32 → 32-bit)
	EMUL	Signed multiply (32 ÷ 32 → 64-bit)
	MULX	Multiply with rounding
	EMULU	Unsigned multiply (32 ÷ 32 → 64-bit)
Floating point operation instructions	ADDF	Floating point add
	CMPF	Floating point compare
	CNVIF	Convert integer → floating point number
	DIVF	Floating point divide
	MULF	Floating point multiply
	ROUND	Convert floating point number → integer
	SUBF	Floating point subtract
High-level language support instructions	SUNTIL	Search until data matching search string found
	SWHILE	Search until data not matching search string found
Other	EXITI	Release interrupt stack frame
	STOP	Stop

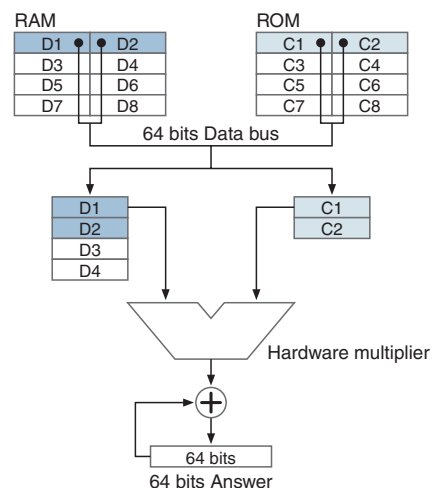
## Enhanced Multiply and Accumulate Instruction

The multiply and accumulate instruction has been further enhanced.

**M32C/80 (2 cycles)**  
16bits × 16bits + 48bits → 48bits



**R32C/100 (1 cycle)**  
32bits × 32bits + 64bits → 64bits

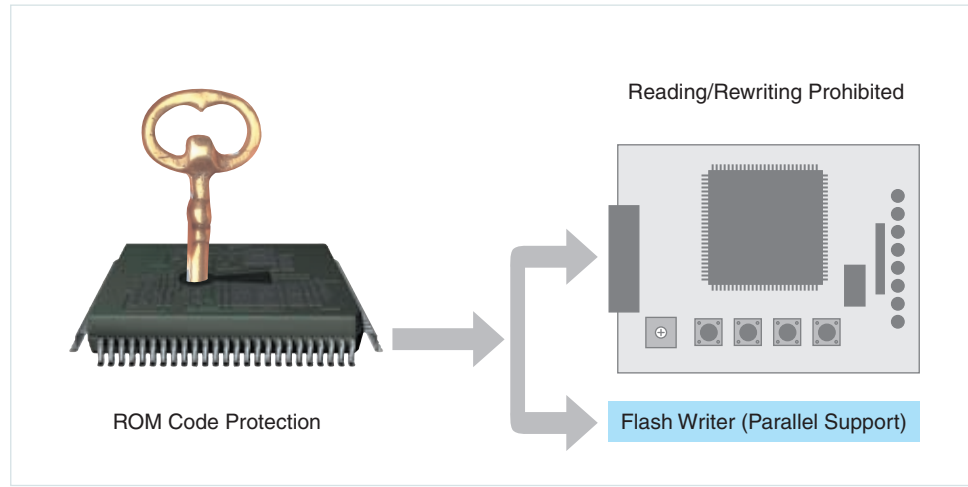


# Concepts Security Functions

The M16C Family incorporates a number of security functions to prevent unauthorized access to its internal ROM contents.

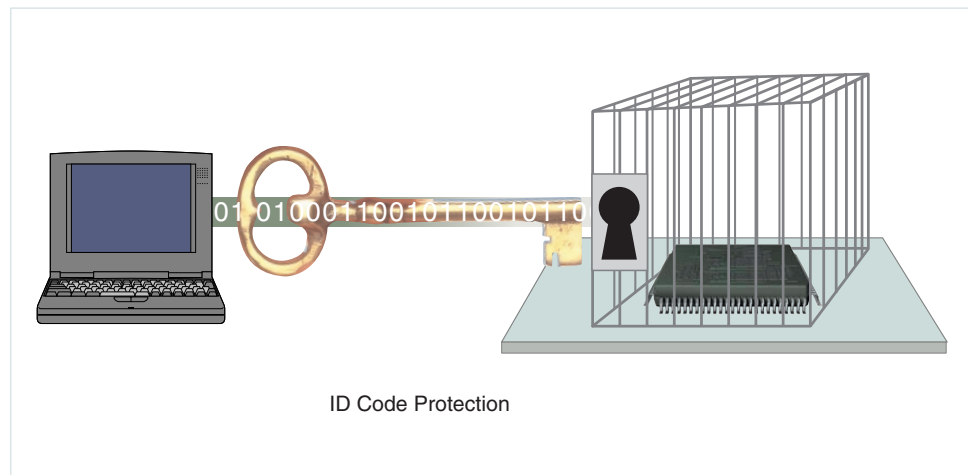
## Flash Memory ROM Code Protection

During parallel programming, the ROM protection bits prevent reading or overwriting of on-chip flash memory. It is not even possible to read the contents of flash memory using an external flash programmer. (The protect bits can only be changed by serial programming.)



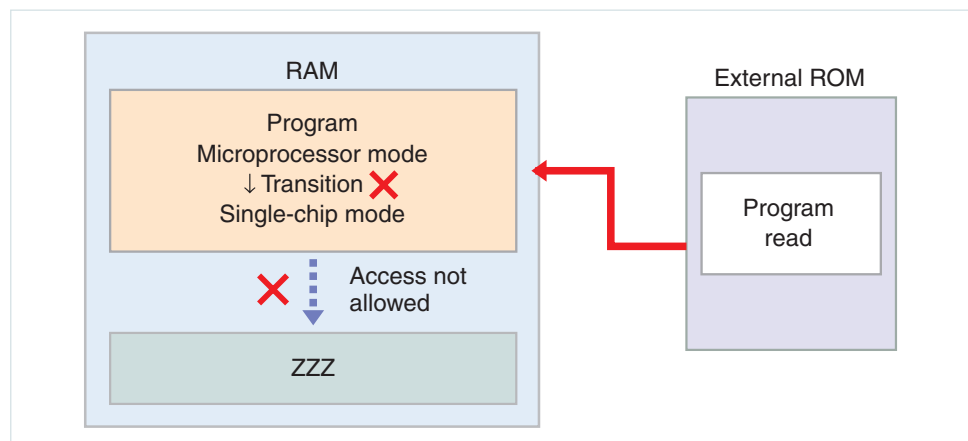
## Flash Memory ID Code Protection

For a serial programming command to be accepted, the ID code sent from the serial programming must match the ID code programmed in internal ROM. This prevents unauthorized access. (Repeated ID verification is not allowed.)



## Prevention of Reading On-Chip Flash Memory

When started in microprocessor mode, data can be copied to on-chip RAM from external ROM. However, it is not possible to switch from microprocessor mode to single-chip mode, so reading of on-chip ROM is not possible. This prevents third parties from making unauthorized copies of the contents of on-chip memory.



Details: ROM correction: The M16C Family has a function that allows program correction of up to four locations using address match interrupts.





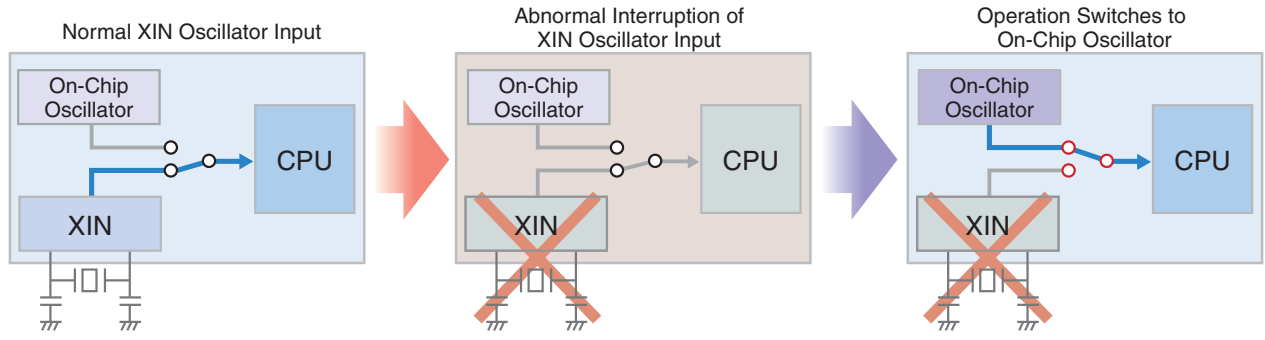
# Concepts Excellent Reliability

The M16C Family incorporates many design features to ensure reliable operation under a variety of conditions.

## On-Chip Oscillator with Fail Safe Feature

Enhanced Reliability with On-Chip Oscillator and Oscillation Stop Detection Circuit

Detects abnormal interruption of XIN oscillator input and switches to the on-chip oscillator in order to continue microcomputer operation.

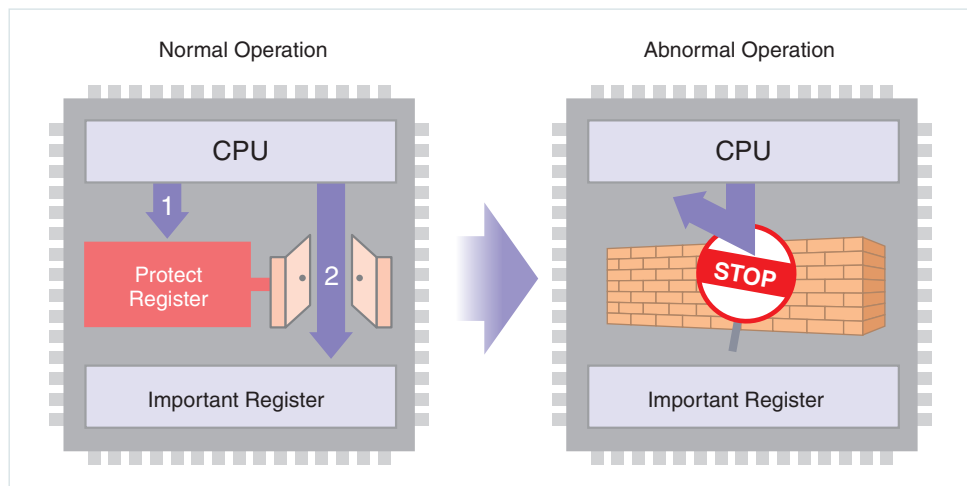


Other Features

- It is possible to use software to halt XIN oscillator input and MCU can operate using the high-speed on-chip oscillator instead. (This also reduces power consumption.)
- The watchdog timer can operate independently using the separate low-speed (125kHz) on-chip oscillator.

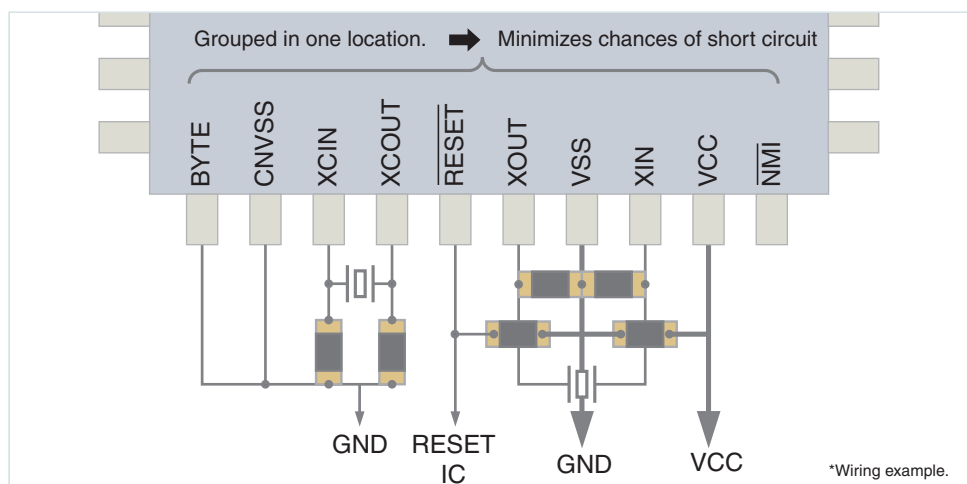
## Protecting Critical Registers

The register protect feature can be used to safeguard access to important registers and ports. This can prevent unauthorized access to key registers should program runaway occur. It is necessary to set the protect register before accessing important registers.



## Grouping Together of Important Pins

The pin layout is designed to simplify arrangement of power supply and ground lines and facilitate the connection of decoupling capacitors. This also minimizes the chances of short circuit.



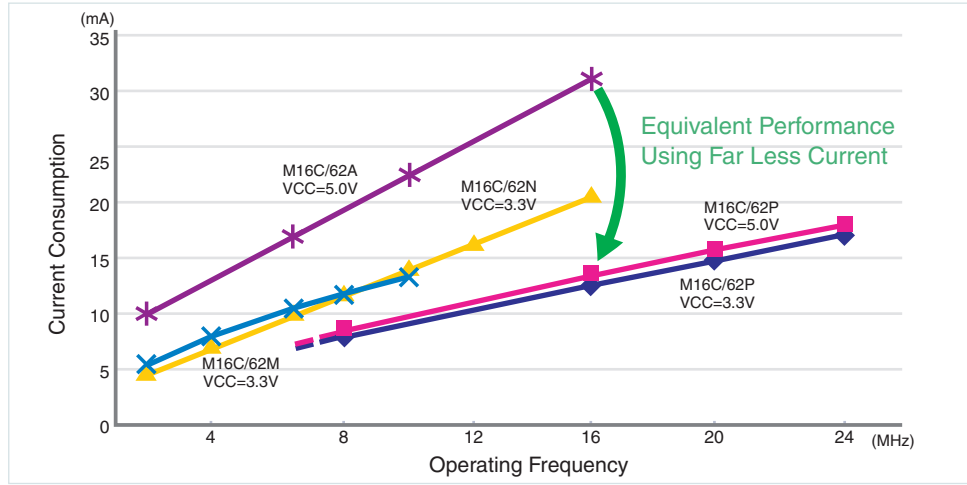
\*Wiring example.

# Concepts Low-Power Operation

M16C MCUs are designed to minimize power consumption.

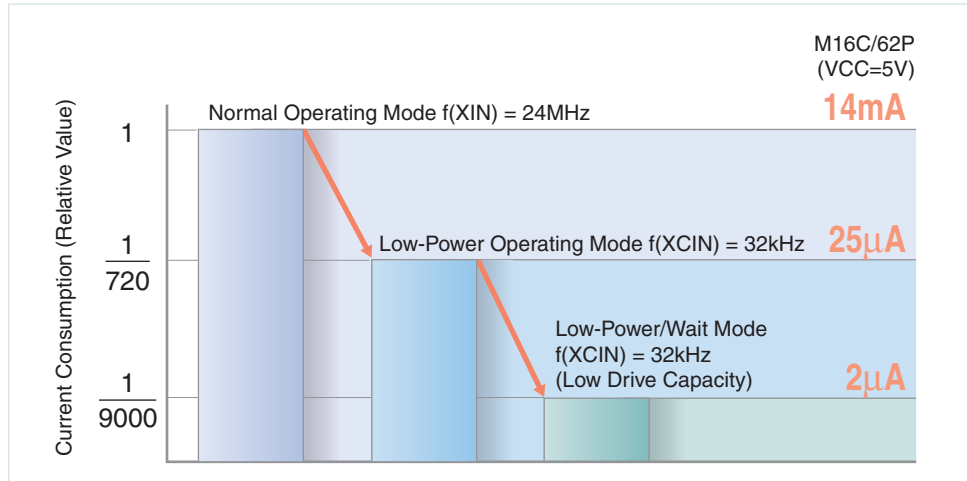
## Low-Current Consumption through Advanced Processes

Advanced fabrication processes bring with them reductions in current consumption. The latest version's MCUs use far less current to provide equivalent processing performance.



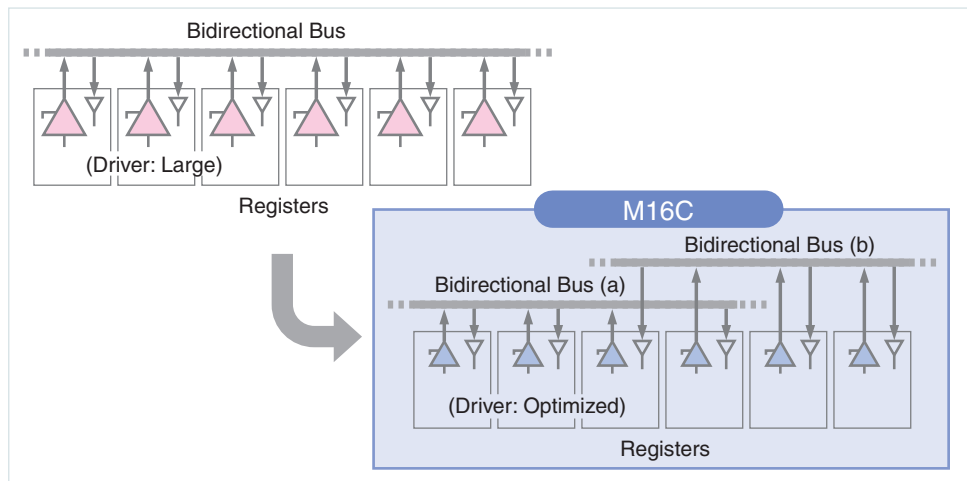
## Multiple Power Management Functions

There are two on-chip clock generator circuits, main clock and subclock. It is possible to switch between them to reduce power consumption and noise (low-power mode switching).



## Reduced Load Capacitance

Discrete buses distribute load capacitance and reduce power loss due to discharging. In addition, lower load capacitance permits faster bus operation.





# Concepts Low EMI/Excellent EMS

The M16C Family is designed to maximize EMI/EMS performance. This reduces costs associated with EMI/EMS countermeasures for application developers.

## Low Electromagnetic Interference (EMI)

The M16C Family is designed to minimize switching noise. Noise output is reduced by as much as 20dB.

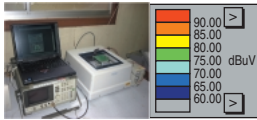
### EM Scan

#### Measurement method:

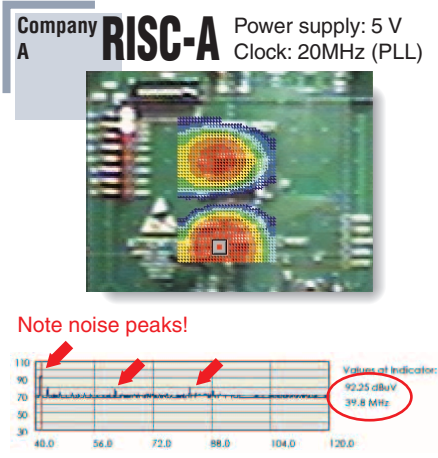
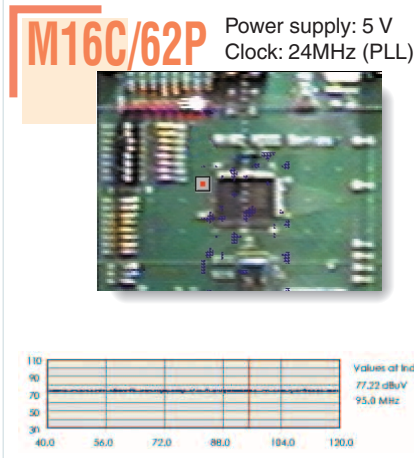
EM scan measurement using electromagnetic field probe

#### Measurement conditions:

Measurement frequency range 40 to 120MHz



Measuring device: EPS-M1 EM scanner, Noise Laboratory Co., Ltd.  
Measurement location: Kansai Electronic Industry Development Center  
Measurement frequency range: 30 to 110MHz  
Measurement unit: 2mm<sup>2</sup>

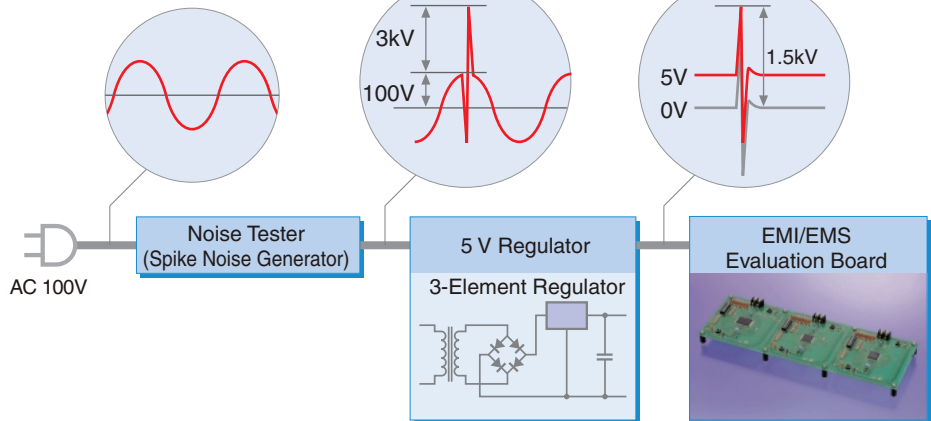


Note: Evaluation is also performed using the VDE and TEM cell methods. Only products that meet uniform standards are produced in volume.

## Excellent Ability to Withstand Noise (EMS)

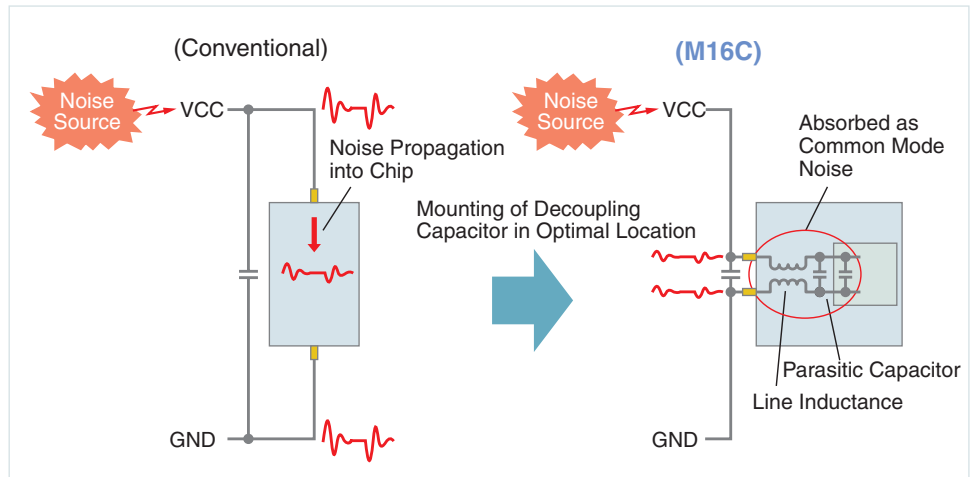
All M16C/M32C MCUs are designed using various noise reduction techniques. These MCUs are extensively tested using different noise test methods.

### Evaluation Method



## Short Distance between VCC and VSS

The VCC and VSS pins are arranged close together on M16C MCUs to prevent noise from entering via the VCC and ground wiring. Internal parasitic capacitors provide further protection against noise at the VCC and VSS pins. This design also helps suppress unwanted noise emission from the chip itself.



# Concepts Excellent Compatibility

The M16C Family provides compatibility in all aspects, allowing easy transition to higher end models.

## Pin Compatible

The products in the M16C Family are pin compatible, so there is almost no need for wiring changes on the board when switching to newer versions or changing to different MCUs within the same family.

### M32C/85 Group Added Functions (Previous Functions Retained)

CTS4 / RTS4 / SS4  
 CTS3 / RTS3 / SS3  
 IEOUT / OUTC2\_0 / SDA3 / SRXD3  
 IEIN / SCL3 / STXD3

CAN0OUT / CAN1OUT  
 HDTXD / OUTC1\_5 / INPC1\_4  
 ISRXD0  
 CAN0IN / ISCLK0 / OUTC1\_4 / INPC1\_4  
 CAN0OUT / ISTXD0 / OUTC1\_3 / INPC1\_3  
 ISRXD1 / OUTC1\_2 / INPC1\_2  
 ISCLK1 / OUTC1\_1 / INPC1\_1  
 INPC1\_0 / SS2 / ISTXD1 / OUTC1\_0

### M16C/62P

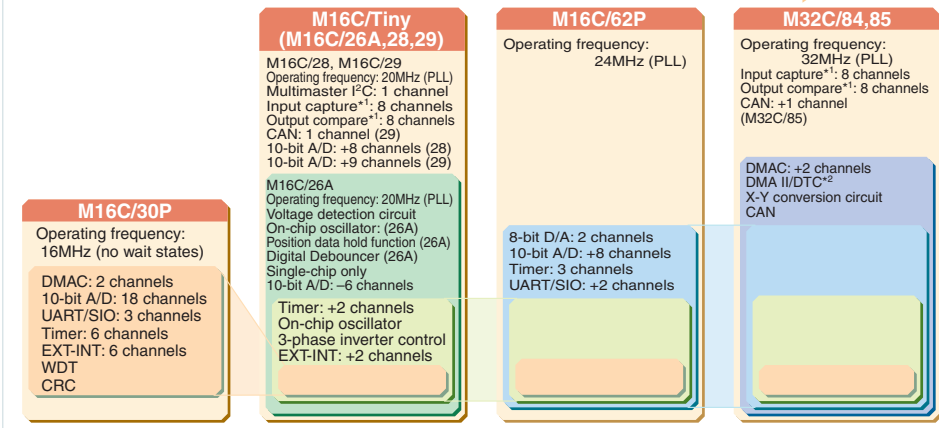
DA1 / TB4IN / P9\_4  
 DA0 / TB3IN / P9\_3  
 SOUT3 / TB2IN / P9\_2  
 SIN3 / TB1IN / P9\_1  
 TB0IN / CLK3 / P9\_0  
 BYTE  
 CNVSS  
 XCIN / P8\_7  
 XCOUT / P8\_6  
 RESET  
 XOUT  
 VSS  
 XIN  
 VCC  
 NMI / P8\_5  
 INT2 / P8\_4  
 INT1 / P8\_3  
 INT0 / P8\_2  
 TA4IN / U / P8\_1  
 TA4OUT / U / P8\_0  
 TA3IN / P7\_7  
 TA3OUT / P7\_6  
 TA2IN / W / P7\_5  
 TA2OUT / W / P7\_4  
 TA1IN / V / CTS2 / RTS2 / P7\_3



## Compatible Peripheral Functions

Products in the M16C Family have compatible CPU cores and peripheral functions.

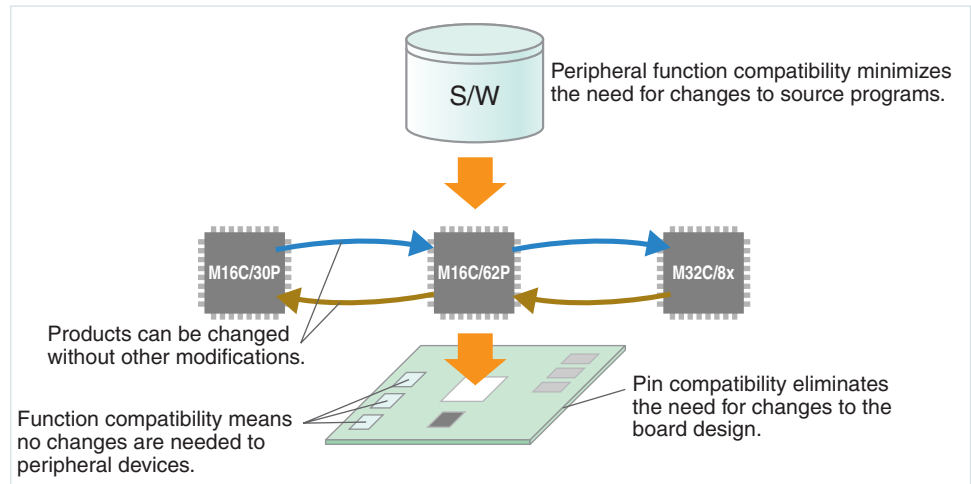
### Compatible Peripheral Functions



Notes  
 1. High-function timer with communication function.  
 2. DMA II and DTC are DMA functions that can be initiated by peripheral I/O requests.

## Advantages of Compatibility

Pin compatibility and peripheral function compatibility minimize the need for changes to the board design or software.



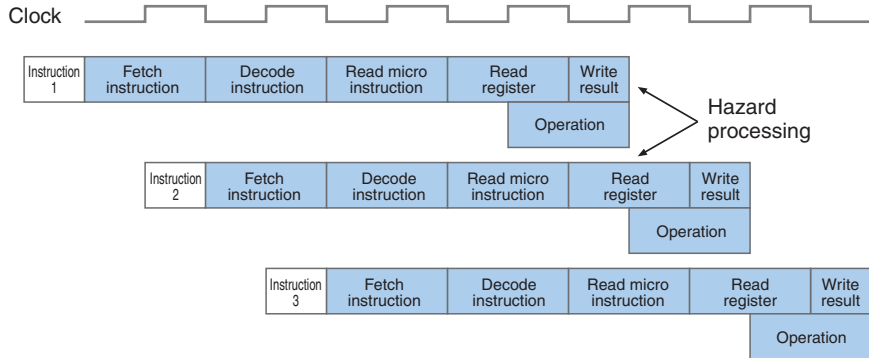


# Concepts High-Speed Processing

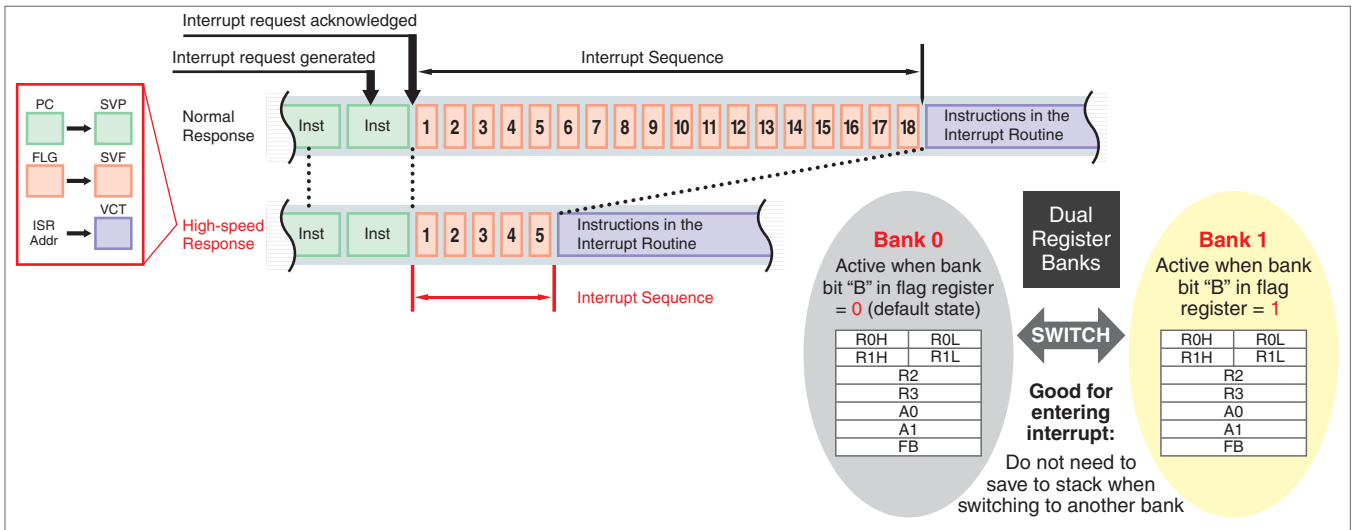
The M16C Family provides high-speed processing under a variety of conditions.

## R32C CPU Core Pipeline

The number of pipeline stages has been increased from three (previous version) to five to boost processing speed.



## High-Speed Interrupt Processing (R32C/M32C)



## Floating Point Instructions (R32C)

The R32C incorporates a single-precision 32-bit FPU and supports floating point instructions.

### Instruction set

- CNVIF: Convert integer → floating point number
- ROUND: Convert floating point number → integer
- ADDF: Floating point add
- SUBF: Floating point subtract
- MULF: Floating point multiply
- DIVF: Floating point divide
- CMPF: Floating point compare

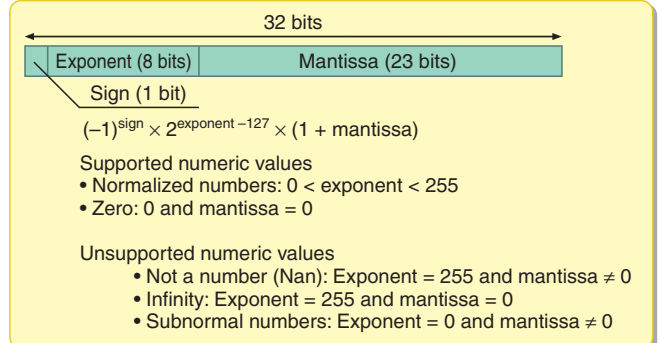
### Rounding modes

- Round to nearest value
- Round towards zero
- Round towards negative infinity

### Exception processing

- Illegal input
- Overflow
- Underflow

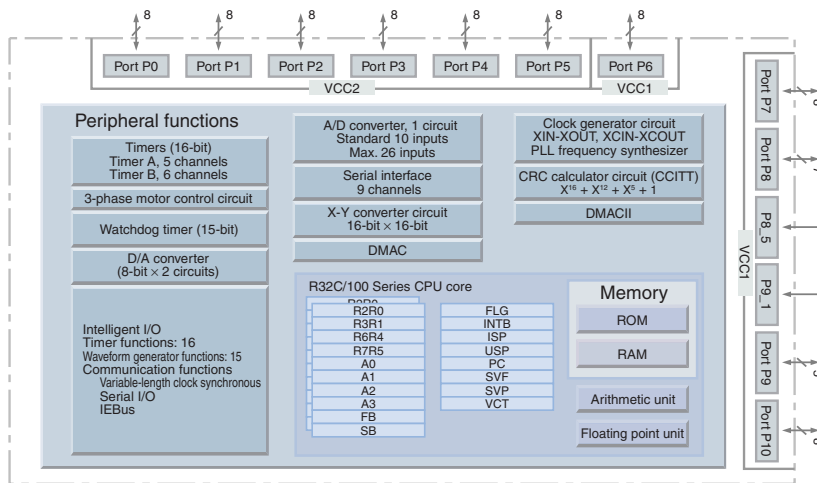
### Data format (single-precision floating point number)



# Concepts Abundant Peripheral Functions

The M16C Family includes high-performance on-chip functions for a variety of applications.

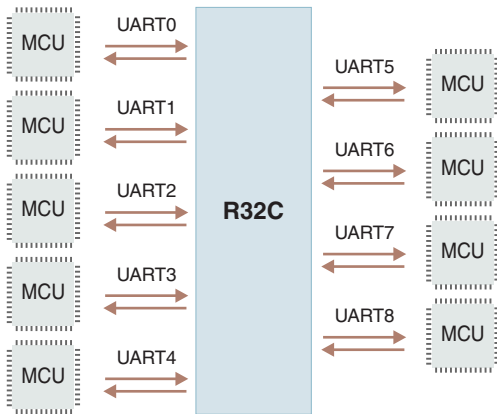
## Block Diagram – R32C/111



## Serial Interface

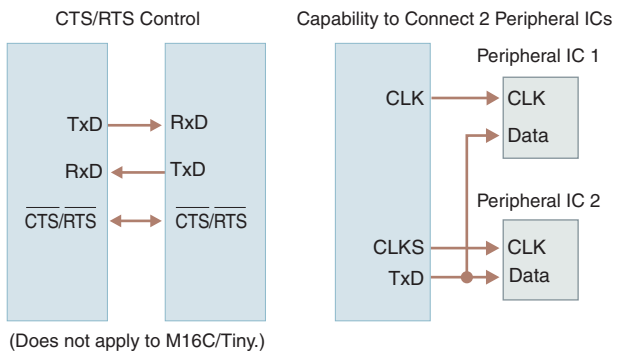
### UART/Clock-Synchronous Serial I/O

The R32C/100 has **nine on-chip** UART/clock-synchronous serial I/O channels.



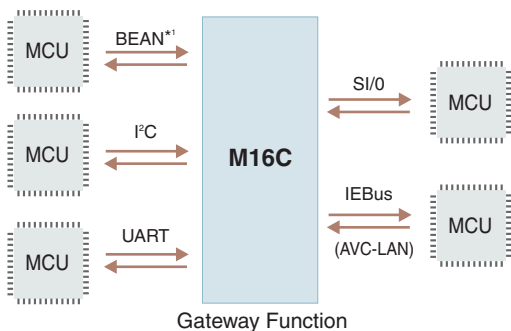
### UART Function

In addition to normal UART capabilities, special functions are also supported.



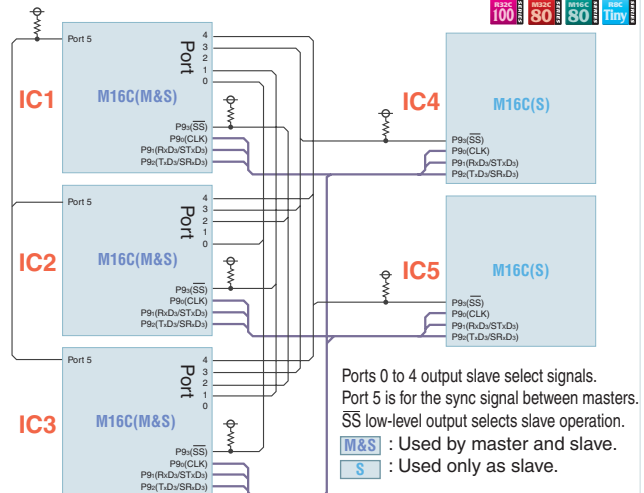
### Gateway Function

Broad range of communication peripherals provides gateway functionality.



\*: M32C/80 Only

### Synchronous Serial Communication Unit



## I<sup>2</sup>C Bus Interface

The I<sup>2</sup>C Bus is supported as a serial interface.

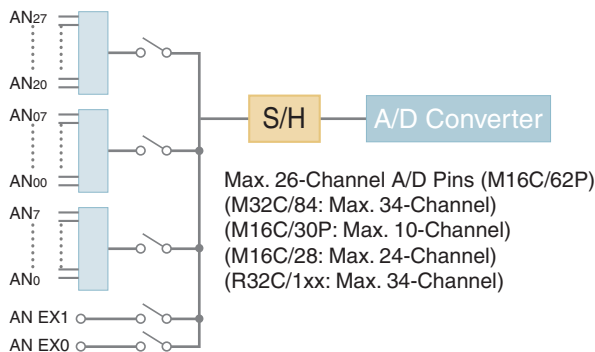


Supported MCUs	M16C/62P, M16C/64, M16C/65, M32C, R32C	M16C/65, M16C/Tiny, R8C/Tiny
Communication control method	Partial software control	Hardware control
Start condition overlap detection	No detection	Detection supported
Arbitration lost detection	Requires flag to be initialized for each byte	Does not require flag to be initialized for each byte
Slave address match determination	Match determination by software	Match determination by hardware, interrupt generated only on match
Initial acknowledge generation	Generated by software after slave address determined	Automatic processing by hardware
Timeout detection function	None	Supported (dedicated timer)
Max. communication speed	384 kbps (because the SCL low duration $\geq 1.3 \mu\text{s}$ standard is not met at faster speeds)	400 kbps (max. value of I <sup>2</sup> C Bus standard high-speed mode)

## A/D Converter

### High-Speed A/D Converter with Sample-and-Hold

- Conversion Speed ( $\varnothing\text{AD} = 25\text{MHz}$ ) (M16C/65) 10-Bit:  $1.72 \mu\text{s}$
- Successive Conversion  $\pm 3$  LSB Accuracy
- High-Speed Sample-and-Hold  
10MHz Operation:  $0.3 \mu\text{s}$ , 20MHz Operation:  $0.15 \mu\text{s}$



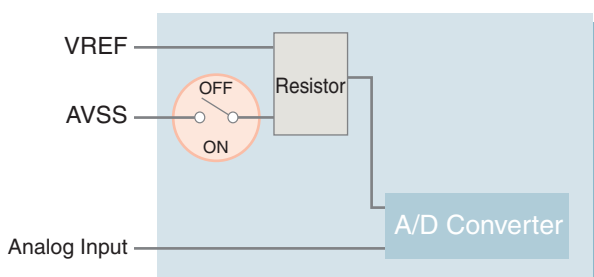
### Improved A/D Converter Characteristics

The M16C/64 and M16C/65 deliver better A/D conversion accuracy than other M16C models.

Max. A/D conversion error		M16C/64, 65	
At AVCC = VREF = 5V	Analog input (AN <sub>i</sub> , AN <sub>j_i</sub> )	$\pm 3$ LSB	↑ Better accuracy
	Extended analog input (ANEX <sub>i</sub> )	$\pm 3$ LSB	
At AVCC = VREF = 3.3V	Analog input (AN <sub>i</sub> , AN <sub>j_i</sub> )	$\pm 3$ LSB	↑ Better accuracy
	Extended analog input (ANEX <sub>i</sub> )	$\pm 3$ LSB	
At AVCC = VREF = 3V	Analog input (AN <sub>i</sub> , AN <sub>j_i</sub> )	$\pm 3$ LSB	↑ Better accuracy
	Extended analog input (ANEX <sub>i</sub> )	$\pm 3$ LSB	

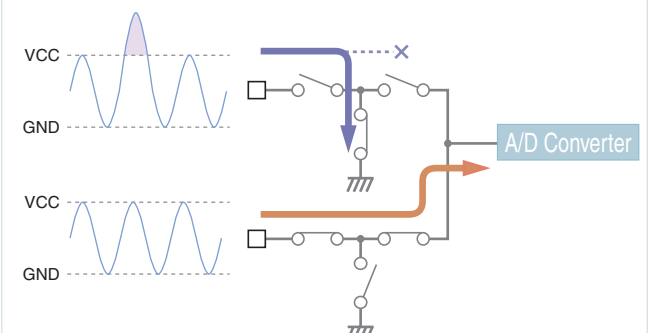
### VREF Cutoff

The analog circuit reference voltage, VREF, can be turned on or off. Turning off VREF when the A/D converter is not being used can help reduce current consumption.



### Measurement Error Avoidance (Unused A/D Overvoltage Processing)

This feature helps prevent measurement error due to wraparound between channels, even if the other A/D inputs include input that exceeds the VCC level. It also provides more accurate A/D conversion values.

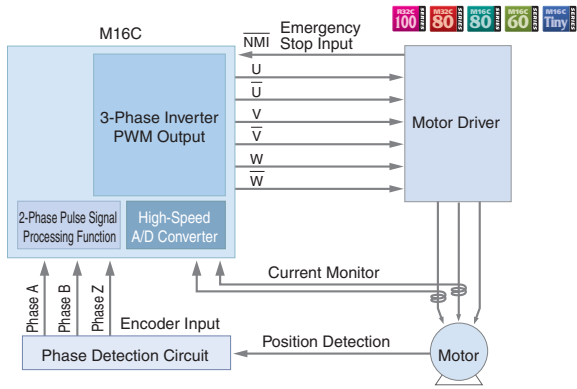


# Concepts Abundant Peripheral Functions

## Highly Functional Timers

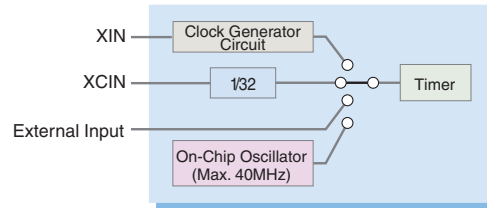
M16C MCUs have input and output timers that are used in combination with other peripheral functions.

### 3-Phase Inverter PWM Output (Applicable to Motor Control Systems)



### Independent Timer Operation

The timer's count operation is independent of the operation of the CPU. Even if the CPU is stopped, it is possible to operate the timer by means of external signals or a subclock (32kHz, etc.), thereby reducing current consumption.



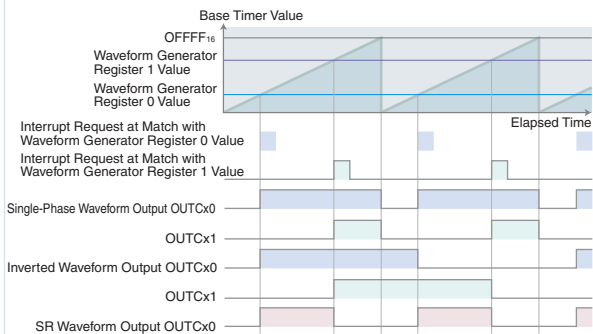
## Intelligent I/O

I/O ports can be configured to implement different peripheral functions.

### Output Compare (Waveform Generator Function)

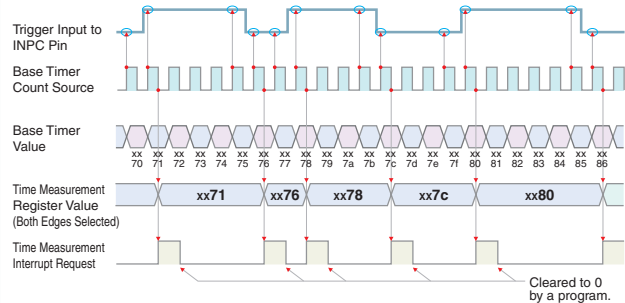
Interrupts are generated when matches occur between the base timer and waveform generator register values, generating a PWM waveform.

- The following waveform output modes are implemented on all groups.  
 (1) Single-Phase Waveform Output (2) Inverted Waveform Output  
 (3) SR Waveform Output



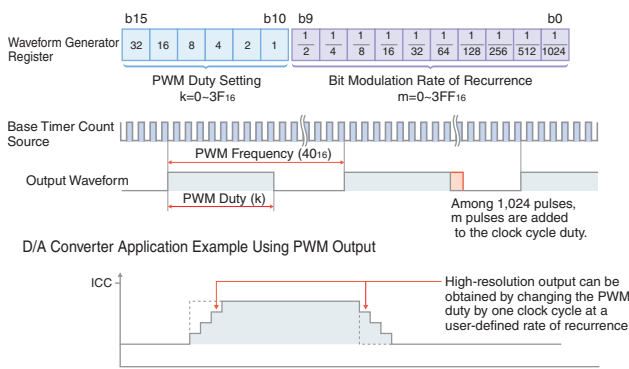
### Input Capture (Time Measurement Function)

At trigger input the timer value is stored in the time measurement register, and an interrupt is generated.



### Bit Modulation PWM

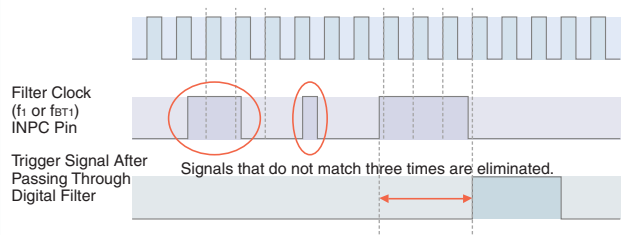
High-frequency PWM output can be produced based on any bit between 6 and 16.



### Input Capture Digital Filter Function

#### Digital Filter Function (INPC10 to INPC17)

The trigger input level is determined every  $f_1$  or  $fbt_1$  and pulses are allowed to pass through when three matches occur. (The clock of the digital filter can be selected to match the noise band.)



Signal Delay Caused by Digital Filter (Max. 3.5 Cycles of Filter Clock)



## Bus Control

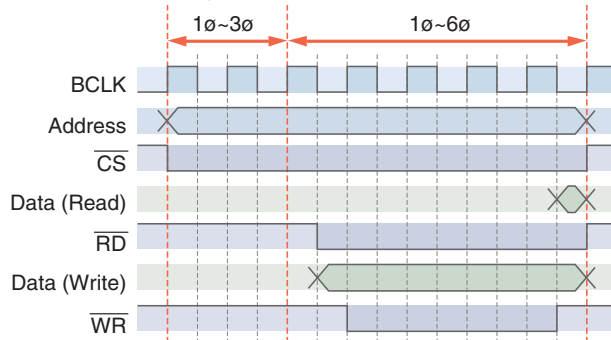
As the CPU operation speed increases, timing control of the external devices becomes more difficult.

### Enhanced External Bus Access Functions



#### Expanded Number of Wait Cycles

1 to 7 Bus Wait Cycles



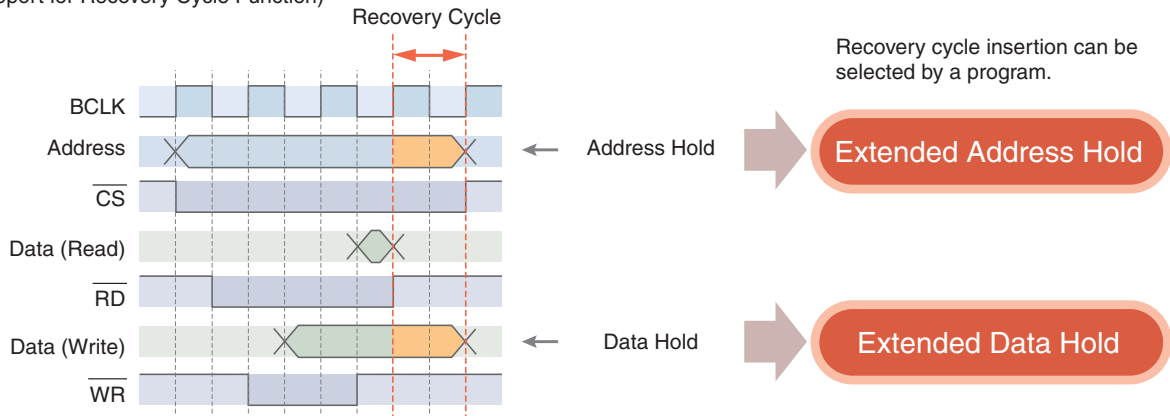
Access Cycles to External Area (32MHz)

0 Wait Cycles	62.4ns	Function Extension
1 Wait Cycles	93.6ns	
2 Wait Cycles	124.8ns	
3 Wait Cycles	156.0ns	
4 Wait Cycles	187.2ns	
5 Wait Cycles	218.4ns	
6 Wait Cycles	249.6ns	
7 Wait Cycles	280.8ns	

Possible to connect external ASIC or slow memory even when CPU operates at high speed.

#### Expanded Number of Address and Data Hold Cycles

(Support for Recovery Cycle Function)



Recovery cycle insertion can be selected by a program.

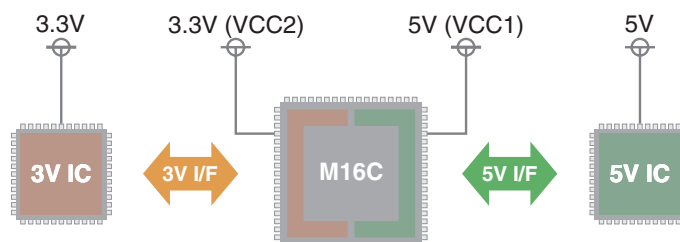
### Dual Peripheral Power Supplies (5V and 3V)

Possible to connect external 5V and 3V peripheral ICs without adding external circuitry.



P6 to P10, P11, P14 :  $2.7V \leq VCC1 \leq 5.5V$

P0 to P5, P12, P13 :  $2.7V \leq VCC2 \leq VCC1$

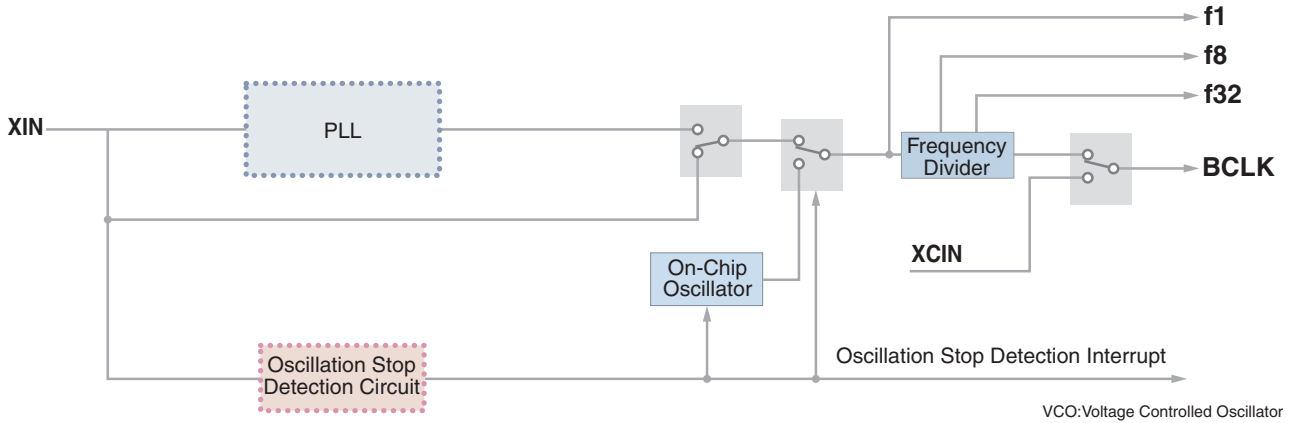


Note: This specification applies to consumer products only.

# Concepts Abundant Peripheral Functions

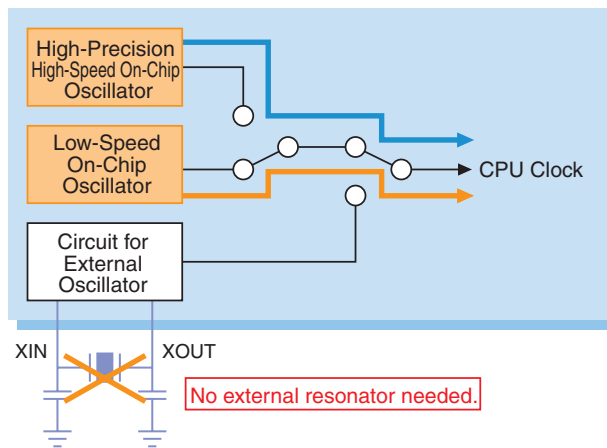
## PLL Oscillator Circuit and Oscillation Stop Detection Circuit

- The on-chip PLL supports a maximum operating frequency of 20MHz to 64MHz.
- When XIN is interrupted, the oscillation stop detection circuit switches to the on-chip oscillator as a backup, allowing operation to continue.



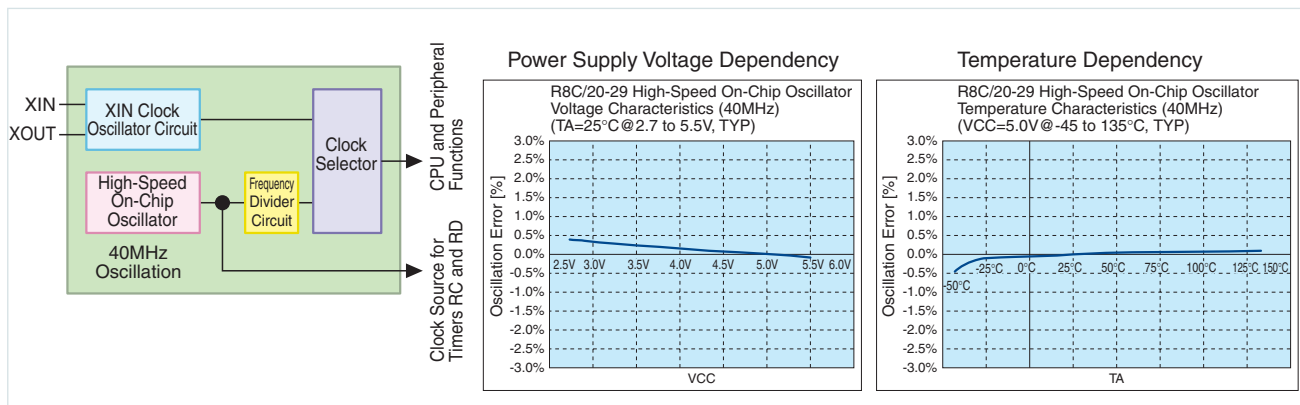
## On-Chip Oscillator Startup

After a reset is cleared, operation starts using the low-speed on-chip oscillator. By using the high-precision high-speed on-chip oscillator, it is possible to configure a system that does not require an external resonator.



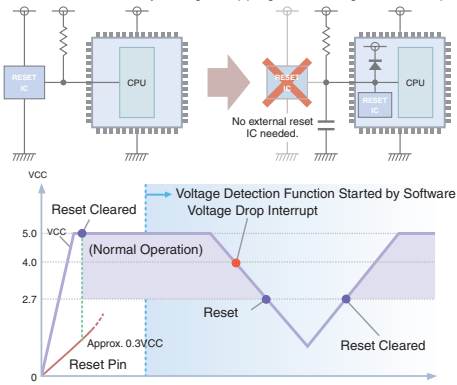
## High-Precision High-Speed On-Chip Oscillator

- Highest precision in the industry over a range of temperatures and voltages.
- The 40MHz clock generated can be used to operate 16-bit timers (Max. 20MHz clock in R8C/Tiny Series).

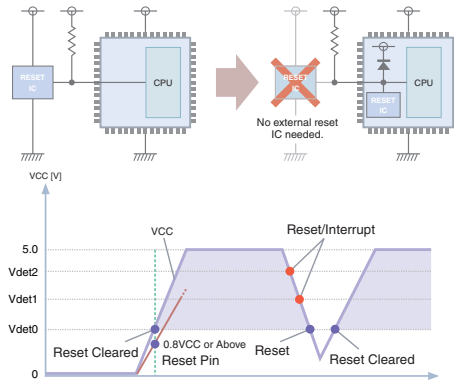


## Reset Function (On-Chip Reset Circuit)

- Voltage-Drop Interrupt (Enabled/Disabled by Software)  
Enables software detection of power supply voltage drops without external circuitry.
- On-Chip Reset Circuit (Enabled/Disabled by Software)  
Prevents malfunctions caused by voltage dropping below the guaranteed operation voltage.



- The number of external reset ICs can be reduced.
- Setting can be made before reset clearing using the optional function select register.



## Watchdog Timer

Optional Function Select Register (Address 0FFFFH)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
CSPROINI	Reserved	LVD0ON	Reserved	ROMCP1	ROMCR	Reserved	WDTON

### CSPROINI

- 1: Count source protect mode disabled after a reset (uses CPU clock)
- 0: Count source protect mode enabled after a reset (uses low-speed on-chip oscillator)

### WDTON

- 1: Watchdog timer remains stopped after a reset
- 0: Watchdog timer automatically restarts after a reset

**Clock is separate from CPU and does not stop!**

Note: Does not apply to R8C/12 and R8C/13.

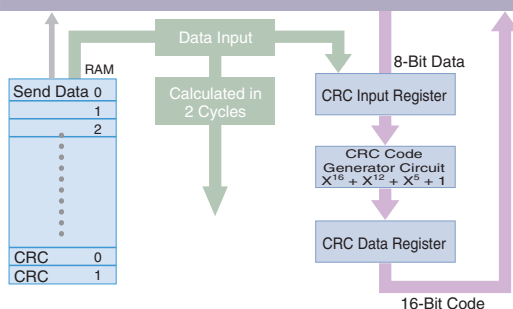
**Constant monitoring of reset start setting!**

## Other Functions

### CRC

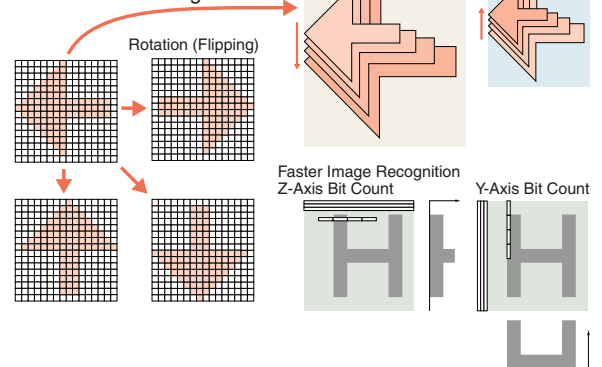
The CRC function can be used to improve data reliability.

- On-chip hardware performs CRC calculations in two cycles.
- Generating polynomial:  $X^{16} + X^{12} + X^5 + 1$  (CCITT standard),  $X^{16} + X^{15} + X^2 + 1$  (CRC-16 standard, M16C/29 only)
- Provides more powerful error verification than parity or checksum methods.



