2005.9

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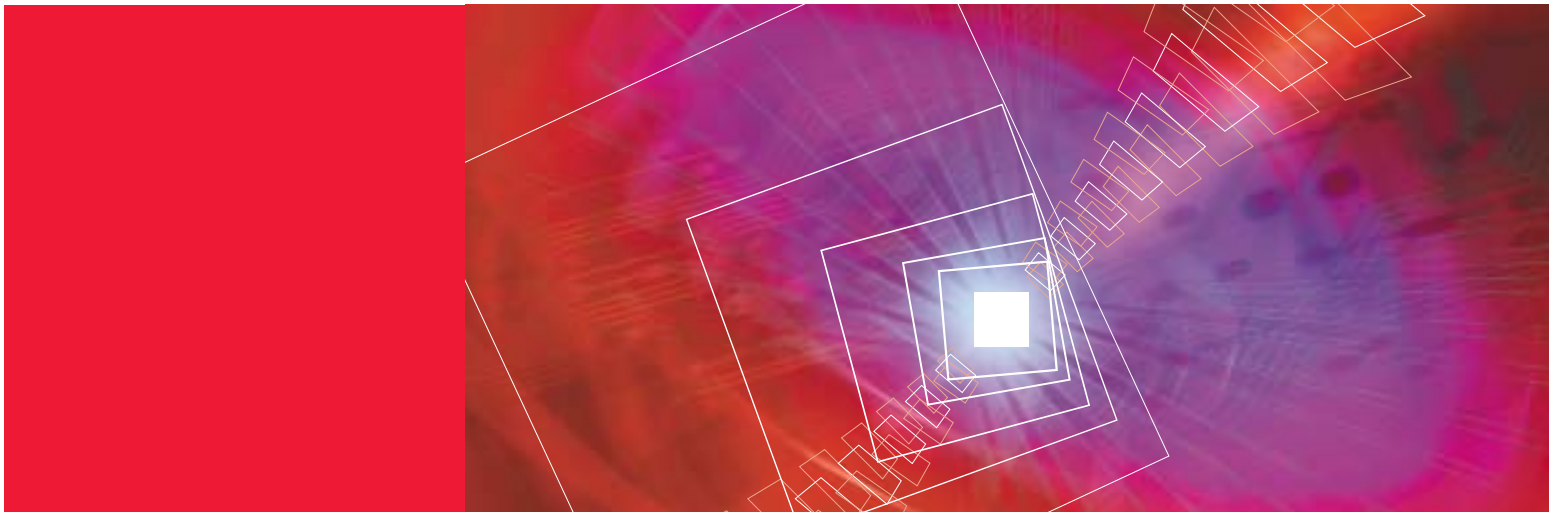
Renesas Microcontroller

M16C Family



Renesas Technology

www.renesas.com

Having trouble reducing product costs and development costs and periods?

	Support from the M16C
High power consumption requiring special attention to heat dissipation and the power supply?	Ultra-low power consumption
Excessive radiated noise?	Eliminates the need for measures against EMI/EMS noise
Impossibility of smooth upward and downward microcomputer-type transitions? manufacturers discontinuing microcomputers?	Guaranteed compatibility
The security of code in on-chip ROM?	Security measures
Measures to reduce failures of products on the market?	ROM-correction
Enough pins being available?	Many usable pins
Measures to reduce malfunctions?	Strong protection against malfunctions
The microcomputers you're using being powerful enough for the applications?	High-speed processing
the on-chip ROM being large enough to hold the whole program?	Highly efficient programs
reprogramming of flash ROM taking too long?	Highly functional flash memory
having to replace all mask-ROM products? the number of components you're adopting making inventory control difficult?	On-chip flash memory
cheaper development tools? debugging on actual target systems?	Support from low-cost tools

The M16C Family Reduces Total System Costs

Greater functionality
Stronger performance

Extensive lineup within groups

M32C/100 (Target specs.)
- ∑4-GB space
- ∑100 MHz
- ∑32-bit multiplier
- ∑32-bit barrel shifter
- ∑Enhanced DSP instructions
- ∑On-chip FPU

M32C/90
- ∑16-MB space
- ∑Over 64 MHz
- ∑Enhanced 32-bit arithmetic instructions
- ∑Barrel shifter
- ∑DMA 4 ch + DMA II

M32C/80
- ∑16-MB space
- ∑Over 32 MHz
- ∑Enhanced 32-bit arithmetic instructions
- ∑Barrel shifter
- ∑DMA 4 ch + DMA II

M16C/80
- ∑16-MB space
- ∑Over 20 MHz
- ∑16-bit multiplier
- ∑High-speed interrupts
- ∑DMA 4 ch

M16C/60
- ∑1-MB space
- ∑16 to 24 MHz
- ∑16-bit multiplier
- ∑DMA 2 ch

M16C/Tiny
- ∑Small package (42 to 80 pins)
- ∑10 to 20 MHz
- ∑Single-chip specific

R8C/Tiny
- ∑Small package (20 to 32 pins)
- ∑20 MHz
- ∑Single-chip specific

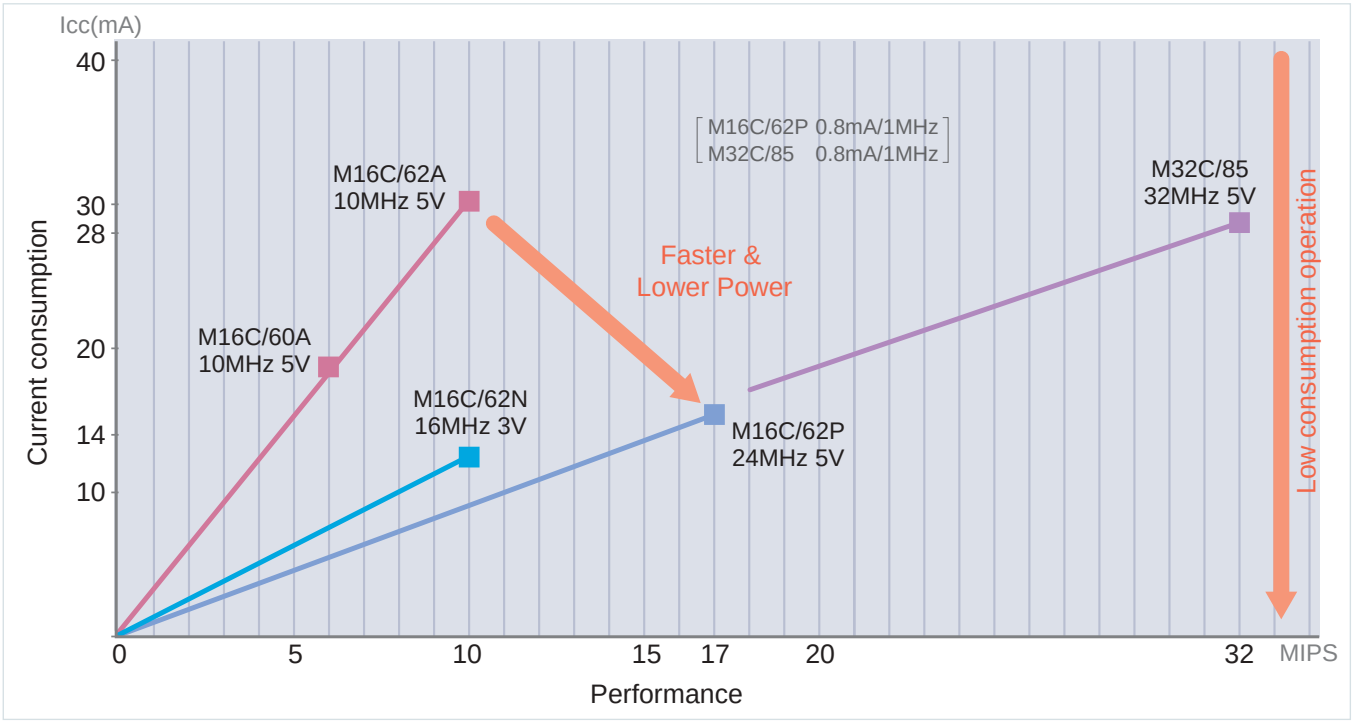
Slimmer functions
Fewer pins

Low Power Dissipation

The M16C minimizes power dissipation while offering maximum performance.

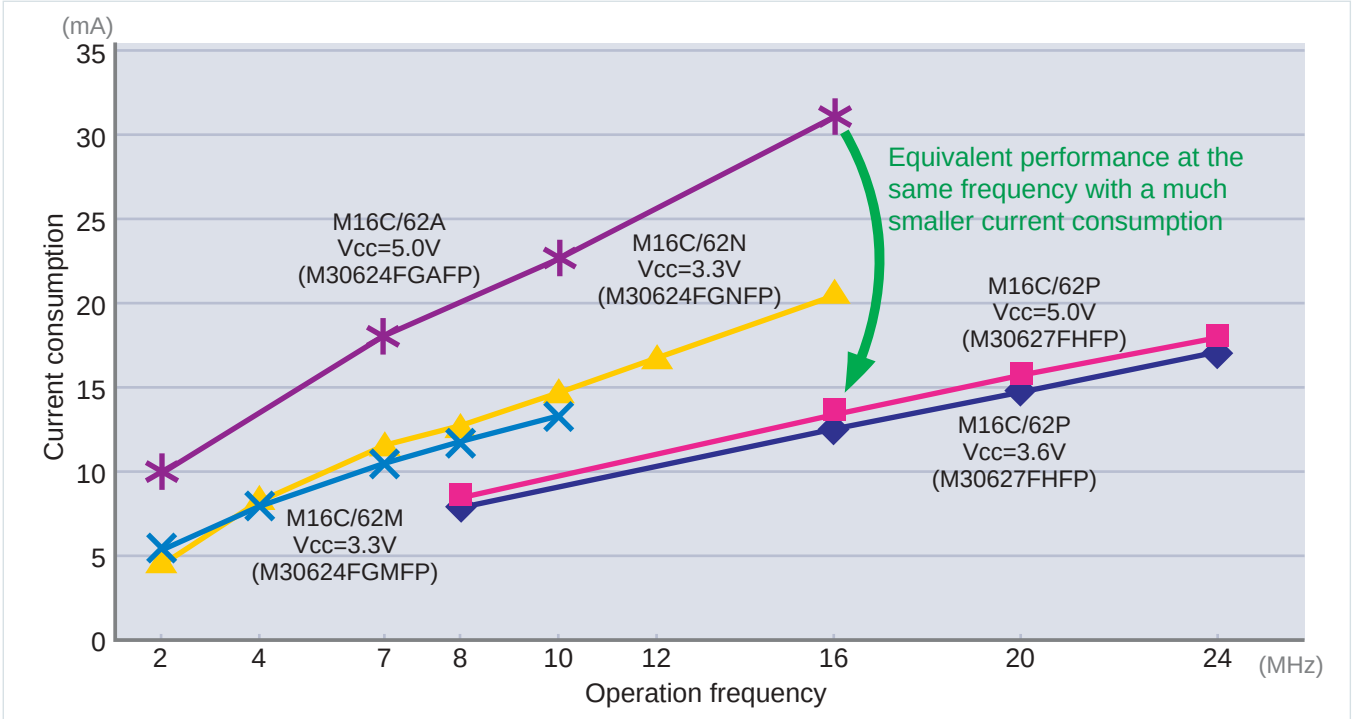
Performance to Power Consumption Ratio

M16C Platform processors achieve high performance processing and low power dissipation through a new processor architecture, advanced chip layout, and decreased internal bus lengths. Additionally, on chip heat generation is minimized, allowing M16C processors to be used effectively in high temperature environments.



Current comparisons on FLASH versions (M16C/62A, M16C/62M, 62N, 62P)

At same frequency, M16C/62P can operate at a much smaller current consumption. (Reference value)

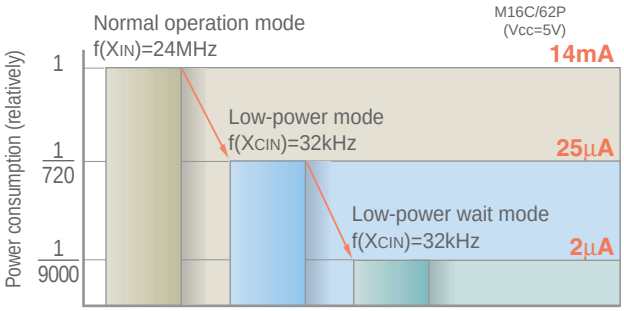


Lower Power Dissipation

The M16C minimizes power dissipation while offering maximum performance.

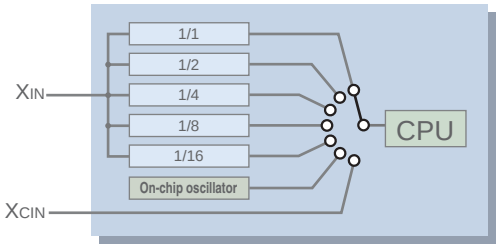
Extensive Power Management

The clock generator contains two switchable circuits, one for the main clock and one for the subclock. This clock switchover helps to reduce the device's power consumption and noise (power mode switchover).



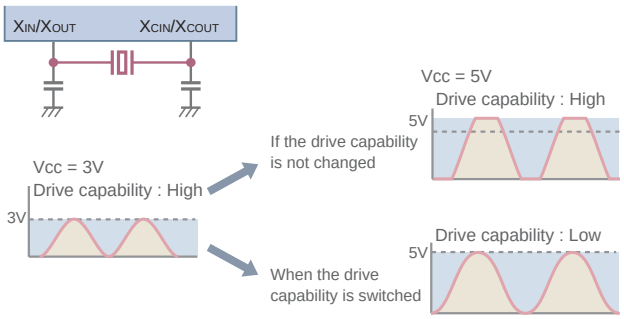
Clock selection circuit

The CPU's main clock can be selected from the following: 1/1, 1/2, 1/4, 1/8, 1/16 of the base oscillator (XIN input), or the sub clock (XCIN input), allowing current consumption to be minimized.



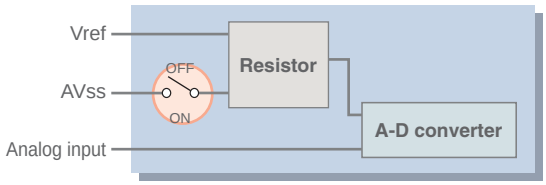
Oscillator Driver Capacity Switching

Switching the oscillator capacity reduces unnecessary radiant noise from the clock driver and power consumption.



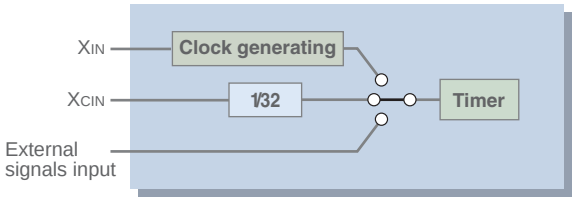
Vref Cut

When not using the A-D converter Vref can be switched OFF to minimize current consumption.



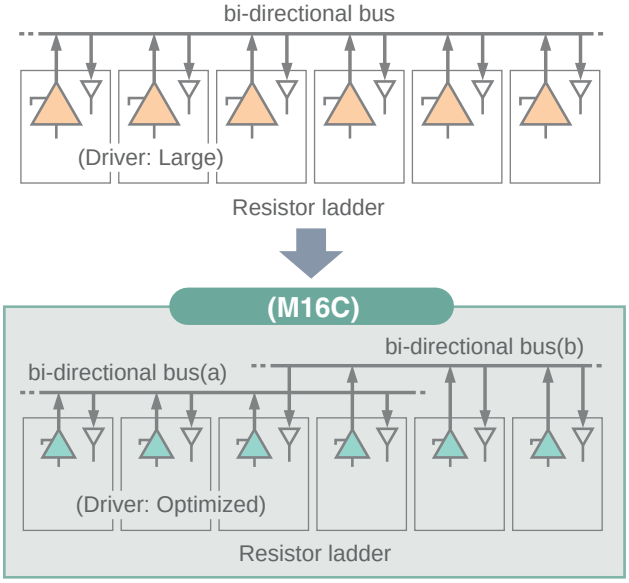
Independent Timer Operation

The timer can function independently without using the base oscillator (XIN input) for counting.
Even when in the STOP state, external signals can be used for timer operation. Current consumption can be minimized by only having the timer operate when in the STOP state.



Reducing the Load Capacitance and Buffer Size by Optimized Bi-directional Bus

Load capacitance is distributed by means of bus separate buses, thereby reducing the charging/discharging-induced power loss. In addition, the reduced load capacitance results in increasing the speed of bus operation.

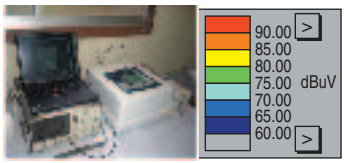


EMI/EMS Countermeasures

M16C platform processors are designed for low noise and low power dissipation.

M16C Advanced EMI Suppression

Microcontroller chips are being used more and more in products which utilize microsignals such as cellular telephones and FM text two-way radios. The requirement for reduced noise emission is growing. Europe has already introduced a CE Mark regulation. The problem is that noise emission tends to increase as products are downsized. This is why the M16C has been designed to minimize switching noise by optimizing transistor size, drastically shortening wiring, and more. These efforts have successfully reduced noise emission to a maximum of 20 dB.

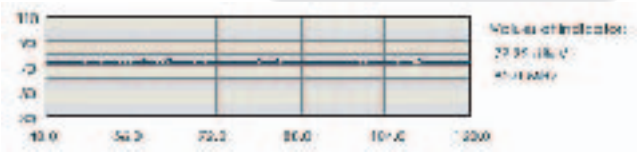


Measuring Equipment : EM Scanner of Noise Laboratory Co.,Ltd, EPS-M1
Measuring Location : Kansai Electronic Industry Development Center
Measuring Frequency Range : 30 to 110 MHz
Measuring Unit : 2 mm square

EM Scan Measuring Method : EM scan measurement using electromagnetic field probe
Measuring Condition : Measurement Frequency Range 40 to 120MHz

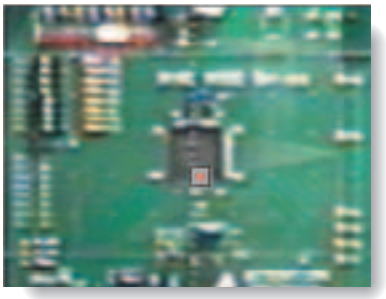
M16C/62P

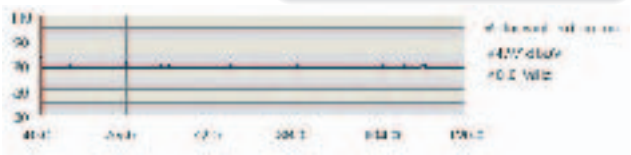
Supply voltage:5V
Oscillation frequency:24MHz(PLL)



M32C/83

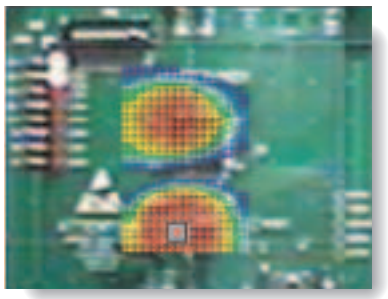
Supply voltage:5V
Oscillation frequency:32MHz



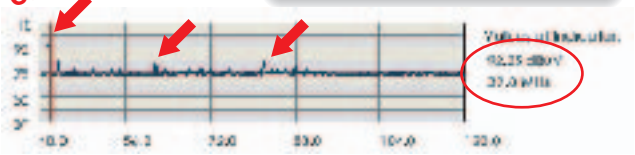


Company A RISC-A

Supply voltage:5V
Oscillation frequency:20MHz(PLL)



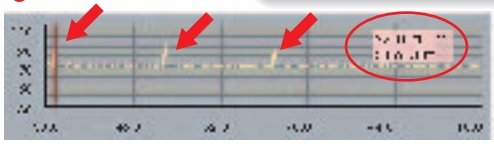
Care of noise peak



Company A CISC-A

Supply voltage:5V
Oscillation frequency:10MHz

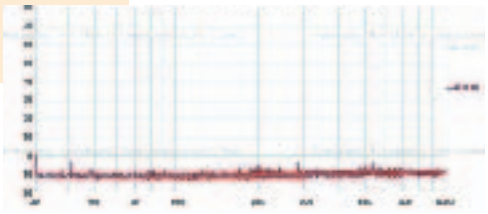
Care of noise peak



TEM Cell Method

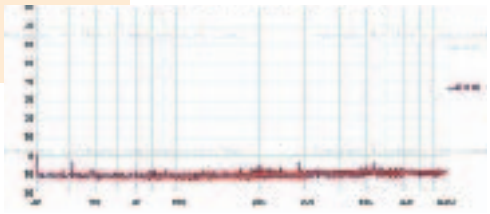
In a measurement by the TEM-cell method currently standardized in the United States and Europe, the noise emission of M16C has been decreased.

M16C/6N4



Supply voltage:5V
Oscillation frequency:20MHz (PLL)

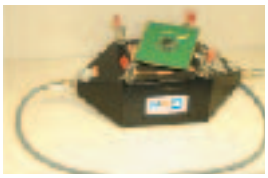
M32C/85



Supply voltage:5V
Oscillation frequency:32MHz (PLL)

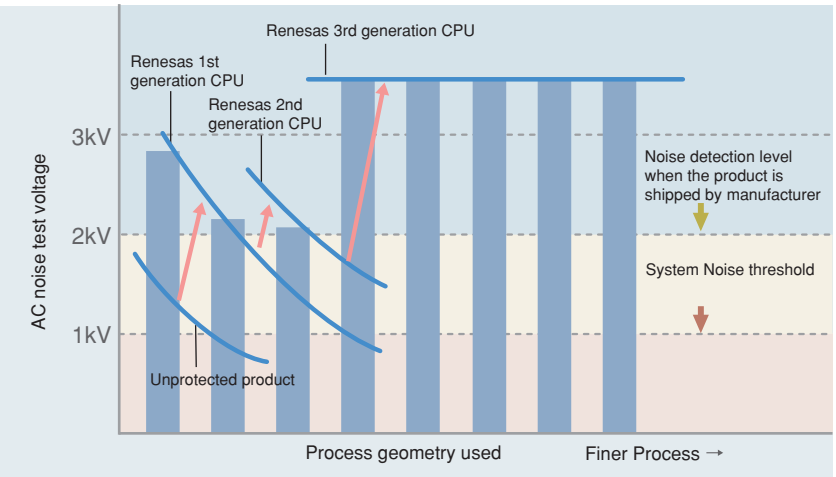
TEM cell method evaluation jig

TEM cell method is to trap the LSI in small sealed space made by metal and to measure the noise emission from the entire LSI

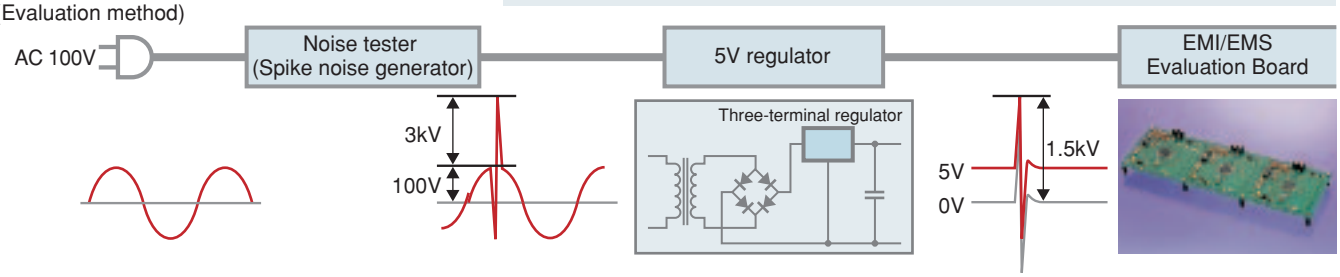


Noise Immunity

CPUs are increasingly used in applications which demand reliable operation. However, the smaller these microcontroller dies get, the more susceptible to noise they become. To maintain noise immunity, the M16C has suitable noise filters in all the necessary places. The overall pin layout has also been designed to minimize noise, such as placing a GND between oscillator pins.



(Evaluation method)

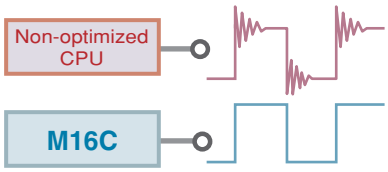


Noise Suppression

M16C platform processors are designed for low noise and low power dissipation.

Output Impedance Optimization

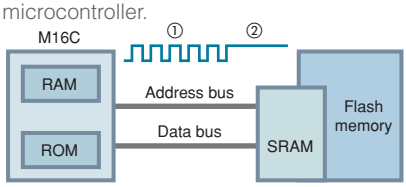
Even when using an external bus, EMI noise is kept to a minimum.



By adjusting the impedance of the output buffer to match the characteristics impedance of the board wiring, ringing when signals are output from the M16C can be suppressed to the minimum.

Noise suppression on external bus pins

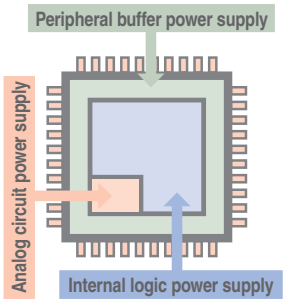
Because unnecessary changes of bus state do not occur even when using external buses, no noise is output from the microcontroller.

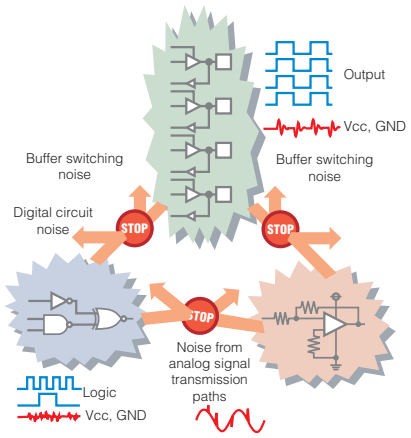


① Bus signals are output only when accessing an external area (e.g., SRAM or flash memory).
② External buses do not change state when accessing an internal area (ROM or RAM).

Power supply and GND lines with reduced mutual interference noise

The power supply lines fed to the chip are separated, for reduced mutual interference noise.

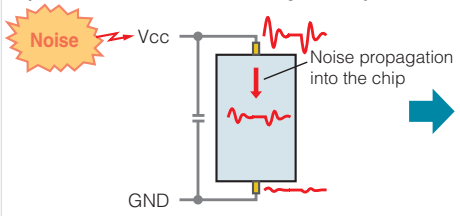




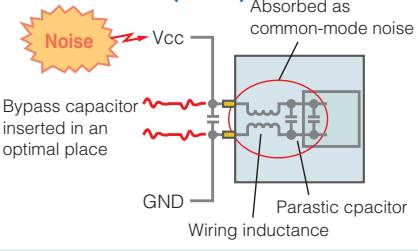
Adjacent Vcc and Vss Layout

In conventional microcontrollers, Vcc and Vss were distant from each other, increasing the length of Vcc/GND wiring.
In the M16C, Vcc and Vss are adjacent to each other, making it easier to prevent noise from affecting the Vcc/GND wiring. Also, a parasitic capacitor is built into the M16C to further prevent noise affecting the Vcc and Vss lines.

(conventional microcomputers)



(M16C)



Upward Compatibility

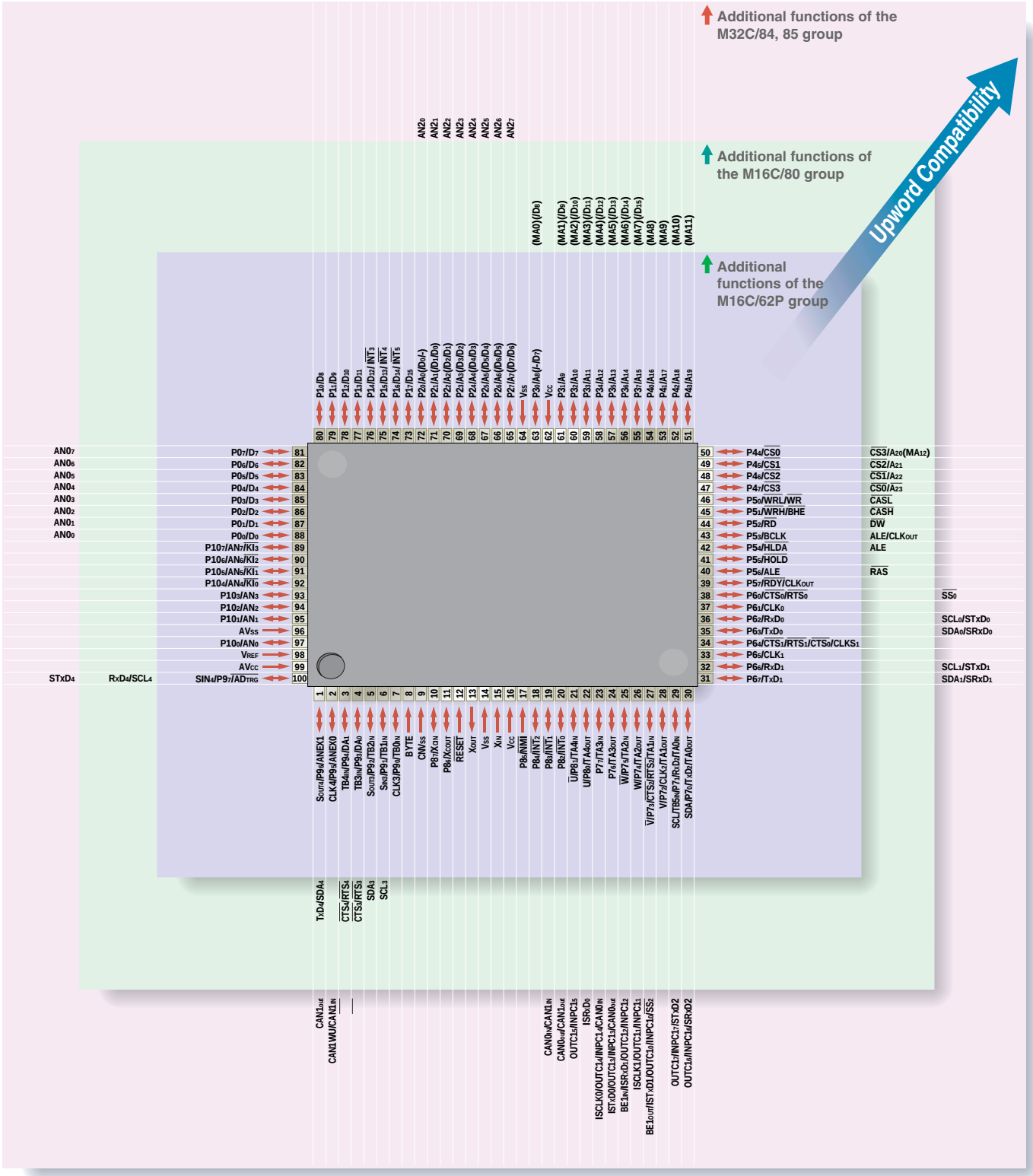
All aspects of platform compatibility are assured, facilitating simple performance upgrades or cost reductions.

Pin Compatibility

Because all series are pin compatible, circuit changes and board layout modifications are eliminated.

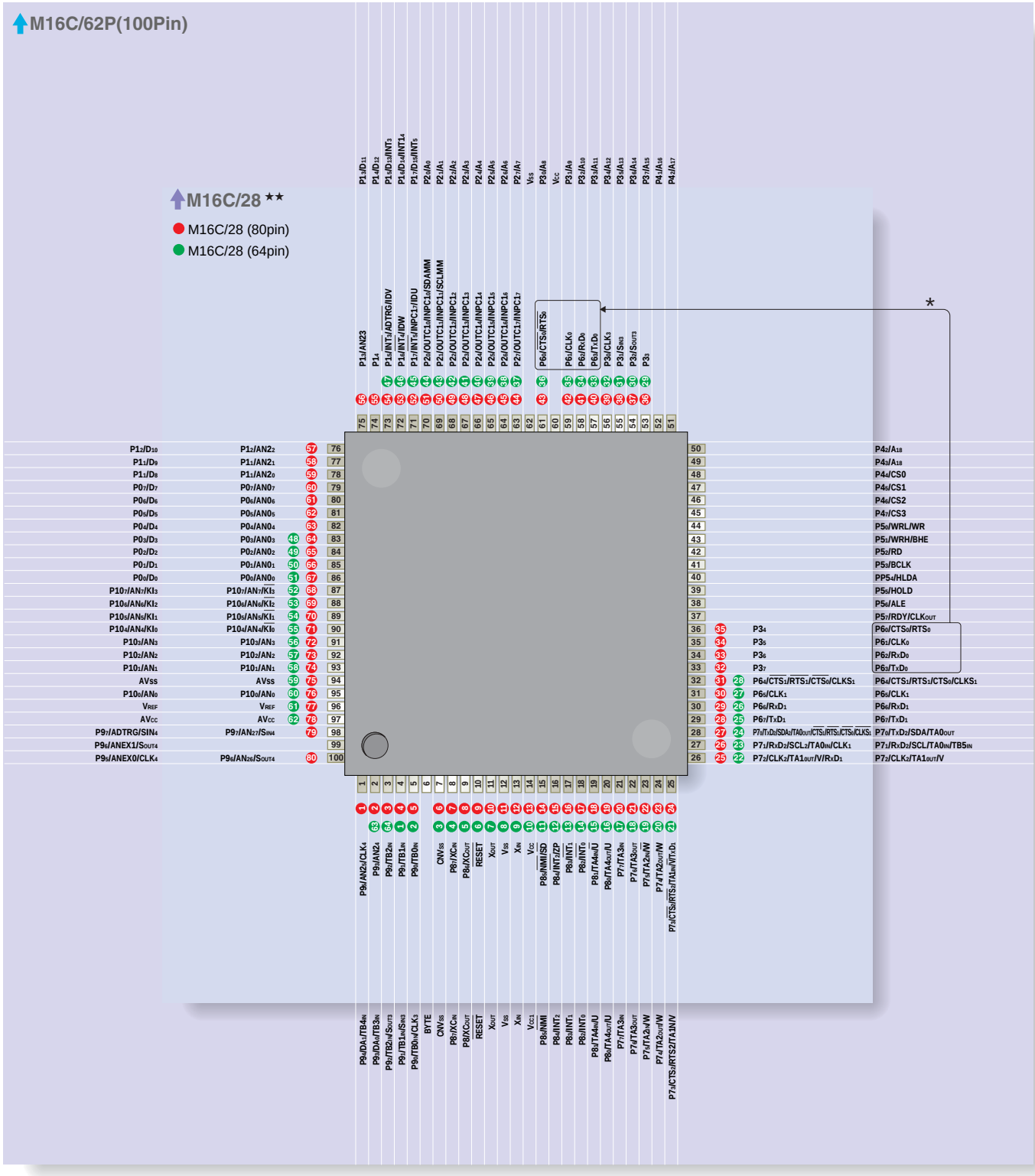
Keep pin-Compatibility (100pin)

- The M16C maintains platform compatibility (pin layout, peripheral functions, control register configuration, and instruction set) with all products. This compatibility facilitates adaptation to new products when the production of the new product supersedes that of the old product.



Keep pin-compatibility (100,80,64pin)

- The figure on the right shows that the M16C/28 (64pin), M16C/28(80pin) and M16C/62A highly achieve pin assignment compatibility and peripheral function compatibility among three models.



*Output for important pins is enabled using different portsin the 64-pin package.

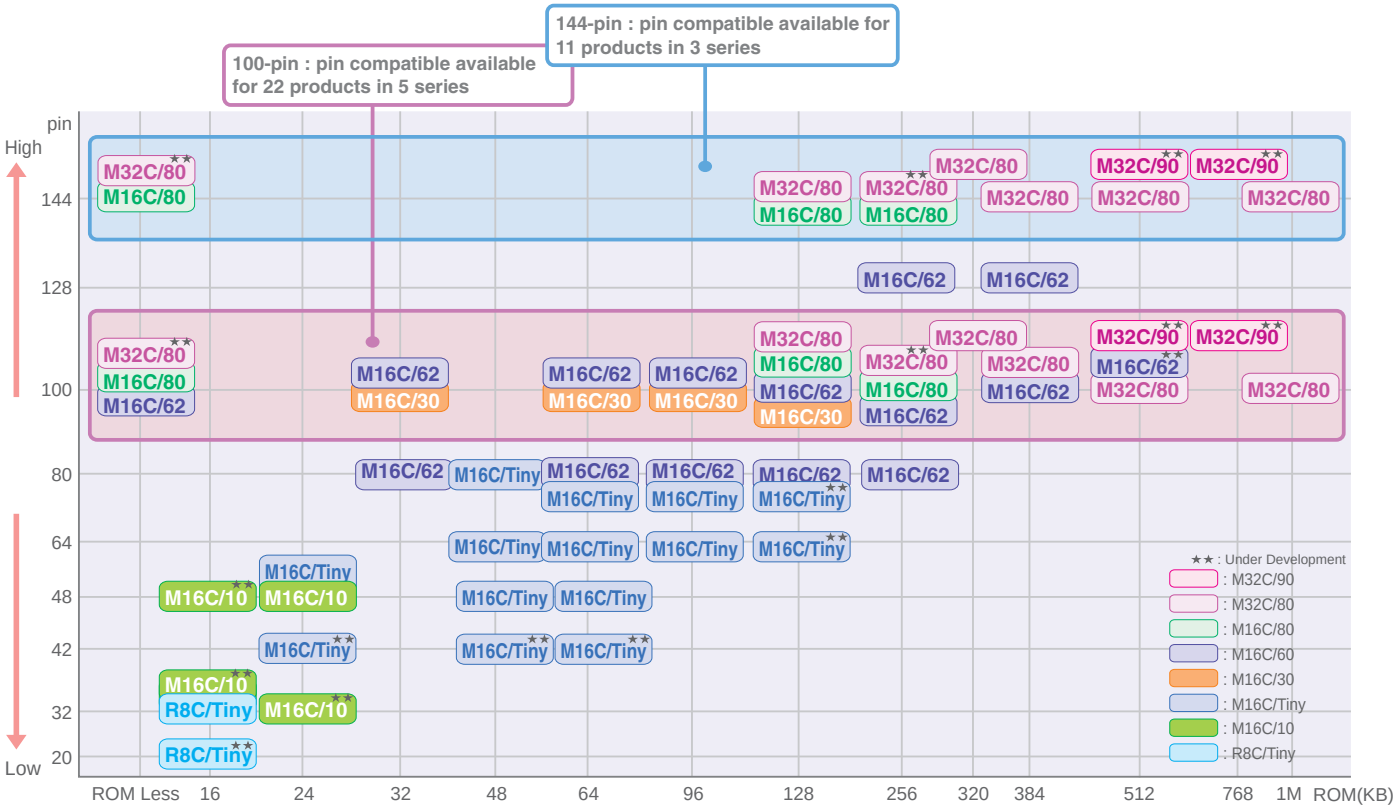
★★:Under Development

Upward Compatibility

All aspects of platform compatibility are assured, facilitating simple performance upgrades or cost reductions.

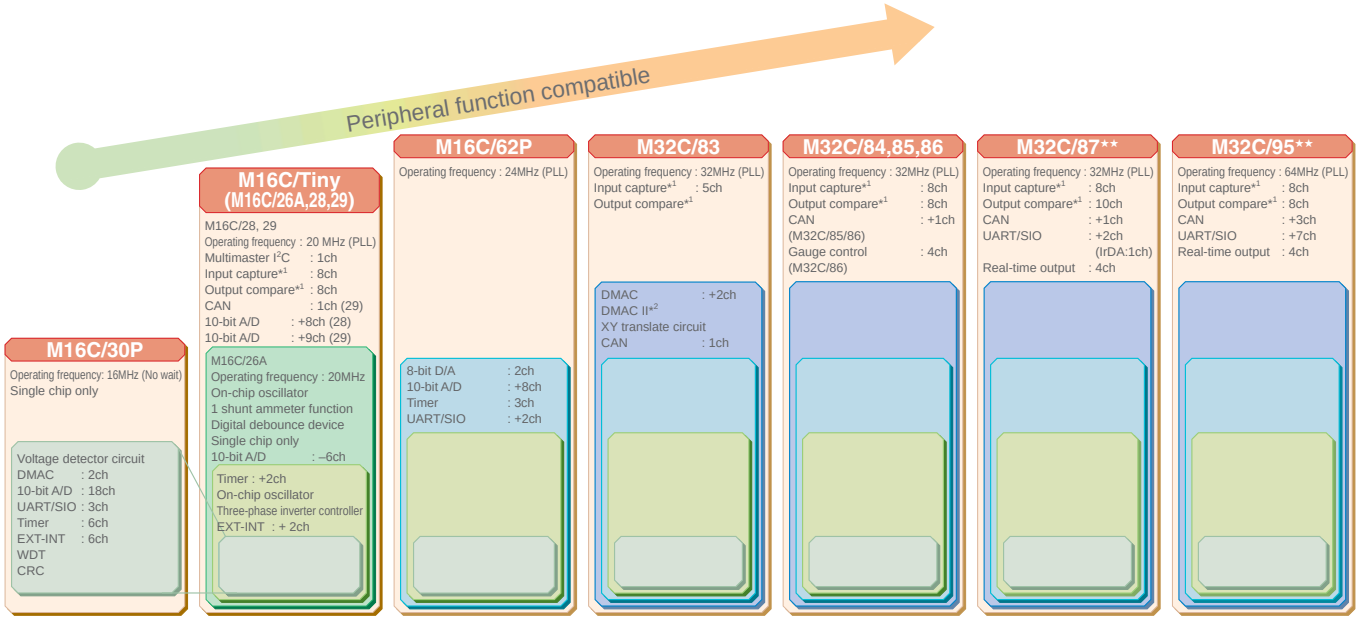
Package compatibility

Compatibility by the same package is maintained in different memory size. This enables to change easily even if changing memory capacity is required.



Compatible with peripheral devices

The M16C/62, M16C/80, M32C/80 not only retains compatibility with the CPU core, but also with peripheral functions.
Compatibility is also retained in the peripheral function control register.(M16C/62→M16C/80→M32C/80 composed of added peripheral functions. M16C/Tiny is composed of streamlined M16C/62 peripheral functions.)



*1: High performance timer enabling communication functions.
*2: DMA II is a DMA function that can be started up by requests from any peripheral I/O.

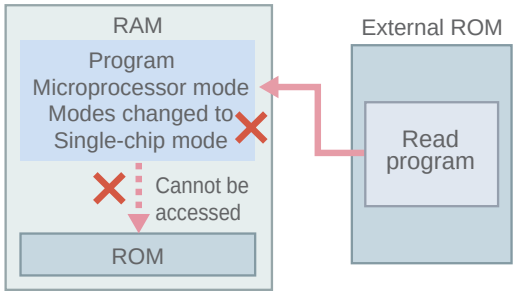
Security

M16C has advanced ROM code security functions to prevent illegal coping.

Feature of Program Read-out Protection

ROM Code Protect 1 (Mask and Flash Memory)

When started in microprocessor mode, the program can access the internal RAM from an external ROM, but cannot access the internal ROM even when the access is attempted after entering single-chip mode from microprocessor mode. This prevents the internal memory from being illegally copied by a third party.

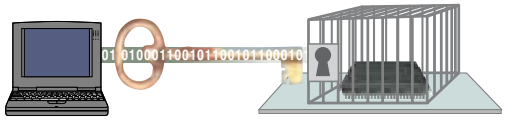


Flash Memory ROM Code Protection

This facility protects the internal flash memory against readout or rewriting during parallel rewrite operation by using a ROM code protect bit. (The protect bit can only be rewritten in serial mode.)

Flash Memory ID Code Protection

This facility protects the flash memory against illegal access during serial rewrite operation by rejecting commands unless the ID code written in the chip and the ID code sent by the serial programmer match. (This makes repetitive ID code confirmation impossible.)

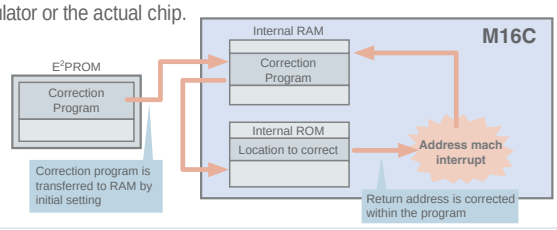


ROM Correct Function

M16C can correct the program made a mask ROM by using the address agreement interrupt register. All number changing becomes unnecessary at the program trouble of the mask ROM.

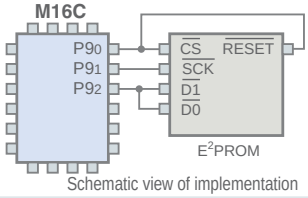
Merits of ROM Correction

(1) There is no need to remake the mask version of microcomputer.
(2) Even a faulty program can be corrected, thanks to the inclusion of E²PROM.
(3) The address match interrupt function can be used to generate a break on an emulator or the actual chip.



Method of Program Correction

(1) If correction information is stored in external E²PROM after reset, the correction program is transferred into the internal RAM.
(2) The address of the faulty program code is set in the Address Match Interrupt Register, thus generating an interrupt immediately before executing the code.
(3) The correction program that has been transferred into the RAM is executed from the interrupt routine.



Schematic view of implementation

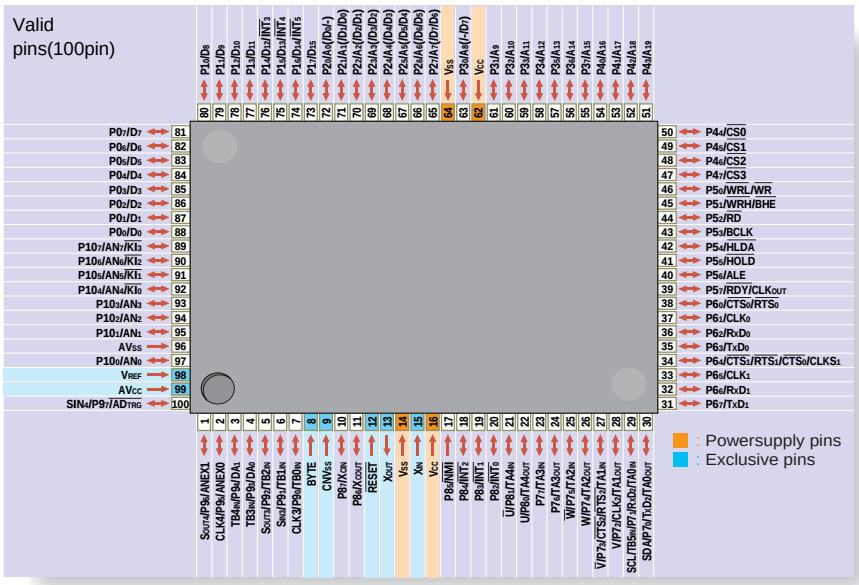
M16C Family Valid Pins

Industry's highest number of valid pins.

■Comparison in 100-pin package

	M16C/62	RISC-A
Power	4	6
Exclusive	7	10
Valid	**89**	84*1

*1 : A 128-pin package is required to support just 90 valid pins.



