Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	M16C/60
Core Size	16-Bit
Speed	32MHz
Connectivity	CANbus, I²C, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	71
Program Memory Size	256KB (256K x 8), 16KB (16K x 8)
Program Memory Type	FLASH
EEPROM Size	8K x 8
RAM Size	20K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 31x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	80-LQFP
Supplier Device Package	80-LQFP (12x12)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f35l2edfe-u0

1.2 Specifications

Table 1.1 to Table 1.4 list specifications of the M16C/5LD Group, M16C/56D Group.

Table 1.1 Specifications (80-pin Version) (1/2)

Item	Function	Specification
CPU	Central processing unit	M16C/60 Series CPU Core (Multiplier: 16 × 16 → 32 bits, Multiply-accumulate unit: 16 × 16 + 32 → 32 bits) • Basic instructions: 91 • Minimum instruction execution time: 31.25 ns (f(BCLK) = 32 MHz, VCC = 3.0 to 5.5 V) 40ns (f(BCLK) = 25MHz, VCC = 2.7 to 5.5V) • Operating mode: Single-chip mode
Memory	ROM, RAM, data flash	See Table 1.5. and Table 1.6.
Voltage Detection	Voltage detector	• 2 voltage detect points
Clock	Clock generator	• 4 circuits (Main clock, sub clock, PLL frequency synthesizer, 125 kHz on-chip oscillator) • Oscillation stop detector: Main clock oscillator stop/restart detection • Frequency divide circuit: Divide-by-1, 2, 4, 8, or 16 selectable • Low-power consumption modes: Wait mode, stop mode • Real-time clock
I/O Ports	Programmable I/O ports	• 71 CMOS inputs/outputs, a pull-up resistor selectable
Interrupts		• Interrupt vectors: 70 • External interrupt inputs: 11 ($\overline{\text{NMI}}$, $\overline{\text{INT}}$ × 6, key input × 4) • Interrupt priority levels: 7
Watchdog Timer		• 15 bits × 1 (with prescaler) • Automatic reset start function selectable •

Table 1.4 Specifications (64-pin Version) (2/2)

Item	Function	Specification
CRC Calculator		• 1 circuit • CRC-CCITT ($X^{16} + X^{12} + X^5 + 1$), CRC-16 ($X^{16} + X^{15} + X^2 + 1$) compliant • MSB/LSB selectable
Multi-master I^2C-bus Interface		1 channel
CAN Module		32-slot message buffer × 1 channel (M16C/5LD Group only)
Flash Memory		• Programming and erasure supply voltage: 2.7 to 5.5 V • Programming and erasure endurance: 1,000 times (program ROM 1, program ROM 2)/10,000 times (data flash) • Program security: ROM code protect, ID code check
Debug Functions		On-board flash rewrite function, address match × 4
Operating Frequency/Power Supply Voltage		32 MHz / 3.0 to 5.5 V 25 MHz / 2.7 to 5.5 V
Current Consumption		Described in 5. “Electrical Characteristics”
Operating Temperature		-40°C to 85°C (1)
Package		64-pin plastic mold LQFP: PLQP0064KB-A (Previous package code: 64P6Q-A)

Note:
1. Refer to Table 1.5 “Product List of M16C/5LD Group” and Table 1.6 “Product List of M16C/56D Group” for the Operating Temperature.

V_{CC} = 5 V

Timing Requirements
(V_{CC} = 5 V, V_{SS} = 0 V, at T_{opr} = 40 °C to 85 °C unless otherwise specified)

5.2.2.6 Serial Interface

Table 5.26 Serial Interface

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(CK)}$	CLKi input cycle time	200		ns
$t_{w(CKH)}$	CLKi input high pulse width	100		ns
$t_{w(CKL)}$	CLKi input low pulse width	100		ns
$t_{d(C-Q)}$	TXDi output delay time		80	ns
$t_{h(C-Q)}$	TXDi hold time	0		ns
$t_{su(D-C)}$	RXDi input setup time	70		ns
$t_{h(C-D)}$	RXDi input hold time	90		ns