### X-Y Data Converter

Performs high-speed flipping, rotation, enlargement, and reduction of image data.



# Lineup of Products with On-Chip Flash Memory

All series in the M16C Family include products with on-chip flash memory.

## Features of M16C MCUs with On-Chip Flash Memory

### 1. High-Speed Programming/Erasing

Programming 256KB of flash memory takes only four seconds (serial rewrite mode). This greatly reduces the programming burden in the volume production process. (M16C/62P)

### 2. High Reliability

High data storage reliability, erasing reliability, and programming reliability help prevent problems following mounting.

### 3. ROM Code Protect Function

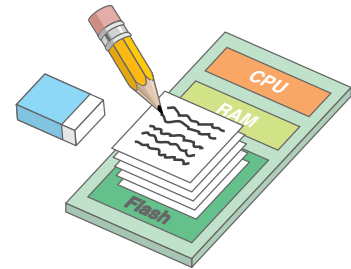
High-level security functionality is built in.

### 4. Support for On-Line Programming (CPU Rewrite Mode)

High-level security functionality is built in.

### 5. Support for Data Flash Memory

Products are available with extra-high guaranteed write/erase counts up to 10,000 times



## List of Flash Programmers

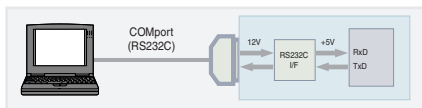
Manufacturer	Product Model	Writing Method
BPM Microsystems	BP-2610, BP-2710, BP-2710M	Parallel (Gang)
Data I/O Corporation	UNISITE, 3980 (3900), Optima, Dual, Qctal, PP100	Parallel (Gang)
	Image Writer	Serial
System General Corp.	T9600	Parallel (Gang)
Sunny Giken Inc.	S550-MFW-1U	Parallel (Gang) and Serial
	S550-SFW1U	Serial
Yokogawa Digital Computer Corporation	NET IMPRESS	Serial
Renesas Solutions Corp.	R0E00008AKCE00(E8a)	Serial
	M3A-0665	Serial
	M3A-0806	Serial

Please contact the writer manufacturer for information on MCU compatibility.

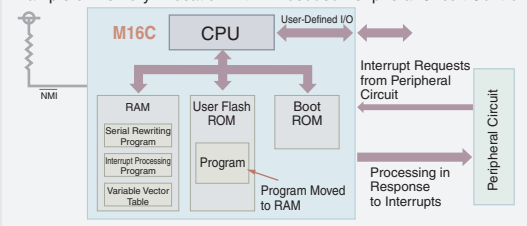
## On-Chip Flash Memory Functions

### Flash Programming Mode

Using flash rewriting program prepared by the customer, the user area can be erased and programmed.



Example of Memory Allocation with Embedded Peripheral Circuit Control



### Data Flash

A small block of flash memory called data flash memory is provided separately from the program flash memory. This area supports a maximum erase count of 10,000 times. It can also be used as a substitute for external EEPROM.

32+4KB Version		64+4KB Version	
00000	SFR	00000	SFR
00400	RAM1KB	00400	RAM2KB
007FF	Internal reserved area	00BFF	Internal reserved area
0F000	Flash Memory 2KB	0F000	Flash Memory 2KB
0F800	Flash Memory 2KB	0F800	Flash Memory 2KB
10000	Internal reserved area	10000	Internal reserved area
F8000	Flash Memory 16KB	F0000	Flash Memory 32KB
FFFFF	Flash Memory 8KB	FFFFF	Flash Memory 16KB
			Flash Memory 8KB

Small Flash Memory Block for Data Storage

**2 KB × 2 Data Flash**

Standard Rewrite Count: 10,000 Times\*

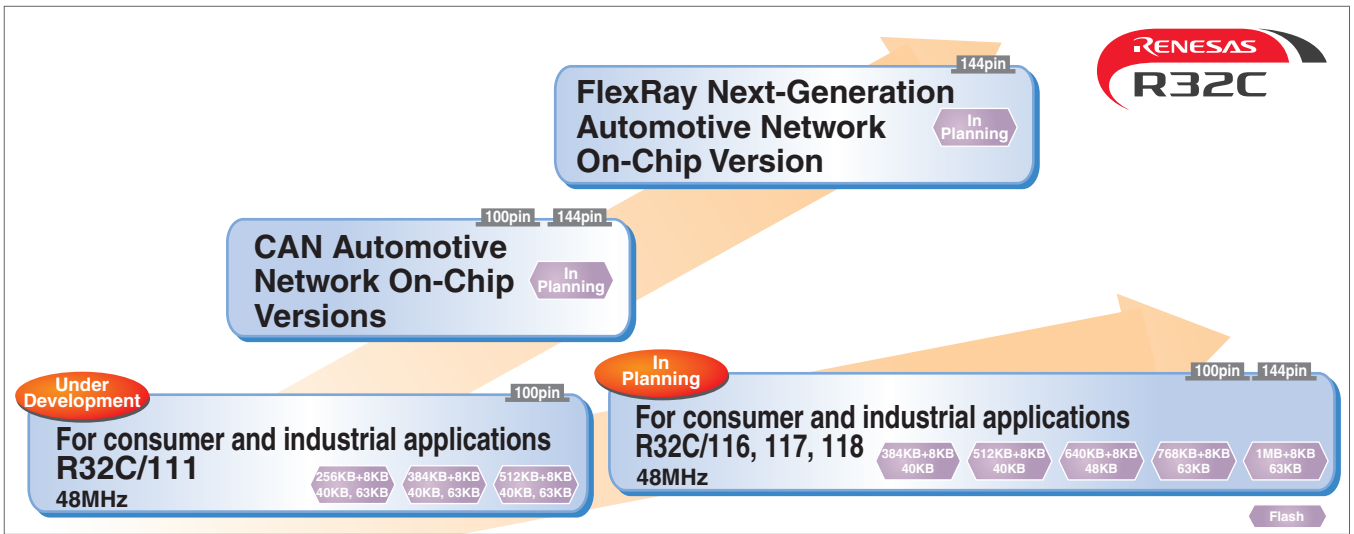
\*Please see the hardware manual for details of individual products.



# Product Lineup

M32C/100 Series

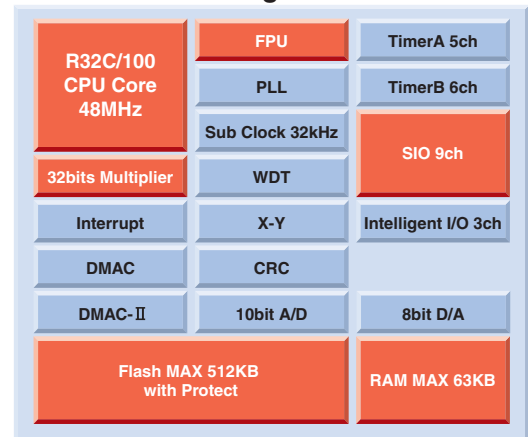
## R32C/100 Series Roadmap



## R32C/111 Group Features

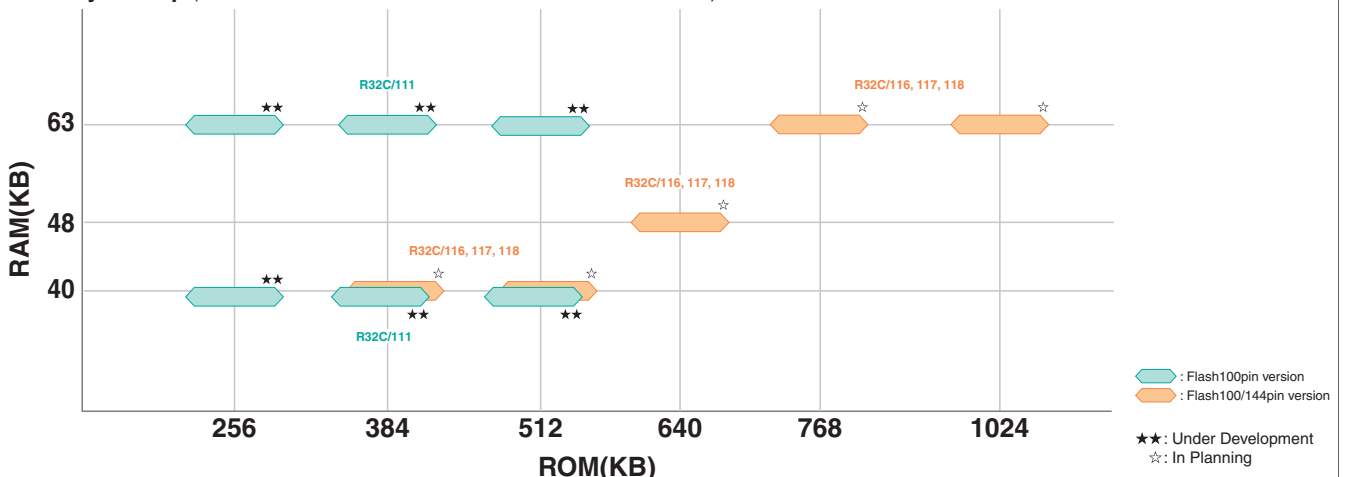
- 32-bit CICS MCUs inheriting the M16C/M32C features and employing R32C/100 Series CPU core.
- 32-bit barrel shifter, 32-bit multiplier, and high-precision FPU on-chip
- Performs 32-bitx32-bit multiply-accumulate operations in one clock cycle.
- Register bit length extended from M32C/80 and number of registers increased.
- 64-bit internal memory bus
- Short jumps with no penalty
- Enhanced Communication Function (SIO x 9 channels)

### R32C/111 Block Diagram



## Memory Lineup

Memory Lineup (Flash versions include an additional 8KB of data flash.)

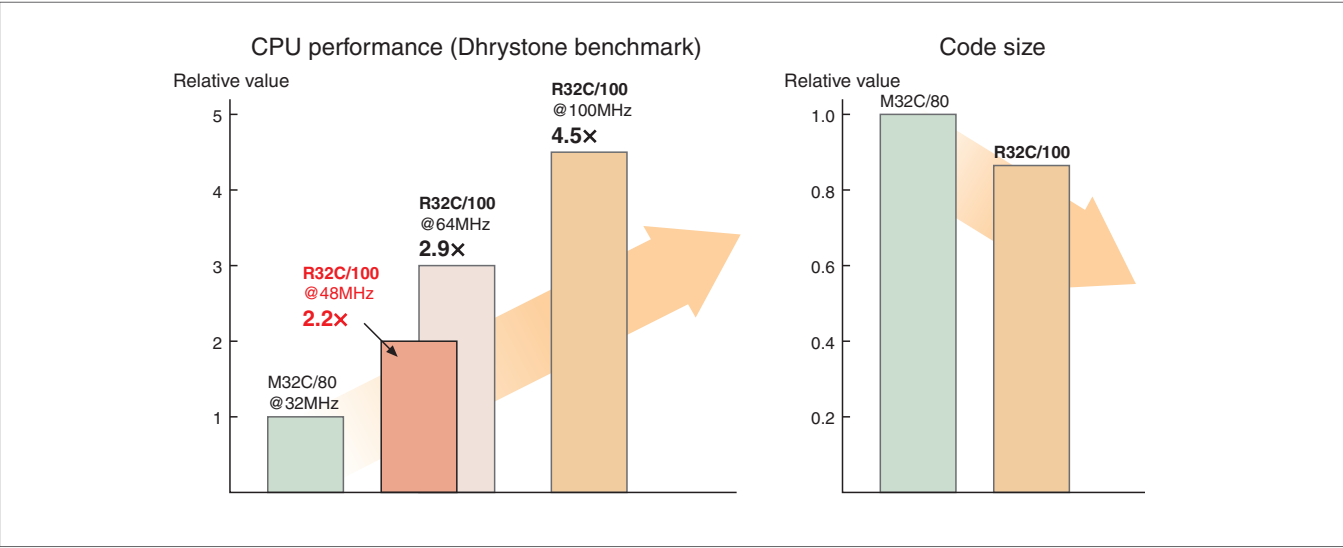




# Product Lineup

M32C/100 Series

## R32C/100 Series Performance (On-Chip ROM/RAM)



## R32C/100 CPU Core Performance Overview

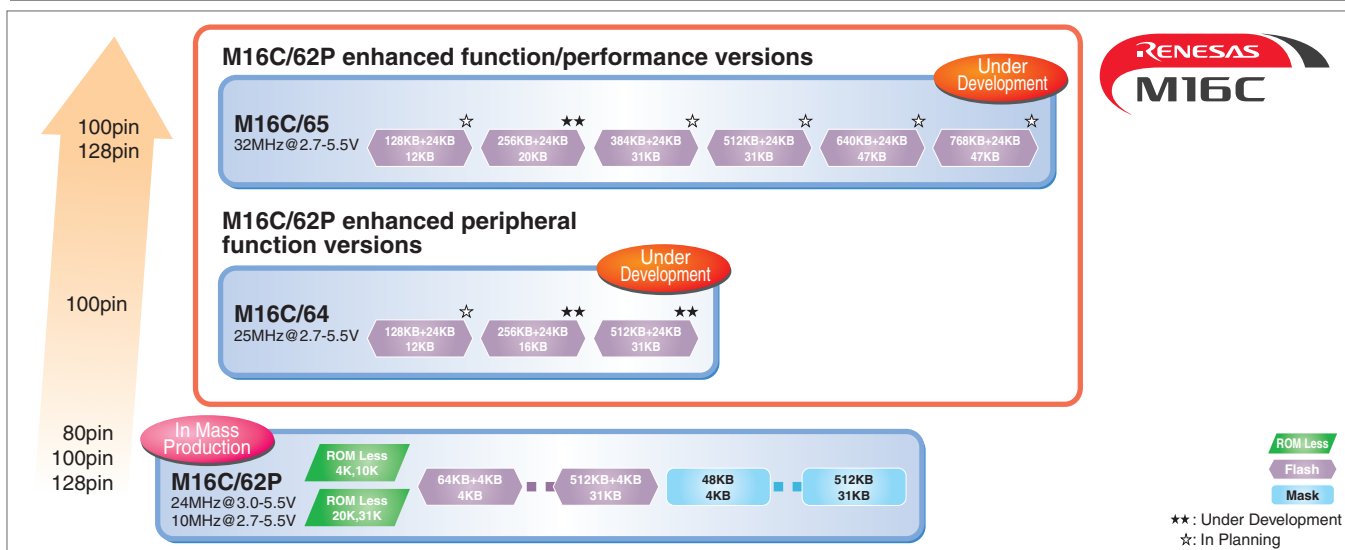
Item	M32C/80	R32C/100
Basic instructions	108 instructions	108 instructions
Hardware multiplier	$16 \times 16 = 32$	$32 \times 32 = 64$
Multiply and accumulate	$16 \times 16 + 48 = 48$	$32 \times 32 + 64 = 64$
FPU	No	Yes (IEEE 754 single-precision)
Barrel shifter	16-bit	32-bit
Address match interrupt	8 points settable	No
DMA transfer unit	8-bit, 16-bit	8-bit, 16-bit, 32-bit
DMA transfer space	Fixed address from 16Mbyte user-specified space (16Mbyte space) 16Mbyte user-specified space from fixed address (16Mbyte space)	User-specified 64MB space from 64MB (00000000h–01FFFFFFh) and (FE000000h–FFFFFFFh) user-specified space
DMA transfer address direction	Forward direction, fixed (not possible to set both transfer source and destination to forward direction or to fixed)	Forward direction, fixed (possible to set both transfer source and destination to forward direction or to fixed)
DMAC II transfer space	64 Kbytes	User-specified 64MB space from 64MB (00000000h–01FFFFFFh) and (FE000000h–FFFFFFFh) user-specified space



# Product Lineup

M16C/64, 65 Series

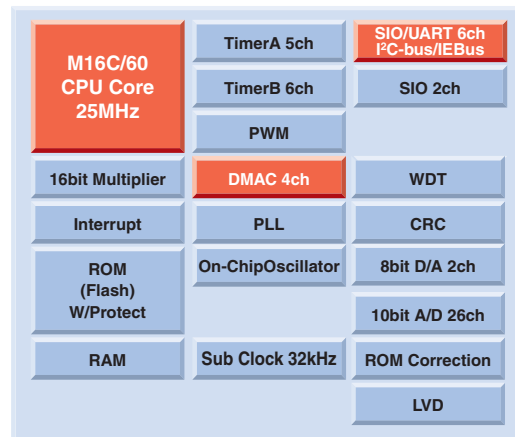
## M16C/64, 65 Series Roadmap



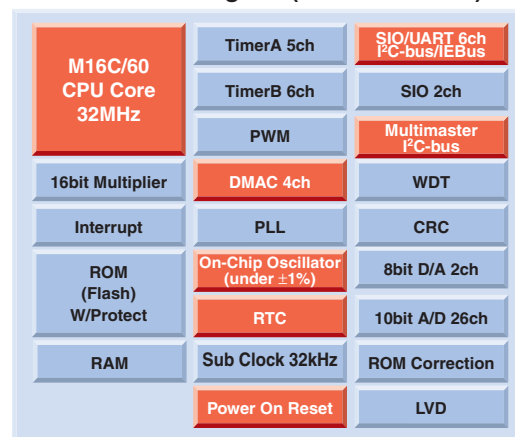
## M16C/64, 65 Series Features

- Continuation of features from M16C/62P
  - Maintains compatibility with M16C and M32C (pin compatibility, compatibility with peripheral functions).
  - Retains features such as low EMI noise and low current consumption.
- Improved performance
  - Faster operation :24MHz (M16C/62P) → 25MHz (M16C/64) → 32MHz (M16C/65)
  - Lower voltage (2.7 V to 5.5 V)
- Contributions to reduced system cost
  - On-chip **power-on reset** function (M16C/65) → Enables elimination of external reset IC/circuit.
  - High-speed (32MHz)/high-precision (±1.0%: target) on-chip oscillator (M16C/65)** → Enables elimination of external oscillator.
- Other main performance and function enhancements
  - Improved DMA (2 channels (M16C/62P) → **4 channels** (M16C/64, M16C/65))
  - Improved serial communication (5 channels (M16C/62P) → **8 channels @ 100 pins** (M16C/64, M16C/65))
  - Faster A/D conversion (2.75 μs @ 12MHz (M16C/62P) → **1.72 μs @ 25MHz** (M16C/64, M16C/65))
  - On-chip realtime clock (1-week timer (M16C/65))

M16C/64 Block Diagram



M16C/65 Block Diagram (100-Pin Version)



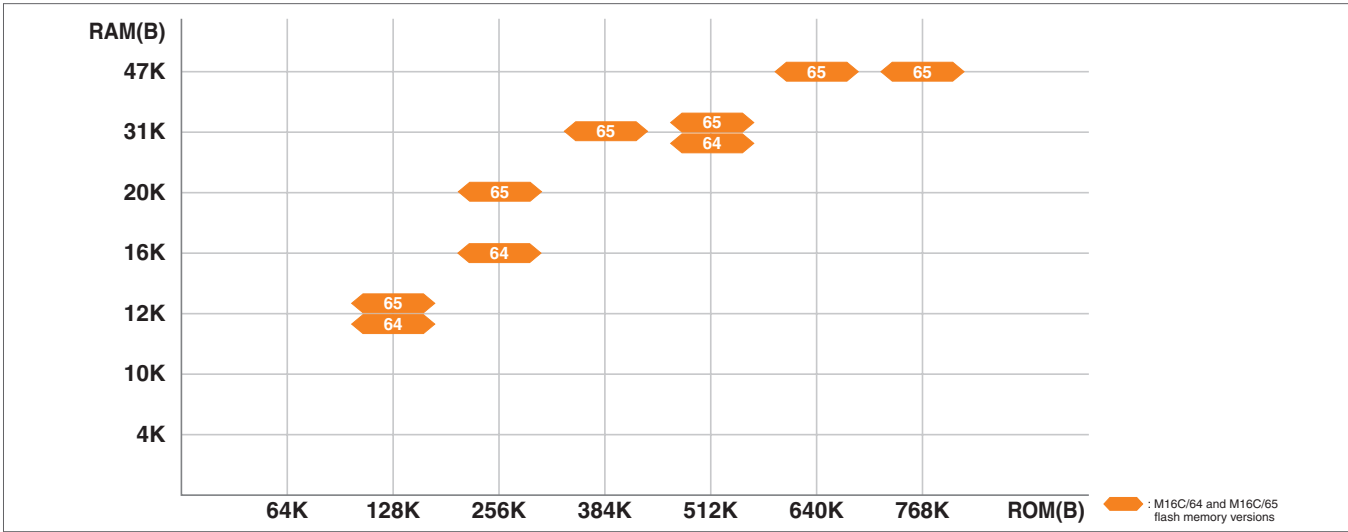


# Product Lineup

M16C/64 Series

## M16C/62P, M16C/64, and M16C/65 Flash Memory Lineup

In planning stage



## M16C/64 and M16C/65 New Functions

Item	M16C/62P	M16C/64	M16C/65	
Max. CPU speed	24MHz (VCC = 3.0 to 5.5V)	<b>25MHz</b> (VCC = 2.7 to 5.5V)	<b>32MHz</b> (VCC = 2.7 to 5.5V)	↑ Faster
I <sup>2</sup> C Bus	Simple I <sup>2</sup> C Bus	Simple I <sup>2</sup> C Bus	<b>Multimaster I<sup>2</sup>C Bus</b>	↑ New function
Realtime clock	No	No	<b>Yes</b>	↑ New function
8-bit PWM	No	No	<b>2 channels</b>	↑ New function
UART	3 channels	<b>6 channels</b>		↑ More channels
DMA	2 channels (24 sources)	<b>4 channels (43 sources)</b>		↑ More channels
External interrupts	6 interrupts	<b>8 interrupts</b>		↑ More interrupts
Port 8_5	Input only	<b>I/O (N channel open drain output)</b>		↑ More output support ports
Timer clock source	f64 not settable	<b>f64 settable</b>		↑ New function
Flash memory erase suspend	No	No	<b>Yes</b>	↑ New function
Flash memory user boot area	No	No	<b>Yes</b>	↑ New function

## M16C/62P, M16C/64, and M16C/65 Specification Comparison

Item	M16C/62P (100-pin version)	M16C/64 (100-pin version)	M16C/65 (100-pin version)
Basic instructions	91 instructions	←	←
Min. instruction time	41.6ns (24MHz, 0 wait states, VCC = 3.0 to 5.5V) 100ns (10MHz, 0 wait states, VCC = 2.7 to 5.5V)	40ns (25MHz, 0 wait states, VCC = 2.7 to 5.5V)	31.2ns (32MHz, 0 wait states, VCC = 2.7 to 5.5V)
Memory	ROM-less: 48KB, 64KB, 96KB, 128KB, 192KB, 256KB, 320KB, 384KB, 512KB RAM: 4KB, 5KB, 10KB, 12KB, 16KB, 20KB, 24KB, 31KB	128KB, 256KB, 512KB 12KB, 16KB, 31KB	128KB, 256KB, 384KB, 512KB, 640KB, 768KB 12KB, 20KB, 31KB, 47KB
I/O ports	P0 to P10: 8-bit × 10, 7-bit × 1	8-bit × 11 (N channel O.D. × 3 (P70, P71, P85))	←
Input ports	P85: 1-bit × 1	←	←
Timers	11 (timer A × 5, timer B × 6)	←	←
PWM	←	←	8-bit × 2 channels
RTC	←	←	1 channel (1 week)
Serial interface	Synchronous/asynchronous × 3 channels (I <sup>2</sup> C Bus and I <sup>2</sup> C Bus support × 3 channels), synchronous × 2 channels	Synchronous/asynchronous × 6 channels (I <sup>2</sup> C Bus and I <sup>2</sup> C Bus support × 6 channels), synchronous × 2 channels	←
Multimaster I <sup>2</sup> C Bus	←	←	1 channel
A/D converter	10-bit × max. 26 channels, ±3 LSB (at 10-bit, 5V), ±2 LSB (at 8-bit) Resolution: 8-bit or 10-bit Conversion speed (10-bit): 2.75 μs at 5V/±AD 12MHz (single, repeat, single sweep, repeat sweep 0, 1)	10-bit × max. 26 channels, ±3 LSB (at 3V and 5V) Resolution: 10-bit Conversion speed (10-bit): 1.72 μs at 5V/±AD 25MHz (single, repeat, single sweep, repeat sweep 0, 1)	←
D/A converter	8-bit × 2	←	←
DMAC	2 channels	4 channels	←
CRC	Yes	←	With SFR access monitor function
Watchdog timer	15-bit × 1 channel (with prescaler)	15-bit × 1 channel (with prescaler)	←
External interrupts	NMI, INTO, INT1, INT2, INT3, INT4, INT5, key input (8 sources)	NMI, INTO, INT1, INT2, INT3, INT4, INT5, INT6, INT7, key input (10 sources)	←
Address match circuits	4	←	←
Remote control reception circuit	←	←	Yes
CEC circuit	←	←	Yes
Clock generator circuit	4 circuits: PLL on-chip oscillator (1MHz), XIN, XCIN (built-in feedback resistor, external ceramic resonator or crystal oscillator)	4 circuits: PLL low-speed (125kHz) on-chip oscillator, XIN, XCIN (built-in feedback resistor, external ceramic resonator or crystal oscillator)	5 circuits: PLL high-speed, high-precision (32MHz at ±1.0%) on-chip oscillator, low-speed (125kHz) on-chip oscillator, XIN, XCIN (built-in feedback resistor, external ceramic resonator or crystal oscillator)
Voltage drop detection circuit	Yes (selectable between 2 values/optional)	Yes (selectable between 2 values)	Yes (selectable among 3 values)
Power-on reset	←	←	Yes
Power supply voltage	3.0 to 5.5V (24MHz), 2.7 to 5.5V (10MHz)	2.7 to 5.5V (25MHz)	2.7 to 5.5V (32MHz)
Package	80-pin (0.65mm pin pitch), 100-pin (0.5/0.65mm pin pitch), 128-pin (0.5mm pin pitch)	100-pin (0.5/0.65mm pin pitch)	80-pin (0.65mm pin pitch), 100-pin (0.5/0.65mm pin pitch), 128-pin (0.5mm pin pitch)
Operating modes	Single-chip, memory expansion, microprocessor	←	←
Tools	For M16C/62P	E100, E8a	←

Legend: Yellow = Difference between M16C/62P and M16C/64; Blue = Difference between M16C/64 and M16C/65; CEC: Consumer Electronics Control (Device control signals and control protocol standardized by HDMI. HDMI: High-Definition Multimedia Interface)

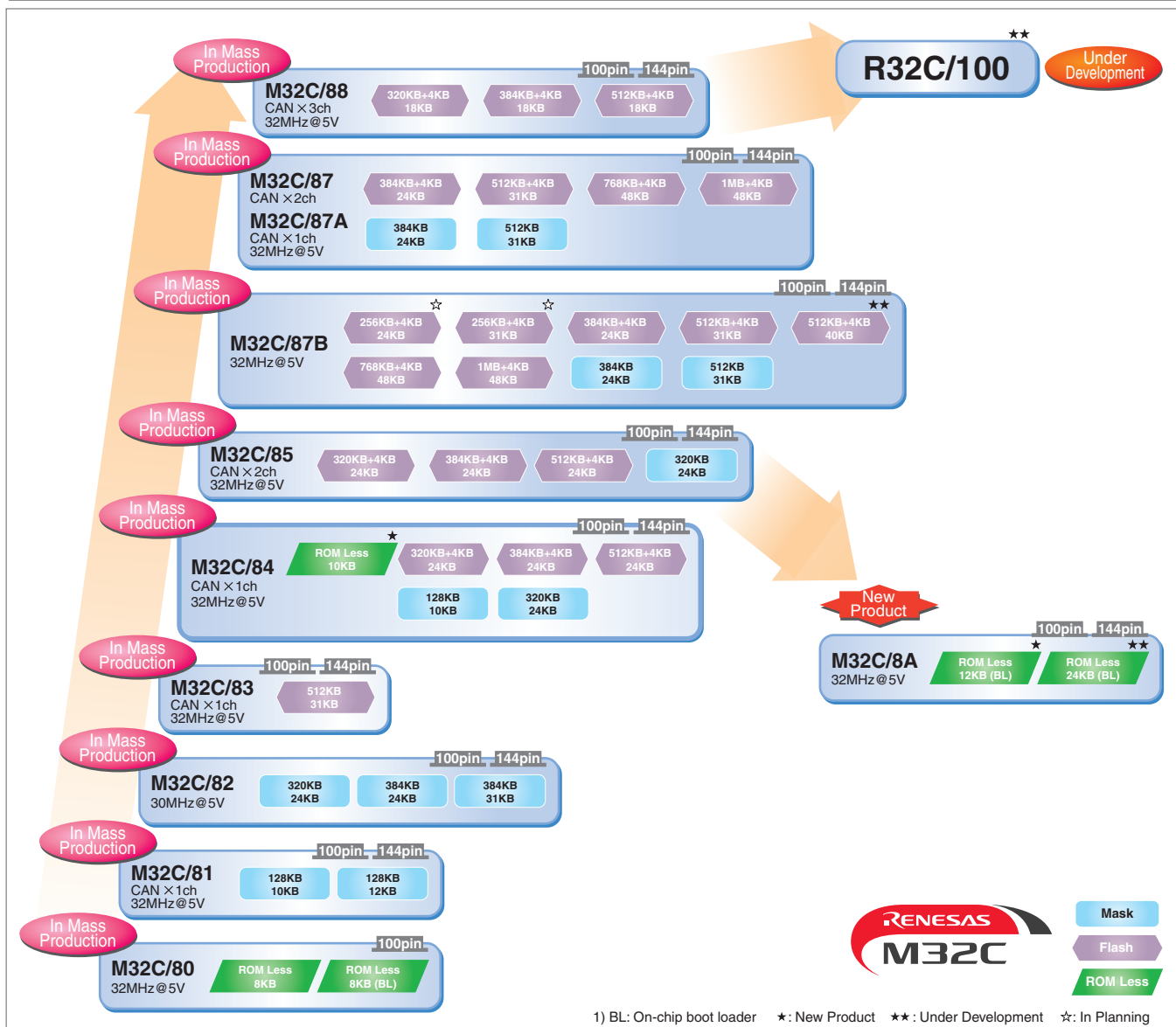




# Product Lineup

M32C/80 Series

## M32C/80 Series Roadmap



## M32C/80 Series Features

- Downward compatible with M16C/80, allowing easy switchover if faster operation is required (32MHz@5V).
- Four basic arithmetic operation and transfer instructions are 32-bit, and 32-bit multiply, divide, and fast shift (using on-chip barrel shifter) instructions provide high-speed operation processing.
- In addition to dedicated timer and SIO functions using intelligent I/O, additional PWM and SIO functions can be implemented. On-chip CAN (max. 2 channels: M32C/85, M32C/87, max. 3 channels: M32C/88) provides support for a range of applications.
- On-chip input-capture timer and output-compare timer, with support for sensor input, are ideal for applications such as motor control.

### M32C/87 Block Diagram

<b>M32C/80 CPU Core 32MHz</b>	PLL	TimerA 5ch
	On-Chip Osc	TimerB 6ch
	Sub Clock 32kHz	Three-phase Motor Cont.
	Multiplier	WDT
	Interrupt	CRC
	DMA-II/DTC	10bit A/D MAX 34ch
	RAM Max 48KB	8bit D/A 2ch
	ROM Max 1MB Flash/Mask W/Protect	DMAC
		Intelligent I/O IC:8ch OC:16ch
		SIO/JART 7ch
	IrDA 1ch	
	LVD	
	CAN 0-2ch	

IC:Input Capture OC:Output Compare



# Product Lineup

M32C/80 Series

## M32C/80 Series Memory Lineup

Memory Lineup (Flash versions include an additional 4KB of data flash.)





# Product Lineup

M16C/Tiny Series

## M16C/Tiny Series Roadmap



**In Mass Production**

**M16C/29**  
20MHz@3.0 to 5.5V  
10MHz@2.7 to 5.5V

64pin 80pin

96KB+4KB 8KB    128KB+4KB 12KB

64KB 4KB    96KB 8KB    128KB 12KB

**In Mass Production**

**M16C/28B**  
24MHz@4.2 to 5.5V \*1  
20MHz@3.0 to 5.5V  
10MHz@2.7 to 5.5V

64pin 80pin

128KB+4KB 12KB

**In Mass Production**

**M16C/28**  
20MHz@3.0 to 5.5V  
10MHz@2.7 to 5.5V

64pin 80pin 85pin \*2

48KB+4KB 4KB    64KB+4KB 4KB    96KB+4KB 8KB    128KB+4KB 12KB

64KB 4KB    96KB 8KB    128KB 12KB

**In Mass Production**

**M16C/26B**  
24MHz@4.2 to 5.5V \*1  
20MHz@3.0 to 5.5V  
10MHz@2.7 to 5.5V

42pin 48pin

64KB+4KB 2KB

**In Mass Production**

**M16C/26A**  
20MHz@3.0 to 5.5V  
10MHz@2.7 to 5.5V

42pin 48pin

24KB+4KB 1KB    48KB+4KB 2KB    64KB+4KB 2KB

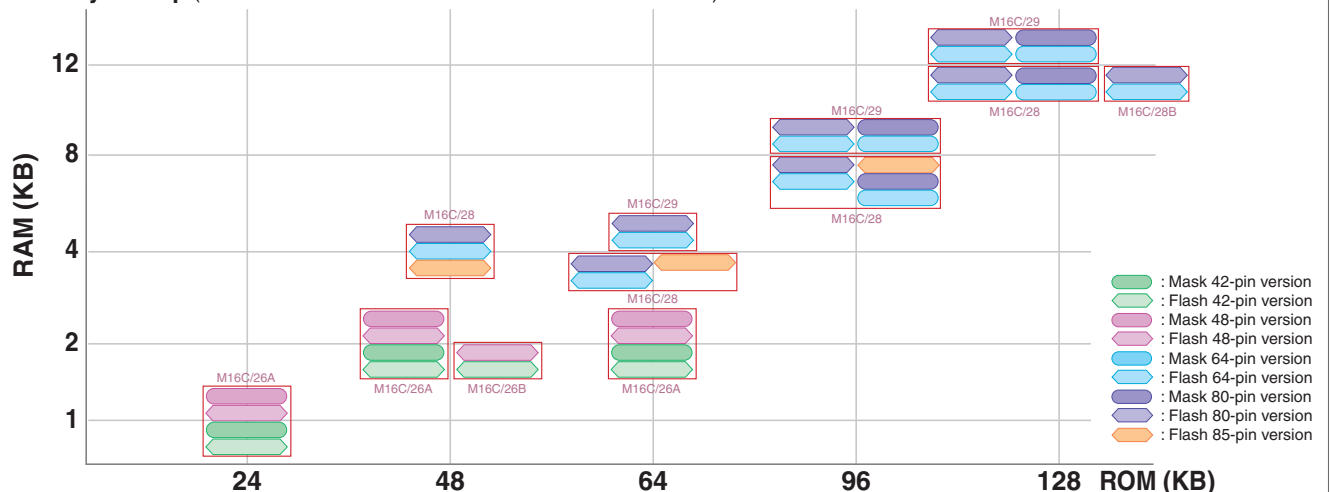
24KB 1KB    48KB 2KB    64KB 2KB

\*1 PLL used for 24MHz operation.  
\*2 85-pin package available for M16C/28 flash version only. (except for 128KB version)

Mask    Flash

## Memory Lineup

Memory Lineup (Flash versions include an additional 4KB of data flash.)





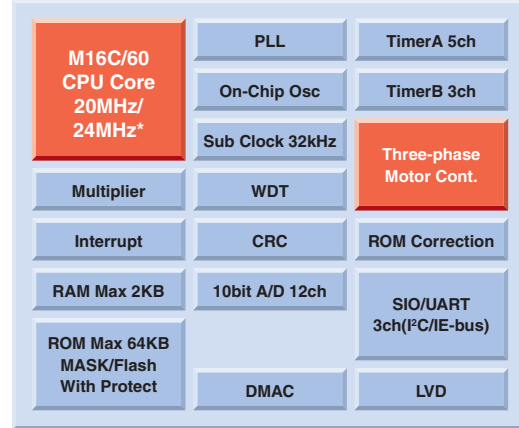
# Product Lineup

M16C/Tiny Series

## M16C/26A Group Features

- Small foot print (7mm square, 48pins) and high-speed operation (20MHz@5V).
- Instructions and peripheral functions are compatible with M16C/62P for easy program portability.
- 3-phase motor control timer, enabling motor control in compact products.
- Data flash area can be used in place of external EEPROM.
- Higher frequency version (24MHz@5V) also available (M16C/26B).

### M16C/26A Block Diagram

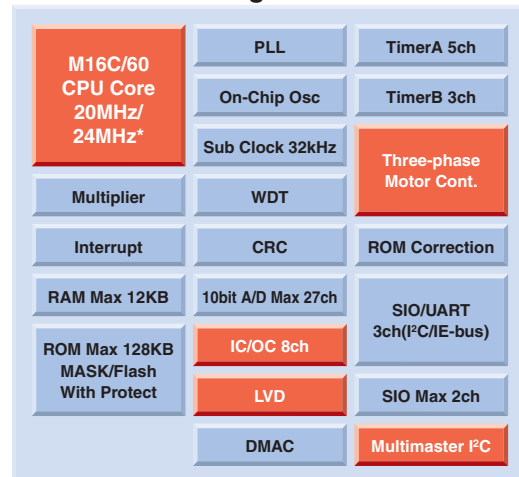


\* M16C/26B uses PLL for 24MHz operation.

## M16C/28 Group Features

- Small foot print and high-speed operation (20MHz@5V)
- Instructions and peripheral functions are compatible with M16C/62P for easy program portability.
- 3-phase motor control timer, enabling motor control in compact products.
- Support for max. 2 I<sup>2</sup>C-bus channels using multimaster I<sup>2</sup>C-bus
- Data flash area can be used in place of external EEPROM.
- Higher frequency version (24MHz@5V) also available (M16C/28B).
- Small package (7mmx7mm: 85pins) available for flash versions only (except for 128KB products of M16C/28 and M16C/28B).

### M16C/28 Block Diagram

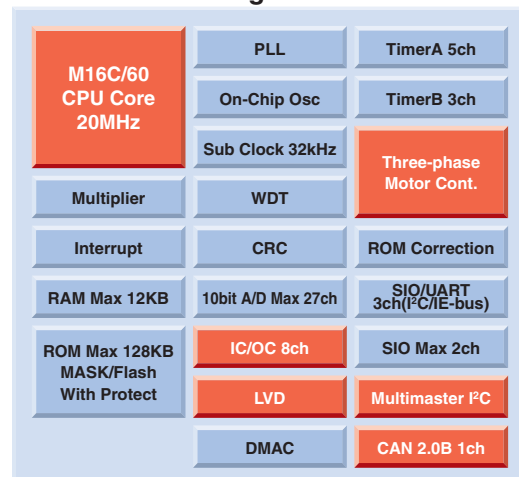


IC:Input Capture OC:Output Compare \* M16C/28B uses PLL for 24MHz operation.

## M16C/29 Group Features

- Adds CAN 2.0B to M16C/28. Compatible with M16C/28.
- Small mounting area and high-speed operation (20MHz@5V)
- Instructions and peripheral functions are compatible with M16C/62P for easy program portability.
- Retains 3-phase motor control timer, enabling motor control in compact products.
- Input-capture and output-compare functions for more flexible signal control
- Support for max. 2 I<sup>2</sup>C-bus channels using multimaster I<sup>2</sup>C-bus
- Data flash area can be used in place of external EEPROM.

### M16C/29 Block Diagram

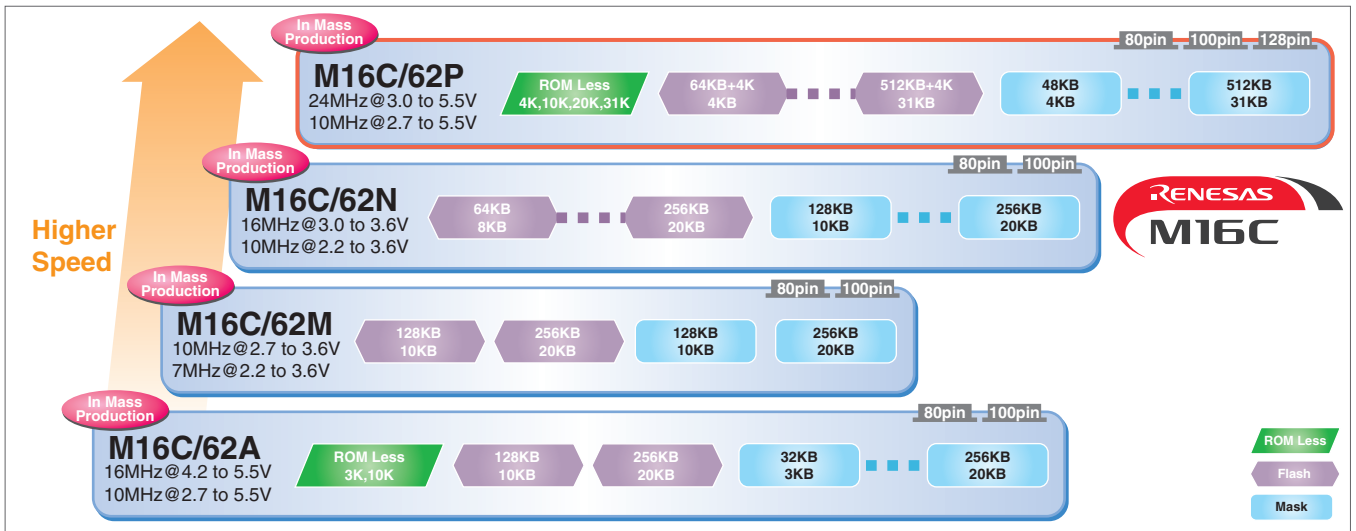




# Product Lineup

M16C/62

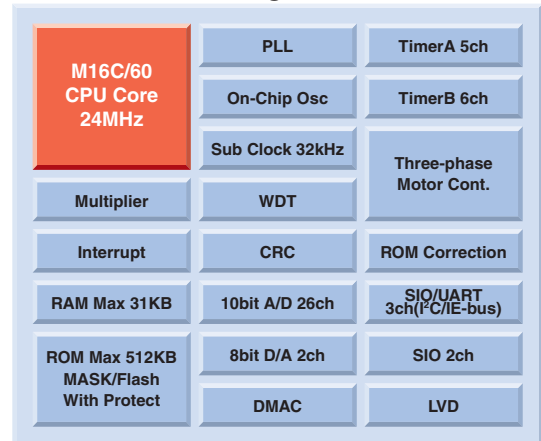
## M16C/62 Roadmap



## M16C/62P Group Features

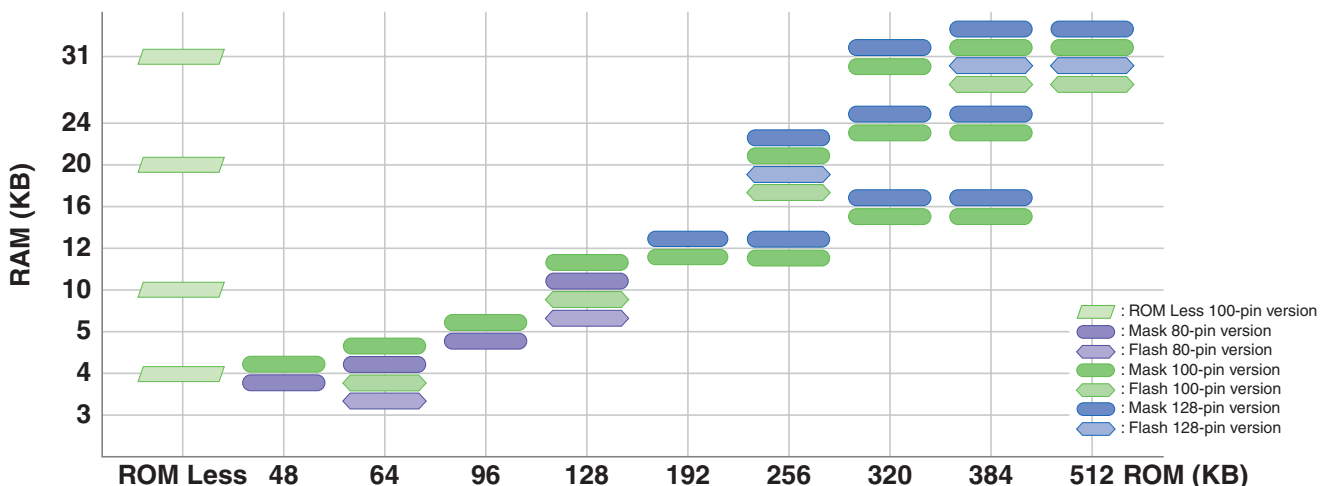
- Wide range of memory options (ROM/RAM: ROM Less/4KB to 512KB/31KB)
- Supports 3V and 5V peripheral power supplies, allowing direct connection to 3V memory and 5V devices.
- SIO (3 channels) supports a subset of the IEBus and I<sup>2</sup>C-bus standards, allowing connection of a large number of devices.
- Insertion of from 0 to 3 wait states can be selected, allowing connection of slower devices.
- Enhanced watchdog timer, oscillation stop detection circuit, and new reset circuit on-chip

### M16C/62P Block Diagram



## Memory Lineup

Memory Lineup (Flash versions include an additional 4KB of data flash.)





# Product Lineup

M16C/6N

## M16C/6N Roadmap



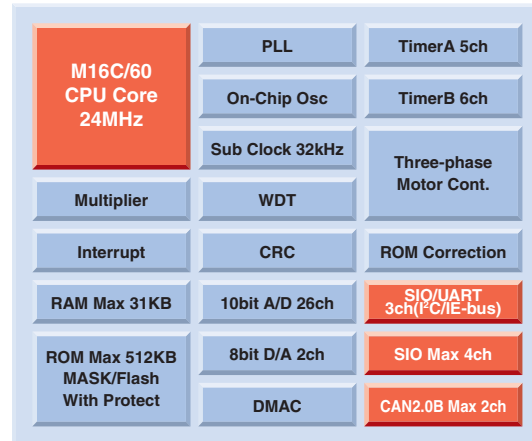
Enhanced Communication



## M16C/6NK Group Features

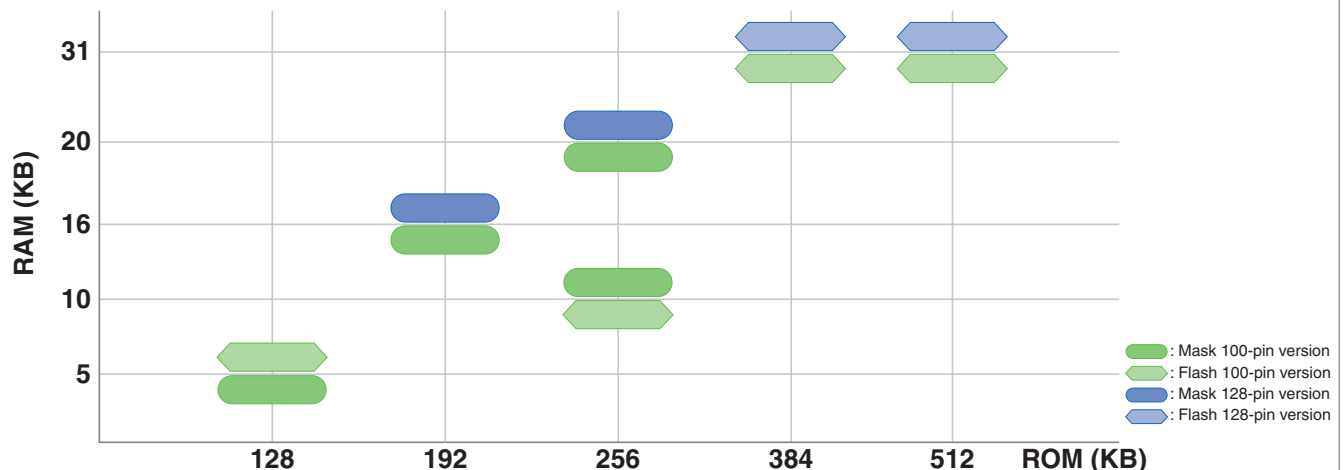
- Retains the features of the M16C/62P (CPU core, low power consumption, EMI characteristics, peripheral functions) and adds CAN (2.0B) support.  
 M16C/6NK, M16C/6NM: CAN 2.0B 2 channels,  
 M16C/6NL, M16C/6NN: CAN 2.0B 1 channel
- Additional communication functions (CAN, serial interface):  
 5 channels (M16C/6NK, M16C/6NL)/  
 7 channels (M16C/6NM, M16C/6NN)
- Improved failsafe functions such as enhanced watchdog timer and oscillation stop detection circuit, additional external interrupts (9 channels: M16C/6NM, M16C/6NN)

### M16C/6NK Block Diagram



## Memory Lineup

Memory Lineup (Flash versions include an additional 4KB of data flash.)





# Product Lineup

M16C/30P Group

## M16C/30P Group Roadmap



Optimized Memory Size and Peripheral Functions

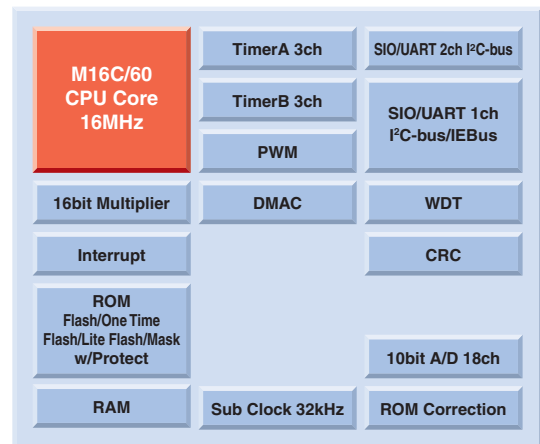


One time flash: Product with on-chip flash memory that can be programmed only once (and cannot be erased).

## M16C/30P Group Features

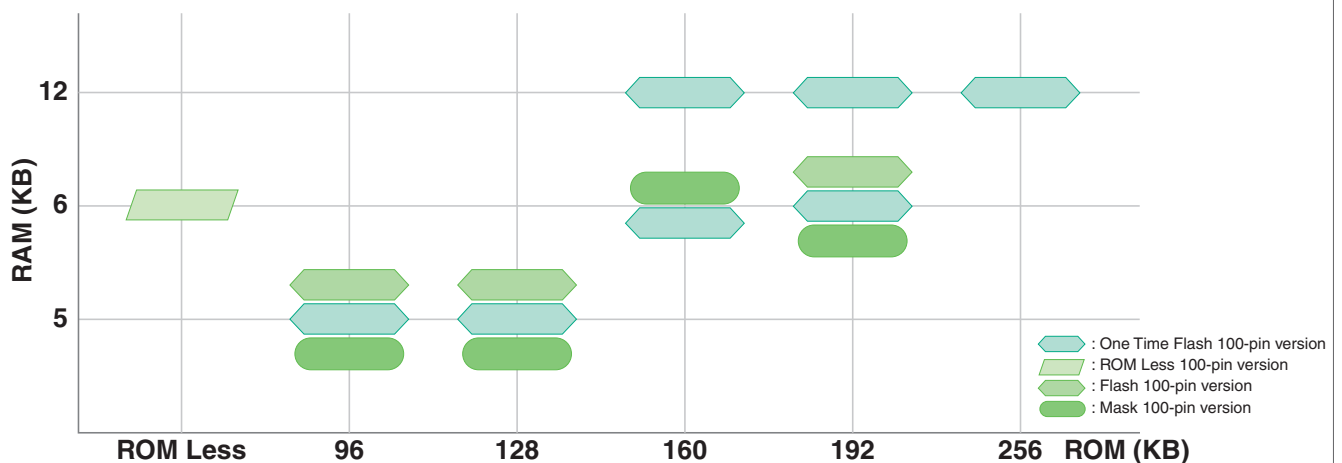
- Compatible with M16C/62P while achieving lower cost through reduced functions and ROM/RAM capacity.
- Operating frequency of 16MHz (3V to 5V)
- Reduced peripheral functions (timer: 6 channels, SIO: 3 channels, A/D; 18 channels), limited to most commonly used functions.
- Package: 100-pin package only.
- Support for single-chip, memory expansion, and microprocessor modes
- Wide variety of on-chip memory options: Mask ROM, flash, one time flash and ROM Less versions available.
- Compatible with development support tools for the M16C/62P.

### M16C/30P Block Diagram



## Memory Lineup

Memory Lineup (Flash versions include an additional 4KB of data flash.)

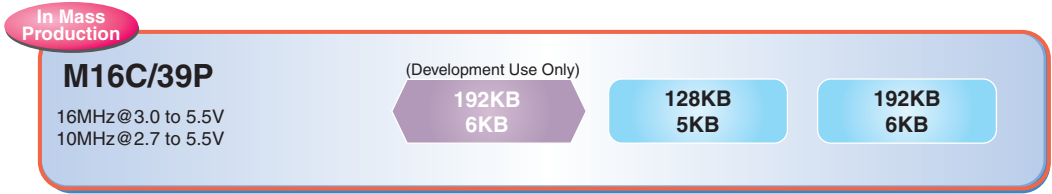




# Product Lineup

M16C/39P Group

## M16C/39P Group Roadmap

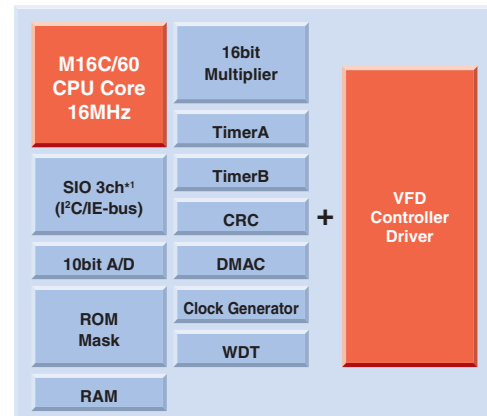


ROM Less  
Flash  
Mask

## M16C/39P Group Features

- SiP combining M16C/30P general MCU and VFD controller/driver
  - Retains features of the M16C/62P while slimming down ROM/RAM and peripheral functions.
  - 34 user-configurable high-voltage ports (setting support for 2 to 16 digits)
  - Dimmer function, variable frame cycle
- SiP: Solution Integrated Product™

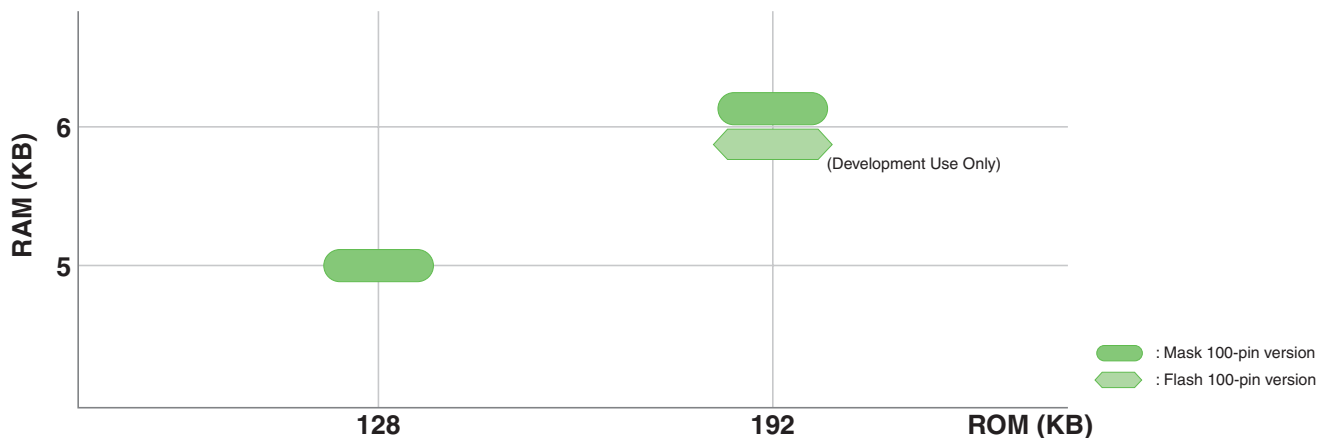
### M16C/39P Block Diagram



\*1. One of the three SIO channels is used for VFD control. Therefore, two SIO channels are available to the user.

## Memory Lineup

### Memory Line up



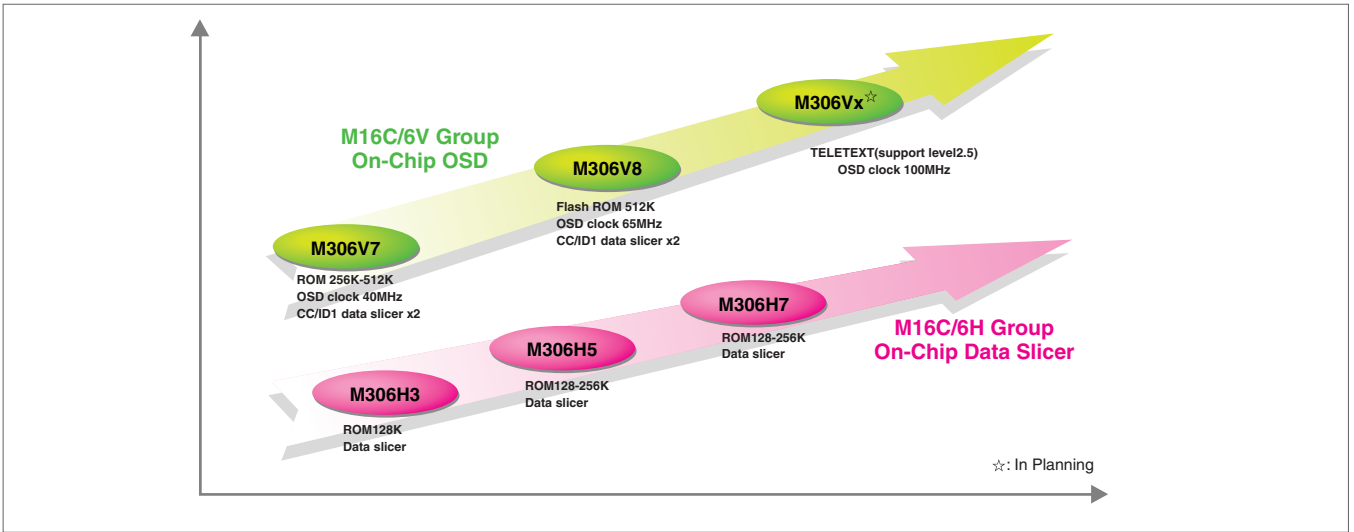




# Product Lineup

ASSP

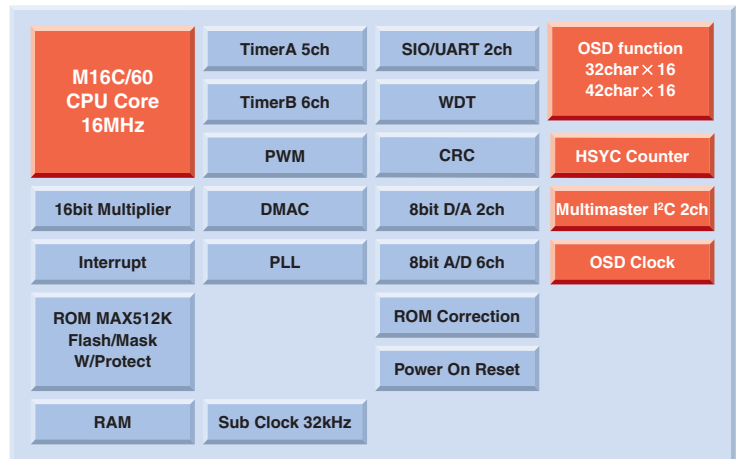
## M16C/6V, M16C/6H Roadmap



## M16C/6V Group Features

- On-chip OSD or data slicer for control of closed caption function or TV with ID1 function
- Memory options from 256KB to 512KB
- OSD supports display of 636 to 890 characters: 32 characters x 16 lines or 40 characters x 16 lines.
- Retains the features of the M16C/62P (low power consumption, EMI/EMS characteristics, peripheral functions).