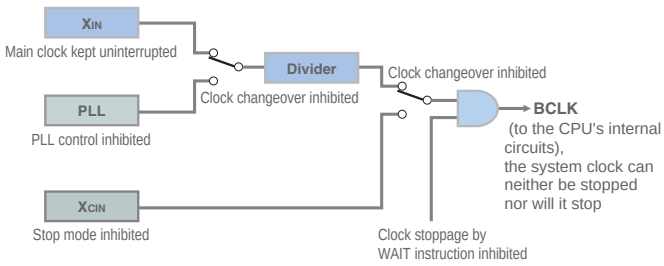
Failsafe Operation

To ensure proper code operation, M16C has implemented many failsafe modes.

Failsafe Operation Features

Enhanced Watchdog Timer (WDT)

Even if a runaway process occurs, the system (CPU and WDT) are kept supplied with a clock.



Problems of the internal WDT in conventional microcontrollers

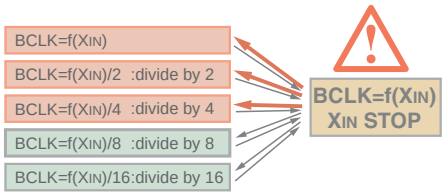
- If the clock supplied to the microcontroller is made to stop by, for example, a damaged external oscillator, the WDT stops functioning.
- Should a runaway process cause the microcontroller to enter the low power mode (WAIT or STOP), the clock stops, so do WDT functions.

New functions added to the WDT

- The supplied clock is monitored using an oscillation stoppage detection circuit, so that when it stops, another clock generated by a on-chip oscillator is supplied to the system (CPU and WDT).
  →Even if the supplied clock stops, the WDT is kept supplied with a clock and can therefore be reset as necessary.
- The clock source for the WDT is connected to a clock generated by a on-chip oscillator in stead of the system clock.
  →Even if a runaway process cause the microcontroller to enter the low power mode (WAIT or STOP), the WDT keeps operating with an independent on-chip oscillator and can therefore be reset as necessary.
- High reliability equivalent to that of an external WDT is provided.

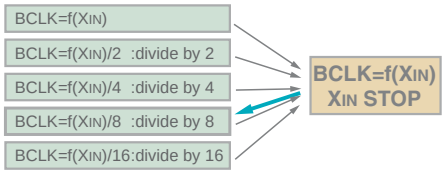
System Clock Divider Circuit

Dangerous unless the XIN oscillation is fully stable!



When the resonator restarts oscillating after being turned off, it requires a finite time before its oscillation stabilizes. While the resonator's oscillation amplitude is insufficient or it is oscillating over-tone, it cannot be used as the system clock for the microcomputer.

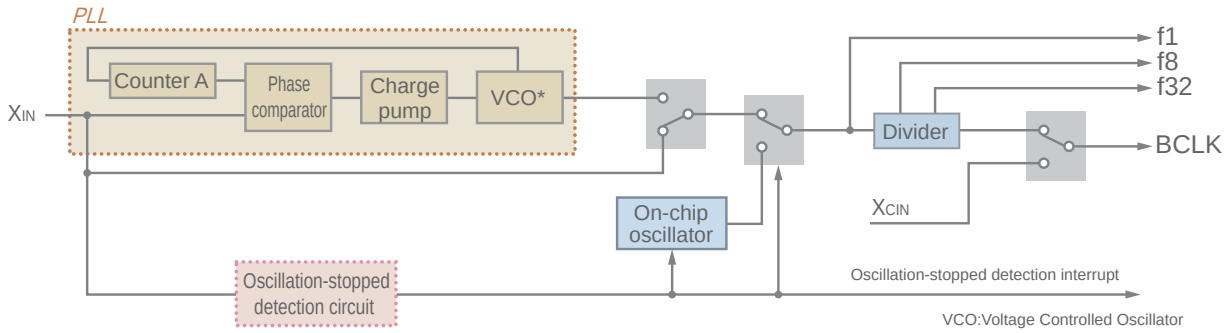
Always returns with divide-by-8



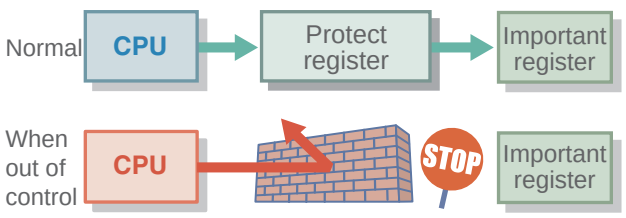
The M16C and M32C, therefore, incorporate a corrective measure so that when the main clock restarts after being inactive for any reason, not just for restoration from reset, the prescaler for the main clock is automatically set to 1/8, which combined with the effect of a low-pass filter at the clock input pin, ensures that the microcomputer is supplied with a stable clock.

PLL Oscillation Circuit and Oscillation-Stopped Detection Circuit

- The internal PLL achieves a max. operating frequency of 24 to 64 MHz (Target)
- The on-chip oscillator detects cessation of XIN (the main system-clock signal).



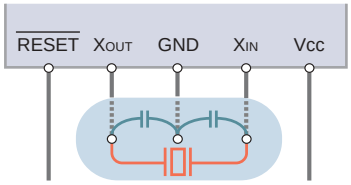
Access Control by Protect Register



The protect register controls access to the important peripheral circuits (SFR), thereby preventing unwanted access when the program is running out of control.

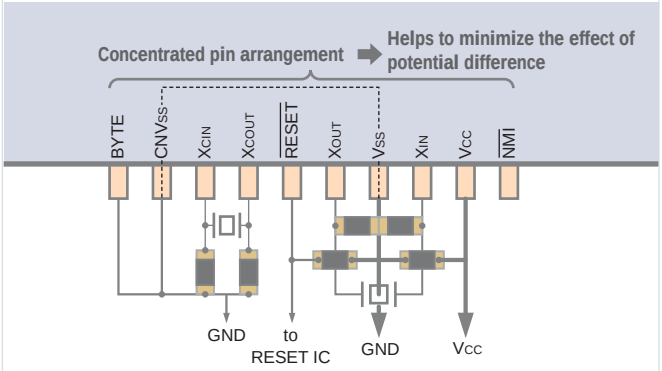
Oscillator Pin Layout

- Easily connected to 3-pin oscillator
- Pin layout avoiding power/ground shorts
  (XOUT - GND - XIN - Vcc)
- Laid out with static signal line on both ends of the oscillator
- Easy noise prevention

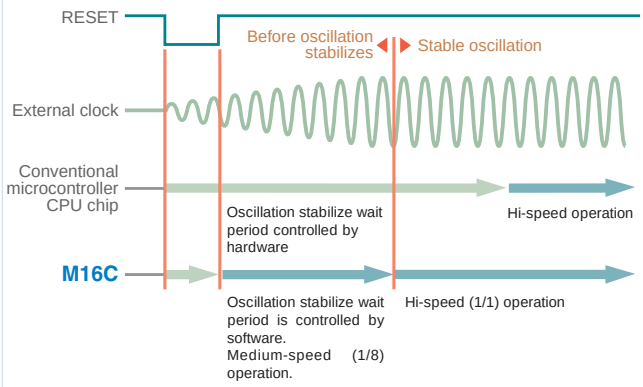


Concentrated Arrangement of Important Pins and Increased Reliability

Pin arrangement to minimize the effect of potential differences due to potential gradient



Oscillation Wait Time Control

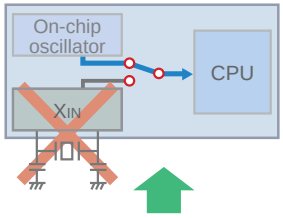


On-chip oscillator

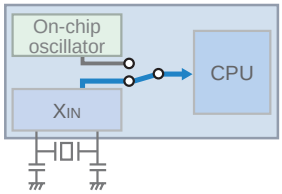
The MCU contains a on-chip oscillator and has an oscillation stop detection function for safety design.

Upon detecting abnormal stoppage of XIN oscillation, the on-chip internal oscillator provides backup for MCU operation.

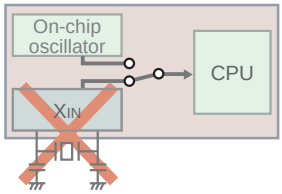
Backup by the internal on-chip oscillation



Normal XIN oscillation

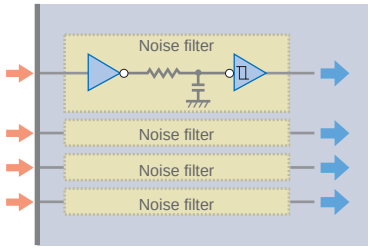


Abnormal stoppage of XIN oscillation



Noise Filter for Input Signals

Noise is eliminated from each input signal by a noise filter, preventing the input of unstable signals.



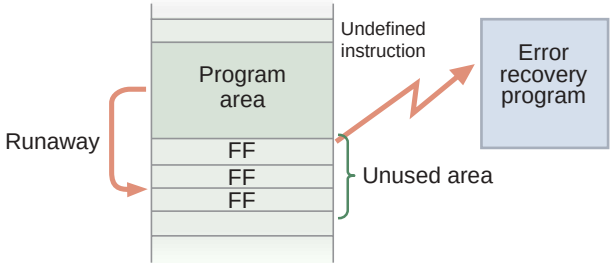
Instructions for Failsafe Operation

Instructions are provided for dealing with situations in which the program is out of control.

Measures Using Instructions

BRK ***(BReaK)***
UND ***(UNDefined instruction)***

Simple instruction codes for program error recovery in unused areas of the program memory are accomplished using the break code (0016) or the undefined instruction (FF16).

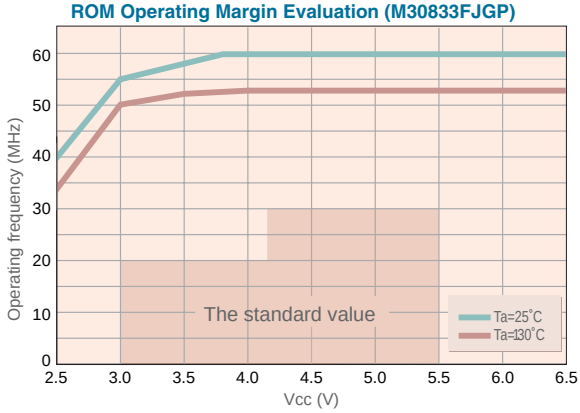


Operation Characteristic Over Wide Temperature Range

M16C and M32C performance are guaranteed over a wide range of temperatures.

The M16C can be employed in equipment with high temperatures such as automobiles and electric ranges.
Operation at low temperatures is even better than at high temperatures, performance being guaranteed between –40 and 85˚C. (–40 to +125˚C version also available)

ROM Operating Margin Evaluation (M30833FJGP)

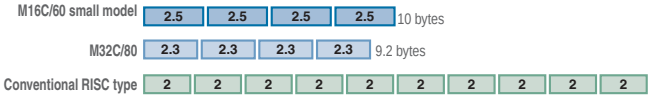


High-speed Processing

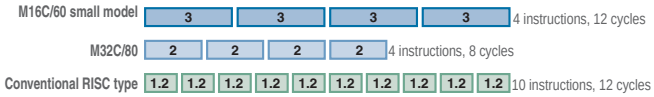
The M16C features high-speed processing under a wide range of conditions.

Comparison of M32C/80 with Conventional RISC Microcontroller

Comparison of program size

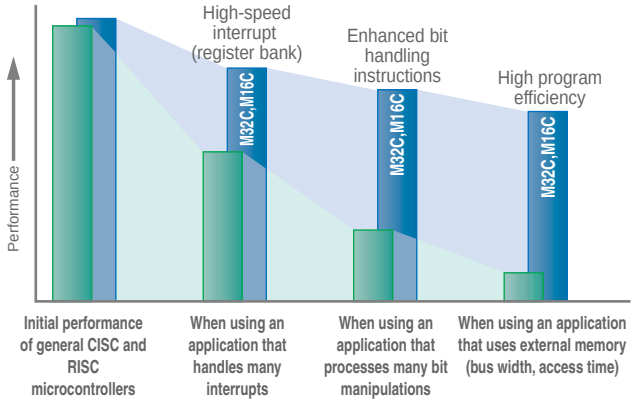


Execution processing comparison



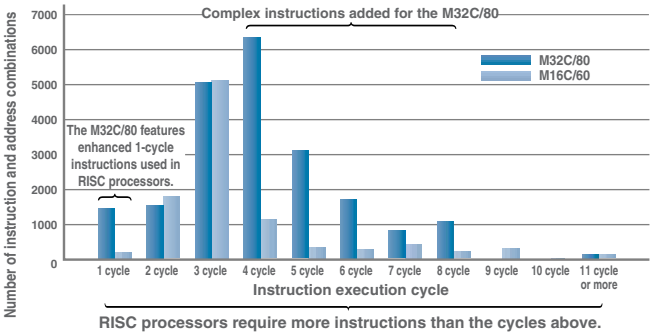
With M16C/60, small models are program models with data area within 64K bytes and program area within 1M bytes.

CPU Processing Capabilities Matched to the Actual Application Needs



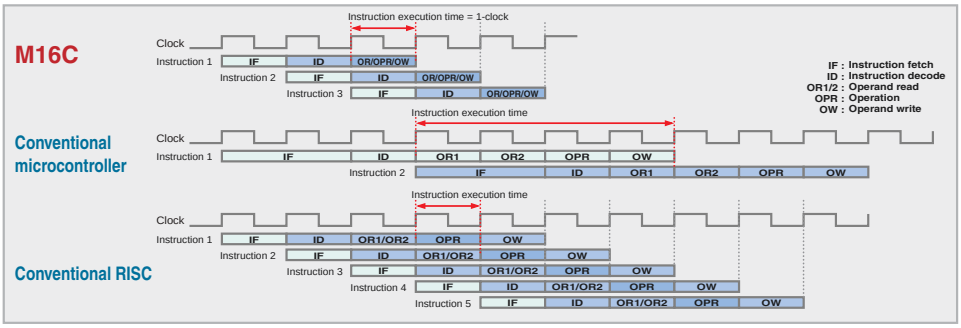
Instruction Cycle Distribution

Complex instructions can now be executed in minimum cycles.



M16C Instruction Execution System

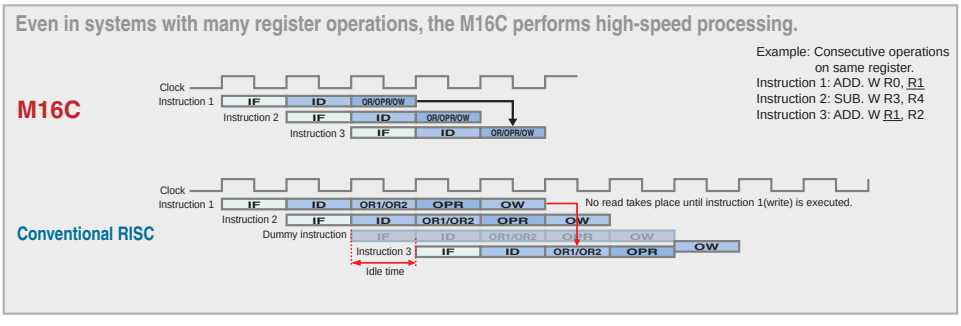
- The M16C executes each CPU stage in one clock.
- The instruction execution time is 1-clock cycle → equivalent to conventional RISC processors.



Execution of Register-to-Register Operating Instructions

- For consecutive operation using the same register, the more pipeline steps, the more idle time.
- In the M16C, each operation is completed in one clock cycle and there is no idle time.

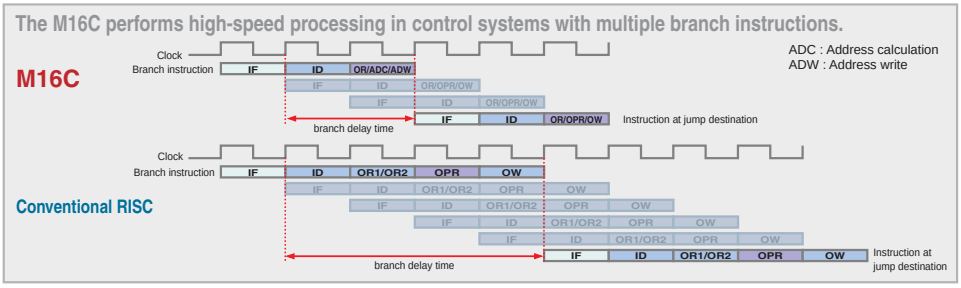
No read takes place until instruction 1 (write) is executed. For conventional RISC processors, the compiler outputs a dummy instruction (NOP, etc.) so that the pipeline flow is not affected. The time required to execute this dummy instruction is wasted.



Execution of Branch Instructions

- The branch delay time increases in line with the number of pipeline steps.
- The M16C branch one time is two clock cycles.

Conventional RISC processors prefetch instructions equivalent to the number of pipeline stages. Therefore, when a change in jump destination is effected as a result of executing a branch instruction, idle time equivalent to the number of prefetched instructions (the number of pipeline stages) occurs. Similarly, idle time occurs when interrupts occur.



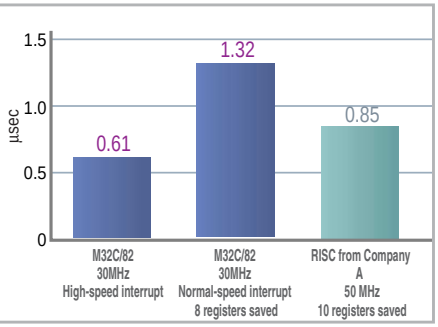
High-speed Interrupts (M32C/80,M16C/80 only)

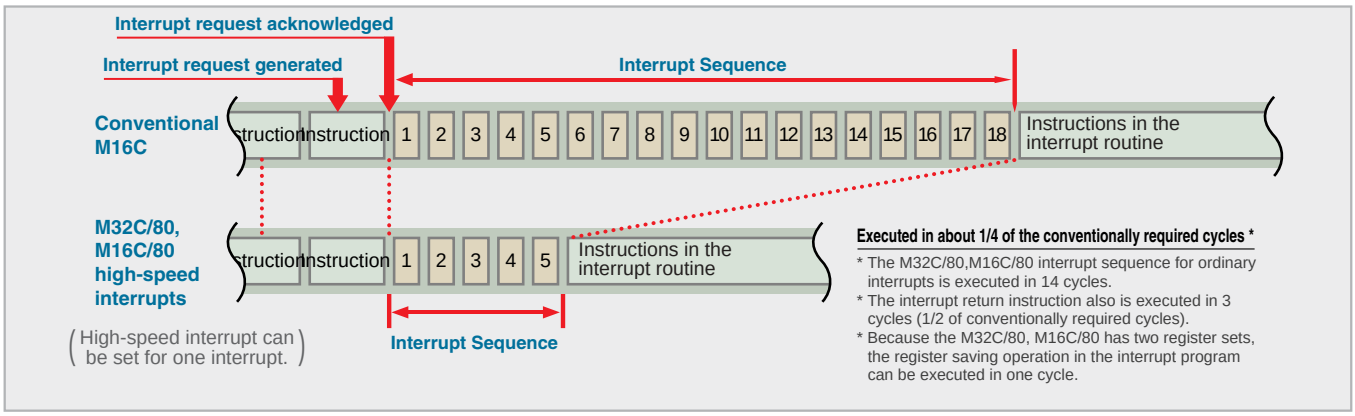
Fastest interrupt response speed in its class

The microcontrollers processing capability is increased by speeding up responses to and return from interrupts. The number of steps in an interrupt routine is reduced, while in frequently invoked interrupts, the processing capability is increased. Interrupt handling that is required of fast responses will be facilitated.

The high-speed interrupt function of the microcontroller helps to realize the fastest interrupt response speed in its class.

A high-level signal is output to a port in an interrupt routine and the port is measured with an oscilloscope.





High Level Operation Instructions

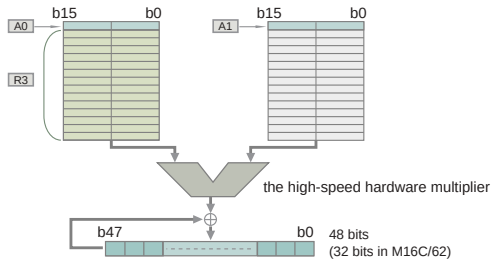
The M32C/80 and M16C/80 execute sum of products operations in two cycles.

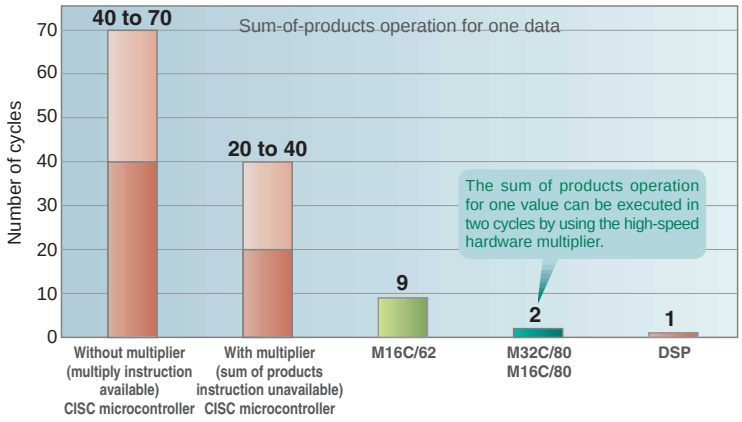
Interrupts can be executed even when this operation is under way.

The M32C and M16C provide high-speed filering performance with the sum-of-product calculation for the DSP function.

RMPA ***(Repeat MultiPle & Addition)***

Function: Sum-of- products operations
High-speed hardware multiplier





Enhanced 32-bit Instructions

The M32C/80 and the M16C/80 series feature enhanced 32-bit operating

Classification	Function	Addressing modes
ADD	ADDition	Immediate to register, Immediate to memory, Register to register, Register to memory, Memory to register, Memory to memory
SUB	SUBtract	Immediate to register, Immediate to memory, Register to register, Register to memory, Memory to register, Memory to memory
CMP	CoMPare	Immediate to register, Immediate to memory, Register to register, Register to memory, Memory to register, Memory to memory
MOV	MOVe	Immediate to register, Immediate to memory, Register to register, Register to memory, Memory to register, Memory to memory
PUSH/POP	PUSH/POP	Immediate, Register, Memory
SHA	SHift Arithmetic	Register, Memory (In the M32C/80 series, plural bit shifts are also possible.)
SHL	SHift Logical	Register, Memory (In the M32C/80 series, plural bit shifts are also possible.)
MUL*1	Multiple	Memory to memory, Register to memory
DIV*2	DIVide	Memory to memory, Register to memory

Notes :*1 32 bits x 32 bits = 32 bits M32C/80,M32C/90 Series
*2 32 bits ÷ 32 bits = 32 bits M32C/80,M32C/90 Series

ROM Code Size Reduction

The M16C has a one-byte space for frequently accessed instructions which enables simplified software development. In addition the M16C has advanced register layout and addressing modes which further simplify software development

Instruction Set Assignment

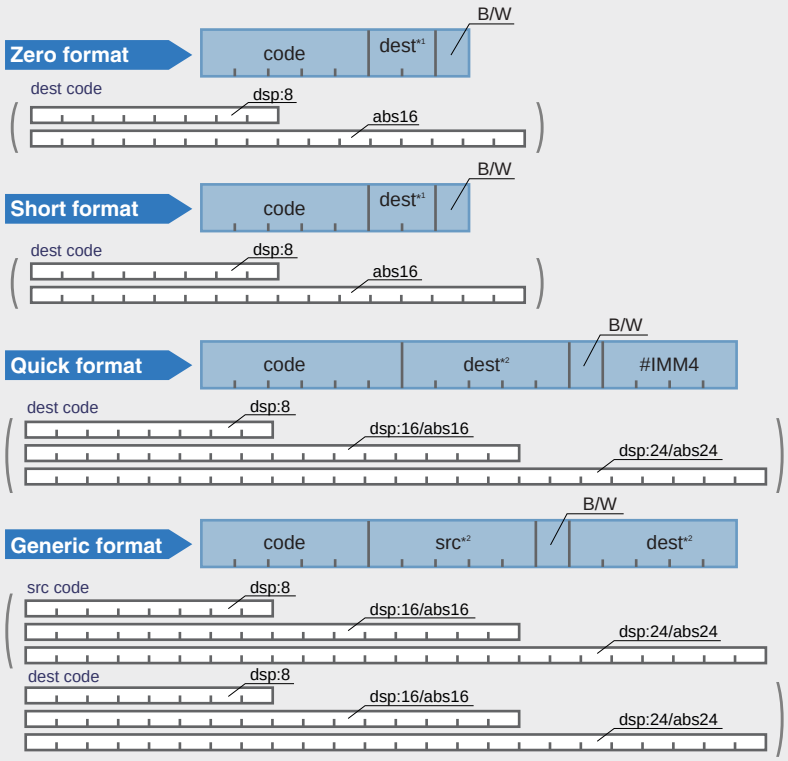
M16C instructions use four formats: zero, short, quick and generic.

Zero Format & Short Format

The zero and short formats are used frequently with programs which use 8-bit registers. Making it possible to create compact programs.

Quick Format & Generic Format

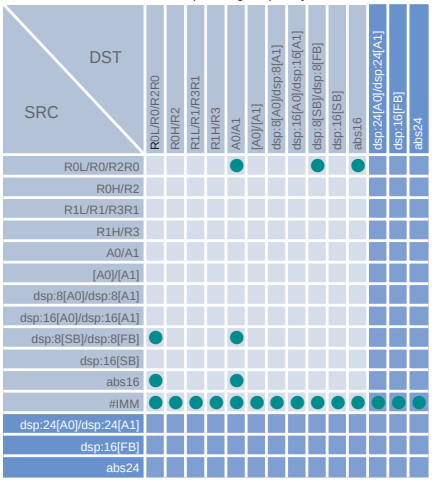
Quick and generic formats not only operate 8-bit registers, but offer an excellent selection of addressing options that enable unrestricted 16-bit register and memory operations.



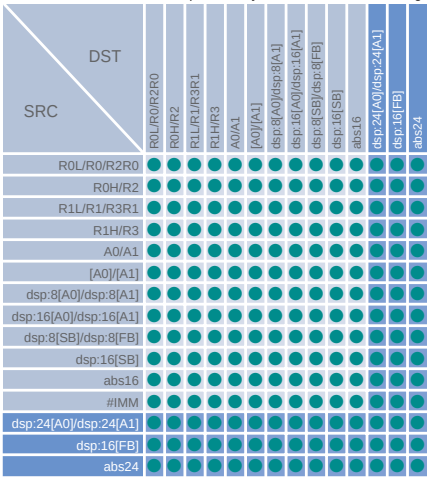
*1=R0L/R0, dsp:8[SB], dsp:8[FB], abs16
*2=R0L/R0/R2R0, R1L/R1/R3R1, R0H/R2, R1H/R3, A0, A1, [A0], [A1], dsp:8[A0], dsp:8[A1], dsp:8[SB], dsp:8[FB], dsp:16[A0], dsp:16[A1], dsp:16[SB], dsp:16[FB], dsp:24[A0], dsp:24[A1], abs16, abs24
#IMM4=immediate

The M16C CPU provides generic addressing for necessary instructions, thus enabling extreme freedom when creating programs (For example, memory-to-memory computation without using a register is possible). Also, to increase the utilization efficiency of program memory, the M16C features short forms for frequently used instructions and addressing modes. This allows programs to be smaller.Addressing inside ▬ boxes is emphasized.

Shortened Instructions — Instruction format using fewer bytes for expressing frequently used instructions.



Generic Instructions — Instruction format with good orthogonality made possible by combination of addressing.



Abundant 1-cycle Execution Instructions

The M16C features single-cycle addressing instructions for frequently used instructions, reducing program code and number of cycles.

- Register to register
- Register to memory
- Immediate to register
- Immediate to memory

These addressing modes can be executed in one cycle.

List of instructions with 1-cycle addressing

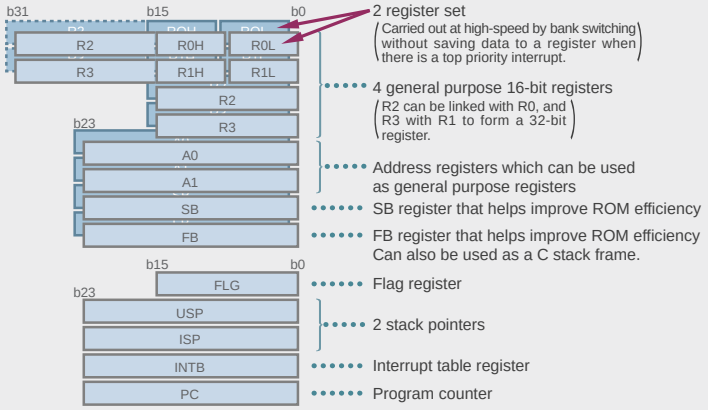
(36 out of 108 instructions for M32C/80)

Classification	Instructions	Function
Arithmetic operation	ABS	ABSolute
	ADC	ADdition with Carry
	ADCF *1	ADdition Carry Flag
	ADD	ADDition
	CMP	CoMPare
	DEC	DECrement
	EXTS	EXTend Sign
	EXTZ	EXTend Zero
	INC	INCrement
	NEG	NEGate
	SBB	SuBtract with Borrow
	SBU	SUBtract
Logic operation	AND	AND
	NOT	NOT
	OR	OR
	TST	TeST
	XOR	eXclusibe OR
Transfer	MOV	MOVe
	PUSH	PUSH
	PUSHM	PUSH Multiple
Bit manipulation	BCLR	Bit CLeaR
	BNOT	Bit NOT
	BNTST	Bit Not TeST
	BSET	Bit SET
	BTST	Bit TeST
Shift	ROLC	ROtate to Left with Carry
	RORC	ROtate to Right with Carry
	ROT *1	ROTate
when shifting one bit	SHA *1	SHift Arithmetic
	SHL *1	SHift Logical
Other	FCLR	Flag register CLeaR
	FSET	Flag register SET
	INDEX	INDEX Type
	INTO	INTerrupt on Overflow
	Jcnd	Jump on Condition
	LDC	LoaD Control register
	NOP	No Operation
	PUSHC	PUSH Control register
	SCcnd	Store Condition on Condition

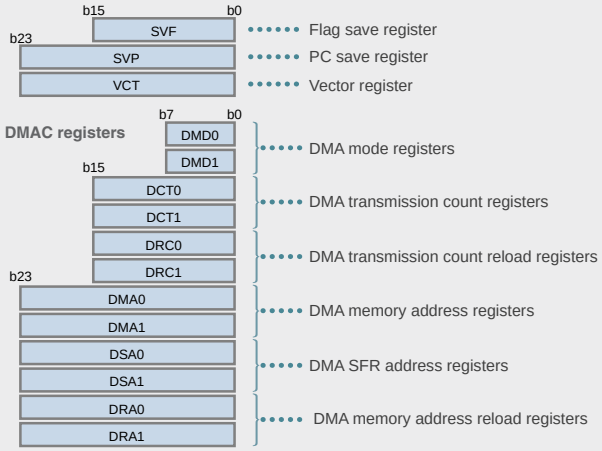
Note : *1 M16C/80 only

Register Configuration (M32C/80)

Conventional registers



High-speed interrupt registers



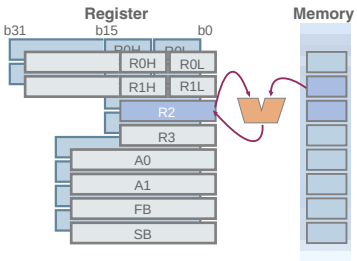
Instruction Set

Classification	Instructions	Function
Transfer	MOVHH	Transfer 4-bit data
	MOVHL	Transfer 4-bit data
	MOVLH	Transfer 4-bit data
	MOVLL	Transfer 4-bit data
	STZ	Conditional transfer
	STNZ	Conditional transfer
	STZX	Conditional transfer
	SMOVF	Transfer string in forward
	SMOVB	Transfer string in reverse
	SMOVU*	Transfer and compare string
	SSTR	Store string
	SIN*	Input string
	SOUT*	Output string
	MAX*	Select maximum value
	MIN*	Select minimum value
	CLIP*	Clip instruction
	XCHG	Register to register/memory exchange
Branching	JMP	Unconditional jump
	ADJNZ	Add and conditional jump
	SBJNZ	Subtract and conditional jump
C language/OS only	ENTER	Build stack frame
	EXITD	Free stack frame
	STCTX	Save context
	LDCTX	Restore context
Bit manipulation	BAND	Bitwise AND
	BNAND	Inverse bitwise AND
	BOR	Bitwise OR
	BNOR	Inverse bitwise OR
	BXOR	Bitwise XOR
	BNXOR	Inverse bitwise XOR
	BMcnd	Conditional bitwise transfer
Arithmetic operation	DIV	Signed division
	DIVU	Unsigned division
	DIVX	Signed division
	MUL	Signed multiplication
	MULU	Unsigned multiplication
	SHA	Arithmetic shift
	SHL	Logical shift

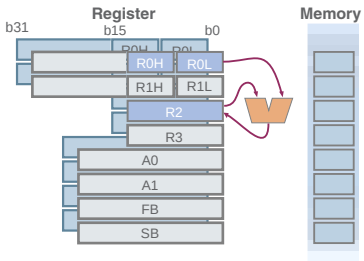
Note: Available for only the M32C/80 and M16C/80.

Addressing Modes

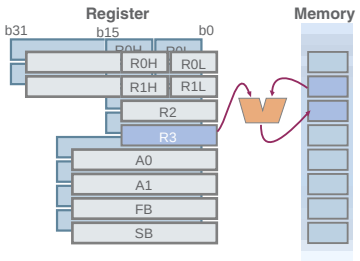
Memory-to-register operation



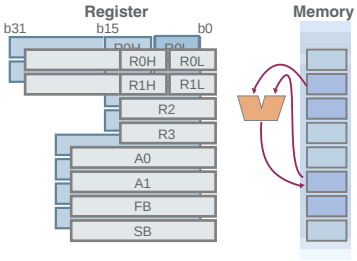
Register-to-register operation



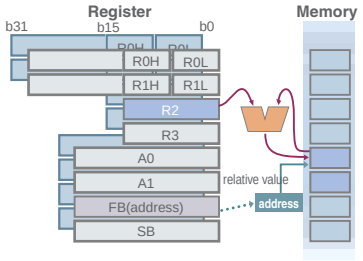
Register-to-memory operation



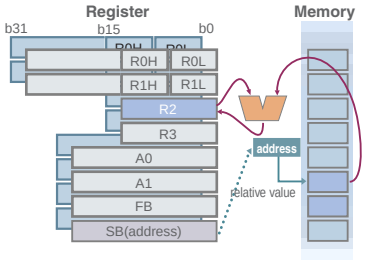
Memory-to-memory operation



Register-to-memory operation (FB relative)



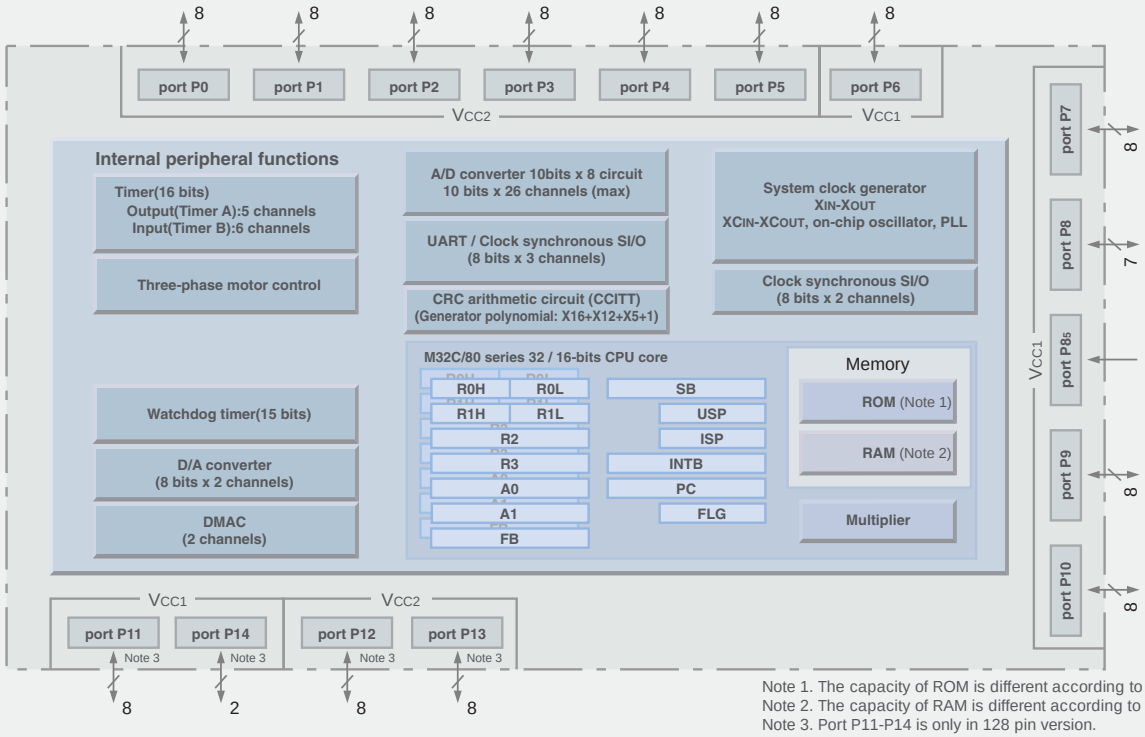
Memory-to-register operation (SB relative)



Many Integrated Peripherals

The M16C platform features sophisticated built-in peripheral functions so that M16C processors can be used in a wide range of applications.

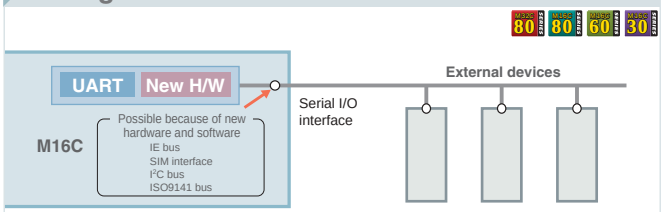
Block Diagram (M32C/83)



Note 1. The capacity of ROM is different according to the kind.
Note 2. The capacity of RAM is different according to the kind.
Note 3. Port P11-P14 is only in 128 pin version.

Cerial Interface

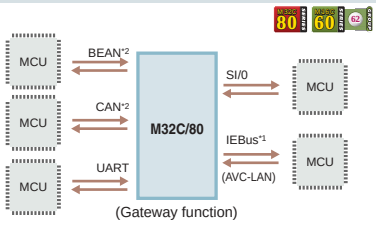
Configurable SIO Interface



Abundant Communication Functions

The M32C/80 incorporates abundant communication functions suitable for most applications,

allowing creation of a single chip communications gateway.

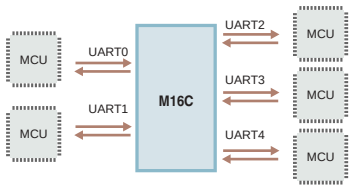


Notes : *1 IE BUS is a trademark of NEC Electronics Corporation.
*2 M32C/80 only

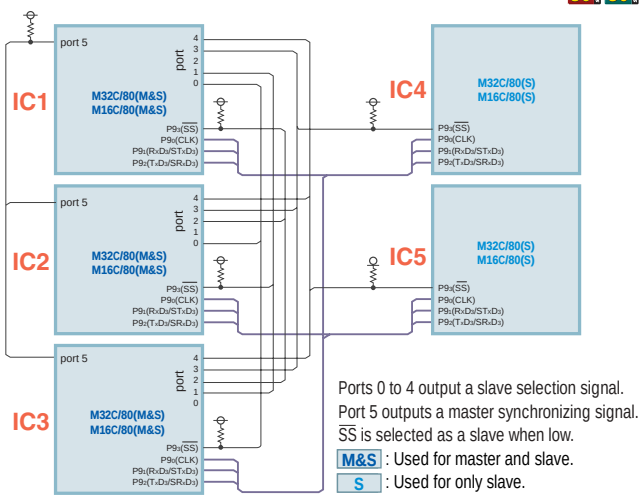
UART / Clock Synchronous SI/O

2-way data communications is possible.

The M32C/80 and M16C/80 contains five lines of UART and clock-synchronous SI/O.



Special Serial Communication Function



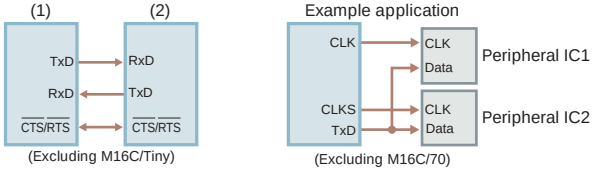
Ports 0 to 4 output a slave selection signal.
Port 5 outputs a master synchronizing signal.
$\overline{SS}$ is selected as a slave when low.

M&S : Used for master and slave.
S : Used for only slave.

UART Function

2-way data communications can be done

With one UART circuit, two peripheral ICs can be connected.
(Only for clock synchronized serial mode)



A/D Conversion

The A/D converter of high-speed high accuracy is built into M16C.
The noise measures mechanism is adopted for the analog input terminal.

10-Bit A/D Converter with Hi-speed Sample & Hold

(1) Conversion speed

(A/D operation clock = 10 MHz)	(A/D operation clock=20MHz(Target))
10 bits : 3.3µs	10 bits 1.65µs
8 bits : 2.8µs	8 bits 1.4µs

(2) 10-bit sequential conversion system ±3 LSB accuracy
(3) Equipped with hi-speed (3-cycle) Sample & Hold (S/H)
(4) 10 input channels (M16C/30 : 8 channels)
(5) Operation amplifier mode
With one external operation amplifier, the number of input signal channels can be increased to 8. (fig-1)
It can be used for gain adjustment of operation amplifier as well. (fig-2)
(6) Vref can be disconnected when not used.

fig-1

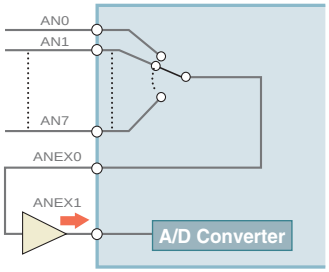
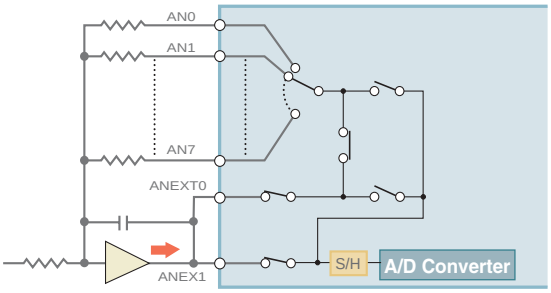


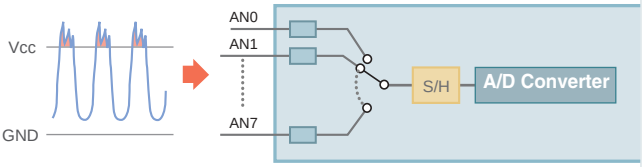
fig-2 (Example of operation amplifier gain adjustment connection)



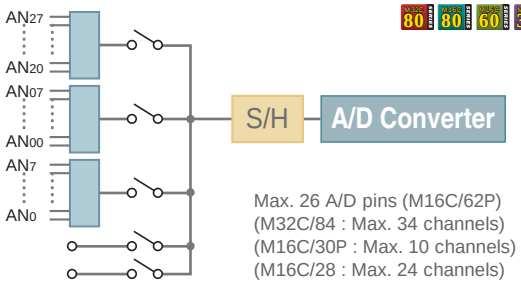
External operational amplifier

Measurement Error Avoidance (processing of unused A/D over voltage)

Accurate A/D conversion is assured, even when voltages greater than Vcc are applied to the A/D inputs.



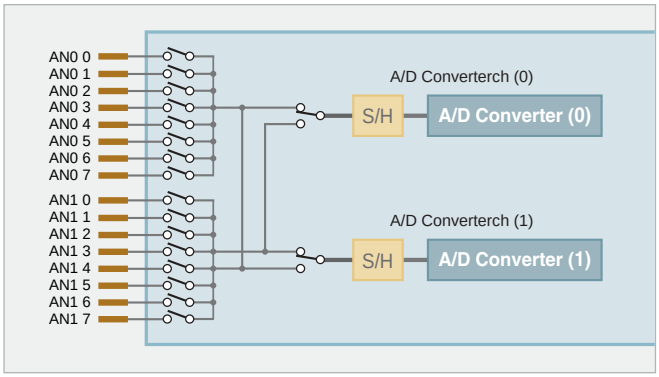
Multiple Channel A/D Input (on enhanced versions)



Max. 26 A/D pins (M16C/62P)
(M32C/84 : Max. 34 channels)
(M16C/30P : Max. 10 channels)
(M16C/28 : Max. 24 channels)

Simultaneous A/D Conversion

The MCU contains two A/D converters, allowing for simultaneous sampling in real time.



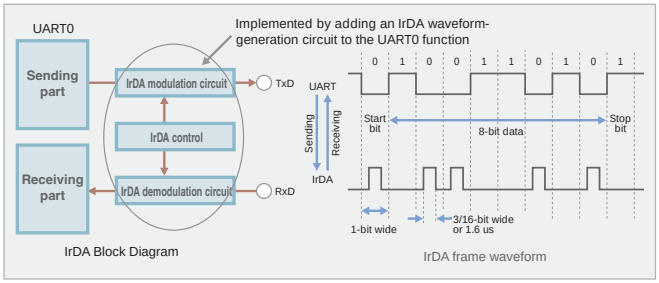
New Watch Dog Timer

- Problems with internal watch dog timers (WDT) in conventional microcomputers
  - If the clock supplied to the microcomputer stops, the WDT functions also stop
  - If the microcomputer goes into low power mode (WAIT, STOP) in the case where it runs out of control, the clock stops and WDT functions also stop

- New functions added to the WDT
  - Monitors the supply clock using an oscillation stop detection circuit, and if the clock stops, it supplies the system (CPU and WDT) with another clock generated by an on-chip oscillator.
  → Keeps a clock supplied to the WDT even when the clock stops, enabling reset when necessary.
  - An on-chip oscillator clock is the source of the WDT instead of the system clock.
  → Even if the CPU runs out of control and goes into low power mode (WAIT, STOP), the WDT operates on an independent clock generated by on-chip oscillator, enabling reset when necessary.

New UART Function (IrDA Function) Optional

Waveform modulation and demodulation in compliance with IrDA ver. 1.0



- IrDA Frame: 1-bit start bit “0,” 8 -bit data, 1 -bit stop bit “1”
  - Sending: Converts UART data into IrDa frame waveform using a modulation circuit, then outputs.
  When data is “0,” outputs “H,” with a width 3/16 of 1-bit
  When data is “1,” outputs “L”
  - Receiving: Converts IrDa frame waveform into UART data using a demodulator circuit, then outputs
  - Transfer rate: Can be set at 2400bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps

Many Integrated Peripherals

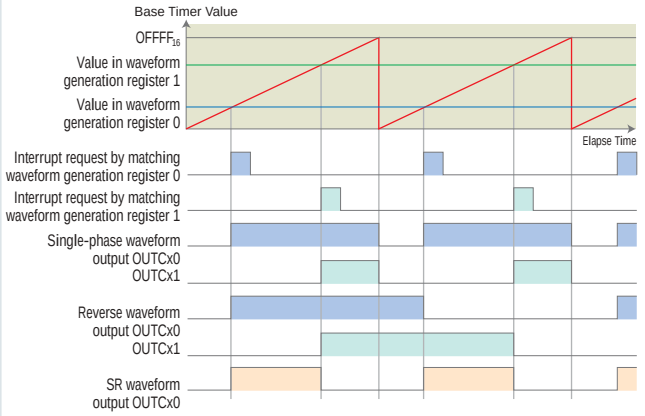
The M16C platform features sophisticated built-in peripheral functions so that M16C processors can be used in a wide range of applications.