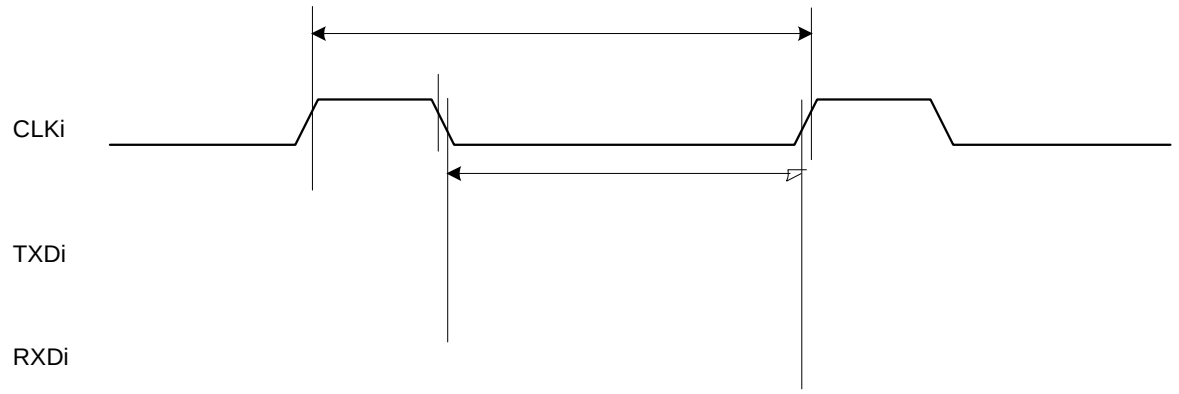

Figure 5.12 Serial Interface

5.2.2.7 External Interrupt **INTi** Input

Table 5.27 External Interrupt **INTi** Input

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{w(INH)}$	**INTi** input high pulse width	250		ns
$t_{w(INL)}$	**INTi** input low pulse width	250		ns

Figure 5.13 External Interrupt **INTi** Input

REVISION HISTORY	M16C/5LD Group, M16C/56D Group Datasheet

Rev.	Date	Description	
		Page	Summary
1.10	Dec.01, 2009	First edition issued	
1.20	Nov. 25, 2011	Overall	Specified Renesas Electronics sales office as a contact.
		Overall	Modified register names are as follows: 0075h CAN0 Receive Completion Interrupt Control Register to CAN0 Reception Complete Interrupt Control Register 0076h CAN0 Transmit Completion Interrupt Control Register to CAN0 Transmission Complete Interrupt Control Register 0071h CAN0 Wakeup Interrupt Control Register to CAN0 Wake-up Interrupt Control Register 037Ch Count Source Protect Mode Register to Count Source Protection Mode Register
		Overall	Changed terminologies are as follows: voltage detector 2 to voltage monitor 2 oscillation stop detection reset to oscillator stop detect reset detection circuit to detector Oscillation stop and re-oscillation detect to Oscillator stop/restart detect oscillation/oscillator circuit to oscillator oscillator to a crystal/ceramic resonator oscillator manufacturer to manufacturer of crystal/ceramic resonator on-chip oscillator oscillation circuit to on-chip oscillator
		Overview	
		3, 5	Table 1.2, Table 1.4 Specifications (2/2) (80-pin, 64-pin): Added the Current Consumption row, and added note 1.
		8, 9	Figure 1.3, Figure 1.4 Block Diagram (80-pin, 64-pin): Deleted 8-bit from the description for the UART/clock synchronous serial interface. Deleted (8-bit x 1 channel) from the description for the Real-time clock. Added (1 channel) to the description for the Multi-master I^2C-bus. Moved dedicated 125 kHz on-chip oscillator for the watchdog timer to description for the watchdog timer.
		10, 13	Figure 1.5, Figure 1.6 Pin Assignments (80-pin, 64-pin): Added TSUDA and TSUDB to pins P8_0 and P8_1, respectively.
		11, 14	Table 1.7, Table 1.9 Pin Names (1/2) (80-pin, 64-pin): Added TSUDA and TSUDB to pins P8_0 and P8_1, respectively.
		16	Table 1.11 Pin Functions (64-Pin and 80-Pin Packages) (1/2): Deleted pin or pins from input pin/pins and output pin/pins . Changed low active input to input . Added Pins to AVCC and AVSS in the Description column of the Analog power supply row. Deleted Low active input pin. from the Reset input row. Changed the description in the Description column of the CNVSS row. Added footnote reference number (1) in the Sub clock input and output rows in the Description column. Deleted INT2 is used to input Z-phase of timer A in the Description column of the **INT** interrupt input row. Added UART0 to UART3 in the Signal Name column of the Serial interface row. Added UART2 to the Signal Name column of the I^2C mode row.
		17	Table 1.12 Pin Functions (64-Pin and 80-Pin Packages) (2/2): Deleted pin or pins from input pin/pins and output pin/pins . Changed low active input to input . Added TSUDA, TSUDB to the Pin Name in the Timer S row. Changed Input pin to Receive data input and Output pin to Transmit data output in the Description column of the CAN Module row. In the Description column of the I/O port row, changed the explanation of the direction register, and changed 4 input ports to 4 bits .

