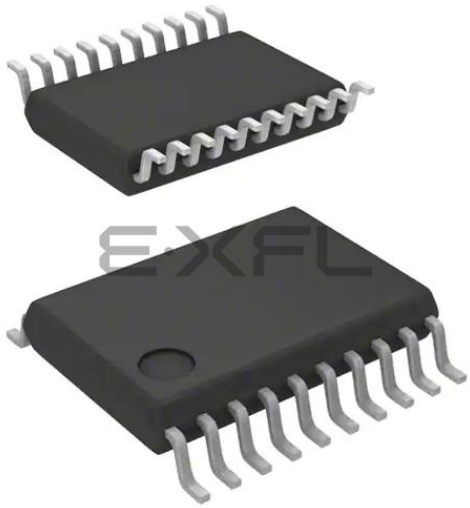


**Welcome to E-XFL.COM**

## 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 | Not For New Designs |
| Core Processor | R8C |
| Core Size | 16-Bit |
| Speed | 20MHz |
| Connectivity | UART/USART |
| Peripherals | POR, PWM, Voltage Detect, WDT |
| Number of I/O | 17 |
| Program Memory Size | 2KB (2K x 8) |
| Program Memory Type | FLASH |
| EEPROM Size | - |
| RAM Size | 256 x 8 |
| Voltage - Supply (Vcc/Vdd) | 1.8V ~ 5.5V |
| Data Converters | A/D 6x10b |
| Oscillator Type | Internal |
| Operating Temperature | -20°C ~ 85°C (TA) |
| Mounting Type | Surface Mount |
| Package / Case | 20-LSSOP (0.173", 4.40mm Width) |
| Supplier Device Package | 20-LSSOP |
| Purchase URL | https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f2m120ansp-u0 |

Table 1.2 lists the R8C/M11A Group Register Settings. These settings correspond to the specification differences between the R8C/M11A Group and R8C/M12A Group.

**Table 1.2 R8C/M11A Group Register Settings**

| Related Function | Register Name | Address | Bit | Setting Method for Access |
|---|---|---|---|---|
| $\overline{\text{INT3}}$ | INTEN | 00038h | INT3EN | Reserved bit. Set to 0. |
| | INTF0 | 0003Ah | INT3F0, INT3F1 | Reserved bits. Set to 0. |
| | ISCR0 | 0003Ch | INT3SA, INT3SB | Reserved bits. Set to 0. |
| | ILVLD | 0004Dh | ILVLD0, ILVLD1 | Reserved bits. Set to 0. |
| | IRR3 | 00053h | IRI3 | Reserved bit. Set to 0. |
| $\overline{\text{KI0}}$ | KIEN | 0003Eh | KI0EN, KI0PL | Reserved bits. Set to 0. |
| Comparator B3 interrupt | ILVL2 | 00042h | ILVL24, ILVL25 | Reserved bits. Set to 0. |
| | IRR2 | 00052h | IRCMP3 | Reserved bit. Set to 0. |
| P1_0 | PD1 | 000A9h | PD1_0 | Reserved bit. Set to 0. |
| | P1 | 000AFh | P1_0 | Reserved bit. Set to 0. |
| | PUR1 | 000B5h | PU1_0 | Reserved bit. Set to 0. |
| | POD1 | 000C1h | POD1_0 | Reserved bit. Set to 0. |
| | PML1 | 000C8h | P10SEL0, P10SEL1 | Reserved bits. Set to 0. |
| P3_3, P3_4, P3_5 | PD3 | 000ABh | PD3_3, PD3_4, PD3_5 | Reserved bits. Set to 0. |
| | P3 | 000B1h | P3_3, P3_4, P3_5 | Reserved bits. Set to 0. |
| | PUR3 | 000B7h | PU3_3, PU3_4, PU3_5 | Reserved bits. Set to 0. |
| | DRR3 | 000BDh | DRR3_3, DRR3_4, DRR3_5 | Reserved bits. Set to 0. |
| | POD3 | 000C3h | POD3_3, POD3_4, POD3_5 | Reserved bits. Set to 0. |
| | PML3 | 000CCh | P33SEL0, P33SEL1 | Reserved bits. Set to 0. |
| | PMH3 | 000CDh | P34SEL0, P34SEL1, P35SEL0, P35SEL1 | Reserved bits. Set to 0. |
| P4_2, P4_5 | PD4 | 000ACh | PD4_2, PD4_5 | Reserved bits. Set to 0. |
| | P4 | 000B2h | P4_2, P4_5 | Reserved bits. Set to 0. |
| | PUR4 | 000B8h | PU4_2, PU4_5 | Reserved bits. Set to 0. |
| | POD4 | 000C4h | POD4_2, POD4_5 | Reserved bits. Set to 0. |
| | PML4 | 000CEh | P42SEL0, P42SEL1 | Reserved bits. Set to 0. |
| | PMH4 | 000CFh | P45SEL0, P45SEL1 | Reserved bits. Set to 0. |
| AN0 | ADINSEL | 0009Dh | CH0, ADGSEL0, ADGSEL1 | Do not set to 000. |
| Comparator B3 | WCMPR | 00180h | WCB3M0, WCB3OUT | Reserved bits. Set to 0. |
| | WCB3INTR | 00182h | All bits | Reserved register. No access is allowed. |

### 1.1.3 Specifications

Tables 1.3 and 1.4 outline the Specifications.