Multi-Function Timers (Intelligent I/O)

Output Compare

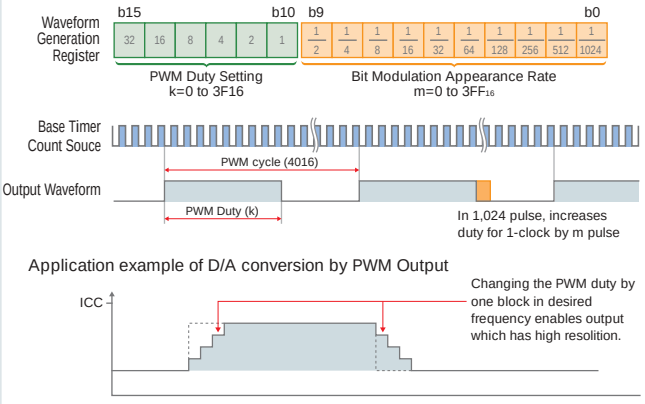
An interrupt is generated when the value of base timer and the one of waveform generation register are matched and outputs the PWM waveform

●Basic Waveform Output
Common waveform output mode in all groups
(1) Single-phase waveform output
(2) Reverse waveform output
(3) SR waveform output



Bit Modulation PWM

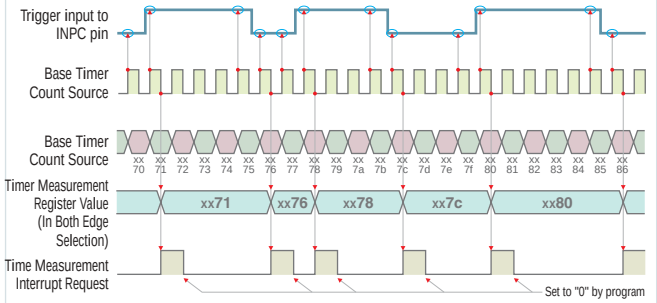
PWM output is materialized by desired bit in 6 to 16 bits with high frequency.



Application example of D/A conversion by PWM Output

Input Capture

Maintains the timer value to the time measurement register in trigger input generation and generates an interrupt



Intelligent I/O

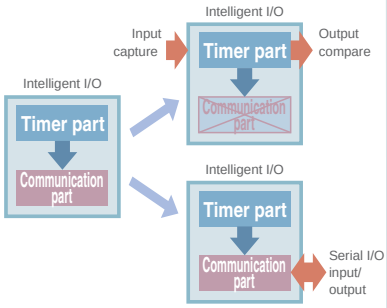
Intelligent I/O is an original Renesas peripheral function built into the M32C/80 Series for the first time, and is composed of a timer part and a communication part.
One 16-bit timer acts as the base timer, enabling rich output such as PWM, and communication functions such as UART, SI/O, IE Bus.

Timer Part

Base timer
5-bit prescaler
16-bit base timer
Input capture
Timer measurement register (4 to 8ch)
Digital filter function (D/F)
Edge select function (E/S)
Gate function/ Prescale function (Gate/Scale)
Output compare
Waveform generation register (0 to 4ch)
PWM circuit

Communication part

Communication part
8-bit receive buffer
8-bit receive register
8-bit transmit buffer
8-bit transmit register
Transmit data generation circuit
Receive data generation circuit
Start/ stop bit generation function
Bit stuffing function
CRC arithmetic function
Receive data match interrupt generation function

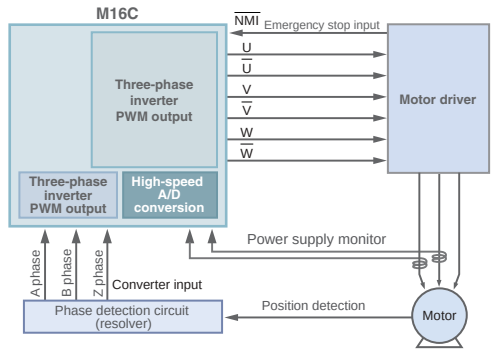


Utilized as a timer when serial bus interface function not used

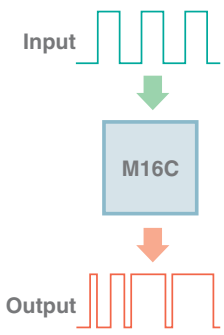
Multi-Function Timers

Three-Phase Inverter PWM Output (for motor control systems)

M32C/83 can output two systems.



Wide Range of Input/Output Functions



- Event counter
- Two-phase pulse signal processing
- Pulse period measurement
- Pulse width measurement

- One-shot output
- 8-bit PWM output
- 16-bit PWM output
- Three-phase inverter PWM output (Excluding M16C/10,M16C/20,M16C/30)

DMAC

DMA

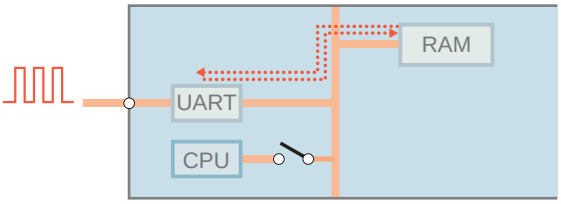
Hi-speed data transfer is possible without going through the CPU.

Functions
- Transfers from one address to one or multiple addresses (1M bytes available space).
- Transfers from multiple addresses to one address (1M bytes available space).
- Number of data sets transferred : 64K words
- 2 built-in channels (DMA0 & DMA1)

Extended to maximum four channels in the 80 series. (M16C/30 is 1channels)
The interlinking of 2 channels allows memory-to-memory transfers.
- Runs in cycle steal mode. (CPU runs while executing the DMA.)

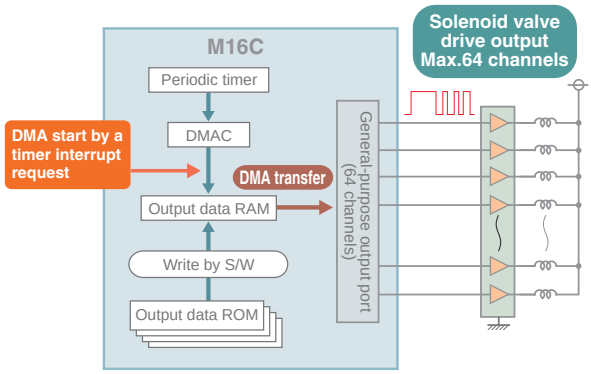
Applications
- Automatic serial I/O transfer
- Motor drive by microstepping
- Multiple channel (max. 64 channels) PWM output

Example of using UART circuit



Multiple Channel (max. 64 channels) PWM Application Using DMA

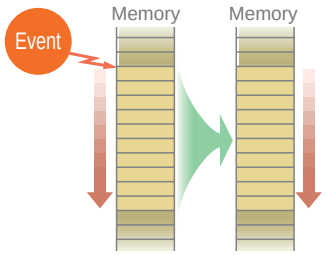
Solenoid valve control (Chopper control)
- The timer interrupt request is generated in DMA start mode.
- Transfer data from the output data RAM is sent to the output port. As the timer interrupt is acknowledged, data output is then read from the port periodically.



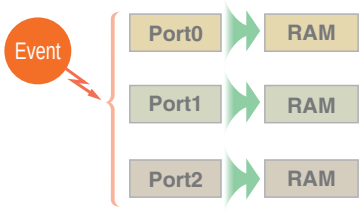
DMA II

DMA II

The DMA II function can be activated by any peripheral functions.



- Multibyte transfers by one event

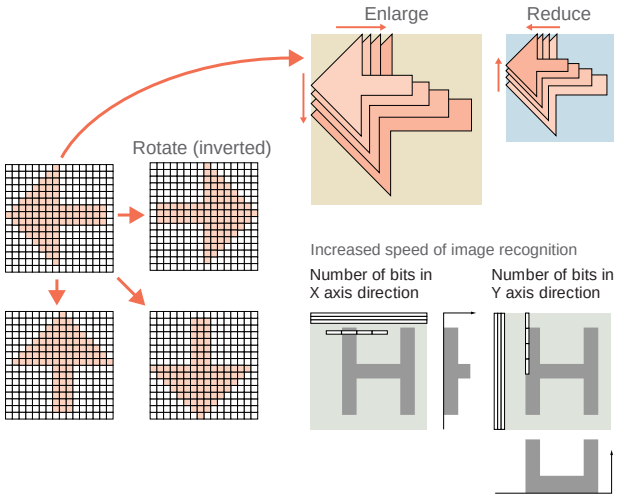


- Data from multiple different addresses transferred at a time by one event

Image Processing Function

X-Y Data Converter

Can invert, rotate, enlarge, and reduce image data at high speed.

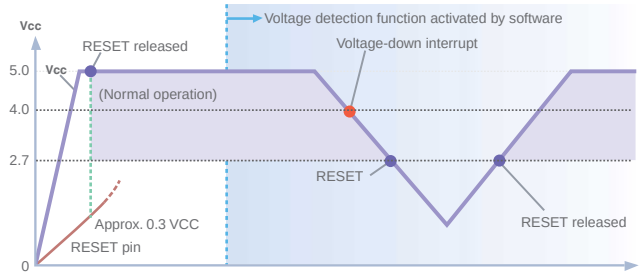


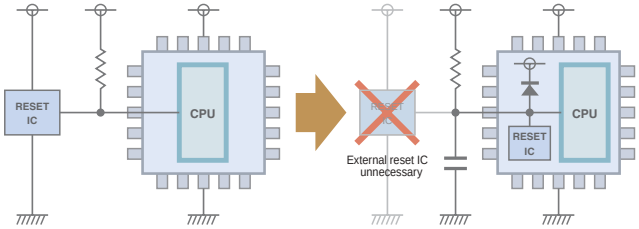
Many Integrated Peripherals

The M16C platform features sophisticated built-in peripheral functions so that M16C processors can be used in a wide range of applications.

New RESET Function

- The low voltage detect circuit built into the microcontroller eliminates the need for an external reset IC.
- Internal reset circuit (can choose enabled/disabled using S/W)
  - Prevents malfunction below guaranteed operating voltage



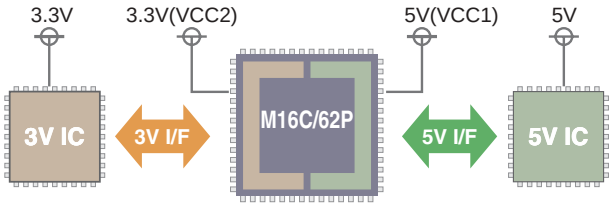


Two Type of Peripheral Power Supply (5V and 3V)

The majority of ICs, while decreasing voltage for high speed memory etc., only have a 5V interface.

Connectable to external 5V IC and 3V IC with no additional circuit

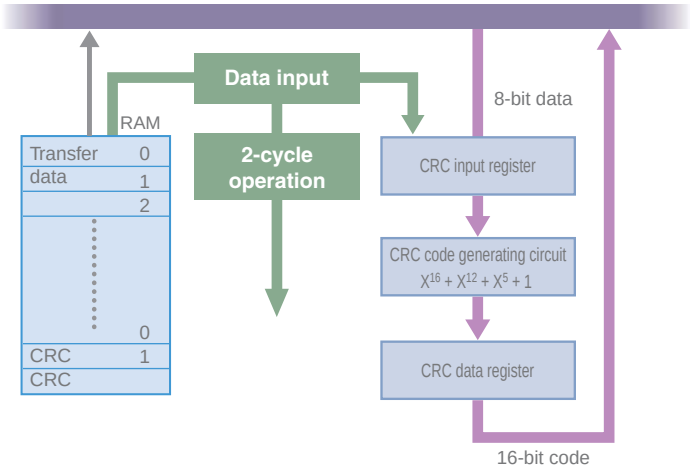
P6 to P10, P11, P14 : 2.7V ≦ VCC1 ≦ 5.5V
P0 to P5, P12, P13 : 2.7V ≦ VCC2 ≦ VCC1



*These specifications are for consumer products only.
*The M32/80 Series possesses same functions.

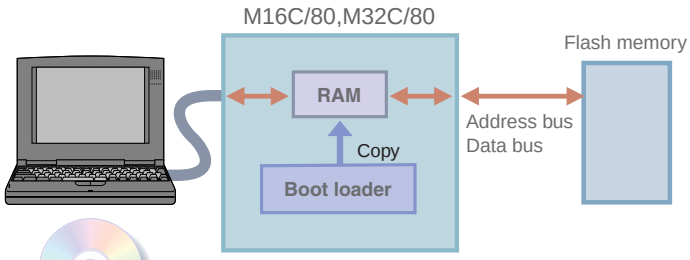
CRC (Cyclic Redundancy Check)

CRC is used to improve reliability in communication data.
- CRC operation requires 2 cycles. The hardware is built-in.
- Generator polynomial: $X^{16} + X^{12} + X^5 + 1$ (CCITT-conforming)
- Error detection is more efficient than parity or check sum.



ROM-less Products with Built-in Boot Loader

ROM-less products with built-in boot loaders, capable of on-board writing to external flash memory.



M3A-0806

The boot loader downloads an external flash memory control program to enable on-board rewriting to external flash memory.

External Bus Cycle Optimization

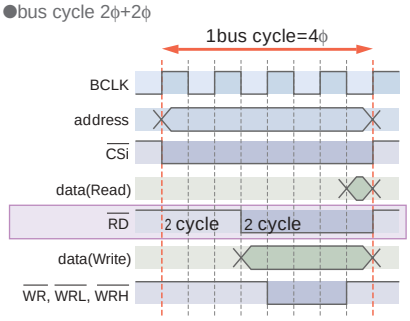
The M16C provides 13 variations of bus cycle settings to support various add-on peripheral devices.

Type of bus cycle

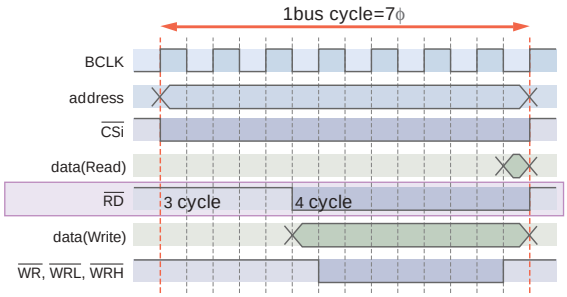
Bus cycle	Read and write signals	
	"H" level	"L" level
1ϕ+1ϕ	1 cycle	1 cycle
1ϕ+2ϕ	1 cycle	2 cycle
1ϕ+3ϕ	1 cycle	3 cycle
1ϕ+4ϕ	1 cycle	4 cycle
1ϕ+5ϕ	1 cycle	5 cycle
1ϕ+6ϕ	1 cycle	6 cycle
2ϕ+2ϕ	2 cycle	2 cycle
2ϕ+3ϕ	2 cycle	3 cycle
2ϕ+4ϕ	2 cycle	4 cycle
3ϕ+3ϕ	3 cycle	3 cycle
3ϕ+4ϕ	3 cycle	4 cycle
3ϕ+5ϕ	3 cycle	5 cycle
3ϕ+6ϕ	3 cycle	6 cycle

*Example table and figures vary according to the separate bus or multiplexed bus.
*Selectable from the bus cycle with one data recovery cycle or with no data recovery cycle.

●bus cycle 2ϕ+2ϕ



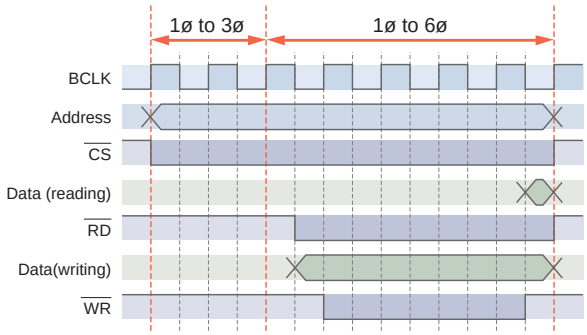
●bus cycle 3ϕ+4ϕ



Enhancement of External Bus Access Function

Wait cycle extension

1 to 7 wait bus cycles



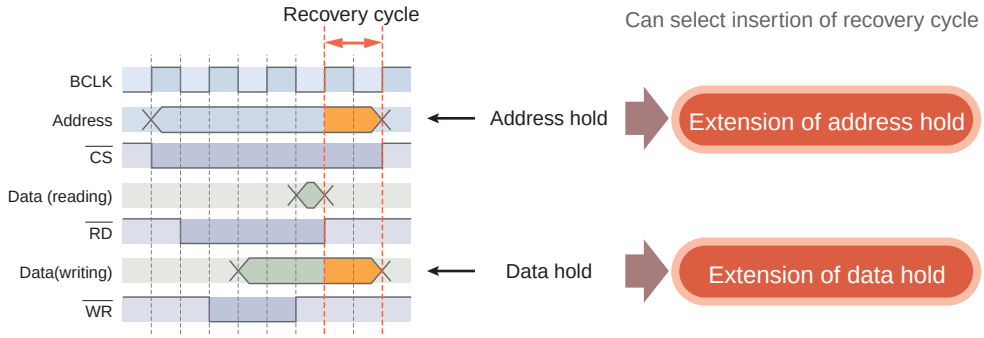
Access cycle to external domain
(for 32MHz)

0 wait	62.4ns	
1 wait	93.6ns	
2 wait	124.8ns	
3 wait	156.0ns	
4 wait	187.2ns	Function extension
5 wait	218.4ns	
6 wait	249.6ns	
7 wait	280.8ns	

Can connect to external ASIC and slow memory during high speed operation

Cycle function of address and data hold extension

(Supports recovery cycle function)

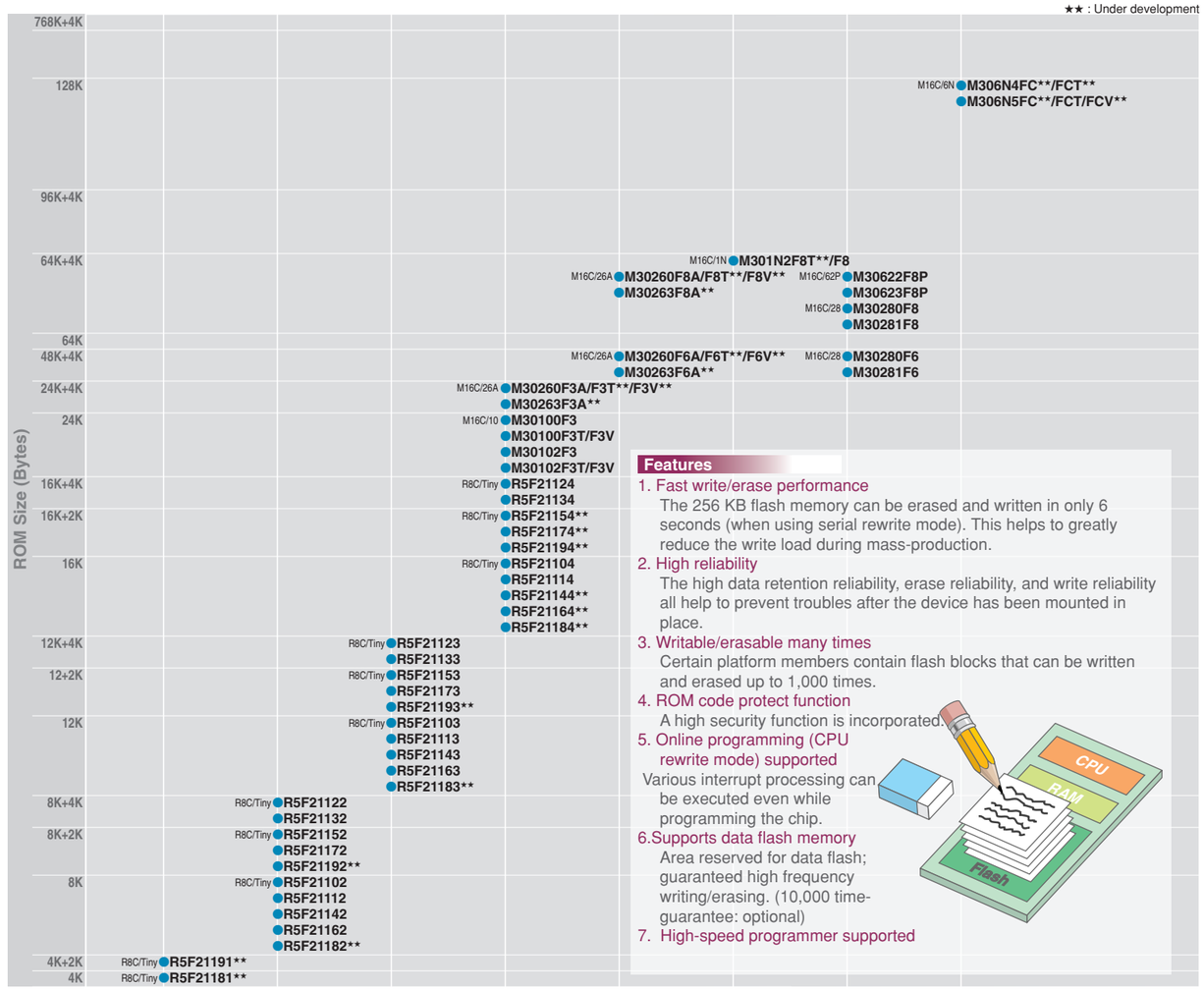


Can select insertion of recovery cycle through program

M16C Family with Built-in Flash Memory

Flash Memory Progression

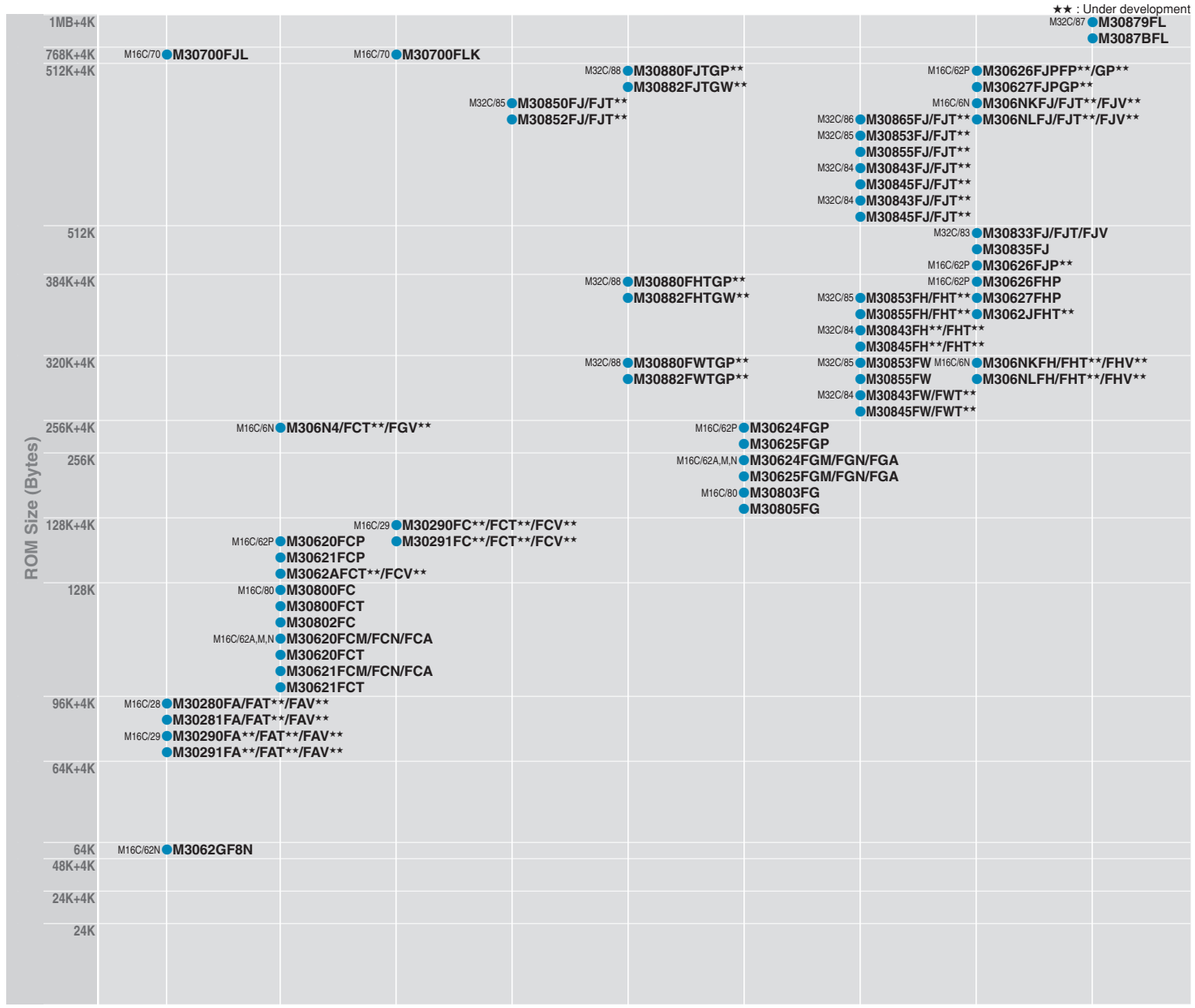
★★ : Under development



Features

1. Fast write/erase performance
   The 256 KB flash memory can be erased and written in only 6 seconds (when using serial rewrite mode). This helps to greatly reduce the write load during mass-production.
2. High reliability
   The high data retention reliability, erase reliability, and write reliability all help to prevent troubles after the device has been mounted in place.
3. Writable/erasable many times
   Certain platform members contain flash blocks that can be written and erased up to 1,000 times.
4. ROM code protect function
   A high security function is incorporated.
5. Online programming (CPU rewrite mode) supported
   Various interrupt processing can be executed even while programming the chip.
6. Supports data flash memory
   Area reserved for data flash; guaranteed high frequency writing/erasing. (10,000 time-guarantee: optional)
7. High-speed programmer supported

★★ : Under development



Outline Specifications

Product series name	R8C/10,11,12,13	R8C/14,15,16,17	R8C/18,19	M16C/26A,28,29	M16C/62A,62M,62N		M16C/62P	M16C/6N4,5,6NK	M16C/70	M32C/84,85,86,87
Supply voltage and maximum operation frequency	3.0 to 5.5V 20MHz (R8C/11,13) 3.0 to 5.5V 16MHz (R8C/10,12) 2.7 to 5.5V 10MHz	3.0 to 5.5V 20MHz 2.7 to 5.5V 10MHz	3.0 to 5.5V 20MHz 2.7 to 5.5V 10MHz	3.0 to 5.5V 20MHz 2.7 to 5.5V 10MHz	4.2 to 5.5V 16MHz 2.7 to 5.5V 10MHz 1wait	3.0 to 3.6V 16MHz 2.4 to 3.6V 7MHz 2.2 to 3.6V 7Mhz 1wait	3.0 to 5.5V 24MHz 2.7 to 5.5V 10MHz	Vcc=3.0 to 5.5V 20MHz FVcc=4.5 to 5.5V (for flash memory)	Vcc=3.0 to 3.6V 34MHz FVcc=4.5 to 5.5V (for flash memory)	4.2 to 5.5V 30MHz 3.0 to 5.5V 20MHz
Package	0.8mm-pitch 32-pin LQFP	0.65mm-pitch 20-pin SDIP	0.65mm-pitch 20-pin SDIP	0.65mm-pitch 80-pin QFP 0.5mm-pitch 64-pin LQFP 0.65mm-pitch 48-pin QFP 0.5mm-pitch 42-pin LQFP	0.5mm-pitch 100-pinLQFP 0.65mm-pitch 100-pinQFP 0.65mm-pitch 80-pinLQFP	0.4mm-pitch 100-pinLQFP 0.5mm-pitch 100-pinLQFP 0.65mm-pitch 100-pinQFP 0.65mm-pitch 80-pinQFP	0.65mm-pitch 80-pin QFP 0.5mm-pitch 100-pin LQFP 0.65mm-pitch 100-pin QFP 0.5mm-pitch 128-pin LQFP	0.4mm-pitch 100-pinLQFP 0.5mm-pitch 100-pinLQFP 0.65mm-pitch 100-pinQFP 0.65mm-pitch 80-pinQFP	0.5mm-pitch 100-pin LQFP	0.5mm-pitch 100-pinLQFP 0.65mm-pitch 100-pinQFP 0.5mm-pitch 144-pinLQFP
Rewrite voltage	3V or 5V single power supply			3V or 5V single power supply	5V single power supply	3V single power supply	3V or 5V single power supply	3V single power supply	Vcc=3.0 to 3.6V FVcc=4.5 to 5.5V	3V or 5V single power supply
Number of times the chip is programmed and erased	10,000 times (guaranteed minimum)			100 times (Note1)	100 times (Note1)					
Data Flash	(2KB X 2)(Note2)(R8C/12,13 only)	(1KB X 2)(R8C/15,17 only)	(1KB X 2)(R8C/19 only)	(2KB X 2)(Note2)	—	—	✓(4KB X 1)(Note2)	—	✓(4KB X 1)	✓(4KB X 1)(Note2)
Erase prevention function	–			Note3	Each flash block is protected from accidental erasure via a lock bit					
Rewrite mode	Serial I/O mode, CPU rewrite mode.			Parallel I/O mode, Serial I/O mode, CPU rewrite mode	Parallel I/O mode, Serial I/O mode, CPU rewrite mode					
Security function	Serial I/O mode			ROM code protect (Parallel I/O mode) / ID code protect (Serial I/O mode)	ROM code protect (Parallel I/O mode) / ID code protect (Serial I/O mode)					
Serial rewrite time	about 2 seconds (16K bytes)			about 3 seconds (128K bytes)	about 6 seconds (256K bytes), about 3 seconds (128K bytes)	about 2 seconds (256K bytes)	about 4 seconds (256K bytes)	about 4 seconds (256K bytes)	about 6 seconds (512K bytes)	about 8 seconds (512Kbytes)

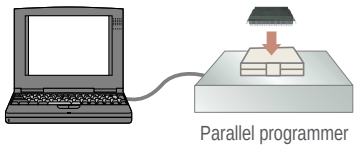
Note 1: Products can be repeatedly written and erased 1,000 times.(option)
Note 2: Products can be repeatedly written and erased 10,000 times.(option)

(Note 3) Has mistaken erasure prevention function due to rewrite permission bit.
10,000 times (guaranteed option only)

Parallel I/O Mode

Using a parallel programmer, the internal flash memory of the microcontroller can be rewritten without requiring any other tool.

(Except : M16C/10,R8C/10/11,12,13)



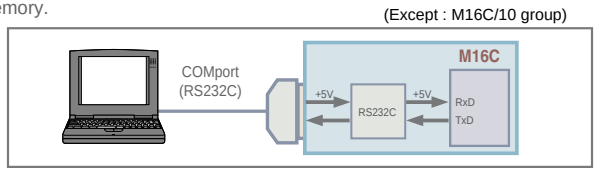
Parallel programmer

CPU Rewrite Mode

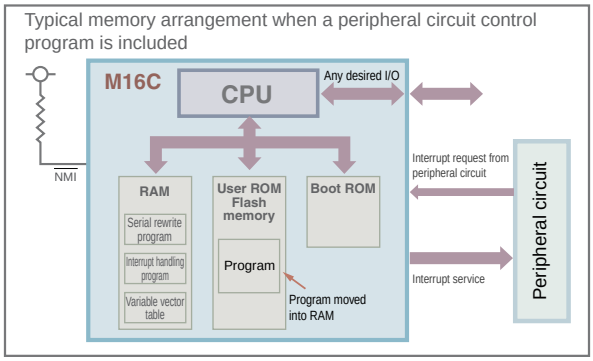
The user area is erased and programmed using the flash rewrite program created by the customer.

(1) Any desired interface such as UART, I²C bus, or IE bus can be selected.
(2) The program can be executed easily even while rewriting the flash memory. Since the M16C allows the interrupt vector table to be located in any desired area, the interrupt handling routine and interrupt vector table can be located in the RAM area. This allows you to use interrupts even while rewriting the flash memory.

(Except : M16C/10 group)

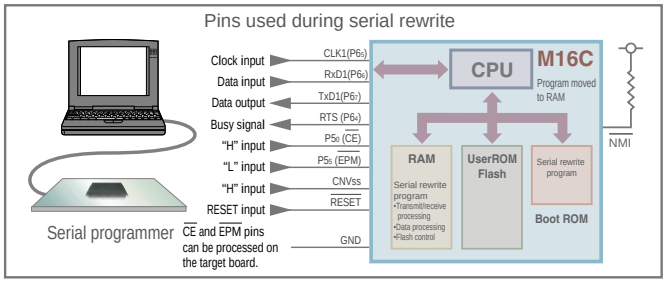


Typical memory arrangement when a peripheral circuit control program is included



Serial I/O Mode

Using a serial programmer, the internal flash memory of the microcontroller can be written while mounted on-board.



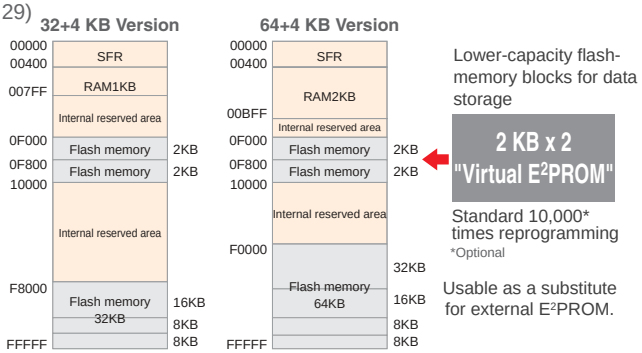
Maker	Product Name	Writing System
SUNNY GIKEN INC.	S550-MFW-1U	parallel(gang) & serial
	S550-SFW1U	serial
Yokogawa Digital Computer Corporation	AF200	serial
	R4953	parallel(gang)
	AF9708	parallel & serial
	AF9709	parallel & serial
	AF9723	parallel(gang)
Suisei Electronics System Corporation	EFP-I	parallel & serial
	EFP-S2	parallel & serial
Renesas Solutions Corporation	M3A-0665	serial
	ROE000080KCE00	serial
	M3A-0806	serial
	M3A-0677S	CAN

Other 3rd party tools under development
Note) It is necessary to download the evaluation version software using the internet.

Data-Flash

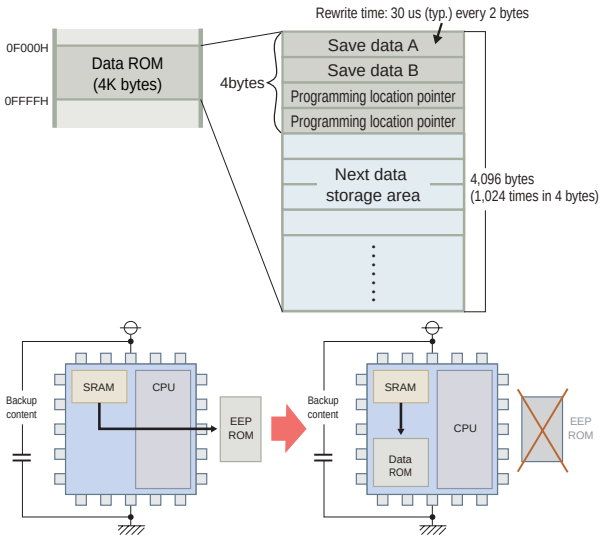
(Only for M32C/84, 85, 86, M16C/70, 62P, 26A, 28, 29,1N, R8C/12, 13, 15, 17)

Includes flash memory of a small block called data flash. Apart from flash memory for programming. This area guarantees the erase endurance a maximum of 10,000 times (option) and substitution of the external E²PROM is also possible.(When M16C/26,26A,24A,28 and 29)



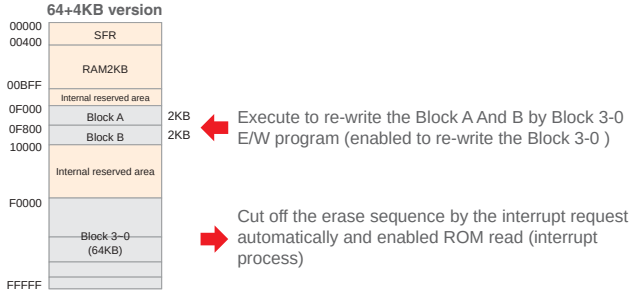
Application of the data ROM area (product types with options set)

The data ROM (4 Kbytes) can be programmed in 4-byte units repeatedly 1,024 times (4,096 bytes divided by 4) after block erasure. Therefore, the data ROM can be rewritten up to about 100,000 times (when guaranteed to be erasable 100 times). Because the data ROM can be rewritten at high speed from a program flash memory, it can be used as an area to back up data in case of power outage. Conventional backups in external E²PROM can be replaced with the internal data ROM.



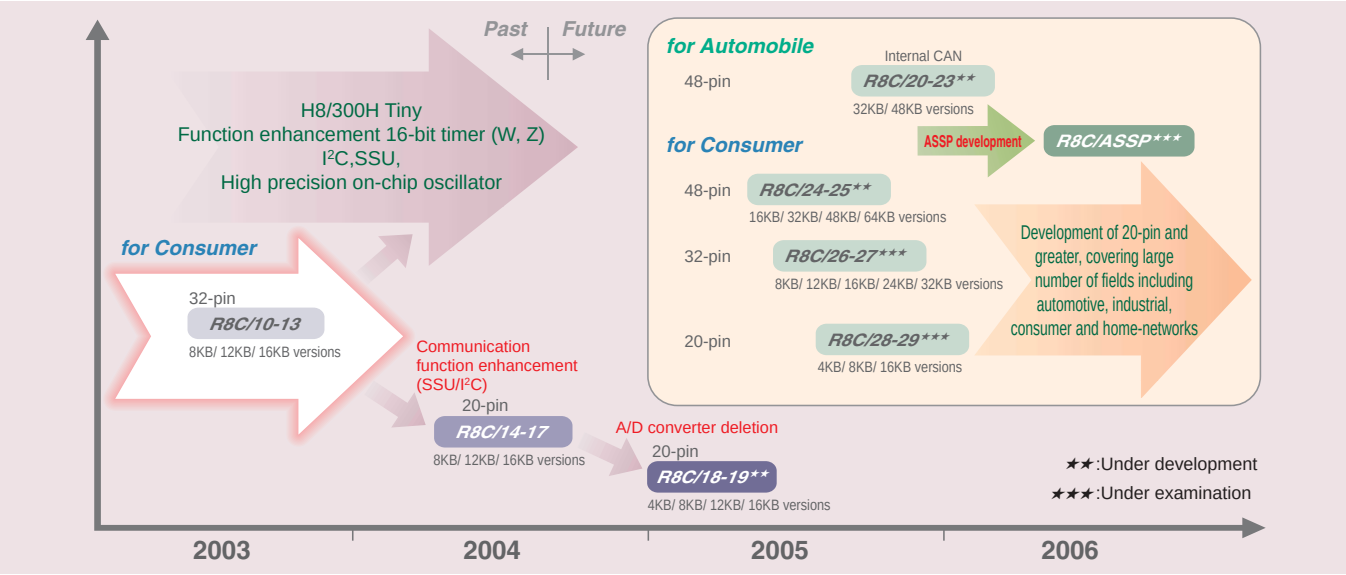
(Other advantages)
- Current consumption can be reduced because no external device operations are involved.
- Mounting area can be reduced.

Erase Suspend Function (M16C/26A,28,29,1N,R8C/12,13,15,17)



Products in Development

R8C/Tiny Series Road Map



R8C Tiny Series

R8C/ Tiny Series CPU Outline

Performance	Machine cycle	50ns (5V for 20MHz)
	Address space	1Mb
No. of instructions		89 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

Features of the R8C/18,19,20,21,22,23,24,25 Group

- **Small pin package, yet C language development possible**
  Small pin package under 48 pins (20-pin, 32-pin, 48-pin), yet has internal 16-bit CPU core and C language development is also possible.
- **Retains characteristics of the M16C family**
  Continuation of high ROM efficiency, extremely low power consumption, low unnecessary radiant noise and high noise resistance of the M16C Family
- **Equipped with small capacity flash memory**
  Has an internal low volume flash memory starting at 8KB, making it ideal for small devices.
- **Low cost emulator available**
  A low-cost on-chip debug emulator (E8 emulator) can be used.

Product development

Function			R8C/18	R8C/19	R8C/20	R8C/21	R8C/22	R8C/23	R8C/24	R8C/25
			20-pin		48-pin				48-pin	
Internal memory	MASK ver.	ROM (Bytes)	–							
		RAM (Bytes)	–							
	Flash ver.	ROM (Bytes)	4K/8K/12K/16K		32K/48K				16K/32K/48K/64K	
		Data Flash (Bytes)	–	2K/2K/2K/2K	–	2K/2K	–	2K/2K	–	2K/2K/2K/2K
		RAM (Bytes)	384/512/768/1K		2K/2.5K				1K/2K/2.5K/3K	
	ROM-less ver.	ROM (Bytes)	–							
		RAM (Bytes)	–							
I/O port (channels)	Input only		3							
	CMOS Input/output		13		41					
	N-Channel open drain		–							
DMAC (Channel)			–							
Timer [16-bit] (channels)			1		2					
Input capture (channels)			1(shared with 16-bit timer)							
Output compare (channels)			2 (shared with 16-bit timer)		1(shared with 16-bit timer)					
Serial Interface (channels)	Clock synchronous/ UART shared		1							
	UART only		1 (clock synchronous only)							
A/D converter (resolution x channel)			–	–	10-bit x 12					
Interrupt (factors)	External		3		5		6		5	
Watch dog timer			1							
Other functions			LED drive port, comparator		CAN controller (R8C/22, 23)				LIN interface LED drive port, SSU, I²C bus	
Package			20-pin SSOP, 20-pin SDIP		48-pin QFP				48-pin LQFP	
Operating voltage (V)			2.7 to 5.5(10MHz), 3.0 to 5.5(20MHz)		3.0 to 5.5(20MHz)				2.7 to 5.5(10MHz), 3.0 to 5.5(20MHz)	
Operating ambient temperature (°C)			–20 to 85, –40 to 85		–40 to 85, –40 to 125				–20 to 85, –40 to 85	

This product is under development and so there is a possibility that specifications may change.

M16C/Tiny Series

M16C/Tiny Series CPU Outline

Performance	Machine cycle	50ns (5V for 20MHz)
	Address space	1Mb
No. of instructions		91 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

Features of M16C/26A Group

- Small mounting surface (7mm square48-pin), yet high speed operation (20MHz@5V)
  42-pin SSOP package also available
- Compatible with instructions/ peripheral devices of M16C/62A(N), and program transfer is simple
- Inherits M16C/62A(N) three-phase motor control timer, enabling motor control on small devices
  Has an internal motor control specialized circuit, enabling a range of controls
- Features a data flash area, enabling external E^{2}PROM substitution
- Low cost emulator available
  Low cost on-chip debug emulator [E8 emulator] can be used.

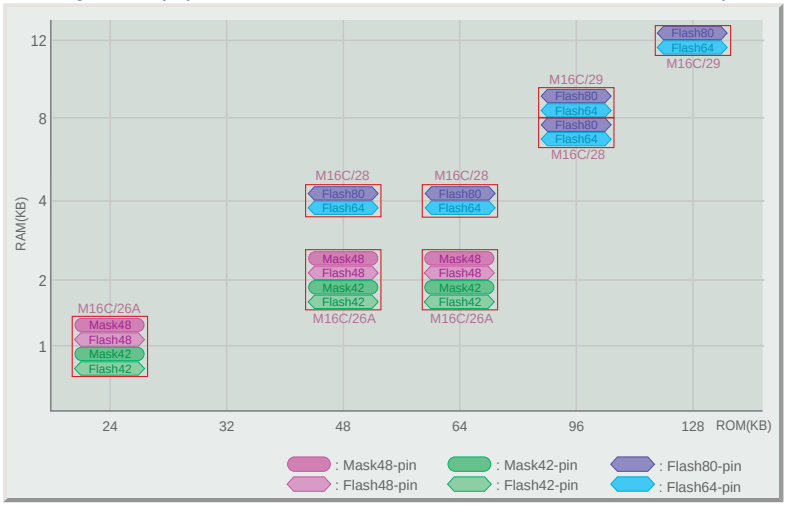
Features of M16C/28 Group

- Small mounting surface, yet high speed operation (20MHz@5V)
- Compatible with instructions/ peripheral devices of M16C/62A(N), and program transfer is simple
- Inherits M16C/62A(N) three-phase motor control timer, enabling motor control on small devices
- Features input capture and output compare, enabling more flexible signal control
- Features multi-master I^{2}C -bus, and equipped with up to 2ch of I^{2}C-bus
- Features a data flash area, enabling external E^{2}PROM substitution
- Low cost emulator available
  Low cost on-chip debug emulator [E8 emulator] can be used.

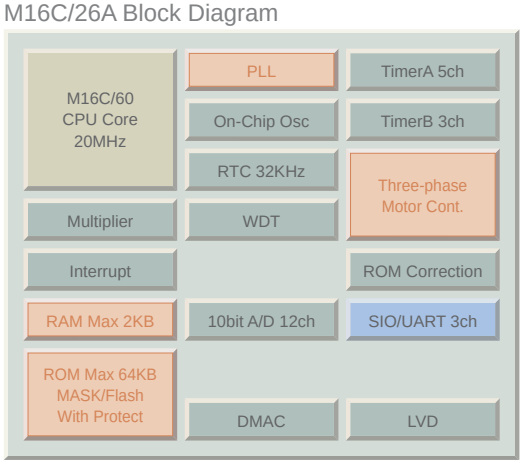
Features of M16C/29 Group

- Single CAN 2.0B added to M16C/28. Upward compatibility with M16C/28.
- Small mounting surface, yet high speed operation (20MHz@5V)
- Compatible with instructions/ peripheral devices of M16C/62A(N), and program transfer is simple
- Inherits M16C/62A(N) three-phase motor control timer, enabling motor control on small devices
- Features input capture and output compare, enabling more flexible signal control
- Features multi-master I^{2}C-bus, and I^{2}C-bus equipped with up to 2ch
- Features a data flash area, enabling external E^{2}PROM substitution
- Low cost emulator available
  Low cost on-chip debug emulator [E8 emulator] can be used.