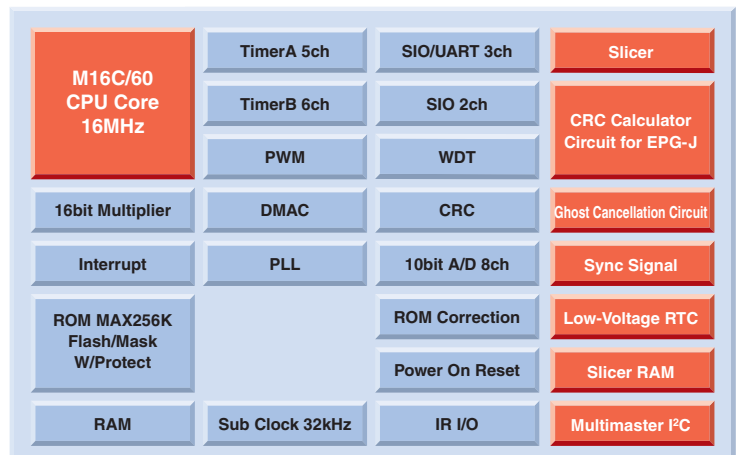
### M16C/6V7 Block Diagram



## M16C/6H Group Features

- MCU with on-chip multi-slicer with worldwide compatibility and designed for DVD/HDD recorders.
- Support for TELETEXT, PDC, VPS, EPG-J, XDS, WSS, VideoID, etc.
- Retains the features of the M16C/62P (low power consumption, EMI/EMS characteristics, peripheral functions).

### M16C/6H7 Block Diagram





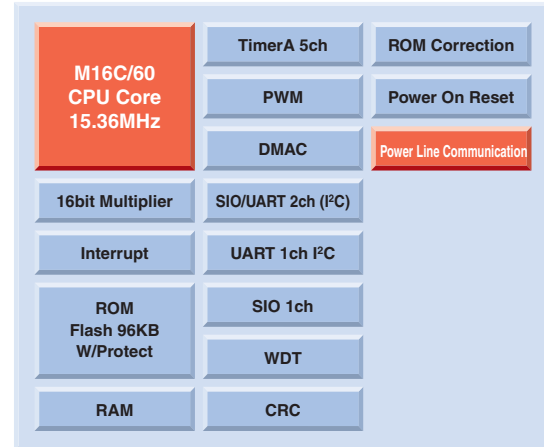
# Product Lineup

ASSP

## M16C/6S Group Features

- MCU with on-chip power line modem developed by Yitran (IT800) for power line communication
- Uses frequency band from 100kHz to 400kHz for power line communication, enabling a data transfer rate of 7.5kbps.
- Retains the features of the M16C/62P (low power consumption, EMI/EMS characteristics, peripheral functions).

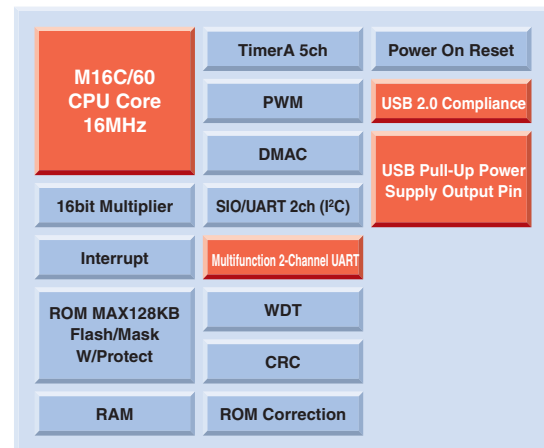
### M16C/6S Block Diagram



## M16C/24 Group Features

- On-chip USB controller with full-speed support
- USB pull-up power supply circuit, USB clock generator circuit, many USB control functions
- Audio interface function implemented through addition of multi-bit serial I/O, memory card interface enhanced by strengthened CRC calculation function.
- Retains the features of the M16C/62P (low power consumption, EMI/EMS characteristics, peripheral functions).

### M16C/24 Block Diagram

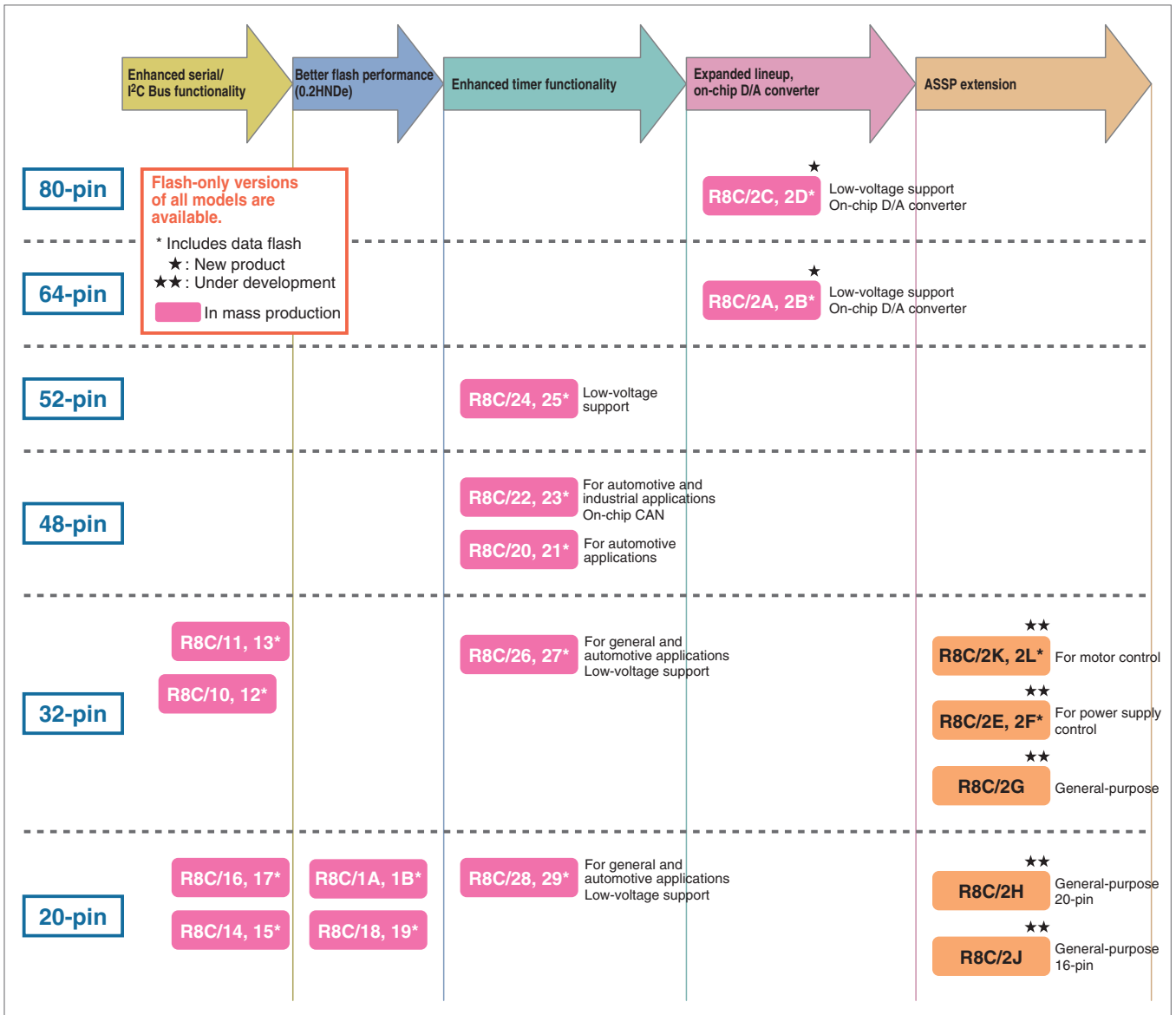




# Product Lineup

R8C/Tiny Series

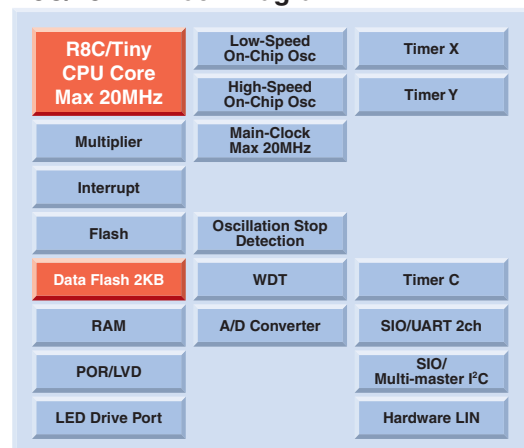
## R8C/Tiny Series Roadmap



## R8C/18-1B Group Features

- High-precision, high-speed on-chip oscillator (8MHz)
- On-chip multimaster I<sup>2</sup>C-bus
- On-chip clock-synchronous serial I/O with chip select
- Data flash area can be used in place of external EEPROM.  
R8C/19 Group, R8C/1B Group
- On-chip switchable sink or source-type large-current drive ports.
- On-chip power-on reset function and voltage detection function eliminate need for separate reset IC.
- 20pin Packages

### R8C/18-1B Block Diagram





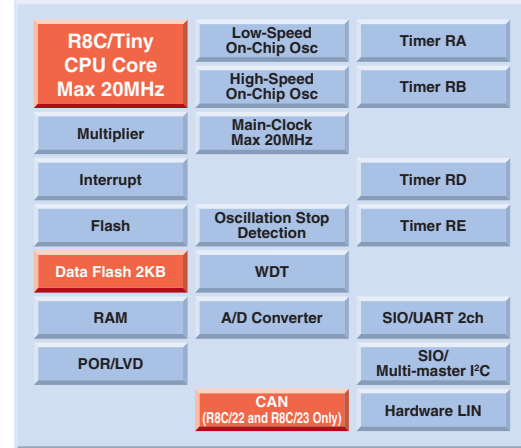
# Product Lineup

R8C/Tiny Series

## R8C/20-23 Group Features

- R8C/Tiny Series for automotive applications
- CAN 2.0B added. Upward compatible with R8C/22 Group, R8C/23 Group, R8C/20 Group, and R8C/21 Group.
- Support for high-temperature operation
  - D version : -40 to 85°C
  - J version : -40 to 85°C
  - K version : -40 to 125°C
- Support for high-speed operation
  - D version : VCC = 2.7 to 3.0V (f(XIN) = 10MHz)
  - D version : VCC = 3.0 to 5.5V (f(XIN) = 20MHz)
  - J version : VCC = 2.7 to 3.0V (f(XIN) = 10MHz)
  - J version : VCC = 3.0 to 5.5V (f(XIN) = 20MHz)
  - K version : VCC = 2.7 to 3.0V (f(XIN) = 10MHz)
  - K version : VCC = 3.0 to 5.5V (f(XIN) = 16MHz)
- High-precision, high-speed on-chip oscillator (40MHz)
- Data flash area can be used in place of external EEPROM. (R8C/21 Group, R8C/23 Group)
- On-chip power-on reset function and voltage detection function eliminate need for separate reset IC.
- 48pin Packages

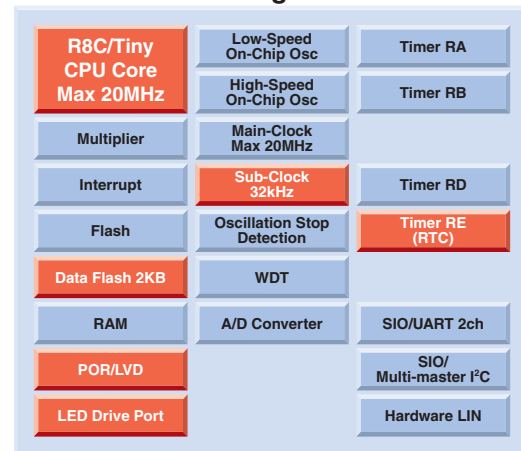
### R8C/20-23 Block Diagram



## R8C/24-25 Group Features

- Support for low-voltage operation
  - VCC = 2.2 to 5.5V (f(XIN) = 5MHz)
  - VCC = 2.7 to 5.5V (f(XIN) = 10MHz)
  - VCC = 3.0 to 5.5V (f(XIN) = 20MHz)
- High-precision, high-speed on-chip oscillator (40MHz)
- On-chip subclock oscillator circuit (32.768kHz)
- On-chip timer RD for motor control
- On-chip multimaster I<sup>2</sup>C-bus
- On-chip clock-synchronous serial I/O with chip select
- Data flash area can be used in place of external EEPROM. (R8C/25 Group)
- On-chip power-on reset function and voltage detection function eliminate need for separate reset IC.
- On-chip switchable sink- or source-type large-current drive ports.
- 52pin Packages

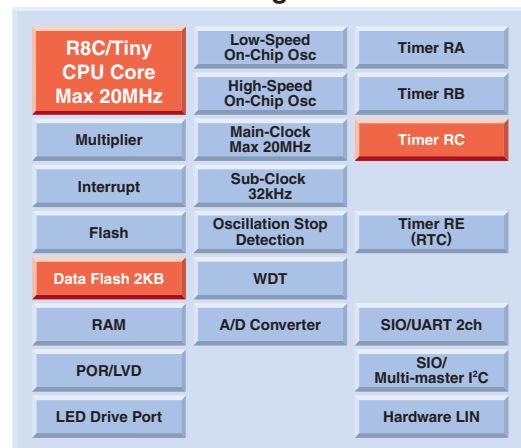
### R8C/24-25 Block Diagram



## R8C/26-29 Group Features

- Support for low-voltage operation
  - VCC = 2.2 to 5.5V (f(XIN) = 5MHz) (N and D versions)
  - VCC = 2.7 to 5.5V (f(XIN) = 10MHz)
  - VCC = 3.0 to 5.5V (f(XIN) = 16MHz) (K version)
  - VCC = 3.0 to 5.5V (f(XIN) = 20MHz) (other than K version)
- High-precision, high-speed on-chip oscillator (40MHz)
- On-chip subclock oscillator circuit (32.768kHz) (N and D versions)
- On-chip multimaster I<sup>2</sup>C-bus
- On-chip clock-synchronous serial I/O with chip select
- Data flash area can be used in place of external EEPROM. (R8C/27 Group, R8C/29 Group)
- On-chip power-on reset function and voltage detection function eliminate need for separate reset IC.
- On-chip switchable sink- or source-type large-current drive ports. (N and D versions)
- 32pin Packages (R8C/26, R8C/27 Group)
- 20pin Packages (R8C/28, R8C/29 Group)

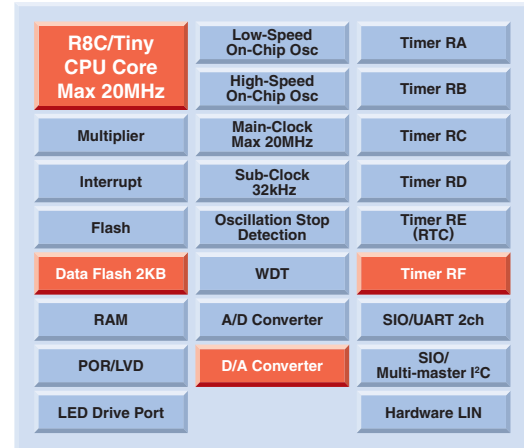
### R8C/26-29 Block Diagram



## R8C/2A-2D Group Features

- Support for low-voltage operation  
 VCC = 2.2 to 5.0V (f(XIN) = 5MHz)  
 VCC = 2.7 to 5.5V (f(XIN) = 10MHz)  
 VCC = 3.0 to 5.5V (f(XIN) = 20MHz)
- High-precision, high-speed on-chip oscillator (40MHz)
- On-chip subclock oscillator circuit (32.768kHz)
- On-chip D/A converter
- Additional 16-bit timer channel (timer RF)
- Support for motor control by on-chip timer RD
- On-chip multimaster I<sup>2</sup>C-bus
- On-chip clock-synchronous serial I/O with chip select
- Data flash area can be used in place of external EEPROM. (R8C/2B Group, R8C/2D Group)
- On-chip power-on reset function and voltage detection function eliminate need for separate reset IC.
- On-chip switchable sink- or source-type large-current drive ports.
- 64pin Packages (R8C/2A, R8C/2B Group)
- 80pin Packages (R8C/2C, R8C/2D Group)

R8C/2A-2D Block Diagram

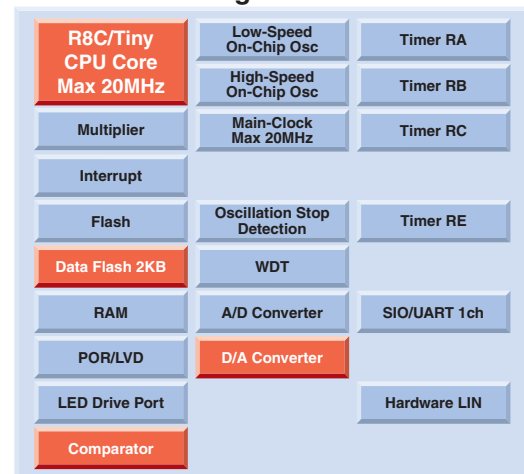


## R8C/2E and R8C/2F Group Features

Under Development

- High-precision, high-speed on-chip oscillator (40MHz)
- On-chip D/A converter
- On-chip comparator enabling comparison with external power supply
- Data flash area that can be used as substitute for external EEPROM (R8C/2F Group)
- No need for separate reset chip thanks to power-on reset function and voltage detection function
- On-chip switchable sink- or source-type large-current drive ports.
- Compatible with low-cost on-chip debugging emulator
- 32-pin package

R8C/2F Block Diagram

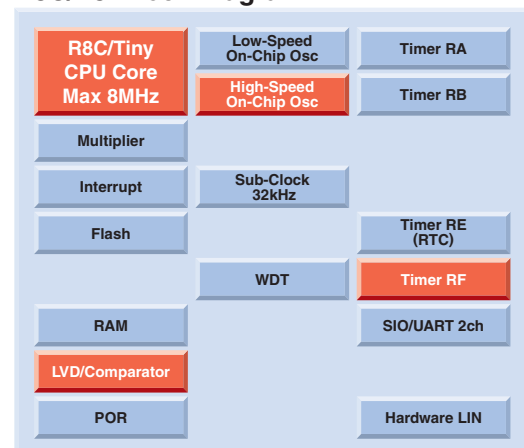


## R8C/2G Group Features

Under Development

- Low-voltage operation possible  
 VCC = 2.2 to 5.5V (f(XIN) = 4MHz)  
 VCC = 2.7 to 5.5V (f(XIN) = 8MHz)
- High-precision, high-speed on-chip oscillator (8MHz)
- On-chip subclock generator circuit (32.768kHz)
- 1-channel 16-bit timer (timer RF)
- On-chip voltage detection circuit (comparison with external power supply possible in comparator mode)
- Compatible with low-cost on-chip debugging emulator
- On-chip hardware LIN (using 1 timer channel)
- 32-pin package

R8C/2G Block Diagram





# Product Lineup

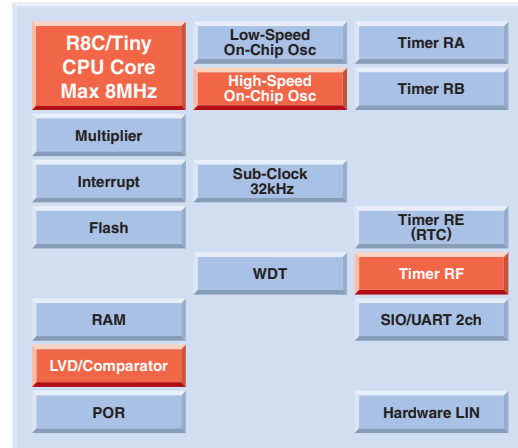
R8C/Tiny Series

## R8C/2H Group Features

Under Development

- Low-voltage operation possible  
VCC = 2.2 to 5.5V (f(XIN) = 4MHz)  
VCC = 2.7 to 5.5V (f(XIN) = 8MHz)
- High-precision, high-speed on-chip oscillator (8MHz)
- On-chip subclock generator circuit (32.768kHz)
- 1-channel 16-bit timer (timer RF)
- On-chip voltage detection circuit (comparison with external power supply possible in comparator mode)
- Compatible with low-cost on-chip debugging emulator
- On-chip hardware LIN (using 1 timer channel)
- 20-pin package

### R8C/2H Block Diagram

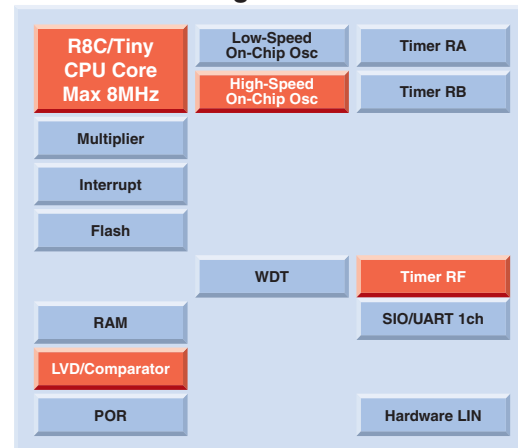


## R8C/2J Group Features

Under Development

- Low-voltage operation possible  
VCC = 2.2 to 5.5V (f(XIN) = 4MHz)  
VCC = 2.7 to 5.5V (f(XIN) = 8MHz)
- High-precision, high-speed on-chip oscillator (8MHz)
- 1-channel 16-bit timer (timer RF)
- On-chip voltage detection circuit (comparison with external power supply possible in comparator mode)
- Compatible with low-cost on-chip debugging emulator
- On-chip hardware LIN (using 1 timer channel)
- 20-pin package (only 16 pins enabled)

### R8C/2J Block Diagram

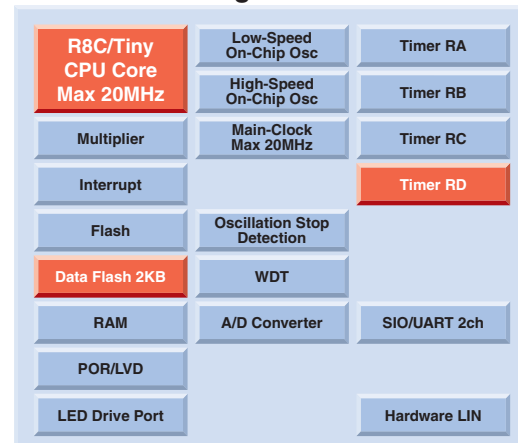


## R8C/2K and R8C/2L Group Features

Under Development

- Low-voltage operation possible  
VCC = 2.2 to 5.5V (f(XIN) = 5MHz)  
VCC = 2.7 to 5.5V (f(XIN) = 10MHz)  
VCC = 3.0 to 5.5V (f(XIN) = 20MHz)
- High-precision, high-speed on-chip oscillator (40MHz)
- Motor control possible using on-chip timer RD
- Data flash area that can be used as substitute for external EEPROM (R8C/2L Group)
- No need for separate reset chip thanks to power-on reset function and voltage detection function
- On-chip switchable sink- or source-type large-current drive ports.
- Compatible with low-cost on-chip debugging emulator
- 32-pin package

### R8C/2L Block Diagram

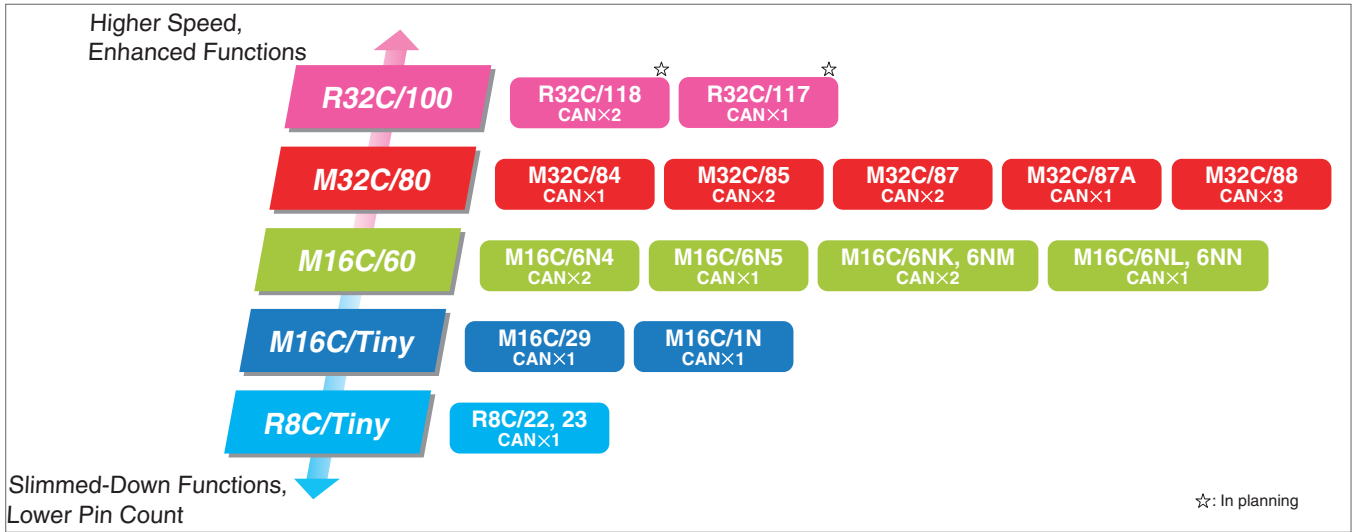




# Product Lineup

On-Chip CAN

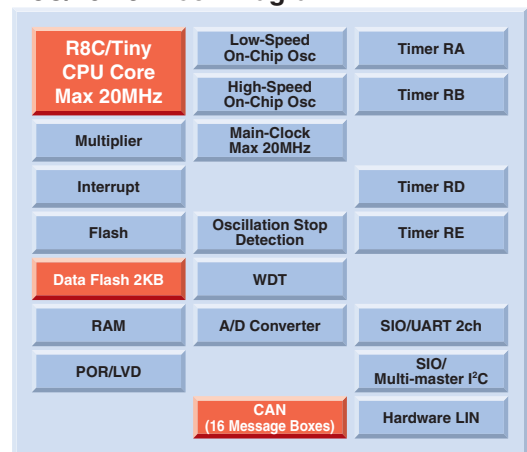
## On-Chip CAN Lineup



## R8C/22, 23 Group Features

- Power supply voltage: 3.0 to 5.5 V/Max. 20MHz, 2.7 to 5.5V/Max. 10MHz
- ROM/RAM capacity: 32KB/2KB, 48KB/2.5KB, 64KB/3KB, 96KB/5KB, 128KB/6KB
  - Data flash 1KB×2 blocks (R8C/23 only)
- Clock generator circuits: 2 on-chip circuits
  - XIN-XOUT main clock (on-chip oscillation stop detection circuit)
  - High-speed (40MHz)/low-speed on-chip oscillators
- Voltage detection circuits (LVD): 2 circuits
- Power-on reset (POR)
- Multifunction timers
  - 8-bit timer: 3 channels (timer RA, timer RB, timer RE)
  - 16-bit timer: 2 channels (timer RD)
- Serial I/O
  - Clock-synchronous/UART: 1 channel, UART: 1 channel
  - I<sup>2</sup>C-bus/SIO: 1 channel
  - H/W-LIN (uses UART and timer RA)
- CAN: 16 message boxes: 1 channel
- A/D converter: 10-bit×12 channels
- Ports
  - Pull-up resistor: Settable for all ports (excluding dedicated input ports)
- Watchdog timer: 1 channel (supports hardware resets)
- Package: 48-pin LQFP (7mm×7mm, 0.5mm pitch)

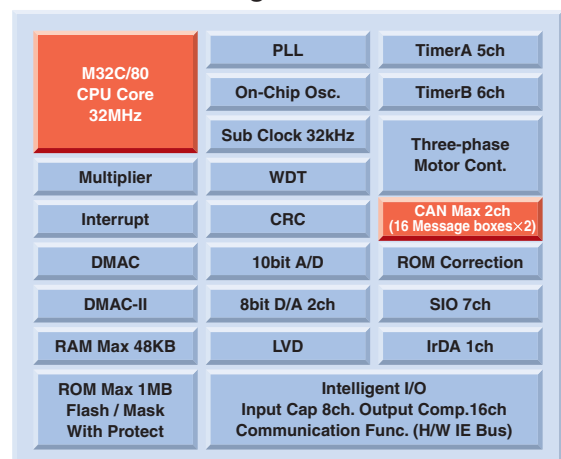
### R8C/20-23 Block Diagram



## M32C/87 Group Features

- High-speed operation and large-capacity on-chip memory
  - M32C/80 core, 32MHz@5V operation
  - On-chip 1MB flash and 48KB RAM is tops in the M16C Family.
- Abundant on-chip peripheral functions
  - Abundant on-chip peripheral functions such as CAN, serial, and IrDA
    - M32C/87: CAN 2 channels
    - M32C/87A: CAN 1 channel
  - On-chip intelligent I/O
    - Implementation of functions such as PWM output and SIO communication based on 16-bit timer.
- Support for easier to use functions
  - Supports 3V and 5V peripheral power function, allowing direct connection to 3V memory and 5V devices.
- Backward compatibility
  - Pin compatible and peripheral function compatible with products such as the M16C/62P, while retaining features including low noise, low power consumption, and high ROM efficiency.

### M32C/87 Block Diagram

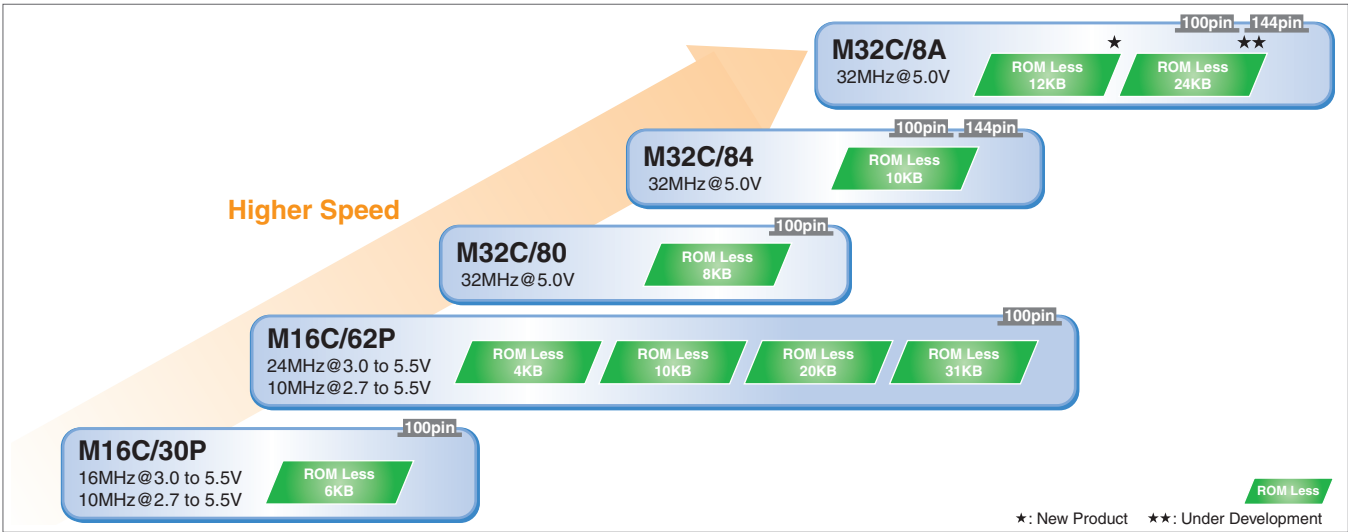




# Product Lineup

ROM Less Versions

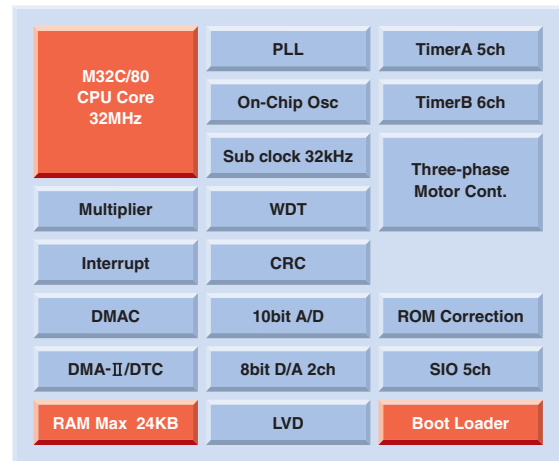
## M16C ROM Less Versions



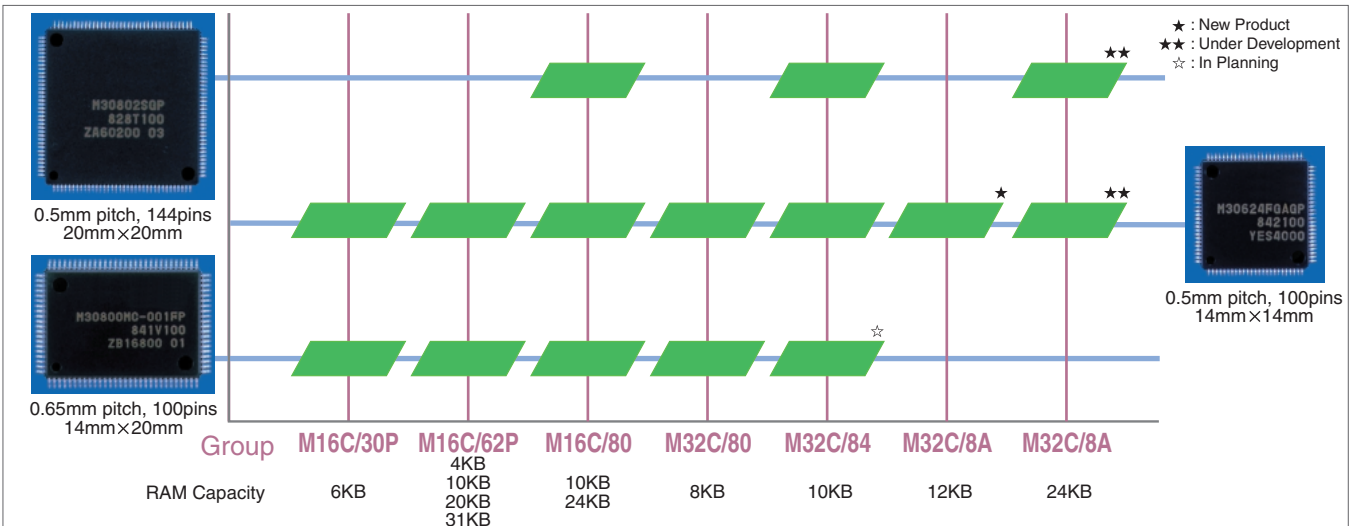
## M16C ROM Less Product Features

- External ROM products ranging from M16C core to M32C core
- Support for function (separate bus) facilitating connection of external memory if large memory capacity is required and function (multiplex bus) to reduce the number of pins used
- Products are available with enhanced bus interfaces supporting a variety of timing requirements.
- Support for simultaneous connection of two voltages, 3.3V for memory interface and 5V for peripheral functions
- Retains the features of the M16C Family (low power consumption, EMI/EMS characteristics, peripheral functions).
- In addition to a full emulator, a compact emulator is under development.

### M32C/80 Block Diagram



## Product Lineup







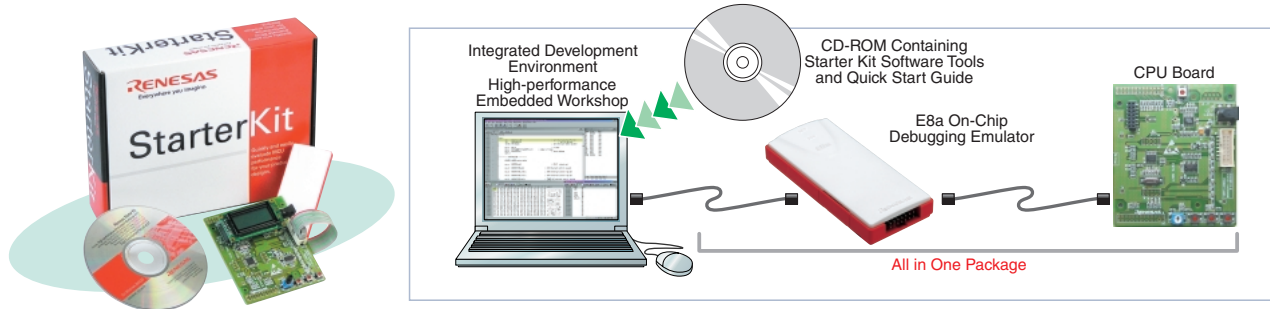
# Development Tools

Renesas provides customers with comprehensive product development support in partnership with leading third-party vendors.

## Renesas Starter Kit for Initial Development

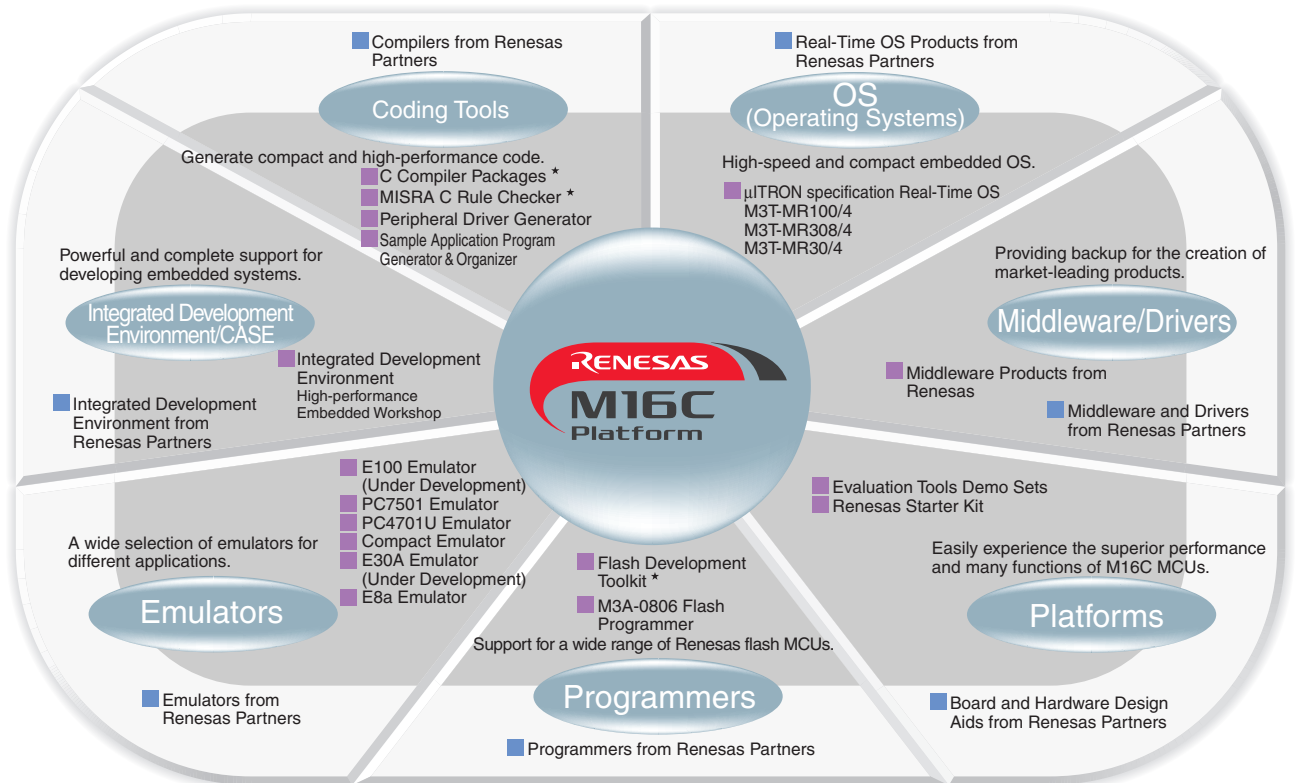
See page 50 for details.

These development tools make it easy to set up a development environment for evaluation.



## Development Environment for Maximizing the Performance of Renesas MCUs

We supply customers with development environment optimized for product development.



\*: Evaluation version available (free of charge).

## Internet-Based Update Utilities

Renesas helps you keep your development environment up to date with support via the Web.

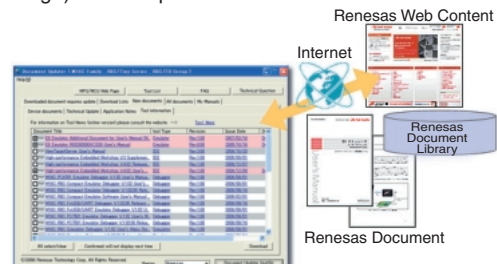
### Auto-Update Utility

This utility notifies you when free upgrades are available for software you have installed on your PC. Simply follow the instructions displayed by the auto-update wizard to upgrade your software to the latest version. (bundled with the products supported High-performance Embedded Workshop V4.0 or later)



### Document Updater

This utility notifies you when new or updated versions of documents related to the target MCU are available. It provides an easy way to review, download and update essential documentation. You can download from our web site (free of charge): URL: <http://www.renesas.com/du>

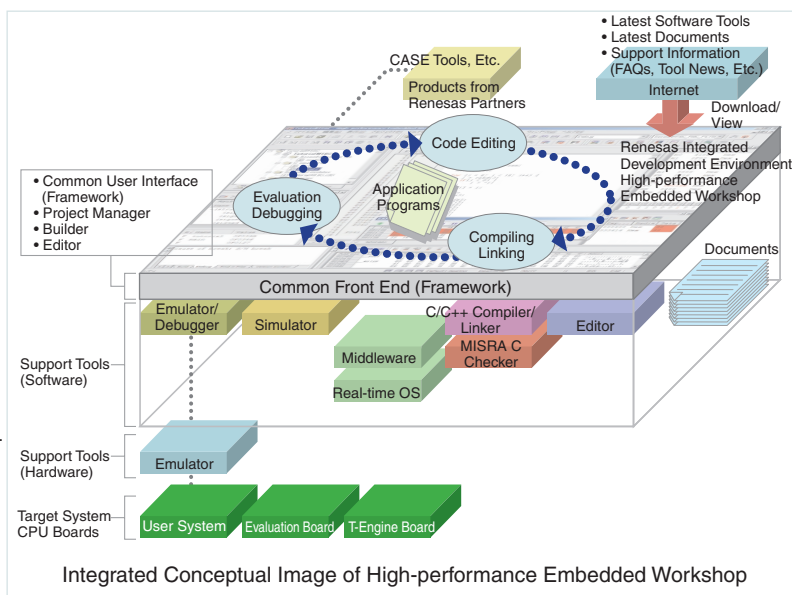


# Integrated Development Environment Providing Powerful and Complete Support for Developing Embedded Systems

Renesas integrated development environment brings together the tools needed for developing applications, including a compiler and debugger (emulator software). All steps from coding to evaluation and verification can be performed using a single application.

## High-performance Embedded Workshop Integrated Development Environment

- Integrated and centralized control over all tools, from the editor to the debugger
  - Flexible support for multiple build\*1 configurations (support for saving multiple optionally specified configurations, support for addition of external build tools, etc.)
  - Per-project management of source files
  - Easy-to-use GUI based on Microsoft Windows
  - Generation of C startup code customized for individual MCUs
  - Test support function (See page 46 for details.)
  - Always up to date tools and documents
    - Auto-update utility (See page 42 for details.)
    - Document updater (See page 42 for details.)
  - Flexible customization functions
    - Custom build phase
    - TargetServer (extended COM functions)
    - Extended TCL/TK functions and scripting
  - Works with products from Renesas partner companies
    - CASE\*2 tools to support upstream process design.
    - Version control tools.
- \*1 Build: The sequence of operations involved in generating object code, including compiling, assembling and linking.  
 \*2 CASE: Computer Aided Software Engineering



## C Compiler Package

### C Compiler

- Conforms to ANSI\*1 language standard.
- Optimization features and many #pragma extended functions for extracting top performance from the MCU
- Support for use of near/far designations with variables
- Function for calculating the stack size to be used
- Support for embedding of SQMint MISRA C\*2 rule checker

\*1 ANSI: American National Standards Institute  
 \*2 MISRA: Motor Industry Software Reliability Association.  
 "MISRA" is a registered trademark of MISRA Ltd. held on behalf of the MISRA Consortium.

### Simulator debugger

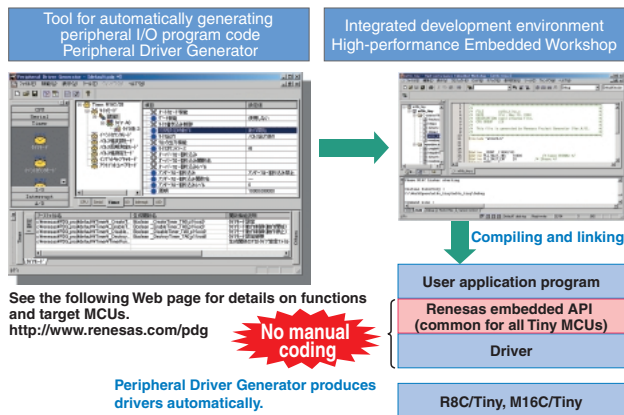
- Support for target-less evaluation
- C language and assembly language source-level debugging
- Support for source file editing
- Trace function
- RAM monitor function
- Virtual port I/O and virtual interrupts functions
- GUI implementation of target I/O functions

\* Each compiler package product includes a simulator debugger.

## Peripheral Driver Generator

This utility automatically generates I/O drivers for MCU on-chip peripheral functions and setting routines (functions) based on settings entered via a simple GUI.

- Shorter development times: Making settings is easy since there is no need to do manual coding of peripheral I/O functions.
- Improved reliability: Avoid mistakes or omissions in peripheral I/O register settings.
- Effective utilization of resources: Smooth portability among different Renesas MCU models.



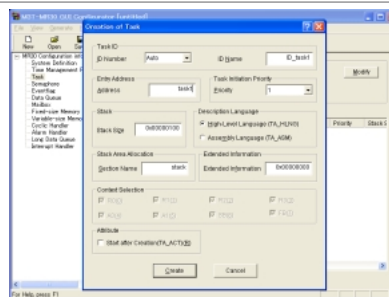
See the following Web page for details on functions and target MCUs.  
<http://www.renesas.com/pdg>

Peripheral Driver Generator produces drivers automatically.

## Real-time OS

Provides easy control of large-scale and complex applications in real time. Reduces program development time and improves reusability and maintainability.

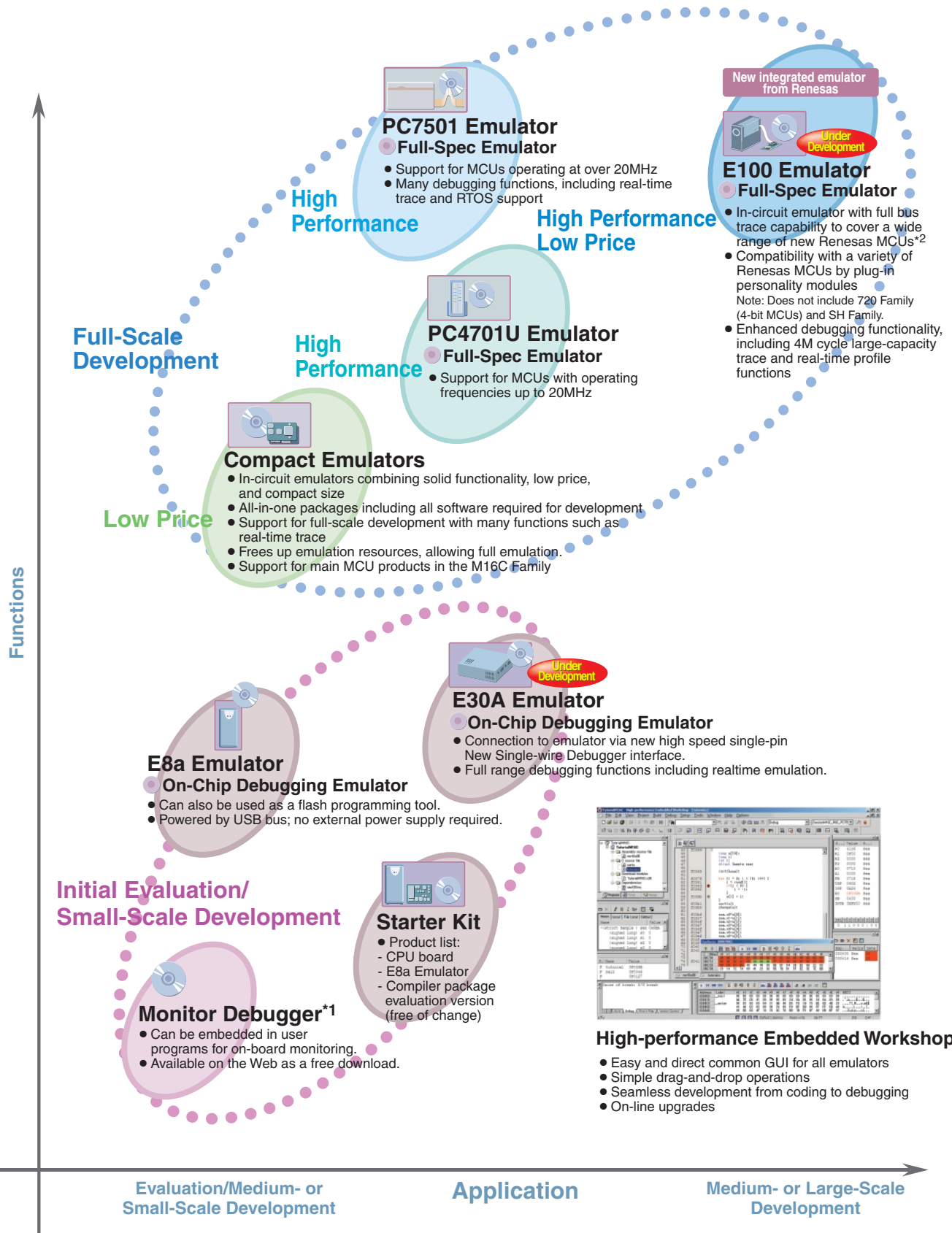
- Conforms to  $\mu$ TRON4.0 standard.
- Compact size suitable for ROM programming.
- Context selection function allows reduction of amount of RAM used.
- Excellent real-time functionality (interrupt response time, task switching time)
- Simple initial setup of application programs for use with real-time OS
- Configurator provided.
- Wide array of operating system debugging functions when integrated debugging in High-performance Embedded Workshop.



Example GUI Configuration Window

\* See the "Development Tools List" listing for the individual MCU for details on available C compiler packages and real-time OS packages as well as information on the operating environment.

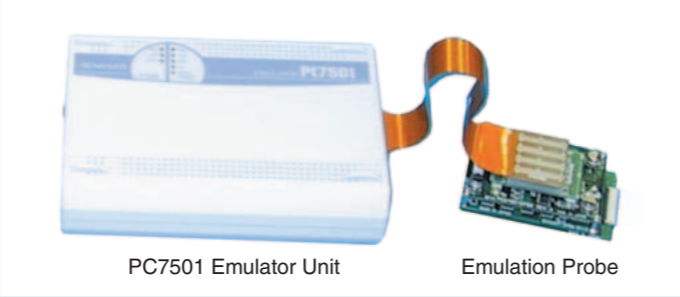
## Emulators (Packaged with High-performance Embedded Workshop Integrated Development Environment)



\*1 System in which a monitor program (control program for debugging) is written to the MCU and debugging is performed.  
 \*2 Support for new MCUs will be added.

The PC7501 is a full-featured emulator that supports M16C Family MCUs with operating frequencies exceeding 20MHz. Switchable evaluation probes provide support for different MCU models in the M16C Family.

- Full-bus-trace emulator for M16C Family MCUs operating at 66MHz
- Compact design with functions packed into the case size of a conventional system emulation pod
- Further extends the many debugging functions of the PC4701U.
- Flexible support for new MCU products by changing the firmware
- Support for USB, LPT parallel, and LAN communication interfaces
- The MCU is positioned on the probe block directly above the user target for enhanced signal integrity.
- AC adapter complying with safety standards supplied.
- Support for power supply voltages of 100 to 240V, 50/60Hz



- Product Contents**
- Emulator unit
  - Software CD-ROM (High-Performance Embedded Workshop integrated development environment)
  - Power, parallel, and USB cables
  - Emulation probe connector cable
  - User's manual

**Main Specifications**

Target MCUs	<ul style="list-style-type: none"> <li>• M32C/80 Series</li> <li>• M16C/60 Series</li> <li>• M16C/30 Series</li> <li>• M16C/Tiny Series</li> <li>• R8C/Tiny Series</li> </ul> See the following URL for details. <a href="http://www.renesas.com/pc7501">http://www.renesas.com/pc7501</a>	<ul style="list-style-type: none"> <li>• 256K cycles</li> <li>• Trace content: Address, data, MCU status, external trigger, timestamp</li> <li>• Trace modes: 5 (break, before, about, after, full)</li> <li>• Writing can be turned on or off for specific events.</li> </ul>	
Max. operating frequency	66.7MHz (depending on product)	Real-time RAM monitor	<ul style="list-style-type: none"> <li>• 4,096bytes (256bytes × 16 blocks)</li> <li>• Data, end address attributes (read, write, non-access)</li> </ul>
Target MCU modes	Single-chip mode, memory expansion mode, microprocessor mode	Execution time measurement	<ul style="list-style-type: none"> <li>• Execution time from program start to end</li> <li>• Maximum, minimum, and average execution time and traversal count for 4 specified segments</li> <li>• Count clock: MCU clock or 16MHz</li> </ul>
Emulation memory	4MB standard (depending on MCU specifications)	C0 coverage	8,192KB (256KB × 32 blocks)
Supported power supply voltage	2.2 to 5.5V (depending on product)	External trigger inputs/event outputs	External trigger inputs × 8 or event outputs (break × 1, event × 7)
Power supply to MCU	From DC power supply of PC7501	PC interface	LPT parallel, USB (USB 1.1, full-speed), LAN (10-BASE-T)
Software breaks	64 points	Operating environment	Windows® XP, Windows® 2000
Hardware breaks	8 points (execution address, bus detect, interrupt, external trigger signal)	Overseas standards	Compliant (FCC standards, CE marking)
Hardware break combinations	• AND, OR, simultaneous AND, state transition		
Exception event detection	Access protect		

**Debugging Functions of High-Performance Embedded Workshop Integrated Development Environment**

**Easy-to-Use Emulator Debugger**

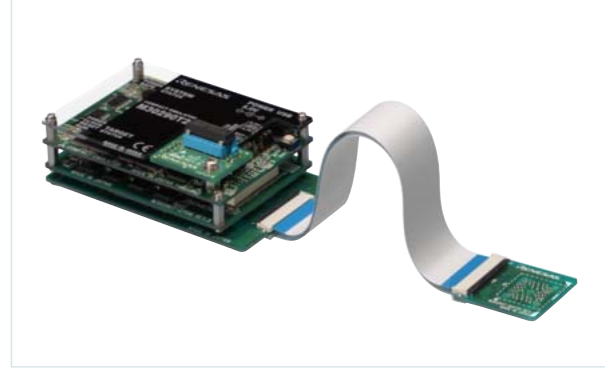
- Enables debugging using High-Performance Embedded Workshop running under Microsoft Windows.
- Simple and direct GUI
- Easy drag-and-drop operations
- Refined basic debugging functions to facilitate development work
- Real-time RAM monitoring
- High-level debugging functions such as real-time trace, C0 coverage, and duration measurement
- Online help in HTML format
- The latest version of High-performance Embedded Workshop is available for download on the Renesas Web site: [http://www.renesas.com/hew\\_download](http://www.renesas.com/hew_download).



Screen Capture of PC7501 Emulator/Debugger Window

Though small in size, these compact emulators provide the solid debugging functions of full-spec units. The product package includes software tools such as an integrated development environment, Emulator Debuggers, Compiler packages evaluation version (free of charge). Customers can begin development work on application programs right away after purchasing it.

- All-in-one packages including all software required for development
- Compact design
- An emulation memory function and microprocessor mode can be added by connecting an optional emulation memory board.
- Low price
- Solid debugging functions
  - Hardware break function
  - Real-time RAM monitor function
  - Real-time trace function
- USB interface support



- Product Contents**
- Emulator unit
  - Software CD-ROM (High-Performance Embedded Workshop integrated development environment, compiler package evaluation version [free of charge])
  - USB and power cables (separate 5V/2A power supply required for compact emulator)
  - User's manual, etc.

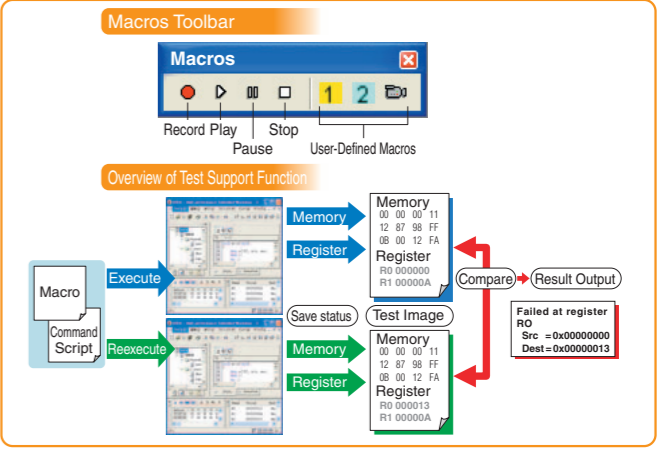
**Main Specifications**

Product	Target MCUs		Compact emulator
	Series	Group	
Product	M32C/80	M32C/81, M32C/82, M32C/83	S30830T-CPE (developed by Sunny Giken Inc.) *5
		M32C/80*3, M32C/84, M32C/85, M32C/8A*3	M30850T3-CPE*1 *2
		M32C/87	M30870T2-CPE
	M16C/80	M16C/80	M30800T-CPE*5
	M16C/60	M16C/62A	M30620T-CPE*5
		M16C/62P	
	M16C/30	M16C/30P	M3062PT3-CPE*2
	M16C/Tiny	M16C/26A	
		M16C/28	M3028BT2-CPE*4
M16C/29			
R8C/Tiny	R8C/10 to 19, 1A to 1B		
	R8C/20 to 29 R8C/2A to 2D, 2K ** , 2L **	ROE521000CPE00	
Target MCU modes	<ul style="list-style-type: none"> <li>• Single-chip mode</li> <li>• Memory expansion mode*2</li> <li>• MPU mode*2</li> </ul> (Supported MCU modes differ depending on the MCU product.)		

\*1. The M30850T3-CPE is the successor to the M30850T2-CPE.  
 \*2. The emulator unit supports single-chip mode and memory expansion mode. To use microprocessor mode it is necessary to purchase a separate emulation memory board.  
 \*3. The M32C/80 and M32C/8A are supported in the microprocessor mode only, so a separate emulation memory board is required.  
 \*4. The M3028BT2-CPE is the successor to the M30290T2-CPE.  
 \*5. The specifications of these compact emulators differ from the main specifications listed above. See the Web site of the specific product for details.  
 \*6. The hardware break function and trace point function cannot be used simultaneously.  
 \*\*: To be supported soon.

**Enhanced Development Efficiency from Test Support Function of High-performance Embedded Workshop**

- **Macro Generator Support Function**  
 The macro generator support function can be used to record repeated operations such as project control, building, and debugging in a macro file (command script file). Macros can be conveniently recorded and played from a toolbar.
- **Test Support Function**  
 Stores the contents of test result windows as test image files. The test image files can then be compared later on.
- **Extra Convenience by Combining Macro Generator Support Function and Test Support Function**  
 For example, you could record the steps in the test procedure in a macro file and record the anticipated test values in a test image file. The results can then be compared easily each time the test is run, improving efficiency and quality.





# PC4701U Emulator



<http://www.renesas.com/pc4701u>

Full-spec Emulator for M16C MCUs operating up to 20MHz

The PC4701U makes it possible to build an emulation system that supports a variety of MCUs by combining it with an emulation pod matching the target MCU.

- Includes debugging functions such as advanced break and real-time trace.
- Includes evaluation functions such as C0 coverage and time measurement.
- Real-time RAM monitor function is standard.
- Support for MCUs with operating frequencies up to 20MHz

#### Target MCUs

- M16C Family

See the following URL for details.

