

To our customers,

---

## Old Company Name in Catalogs and Other Documents

---

On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

## Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
  - “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
  - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
  - “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

To all our customers

---

## **Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.**

---

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

# 3812 Group

## SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

### DESCRIPTION

The 3812 group is the 8-bit microcomputer based on the 740 family core technology.

The 3812 group has six 8-bit timers, and an 8-channel A-D converter as additional functions.

The various microcomputers in the 3812 group include variations of internal memory size and packaging. For details, refer to the section on part numbering.

### FEATURES

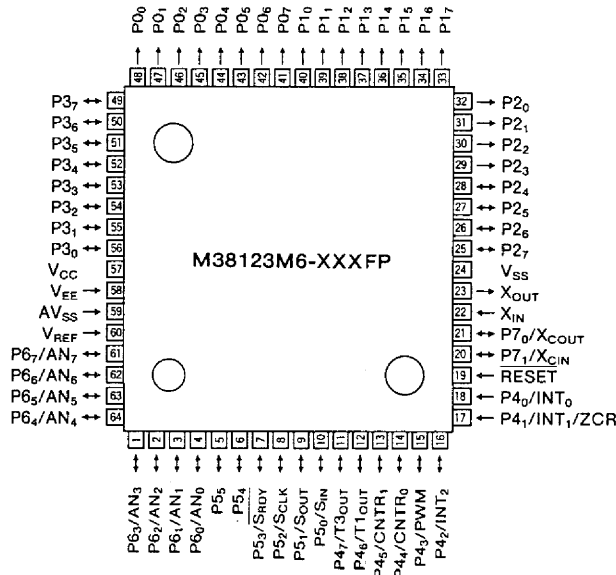
- Basic machine-language instructions ..... 71
- The minimum instruction execution time ..... 0.63μs  
(at 6.3MHz oscillation frequency)
- Memory size
- ROM ..... 4K to 60K bytes
- RAM ..... 192 to 1024 bytes
- Programmable input/output ports ..... 34
- High-breakdown-voltage output ports ..... 28
- Software pull-up/pull-down resistors (P2<sub>4</sub>-P2<sub>7</sub>, P5<sub>0</sub>-P5<sub>5</sub>)
- Interrupts ..... 14 sources, 13 vectors
- Timers ..... 8-bit×6
- Serial I/O ..... 8-bit×1 (Clock-synchronized)

- A-D converter ..... 8-bit×8 channel
- Zero cross detection input ..... 1 channel
- 2 Clock generating circuit
- Clock (X<sub>IN</sub>-X<sub>OUT</sub>) ..... Internal feedback resistor
- Sub-clock (X<sub>CIN</sub>-X<sub>COU</sub>T) ..... without internal feedback resistor  
(connect to an external ceramic resonator or a quartz-crystal oscillator)
- Power source voltage
- In high-speed mode ..... 4.0 to 5.5V  
(at 6.3MHz oscillation frequency and high-speed selected)
- In middle-speed mode ..... 2.8 to 5.5V  
(at 6.3MHz oscillation frequency and middle-speed selected)
- In low-speed mode ..... 2.8 to 5.5V  
(at 32KHz oscillation frequency)
- Power dissipation
- In high-speed mode ..... 38mW  
(at 6.3MHz oscillation frequency)
- In low-speed mode ..... 300μW  
(at 32KHz oscillation frequency)
- Operating temperature range ..... -10 to +85°C

### APPLICATIONS

VCRs, tuners, musical instruments, office automation, etc.