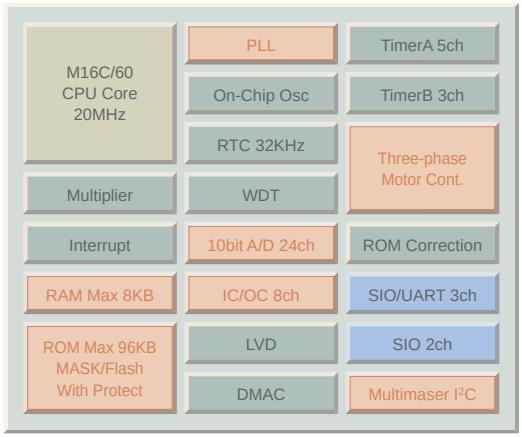
Memory Line up (The flash version have the data flash area of :4KB)



M16C/26A Block Diagram

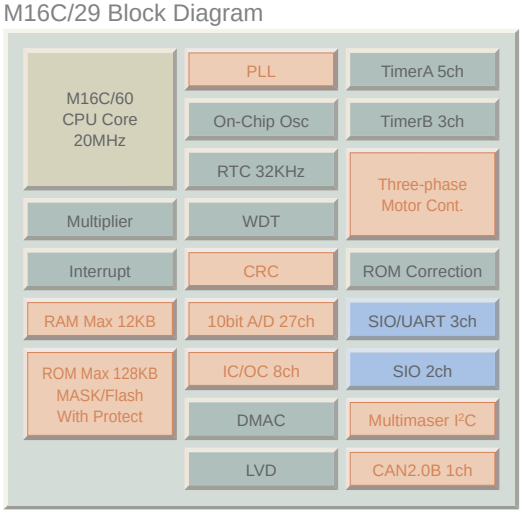


M16C/28 Block Diagram



IC:InputCapture
OC:OutputCompare

M16C/29 Block Diagram



IC:InputCapture
OC:OutputCompare

Product development

Function			M16C/26A	M16C/28	M16C/29★★
			42-pin/48-pin	64-pin/80-pin	
Internal memory	MASK ver.	ROM (Bytes)	24K/48K/64K	–	
		RAM (Bytes)	1K/2K/2K	–	
	Flash ver.	ROM (Bytes)	24K/48K/64K	48K/64K/96K	96K/128K
		Data Flash (Bytes)	4K(2K X 2)	4K(2K X 2)	
		RAM (Bytes)	1K/2K/2K	4K/4K/8K	8K/12K
	ROM-less ver.	ROM (Bytes)	–		
		RAM (Bytes)	–		
I/O port (channels)	Input only		–		
	CMOS Input/output		39(48-pin)	71(80-pin)	
	N-Channel open drain		–		
DMAC (Channel)			2		
Timer [16-bit] (channels)			5+3		
Input capture (channels)			–	8	–
Output compare (channels)			–	8	–
Serial Interface (channels)	Clock synchronous/ UART shared		3		
	UART only		–	2	–
A/D converter (resolution x channel)			10-bit x 2	10-bit x 24	10-bit x 27
Interrupt (factors)	External		8	8	8
Watch dog timer			1		
Other functions			Three-phase inverter control circuit, I²C-bus, IE Bus, On-chip oscillator	Three-phase inverter control circuit, I²C-bus, IE Bus, On-chip oscillator, Multi-master I²C-bus	Three-phase inverter control circuit, I²C-bus, IE Bus, On-chip oscillator, Multi-master I²C-bus, CAN controller (CAN2.0 specification standard) 1ch
Package			42-pin SSOP/48-pin LQFP	64-pin LQFP/80-pin LQFP	
Operating voltage (V)			2.7 to 5.5(10MHz), 3.0 to 5.5(20MHz)		
Operating ambient temperature (˚C)			–20 to 85, –40 to 85		

This product is under development and so there is a possibility that specifications may change.

★★ : Under development

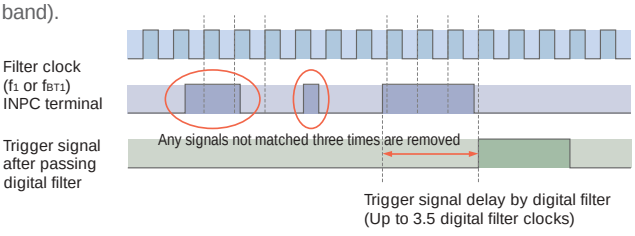
Function features of the M16C/Tiny

Input capture digital filter function/ Digital debounce function

Digital filter function

(INPC10 to INPC17)

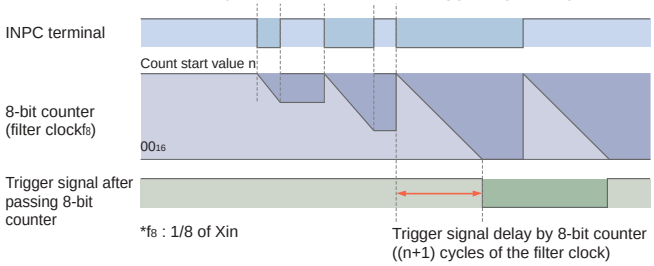
The trigger input level is determined at each f_1 or f_{BT1}, allowing three-times matched pulse components to pass.
(The digital filter clock can be selected after adjusting to noise frequency band).



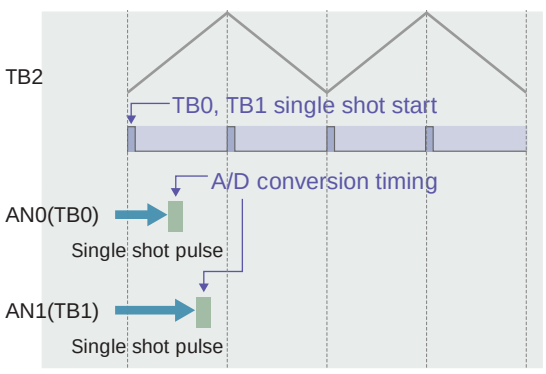
Digital debounce function

(INT5 to INPC17)

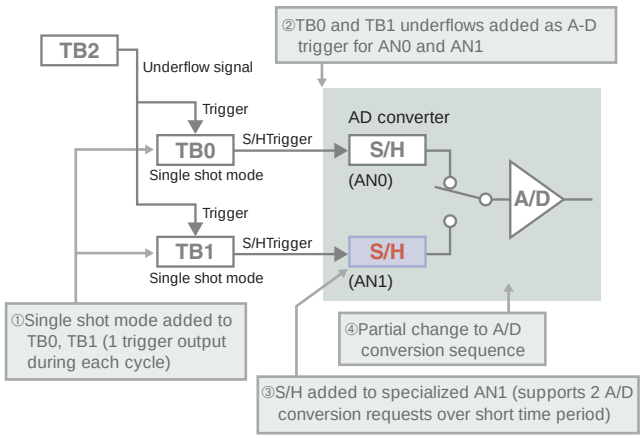
The 8-bit counter of the digital debounce function commences counting when there is a change in the input level, and stops counting when the input level returns again to the normal level.
When this 8-bit counter experiences underflow, a trigger signal is generated.



With AN0, AN1 delay trigger



With TB2 underflow as trigger, TB0 and TB1 start up in single shot mode.
With TB0 and TB1 as triggers, priority execution of A/D conversion of AN0 and AN1with Sample & Hold.



M16C/30P Group

M16C/30P Series CPU Outline

Performance	Machine cycle	50ns (5V for 20MHz)
	Address space	1Mb
No. of instructions		91 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

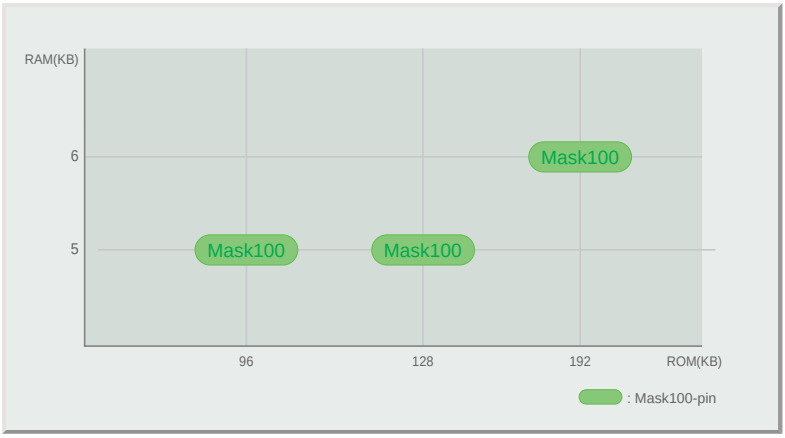
Features of the M16C/30P

- Inherits features of M16C/62P, however able to obtain a lower price due to a reduction in functions and reduction in ROM/RAM
- Operating frequency limited to 16MHz
- Reduction of peripheral functions (timer: 6ch, SIO:3ch, A/D: 18ch); limited to most used functions only
- Package: 100-pin limit
- Single chip only
- Flash ver.: Substitution using M16C/62P
- Development support tool: Use M16C/62P tools

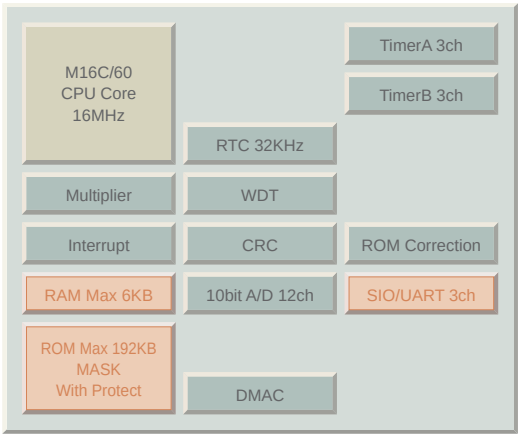
Differences between M16C/30P and M16C/62P

Item		M16C/30P
Shortest instruction execution time		62.5ns (f(Xin)=16MHz,Vcc=5.0V)
Memory capacity	RAM	5K, 5K, 6K Byte
Timer		6 timers (Timer A x 3, Timer B x 3)
Serial interface		Synchronous/ Asynchronous 3ch (I²C supported 1ch, IEBus supported 1ch)
A/D converter		0-bit x up to 18ch, ±5LSB (single shot, repetitive)
D/A converter		No
External interrupt		NMI, INT0, INT1, INT2, INT3, INT4, key input (7factors)
Address multiple circuits		multiple circuits 2
Clock generation circuit		2 circuits internal, Xin, Xcin (no main clock oscillation stop detection function) (internal return resistance, external ceramic resonator or quartz oscillator)
Power supply voltage		4.2V to 5.5V (f(Xin)=16MHz), 2.7V to 5.5V (f(Xin)=10MHz)
Package		100 -pin (100P6S-A, 100P6Q-A)
Notes	Package	100P6S, 100P6Q

Memory Line up



M16C/30P Block Diagram



Product development

Function			M16C/30P★★
			100-pin
Internal memory	MASK ver.	ROM (Bytes)	96K/128K/192K
		RAM (Bytes)	5K/5K/6K
	Flash ver.	ROM (Bytes)	–
		Data Flash (Bytes)	–
		RAM (Bytes)	–
	ROM-less ver.	ROM (Bytes)	–
		RAM (Bytes)	–
I/O port (channels)	Input only		1
	CMOS Input/output		85
	N-Channel open drain		2
DMAC (Channel)			2
Timer [16-bit] (channels)			3+3
Input capture (channels)			–
Output compare (channels)			–
Serial Interface (channels)	Clock synchronous/ UART shared		3
	UART only		–
A/D converter (resolution x channel)			10-bit x 18
Interrupt (factors)	External		–
Watch dog timer			–
Other functions			IEBus, I²C-bus, SIM interface
Package			100-pin LQFP/100-pin QFP
Operating voltage (V)			4.2 to 5.5(16MHz), 2.7 to 5.5(10MHz)
Operating ambient temperature (˚C)			–20 to 85, –40 to 85

This product is under development and so there is a possibility that specifications may change.

★★ : Under development

M16C/62P Group

M16C/62P Series CPU Outline

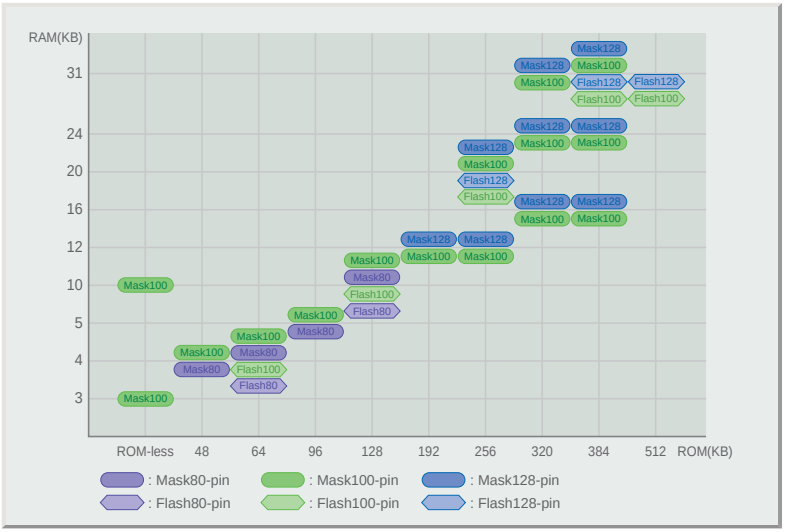
Performance	Machine cycle	47.1ns (5V for 24MHz)
	Address space	1Mb
No. of instructions		91 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

	M16C/62P
	41.6ns (f(cpu)=24MHz,Vcc=5.0V),
	4K, 5K, 10K, 12K, 16K, 20K, 24K, 31K Byte
	11 timers (Timer A x 5, Timer B x 6)
	Synchronous Asynchronous 3ch (I²C, IEBus supported 3ch) simultaneous 2ch
	10-bit x up to 26ch, ±3LSB (Single, repetitive, single sweep operation, repetitive sweep operation)
	Yes
	NMI, INT0, INT1, INT2, INT3, INT4, INT5, Key input (8 factors)
	4
	4 internal circuits, PLL, On-chip oscillator, Xin and Xcin
	(internal return resistance, external ceramic resonator or quartz oscillator)
	3.0V to 5.5V (f(cpu)=24MHz), 2.7V to 5.5V (f(Xin)=10MHz80pin
	80-pin (80P6S-A), 100 -pin (100P6S-A, 100P6Q-A),128-pin
	80P6S,100P6S,100P6Q,128P6Q

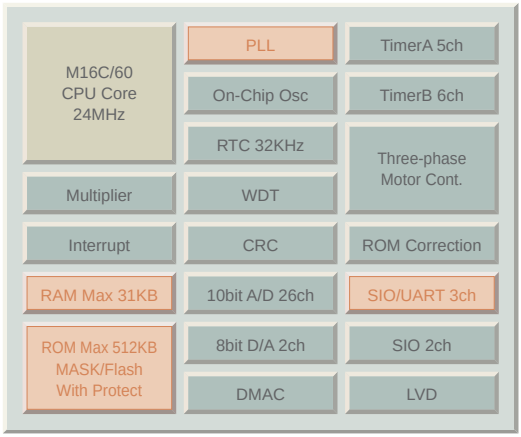
Features of the M16C/62P

- Inherits features of M16C/62A(M/N)
- Extensive memory development (ROM/RAM: ROM-less/3KB to 512KB/31KB)
- High speed operation (24MHz, 1.5 times speed of M16C/62A(N))
- Can use 3V and 5V power supply, enabling the direct connection of 3V type memory to 5V type device
- Can connect with large number of devices through IEBus and I_C-bus subset supported SIO (3ch)
- Can choose a wait cycle insertion from 0 to 3, enabling connection to slow devices
- Offers even higher reliability with enhancement of watch dog timer, internal oscillation stop detection circuit and new reset circuit.

Memory Line up (The flash version have the data flash area of :4KB)



M16C/62P Block Diagram



Product development

Function			M16C/62P		
			80-pin	100-pin	128-pin
Internal memory	MASK ver.	ROM (Bytes)	48K/64K/96K/128K	48K/64K/96K/128K/192K/256K/256K/320K/320K/320K/384K/384K/384K	192K/256K/256K/320K/320K/320K/384K/384K/384k
		RAM (Bytes)	4K/4K/5K/10K	4K/4K/5K/10K/12K/12K/20K/16K/24K/31K/16K/24K/31K	12K/12K/20K/16K/24K/31K/16K/24K/31K
	Flash ver.	ROM (Bytes)	64K/128K	64K/128K/256K/384K/512K	256K/384K/512K
		Data Flash (Bytes)	4K/4K	4K/4K/4K/4K/4K	4K/4K/4K
		RAM (Bytes)	4K/10K	4K/10K/20K/31K	20K/31K/31K
	ROM-less ver.	ROM (Bytes)	–		
		RAM (Bytes)	–	4K/10K	–
I/O port (channels)	Input only		1		
	CMOS Input/output		70	87	113
	N-Channel open drain		–		
DMAC (Channel)			2		
Timer [16-bit] (channels)			6+5		
Input capture (channels)			–		
Output compare (channels)			–		
Serial Interface (channels)	Clock synchronous/ UART shared		3		
	UART only		2		
A/D converter (resolution x channel)			24+2		
Interrupt (factors)	External		8		
Watch dog timer			1		
Other functions			Three-phase inverter control circuit, PLL frequency conversion circuit, On-chip oscillator, IE Bus, I²C-bus		
Package			80-pin QFP	100-pin QFP/100-pin LQFP	128-pin LQFP
Operating voltage (V)			2.7 to 5.5(10MHz), 3.0 to 5.5(24MHz)		
Operating ambient temperature (˚C)			–20 to 85 or –40 to 85		

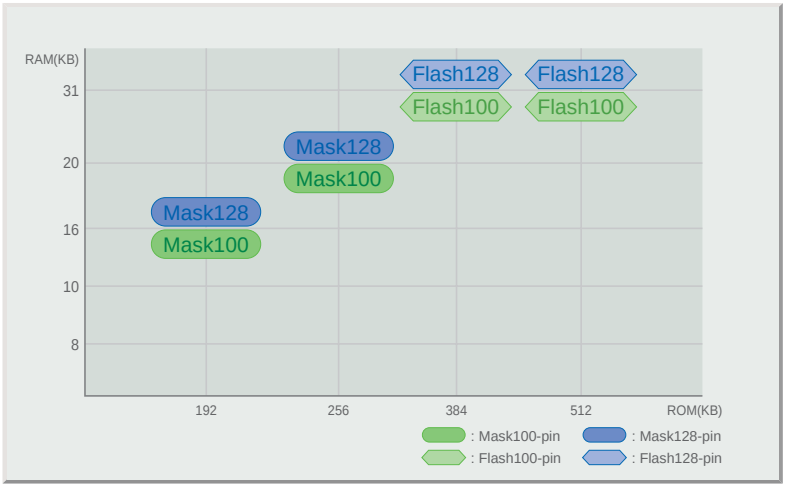
This product is under development and so there is a possibility that specifications may change.

M16C/6NK Series

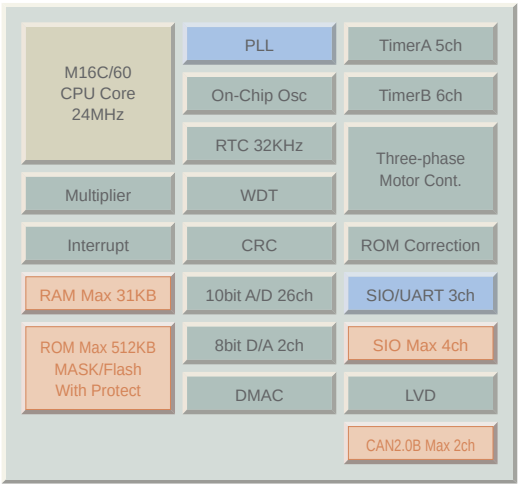
Features of M16C/6NK Group

- Inherits features of M16C/62P (CPU core, low power consumption, EMI properties, peripheral functions), and also equipped with CAN (2.0B supported)
- M16C/6NK, M:CAN2.0B 2ch, M16C/6NL, N:CAN2.0B 1ch
- Increased communication functions (CAN, Serial interface:5ch(M16C/6NK,L)/7ch(M16C/6NM,N)
- In addition to increased fail-safe functions such as an enhanced surveillance timer and an internal oscillation stop detection circuit, increased external interrupts (9ch:M16C/6NM,N)

Memory Line up (The flash version have the data flash area of :4KB)



M16C/6NK Block Diagram



Product development

Function			M16C/6NK		M16C/6NL		M16C/6NM		M16C/6NN	
			100-pin	128-pin	100-pin	128-pin	100-pin	128-pin	100-pin	128-pin
Internal memory	MASK ver.	ROM (Bytes)	192K/256K							
		RAM (Bytes)	16K/20K							
	Flash ver.	ROM (Bytes)	384K/512K							
		Data Flash (Bytes)	4K							
		RAM (Bytes)	31K							
	ROM-less ver.	ROM (Bytes)	–							
		RAM (Bytes)	–							
I/O port (channels)	Input only		1							
	CMOS Input/output		87	113	87	113	87	113	87	113
	N-Channel open drain		–							
DMAC (Channel)			2							
Timer [16-bit] (channels)			5+6							
Input capture (channels)			–							
Output compare (channels)			–							
Serial Interface (channels)	Clock synchronous/ UART shared		3	2	3	2	3	2	3	2
	Clock synchronous		2	4	2	4	2	4	2	4
A/D converter (resolution x channel)			24+2							
Interrupt (factors)	External		9	12	9	12	9	12	9	12
Watch dog timer			1							
Other functions			CAN controller (CAN2.0 specification standard), PLL frequency conversion circuit, On-chip oscillator							
Package			100-pin LQFP	128-pin LQFP	100-pin LQFP	128-pin LQFP	100-pin LQFP	128-pin LQFP	100-pin LQFP	128-pin LQFP
Operating voltage (V)			3.0 to 5.5(20MHz)							
Operating ambient temperature (˚C)			–40 to 85							

This product is under development and so there is a possibility that specifications may change.

M32C/80 Series

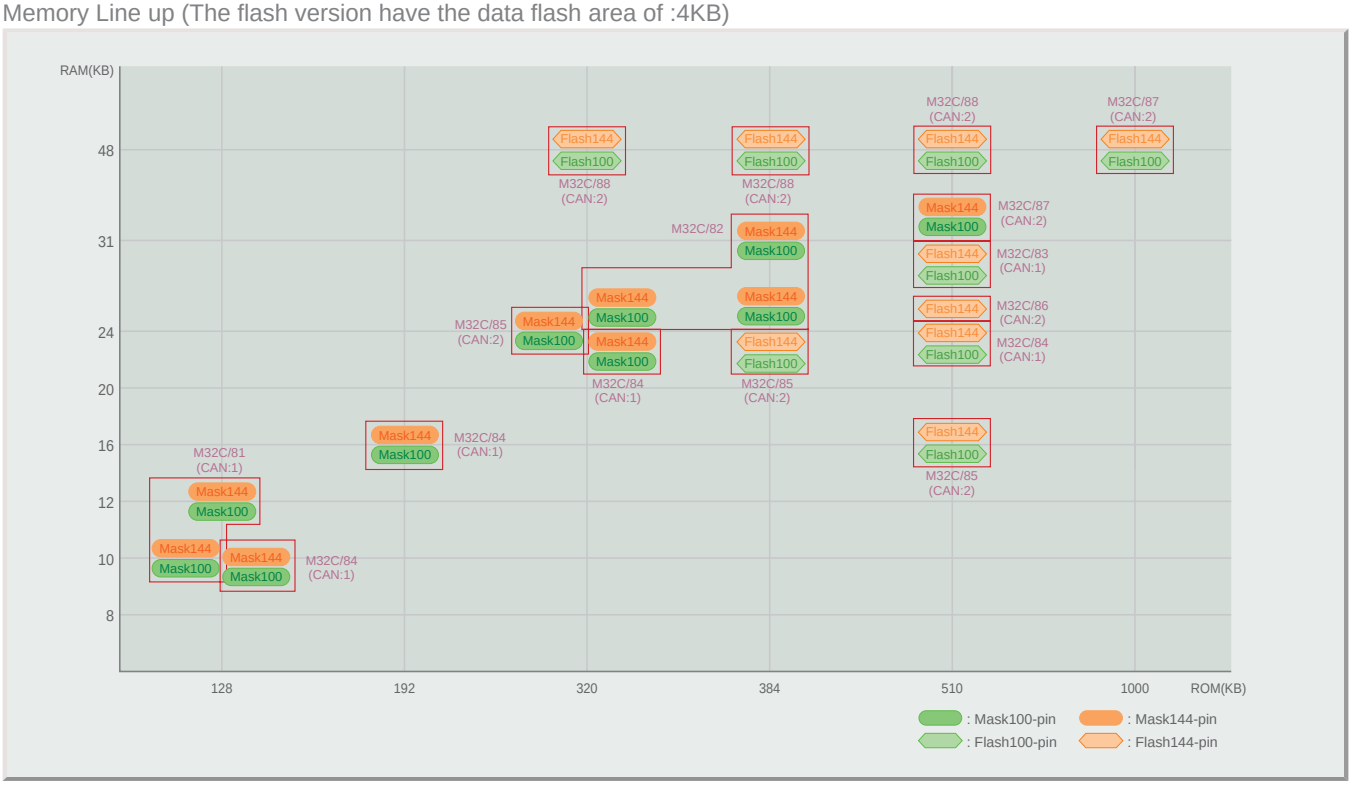
M32C/80 Series CPU Outline

Performance	Machine cycle	31ns (5V for 32MHz)
	Address space	16Mb
No. of instructions		108 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

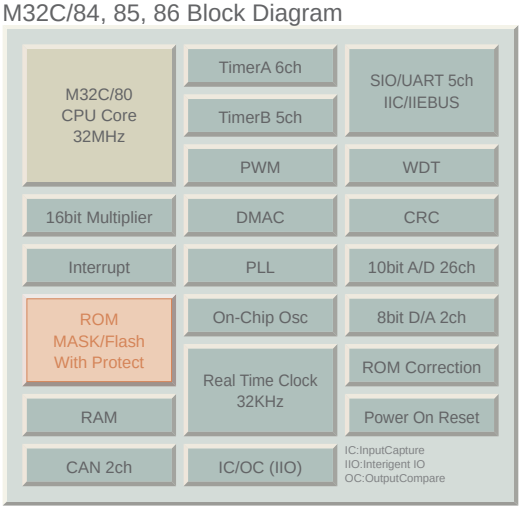
Features of M32C/80 Series

- Retains upward compatibility from M16C/80, and easy to reset if high-speed operation is required (32MHz@5V)
- Features multiply/divide instruction and high speed 32 -bit multiple shift instruction (internal barrel shifter) in addition to 32 -bit arithmetic operation/ forward instruction, so can easily support high-speed arithmetic processing
- With specialized timer enabled by intelligent I/O, PWM in addition to SIO, is able to increase SIO, as well as internal CAN (up to 2ch:M32C/85,86,87), enabling support in many fields
- With an internal input capture timer and output compare timer, making it ideal for sensor application and motor control application

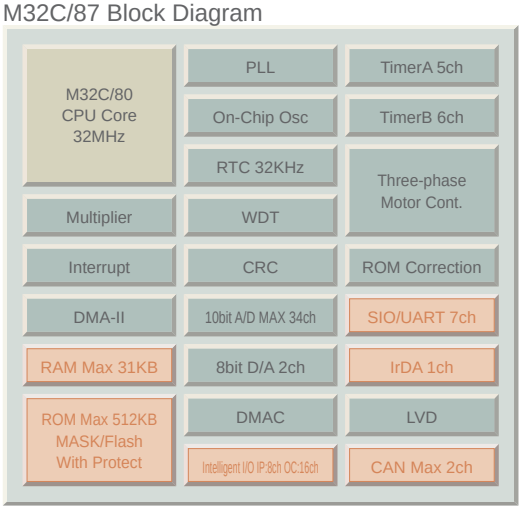
Memory Line up (The flash version have the data flash area of :4KB)



M32C/84, 85, 86 Block Diagram



M32C/87 Block Diagram



M32C/80 Series

Product development M32C/83, 84, 85, 86

Function			M32C/83		M32C/84		M32C/85		M32C/86★★	
			100-pin	144-pin	100-pin	144-pin	100-pin	144-pin	100-pin	144-pin
Internal memory	MASK ver.	ROM (Bytes)	-		128K/192K/320K		320K			
		RAM (Bytes)	-		10K/16K/24K		–	24K	–	
	Flash ver.	ROM (Bytes)	512K		512K		320K/384K/512K			
		Data Flash (Bytes)	-		4K		4K/4K/4K			
		RAM (Bytes)	31K		24K		24K/24K/24K			
	ROM-less ver.	ROM (Bytes)	–							
		RAM (Bytes)	–		10K		–			
I/O port (channels)	Input only		1							
	CMOS Input/output		87	123	87	123	87	123	85	121
	N-Channel open drain		2							
DMAC (Channel)			4							
Timer [16-bit] (channels)			5+6							
Input capture (channels)			12		8					
Output compare (channels)			28		8					
Serial Interface (channels)	Clock synchronous/ UART shared		1		5					
	UART only		–		1					
A/D converter (resolution x channel)			10 x 26	10 x 34	10 x 26	10 x 34	10 x 26	10 x 34	10 x 26	10 x 34
Interrupt (factors)	External									
Watch dog timer										
Other functions			Three-phase inverter control circuit, PLL, On-chip oscillator, IEBus, I²C-Bus, X-Y encoder, variable wait control function, CAN controller						2-phase stepping motor, Three-phase inverter control circuit, PLL, On-chip oscillator, IEBus, I²C-bus, X-Y encoder, variable wait control function, CAN controller	
Package			100-pin QFP 100-pin LQFP	144-pin LQFP	100-pin QFP 100-pin LQFP	144-pin LQFP	100-pin QFP 100-pin LQFP	144-pin LQFP	100-pin QFP 100-pin LQFP	144-pin LQFP
Operating voltage (V)			3.0 to 5.5(24MHz), 4.2 to 5.5(32MHz)							
Operating ambient temperature (˚C)			–20 to 85 or –40 to 85							

This product is under development and so there is a possibility that specifications may change.

★★ : Under development

Product development M32C/87, 88

Function			M32C/87		M32C/88★★	
			100-pin	144-pin	100-pin	144-pin
Internal memory	MASK ver.	ROM (Bytes)	512K		–	
		RAM (Bytes)	31K		–	
	Flash ver.	ROM (Bytes)	1M		320K/384K/512K	
		Data Flash (Bytes)	4K		4K/4K/4K	
		RAM (Bytes)	48K		18K/18K/18K	
	ROM-less ver.	ROM (Bytes)	–			
		RAM (Bytes)	–			
I/O port (channels)	Input only		1			
	CMOS Input/output		87	123	87	123
	N-Channel open drain		2			
DMAC (Channel)			4			
Timer [16-bit] (channels)			5+6			
Input capture (channels)			8	8	8	
Output compare (channels)			10	16	8	
Serial Interface (channels)	Clock synchronous/ UART shared		7		5	
	UART only		–			
A/D converter (resolution x channel)			10 x 26	10 x 34	10 x 26	10 x 34
Interrupt (factors)	External		8	11	8	
Watch dog timer			1			
Other functions			Three-phase inverter control circuit, PLL, On-chip oscillator, IE Bus, I²C-Bus, X-Y encoder, variable wait control function, CAN controller, IrDA		Three-phase inverter control circuit, PLL, On-chip oscillator, IE Bus, I²C-Bus, X-Y encoder, variable wait control function	
Package			100-pin QFP, 100-pin LQFP	144-pin LQFP	100-pin LQFP	144-pin LQFP
Operating voltage (V)			3.0 to 5.5(24MHz), 4.2 to 5.5(32MHz)			
Operating ambient temperature (˚C)			–20 to 85 or –40 to 85			

This product is under development and so there is a possibility that specifications may change.

★★ : Under development

M16C/90 Series

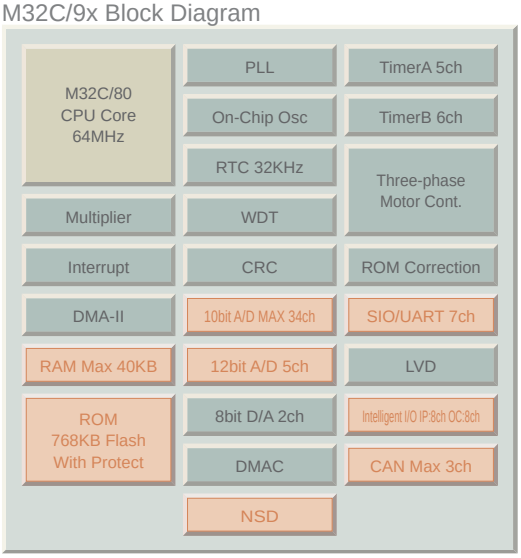
M32C/90 Series CPU Outline

Performance	Machine cycle	15.5ns (5V for 64MHz)
	Address space	16Mb
No. of instructions		108 instructions
Register composition		General register: 16 -bit x 6 x 2 bank, exclusive register:16 -bit x 5

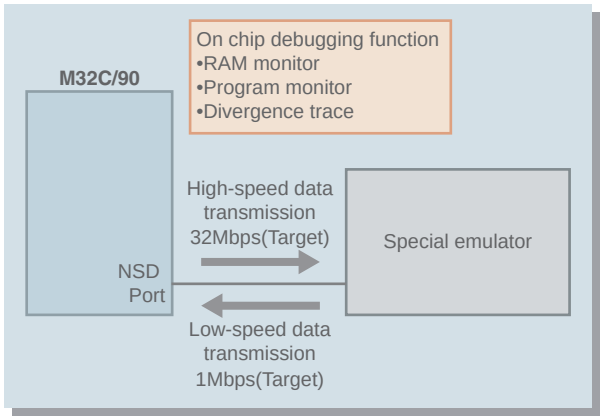
Features of M32C/90 Series

- Double the speed (64MHz@5V) of the maximum operating frequency compared to the M32C/80 Series.
- Features single line type NSD (Non-step Debugger) interface for connection using only 1 terminal.
- Realization of basic debugger using low cost emulator
- With enhanced communication functions (CAN:3CHÅASI/O:7CH), ideal as a gateway for connecting multiple networks.
- Conversion rate: Internal high speed A/D converter capable of 10-bit 1.65_s
- Features “low power consumption, low unnecessary radiant noise and high noise resistance” inherited from the M16C, even when carrying out high speed operation.

M32C/9x Block Diagram



Debugging with built-in NSD circuit



Product development M32C/94, 95

Function			M32C/94★★		M32C/95★★	
			100-pin	144-pin	100-pin	144-pin
Internal memory	MASK ver.	ROM (Bytes)	–		–	
		RAM (Bytes)	–		–	
	Flash ver.	ROM (Bytes)	256K/512K/768K		512K/768K	
		Data Flash (Bytes)	–		–	
		RAM (Bytes)	16K/24K/40K		32K/40K	
	ROM-less ver.	ROM (Bytes)	–		–	
		RAM (Bytes)	–		–	
I/O port (channels)	Input only		1		1	
	CMOS Input/output		87	123	87	123
	N-Channel open drain		2			
DMAC (Channel)			4			
Timer [16-bit] (channels)			5+6			
Input capture (channels)			16			
Output compare (channels)			16			
Serial Interface (channels)	Clock synchronous/ UART shared		7			
	UART only		–			
A/D converter (resolution x channel)			10-bit x 26	10-bit x 34	10-bit x 26	10-bit x 34
Interrupt (factors)	External		8			
Watch dog timer			1			
Other functions			Three-phase inverter control circuit, IE Bus, I²C-bus, X-Y encoder, On-chip oscillator, PLL			
Package			100-pin LQFP	144-pin LQFP	100-pin LQFP	144-pin LQFP
Operating voltage (V)			3.0 to 5.5(24MHz), 4.2 to 5.5(32MHz)			
Operating ambient temperature (˚C)			–20 to 85 or –40 to 85			

This product is under development and so there is a possibility that specifications may change.

★★ : Under development

M16C ASSP Progression

M16C/6S Group

(Specialized type for power line transmission)

The M16C/6S are a M16C/60CPU with IT800 power line modems, developed by the YITRAN Corporation, built into their core, and are fully optimized microcomputers for power-line transmission. For power line transmission, they use a frequency band ranging from 100kHz to 400kHz, with transmission up to 7.5Kbps possible. For suitable home-network support, they can be equipped with SCP (Simple Control Protocol), the communication protocol offered by Microsoft Corporation.

Product lineup

Function			M16C/6S
Internal memory	MASK ver.	ROM (Bytes)	–
		RAM (Bytes)	–
	Flash ver.	ROM (Bytes)	96K
		Data Flash (Bytes)	–
		RAM (Bytes)	24K
	ROM-less ver.	ROM (Bytes)	–
		RAM (Bytes)	–
I/O port (channels)	Input only		–
	CMOS Input/output		20
	N-Channel open drain		1
DMAC (Channel)			2
Timer [16-bit] (channels)			5
Input capture (channels)			–
Output compare (channels)			–
Serial Interface (channels)	Clock synchronous/ UART shared		3
	Clock synchronous only		2(One line is for dedicated IT800 internal connection)
A/D converter (resolution x channel)			–
Interrupt (factors)	External		3
Watch dog timer			1
Other functions			Power-line transmission function, I²C-bus, PLL, On-chip oscillator
Package			64-pin LQFP(64P6Q-A)
Operating voltage (V)			3.0 to 3.6(15.36MHz)
Operating ambient temperature (˚C)			–20 to 85

M16C/6K Group

(Internal keyboard controller type)

The M16C/6K are a line-up of keyboard controller microcomputers equipped with host bus interface circuits (LPC, ISA-Bus). They also have an internal I_C-bus with enhanced communication functions.

Product lineup

Function			M16C/6K		
			K7	K9	KA
Internal memory	MASK ver.	ROM (Bytes)	–	–	
		RAM (Bytes)	–	–	
	Flash ver.	ROM (Bytes)	68K	128K	
		Data Flash (Bytes)	–	–	
		RAM (Bytes)	3K	5K	
	ROM-less ver.	ROM (Bytes)	–	–	
		RAM (Bytes)	–	–	
I/O port (channels)	Input only		1		
	CMOS Input/output		129		
	N-Channel open drain		8		
DMAC (Channel)			25		–
Timer [16-bit] (channels)			5+6		
Input capture (channels)			–		
Output compare (channels)			–		
Serial Interface (channels)	Clock synchronous/ UART shared		3		1
	UART only		2		
A/D converter (resolution x channel)			10bits x 8(+2)		
Interrupt (factors)	External		15	16	
Watch dog timer			1		
Other functions			I²C-bus(option 2ch)	I²C-bus(option 3ch)	
Package			144-pin TQFP		
Operating voltage (V)			3.0 to 3.6(8MHz)	3.0 to 3.6(16MHz)	
Operating ambient temperature (˚C)			–20 to 85		

M16C/24 Group

(Internal USB controller type)

The M16C/24 inherits the CPU core and peripheral functions of the M16C/60, and in addition, has an internal USB controller which supports full speed application. Features USB interface application for PC peripheral devices such as audio equipment, electronic instruments, printers, scanners, modems, and can be used with all applications in a wide range of uses.

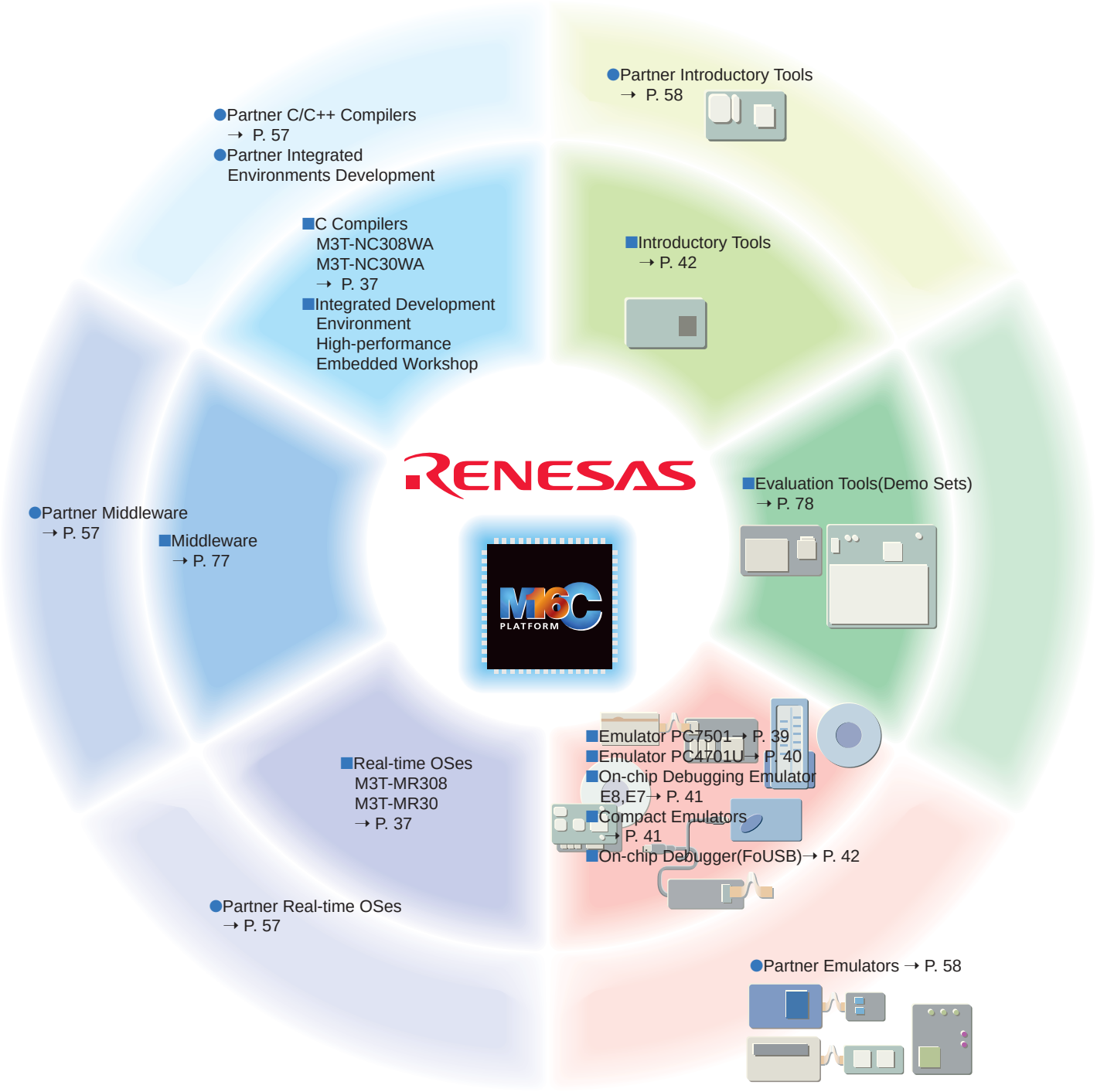
Product lineup

Function			M16C/24			
			M30240			M30245
Internal memory	MASK ver.	ROM (Bytes)	40K	48K	128K*	64K
		RAM (Bytes)	3K	3K	5K	5K
	Flash ver.	ROM (Bytes)	–	–	–	128K
		Data Flash (Bytes)	–	–	–	–
		RAM (Bytes)	–	–	–	10K
	ROM-less ver.	ROM (Bytes)	–	–	–	–
		RAM (Bytes)	–	–	–	–
I/O port (channels)	Input only		1			
	CMOS Input/output		63			80
	N-Channel open drain		–			2
DMAC (Channel)			2			4
Timer [16-bit] (channels)			5+3			5
Input capture (channels)			–			–
Output compare (channels)			–			–
Serial Interface (channels)	Clock synchronous/ UART shared		3			2
	UART only		–			2(multifunction)
A/D converter (resolution x channel)			10 bits x 8			
Interrupt (factors)	External		4			5
Watch dog timer			–			–
Other functions			Conforms to USB2.0 specifications, USB pull-up power output terminal			
Package			480-pin QFP			100-pin LQFP
Operating voltage (V)			4.1 to 5.25(12MHz)			3.0~3.6(16MHz)
Operating ambient temperature (˚C)			–20 to 85			

* OTP version

Development Tools

Renesas provides world class development support tools for the M16C Platform. We are continuously improving the functionality of our existing tools and expanding our support with the introduction of new tools, to meet the evolving needs of our customers. In addition to Renesas provided tools, many partner tools companies support the M16C platform.



* "308" and "30" found in product names indicate the following division,
308: M32C/80, M16C/80 Series, 30: M16C/60, 30, Tiny, 20, 10 Series.

Programming Environment

Renesas offers a programming environment for C and assembly languages. And, the integrated development environments (packaged in the C compiler) make programming highly efficient and ensure high operability.

Integrated Development Environment, High-performance Embedded Workshop

- Compliant with Windows XP/Me/98/2000/NT 4.0
- Seamless tool operations from editor to debugger
- Automatically runs a sequence that consists of compiling, assembling, and linking
- Manages source files by "Project"
- Registration and startup of an external tool
- Display of file dependency
- Automatically generates startup code
- Find In Files
- Project management in network environment
- Version Control Support

Integrated development environment

C Compiler M3T-NC308WA/M3T-NC30WA

- Compliance with ANSI standards.
- Optimizations
- Creating ROMable programs
- Specifying memory models of variables
- Supports real-time OS M3T-MR308/M3T-MR30
- C source level debugging information
- Standard library
- Calculating stack size (stk and STK viewer)
- Displaying the mapping information (MAP viewer)
- Online upgrade from Renesas Tools Homepage

MISRA C Rule Checker SQMlint

SQMlint is a tool to inspect C source codes according to MISRA C rules*. Because SQMlint assists developers in source code review through automatic inspection, it helps to develop high-quality C source codes efficiently.

* MISRA C refers to the guidelines for the use of the C language in vehicle-based software that have been created by the Motor Industry Software Reliability Association (MISRA), a nonprofit organization for software reliability that was organized primarily by the automotive industry.

※1 MISRA:Motor Industry Software Reliability Association
"MISRA" is a registered trademark of MIRA Ltd, held on behalf of the MISRA Consortium.

Simulator Debugger

- Targetless debugging of single software module
- Comfortable drag & drop operation
- C/assembly-level debugging
- Source file editing function
- Tracing features
- RAM monitor display
- Virtual port input/output and virtual interrupts
- GUI-based target input/output features
- Customizable & expandable (PDSDK COM Kit available)

Simulator Debugger Customizing Kit PDxxSIM I/O DLL

The I/O DLL function is provided to create I/O simulation with Microsoft "Visual C++". Renesas offers "Visual C++" project and each function pattern as a template.
The user can describe I/O to the port, occurrence of interrupt and peripheral I/O operation, etc. inside its function in C/C++ language to prepare a project.
When the project thus created is built, "Visual C++" generates a DLL (Dynamic Link Library) file. This DLL file is read at PDxxSIM startup with the simulator engine.

Real-time OS M3T-MR308/M3T-MR30

This real-time OS facilitates development application software for embedded systems and shortens its turn-around time.