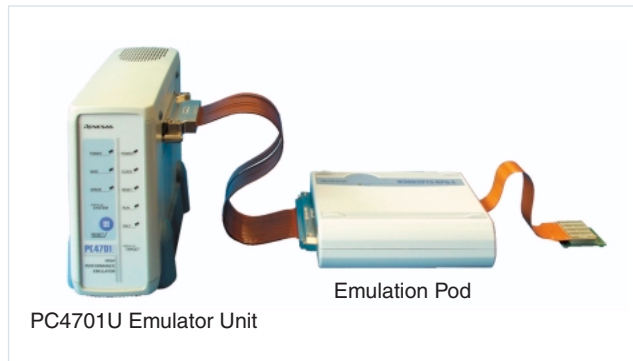
<http://www.renesas.com/pc4701u>

#### Operating Environment

- Microsoft Windows® XP, Windows® 2000

#### Product Contents

- Emulator unit
- USB cable, etc.
- High-Performance Embedded Workshop integrated development environment (Latest version available for download on Web site.)



# E30A Emulator \* Under Development



<http://www.renesas.com/e30a>

Emulator with NSD interface allowing connection via a single pin

The E30A emulator features a NSD (New Single-wire Debugger) interface and supports the R32C/100 Series. It makes it simple to perform software verification functions such as on-chip debugging and data tuning in the actual operating environment.

- Connection to emulator via newly developed single-pin NSD interface. (A coaxial cable is the only additional item required to perform debugging.)
- OCD (On-Chip Debugger) functionality  
It is not necessary to probe the foot pattern of the target MCU, so there is no MCU signal deterioration. No need for custom evaluation chips or custom packages. (Debugging can be performed with the target MCU in place.)
- Full range debugging functions  
Supports realtime emulation at the MCU's maximum operating frequency. Break and trace functionality are implemented in the MCU's on-chip circuitry.

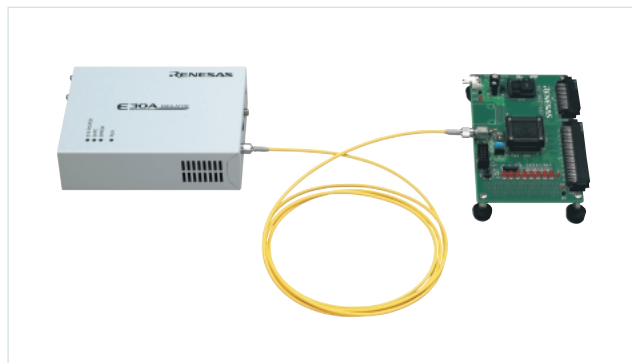
Target MCU: R32C/100 Series

#### Operating Environment:

Microsoft Windows® XP, Windows® 2000

#### Product Contents

- Emulator unit
- Oscillator circuit board
- AC Adaptor
- AC power cable
- USB cable, etc.
- Software CD-ROM (High-Performance Embedded Workshop integrated development environment)





# E8a Emulator



<http://www.renesas.com/e8a>

Low-priced on-chip debugging emulator that can also be used to program flash memory on 8-bit to 32-bit Renesas MCUs.

- A single unit provides support for on-chip debugging and flash programming.
- Since the actual MCU is used, evaluation can be performed under conditions, very close to those of the actual system such as electrical characteristics.
- The emulator uses USB bus power from the PC and does not require a separate power supply to operate.
- A 3.5V or 5.0V power supply may be provided to the target system via the emulator.
- The connector to the system under development and the debugger user interface are compatible with the E8 (discontinued product), facilitating a smooth transition.
- The following software is bundled with the product, so you can start application development immediately after purchasing it.
  - High-performance Embedded Workshop integrated development environment
  - Compiler package (evaluation version [free of charge])
  - Flash Development Toolkit (evaluation version [free of charge])
- The bundled software can also be downloaded free of charge from the E8a emulator Web site.
- Compact design measuring 92mm × 42mm × 15mm (40% the volume of the E8).
- Case made of environmentally friendly polylactide, which is derived from vegetable matter.

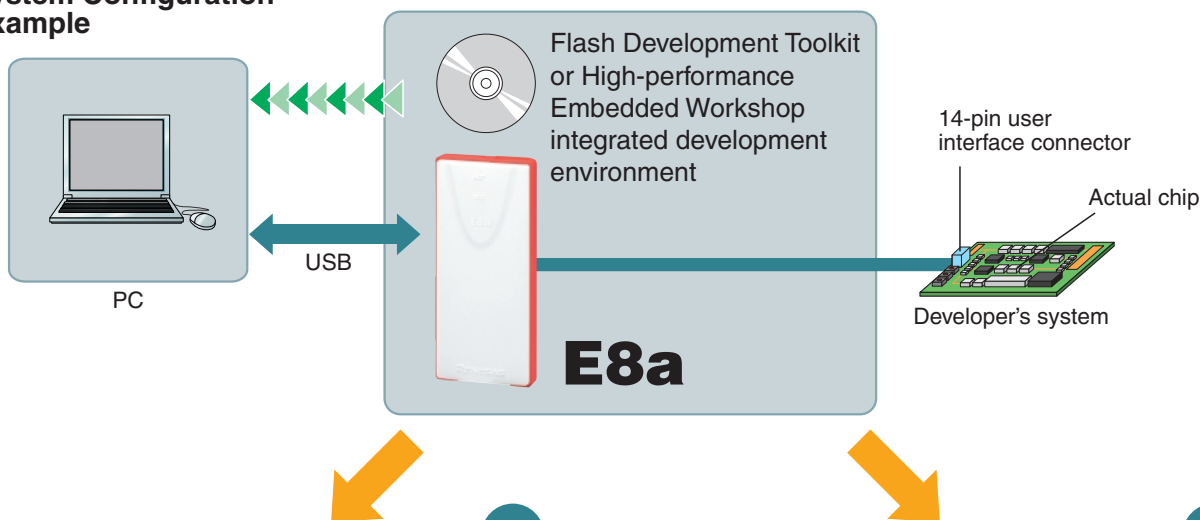
## Main Specifications

Target MCUs in the M16C Family	Series	Group
	M32C/80	M32C/84, M32C/85, M32C/87, M32C/88
	M16C/60	M16C/62P, M16C/6N4, M16C/6N5, M16C/6NK, M16C/6NL, M16C/6NM, M16C/6NN, M16C/6S, M16C/64**, M16C/65**
	M16C/30	M16C/30P
	M16C/Tiny	M16C/26A, M16C/28, M16C/29
R8C/Tiny	R8C/10, R8C/11, R8C/12, R8C/13, R8C/14, R8C/15, R8C/16, R8C/17, R8C/18, R8C/19, R8C/1A, R8C/1B, R8C/20, R8C/21, R8C/22, R8C/23, R8C/24, R8C/25, R8C/26, R8C/27, R8C/28, R8C/29, R8C/2A, R8C/2B, R8C/2C, R8C/2D, R8C/2E**, R8C/2F**, R8C/2G**, R8C/2H**, R8C/2J**, R8C/2K**, R8C/2L**	
	Max. operating frequency of target MCU	
Max. operating frequency	Max. operating frequency of target MCU	
Target MCU modes	Single-chip mode, memory expansion mode (supported MCU modes differ depending on the MCU product)	
Supported power supply voltage	2.7V to 5.5V (within guaranteed flash programming operation range of target MCU)	
Power supply to MCU	Supplied by emulator (3.3V or 5.0V, max. 300mA) or from Vcc on user board.	
Software breaks	255 points	
Hardware breaks	Number of break points differs depending on the MCU product.*1 4 address break points on R8C/Tiny Series (excluding R8C/10 to R8C/13). Otherwise 2 address break points + 1 data condition break point.	
Special breaks	Forced break pushing the STOP button of debugger.	
Trace	Number of jumps differs depending on the MCU product.*1 Jump source PC trace (jump source address for latest 4 jumps) on R8C/Tiny Series (excluding R8C/10 to R8C/13).	
PC interface	USB 1.1/2.0 full speed	
Operating environment	Windows® XP, Windows® 2000	
User interface	14-pin connector (product No. 7614-6002, Sumitomo 3M Limited) (Sold separately.) Note: Compatible with E8.	
Connection to developer's system	Connects using supplied user interface cable. (Connection signals differ depending on the target MCU product.*1)	
Use of developer's resources	On some MCU models, the emulator may require access to some port peripheral functions and ROM or RAM.*1	
Dimensions (mm)	92 × 42 × 15	
Overseas standards	Compliant (FCC standards, CE marking)	

\*1 Be sure to read the E8a user's manual corresponding to the target MCU before using the E8a emulator. See the E8a emulator Web site for details of target MCUs: <http://www.renesas.com/e8a>.

\*\* : To be supported soon.

## System Configuration Example



Works as a debugger in combination with the High-performance Embedded Workshop integrated development environment.

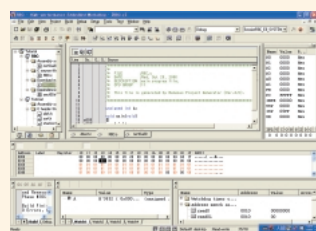
See page 43.

Bundled software

Works as a programmer in combination with the Flash Development Toolkit (evaluation version [free of charge]).

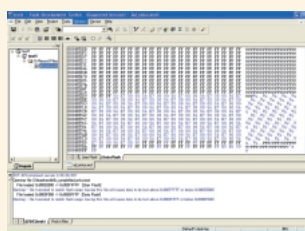
See page 49.

Bundled software



High-performance Embedded Workshop

740	R8C/Tiny
Super Low Power	M16C
H8/Tiny	M32C



Flash Development Toolkit

740	R8C/Tiny	H8S
Super Low Power	M16C	H8SX
H8	M32C	SuperH

Note: For programming of the final product, use ROC0000FDW04R (commercial product), which includes technical support, rather than the evaluation version (free of charge) of Flash Development Toolkit bundled with the E8a.

### ■ E8 emulator (discontinued product)

Although the E8a has replaced the E8, support for new MCU models will continue to be added to the E8 through July 2008. (This will consist mainly of adding support for versions of existing products with new ROM/RAM configurations.) However, there are no plans to provide support for MCU products (740 Family, M16C/65 Group, etc.) that would require major changes to the emulator software.



# Flash Development Toolkit



<http://www.renesas.com/fdt>

An On-Board Programming Tool from Renesas. (Flash Development Toolkit)

Supports on-board programming of Renesas flash MCUs using a graphical user interface (GUI) for ease of use.

### Features

- GUI designed specifically for flash programming
- Comprehensive message log
- Functions for preventing operation errors
- Evaluation version (free of charge) available for download on Web

### Main specifications

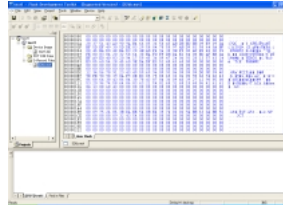
Target MCUs	Supports a wide variety of MCUs ranging from 8-bit to 32-bit models. (See Web site for details.)
Operating environment	Windows® XP, Windows® 2000
Distribution media	CD-ROM
Supported languages	Japanese/English
Main functions	<ul style="list-style-type: none"> <li>• File download</li> <li>• Block erase</li> <li>• Upload</li> <li>• Blank check</li> <li>• File checksum</li> <li>• Edit file</li> <li>• Join files</li> <li>• Manage project</li> <li>• Select protection level for flash programming</li> <li>• Select output messages (standard/advanced)</li> </ul>

### Flexible GUI

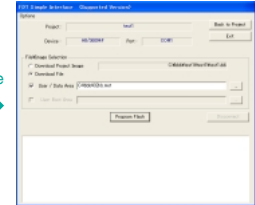
Three programming operation window styles are available to match the user's development environment.

#### Using the Toolkit by Creating a Project

##### 1. Main Window



##### 2. Simple Interface Window



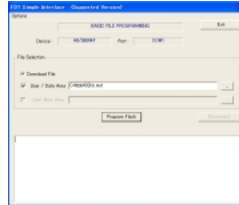
Switchable

The project management function enables efficient data management for systems incorporating multiple MCUs or for different development phases. It is very convenient when using the toolkit for development work.

The simple interface window is called up from the main window. It allows the user to program flash memory for multiple projects easily using the project management function.

#### Using the Toolkit without Creating a Project

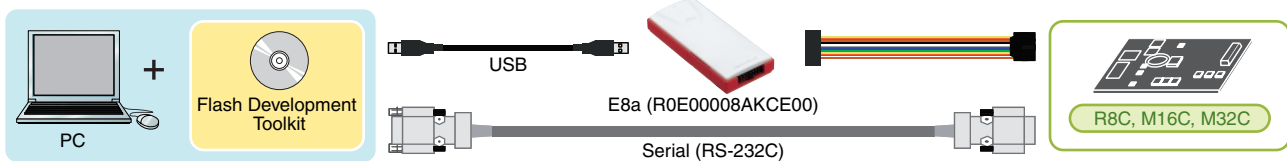
##### 3. Basic Window



This window style can be used to program flash memory without first creating a project. The number of files that can be programmed at one time is limited to one.

Note: Available since FDT with version 3.

### Programming Tool Configuration Diagram



Note: Support for programming of M16C Family and 740 Family MCUs via a serial connection (RS-232C) is being added to the Flash Development Toolkit incrementally. See the Web site for details of supported MCUs: <http://www.renesas.com/fdt>.



# On-Chip Flash MCU Programming Environments



[http://www.renesas.com/flash\\_programming\\_tools](http://www.renesas.com/flash_programming_tools)

A Variety of Flash Programming Environments Provided by Renesas.

Renesas Technology supplies a truly extensive variety of flash MCU products. We have teamed up with our partner vendors to provide an equally wide array of flash programming environments to deliver flexible support for every customer's goals and situation.

### Programmers from Renesas Partners that Support a Broad Range of Renesas flash MCUs

There are two types of programmers that support Renesas flash MCUs. On-board programmers support programming of the MCU when mounted in the system, and PROM programmers are used to program the MCU without a target board. We work together with our partner vendors to ensure availability of a wide range of programmer products to meet a variety of requirements.



See page 61 for information on Renesas partner vendors.



# Initial Implementation Tools

Low-priced and Support for Basic Functions

## Renesas Starter Kit

This is a user-friendly evaluation tool for Renesas MCUs. The included E8a emulator and High-Performance Embedded Workshop integrated development environment provide support for coding and debugging. In addition, it is possible to perform on-board programming of MCUs using Flash Development Toolkit.

### Lineup

Target MCUs		Product name	Part No.
Group	Series		
M32C/80	M32C/84, 85, 87, 88	Renesas Starter Kit for M32C/87	ROK330879S000BE
M16C/60	M16C/62P_30P	Renesas Starter Kit for M16C/62P	ROK33062PS000BE
	M16C/6NK	Renesas Starter Kit for M16C/6NK	ROK3306NKS000BE
M16C/Tiny	M16C/28, 29	Renesas Starter Kit for M16C/29	ROK330290S000BE
	M16C/26A	Renesas Starter Kit for M16C/26A	ROK33026AS000BE
R8C/Tiny	R8C/1A, 1B	Renesas Starter Kit for R8C/1B	ROK5211B4S000BE
	R8C/20-23	Renesas Starter Kit for R8C/23	ROK521237S000BE
	R8C/24, 25	Renesas Starter Kit for R8C/25	ROK521256S000BE
	R8C/26, 27	Renesas Starter Kit for R8C/27	ROK521276S000BE
	R8C/2C, 2D	Renesas Starter Kit for R8C/2D	ROK5212D8S000BE

### Product Contents

- CPU board
- E8a on-chip debugging emulator unit\*1
- Software CD-ROM
  - High-performance Embedded Workshop integrated development environment
  - Compiler (evaluation version [free of charge])
  - E8a emulator debugger\*1
  - Flash Development Toolkit (evaluation version [free of charge]), etc.
- Connecting cable, etc.

\*1: Older kits may include E8 instead.



## M3A-0806

The M3A-0806 is a flash writer that uses standard serial I/O mode 2 (UART mode). It rewrites programs using only four lines (TxD, RxD, GND, and Vcc). If the supplied cable is used, there is no need for an RS-232C driver for the target board. Note that the M3A-0806 does not support rewriting of the data area.

- Package includes flash reprogramming software and a custom serial cable.
- Very economically priced flash writer

### Target MCUs

R8C/10 to R8C/1B, R8C/20 to R8C/29, M16C/26A, M16C/28, M16C/29, M16C/62A, M16C/62M, M16C/62P, M16C/6N, M16C/80, M16C/30P, M32C/83, M32C/84, M32C/85, M32C/87

### Operating Environment

Microsoft Windows® XP, Windows® 2000

Note: The flash rewriting (Flashstarter) software used by the M3A-0806 is distributed free of charge. The EXE file and source code are available for download from the Renesas Web site. <http://www.renesas.com/download>



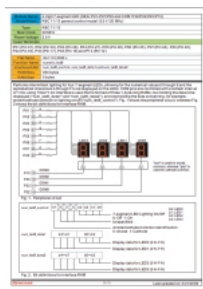
Note: The target board is not included.



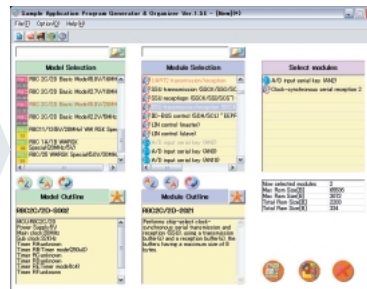
# Sample Application Program Generator & Organizer

Simply select the functions you want to implement with your MCU and this free utility will generate sample code.

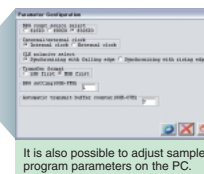
- **Simple Operation**  
Generates MCU sample programs and requires no complex environment settings.
- **Flexible Settings**  
Allows developers freely to combine code for different applications, such as communication control or data flash control.
- **Improved Efficiency**  
Allows developers to combine program code they have written themselves with other program code.
- **Training Materials**  
Detailed software reference materials are built in, such as MCU peripheral circuit diagrams and timing charts. C language source code output files include extensive comments.
- **Free Download from the Renesas Web Site**  
<http://www.renesas.com/sango>



All sample programs include detailed documentation that can be displayed with a single mouse click.



Simple select functions from the menu to generate usable sample program code.



It is also possible to adjust sample program parameters on the PC.

Target MCUs: R8C/Tiny Series 11, 13, 1A, 1B, 24, 25, 26, 27, 2C, 2D (as of October 2007)



# Development Tools List

## R32C 100 SERIES Development Tools for R32C/100 Series

MCU		Software tools			Emulator
Series	RTOS	C compiler package *2	IDE		
R32C/100 ★★	M3T-MR100/4 *1 *6	R32C/100 Series C compiler package (MISRA C *3)	High-performance Embedded Workshop *4	E30A *5 ★★	

- \*1. M3T-MR100/4 is a general term referring to the real-time OS development kit (M3T-MR100K/4) and the mass production contract (M3T-MR100S/4).
- \*2. C compiler package includes integrated development environment (High-performance Embedded Workshop), C compiler, assembler and simulator debugger.
- \*3. MISRA C rule checking functionality may be added by installing the optional SQMint MISRA C rule checker.
- \*4. High-performance Embedded Workshop is included with C compiler package and Emulator software.
- \*5. E30A emulator bundles emulator software.
- \*6. Please refer to the following URL for the target MCU group (<http://www.renesas.com/r32c100>)
- ★★ Under development or evaluation: product name may be changed.

## R32C 100 SERIES Operating Environment for R32C/100 Series Software Tools

Product type	Product name	Host machine (OS) *6
RTOS	M3T-MR100/4 *1	IBM PC/AT compatibles (Windows® XP, 2000)
C compiler package	C compiler package for R32C/100 Series *2	IBM PC/AT compatibles (Windows® XP, 2000)
MISRA C rule checker	SQMint *3	IBM PC/AT compatibles (Windows® XP, 2000)
IDE	High-performance Embedded Workshop *4	IBM PC/AT compatibles (Windows® XP, 2000)
Simulator debugger	Simulator Debugger for R32C *5	IBM PC/AT compatibles (Windows® XP, 2000)

- \*1. M3T-MR100/4 is a general term referring to the real-time OS development kit (M3T-MR100K/4) and the mass production contract (M3T-MR100S/4).
- \*2. The C compiler package for R32C/100 Series includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.
- \*3. SQMint MISRA C rule checker (Part No.: R0C00000SCW01R) is sold as the optional product of Renesas C compiler.
- \*4. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.
- \*5. Simulator debugger is included with C compiler package.
- \*6. Please refer to the following URL for Windows® Vista.  
[http://www.renesas.com/tool\\_env](http://www.renesas.com/tool_env)

## R32C 80 SERIES Development Tools for M32C/80 Series

MCU		Introductory tools		Software tools			Emulator (included emulator debugger *7)			Programming tool		
Series	Group	Starter kit	RTOS	C compiler package	IDE	Onchip debugging emulator	Compact emulator	In-circuit emulator		Flash programmer *10	IC socket board *13	
								Emulator	Emulation probe			
M32C/80	M32C/80	Renesas Starter Kit for M32C/87 (Type No.: R0K330879S000BE) <sup>1</sup>	M3T-MR308/4 *2	M3T-NC308WA *3 (MISRA C *4)	High-performance Embedded Workshop *5	E8a *6	M30850T3-CPE *8	PC7501	M30850T2-EPB	Flash Development Toolkit *11 (E8a emulator is necessary at programming) or M3A-0806 *12	R0K3100PS2000BR (for PPOP100JB-A) [Previous code: 100PS-A] R0K3100PQ2000BR (for PLOP100KB-A) [Previous code: 100PQ-A] R0K3144PS2000BR (for PLOP144KA-A) [Previous code: 144PQ-A]	
	M30830T-EPB *9								M30850T2-EPB			
	M30870T-EPB											
	M30880T-EPB								Flash Development Toolkit *11 (E8a emulator is necessary at programming)			R0K3100PQ2000BR (for PLOP100KB-A) [Previous code: 100PQ-A] R0K3144PS2000BR (for PLOP144KA-A) [Previous code: 144PQ-A]
	M30850T3-CPE *8											

- \*1. CPU board, EB on-chip debugging emulator, software (High-Performance Embedded Workshop integrated development environment, M3T-NC308WA C compiler package evaluation version, E8 emulator software, Flash Development Toolkit evaluation version), etc., are included. Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*2. M3T-MR308/4 is a general term referring to the real-time OS development kit (M3T-MR308K/4) and the mass production contract (M3T-MR308S/4).
- \*3. The M3T-NC308WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.
- \*4. MISRA C rule checking functionality may be added by installing the optional SQMint MISRA C rule checker (Part No.: R0C00000SCW01R).
- \*5. High-performance Embedded Workshop is included with C compiler package and Emulator software.
- \*6. The E8a emulator (Part No.: R0E00008AKCE00) includes emulator software (High-Performance Embedded Workshop integrated development environment, E8a emulator software, compiler evaluation version, Flash Development Toolkit evaluation version). Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*7. Each emulator includes an emulator debugger. Depending on the shipping date, the bundled emulator debugger may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*8. The M30850T3-CPE is the successor to the M30850T2-CPE. The M30850T3-CPE supports allocation of emulation memory to an external area and microprocessor mode using the optional R0E330850MSRC0 emulation memory board.
- \*9. The M32C/82 Group can be used with the combination of an emulator debugger, the PC4701U emulator and the M30830T-RPD-E emulation pod only when the MCU operating frequency is 20MHz or less.
- \*10. A variety of compatible programmers are available from our partner vendors. Contact the manufacturer regarding programmer details, supported MCUs and suitability for installation in a mass production or factory environment.
- \*11. Flash Development Toolkit (Part No.: R0C00000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). The E8a emulator is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/td>) to confirm support details for specific MCU product numbers.
- \*12. The data flash areas of the M32C/84 and M32C/85 Groups cannot be reprogrammed.
- \*13. The IC socket board is a programming adapter that supports a specific programmer.

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).



## Accessories for M32C/80 Series

MCU		Accessories			
Series	Group	Package type	Package name	Previous code	Recommended accessories *1
M32C/80	M32C/80	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)
		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)
	M32C/82 M32C/84 (M32C/84, M32C/84T) M32C/85 (M32C/85, M32C/85T) M32C/87 (M32C/87, M32C/87A, M32C/87B)	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)
		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)
		144 pin 0.5mm pitch LQFP	PLQP0144KA-A	144P6Q-A	M3T-FLX-144NSD (optional)
	M32C/88 (M32C/88T)	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)
		144 pin 0.5mm pitch LQFP	PLQP0144KA-A	144P6Q-A	M3T-FLX-144NSD (optional)
M32C/8A	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)	

\*1. A variety of other accessories are available. Visit the Renesas Technology Web site (<http://www.renesas.com/accessory>) for details. (optional): Not included with compact emulator or emulation probe. Purchase it separately.



## Development Tools for M16C/80 Series

MCU		Software tools			Emulator (bundled Emulator debugger *5)			Programming tool	
Series	Group	TROS	C compiler package	IDE	Compact emulator	In-circuit emulator		Flash programmer	IC socket board *7
						Emulator	Emulation pod or Probe		
M16C/80	M16C/80	M3T-MR308/4 *1	M3T-NC308WA *2 (MISRA C *3)	High-performance Embedded Workshop *4	M30800T-CPE (RAM 10K)	PC4701U	M30803T-RPD-E (RAM 24K) *6	M3A-0806	R0K3100PSZ000BR (for PRQP0100JB-A [Previous code: 100P6S-A]) R0K3100PCZ000BR (for PLQP0100KB-A [Previous code: 100P6Q-A]) R0K3144PSZ000BR (for PLQP0144KA-A [Previous code: 144P6Q-A])

\*1. M3T-MR308/4 is a general term referring to the real-time OS development kit (M3T-MR308K/4) and the mass production contract (M3T-MR308S/4).  
 \*2. The M3T-NC308WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.  
 \*3. MISRA C rule checking functionality may be added by installing the optional SQMint MISRA C rule checker (Part No. R0C00005SCW01R).  
 \*4. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.  
 \*5. Each emulator includes an emulator debugger. Depending on the shipping date, the bundled emulator debugger may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).  
 \*6. Please contact us when you use this for the M16C/80T Group for automotive applications.  
 \*7. The IC socket board is a programming adapter that supports a specific programmer.



## Accessories for M16C/80 Series

MCU		Accessories			
Series	Group	Package type	Package name	Previous code	Recommended accessories *1
M16C/80	M16C/80	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)
		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
		144 pin 0.5mm pitch LQFP	PLQP0144KA-A	144P6Q-A	M3T-FLX-144NSD (optional)

\*1. A variety of other accessories are available. Visit the Renesas Technology Web site (<http://www.renesas.com/accessory>) for details. (optional): Not included with emulation pod or probe. Purchase it separately. (included): Included with emulation pod or probe.

Note: Evaluation versions of software tools are free of charge.  
 Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).

# Development Tools List



## Operating Environment for M32C/80 and M16C/80 Series Software Tools

Product type	Product name	Host machine (OS) *8
RTOS	M3T-MR308/4 *1	IBM PC/AT compatibles (Windows® XP, 2000)
C compiler package	M3T-NC308WA *2	IBM PC/AT compatibles (Windows® XP, 2000)
MISRA C rule checker	SQMLint *3	IBM PC/AT compatibles (Windows® XP, 2000)
IDE	High-performance Embedded Workshop *4	IBM PC/AT compatibles (Windows® XP, 2000)
Simulator debugger	Simulator Debugger for M32C *5	IBM PC/AT compatibles (Windows® XP, 2000)
Emulator debugger	PC7501 Emulator Debugger for M32C Series *6 PC4701 Emulator Debugger for M32C Series *6 Compact Emulator Debugger for M32C Series *6 FoUSB/UART Debugger for M32C Series *6 E8a Emulator Software *6	IBM PC/AT compatibles (Windows® XP, 2000)
Flash and PROM Programming	Flash Development Toolkit *7	IBM PC/AT compatibles (Windows® XP, 2000)

- \*1. M3T-MR308/4 is a general term referring to the real-time OS development kit (M3T-MR308K/4) and the mass production contract (M3T-MR308S/4).
- \*2. The M3T-NC308WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.
- \*3. SQMLint MISRA C rule checker (Part No.: R0C0000SCW01R) is sold as the optional product of Renesas C compiler.
- \*4. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.
- \*5. Simulator debugger is included with C compiler package.
- \*6. Emulator debugger is bundled with emulators.
- \*7. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support).  
The E8a emulator (Part No.: R0E00008AKCE00) is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.
- \*8. Please refer to the following URL for Windows® Vista. [http://www.renesas.com/tool\\_env](http://www.renesas.com/tool_env)



## Development tools for M16C/60, 30, 20, and 10 Series

MCU			Introductory tools		Software tools			Emulator (included Emulator debugger *7)			Programming tool		
Series	Group	MCU	Starter kit	RTOS	C compiler package	IDE	On-chip debugging emulator	Compact emulator	In-circuit emulator		Flash programmer *16	IC socket board *21	
							Emulator	Emulation probe or pod					
M16C/60	M16C/64**		**				E8a *6	—	E100 **	*22	Flash Development Toolkit *19 ** (E8a emulator is necessary at programming)	—	
	M16C/65**		**				**	—	**	**	—	—	
	M16C/62A		Renesas Starter Kit for M16C/62P (R0K33062PFS000BE) *1					M30620T-CPE	PC4701U	M30620TL-RPD-E	M3A-0806 *17 *18	R0K3100PS2000BR (for PRQP0100JB-A [Previous code: 100P6S-A]) R0K3100PQZ000BR (for PLOP0100KB-A [Previous code: 100P6Q-A])	
	M16C/62M		—				M3A-0665	—	—	M30620TL-RPD-E	M3A-0806 *17		
	M16C/62N		—							M3062NT3-RPD-E	M3A-0806 *17		
	M16C/62P		Renesas Starter Kit for M16C/62P (R0K33062PFS000BE) *1				E8a *6	M3062PT3-CPE *8	PC7501	M3062PT2-EPB *10	Flash Development Toolkit *19 (E8a emulator is necessary at programming) or M3A-0806 *17		
	M16C/6V	M306V7					—	—	PC4701U	M306V7T-RPD-E	M3A-0665 *20	—	
		M306N4 M306N5		—									
	M16C/6N	M306NK M306NL M306NM M306NN		Renesas Starter Kit for M16C/6NK (R0K3306NKSO00BE) *1	M3T-MR30/4 *2	M3T-NC30WA *3 (MISRA C *4)	High-performance Embedded Workshop *5	E8a *6	—	PC7501	M306NKT-EPB *11	Flash Development Toolkit *19 (E8a emulator is necessary at programming) or M3A-0806 *17	R0K3100PS2000BR (for PRQP0100JB-A [Previous code: 100P6S-A]) R0K3100PQZ000BR (for PLOP0100KB-A [Previous code: 100P6Q-A])
	M16C/6H	M306H7		—			—	—	PC4701U	M306H7T3-RPD-E	—	—	
M16C/6S	M306S0		—			E8a *6	M3062PT3-CPE + M306S0T-PRB *9	PC7501	M3062PT2-EPB *12 + M306S0T-PRB *9	Flash Development Toolkit *19 (E8a emulator is necessary at programming) or M3A-0806 *17	—		
M16C/30	M16C/30P	M30302 M30304		Renesas Starter Kit for M16C/30P (R0K33062PFS000BE) *1			E8a *6	M3062PT3-CPE *8	PC7501	M3062PT2-EPB *10	—	—	
	M16C/39P	M30392		—			—	—		M3062PT2-EPB *13 + M30396T-PRB *14	—	—	
M16C/20	M16C/24	M30245		—			—		PC4701U	M30245T3-RPD-E	*16	—	
M16C/10	M16C/1N	M301N2		—			—	—	PC4701U	M30100T3-RPD-E + M301N2T-PRB *15	M3A-0806 *17	—	

- \*1. CPU board, E8 on-chip debugging emulator, software (High-Performance Embedded Workshop integrated development environment, M3T-NC30WA C compiler package evaluation version, E8 emulator software, Flash Development Toolkit evaluation version), etc., are included. Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*2. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).
- \*3. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.
- \*4. MISRA C rule checking functionality may be added by installing the optional SQMLint MISRA C rule checker (Part No.: R0C0000SCW01R).
- \*5. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.
- \*6. The E8a emulator (Part No.: R0E00008AKCE00) includes emulator software (High-Performance Embedded Workshop integrated development environment, E8a emulator software, compiler evaluation version, Flash Development Toolkit evaluation version). Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*7. Each emulator includes an emulator debugger. Depending on the shipping date, the bundled emulator debugger may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).
- \*8. Allocation of emulation memory to an external area and microprocessor mode are supported using the optional R0E33062PMSRC0 emulation memory board.
- \*9. Signal converter board for the M16C/6S0 in the M16C/6S Group.
- \*10. May be used with the combination of the PC4701U emulator, M3062PT3-RPD-E emulation pod only when the MCU operating frequency is 16MHz or less.
- \*11. The M306N4 and M306N5 in the M16C/6N Group can be used with the combination of the PC4701U emulator and M306NKT3-RPD-E emulation pod only when the MCU operating frequency is 16MHz or less.
- \*12. May be used with the combination of the PC4701U emulator, M3062PT3-RPD-E and M306S0T-PRB emulation pod only when the MCU operating frequency is 16MHz or less.
- \*13. May be used with the combination of the PC4701U emulator, M3062PT3-RPD-E emulation and M30396T-PRB only when the MCU operating frequency is 16MHz or less.
- \*14. Signal converter board for the M16C/39P Group.
- \*15. Pod probe for the M16C/1N Group.
- \*16. A variety of compatible programmers are available from our partner vendors. Contact the manufacturer regarding programmer details, supported MCUs and suitability for installation in a mass production or factory environment.
- \*17. The data flash area cannot be reprogrammed.
- \*18. Advantest Corporation's R4945 or R4945A programmer and PCA7412F-80 program writer adapter for the PRQP0080JA-A (formerly 80P6S-A) package or PCA7412F-100 program writer adapter for the PRQP0100JB-A (formerly 100P6S-A) package may be used to program the M16C/62A one-time PROM.
- \*19. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). The E8a emulator is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.
- \*20. Advantest Corporation's R4945 or R4945A programmer and PCA7412F-100 program writer adapter for the PRQP0100JB-A (formerly 100P6S-A) package may be used to program the M16C/6V one-time PROM.
- \*21. The IC socket board is a programming adapter that supports a specific programmer.
- \*22. M16C/64, 65 MCU units (for E100) are necessary.
- \*\* Under development

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).



## Set Package of Compact Emulators for M16C/62P and M16C/30P Group

Series	Group	Target MCU			Product Type name	Components *1
		Package type	Package name	Previous code		
M16C/60 M16C/30	M16C/62P M16C/30P	80 pin 0.65mm pitch QFP	PRQP0080JA-A	80P6S-A	M3062PT3-CPE-1	Compact emulator M3062PT3-CPE *2 Converter board M3062PT-80FPB
		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3062PT3-CPE-2	Compact emulator M3062PT3-CPE *2 Converter board M30800T-PTC IC socket IC61-1004-051
					M3062PT3-CPE-5	Compact emulator M3062PT3-CPE *2 Converter board M3T-F160-100NRB
		100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3062PT3-CPE-3	Compact emulator M3062PT3-CPE *2 Converter board M3T-F160-100NSD
128 pin 0.5mm pitch LQFP	PLQP0128KB-A	128P6Q-A	M3062PT3-CPE-4	Compact emulator M3062PT3-CPE *2 Converter board M3T-FLX-128NRD		

\*1. For debugging, the combination of a compact emulator and a conversion board supporting the target MCU are used to connect to the user's system. Compact emulators and conversion boards can be purchased individually.

\*2. With the optional emulation memory board R0E33062PMSRC0, emulation memory allocation function and microprocessor mode are available.



## Accessories for M16C/60, 30, 20, and 10 Series

MCU			Accessories				Emulator	
Series	Group	MCU	Package type	Package name	Previous code	Recommended accessories *1		
M16C/60	M16C/64 ★★ M16C/65 ★★		100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	★★	E100 ★★	
			100 pin 0.65mm pitch QFP	PRQP0100JD-B	100P6F-A	★★		
	M16C/62A M16C/62M		80 pin 0.65mm pitch QFP	PRQP0080JA-A	80P6S-A	M3T-FLX-100LCC (included) + M3T-100LCC-80QSB (optional)	PC4701U	
			100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-FLX-100NSD (optional)		
			100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-FLX-100NRB (optional)		
	M16C/62N		80 pin 0.65mm pitch QFP	PRQP0080JA-A	80P6S-A	M3062PT-80FPB (optional)	PC4701U	
			100 pin 0.4mm pitch TQFP	PTQP0100LB-A	100PFB-A	M3T-F160-100NSE (optional)		
			100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)		
			100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)		
	M16C/62P		80 pin 0.65mm pitch QFP	PRQP0080JA-A	80P6S-A	M3062PT-80FPB (optional)	PC7501	
			100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)		
			100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)		
			128 pin 0.5mm pitch LQFP	PLQP0128KB-A	128P6Q-A	M3T-F160-128NRD (optional)		
	M16C/6V	M306V7		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)	PC4701U
	M16C/6N	M306N4 M306N5		100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)	PC7501
				100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)	
		M306NK M306NL	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)		
	M306NM M306NN	128 pin 0.5mm pitch LQFP	PLQP0128KB-A	128P6Q-A	M3T-F160-128NRD (optional)			
M16C/6H	M306H7		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M30800T-PTC (included) + LCC socket (included)	PC4701U	
M16C/6S	M306S0		64 pin 0.5mm pitch LQFP	PLQP0064KB-A	64P6Q-A	*2	PC7501	
M16C/30	M16C/30P	M30302 M30304	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-F160-100NSD (optional)	PC7501	
			100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A	M3T-F160-100NRB (optional)		
	M16C/39P	M30392		100 pin 0.65mm pitch QFP	PRQP0100JB-A	100P6S-A		M3T-F160-100NRB (optional)
M16C/20	M16C/24	M30245	100 pin 0.5mm pitch LQFP	PLQP0100KB-A	100P6Q-A	M3T-FLX-100NSD (included)	PC4701U	
M16C/10	M16C/1N	M301N2	48 pin 0.5mm pitch LQFP	PLQP0048KB-A	48P6Q-A	M30102T-PTC (optional)		

\*1. A variety of other accessories are available. Visit the Renesas Technology Web site (<http://www.renesas.com/accessory>) for details.

\*2. Accessories are attached to signal conversion board M306S0T-PRB.

(included): Included with compact emulator, emulation pod or probe.

(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

★★ Under development

Note: Evaluation versions of software tools are free of charge.

Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).

# Development Tools List

## Operating Environment for M16C/60, 30, 20, and 10 Series Software Tools

Product type	Product name	Host machine (OS) *8
RTOS	M3T-MR30/4 *1	IBM PC/AT compatibles (Windows® XP, 2000)
C compiler package	M3T-NC30WA *2	IBM PC/AT compatibles (Windows® XP, 2000)
MISRA C rule checker	SQMLint *3	IBM PC/AT compatibles (Windows® XP, 2000)
IDE	High-performance Embedded Workshop *4	IBM PC/AT compatibles (Windows® XP, 2000)
Simulator debugger	Simulator Debugger for M16C and R8C/Tiny Series *5	IBM PC/AT compatibles (Windows® XP, 2000)
Emulator debugger	PC7501 Emulator Debugger for M16C and R8C/Tiny Series *6 PC4701 Emulator Debugger for M16C Series *6 Compact Emulator Debugger for M16C and R8C/Tiny Series *6 FoUSB/UART Debugger for M16C and R8C/Tiny Series *6 E8a Emulator Software *6	IBM PC/AT compatibles (Windows® XP, 2000)
Flash and PROM Programming	Flash Development Toolkit *7	IBM PC/AT compatibles (Windows® XP, 2000)

- \*1. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).  
 \*2. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.  
 \*3. SQMLint MISRA C rule checker (Part No.: R0C0000SCW01R) is sold as the optional product of Renesas C compiler.  
 \*4. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.  
 \*5. Simulator debugger is included with C compiler package.  
 \*6. Emulator debugger is bundled with emulators.  
 \*7. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support).  
 The E8a emulator (Part No.: R0E00008AKCE00) is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.  
 \*8. Please refer to the following URL for Windows® Vista.  
[http://www.renesas.com/tool\\_env](http://www.renesas.com/tool_env)

## Development tools for M16C/Tiny Series

Series	Group	MCU	Introductory tool	Software tool			Emulator (Emulator debugger is included. *6)		Programming tool			
				RTOS	C compiler package	IDE	Onchip debugging emulator	Compact emulator	In-circuit emulator	Flash Programmer *12	IC socket board *13	
M16C/Tiny	M16C/26A (M16C/26A, M16C/26B, M16C/26T)	M30260	Renesas Starter Kit for M16C/26A (R0K33026AS000BE) *1	M3T-MR30/4 *2	M3T-NC30WA *3 (MISRA C *4)	High-performance Embedded Workshop *5	E8a (R0E00008AKCE00) *7	M3028BT2-CPE *8	PC7501	M3028BT-EPB *9	Flash Development Toolkit (R0C0000FDW04R) *10 (E8a emulator is necessary at programming) or M3A-0806 *11	R0K33048PQ2000BR (for PLQP0048KB-A [Previous code: 48PQ-A])
		M30263										R0K33064PQ2000BR (for PLOP100KB-A [Previous code: 64PQ-A])
	M30280	R0K330290P2000BR (for PLOP0080KB-A [Previous code: 80PQ-A])										
	M30281											
	M30290											
	M16C/28 (M16C/28, M16C/28B, M16C/28T)	M30281	Renesas Starter Kit for M16C/29 (R0K330290S000BE) *1									
	M16C/29	M30290										
		M30291										

- \*1. CPU board, E8 on-chip debugging emulator, software (High-Performance Embedded Workshop integrated development environment, M3T-NC308WA C compiler package evaluation version, E8 emulator software, Flash Development Toolkit evaluation version), etc., are included. Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).  
 \*2. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).  
 \*3. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.  
 \*4. MISRA C rule checking functionality may be added by installing the optional SQMLint MISRA C rule checker (Part No.: R0C0000SCW01R).  
 \*5. High-performance Embedded Workshop is included with C compiler package and emulator debugger.  
 \*6. Each emulator includes an emulator debugger. Depending on the shipping date, the bundled emulator debugger may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).  
 \*7. The E8a emulator (Part No.: R0E00008AKCE00) includes emulator software (High-Performance Embedded Workshop integrated development environment, E8a emulator software, compiler evaluation version, Flash Development Toolkit evaluation version). Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).  
 \*8. M3028BT2-CPE is the successor product of the M30290T2-CPE. It supports 24MHz operation of M16C/Tiny series MCUs. The conversion board for the target connection is necessary for M3028BT2-CPE. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of "Set Package of Compact Emulator for M16C/Tiny Series" and "Converter Board for M16C/Tiny Series".  
 \*9. M3028BT-EPB is the successor product of the M30290T-EPB. It supports 24MHz operation of M16C/Tiny series MCUs. The conversion board for the target connection is necessary for M3028BT-EPB. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of "Set Package of PC7501 Emulation Probe for M16C/Tiny Series" and "Converter Board for M16C/Tiny Series".  
 \*10. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.  
 \*11. The data flash areas cannot be reprogrammed.  
 \*12. A variety of compatible programmers are available from our partner vendors. Contact the manufacturer regarding programmer details, supported MCUs and suitability for installation in a mass production or factory environment.  
 \*13. The IC socket board is a programming adapter that supports a specific programmer.

## Set Package of Compact emulator for M16C/Tiny Series

Series	Group	MCU	Target MCU			Product name	Components *1
			Package type	Package name	Previous code		
M16C/Tiny	M16C/26A (M16C/26A, M16C/26B, M16C/26T)	M30263	42 pin 0.8mm pitch SSOP	PRSP0042GA-B	42P2R-E	M3028BT2-CPE-1	Compact emulator M3028BT2-CPE Converter board M30263T-42SSB
		M30260	48 pin 0.5mm pitch LQFP	PLQP0048KB-A	48P6Q-A	M3028BT2-CPE-2	Compact emulator M3028BT2-CPE Converter board M30260T-48FPD
	M16C/28 (M16C/28, M16C/28B, M16C/28T)	M30281	64 pin 0.5mm pitch LQFP	PLQP0064KB-A	64P6Q-A	M3028BT2-CPE-3	Compact emulator M3028BT2-CPE Converter board M30291T-64FPD
		M30280	80 pin 0.5mm pitch LQFP	PLQP0080KB-A	80P6Q-A	M3028BT2-CPE-4	Compact emulator M3028BT2-CPE Converter board M30290T-80FPD
	M16C/28 (M16C/28, M16C/28B)	M30280	85 pin 0.65mm pitch TFLGA	PTLG0085JB-A	85F0G	M3028BT2-CPE-5	Compact emulator M3028BT2-CPE Converter board M30280T-85LGF

- \*1. For debugging, the combination of a compact emulator and a conversion board supporting the target MCU are used to connect to the user's system. Compact emulators and conversion boards can be purchased individually.

Note: Evaluation versions of software tools are free of charge.  
 Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).



## Set Package of PC7501 Emulation probe for M16C/Tiny Series

Series	Group	MCU	Target MCU			Product name	Components *1
			Package type	Package name	Previous code		
M16C/Tiny	M16C/26A (M16C/26A, M16C/26B, M16C/26T)	M30263	42 pin 0.8mm pitch SSOP	PRSP0042GA-B	42P2R-E	M3028BT-EPB-1	Emulation probe M3028BT-EPB Converter board M30263T-42SSB
		M30260	48 pin 0.5mm pitch LQFP	PLQP0048KB-A	48P6Q-A	M3028BT-EPB-2	Emulation probe M3028BT-EPB Converter board M30260T-48FPD
	M16C/28 (M16C/28, M16C/28B, M16C/29)	M30281 M30291	64 pin 0.5mm pitch LQFP	PLQP0064KB-A	64P6Q-A	M3028BT-EPB-3	Emulation probe M3028BT-EPB Converter board M30291T-64FPD
		M30280 M30290	80 pin 0.5mm pitch LQFP	PLQP0080KB-A	80P6Q-A	M3028BT-EPB-4	Emulation probe M3028BT-EPB Converter board M30290T-80FPD
	M16C/28 (M16C/28, M16C/28B)	M30280	85 pin 0.65mm pitch TFLGA	PTLG0085JB-A	85F0G	M3028BT-EPB-5	Emulation probe M3028BT-EPB Converter board M30280T-85LGF

\*1. For debugging, the combination of an emulation probe and a conversion board supporting the target MCU are used to connect to the user's system. Emulation probes and conversion boards can be purchased individually.



## Converter Board for M16C/Tiny Series \*1

Series	Group	MCU	Target MCU			Product name
			Package type	Package name	Previous code	
M16C/Tiny	M16C/26A (M16C/26A, M16C/26B, M16C/26T)	M30263	42 pin 0.8mm pitch SSOP	PRSP0042GA-B	42P2R-E	M30263T-42SSB
		M30260	48 pin 0.5mm pitch LQFP	PLQP0048KB-A	48P6Q-A	M30260T-48FPD
	M16C/28 (M16C/28, M16C/28B) M16C/29	M30281 M30291	64 pin 0.5mm pitch LQFP	PLQP0064KB-A	64P6Q-A	M30291T-64FPD
		M30280 M30290	80 pin 0.5mm pitch LQFP	PLQP0080KB-A	80P6Q-A	M30290T-80FPD
	M16C/28 (M16C/28, M16C/28B)	M30280	85 pin 0.65mm pitch TFLGA	PTLG0085JB-A	85F0G	M30280T-85LGF

\*1. A variety of other accessories are available. Visit the Renesas Technology Web site (<http://www.renesas.com/accessory>) for details.



## Operating Environment for M16C/Tiny Series Software Tools

Product type	Product name	Host machine (OS) *8
RTOS	M3T-MR30/4 *1	IBM PC/AT compatibles (Windows® XP, 2000)
C compiler package	M3T-NC30WA *2	IBM PC/AT compatibles (Windows® XP, 2000)
MISRA C rule checker	SQMIint *3	IBM PC/AT compatibles (Windows® XP, 2000)
IDE	High-performance Embedded Workshop *4	IBM PC/AT compatibles (Windows® XP, 2000)
Simulator debugger	Simulator Debugger for M16C and R8C/Tiny Series *5	IBM PC/AT compatibles (Windows® XP, 2000)
Emulator debugger	PC7501 Emulator Debugger for M16C and R8C/Tiny Series *6 Compact Emulator Debugger for M16C and R8C/Tiny Series *6 E8a Emulator Software *6	IBM PC/AT compatibles (Windows® XP, 2000)
Flash and PROM Programming	Flash Development Toolkit *7	IBM PC/AT compatibles (Windows® XP, 2000)

\*1. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).

\*2. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.

\*3. SQMIint MISRA C rule checker (Part No.: R0C0000SCW01R) is sold as the optional product of Renesas C compiler.

\*4. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.

\*5. Simulator debugger is included with C compiler package.

\*6. Emulator debugger is bundled with emulators.

\*7. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). The E8a emulator (Part No.: R0E00008AKCE00) is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.

\*8. Please refer to the following URL for Windows® Vista.  
[http://www.renesas.com/tool\\_env](http://www.renesas.com/tool_env)

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).

# Development Tools List

## R8C/Tiny Development tools for R8C/Tiny Series

MCU		Introductory tool	Software tool			Emulator (Emulator debugger is included. *6)				Programming tool		
Series	Group	Starter kit *1	RTOS	C compiler package *3	IDE	Onchip debugging emulator	Compact emulator	In-circuit emulator		Flash Programmer *12	IC socket board *13	
								Emulator	Emulation probe			
R8C/Tiny	R8C/18	—	M3T-MR30/4 *14	M3T-NC30WA *2 (MISRA C *4)	High-performance Embedded Workshop *5	E8a (R0E00008AKCE00) *7	R0E521000CPE00 *8	PC7501	R0E521000EPB00 *9	Flash Development Toolkit (R0C0000FDW04R) *10 (E8a emulator is necessary at programming.) or M16C Flash Starter M3A-0806 *11	M3A-0114	
	R8C/19	—									R0K521238Z000BR	
	R8C/1A	Renesas Starter Kit for R8C/1B (R0K5211B4S000BE)									—	R0K521258Z000BR
	R8C/1B	—									—	
	R8C/20	Renesas Starter Kit for R8C/23 (R0K521237S000BE)									—	R0K521276Z000BR
	R8C/21	—									—	—
	R8C/22	—									—	—
	R8C/23	—									—	—
	R8C/24	Renesas Starter Kit for R8C/25 (R0K521256S000BE)									—	—
	R8C/25	—									—	—
	R8C/26	Renesas Starter Kit for R8C/27 (R0K521276S000BE)	—	—								
	R8C/27	—	—	—								
	R8C/28	—	—	—								
	R8C/29	—	—	—								
	R8C/2A	—	—	—								
	R8C/2B	—	—	—								
	R8C/2C	Renesas Starter Kit for R8C/2D (R0K5212D8S000BE)	—	—								
	R8C/2D	—	—	—								
	R8C/2E	—	—	—								
	R8C/2F	—	—	—								
R8C/2G	—	—	—									
R8C/2H	—	—	—									
R8C/2J	—	—	—									
R8C/2K	—	—	—									
R8C/2L	—	—	—									

\*1. CPU board, E8 on-chip debugging emulator, software (High-Performance Embedded Workshop integrated development environment, M3T-NC30WA C compiler package evaluation version, E8 emulator software, Flash Development Toolkit evaluation version), etc., are included. Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).

\*2. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.

\*3. Evaluation version of C compiler package exists.

\*4. MISRA C rule checking functionality may be added by installing the optional SQMLint MISRA C rule checker (Part No.: R0C0000SCW01R).

\*5. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.

\*6. Each emulator includes an emulator debugger. Depending on the shipping date, the bundled emulator debugger may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).

\*7. The E8a emulator (Part No.: R0E00008AKCE00) includes emulator software (High-Performance Embedded Workshop integrated development environment, E8a emulator software, compiler evaluation version, Flash Development Toolkit evaluation version). Depending on the shipping date, the bundled software may include products or versions that are not the most recent ones available. The latest versions may be downloaded (free of charge) from the Renesas Technology Web site (<http://www.renesas.com/download>).

\*8. The conversion board for the target connection is necessary for R0E521000CPE00. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of Set Package of Compact Emulator for R8C/Tiny Series.

\*9. The conversion board for the target connection is necessary for R0E521000EPB00. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of "Set Package of PC7501 Emulation Probe for R8C/Tiny Series".

\*10. Flash Development Toolkit (Part No.: R0C0000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.

\*11. Flash Programmer which supports standard serial I/O mode 2 (UART) and includes the M16C Flash Starter Software (for Windows).

\*12. A variety of compatible programmers are available from our partner vendors. Contact the manufacturer regarding programmer details, supported MCUs and suitability for installation in a mass production or factory environment.

\*13. The IC socket board is a programming adapter that supports a specific programmer.

\*14. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).

\*\* Under development or evaluation: product name may be changed. When MCU is under development, restrictions and other limitation for tools may arise.

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).



## Set Package of Compact Emulator for R8C/Tiny Series

Target MCU		Product name	Components (Compact emulator and converter board are also sold separately.)	
Group	Package name		Compact emulator	Converter board *1
R8C/18 R8C/19 R8C/1A R8C/1B	PLSP0020JB-A Previous code : 20P2F-A (20-pin 0.65mm-pitch LSSOP)	R0E521174CPE00	R0E521000CPE00	R0E521174CSJ00
	PRDP0020BA-A Previous code : 20P4B (20-pin 1.778mm-pitch SDIP)	R0E521174CPE10		R0E521174CDB00
R8C/20 R8C/21 R8C/22 R8C/23	PLQP0048KB-A Previous code : 48P6Q-A (48-pin 0.5mm-pitch LQFP)	R0E521237CPE00		R0E521237CFK00
R8C/24 R8C/25	PLQP0052JA-A Previous code : 52P6A-A (52-pin 0.65mm-pitch LQFP)	R0E521258CPE00		R0E521258CFJ00
R8C/26 R8C/27	PLQP0032GB-A Previous code : 32P6U-A (32-pin 0.8mm-pitch LQFP)	R0E521276CPE00		R0E521276CFG00
R8C/28 R8C/29	PLSP0020JB-A Previous code : 20P2F-A (20-pin 0.65mm-pitch LSSOP)	R0E521174CPE00		R0E521174CSJ00
R8C/2A R8C/2B	PLQP0064KB-A Previous code : 64P6Q-A (64-pin 0.5mm-pitch LQFP)	R0E5212BACPE10		R0E5212BACFK00
	PLQP0064GA-A Previous code : 64P6U-A (64-pin 0.8mm-pitch LQFP)	R0E5212BACPE00		R0E5212BACFG00
R8C/2C R8C/2D	PLQP0080KB-A Previous code : 80P6Q-A (80-pin 0.5mm-pitch LQFP)	R0E5212DACPE00		R0E5212DACFK00
R8C/2K ★★	PLQP0032GB-A Previous code : 32P6U-A (32-pin 0.8mm-pitch LQFP)	R0E5212L4CPE00		R0E5212L4CFG00
R8C/2L ★★				

\*1. Converter board, socket for user system connection and user's manual are included.

★★Under development

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).





# Development Tools List

## **nb** Tiny **STAMP** Set Package of PC7501 Emulation probe for R8C/Tiny Series

Target MCU		Product name	Components (Compact emulator and converter board are also sold separately.)	
Group	Package name		Compact emulator	Converter board *1
R8C/18 R8C/19 R8C/1A R8C/1B	PLSP0020JB-A Previous code : 20P2F-A (20-pin 0.65mm-pitch LSSOP)	R0E521174EPB00	R0E521000EPB00	R0E521174CSJ00
	PRDP0020BA-A Previous code : 20P4B (20-pin 1.778mm-pitch SDIP)	R0E521174EPB10		R0E521174CDB00
R8C/20 R8C/21 R8C/22 R8C/23	PLQP0048KB-A Previous code : 48P6Q-A (48-pin 0.5mm-pitch LQFP)	R0E521237EPB00		R0E521237CFK00
R8C/24 R8C/25	PLQP0052JA-A Previous code : 52P6A-A (52-pin 0.65mm-pitch LQFP)	R0E521258EPB00		R0E521258CFJ00
R8C/26 R8C/27	PLQP0032GB-A Previous code : 32P6U-A (32-pin 0.8mm-pitch LQFP)	R0E521276EPB00		R0E521276CFG00
R8C/28 R8C/29	PLSP0020JB-A Previous code : 20P2F-A (20-pin 0.65mm-pitch LSSOP)	R0E521174EPB00		R0E521174CSJ00
R8C/2A R8C/2B	PLQP0064KB-A Previous code : 64P6Q-A (64-pin 0.5mm-pitch LQFP)	R0E5212BAEPB10		R0E5212BACFK00
	PLQP0064GA-A Previous code : 64P6U-A (64-pin 0.8mm-pitch LQFP)	R0E5212BAEPB00		R0E5212BACFG00
R8C/2C R8C/2D	(PLQP0080KB-A Previous code : 80P6Q-A (80-pin 0.5mm-pitch LQFP)	R0E5212DAEPB00		R0E5212DACFK00
R8C/2K ★★	PLQP0032GB-A Previous code : 32P6U-A (32-pin 0.8mm-pitch LQFP)	R0E5212L4EPB00 ★★		R0E5212L4CFG00 ★★
R8C/2L ★★				

\*1. Converter board, socket for user system connection and user's manual are included.  
★★Under development

Note: Evaluation versions of software tools are free of charge.  
Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).



## Operating Environment for R8C/Tiny Series Software Tools

Product type	Product name	Host machine (OS) *7
RTOS	M3T-MR30/4 *8	IBM PC/ATcompatibles (Windows® XP, 2000)
C compiler package	M3T-NC30WA *1	IBM PC/ATcompatibles (Windows® XP, 2000)
MISRA C rule checker	SQMIint *2	IBM PC/ATcompatibles (Windows® XP, 2000)
IDE	High-performance Embedded Workshop *3	IBM PC/ATcompatibles (Windows® XP, 2000)
Simulator debugger	Simulator Debugger for M16C and R8C/Tiny Series *4	IBM PC/ATcompatibles (Windows® XP, 2000)
Emulator debugger	PC7501 Emulator Debugger for M16C and R8C/Tiny Series *5 Compact Emulator Debugger for M16C and R8C/Tiny Series *5 E8a Emulator Software *5	IBM PC/ATcompatibles (Windows® XP, 2000)
Flash and PROM Programming	Flash Development Toolkit *6	IBM PC/ATcompatibles (Windows® XP, 2000)

\*1. The M3T-NC30WA includes an integrated development environment (High-Performance Embedded Workshop), C compiler, assembler and simulator debugger.

\*2. SQMIint MISRA C rule checker (Part No.: R0C00000SCW01R) is sold as the optional product of Renesas C compiler.

\*3. High-performance Embedded Workshop is included with C compiler package and Emulator debugger.

\*4. Simulator debugger is included with C compiler package.

\*5. Emulator debugger is bundled with emulators.

\*6. Flash Development Toolkit (Part No.: R0C00000FDW04R) is available in a product version (with technical support) and an evaluation version (without technical support). The E8a emulator (Part No.: R0E00008AKCE00) is necessary for programming. Visit the Renesas Technology Web site (<http://www.renesas.com/fdt>) to confirm support details for specific MCU product numbers.

\*7. Please refer to the following URL for Windows® Vista.

[http://www.renesas.com/tool\\_env](http://www.renesas.com/tool_env)

\*8. M3T-MR30/4 is a general term referring to the real-time OS development kit (M3T-MR30K/4) and the mass production contract (M3T-MR30S/4).

Note: Evaluation versions of software tools are free of charge.

Please refer to the following URL for details ([http://www.renesas.com/tool\\_evaluation](http://www.renesas.com/tool_evaluation)).

# Partners Tools

Powerful alliances between Renesas and its partner companies support the product development work of our customers.