### PIN CONFIGURATION (TOP VIEW)

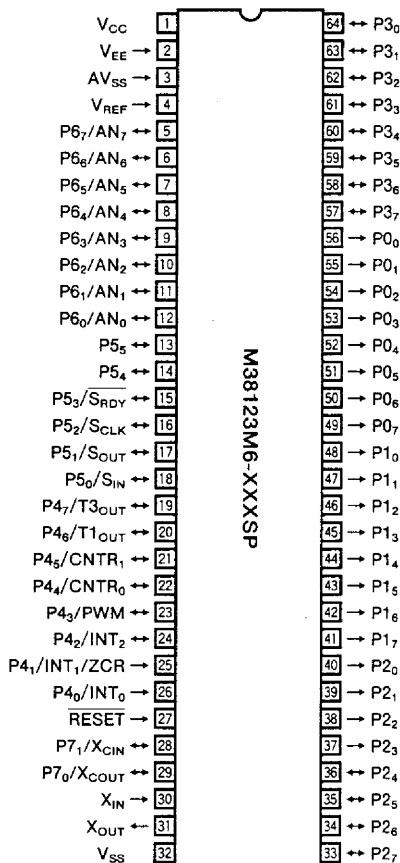


Package type : 64P6N-A

64-pin plastic-molded QFP

SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

PIN CONFIGURATION (TOP VIEW)