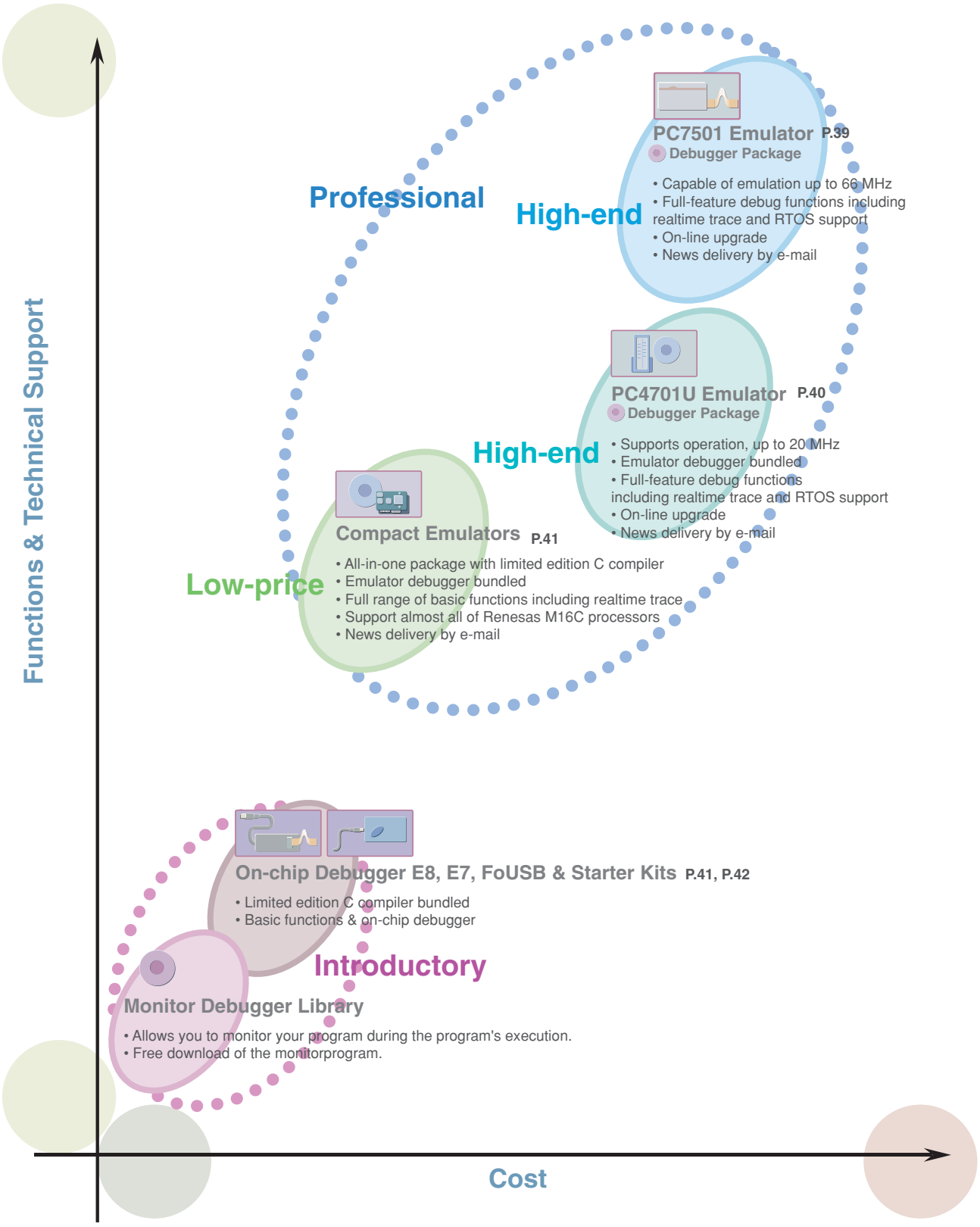
- ITRON specifications conformance
  (The TRON architecture standard developed by Dr. Ken Sakamura at the University of Tokyo.)
- Compact size for ROM
- Context selection function reduces RAM size to be used.
- Fast interrupt response
- Memory pool function
- Included C interface library for the C compiler M3T-NC308WA/M3T-NC30WA enables C programs to embed M3T-MR308/M3T-MR30 efficiently.
- Configurator
- Online upgrade from Renesas Tools Homepage
- Various OS debugging functions in combination with the emulator debugger M3T-PD308F, M3T-PD30F, M3T-PD308, M3T-PD30

* "308" and "30" found in product names indicate the following division, 308: M32C/80, M16C/80 Series, 30: M16C/60, 30, Tiny, 20, 10 Series.

Extensive Emulator Line

Renesas offers various emulator products to meet the needs of all M16C development environments, allowing the customer the flexibility to choose the perfect product to meet their specific needs.

Emulator Selection According to Stage and Scale of Product Development



*** The xx found in product names varies according to MCU family and series.**

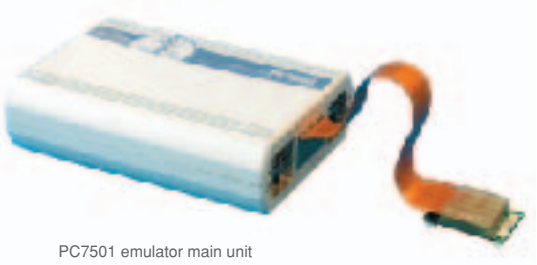
PC7501 Emulator System

New Emulator System PC7501 for the M16C

The PC7501 emulator with full bus trace is available for in circuit emulation in systems designed around the M16C Platform of processors. The PC7501 can be easily adapted to any member of the M16C platform by using the corresponding emulator probe. This compact unit is capable of emulation up to 66 MHz and has many other enhancements of the PC4701U.

PC7501 Emulator

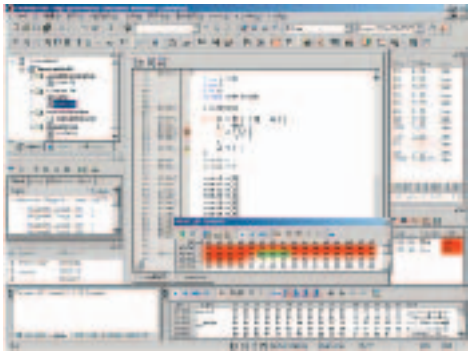
- In circuit emulator with full bus trace for emulation of M16C platform microcontrollers up to 66 MHz.
- Compact design fitting all functions into a single unit.
- Enhanced debugging features compared with the PC4701U.
- Simple MCU-dependent firmware download allows for use with various processors
- LAN, USB and LPT interfaces available
- The MCU probe is purposefully designed to match the electrical equivalence (as m as possible) with using an actual MCU in the system.
- AC adapter conforming to safety standards
- Power supply voltage: 100-240 V, 50/60 Hz
- FCC, CE certified
- PC7501 emulator website
  http://www.renesas.com/eng/products/mpumcu/toolhp/pc7501/



PC7501 emulator main unit

PC7501 Emulator Debugger

- Windows XP, Windows Me, Windows 98SE, Windows 2000 support
- Convenient debugging environment provided by drag & drop operation
- C language and assembly language source level debugging and many other basic debug features
- Source file editing function
- Real-time RAM monitoring
- Real-time tracing, C0 coverage, Time measurement and other advanced features
- USB, LPT parallel and LAN interfaces
- Online help in HTML
- The latest version is downloadable from Renesas Tools Homepage
  http://www.renesas.com/eng/products/mpumcu/toolhp/online/



Emulator software

PC7501 & PC4701U Specifications

	PC7501
Supported MCU	• M32C/80 Series • M16C/60 Series • M16C/30 Series • M16C/Tiny Series • R8C/Tiny Series
Maximum operating frequency	66.7MHz(Depends on MCU-dependent part)
MCU mode	Single-chip, Memory expansion, Microprocessor
Emulation memory	The default is 4 MB (Max. 16 MB)
Power voltage	2.7 to 5.5V(Depends on MCU-dependent part)
Power supply to MCU	Supplied from DC power supply of PC7501
Software break	64 points
Hardware break	16 points* (Execution address/Bus detection/Interrupt/External trigger signal)
Hardware break condition	• AND/OR/AND (Same time)/State transition • Pass counts: 255 times
Exception event detection	Access protect
Real-time trace	• 256K cycles • Trace data: Bus, External trigger, and Time stamp • 5 trace modes: Break/Before/About/After/Full • Can be recorded ON/OFF by events
Real-time RAM monitor	• 4,096 bytes (256 bytes x 16 blocks) • Data/Last access result
Time measurement	• Execution time between program start to stop • Maximum/minimum/average execution time and pass count of specified four zones • Count clock: Equal to MCU Clock or 16MHz
C0 coverage	8,192 KB (256 KB x 32 blocks)
Event output	Break x 1, event x 7
External trigger input	MCU-dependent-voltage CMOS level x 8
PC interface	LPT parallel, USB, LAN (10Base-T)
Overseas standards	Compliant

Depends on the specifications of the emulator debugger M3T-PDxxF.

Emulation Probes

- Just replacing an MCU-dependent emulation probe (option) allows to debug various M16C processors

Emulator Debugger M3T-PD308F/M3T-PD30F/M3T-PD308/M3T-PD30

- Windows XP, Windows Me, Windows 98, Windows 95, Windows 2000, Windows NT 4.0 support
- Comfortable debugging environment provided by drag & drop operation
- C language and assembly language source level debugging and many other basic debug features
- Source file editing function
- Real-time OS support (see right)
- Real-time RAM monitoring
- Real-time tracing, C0 coverage, Time measurement and other advanced features
- Online help in HTML
- The latest version is downloadable from Renesas Tools Homepage
  http://www.renesas.com/eng/products/mpumcu/toolhp/online/

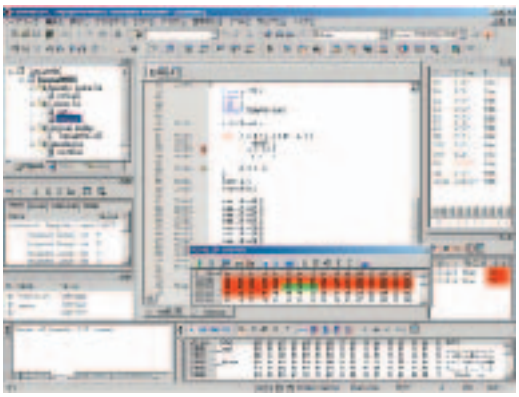
Example of displaying high performance window for realtime operating system

* "308" and "30" found in product names indicate the following division, 308: M32C/80, M16C/80 Series, 30: M16C/60, 30, Tiny, 20, 10 Series.

PC4701U Emulator System

8-bit & 16-bit Common Emulator PC4701

The PC4701 emulator system creates a flexible development environment, improving the debugging efficiency of your applications. This system can also support future MCUs, up to 20 MHz, by simply changing the emulation pod.



Emulator software

PC4701U emulator main unit

Emulation pod

	PC4701U
Supported MCU	• M32C/80 Series (up to 20 MHz) • M16C/80, 60, 30, Tiny, 20, 10 Series • 7700 Family (16-bit) • 740 Family (8-bit)
Maximum operating frequency	20 MHz (Depends on MCU-dependent part)
MCU mode	Single-chip, Memory expansion, Microprocessor
Emulation memory	Max. 2 MB (Depends on MCU-dependent part)
Power voltage	2.7 - 5.5 V (Depends on MCU-dependent part)
Power supply to MCU	Supplied from DC power supply of PC4701U
Software break	64 points
Hardware break	6 points Execution address/Bus detection/Interrupt/External trigger signal
Hardware break condition	• AND/OR/AND (Same time)/State transition
Exception event detection	Access protect
Real-time trace	• 32K cycles • Trace data: Bus, 8-bit external trace signal, 40-bit time stamp • Five trace modes: Break/Before/About/After/Full • Can be recorded ON/OFF by events
Real-time RAM monitor	• 1,024 bytes • Data/Accessed or not/Last access result
Time measurement	• Execution time between program start to stop • Maximum/minimum/average execution time and pass count of specified four zones • Count clock: Equal to MCU Clock or 16MHz
C0 coverage	256 KB
Event output	Break x 1, event x 6
External trigger input	TTL level x 8
PC interface	LPT parallel, USB, LAN (10Base-T)
Overseas standards	Compliant

PC4701U Emulator

- Support almost all of 8- and 16-bit MCUs
- Support future MCUs by simply changing the emulation pod.
- High-level breaks and real-time trace
- Performance evaluation such as code coverage and time measurement functions
- Real-time RAM monitor
- LAN, USB and LPT interfaces available
- Compact design with built in AC power supply
- UL, FCC, CE certified
- Emulator debugger bundled
- The latest emulator debugger available for free download
  http://www.renesas.com/eng/products/mpumcu/toolhp/pc4701/

Emulation Pods

- Supports high-speed clock
- Supports low-voltage
- Flexible cable
- Compliant with overseas standards

Debugger Customizing Kit PDSDK COM *

COM interface has been added to our emulator debugger and simulator debugger so that these debuggers can be customized, using a commercially available Windows application development tool.

Supported debuggers:
- Emulator debugger M3T-PD308F, M3T-PD30F, M3T-PD308, M3T-PD30
- Simulator debugger M3T-PD308SIM, M3T-PD30SIM

Application Examples:
- The GUI part on the target board can be created as a pseudo target. For GUI on the target board, it is possible to utilize standard control parts that "Visual Basic" and "Visual C++" are provided with, such as a button. Also available are freeware and shareware control parts (Active X control).
- It is possible to write the memory contents at target program stop into the cell of table calculation software "Excel". The data are totalized automatically, thereby facilitating data analysis and graphic display.

* "COM" is short for "Component Object Model" - Standard for linking with OS and applications that is proposed by Microsoft Corporation.

Low-Cost, All-in-One Compact Emulators

Compact Emulators

Renesas offers a wide selection of development tools ranging from the evaluation boards and starter kits to high performance emulators.
Among these, the compact emulators provide superior cost-performance ratio in an extremely compact design.

Components:
- Emulator main unit
- Emulator debugger M3T-PDxxM
- Limited edition Cross tools
- Interface cables
- User's manual,etc.

Features:
- All-in-one package (programming and debugging tools included)
- Compact body
- Supports memory expansion mode and single-chip mode
- Economical price
- Basic debugging functions
- Real-time RAM monitor
- Real-time tracing functions
- Supports USB interface

Functional Comparison

	First generation compact emulator M30620T-CPE	Second generation compact emulator M30800T-CPE	Third generation compact emulators M3xxxxT2-CPE or later
Supported processor	M16C/62A Group	M16C/80 Series	M16C/6K Group, M16C/80 Series
MCU mode	• Single-chip mode		• Single-chip mode • Memory expansion mode
Software break	64 points		
Hardware break	–	1 point (Bus detection only)	1 point (Bus detection only)
Real-time trace	• Trace range: 32K-cycle • Trace data: 20-bit address, 16-bit data, 12-bit MCU status • Trace modes: 2 modes (Before Break/After Go)		
Real-time RAM monitor	–		1024 bytes (Data/Accessed or not)
Execution time measurement	Execution time between program start to stop Count clock: 10 MHz		
PC interface	RS-232C serial (Max. 115.2K bps)		USB (USB 1.1, Full-speed)
External dimensions	110mm x 80mm	100mm x 70mm	80mm x 65mm
Operating environment	Windows 98, Windows 95, Windows 2000, Windows NT4.0		Windows XP, Windows Me, Windows 98SE, Windows 2000

For details, refer to http://www.renesas.com/eng/products/mpumcu/toolhp/sales/

Supported processors:

Series	Group	Compact Emulator
M32C/80	M32C/81, 82, 83	S30830T-CPE (Made by Sunny Giken Inc.)
	M32C/84, 85, 86	M30850T2-CPE
	M32C/87	M30870T2-CPE (Under development)
M16C/80	M16C/80	M30800T-CPE
M16C/60	M16C/62A	M30620T-CPE
	M16C/62P, M16C/30P	S3062PT-CPE (Made by Sunny Giken Inc.)
	M16C/6K (M306K9)	M306K9T2-CPE
M16C/Tiny	M16C/26A (M30260)	M30260T2-CPE-GP
	M16C/26A (M30263)	M30263T2-CPE-FP
	M16C/28 (M30280)	M30290T2-CPE-HP
	M16C/29 (M30290)	
	M16C/28 (M30281)	M30291T2-CPE-HP
	M16C/29 (M30291)	
R8C/Tiny	-	(Under development)

On-chip Debugging Emulator E8/E7

The On-chip debugging emulator excellent in cost performance.
The E8/E7 realizes an efficient debugging environment with the integrated development environment High performance Embedded Workshop

E8

Supported processors:
R8C/Tiny Series R8C/10, 11, 12, 13, 14, 15, 16, 17 Groups
R8C/Tiny Series R8C/18, 19 Groups (Under evaluation)

Operating environment:
Windows XP, Windows ME, Windows 2000, Windows 98SE

Components:
- E8 main unit
- Software CD-ROM
- USB cable etc.

External dimensions:
97mm x 65mm x 22mm

For more information, visit http://www.renesas.com/en/e8

E7

Supported processors:
R8C/Tiny Series R8C/10, 11, 12, 13 Groups

Operating environment:
Windows XP, Windows ME, Windows 2000, Windows 98SE

Components:
- E7 main unit
- Software CD-ROM
- USB cable etc.

External dimensions:
97mm x 65mm x 22mm

For more information, visit http://www.renesas.com/en/e7

Introductory Emulator Line for the M16C

Starter Kits

All-in-one package supporting basic functions at a low introductory price

Supported processors: R8C/TinySeries
• SKP8CMINI

M16C/26 Group
• SKP16C26

M16C/62 Group
• SKP16C62P

Components:
• Starter kit main board
• Limited edition C-Compiler KNCxxWA or dedicated M3T-NC30WA
• Remote Debugger KDxx
• Flash memory programmer M16C Flash Starter or FoUSB
• Cable
• Manuals etc.

Operating environment:Windows XP, Windows Me, Windows 2000, Windows 98, Windows 95
For details, refer to http://www.renesas.com/eng/products/mpumcu/16bit/m16c/mctoole.htm

FoUSB (Type name: M3A-0665)

The USB Flash Writer M3A-0665 functions as an on-chip debugger that can be controlled by the KD30 or KD3083 remote debugger. Software can be easily debugged with the following connection configuration: PC to USB Monitor Board to Target MCU.

• Supplies 5V via USB cable
• Compact size

Supported processors:
R8C/10, 11, 12, 13 Groups, M16C/62P Group,
M16C/6N Group, M16C/24 Group, M16C/26A, 28, 29 Groups,
M16C/10, 1N Groups, M16C/80 Group, M32C/83, 84, 85, 86, 87 Groups

Operating environment:
Windows XP, Windows Me, Windows 2000,
Windows NT, Windows 98SE

Components:
• FoUSB
• USB cable (for connecting host machine)
• Flat cable (for connecting target system)
• 10-pin connector
• Software CD-ROM
• Document (in CD-ROM)

This product functions as a flash programmer.

M3A-0806

M3A-0806 is a flash writer using standard serial Input/output mode 2 (UART mode). The flash starter rewrites programs using only 4 wires (TxD, RxD, GND and Vcc). Using the provided cable eliminates the necessity for an RS-232C driver on the target board.

[Features]
• PC software and special serial cable provided.
• Extremely low-cost flash writer.
[Ordering information]
M3A-0806
[Useful MCU types]
R8C/10, 11, M16C/10, 26, 26A, 28, 29, 62A, 62M, 62P, 6N, 80, M32C/83, 85

The flash renewal software of M3A-0806 is free software.
An EXE file and a source program set can download from [the M16C technological information homepage], too.

*The target PCB is not included.

List of Tools

Development Tools for M32C/80 Series

MCU		Software tools				Hardware tools			Accessories		
Series	Group	RTOS	C compiler package	Simulator debugger	IDE	Emulator debugger ※7	Emulator ※7	Emulation probe or pod ※7	Package type	Package name	Recommended accessories ※8※9
M32C/80	M32C/80	M3T-MR308※1	M3T-NC308WA※2 (MISRA C※3)	M3T-PD308SIM※4	High-performance Embedded Workshop※5	Bundled with emulator ※6	PC7501	M30850T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
	M32C/81							M30830T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/82							M30830T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/83							M30830T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/84							M30850T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/85							M30850T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/86							M30850T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/87							M30870T-EPB	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/88**							M30880T-EPB	144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)

※1. M3T-MR308 is the generic name for real-time OS development kit (M3T-MR308K) and mass production contract (M3T-MR308S).
※2. M3T-NC308WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and simulator debugger M3T-PD308SIM.
※3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
※4. M3T-PD308SIM is included with C compiler package.
※5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
※6. Emulator PC7501 bundles emulator debugger M3T-PD308F, and emulator PC4701U bundles emulator debugger M3T-PD308.
※7. For the use of 20 MHz or less, you can use the combination of emulator debugger M3T-PD308, emulator PC4701U and emulation pod M30830T-RPD-E.
※8. Various other useful accessory tool products are also available.
※9. Use the first combination to perform debug only; use the second combination to perform both debug and on-board evaluation.
★★ Under development or evaluation: product name may be changed or MCU is under development.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Development Tools for M32C/90 Series

MCU		Software tools				Hardware tools
Series	Group	RTOS	C compiler package	Simulator debugger	IDE	Emulator
M32C/90	M32C/94** M32C/95**	M3T-MR308**※1	M3T-NC308WA※2 (MISRA C※3)**	M3T-PD308SIM**※4	High-performance Embedded Workshop※5	★★※6

※1. M3T-MR308 is the generic name for real-time OS development kit (M3T-MR308K) and mass production contract (M3T-MR308S).
※2. M3T-NC308WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and simulator debugger M3T-PD308SIM.
※3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
※4. M3T-PD308SIM is included with C compiler package.
※5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
※6. Onchip Emulator which implements a new method is under development.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Starter Kits for M32C/80 Series

Series	Group	Starter kit	Package type	Package name	
M32C/80	M32C/83	M3A-0835 (UART version)	100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A
		M3A-0836 (UART version)	144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A
	M32C/85	M3A-0854 (with E8)***	100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A
		M3A-0855 (with E8)***	144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A
	M32C/87	M3A-0874 (with E8)***	100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A
		M3A-0875 (with E8)***	144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A

★★★ Under planning

Compact Emulators for M32C/80 Series

Series	Group	Product name	Accessories		
			Package type	Package name	Recommended accessories ※1
M32C/80	M32C/84 M32C/85 M32C/86	M30850T2-CPE	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
			100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
			144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)
	M32C/87	M30870T2-CPE**	100-pin 0.5mm-pitch LQFP	100P6Q-A PLQP0100-KB-A	M3T-F160-100NSD (optional)
			100-pin 0.65mm-pitch QFP	100P6S-A PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
			144-pin 0.5mm-pitch LQFP	144P6Q-A PLQP0144KA-A	M3T-FLX-144NSD (optional)

※1. Various other useful accessory tool products are also available.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Programmers for M32C/80 Series

Series	Group	Memory	Package type	Package name		Programmer ※1
M32C/80	M32C/83 M32C/84 M32C/85 M32C/86	Flash	100-pin 0.5mm-pitch LQFP	100P6Q-A	PLQP0100-KB-A	M3A-0665 M3A-0806※2
			100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A	
			144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A	
	M32C/87 M32C/88**		100-pin 0.5mm-pitch LQFP	100P6Q-A	PLQP0100-KB-A	M3A-0665**
			100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A	
			144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A	

※1. Third party programmers are available for flash memory. For detailed information concerning programmers, supported MCUs, and applicability to mass-production or production equipment, please contact the concerned manufacturers.
※2. Data flash area are not available.
★★ MCU under development

Development Tools for M16C/80 Series

MCU		Software tools				Hardware tools			Accessories			
Series	Group	RTOS	C compiler package	Simulator debugger	IDE	Emulator debugger	Emulator	Emulation probe or pod	Package type	Package name		Recommended accessories ✻8
M16C/80	**M16C/80**	M3T-MR308✻1	M3T-NC308WA *2 (MISRA C *3)	M3T-PD308SIM *4	High-performance Embedded Workshop✻5	Bundled with emulator ✻6	PC4701U	M30803T-RPD-E (RAM 24K) ✻7	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100-KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									144-pin 0.5-mm-pitch LQFP	144P6Q-A	PLQP0144KA-A	M3T-FLX-144NSD (optional)

✻1. M3T-MR308 is the generic name for real-time OS development kit (M3T-MR308K) and mass production contract (M3T-MR308S).
✻2. M3T-NC308WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and simulator debugger M3T-PD308SIM.
✻3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻4. M3T-PD308SIM is included with C compiler package.
✻5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻6. Emulator PC4701U bundles emulator debugger M3T-PD308.
✻7. When using for M16C/80T Group for automobile MCUs, please inform of that at the time of product order.
✻8. Various other useful accessory tool products are also available.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Development tools for M16C/60 Series

MCU			Software tools			Hardware tools			Accessories			
Series	Group	MCU	RTOS	C compiler package (with simulator debugger)	IDE	Emulator (with emulator debugger ✻5)✻6	Emulation pod or probe		Package type	Package name		Recommended accessories ✻10✻11
M16C/60	**M16C/62A**		M3T-MR30✻1	M3T-NC30WA✻2 (MISRA C✻3)	High-performance Embedded Workshop✻4	PC4701U	M30620T2-RPD-E		100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-FLX-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3T-FLX-100NRB (optional)
									80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3T-FLX-100LCC (included) + M3T-100LCC-80QSB (optional)
	M16C/62M					PC4701U	M30620TL-RPD-E		100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-FLX-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3T-FLX-100NRB (optional)
									80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3T-FLX-100LCC (included) + M3T-100LCC-80QSB (optional)
	M16C/62N					PC4701U	M3062NT3-RPD-E✻7 (M30620TL-RPD-E)		100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									100-pin 0.4-mm-pitch TQFP	100PFB-A	PTQP100LB-A	M3T-F160-100NSE (optional)
									80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3062PT-80FPB (optional)
	M16C/62P					PC7501	M3062PT-EPB or M3062PT2-EPB★★		100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A	M3T-F160-128NRD (optional)
									80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3062PT-80FPB (optional)
						PC4701U	M3062PT3-RPD-E		100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
									100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
									128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A	M3T-F160-128NRD (optional)
									80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3062PT-80FPB (optional)
	M16C/6V	**M306V0**				PC4701U	M306V0T-RPD-E		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3T-FLX-100NRB (optional)
		M306V2					M306V2T-RPD-E		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3T-FLX-100NRB (optional)
		M306V7					M306V7T-RPD-E		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M3T-FLX-100LCC (included) + LCC socket (included) (2) M3T-FLX-100NRB (optional)
		M306V8				PC7501	M306V8T-EPB		116-pin 0.65mm-pitch LQFP	116P6A-A	PLQP0116JA-A	M306V8T-PTC (included)
	M16C/6K	**M306K7**				PC4701U	M306K7T-RPD-E★★		144-pin 0.4-mm-pitch TQFP	144PFB-A	PLQP0144KA-A	M3T-FLX-144NSE (included)
		M306K9				M306K9T2-CPE✻8			144-pin 0.4-mm-pitch TQFP	144PFB-A	PLQP0144KA-A	M3T-FLX-144NSE (optional)
		M306KA				M306KAT2-CPE★★✻8			144-pin 0.4-mm-pitch TQFP	144PFB-A	PLQP0144KA-A	M3T-FLX-144NSE (optional)
	M16C/6N	**M306N4** **M306N5**				PC7501	M306NKT-EPB		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
						PC4701U	M306NKT3-RPD-E		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
		M306NK **M306NL** **M306NM** **M306NN**				PC7501	M306NKT-EPB		128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A	M3T-F160-128NRD (optional)
									100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
						PC4701U	M306NKT3-RPD-E		128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A	M3T-F160-128NRD (optional)
									100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
	M16C/6H	**M306H2**				PC4701U	M306H2T-RPD-E (B.T.O.)		116-pin 0.65-mm-pitch LQFP	116P6A-A	PLQP0116JA-A	M306H2T-PTC (included)
		M306H3					M306H3T3-RPD-E		116-pin 0.65-mm-pitch LQFP	116P6A-A	PLQP0116JA-A	M306H2T-PTC (included)
		M306H5					M306H5T3-RPD-E		116-pin 0.65-mm-pitch LQFP	116P6A-A	PLQP0116JA-A	M306H2T-PTC (included)
	M16C/6S	**M306S0**				PC7501	M3062PT-EPB or M3062PT2-EPB★★ + M306S0T-RPB✻9		64-pin 0.5-mm-pitch QFP	64P6Q-A	PLQP0064KB-A	–✻12
						PC4701U	M3062PT3-RPD-E + M306S0T-RPB✻9		64-pin 0.5-mm-pitch QFP	64P6Q-A	PLQP0064KB-A	–✻12

✻1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
✻2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
✻3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻4. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻5. You can download the latest version of the following debuggers: M16C R8C Debugger Package (without OS debugging function), M3T-PD30F (for PC7501 emulator / with OS debugging function), M3T-PD30 (for PC4701 emulator / with OS debugging function). M3T-PDxx can be started as an external tool in High-performance Embedded Workshop.
✻6. When the operating frequency is 16 MHz or less, you can use the combination of M3T-PD30, PC4701U and M306xxTx-RPD-E.
✻7. When the operating frequency is 10MHz@2.2-3.6V on M16C/62N group MCUs, you can use the emulation pod M30620TL-RPD-E for M16C/62M group.
✻8. Compact emulator is provided.
✻9. Signal converter board for M16C/6S group M16C/6S0. This product is available only for use with the Datalink layer library for M16C/6S, which is planned to be released by Renesas.
✻10. Various other useful accessory tool products are also available.
✻11. Use the first combination to perform debug only; use the second combination to perform both debug and on-board evaluation.
✻12. Accessories are included with signal converter board M306S0T-RPB.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.
★★ Under development or evaluation: product name may be changed or MCU is under development.

List of Tools

Operating Environment for M32C/90, M32C/80, M16C/80 Series

Product type	Product type name	Host machine (OS)
RTOS	M3T-MR308 *1	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
C compiler package	M3T-NC308WA *2	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
MISRA C rule checker SQMlint	R0C00000SCW01R *3	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Simulator debugger	M3T-PD308SIM *4	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
IDE	High-performance Embedded Workshop *5	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
Emulator debugger for PC7501 (M32C/80 Series)	M3T-PD308F *6	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Emulator debugger for PC4701U (M32C/80, M16C/80 Series)	M3T-PD308 *7	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)

✻1. M3T-MR308 is the generic name for real-time OS development kit (M3T-MR308K) and mass production contract (M3T-MR308S).
✻2. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻3. M3T-NC308WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and simulator debugger M3T-PD308SIM.
✻4. M3T-PD308SIM is included with C compiler package.
✻5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻6. M3T-PD308F is bundled with emulator PC7501.
✻7. M3T-PD308 is bundled with emulator PC4701U.

Product type names of RTOS for M32C/90, M32C/80, M16C/80 Series

Product name	Product type name *1	Specification	Host machine (OS)
M3T-MR308	R0R30800TRW01wE	µ ITRON3.0	IBM PC/AT compatibles (Windows® XP, 98, Me, 2000, NT® 4.0)

✻1. w="1": Evaluation contract, one host machine
w="5": Evaluation contract, up to 5 host machines
w="A": Evaluation contract, up to 10 host machines
w="K": Mass production contract, up to 1,000 user systems
w="U": Mass production contract, no limit on the number of user systems
w="Z": Mass production contract, no limit on the number of user systems, with kernel source code

Compact Emulators for M16C/80 Series

Series	Group	Product name	Accessories			
			Package type	Package name		Recommended accessories *1
M16C/80	**M16C/80**	M30800T-CPE (RAM 10K)	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100-KB-A	M3T-F160-100NSD (optional)
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
			144-pin 0.5-mm-pitch LQFP	144P6Q-A	PLQP0144KA-A	M3T-FLX-144NSD (optional)

✻1. Various other useful accessory tool products are also available.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Programmers for M16C/80 Series

Series	Memory	Package type	Package name		Programmer *1
M16C/80	Flash	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100-KB-A	M3A-0665, M3A-0806, EFP-I*2, NET IMPRESS*3, R4953*4, AF9708*5, AF9709*5, AF9723*5, MFW-1*6, SFW-62SA*6
		100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	
		144-pin 0.5-mm-pitch LQFP	144P6Q-A	PLQP0144KA-A	

✻1. For detailed information concerning programmers, supported MCUs, and applicability to mass-production or production equipment, please contact the concerned manufacturers.
✻2. EFP-I is a product of Suisei Electronics System Co. Ltd.
✻3. NET IMPRESS is a product of Yokogawa Digital Computer Corporation.
✻4. R4953 is a product of Advantest Corporation.
✻5. AF9708, AF9709, and AF9723 are products of Ando Electric Co. Ltd.
✻6. MFW-1 and SFW-62SA are products of Sunny Giken Inc.

Starter kits for M16C/80 Series

Series	Group	Starter kit	Package type	Package name	
M16C/80	**M16C/80**	M3A-0801G02 (UART version)	100-pin 0.65mm-pitch QFP	100P6S-A	PRQP0100JB-A
		M3A-0802G02 (UART version)	144-pin 0.5mm-pitch LQFP	144P6Q-A	PLQP0144KA-A

Programmers and programming adapters for M16C/60 Series

Series	Group	Memory	Package type	Package name		Programmer *1	Programming adapter
M16C/60	M16C/62A	Flash	80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3A-0665 *2 M3A-0806 *3 Third-party programmer	—
			100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A		
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A		
		OTP	80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	R4945 *4 or R4945A *4	PCA7413F-80
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A		PCA7412F-100
	M16C/62M	Flash	80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3A-0665 *2 M3A-0806 *3 Third-party programmer	—
			100-pin 0.5-mm-pitch LQFP	100P6Q-A	PRQP0100JB-A		
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A		
	M16C/62N	Flash	80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3A-0665 *2 M3A-0806 *3 Third-party programmer	—
			100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A		
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A		
	M16C/62P	Flash	80-pin 0.65-mm-pitch QFP	80P6S-A	PRQP0080JA-A	M3A-0665 *2 M3A-0806 *3 Third-party programmer	—
			100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A		
			100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A		
			128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A		
	M16C/6K	Flash	144-pin 0.4-mm-pitch TQFP	144PFB-A	PTQP0144LA-A	Third-party programmer	—
	M16C/6N	Flash	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3A-0665 *2 M3A-0806 *3 Third-party programmer	—
			100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	S550-MFW1U *5	
			128-pin 0.5-mm-pitch LQFP	128P6Q-A	PLQP0128KB-A	S550-SFW1U *5	
	M16C/6S	Flash	64-pin 0.5-mm-pitch LQFP	64P6Q-A	PLQP0064KB-A	M3A-0806	—
	M16C/6V	Flash	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3A-0665 Third-party programmer	—
		OTP	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	R4945 *4 or R4945A *4	PCA7412F-100
	M16C/6H	Flash	116-pin 0.65-mm-pitch LQFP	116P6A-A	PLQP0116JA-A	Third-party programmer	—

*1. Partner products are available for flash memory. For detailed information concerning programmers, supported MCUs, and applicability to mass-production or production equipment, please contact the concerned manufacturers.
*2. M3A-0665 will support MCUs under development of M16C/62P and M16C/6N and MCUs of 100PFB-A and 80P6S-A package of M16C/62N.
*3. Cannot rewrite the ROM+4K area.
*4. R4945 and R4945A are products of Advantest Corporation.
*5. S550-MFW1U and S550-SFW1U are products of Sunny Giken Inc.

Starter kits for M16C/60 Series

Series	Group	Starter kit	Package type	Package name	
M16C/60	M16C/62A	M3A-0654G02 (UART version)	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A
	M16C/62M	M3A-0654G01 (UART version)	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A
	M16C/62P	M3A-0664 (FoUSB version)	100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A

Compact emulators for M16C/60, M16C/30 Series

Series	Group	Product name	Remarks	Accessories *1		
				Package type	Package name	Recommended accessories
M16C/60	M16C/62A	M30620T-CPE	[3.0-5.0V] 10 MHz 0-wait [3.3-5.0V] 16 MHz 0-wait	100-pin 0.5-mm-pitch LQFP	100P6Q-A PLQP0100KB-A	M3T-100LCC-QSD (optional)
				100-pin 0.65-mm-pitch QFP	100P6S-A PRQP0100JB-A	LCC socket (optional)
				80-pin 0.65-mm-pitch QFP	80P6S-A PRQP0080JA-A	M3T-100LCC-80QSB (optional)
M16C/30	M16C/30	M30620T-CPE	[3.0-5.0V] 10 MHz 0-wait [3.3-5.0V] 16 MHz 0-wait	100-pin 0.5-mm-pitch LQFP	100P6Q-A PLQP0100KB-A	M3T-100LCC-QSD (optional)
				100-pin 0.65-mm-pitch QFP	100P6S-A PRQP0100JB-A	LCC socket (optional)
M16C/60	M16C/6K (M306K9)	M306K9T2-CPE	[3.0-3.6V] 16 MHz 0-wait	144-pin 0.4-mm-pitch TQFP	144PFB-A PLQP0144KA-A	M3T-FLX-144NSE (optional)

*1. Various other useful accessory tool products are also available.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Emulation pods for M16C/62x, M16C/30x Groups (PC4701 emulators)

MCU			M30620T2-RPD-E *1 [16 MHz, 2.7-5.5V]	M30620TL-RPD-E [10MHz, 2.2-3.6V]	M3062NT3-RPD-E [16MHz, 2.2-3.6V]	M3062PT3-RPD-E [16MHz, 2.7-5.5V]
Group	MCU	Specifications				
M16C/62A	M3062xx	[16 MHz, 2.7-5.5V]	Available	Unavailable	Unavailable	Unavailable
	M3062xxT	[16 MHz, 4.2-5.5V]				
	M3062xxU	[16 MHz, 4.2-5.5V]				
	M3062xxV	[16 MHz, 4.2-5.5V]				
	M3062xxA	[16 MHz, 2.7-5.5V]				
M16C/30	M3030xx	[16 MHz, 2.7-5.5V]				
M16C/62M	M3062xxM	[10 MHz, 2.2-3.6V]	Unavailable	Available	Unavailable	Unavailable
M16C/62N	M3062xxN	[16 MHz, 2.2-3.6V]	With limits [5 MHz, 2.7-3.6V]	With limits [10 MHz, 3.0-3.6V]	Available	Unavailable
M16C/30L	M3030xxxL	[16 MHz, 2.2-3.6V]				
M16C/62P	M3062xxxP	[24 MHz, 2.7-5.5V]	Unavailable	Unavailable	Unavailable	With limits [16 MHz, 3.2-5.5V] *2
M16C/30P	M3030xxxP	[16 MHz, 2.7-5.5V]				

*1. The earlier models (discontinued products), M30620T-RPD-E and M30620TB-RPD-E, do not allow to debug M16C/62 Group A version.
*2. For MCU operating frequency of over 16 MHz, use emulator PC7501 and emulation probe M3062PT2-EPB.

Product type names of RTOS for M16C/60, M16C/30, M16C/20, M16C/10 Series

Product name	Product type name *1	Specification	Host machine (OS)
M3T-MR30	R0R30600TRW01wE	µ ITRON3.0	IBM PC/AT compatibles (Windows® XP, 98, Me, 2000, NT® 4.0)

*1. w="1": Evaluation contract, one host machine
w="5": Evaluation contract, up to 5 host machines
w="A": Evaluation contract, up to 10 host machines
w="K": Mass production contract, up to 1,000 user systems
w="U": Mass production contract, no limit on the number of user systems
w="Z": Mass production contract, no limit on the number of user systems, with kernel source code

Operating Environment for M16C/60, M16C/30, M16C/20, M16C/10 Series

Product type	Product type name	Host machine (OS)
RTOS	M3T-MR30 *1	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
C compiler package	M3T-NC30WA *2	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
MISRA C rule checker SQMlint	R0C00000SCW01R *3	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Simulator debugger	M16C R8C Simulator Debugger *4	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30SIM *4	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
IDE	High-performance Embedded Workshop *5	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
Emulator debugger for PC7501	M16C R8C PC7501 Emulator Debugger *6	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30F *7	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Emulator debugger for PC4701U	M16C PC4701 Emulator Debugger *6	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30 *8	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)

*1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
*2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
*3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
*4. M16C R8C Simulator Debugger and M3T-PD30SIM are included with C compiler package.
*5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
*6. M16C R8C PC7501 Emulator Debugger (without OS debugging function) and M16C PC4701 Emulator Debugger (without OS debugging function) are bundled with emulator PC7501, PC4701, compact emulator M30290T2-CPE, and FoUSB M3A-0665 as M16C R8C Debugger Package.
*7. M3T-PD30F (support OS debugging function) is bundled with emulator PC7501. M3T-PD30F can be started as an external tool in High-performance Embedded Workshop.
*8. M3T-PD30 (support OS debugging function) is bundled with emulator PC4701U. M3T-PD30 can be started as an external tool in High-performance Embedded Workshop.

Operating Environment for M16C/Tiny Series

Product type	Product type name	Host machine (OS)
RTOS	M3T-MR30 *1	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
C compiler package	M3T-NC30WA *2	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
MISRA C rule checker SQMlint	R0C00000SCW01R *3	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Simulator debugger	M16C R8C Simulator Debugger *4	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30SIM *4	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
IDE	High-performance Embedded Workshop *5	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
Emulator debugger for PC7501	M16C R8C PC7501 Emulator Debugger *6	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30F *7	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Emulator debugger for PC4701U	M16C PC4701 Emulator Debugger *6	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30 *8	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)

*1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
*2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
*3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
*4. M16C R8C Simulator Debugger and M3T-PD30SIM are included with C compiler package.
*5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
*6. M16C R8C PC7501 Emulator Debugger (without OS debugging function) and M16C PC4701 Emulator Debugger (without OS debugging function) are bundled with emulator PC7501, PC4701, compact emulator M30290T2-CPE, and FoUSB M3A-0665 as M16C R8C Debugger Package.
*7. M3T-PD30F (support OS debugging function) is bundled with emulator PC7501. M3T-PD30F can be started as an external tool in High-performance Embedded Workshop.
*8. M3T-PD30 (support OS debugging function) is bundled with emulator PC4701U. M3T-PD30 can be started as an external tool in High-performance Embedded Workshop.

Product Type Names of RTOS for M16C/Tiny Series

Product name	Product type name *1	Specification	Host machine (OS)
M3T-MR30	R0R30600TRW01wE	µ ITRON3.0	IBM PC/AT compatibles (Windows® XP, 98, Me, 2000, NT® 4.0)

*1. w="1": Evaluation contract, one host machine
w="5": Evaluation contract, up to 5 host machines
w="A": Evaluation contract, up to 10 host machines
w="K": Mass production contract, up to 1,000 user systems
w="U": Mass production contract, no limit on the number of user systems
w="Z": Mass production contract, no limit on the number of user systems, with kernel source code

Programmers and programming adapters for M16C/20 Series

Series	Group	Memory	Package type	Package name		Programmer *1	Programming adapter
M16C/20	**M16C/24**	Flash	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3A-0665 Third-party programmer	—
		OTP	80-pin 0.8-mm-pitch QFP	80P6N-A	PRQP0080GB-A	R4945 *2 or R4945A *2	PCA7302E1F-80

*1. Partner products are available for flash memory. For detailed information concerning programmers, supported MCUs, and applicability to mass-production or production equipment, please contact the concerned manufacturers.
*2. R4945 and R4945A are products of Advantest Corporation.

Programmers for M16C/10 Series

Series	Group	Memory	Package type	Package name		Programmer
M16C/10	**M16C/10**	Flash	32-pin 0.8-mm-pitch LQFP	32P6U-A	PLQP0032GB-A	M3A-0665
			48-pin 0.5-mm-pitch LQFP	48P6Q-A	PLQP0048KB-A	M3A-0806
	M16C/1N		48-pin 0.5-mm-pitch LQFP	48P6Q-A	PLQP0048KB-A	M3A-0806 *1

*1. Cannot rewrite the ROM+4K area.

Development tools for M16C/Tiny Series

MCU			Introductory tool	Software tools			Emulator (with debugger ✻7)			Flash programming	
										In-circuit emulator	
Series	Group	MCU	Starter kit	RTOS	C compiler package (with simulator debugger)	IDE	Onchip debugging emulator	Compact emulator		Emulator	Emulation pod	Flash programmer
M16C/Tiny	M16C/26A	M30260 ★★	M3A-0264 ✻1 (with E8)★★	M3T-MR30 ✻3	M3T-NC30WA ✻4 (MISRA C ✻5)	High-performance Embedded Workshop ✻6	E8 ✻8 ★★	M30290T2-CPE ✻9		PC7501	M30290T-EPB ✻10	M3A-0665 ✻11 M3A-0806 ✻12 Third-party programmer
		M30263 ★★										
	M16C/28	M30280	M3A-0284 ✻2 (with FoUSB M3A-0665)									
		M30281										
	M16C/29	M30290 ★★										
		M30291 ★★										

✻1. Starter kit M3A-0264 will bundle a CPU board, onchip debugging emulator E8, software (Evaluation version of C compiler package M3T-NC30WA, IDE High-performance Embedded Workshop, E8 emulator debugger, and Evaluation version of Flash Development Toolkit, etc.).
✻2. Starter kit M3A-0284 bundles a CPU board, FoUSB M3A-0665, software (Evaluation version of C compiler package M3T-NC30WA, Emulator debugger KD30, etc.).
✻3. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
✻4. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
✻5. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻6. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻7. You can download the latest version of the following debuggers: M16C R8C Debugger Package (without OS debugging function), M3T-PD30F (for PC7501 emulator / with OS debugging function), M3T-PD30 (for PC4701 emulator / with OS debugging function). M3T-PDxx can be started as an external tool in High-performance Embedded Workshop.
✻8. E8 emulator includes software (High-performance Embedded Workshop, E8 emulator debugger, Evaluation version of C compiler package M3T-NC30WA, Evaluation version of Flash Development Toolkit). Depending on the time of delivery, the bundled software you purchased may include the previous version. You can download the latest version without charge from the web page at http://download.renesas.com/eng/mpumcu/index.html.
✻9. The conversion board for the target connection is necessary for M30290T-CPE. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of "Compact emulators for M16C/Tiny Series" and "Converter board for M16C/Tiny Series".
✻10. The conversion board for the target connection is necessary for M30290T-EPB. The set sales of the emulator and the conversion board are also available. For details, please refer to the lists of "Emulation probes for PC7501 emulator for M16C/Tiny Series" and "Converter board for M16C/Tiny Series".
✻11. Can rewrite data flash area.
✻12. Cannot rewrite data flash area.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Development tools for M16C/20 Series

MCU			Software tools				Hardware tools			Accessories		
Series	Group	MCU	RTOS	C compiler package (with simulator debugger)	IDE	Emulator (with emulator debugger ✻5)	Emulation pod	Pod probe		Package type	Package name	Recommended accessories
M16C/20	M16C/24	M30240	M3T-MR30 ✻1	M3T-NC30WA ✻2 (MISRA C ✻3)	High-performance Embedded Workshop ✻4	PC4701U	M30240T-RPD-E	—		80-pin 0.8-mm-pitch QFP	80P6N-A	M3T-FLX-80NRA (optional)
		M30245					M30245T3-RPD-E	—		100-pin 0.5-mm-pitch LQFP	100P6Q-A	M3T-FLX-100NSD (included)

✻1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
✻2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
✻3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻4. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻5. You can download the latest version of the following debuggers: M16C R8C Debugger Package (without OS debugging function), M3T-PD30F (for PC7501 emulator / with OS debugging function), M3T-PD30 (for PC4701 emulator / with OS debugging function). M3T-PDxx can be started as an external tool in High-performance Embedded Workshop.
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Development tools for M16C/10 Series

MCU			Software tools				Hardware tools			Accessories		
Series	Group	MCU	RTOS	C compiler package (with simulator debugger)	IDE	Emulator (with emulator debugger ✻5)	Emulation pod	Pod probe		Package type	Package name	Recommended accessories
M16C/10	M16C/10	M30100	M3T-MR30 ✻1	M3T-NC30WA ✻2 (MISRA C ✻3)	High-performance Embedded Workshop ✻4	PC4701U	M30100T3-RPD-E	M30100T-PRB		32-pin 0.8-mm-pitch LQFP	32P6U-A	M30100T-PTC (optional)
		M30102								48-pin 0.5-mm-pitch LQFP	48P6Q-A	M30102T-PTC (optional)
	M16C/1N	M301N2						M301N2T-PRB		48-pin 0.5-mm-pitch LQFP	48P6Q-A	M30102T-PTC (optional)

✻1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
✻2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
✻3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
✻4. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
✻5. You can download the latest version of the following debuggers: M16C R8C Debugger Package (without OS debugging function), M3T-PD30F (for PC7501 emulator / with OS debugging function), M3T-PD30 (for PC4701 emulator / with OS debugging function). M3T-PDxx can be started as an external tool in High-performance Embedded Workshop.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Development tools for M16C/30 Series

MCU / Software tools / Hardware tools

Series	Group	MCU	RTOS	C compiler package (with simulator debugger)	IDE	Emulator (with emulator debugger*5)	Emulation pod or probe*7	Package type	Package name		Accessories: Recommended accessories *8 *9
M16C/30	M16C/30	M30302	M3T-MR30*1	M3T-NC30WA*2 (MISRA C*3)	High-performance Embedded Workshop *4	PC4701U	M30620T2-RPD-E	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-FLX-100NSD (optional)
								100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	M3T-FLX-100NRB (optional)
	M16C/30L						M3062NT3-RPD-E	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
								100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
	M16C/30P**					PC7501*6	M3062PT-EPB or M3062PT2-EPB** *6	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
								100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)
						PC4701U*6	M3062PT3-RPD-E *6	100-pin 0.5-mm-pitch LQFP	100P6Q-A	PLQP0100KB-A	M3T-F160-100NSD (optional)
								100-pin 0.65-mm-pitch QFP	100P6S-A	PRQP0100JB-A	(1) M30800T-PTC (included) + LCC socket (included) (2) M30800T-PTC (included) + M3T-100LCC-DMS (optional) + M3T-FLX-100NRB (optional)

*1. M3T-MR30 is the generic name for real-time OS development kit (M3T-MR30K) and mass production contract (M3T-MR30S).
*2. M3T-NC30WA includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler, M16C R8C simulator debugger (without OS debugging function), and M3T-PD30SIM (with debugging function). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
*3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
*4. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
*5. You can download the latest version of the following debuggers: M16C R8C Debugger Package (without OS debugging function), M3T-PD30F (for PC7501 emulator / with OS debugging function), M3T-PD30 (for PC4701 emulator / with OS debugging function). M3T-PDxx can be started as an external tool in High-performance Embedded Workshop.
*6. MCU operating frequency is 24 MHz for PC7501 and M3062PT-EPB or M3062PT2-EPB (under development), 16 MHz for PC4701U and M3062PT3-RPD-E.
*7. Choose an emulation pods depending on MCU. For details see "Emulation pods for M16C/62x, M16C/30 Groups (PC4701 emulators)".
*8. Various other useful accessory tool products are also available.
*9. Use the first combination to perform debug only; use the second combination to perform both debug and on-board evaluation.
★★ MCU under development
(included): Included with compact emulator, emulation pod or probe.
(optional): Not included with compact emulator, emulation pod or probe. Purchase it separately.