**Table 1.3 Specifications (1)**

| Item | Function | Description |
|---|---|---|
| CPU | Central processing unit | R8C CPU core<br>• Number of fundamental instructions: 89<br>• Minimum instruction execution time:<br>50 ns (f(XIN) = 20 MHz, VCC = 2.7 V to 5.5 V)<br>200 ns (f(XIN) = 5 MHz, VCC = 1.8 V to 5.5 V)<br>• Multiplier: 16 bits × 16 bits → 32 bits<br>• Multiply-accumulate instruction: 16 bits × 16 bits + 32 bits → 32 bits<br>• Operating mode: Single-chip mode (address space: 1 Mbyte) |
| Memory | ROM, RAM, data flash | See **Table 1.5 Product List**. |
| Reset sources | | • Hardware reset by $\overline{\text{RESET}}$<br>• Power-on reset<br>• Watchdog timer reset<br>• Software reset<br>• Reset by voltage detection 0 |
| Voltage detection | Voltage detection circuit | Voltage detection with two check points:<br>Voltage detection 0, voltage detection 1 (detection levels selectable) |
| Watchdog timer | | • 14 bits × 1 (with prescaler)<br>• Reset start function selectable<br>• Count source protection function selectable<br>• Periodic timer function selectable |
| Clock | Clock generation circuits | • 3 circuits: XIN clock oscillation circuit,<br>high-speed on-chip oscillator (with frequency adjustment function),<br>low-speed on-chip oscillator<br>• Oscillation stop detection: XIN clock oscillation stop detection function<br>• Clock frequency divider circuit integrated |
| Power control | | • Standard operating mode<br>• Wait mode (CPU stopped, peripheral functions in operation)<br>• Stop mode (CPU and peripheral functions stopped) |
| Interrupts | | • Number of interrupt vectors: 69<br>• External interrupt inputs: 8 ($\overline{\text{INT}}$ × 4, key input × 4)<br>• Priority levels: 2 |
| I/O ports | Programmable I/O ports | • CMOS I/O: 17 (pull-up resistor selectable)<br>• High-current drive ports: 8 |
| Timer | Timer RJ2 | 16 bits × 1<br>Timer mode, pulse output mode (output level inverted every period), event counter mode, pulse width measurement mode, pulse period measurement mode |
| | Timer RB2 | 8 bits × 1 (with 8-bit prescaler) or 16 bits × 1 (selectable)<br>Timer mode, programmable waveform generation mode (PWM output), programmable one-shot generation mode, programmable wait one-shot generation mode |
| | Timer RC | 16 bits × 1 (with 4 capture/compare registers)<br>Timer mode (output compare function, input capture function), PWM mode (3 outputs), PWM2 mode (1 PWM output) |
| Serial interface | UART0 | Clock synchronous serial I/O. Also used for asynchronous serial I/O. |
| A/D converter | | • Resolution: 10 bits × 6 channels<br>• Sample and hold function, sweep mode |
| Comparator B | | 2 circuits |

## 1.2 Product List

Table 1.5 lists the Product List. Figure 1.1 shows the Product Part Number Structure.

**Table 1.5 Product List** **Current of May 2012**

| Group Name | Part No. | Internal ROM Capacity | | Internal RAM Capacity | Package Type | Remarks |
|---|---|---|---|---|---|---|
| | | Program ROM | Data Flash | | | |
| R8C/M11A Group | R5F2M110ANSP | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PTSP0014JA-B | N version |
| | R5F2M111ANSP | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M112ANSP | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |
| | R5F2M110ANDD | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PRDP0014AC-A | |
| | R5F2M111ANDD | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M112ANDD | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |
| | R5F2M110ADSP | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PTSP0014JA-B | D version |
| | R5F2M111ADSP | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M112ADSP | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |
| R8C/M12A Group | R5F2M120ANSP | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PLSP0020JB-A | N version |
| | R5F2M121ANSP | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M122ANSP | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |
| | R5F2M120ANDD | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PRDP0020AD-A | |
| | R5F2M121ANDD | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M122ANDD | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |
| | R5F2M120ADSP | 2 Kbytes | 1 Kbyte × 2 | 256 bytes | PLSP0020JB-A | D version |
| | R5F2M121ADSP | 4 Kbytes | 1 Kbyte × 2 | 384 bytes | | |
| | R5F2M122ADSP | 8 Kbytes | 1 Kbyte × 2 | 512 bytes | | |