## Coding Tools

**Altium Limited**  
 Renesas M16C Software Development Tool V.3.1  
 12A Rodborough Rd, Frenchs Forest NSW 2086  
 TEL: +61 2 9975 7710  
 FAX: +61 2 9975 7720  
 E-mail: info@altium.com  
 http://www.altium.com/tasking








**Gaio Technology Co., Ltd.**  
 IDE for embedded real-time systems OPEN plus  
 Gaio Technology, Inc.  
 TEL: 1-800-293-9053  
 FAX: 408-351-3370  
 E-mail: info@gaio.com  
 http://www.gaiotech.com/











**IAR Systems**  
 IAR Embedded Workbench®visualSTATE®  
 IAR Systems AB  
 PO Box 23051, SE75023 Uppsala, Sweden  
 TEL: +46 18 16 78 00  
 FAX: +46 18 16 78 38  
 E-mail: info@iar.se  
 http://www.iar.com




**KPIT Cummins Infosystems Limited**  
 KPIT GNU Tools  
 KPIT Infosystems Limited  
 Talisman House, 181-183 Kings Road Reading, Berkshire RG1 4EX, UK  
 TEL: +44 118 951 9400  
 FAX: +44 118 951 9409  
 E-mail: kpituk@kpitcummins.com  
 http://www.kpitgnutools.com/

**SEGGER Microcontroller Systeme GmbH**  
 IAR EWM16C, IAR EWM32C  
 TEL: +49 (0) 2103-2878-0  
 E-mail: info@segger.com  
 http://www.segger.com/

**Red Hat, Inc.**  
 Red Hat®GNUPro®  
 Red Hat, Inc.  
 TEL: +1-919-754-3700  
 http://www.redhat.com/

## Middleware & Drivers

**Altium Limited**  
 CMX MicroNet, CMX TCP/IP  
 12A Rodborough Rd, Frenchs Forest NSW 2086  
 TEL: +61 2 9975 7710  
 FAX: +61 2 9975 7720  
 E-mail: info@altium.com  
 http://www.altium.com/tasking








**CMX Systems, Inc.**  
 CMX TCP/IP, CMX-FFS, CMX-FFS-FAT, CMX-MicroNet  
 12276 San Jose Blvd, Suite 119, Jacksonville, FL 32223  
 TEL: +1 904-880-1840  
 FAX: +1 904-880-1632  
 E-mail: cmx@cmx.com  
 http://www.cmx.com/


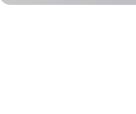








**IXXAT, Inc.**  
 DeviceNet, CANopen  
 120 Bedford Center Road, Bedford, NH, United States  
 TEL: +1 603-471-0800  
 E-mail: seitz@ixxat.com  
 http://www.ixxat.com

**Micrium**  
 uC/TCP-IP  
 949 Crestview Circle, Weston, FL U.S.  
 TEL: +1 954-217-2036  
 E-mail: jean.labrosse@micrium.com  
 http://www.dataio.com

**SEGGER Microcontroller Systeme GmbH**  
 emFile, emLoad, emWin  
 TEL: +49 (0) 2103-2878-0  
 E-mail: info@segger.com  
 http://www.segger.com/

**sevenstax GmbH**  
 Internet communication sevenstax  
 Hamburger Allee 43, 30161 Hannover  
 TEL: +49(0)511473 860 4  
 FAX: +49(0)721/151 505 622  
 info@sevenstax.de  
 http://www.sevenstax.de





**Thesycon Systemssoftware & Consulting GmbH**  
 USB Firmware Library - VUFIL  
 Werner-von-Siemens-Str. 2, Ilmenau, Thüringen, Germany  
 TEL: +49 3677 8462 0  
 E-mail: Ute.Eberhardt@thesycon.de  
 http://www.thesycon.de/vufil








**Ubiquitous Corporation**  
 TCP/IP-OS and Middleware  
 Shinjuku Center Bldg.10F, 1-25-1 Nishi-Shinjuku, Shinjuku-Ku, Tokyo 163-0610, JAPAN  
 TEL: +81-3-5908-3451  
 FAX: +81-3-5908-3452  
 info@ubiquitous.co.jp  
 http://www.ubiquitous.co.jp/







**Vector Informatik GmbH**  
 CANbedded  
 Ingersheimer Str.24, D-70499 Stuttgart  
 TEL: +49 711 80670-0  
 FAX: +49 711 80670-111  
 E-mail: info@vector-informatik.de  
 http://www.vector-informatik.de/








## OS

**Altium Limited**  
**CMX-RTX**  
 12A Rodborough Rd, Frenchs Forest  
 NSW 2086  
 TEL: +61 2 9975 7710  
 FAX: +61 2 9975 7720  
 E-mail: info@altium.com  
<http://www.altium.com/tasking>

**CMX Systems, Inc.**  
**CMX-Tiny+, CMX-RTX**  
 12276 San Jose Blvd, Suite 119,  
 Jacksonville, FL 32223  
 TEL: +1 904-880-1840  
 FAX: +1 904-880-1632  
 E-mail: cmx@cmx.com  
<http://www.cmx.com/>








**Elektrobit Automotive Software**  
**tresos ECU with OSEK Plug-in**  
 TEL: +81 (0)3 5775 6160  
 E-mail: info-jp@elektrobit.com  
<http://www.elektrobit.com>





**Enea Embedded Technology**  
**OSE Epsilon RTOS**  
 P.O. Box 1033 Skalholtsgatan 9  
 SE-164 21 Kista, Sweden  
 TEL: +46 (0)8 507 140 00  
 FAX: +46 (0)8 507 140 40  
 E-mail: info@enea.se  
<http://www.enea.com>








**ETAS Group**  
**RTA-OSEK**  
 LiveDevices, ETAS Group  
 Atlas House Link Business Park Osbaldwick  
 Link Road Osbaldwick York YO103JB, Great Britain  
 TEL: +44 1904 562580  
 FAX: +44 1904 562581  
 E-mail: info@livedevices.com  
<http://en.etasgroup.com/products/rtia/index.shtml>







**Mentor Graphics**  
**Nucleus iiPLUS, RTOS Nucleus PLUS**  
 Embedded Systems Division Headquarters  
 739 North University Blvd.  
 Mobile, AL 36608  
 TEL: (251) 661-5770  
 FAX: (251) 661-5788  
 info@acceleratedtechnology.com  
<http://www.mentor.com/embedded/>


**Micrium**  
**uC/OS-II**  
 949 Crestview Circle, Weston,  
 FL U.S.  
 TEL: +1 954-217-2036  
 E-mail: jean.labrosse@micrium.com  
<http://www.dataio.com>




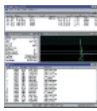


**Quadros Systems, Inc.**  
**Real-time OS RTX**  
 Quadros Systems, Inc. (formerly  
 Embedded Power Corporation)  
 E-mail: sales@quadros.com  
<http://www.quadros.com/>

**SCIOTPA Systems AG**  
**SCIOPTA Real-Time Operating System**  
 Fiechthagstrasse 19  
 103 Bottmingen / Basel, Schweiz  
 TEL: +41 61 423 10 62  
 FAX: +41 61 423 10 63  
 E-mail: sales@sciopta.com  
<http://www.sciopta.com>



**SEGGER Microcontroller Systeme GmbH**  
**Real-time OS embOS**  
 TEL: +49 (0) 2103-2878-0  
 E-mail: info@segger.com  
<http://www.segger.com/>



**Vector Informatik GmbH**  
**CANoe, osCAN**  
 Ingersheimer Str.24, D-70499 Stuttgart  
 TEL: +49 711 80670-0  
 FAX: +49 711 80670-111  
 E-mail: info@vector-informatik.de  
<http://www.vector-informatik.de/>





## Emulation & Debugging

**IAR Systems**  
**IAR C-SPY ROM-monitor debugger**  
**IAR C-SPY PC7501 emulator debugger**  
**IAR C-SPY E8 emulator debugger**  
 IAR Systems AB  
 PO Box 23051, SE75023 Uppsala, Sweden  
 TEL: +46 18 16 78 00  
 FAX: +46 18 16 78 38  
 E-mail: info@iar.se  
<http://www.iar.com>

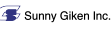





**Sophia Systems Co., Ltd.**  
**Emulator EJ-Debug, UniSTAC II, HyperSTAC**  
 6-2 Minami-kurokawa, Asao-ku,  
 Kawasaki-shi, Kanagawa, 215-8588, Japan  
 TEL: +81 44 989 7110  
 FAX: +81 44 989 7014  
 E-mail: sales@sophia.com  
<http://www.sophia.com>


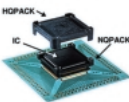








**Sunny Giken Inc.**  
**Compact emulator S30830T-CPE,**  
**S3062PT-CPE**  
 Renesas Solutions Corp.  
 E-mail: support\_apl@renesas.com  
<http://www.sunnygiken.co.jp/english/>

**Tokyo Eletech Corporation**  
**NQPACK families, SICA, CSPACK families**  
 3-10 Akihabara, Taito-ku TOKYO  
 110-0006 Japan  
 TEL: +81-3-5295-1661  
 FAX: +81-3-5295-1775  
 E-mail: info@tetc.co.jp  
<http://www.tetc.co.jp/>

**Yokogawa Digital Computer Corporation**  
**Emulator advicePlus, Emulator advice**  
 Keio-Fuchu 1-Chome Building, 3rd FL.,  
 1-9 Fuchicho, Fuchu-shi, Tokyo, 183-8516 Japan  
 TEL: +81-42-333-6222  
 FAX: +81-42-352-6107  
 E-mail: info-ovs@yokogawa-digital.com  
<http://www.yokogawa-digital.com/en/>



# Partners Tools

Powerful alliances between Renesas and its partner companies support the product development work of our customers.

## Flash & PROM Programming

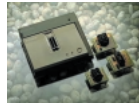
### BPM Microsystems

BP-2610, BP-2710, BP-2710M  
E-mail: [web@bpmicro.com](mailto:web@bpmicro.com)  
<http://www.bpmicro.com/>



### HI-LO System Research Co., Ltd.

Universal Programmer ALL-11  
TEL: +886-2-8792-3301  
FAX: +886-2-8792-3285  
E-mail: [sales@hilosystems.com.tw](mailto:sales@hilosystems.com.tw)  
<http://www.hilosystems.com.tw/>



### SEGGER Microcontroller Systeme GmbH

Programming tool for Renesas flash microcontrollers with on-chip flash Flasher 4

TEL: +49 (0) 2103-2878-0  
E-mail: [info@segger.com](mailto:info@segger.com)  
<http://www.segger.com/>



### System General Corp.

T9600  
1623 South Main Street, Milpitas, CA 95035  
TEL: +1 408-263-6667  
E-mail: [sales@systemgeneral.com](mailto:sales@systemgeneral.com)  
<http://www.systemgeneral.com/>



### Yokogawa Digital Computer Corporation

In-circuit Flash Micom Programmer MegaNETIMPRESS, C'arNETIMPRESS

J-Tower, 6th Fl., 1-1 Nikko-cho, Fuchu-shi, Tokyo, 183-0044 Japan  
TEL: +81-42-333-6224  
FAX: +81-42-352-6109  
E-mail: [info-impres@yokogawa-digital.com](mailto:info-impres@yokogawa-digital.com)  
<http://www.yokogawa-digital.com/en>



### Data I/O Corporation

FlashPAK, PS288/PS300, RoadRunner  
Redmond, WA USA  
TEL: +1 425-867-6893  
FAX: +1 425-881-2917  
E-mail: [rodgerb@data-io.com](mailto:rodgerb@data-io.com)  
<http://www.dataio.com>



### Leap Electronic Co., Ltd.

SU3000 Gang-8 programmer  
6F-4, No. 4, Lane 609, ChungHsin Rd., Sec. 5, Sanchung, Taipei Hsien, Taiwan  
TEL: +886 2 2999-1860  
FAX: +886 2 2999-9873  
E-mail: [service@leap.com.tw](mailto:service@leap.com.tw)  
<http://www.leap.com.tw>



### Suisei Electronics System Co., Ltd.

EFP-RC, EFP-S2/S2V

TEL: +81-6-6913-4531  
FAX: +81-6-6913-4534  
E-mail: [support@suisei.co.jp](mailto:support@suisei.co.jp)  
[http://www.suisei.co.jp/index\\_e.html](http://www.suisei.co.jp/index_e.html)



### Tokyo Eletech Corporation

SICA  
3-10 Akihabara, Taito-ku TOKYO 110-0006 Japan  
TEL: +81-3-5295-1661  
FAX: +81-3-5295-1775  
E-mail: [info@tetc.co.jp](mailto:info@tetc.co.jp)  
<http://www.tetc.co.jp/>



### Flash Support Group, Inc

Programmer AF9708, AF9709B, AF9723

9162-1 Miyakoda-cho, Hamamatsu-shi, Shizuoka 431-2102, Japan  
TEL: +81-53-428-8380  
FAX: +81-53-428-8377  
E-mail: [support@j-fsg.co.jp](mailto:support@j-fsg.co.jp)  
<http://www.j-fsg.co.jp/>



### Minato Electronics Inc.

Model 1894

TEL: +81-45-592-5549  
FAX: +81-45-591-5618  
E-mail: [h\\_kinoshita@minato.co.jp](mailto:h_kinoshita@minato.co.jp)  
[http://www.minato.co.jp/index\\_e.asp](http://www.minato.co.jp/index_e.asp)



### Sunny Giken Inc.

Flash Microcomputer Programmer S550-MFW1U, SFW-62SA

Renesas Solutions Corp.  
E-mail: [support\\_apl@renesas.com](mailto:support_apl@renesas.com)  
<http://www.sunnygiken.co.jp/english/>



### Wave Technology Co., Ltd.

Flash programming and testing system Y3000-8

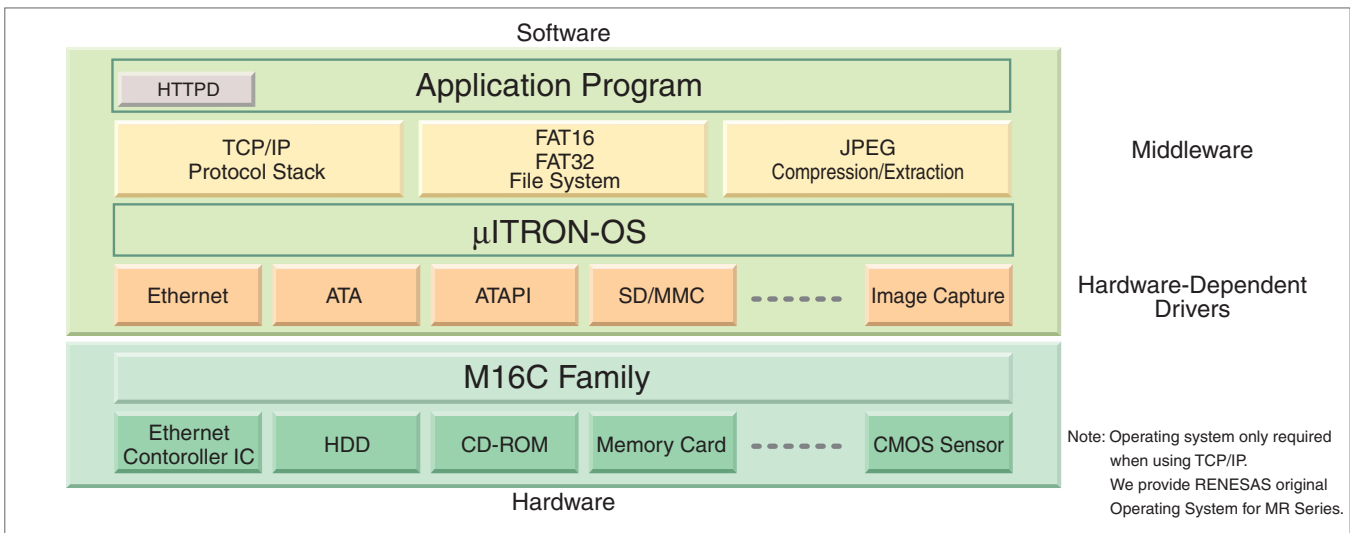
TEL: +81-3-5304-1885  
FAX: +81-3-5304-1886  
E-mail: [e\\_sales@y1000.com](mailto:e_sales@y1000.com)  
[http://www.y1000.com/index\\_e.html](http://www.y1000.com/index_e.html)





# Middleware

## M16C Middleware



## TCP/IP Protocol Stack

Two versions of the standard Internet protocol stack, slim and ultra-compact, are available for the M16C family. Both designed to use a minimum of ROM and RAM. Flexible support for a variety of applications.

### Features

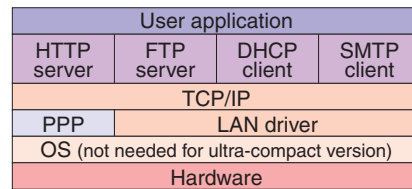
- Slim version (target MCUs: M16C/62 Group\*1)
    - Essential functions and a compact design (uses approx. 33 Kbytes of ROM).
    - Enables protocol processing using the MCU's on-chip memory.
  - Ultra-compact version (target MCUs: M16C/Tiny and R8C/Tiny Series)
    - The ultra-compact version required no OS (uses approx. 8 Kbytes of ROM) and can be stored in the on-chip memory of the Tiny Series.
- Note: See the lineup of Software Libraries to Support Tiny MCUs on the next page for details.

\*1. Compatible with M16C/62A, M16C/62M, M16C/62N, and M16C/62P

### Applications

Internet cameras, remote monitoring/control systems, Internet-capable home appliances, etc.

### Implementation model



## FAT File System

The FAT file system library provides data compatibility with PCs for various types of memory cards and enables storage of large-volume resources on hard disks to support the increasing popularity of broadband connections.

### Features

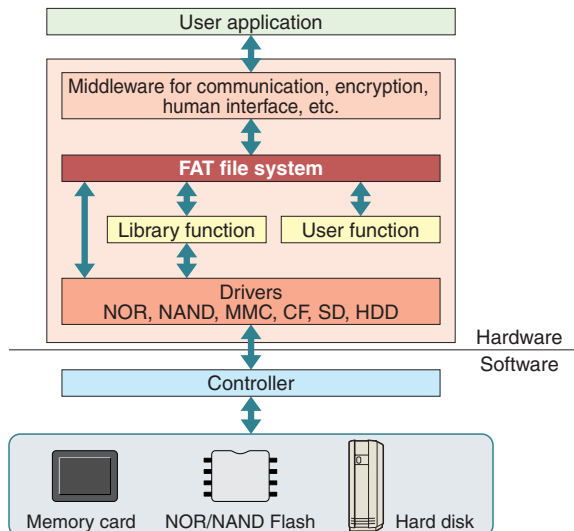
- Support for FAT12, FAT16, VFAT, and FAT32
- Support for multiple drives
- Support for long filenames and Japanese filenames
- Light version available with support for short filenames only (for M16C)
- Minimal memory usage, fast operation
- Includes sample source code for compact flash card driver

### Applications

Digital cameras, digital camcorders, hard disk drive video recorders, hard disk drive audio recorders, other PC-compatible data storage devices

### Total support from Renesas

Renesas provides developers with total support in the form of drivers for MCU and memory as well as middleware to enable efficient implementation of functions.



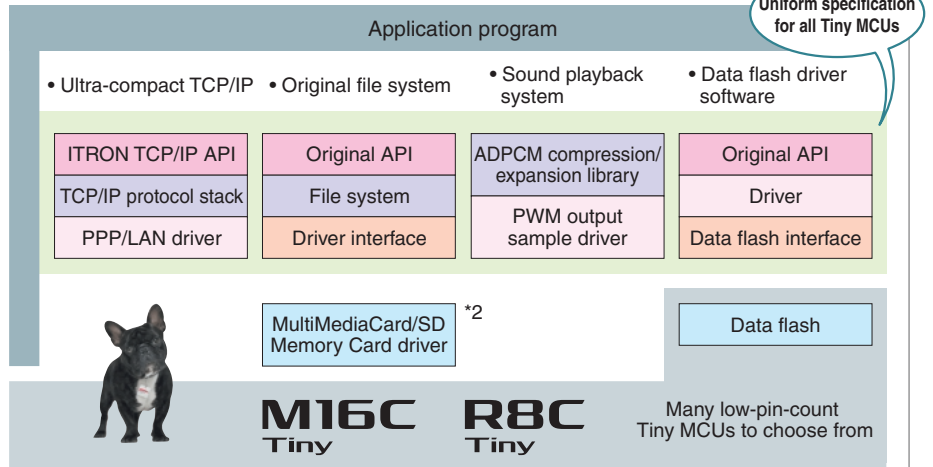
# Software Libraries to Support Tiny MCUs



[http://www.renesas.com/tiny\\_swlib](http://www.renesas.com/tiny_swlib)

Renesas supplies software libraries for evaluation purposes to customers using Tiny Series MCUs. Designed to be compact enough for embedding on a single chip, these programs are compatible with all Tiny MCUs. The software libraries for Tiny MCUs enable developers to create applied solutions for embedded devices essential in today's ubiquitously networked society, for example devices supporting remote operation via a network.

The programs composing the software libraries implement simple functions and are easy to use, making them ideal for use in training and evaluation. They can be embedded in systems that are mass produced,\*1 thereby helping bring down the final market cost of the product. Feel free to try them out and see what they can do for you.



\*1. Since they are intended for evaluation, these software libraries come with no warranty or support.

\*2. MultiMediaCard and SD Memory Card drivers are sold separately. Development of systems using MultiMediaCard (MMC) or SD Memory Card technology requires purchase of a license. For information on licensing, contact the MultiMediaCard Association or SD Card Association.

## Ultra-Compact TCP/IP Protocol Stack

This communication protocol software library achieves very compact size by keeping the number of functions to a bare minimum.

- Small memory requirements: Approx. 8 Kbytes of ROM and 0.5 Kbytes of RAM (in case of R8C/Tiny) (Enables TCP/IP protocol handling using the on-chip memory of a Tiny MCU.)
- No OS necessary.
- Conforms to ITRON TCP/IP API standard.
- Includes sample driver for LAN controller (RTL8019AS).
- Includes sample driver for PPP.

### Applications

- Remote device control/monitoring using mobile phone packet communication terminal (vehicle position data management, remote equipment malfunction diagnostics, etc.)
- Security services (communication of information on visitors/intruders to mobile phones, etc.)
- Centralized equipment management in office buildings and factories (management of climate control systems, lighting, sensors, etc.)

### Advanced version (under development)

An ultra-compact TCP/IP protocol stack with support for multiple communication terminals and higher data transfer speeds is currently under development.

## Original File System

The original file system supports storage of measurement data or history data and the reprogramming of internal memory with data stored on memory cards.

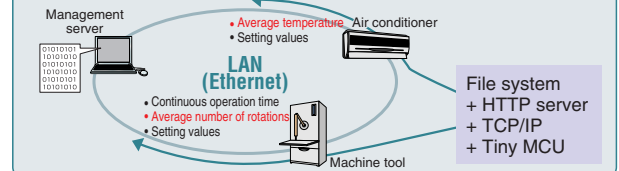
- Small memory requirements: Approx. 9.8 Kbytes of ROM and 256 bytes of RAM (in case of R8C/Tiny)
- No OS necessary. • File system uses original format.
- FAT file system conversion function provides compatibility with PC data.

### Applications

- Data storage and data logging on devices of various kinds
- Storage of personal user data on healthcare products, etc.
- Updating of programs and data on memory cards or devices that utilize data

### [Application example combining network middleware and file system]

Centralized equipment management in an office building or factory using a Web browser



### Advanced version (under development)

A version of the original file system with extended functionality, such as support for directory and user-defined filenames, is currently under development.

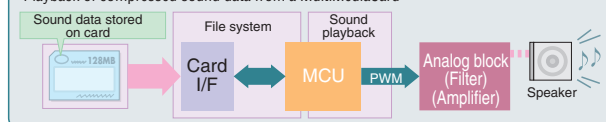
## Sound Playback System

This software enables sound output on any system incorporating a Tiny MCU. It can be used to add true sound output functionality to devices that previously only provided visual indications or beeps.

- Sound compression and expansion using exclusive ADPCM format.
- Small memory requirements: Approx. 0.6 Kbytes of ROM and 30 bytes of RAM (in case of R8C/Tiny)
- Includes sound compression/expansion utility (PC application) for compressing recorded sound data (in WAV format) on a PC. (The compressed data can then be used by the MCU.)
- Includes sample driver for PWM output.

### [Application example combining file system and sound playback]

Playback of compressed sound data from a MultiMediaCard



## Data Flash Driver Software

This block device driver enables the storing of data in data flash on R8C/Tiny and M16C/Tiny MCUs. It simplifies the task of building a data management system using data flash.

- Small memory requirements: Approx. 3 Kbytes of ROM and 100 bytes of RAM (including stack)
- Capable of handling different data sizes.
- Max. data update count: 1,000,000 times or more (depending on number and size of data units and the update count)
- Old data can be restored if system shutdown occurs during data update.
- Drive function interrupt/restart supported. This prevents the driver from monopolizing the CPU for an excessive length of time.



# Demo Sets

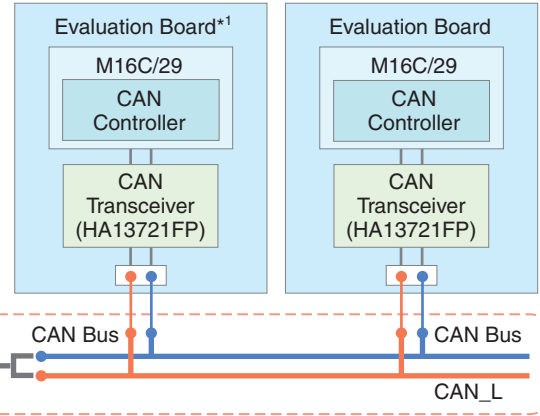
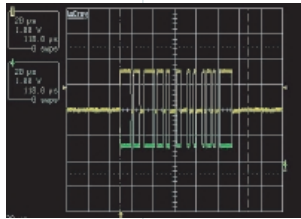
## CAN Communication Demo Set for Industrial Applications (M16C/29)

### ■ Features

- CAN employing starter kit for M16C/29  
Enables direct measurement of CAN communication waveforms on the bus.

### ○ CAN Controller Features

- Communication speed:  
Max. 1Mbps
- Bus length: 40m/1Mbps
- Protocol specification: Ver. 2.0B
- Hardware synchronization/resynchronization

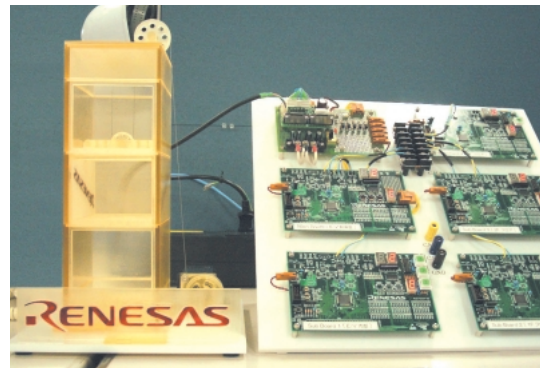
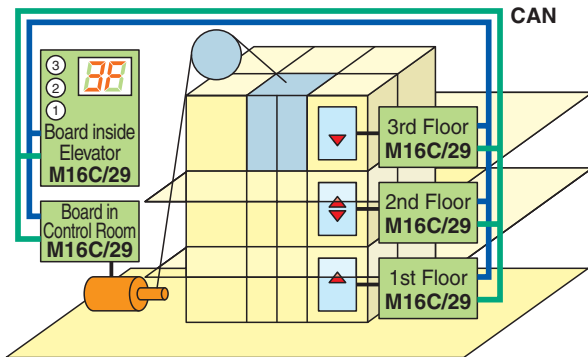


\*1. OAKS16-29CAN manufactured by Oaks Electronics Co., Ltd. used.

## Application of CAN MCUs in an Elevator (M16C)

### ■ Features

- Recreates an elevator system as an example of the use of CAN communication functionality.
- CAN communication is safe even from noise output from the motor.
- The M16C/29 can be used to implement both motor drive and CAN communication functions.



## Audio Decompression/Audio Output Demo Set (M16C/26A)

### ■ Features

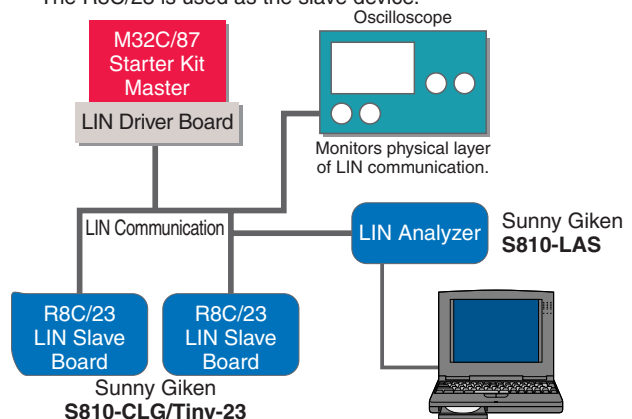
- Decompresses compressed audio data stored in the MCU's on-chip flash memory and produces PWM output for audio playback. The data compression format is ADPCM.
- The demo kit consists of an audio board (board with an amplifier, LPF, and compact speaker mounted on it) connected to the Renesas Starterkit for M16C/26A.



## LIN Communication Demo Set (M32C/87)

### ■ Features

- LIN communication is implemented using the M32C/87 as the master device.
- The R8C/23 is used as the slave device.













# Flash Memory Versions

## Memory Options (ROM/RAM)

ROM size (bytes)	RAM size (bytes)													
	256	384	512	768	1K	1.5K	2K	2.5K	3K	4K	5K	6K	8K	10K
2K	R8C/2J** R8C/2H**													
4K		R8C/18 R8C/1A R8C/2J**												
4K+2K		R8C/19 R8C/1B												
8K		R8C/2H**	R8C/10 R8C/11 R8C/14 R8C/16 R8C/18 R8C/1A R8C/26 R8C/28 R8C/2E**		R8C/2K**									
8K+2K			R8C/15 R8C/17 R8C/19 R8C/1B R8C/27 R8C/29 R8C/2F**		R8C/2L**									
8K+4K			R8C/12 R8C/13											
12K				R8C/10 R8C/11 R8C/14 R8C/16 R8C/18 R8C/1A										
12K+2K				R8C/15 R8C/17 R8C/19 R8C/1B										
12K+4K				R8C/12 R8C/13										
16K			R8C/2G**		R8C/10 R8C/11 R8C/14 R8C/16 R8C/18 R8C/1A R8C/24 R8C/26 R8C/28 R8C/2E**	R8C/2K**								
16K+2K					R8C/15 R8C/17 R8C/19 R8C/1B R8C/25 R8C/27 R8C/29 R8C/2F**	R8C/2L**								
16K+4K					R8C/12 R8C/13									
24K					R8C/2G**	R8C/26	R8C/24							
24K+2K						R8C/27	R8C/25							
24K+4K					M16C/26A									
32K					R8C/2G**	R8C/26	R8C/20 R8C/22 R8C/24							
32K+2K						R8C/27	R8C/21 R8C/23 R8C/25							

\*\* : Under Development

## Memory Options (ROM/RAM)

ROM size (bytes)	RAM size (bytes)																			
	2K	2.5K	3K	4K	5K	6K	7K	7.5K	8K	10K	12K	16K	18K	20K	24K	31K	40K	48K	63K	
48K		R8C/20 R8C/22 R8C/24 R8C/2A R8C/2C																		
48K+2K		R8C/21 R8C/23 R8C/25 R8C/2B R8C/2D																		
48K+4K	M16C/26A			M16C/28																
64K			R8C/20 R8C/22 R8C/24 R8C/2A R8C/2C						M16C/62N											
64K+2K			R8C/21 R8C/23 R8C/25 R8C/2B R8C/2D																	
64K+4K	M16C/26A		M16C/1N	M16C/28 M16C/62P																
96K					R8C/20 R8C/22 M16C/30P				R8C/2A R8C/2C											
96K+2K					R8C/21 R8C/23				R8C/2B R8C/2D											
96K+4K					M16C/30P				M16C/28 M16C/29											
128K					M16C/30P	R8C/20 R8C/22			R8C/2A R8C/2C		M16C/62A M16C/62N M16C/80									
128K+2K						R8C/21 R8C/23			R8C/2B R8C/2D											
128K+4K					M16C/6N M16C/30P						M16C/62P	M16C/28 M16C/29								
160K					M16C/30P							M16C/30P								
192K						M16C/30P						M16C/30P								
192K+4K						M16C/30P														
256K												M16C/30P			M16C/62A M16C/62N M16C/80					
256K+4K										M16C/6N					M16C/62P					
256K+24K												M16C/64**			M16C/65**					
320K+4K															M32C/88			M32C/84 M32C/85		
384K+4K															M32C/88			M32C/84 M32C/85 M32C/87	M16C/62P M16C/6N	
512K																			M32C/83	
512K+4K															M32C/88			M32C/84 M32C/85 M32C/87	M16C/62P M16C/6N	
512K+8K																				R32C/111**
512K+24K																				M16C/64**
768K+4K																				M32C/87
1MB+4K																				M32C/87

★★ : Under Development



# Flash Memory Versions

## Memory Options (Pin count)

		Pin count								
		20	32	42	48	52	64	80	85	100
ROM size (bytes)	2K	R8C/2J**								
	4K	R8C/18								
		R8C/1A								
		R8C/2H**								
		R8C/2J**								
	4K+2K	R8C/19								
		R8C/1B								
	8K	R8C/14	R8C/10							
		R8C/16	R8C/11							
		R8C/18	R8C/26							
		R8C/1A	R8C/2E**							
		R8C/28	R8C/2K**							
		R8C/2H**								
	8K+2K	R8C/15	R8C/27							
		R8C/17	R8C/2F**							
		R8C/19	R8C/2L**							
		R8C/1B								
R8C/29										
8K+4K		R8C/12								
		R8C/13								
12K	R8C/14	R8C/10								
	R8C/16	R8C/11								
	R8C/18									
	R8C/1A									
12K+2K	R8C/15									
	R8C/17									
	R8C/19									
	R8C/1B									
12K+4K		R8C/12								
		R8C/13								
16K	R8C/14	R8C/10				R8C/24				
	R8C/16	R8C/11								
	R8C/18	R8C/26								
	R8C/1A	R8C/2E**								
	R8C/28	R8C/2G**								
		R8C/2K**								
16K+2K	R8C/15	R8C/27				R8C/25				
	R8C/17	R8C/2F**								
	R8C/19	R8C/2L**								
	R8C/1B									
	R8C/29									
16K+4K		R8C/12								
		R8C/13								
24K		R8C/26				R8C/24				
		R8C/2G**								
24K+2K		R8C/27				R8C/25				
24K+4K			M16C/26A	M16C/26A						
32K		R8C/26			R8C/20	R8C/24				
		R8C/2G**			R8C/22					
32K+2K		R8C/27			R8C/21	R8C/25				
					R8C/23					

★★: Under Development



## Memory Options (Pin count)

	Pin count								
	42	48	52	64	80	85	100	128	144
48K		R8C/20 R8C/22	R8C/24	R8C/2A	R8C/2C				
48K+2K		R8C/21 R8C/23	R8C/25	R8C/2B	R8C/2D				
48K+4K	M16C/26A	M16C/26A		M16C/28	M16C/28	M16C/28			
64K		R8C/20 R8C/22	R8C/24	R8C/2A	R8C/2C				
64K+2K		R8C/21 R8C/23	R8C/25	R8C/2B	R8C/2D				
64K+4K	M16C/26A	M16C/26A M16C/1N		M16C/28	M16C/28 M16C/62P	M16C/28			
96K		R8C/20 R8C/22		R8C/2A	R8C/2C		M16C/30P		
96K+2K		R8C/21 R8C/23		R8C/2B	R8C/2D				
96K+4K				M16C/28 M16C/29	M16C/28 M16C/29	M16C/28	M16C/30P		
128K		R8C/20 R8C/22		R8C/2A	R8C/2C		M16C/30P M16C/62A M16C/62N M16C/80		M16C/80
128K+2K		R8C/21 R8C/23		R8C/2B	R8C/2D				
128K+4K				M16C/28 M16C/29	M16C/28 M16C/29 M16C/62P		M16C/30P M16C/62P M16C/6N		
160K							M16C/30P		
192K							M16C/30P		
192K+4K							M16C/30P		
256K							M16C/62A M16C/30P M16C/62N M16C/80		M16C/80
256K+4K							M16C/62P M16C/6N	M16C/62P	
256K+24K							M16C/64** M16C/65**	M16C/65**	
320K+4K							M32C/84 M32C/85 M32C/88		M32C/84 M32C/85 M32C/88
384K+4K							M16C/62P M16C/6N M32C/84 M32C/85 M32C/87 M32C/88	M16C/62P M16C/6N	M32C/84 M32C/85 M32C/88 M32C/87
512K							M32C/83		M32C/83
512K+4K							M16C/62P M16C/6N M32C/84 M32C/85 M32C/87 M32C/88	M16C/62P M16C/6N	M32C/84 M32C/85 M32C/88 M32C/87
512K+8K							R32C/111**		
512K+24K							M16C/64**		
768K+4K							M32C/87		M32C/87
1MB+4K							M32C/87		M32C/87

★★: Under Development



# Mask Versions

## Memory Options (ROM/RAM)

		RAM size (bytes)													
		1K	2K	3K	4K	5K	6K	8K	10K	12K	16K	18K	20K	24K	31K
ROM size (bytes)	ROM Less			M16C/62P			M16C/30P	M32C/80	M16C/80 M16C/62P M32C/84	M32C/8A			M16C/62P	M16C/80 M32C/8A**	M16C/62P
	24K	M16C/26A													
	32K	M16C/1N		M16C/62A											
	48K		M16C/26A		M16C/62P										
	64K		M16C/26A	M16C/1N	M16C/28 M16C/29 M16C/62A M16C/62P				M16C/62A						
	96K					M16C/30P M16C/62A M16C/62P		M16C/28 M16C/29	M16C/62A						
	128K					M16C/30P M16C/39P M16C/62A M16C/6N			M16C/62A M16C/62N M16C/62P M16C/80 M32C/81 M32C/84	M16C/28 M16C/29 M16C/62N M32C/81					
	160K						M16C/30P								
	192K						M16C/30P M16C/39P			M16C/62P	M16C/6N				
	256K								M16C/6N	M16C/62P			M16C/62A M16C/62N M16C/62P M16C/6N M16C/80 M32C/84 M32C/85		
	320K										M16C/62P			M16C/62P M32C/82 M32C/84 M32C/85	M16C/62P
	384K										M16C/62P			M16C/62P M32C/82 M32C/84 M32C/85 M32C/87	M16C/62P M32C/82
	512K														

\*\* : Under Development

## Memory Options (Pin count)

		Pin count						
		42	48	64	80	100	128	144
ROM size (bytes)	ROM Less					M16C/62P M16C/80 M32C/8A M32C/80 M32C/84		M16C/80 M32C/8A M32C/84
	24K	M16C/26A	M16C/26A					
	32K		M16C/1N		M16C/62N	M16C/62A		
	48K	M16C/26A	M16C/26A		M16C/62P	M16C/62P		
	64K	M16C/26A	M16C/26A M16C/1N	M16C/28 M16C/29	M16C/28 M16C/29 M16C/62A M16C/62P	M16C/62A M16C/62P		
	96K			M16C/28 M16C/29	M16C/28 M16C/29 M16C/62A M16C/62P	M16C/30P M16C/62A M16C/62P		
	128K			M16C/28 M16C/29	M16C/28 M16C/29 M16C/62A M16C/62P	M16C/30P M16C/39P M16C/62A M16C/62N M16C/62P M16C/6N M16C/80 M32C/81 M32C/84		M32C/81 M32C/84
	160K					M16C/30P		
	192K					M16C/30P M16C/39P M16C/62P M16C/6N	M16C/62P M16C/6N	
	256K				M16C/62A M16C/62N	M16C/62A M16C/62N M16C/62P M16C/6N M16C/80	M16C/62P M16C/6N	M16C/80
	320K					M16C/62P M32C/82 M32C/84 M32C/85	M16C/62P	M32C/82 M32C/84 M32C/85
384K					M16C/62P M32C/82 M32C/87	M16C/62P	M32C/82 M32C/87	
512K					M32C/87		M32C/87	



# Products Lineup

## • Specifications (M32C/80 Series)

Group		M32C/8A	M32C/80			M32C/81						
Memory	ROM (Bytes)		-			128K						
	RAM (Bytes)	12K	8K			10K		12K				
	ROM Type*1		L			M						
	Data Flash					-						
	Program Security					-						
CPU	CPU					M32C/80 Core						
	Basic Instructions					10B						
	Minimum Instruction Execution Time (ns)					31.3 (@32MHz)						
	Multiplier					16 × 16 → 32						
	Multiply-Accumulate Instruction					16 × 16 + 48 → 48						
	Barrel Shifter					Yes						
DMA	DMAC (Channels)					4						
	DTC/DMACII					DMACII (Starts by all peripheral interrupt factors)						
External Bus Expansion	Address Space (Bytes)					16M						
	External Bus Interface	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals, Page mode support	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals			Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals						
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)										
	DRAM Controller		-			Yes						
Clock	Clock Generation Circuit					4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)						
	PLL					Yes						
	Subclock					Yes						
	On-Chip Oscillator					Yes						
	Oscillation Stop Detection					Yes						
	Frequency Divider					1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)						
	Power Save					Wait/Stop						
Power Supply Voltage Detection	Power-On Reset/POR					-						
	Low Voltage Detection/LVD		Yes (Low voltage)			-						
A/D Converter	Resolution × Channels		10-bit × 10			10-bit × 26		10-bit × 34	10-bit × 26	10-bit × 34		
	Sample and Hold					Yes						
	Multi-Channel Sample and Hold					-						
D/A Converter	Resolution × Channels					8-bit × 2						
	8-bit					-						
Timer	16-bit					11 (Timer A, Timer B)						
	Input Capture		-			5 (Intelligent I/O)		12 (Intelligent I/O)	5 (Intelligent I/O)	12 (Intelligent I/O)		
	Output Compare		-			8 (Intelligent I/O)		20 (Intelligent I/O)	8 (Intelligent I/O)	20 (Intelligent I/O)		
	PWM Output		5 (Timer A)			13 (Timer A, Intelligent I/O)		25 (Timer A, Intelligent I/O)	13 (Timer A, Intelligent I/O)	25 (Timer A, Intelligent I/O)		
	Real-Time Port		-			3 (Intelligent I/O)		8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)		
	Event Counter					11 (Timer A, Timer B)						
	2-Phase Encoder Input		3 (Timer A)			3 (Timer A) + 2 (Intelligent I/O)						
	3-Phase Inverter Control					1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)						
	Watchdog Timer					1						
Serial Interface	Clock Sync./ Clock Async.		5 (UART)			7 (UART, Intelligent I/O)						
	Clock Sync. Only		2 (Intelligent I/O)			1 (Intelligent I/O)						
	Clock Async. Only					-						
I <sup>2</sup> C-bus					5 (UART)							
IEBus		5 (UART)			6 (UART, Intelligent I/O)							
Smart Card/SIM					5 (UART)							
Synchronous Serial Communication Unit/Special Serial I/O					5 (UART)							
CAN	Channels		-			1						
	Message Box (Numbers)		-			16						
IrDA					-							
CRC Calculation Circuit					1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))							
X/Y Converter	Input Only (Numbers)					Yes						
	CMOS I/O (Numbers)		45			85		121	85	121		
	N-Channel Open Drain Port (Numbers)					2						
	High Current Drive Port					-						
	Pull-Up Resistor		45			85		121	85	121		
External Interrupts Pins					11							
Debugging Function	On-Chip Debug					-						
	On-Board Flash Program					-						
Other Functions	ROM Correction Function		-			Yes						
	Others					3V, 5V Interface						
Operating Frequency/Supply Voltage		32MHz/4.2 to 5.5V, 24MHz/3.0 to 5.5V			32MHz/4.2 to 5.5V, 20MHz/3.0 to 5.5V							
Operating Ambient Temperature (°C)					- 20 to 85, - 40 to 85							
Package*2		PLQP0100KB-A	PROP0100JB-A	PLQP0100KB-A	PROP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PROP0100JB-A	PLQP0100KB-A	PLQP0144KA-A		
Part No.		M308A0SGP*	M30800SAFF	M30800SAFF-BL <sup>Non</sup>	M30800SAGP	M30800SAGP-BL <sup>Non</sup>	M30810MC-XXXXFP	M30810MC-XXXXGP	M30812MC-XXXXGP	M3081LMC-XXXXFP	M3081LMC-XXXXGP	M3081NMC-XXXXGP

\*1 Built-in boot loader function ROM-less version

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (M32C/80 Series)

Group		M32C/82								M32C/83			
Memory	ROM (Bytes)	320K				384K				512K			
	RAM (Bytes)	24K								31K			
	ROM Type**1					M				F			
	Data Flash					-							
	Program Security					-				Yes (ID Code Check Function, ROM Code Protect Function)			
CPU	CPU	M32C/80 Core											
	Basic Instructions	108											
	Minimum Instruction Execution Time (ns)	33.3 (@30MHz)											
	Multiplier	16 × 16 → 32											
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 48 → 48											
DMA	DMAC (Channels)	4											
	DTC/DMACII	DMACII (Starts by all peripheral interrupt factors)											
External Bus Expansion	Address Space (Bytes)	16M											
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals											
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)											
	DRAM Controller	Yes											
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)											
	PLL	Yes											
	Subclock	Yes											
	On-Chip Oscillator	Yes											
	Oscillation Stop Detection	Yes											
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)											
Power Supply Voltage Detection	Power Save	Wait/Stop											
	Power-On Reset/POR	-											
A/D Converter	Low Voltage Detection/LVD	-											
	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26 (2 circuits)	10-bit × 34 (2 circuits)				
D/A Converter	Sample and Hold	Yes											
	Multi-Channel Sample and Hold	-											
Timer	Resolution × Channels	8-bit × 2											
	8-bit	-											
	16-bit	11 (Timer A, Timer B)											
	Input Capture	5 (Intelligent I/O)	12 (Intelligent I/O)	5 (Intelligent I/O)	12 (Intelligent I/O)	5 (Intelligent I/O)	12 (Intelligent I/O)	5 (Intelligent I/O)	12 (Intelligent I/O)	5 (Intelligent I/O)	12 (Intelligent I/O)		
	Output Compare	8 (Intelligent I/O)	20 (Intelligent I/O)	8 (Intelligent I/O)	20 (Intelligent I/O)	8 (Intelligent I/O)	20 (Intelligent I/O)	8 (Intelligent I/O)	20 (Intelligent I/O)	10 (Intelligent I/O)	28 (Intelligent I/O)		
	PWM Output	13 (Timer A, Intelligent I/O)	25 (Timer A, Intelligent I/O)	13 (Timer A, Intelligent I/O)	25 (Timer A, Intelligent I/O)	13 (Timer A, Intelligent I/O)	25 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	32 (Timer A, Intelligent I/O)				
	Real-Time Port	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	4 (Intelligent I/O)	16 (Intelligent I/O)				
	Event Counter	11 (Timer A, Timer B)											
	2-Phase Encoder Input	3 (Timer A) + 2 (Intelligent I/O)											
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)											
Watchdog Timer		1											
	Clock Sync./ Clock Async.	7 (UART, Intelligent I/O)											
Serial Interface	Clock Sync. Only	1 (Intelligent I/O)								2 (Intelligent I/O)			
	Clock Async. Only	-											
I <sup>2</sup> C-bus		5 (UART)											
IEBus		6 (UART, Intelligent I/O)											
Smart Card/SIM		5 (UART)											
Synchronous Serial Communication Unit/Special Serial I/O		5 (UART)											
CAN	Channels	-											
	Message Box (Numbers)	-											
IrDA		-											
	CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))											
X/Y Converter		Yes											
		-											
I/O Ports	Input Only (Numbers)	1											
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121		
	N-Channel Open Drain Port (Numbers)	2											
	High Current Drive Port	-											
	Pull-Up Resistor	85	121	85	121	85	121	85	121	85	121		
External Interrupts Pins		11											
	On-Chip Debug	-											
Debugging Function	On-Board Flash Program	-											
	ROM Correction Function	Yes											
Other Functions		-											
	Others	-											
Operating Frequency/Supply Voltage		30MHz/4.2 to 5.5V, 20MHz/3.0 to 5.5V								32MHz/4.2 to 5.5V, 20MHz/3.0 to 5.5V			
Operating Ambient Temperature (°C)		-20 to 85, -40 to 85											
Package**2		PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A
		M30823MW-XXXXFP	M30823MW-XXXGJP	M30825MW-XXXGJP	M30823MH-XXXXFP	M30823MH-XXXGJP	M30825MH-XXXGJP	M30826MH-XXXXFP	M30826MH-XXXGJP	M30828MH-XXXGJP	M30833F-JFP	M30833F-JGP	M30835F-JGP

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



# Products Lineup

## • Specifications (M32C/80 Series)

Group		M32C/84																		
Memory	ROM (Bytes)	-		128K		320K		320K + 4K		384K		320K + 4K		512K + 4K						
	RAM (Bytes)	10K																		
	ROM Type*1	L			M			F			M			F						
	Data Flash	-			-			Yes (4K)			-			Yes (4K)						
	Program Security	-			-			Yes (ID Code Check Function, ROM Code Protect Function)			-			Yes (ID Code Check Function, ROM Code Protect Function)						
CPU	M32C/80 Core																			
	Basic Instructions	108																		
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)																		
	Multiplier	16 × 16 → 32																		
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48																		
DMA	DMAC (Channels)	4																		
	DTC/DMACII	DMACII (Starts by all peripheral interrupt factors)																		
External Bus Expansion	Address Space (Bytes)	16M																		
	External Bus Interface	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals, Page mode support		Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals																
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)																		
Clock	DRAM Controller	-																		
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)																		
	PLL	Yes																		
	Subclock	Yes																		
	On-Chip Oscillator	Yes																		
	Oscillation Stop Detection	Yes																		
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)																		
Power Supply Voltage Detection	Power Save	Wait/Stop																		
	Power-On Reset/POR	-																		
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)																		
	Resolution × Channels	10-bit × 10	10-bit × 18	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34					
	Sample and Hold	Yes																		
D/A Converter	Multi-Channel Sample and Hold	-																		
	Resolution × Channels	8-bit × 2																		
Timer	8-bit	-																		
	16-bit	11 (Timer A, Timer B)																		
	Input Capture	8 (Intelligent I/O)																		
	Output Compare	8 (Intelligent I/O)																		
	PWM Output	13 (Timer A, Intelligent I/O)																		
	Real-Time Port	-																		
	Event Counter	11 (Timer, Timer B)																		
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)																		
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																		
		1																		
		6 (UART, Intelligent I/O)																		
Serial Interface	Clock Sync./ Clock Async.	1 (Intelligent I/O)																		
	Clock Sync. Only	-																		
	Clock Async. Only	-																		
I <sup>2</sup> C-bus		5 (UART)																		
	IEBus	5 (UART)																		
Smart Card/SIM		5 (UART)																		
	Synchronous Serial Communication Unit/Special Serial I/O	5 (UART)																		
CAN	Channels	1																		
	Message Box (Numbers)	16																		
IrDA		-																		
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>3</sup> + 1))																		
X/Y Converter		Yes																		
	Input Only (Numbers)	1																		
	CMOS I/O (Numbers)	45	81	85	121	85	121	85	121	85	121	85	121	85	121					
	N-Channel Open Drain Port (Numbers)	2																		
	High Current Drive Port	-																		
External Interrupts Pins	Pull-Up Resistor	45	81	85	121	85	121	85	121	85	121	85	121	85	121					
		11																		
Debugging Function	On-Chip Debug	-			-			Yes			-			Yes						
	On-Board Flash Program	-			-			Yes			-			Yes						
Other Functions	ROM Correction Function	-			Yes			-			Yes			-						
	Others	3V, 5V Interface																		
Operating Frequency/Supply Voltage		32MHz/4.2 to 5.5V, 24MHz/3.0 to 5.5V																		
Operating Ambient Temperature (°C)		- 20 to 85, - 40 to 85																		
Package*2		PRQP0100JB-A	PLOP0100KB-A	PLOP0144KA-A	PRQP0100JB-A	PLOP0100KB-A	PLOP0144KA-A	PRQP0100JB-A	PLOP0100KB-A	PLOP0144KA-A	PRQP0100JB-A	PLOP0100KB-A	PLOP0144KA-A	PRQP0100JB-A	PLOP0100KB-A	PLOP0144KA-A				
		M30840SFP	M30840SGP	M30842SGP	M30840MC-XXXFP*	M30840MC-XXXGP*	M30842MC-XXXGP*	M30843MW-XXXFP	M30843MW-XXXGP	M30845MW-XXXGP	M30843FWGP	M30845FWGP	M30843MH-XXXGP**	M30845MH-XXXGP**	M30843FHFP	M30843FHGP	M30845FHGP	M30843FJFP	M30843FJGP	M30845FJGP
	Part No.																			