Development Tools for R8C/Tiny Series

MCU / Introductory tool / C compiler package / Emulator (with debugger) / Flash programming

Series	Group	MCU	Starter kit *1	C compiler package	IDE	Onchip debugging emulator	Compact emulator	In-circuit emulator: Emulator	In-circuit emulator: Emulation probe	Flash programmer	IC socket
R8C/Tiny	R8C/10	R5F21102	M3A-0113 (with E8)	M3T-NC30WA Professional version *4 or M3T-NC30WA Evaluation version *5 (MISRA C *3)	High-performance Embedded Workshop *7	E8 *6 *7	R0E521000CPE00 *8 ★★	PC7501	R0E521000EPB00 *8 ★★	Flash Development Toolkit *10 or FoUSB M3A-0665 or M16C Flash Starter M3A-0806 *11	M3A-0112
		R5F21103									
		R5F21104									
	R8C/11	R5F21112									
		R5F21113									
		R5F21114									
	R8C/12	R5F21122									
		R5F21123									
		R5F21124									
	R8C/13	R5F21132									
		R5F21133									
		R5F21134									
	R8C/14	R5F21142	M3A-0115 (with E8)			E8 *6				"Flash Development Toolkit *10 or M16C Flash Starter M3A-0806 *11	M3A-0114 ★★
		R5F21143									
		R5F21144									
	R8C/15	R5F21152									
		R5F21153									
		R5F21154									
	R8C/16	R5F21162	M3A-0117 (with E8)								
		R5F21163									
		R5F21164									
	R8C/17	R5F21172									
		R5F21173									
		R5F21174									
	R8C/18**	R5F21181	M3A-0115 (with E8)			E8 *6 ★★				Flash Development Toolkit *10 ★★ or M16C Flash Starter M3A-0806 *11 ★★	★★
		R5F21182									
		R5F21183									
		R5F21184									
	R8C/19**	R5F21191	M3A-0117 (with E8)								
		R5F21192									
		R5F21193									
		R5F21194									
	R8C/20**	R5F21206	—			E8 *6 ★★				M16C Flash Starter M3A-0806 *11★★	—
		R5F21207									
	R8C/21**	R5F21216									
		R5F21217									
	R8C/22**	R5F21226									
		R5F21227									
	R8C/23**	R5F21236									
		R5F21237									
	R8C/24**	R5F21244	★★★								★★★
		R5F21246									
	R8C/25**	R5F21254									
		R5F21256									

*1. Starter kit M3A-0113, M3A-0115, and M3A-0117 bundles a CPU board, Onchip debugging emulator E8, software (Evaluation version of C compiler M3T-NC30WA, IDE High-performance Embedded Workshop, E8 emulator debugger, and Evaluation version of Flash Development Toolkit, etc.).
*2. M3T-NC30WA professional version includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and M16C R8C simulator debugger (without OS debugging function), M3T-PD30SIM (support OS debugging function)). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
*3. M3T-NC30WA evaluation version includes integrated development environment (High-performance Embedded Workshop, C compiler, assembler and M16C R8C simulator debugger (without OS debugging function). You can download M3T-NC30WA evaluation version without charge. The link size will be restricted to 64 Kbytes on and after the 61st day from when you begin using the compiler. The support service is not available.
*4. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
*5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
*6. E8 emulator includes software for emulator (High-performance Embedded Workshop, E8 emulator debugger, Evaluation version of C compiler package M3T-NC30WA, Evaluation version of Flash Development Toolkit). Depending on the time of delivery, the bundled software you purchased may include the previous version. You can download the latest version without charge from the web page at http://download.renesas.com/eng/mpumcu/index.html.
*7. You can use E7 emulator. E7 emulator comes with High-performance Embedded Workshop V.3.0 (with builder and E7 debugger). You can download E7 debugger from the Renesas website even if it is not included in your E7.
*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 "Compact emulators for R8C/Tiny Series" and "Converter board 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 "Emulation probes for PC7501 emulator for R8C/Tiny Series" and "Converter board for R8C/Tiny Series".
*10. There are two kinds of Flash Development Toolkit (product version with technical support and evaluation version without technical support). Refer to the download site page for the difference: http://download.renesas.com/eng/mpumcu/evaluation_software/flash_and_prom_programming/fdt/index.html
*11. Flash Programmer which supports standard serial I/O mode 2 (UART) and includes the M16C Flash Starter Software (for Windows).
*12. The IC socket board is an adapter board for programmers that allows to program R8C/Tiny.
★★ Under development or evaluation: product name may be changed or MCU is under development.
★★★ Under planning.

List of Tools

Programmers for M16C/Tiny Series

Series	Group	Memory	Package type	Package name	Programmer *1
M16C/Tiny	M16C/26A ★★	Flash	42-pin 0.8-mm-pitch SSOP	42P2R-E	M3A-0665 *2 M3A-0806 *3 Third-party programmer
			48-pin 0.5-mm-pitch LQFP	48P6Q-A	
	M16C/28		64-pin 0.5-mm-pitch LQFP	64P6Q-A	
			80-pin 0.5-mm-pitch LQFP	80P6Q-A	
	M16C/29 ★★		64-pin 0.5-mm-pitch LQFP	64P6Q-A	
			80-pin 0.5-mm-pitch LQFP	80P6Q-A	

*1. Partner products are available for flash memory. For detailed information concerning programmers, supported MCUs, and applicability to mass-production or production equipment, please contact the concerned manufacturers.
*2. Can rewrite data flash area.
*3. Cannot rewrite data flash area.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Converter Board for M16C/Tiny Series

Series	Group	Target MCU		Product name
		Package type	Package name	
M16C/Tiny	M16C/26A (M30260)	48-pin 0.5-mm-pitch LQFP	48P6Q-A	M30260T-48FPD
	M16C/26A (M30263)	42-pin 0.8-mm-pitch SSOP	42P2R-E	M30263T-42SSB
	M16C/28 (M30280) M16C/29 (M30290)	80-pin 0.5-mm-pitch LQFP	80P6Q-A	M30290T-80FPD
	M16C/28 (M30281) M16C/29 (M30291)	64-pin 0.5-mm-pitch LQFP	64P6Q-A	M30291T-64FPD

Spare MCU Board for M16C/Tiny Series

Series	Group	Target MCU		Product name
		Package type	Package name	
M16C/Tiny	M16C/26A (M30260)	48-pin 0.5-mm-pitch LQFP	48P6Q-A	M30290T-EPBM
	M16C/26A (M30263)	42-pin 0.8-mm-pitch SSOP	42P2R-E	
	M16C/28 (M30281)	80-pin 0.5-mm-pitch LQFP	80P6Q-A	
	M16C/29 (M30291)	64-pin 0.5-mm-pitch LQFP	64P6Q-A	

Operating Environment for R8C/Tiny Series

Product type	Product type name	Host machine (OS)
C compiler package	M3T-NC30WA *1*2	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
MISRA C rule checker SQMlint	R0C00000SCW01R *3	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
Simulator debugger	M16C R8C Simulator Debugger *4	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	M3T-PD30SIM *4	IBM PC/AT compatibles (Windows® XP, Me, 98, 2000, NT® 4.0)
IDE	High-performance Embedded Workshop *5	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
Emulator debugger	E8 emulator debugger *6	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)
	E7 emulator debugger *7	IBM PC/AT compatibles (Windows® XP, Me, 98SE, 2000)

*1. M3T-NC30WA professional version includes integrated development environment (High-performance Embedded Workshop, TM), C compiler, assembler and M16C R8C simulator debugger (without OS debugging function),
M3T-PD30SIM (support OS debugging function)). M3T-PD30SIM can be started as an external tool in High-performance Embedded Workshop.
*2. M3T-NC30WA evaluation version includes integrated development environment (High-performance Embedded Workshop, C compiler, assembler and M16C R8C simulator debugger (without OS debugging function). You can download M3T-NC30WA evaluation version without charge.
The link size will be restricted to 64 Kbytes on and after the 61st day from when you begin using the compiler. The support service is not available.
*3. MISRA C rule checker SQMlint (type name: R0C00000SCW01R) is an optional product for the Renesas C compiler.
*4. M16C R8C simulator debugger and M3T-PD30SIM are bundled with C compiler package.
*5. High-performance Embedded Workshop is included with C compiler package. Integrated development environment TM is also available.
*6. E8 emulator debugger is bundled with E8 emulator.
*7. E7 emulator debugger is bundled with E7 emulator.

Compact Emulators for R8C/Tiny Series

Series	Group	Target MCU		Product name	Contents *1
		Package type	Package name		
R8C/Tiny	**R8C/10 R8C/11 R8C/12 R8C/13**	32-pin 0.8-mm-pitch LQFP	32P6U-A	R0E521134CPE00**	Compact emulator R0E521000CPE00 Converter board R0E521134CFG00
	R8C/14 R8C/15 R8C/16	20-pin 0.65-mm-pitch SSOP	20P2F-A	R0E521174CPE00**	Compact emulator R0E521000CPE00 Converter board R0E521174CSJ00
	R8C/17 R8C/18 R8C/19	20-pin 1.778-mm-pitch SDIP	20P4B	R0E521174CPE10**	Compact emulator R0E521000CPE00 Converter board R0E521174CDB00

*1. Compact emulator and converter board are also sold separately.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Emulation Probes for PC7501 Emulator for R8C/Tiny Series

Series	Group	Target MCU		Product name	Contents *1
		Package type	Package name		
R8C/Tiny	**R8C/10 R8C/11 R8C/12 R8C/13**	32-pin 0.8-mm-pitch LQFP	32P6U-A	R0E521134EPB00**	Emulation probe R0E521000EPB00 Converter board R0E521134CFG00
	R8C/14 R8C/15 R8C/16	20-pin 0.65-mm-pitch SSOP	20P2F-A	R0E521174EPB00**	Emulation probe R0E521000EPB00 Converter board R0E521174CSJ00
	R8C/17 R8C/18 R8C/19	20-pin 1.778-mm-pitch SDIP	20P4B	R0E521174EPB10**	Emulation probe R0E521000EPB00 Converter board R0E521174CDB00

*1. Emulation probe and converter board are also sold separately.
★★ Under development or evaluation: product name may be changed or MCU is under development.

Converter Board for R8C/Tiny Series

Series	Group	Target MCU		Product name
		Package type	Package name	
R8C/Tiny	**R8C/10 R8C/11 R8C/12 R8C/13**	32-pin 0.8-mm-pitch LQFP	32P6U-A	R0E521134CFG00**
	R8C/14 R8C/15 R8C/16	20-pin 0.65-mm-pitch SSOP	20P2F-A	R0E521174CSJ00**
	R8C/17 R8C/18 R8C/19	20-pin 1.778-mm-pitch SDIP	20P4B	R0E521174CDB00**

★★ Under development or evaluation: product name may be changed or MCU is under development.

Partners Tools

Coding Tools

Embedded Development Environment codelab EDE
Accelerated Technology, Embedded Systems Division of Mentor Graphics
E-mail: info@acceleratedtechnology.com
http://www.acceleratedtechnology.com/
http://www.mentor.com/embedded/

TASKING M16C Software Development Toolset,
TASKING R8C/Tiny Software Development Toolset
Altium Limited
E-mail: info@altium.com
http://www.altium.com/tasking

IDE for embedded real-time systems OPENplus
Overseas: Gaio Technology, Inc.
E-mail: info@gaio.com
http://www.gaio.com/
Japan: Gaio Technology Co., Ltd.
E-mail: sales@gaio.co.jp
http://www.gaio.com/

IAR Embedded Workbench
Americas: IAR Systems Inc.
E-mail: info@iar.com
http://www.iar.com
Northern/Southern Europe & Asia: IAR Systems AB
E-mail: info@iar.se
http://www.iar.com
Japan: IAR Systems K.K.
E-mail: info@iarsys.co.jp
http://www.iarsys.co.jp
Germany, Central & Eastern Europe
E-mail: info@iar.de
http://www.iar.com

Red Hat® GNUPro®
Red Hat, Inc.
http://www.redhat.com/

IAR EWM16C
SEEGER Microcontroller Systeme GmbH
E-mail: info@segger.com
http://www.segger.com/

Emulation and Debugging

Emulator Ultra-M16C
International Headquarters: Ashling Microsystems Ltd.
E-mail: sales.ie@ashling.com
http://www.ashling.com/
USA and Canada: Ashling Microsystems Inc.
E-mail: sales.usa@ashling.com
Germany: AK Elektronik
E-mail: pkl@ak-elektronik.de
E-mail: gt@ak-elektronik.de
France: Ashling Microsystems sarl
E-mail: sales.fr@ashling.com
UK: Ashling Microsystems (UK) Limited
E-mail: sales.uk@ashling.com

Emulator EMUL-M16C-PC
Nohau Corporation
E-mail: sales@nohau.com
http://www.nohau.com/

Compact emulator M30830T-CPE, M3062PT-CPE
Sunny Giken Inc.
E-mail: support_apl@renesas.com
http://www.sunnygiken.co.jp/english/

Emulator advicePlus, Emulator advice
Yokogawa Digital Computer Corporation
E-mail: info@advice.ydc.co.jp
http://www.advice-plus.com/

Emulator EJ-Debugger, UniSTAC II, HyperSTAC
Global: Sophia Systems Co., Ltd.
E-mail: sales@sophia.com
http://www.sophia.com
United States and Canada: Enable Engineering Co., Inc
E-mail: sales@eecosales.com
http://www.eecosales.com
France: Antycip
E-mail: akkouche@antycip.com
http://www.antycip.com
United Kingdom: Direct Insight
E-mail: sales@directinsight.co.uk
http://www.directinsight.co.uk
Eastern Europe:
Eastern Trade Embedded Systems Trading and Consulting GmbH
E-mail: info@easterntrade.de
http://www.easterntrade.de
Israel: Sightsys
E-mail: dani@sightsys.co.il
http://www.sightsys.co.il
China & Hong Kong:
EmDoor Electronic & Technology Co., Ltd.
E-mail: sam@emdoor.com
http://www.emdoor.com
Korea: MDS Technology
E-mail: hyungkwan@hkmds.com
http://www.mdstec.com
Taiwan: SuperLink Technologies
E-mail: sulin@superlink.com.tw
http://www.superlink.com.tw
Singapore/Malaysia: Flash Technology
E-mail: flashsgp@pacific.net.sg
http://www.flashtech.com.sg
North India: Trident Infosol
E-mail: msashok@tridentinfosol.com
http://www.tridentinfosol.com
South India: Steffi Smile Agencies
E-mail: rameshwarbandi@vsnl.net

OS

Real Time Operating System Nucleus PLUS, Nucleus µiPLUS
Accelerated Technology, Embedded Systems Division of Mentor Graphics
E-mail: info@acceleratedtechnology.com
http://www.acceleratedtechnology.com/
http://www.mentor.com/embedded/

CMX-RTX, CMX-Tiny+
Altium Limited
E-mail: info@altium.com
http://www.altium.com/tasking

CMX-RTX, CMX-Tiny+
CMX Systems, Inc.
E-mail: cmx@cmx.com
http://www.cmx.com/

RTA-OSEK
Europe, USA, Asia Pacific: LiveDevices, ETAS Group
E-mail: info@livedevices.com
http://en.etasgroup.com/products/rta/index.shtml

OSE Epsilon RTOS
Europe: Enea Embedded Technology
E-mail: info.ose@enea.se
http://www.ose.com/
USA: Enea Embedded Technology
E-mail: info@enea.com
http://www.ose.com/
Asia Pacific: Enea Embedded Technology
E-mail: osesales_jp@enea.se
http://www.ose.com/jp

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

Internet communication sevenstax
sevenstax GmbH
E-mail: info@sevenstax.de
http://www.sevenstax.de

Multitasking real-time operating system osCAN, Tool for simulation and testing of networks and electronic control units CANoe
Asia: Vector Japan Co., Ltd.
E-mail: eng@vector-japan.co.jp
http://www.vector-japan.co.jp/./products/canbedded.html
Europe (Germany): Vector Infomatik GmbH
E-mail: info@vector-infomatik.de
http://www.vector-infomatik.de/
USA: Vector CANtech Inc.
E-mail: info@vector-cantech.com
http://www.vector-cantech.com

Middleware and Driver

CMX TCP/IP, CMX MicroNet
Altium Limited
E-mail: info@altium.com
http://www.altium.com/tasking

CMX-MicroNet, CMX TCP/IP, CMX-FFS, CMX-FFS-FAT
CMX Systems, Inc.
E-mail: cmx@cmx.com
http://www.cmx.com

GR-USB Series, GR-PictBG
Grape Systems Inc.
E-mail: middle@info.grape.co.jp
http://www.grape.co.jp/

IAR visualSTATE
Americas: IAR Systems Inc.
E-mail: info@iar.com
http://www.iar.com
Northern/Southern Europe & Asia
E-mail: info@iar.se
http://www.iar.com
Japan: IAR Systems K.K
E-mail: info@iarsys.co.jp
http://www.iarsys.co.jp
Germany, Central & Eastern Europe
E-mail: info@iar.de
http://www.iar.com

Real-time OS, emWin, emFile, emLoad
SEGGER Microcontroller Systeme GmbH
E-mail: info@segger.com
http://www.segger.com/

Protocols and drivers for CAN communication CANbedded
Asia: Vector Japan Co., Ltd.
E-mail: eng@vector-japan.co.jp
http://www.vector-japan.co.jp/./products/canbedded.html
Europe (Germany): Vector Infomatik GmbH
E-mail: info@vector-infomatik.de
http://www.vector-infomatik.de/
USA: Vector CANtech Inc.
E-mail: info@vector-cantech.com
http://www.vector-cantech.com

Internet communication sevenstax
sevenstax GmbH
E-mail: info@sevenstax.de
http://www.sevenstax.de

Flash and PROM Programming

Programmer AF9708, AF9709B, AF9723
USA and Canada: FXP LIMITED, INC.
E-mail: holepack@aol.com
http://www.j-fsg.co.jp
Europe: Ando Europe B.V.
E-mail: mid@ando.nl
http://www.j-fsg.co.jp/
Japan: Flash Support Group, Inc.
E-mail: support@j-fsg.co.jp
http://www.j-fsg.co.jp/

Programming tool for Renesas flash microcontrollers with on-chip flash Flasher 4
SEGGER Microcontroller Systeme GmbH
E-mail: info@segger.com
http://www.segger.com/

Model 1894
Minato Electronics Inc.
E-mail: h_kinoshita@minato.co.jp
http://www.minato.co.jp/index_e.asp

Universal Programmer ALL-11
HI-LO SYSTEM RESEARCH CO., LTD.
E-mail: sales@hilosystems.com.tw
http://www.hilosystems.com.tw/

Multifunctional Flash Microcomputer Programmer S550-MFW1U, Ultra Small Flash Microcomputer Programmer S550-SFW1U
Sunny Giken Inc.
E-mail: support_apl@renesas.com
http://www.sunnygiken.co.jp/english/

Flash Memory Programmer EFP-I, MSP-II
Suisei Electronics System Co., Ltd.
E-mail: support@suisei.co.jp
http://www.suisei.co.jp/index_e.htm

3980xpi™, FlashPAK™, MultiSyte™
United States, Canada and Mexico: Data I/O Corporation
http://www.dataio.com
Europe, Africa and Middle East: Data I/O GMBH
http://www.dataio.de
China - Hong Kong: Data I/O China Limited
http://www.dataio.com.cn
Japan: Data I/O Japan/Synchro-Work Corp
http://www.data-io.co.jp

Flash programming and testing system Y1100-8T
Wave Technology Co., Ltd.
E-mail: sales@y1000.com
http://www.y1000.com/index_e.html

In-circuit Flash Micom Programmer NET IMPRESS
USA and Canada:
Yokogawa Digital Computer Corporation of America
http://www.ydc.co.jp/micom/index_E.htm
Europe: Ashling Microsystems Limited
http://www.ashling.com/
Japan: Yokogawa Digital Computer Corporation
http://www.ydc.co.jp/micon/index_E.htm

For the latest partners information, visit http://www.renesas.com/
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Product-Peripheral Function Matrix

Applied field

● :It is best suited. ○ :It is suited.

Series	Group	AV/Home Use: Audio	Video	Household Appliances	Amusement	Computer Related: Computers	Storage Systems	Imaging	Display	Automotive (Supported Products Available): Engine	Pedestrian Safety	Body/Chassis Systems	Navigation/Information	Car Audio	Mobile	Network	Industry/Security	Note
M32C/80	M32C/87★★	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	Application of mass flash memory
	M32C/86	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	
	M32C/85★	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	
	M32C/84★	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	
	M32C/83	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	
	M32C/82	●	○	●	○	○	○	○	○	○	●	●	○	●	○	○	●	
	M32C/81	●	○	●	○	○	○	○	○	○	●	●	○	●	○	●	●	
	M32C/80	●	○	○	●	○	○	○	○				○	○	○	○	●	
M16C/80	M16C/80	○	○	○	●	○	○	○	○	○	●	●	○	○	○	○	●	
M16C/70	M16C/70		○			○	●	○									○	Application of mass flash memory
M16C/60	M16C/6V	○	●				●						○					
	M16C/6S★	○		○												●	○	
	M16C/6N										●	●	○	●		●	●	
	M16C/6K					●												
	M16C/6H		●				●						○					
	M16C/62P	●	○	○	○	○	○	○	○		●	●	○	●	○	○	●	
	M16C/62N	●	○	○	○	○	○	○	○				○	●	○	○	●	
	M16C/62M	●	○	○	○	○	○	○	○				○	●	○	○	●	
M16C/30	M16C/30P	●	○	○	○									●	○	○	○	
	M16C/30L	●	○	○	○									○	○	○	○	
M16C/20	M16C/2N										●	●				●		
	M16C/24				○	●	●	○									○	
M16C/Tiny	M16C/29★★	●		○						○	●	●	○	○		●	●	
	M16C/28★★		○	●	○	○				○	●	●		○			●	
	M16C/26A★★		○	●	○	○				○	●	●		○			●	
M16C/10	M16C/1N★★				●	○		○			●	●				●	●	
R8C/Tiny	R8C/17★		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/16★		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/15★		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/14★		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/13		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/12		○	●	●	○		○					○	○	○	○	●	Photocopiers/Page Printers
	R8C/11		○	●	●	○		○					○	○	○	○	●	Motor Applications/Photocopiers/Page Printers
	R8C/10		○	●									○	○	○	○	●	Photocopiers/Page Printers

★ : New product ★★ : Under development

Function comparison by M16C and M32C Groups

group	data flash	I^2C-bus	IE Bus	CAN	three phase PWM	3V operation	NSD
M16C/26A	✔	✔	✔		✔(Note2)	✔	
M16C/28	✔	✔(Note1)	✔		✔(Note2)	✔	
M16C/29	✔	✔(Note1)	✔	✔	✔(Note2)	✔	
M16C/30P		✔	✔			✔	
M16C/62A		✔	✔		✔	✔	
M16C/62N		✔	✔		✔	✔(Note3)	
M16C/62P	✔	✔	✔		✔	✔	
M16C/6N	✔	✔	✔	✔	✔		
M16C/70	✔					✔(Note3)	
M16C/80		✔	✔		✔	✔	
M32C/80		✔	✔		✔	✔	
M32C/81,82,83		✔	✔	✔(/82 is excluded)	✔	✔	
M32C/84,85,86	✔	✔	✔	✔(Note4)	✔	✔	
M32C/87		✔	✔	✔(Note5)	✔	✔	
M32C/88	✔	✔	✔	✔(3ch)	✔	✔	
M32C/95	✔	✔	✔	✔(Note6)	✔	✔	✔

Note 1: Has I2C-bus dedicated circuit
Note 2: Has three phase PWM dedicated function
Note 3: Only 3V operation
Note 4: 1ch for M32C/84, 2ch for M32C/85, 86
Note 5: M32C/87 CAN 2ch, M32C/87A CAN 1ch, M32C/87B No CAN
Note 6: Of CAN 3ch, 1ch supports 32 slot

I^2C Bus is a registered trademark of the Philips Corporation
IE Bus is a registered trademark of NEC Electronics

Standard function

CPU, Memory, Bus Function (1)

Series	Group	CPU						DMA		Memory								
		Multiplier	Multiply-Acumulate Instruction	Barrel Shifter	FPU	Cache Memory	MMU	DMAC	DTC/DMAC II	RAM	Flash Memory	Mask ROM	One-Time PROM	EPROM	E^2PROM	ROM-Less	Data Flash	Program Security
M32C/80	M32C/87★★	●	●	●				●	●	●	●	●					●	●
	M32C/86★	●	●	●				●	●	●	●						●	●
	M32C/85★	●	●	●				●	●	●	●	●					●	●
	M32C/84★	●	●	●				●	●	●	●	●				●	●	●
	M32C/83	●	●	●				●	●	●	●							●
	M32C/82	●	●	●				●	●	●		●						●
	M32C/81	●	●	●				●	●	●		●						●
	M32C/80★	●	●	●				●	●	●						●		
M16C/80	M16C/80	●	●	●				●	●	●	●	●				●		●
M16C/70	M16C/70	●	●					●		●	●							●
M16C/60	M16C/6V	●	●					●		●	●	●	●	●				●
	M16C/6S★	●	●					●		●	●							●
	M16C/6N	●	●					●		●	●	●					●	●
	M16C/6K	●	●					●		●	●							●
	M16C/6H	●	●					●		●	●							●
	M16C/62P	●	●					●		●	●	●				●	●	●
	M16C/62N	●	●					●		●	●	●						●
	M16C/62M	●	●					●		●	●	●						●
M16C/30	M16C/30P★★	●	●					●		●		●						●
	M16C/30L	●	●					●		●		●						●
M16C/20	M16C/2N	●	●							●	●							●
	M16C/24	●	●					●		●	●		●					●
M16C/Tiny	M16C/29★★	●	●					●		●	●						●	●
	M16C/28	●	●					●		●	●						●	●
	M16C/26A	●	●					●		●	●	●					●	●
M16C/10	M16C/1N★★	●	●							●	●	●					●	●
R8C/Tiny	R8C/17★	●	●							●	●						●	●
	R8C/16★	●	●							●	●							●
	R8C/15★	●	●							●	●						●	●
	R8C/14★	●	●							●	●							●
	R8C/13	●	●							●	●						●	●
	R8C/12	●	●							●	●						●	●
	R8C/11	●	●							●	●							●
	R8C/10	●	●							●	●							●

CPU, Memory, Bus Function (2) / Clock, Power Supply Function

Series	Group	External Bus Expansion							Clock						Power Supply Voltage Detection		Operating Voltage			
		Address/Data Separate Bus	Address/Data Multiplex Bus	DRAM Controller	SDRAM Controller	PCI Controller	Endian Conversion	Host Interface	PLL	Subclock/RTC	On-Chip Oscillator	Oscillation Stop Detection	Frequency Divider	Low Power Architecture	Power-On Reset/POR	Low Voltage Detection/LVD	5V	3V	2V	Below 2V
M32C/80	M32C/87★★	●	●						●	●	●	●	●	●		●	●	●		
	M32C/86★	●	●						●	●	●	●	●	●		●	●	●		
	M32C/85★	●	●						●	●	●	●	●	●		●	●	●		
	M32C/84★	●	●						●	●	●	●	●	●		●	●	●		
	M32C/83	●	●	●					●	●	●	●	●	●			●	●		
	M32C/82	●	●	●					●	●	●	●	●	●			●	●		
	M32C/81	●	●	●					●	●	●	●	●	●			●	●		
	M32C/80★	●	●						●	●	●	●	●	●		●	●	●		
M16C/80	M16C/80	●	●	●						●			●	●			●	●		
M16C/70	M16C/70	●	●						●				●					●		
M16C/60	M16C/6V							●		●			●				●	●		
	M16C/6S★								●		●		●					●		
	M16C/6N	●	●							●	●		●				●	●		
	M16C/6K							●		●			●					●		
	M16C/6H									●			●	●			●			
	M16C/62P	●	●						●	●	●	●	●	●		●	●	●		
	M16C/62N	●	●							●			●	●				●		
	M16C/62M	●	●							●			●	●				●		
M16C/30	M16C/30P★★									●			●	●			●			
	M16C/30L	●	●							●			●	●				●		
M16C/20	M16C/2N									●			●				●			
	M16C/24									●			●				●			
M16C/Tiny	M16C/29★★								●	●	●	●	●	●		●	●	●		
	M16C/28								●	●	●	●	●	●		●	●	●		
	M16C/26A								●	●	●	●	●	●		●	●	●		
M16C/10	M16C/1N★★									●	●	●	●	●			●			
R8C/Tiny	R8C/17★										●	●	●	●	●	●	●	●		
	R8C/16★										●	●	●	●	●	●	●	●		
	R8C/15★										●	●	●	●	●	●	●	●		
	R8C/14★										●	●	●	●	●	●	●	●		
	R8C/13										●	●	●	●	●	●	●	●		
	R8C/12										●	●	●	●			●	●		
	R8C/11										●	●	●	●	●	●	●	●		
	R8C/10										●	●	●	●			●	●		

Peripharal Function (1)

Series	Group	A/D Converter						D/A Converter		Timer		Timer Length					Function				
		8-bit	10-bit	12-bit	ΔΣ 14-Bit	Sample and Hold	Multi-Channel Sample and Hold (mode1)	8-Bit D/A Converter	10-Bit D/A Converter	Input Capture	Output Compare	8-bit	16-bit	More than 32-Bit	Other Bit Lenght	Prescaler	PWM Output	Real-Time Port	Event Counter	2-Phase Encoder Input	3-Phase Inverter Control
M32C/80	M32C/87★★		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/86★		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/85★		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/84★		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/83		●			●	●	●		●	●		●			●	●	●	●	●	●
	M32C/82		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/81		●			●		●		●	●		●			●	●	●	●	●	●
	M32C/80★		●			●		●					●			●	●		●	●	●
M16C/80	M16C/80		●			●		●					●				●		●		●
M16C/70	M16C/70		●			●		●					●				●		●		
M16C/60	M16C/6V	●						●					●			●	●		●		
	M16C/6S★												●								
	M16C/6N		●										●								●
	M16C/6K		●										●				●		●		
	M16C/6H												●								
	M16C/62P		●					●					●				●		●		●
	M16C/62N		●					●					●				●				●
	M16C/62M		●					●					●				●		●		●
M16C/30	M16C/30P★★		●										●						●		
	M16C/30L		●										●						●		
M16C/20	M16C/2N		●										●								
	M16C/24		●										●								
M16C/Tiny	M16C/29★★		●							●	●		●				●		●	●	●
	M16C/28		●							●	●		●				●		●	●	●
	M16C/26A		●										●				●		●	●	●
M16C/10	M16C/1N★★		●					●				●	●						●		
R8C/Tiny	R8C/17★		●			●				●	●	●	●			●	●		●		
	R8C/16★		●			●				●	●	●	●			●	●		●		
	R8C/15★		●			●				●	●	●	●			●	●		●		
	R8C/14★		●			●				●	●	●	●			●	●		●		
	R8C/13		●			●				●	●	●	●			●	●		●		
	R8C/12		●			●				●		●	●			●	●		●		
	R8C/11		●			●				●	●	●	●			●	●		●		
	R8C/10		●			●				●		●	●			●	●		●		

Peripharal Function (2)

Series	Group		Serial Interface		High-Performance Communication											
		Watchdog Timer	Clock Async. Serial Interface	Clock Sync. Serial Interface	I^2C-bus	IEBus	Srmart Card/SIM	Synchronous Serial Communication Unit/Special Serial I/O	CAN	LIN	Ethernet	HDLC	USB Host	USB Function	LPC/ISA	IrDA
M32C/80	M32C/87★★	●	●	●	●	●	●	●	●	●		●				●
	M32C/86★	●	●	●	●	●	●	●	●	●		●				
	M32C/85★	●	●	●	●	●	●	●	●	●		●				
	M32C/84★	●	●	●	●	●	●	●	●	●		●				
	M32C/83	●	●	●	●	●	●	●	●	●		●				
	M32C/82	●	●	●	●	●	●	●				●				
	M32C/81	●	●	●	●	●	●	●	●	●		●				
	M32C/80★	●	●	●	●	●	●	●				●				
M16C/80	M16C/80	●	●	●	●	●	●	●								
M16C/70	M16C/70	●	●	●												
M16C/60	M16C/6V	●	●	●	●											
	M16C/6S★	●	●	●	●											
	M16C/6N	●	●	●	●	●	●	●	●	●						
	M16C/6K	●	●	●	●										●	
	M16C/6H	●	●	●	●											
	M16C/62P	●	●	●	●	●	●									
	M16C/62N	●	●	●	●	●	●									
	M16C/62M	●	●	●	●	●	●									
M16C/30	M16C/30P★★	●	●	●	●	●	●									
	M16C/30L	●	●	●	●	●	●									
M16C/20	M16C/2N	●	●	●		●										
	M16C/24	●	●	●	●	●								●		
M16C/Tiny	M16C/29★★	●	●	●	●	●			●	●						
	M16C/28	●	●	●	●	●				●						
	M16C/26A	●	●	●	●	●				●						
M16C/10	M16C/1N★★	●	●	●	●				●	●						
R8C/Tiny	R8C/17★	●	●	●	●											
	R8C/16★	●	●	●	●											
	R8C/15★	●	●	●				●								
	R8C/14★	●	●	●				●								
	R8C/13	●	●	●												
	R8C/12	●	●	●												
	R8C/11	●	●	●												
	R8C/10	●	●	●												

Peripharal Function (3)

Display Functions			Operation Function		I/O Port						Debug Function			Other Functions	Group	Series
LCD	VFD	OSD	CRC	X/Y Converter	DTMF	High Current Drive Port	High Voltage Port	N-Channel Open Drain Port	Pull-Up Resistor	NMOS Push-Pull	Boundary Scan/JTAG	On-Chip Debug	On-Board Flash Rewrite			
			●	●				●	●			●	●		M32C/87★★	M32C/80
			●	●				●	●			●	●		M32C/86★	
			●	●				●	●			●	●		M32C/85★	
			●	●				●	●			●	●		M32C/84★	
			●	●				●	●			●	●		M32C/83	
			●	●				●	●			●			M32C/82	
			●	●				●	●			●			M32C/81	
			●	●				●	●			●			M32C/80★	
			●	●				●	●			●	●		M16C/80	M16C/80
												●	●		M16C/70	M16C/70
		●						●	●					I/O is 5.5V, and the inside is 3.3V.	M16C/6V	M16C/60
															M16C/6S★	
			●												M16C/6N	
						●		●	●					Bullt-in PS/2 I/F	M16C/6K	
			●										●	Bullt-in data sllcer	M16C/6H	
			●					●	●			●	●		M16C/62P	
			●					●	●				●		M16C/62N	
			●					●	●				●		M16C/62M	
			●					●	●						M16C/30P★★	M16C/30
								●	●						M16C/30L	
						●									M16C/2N	M16C/20
														Bullt-in serial sound I/F	M16C/24	
			●						●			●	●		M16C/29★★	M16C/Tiny
			●						●			●	●		M16C/28	
			●						●			●	●		M16C/26A	
			●			●									M16C/1N★★	M16C/10
						●			●			●	●		R8C/17★	R8C/Tiny
						●			●			●	●		R8C/16★	
						●			●			●	●		R8C/15★	
						●			●			●	●		R8C/14★	
						●			●			●	●		R8C/13	
						●			●			●	●		R8C/12	
						●			●			●	●		R8C/11	
						●			●			●	●		R8C/10	

*1 More than 2 analog values are A/D converted simultaneously.

★ : New product ★★ : Under development

Package selection

FLASH
MASK
LOMLESS
★★ : Under development
★ : New product

M16C/Tiny

M16C/26A

20P2F/PLSP0020JB (0.65mm pitch)	32P6U/PLQP0032GB (0.8mm pitch)	42P2R/PRSP0042GA (0.8mm pitch)	48P6Q-A/PLQP0048KB-A (0.5mm pitch)	64P6Q-A/PLQP0064KB-A (0.5mm pitch)	80P6Q-A/PLQP0080KB-A (0.5mm pitch)
M30263F8AFP*	M30263F6AFP*	M30263F3AFP*	M30263M8A-XXXFP*	M30263M6A-XXXFP*	M30263M3A-XXXFP*
M30260F8AGP*	M30260F6AGP*	M30260F3AGP*	M30260M8A-XXXGP*	M30260M6A-XXXGP*	M30260M3A-XXXGP*

M16C/26A

20P2F/PLSP0020JB (0.65mm pitch)	32P6U/PLQP0032GB (0.8mm pitch)
M30100F3FP	M30102F3FP
M30100M3-XXXFP	M30102M3-XXXFP
M30100M2-XXXFP	M30102M2-XXXFP

R8C/Tiny

R8C/13

20P2F/PLSP0020JB (0.65mm pitch)	32P6U/PLQP0032GB (0.8mm pitch)
R5F21134FP*	R5F21133FP*
R5F21132FP*	

R8C/19

20P2F/PLSP0020JB (0.65mm pitch)
R5F21191SP**
R5F21192SP**
R5F21193SP**
R5F21194SP**

R8C/12

32P6U/PLQP0032GB (0.8mm pitch)
R5F21124FP*
R5F21123FP*
R5F21122FP*

R8C/18

20P2F/PLSP0020JB (0.65mm pitch)
R5F21181SP**
R5F21182SP**
R5F21183SP**
R5F21184SP**

R8C/11

32P6U/PLQP0032GB (0.8mm pitch)
R5F21114FP*
R5F21113FP*
R5F21112FP*

R8C/17

20P2F/PLSP0020JB (0.65mm pitch)
R5F21174SP*
R5F21173SP*
R5F21172SP*

R8C/10

32P6U/PLQP0032GB (0.8mm pitch)
R5F21104FP
R5F21103FP
R5F21102FP

R8C/16

20P2F/PLSP0020JB (0.65mm pitch)
R5F21164SP*
R5F21163SP*
R5F21162SP*

R8C/15

20P2F/PLSP0020JB (0.65mm pitch)
R5F21154SP*
R5F21153SP*
R5F21152SP*

R8C/14

20P2F/PLSP0020JB (0.65mm pitch)
R5F21144SP*
R5F21143SP*
R5F21142SP*

M16C/29

64P6Q-A/PLQP0064KB-A (0.5mm pitch)	80P6Q-A/PLQP0080KB-A (0.5mm pitch)
M30291FCHP*	M30290FCHP*
M30291FAHP*	M30290FAHP*

M16C/28

64P6Q-A/PLQP0064KB-A (0.5mm pitch)	80P6Q-A/PLQP0080KB-A (0.5mm pitch)
M30281FAHP*	M30280FAHP*
M30281F8HP*	M30280F8HP*
M30281F6HP*	M30280F6HP*

M16C/62P

80P6S-A/PRQP0080JA-A (0.65mm pitch)	100PFB/PTQP100LB-A (0.4mm pitch)	100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)	144P6Q-A/PLQP0144KA-A (0.5mm pitch)
M30621FCPGP*		M30626FJPGP**	M30626FJPFP**	M30627FJPGP**	
M30623F8PGP*		M30626FHPGP	M30626FHPFP	M30627FHPGP	
		M30624FGPGP	M30624FGPFP	M30625FGPGP	
		M30620FCPGP	M30620FCPFP		
		M30622F8PGP	M30622F8PFP		
		M30626MJP-XXXGP**	M30626MJP-XXXFP**	M30627MJP-XXXGP**	
		M30626MHP-XXXGP	M30626MHP-XXXFP	M30627MHP-XXXGP	
		M30624MHP-XXXGP	M30624MHP-XXXFP	M30625MHP-XXXGP	
		M30622MHP-XXXGP	M30622MHP-XXXFP	M30623MHP-XXXGP	
		M30626MWP-XXXGP	M30626MWP-XXXFP	M30627MWP-XXXGP	
		M30624MWP-XXXGP	M30624MWP-XXXFP	M30625MWP-XXXGP	
		M30622MWP-XXXGP	M30622MWP-XXXFP	M30623MWP-XXXGP	
		M30624MGP-XXXGP	M30624MGP-XXXFP	M30625MGP-XXXGP	
		M30622MGP-XXXGP	M30622MGP-XXXFP	M30623MGP-XXXGP	
		M30622MEP-XXXGP	M30622MEP-XXXFP	M30623MEP-XXXGP	
M30621MCP-XXXGP*		M30620MCP-XXXGP	M30620MCP-XXXFP		
M30623MAP-XXXGP*		M30622MAP-XXXGP	M30622MAP-XXXFP		
M30623M8P-XXXGP*		M30622M8P-XXXGP	M30622M8P-XXXFP		
M30623M6P-XXXGP*		M30622M6P-XXXGP	M30622M6P-XXXFP		
		M30620SPGP	M30620SPFP		
		M30622SPGP	M30622SPFP		

M16C/62M

80P6S-A/PRQP0080JA-A (0.65mm pitch)	100PFB/PTQP100LB-A (0.4mm pitch)	100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)
M30625FGMGP		M30624FGMGP	M30624FGMFP
M30621FCMGP		M30620FCMGP	M30620FCMFP
M30625MGM-XXXGP		M30624MGM-XXXGP	M30624MGM-XXXFP
M30621MCM-XXXGP		M30620MCM-XXXGP	M30620MCM-XXXFP

M16C/62N

80P6S-A/PRQP0080JA-A (0.65mm pitch)	100PFB/PTQP100LB-A (0.4mm pitch)	100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)
M30625FGNGP	M30624FGNHP	M30624FGNGP	M30624FGNFP
M30621FCNGP		M30620FCNGP	M30620FCNFP
		M3062GF8NGP	M3062GF8NFP
M30625MGM-XXXGP	M30624MGN-XXXHP	M30624MGN-XXXGP	M30624MGN-XXXFP
M30621MCN-XXXGP	M30622MGN-XXXHP	M30622MGN-XXXGP	M30622MGN-XXXFP
	M30620MCN-XXXHP	M30620MCN-XXXGP	M30620MCN-XXXFP

M16C/30P

100PFB/PTQP100LB-A (0.4mm pitch)	100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)
M30302MAP-XXXGP	M30302MAP-XXXFP	
M30302MCP-XXXGP*	M30302MCP-XXXFP*	
M30302MEP-XXXGP*	M30302MEP-XXXFP*	

M16C/88

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30880FWTGP*	M30880FWTFP*	M30882FWTGP*
M30880FHTGP*	M30880FHTFP*	M30882FHTGP*
M30880FJTGP*	M30880FJTFP*	M30882FJTGP*

M32C/87

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30879FLGP*	M30879FLFP*	M3087BFLGP*
M30876MJ-XXXGP*	M30876MJ-XXXFP*	M30878MJ-XXXGP*

M32C/86

128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30865FJGP

M32C/85

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30850FJGP	M30850FJFP	M30852FJGP
M30853FHGP	M30853FHFP	M30855FHGP
M30853MW-XXXGP*	M30853MW-XXXFP	M30855MW-XXXGP

M32C/84

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30843FJGP	M30843FJFP	M30845FJGP
M30843MW-XXXGP	M30843MW-XXXFP	M30845MW-XXXGP
M30840ME-XXXGP	M30843ME-XXXFP	M30845ME-XXXGP
M30840MC-XXXGP	M30843MC-XXXFP	M30845MC-XXXGP
M30840MSGP	M30843MSFP	M30845MSGP

M32C/83

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30833FJGP	M30833FJFP	M30835FJGP

M32C/82

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30827MH-XXXGP	M30823MH-XXXFP	M30829MH-XXXGP
M30823MH-XXXGP	M30823MH-XXXFP	M30825MH-XXXGP
M30823MW-XXXGP	M30823MW-XXXFP	M30825MW-XXXGP

M32C/81

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M3081LMC-XXXGP	M3081LMC-XXXFP	M3081NMC-XXXGP
M30810MC-XXXGP**	M30810MC-XXXFP	M30812MC-XXXGP

M32C/80

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)
M30800SAGP-BL*	M30800SAFP-BL*
M30800SAGP*	M30800SAFP*

M16C/80

100P6Q-A/PLQP0100KB-A (0.5mm pitch)	100P6S-A/PRQP0100JB-A (0.65mm pitch)	128P6Q-A/PLQP0128KB-A (0.5mm pitch)
M30803FGGP	M30803FGFP	M30805FGGP
M30800FCGP	M30800FCFP	M30802FCGP
M30803MG-XXXGP	M30803MG-XXXFP	M30805MG-XXXGP
M30800MC-XXXGP	M30800MC-XXXFP	M30802MC-XXXGP
M30803SGP-BL	M30803SFP-BL	M30805SGP-BL
M30800SGP-BL	M30800SFP-BL	M30802SGP-BL
M30803SGP	M30803SFP	M30805SGP
M30800SGP	M30800SFP	M30802SGP

M16C/70

80P6S-A/PRQP0080JA-A (0.65mm pitch)
M30700FKLGP
M30700FJLGP

Summary of Performance and Peripheral Functions

Item	M32C/80 series (80, 84, 85, 86 group)	M16C/80 series	M16C/60 series (6N group)	M16C/60 series (62A, 62M, 62N group)	M16C/60 series (62P group)
Number of basic instructions	108	106	91	91	91
Shortest instruction execution time	31.2ns (f(XIN)=32MHz)	50ns (f(XIN)=20MHz)	41.7ns(f(XIN)=24MHz) 50.0ns(f(XIN)=20MHz)	100ns(f(XIN)=10MHz) 62.5ns(f(XIN)=16MHz)M16C/62N only	41.7ns(f(XIN)=24MHz)
Memory capacity	ROM: 128K / 320K / 384K / 512K bytes 384K / 512K bytes (Flash version) Data flush: 4K bytes(Flash version) RAM: 10K / 24K / 31K bytes 16K / 24K / 31K bytes (Flash version)	ROM: ROM-less / 128K / 256K bytes 128K / 256K bytes (Flash version) RAM: 10K / 20K / 24K bytes 10K / 20K bytes (Flash version)	ROM: 128K/256K 128K/192K/256K/384K/512K/ bytes(Flash version) Data flush: 4K bytes(Flash version) RAM: 5K / 10K / 16K / 20K bytes 5K / 10K / 31K bytes (Flash version)	ROM: ROM-less/32K/64K/96K/128K/256K bytes 128K / 256K bytes(Flash version) RAM: 3K/4K/5K/10K/20K bytes 10K/20K bytes(Flash version)	ROM: ROM-less/48K/64K/96K/128K/192K/256K/320K/384K bytes 64K/128K/256K(384K(Flash version) Data flush: 4K bytes(Flash version only) RAM: 4K/5K/10K/12K/16K/20K/24K/31K bytes 4K/10K/20K/31K bytes(Flash version)
Power supply voltage	MASK,Flash version 4.2V to 5.5V (f(XIN)=30MHz) 3.0V to 5.5V (f(XIN)=20MHz)	MASK,Flash 5V version 2.7V to 5.5V (f(XIN)=10MHz) 4.2V to 5.5V (f(XIN)=20MHz)	Vcc=4.2V to 5.5V (f(XIN=20MHz) FVcc=3.0V to 5.5V (f(XIN=24MHz)	M16C/62N(MASK,Flash 3V versoion) 3.0V to 3.6V (f(XIN)=16MHz) M16C/62N(MASK,Flash 3V versoion) 2.4V to 3.6V (f(XIN)=7MHz) M16C/62N(MASK,3V version) 2.2V to 3.6V (f(XIN)=7MHz 1wait)	MASK,Flash version 3.0V to 5.5V (f(XIN)=24MHz) MASK,Flash version 2.7V to 5.5V (f(XIN)=10MHz)
Power consumption	26mA (Vcc=3V f(XIN)=20MHz)	12mA (Vcc=3V f(XIN)=10MHz) MASK version	18mA(f(XIN)=20MHz),23mA(f(XIN)=24MHz)Flash version	8.5mA(Vcc=3V f(XIN)=10MHz 1wait)	8mA(Vcc=3V f(XIN)=10MHz)
Operating temperature	–45°C to +85°C (–40°C to +125°C available)	–40°C to +85°C* (–40°C to +125°C currently under consideration)	–40°C to +85°C	–40°C to +85°C(–40°C to +125°C available)	–20°C to +85°C or –40°C~+85°C
Element construction	CMOS silicon gate	CMOS silicon gate	CMOS silicon gate	CMOS silicon gate	CMOSsilicon gate
Package	100-pin / 144-pin plastic mold	100-pin / 144-pin plastic mold	100-pin plastic mold	100-pin/80-pin plastic mold	80-pin /100-pin /128-pin plastic mold

*: Products under development are subject to specification changes.