REVISION HISTORY	M16C/5LD Group, M16C/56D Group Datasheet

Rev.	Date	Description	
		Page	Summary
1.20	Nov. 25, 2011	18	Table 1.13 Pin Functions (80-Pin Package Only): Deleted pin or pins from input pin/pins and output pin/pins . Added UART4 to the Signal Name column of the Serial interface row. In the Description column of the I/O port row, changed the explanation of the direction register, and changed 4 input ports to 4 bits .
		Memory	
		23	Figure 3.1 Memory Map: Added note 2. Added footnote reference numbers (1) and (2).
		Special Function Registers (SFRs)	
		56	4.2.1 Register Settings: Added the description regarding read-modify-write instructions.
		57	Table 4.34 Read-Modify-Write Instructions: Added.
		Electrical Characteristics	
		Chap. 5.	Specified symbols for the following pins according to the change in Timer S. P8_0, P8_0 (A-phase) to TSUDA P8_1, P8_1 (B-phase) to TSUDB
		Common to 3 V and 5 V	
		58	Table 5.1 Absolute Maximum Ratings: Deleted VREF from the V_I.
		59	Table 5.2 Operating Conditions (1): Changed the minimum value of V_{CC} from 3.0 . Changed the maximum value of $I_{OH(sum)}$ from 80 . Changed the maximum value of $I_{OL(sum)}$ from -80.
		61	Table 5.4 A/D Conversion Characteristics $^{(1, 3)}$: Changed note 3.
		64	Table 5.9 Voltage Detector 2 Electrical Characteristics: Added Vdet2_0 to Vdet2_3, and Vdet2_5 to Vdet2_7.
		65	Table 5.11 Power Supply Circuit Timing Characteristics: Changed the maximum value of td(W-S) from 150 .
		66	Figure 5.5 Power Supply Circuit Timing Diagram: Changed Low voltage detection circuit to Voltage detection circuit
		66	Table 5.12 125kHz On-Chip Oscillator Electrical Characteristics: Added the Dedicated 125 kHz on-chip oscillator for the watchdog timer oscillation frequency.
		Vcc = 5 V	
		67	Table 5.13 Electrical Characteristics (1): Changed the maximum value of V_T+-V_{T-}, which includes TA0IN and others in Hysteresis, from 2.5 .
		73	5.2.2.5 Timer S Input: Added.
		75	Figure 5.14 Multi-master I^2C-bus: Changed t_{HD};DTA to t_{HD};DAT and t_{su};DTA to t_{su};DAT.
		Vcc = 3 V	
		76	Table 5.29 Electrical Characteristics (1): Changed the maximum value of V_T+-V_{T-}, which includes TA0IN and others in Hysteresis, from 1.8 .
		82	5.3.2.5 Timer S Input: Added.
		84	Figure 5.23 Multi-master I^2C-bus: Changed t_{HD};DTA to t_{HD};DAT and t_{su};DTA to t_{su};DAT.

All trademarks and registered trademarks are the property of their respective owners.

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.

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

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

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

© 2012 Renesas Electronics Corporation. All rights reserved.

Colophon 1.1