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

## • Specifications (M32C/80 Series)

Group		M32C/85													
Memory	ROM (Bytes)	320K		320K + 4K		384K		384K + 4K		512K + 4K					
	RAM (Bytes)	24K													
	ROM Type**1	M		F		M		F							
	Data Flash	-		Yes (4K)		-		Yes (4K)							
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)							
CPU	CPU	M32C/80 Core													
	Basic Instructions	10B													
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)													
	Multiplier	16 × 16 → 32													
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 48 → 48													
DMA	DMAC (Channels)	4													
	DTC/DMACII	DMACII (Starts by all peripheral interrupt factors)													
External Bus Expansion	Address Space (Bytes)	16M													
	External Bus Interface	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals													
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)													
Clock	DRAM Controller	-													
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)													
	PLL	Yes													
	Subclock	Yes													
	On-Chip Oscillator	Yes													
	Oscillation Stop Detection	Yes													
Power Supply Voltage Detection	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)													
	Power Save	Wait/Stop													
A/D Converter	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34				
	Sample and Hold	Yes													
	Multi-Channel Sample and Hold	-													
D/A Converter	Resolution × Channels	8-bit × 2													
	8-bit	-													
Timer	16-bit	11 (Timer A, Timer B)													
	Input Capture	8 (Intelligent I/O)													
	Output Compare	8 (Intelligent I/O)													
	PWM Output	13 (Timer A, Intelligent I/O)													
	Real-Time Port	-													
	Event Counter	11 (Timer A, Timer B)													
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)													
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)													
Watchdog Timer		1													
	Clock Sync./ Clock Async.	6 (UART, Intelligent I/O)													
Serial Interface	Clock Sync. Only	1 (Intelligent I/O)													
	Clock Async. Only	-													
I <sup>2</sup> C-bus	5 (UART)														
IEBus	5 (UART)														
Smart Card/SIM	5 (UART)														
Synchronous Serial Communication Unit/Special Serial I/O	5 (UART)														
CAN	Channels	2													
	Message Box (Numbers)	16 × 2													
IrDA	-														
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))														
X/Y Converter		Yes													
	Input Only (Numbers)	1													
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121				
	N-Channel Open Drain Port (Numbers)	2													
I/O Ports	High Current Drive Port	-													
	Pull-Up Resistor	85	121	85	121	85	121	85	121	85	121				
External Interrupts Pins	11														
Debugging Function	On-Chip Debug	-		Yes		-		-		Yes					
	On-Board Flash Program	-		Yes		-		-		Yes					
Other Functions	ROM Correction Function	Yes		-		-		Yes		-					
	Others	3V, 5V Interface													
Operating Frequency/Supply Voltage	32MHz/4.2 to 5.5V, 24MHz/3.0 to 5.5V														
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85														
Package*2		PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0144KA-A
		M30853MW-XXFP	M30853MW-XXGP	M30853MW-XXGP	M30853FWFP	M30853FWGP	M30853FWGP	M30853MH-XXGP**	M30853MH-XXGP**	M30853FHFP	M30853FHGP	M30853FHGP	M30853FJFP	M30853FJGP	M30853FJGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

# Products Lineup

## • Specifications (M32C/80 Series)

Group		M32C/87 (M32C/87)										M32C/87 (M32C/87A)							
Memory	ROM (Bytes)	384K		384K + 4K		512K		512K + 4K		768K + 4K		1M + 4K		384K		384K + 4K		512K	
	RAM (Bytes)	24K																	
	ROM Type*1	M			F			M			F			M			F		
	Data Flash	-		Yes (4K)		-		-		-		Yes (4K)		-		Yes (4K)		-	
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		-		-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-	
CPU	M32C/80 Core																		
	Basic Instructions	108																	
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)																	
	Multiplier	16 × 16 → 32																	
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48																	
DMA	Barrel Shifter	Yes																	
	DMAC (Channels)	4																	
External Bus Expansion	DTC/DMACII	DMACII (Starts by all peripheral interrupt factors)																	
	Address Space (Bytes)	16M																	
	External Bus Interface	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals																	
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)																	
Clock	DRAM Controller	-																	
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)																	
	PLL	Yes																	
	Subclock	Yes																	
	On-Chip Oscillator	Yes																	
	Oscillation Stop Detection	Yes																	
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)																	
Power Supply Voltage Detection	Power Save	Wait/Stop																	
	Power-On Reset/POR	-																	
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)																	
	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34
	Sample and Hold	Yes																	
D/A Converter	Multi-Channel Sample and Hold	-																	
	Resolution × Channels	8-bit × 2																	
Timer	8-bit	-																	
	16-bit	11 (Timer A, Timer B)																	
	Input Capture	8 (Intelligent I/O)																	
	Output Compare	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)
	PWM Output	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)
	Real-Time Port	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)
	Event Counter	11 (Timer A, Timer B)																	
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)																	
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																	
	Watchdog Timer	1																	
Clock Sync./ Clock Async.		7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)
Clock Sync. Only		2 (Intelligent I/O)																	
I <sup>2</sup> C-bus	Clock Async. Only	-																	
	5 (UART)																		
IEBus	6 (UART, Intelligent I/O)																		
Smart Card/SIM	5 (UART)																		
Synchronous Serial Communication Unit/Special Serial I/O	5 (UART)																		
	CAN	2																	
IrDA	Channels	2																	
	Message Box (Numbers)	16 × 2																	
CRC Calculation Circuit	Yes (UART)																		
	X/Y Converter	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																	
I/O Ports	Input Only (Numbers)	1																	
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121
	N-Channel Open Drain Port (Numbers)	2																	
	High Current Drive Port	-																	
	Pull-Up Resistor	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121
External Interrupts Pins	11																		
	14																		
Debugging Function	On-Chip Debug	-		Yes		-		-		Yes		-		-		Yes		-	
	On-Board Flash Program	-		Yes		-		-		Yes		-		-		Yes		-	
Other Functions	ROM Correction Function	Yes		-		Yes		-		-		-		Yes		-		Yes	
	Others	3V, 5V Interface																	
Operating Frequency/Supply Voltage	32MHz/4.2 to 5.5V, 24MHz/3.0 to 5.5V																		
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85																		
Package**	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PRQP0100JB-A																		
	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PRQP0100JB-A																		
	PLOP0100KB-A																		
	PLOP0144KA-A																		
	PRQP0100JB-A																		
	PLOP0100KB-A																		
Part No.	M30873MH-XXXXGP																		
	M30875MH-XXXXGP																		
	M30873FHGP																		
	M30875FHGP																		
	M30876MJ-XXXXFP																		
	M30876MJ-XXXXGP																		
	M30878MJ-XXXXGP																		
	M30876FJ-GP																		
	M30878FJ-GP																		
	M30879FKGP																		
	M3087BFKGP																		
	M30879FLFP																		
	M30879FLGP																		
	M30879FLGP																		
	M30873MHA-XXXXGP																		
	M30875MHA-XXXXGP																		
M30873FHAGP																			
M30875FHAGP																			
M30876MJA-XXXXFP																			
M30876MJA-XXXXGP																			
M30878MJA-XXXXGP																			

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



• Specifications (M32C/80 Series)

Group		M32C/87 (M32C/87A)								M32C/87 (M32C/87B)											
Memory	ROM (Bytes)	512K + 4K		768K + 4K		1M + 4K		384K		384K + 4K		512K		512K + 4K		768K + 4K		1M + 4K			
	RAM (Bytes)	31K				48K				24K				31K				48K			
	ROM Type**	F				M				F				M				F			
	Data Flash	Yes (4K)				-				Yes (4K)				-				Yes (4K)			
Program Security	Yes (ID Code Check Function, ROM Code Protect Function)								Yes (ID Code Check Function, ROM Code Protect Function)												
CPU	CPU	M32C/80 Core																			
	Basic Instructions	108																			
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)																			
	Multiplier	16 × 16 → 32																			
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48																			
	Barrel Shifter	Yes																			
DMA	DMAC (Channels)	4																			
	DTC/DMACII	DMACII (Starts by all peripheral interrupt factors)																			
External Bus Expansion	Address Space (Bytes)	16M																			
	External Bus Interface	Support for insertion of 1 to 6 wait states, Outputs 4 chip-select signals																			
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)																			
	DRAM Controller	-																			
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub-clock and On-chip oscillator)																			
	PLL	Yes																			
	Subclock	Yes																			
	On-Chip Oscillator	Yes																			
	Oscillation Stop Detection	Yes																			
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)																			
Power Supply Voltage Detection	Power Save	Wait/Stop																			
	Power-On Reset/POR	-																			
A/D Converter	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34		
	Sample and Hold	Yes																			
	Multi-Channel Sample and Hold	-																			
D/A Converter	Resolution × Channels	8-bit × 2																			
	8-bit	-																			
Timer	16-bit	11 (Timer A, Timer B)																			
	Input Capture	8 (Intelligent I/O)																			
	Output Compare	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)	10 (Intelligent I/O)	16 (Intelligent I/O)		
	PWM Output	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)	15 (Timer A, Intelligent I/O)	21 (Timer A, Intelligent I/O)		
	Real-Time Port	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)	3 (Intelligent I/O)	8 (Intelligent I/O)		
	Event Counter	11 (Timer A, Timer B)																			
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)																			
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																			
Serial Interface	Clock Sync./ Clock Async.	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)	7 (UART, Intelligent I/O)	8 (UART, Intelligent I/O)		
	Clock Sync. Only	2 (Intelligent I/O)																			
	Clock Async. Only	-																			
UART	5 (UART)																				
IEBus	6 (UART, Intelligent I/O)																				
Smart Card/SIM	5 (UART)																				
Synchronous Serial Communication Unit/Special Serial I/O	5 (UART)																				
CAN	Channels	-																			
	Message Box (Numbers)	16																			
IrDA	CRC Calculation Circuit	Yes (UART)																			
	X/Y Converter	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																			
I/O Ports	Input Only (Numbers)	1																			
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121		
	N-Channel Open Drain Port (Numbers)	2																			
	High Current Drive Port	-																			
	Pull-Up Resistor	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121	85	121		
External Interrupts Pins	On-Chip Debug	11	14	11	14	11	14	11	14	11	14	11	14	11	14	11	14	11	14		
	On-Board Flash Program	Yes																			
Other Functions	ROM Correction Function	-																			
	Others	Yes																			
Operating Frequency/Supply Voltage	3V, 5V Interface																				
Operating Ambient Temperature (°C)	32MHz/4.2 to 5.5V, 24MHz/3.0 to 5.5V																				
Package**	PLOP0100KB-A																				
	PLOP0144KA-A																				
Part No.	M30876FJAGP																				
	M30878FJAGP																				
	M30879FKAGP																				
	M3087BFBKAGP																				
	M30879FLAFP																				
	M30879FLAGP																				
	M30879FLBAGP																				
	M30879MLHB-XXXGP																				
	M30875MLHB-XXXGP																				
	M30873FHBGP																				
	M30875FHBGP																				
	M30876MLJB-XXXFP																				
	M30876MLJB-XXXGP																				
	M30876MLJB-XXXGP																				
	M30876FJBGFP																				
	M30879FKBGP																				
M3087BFBKBP																					
M30879FLBFP																					
M30879FLBGP																					
M30879FLBGP																					

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

# Products Lineup

## • Specifications (M16C/80 Series)

Group		M16C/80																															
Memory	ROM (Bytes)	10K				24K				128K				256K																			
	RAM (Bytes)									10K				20K																			
	ROM Type <sup>*1</sup>					L				F		M		F		M																	
	Data Flash	-																															
Memory	Program Security					-				Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-													
	CPU	M16C/80 Core																															
CPU	Basic Instructions	106																															
	Minimum Instruction Execution Time (ns)	50 (@20MHz)																															
	Multiplier	16 × 16 → 32																															
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48																															
DMA	Barrel Shifter	-																															
	DMAC (Channels)	4																															
External Bus Expansion	DTC/DMACII	-																															
	Address Space (Bytes)	16M																															
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals																															
External Bus Expansion	Bus Structure	Selectable from Separate bus, Multiplex bus, Data bus width can be selected (8/16-bit), The number of output address buses can be selected (16/20)																															
	DRAM Controller	Yes																															
	Clock Generation Circuit	2 circuits (Main clock, Sub-clock)																															
Clock	PLL	-																															
	Subclock	Yes																															
	On-Chip Oscillator	-																															
	Oscillation Stop Detection	-																															
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)																															
	Power Save	Wait/Stop																															
Power Supply Voltage Detection	Power-On Reset/POR	-																															
	Low Voltage Detection/LVD	-																															
A/D Converter	Resolution × Channels	10-bit × 10																															
	Sample and Hold	Yes																															
	Multi-Channel Sample and Hold	-																															
D/A Converter	Resolution × Channels	8-bit × 2																															
	8-bit	-																															
Timer	16-bit	11 (Timer A, Timer B)																															
	Input Capture	-																															
	Output Compare	-																															
	PWM Output	5 (Timer A)																															
	Real-Time Port	-																															
	Event Counter	11 (Timer A, Timer B)																															
	2-Phase Encoder Input	3 (Timer A)																															
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																															
Watchdog Timer	1	-																															
	5 (UART)	-																															
Serial Interface	Clock Sync./ Clock Async.	5 (UART)																															
	Clock Sync. Only	-																															
	Clock Async. Only	-																															
IC-bus	3 (UART)																																
IEBus	3 (UART)																																
Smart Card/SIM	3 (UART)																																
Synchronous Serial Communication Unit/Special Serial I/O	3 (UART)																																
CAN	Channels	-																															
	Message Box (Numbers)	-																															
IrDA	-																																
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																																
X/Y Converter	Yes																																
I/O Ports	Input Only (Numbers)	1																															
	CMOS I/O (Numbers)	45				81				45				81				85				121				85				121			
	N-Channel Open Drain Port (Numbers)	2																															
	High Current Drive Port	-																															
	Pull-Up Resistor	45				81				45				81				85				121				85				121			
External Interrupts Pins	11																																
Debugging Function	On-Chip Debug					-				Yes		-		Yes		-		Yes		-		Yes		-									
	On-Board Flash Program	-				-				Yes		-		Yes		-		Yes		-		Yes		-									
Other Functions	ROM Correction Function	-								Yes		-		Yes		-		Yes		-		Yes		-									
	Others	-																															
Operating Frequency/Supply Voltage	20MHz/4.2 to 5.5V, 10MHz/2.7 to 5.5V																																
Operating Ambient Temperature (°C)	- 20 to 85, - 40 to 85																																
Package <sup>*2</sup>	PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A, PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A, PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A, PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A, PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A, PRQP0100JB-A, PLOP0100KB-A, PLOP0144KA-A																																
Part No.	M30800SFP, M30800SFP-BL, M30800SGP, M30800SGP-BL, M30802SGP, M30802SGP-BL, M30803SFP, M30803SFP-BL, M30803SGP, M30803SGP-BL, M30805SGP, M30805SGP-BL, M30800FOFP, M30800FCGP, M30800MC-XXXFP, M30800MC-XXXGP, M30802FCGP, M30802MC-XXXGP, M30803FGFP, M30803FGGP, M30803MG-XXXFP, M30803MG-XXXGP, M30805FGGP, M30805MG-XXXGP																																

\* Built-in boot loader function ROM-less version

\* : New product \*\* : Under development

\*<sup>1</sup> F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
<sup>\*2</sup> Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (M16C/60 Series)

Group		M16C/64				M16C/65						
Memory	ROM (Bytes)	256K + 24K		512K + 24K		256K + 24K						
	RAM (Bytes)	16K		31K		20K						
	ROM Type**	F										
	Data Flash	Yes (8K)										
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)										
CPU	CPU	M16C/60 Core										
	Basic Instructions	91										
	Minimum Instruction Execution Time (ns)	40.0 (@25MHz)				31.3 (@32MHz)						
	Multiplier	16 × 16→32										
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 32→32										
DMA	DMAC (Channels)	4										
	DTC/DMACII	-										
External Bus Expansion	Address Space (Bytes)	1M										
	External Bus Interface	Support for insertion of 0 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function				Support for insertion of 0 to 5 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function						
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)										
Clock	DRAM Controller	-										
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)										
	PLL	Yes										
	Subclock	Yes (32.768kHz)										
	Real Time clock	-										
	On-Chip Oscillator	Yes (Low speed:125kHz)				Yes (High speed:40MHz, Low speed:125kHz)						
	Oscillation Stop Detection	Yes										
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)										
Power Supply Voltage Detection	Power Save	Wait/Stop										
	Power-On Reset/POR	-										
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)				Yes (Voltage detection 3)						
	Resolution × Channels	10-bit × 26										
	Sample and Hold	Yes										
D/A Converter	Multi-Channel Sample and Hold	-										
	Resolution × Channels	8-bit × 2										
Timer	8-bit	-										
	16-bit	11 (Timer A, Timer B)										
	Input Capture	-										
	Output Compare	-										
	PWM Output	5 (Timer A)				7 (Timer A, PWM Function)						
	Real-Time Port	-										
	Event Counter	11 (Timer A, Timer B)										
	2-Phase Encoder Input	3 (Timer A)										
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)										
	Watchdog Timer	1										
Serial Interface	Clock Sync./ Clock Async.	6 (UART)										
	Clock Sync. Only	2 (S/I/O)										
	Clock Async. Only	-										
I <sup>2</sup> C-bus	6 (UART)				7 (Multi master I <sup>2</sup> C, UART)							
IEBus	6 (UART)											
Smart Card/SIM	1 (UART)											
Synchronous Serial Communication Unit/Special Serial I/O	6 (UART)											
CAN	Channels	-										
	Message Box (Numbers)	-										
IrDA	-											
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> +X <sup>12</sup> +X <sup>6</sup> +1))				1 (CRC-CCITT (X <sup>16</sup> +X <sup>12</sup> +X <sup>6</sup> +1)/CRC-16 (X <sup>16</sup> +X <sup>15</sup> +X <sup>2</sup> +1))							
X/Y Converter	-											
I/O Ports	Input Only (Numbers)	-										
	CMOS I/O (Numbers)	85										
	N-Channel Open Drain Port (Numbers)	3										
	High Current Drive Port	-										
	Pull-Up Resistor	85										
External Interrupts Pins	13											
Debugging Function	On-Chip Debug	Yes										
	On-Board Flash Program	Yes										
Other Functions	ROM Correction Function	-										
	Others	-										
Operating Frequency/Supply Voltage	3V, 5V interface 25MHz/2.7 to 5.5V								3V, 5V Interface Pattern Matching Input 32MHz/2.7 to 5.5V			
Operating Ambient Temperature (°C)	-40 to 85		-20 to 85		-40 to 85		-20 to 85		-40 to 85		-20 to 85	
Package**	PROF0100JD-B	PLQP0100KB-A	PROF0100JD-B	PLQP0100KB-A	PROF0100JD-B	PLQP0100KB-A	PROF0100JD-B	PLQP0100KB-A	PROF0100JD-B	PLQP0100KB-A	PROF0100JD-B	PLQP0100KB-A
	RSF3640DDFA**	RSF3640DDFB**	RSF3640DNFA**	RSF3640DNFB**	RSF3640MDFB**	RSF3640MDFA**	RSF3640MDFB**	RSF3640MNFA**	RSF3650EDFB**	RSF3650EDFA**	RSF3650ENFA**	RSF3650ENFB**

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



# Products Lineup

## • Specifications (M16C/60 Series)

Group		M16C/62P														
Memory	ROM (Bytes)	-			48K		64K		64K + 4K		96K					
	RAM (Bytes)	10K		20K		31K		4K		5K						
	ROM Type*1	L			M				F		M					
	Data Flash				-				Yes (4K)		-					
	Program Security				-				Yes (ID Code Check Function, ROM Code Protect Function)		-					
CPU	M16C/60 Core															
	Basic Instructions	91														
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)														
	Multiplier	16 × 16 → 32														
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32														
DMA	DMAC (Channels)	2														
	DTC/DMACII	-														
External Bus Expansion	Address Space (Bytes)	1M			-		1M		-		1M		-			
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function				-		Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function		-		Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function		-		
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)				-		Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)		-		Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)		-		
	DRAM Controller	-														
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)														
	PLL	Yes														
	Subclock	Yes														
	On-Chip Oscillator	Yes														
	Oscillation Stop Detection	Yes														
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)														
	Power Save	Wait/Stop														
Power Supply Voltage Detection	Power-On Reset/POR	-														
	Low Voltage Detection/LVD	Yes (Low voltage)														
A/D Converter	Resolution × Channels	10-bit × 26														
	Sample and Hold	Yes														
D/A Converter	Multi-Channel Sample and Hold	-														
	Resolution × Channels	8-bit × 2														
Timer	8-bit	-														
	16-bit	11 (Timer A, Timer B)														
	Input Capture	-														
	Output Compare	-														
	PWM Output	5 (Timer A)			-		3 (Timer A)		5 (Timer A)		3 (Timer A)		5 (Timer A)		3 (Timer A)	
	Real-Time Port	-														
	Event Counter	11 (Timer A, Timer B)														
	2-Phase Encoder Input	3 (Timer A)				2 (Timer A)		3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)		
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)				-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		
	Watchdog Timer	1														
Serial Interface	Clock Sync./ Clock Async.	3 (UART)			-		2 (UART)		3 (UART)		2 (UART)		3 (UART)		2 (UART)	
	Clock Sync. Only	-			2 (SI/O)		1 (UART)		-		1 (UART)		-		1 (UART)	
	Clock Async. Only	-			-		-		-		-		-		-	
I <sup>2</sup> C-bus	3 (UART)															
IEBus	3 (UART)															
Smart Card/SIM	1 (UART)															
Synchronous Serial Communication Unit/Special Serial I/O	3 (UART)															
CAN	Channels	-														
	Message Box (Numbers)	-														
IrDA	-															
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))															
X/Y Converter	-															
I/O Ports	Input Only (Numbers)	1														
	CMOS I/O (Numbers)	50		85		68		85		68		85		68		
	N-Channel Open Drain Port (Numbers)	2														
	High Current Drive Port	-														
	Pull-Up Resistor	50		85		68		85		68		85		68		
External Interrupts Pins	11															
Debugging Function	On-Chip Debug	-														
	On-Board Flash Program	-														
Other Functions	ROM Correction Function	Yes														
	Others	-														
Operating Frequency/Supply Voltage	24MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V															
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85															
Package*2	PRQP0100JB-A	PRQP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	
	M30620SPFP	M30620SPGP	M30624SPFP	M30624SPGP	M30626SPFP	M30626SPGP	M30622SPFP	M30622SPGP	M30622M8P-XXXFP	M30622M8P-XXXGP	M30622M8P-XXXFP	M30622M8P-XXXGP	M30623M8P-XXXFP	M30623M8P-XXXGP	M30622F8FP	
	M30622F8FP	M30622F8GP	M30623F8FP	M30623F8GP	M30622MAP-XXXFP	M30622MAP-XXXGP	M30622MAP-XXXFP	M30622MAP-XXXGP	M30623MAP-XXXFP	M30623MAP-XXXGP	M30623MAP-XXXFP	M30623MAP-XXXGP	M30623MAP-XXXFP	M30623MAP-XXXGP	M30623MAP-XXXFP	

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development

• Specifications (M16C/60 Series : M16C/62P Group)

Group		M16C/62P																					
Memory	ROM (Bytes)	128K				128K + 4K				192K				256K				256K + 4K				320K	
	RAM (Bytes)	10K														16K							
	ROM Type*1	M				F				M				F				M					
	Data Flash	-				Yes (4K)				-				Yes (4K)				-					
	Program Security	-				Yes (ID Code Check Function, ROM Code Protect Function)				-				Yes (ID Code Check Function, ROM Code Protect Function)				-					
CPU	CPU	M16C/60 Core																					
	Basic Instructions	91																					
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)																					
	Multiplier	16 × 16 → 32																					
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																					
DMA	Barrel Shifter	-																					
	DMAC (Channels)	2																					
	DTC/DMACII	-																					
External Bus Expansion	Address Space (Bytes)	1M				-				1M				-									
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function				-				Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function				-									
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)				-				Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)				-									
	DRAM Controller	-																					
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)																					
	PLL	Yes																					
	Subclock	Yes																					
	On-Chip Oscillator	Yes																					
	Oscillation Stop Detection	Yes																					
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																					
	Power Save	Wait/Stop																					
Power Supply Voltage Detection	Power-On Reset/POR	-																					
	Low Voltage Detection/LVD	Yes (Low voltage)																					
A/D Converter	Resolution × Channels	10-bit × 26																					
	Sample and Hold	Yes																					
D/A Converter	Multi-Channel Sample and Hold	-																					
	Resolution × Channels	8-bit × 2																					
Timer	8-bit	-																					
	16-bit	11 (Timer A, Timer B)																					
	Input Capture	-																					
	Output Compare	-																					
	PWM Output	5 (Timer A)				3 (Timer A)				5 (Timer A)				3 (Timer A)									
	Real-Time Port	-																					
	Event Counter	11 (Timer A, Timer B)																					
	2-Phase Encoder Input	3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)		-				3 (Timer A)									
3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		-				1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)										
Watchdog Timer	1																						
Serial Interface	Clock Sync./ Clock Async.	3 (UART)		2 (UART)		3 (UART)		2 (UART)		-				3 (UART)									
	Clock Sync. Only	2 (S/I/O)																					
	Clock Async. Only	-		1 (UART)		-		1 (UART)		-				-									
I <sup>2</sup> C-bus	3 (UART)																						
IEBus	3 (UART)																						
Smart Card/SIM	1 (UART)																						
Synchronous Serial Communication Unit/Special Serial I/O	3 (UART)																						
CAN	Channels	-																					
	Message Box (Numbers)	-																					
IrDA	-																						
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																						
X/Y Converter	-																						
I/O Ports	Input Only (Numbers)	1																					
	CMOS I/O (Numbers)	85		68		85		68		85		111		85		111		85		111			
	N-Channel Open Drain Port (Numbers)	2																					
	High Current Drive Port	-																					
External Interrupts Pins	Pull-Up Resistor	85		68		85		68		85		111		85		111		85		111			
	On-Chip Debug	11																					
Debugging Function	On-Board Flash Program	-				Yes				-				Yes				-					
	ROM Correction Function	Yes				-				Yes				-				Yes					
Other Functions	Others	3V, 5V interface																					
	Operating Frequency/Supply Voltage	24MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V																					
Operating Ambient Temperature (°C)	- 20 to 85, - 40 to 85																						
Package*2	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0128KB-A			
Part No.	M30620MCP-XXXFP	M30620MCP-XXXGP	M30621MCP-XXXGP	M30620FCFPF	M30620FCGPG	M30621FCGPG	M30622MEP-XXXFP	M30622MEP-XXXGP	M30623MEP-XXXGP	M30622MGP-XXXFP	M30622MGP-XXXGP	M30623MGP-XXXFP	M30625MGP-XXXGP	M30624FGFPF	M30624FGGPG	M30625FGGPG	M3062LFGFPF	M3062LFGGPG	M30622MWP-XXXFP	M30622MWP-XXXGP	M30623MWP-XXXGP		

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (M16C/60 Series : M16C/62P Group)

Group		M16C/62P																				
Memory	ROM (Bytes)	320K				384K				384K + 4K				512K		512K + 4K						
	RAM (Bytes)	24K		31K		16K		24K		31K												
	ROM Type*1					M				F				M		F						
	Data Flash					-				Yes (4K)				-		Yes (4K)						
	Program Security					-				Yes (ID Code Check Function, ROM Code Protect Function)				-		Yes (ID Code Check Function, ROM Code Protect Function)						
CPU	CPU	M16C/60 Core																				
	Basic Instructions	91																				
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)																				
	Multiplier	16 × 16 → 32																				
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																				
DMA	Barrel Shifter	-																				
	DMAC (Channels)	2																				
External Bus Expansion	DTC/DMACII	-																				
	Address Space (Bytes)	1M																				
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function																				
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)																				
Clock	DRAM Controller	-																				
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)																				
	PLL	Yes																				
	Subclock	Yes																				
	On-Chip Oscillator	Yes																				
	Oscillation Stop Detection	Yes																				
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																				
Power Supply Voltage Detection	Power Save	Wait/Stop																				
	Power-On Reset/POR	-																				
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)																				
	Resolution × Channels	10-bit × 26																				
D/A Converter	Sample and Hold	Yes																				
	Multi-Channel Sample and Hold	-																				
Timer	Resolution × Channels	8-bit × 2																				
	8-bit	-																				
	16-bit	11 (Timer A, Timer B)																				
	Input Capture	-																				
	Output Compare	-																				
	PWM Output	5 (Timer A)																				
	Real-Time Port	-																				
	Event Counter	11 (Timer A, Timer B)																				
	2-Phase Encoder Input	3 (Timer A)																				
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																				
		1																				
Serial Interface	Clock Sync./ Clock Async.	3 (UART)																				
	Clock Sync. Only	2 (SI/O)																				
	Clock Async. Only	-																				
I <sup>2</sup> C-bus		3 (UART)																				
IEBus		3 (UART)																				
Smart Card/SIM		1 (UART)																				
Synchronous Serial	Communication Unit/Special Serial I/O	3 (UART)																				
	Channels	-																				
CAN	Message Box (Numbers)	-																				
		-																				
IrDA		-																				
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																				
X/Y Converter		-																				
I/O Ports	Input Only (Numbers)	1																				
	CMOS I/O (Numbers)	85	111	85	111	85	111	85	111	85	111	85	111	85	111	85	111					
	N-Channel Open Drain Port (Numbers)	2																				
	High Current Drive Port	-																				
	Pull-Up Resistor	85	111	85	111	85	111	85	111	85	111	85	111	85	111	85	111					
External Interrupts Pins		11																				
Debugging Function	On-Chip Debug	-												Yes		-		Yes				
	On-Board Flash Program	-												Yes		-		Yes				
Other Functions	ROM Correction Function	Yes												-		Yes		-				
	Others	3V, 5V interface																				
Operating Frequency/Supply Voltage		24MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V																				
Operating Ambient Temperature (°C)		-20 to 85, -40 to 85																				
Package*2		PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A	PRQP0100JB-A	PLQP0100KB-A	PLQP0128KB-A			
		M30624MWP-XXXFP	M30624MWP-XXXGP	M30625MWP-XXXGP	M30626MWP-XXXFP	M30626MWP-XXXGP	M30627MWP-XXXGP	M30622MHP-XXXFP	M30622MHP-XXXGP	M30623MHP-XXXGP	M30624MHP-XXXFP	M30624MHP-XXXGP	M30625MHP-XXXGP	M30626MHP-XXXFP	M30626MHP-XXXGP	M30627MHP-XXXGP	M30626MJP-XXXFP	M30626MJP-XXXGP	M30627MJP-XXXGP	M30626FJFP	M30626FJGP	M30627FJGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

• Specifications (M16C/60 Series : M16C/62A Group)

Group		M16C/62A											
Memory	ROM (Bytes)	-		32K		64K		96K		5K			
	RAM (Bytes)	10K		3K		10K		4K		10K			
	ROM Type*1	L				M							
	Data Flash	-											
	Program Security	-											
CPU	CPU	M16C/60 Core											
	Basic Instructions	91											
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)											
	Multiplier	16 × 16 → 32											
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 32 → 32											
DMA	DMAC (Channels)	2											
	DTC/DMACII	-											
External Bus Expansion	Address Space (Bytes)	1M		-		1M		-		1M			
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals		-		Support for insertion of 1 wait states, Outputs 4 chip-select signals		-		Support for insertion of 1 wait states, Outputs 4 chip-select signals			
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)		-		Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)		-		Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)			
	DRAM Controller	-											
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)											
	PLL	-											
	Subclock	Yes											
	On-Chip Oscillator	-											
	Oscillation Stop Detection	-											
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)											
Power Supply Voltage Detection	Power-On Reset/POR	-											
	Low Voltage Detection/LVD	-											
A/D Converter	Resolution × Channels	10-bit × 10											
	Sample and Hold	Yes											
D/A Converter	Resolution × Channels	8-bit × 2											
	Multi-Channel Sample and Hold	-											
Timer	8-bit	-											
	16-bit	11 (Timer A, Timer B)											
	Input Capture	-											
	Output Compare	-											
	PWM Output	5 (Timer A)		3 (Timer A)		5 (Timer A)		3 (Timer A)		5 (Timer A)			
	Real-Time Port	-											
	Event Counter	-											
	2-Phase Encoder Input	3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)		3 (Timer A)			
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)			
	Watchdog Timer	1											
Serial Interface	Clock Sync./ Clock Async.	3 (UART)		2 (UART)		3 (UART)		2 (UART)		3 (UART)			
	Clock Sync. Only	2 (S/I/O)											
	Clock Async. Only	-		1 (UART)		-		1 (UART)		-			
I <sup>2</sup> C-bus	1 (UART)												
IEBus	1 (UART)												
Smart Card/SIM	1 (UART)												
Synchronous Serial Communication Unit/Special Serial I/O	Channels	-											
	Message Box (Numbers)	-											
IrDA	Channels	-											
	Message Box (Numbers)	-											
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))												
X/Y Converter	-												
I/O Ports	Input Only (Numbers)	1											
	CMOS I/O (Numbers)	50		85		68		85		68			
	N-Channel Open Drain Port (Numbers)	2											
	High Current Drive Port	-											
	Pull-Up Resistor	50		85		68		85		68			
External Interrupts Pins	11		8		11		8		11				
Debugging Function	On-Chip Debug	-											
	On-Board Flash Program	-											
Other Functions	ROM Correction Function	Yes											
	Others	-											
Operating Frequency/Supply Voltage	16MHz/4.2 to 5.5V, 10MHz (1 wait) /2.7 to 5.5V												
Operating Ambient Temperature (°C)	- 20 to 85, - 40 to 85												
Package*2	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	
Part No.	M30620SAFP	M30620SAGP	M30622SAFP	M30622SAGP	M30622MAA-XXXFP	M30622MAA-XXXGP	M30623MAA-XXXFP	M30623MAA-XXXGP	M30620MBA-XXXFP	M30622MBA-XXXFP	M30622MBA-XXXGP	M30623MBA-XXXFP	M30623MBA-XXXGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code  
 ★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/60 Series : M16C/62A Group)

Group		M16C/62A													
Memory	ROM (Bytes)	128K				256K									
	RAM (Bytes)	10K				20K									
	ROM Type*1	F	M	F	M	F	M	F	M						
	Data Flash	-													
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-						
CPU	CPU	M16C/60 Core													
	Basic Instructions	91													
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)													
	Multiplier	16 × 16 → 32													
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32													
DMA	Barrel Shifter	-													
	DMAC (Channels)	2													
External Bus Expansion	DTC/DMACII	-													
	Address Space (Bytes)	1M				1M				1M		-			
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals				Support for insertion of 1 wait states, Outputs 4 chip-select signals				Support for insertion of 1 wait states, Outputs 4 chip-select signals					
External Bus Expansion	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)				Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)				Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)					
	DRAM Controller	-													
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)													
	PLL	-													
	Subclock	Yes													
	On-Chip Oscillator	-													
	Oscillation Stop Detection	-													
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)													
	Power Save	Wait/Stop													
Power Supply Voltage Detection	Power-On Reset/POR	-													
	Low Voltage Detection/LVD	-													
A/D Converter	Resolution × Channels	10-bit × 10													
	Sample and Hold	Yes													
	Multi-Channel Sample and Hold	-													
D/A Converter	Resolution × Channels	8-bit × 2													
	8-bit	-													
Timer	16-bit	11 (Timer A, Timer B)													
	Input Capture	-													
	Output Compare	-													
	PWM Output	5 (Timer A)		3 (Timer A)		5 (Timer A)		3 (Timer A)		5 (Timer A)		3 (Timer A)			
	Real-Time Port	-													
	Event Counter	11 (Timer A, Timer B)													
	2-Phase Encoder Input	3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)			
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)				-				1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)					
	Watchdog Timer	1													
	Serial Interface	Clock Sync./ Clock Async.	3 (UART)		2 (UART)		3 (UART)		2 (UART)		3 (UART)		2 (UART)		
Clock Sync. Only		2 (SIO)													
Clock Async. Only		-				1 (UART)		-		1 (UART)		-			
I <sup>2</sup> C-bus	1 (UART)														
IEBus	1 (UART)														
Smart Card/SIM	1 (UART)														
Synchronous Serial Communication Unit/Special Serial I/O	-														
CAN	Channels	-													
	Message Box (Numbers)	-													
IrDA	-														
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>3</sup> + 1))														
X/Y Converter	Input Only (Numbers)	1													
	CMOS I/O (Numbers)	85		68		85		68		85		68			
	N-Channel Open Drain Port (Numbers)	2													
	High Current Drive Port	-													
	Pull-Up Resistor	85		68		85		68		85		68			
External Interrupts Pins	11		8		11		8		11		8				
Debugging Function	On-Chip Debug	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-		
	On-Board Flash Program	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-		
Other Functions	ROM Correction Function	-	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-	Yes		
	Others	-													
Operating Frequency/Supply Voltage	16MHz/4.2 to 5.5V, 10MHz (1 wait) /2.7 to 5.5V														
Operating Ambient Temperature (°C)	- 20 to 85, - 40 to 85														
Package*2	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A		
Part No.	M30620FCAP	M30620FCAGP	M30620MCA-XXXFP	M30620MCA-XXXGP	M30621FCAGP	M30621MCA-XXXGP	M30622MCA-XXXFP	M30622MCA-XXXGP	M30623MCA-XXXGP	M30624FGAFP	M30624FGAGP	M30624MGA-XXXFP	M30624MGA-XXXGP	M30625FGAGP	M30625MGA-XXXGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



• Specifications (M16C/60 Series : M16C/62M Group)

Group		M16C/62M								
Memory	ROM (Bytes)	128K				256K				
	RAM (Bytes)	10K				20K				
	ROM Type**1	F	M	F	M	F	M	F	M	
	Data Flash	-								
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-	Yes (ID Code Check Function, ROM Code Protect Function)	-	
CPU	CPU	M16C/60 Core								
	Basic Instructions	91								
	Minimum Instruction Execution Time (ns)	100 (@10MHz)								
	Multiplier	16 × 16 → 32								
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32								
DMA	DMAC (Channels)	2								
	DTC/DMACII	-								
External Bus Expansion	Address Space (Bytes)	1M				1M				
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals				Support for insertion of 1 wait states, Outputs 4 chip-select signals				
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)				Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)				
	DRAM Controller	-								
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)								
	PLL	-								
	Subclock	Yes								
	On-Chip Oscillator	-								
	Oscillation Stop Detection	-								
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)								
Power Supply Voltage Detection	Power Save	Wait/Stop								
	Power-On Reset/POR	-								
A/D Converter	Low Voltage Detection/LVD	-								
	Resolution × Channels	10-bit × 10								
	Sample and Hold	Yes								
D/A Converter	Multi-Channel Sample and Hold	-								
	Resolution × Channels	8-bit × 2								
Timer	8-bit	-								
	16-bit	11 (Timer A, Timer B)								
	Input Capture	-								
	Output Compare	-								
	PWM Output	5 (Timer A)		3 (Timer A)		5 (Timer A)		3 (Timer A)		
	Real-Time Port	-								
	Event Counter	11 (Timer A, Timer B)								
	2-Phase Encoder Input	3 (Timer A)		2 (Timer A)		3 (Timer A)		2 (Timer A)		
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)		-		
	Watchdog Timer	1								
Serial Interface	Clock Sync./ Clock Async.	3 (UART)		2 (UART)		3 (UART)		2 (UART)		
	Clock Sync. Only	2 (SI/O)								
	Clock Async. Only	-		1 (UART)		-		1 (UART)		
FC-bus	1 (UART)									
IEBus	1 (UART)									
Smart Card/SIM	1 (UART)									
Synchronous Serial Communication Unit/Special Serial I/O	-									
CAN	Channels	-								
	Message Box (Numbers)	-								
IrDA	-									
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>2</sup> + 1))									
X/Y Converter	Input Only (Numbers)	1								
	CMOS I/O (Numbers)	85		68		85		68		
	N-Channel Open Drain Port (Numbers)	2								
	High Current Drive Port	-								
	Pull-Up Resistor	85		68		85		68		
External Interrupts Pins	11		8		11		8			
Debugging Function	On-Chip Debug	Yes	-	Yes	-	Yes	-	Yes	-	
	On-Board Flash Program	Yes	-	Yes	-	Yes	-	Yes	-	
Other Functions	ROM Correction Function	-	Yes	-	Yes	-	Yes	-	Yes	
Others	-									
Operating Frequency/Supply Voltage	10MHz/2.7 to 3.6V, 7MHz/2.4 to 3.6V, 7MHz (1 wait) /2.2 to 3.6V									
Operating Ambient Temperature (°C)	- 20 to 85, - 40 to 85									
Package**2	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0080JA-A
	M30620FCMFP	M30620FCMGP	M30620MCM-XXXFP	M30620MCM-XXXGP	M30621FCMGP	M30621MCM-XXXGP	M30624FGMFP	M30624FGMGP	M30624MGM-XXXFP	M30624MGM-XXXGP
	M30625FGMFP	M30625FGMGP	M30625MGM-XXXFP	M30625MGM-XXXGP						

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/60 Series : M16C/62N Group)

Group		M16C/62N																			
Memory	ROM (Bytes)	64K			128K			12K		256K											
	RAM (Bytes)	8K			10K					20K											
	ROM Type*1	F			M			F		M		F	M								
	Data Flash							-													
Memory	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)			-			Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)	-								
	CPU	M16C/60 Core																			
CPU	Basic Instructions	91																			
	Minimum Instruction Execution Time (ns)	100 (@10MHz)			62.5 (@16MHz)																
	Multiplier	16 × 16 → 32																			
	Multiplier-Accumulate Instruction	16 × 16 + 32 → 32																			
DMA	Barrel Shifter	-																			
	DMAC (Channels)	2																			
External Bus Expansion	DTC/DMACII	-																			
	Address Space (Bytes)	1M			-			1M		-											
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals	Support for insertion of 1 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function			-		Support for insertion of 1 wait states, Outputs 4 chip-select signals, Available to 4M bytes by address space expansion function			-										
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)			-			Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)			-										
Clock	DRAM Controller	-																			
	Clock Generation Circuit	2 circuits (Main clock, Sub clock)																			
	PLL	-																			
	Subclock	Yes																			
	On-Chip Oscillator	-																			
	Oscillation Stop Detection	-																			
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																			
	Power Save	Wait/Stop																			
Power Supply Voltage Detection	Power-On Reset/POR	-																			
	Low Voltage Detection/LVD	-																			
A/D Converter	Resolution × Channels	10-bit × 10			10-bit × 18																
	Sample and Hold	Yes																			
	Multi-Channel Sample and Hold	-																			
D/A Converter	Resolution × Channels	8-bit × 2																			
	8-bit	-																			
	16-bit	11 (Timer A, Timer B)																			
	Input Capture	-																			
	Output Compare	-																			
	PWM Output	5 (Timer A)			3 (Timer A)			5 (Timer A)		3 (Timer A)											
	Real-Time Port	-																			
	Event Counter	11 (Timer A, Timer B)																			
Timer	2-Phase Encoder Input	3 (Timer A)			2 (Timer A)			3 (Timer A)		2 (Timer A)											
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)			-			1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)			-										
	Watchdog Timer	1																			
Serial Interface	Clock Sync./ Clock Async.	3 (UART)			2 (UART)			3 (UART)		2 (UART)											
	Clock Sync. Only	-																			
	Clock Async. Only	-			1 (UART)			-		1 (UART)											
iC-bus	1 (UART)																				
IEBus	1 (UART)																				
Smart Card/SIM	1 (UART)																				
Synchronous Serial Communication Unit/Special Serial I/O	-																				
CAN	Channels	-																			
	Message Box (Numbers)	-																			
IrDA	-																				
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																				
X/Y Converter	-																				
I/O Ports	Input Only (Numbers)	85			68			85		68											
	CMOS I/O (Numbers)	85			68			85		68											
	N-Channel Open Drain Port (Numbers)	2																			
	High Current Drive Port	-																			
	Pull-Up Resistor	85			68			85		68											
External Interrupts Pins	11																				
Debugging Function	On-Chip Debug	Yes			-			Yes		-											
	On-Board Flash Program	Yes			-			Yes		-											
Other Functions	ROM Correction Function	-			Yes			-		Yes											
	Others	-																			
Operating Frequency/Supply Voltage	10MHz/ 2.7 to 3.6V	16MHz/ 3.0 to 3.6V, 7MHz/ 2.4 to 3.6V	16MHz/3.0 to 3.6V, 7MHz/2.4 to 3.6V, 7MHz (1 wait)/2.2 to 3.6V	16MHz/ 3.0 to 3.6V, 7MHz/ 2.4 to 3.6V	16MHz/3.0 to 3.6V, 7MHz/2.4 to 3.6V, 7MHz (1 wait)/2.2 to 3.6V	16MHz/3.0 to 3.6V, 7MHz/2.4 to 3.6V	16MHz/3.0 to 3.6V, 7MHz/2.4 to 3.6V	16MHz/3.0 to 3.6V, 7MHz/2.4 to 3.6V, 7MHz (1 wait)/2.2 to 3.6V	16MHz/ 3.0 to 3.6V, 7MHz/ 2.4 to 3.6V, 7MHz (1 wait)/ 2.2 to 3.6V	16MHz/ 3.0 to 3.6V, 7MHz/ 2.4 to 3.6V, 7MHz (1 wait)/ 2.2 to 3.6V											
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85																				
Package**	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PRQP0100JB-A	PLQP0100KB-A	PTQP0100LB-A	PRQP0080JA-A	PRQP0100JB-A	PLQP0100KB-A	PTQP0100LB-A	PRQP0100JB-A	PLQP0100KB-A	PTQP0100LB-A	PRQP0080JA-A						
Part No.	M30623FBNFP	M30623FBNGP	M30620FCNFP	M30620FCNGP	M30620MGN-XXXFP	M30620MGN-XXXGP	M30620MGN-XXXHP	M30621FCNFP	M30621FCNGP	M30621MGN-XXXFP	M30621MGN-XXXGP	M30621MGN-XXXHP	M30624FCNFP	M30624FCNGP	M30624FGNHP	M30624MGN-XXXFP	M30624MGN-XXXGP	M30624MGN-XXXHP	M30625FCNFP	M30625FCNGP	M30625MGN-XXXGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development

• Specifications (M16C/60 Series : M16C/6N Group)

Group		M16C/6N4				M16C/6N5				
Memory	ROM (Bytes)	128K	128K + 4K	256K	256K + 4K	128K	128K + 4K			
	RAM (Bytes)		5K		10K		5K			
	ROM Type**1	M	F	M	F	M	F			
	Data Flash	—	Yes (4K)	—	Yes (4K)	—	Yes (4K)			
	Program Security	—	Yes (ID Code Check Function, ROM Code Protect Function)	—	Yes (ID Code Check Function, ROM Code Protect Function)	—	Yes (ID Code Check Function, ROM Code Protect Function)			
CPU	CPU	M16C/60 Core								
	Basic Instructions	91								
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)								
	Multiplier	16 × 16→32								
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 32→32								
DMA	DMAC (Channels)	2								
	DTC/DMACII	—								
External Bus Expansion	Address Space (Bytes)	1M								
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals								
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)								
Clock	DRAM Controller	—								
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)								
	PLL	Yes								
	Subclock	Yes								
	On-Chip Oscillator	Yes								
	Oscillation Stop Detection	Yes								
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)								
Power Supply Voltage Detection	Power Save	Wait/Stop								
	Power-On Reset/POR	—								
A/D Converter	Low Voltage Detection/LVD	—								
	Resolution × Channels	10-bit × 26								
	Sample and Hold	Yes								
D/A Converter	Multi-Channel Sample and Hold	—								
	Resolution × Channels	8-bit × 2								
Timer	8-bit	—								
	16-bit	11 (Timer A, Timer B)								
	Input Capture	—								
	Output Compare	—								
	PWM Output	5 (Timer A)								
	Real-Time Port	—								
	Event Counter	11 (Timer A, Timer B)								
	2-Phase Encoder Input	3 (Timer A)								
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)								
Watchdog Timer		1								
	Clock Sync./ Clock Async.	3 (UART)								
Serial Interface	Clock Sync. Only	1 (SI/O)								
	Clock Async. Only	—								
I <sup>2</sup> C-bus		3 (UART)								
IEBus		3 (UART)								
Smart Card/SIM		1 (UART)								
Synchronous Serial Communication Unit/Special Serial I/O		3 (UART)								
CAN	Channels	2				1				
	Message Box (Numbers)	16 + 16				16				
IrDA		—								
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))								
X/Y Converter		—								
I/O Ports	Input Only (Numbers)	1								
	CMOS I/O (Numbers)	85								
	N-Channel Open Drain Port (Numbers)	2								
	High Current Drive Port	—								
	Pull-Up Resistor	85								
External Interrupts Pins		11								
Debugging Function	On-Chip Debug	—	Yes	—	Yes	—	Yes			
	On-Board Flash Program	—	Yes	—	Yes	—	Yes			
Other Functions	ROM Correction Function	Yes	—	Yes	—	Yes	—			
	Others	—								
Operating Frequency/Supply Voltage		24MHz/3.0 to 5.5V								
Operating Ambient Temperature (°C)		-40 to 85								
Package**2		PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	
		M306N4MC-XXXGP	M306N4FCFP	M306N4FCGP	M306N4MG-XXXGP	M306N4FCFP	M306N4FCGP	M306N5MC-XXXGP	M306N5FCFP	M306N5FCGP
Part No.		M306N4MC-XXXGP	M306N4FCFP	M306N4FCGP	M306N4MG-XXXGP	M306N4FCFP	M306N4FCGP	M306N5MC-XXXGP	M306N5FCFP	M306N5FCGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/60 Series : M16C/6N Group)

Group		M16C/6NK				M16C/6NL				M16C/6NM				M16C/6NN			
Memory	ROM (Bytes)	192K	256K	384K + 4K	512K + 4K	192K	256K	384K + 4K	512K + 4K	192K	256K	384K + 4K	512K + 4K	192K	256K	384K + 4K	512K + 4K
	RAM (Bytes)	16K	20K	31K		16K	20K	31K		16K	20K	31K		16K	20K	31K	
	ROM Type*1	M		F		M		F		M		F		M		F	
	Data Flash	-		Yes (4K)		-		Yes (4K)		-		Yes (4K)		-		Yes (4K)	
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)	
CPU	CPU	M16C/60 Core															
	Basic Instructions	91															
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)															
	Multiplier	16 × 16 → 32															
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32															
DMA	Barrel Shifter	-															
	DMAC (Channels)	2															
External Bus Expansion	DTC/DMACII	-															
	Address Space (Bytes)	1M															
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals															
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)															
	DRAM Controller	-															
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)															
	PLL	Yes															
	Subclock	Yes															
	On-Chip Oscillator	Yes															
	Oscillation Stop Detection	Yes															
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)															
	Power Save	Wait/Stop															
Power Supply Voltage Detection	Power-On Reset/POR	-															
	Low Voltage Detection/LVD	-															
A/D Converter	Resolution × Channels	10-bit × 26															
	Sample and Hold	Yes															
D/A Converter	Multi-Channel Sample and Hold	-															
	Resolution × Channels	8-bit × 2															
Timer	8-bit	-															
	16-bit	11 (Timer A, Timer B)															
	Input Capture	-															
	Output Compare	-															
	PWM Output	5 (Timer A)															
	Real-Time Port	-															
	Event Counter	11 (Timer A, Timer B)															
	2-Phase Encoder Input	3 (Timer A)															
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)															
Watchdog Timer		1															
	Clock Sync./ Clock Async.	3 (UART)															
	Clock Sync. Only	2 (SI/O)								4 (SI/O)							
I <sup>2</sup> C-bus	Clock Async. Only	-															
		3 (UART)															
IEBus		3 (UART)															
	Smart Card/SIM	1 (UART)															
Synchronous Serial Communication Unit/Special Serial I/O		3 (UART)															
	CAN	2				1				2				1			
IrDA	Message Box (Numbers)	16 + 16				16				16 + 16				16			
	CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))															
X/Y Converter		-															
	Input Only (Numbers)	1															
	CMOS I/O (Numbers)	85															
	N-Channel Open Drain Port (Numbers)	2															
	High Current Drive Port	-															
External Interrupts Pins	Pull-Up Resistor	85								111							
		11															
	On-Chip Debug	-		Yes		-		Yes		-		Yes		-		Yes	
	On-Board Flash Program	-		Yes		-		Yes		-		Yes		-		Yes	
	ROM Correction Function	Yes		-		Yes		-		Yes		-		Yes		-	
Other Functions	Others	-															
		-															
Operating Frequency/Supply Voltage		24MHz/3.0 to 5.5V															
Operating Ambient Temperature (°C)		- 40 to 85															
Package*2		PLQP0100KB-A								PLQP0128KB-A							
Part No.		M306NKME-XXXGP	M306NKMG-XXXGP	M306NKFHGP	M306NKFJGP	M306NLMG-XXXGP	M306NLMG-XXXGP	M306NLFHGP	M306NLFJGP	M306NMME-XXXGP	M306NMMG-XXXGP	M306NMFHGP	M306NMFJGP	M306NNME-XXXGP	M306NNMG-XXXGP	M306NNFHGP	M306NNFJGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

## • Specifications (M16C/30 Series)

Group		M16C/30P											
Memory	ROM (Bytes)	—		96K			96K + 4K			128K			
	RAM (Bytes)	6K		—			5K			—			
	ROM Type*1	L	F			M			F		M		
	Data Flash	—		—			Yes (4K)			—			
	Program Security	—	Yes (ID Code Check Function, ROM Code Protect Function)			—			Yes (ID Code Check Function, ROM Code Protect Function)				
CPU	CPU	M16C/60 Core											
	Basic Instructions	91											
	Minimum Instruction Execution Time (ns)	62.5 (@16MHz)											
	Multiplier	16 × 16 → 32											
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32											
	Barrel Shifter	—											
DMA	DMAC (Channels)	2											
	DTC/DMACII	—											
External Bus Expansion	Address Space (Bytes)	1M											
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals											
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)											
	DRAM Controller	—											
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub-clock)											
	PLL	—											
	Subclock	Yes											
	On-Chip Oscillator	—											
	Oscillation Stop Detection	—											
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)											
	Power Save	Wait/Stop											
Power Supply Voltage Detection	Power-On Reset/POR	—											
	Low Voltage Detection/LVD	—											
A/D Converter	Resolution × Channels	10-bit × 18											
	Sample and Hold	Yes											
D/A Converter	Multi-Channel Sample and Hold	—											
	Resolution × Channels	—											
Timer	8-bit	—											
	16-bit	6 (Timer A, Timer B)											
	Input Capture	—											
	Output Compare	—											
	PWM Output	3 (Timer A)											
	Real-Time Port	—											
	Event Counter	6 (Timer A, Timer B)											
	2-Phase Encoder Input	1 (Timer A)											
3-Phase Inverter Control	—												
Watchdog Timer		1											
Serial Interface	Clock Sync./ Clock Async.	3 (UART)											
	Clock Sync. Only	—											
	Clock Async. Only	—											
I <sup>2</sup> C-bus		3 (UART)											
IEBus		1 (UART)											
Smart Card/SIM		1 (UART)											
Synchronous Serial Communication Unit/Special Serial I/O		1 (UART)											
CAN	Channels	—											
	Message Box (Numbers)	—											
IrDA		—											
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))											
X/Y Converter		—											
I/O Ports	Input Only (Numbers)	1											
	CMOS I/O (Numbers)	85											
	N-Channel Open Drain Port (Numbers)	2											
	High Current Drive Port	—											
	Pull-Up Resistor	85											
External Interrupts Pins		10											
Debugging Function	On-Chip Debug	—		—			Yes			—			
	On-Board Flash Program	—	Yes (Only Rewriting is possible)			—			Yes (Only Rewriting is possible)				
Other Functions	ROM Correction Function	Yes											
	Others	—											
Operating Frequency/Supply Voltage		16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V											
Operating Ambient Temperature (°C)		-20 to 85, -40 to 85											
Package*2		PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A	PRQP0100JB-A	PLOP0100KB-A
Part No.		M30302SPFP	M30302SPGP	M30302GAPFP* <sup>Note1</sup>	M30302GAPGP* <sup>Note1</sup>	M30302MAP-XXXFP	M30302MAP-XXXGP	M30302FAPFP	M30302FAPGP	M30302GCPFP* <sup>Note1</sup>	M30302GCPGP* <sup>Note1</sup>	M30302MCP-XXXFP	M30302MCP-XXXGP

\*1 Data can only be written once and cannot be erased.

★ : New product ★★ : Under development

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (M16C/30 Series)

Group		M16C/30P										
Memory	ROM (Bytes)	128K + 4K		160K			192K			192K + 4K		256K
	RAM (Bytes)	5K		6K			12K			6K		12K
	ROM Type <sup>*1</sup>	F		M			F			M		F
	Data Flash	Yes (4K)		-			-			Yes (4K)		-
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)		-			Yes (ID Code Check Function, ROM Code Protect Function)			-		Yes (ID Code Check Function, ROM Code Protect Function)
CPU	CPU	M16C/60 Core										
	Basic Instructions	91										
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)										
	Multiplier	16 × 16 → 32										
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32										
DMA	Barrel Shifter	-										
	DMAC (Channels)	2										
External Bus Expansion	DTC/DMACII	1M										
	Address Space (Bytes)	1M										
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals										
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)										
	DRAM Controller	-										
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub-clock)										
	PLL	-										
	Subclock	Yes										
	On-Chip Oscillator	-										
	Oscillation Stop Detection	-										
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)										
Power Supply Voltage Detection	Power Save	Wait/Stop										
	Power-On Reset/POR	-										
A/D Converter	Low Voltage Detection/LVD	-										
	Resolution × Channels	10-bit × 18										
D/A Converter	Sample and Hold	Yes										
	Multi-Channel Sample and Hold	-										
Timer	Resolution × Channels	-										
	8-bit	-										
	16-bit	6 (Timer A, Timer B)										
	Input Capture	-										
	Output Compare	-										
	PWM Output	3 (Timer A)										
	Real-Time Port	-										
	Event Counter	6 (Timer A, Timer B)										
	2-Phase Encoder Input	1 (Timer A)										
3-Phase Inverter Control	-											
Watchdog Timer	1	1										
	Clock Sync./ Clock Async.	3 (UART)										
Serial Interface	Clock Sync. Only	-										
	Clock Async. Only	-										
	3 (UART)	3 (UART)										
I <sup>2</sup> C-bus	1 (UART)											
IEBus	1 (UART)											
Smart Card/SIM	1 (UART)											
Synchronous Serial Communication Unit/Special Serial I/O	Channels	1 (UART)										
	Message Box (Numbers)	-										
CAN	Channels	-										
	Message Box (Numbers)	-										
IrDA	-											
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))											
X/Y Converter	Input Only (Numbers)	1										
	CMOS I/O (Numbers)	85										
	N-Channel Open Drain Port (Numbers)	2										
	High Current Drive Port	-										
	Pull-Up Resistor	85										
External Interrupts Pins	10											
Debugging Function	On-Chip Debug	Yes		-			-			Yes		-
	On-Board Flash Program	Yes		Yes (Only Rewriting is possible)			Yes (Only Rewriting is possible)			Yes (Only Rewriting is possible)		Yes (Only Rewriting is possible)
Other Functions	ROM Correction Function	-		-			Yes			-		Yes
	Others	-										
Operating Frequency/Supply Voltage	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V											
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85											
Package <sup>*2</sup>	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
	PRQP0100JB-A	PRQP0100JB-A										
	PLQP0100KB-A	PLQP0100KB-A										
Part No.	M30302FCPP	M30302FCPP										
	M30302FCGP	M30302FCGP										
	M30302GDFP <sup>Non1</sup>	M30302GDFP <sup>Non1</sup>										
	M30302GDFP <sup>Non1</sup>	M30302GDFP <sup>Non1</sup>										
	M30302MDP-XXXFP	M30302MDP-XXXFP										
	M30302MDP-XXXGP	M30302MDP-XXXGP										
	M30304GDFP <sup>Non1</sup>	M30304GDFP <sup>Non1</sup>										
	M30304GDFP <sup>Non1</sup>	M30304GDFP <sup>Non1</sup>										
	M30302GEFP <sup>Non1</sup>	M30302GEFP <sup>Non1</sup>										
	M30302GEFP <sup>Non1</sup>	M30302GEFP <sup>Non1</sup>										
	M30302MEP-XXXFP	M30302MEP-XXXFP										
	M30302MEP-XXXGP	M30302MEP-XXXGP										
	M30304GEFP <sup>Non1</sup>	M30304GEFP <sup>Non1</sup>										
	M30304GEFP <sup>Non1</sup>	M30304GEFP <sup>Non1</sup>										
	M30302FEFP	M30302FEFP										
	M30302FEFP	M30302FEFP										
M30302GGFP <sup>Non1</sup>	M30302GGFP <sup>Non1</sup>											
M30302GGFP <sup>Non1</sup>	M30302GGFP <sup>Non1</sup>											

<sup>1</sup> Data can only be written once and cannot be erased.

<sup>\*1</sup> F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

<sup>\*2</sup> Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

• Specifications (M16C/1N Group)

Group		M16C/1N
Memory	ROM (Bytes)	64K + 4K
	RAM (Bytes)	3K
	ROM Type**1	F
	Data Flash	Yes (4K)
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)
CPU	CPU	M16C/60 Core
	Basic Instructions	91
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)
	Multiplier	16 × 16→32
	Multiply-Accumulate Instruction	16 × 16 + 32→32
DMA	DMAC (Channels)	—
	DTC/DMACII	—
External Bus Expansion	Address Space (Bytes)	—
	External Bus Interface	—
	Bus Structure	—
	DRAM Controller	—
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)
	PLL	—
	Subclock	Yes
	On-Chip Oscillator	Yes
	Oscillation Stop Detection	Yes
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)
Power Supply Voltage Detection	Power-On Reset/POR	Wait/Stop
	Low Voltage Detection/LVD	—
A/D Converter	Resolution × Channels	10-bit × 14
	Sample and Hold	Yes
	Multi-Channel Sample and Hold	—
D/A Converter	Resolution × Channels	8-bit × 1
	8-bit	4 (Timer 1, Timer X, Timer Y, Timer Z)
Timer	16-bit	1 (Timer C)
	Input Capture	1 (Timer C)
	Output Compare	—
	PWM Output	2 (Timer Y, Timer Z)
	Real-Time Port	—
	Event Counter	1 (Timer X)
	2-Phase Encoder Input	—
	3-Phase Inverter Control	—
	Watchdog Timer	—
Serial Interface	Clock Sync./ Clock Async.	2 (UART)
	Clock Sync. Only	—
	Clock Async. Only	—
I <sup>2</sup> C-bus	—	
IEBus	—	
Smart Card/SIM	—	
Synchronous Serial Communication Unit/Special Serial I/O	—	
CAN	Channels	1
	Message Box (Numbers)	16
IrDA	—	
CRC Calculation Circuit	—	
X/Y Converter	—	
I/O Ports	Input Only (Numbers)	—
	CMOS I/O (Numbers)	37
	N-Channel Open Drain Port (Numbers)	—
	High Current Drive Port	8
	Pull-Up Resistor	37
External Interrupts Pins	8	
Debugging Function	On-Chip Debug	Yes
	On-Board Flash Program	Yes
Other Functions	ROM Correction Function	—
	Others	—
Operating Frequency/Supply Voltage	16MHz/4.2 to 5.5V	
Operating Ambient Temperature (°C)	– 40 to 85	
Package**2	PLOP0048KB-A	
Part No.	M301N2F8FP	

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/Tiny Series)

Group		M16C/26A (M16C/26A)												M16C/26A (M16C/26B)	
Memory	ROM (Bytes)	24K		24K + 4K		48K		48K + 4K		64K		64K + 4K			
	RAM (Bytes)	1K								2K					
	ROM Type*1	M		F		M		F		M		F			
	Data Flash	-		Yes (4K)		-		Yes (4K)		-		Yes (4K)			
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)			
CPU	M16C/60 Core														
	Basic Instructions	91													
	Minimum Instruction Execution Time (ns)	50 (@20MHz)												41.7 (@24MHz)	
	Multiplier	16 × 16 → 32													
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32													
DMA	Barrel Shifter	-													
	DMAC (Channels)	2													
External Bus Expansion	DTC/DMACII	-													
	Address Space (Bytes)	-													
	External Bus Interface	-													
	Bus Structure	-													
Clock	DRAM Controller	-													
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)													
	PLL	Yes													
	Subclock	Yes													
	On-Chip Oscillator	Yes													
	Oscillation Stop Detection	Yes													
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)													
Power Supply Voltage Detection	Power Save	Wait/Stop													
	Power-On Reset/POR	-													
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)													
	Resolution × Channels	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10	10-bit × 12	10-bit × 10
D/A Converter	Sample and Hold	Yes													
	Multi-Channel Sample and Hold	Yes													
Timer	Resolution × Channels	-													
	8-bit	-													
	16-bit	8 (Timer A, Timer B)													
	Input Capture	-													
	Output Compare	-													
	PWM Output	5 (Timer A)													
	Real-Time Port	-													
	Event Counter	8 (Timer A, Timer B)													
	2-Phase Encoder Input	3 (Timer A)													
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)													
		1													
Serial Interface	Clock Sync./ Clock Async.	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)
	Clock Sync. Only	-													
	Clock Async. Only	-													
I <sup>2</sup> C-bus		1 (UART)													
IEBus		1 (UART)													
Smart Card/SIM		1 (UART)													
Synchronous Serial	Communication Unit/Special Serial I/O	1 (UART)													
	Channels	-													
CAN	Message Box (Numbers)	-													
		-													
IrDA		-													
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1) /CRC-16 (X <sup>16</sup> + X <sup>15</sup> + X <sup>2</sup> + 1))													
X/Y Converter		-													
	Input Only (Numbers)	-													
	CMOS I/O (Numbers)	39	33	39	33	39	33	39	33	39	33	39	33	39	33
	N-Channel Open Drain Port (Numbers)	-													
	High Current Drive Port	-													
External Interrupts Pins	Pull-Up Resistor	39	33	39	33	39	33	39	33	39	33	39	33	39	33
		11													
Debugging Function	On-Chip Debug	-		Yes		-		Yes		-		Yes		-	
	On-Board Flash Program	-		Yes		-		Yes		-		Yes		-	
Other Functions	ROM Correction Function	Yes (Address match × 2)		-		Yes (Address match × 2)		-		Yes (Address match × 2)		-		-	
	Others	-													
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V												24MHz/4.2 to 5.5V, 20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	
Operating Ambient Temperature (°C)		-20 to 85, -40 to 85												-40 to 85, -20 to 85	
Package*2		PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B	PLQP0048KB-A	PRSP0042GA-B
		M30260M6A-XXXGP	M30263M6A-XXXFP	M30260F3AGP	M30263F3AFP	M30260M6A-XXXGP	M30263M6A-XXXFP	M30260F8AGP	M30263F8AFP	M30260M6A-XXXGP	M30263M6A-XXXFP	M30260F8AGP	M30263F8AFP	M30260F8BGP*	M30263F8BFP*
Part No.															