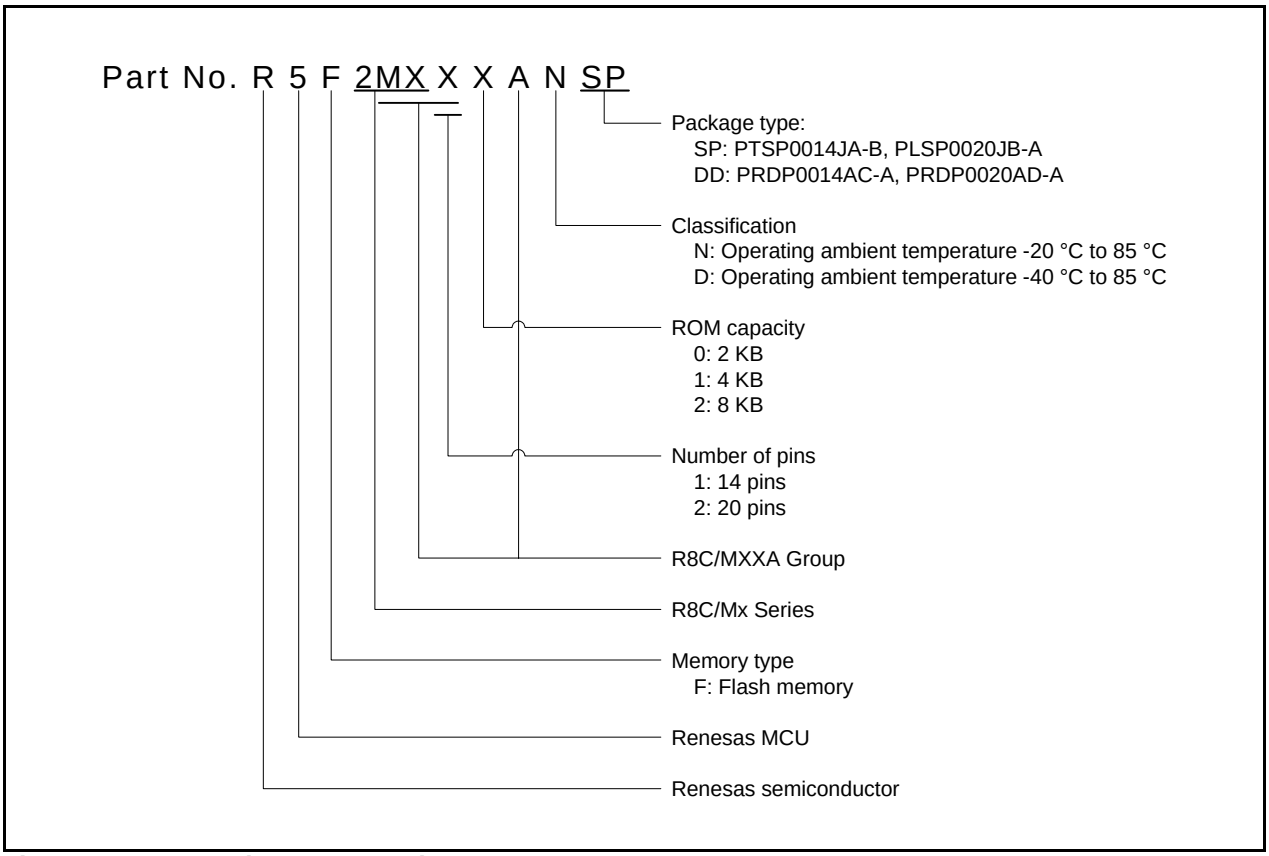



**Figure 1.1 Product Part Number Structure**

## 1.3 Block Diagram

Figure 1.2 shows the Block Diagram.