Item		M32C/84,85,86,87 group	M16C/80 series	M16C/6N series	M16C/62A,62M,62N series	M16C/62P group	M16C/30P series	M16C/26A,28,29 group	R8C/10,11,12,13 group	R8C/14,15,16,17 group
I/O port	8 bits x 13, 7 bits x 2, 5 bits x 1 (144-pin package)	123 I/O	123 I/O	123 I/O	–	–	–	–	–	–
	8 bits x 13, 7 bits x 1, 2 bits x 1	–	–	–	–	113 I/O	–	–	–	–
	8 bits x 10, 7 bits x 1	87 I/O	87 I/O	87 I/O	–	87 I/O	87 I/O	–	–	–
	8 bits x 10, 5 bits x 1	–	–	–	85 I/O	–	–	–	–	–
	8 bits x 8, 7 bits x 1	–	–	–	–	–	–	71 I/O (80-pin version)	–	–
	8 bits x 3, 6 bits x 2, 5 bits x 1, 2 bits x 1 (including LED drive port, 8 bits)	–	–	–	–	–	–	–	–	–
	8 bits x 3, 7 bits x 1, 4 bits x 1, 3 bits x 1	–	–	–	–	–	–	38 I/O (48-pin version)	–	–
	8 bits x 4, 2 bits x 1 (including LED drive port, 8 bits)	–	–	–	–	–	–	–	–	–
	8 bits x 4, 4 bits x 1, 3 bits x 1	–	–	–	–	–	–	39 I/O (26A)	–	–
	8 bits x 2, 5 bits x 1, 1 bits x 1 (including LED drive port, 8 bits)	–	–	–	–	–	–	–	22 I/O	13 I/O
	8 bits x 5, 4 bits x 3, 3 bits x 1	–	–	–	–	–	–	53 I/O (64-pin version)	–	–
	8 bits x 3, 6 bits x 1, 3 bits x 1, 2 bits x 1	–	–	–	–	–	–	33 I/O (26A)	–	–
Input port	1 bit x 1 (NMI input)	✓	✓	✓	✓	✓	✓	–	–	–
	2 bit x 1	–	–	–	–	–	–	–	✓	✓
Timer	Timer 1	–	–	–	–	–	–	–	–	–
	Timer mode	–	–	–	–	–	–	–	–	–
	Timer A	5	5	5	5	5	3	5	–	–
	Timer mode	✓	✓	✓	✓	✓	✓	✓	–	–
	Event counter mode (cascade connect possible)	✓	✓	✓	✓	✓	✓	✓	–	–
	One-shot timer mode (delayed one-shot possible)	✓	✓	✓	✓	✓	✓	✓	–	–
	Pulse width modulation (PWM) mode	✓	✓	✓	✓	✓	✓	✓	–	–
	Timer B	6	6	6	3	6	2	3	–	–
	Timer mode	✓	✓	✓	✓	✓	✓	✓	–	–
	Event counter mode	✓	✓	✓	✓	✓	✓	✓	–	–
	Pulse period/Pulse width measuring mode	✓	✓	✓	✓	✓	✓	✓	–	–
	3-phase PWM output mode	✓	✓	✓	–	✓	–	✓	–	–
	Timer S (ICOC)	–	–	–	–	–	–	1(28,29)	–	–
	Timer C	–	–	–	–	–	–	–	1	1
	Time measurement functions	–	–	–	–	–	–	–	✓	✓
	Timer X	–	–	–	–	–	–	–	1	1
	Timer mode	–	–	–	–	–	–	–	✓	✓
	Event counter mode	–	–	–	–	–	–	–	✓	✓
	One-shot timer mode (delayed one-shot possible)	–	–	–	–	–	–	–	–	–
	Pulse period/Pulse width measuring mode	–	–	–	–	–	–	–	✓	✓
	Pulse width modulation (PWM) mode	–	–	–	–	–	–	–	–	–
	Timer Y	–	–	–	–	–	–	–	1	–
	Timer mode	–	–	–	–	–	–	–	✓	–
	Programmable waveform generation mode(PWM)	–	–	–	–	–	–	–	✓	–
	Timer Z	–	–	–	–	–	–	–	1	1
	Timer mode	–	–	–	–	–	–	–	✓	✓
	Programmable waveform generation mode(PWM)	–	–	–	–	–	–	–	✓	✓
	Programmable one-shot generation mode	–	–	–	–	–	–	–	✓	✓
	Programmable wait One-shot generation mode	–	–	–	–	–	–	–	✓	✓
Serial interface	CMOS output SI/O (UART/Clock synchronization)	4ch	4ch	4ch	2ch	2ch	2ch	2ch(28,29)	1ch (48-pin version)	1ch
	CLK polarity selection	✓	✓	✓	✓	✓	✓	✓	✓	✓
	CLK phase selection	✓	✓	✓	–	–	–	–	–	–
	CMOS/Nch open-drain output selection	✓	✓	✓	–	✓	✓	✓	✓	✓
	LSB first/MSB first selection	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Continuous reception mode	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Transmission interrupt mode selection	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Transfer clock multiple-pin output	–	✓	✓	–	✓	✓	✓	✓	✓
	RxD input port selection functions	–	–	–	–	–	–	–	✓	✓
	Nch open-drain output SI/O (UART/Clock synchronization)	1ch	1ch	1ch	–	1ch	1ch	–	–	–
	CLK polarity selection	✓	✓	✓	–	✓	✓	✓	–	–
	CLK phase selection	✓	✓	✓	–	–	–	–	–	–
	LSB first/MSB first selection	✓	✓	✓	–	✓	✓	✓	–	–
	Continuous reception mode	✓	✓	✓	–	✓	✓	✓	–	–
	Transmission interrupt cause selection	✓	✓	✓	–	✓	✓	✓	–	–
	IE bus applicable 1)	✓	✓	✓	–	✓	✓	✓	–	–
	I²C bus applicable 2)	✓	✓	✓	–	✓	✓	✓	–	1ch (16,17)
	CMOS output SI/O (Clock synchronization)	–	–	–	–	2ch	–	2ch (28,29)	–	–
	CMOS output SI/O (UART only)	–	–	–	–	–	–	–	1ch	–
	Multi Muster I²C bus	– IrDA	–	–	–	–	–	1ch (28,29)	–	–

1) IE Bus is a trademark of NEC Electronics Corporation.
2) I2C BUS is a registered trademark of Philips.

Item	M16C/30 series (30P group) *	M16C/Tiny series (26A group) *	M16C/Tiny series (28, 29 group) *	R8C/Tiny series
Number of basic instructions	91	91	91	89
Shortest instruction execution time	62.5ns(f(XIN)=16MHz)	50ns(f(XIN)=20MHz)	50ns(f(XIN)=20MHz)	62.5ns(f(XIN)=16MHz)(R8C/10,12=16MHz) 50ns(f(XIN)=16MHz)(R8C/11,13,14,15,16,17)
Memory capacity	ROM:32K/64K/96K/128K/192K bytes	ROM:24K/32K/48K/64K bytes (Flash version) Data Flash:4Kbytes	ROM:48K/64K/96K/128K bytes (Flash version) Data Flash:4Kbytes	ROM:8K / 12K / 16K bytes (Flash version) Data Flash:4Kbytes(R8C/12,13,15,17) Data Flash:2Kbytes(R8C/15,17)
	RAM:2K/3K/5K/6K bytes	RAM:1K/2K bytes (Flash version)	RAM:4K/8K/12K bytes (Flash version)	RAM:512 / 768 / 1K bytes
Power supply voltage	MASK 5V Version 4.2V to 5.5V (f(XIN)=16MHz) MASK 5V Version 2.7V to 5.5V (f(XIN)=10MHz 1wait) MASK 3V Version 3.0V to 3.6V (f(XIN)=16MHz) MASK 3V Version 2.4V to 3.6V (f(XIN)=7MHz)	Flash version 3.0V to 5.5V (f(XIN)=20MHz) 2.7V to 5.5V (f(XIN)=10MHz)	Flash version 3.0V to 5.5V (f(XIN)=20MHz) 2.7V to 5.5V (f(XIN)=10MHz)	Flash version 3.0V to 5.5V(f(XIN)=16MHz)(R8C/11,13,14,15,16,17) 2.7V to 5.5V(f(XIN)=10MHz) 3.0V to 5.5V(f(XIN)=20MHz)(R8C/14,15,16,17)
Power consumption	8.5mA(Vcc=3V f(XIN)=10MHz)	7mA(Vcc=3V f(XIN)=10MHz)	7mA(Vcc=3V f(XIN)=10MHz)	TBD
Operating temperature	–20°C to +85°C or –40°C to +85°C	–20°C to +85°C or –40°C to +85°C	–20°C to +85°C or –40°C to +85°C	–20°C to +85°C (–40°C to +85°C available)
Element construction	CMOS silicon gate	CMOS silicon gate	CMOS silicon gate	CMOS silicon gate
Package	100-pin plastic mold	42-pin SSOP 48-pin plastic mold	64-pin/80-pin plastic mold	32-pin plastic mold

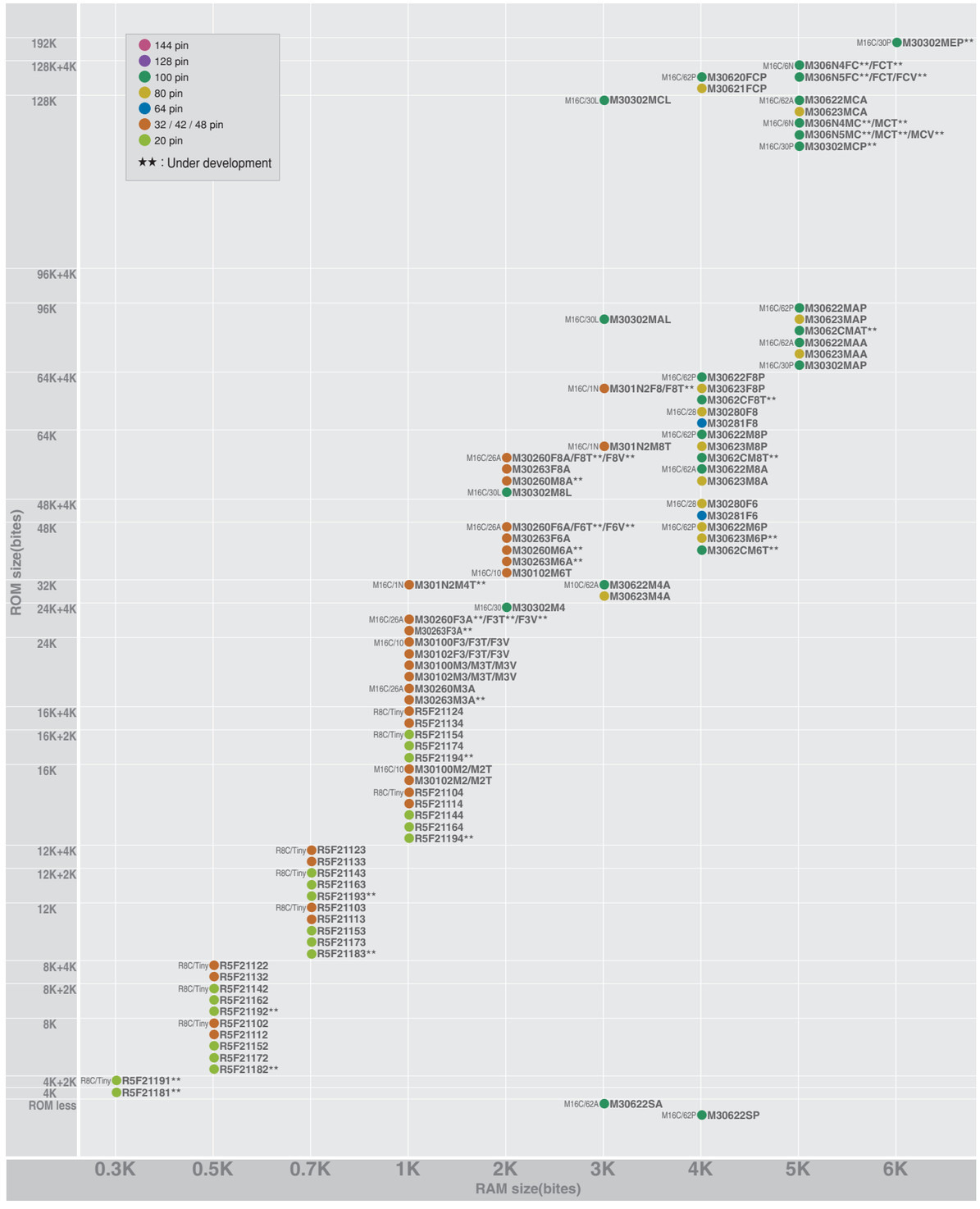
*: Products under development are subject to specification changes.

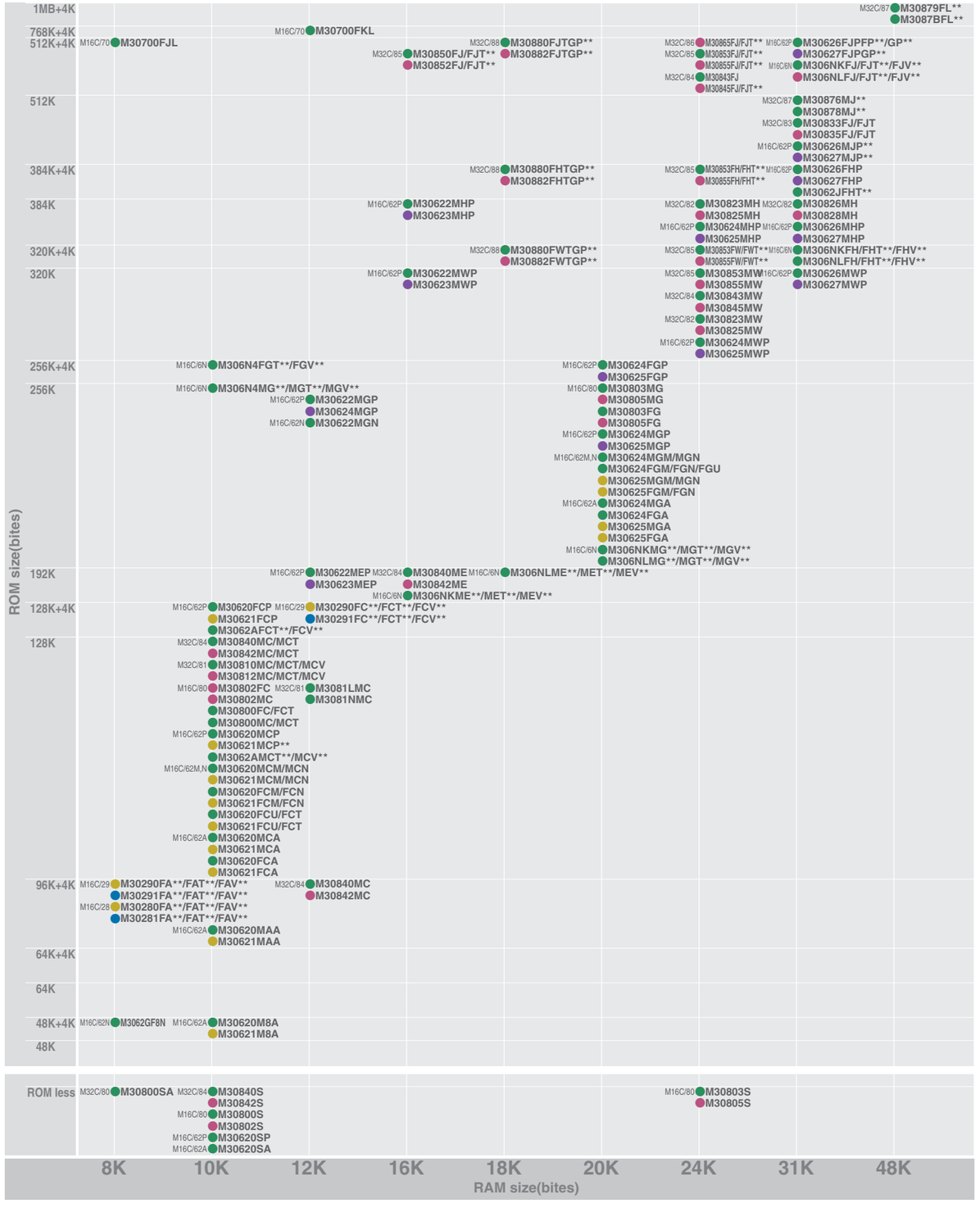
Item		M32C/84,85,86,87 group	M16C/80 series	M16C/6N series	M16C/62A,62M,62N series	M16C/62P group	M16C/30P series	M16C/26A,28,29 group	R8C/10,11,12,13 group	R8C/14,15,16,17 group
Intelligent I/O	Intellegent I/O	1 group	–	–	–	–	–	–	–	–
	Input Capture	8ch	–	–	–	–	–	–	1ch (11,13)	1ch
	Output Compare	8ch, 16ch(87)	–	–	–	–	–	–	1ch (11,13)	1ch
	Stepping Motor Control	4ch X 4 (86)	–	–	–	–	–	–	–	–
CRC calculation circuit	CRC calculation circuit (Generator polynomial:$X^{16}+X^{12}+X^5+1$)	1	1	1	–	1	–	1 (26A,29)	–	–
X-Y conversion circuit	16 bits x 16 bits X-Y conversion circuit	1	1	1	–	–	–	–	–	–
Watchdog timer	Watchdog timer with prescaler (15 bits)	1	1	1	1	1	1	1	1	1
CAN	CAN	1ch (M32C/84) 2ch (M32C/85,86,87)	–	–	–	–	–	1ch (29)	–	–
A/D converter	10-bit A/D converter	34ch (144-pin version)	(8+2) ch1)	(8+2) ch1)	8ch	(24+2) ch1)	(8+2) ch	24ch (M16C/26,80-pin version) 27ch (M16C/29,80-pin version)	8ch (10,12) 12 (11,13)	4ch
	One-shot A/D conversion	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Repeat A/D conversion	✓	✓	✓	✓	✓	–	✓	✓	✓
	Single sweep A/D conversion	✓	✓	✓	✓	✓	–	✓	–	–
	Repeat sweep A/D conversion (Conversion cycle stacking ON/OFF)	✓	✓	✓	✓	✓	–	✓	–	–
	Sample & Hold function (Sampling time: 3 cycles)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	8-bit A/D/10-bit A/D selection function (28 cycles/33 cycles)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	External triggered A/D conversion start function	✓	✓	✓	✓	✓	✓	✓	–	–
	External operation amplifier connection function	✓	✓	✓	–	✓	–	–	–	–
	Analog input pin expansion function	✓	✓	✓	–	✓	–	–	✓	✓
	Vref connect/disconnect selection	✓	✓	✓	✓	✓	✓	✓	✓	✓
D/A converter	8-bit D/A converter	2ch	2ch	2ch	3ch	2ch	–	–	–	–
DMAC	DMAC	4ch2)	4ch2)	4ch2)	4ch	2ch	1ch	2ch	–	–
	Single transfer	✓	✓	✓	✓	✓	✓	✓	–	–
	Repeat transfer	✓	✓	✓	✓	✓	✓	✓	–	–
	Number of DMA request factors	31	24	24	16	24	13	31	–	–
DMAC II	DMAC II	Activated by any variable vector intreeupt sources	–	–	–	–	–	–	–	–
	Single transfer	✓	–	–	–	–	–	–	–	–
	Burst transfer	✓	–	–	–	–	–	–	–	–
DRAMC	DRAMC	–	1ch	1ch	–	–	–	–	–	–
	EDO applicable	–	✓	✓	–	–	–	–	–	–
	First page applicable	–	✓	✓	–	–	–	–	–	–
	CAS before RAS refresh	–	✓	✓	–	–	–	–	–	–
	Self refresh	–	✓	✓	–	–	–	–	–	–
Interrupt	Number of internal interrupts	41	29	29	17	25	16	25	10	9
	Number of external interrupts	8, 11(87)	8	8	6	8	5	8	5	4
	Number of software interrupts	4	4	4	4	4	4	4	4	4
	Number of interrupt levels	7	7	7	7	7	7	7	7	7
	High-speed interrupts (internal / external)	13)	13)	13)	1	–	–	–	–	–
Clock generating circuit	XIN	1ch	1ch	1ch	1ch	1ch	1ch	1ch	1ch	1ch
	Maximum operation frequency 10MHz (no wait)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Maximum operation frequency 16MHz (no wait)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Maximum operation frequency 20MHz (no wait)	✓	✓	✓	✓	✓	–	✓	✓ (11,13)	✓
	Maximum operation frequency 24MHz (no wait)	✓	–	–	✓	✓	–	–	–	–
	Maximum operation frequency 32MHz (no wait)	✓	–	–	✓	–	–	–	–	–
	Maximum operation frequency 34MHz (no wait)	–	–	–	✓	–	–	–	–	–
	XCIN	1ch	1ch	1ch	–	1ch	1ch	1ch	–	–
	Maximum operation frequency 50kHz	✓	✓	✓	–	✓	✓	✓	–	–
	on-chip oscillator	✓	–	–	–	✓	–	✓	✓	✓
External bus	16M-byte addressing space	✓	✓	✓	✓	–	–	–	–	–
	Chip select output (CS0 / CS1 / CS2 / CS3)	✓	✓	✓	✓	✓	✓	–	–	–
	(RD,BHE,WR) / (RD,WRH,WRL) selection	✓	✓	✓	✓	✓	✓	–	–	–
	Multiplex bus / Separate bus selection	✓	✓	✓	✓	✓	✓	–	–	–
	Number of address bus switch (16 / 20)	✓	✓	✓	✓(8/20)	✓	✓	–	–	–
	Data bus width selection (8bits / 16bits)	✓	✓	✓	✓	✓	✓	–	–	–
	Variable 1 to 3 wait cycles insert selection	✓(13 mode)	✓	✓	✓(13 mode)	✓	–	–	–	–
	1 wait cycle insert selection	–	–	–	–	–	✓	–	–	–

3) The M30800MCT, M30800FCT, and M30620FCT support 24+2ch.
4) Internal registers are used partly.(16C/62P Group)
5) Only one line of external or internal interrupt can be set.

The M16C Platform

The Industries Most extensive 16-bit MCU Platform





List of Part Numbers

R8C/10,11,12 and 13 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
R8C/10	Flash ROM	8K	–	512	R5F21102FP	16	62.5	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 3.0 to 5.5 [16MHz]	2	22	• 8 bit timer : 3 • 16 bit timer : 1(input-capture) • 10-bit A/D converter : 8ch • Sirial Interface : 1 • UART : 1 • Watchdog timer : 1	32P6U-A	PLQP0032GB-A
		12K		768	R5F21103FP									
		16K		1K	R5F21104FP									
R8C/11		8K		512	R5F21112FP	20	50		2.7 to 5.5 [10MHz] 3.0 to 5.5 [20MHz]			• 8 bit timer : 3 • 16 bit timer : 1(input-capture/output-compare) • 10-bit A/D converter : 12ch • Sirial Interface : 1 • UART : 1 • Watchdog timer : 1		
		12K		768	R5F21113FP									
		16K		1K	R5F21114FP									
R8C/12		8K	2Kx2	512	R5F21122FP	16	62.5		2.7 to 5.5 [10MHz] 3.0 to 5.5 [16MHz]			• 8 bit timer : 3 • 16 bit timer : 1(input-capture) • 10-bit A/D converter : 8ch • Sirial Interface : 1 • UART : 1 • Watchdog timer : 1		
		12K		768	R5F21123FP									
		16K		1K	R5F21124FP									
R8C/13		8K		512	R5F21132FP	20	50		2.7 to 5.5 [10MHz] 3.0 to 5.5 [20MHz]			• 8 bit timer : 3 • 16 bit timer : 1(input-capture/output-compare) • 10-bit A/D converter : 12ch • Sirial Interface : 1 • UART : 1 • Watchdog timer : 1		
		12K		768	R5F21133FP									
		16K		1K	R5F21134FP									

R8C/14,15,16 and 17 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
R8C/14	Flash ROM	8K	–	512	R5F21142SP	20	50	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 3.0 to 5.5 [20MHz]	2	13	• 8 bit timer : 2 • 16 bit timer : 1(input-capture/output-compare) • 10-bit A/D converter : 4ch • Sirial Interface : 1 • SSU : 1 • Watchdog timer : 1	20P2F-A	PLSP0020JB-A
		12K		768	R5F21143SP									
		16K		1K	R5F21144SP									
R8C/15		8K	1Kx2	512	R5F21152SP									
		12K		768	R5F21153SP									
		16K		1K	R5F21154SP									
R8C/16		8K	–	512	R5F21162SP							• 8 bit timer : 2 • 16 bit timer : 1(input-capture/output-compare) • 10-bit A/D converter : 4ch • Sirial Interface : 1 • IIC : 1 • Watchdog timer : 1		
		12K		768	R5F21163SP									
		16K		1K	R5F21164SP									
R8C/17		8K	1Kx2	512	R5F21172SP									
		12K		768	R5F21173SP									
		16K		1K	R5F21174SP									

R8C/18 and19 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
R8C/18	Flash ROM	4K	–	384	R5F21181SP★★	20	50	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 3.0 to 5.5 [20MHz]	3	13	• 8 bit timer : 2 • 16 bit timer : 1(input-capture/output-compare) • 1-bit A/D converter : 4ch • Sirial Interface : 2 • Watchdog timer : 1	20P2F-A	PLSP0020JB-A
		8K		512	R5F21182SP★★									
		12K		768	R5F21183SP★★									
		16K		1K	R5F21184SP★★									
R8C/19		4K	1Kx2	384	R5F21191SP★★							• 8 bit timer : 2 • 16 bit timer : 1(input-capture/output-compare) • 1-bit A/D converter : 4ch • Sirial Interface : 2 • Watchdog timer : 1		
		8K		512	R5F21192SP★★									
		12K		768	R5F21193SP★★									
		16K		1K	R5F21194SP★★									

★★ : Under development

M16C/26A,28 and 29 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/26A	Mask ROM	24K	–	1K	M30260M3A-XXXGP	20	50	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 3.0 to 5.5 [20MHz]	–	39	• Input timer : 3 • Output timer : 5 • 10-bit A/D converter : 12ch (48pin) • Sirial Interface : 3 (48pin) • Watchdog timer : 1 • 3-Phase Inverter control : 6 • PLL	48P6Q-A	PLQP0048KB-A
					M30263M3A-XXXFP★★						33		42P2R	PLSP0042GA-B
		48K		2K	M30260M6A-XXXGP						39		48P6Q-A	PLQP0048KB-A
					M30263M6A-XXXFP★★						33		42P2R	PLSP0042GA-B
		64K			M30260M8A-XXXGP						39		48P6Q-A	PLQP0048KB-A
					M30263M8A-XXXFP★★						33		42P2R	PLSP0042GA-B
	Flash ROM	24K	4K	1K	M30260F3AGP						39		48P6Q-A	PLQP0048KB-A
					M30263F3AFP★★						33		42P2R	PLSP0042GA-B
		48K		2K	M30260F6AGP						39		48P6Q-A	PLQP0048KB-A
					M30263F6AFP★★						33		42P2R	PLSP0042GA-B
		64K			M30260F8AGP						39		48P6Q-A	PLQP0048KB-A
					M30263F8AFP★★						33		42P2R	PLSP0042GA-B
M16C/28		48K		4K	M30280F6HP						71	• Input timer : 3 • Output timer : 5 • Input capture : 8 • Output compare : 8 • 10-bit A/D converter : 24ch (80pin) • Serial I/O : 5 • Watchdog timer : 1 • 3-Phase Inverter control : 6 • Multi master I2C-bus • PLL	80P6Q-A	PLQP0080KB-A
					M30281F6HP						55		64P6Q-A	PLQP0064KB-A
		64K			M30280F8HP						71		80P6Q-A	PLQP0080KB-A
					M30281F8HP						55		64P6Q-A	PLQP0064KB-A
		96K		8K	M30280FAHP						71		80P6Q-A	PLQP0080KB-A
					M30281FAHP						55		64P6Q-A	PLQP0064KB-A
M16C/29		96K		8K	M30290FAHP★★						71	• Input timer : 3 • Output timer : 5 • Input capture : 8 • Output compare : 8 • 10-bit A/D converter : 24ch (80pin) • Serial I/O : 5 • Watchdog timer : 1 • 3-Phase Inverter control : 6 • Multi master I2C-bus • CRC calculation circuit • PLL • CAN : 1ch	80P6Q-A	PLQP0080KB-A
					M30291FAHP★★						55		64P6Q-A	PLQP0064KB-A
		128K		12K	M30290FCHP★★						71		80P6Q-A	PLQP0080KB-A
					M30291FCHP★★						55		64P6Q-A	PLQP0064KB-A

Note : These products are in planning or under development, specifications may be changed.

★★ : Under development

M16C/30P Group

Group	Memory type	Internal memory(Byte) ROM	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/30P	Mask ROM	96K	5K	M30302MAP-XXXFP★★	16	62.5	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz,1wait] 4.2 to 5.5 [16MHz]	1	87	• Input timer : 2 • Output timer : 3 • 10-bit A/D converter : 12ch • DMAC:1ch • Serial I/O : 3 • Watchdog timer : 1	100P6S-A	PLQP0100JB-A
				M30302MAP-XXXGP★★								100P6Q-A	PLQP0100KB-A
		128K		M30302MCP-XXXFP★★								100P6S-A	PLQP0100JB-A
				M30302MCP-XXXGP★★								100P6Q-A	PLQP0100KB-A
		192K	6K	M30302MEP-XXXFP★★								100P6S-A	PLQP0100JB-A
				M30302MEP-XXXGP★★								100P6Q-A	PLQP0100KB-A

★★ : Under development

M16C/62P Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/62P	Mask ROM	48K	–	4K	M30622M6P-XXXFP	24	41.7	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 3.0 to 5.5 [24MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : (24+2)ch • 8-bit D/A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit • 3-Phase Inverter control : 6	100P6S-A	PRQP0100JB-A
					M30622M6P-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623M6P-XXXGP						70		80P6S-A	PRQP0080JA-A
		64K			M30622M8P-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622M8P-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623M8P-XXXGP						70		80P6S-A	PRQP0080JA-A
		96K		5K	M30622MAP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622MAP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623MAP-XXXGP						70		80P6S-A	PRQP0080JA-A
		128K		10K	M30620MCP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30620MCP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30621MCP-XXXGP						70		80P6S-A	PRQP0080JA-A
		192K		12K	M30622MEP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622MEP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623MEP-XXXGP						113		128P6Q-A	PLQP0128KB-A
		256K			M30622MGP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622MGP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623MGP-XXXGP						113		128P6Q-A	PLQP0128KB-A
				20K	M30624MGP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30624MGP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30625MGP-XXXGP						113		128P6Q-A	PLQP0128KB-A
		320K		16K	M30622MWP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622MWP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623MWP-XXXGP						113		128P6Q-A	PLQP0128KB-A
				24K	M30624MWP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30624MWP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30625MWP-XXXGP						113		128P6Q-A	PLQP0128KB-A
				31K	M30626MWP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30626MWP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30627MWP-XXXGP						113		128P6Q-A	PLQP0128KB-A
		384K		16K	M30622MHP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30622MHP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30623MHP-XXXGP						113		128P6Q-A	PLQP0128KB-A
				24K	M30624MHP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30624MHP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30625MHP-XXXGP						113		128P6Q-A	PLQP0128KB-A
				31K	M30626MHP-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30626MHP-XXXGP								100P6Q-A	PLQP0100KB-A
					M30627MHP-XXXGP						113		128P6Q-A	PLQP0128KB-A
	Flash ROM	64K	4K	4K	M30622F8PFP						87		100P6S-A	PRQP0100JB-A
					M30622F8PGP								100P6Q-A	PLQP0100KB-A
					M30623F8PGP						70		80P6S-A	PRQP0080JA-A
		128K		10K	M30620FCPFP						87		100P6S-A	PRQP0100JB-A
					M30620FCPGP								100P6Q-A	PLQP0100KB-A
					M30621FCPGP						70		80P6S-A	PRQP0080JA-A
		256K		20K	M30624FGPFP						87		100P6S-A	PRQP0100JB-A
					M30624FGPGP								100P6Q-A	PLQP0100KB-A
					M30625FGPGP						113		128P6Q-A	PLQP0128KB-A
		384K		31K	M30626FHPFP						87		100P6S-A	PRQP0100JB-A
					M30626FHPGP								100P6Q-A	PLQP0100KB-A
					M30627FHPGP						113		128P6Q-A	PLQP0128KB-A
		512K			M30626FJPFP★★						87		100P6S-A	PRQP0100JB-A
					M30626FJPGP★★								100P6Q-A	PLQP0100KB-A
	ROM less	–	–	4K	M30622SPFP						87		100P6S-A	PRQP0100JB-A
					M30622SPGP								100P6Q-A	PLQP0100KB-A
				10K	M30620SPFP								100P6S-A	PRQP0100JB-A
					M30620SPGP								100P6Q-A	PLQP0100KB-A

★★ : Under development

M16C/62A,62M and 62N Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/62A	Mask ROM	32K	3K	M30622M4A-XXXFP	16	62.5	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz,1wait] 4.2 to 5.5 [16MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : (8+2)ch • 8-bit D/A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit	100P6S-A	PLQP0100JB-A
				M30622M4A-XXXGP								100P6Q-A	PLQP0100KB-A
				M30623M4A-XXXGP						70		80P6S-A	PLQP0080JA-A
		64K	4K	M30622M8A-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30622M8A-XXXGP								100P6Q-A	PLQP0100KB-A
				M30623M8A-XXXGP						70		80P6S-A	PLQP0080JA-A
			10K	M30620M8A-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30620M8A-XXXGP								100P6Q-A	PLQP0100KB-A
				M30621M8A-XXXGP						70		80P6S-A	PLQP0080JA-A
		96K	5K	M30622MAA-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30622MAA-XXXGP								100P6Q-A	PLQP0100KB-A
				M30623MAA-XXXGP						70		80P6S-A	PLQP0080JA-A
			10K	M30620MAA-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30620MAA-XXXGP								100P6Q-A	PLQP0100KB-A
				M30621MAA-XXXGP						70		80P6S-A	PLQP0080JA-A
		128K	5K	M30622MCA-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30622MCA-XXXGP								100P6Q-A	PLQP0100KB-A
				M30623MCA-XXXGP						70		80P6S-A	PLQP0100JB-A
			10K	M30620MCA-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30620MCA-XXXGP								100P6Q-A	PLQP0080JA-A
				M30621MCA-XXXGP						70		80P6S-A	PLQP0100JB-A
		256K	20K	M30624MGA-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30624MGA-XXXGP								100P6Q-A	PLQP0100JB-A
				M30625MGA-XXXGP						70		80P6S-A	PLQP0100KB-A
	Flash ROM	128K	10K	M30620FCAFP						87		100P6S-A	PLQP0100JB-A
				M30620FCAGP								100P6Q-A	PLQP0100JB-A
				M30621FCAGP						70		80P6S-A	PLQP0100KB-A
		256K	20K	M30624FGAFP						87		100P6S-A	PLQP0100JB-A
				M30624FGAGP								100P6Q-A	PLQP0100KB-A
				M30625FGAGP						70		80P6S-A	PLQP0080JA-A
	ROM less	–	3K	M30622SAFP						47		100P6S-A	PLQP0100JB-A
				M30622SAGP								100P6Q-A	PLQP0100KB-A
			10K	M30620SAFP								100P6S-A	PLQP0100JB-A
				M30620SAGP								100P6Q-A	PLQP0100KB-A
M16C/62M	Mask ROM	128K	10K	M30620MCM-XXXFP	10	100		2.2 to 3.6 [7MHz,1wait] 2.4 to 3.6 [7MHz] 2.7 to 3.6 [10MHz]		87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : (8+2)ch • 8-bit D/A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit	100P6S-A	PLQP0100JB-A
				M30620MCM-XXXGP								100P6Q-A	PLQP0100KB-A
		256K	20K	M30621MCM-XXXGP						70		80P6S-A	PLQP0080JA-A
				M30624MGM-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30624MGM-XXXGP								100P6Q-A	PLQP0100KB-A
				M30625MGM-XXXGP						70		80P6S-A	PLQP0080JA-A
	Flash ROM	128K	10K	M30620FCMFP						87		100P6S-A	PLQP0100JB-A
				M30620FCMGP								100P6Q-A	PLQP0100KB-A
		256K	20K	M30621FCMGP						70		80P6S-A	PLQP0080JA-A
				M30624FGMFP						87		100P6S-A	PLQP0100JB-A
				M30624FGMGP								100P6Q-A	PLQP0100KB-A
M16C/62N	Mask ROM	128K	10K	M30625FGMGP	16	62.5		2.2 to 3.0 [7MHz,1wait] 2.4 to 3.0 [7MHz] 3.0 to 3.6 [16MHz]		70	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : (8 x 2)ch+2ch(100pin) • 8-bit D/A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PLQP0080JA-A
				M30620MCN-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30620MCN-XXXGP								100P6Q-A	PLQP0100KB-A
			12K	M30621MCN-XXXGP						70		80P6S-A	PLQP0080JA-A
				M30622MGN-XXXFP						87		100P6S-A	PLQP0100JB-A
		256K	20K	M30622MGN-XXXGP								100P6Q-A	PLQP0100KB-A
				M30624MGN-XXXFP						87		100P6S-A	PLQP0100JB-A
				M30624MGN-XXXGP								100P6Q-A	PLQP0100KB-A
	Flash ROM	64K	8K	M30625MGN-XXXGP	10	100		2.7 to 3.6		70		80P6S-A	PLQP0080JA-A
				M3062GF8NFP						87		100P6S-A	PLQP0100JB-A
		128K	10K	M3062GF8NGP	16	62.5		2.4 to 3.0 [7MHz] 3.0 to 3.6 [16MHz]				100P6Q-A	PLQP0100KB-A
				M30620FCNFP						87		100P6S-A	PLQP0100JB-A
				M30620FCNGP								100P6Q-A	PLQP0100KB-A
		256K	20K	M30621FCNGP						70		80P6S-A	PLQP0080JA-A
				M30624FGNFP						87		100P6S-A	PLQP0100JB-A
				M30624FGNGP								100P6Q-A	PLQP0100KB-A
				M30625FGNGP						70		80P6S-A	PLQP0080JA-A

M16C/70 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) Data Flush	Internal memory(Byte) RAM	Memory type	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/70	Flash ROM	512K	4K	8K	M30700FJLGP	34	29.4	–20 to 85	3.0 to 3.6 4.5 to 5.5 (Flash ROM)	–	85	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : 8ch • 8-bit D/A converter : 3ch • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • PLL	100P6Q-A	PLQP0100KB-A
		768K	9K	12K	M30700FKLGP									

*Supply voltage maybe changed

M16C/80 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Memory type	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/80	Mask ROM	128K	10K	M30800MC-XXXFP	20	50	–20 to 85 or –40 to 85	2.7 to 5.5 [10MHz] 4.2 to 5.5 [20MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : (8+2)ch • 8-bit D/A converter : 2ch • DMAC : 4ch • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
				M30800MC-XXXGP						123		100P6Q-A	PLQP0100KB-A
				M30802MC-XXXGP								144P6Q-A	PLQP0144KA-A
		256K	20K	M30803MG-XXXFP						87		100P6S-A	PRQP0100JB-A
				M30803MG-XXXGP								100P6Q-A	PLQP0100KB-A
				M30805MG-XXXGP						123		144P6Q-A	PLQP0144KA-A
	Flash ROM	128K	10K	M30800FCFP						87		100P6S-A	PRQP0100JB-A
				M30800FCGP								100P6Q-A	PLQP0100KB-A
				M30802FCGP						123		144P6Q-A	PLQP0144KA-A
		256K	20K	M30803FGFP						87		100P6S-A	PRQP0100JB-A
				M30803FGGP								100P6Q-A	PLQP0100KB-A
				M30805FGGP						123		144P6Q-A	PLQP0144KA-A
	ROM less	–	10K	M30800SFP						47		100P6S-A	PRQP0100JB-A
				M30800SGP								100P6Q-A	PLQP0100KB-A
				M30802SGP						83		144P6Q-A	PLQP0144KA-A
			24K	M30803SFP						47		100P6S-A	PRQP0100JB-A
				M30803SGP								100P6Q-A	PLQP0100KB-A
				M30805SGP						83		144P6Q-A	PLQP0144KA-A
	ROM less (Boot loader)		10K	M30800SFP-BL						47		100P6S-A	PRQP0100JB-A
				M30800SGP-BL								100P6Q-A	PLQP0100KB-A
				M30802SGP-BL						83		144P6Q-A	PLQP0144KA-A
			24K	M30803SFP-BL						47		100P6S-A	PRQP0100JB-A
				M30803SGP-BL								100P6Q-A	PLQP0100KB-A
				M30805SGP-BL						83		144P6Q-A	PLQP0144KA-A

M32C/80 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Memory type	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/80	ROM less	–	8K	M30800SAFP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	47	• Input timer : 6 • Output timer : 5 • 16-bit timer : 11 • 10-bit A/D converter : 100pin:24ch,144pin:36ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
				M30800SAGP								100P6Q-A	PLQP0100KB-A
	ROM less (Boot loader)			M30800SAFP-BL								100P6S-A	PRQP0100JB-A
				M30800SAGP-BL								100P6Q-A	PLQP0100KB-A

M32C/81 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Memory type	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/81	Mask ROM	128K	10K	M30810MC-XXXFP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [20MHz] 4.2 to 5.5 [32MHz]	1	87	• Input timer : 6 • Output timer : 5 • 16-bit timer : 11 • 10-bit A/D converter : 100pin:24ch,144pin:36ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
				M30810MC-XXXGP						123		100P6Q-A	PLQP0100KB-A
				M30812MC-XXXGP								144P6Q-A	PLQP0144KA-A
				M30810MCT-XXXFP						87		100P6S-A	PRQP0100JB-A
				M30810MCT-XXXGP								100P6Q-A	PLQP0100KB-A
				M30812MCT-XXXGP						123		144P6Q-A	PLQP0144KA-A
				M30810MCV-XXXFP						87		100P6S-A	PRQP0100JB-A
				M30810MCV-XXXGP								100P6Q-A	PLQP0100KB-A
				M30812MCV-XXXGP						123		144P6Q-A	PLQP0144KA-A
			12K	M3081LMC-XXXFP						87		100P6S-A	PRQP0100JB-A
				M3081LMC-XXXGP								100P6Q-A	PLQP0100KB-A
				M3081NMC-XXXGP						123		144P6Q-A	PLQP0144KA-A

M32C/82 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Memory type	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/82	Mask ROM	320K	24K	M30823MW-XXXFP	30	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [20MHz] 4.2 to 5.5 [30MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter : 100pin:24ch,144pin:36ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 3 groups • Serial I/O : 5 • Watchdog timer : 1 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
				M30823MW-XXXGP						123		100P6Q-A	PLQP0100KB-A
				M30825MW-XXXGP								144P6Q-A	PLQP0144KA-A
		384K		M30823MH-XXXFP						87		100P6S-A	PRQP0100JB-A
				M30823MH-XXXGP								100P6Q-A	PLQP0100KB-A
				M30825MH-XXXGP						123		144P6Q-A	PLQP0144KA-A
			31K	M30827MH-XXXFP						87		100P6S-A	PRQP0100JB-A
				M30827MH-XXXGP								100P6Q-A	PLQP0100KB-A
				M30829MH-XXXGP						123		144P6Q-A	PLQP0144KA-A