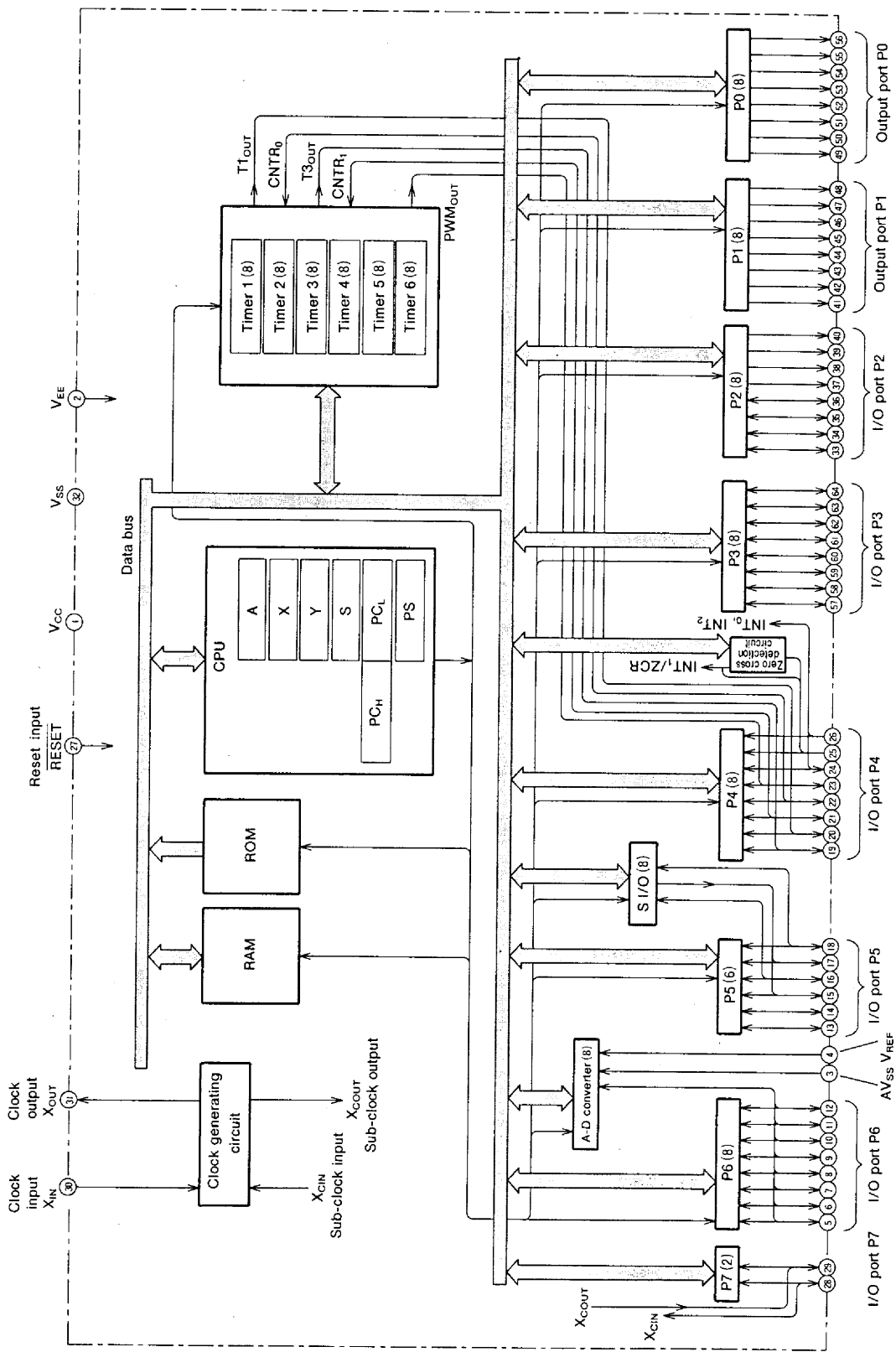
M38123M6-XXXXSP

Package type : 64P4B

64-pin shrink plastic-molded DIP

SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

FUNCTIONAL BLOCK DIAGRAM (Package : 64P4B)



SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

PIN DESCRIPTION

Pin	Name	Function	
			Function except a port function
V <sub>CC</sub> , V <sub>SS</sub>	Power source	• Apply voltage of 4.0 to 5.5V to V <sub>CC</sub> , and 0V to V <sub>SS</sub> .	
V <sub>EE</sub>	Pull-down power source input	• Applies voltage supplied to pull-down resistors of ports P0, P1, and P2 <sub>0</sub> -P2 <sub>3</sub> .	
V <sub>REF</sub>	Analog reference voltage	• Reference voltage input pin for A-D converter	
AV <sub>SS</sub>	Analog power source	• Analog power source input pin for A-D converter • Connect AV <sub>SS</sub> to V <sub>SS</sub> .	
RESET	Reset input	• Reset input pin for active "L"	
X <sub>IN</sub>	Clock input	• Input and output signals for the internal clock generating circuit. • Feedback resistor is built in between X <sub>IN</sub> pin and X <sub>OUT</sub> pin.	
X <sub>OUT</sub>	Clock output	• Connect a ceramic resonator or a quartz-crystal oscillator between the X <sub>IN</sub> and X <sub>OUT</sub> pins to set the oscillation frequency. • If an external clock is used, connect the clock source to the X <sub>IN</sub> pin and leave the X <sub>OUT</sub> pin open. • This clock is used as the oscillating source of system clock.	
P0 <sub>0</sub> -P0 <sub>7</sub>	Output port P0	• 8-bit output port • Each port builds in pull-down resistor between the output and the V <sub>EE</sub> pin.	
P1 <sub>0</sub> -P1 <sub>7</sub>	Output port P1	• The high-breakdown-voltage p-channel open-drain output • At reset these pins are set to the V <sub>EE</sub> pin level.	
P2 <sub>0</sub> -P2 <sub>3</sub>	Output port P2	• 4-bit output port with the same function as port P0.	
P2 <sub>4</sub> -P2 <sub>7</sub>	I/O port P2	• 4-bit I/O port • I/O direction register allows each pin to be individually programmed as either input or output. • At reset this port is set to input mode. • Pull-up/pull-down register and I/O direction register allow each pin to be programmed as pull-down. • TTL input level • CMOS 3-state output	
P3 <sub>0</sub> -P3 <sub>7</sub>	I/O port P3	• 8-bit I/O port with the same function as port P2 <sub>4</sub> -P2 <sub>7</sub> • CMOS compatible input level • The high-breakdown-voltage P-channel open-drain.	
P4 <sub>0</sub> /INT <sub>0</sub> , P4 <sub>1</sub> /INT <sub>1</sub> / ZCR	Input port P4	• 2-bit input port. • CMOS compatible input level	External interrupt input pins A zero cross detection circuit input pin (P4 <sub>1</sub> )  A PWM output pin (Timer output pin)  Timer 2, Timer 4 input pins  Timer 1, Timer 3 output pins
P4 <sub>2</sub> /INT <sub>2</sub>	I/O port P4	• 6-bit CMOS I/O port with the same function as port P2 <sub>4</sub> -P2 <sub>7</sub> • CMOS compatible input level • CMOS 3-state output	
P4 <sub>3</sub> /PWM			
P4 <sub>4</sub> /CNTR <sub>0</sub> , P4 <sub>5</sub> /CNTR <sub>1</sub>			
P4 <sub>6</sub> /T1 <sub>OUT</sub> , P4 <sub>7</sub> /T3 <sub>OUT</sub>			

SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

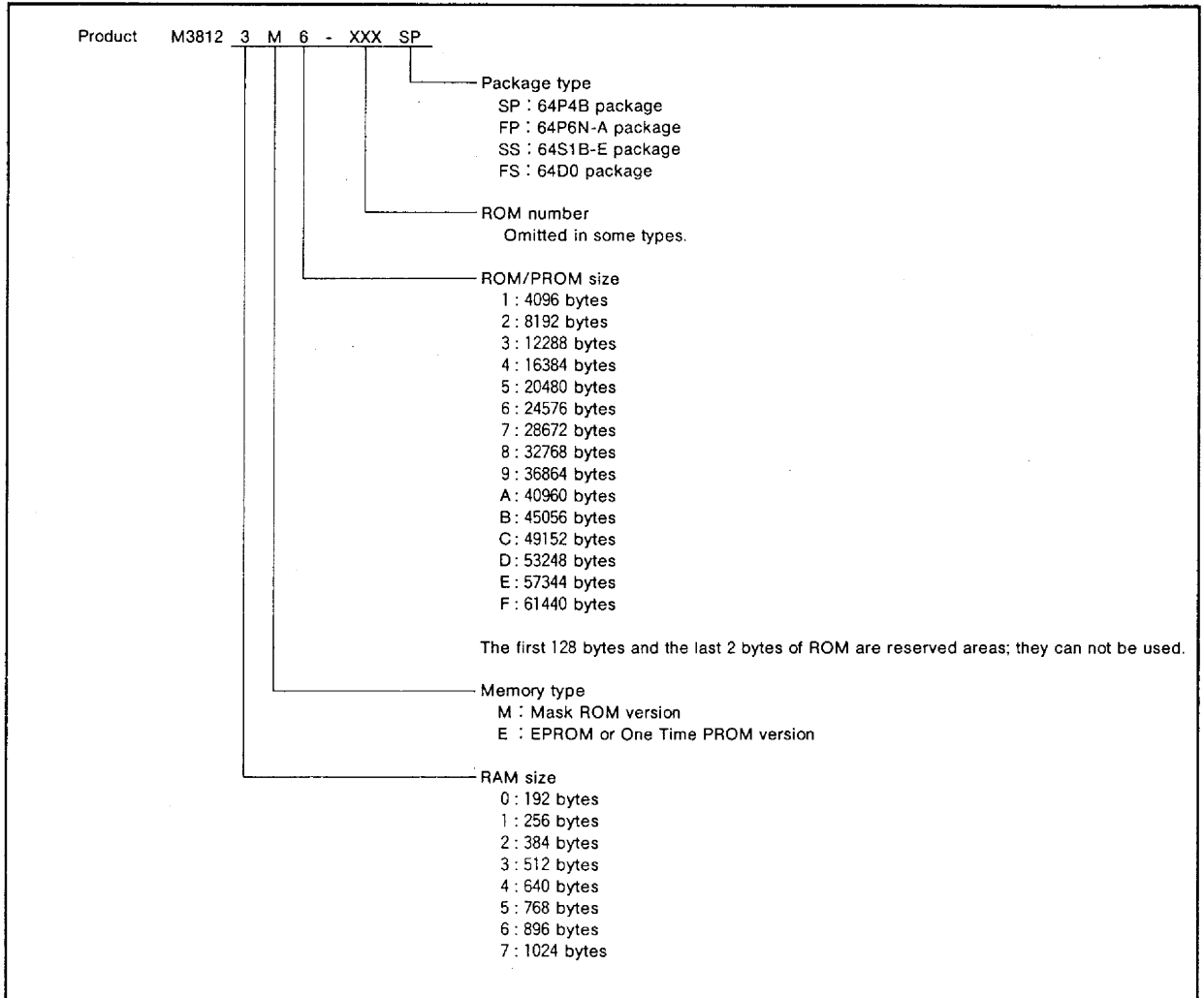
PIN DESCRIPTION (Continued)