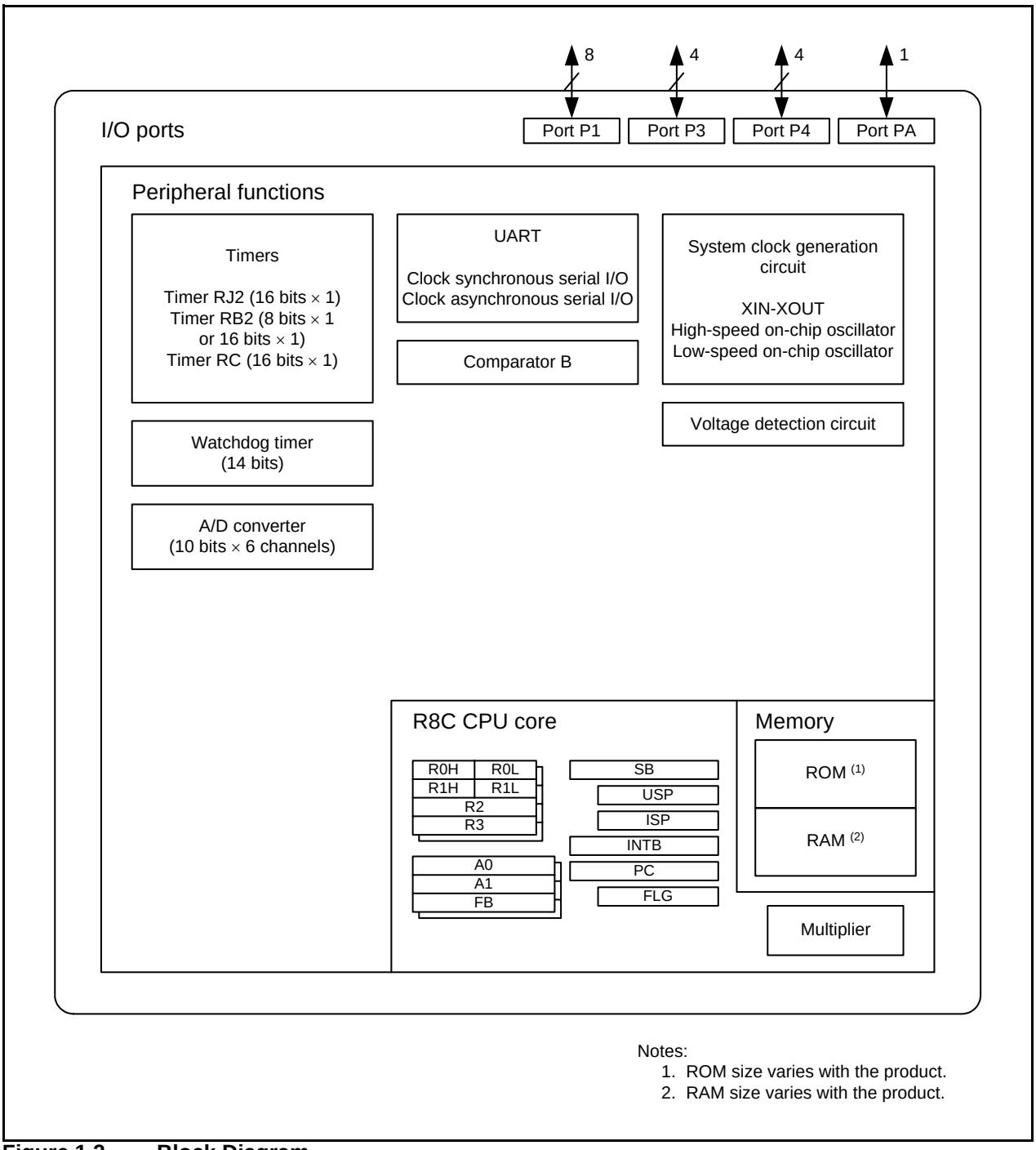



**Figure 1.2 Block Diagram**

## 1.5 Pin Functions

Table 1.7 lists the Pin Functions.

**Table 1.7 Pin Functions**

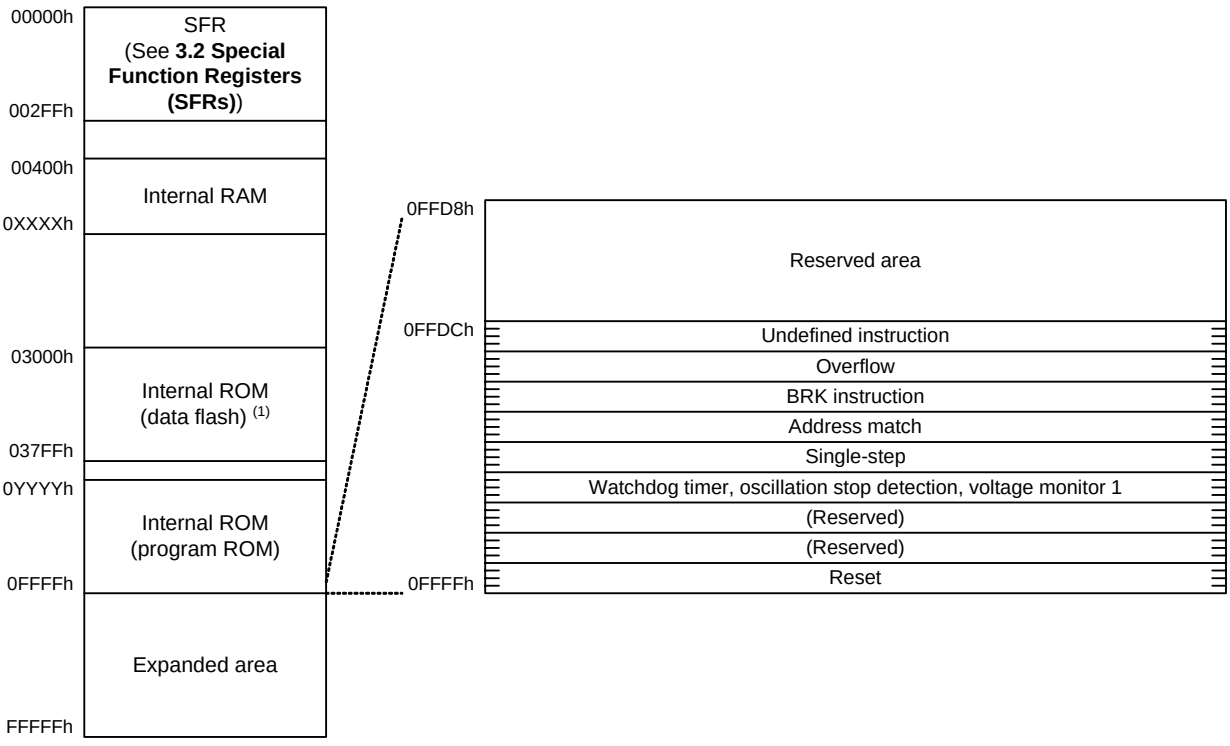
| Item | Pin Name | I/O | Description |
|---|---|---|---|
| Power supply input | VCC, VSS | — | Apply 1.8 V through 5.5 V to the VCC pin.<br>Apply 0 V to the VSS pin. |
| Analog power supply input | AVCC, AVSS | — | Power supply input for the A/D converter.<br>Connect a capacitor between pins AVCC and AVSS. |
| Reset input | $\overline{\text{RESET}}$ | I | Applying a low level to this pin resets the MCU. |
| MODE | MODE | I | Connect this pin to the VCC pin via a resistor. |
| XIN clock input | XIN | I | I/O for the XIN clock generation circuit.<br>Connect a ceramic resonator or a crystal oscillator between pins XIN and XOUT. (1)<br>To use an external clock, input it to the XIN pin. P4_7 can be used as an I/O port at this time. |
| XIN clock output | XOUT | O | |
| $\overline{\text{INT}}$ interrupt input | $\overline{\text{INT0}}$ to $\overline{\text{INT3}}$ | I | $\overline{\text{INT}}$ interrupt input. |
| Key input interrupt | $\overline{\text{KI0}}$ to $\overline{\text{KI3}}$ | I | Key input interrupt input. |
| I/O ports | P1_0 to P1_7,<br>P3_0 to P3_5, P3_7,<br>P4_2, P4_5 to P4_7,<br>PA_0 | I/O | CMOS I/O ports.<br>Each port has an I/O select direction register, enabling switching input and output for each port.<br>For input ports other than PA_0, the presence or absence of a pull-up resistor can be selected by a program.<br>P1_2 to P1_5, P3_3 to P3_5, and P3_7 can be used as LED drive ports. |
| Timer RJ2 | TRJIO | I/O | Timer RJ2 I/O. |
| | TRJO | O | Timer RJ2 output. |
| Timer RB2 | TRBO | O | Timer RB2 output. |
| Timer RC | TRCCLK | I | External clock input. |
| | TRCTRG | I | External trigger input. |
| | TRCIOA, TRCIOB,<br>TRCIOC, TRCIOD | I/O | Timer RC I/O. |
| Serial interface | CLK0 | I/O | Transfer clock I/O. |
| | RXD0 | I | Serial data input. |
| | TXD0 | O | Serial data output. |
| A/D converter | AN0 to AN4, AN7 | I | Analog input for the A/D converter. |
| | $\overline{\text{ADTRG}}$ | I | External trigger input for the A/D converter. |
| Comparator B | IVCMP1, IVCMP3 | I | Analog voltage input for comparator B. |
| | IVREF1, IVREF3 | I | Reference voltage input for comparator B. |
| | VCOUT1, VCOUT3 | O | Comparison result output for comparator B. |