M32C/83 Group

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) Data Flash	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/83	Flash ROM	512K	–	31K	M30833FJFP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter:100pin:26ch,144pin:34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 4 groups • Serial I/O : 5 • Watchdog timer : 1 • CAN : 2ch • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
					M30833FJGP								100P6Q-A	PLQP0100KB-A
					M30835FJGP						123		144P6Q-A	PLQP0144KA-A
					M30833FJTGP						87		100P6S-A	PRQP0100JB-A
					M30833FJVGP								100P6Q-A	PLQP0100KB-A

List of Part Numbers

M32C/84 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shortest instruction execution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/84	ROM iess	–	–	10K	M30840SFP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	47	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter :100pin:26ch,144pin:34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 1 groups • Serial I/O : 5 • Watchdog timer : 1 • CAN:2ch • CRC calculation circuit • X-Y conversion circuit • PLL	100P6S-A	PRQP0100JB-A
					M30840SGP								100P6Q-A	PLQP0100KB-A
					M30842SGP						83		144P6Q-A	PLQP0144KA-A
	Mask ROM	128K	–	10K	M30840MC-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30840MC-XXXGP								100P6Q-A	PLQP0100KB-A
					M30842MC-XXXGP						123		144P6Q-A	PLQP0144KA-A
		192K		16K	M30840ME-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30840ME-XXXGP								100P6Q-A	PLQP0100KB-A
					M30842ME-XXXGP						123		144P6Q-A	PLQP0144KA-A
		320K		24K	M30843MW-XXXFP						87		100P6S-A	PRQP0100JB-A
					M30843MW-XXXGP								100P6Q-A	PLQP0100KB-A
					M30845MW-XXXGP						123		144P6Q-A	PLQP0144KA-A
	Flash ROM	320K	4K	24K	M30843FWFP★★						87		100P6S-A	PRQP0100JB-A
					M30843FWGP								100P6Q-A	PLQP0100KB-A
					M30845FWGP						123		144P6Q-A	PLQP0144KA-A
					M30843FWTGP★★						87		100P6Q-A	PLQP0100KB-A
					M30845FWTGP★★								144P6Q-A	PLQP0144KA-A
		384K			M30843FHFP★★						123		100P6S-A	PRQP0100JB-A
					M30843FHGP						87		100P6Q-A	PLQP0100KB-A
					M30845FHGP								144P6Q-A	PLQP0144KA-A
					M30843FHTGP★★						123		100P6Q-A	PLQP0100KB-A
					M30845FHTGP★★						87		144P6Q-A	PLQP0144KA-A
		512K			M30843FJFP★★						123		100P6S-A	PRQP0100JB-A
					M30843FJGP								100P6Q-A	PLQP0100KB-A
					M30845FJGP						87		144P6Q-A	PLQP0144KA-A
					M30843FJTGP★★								100P6Q-A	PLQP0100KB-A
					M30845JTGP★★						123		144P6Q-A	PLQP0144KA-A

★★ : Under development

M32C/85 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shortest instruction execution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/85	Mask ROM	320K	–	24K	M30853MW-XXXFP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter :100pin:26ch,144pin:34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function.(except FWT,FHT,FGT) • Intelligent I/O : 1 groups • Serial I/O : 5 • Watchdog timer : 1 • CAN:2ch • CRC calculation circuit • X-Y conversion circuit • PLL	100P6S-A	PRQP0100JB-A
					M30853MW-XXXGP								100P6Q-A	PLQP0100KB-A
					M30855MW-XXXGP						123		144P6Q-A	PLQP0144KA-A
	Flash ROM		4K		M30853FiWFP★★						87		100P6S-A	PRQP0100JB-A
					M30853FWGP								100P6Q-A	PLQP0100KB-A
					M30855FWGP						123		144P6Q-A	PLQP0144KA-A
					M30853FWTGP★★						87		100P6Q-A	PLQP0100KB-A
					M30855FWTGP★★						123		144P6Q-A	PLQP0144KA-A
		384K			M30853FHFP★★						87		100P6S-A	PRQP0100JB-A
					M30853FHGP								100P6Q-A	PLQP0100KB-A
					M30855FHGP						123		144P6Q-A	PLQP0144KA-A
					M30853FHTGP★★						87		100P6Q-A	PLQP0100KB-A
					M30855FHTGP★★						123		144P6Q-A	PLQP0144KA-A
		512K			M30853FJFP★★						87		100P6S-A	PRQP0100JB-A
					M30853FJGP								100P6Q-A	PLQP0100KB-A
					M30855FJGP						123		144P6Q-A	PLQP0144KA-A
					M30853FJTGP★★						87		100P6Q-A	PLQP0144KA-A
					M30855FJTGP★★						123		144P6Q-A	PLQP0144KA-A

★★ : Under development

M32C/86 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shortest instruction execution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/86	Flash ROM	512K	4K	24K	M30865FJGP	32	31.2	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	123	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter :34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 1 groups • Serial I/O : 5 • Watchdog timer : 1 • CAN:2ch • CRC calculation circuit • X-Y conversion circuit • 2-Phase Stepping Controller 4ch x 4sets • PLL	144P6Q-A	PLQP0144KA-A
					M30865FJTGP★★									

★★ : Under development

M32C/87 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (˚C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/87	Mask ROM	512K	–	31K	M30876MJ-XXXFP★★	32	31.3	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter:100pin:26ch,144pin:34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 2 groups • Serial I/O : 100pin:6,144pin:7 • Watchdog timer : 1 • CAN : 2ch • CRC calculation circuit • X-Y conversion circuit • PLL	100P6S-A	PRQP0100JB-A
					M30876MJ-XXXGP★★								100P6Q-A	PLQP0100KB-A
					M30878MJ-XXXGP★★						123		144P6Q-A	PLQP0144KA-A
	Mask ROM	1M	4K	48K	M30879FLFP						87		100P6S-A	PRQP0100JB-A
					M30879FLGP								100P6Q-A	PLQP0100KB-A
					M3087BFLGP						123		144P6Q-A	PLQP0144KA-A

★★ : Under development

M32C/88 Group

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (˚C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/88	Mask ROM	320K	4K	48K	M30880FWTGP★★	32	31.3	–20 to 85 or –40 to 85	3.0 to 5.5 [24MHz] 4.2 to 5.5 [32MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A/D converter:100pin:26ch,144pin:34ch • 8-bit D/A converter : 2ch • DMAC : 4ch • DMACII : Activated by an interrupt from any peripheral function. • Intelligent I/O : 2 groups • Serial I/O : 100pin:6,144pin:7 • Watchdog timer : 1 • CAN : 2ch • CRC calculation circuit • X-Y conversion circuit • PLL	100P6S-A	PRQP0100JB-A
					M30882FWTGP★★						123		144P6Q-A	PLQP0144KA-A
		384K			M30880FHTGP★★						87		100P6S-A	PRQP0100JB-A
					M30882FHTGP★★						123		144P6Q-A	PLQP0144KA-A
		512K			M30880FJTGP★★						87		100P6S-A	PRQP0100JB-A
					M30882FJTGP★★						123		144P6Q-A	PLQP0144KA-A

★★ : Under development

Automotive(M16C/1N Group)

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (˚C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/1N	Mask ROM	32K	—	1K	M301N2M4T-XXXFP★★	16	62.5	–40 to 85	4.2 to 5.5 [16MHz]*	–	37	• 8-bit timer : 4 • 16-bit timer : 1 • 10-bit A/D converter:12+2ch • 8-bit D/A converter : 1ch • Serial I/O : 2 • Watchdog timer : 1 • CAN : 1ch	48P6Q-A	PLQP0048KB-A
		64K		3K	M301N2M8T-XXXFP★★									
	Flash ROM	64K	4K	3K	M301N2F8TFP★★									

* Supply voltage may be changed

★★ : Under development

Automotive(M16C/26A,28,29 Group)

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (*3)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/26A	Flash ROM	24K	4K	1K	M30260F3TGP★★	20	50	–40 to 85	3.0 to 5.5	–	39	• Input timer : 3 • Output timer : 5 • 10-bit A/D converter : 12ch • Serial I/O : 3 • Watchdog timer : 1 • 3-Phase Inverter control:6 • CRC calculation circuit	48P6Q-A	PLQP0048KB-A
					M30260F3VGP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
		48K		2K	M30260F6TGP★★	20	50	–40 to 85	3.0 to 5.5					
					M30260F6VGP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
		64K			M30260F8TGP★★	20	50	–40 to 85	3.0 to 5.5					
					M30260F8VGP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
M16C/28		96K		8K	M30280FATHP★★	20	50	–40 to 85	3.0 to 5.5		71	• Input timer : 3 • Output timer : 5 • Input capture : 8 • Output compare : 8 • 10-bit A/D converter : 24ch (80pin) • Serial I/O : 5 • Watchdog timer : 1 • 3-Phase Inverter control:6 • Multi master I²C-bus	80P6Q-A	PLQP0080KB-A
					M30280FAVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
					M30281FATHP★★	20	50	–40 to 85	3.0 to 5.5		55		64P6Q-A	PLQP0064KB-A
					M30281FAVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
M16C/29		96K		8K	M30290FATHP★★	20	50	–40 to 85	3.0 to 5.5		71	• Input timer : 3 • Output timer : 5 • Input capture : 8 • Output compare : 8 • 10-bit A/D converter : 27ch (80pin) • Serial I/O : 5 • Watchdog timer : 1 • 3-Phase Inverter control:6 • Multi master I²C-bus • CRC calculation circuit • CAN : 1ch	80P6Q-A	PLQP0080KB-A
					M30290FAVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
					M30291FATHP★★	20	50	–40 to 85	3.0 to 5.5		55		64P6Q-A	PLQP0064KB-A
					M30291FAVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
		128K		12K	M30290FCTHP★★	20	50	–40 to 85	3.0 to 5.5		71		80P6Q-A	PLQP0080KB-A
					M30290FCVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					
					M30291FCTHP★★	20	50	–40 to 85	3.0 to 5.5		55		64P6Q-A	PLQP0064KB-A
					M30291FCVHP★★	(*1)	(*2)	–40 to 105 or –40 to 125	4.2 to 5.5					

* Supply voltage may be changed

★★ : Under development

*1 : 20MHz (–40 to 105˚C), 16MHz (–40 to 125˚C)

*2 : 50ns (–40 to 105˚C), 62.5ns (–40 to 125˚C)

*3 : Continuous operation at temperature exceeding 85˚C cannot be guaranteed. Customers considering applications where the operating temperature exceeds 85˚C are requested to cousult with Renesas.

Automotive(M16C/62 Group)

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)(H)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/62	Mask ROM	32K	–	3K	M30623M4T-XXXGP	16	62.5	–40 to 85	4.2 to 5.5	1	69	• Input timer : 5 • Output timer : 3 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PRQP0080JA-A
		64K		4K	M30622M8T-XXXFP						87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • Three-phase PWM output : 6 • CRC calculation circuit	100P6S-A	PRQP0100JB-A
					M30622M8V-XXXFP			–40 to 125						
					M30623M8T-XXXGP			–40 to 85			69	• Input timer : 5 • Output timer : 3 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PRQP0080JA-A
					M30623M8V-XXXGP			–40 to 125						
		128K		5K	M30622MCT-XXXFP			–40 to 85			87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • Three-phase PWM output : 6 • CRC calculation circuit	100P6S-A	PRQP0100JB-A
					M30622MCV-XXXFP			–40 to 125						
					M30623MCT-XXXGP			–40 to 85			69	• Input timer : 5 • Output timer : 3 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PRQP0080JA-A
					M30623MCV-XXXGP			–40 to 125						
	Flash ROM			10K	M30621MCV-XXXGP									
					M30620MCT-XXXFP			–40 to 85			87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • Three-phase PWM output : 6 • CRC calculation circuit	100P6S-A	PRQP0100JB-A
					M30620FCT-XXXFP									
					M30620FCTFP									
					M30620FCUFP			–40 to 105						
					M30621FCTGP			–40 to 85			6	• Input timer : 5 • Output timer : 3 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PRQP0080JA-A
					M30621FCUGP			–40 to 105						
		256K		20K	M30624FGU-XXXFP						87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • Three-phase PWM output : 6 • CRC calculation circuit	100P6S-A	PRQP0100JB-A
					M30624FGUFP									
	OTP PROM	128K		5K	M30622ECT-XXXFP			–40 to 85	4.5 to 5.5					
					M30622ECTFP									
					M30622ECV-XXXFP			–40 to 125						
					M30622ECVFP									
					M30623ECT-XXXGP			–40 to 85			69	• Input timer : 5 • Output timer : 3 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • UART : 3 • DMAC : 2ch • Serial I/O : 2 • Watchdog timer : 1 • CRC calculation circuit	80P6S-A	PRQP0080JA-A
					M30623ECTGP									
					M30623ECV-XXXGP			–40 to 125						
					M30623ECVGP									
M16C/62PT	Mask ROM	48K	–	4K	M3062CM6T-XXXFP	24	41.7	–40 to 85	4.0 to 5.5	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • Watchdog timer : 1 • Three-phase PWM output : 6 • PLL • CRC calculation circuit	100P6S-A	PRQP0100JB-A
					M3062CM6T-XXXGP								100P6Q-A	PLQP0100KB-A
		64K			M3062CM8T-XXXFP								100P6S-A	PRQP0100JB-A
					M3062CM8T-XXXGP								100P6Q-A	PLQP0100KB-A
		96K		5K	M3062CMAT-XXXFP								100P6S-A	PRQP0100JB-A
					M3062CMAT-XXXGP								100P6Q-A	PLQP0100KB-A
		128K		10K	M3062AMCT-XXXFP								100P6S-A	PRQP0100JB-A
					M3062AMCT-XXXGP★★								100P6Q-A	PLQP0100KB-A
					M3062AMCV-XXXFP★★			–40 to 125					100P6S-A	PRQP0100JB-A
					M3062AMCV-XXXGP★★								100P6S-A	PRQP0100JB-A
	Flash ROM	64K	4K	4K	M3062CF8TFP★★			–40 to 85					100P6Q-A	PLQP0100KB-A
					M3062CF8TGP								100P6Q-A	PLQP0100KB-A
		128K		10K	M3062AFCTFP								100P6S-A	PRQP0100JB-A
					M3062AFCTGP★★								100P6Q-A	PLQP0100KB-A
					M3062AFCVFP★★			–40 to 125					100P6S-A	PRQP0100JB-A
					M3062AFCVGP★★								100P6Q-A	PLQP0100KB-A
		384K		31K	M3062JFHTFP			–40 to 85					100P6S-A	PRQP0100JB-A
					M3062JFHTGP								100P6Q-A	PLQP0100KB-A

*: Continuous operation at temperature exceeding 85°C cannot be guaranteed. Customers considering applications where the operating temperature exceeds 85°C are requested to cousult with Renesas.

★★ : Under development

Automotive(M16C/6N Group)

Group	Memory type	Internal memory(Byte) ROM	Data Flash	RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)(H)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/6N (M16C/6N4)	Mask ROM	128K	–	5K	M306N4MC-XXXFP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 4 • CAN : 2ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6	100P6S-A	PRQP0100JB-A
					M306N4MC-XXXGP**								100P6Q-A	PLQP0100KB-A
		256K		10K	M306N4MG-XXXFP**								100P6S-A	PRQP0100JB-A
					M306N4MG-XXXGP**								100P6Q-A	PLQP0100KB-A
		128K		5K	M306N4MCT-XXXFP	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]				100P6S-A	PRQP0100JB-A
					M306N4MCT-XXXGP**								100P6Q-A	PLQP0100KB-A
		256K		10K	M306N4MGT-XXXFP**								100P6S-A	PRQP0100JB-A
					M306N4MGT-XXXGP**								100P6Q-A	PLQP0100KB-A
					M306N4MGV-XXXFP**			–40 to 125 (V-Ver)					100P6S-A	PRQP0100JB-A
					M306N4MGV-XXXGP**								100P6Q-A	PLQP0100KB-A
	Flash ROM	128K	4K	5K	M306N4FCFP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]				100P6S-A	PRQP0100JB-A
					M306N4FCGP**								100P6Q-A	PLQP0100KB-A
		256K		10K	M306N4FGFP**								100P6S-A	PRQP0100JB-A
					M306N4FGGP**								100P6Q-A	PLQP0100KB-A
		128K		5K	M306N4FCTFP	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]				100P6S-A	PRQP0100JB-A
					M306N4FCTGP**								100P6Q-A	PLQP0100KB-A
		256K		10K	M306N4FGTFP								100P6S-A	PRQP0100JB-A
					M306N4FGTGP**								100P6Q-A	PLQP0100KB-A
					M306N4FGVFP			–40 to 125 (V-Ver)					100P6S-A	PRQP0100JB-A
					M306N4FGVGP**								100P6Q-A	PLQP0100KB-A
M16C/6N (M16C/6N5)	Mask ROM	128K	–	5K	M306N5MC-XXXFP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]			• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 4 • CAN : 1ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6	100P6S-A	PRQP0100JB-A
					M306N5MC-XXXGP**								100P6Q-A	PLQP0100KB-A
					M306N5MCT-XXXFP	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]				100P6S-A	PRQP0100JB-A
					M306N5MCT-XXXGP**								100P6Q-A	PLQP0100KB-A
					M306N5MCV-XXXFP			–40 to 125 (V-Ver)					100P6S-A	PRQP0100JB-A
					M306N5MCV-XXXGP**								100P6Q-A	PLQP0100KB-A
	Flash ROM		4K		M306N5FCFP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]				100P6S-A	PRQP0100JB-A
					M306N5FCGP**								100P6Q-A	PLQP0100KB-A
					M306N5FCTFP	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]				100P6S-A	PRQP0100JB-A
					M306N5FCTGP**								100P6Q-A	PLQP0100KB-A
					M306N5FCVFP			–40 to 125 (V-Ver)					100P6S-A	PRQP0100JB-A
					M306N5FCVGP**								100P6Q-A	PLQP0100KB-A
M16C/6N (M16C/6NK)	Mask ROM	192K	–	16K	M306NKME-XXXGP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]			• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • CAN : 2ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6	100P6Q-A	PLQP0100KB-A
		256K		20K	M306NKMG-XXXGP**									
		192K		16K	M306NKMET-XXXGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		256K		20K	M306NKMGT-XXXGP**									
		192K		16K	M306NKMEV-XXXGP**			–40 to 125 (V-Ver)						
		256K		20K	M306NKMGV-XXXGP**									
	Flash ROM	384K	4K	31K	M306NKFHGP	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]					
		512K			M306NKFJGP									
		384K			M306NKFHTGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		512K			M306NKFJTGP **									
		384K			M306NKFHVGP**			–40 to 125 (V-Ver)						
		512K			M306NKFJVGP**									
M16C/6N (M16C/6NL)	Mask ROM	192K	–	16K	M306NLME-XXXGP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]			• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 5 • CAN : 1ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6		
		256K		20K	M306NLMG-XXXGP**									
		192K		16K	M306NLMET-XXXGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		256K		20K	M306NLMGT-XXXGP**									
		192K		16K	M306NLMEV-XXXGP**			–40 to 125 (V-Ver)						
		256K		20K	M306NLMGV-XXXGP**									
	Flash ROM	384K	4K	31K	M306NLFHGP	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]					
		512K			M306NLFJGP									
		384K			M306NLFHTGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		512K			M306NLFJTGP**									
		384K			M306NLFHVGP**			–40 to 125 (V-Ver)						
		512K			M306NLFJVGP**									
M16C/6N (M16C/6NM)	Mask ROM	192K	–	16K	M306NMME-XXXGP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]		113	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 7 • CAN : 2ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6	128P6Q-A	PLQP0128KB-A
		256K		20K	M306NMMG-XXXGP**									
		192K		16K	M306NMMET-XXXGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		256K		20K	M306NMMGT-XXXGP**									
		192K		16K	M306NMMEV-XXXGP**			–40 to 125 (V-Ver)						
		256K		20K	M306NMMGV-XXXGP**									
	Flash ROM	384K	4K	31K	M306NMFHGP	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]					
		512K			M306NMFJGP**									
		384K			M306NMFHTGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		512K			M306NMFJTGP**									
		384K			M306NMFHVGP**			–40 to 125 (V-Ver)						
		512K			M306NMFJVGP**									
M16C/6N (M16C/6NN)	Mask ROM	192K	–	16K	M306NNME-XXXGP**	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]			• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : (24+2)ch • 8-bit D-A converter : 2ch • DMAC : 2ch • Serial I/O : 7 • CAN : 1ch • Watchdog timer : 1 • CRC calculation circuit • Three-phase PWM output : 6		
		256K		20K	M306NNMG-XXXGP**									
		192K		16K	M306NNMET-XXXGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		256K		20K	M306NNMGT-XXXGP**									
		192K		16K	M306NNMEV-XXXGP**			–40 to 125 (V-Ver)						
		256K		20K	M306NNMGV-XXXGP**									
	Flash ROM	384K	4K	31K	M306NNFHGP	24	41.7	–40 to 85 (Non-T)	3.0 to 5.5 [24MHz]					
		512K			M306NNFJGP									
		384K			M306NNFHTGP**	20	50.0	–40 to 85 (T-Ver)	4.2 to 5.5 [20MHz]					
		512K			M306NNFJTGP**									
		384K			M306NNFHVGP**			–40 to 125 (V-Ver)						
		512K			M306NNFJVGP**									

★★ : Under development

Automotive(M16C/80 Group)

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M16C/80	Mask ROM	128K	10K	M30800MCHT-XXXFP	20	50	–40 to 85	4.2 to 5.5	1	87	• Input timer : 6 • Output timer : 5 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • Serial I/O : 5 • DMAC : 4ch • Watchdog timer : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
	Flash ROM			M30800FCHTFP									

Automotive(M32C/81 Group)

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/81	Mask ROM	128K	10K	M30810MCT-XXXFP	32	31.2	–40 to 85	4.2 to 5.5	1	87	• 16-bit timer : 11 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 2 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
				M30810MCT-XXXGP								100P6Q-A	PLQP0100KB-A
				M30810MCV-XXXFP			–40 to 125					100P6S-A	PRQP0100JB-A
				M30810MCV-XXXGP								100P6Q-A	PLQP0100KB-A
				M30812MCT-XXXGP			–40 to 85			123	• 16-bit timer : 11 • 10-bit A-D converter : 34ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 2 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	144P6Q-A	PLQP0144KA-A
				M30812MCV-XXXGP			–40 to 125						

Automotive(M32C/83 Group)

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/83	Flash ROM	512K	31K	M30833FJTGP	32	31.2	–40 to 85	4.2 to 5.5	1	87	• 16-bit timer : 11 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 4 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	100P6Q-A	PLQP0100KB-A
				M30833FJVGP			–40 to 125						
				M30835FJTGP			–40 to 85			123	• 16-bit timer : 11 • 10-bit A-D converter : 34ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 4 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	144P6Q-A	PLQP0144KA-A

Automotive(M32C/84 Group)

Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) Data Flash	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/84	Mask ROM	128K	–	10K	M30840MCT-XXXGP M30842MCT-XXXGP	32	31.2	–40 to 85	4.2 to 5.5	1	87	• 16-bit timer : 11 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 1 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	100P6Q-A	PLQP0100KB-A
	Flash ROM	512K	4K	24K	M30843FJTGP									
					M30845FJTGP						123	• 16-bit timer : 11 • 10-bit A-D converter : 34ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 1 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	144P6Q-A	PLQP0144KA-A

Automotive(M32C/85 Group)

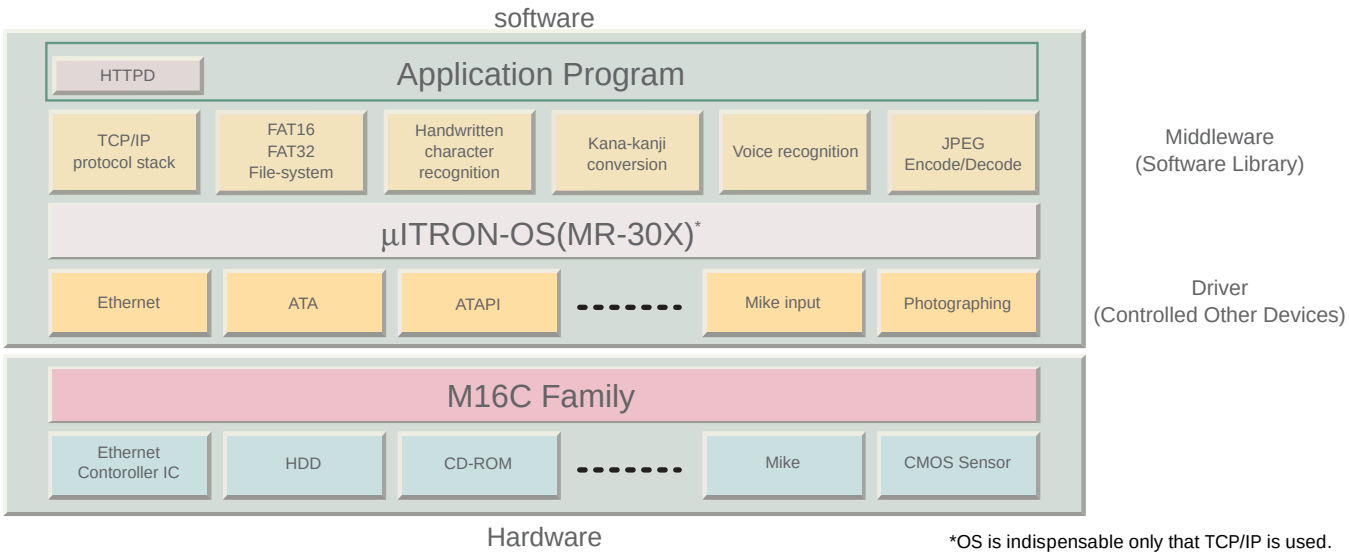
Group	Memory type	Internal memory(Byte) ROM	Internal memory(Byte) Data Flash	Internal memory(Byte) RAM	Type name	Operating frequency (MHz)	Shotest instruction excution time (ns)	Operating temperature (°C)(H)	Supply voltage (V)	Input port	I/O port	Function	Package	
M32C/85	Flash ROM	320K	4K	24K	M30853FWTGP	1	31.2	–40 to 85	4.2 to 5.5	1	87	• 16-bit timer : 11 • 10-bit A-D converter : 26ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 1 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	100P6S-A	PRQP0100JB-A
		384K		24K	M30853FHTGP									
		512K		16K	M30853FJTGP									
		320K	4K	24K	M30855MWT-XXXGP						123	• 16-bit timer : 11 • 10-bit A-D converter : 34ch • 8-bit D-A converter : 2ch • DMAC : 4ch • Intelligent I/O : 1 block • Serial I/O : 5 • Watchdog timer : 1 • CAN : 1 • Three-phase PWM output : 6 • CRC calculation circuit • X-Y conversion circuit	144P6Q-A	PLQP0144KA-A
		384K		24K	M30855FHTGP									
		512K		16K	M30852FJTGP									

*: Continuous operation at temperature exceeding 85°C cannot be guaranteed. Customers considering applications where the operating temperature exceeds 85°C are requested to cousult with Renesas.

Middleware

The software libraries (middleware) normally provided for microprocessors are available for the M16C-family microcontrollers which essentially are used for controller applications. These software libraries help to reduce the software development time as well as the number of dedicated external ICs needed.

Abundant M16C middleware (software libraries)

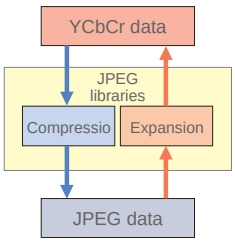


*OS is indispensable only that TCP/IP is used.

Features of JPEG compression/expansion

■JPEG (Joint Photographic Experts Group of CCITT-ISO/IEC) compression by a base line method
■Full-color data (24 bits per pixel) is compressed to about 1/10 to 1/20 and expanded therefrom.
■High-speed conversion
- Compression time: approx. 0.5 s (XIN = 16 MHz, 5 V)
- Expansion time: approx. 0.4 s (XIN = 16 MHz, 5 V)
- Sampling ratio Y:Cb:Cr = 4:2:2
- QCIF (144 x 160 x 3 (RGB)) approx. 70,000 pixels

■Compact library that can be incorporated into the internal ROM or RAM
- Compression: ROM, approx. 5 KB / RAM, approx. 4 KB
- Expansion: ROM, approx. 6 KB / RAM, approx. 6 KB



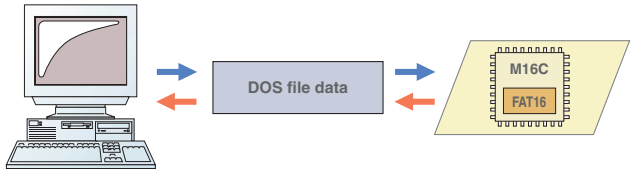
Features of the DOS file system library

■Interfaces for DOS-compatible FAT file systems supported
- A total of 14 file system manipulating functions are supported.
- 12-bit FAT and 16-bit FAT are supported.
- Long filenames are supported.
- Up to 26 drives can be connected.
- Up to 260 S-JIS characters for full path names are supported.

Path a:¥a¥a¥a...a¥aaaaaaa up to 260 characters
- Up to 255 Unicode characters for long filenames are supported.

Filename Aaaa...aaa up to 255 characters

■Source code for ATA card driver sample programs are supplied.
<Driver software for Renesas BGO flash memory can also be supplied.>

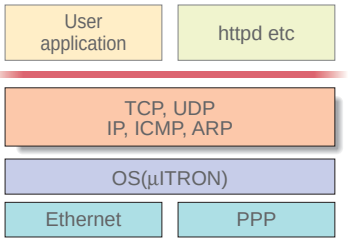


Features of TCP/IP

■Features
- Protocol processing is accomplished by using only the internal memory of the M16C.
- Processing on the client side is performed by the M16C.

■Specifications
- Compliant with µITRON TCP/IP API specification
  http://www.itron.gr.jp/SPEC/tcpip-j.html
- TCP, UDP, IP, ICMP and ARP are supported.

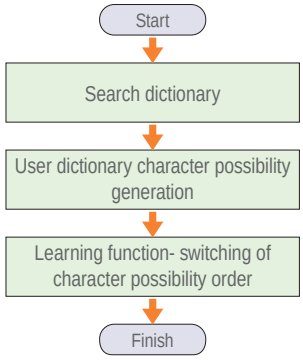
Other specifications such as PPP, httpd, smtp and pop3 are being considered.



Features of the Japanese syllable/ Chinese character conversion library

■High speed conversion of simple structured strings of Japanese syllables into a Japanese syllable/ Chinese character composite sentence (SJIS code, up to 25 characters) (one conversion/130ms with M16C/62@16MHz)
■Compact sized dictionary: approx 300kB (Contains approx 45,000words)
■Creation/ registration/ reference/ deletion of user registration dictionary possible
■Learning function of fixed possible Chinese characters (order change of possible characters)

Processing details of the Japanese syllable/ Chinese character conversion library



Demo Set

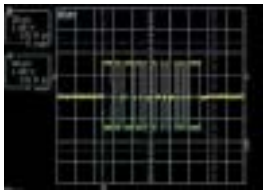
List of M16C Family demo sets

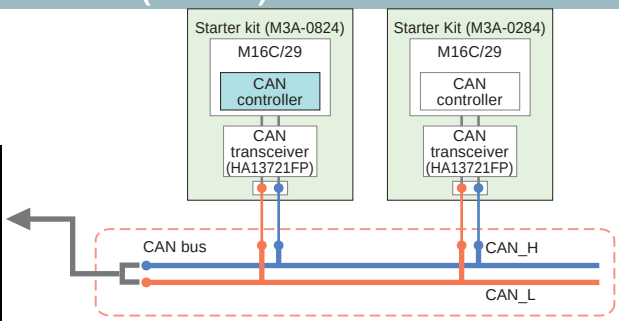
M32C/80	M32C/86	gauge (automobile meter) Demo set		
	M32C/83	HDD Music Server	3 phase motor drive demo	Stepping motor demo set
M16C/80	M16C/80			
M16C/60	M16C/62P	Oscillation stop detection function demo set	Voltage reduction detection function demo set	
	M16C/62N			
	M16C/62M	JPEG demo set	Scheduler demo set	AR camera connection demo set (WWW connection)
	M16C/62A			
M16C/30	M16C/30			
M16C/Tiny	M16C/26, 26A	Industrial orientated CAN communication demo set	Motor control demo set	
	M16C/28, 29			
R8C/Tiny	R8C/10, 11, 12 ,13	Misty demo	PPP/HTTP Protocol Demo (ChoroQ)	Data drive demo set

Industrial orientated CAN communication demo set (M16/29)

Easily evaluate CAN communication operation method using M16/29 internal CAN controller
[Features]
Directly measures CAN communication waveforms on the CAN bus using the start kit for M16/29

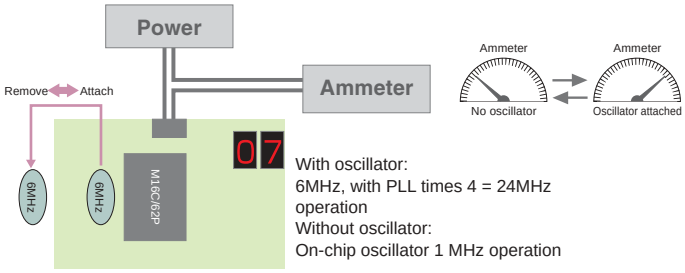
■Features of the CAN controller
- Transmission speed: up to 1Mbps
- Bus length: 40m/ 1Mbps
- Protocol standard: Ver. 2.0B
- H/W synchronous/ re-synchronous





Oscillation stop detection function demo set (M16C/62P)

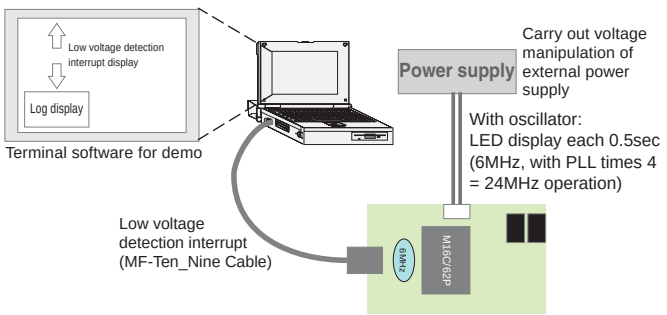
When the external oscillator stops due to a system malfunction, the internal on-chip oscillator automatically switches over in tandem with the interrupt generation, and emergency processing easily be carried out at very low power consumption.
[Features]
The oscillator is removed, and while conducting verification of operation through the on-chip oscillator, power consumption reduction during operation of the on-chip oscillator is also carried out.



With oscillator:
6MHz, with PLL times 4 = 24MHz operation
Without oscillator:
On-chip oscillator 1 MHz operation

Voltage reduction detection function demo set (M16C/62P)

Internal reset circuit and voltage detection circuit enable detection of decrease in voltage of external power supply and carrying out of automatic reset. While detecting a decrease in external power supply and making back-up operation possible, judgment after reset release is also made easy due to the cold/warm start detection bit.
[Features]
By decreasing the external power supply a voltage reduction detection interrupt is generated, and that interrupt generation is notified to the external PC by serial transmission.
A cold/warm start judgment is performed after reset release, and that result is notified to the external PC.

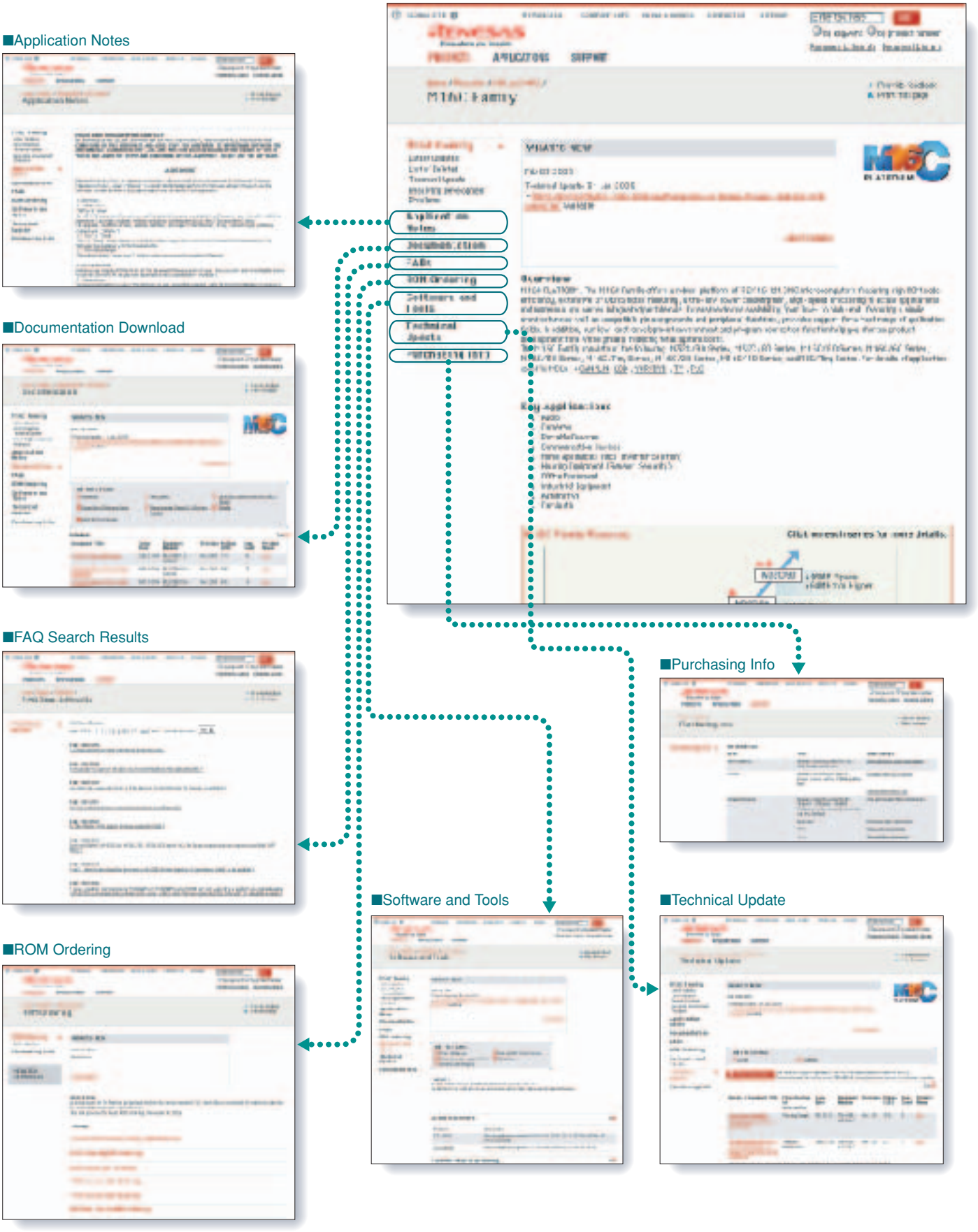


Customer Support

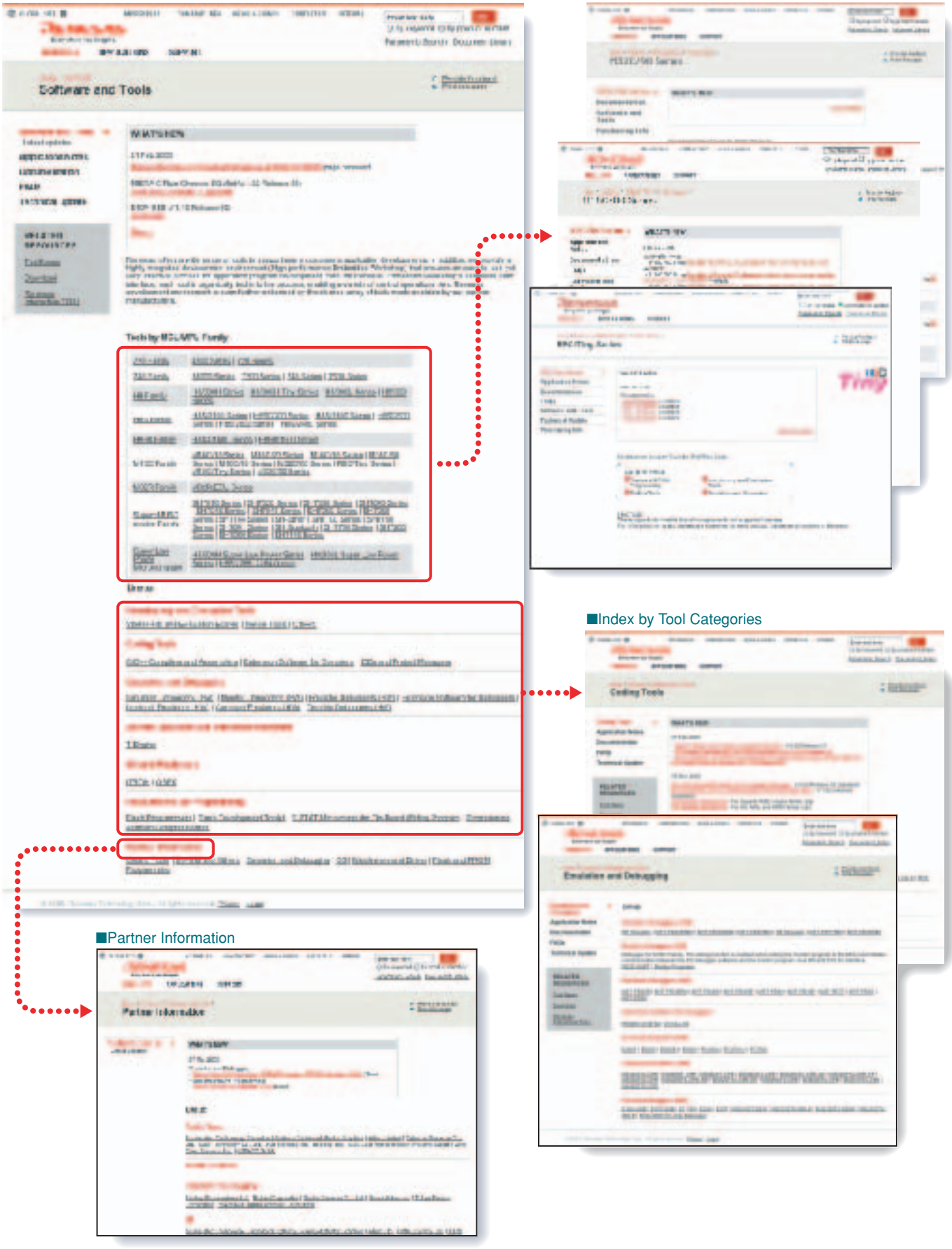
Renesas Website provides the latest information of the M16C platform of processors.

M16C Technical Information Website http://www.renesas.com/en/m16c

Menu Examples

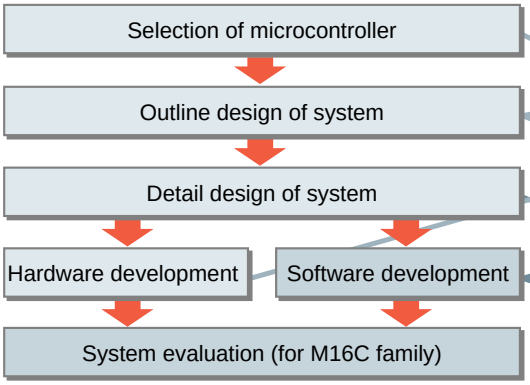


Renesas Development Tools Website http://www.renesas.com/en/tools



Related Documents

Usage (Microcontroller development flow)



	Type of document	Contents
Hardware	Data sheet and data book User's manual	Hardware specification (pin assignment, memory map, specifications of peripheral functions, electrical characteristics, timing charts)
Hardware	Programming manual	Detailed description about hardware specifications, operation, and application examples (connection with peripherals, relationship with software)
Software	Software manual	Method for creating programs using assembly and C languages
Software	Sample program collection	Detailed description about operation of each instruction (assembly language) Sample program collection using assembly language

App Notes

A lot of application notes by which use becomes possible at once because of the customer's program in addition to the manual of each product are prepared.

Application note(excerpt)

App Notes Title	Target MCU
M16C/62 RTC and WAIT Functions	M16C/62,/62A
16-Bit Microcontroller Trigonometrical Functions	M16C/62,M32C/83
How to change a M16C/62A to a M32C/83 design	M16C/62A,M32C/83
Connect the M16C with a Compact Flash Card	M16C/62
BlueFreeTM reference design for Hands-Free application	M16C/62N
How to check the Flash Version on M16C/62	M16C/62A,/62M,/62N,/62P
Using the M16C/62 Analog to Digital Converter in Repeat Sweep Mode 1	M16C/62,/62A
Startup project for M16C/62P	M16C/62P
Startup project for M16C/26	M16C/26
Simple Communications With HyperTerminal	M16C/62
Memory Expansion Mode Example Using The M16C ROM Monitor	M16C/62
Virtual E^2PROM management	M16C/62P
BlueSerialTM reference design for BluetoothTM to RS232 gateway	M16C/26
Using the M16C/62 Analog to Digital Converter in Repeat Mode	M16C/62,/62A
Using the M16C/62 Analog to Digital Converter in Repeat Sweep Mode 0	M16C/62,/62A
Using the M16C/62 Analog to Digital Converter in One-Shot Mode	M16C/62,/62A
Using the M16C/62 Analog to Digital Converter in Single Sweep Mode	M16C/62,/62A
C Compiler Startup Files for the M16C/62 MCU	M16C/62,/62A
Using the M16C/62 CRC	M16C/62,/62A
Using the M16C/62 D-A Converter	M16C/62,/62A
Using the M16C/62 DMAC in Forward Destination Mode	M16C/62,/62A
Using the M16C/62 DMAC in Forward Source Mode	M16C/62,/62A
Using the Expanded Memory Mode with the M16C/62	M16C/62A
Virtual Flash E^2PROM Driver for the M16C/62	M16C/62A
Programming the M16C/62 Flash in Asynchronous Serial Mode	M16C/62A
Programming the M16C/62 in Flash Parallel Mode	M16C/62A
Programming the M16C/62 Flash in CPU Rewrite Mode	M16C/62A
Using the M16C/62 Power Saving Modes	M16C/62
Special Function Register Header Files for the M16C/62A MCU	M16C/62A
Using the M16C/62 Timer in Event Counter Mode	M16C/62,/62A
Using the M16C/62 Timers in Timer Mode	M16C/62,/62A
Using the M16C/62 Timers in One-Shot Mode	M16C/62,/62A
Using the M16C/62 Timer in Pulse Period/Width Measurement Mode	M16C/62,/62A
Using the M16C/62 Timer in Pulse Output Mode	M16C/62,/62A
Using the M16C/62 Timer in PWM Mode	M16C/62,/62A
Using the M16C/62 Watchdog Timer	M16C/62,/62A
Writing M16C/62 Interrupt Handlers in C	M16C/62,/62A
M16C Firmware Requirements for In-Circuit Debugger	M16C

You can download PDF files of the latest information of each document documents from the M16C technical information home page.
URL: www.renesas.com/jpn/products/mpumcu/16bit/m16c/mcdsum.htm(Some Documents)
URL: www.renesas.com/jpn/products/mpumcu/16bit/m16c/mcapno.htm(Some App Notes)

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http://www.renesas.com

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

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