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



• Specifications (M16C/Tiny Series)

Group		M16C/28														M16C/28 (M16C/28B)			
Memory	ROM (Bytes)	48K + 4K				64K		64K + 4K				96K		96K + 4K		128K		128K + 4K	
	RAM (Bytes)					4K						8K		12K					
	ROM Type*1	F				M		F				M		F		M		F	
	Data Flash	Yes (4K)				-		Yes (4K)				-		Yes (4K)		-			
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)				-		Yes (ID Code Check Function, ROM Code Protect Function)				-		Yes (ID Code Check Function, ROM Code Protect Function)		-			
CPU	CPU	M16C/60 Core																	
	Basic Instructions	91																	
	Minimum Instruction Execution Time (ns)	50 (@20MHz)														41.7 (@24MHz)			
	Multiplier	16 × 16 → 32																	
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																	
	Barrel Shifter	-																	
DMA	DMAC (Channels)	2																	
	DTC/DMACII	-																	
External Bus Expansion	Address Space (Bytes)	-																	
	External Bus Interface	-																	
	Bus Structure	-																	
	DRAM Controller	-																	
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)																	
	PLL	Yes																	
	Subclock	Yes																	
	On-Chip Oscillator	Yes																	
	Oscillation Stop Detection	Yes																	
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																	
Power Supply	Power-On Reset/POR	-																	
	Low Voltage Detection/LVD	Yes (Low voltage)																	
A/D Converter	Resolution × Channels	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13	10-bit × 24	10-bit × 13		
	Sample and Hold	Yes																	
D/A Converter	Resolution × Channels	-																	
	8-bit	-																	
Timer	16-bit	8 (Timer A, Timer B)																	
	Input Capture	8 (Timer S)																	
	Output Compare	8 (Timer S)																	
	PWM Output	13 (Timer A, Timer S)																	
	Real-Time Port	-																	
	Event Counter	8 (Timer A, Timer B)																	
	2-Phase Encoder Input	3 (Timer A)+1 (Timer S)																	
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)																	
Watchdog Timer	1																		
Serial Interface	Clock Sync./ Clock Async.	3 (UART)																	
	Clock Sync. Only	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)		
	Clock Async. Only	-																	
I <sup>2</sup> C-bus	2 (Multi master I <sup>2</sup> C, UART)																		
IEBus	1 (UART)																		
Smart Card/SIM	1 (UART)																		
Synchronous Serial Communication Unit/Special Serial I/O	1 (UART)																		
CAN	Channels	-																	
	Message Box (Numbers)	-																	
IrDA	-																		
CRC Calculation Circuit	-																		
X/Y Converter	-																		
I/O Ports	Input Only (Numbers)	-																	
	CMOS I/O (Numbers)	71	55	71	55	71	55	71	55	71	55	71	55	71	55	71	55		
	N-Channel Open Drain Port (Numbers)	-																	
	High Current Drive Port	-																	
External Interrupts Pins	Pull-Up Resistor	71	55	71	55	71	55	71	55	71	55	71	55	71	55	71	55		
	Others	11																	
Debugging Function	On-Chip Debug	Yes				-		Yes				-		Yes		-		Yes	
	On-Board Flash Program	Yes				-		Yes				-		Yes		-		Yes	
Other Functions	ROM Correction Function	-				Yes (Address match × 2)		-				Yes (Address match × 2)		-		Yes (Address match × 2)		-	
	Others	-																	
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V																24MHz/4.2 to 5.5V, 20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V		
Operating Ambient Temperature (°C)	-20 to 85, -40 to 85		-20 to 85		-20 to 85, -40 to 85				-20 to 85		-20 to 85, -40 to 85				-20 to 85		-40 to 85		
Package*2	PLOP0080KB-A																		
	PTLG0085JB-A																		
Part No.	M30280FBHP																		
	M30280FBWG																		
	M30281FBHP																		
	M30280MB-XXXHP																		
	M30281MB-XXXHP																		
	M30280FBHP																		
	M30280FBWG																		
	M30281FBHP																		
	M30280MA-XXXHP																		
	M30281MA-XXXHP																		
	M30280FAHP																		
	M30280FAWG																		
	M30281FAHP																		
	M30280MC-XXXHP																		
M30281MC-XXXHP																			
M30280FCHP																			
M30281FCHP																			
M30280FCBHP																			
M30281FCBHP																			

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/Tiny Series)

Group		M16C/29									
Memory	ROM (Bytes)	64K		96K		96K + 4K		128K		128K + 4K	
	RAM (Bytes)	4K		8K				12K			
	ROM Type*1	M		F		M		F		F	
	Data Flash	-		Yes (4K)		-		Yes (4K)		-	
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		-	
CPU	CPU	M16C/60 Core									
	Basic Instructions	91									
	Minimum Instruction Execution Time (ns)	50 (@20MHz)									
	Multiplier	16 × 16 → 32									
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32									
DMA	Barrel Shifter	-									
	DMAC (Channels)	2									
External Bus Expansion	DTC/DMACII	-									
	Address Space (Bytes)	-									
	External Bus Interface	-									
	Bus Structure	-									
Clock	DRAM Controller	-									
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)									
	PLL	Yes									
	Subclock	Yes									
	On-Chip Oscillator	Yes									
	Oscillation Stop Detection	Yes									
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)									
Power Supply Voltage Detection	Power Save	Wait/Stop									
	Power-On Reset/POR	-									
A/D Converter	Low Voltage Detection/LVD	Yes (Low voltage)									
	Resolution × Channels	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16
D/A Converter	Sample and Hold	Yes									
	Multi-Channel Sample and Hold	Yes									
Timer	Resolution × Channels	-									
	8-bit	-									
	16-bit	8 (Timer A, Timer B)									
	Input Capture	8 (Timer S)									
	Output Compare	8 (Timer S)									
	PWM Output	13 (Timer A, Timer S)									
	Real-Time Port	-									
	Event Counter	8 (Timer A, Timer B)									
	2-Phase Encoder Input	3 (Timer A)+1 (Timer S)									
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead time timer)									
		1									
Serial Interface	Clock Sync./ Clock Async.	3 (UART)									
	Clock Sync. Only	2 (Si/O)	1 (Si/O)	2 (Si/O)	1 (Si/O)	2 (Si/O)	1 (Si/O)	2 (Si/O)	1 (Si/O)	2 (Si/O)	1 (Si/O)
	Clock Async. Only	-									
I <sup>2</sup> C-bus		2 (Multi master I <sup>2</sup> C, UART)									
IEBus		1 (UART)									
Smart Card/SIM		1 (UART)									
Synchronous Serial Communication Unit/Special Serial I/O		1 (UART)									
	Channels	1									
CAN	Message Box (Numbers)	16									
		-									
IrDA		-									
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1)/CRC-16 (X <sup>16</sup> + X <sup>15</sup> + X <sup>2</sup> + 1))									
X/Y Converter		-									
	Input Only (Numbers)	-									
	CMOS I/O (Numbers)	71	55	71	55	71	55	71	55	71	55
	N-Channel Open Drain Port (Numbers)	-									
	High Current Drive Port	-									
External Interrupts Pins	Pull-Up Resistor	71	55	71	55	71	55	71	55	71	55
		11									
Debugging Function	On-Chip Debug	-		Yes		-		Yes		-	
	On-Board Flash Program	-		Yes		-		Yes		-	
Other Functions	ROM Correction Function	Yes (Address match × 2)		-		Yes (Address match × 2)		-		-	
	Others	-									
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V									
Operating Ambient Temperature (°C)		- 20 to 85, - 40 to 85									
Package*2		PLQP0080KB-A	PLQP0064KB-A	PLQP0080KB-A	PLQP0064KB-A	PLQP0080KB-A	PLQP0064KB-A	PLQP0080KB-A	PLQP0064KB-A	PLQP0080KB-A	PLQP0064KB-A
	Part No.	M30290MB-XXXHP	M30291MB-XXXHP	M30290MA-XXXHP	M30291MA-XXXHP	M30290FAHP	M30291FAHP	M30290MC-XXXHP	M30291MC-XXXHP	M30290FCHP	M30291FCHP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (M16C/6H Group)

Group		M16C/6H		
Memory	ROM (Bytes)	128K		256K
	RAM (Bytes)	5K		8K
	ROM Type**1		M	F
	Data Flash		–	
	Program Security		–	Yes (ID code check function, ROM code protect function)
CPU	CPU	M16C/60 Core		
	Basic Instructions	91		
	Minimum Instruction Execution Time (ns)	62.5 (@16MHz)		
	Multiplier	16 × 16→32		
	Multiply-Accumulate Instruction	16 × 16 + 32→32		
DMA	DMAC (Channels)	2		
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub-clock)		
	PLL	–		
	Subclock	Yes		
	Real Time clock	Yes		
	On-Chip Oscillator	–		
	Frequency Divider	1/n (n = 1, 2, 4, 8, 16)		
Power Save	Normal operation (High-speed, Medium-speed, Low-speed, Low-power consumption)/Wait/Stop			
A/D Converter	Resolution × Channels	8-bit × (8 + 2)		
D/A Converter	Resolution × Channels	–		
Timer	16-bit	11 (Timer A, Timer B)		
Watchdog Timer		1		
Serial Interface	Clock Sync./ Clock Async.	3 (UART0 to UART2)		
	Clock Sync. Only	2 (SI/O3, SI/O4)		
	Clock Async. Only	–		
I <sup>2</sup> C-bus		4 (UART0 to UART2 + Multi master I <sup>2</sup> C)		
IEBus		1 (UART2)		
Smart Card/SIM		1 (UART2)		
Synchronous Serial Communication Unit/Special Serial I/O		–		
CAN	Channels	–		
	Message Box (Numbers)	–		
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>2</sup> + 1))		
I/O Ports	Input Only (Numbers)		1	
	CMOS Output Only (Numbers)	–		1
	CMOS I/O (Numbers)		79	
	N-Channel Open Drain Port (Numbers)		4	
External Interrupts Pins		8		
Debugging Function	On-Board Flash Program			Yes
Other Functions	ROM Correction Function	Yes (Address match × 4)		–
	Others	VBI Data slicer (PDC, VPS, WSS, EPG-J, CCD, CC2X, ID-1)		
Operating Frequency/Supply Voltage		16MHz/4.5 to 5.5V		
Operating Ambient Temperature (°C)		–20 to 70		
Package**2		PRQP0100JB-A		
Part No.		M306H7MC-XXXFP	M306H7MG-XXXFP	M306H7FGFP

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

## • Specifications (M16C/6S Group)

Group		M16C/6S
Memory	ROM (Bytes)	96K
	RAM (Bytes)	24K
	ROM Type*1	F
	Data Flash	—
	Program Security	Yes (ID code check function, ROM code protect function)
CPU	CPU	M16C/60 Core
	Basic Instructions	91
	Minimum Instruction Execution Time (ns)	65.1 (@ 15.36MHz)
	Multiplier	16 × 16 → 32
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32
DMA	DMAC (Channels)	2
	DTC/DMAcII	—
External Bus Expansion	Address Space (Bytes)	—
	External Bus Interface	—
	Bus Structure	—
	DRAM Controller	—
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)
	PLL	—
	Subclock	—
	Real Time clock	—
	On-Chip Oscillator	Yes
	Oscillation Stop Detection	—
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)
Power Supply Voltage Detection	Power Save	Normal operation (High-speed, Medium-speed)/Wait/Stop
	Power-On Reset/POR	—
A/D Converter	Low Voltage Detection/LVD	—
	Resolution × Channels	—
D/A Converter	Sample and Hold	—
	Multi-Channel Sample and Hold	—
Timer	Resolution × Channels	—
	8-bit	—
	16-bit	5 (Timer A)
	Input Capture	—
	Output Compare	—
	PWM Output	—
	Real-Time Port	—
	Event Counter	—
Watchdog Timer	2-Phase Encoder Input	—
	3-Phase Inverter Control	—
Serial Interface	Clock Sync./ Clock Async.	2 (UART0, UART1)
	Clock Sync. Only	2 (SI/O4 is internally connected to IT800)
	Clock Async. Only	1 (UART2)
I <sup>2</sup> C-bus		3 (UART0 to UART2)
IEBus		—
Smart Card/SIM		—
Synchronous Serial	Communication Unit/Special Serial I/O	—
CAN	Channels	—
	Message Box (Numbers)	—
IrDA		—
CRC Calculation Circuit		—
X/Y Converter		—
I/O Ports	Input Only (Numbers)	1
	CMOS I/O (Numbers)	20
	N-Channel Open Drain Port (Numbers)	1 (P7_0)
	High Current Drive Port	—
	Pull-Up Resistor	20 (Pull-up resistor can be set every four ports)
External Interrupts Pins		3 (INT1-INT3)
Debugging Function	On-Chip Debug	Yes
	On-Board Flash Program	Yes
Other Functions	ROM Correction Function	—
	Others	Power line communication function
Operating Frequency/Supply Voltage		15.36MHz/3.0 to 3.6V
Operating Ambient Temperature (°C)		– 20 to 85, – 40 to 85
Package*2		PLQP0064KB-A
Part No.		M306S0FAGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

## • Specifications (M16C/39P Group)

Group		M16C/39P	
Memory	ROM (Bytes)	128K	192K
	RAM (Bytes)	5K	6K
	ROM Type**1		M
	Data Flash		—
	Program Security		—
CPU	CPU	M16C/60 Core	
	Basic Instructions	91	
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)	
	Multiplier	16 × 16→32	
DMA	Multiply-Accumulate Instruction	16 × 16 + 32→32	
	DMAC (Channels)	2	
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)	
	PLL	—	
	Subclock	Yes (32.768kHz)	
	On-Chip Oscillator	—	
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)	
	Power Save	Normal operation (High-speed, Medium-speed, Low-speed, Low-power consumption)/Wait/Stop	
A/D Converter	Resolution × Channels	10-bit × 18	
D/A Converter	Resolution × Channels	—	
Timer	16-bit	6 (Timer A, Timer B)	
	PWM Output	3 (shared with Timer A)	
	Event Counter	6 (shared with Timer A, Timer B)	
	2-Phase Encoder Input	1 (shared with Timer A2)	
Watchdog Timer		1	
Serial Interface	Clock Sync./ Clock Async.	2 (UART1, UART2)	
	Clock Sync. Only	1 (used in UART0, VFD Controller)	
FC-bus		2 (shared with UART1, UART2)	
IEBus		1 (shared with UART2)	
Smart Card/SIM		1 (shared with UART2)	
Synchronous Serial Communication Unit/Special Serial I/O		1 (UART2 : Special mode 2)	
VFD		High Current Drive Port 34 (Segment (Numbers) ≤ 32, 2 ≤ Digit (Numbers) ≤ 16)	
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))	
I/O Ports	Input Only (Numbers)	1	
	CMOS I/O (Numbers)	51	
	High Current Drive Port	34	
	N-Channel Open Drain Port (Numbers)	2 (P7_0, P7_1)	
	Pull-Up Resistor	51 (Pull-up resistor can be set every four ports)	
External Interrupts Pins		7	
Other Functions	ROM Correction Function	Yes (Address match × 2)	
	Others	—	
Operating Frequency/Supply Voltage		When using VFD:16MHz/4.5 to 5.5V, 10MHz/3.0 to 3.6V, When not using VFD:16MHz/4.2 to 5.5V, 10MHz/2.7 to 5.5V	
Operating Ambient Temperature (°C)		- 20 to 75	
Package**2		PRQP0100JB-A	
Part No.		M30392MCP-XXXFP	M30392MEP-XXXFP

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (R8C/Tiny Series)

Group		R8C/18				R8C/19								
Memory	ROM (Bytes)	4K	8K	12K	16K	4K + 2K	8K + 2K	12K + 2K	16K + 2K					
	RAM (Bytes)	384	512	768	1K	384	512	768	1K					
	ROM Type*1	F												
	Data Flash	-				Yes (2K)								
Program Security		Yes (ID code check function, ROM code protect function)												
CPU	CPU	R8C Core												
	Basic Instructions	89												
	Minimum Instruction Execution Time (ns)	50 (@20MHz)												
	Multiplier	16 × 16 → 32												
Multiply-Accumulate Instruction		16 × 16 + 32 → 32												
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)												
	PLL	-												
	Subclock	-												
	Real Time clock	-												
	On-Chip Oscillator	Yes (High precision, High speed : 8MHz, Low speed : 125kHz)												
	Oscillation Stop Detection	Yes												
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)												
Power Save		Wait/Stop												
Power-On Reset/POR		Yes												
Voltage Detection		Yes (Voltage detection 2)												
Resolution × Channels		-												
Sample and Hold		-												
Resolution × Channels		-												
Timer	8-bit	2 (Timer X, Timer Z)												
	16-bit	1 (Timer C)												
	Input Capture	1 (shaed with Timer C)												
	Output Compare	1 (shaed with Timer C)												
	PWM Output	1 (shaed with Timer Z)												
	Real-Time Port	-												
	Event Counter	1 (shaed with Timer X)												
	2-Phase Encoder Input	-												
	3-Phase Inverter Control	-												
	Watchdog Timer		1 (with automatic starting function and clock source protection function)											
Clock Sync./ Clock Async.		1 (UART0)												
Clock Sync. Only		-												
Clock Async. Only		1 (UART1)												
fC-bus		-												
Synchronous Serial Communication Unit/Special Serial I/O		-												
Channels		-												
Message Box (Numbers)		-												
Input Only (Numbers)		3												
CMOS I/O (Numbers)		13												
N-Channel Open Drain Port (Numbers)		-												
High Current Drive Port		4												
Pull-Up Resistor		13												
External Interrupts Pins		7												
On-Chip Debug		Yes												
On-Board Flash Program		Yes												
ROM Correction Function		-												
Others		comparator												
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V												
Operating Ambient Temperature (°C)		-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85
Package**		PRDP0020BA-A	PLSP0020JB-A	PRDP0020BA-A	PWQN0028KA-B	PLSP0020JB-A	PRDP0020BA-A	PWQN0028KA-B	PLSP0020JB-A	PRDP0020BA-A	PWQN0028KA-B	PLSP0020JB-A	PRDP0020BA-A	PWQN0028KA-B
Part No.		R5F21181DD	R5F21181SP	R5F21181DSP	R5F21182DD	R5F21182NP	R5F21182SP	R5F21183DD	R5F21183NP	R5F21183SP	R5F21183DD	R5F21184DD	R5F21184NP	R5F21184DSP
		R5F21191DD	R5F21191SP	R5F21191DSP	R5F21192SP	R5F21192NP	R5F21192DD	R5F21192DSP	R5F21193DD	R5F21193NP	R5F21193SP	R5F21194DD	R5F21194NP	R5F21194DSP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (R8C/Tiny Series)

Group		R8C/1A				R8C/1B																									
Memory	ROM (Bytes)	4K	8K	12K	16K	4K + 2K	8K + 2K	12K + 2K	16K + 2K																						
	RAM (Bytes)	384	512	768	1K	384	512	768	1K																						
	ROM Type <sup>*1</sup>					F																									
	Data Flash	-				Yes (2K)																									
	Program Security	Yes (ID code check function, ROM code protect function)																													
CPU	CPU	R8C Core																													
	Basic Instructions	89																													
	Minimum Instruction Execution Time (ns)	50 (@20MHz)																													
	Multiplier	16 × 16 → 32																													
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																													
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)																													
	PLL	-																													
	Subclock	-																													
	Real Time clock	-																													
	On-Chip Oscillator	Yes (High precision, High speed : 8MHz, Low speed : 125kHz)																													
	Oscillation Stop Detection	Yes																													
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																													
	Power Save	Wait/Stop																													
Power Supply Voltage Detection	Power-On Reset/POR	Yes																													
	Low Voltage Detection/LVD	Yes (Voltage detection 2)																													
A/D Converter	Resolution × Channels	10-bit × 4																													
	Sample and Hold	Yes																													
D/A Converter	Resolution × Channels	-																													
	8-bit	2 (Timer X, Timer Z)																													
Timer	16-bit	1 (Timer C)																													
	Input Capture	1 (shared with Timer C)																													
	Output Compare	1 (shared with Timer C)																													
	PWM Output	1 (shared with Timer Z)																													
	Real-Time Port	-																													
	Event Counter	1 (shared with Timer X)																													
	2-Phase Encoder Input	-																													
	3-Phase Inverter Control	-																													
Watchdog Timer	1 (with automatic starting function and clock source protection function)																														
Serial Interface	Clock Sync./ Clock Async.	1 (UART0)																													
	Clock Sync. Only	-																													
	Clock Async. Only	1 (UART1)																													
ƒC-bus	1 (shared with Synchronous Serial Communication Unit)																														
Synchronous Serial Communication Unit/Special Serial I/O	1 (shared with ƒC)																														
CAN	Channels	-																													
	Message Box (Numbers)	-																													
I/O Ports	Input Only (Numbers)	3																													
	CMOS I/O (Numbers)	13																													
	N-Channel Open Drain Port (Numbers)	-																													
	High Current Drive Port	4																													
	Pull-Up Resistor	13																													
External Interrupts Pins	7																														
Debugging Function	On-Chip Debug	Yes																													
	On-Board Flash Program	Yes																													
Other Functions	ROM Correction Function	-																													
	Others	-																													
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V																														
Operating Ambient Temperature (°C)	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85																	
Package <sup>*2</sup>	PLSP0020JB-A	PRDP0020BA-A	PLSP0020JB-A	PWQN0028KA-B	PRDP0020BA-A	PLSP0020JB-A	PWQN0028KA-B	PRDP0020BA-A	PLSP0020JB-A	PWQN0028KA-B	PRDP0020BA-A	PLSP0020JB-A	PWQN0028KA-B	PRDP0020BA-A																	
Part No.	R5F211A1DSP	R5F211A1SP	R5F211A1DD	R5F211A2SP	R5F211A2NP	R5F211A2DD	R5F211A2DSP	R5F211A3SP	R5F211A3NP	R5F211A3DD	R5F211A3DSP	R5F211A3DD	R5F211A4DD	R5F211A4DSP	R5F211A4SP	R5F211A4NP	R5F211B1DSP	R5F211B1SP	R5F211B1DD	R5F211B2NP	R5F211B2SP	R5F211B2DSP	R5F211B2DD	R5F211B3DSP	R5F211B3SP	R5F211B3NP	R5F211B3DD	R5F211B4DSP	R5F211B4SP	R5F211B4NP	R5F211B4DD

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (R8C/Tiny Series)

Group		R8C/22			R8C/23		
Memory	ROM (Bytes)	32K	48K	64K	32K + 2K	48K + 2K	64K + 2K
	RAM (Bytes)	2K	2.5K	3K	2K	2.5K	3K
	ROM Type <sup>*1</sup>	F					
	Data Flash	-			Yes (2K)		
Program Security		Yes (ID code check function, ROM code protect function)					
CPU	CPU	R8C Core					
	Basic Instructions	89					
	Minimum Instruction Execution Time (ns)	50 (@20MHz)					
	Multiplier	16 × 16 → 32					
Multiply-Accumulate Instruction		16 × 16 + 32 → 32					
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)					
	PLL	-					
	Subclock	-					
	Real Time clock	-					
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)					
	Oscillation Stop Detection	Yes					
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)					
Power Save		Wait/Stop					
Power Supply Voltage Detection	Power-On Reset/POR	Yes					
	Low Voltage Detection/LVD	Yes (Voltage detection 2)					
A/D Converter	Resolution × Channels	10-bit × 12					
	Sample and Hold	Yes					
D/A Converter	Resolution × Channels	-					
	8-bit	3 (Timer RA, Timer RB, Timer RE)					
Timer	16-bit	2 (Timer RD)					
	Input Capture	8 (shared with Timer RD)					
	Output Compare	9 (shared with Timer RD, Timer RE)					
	PWM Output	7 (shared with Timer RB, Timer RD)					
	Real-Time Port	-					
	Event Counter	1 (shared with Timer RA)					
	2-Phase Encoder Input	-					
	3-Phase Inverter Control	1 (shared with Timer RD)					
Watchdog Timer	1 (with automatic starting function and clock source protection function)						
Serial Interface	Clock Sync./ Clock Async.	1 (UART0)					
	Clock Sync. Only	-					
	Clock Async. Only	1 (UART1)					
I <sup>2</sup> C-bus		1 (shared with Synchronous Serial Communication Unit)					
Synchronous Serial Communication Unit/Special Serial I/O		1 (shared with I <sup>2</sup> C)					
CAN	Channels	1					
	Message Box (Numbers)	16					
I/O Ports	Input Only (Numbers)	3					
	CMOS I/O (Numbers)	41					
	N-Channel Open Drain Port (Numbers)	-					
	High Current Drive Port	-					
	Pull-Up Resistor	41					
External Interrupts Pins		8					
Debugging Function	On-Chip Debug	Yes					
	On-Board Flash Program	Yes					
Other Functions	ROM Correction Function	-					
	Others	-					
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V					
Operating Ambient Temperature (°C)		- 40 to 85					
Package <sup>*2</sup>		PLQP0048KB-A					
Part No.		R5F21226DFP	R5F21227DFP	R5F21228DFP	R5F21236DFP	R5F21237DFP	R5F21238DFP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



## • Specifications (R8C/Tiny Series)

Group		R8C/24						R8C/25																		
Memory	ROM (Bytes)	16K	24K	32K	48K	64K	16K + 2K	24K + 2K	32K + 2K	48K + 2K	64K + 2K															
	RAM (Bytes)	1K	2K		2.5K	3K	1K	2K		2.5K	3K															
	ROM Type**1							F																		
	Data Flash	-						Yes (2K)																		
	Program Security	Yes (ID code check function, ROM code protect function)																								
CPU	CPU	R8C Core																								
	Basic Instructions	89																								
	Minimum Instruction Execution Time (ns)	50 (@20MHz)																								
	Multiplier	16 × 16→32																								
	Multiply-Accumulate Instruction	16 × 16 + 32→32																								
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)																								
	PLL	-																								
	Subclock	Yes (32.768kHz)																								
	Real Time clock	Yes (Timer RE)																								
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)																								
	Oscillation Stop Detection	Yes																								
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																								
Power Supply	Power Save	Wait/Stop																								
	Power-On Reset/POR	Yes																								
Voltage Detection	Low Voltage Detection/LVD	Yes (Voltage detection 3)																								
	Resolution × Channels	10-bit × 12																								
A/D Converter	Sample and Hold	Yes																								
D/A Converter	Resolution × Channels	-																								
	8-bit	3 (Timer RA, Timer RB, Timer RE)																								
Timer	16-bit	2 (Timer RD)																								
	Input Capture	8 (shared with Timer RD)																								
	Output Compare	9 (shared with Timer RD, Timer RE)																								
	PWM Output	7 (shared with Timer RB, Timer RD)																								
	Real-Time Port	-																								
	Event Counter	1 (shared with Timer RA)																								
	2-Phase Encoder Input	-																								
	3-Phase Inverter Control	1 (shared with Timer RD)																								
	Watchdog Timer	1 (with automatic starting function and clock source protection function)																								
Serial Interface	Clock Sync./ Clock Async.	2 (UART0, UART1)																								
	Clock Sync. Only	-																								
	Clock Async. Only	-																								
I <sup>2</sup> C-bus	1 (shared with Synchronous Serial Communication Unit)																									
Synchronous Serial Communication Unit/Special Serial I/O	1 (shared with I <sup>2</sup> C)																									
CAN	Channels	-																								
	Message Box (Numbers)	-																								
I/O Ports	Input Only (Numbers)	3																								
	CMOS I/O (Numbers)	41																								
	N-Channel Open Drain Port (Numbers)	-																								
	High Current Drive Port	8																								
	Pull-Up Resistor	41																								
External Interrupts Pins	8																									
Debugging Function	On-Chip Debug	Yes																								
	On-Board Flash Program	Yes																								
Other Functions	ROM Correction Function	-																								
	Others	-																								
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V, 5MHz/2.2 to 5.5V																									
Operating Ambient Temperature (°C)	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85											
Package**2	PLOP0052JA-A	PTLG0064JA-A		PLOP0052JA-A		PTLG0064JA-A		PLOP0052JA-A		PTLG0064JA-A		PLOP0052JA-A		PTLG0064JA-A												
	R5F21244SDFF	R5F21244SNLG	R5F21244SNFP	R5F21246SDFF	R5F21246SNLG	R5F21246SNFP	R5F21247SDFF	R5F21247SNLG	R5F21247SNFP	R5F21248SDFF	R5F21248SNLG	R5F21248SNFP	R5F21254SDFF	R5F21254SNLG	R5F21254SNFP	R5F21255SDFF	R5F21255SNLG	R5F21255SNFP	R5F21256SDFF	R5F21256SNLG	R5F21256SNFP	R5F21257SDFF	R5F21257SNLG	R5F21257SNFP	R5F21258SDFF	R5F21258SNLG

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (R8C/Tiny Series)

Group		R8C/26				R8C/27				R8C/28		R8C/29													
Memory	ROM (Bytes)	8K	16K	24K	32K	8K + 2K	16K + 2K	24K + 2K	32K + 2K	8K	16K	8K + 2K	16K + 2K												
	RAM (Bytes)	512	1K	1.5K		512	1K	1.5K		512	1K	512	1K												
	ROM Type*1	F																							
	Data Flash	-				Yes (2K)				-		Yes (2K)													
Program Security		Yes (ID code check function, ROM code protect function)																							
CPU	CPU	R8C Core																							
	Basic Instructions	89																							
	Minimum Instruction Execution Time (ns)	50 (@20MHz)																							
	Multiplier	16 × 16 → 32																							
Multiply-Accumulate Instruction		16 × 16 + 32 → 32																							
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)																							
	PLL	-																							
	Subclock	Yes (32.768kHz)																							
	Real Time clock	Yes (Timer RE)																							
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)																							
	Oscillation Stop Detection	Yes																							
Frequency Divider		1/n (n=1, 2, 4, 8, 16)																							
Power Save		Wait/Stop																							
Power Supply Voltage Detection	Power-On Reset/POR	Yes																							
	Low Voltage Detection/LVD	Yes (Voltage detection 3)																							
A/D Converter	Resolution × Channels	10-bit × 12								10-bit × 4															
	Sample and Hold	Yes																							
D/A Converter	Resolution × Channels	-																							
	8-bit	3 (Timer RA, Timer RB, Timer RE)																							
Timer	16-bit	1 (Timer RC)																							
	Input Capture	4 (shared with Timer RC)																							
	Output Compare	5 (shared with Timer RC, Timer RE)																							
	PWM Output	4 (shared with Timer RB, Timer RC)																							
	Real-Time Port	-																							
	Event Counter	1 (shared with Timer RA)																							
	2-Phase Encoder Input	-																							
	3-Phase Inverter Control	-																							
Watchdog Timer		1 (with automatic starting function and clock source protection function)																							
Serial Interface	Clock Sync./ Clock Async.	2 (UART0, UART1)								1 (UART0)															
	Clock Sync. Only	-																							
	Clock Async. Only	-								1 (UART1)															
I <sup>2</sup> C-bus		1 (shared with Synchronous Serial Communication Unit)																							
Synchronous Serial Communication Unit/Special Serial I/O		1 (shared with I <sup>2</sup> C)																							
CAN	Channels	-																							
	Message Box (Numbers)	-																							
I/O Ports	Input Only (Numbers)	3								-															
	CMOS I/O (Numbers)	25								13															
	N-Channel Open Drain Port (Numbers)	-																							
	High Current Drive Port	8								-															
Pull-Up Resistor		25								13															
External Interrupts Pins		7																							
Debugging Function	On-Chip Debug	Yes																							
	On-Board Flash Program	Yes																							
Other Functions	ROM Correction Function	-																							
	Others	-																							
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V, 5MHz/2.2 to 5.5V																							
Operating Ambient Temperature (°C)		-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85										
Package**		PLQP0032GB-A										PLSP0020JB-A													
Part No.		R6F21282SDFF	R6F21282SNFF	R6F21284SNFF	R6F21284SDFF	R6F21285SNFF	R6F21285SDFF	R6F21286SNFF	R6F21286SDFF	R6F21272SDFF	R6F21272SNFF	R6F21274SNFF	R6F21274SDFF	R6F21275SNFF	R6F21275SDFF	R6F21276SDFF	R6F21276SNFF	R6F21282SDSP	R6F21282SNSP	R6F21284SNSP	R6F21284SDSP	R6F21282SNSP	R6F21282SDSP	R6F21284SDSP	R6F21284SNSP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (R8C/Tiny Series)

Group		R8C/2A				R8C/2B								
Memory	ROM (Bytes)	48K	64K	96K	128K	48K + 2K	64K + 2K	96K + 2K	128K + 2K					
	RAM (Bytes)	2.5K	3K	7K	7.5K	2.5K	3K	7K	7.5K					
	ROM Type**1					F								
	Data Flash	-				Yes (2K)								
	Program Security	Yes (ID code check function, ROM code protect function)												
CPU	CPU	R8C Core												
	Basic Instructions	89												
	Minimum Instruction Execution Time (ns)	50 (@20MHz)												
	Multiplier	16 × 16 → 32												
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32												
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)												
	PLL	-												
	Subclock	Yes (32.768kHz)												
	Real Time clock	Yes (Timer RE)												
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)												
	Oscillation Stop Detection	Yes												
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)												
	Power Save	Wait/Stop												
Power Supply Voltage Detection	Power-On Reset/POR	Yes												
	Low Voltage Detection/LVD	Yes (Voltage detection 3)												
A/D Converter	Resolution × Channels	10-bit × 12												
	Sample and Hold	Yes												
D/A Converter	Resolution × Channels	8-bit × 2												
		3 (Timer RA, Timer RB, Timer RE)												
Timer	8-bit	4 (Timer RC, Timer RD, Timer RF)												
	16-bit	13 (shared with Timer RC, Timer RD, Timer RF)												
	Input Capture	14 (shared with Timer RC, Timer RD, Timer RE, Timer RF)												
	Output Compare	10 (shared with Timer RB, Timer RC, Timer RD)												
	PWM Output	-												
	Real-Time Port	-												
	Event Counter	1 (shared with Timer RA)												
	2-Phase Encoder Input	-												
	3-Phase Inverter Control	1 (shared with Timer RD)												
Watchdog Timer		1 (with automatic starting function and clock source protection function)												
Serial Interface	Clock Sync./ Clock Async.	3 (UART0 to UART2)												
	Clock Sync. Only	-												
	Clock Async. Only	-												
I <sup>2</sup> C-bus		1 (shared with Synchronous Serial Communication Unit)												
Synchronous Serial Communication Unit/Special Serial I/O		1 (shared with I <sup>2</sup> C)												
CAN	Channels	-												
	Message Box (Numbers)	-												
I/O Ports	Input Only (Numbers)	2												
	CMOS I/O (Numbers)	55												
	N-Channel Open Drain Port (Numbers)	-												
	High Current Drive Port	8												
	Pull-Up Resistor	55												
External Interrupts Pins		8												
Debugging Function	On-Chip Debug	Yes												
	On-Board Flash Program	Yes												
Other Functions	ROM Correction Function	-												
	Others	-												
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V, 5MHz/2.2 to 5.5V												
Operating Ambient Temperature (°C)		-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85
Package**2		PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A	PLQP0064KB-A	PLQP0064GA-A
Part No.		R5F212A7SNFA*	R5F212A7SNFP*	R5F212A7SDFA*	R5F212A7SDFP*	R5F212A8SDFA*	R5F212A8SDFP*	R5F212A8SNFA*	R5F212A8SNFP*	R5F212A8SDFA*	R5F212A8SDFP*	R5F212A8SNFA*	R5F212A8SNFP*	R5F212A8SDFA*

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (R8C/Tiny Series)

Group		R8C/2C						R8C/2D									
Memory	ROM (Bytes)	48K	64K	96K	128K	48K + 2K	64K + 2K	96K + 2K	128K + 2K	48K	64K	96K	128K				
	RAM (Bytes)	2.5K	3K	7K	7.5K	2.5K	3K	7K	7.5K								
	ROM Type*1	F															
	Data Flash	-						Yes (2K)									
	Program Security	Yes (ID code check function, ROM code protect function)															
CPU	CPU	R8C Core															
	Basic Instructions	89															
	Minimum Instruction Execution Time (ns)	50 (@20MHz)															
	Multiplier	16 × 16 → 32															
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32															
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)															
	PLL	-															
	Subclock	Yes (32.768kHz)															
	Real Time clock	Yes (Timer RE)															
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)															
	Oscillation Stop Detection	Yes															
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)															
	Power Save	Wait/Stop															
Power Supply Voltage Detection	Power-On Reset/POR	Yes															
	Low Voltage Detection/LVD	Yes (Voltage detection 3)															
A/D Converter	Resolution × Channels	10-bit × 20															
	Sample and Hold	Yes															
D/A Converter	Resolution × Channels	8-bit × 2															
	8-bit	3 (Timer RA, Timer RB, Timer RE)															
Timer	16-bit	4 (Timer RC, Timer RD, Timer RE, Timer RF)															
	Input Capture	13 (shared with Timer RC, Timer RD, Timer RE)															
	Output Compare	14 (shared with Timer RC, Timer RD, Timer RE, Timer RF)															
	PWM Output	10 (shared with Timer RB, Timer RC, Timer RD)															
	Real-Time Port	-															
	Event Counter	1 (shared with Timer RA)															
	2-Phase Encoder Input	-															
	3-Phase Inverter Control	1 (shared with Timer RD)															
Watchdog Timer		1 (with automatic starting function and clock source protection function)															
Serial Interface	Clock Sync./ Clock Async.	3 (UART0 to UART2)															
	Clock Sync. Only	-															
	Clock Async. Only	-															
I <sup>2</sup> C-bus		1 (shared with Synchronous Serial Communication Unit)															
Synchronous Serial Communication Unit/Special Serial I/O		1 (shared with I <sup>2</sup> C)															
CAN	Channels	-															
	Message Box (Numbers)	-															
I/O Ports	Input Only (Numbers)	2															
	CMOS I/O (Numbers)	71															
	N-Channel Open Drain Port (Numbers)	-															
	High Current Drive Port	8															
	Pull-Up Resistor	71															
External Interrupts Pins		8															
Debugging Function	On-Chip Debug	Yes															
	On-Board Flash Program	Yes															
Other Functions	ROM Correction Function	-															
	Others	-															
Operating Frequency/Supply Voltage		20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V, 5MHz/2.2 to 5.5V															
Operating Ambient Temperature (°C)	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85			
Package**		PLQP0080KB-A															
Part No.		REF212C7SNFP*	REF212C7SDFP*	REF212C8SDFP*	REF212C8SNFP*	REF212CASDFF*	REF212CASNFP*	REF212CCSDFP*	REF212CCSNFP*	REF212D7SDFP*	REF212D7SNFP*	REF212D8SDFP*	REF212D8SNFP*	REF212DASNFP*	REF212DASDFF*	REF212DCSNFP*	REF212DCSDFP*

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

## • Specifications (R8C/Tiny Series)

Group		R8C/2E				R8C/2F			
Memory	ROM (Bytes)	8K		16K		8K + 2K		16K + 2K	
	RAM (Bytes)	512		1K		512		1K	
	ROM Type**1					F			
	Data Flash	-				Yes (2K)			
	Program Security	Yes (ID code check function, ROM code protect function)							
CPU	CPU	R8C Core							
	Basic Instructions	89							
	Minimum Instruction Execution Time (ns)	50 (@20MHz)							
	Multiplier	16 × 16→32							
	Multiply-Accumulate Instruction	16 × 16 + 32→32							
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)							
	PLL	-							
	Subclock	-							
	Real Time clock	-							
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)							
	Oscillation Stop Detection	Yes							
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)							
Power Supply	Power Save	Wait/Stop							
	Power-On Reset/POR	Yes							
	Low Voltage Detection/LVD	Yes (Voltage detection 2)							
A/D Converter	Resolution × Channels	10-bit × 12							
	Sample and Hold	Yes							
D/A Converter	Resolution × Channels	8-bit × 2							
	8-bit	3 (Timer RA, Timer RB, Timer RE)							
Timer	16-bit	1 (Timer RC)							
	Input Capture	4 (shared with Timer RC)							
	Output Compare	5 (shared with Timer RC, Timer RE)							
	PWM Output	4 (shared with Timer RB, Timer RC)							
	Real-Time Port	-							
	Event Counter	1 (shared with Timer RA)							
	2-Phase Encoder Input	-							
	3-Phase Inverter Control	-							
Watchdog Timer	1 (with automatic starting function and clock source protection function)								
Serial Interface	Clock Sync./ Clock Async.	1 (UART0)							
	Clock Sync. Only	-							
	Clock Async. Only	-							
FC-bus	-								
Synchronous Serial Communication Unit/Special Serial I/O	-								
CAN	Channels	-							
	Message Box (Numbers)	-							
I/O Ports	Input Only (Numbers)	3							
	CMOS I/O (Numbers)	25							
	N-Channel Open Drain Port (Numbers)	-							
	High Current Drive Port	8							
	Pull-Up Resistor	25							
External Interrupts Pins	7								
Debugging Function	On-Chip Debug	Yes							
	On-Board Flash Program	Yes							
Other Functions	ROM Correction Function	-							
	Others	comparator × 2							
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V								
Operating Ambient Temperature (°C)	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	
Package**2	PLQP0032GB-A								
Part No.	R5F212E2DFP**	R5F212E2NFP**	R5F212E4DFP**	R5F212E4NFP**	R5F212F2DFP**	R5F212F2NFP**	R5F212F4DFP**	R5F212F4NFP**	

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

## • Specifications (R8C/Tiny Series)

Group		R8C/2G						R8C/2H			R8C/2J				
Memory	ROM (Bytes)	16K	24K	32K	4K	8K	2K	4K	F	-	-	-	-		
	RAM (Bytes)	512	1K	256	384	256	384								
	ROM Type <sup>*1</sup>	Yes (ID code check function, ROM code protect function)													
	Data Flash	-													
Program Security		Yes (ID code check function, ROM code protect function)													
CPU	CPU	R8C Core						R8C Core							
	Basic Instructions	89						89							
	Minimum Instruction Execution Time (ns)	125 (@8MHz)						125 (@8MHz)							
	Multiplier	16 × 16 → 32						16 × 16 → 32							
Clock	Clock Generation Circuit	2 circuits (Sub clock, On-chip oscillator)						1 circuit (On-chip oscillator)							
	PLL	-						-							
	Subclock	Yes (32.768kHz)			-			Yes (32.768kHz)			-				
	Real Time clock	Yes (Timer RE)						-							
	On-Chip Oscillator	Yes (High precision, High speed : 8MHz, Low speed : 125kHz)						-							
	Oscillation Stop Detection	-						-							
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)						-							
	Power Save	Wait/Stop						-							
Power Supply Voltage Detection	Power-On Reset/POR	Yes						Yes							
	Low Voltage Detection/LVD	Yes (Voltage detection 3)						-							
A/D Converter	Resolution × Channels	-						-							
	Sample and Hold	-						-							
D/A Converter	Resolution × Channels	-						-							
	8-bit	3 (Timer RA, Timer RB, Timer RE)						-			2 (Timer RA, Timer RB)				
Timer	16-bit	-						1 (Timer RF)			-				
	Input Capture	-						4 (shared with Timer RF)							
	Output Compare	2 (shared with Timer RE, Timer RF)						-			1 (shared with Timer RF)				
	PWM Output	-						1 (shared with Timer RB)			-				
	Real-Time Port	-						-							
	Event Counter	-						1 (shared with Timer RA)			-				
	2-Phase Encoder Input	-						-							
Watchdog Timer	3-Phase Inverter Control	-						-							
		1 (with automatic starting function and clock source protection function)						-			1 (UART0)				
Serial Interface	Clock Sync./ Clock Async.	2 (UART0, UART2)						-			1 (UART0)				
	Clock Sync. Only	-						-							
	Clock Async. Only	-						-							
I <sup>2</sup> C-bus		-						-							
Synchronous Serial Communication Unit/Special Serial I/O		-						-							
CAN	Channels	-						-							
	Message Box (Numbers)	-						-							
I/O Ports	Input Only (Numbers)	-						-			-				
	CMOS I/O (Numbers)	28						16			12				
	N-Channel Open Drain Port (Numbers)	-						-							
	High Current Drive Port	-						-							
External Interrupts Pins	Pull-Up Resistor	28						16			12				
		8						-			6				
Debugging Function	On-Chip Debug	-						Yes							
	On-Board Flash Program	-						Yes							
Other Functions	ROM Correction Function	-						-							
	Others	-						comparator × 2 (shared with voltage monitor 1 and 2)							
Operating Frequency/Supply Voltage		8MHz/2.7 to 5.5V, 4MHz/2.2 to 5.5V						-							
Operating Ambient Temperature (°C)		-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85		
Package <sup>*2</sup>		PLQP0032GB-A						PLSP0020JB-A							
Part No.		REF212G4SDFP**	REF212G4SNFP**	REF212G5SDFP**	REF212G5SNFP**	REF212G6SDFP**	REF212G6SNFP**	REF212H1SDSP**	REF212H1SNSP**	REF212H2SDSP**	REF212H2SNSP**	REF212J0SDSP**	REF212J0SNSP**	REF212J1SDSP**	REF212J1SNSP**

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product    ★★ : Under development

## • Specifications (R8C/Tiny Series)

Group		R8C/2K				R8C/2L			
Memory	ROM (Bytes)	8K		16K		8K + 2K		16K + 2K	
	RAM (Bytes)	1K		1.5K		1K		1.5K	
	ROM Type <sup>*1</sup>					F			
	Data Flash	-				Yes (2K)			
	Program Security	Yes (ID code check function, ROM code protect function)							
CPU	CPU	R8C Core							
	Basic Instructions	89							
	Minimum Instruction Execution Time (ns)	50 (@20MHz)							
	Multiplier	16 × 16→32							
	Multiply-Accumulate Instruction	16 × 16 + 32→32							
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)							
	PLL	-							
	Subclock	-							
	Real Time clock	-							
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)							
	Oscillation Stop Detection	Yes							
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)							
	Power Save	Wait/Stop							
Power Supply Voltage Detection	Power-On Reset/POR	Yes							
	Low Voltage Detection/LVD	Yes (Voltage detection 3)							
A/D Converter	Resolution × Channels	10-bit × 9							
	Sample and Hold	Yes							
D/A Converter	Resolution × Channels	-							
	8-bit	2 (Timer RA, Timer RB)							
Timer	16-bit	3 (Timer RC, Timer RD)							
	Input Capture	12 (shared with Timer RC, Timer RD)							
	Output Compare	12 (shared with Timer RC, Timer RD)							
	PWM Output	10 (shared with Timer RB, Timer RC, Timer RD)							
	Real-Time Port	-							
	Event Counter	1 (shared with Timer RA)							
	2-Phase Encoder Input	-							
	3-Phase Inverter Control	1 (shared with Timer RD)							
	Watchdog Timer	1 (with automatic starting function and clock source protection function)							
Serial Interface	Clock Sync./ Clock Async.	2 (UART0, UART2)							
	Clock Sync. Only	-							
	Clock Async. Only	-							
FC-bus	-								
Synchronous Serial Communication Unit/Special Serial I/O	-								
CAN	Channels	-							
	Message Box (Numbers)	-							
I/O Ports	Input Only (Numbers)	3							
	CMOS I/O (Numbers)	25							
	N-Channel Open Drain Port (Numbers)	-							
	High Current Drive Port	8							
	Pull-Up Resistor	25							
External Interrupts Pins	7								
Debugging Function	On-Chip Debug	Yes							
	On-Board Flash Program	Yes							
Other Functions	ROM Correction Function	-							
	Others	-							
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V, 5MHz/2.2 to 5.5V								
Operating Ambient Temperature (°C)	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	-40 to 85	-20 to 85	
Package <sup>*2</sup>	PLQP0032GB-A								
Part No.	REF212K2SDFF**	REF212K2SNFP**	REF212K4SDFF**	REF212K4SNFP**	REF212L2SDFF**	REF212L2SNFP**	REF212L4SDFF**	REF212L4SNFP**	

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

Automotive MCUs

## • Specifications (M32C/80 Series)

Group		M32C/84 (M32C/84T)													
Memory	ROM (Bytes)	128K		256K		320K		384K		384K + 4K		512K + 4K			
	RAM (Bytes)	10K		20K						24K					
	ROM Type*1													M	F
	Data Flash													-	Yes (4K)
	Program Security													-	Yes (ID Code Check Function, ROM Code Protect Function)
CPU	CPU	M32C/80 Core													
	Basic Instructions	108													
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)													
	Multiplier	16 × 16 → 32													
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48													
DMA	Barrel Shifter	Yes													
	DMAC (Channels)	4													
External Bus Expansion	DTC/DMACII	DMACII (Startup Possible with All Peripheral Function Interrupt Causes)													
	Address Space (Bytes)	-													
	External Bus Interface	-													
	Bus Structure	-													
Clock	DRAM Controller	-													
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)													
	PLL	Yes													
	Subclock	Yes													
	RTC	-													
	On-Chip Oscillator	Yes													
	Oscillation Stop Detection	Yes													
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)													
Power Supply Voltage Detection	Power Save	Wait/Stop													
	Power-On Reset/POR	-													
A/D Converter	Low Voltage Detection/LVD	-													
	Resolution × Channels	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26
	Sample and Hold	Yes													
D/A Converter	Multi-Channel Sample and Hold	-													
	Resolution × Channels	8-bit × 2													
Timer	8-bit	-													
	16-bit	11 (Timer A, Timer B)													
	Input Capture	8 (Intelligent I/O)													
	Output Compare	8 (Intelligent I/O)													
	PWM Output	13 (Timer A, Intelligent I/O)													
	Real-Time Port	-													
	Event Counter	11 (Timer A, Timer B)													
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)													
3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)														
Watchdog Timer		1													
	Clock Sync./Clock Async.	6 (UART, Intelligent I/O)													
	Clock Sync. Only	1 (Intelligent I/O)													
Serial Interface	Clock Async. Only	-													
		5 (UART)													
I <sup>2</sup> C-bus		5 (UART)													
		5 (UART)													
Smart Card/SIM		5 (UART)													
		5 (UART)													
Synchronous Serial Communication Unit/Special Serial I/O		5 (UART)													
		5 (UART)													
CAN	Channels	1													
	Message Box (Numbers)	16													
IrDA		-													
		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))													
CRC Calculation Circuit		Yes													
	X/Y Converter	-													
I/O Ports	Input Only (Numbers)	1													
	CMOS I/O (Numbers)	121	85	121	85	121	85	121	85	121	85	121	85	121	85
	N-Channel Open Drain Port (Numbers)	2													
	High Current Drive Port	-													
	Pull-Up Resistor	121	85	121	85	121	85	121	85	121	85	121	85	121	85
External Interrupts Pins		11													
	On-Chip Debug	-													
Debugging Function	On-Board Flash Program	-													
		Yes													
Other Functions	ROM Correction Function	Yes													
	Others	-													
Operating Frequency/Supply Voltage		32MHz/4.2 to 5.5V													
Operating Ambient Temperature (°C)		-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105
Package**		PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A	PLQP0144KA-A	PLQP0100KB-A
		M30842MCT-XXXGP	M30840MCL-XXXGP*	M30840MCT-XXXGP	M30842MCL-XXXGP*	M30843MGL-XXXGP*	M30845MGL-XXXGP*	M30845MGT-XXXGP	M30843MGT-XXXGP	M30843MWT-XXXGP	M30843MWU-XXXGP*	M30843MHT-XXXGP*	M30843MHU-XXXGP*	M30843MHT-XXXGP	M30845MHU-XXXGP*
Part No.		M30843FHUGP	M30843FHUGP	M30845FHUGP	M30845FHUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP
		M30843FJUGP	M30843FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP	M30845FJUGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



## • Specifications (M32C/80 Series)

Group		M32C/85 (M32C/85T)																	
Memory	ROM (Bytes)	256K				320K				320K + 4K				384K		384K + 4K		512K + 4K	
	RAM (Bytes)	20K																	
	ROM Type*1	M								F				M		F			
	Data Flash	-																	
	Program Security	-								Yes (4K)				-		Yes (4K)			
CPU	CPU	M32C/80 Core																	
	Basic Instructions	108																	
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)																	
	Multiplier	16 × 16 → 32																	
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48																	
	Barrel Shifter	Yes																	
DMA	DMAC (Channels)	4																	
	DTC/DMACII	DMACII (Startup Possible with All Peripheral Function Interrupt Causes)																	
External Bus Expansion	Address Space (Bytes)	-																	
	External Bus Interface	-																	
	Bus Structure	-																	
	DRAM Controller	-																	
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)																	
	PLL	Yes																	
	Subclock	Yes																	
	RTC	-																	
	On-Chip Oscillator	Yes																	
	Oscillation Stop Detection	Yes																	
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)																	
Power Supply Voltage Detection	Power-On Reset/POR	Wait/Stop																	
A/D Converter	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34				
	Sample and Hold	Yes																	
	Multi-Channel Sample and Hold	-																	
D/A Converter	Resolution × Channels	8-bit × 2																	
	8-bit	-																	
Timer	16-bit	11 (Timer A, Timer B)																	
	Input Capture	8 (Intelligent I/O)																	
	Output Compare	8 (Intelligent I/O)																	
	PWM Output	13 (Timer A, Intelligent I/O)																	
	Real-Time Port	-																	
	Event Counter	11 (Timer A, Timer B)																	
	2-Phase Encoder Input	3 (Timer A) + 1 (Intelligent I/O)																	
3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)																		
Watchdog Timer	Clock Sync./ Clock Async.	1																	
Serial Interface	Clock Sync. Only	6 (UART, Intelligent I/O)																	
	Clock Async. Only	1 (Intelligent I/O)																	
I <sup>2</sup> C-bus	Channels	5 (UART)																	
IEBus	Channels	5 (UART)																	
Smart Card/SIM	Channels	5 (UART)																	
Synchronous Serial Communication Unit/Special Serial I/O	Channels	5 (UART)																	
CAN	Channels	2																	
	Message Box (Numbers)	16 × 2																	
IrDA	Channels	-																	
CRC Calculation Circuit	Algorithm	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))																	
X/Y Converter	Input Only (Numbers)	Yes																	
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121	85	121	85	121				
I/O Ports	N-Channel Open Drain Port (Numbers)	2																	
	High Current Drive Port	-																	
External Interrupts Pins	Channels	85	121	85	121	85	121	85	121	85	121	85	121	85	121				
	Pull-Up Resistor	-																	
Debugging Function	On-Chip Debug	-				Yes				-				Yes					
	On-Board Flash Program	-				Yes				-				Yes					
Other Functions	ROM Correction Function	Yes				-				Yes				-					
	Others	-																	
Operating Frequency/Supply Voltage	32MHz/4.2 to 5.5V																		
Operating Ambient Temperature (°C)	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105				
Package*2	PLOP0100KB-A	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	PLOP0100KB-A	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
Part No.	M30853MGU-XXGXP*	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30855MGT-XXGXP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30853MGT-XXGXP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30855MGU-XXGXP*	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30855MWT-XXGXP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30853MWT-XXGXP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30855MWU-XXGXP*	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30853MWU-XXGXP*	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30855FVTGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30853FWUGP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30853FVTGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30855FVUGP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30853MHU-XXGXP*	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30853MHT-XXGXP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
	M30855MHU-XXGXP*	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A					
	M30855MHT-XXGXP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A			
M30855FHUGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A						
M30853FHTGP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A				
M30855FHUGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A						
M30853FJGTP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A				
M30855FJUGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A						
M30855FJTGP	PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A		PLOP0144KA-A				
M30855FJUGP	PLOP0100KB-A				PLOP0144KA-A				PLOP0100KB-A				PLOP0144KA-A						

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

Automotive MCUs

## • Specifications (M32C/80 Series)

Group		M32C/88 (M32C/88T)										
Memory	ROM (Bytes)	320K + 4K				384K + 4K				512K + 4K		
	RAM (Bytes)	18K										
	ROM Type*1	F										
	Data Flash	Yes (4K)										
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)										
CPU	CPU	M32C/80 Core										
	Basic Instructions	108										
	Minimum Instruction Execution Time (ns)	31.3 (@32MHz)										
	Multiplier	16 × 16 → 32										
	Multiply-Accumulate Instruction	16 × 16 + 48 → 48										
DMA	Barrel Shifter	Yes										
	DMAC (Channels)	4										
External Bus Expansion	DTC/DMACII	DMACII (Startup Possible with All Peripheral Function Interrupt Causes)										
	Address Space (Bytes)	-										
	External Bus Interface	-										
	Bus Structure	-										
Clock	DRAM Controller	-										
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)										
	PLL	Yes										
	Subclock	Yes										
	RTC	-										
	On-Chip Oscillator	Yes										
	Oscillation Stop Detection	Yes										
	Frequency Divider	1/n (n=1, 2, 3, 4, 6, 8, 10, 12, 14, 16)										
Power Supply Voltage Detection	Power Save	Wait/Stop										
	Power-On Reset/POR	-										
A/D Converter	Low Voltage Detection/LVD	-										
	Resolution × Channels	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	10-bit × 26	10-bit × 34	
D/A Converter	Sample and Hold	Yes										
	Multi-Channel Sample and Hold	-										
Timer	Resolution × Channels	8-bit × 2										
	8-bit	-										
	16-bit	11 (Timer A, Timer B)										
	Input Capture	8 (Intelligent I/O)										
	Output Compare	8 (Intelligent I/O)										
	PWM Output	13 (Timer A, Intelligent I/O)										
	Real-Time Port	-										
	Event Counter	11 (Timer A, Timer B)										
	2-Phase Encoder Input	3 (Timer A) + 2 (Intelligent I/O)										
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)										
		1										
Serial Interface	Clock Sync./ Clock Async.	6 (UART, Intelligent I/O)										
	Clock Sync. Only	1 (Intelligent I/O)										
	Clock Async. Only	-										
I <sup>2</sup> C-bus		5 (UART)										
IEBus		5 (UART)										
Smart Card/SIM		5 (UART)										
Synchronous Serial	Communication Unit/Special Serial I/O	5 (UART)										
	Channels	3										
CAN	Message Box (Numbers)	16 × 3										
		-										
IrDA		-										
CRC Calculation Circuit		1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))										
X/Y Converter		Yes										
	Input Only (Numbers)	1										
	CMOS I/O (Numbers)	85	121	85	121	85	121	85	121	85	121	
	N-Channel Open Drain Port (Numbers)	2										
	High Current Drive Port	-										
External Interrupts Pins	Pull-Up Resistor	85	121	85	121	85	121	85	121	85	121	
		11										
Debugging Function	On-Chip Debug	Yes										
	On-Board Flash Program	Yes										
Other Functions	ROM Correction Function	-										
	Others	-										
Operating Frequency/Supply Voltage		32MHz/4.2 to 5.5V										
Operating Ambient Temperature (°C)		-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105	-40 to 85	-40 to 105		
Package*2		PLOP0100KE-A	PLOP0144KA-A	PLOP0100KE-A	PLOP0144KA-A	PLOP0100KE-A	PLOP0144KA-A	PLOP0100KE-A	PLOP0144KA-A	PLOP0100KE-A	PLOP0144KA-A	
	Part No.	M30880FWLGP	M30882FVFTGP	M30880FVFTGP	M30882FWLGP	M30882FHTGP	M30882FHLGP	M30880FHLGP	M30880FHTGP	M30882FJTG	M30880FJLGP	M30880FJTG

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

• Specifications (M16C/60 Series)

Group		M16C/62P (M16C/62PT)								
Memory	ROM (Bytes)	48K	64K	64K + 4K	96K	128K	128K + 4K	384K + 4K		
	RAM (Bytes)	4K			5K	10K	31K			
	ROM Type**1	M		F		M	F			
	Data Flash	-		Yes (4K)		-		Yes (4K)		
	Program Security	-		Yes (ID Code Check Function, ROM Code Protect Function)		-		Yes (ID Code Check Function, ROM Code Protect Function)		
CPU	CPU	M16C/60 Core								
	Basic Instructions	91								
	Minimum Instruction Execution Time (ns)	41.7 (@24MHz)								
	Multiplier	16 × 16→32								
	Multiply-Accumulate Instruction	16 × 16 + 32→32								
	Barrel Shifter	-								
DMA	DMAC (Channels)	2								
	DTC/DMACII	-								
External Bus Expansion	Address Space (Bytes)	-								
	External Bus Interface	-								
	Bus Structure	-								
	DRAM Controller	-								
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)								
	PLL	Yes								
	Subclock	Yes								
	RTC	-								
	On-Chip Oscillator	Yes								
	Oscillation Stop Detection	Yes								
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)								
	Power Save	Wait/Stop								
Power Supply Voltage Detection	Power-On Reset/POR	-								
	Low Voltage Detection/LVD	-								
A/D Converter	Resolution × Channels	10-bit × 26								
	Sample and Hold	Yes								
D/A Converter	Multi-Channel Sample and Hold	-								
	Resolution × Channels	8-bit × 2								
Timer	8-bit	-								
	16-bit	11 (Timer A, Timer B)								
	Input Capture	-								
	Output Compare	-								
	PWM Output	5 (Timer A)								
	Real-Time Port	-								
	Event Counter	11 (Timer A, Timer B)								
	2-Phase Encoder Input	3 (Timer A)								
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)								
	Watchdog Timer	1								
Serial Interface	Clock Sync./ Clock Async.	3 (UART)								
	Clock Sync. Only	2 (SI/O)								
	Clock Async. Only	-								
I <sup>2</sup> C-bus	3 (UART)									
IEBus	3 (UART)									
Smart Card/SIM	1 (UART)									
Synchronous Serial Communication Unit/Special Serial I/O	3 (UART)									
CAN	Channels	-								
	Message Box (Numbers)	-								
IrDA	-									
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))									
X/Y Converter	-									
I/O Ports	Input Only (Numbers)	1								
	CMOS I/O (Numbers)	85								
	N-Channel Open Drain Port (Numbers)	2								
	High Current Drive Port	-								
	Pull-Up Resistor	85								
External Interrupts Pins	11									
Debugging Function	On-Chip Debug	-	Yes	-	-	-	-	Yes		
	On-Board Flash Program	-	Yes	-	-	-	-	Yes		
Other Functions	ROM Correction Function	Yes	-	-	Yes	-	-	-		
	Others	-								
Operating Frequency/Supply Voltage	24MHz/4.0 to 5.5V									
Operating Ambient Temperature (°C)	-40 to 85									
Package**2	PLQP0100XB-A				PRQP0100JB-A				PLQP0100XB-A	
Part No.	M3062CM6T-XXXXGP	M3062CM8T-XXXXGP	M3062CF8TGP	M3062CMAT-XXXXGP	M3062AMCT-XXXXGP	M3062AFCTGP	M3062JHFTFP	M3062JHTGP		