Note:
1. Contact the oscillator manufacturer for oscillation characteristics.

# 3. Address Space

## 3.1 Memory Map

Figure 3.1 shows the Memory Map. The R8C/M11A Group and R8C/M12A Group have a 1-Mbyte address space from addresses 00000h to FFFFFh. The internal ROM (program ROM) is allocated at lower addresses, beginning with address 0FFFFh. For example, an 8-Kbyte internal ROM area is allocated at addresses 0E000h to 0FFFFh.
The fixed interrupt vector table is allocated at addresses 0FFDCh to 0FFFFh. The start address of each interrupt routine is stored here.
The internal ROM (data flash) is allocated at addresses 03000h to 037FFh.
The internal RAM is allocated at higher addresses, beginning with address 00400h. For example, a 512-byte internal RAM area is allocated at addresses 00400h to 005FFh. The internal RAM is used not only for data storage but also as a stack area when a subroutine is called or when an interrupt request is acknowledged.
Special function registers (SFRs) are allocated at addresses 00000h to 002FFh. Peripheral function control registers are allocated here. All unallocated spaces within the SFRs are reserved and cannot be accessed by users.




Notes:
1. Data flash indicates block A (1 Kbyte) and block B (1 Kbyte).
2. The blank areas are reserved. No access is allowed.

| Part Number | Internal ROM | | Internal RAM | |
|---|---|---|---|---|
| | Capacity | Address 0YYYYh | Capacity | Address 0XXXXh |
| R5F2M110ANSP, R5F2M110ANDD, R5F2M110ADSP, R5F2M120ANSP, R5F2M120ANDD, R5F2M120ADSP | 2 Kbytes | 0F800h | 256 bytes | 004FFh |
| R5F2M111ANSP, R5F2M111ANDD, R5F2M111ADSP, R5F2M121ANSP, R5F2M121ANDD, R5F2M121ADSP | 4 Kbytes | 0F000h | 384 bytes | 0057Fh |
| R5F2M112ANSP, R5F2M112ANDD, R5F2M112ADSP, R5F2M122ANSP, R5F2M122ANDD, R5F2M122ADSP | 8 Kbytes | 0E000h | 512 bytes | 005FFh |