Pin	Name	Function	Function except a port function
P5 <sub>0</sub> /S <sub>IN</sub> , P5 <sub>1</sub> /S <sub>OUT</sub> , P5 <sub>2</sub> /S <sub>CLK</sub> , P5 <sub>3</sub> /S <sub>RDY</sub>	I/O port P5	<ul style="list-style-type: none"> <li>8-bit CMOS I/O port with the same function as port P2<sub>4</sub>-P2<sub>7</sub></li> <li>Keep the input voltage of this port between 0V and V<sub>CC</sub>.</li> <li>The pull-up/pull-down register and I/O direction register allow each pin to be programmed as pull-up.</li> <li>CMOS compatible input level</li> <li>N-channel open-drain output</li> </ul>	Serial I/O pins
P5 <sub>4</sub> , P5 <sub>5</sub>		<ul style="list-style-type: none"> <li>2-bit CMOS I/O port with the same function as port P2<sub>4</sub>-P2<sub>7</sub></li> <li>The pull-up/pull-down register and I/O direction register allow each pin to be programmed as pull-up.</li> <li>CMOS compatible input level</li> <li>CMOS 3-state output</li> </ul>	
P6 <sub>0</sub> /AN <sub>0</sub> - P6 <sub>7</sub> /AN <sub>7</sub>	I/O port P6	<ul style="list-style-type: none"> <li>8-bit CMOS I/O port with the same function as port P2<sub>4</sub>-P2<sub>7</sub></li> <li>CMOS compatible input level</li> <li>CMOS 3-state output</li> </ul>	A-D converter input pins
P7 <sub>0</sub> /X <sub>COU</sub> T, P7 <sub>1</sub> /X <sub>CIN</sub>	I/O port P7	<ul style="list-style-type: none"> <li>2-bit CMOS I/O port with the same function as port P2<sub>4</sub>-P2<sub>7</sub></li> <li>CMOS compatible input level</li> <li>CMOS 3-state output</li> </ul>	An I/O pin for the internal sub-clock generating circuit (connect a ceramic resonator or a quartz-crystal oscillator)



**SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER**

**PART NUMBERING**



SINGLE-CHIP 8-BIT CMOS MICROCOMPUTER

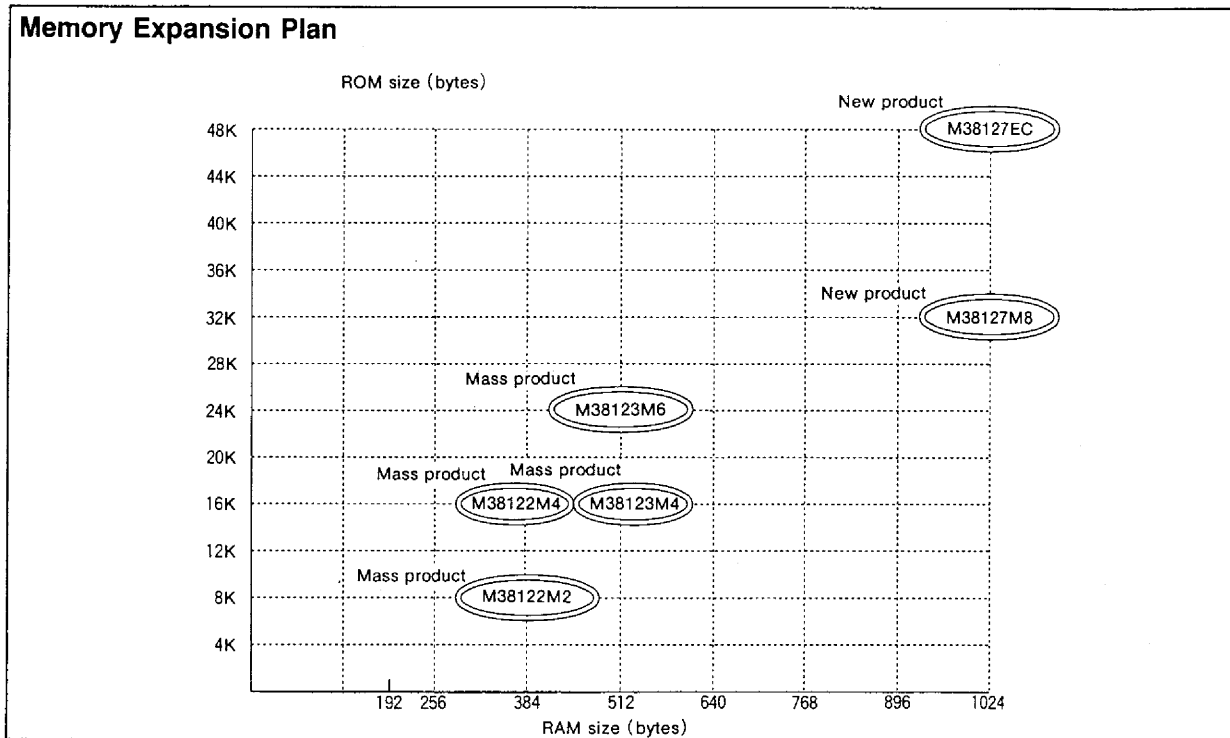
GROUP EXPANSION

Mitsubishi plans to expand the 3812 group as follows:

- (1) Support for mask ROM, One Time PROM, and EPROM versions
  - ROM/PROM size ..... 8K to 48K bytes
  - RAM size ..... 384 to 1024 bytes

(2) Packages

- 64P4B ..... Shrink plastic molded DIP
- 64P6N-A ..... Plastic molded QFP
- 64S1B-E ..... Shrink ceramic DIP (EPROM version)
- 64D0 ..... Ceramic LCC (EPROM version)



Currently supported products are listed below.

As of May 1996

Product	(P) ROM size (bytes) ROM size for User in ( )	RAM size (bytes)	Package	Remarks
M38122M2-XXXSP	8192	384	64P4B	Mask ROM version
M38122M2-XXXFP	(8062)		64P6N-A	Mask ROM version
M38122M4-XXXSP	16384 (16254)		64P4B	Mask ROM version
M38122M4-XXXFP			64P6N-A	Mask ROM version
M38123M4-XXXSP		512	64P4B	Mask ROM version
M38123M4-XXXFP			64P6N-A	Mask ROM version
M38123M6-XXXSP	24576 (24446)		64P4B	Mask ROM version
M38123M6-XXXFP			64P6N-A	Mask ROM version
M38127M8-XXXSP		1024	64P4B	Mask ROM version
M38127M8-XXXFP			64P6N-A	Mask ROM version
M38127EC-XXXSP	49152 (49022)		64P4B	One Time PROM version
M38127EC-XXXFP			64P6N-A	One Time PROM version
M38127ECSP			64P4B	One Time PROM version (blank)
M38127ECFP			64P6N-A	One Time PROM version (blank)
M38127ECSS		64S1B-E	EPROM version	
M38127ECFS		64D0	EPROM version	

## Renesas Technology Corp.

Nippon Bldg.,6-2,Otemachi 2-chome,Chiyoda-ku,Tokyo,100-0004 Japan

### Keep safety first in your circuit designs!

- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

### Notes regarding these materials

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
- The information described here may contain technical inaccuracies or typographical errors. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors. Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page (<http://www.mitsubishichips.com>).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.

REVISION HISTORY

3812 GROUP USER'S MANUAL

Rev.	Date	Description	
		Page	Summary
1.0	07/10/02		The first edition is issued.