\*\* F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

Automotive MCUs

## • Specifications (M16C/60 Series)

Group		M16C/62A (M16C/62T)											
Memory	ROM (Bytes)	32K	64K					128K				256K	
	RAM (Bytes)	3K	4K					5K				10K	20K
	ROM Type*1	M							O				F
	Data Flash	-											
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)											
CPU	CPU	M16C/60 Core											
	Basic Instructions	91											
	Minimum Instruction Execution Time (ns)	62.5 (@16MHz)											
	Multiplier	16 × 16 → 32											
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32											
DMA	DMAC (Channels)	2											
	DTC/DMACII	-											
External Bus Expansion	Address Space (Bytes)	-											
	External Bus Interface	-											
	Bus Structure	-											
	DRAM Controller	-											
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)											
	PLL	-											
	Subclock	Yes											
	RTC	-											
	On-Chip Oscillator	-											
	Oscillation Stop Detection	-											
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)											
Power Supply Voltage Detection	Power-On Reset/POR	-											
	Low Voltage Detection/LVD	-											
A/D Converter	Resolution × Channels	10-bit × 26											
	Sample and Hold	Yes											
D/A Converter	Resolution × Channels	8-bit × 2											
	8-bit	-											
Timer	16-bit	11 (Timer A, Timer B)											
	Input Capture	-											
	Output Compare	-											
	PWM Output	3 (Timer A)	5 (Timer A)	3 (Timer A)	5 (Timer A)	3 (Timer A)	3 (Timer A)	3 (Timer A)	3 (Timer A)	2 (Timer A)	5 (Timer A)	3 (Timer A)	5 (Timer A)
	Real-Time Port	-											
	Event Counter	11 (Timer A, Timer B)											
	2-Phase Encoder Input	2 (Timer A)	3 (Timer A)	2 (Timer A)	3 (Timer A)	2 (Timer A)	3 (Timer A)	2 (Timer A)	3 (Timer A)	2 (Timer A)	3 (Timer A)	2 (Timer A)	3 (Timer A)
	3-Phase Inverter Control	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)	-	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)
	Watchdog Timer	1											
	Serial Interface	Clock Sync./ Clock Async.	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)	3 (UART)	2 (UART)
Clock Sync. Only		2 (SI/O)											
Clock Async. Only		1 (UART)	-	1 (UART)	-	1 (UART)	-	1 (UART)	-	1 (UART)	-	1 (UART)	-
I <sup>2</sup> C-bus	1 (UART)												
IEBus	1 (UART)												
Smart Card/SIM	1 (UART)												
Synchronous Serial Communication Unit/Special Serial I/O	-												
CAN	Channels	-											
	Message Box (Numbers)	-											
IrDA	-												
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))												
X/Y Converter	-												
I/O Ports	Input Only (Numbers)	1											
	CMOS I/O (Numbers)	68	85	68	85	68	85	68	85	68	85	68	85
	N-Channel Open Drain Port (Numbers)	2											
	High Current Drive Port	-											
External Interrupts Pins	Pull-Up Resistor	68	85	68	85	68	85	68	85	68	85	68	85
	On-Chip Debug	8	11	8	11	8	11	8	11	8	11	8	11
Debugging Function	On-Board Flash Program	-											
	ROM Correction Function	Yes											
Other Functions	Others	-											
	Operating Frequency/Supply Voltage	16MHz/4.2 to 5.5V						16MHz/4.5 to 5.5V				16MHz/4.2 to 5.5V	
Operating Ambient Temperature (°C)		-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 105	-40 to 85	-40 to 105
		-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 105	-40 to 85	-40 to 105
Package**		PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0100JB-A	PRQP0100JB-A
		PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0080JA-A	PRQP0100JB-A	PRQP0100JB-A
Part No.		M30623M4T-XXXGP	M30622M8V-XXXFP	M30622M8T-XXXFP	M30623M8T-XXXGP	M30623M8V-XXXGP	M30622MCV-XXXFP	M30622MCT-XXXFP	M30623MCT-XXXGP	M30623MCT-XXXGP	M30623MCT-XXXGP	M30622MCT-XXXFP	M30622MCT-XXXFP
		M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP	M30622MCT-XXXFP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development

## • Specifications (M16C/60 Series)

Group		M16C/6N4						M16C/6N5								
Memory	ROM (Bytes)	128K		128K + 4K		256K		256K + 4K		128K		128K + 4K				
	RAM (Bytes)	5K						10K								
	ROM Type*1	M			F			M			F					
	Data Flash	-			Yes (4K)			-			Yes (4K)					
	Program Security	-			Yes (ID Code Check Function, ROM Code Protect Function)			-			Yes (ID Code Check Function, ROM Code Protect Function)					
CPU	M16C/60 Core															
	Basic Instructions	91														
	Minimum Instruction Execution Time (ns)	50 (@20MHz)														
	Multiplier	16 × 16 → 32														
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32														
DMA	Barrel Shifter	-														
	DMAC (Channels)	2														
External Bus Expansion	DTC/DMACII	-														
	Address Space (Bytes)	1M														
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals														
	Bus Structure	Selectable from Separate bus, Multiplex bus, Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (12/16/20)														
	DRAM Controller	-														
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)														
	PLL	Yes														
	Subclock	Yes														
	RTC	-														
	On-Chip Oscillator	Yes														
	Oscillation Stop Detection	Yes														
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)														
Power Supply Voltage Detection	Power-On Reset/POR	-														
	Low Voltage Detection/LVD	-														
A/D Converter	Resolution × Channels	10-bit × 26														
	Sample and Hold	Yes														
D/A Converter	Multi-Channel Sample and Hold	-														
	Resolution × Channels	8-bit × 2														
Timer	8-bit	-														
	16-bit	11 (Timer A, Timer B)														
	Input Capture	-														
	Output Compare	-														
	PWM Output	5 (Timer A)														
	Real-Time Port	-														
	Event Counter	11 (Timer A, Timer B)														
	2-Phase Encoder Input	3 (Timer A)														
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)														
Watchdog Timer	1															
Serial Interface	Clock Sync./ Clock Async.	3 (UART)						-								
	Clock Sync. Only	1 (SI/O)						-								
	Clock Async. Only	-														
I <sup>2</sup> C-bus	3 (UART)															
IEBus	3 (UART)															
Smart Card/SIM	1 (UART)															
Synchronous Serial Communication Unit/Special Serial I/O	3 (UART)															
CAN	Channels	2						1								
	Message Box (Numbers)	16 + 16						16								
IrDA	-															
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))															
X/Y Converter	-															
I/O Ports	Input Only (Numbers)	1														
	CMOS I/O (Numbers)	85														
	N-Channel Open Drain Port (Numbers)	2														
	High Current Drive Port	1														
	Pull-Up Resistor	85														
External Interrupts Pins	11															
Debugging Function	On-Chip Debug	-			Yes			-			Yes					
	On-Board Flash Program	-			Yes			-			Yes					
Other Functions	ROM Correction Function	Yes			-			Yes			-					
	Others	-														
Operating Frequency/Supply Voltage																
20MHz/4.2 to 5.5V																
Operating Ambient Temperature (°C)																
-40 to 85    -40 to 125    -40 to 85    -40 to 125    -40 to 85    -40 to 125    -40 to 85    -40 to 125    -40 to 85    -40 to 125    -40 to 85    -40 to 125    -40 to 85																
Package*2	PLQP0100KB-A															
	PRQP0100JB-A															
Part No.	M306N4MCT-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MCT-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MCV-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MCV-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FCTGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FCVFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FCVGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FCTFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MGT-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MGT-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MGV-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4MGV-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FGTGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FGVFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N4FGVGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
	M306N5MCT-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85		
M306N5MCV-XXXGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5MCV-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5MCT-XXXFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5FCVFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5FCVGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5FCTGP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			
M306N5FCTFP	-40 to 85			-40 to 125			-40 to 85			-40 to 125			-40 to 85			

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

Automotive MCUs

## • Specifications (M16C/60 Series)

Group		M16C/6NK			M16C/6NM			
Memory	ROM (Bytes)	384K + 4K		512K + 4K	384K + 4K		512K + 4K	
	RAM (Bytes)	31K						
	ROM Type*1	F						
	Data Flash	Yes (4K)						
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)						
CPU	CPU	M16C/60 Core						
	Basic Instructions	91						
	Minimum Instruction Execution Time (ns)	50 (@20MHz)						
	Multiplier	16 × 16 → 32						
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32						
DMA	DMAC (Channels)	2						
	DTC/DMAII	-						
External Bus Expansion	Address Space (Bytes)	-						
	External Bus Interface	-						
	Bus Structure	-						
	DRAM Controller	-						
Clock	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)						
	PLL	Yes						
	Subclock	Yes						
	RTC	-						
	On-Chip Oscillator	Yes						
	Oscillation Stop Detection	Yes						
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)						
	Power Save	Wait/Stop						
Power Supply Voltage Detection	Power-On Reset/POR	-						
	Low Voltage Detection/LVD	-						
A/D Converter	Resolution × Channels	10-bit × 26						
	Sample and Hold	Yes						
D/A Converter	Multi-Channel Sample and Hold	-						
	Resolution × Channels	8-bit × 2						
Timer	8-bit	-						
	16-bit	11 (Timer A, Timer B)						
	Input Capture	-						
	Output Compare	-						
	PWM Output	5 (Timer A)						
	Real-Time Port	-						
	Event Counter	11 (Timer A, Timer B)						
	2-Phase Encoder Input	3 (Timer A)						
3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)							
Watchdog Timer	1							
Serial Interface	Clock Sync./ Clock Async.	2 (SI/O)			3 (UART)			
	Clock Sync. Only	-			4 (SI/O)			
	Clock Async. Only	-						
I <sup>2</sup> C-bus	3 (UART)							
IEBus	3 (UART)							
Smart Card/SIM	1 (UART)							
Synchronous Serial Communication Unit/Special Serial I/O	Channels	3 (UART)						
	Message Box (Numbers)	2						
CAN	Channels	16 + 16						
	Message Box (Numbers)	-						
IrDA	-							
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1))							
X/Y Converter	-							
I/O Ports	Input Only (Numbers)	85			1			
	CMOS I/O (Numbers)	-			111			
	N-Channel Open Drain Port (Numbers)	-			2			
	High Current Drive Port	-						
External Interrupts Pins	Pull-Up Resistor	85			111			
	External Interrupts Pins	11			14			
Debugging Function	On-Chip Debug	Yes						
	On-Board Flash Program	Yes						
Other Functions	ROM Correction Function	-						
	Others	-						
Operating Frequency/Supply Voltage	20MHz/4.2 to 5.5V							
Operating Ambient Temperature (°C)	- 40 to 125	- 40 to 85	- 40 to 125	- 40 to 85	- 40 to 125	- 40 to 85	- 40 to 125	
Package*2	PLQP0100KB-A			PLQP0128KB-A				
Part No.	M306NKHFHJGVP	M306NKHFHTGP	M306NKFJTGP	M306NKFJVGVP	M306NMFHTGP	M306NMFHJGVP	M306NMFJTGP	M306NMFJVGP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

## • Specifications (M16C/Tiny Series)

Group		M16C/26A (M16C/26T)				M16C/28								
Memory	ROM (Bytes)	24K + 4K	48K + 4K	64K + 4K		64K		96K		96K + 4K				
	RAM (Bytes)	1K	2K		4K		8K							
	ROM Type*1	F				M				F				
	Data Flash	Yes (4K)				-				Yes (4K)				
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)				-				Yes (ID Code Check Function, ROM Code Protect Function)				
CPU	CPU	M16C/60 Core												
	Basic Instructions	91												
	Minimum Instruction Execution Time (ns)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)
	Multiplier	16 × 16 → 32												
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32												
DMA	Barrel Shifter	-												
	DMAC (Channels)	2												
External Bus Expansion	DTC/DMACII	-												
	Address Space (Bytes)	-												
	External Bus Interface	-												
	Bus Structure	-												
Clock	DRAM Controller	-												
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)												
	PLL	Yes												
	Subclock	Yes												
	RTC	-												
	On-Chip Oscillator	Yes												
	Oscillation Stop Detection	Yes												
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)												
Power Supply	Power-On Reset/POR	-												
	Low Voltage Detection/LVD	-												
A/D Converter	Resolution × Channels	10-bit × 12		10-bit × 16	10-bit × 27	10-bit × 16   10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 27	10-bit × 16				
	Sample and Hold	Yes												
D/A Converter	Multi-Channel Sample and Hold	Yes												
	Resolution × Channels	-												
Timer	8-bit	-												
	16-bit	8 (Timer A, Timer B)												
	Input Capture	-		-		-		8 (Timer S)		-				
	Output Compare	-		-		-		8 (Timer S)		-				
	PWM Output	5 (Timer A)		-		-		13 (Timer A, Timer S)		-				
	Real-Time Port	-												
	Event Counter	8 (Timer A, Timer B)												
	2-Phase Encoder Input	3 (Timer A)		-		-		3 (Timer A) + 1 (Timer S)		-				
	3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)												
Watchdog Timer	1													
Serial Interface	Clock Sync./ Clock Async.	3 (UART)												
	Clock Sync. Only	-		1 (SI/O)	2 (SI/O)	1 (SI/O)   2 (SI/O)	1 (SI/O)	2 (SI/O)	1 (SI/O)					
I <sup>2</sup> C-bus	Clock Async. Only	-												
		1 (UART)		2 (Multi master I <sup>2</sup> C, UART)										
IEBus	1 (UART)													
Smart Card/SIM	1 (UART)													
Synchronous Serial Communication Unit/Special Serial I/O	1 (UART)													
CAN	Channels	-												
	Message Box (Numbers)	-												
IrDA	-													
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1)/CRC-16 (X <sup>16</sup> + X <sup>15</sup> + X <sup>2</sup> + 1))													
X/Y Converter	-													
I/O Ports	Input Only (Numbers)	-												
	CMOS I/O (Numbers)	39		55	71	55	71	55	71	55	71	55		
	N-Channel Open Drain Port (Numbers)	-												
	High Current Drive Port	-												
	Pull-Up Resistor	39		55	71	55	71	55	71	55	71	55		
External Interrupts Pins	11													
Debugging Function	On-Chip Debug	Yes		-		-		-		-		Yes		
	On-Board Flash Program	Yes		-		-		-		-		Yes		
Other Functions	ROM Correction Function	-		-		-		Yes (Address match × 2)		-		-		
	Others	-												
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V	20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V	20MHz/3.0 to 5.5V	16MHz/4.2 to 5.5V		20MHz/3.0 to 5.5V	16MHz/4.2 to 5.5V	20MHz/3.0 to 5.5V	16MHz/4.2 to 5.5V	
Operating Ambient Temperature (°C)	-40 to 85		-40 to 125	-40 to 85		-40 to 125	-40 to 85	-40 to 125		-40 to 85	-40 to 125	-40 to 85	-40 to 125	
Package*2	PLQP0048KB-A				PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A	
	PLQP0048KB-A				PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A	
	PLQP0048KB-A				PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A	
	PLQP0048KB-A				PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A		PLQP0080KB-A		PLQP0064KB-A	
Part No.	M30260F3TGP	M30260F6TGP	M30260F8VGP	M30260F8TGP	M30281M8TXXXHP	M30280M8VXXXHP	M30280M8TXXXHP	M30281M8VXXXHP	M30280MAVXXXHP	M30281MATXXXHP	M30281MAVXXXHP	M30280MATXXXHP	M30280FAVHP	M30280FATHP
	M30260F3TGP	M30260F6TGP	M30260F8VGP	M30260F8TGP	M30281M8TXXXHP	M30280M8VXXXHP	M30280M8TXXXHP	M30281M8VXXXHP	M30280MAVXXXHP	M30281MATXXXHP	M30281MAVXXXHP	M30280MATXXXHP	M30280FAVHP	M30280FATHP
	M30260F3TGP	M30260F6TGP	M30260F8VGP	M30260F8TGP	M30281M8TXXXHP	M30280M8VXXXHP	M30280M8TXXXHP	M30281M8VXXXHP	M30280MAVXXXHP	M30281MATXXXHP	M30281MAVXXXHP	M30280MATXXXHP	M30280FAVHP	M30280FATHP
	M30260F3TGP	M30260F6TGP	M30260F8VGP	M30260F8TGP	M30281M8TXXXHP	M30280M8VXXXHP	M30280M8TXXXHP	M30281M8VXXXHP	M30280MAVXXXHP	M30281MATXXXHP	M30281MAVXXXHP	M30280MATXXXHP	M30280FAVHP	M30280FATHP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



# Products Lineup

Automotive MCUs

## • Specifications (M16C/Tiny Series)

Group		M16C/29																
Memory	ROM (Bytes)	64K				96K				96K + 4K				128K		128K + 4K		
	RAM (Bytes)	4K				8K								12K				
	ROM Type*1	M				F				M				F				
	Data Flash	-				Yes (4K)				-				Yes (4K)				
	Program Security	-				Yes (ID Code Check Function, ROM Code Protect Function)				-				Yes (ID Code Check Function, ROM Code Protect Function)				
CPU	M16C/60 Core																	
	Basic Instructions	91																
	Minimum Instruction Execution Time (ns)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	
	Multiplier	16 × 16 → 32																
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																
DMA	Barrel Shifter	-																
	DMAC (Channels)	2																
External Bus Expansion	DTC/DMACII	-																
	Address Space (Bytes)	-																
	External Bus Interface	-																
	Bus Structure	-																
Clock	DRAM Controller	-																
	Clock Generation Circuit	4 circuits (Main clock, PLL, Sub clock, On-chip oscillator)																
	PLL	Yes																
	Subclock	Yes																
	RTC	-																
	On-Chip Oscillator	Yes																
	Oscillation Stop Detection	Yes																
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																
Power Supply Voltage Detection	Power Save	Wait/Stop																
	Power-On Reset/POR	-																
A/D Converter	Low Voltage Detection/LVD	-																
	Resolution × Channels	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27	10-bit × 16	10-bit × 27		
	Sample and Hold	Yes																
D/A Converter	Multi-Channel Sample and Hold	Yes																
	Resolution × Channels	-																
Timer	8-bit	-																
	16-bit	8 (Timer A, Timer B)																
	Input Capture	8 (Timer S)																
	Output Compare	8 (Timer S)																
	PWM Output	13 (Timer A, Timer S)																
	Real-Time Port	-																
	Event Counter	8 (Timer A, Timer B)																
	2-Phase Encoder Input	3 (Timer A) + 1 (Timer S)																
3-Phase Inverter Control	1 (shared with Timer A4, Timer A1, Timer A2, Timer B2, Dead Time Timer)																	
Watchdog Timer	1																	
	Clock Sync./ Clock Async.	3 (UART)																
Serial Interface	Clock Sync. Only	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)	1 (S/I/O)	2 (S/I/O)		
	Clock Async. Only	-																
I <sup>2</sup> C-bus	2 (Multi master I <sup>2</sup> C, UART)																	
IEBus	1 (UART)																	
Smart Card/SIM	1 (UART)																	
Synchronous Serial Communication Unit/Special Serial I/O	1 (UART)																	
CAN	Channels	1																
	Message Box (Numbers)	16																
IrDA	-																	
CRC Calculation Circuit	1 (CRC-CCITT (X <sup>16</sup> + X <sup>12</sup> + X <sup>5</sup> + 1)/CRC-16 (X <sup>16</sup> + X <sup>15</sup> + X <sup>2</sup> + 1))																	
X/Y Converter	-																	
I/O Ports	Input Only (Numbers)	-																
	CMOS I/O (Numbers)	71	55	71	55	71	55	71	55	71	55	71	55	71	55	71		
	N-Channel Open Drain Port (Numbers)	-																
	High Current Drive Port	-																
	Pull-Up Resistor	71	55	71	55	71	55	71	55	71	55	71	55	71	55	71		
External Interrupts Pins	11																	
Debugging Function	On-Chip Debug	-				Yes				-				Yes				
	On-Board Flash Program	-				Yes				-				Yes				
Other Functions	ROM Correction Function	Yes (Address match × 2)				-				Yes (Address match × 2)				-				
	Others	-																
Operating Frequency/Supply Voltage	20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V				20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V		20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V		20MHz/3.0 to 5.5V		16MHz/4.2 to 5.5V	
Operating Ambient Temperature (°C)	-40 to 85		-40 to 125				-40 to 85		-40 to 125		-40 to 85		-40 to 125		-40 to 85		-40 to 125	
Package**	PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A	
	PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A		PLOP0084KB-A		PLOP0080KB-A	
Part No.	M30290M8T-XXXHP		M30291M8T-XXXHP		M30291M8V-XXXHP		M30290M8V-XXXHP		M30291MAV-XXXHP		M30291MAT-XXXHP		M30290MAT-XXXHP		M30290MAV-XXXHP		M30290FATHP	
	M30291FAVHP		M30291FATHP		M30290FAVHP		M30291MCV-XXXHP		M30290MCV-XXXHP		M30290MCT-XXXHP		M30291MCT-XXXHP		M30290FCTHP		M30291FCVHP	
	M30291FCTHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP	
	M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP	
	M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP	
	M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP	
	M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP	
	M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP	
	M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP	
	M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP		M30291FOVHP		M30290FOVHP	

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



## • Specifications (M16C/10 Series)

Group		M16C/1N					
Memory	ROM (Bytes)	32K		64K		64K + 4K	
	RAM (Bytes)	1K		3K			
	ROM Type**1			M		F	
	Data Flash			-		Yes (4K)	
	Program Security			-		Yes (ID Code Check Function, ROM Code Protect Function)	
CPU	CPU	M16C/60 Core					
	Basic Instructions	91					
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)					
	Multiplier	16 × 16→32					
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 32→32					
DMA	DMAC (Channels)	-					
	DTC/DMACII	-					
External Bus Expansion	Address Space (Bytes)	-					
	External Bus Interface	-					
	Bus Structure	-					
	DRAM Controller	-					
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub clock, On-chip oscillator)					
	PLL	-					
	Subclock	Yes					
	RTC	-					
	On-Chip Oscillator	Yes					
	Oscillation Stop Detection	Yes					
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)					
Power Supply	Power Save	Wait/Stop					
Power Supply Voltage Detection	Power-On Reset/POR	-					
	Low Voltage Detection/LVD	-					
A/D Converter	Resolution × Channels	10-bit × 14					
	Sample and Hold	Yes					
D/A Converter	Multi-Channel Sample and Hold	-					
	Resolution × Channels	8-bit × 1					
Timer	8-bit	4 (Timer 1, Timer X, Timer Y, Timer Z)					
	16-bit	1 (Timer C)					
	Input Capture	1 (Timer C)					
	Output Compare	-					
	PWM Output	2 (Timer Y, Timer Z)					
	Real-Time Port	-					
	Event Counter	1 (Timer X)					
	2-Phase Encoder Input	-					
Watchdog Timer	3-Phase Inverter Control	-					
		-					
Serial Interface	Clock Sync./ Clock Async.	2 (UART)					
	Clock Sync. Only	-					
	Clock Async. Only	-					
I <sup>2</sup> C-bus		-					
IEBus		-					
Smart Card/SIM		-					
Synchronous Serial Communication Unit/Special Serial I/O		-					
CAN	Channels	1					
	Message Box (Numbers)	16					
IrDA		-					
CRC Calculation Circuit		-					
X/Y Converter		-					
I/O Ports	Input Only (Numbers)	-					
	CMOS I/O (Numbers)	37					
	N-Channel Open Drain Port (Numbers)	-					
	High Current Drive Port	8					
	Pull-Up Resistor	37					
External Interrupts Pins		8					
Debugging Function	On-Chip Debug	-				Yes	
	On-Board Flash Program	-				Yes	
Other Functions	ROM Correction Function	Yes				-	
	Others	-					
Operating Frequency/Supply Voltage		16MHz/4.2 to 5.5V					
Operating Ambient Temperature (°C)		- 40 to 125	- 40 to 85	- 40 to 125	- 40 to 85	- 40 to 125	- 40 to 85
Package**2		PLOP0048KB-A					
Part No.		M301N2M4V-XXXXFP	M301N2M4T-XXXXFP	M301N2M8V-XXXXFP	M301N2M8T-XXXXFP	M301N2F8VFP	M301N2F8TFP

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

Automotive MCUs

## • Specifications (R8C/Tiny Series)

Group		R8C/20								R8C/21											
Memory	ROM (Bytes)	32K	48K	64K	96K	128K	32K + 2K	48K + 2K	64K + 2K	96K + 2K	128K + 2K										
	RAM (Bytes)	2K	2.5K	3K	5K	6K	2K	2.5K	3K	5K	6K										
	ROM Type*1	F																			
	Data Flash	-								Yes (2K)											
Program Security		Yes (ID Code Check Function, ROM Code Protect Function)																			
CPU		R8C Core																			
Basic Instructions		89																			
CPU	Minimum Instruction Execution Time (ns)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)				
	Multiplier	16 × 16 → 32																			
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																			
	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)																			
Clock	PLL	-																			
	Subclock	-																			
	RTC	-																			
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)																			
	Oscillation Stop Detection	Yes																			
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																			
	Power Save	Wait/Stop																			
Power Supply Voltage Detection	Power-On Reset/POR	Yes																			
	Low Voltage Detection/LVD	Yes (Voltage detection 2)																			
A/D Converter	Resolution × Channels	10-bit × 12																			
	Sample and Hold	Yes																			
D/A Converter	Resolution × Channels	-																			
	8-bit	3 (Timer RA, Timer RB, Timer RE)																			
Timer	16-bit	2 (Timer RD)																			
	Input Capture	8 (shared with Timer RD)																			
	Output Compare	9 (shared with Timer RD, Timer RE)																			
	PWM Output	7 (shared with Timer RB, Timer RD)																			
	Real-Time Port	-																			
	Event Counter	1 (shared with Timer RA)																			
	2-Phase Encoder Input	-																			
	3-Phase Inverter Control	1 (shared with Timer RD)																			
Watchdog Timer	1 (with automatic start, clock source protection function)																				
Serial Interface	Clock Sync./ Clock Async.	1 (UART0)																			
	Clock Sync. Only	-																			
	Clock Async. Only	1 (UART1)																			
I <sup>2</sup> C-bus		1 (Share with Synchronous Serial Communication Unit)																			
Synchronous Serial Communication Unit/Special Serial I/O	Channels	1 (Share with I <sup>2</sup> C)																			
	Message Box (Numbers)	-																			
I/O Ports	Input Only (Numbers)	3																			
	CMOS I/O (Numbers)	41																			
	N-Channel Open Drain Port (Numbers)	-																			
	High Current Drive Port	-																			
External Interrupts Pins		41																			
Debugging Function	On-Chip Debug	Yes																			
	On-Board Flash Program	Yes																			
Other Functions	ROM Correction Function	-																			
	Others	-																			
Operating Frequency/Supply Voltage		16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V				
Operating Ambient Temperature (°C)		-40 to 125																			
Package**		PLQP0048KB-A																			
Part No.		R5F21206KFP	R5F21206JFP	R5F21207JFP	R5F21207KFP	R5F21208JFP	R5F21208KFP	R5F2120AJFP*	R5F2120AKFP**	R5F2120CJFP*	R5F2120CKFP**	R5F21216JFP	R5F21216KFP	R5F21217KFP	R5F21217JFP	R5F21218KFP	R5F21218JFP	R5F2121AJFP*	R5F2121AKFP**	R5F2121CJFP*	R5F2121CKFP**

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

## • Specifications (R8C/Tiny Series)

Group		R8C/22						R8C/23													
Memory	ROM (Bytes)	32K	48K	64K	96K	128K	32K + 2K	48K + 2K	64K + 2K	96K + 2K	128K + 2K										
	RAM (Bytes)	2K	2.5K	3K	5K	6K	2K	2.5K	3K	5K	6K										
	ROM Type**1	F																			
	Data Flash	-						Yes (2K)													
	Program Security	Yes (ID Code Check Function, ROM Code Protect Function)																			
CPU	CPU	R8C Core																			
	Basic Instructions	89																			
	Minimum Instruction Execution Time (ns)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)						
	Multiplier	16 × 16 → 32																			
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32																			
Clock	Clock Generation Circuit	2 circuits (Main clock, On-chip oscillator)																			
	PLL	-																			
	Subclock	-																			
	RTC	-																			
	On-Chip Oscillator	Yes (High precision, High speed : 40MHz, Low speed : 125kHz)																			
	Oscillation Stop Detection	Yes																			
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)																			
Power Supply	Power-On Reset/POR	Wait/Stop																			
	Voltage Detection	Yes																			
A/D Converter	Low Voltage Detection/LVD	Yes (Voltage detection 2)																			
	Resolution × Channels	10-bit × 12																			
D/A Converter	Sample and Hold	Yes																			
	Resolution × Channels	-																			
Timer	8-bit	3 (Timer RA, Timer RB, Timer RE)																			
	16-bit	2 (Timer RD)																			
	Input Capture	8 (shared with Timer RD)																			
	Output Compare	9 (shared with Timer RD, Timer RE)																			
	PWM Output	7 (shared with Timer RB, Timer RD)																			
	Real-Time Port	-																			
	Event Counter	1 (shared with Timer RA)																			
	2-Phase Encoder Input	-																			
Watchdog Timer	3-Phase Inverter Control	1 (shared with Timer RD)																			
		1 (with automatic start, clock source protection function)																			
Serial Interface	Clock Sync./ Clock Async.	1 (UART0)																			
	Clock Sync. Only	-																			
	Clock Async. Only	1 (UART1)																			
I <sup>2</sup> C-bus		1 (Share with Synchronous Serial Communication Unit)																			
	Synchronous Serial Communication Unit/Special Serial I/O	1 (Share with I <sup>2</sup> C)																			
CAN	Channels	1																			
	Message Box (Numbers)	16																			
	Input Only (Numbers)	3																			
I/O Ports	CMOS I/O (Numbers)	41																			
	N-Channel Open Drain Port (Numbers)	-																			
	High Current Drive Port	-																			
	Pull-Up Resistor	41																			
External Interrupts Pins	8																				
Debugging Function	On-Chip Debug	Yes																			
	On-Board Flash Program	Yes																			
Other Functions	ROM Correction Function	-																			
	Others	-																			
Operating Frequency/Supply Voltage		16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V						
Operating Ambient Temperature (°C)		-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85						
Package**		PLQP0048KB-A																			
Part No.		R5F21228KFP	R5F21226JFP	R5F21227KFP	R5F21227JFP	R5F21228KFP	R5F21228JFP	R5F2122AJFP*	R5F2122AKFP**	R5F2122CKFP**	R5F2122CJFP*	R5F21236JFP	R5F21236KFP	R5F21237JFP	R5F21237KFP	R5F21238KFP	R5F21238JFP	R5F2123AKFP**	R5F2123AJFP*	R5F2123CJFP*	R5F2123CKFP**

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

\* : New product \*\* : Under development

\*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

Automotive MCUs

## • Specifications (R8C/Tiny Series)

Group		R8C/26				R8C/27				R8C/28	R8C/29		
Memory	ROM (Bytes)	16K		32K		16K + 2K		32K + 2K		16K	16K + 2K		
	RAM (Bytes)	1K		1.5K		1K		1.5K		1K			
	ROM Type*1	F											
	Data Flash	-				Yes (2K)				-	Yes (2K)		
Program Security		Yes (ID Code Check Function, ROM Code Protect Function)											
CPU		R8C Core											
Basic Instructions		89											
Minimum Instruction Execution Time (ns)		50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)	50 (@20MHz)	62.5 (@16MHz)		
Multiplier		16 × 16 → 32											
Multiply-Accumulate Instruction		16 × 16 + 32 → 32											
Clock Generation Circuit		2 circuits (Main clock, On-chip oscillator)											
PLL		-											
Subclock		-											
RTC		-											
On-Chip Oscillator		Yes (High precision, High speed : 40MHz, Low speed : 125kHz)											
Oscillation Stop Detection		Yes											
Frequency Divider		1/n (n=1, 2, 4, 8, 16)											
Power Save		Wait/Stop											
Power-On Reset/POR		Yes											
Voltage Detection		Yes (Voltage detection 2)											
Resolution × Channels		10-bit × 12								10-bit × 4			
Sample and Hold		Yes											
Resolution × Channels		-											
8-bit		3 (Timer RA, Timer RB, Timer RE)											
16-bit		1 (Timer RC)											
Input Capture		4 (shared with Timer RC)											
Output Compare		5 (shared with Timer RC, Timer RE)											
PWM Output		4 (shared with Timer RB, Timer RC)											
Real-Time Port		-											
Event Counter		1 (shared with Timer RA)											
2-Phase Encoder Input		-											
3-Phase Inverter Control		-											
Watchdog Timer		1 (with automatic start, clock source protection function)											
Clock Sync./ Clock Async.		2 (UART0, UART1)				-				1 (UART0)			
Clock Sync. Only		-											
Clock Async. Only		-				-				1 (UART1)			
I <sup>2</sup> C-bus		1 (Share with Synchronous Serial Communication Unit)											
Synchronous Serial Communication Unit/Special Serial I/O		1 (Share with I <sup>2</sup> C)											
Channels		-											
Message Box (Numbers)		-											
Input Only (Numbers)		3											
CMOS I/O (Numbers)		25								13			
N-Channel Open Drain Port (Numbers)		-											
High Current Drive Port		-											
Pull-Up Resistor		25								13			
External Interrupts Pins		7											
On-Chip Debug		Yes											
On-Board Flash Program		Yes											
ROM Correction Function		-											
Others		-											
Operating Frequency/Supply Voltage		20MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	16MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	20MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	16MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	20MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	16MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	20MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V	16MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	20MHz/3.0 to 5.5V, 10MHz/2.7 to 5.5V	16MHz/ 3.0 to 5.5V, 10MHz/ 2.7 to 5.5V		
Operating Ambient Temperature (°C)		-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125	-40 to 85	-40 to 125		
Package**		PLQP0032GB-A								PLSP0020JB-A			
Part No.		R5F21264JFP**	R5F21264KFP**	R5F21266JFP**	R5F21266KFP**	R5F21274JFP**	R5F21274KFP**	R5F21276JFP**	R5F21276KFP**	R5F21284KSP*	R5F21284JSP*	R5F21284JSP*	R5F21284KSP*

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\* Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

\* : New product \*\* : Under development



# Products Lineup

MCUs for Notebook PCs / PC Servers

## • Specifications (M16C/6K Group)

Group		M16C/6KA
Memory	ROM (Bytes)	128K
	RAM (Bytes)	5K
	ROM Type*1	F
	Data Flash	—
	Program Security	—
CPU	CPU	M16C/60 Core
	Basic Instructions	91
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)
	Multiplier	16 × 16→32
	Multiply-Accumulate Instruction Barrel Shifter	16 × 16 + 32→32
DMA	DMAC (Channels)	—
Clock	Clock Generation Circuit	2 circuits (Main clock, Sub clock)
	Subclock	—
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)
	Power Save	Normal operating (High-speed, Medium-speed) /Wait/Stop
A/D Converter	Resolution × Channels	10-bit × 10
D/A Converter	Resolution × Channels	—
	Sample and Hold	—
Timer	8-bit	—
	16-bit	11
	PWM Output	6
	Event Counter	—
Watchdog Timer		1
Serial Interface	Clock Sync./ Clock Async.	1
	Clock Sync. Only	2 (SI/O3, SI/O4)
	Clock Async. Only	—
I <sup>2</sup> C-bus		3
		1
I/O Ports	Input Only (Numbers)	1
	CMOS I/O (Numbers)	129
	N-Channel Open Drain Port (Numbers)	37
	High Current Drive Port	16
	Pull-Up Resistor	104
External Interrupts Pins		16
Other Functions	ROM Correction Function	—
	Others	PS/2 Interface × 3
Operating Frequency/Supply Voltage		16MHz/3.0 to 3.6V
Operating Ambient Temperature (°C)		−20 to 85
Package*2		PTQP0144LA-A
Part No.		M306KAFCLRP

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version

★ : New product ★★ : Under development

\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code



# Products Lineup

USB MPUs and MCUs

## • Specifications (M16C/20 Series)

Group		M16C/24		
Memory	ROM (Bytes)	64K		128K
	RAM (Bytes)	5K		10K
	ROM Type*1		M	F
	Data Flash		—	
	Program Security		—	Yes (ID code check function, ROM code protect function)
CPU	CPU	M16C/60 Core		
	Basic Instructions	91		
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)		
	Multiplier	16 × 16 → 32		
	Multiply-Accumulate Instruction	16 × 16 + 32 → 32		
DMA	Barrel Shifter	—		
	DMAC (Channels)	4		
External Bus Expansion	DTC/DMACII	—		
	Address Space (Bytes)	1M		
	External Bus Interface	Support for insertion of 1 to 3 wait states, Outputs 4 chip-select signals		
	Bus Structure	Data Bus Width can be selected (8/16-bit), The number of output address buses can be selected (16/20)		
	DRAM Controller	—		
Clock	Clock Generation Circuit	3 circuits (Main clock, Sub-clock and On-chip oscillator)		
	PLL	Yes		
	Subclock	Yes		
	RTC	—		
	On-Chip Oscillator	Yes		
	Oscillation Stop Detection	Yes		
	Frequency Divider	1/n (n = 1, 2, 4, 8, 16)		
Power Supply Voltage Detection	Power Save	Normal operating (High-speed, Medium-speed, Low-speed, Low-power consumption) /Wait/Stop		
A/D Converter	Power-On Reset/POR	—		
	Low Voltage Detection/LVD	—		
D/A Converter	Resolution × Channels	10-bit × 8		
	Sample and Hold	Yes		
Timer	Multi-Channel Sample and Hold	—		
	Resolution × Channels	—		
	8-bit	—		
	16-bit	5 (Timer A0, Timer A1, Timer A2, Timer A3, Timer A4)		
	Input Capture	—		
	Output Compare	—		
	PWM Output	5 (shared with Timer A0, Timer A1, Timer A2, Timer A3, Timer A4)		
	Real-Time Port	—		
	Event Counter	5 (shared with Timer A0, Timer A1, Timer A2, Timer A3, Timer A4)		
Watchdog Timer	2-Phase Encoder Input	—		
	3-Phase Inverter Control	—		
Serial Interface	Clock Sync./ Clock Async.	4 (UART0, UART1, UART2, UART3)		
	Clock Sync. Only	—		
	Clock Async. Only	—		
I <sup>2</sup> C-bus	4 (UART0, UART1, UART2, UART3)			
IEBus	4 (UART0, UART1, UART2, UART3)			
Smart Card/SIM	4 (UART0, UART1, UART2, UART3)			
Synchronous Serial	2 (UART0, UART1, Serial sound interface)			
CAN	Channels	—		
	Message Box (Numbers)	—		
USB Function	Yes (Full-Speed)			
IrDA	—			
CRC Calculation Circuit	2 (CRC-CCITT, CRC16)			
X/Y Converter	—			
I/O Ports	Input Only (Numbers)	1		
	CMOS I/O (Numbers)	80		
	N-Channel Open Drain Port (Numbers)	2		
	High Current Drive Port	8 (20mA)		
	Pull-Up Resistor	80 (Possible to Set Each of 4 Ports)		
External Interrupts Pins	12 (INT × 3, NMI × 1, Key Input × 8)			
Debugging Function	On-Chip Debug	—		
	On-Board Flash Program	—		
Other Functions	ROM Correction Function	Yes (Address match)		
	Others	Serial Sound Interface : 2, AND Flash Controller		
Operating Frequency/Supply Voltage	16MHz/3.0 to 3.6			
Operating Ambient Temperature (°C)	- 20 to 85			
Package*2	PLQP0100KB-A			
Part No.	M30245M8-XXXGP	M30245MC-XXXGP	M30245FCGP	

\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development



# Products Lineup

TV MCUs

## • Specifications (M16C/6V Group)

Group		M16C/6V							
Memory	ROM (Bytes)	256K		384K		512K		16K	
	RAM (Bytes)	10K							
	ROM Type**1	M	F	M	F	M	F	M	F
	Data Flash	-							
	Program Security	-	Yes (ID code check function)	-	Yes (ID code check function)	-	Yes (ID code check function)	-	Yes (ID code check function)
CPU	CPU	M16C/60 Core							
	Basic Instructions	91							
	Minimum Instruction Execution Time (ns)	62.5 (@ 16MHz)							
	Multiplier	16 × 16→32							
	Multiply-Accumulate Instruction	16 × 16 + 32→32							
DMA	Barrel Shifter	-							
	DMAC (Channels)	2							
External Bus Expansion	DTC/DMACII	-							
	Address Space (Bytes)	1M							
	External Bus Interface	Support for insertion of 1 wait states, Outputs 4 chip-select signals (CS0, CS1, CS2, CS3)							
	Bus Structure	Separate bus, Data bus width can be selected (8-bit/16-bit), The number of output address buses can be selected (16/20)							
Clock	DRAM Controller	-							
	Clock Generation Circuit	3 circuits (Main clock, Sub-clock OSD clock)							
	PLL	-							
	Subclock	Yes							
	Real Time clock	-							
	On-Chip Oscillator	-							
	Oscillation Stop Detection	-							
	Frequency Divider	1/n (n=1, 2, 4, 8, 16)							
Power Supply	Power Save	Normal operation (High-speed, Medium-speed, Low-speed, Low-power consumption)/Wait/Stop							
	Power-On Reset/POR	-							
Voltage Detection	Low Voltage Detection/LVD	-							
	Resolution × Channels	8-bit × 6							
A/D Converter	Sample and Hold	Yes							
	Multi-Channel Sample and Hold	-							
D/A Converter	Resolution × Channels	8-bit × 2							
	8-bit	-							
Timer	16-bit	8 (Timer A, Timer B)							
	Input Capture	-							
	Output Compare	-							
	PWM Output	2 (Timer A)							
	Real-Time Port	-							
	Event Counter	8 (Timer A, Timer B)							
	2-Phase Encoder Input	-							
	3-Phase Inverter Control	-							
Watchdog Timer		1							
	Clock Sync./ Clock Async.	2 (UART0, UART2)							
Serial Interface	Clock Sync. Only	-							
	Clock Async. Only	-							
I <sup>2</sup> C-bus		2 (Multi master I <sup>2</sup> C)							
IEBus		-							
Smart Card/SIM		-							
Synchronous Serial Communication Unit/Special Serial I/O		-							
CAN	Channels	-							
	Message Box (Numbers)	-							
IrDA		-							
CRC Calculation Circuit		-							
X/Y Converter		-							
I/O Ports	Input Only (Numbers)	-							
	CMOS I/O (Numbers)	74							
	N-Channel Open Drain Port (Numbers)	2							
	High Current Drive Port	-							
	Pull-Up Resistor	74 (Pull-up resistor can be set every four ports)							
External Interrupts Pins		3							
	On-Chip Debug	-	Yes	-	Yes	-	Yes	-	Yes
Debugging Function	On-Board Flash Program	-	Yes	-	Yes	-	Yes	-	Yes
	ROM Correction Function	Yes (Address match × 2)	-	Yes (Address match × 2)	-	Yes (Address match × 2)	-	Yes (Address match × 2)	-
Other Functions	Others	CCD, ID1 : 2 circuits, Triple-layer, 512-color OSD							
Operating Frequency/Supply Voltage		16MHz/3.15 to 3.45V							
Operating Ambient Temperature (°C)		-20 to 70							
Package**2		PRQP0100JB-A							
Part No.		M306V7MG-XXXFP	M306V7FGFP	M306V7MH-XXXFP	M306V7FHFP	M306V7MJ-XXXFP	M306V7FJFP	M306V7MJA-XXXFP	M306V7FJAFP

\*\*1 F : Flash memory version, L : ROM-less version, M : Mask ROM version, O : One time PROM version, Qz : QzROM version  
 \*\*2 Please refer to "Package Code and Size Table" in the end of this catalog for the previous code

★ : New product ★★ : Under development

# Support System

Get the latest information on the M16C Family at the Renesas Web site.

Technical Support E-mail: [csc@renesas.com](mailto:csc@renesas.com)

## Renesas M16C Family Web Page <http://www.renesas.com/m16c>

A wealth of information is available, including the latest technical data necessary for system development.

**Display of Information Focusing on a Specific Topic**  
ON THIS PAGE: Check, Disable, Hide  
Block Download: The Technical Updates displayed in the list will be downloaded in block as one PDF. The downloaded file will be around 100KB. It may take some time for downloads to complete.

**Technical Update**  
This link displays a page where documents such as usage notes and additions to the product documentation are available in PDF format.

**Documentation**  
This link displays a page where product documentation such as manuals, data sheets, and catalogs are available in PDF format.

**Application Notes**  
This link displays a page where documents covering the usage of on-chip functions, technical application information, etc., are available in PDF format.

**FAQs**  
This link displays a page providing answers to frequently asked questions in Q&A format.

**Series Pages**  
These links display pages containing overviews of the specifications of each product series and show the available product groups.

**Group Pages**  
These links display pages containing overviews of the specifications of each product group and listings of the individual products available. Items such as sample programs and reference oscillator circuit constants can also be found on these pages.

**Search Options**  
A variety of search functions is available to help you locate the information you need. Enter a Part No.: Use this search function to confirm the detailed specifications of individual products specified by part number. Parametric Search: This search function is useful for locating products that match the specifications you designate.

**CONTACT US**  
This link displays a page containing contact information for submitting technical inquiries to Renesas. Inquiries may also be emailed to the following address.  
E-mail: [csc@renesas.com](mailto:csc@renesas.com)

**M16C Family (R32C/M32C/M16C/R8C)**  
Home / Products / MPU and MCU / M16C Family (R32C/M32C/M16C/R8C)  
What's New: 25 Oct 2007 - IC Socket Board for M16C Family - Updated  
Overview: M16C PLATFORM. The M16C Family offers a robust platform of 32/16-bit CISC microcomputers featuring high ROM code efficiency, extensive EMI/EMS noise immunity, ultra-low power consumption, high-speed processing in actual applications, and numerous and varied integrated peripherals. Extensive device scalability from low- to high-end, featuring a single architecture as well as compatible pin assignments and peripheral functions, provides support for a wide range of application fields. In addition, our low-cost development environment and program conversion support help you shorten product development time while greatly reducing total system costs. The M16C Family consists of the following: R32C/100 Series, M32C/80 Series, M16C/60 Series, M16C/30 Series, M16C/Tiny Series, M16C/20 Series, M16C/10 Series, and R8C/Tiny Series. For details of application specific MCUs → USB, DVD-R/DW Recorder, TV, PLC  
Key Applications: Audio Equipment, TV, Cameras; Communication/Portable Equipment; Electronic Household Appliances (incl. Inverter Solution), Motor Control, Housing Equipment (Sensors, Security Systems); Office Equipment, General Industrial Equipment, Consumer Products; Automotive (incl. Body, Safety, Audio)

**M16C Family Product Expansion**  
Higher Performance Higher Functionality: R32C/100 (40B Space, 48MHz or Higher, Ultra High-speed Calculation, Highly-functional Rich Peripherals, High-capacity On-chip Flash), M32C/80 (16MB Space, 32MHz to 32MHz), M16C/60 (1MB Space, 10MHz to 32MHz), M16C/30 (1MB Space, 10MHz), High-speed Process with Compact Mounting Area: M16C/Tiny (20MHz to 32MHz, 42- to 80-pin Small Packages), Smaller Functions Small Packages: R8C/Tiny (10MHz to 20MHz, 20-pin to 80-pin Small Packages), Under Development

**R8C/Tiny Series**  
The R8C/Tiny Series features the smaller package (available in 20 pins, 28 pins, 32 pins, 48 pins, 52 pins, 64 pins, and 80 pins). Maximum operating frequency is 20MHz.  
R8C/10 Group | R8C/11 Group | R8C/12 Group | R8C/13 Group | R8C/14 Group | R8C/15 Group | R8C/16 Group | R8C/17 Group | R8C/18 Group | R8C/19 Group | R8C/1A Group | R8C/1B Group | R8C/1C Group | R8C/1D Group | R8C/1E Group | R8C/1F Group | R8C/1G Group | R8C/1H Group | R8C/1I Group | R8C/1J Group | R8C/1K Group | R8C/1L Group | R8C/1M Group | R8C/1N Group | R8C/1O Group | R8C/1P Group | R8C/1Q Group | R8C/1R Group | R8C/1S Group | R8C/1T Group | R8C/1U Group | R8C/1V Group | R8C/1W Group | R8C/1X Group | R8C/1Y Group | R8C/1Z Group

**M16C/10 Series**  
Maximum operating frequency is 16MHz. 48-pin package is available.  
M16C/10 Group

**M16C/20 Series**  
Only USB MCUs are available. Maximum operating frequency is 16MHz. 80-pin and 100-pin packages are available.  
M16C/20 (M30245) Group

**M16C/Tiny Series**  
The M16C/Tiny Series enables functional upgrading along with the slimmer package (available in 42 pins, 48 pins, 64 pins, 80 pins and 85 pins). Maximum operating frequency is 24MHz when using PLL Synthesizer.  
M16C/26 Group | M16C/26A Group | M16C/26B Group | M16C/26C Group | M16C/26D Group | M16C/26E Group | M16C/26F Group | M16C/26G Group | M16C/26H Group | M16C/26I Group | M16C/26J Group | M16C/26K Group | M16C/26L Group | M16C/26M Group | M16C/26N Group | M16C/26O Group | M16C/26P Group | M16C/26Q Group | M16C/26R Group | M16C/26S Group | M16C/26T Group | M16C/26U Group | M16C/26V Group | M16C/26W Group | M16C/26X Group | M16C/26Y Group | M16C/26Z Group

**M16C/30 Series**  
The M16C/30 Series features the slimmer functions and internal memory capacity. Maximum operating frequency is 16MHz. 100-pin package is available.  
M16C/30 (M30245) Group

**M16C/60 Series**  
The M16C/60 Series offers M16C Family standard products. Maximum operating frequency is 32MHz when using PLL Synthesizer. 64-pin (Specific MCU), 80-pin, 100-pin, 116-pin (Specific MCU), 128-pin packages are available.  
M16C/60 Group | M16C/61 Group | M16C/62 Group | M16C/63 Group | M16C/64 Group | M16C/65 Group | M16C/66 Group | M16C/67 Group | M16C/68 Group | M16C/69 Group | M16C/6A Group | M16C/6B Group | M16C/6C Group | M16C/6D Group | M16C/6E Group | M16C/6F Group | M16C/6G Group | M16C/6H Group | M16C/6I Group | M16C/6J Group | M16C/6K Group | M16C/6L Group | M16C/6M Group | M16C/6N Group | M16C/6O Group | M16C/6P Group | M16C/6Q Group | M16C/6R Group | M16C/6S Group | M16C/6T Group | M16C/6U Group | M16C/6V Group | M16C/6W Group | M16C/6X Group | M16C/6Y Group | M16C/6Z Group

## Renesas Software and Tools Web Page <http://www.renesas.com/tools>

For customers considering purchasing Renesas tools, this Web page contains links relating to individual products, including function overviews and downloads of software evaluation versions. It is also a place where customers who already own Renesas tools can obtain the latest information, software upgrades, and more.

### Information for Customers Considering Purchasing Renesas Tools

**Evaluation Software**  
Evaluation versions of software are provided free of charge to enable customers to assess product functions and performance.

**Product Information**  
These links display pages containing datasets providing overviews, features, and functions of the main Renesas tool products.

**Documentation**  
This link displays a page where product documentation for Renesas tool products such as manuals can be downloaded.

**Information on Accessories**  
This link displays a page with information such as patterns for connecting emulators and user systems and details of accessories used to make connections.

**Renesas Partner Information**  
This link displays a page containing overviews and contact information for Renesas partner companies.

### Information for Customers who Already Own Renesas Tools

**Technical Update**  
This link displays a page containing important usage information on Renesas MCUs and tools.

**Application Notes**  
This link displays a page containing application examples and sample program listings.

**FAQs**  
This link displays a page providing answers to questions about the main Renesas tool products in Q&A format.

**Downloads (Upgrades and Sample Programs)**  
This link displays a page where customers who have purchased software tools can download upgrades free of charge.

**Tool News**  
This link displays the latest information on Renesas tools, updated twice a month.

**Software and Tools**  
This link displays a page with links to a variety of development tool products such as starter kits and flash memory programmers.

**Evaluation Software**  
Evaluation version software is provided free-of-charge for customers to evaluate product functions and performance prior to purchase.

**Product Information**  
This link displays a page where product documentation for Renesas tool products such as manuals can be downloaded.

**Information on Accessories**  
This link displays a page with information such as patterns for connecting emulators and user systems and details of accessories used to make connections.

**Renesas Partner Information**  
This link displays a page containing overviews and contact information for Renesas partner companies.

**Software and Tools**  
This link displays a page with links to a variety of development tool products such as starter kits and flash memory programmers.

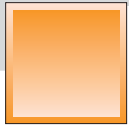
**Alliance Partners**  
The Alliance program provides online tools to increase the synergy between our customers, third-party partners, and Renesas.

**Alliance Partner**  
Find Renesas Authorized 3rd party 3rd vendors, consultants, design houses and contract manufacturers. Sign-up today for the Renesas Alliance Partner Program and let Renesas customers contact you about supporting their design. Manage your Renesas Alliance partner profile right from the web.

**Light to Alliance Partner**  
Fill in the fields below and click Submit to access your account. Indicate Required Fields. Login ID: Password: Confirm Your Password: Submit

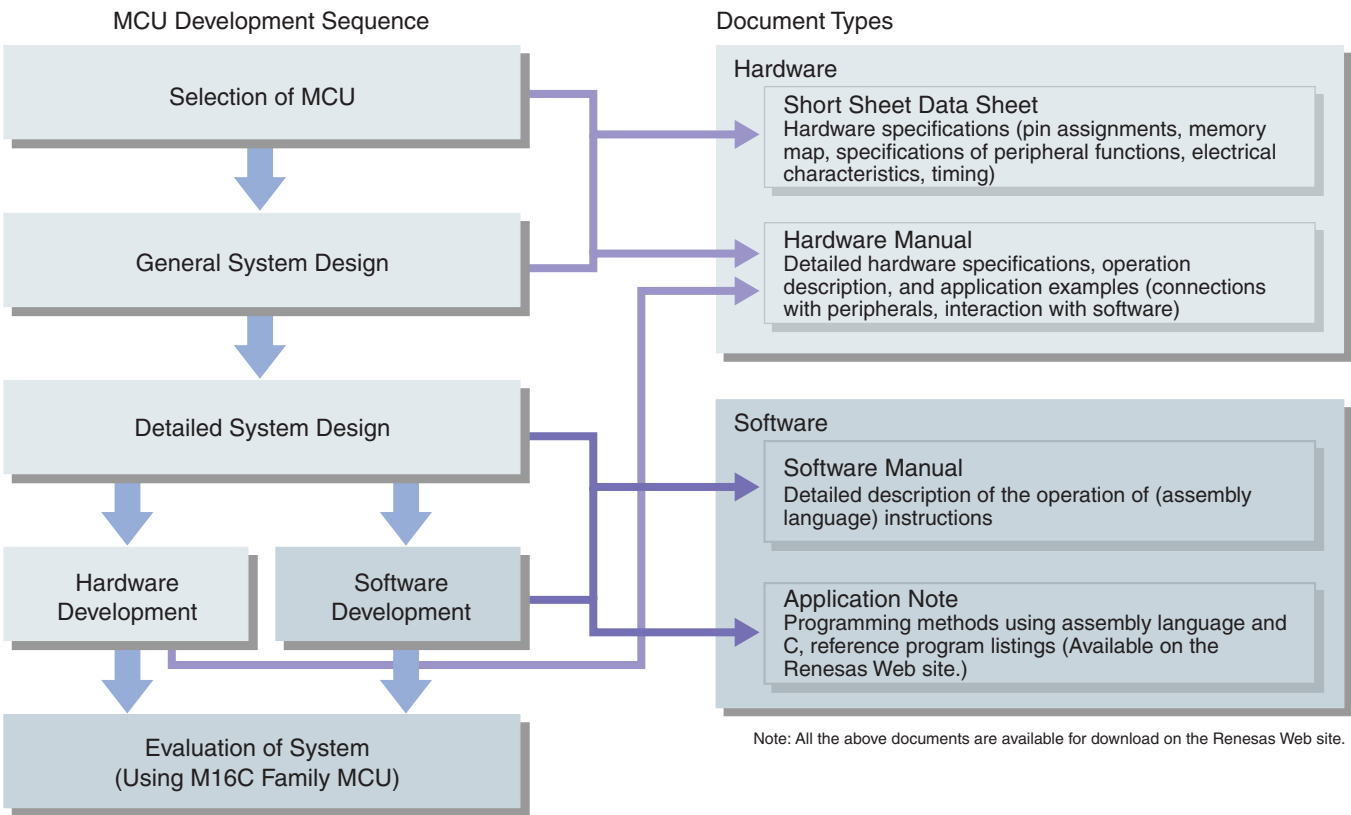
**Light to Alliance Partner Description**  
The Alliance program provides online tools to increase the synergy between our customers, 3rd Party Partners and Renesas. Customers can search our online database to quickly find qualified design consultants, programming houses, 3rd Party Development Tools, and Manufacturing Companies that provide services or products that support Renesas products and customers. Registered for the Renesas Partner Program are the following benefits. Gain visibility with Renesas Customers. Your company profile will be visible on the Renesas website. Highlight Your Products. Link your company products and/or services to the thousands of Renesas customers online.





# Documentation

## Application



## Application Notes

In addition to the manuals for each product, a large number of application notes are available that customers can make immediate use of in their programs.

List of Application Note Categories		
A/D Converters	D/A Converters	Flash Memory
I <sup>2</sup> C-bus	Intelligent I/O	Interrupts
Noise	CRC	Program Security
Resets	Serial Interfaces	PWM Timers for 3-Phase Motor Drive
Timers	Watchdog Timers	DMAC
CAN	USB	External Buses
Applications	Motors	Inverter
Automotive	Development Tools	

The latest versions of Renesas documents are available for download on the following Web page.

URL <http://www.renesas.com/m16c>



**Renesas Technology Corp.** Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

**Notes:**

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guaranties regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
  - (1) artificial life support devices or systems
  - (2) surgical implantations
  - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
  - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



## RENESAS SALES OFFICES

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

### **Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

### **Renesas Technology Europe Limited**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

### **Renesas Technology (Shanghai) Co., Ltd.**

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120  
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

### **Renesas Technology Hong Kong Ltd.**

7th Fl., North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2377-3473

### **Renesas Technology Taiwan Co., Ltd.**

10th Fl., No.99, Fushing North Road, Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

### **Renesas Technology Singapore Pte. Ltd.**

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

### **Renesas Technology Korea Co., Ltd.**

Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea  
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

### **Renesas Technology Malaysia Sdn. Bhd.**

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: <603> 7955-9390, Fax: <603> 7955-9510