**Figure 3.1 Memory Map**

**Table 3.2 SFR Information (2) (1)**

| Address | Register Name | Symbol | After Reset |
|---|---|---|---|
| 0003Ah | INT Input Filter Select Register 0 | INTF0 | 00h |
| 0003Bh | | | |
| 0003Ch | INT Input Edge Select Register 0 | ISCR0 | 00h |
| 0003Dh | | | |
| 0003Eh | Key Input Enable Register | KIEN | 00h |
| 0003Fh | | | |
| 00040h | Interrupt Priority Level Register 0 | ILVL0 | 00h |
| 00041h | | | |
| 00042h | Interrupt Priority Level Register 2 | ILVL2 | 00h |
| 00043h | Interrupt Priority Level Register 3 | ILVL3 | 00h |
| 00044h | Interrupt Priority Level Register 4 | ILVL4 | 00h |
| 00045h | Interrupt Priority Level Register 5 | ILVL5 | 00h |
| 00046h | Interrupt Priority Level Register 6 | ILVL6 | 00h |
| 00047h | Interrupt Priority Level Register 7 | ILVL7 | 00h |
| 00048h | Interrupt Priority Level Register 8 | ILVL8 | 00h |
| 00049h | Interrupt Priority Level Register 9 | ILVL9 | 00h |
| 0004Ah | Interrupt Priority Level Register A | ILVLA | 00h |
| 0004Bh | Interrupt Priority Level Register B | ILVLB | 00h |
| 0004Ch | Interrupt Priority Level Register C | ILVLC | 00h |
| 0004Dh | Interrupt Priority Level Register D | ILVLD | 00h |
| 0004Eh | Interrupt Priority Level Register E | ILVLE | 00h |
| 0004Fh | | | |
| 00050h | Interrupt Monitor Flag Register 0 | IRR0 | 00h |
| 00051h | Interrupt Monitor Flag Register 1 | IRR1 | 00h |
| 00052h | Interrupt Monitor Flag Register 2 | IRR2 | 00h |
| 00053h | External Interrupt Flag Register | IRR3 | 00h |
| 00054h | | | |
| 00055h | | | |
| 00056h | | | |
| 00057h | | | |
| 00058h | Voltage Monitor Circuit Edge Select Register | VCAC | 00h |
| 00059h | | | |
| 0005Ah | Voltage Detect Register 2 | VCA2 | 00100100b (2)<br>00000100b (3) |
| 0005Bh | Voltage Detection 1 Level Select Register | VD1LS | 00000111b |
| 0005Ch | Voltage Monitor 0 Circuit Control Register | VW0C | 1100X011b (2)<br>1100X010b (3) |
| 0005Dh | Voltage Monitor 1 Circuit Control Register | VW1C | 10001010b |
| 0005Eh | | | |
| 0005Fh | Reset Source Determination Register | RSTFR | 0000XXXXb (4) |
| 00060h | | | |
| 00061h | | | |
| 00062h | | | |
| 00063h | | | |
| 00064h | High-Speed On-Chip Oscillator 18.432 MHz Control Register 0 | FR18S0 | Value when shipped |
| 00065h | High-Speed On-Chip Oscillator 18.432 MHz Control Register 1 | FR18S1 | Value when shipped |
| 00066h | | | |
| 00067h | High-Speed On-Chip Oscillator Control Register 1 | FRV1 | Value when shipped |
| 00068h | High-Speed On-Chip Oscillator Control Register 2 | FRV2 | Value when shipped |
| 00069h | | | |
| 0006Ah | | | |
| 0006Bh | | | |
| 0006Ch | | | |
| 0006Dh | | | |
| 0006Eh | | | |
| 0006Fh | | | |
| 00070h | | | |
| 00071h | | | |
| 00072h | | | |
| 00073h | | | |
| 00074h | | | |
| 00075h | | | |
| 00076h | | | |
| 00077h | | | |
| 00078h | | | |
| 00079h | | | |

X: Undefined

Notes:

1. The blank areas are reserved. No access is allowed.
2. The LVDAS bit in the OFS register is 0.
3. The LVDAS bit in the OFS register is 1.
4. The value after a reset differs depending on the reset source.

**Table 3.3 SFR Information (3) (1)**

| Address | Register Name | Symbol | After Reset |
|---|---|---|---|
| 0007Ah | | | |
| 0007Bh | | | |
| 0007Ch | | | |
| 0007Dh | | | |
| 0007Eh | | | |
| 0007Fh | | | |
| 00080h | UART0 Transmit/Receive Mode Register | U0MR | 00h |
| 00081h | UART0 Bit Rate Register | U0BRG | XXh |
| 00082h | UART0 Transmit Buffer Register | U0TBL | XXh |
| 00083h | | U0TBH | XXh |
| 00084h | UART0 Transmit/Receive Control Register 0 | U0C0 | 00001000b |
| 00085h | UART0 Transmit/Receive Control Register 1 | U0C1 | 00000010b |
| 00086h | UART0 Receive Buffer Register | U0RBL | XXh |
| 00087h | | U0RBH | XXh |
| 00088h | UART0 Interrupt Flag and Enable Register | U0IR | 00h |
| 00089h | | | |
| 0008Ah | | | |
| 0008Bh | | | |
| 0008Ch | | | |
| 0008Dh | | | |
| 0008Eh | | | |
| 0008Fh | | | |
| 00090h | | | |
| 00091h | | | |
| 00092h | | | |
| 00093h | | | |
| 00094h | | | |
| 00095h | | | |
| 00096h | | | |
| 00097h | | | |
| 00098h | A/D Register 0 | AD0L | XXh |
| 00099h | | AD0H | 000000XXb |
| 0009Ah | A/D Register 1 | AD1L | XXh |
| 0009Bh | | AD1H | 000000XXb |
| 0009Ch | A/D Mode Register | ADMOD | 00h |
| 0009Dh | A/D Input Select Register | ADINSEL | 00h |
| 0009Eh | A/D Control Register 0 | ADCON0 | 00h |
| 0009Fh | A/D Interrupt Control Status Register | ADICSR | 00h |
| 000A0h | | | |
| 000A1h | | | |
| 000A2h | | | |
| 000A3h | | | |
| 000A4h | | | |
| 000A5h | | | |
| 000A6h | | | |
| 000A7h | | | |
| 000A8h | | | |
| 000A9h | Port P1 Direction Register | PD1 | 00h |
| 000AAh | | | |
| 000ABh | Port P3 Direction Register | PD3 | 00h |
| 000ACh | Port P4 Direction Register | PD4 | 00h |
| 000ADh | Port PA Direction Register | PDA | 00h |
| 000AEh | | | |
| 000AFh | Port P1 Register | P1 | 00h |
| 000B0h | | | |
| 000B1h | Port P3 Register | P3 | 00h |
| 000B2h | Port P4 Register | P4 | 00h |
| 000B3h | Port PA Register | PA | 00h |
| 000B4h | | | |
| 000B5h | Pull-Up Control Register 1 | PUR1 | 00h |
| 000B6h | | | |
| 000B7h | Pull-Up Control Register 3 | PUR3 | 00h |
| 000B8h | Pull-Up Control Register 4 | PUR4 | 00h |
| 000B9h | Port I/O Function Control Register | PINSR | 00h |
| 000BAh | | | |
| 000BBh | Drive Capacity Control Register 1 | DRR1 | 00h |
| 000BCh | | | |
| 000BDh | Drive Capacity Control Register 3 | DRR3 | 00h |
| 000BEh | | | |
| 000BFh | | | |

X: Undefined

Note:

1. The blank areas are reserved. No access is allowed.

**Table 3.6 SFR Information (6) (1)**

| Address | Register Name | Symbol | After Reset |
|---|---|---|---|
| 00140h | | | |
| 00141h | | | |
| 00142h | | | |
| 00143h | | | |
| 00144h | | | |
| 00145h | | | |
| 00146h | | | |
| 00147h | | | |
| 00148h | | | |
| 00149h | | | |
| 0014Ah | | | |
| 0014Bh | | | |
| 0014Ch | | | |
| 0014Dh | | | |
| 0014Eh | | | |
| 0014Fh | | | |
| 00150h | | | |
| 00151h | | | |
| 00152h | | | |
| 00153h | | | |
| 00154h | | | |
| 00155h | | | |
| 00156h | | | |
| 00157h | | | |
| 00158h | | | |
| 00159h | | | |
| 0015Ah | | | |
| 0015Bh | | | |
| 0015Ch | | | |
| 0015Dh | | | |
| 0015Eh | | | |
| 0015Fh | | | |
| 00160h | | | |
| 00161h | | | |
| 00162h | | | |
| 00163h | | | |
| 00164h | | | |
| 00165h | | | |
| 00166h | | | |
| 00167h | | | |
| 00168h | | | |
| 00169h | | | |
| 0016Ah | | | |
| 0016Bh | | | |
| 0016Ch | | | |
| 0016Dh | | | |
| 0016Eh | | | |
| 0016Fh | | | |
| 00170h | | | |
| 00171h | | | |
| 00172h | | | |
| 00173h | | | |
| 00174h | | | |
| 00175h | | | |
| 00176h | | | |
| 00177h | | | |
| 00178h | | | |
| 00179h | | | |
| 0017Ah | | | |
| 0017Bh | | | |
| 0017Ch | | | |
| 0017Dh | | | |
| 0017Eh | | | |
| 0017Fh | | | |

Note:
1. The blank areas are reserved. No access is allowed.

**Table 3.7 SFR Information (7) (1)**

| Address | Register Name | Symbol | After Reset |
|---|---|---|---|
| 00180h | Comparator B Control Register | WCMPR | 00h |
| 00181h | Comparator B1 Interrupt Control Register | WCB1INTR | 00h |
| 00182h | Comparator B3 Interrupt Control Register | WCB3INTR | 00h |
| 00183h | | | |
| 00184h | | | |
| 00185h | | | |
| 00186h | | | |
| 00187h | | | |
| 00188h | | | |
| 00189h | | | |
| 0018Ah | | | |
| 0018Bh | | | |
| 0018Ch | | | |
| 0018Dh | | | |
| 0018Eh | | | |
| 0018Fh | | | |
| 00190h | | | |
| 00191h | | | |
| 00192h | | | |
| 00193h | | | |
| 00194h | | | |
| 00195h | | | |
| 00196h | | | |
| 00197h | | | |
| 00198h | | | |
| 00199h | | | |
| 0019Ah | | | |
| 0019Bh | | | |
| 0019Ch | | | |
| 0019Dh | | | |
| 0019Eh | | | |
| 0019Fh | | | |
| 001A0h | | | |
| 001A1h | | | |
| 001A2h | | | |
| 001A3h | | | |
| 001A4h | | | |
| 001A5h | | | |
| 001A6h | | | |
| 001A7h | | | |
| 001A8h | | | |
| 001A9h | Flash Memory Status Register | FST | 10000000b |
| 001AAh | Flash Memory Control Register 0 | FMR0 | 00h |
| 001ABh | Flash Memory Control Register 1 | FMR1 | 00h |
| 001ACh | Flash Memory Control Register 2 | FMR2 | 00h |
| 001ADh | Flash Memory Refresh Control Register | FREFR | 00h |
| 001AEh | | | |
| 001AFh | | | |
| 001B0h | | | |
| 001B1h | | | |
| 001B2h | | | |
| 001B3h | | | |
| 001B4h | | | |
| 001B5h | | | |
| 001B6h | | | |
| 001B7h | | | |
| 001B8h | | | |
| 001B9h | | | |
| 001BAh | | | |
| 001BBh | | | |
| 001BCh | | | |
| 001BDh | | | |
| 001BEh | | | |
| 001BFh | | | |

Note:
1. The blank areas are reserved. No access is allowed.

**Table 3.8 SFR Information (8) (1)**

| Address | Register Name | Symbol | After Reset |
|---|---|---|---|
| 001C0h | Address Match Interrupt Register 0 | AIADR0L | 00h |
| 001C1h | | AIADR0M | 00h |
| 001C2h | | AIADR0H | 00h |
| 001C3h | Address Match Interrupt Enable Register 0 | AIEN0 | 00h |
| 001C4h | Address Match Interrupt Register 1 | AIADR1L | 00h |
| 001C5h | | AIADR1M | 00h |
| 001C6h | | AIADR1H | 00h |
| 001C7h | Address Match Interrupt Enable Register 1 | AIEN1 | 00h |
| 001C8h | | | |
| 001C9h | | | |
| 001CAh | | | |
| 001CBh | | | |
| 001CCh | | | |
| 001CDh | | | |
| 001CEh | | | |
| 001CFh | | | |
| 001D0h | | | |
| 001D1h | | | |
| 001D2h | | | |
| 001D3h | | | |
| 001D4h | | | |
| 001D5h | | | |
| 001D6h | | | |
| 001D7h | | | |
| 001D8h | | | |
| 001D9h | | | |
| 001DAh | | | |
| 001DBh | | | |
| 001DCh | | | |
| 001DDh | | | |
| 001DEh | | | |
| 001DFh | | | |
| 001E0h | | | |
| 001E1h | | | |
| 001E2h | | | |
| 001E3h | | | |
| 001E4h | | | |
| 001E5h | | | |
| 001E6h | | | |
| 001E7h | | | |
| 001E8h | | | |
| 001E9h | | | |
| 001EAh | | | |
| 001EBh | | | |
| 001ECh | | | |
| 001EDh | | | |
| 001EEh | | | |
| 001EFh | | | |
| 001F0h | | | |
| 001F1h | | | |
| 001F2h | | | |
| 001F3h | | | |
| 001F4h | | | |
| 001F5h | | | |
| 001F6h | | | |
| 001F7h | | | |
| 001F8h | | | |
| 001F9h | | | |
| 001FAh | | | |
| 001FBh | | | |
| 001FCh | | | |
| 001FDh | | | |
| 001FEh | | | |
| 001FFh | | | |

Note:
1. The blank areas are reserved. No access is allowed.

# 4. Electrical Characteristics

**Table 4.1 Absolute Maximum Ratings**

| Symbol | Parameter | | Condition | Rated Value | Unit |
|---|---|---|---|---|---|
| $V_{CC}$/$AV_{CC}$ | Power supply voltage | | | -0.3 to 6.5 | V |
| $V_I$ | Input voltage | XIN | XIN-XOUT oscillation on (oscillation circuit used) (1) | -0.3 to 1.9 | V |
| | | | XIN-XOUT oscillation off (oscillation circuit not used) (1) | -0.3 to Vcc + 0.3 | V |
| | | Other pins | | -0.3 to Vcc + 0.3 | V |
| $V_O$ | Output voltage | XOUT | XIN-XOUT oscillation on (oscillation circuit used) (1) | -0.3 to 1.9 | V |
| | | | XIN-XOUT oscillation off (oscillation circuit not used) (1) | -0.3 to Vcc + 0.3 | V |
| | | Other pins | | -0.3 to Vcc + 0.3 | V |
| $P_d$ | Power consumption | | -40 °C ≤ Topr ≤ 85 °C | 500 | mW |
| $T_{opr}$ | Operating ambient temperature | | | -20 to 85 (N version)/ -40 to 85 (D version) | °C |
| $T_{stg}$ | Storage temperature | | | -60 to 150 | °C |

Note:
1. When the oscillation circuit is used: bits CKPT1 to CKPT0 in the EXCKCR register are set to 11b
   When the oscillation circuit is not used: bits CKPT1 to CKPT0 in the EXCKCR register are set to any value other than 11b

**Table 4.3 A/D Converter Characteristics**

| Symbol | Parameter | Condition | | Standard | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| — | Resolution | | | — | — | 10 | Bit |
| — | Absolute accuracy | AVcc = 5.0 V | AN0 to AN4, AN7 input | — | — | ±3 | LSB |
| | | AVcc = 3.0 V | AN0 to AN4, AN7 input | — | — | ±5 | LSB |
| | | AVcc = 1.8 V | AN0 to AN4, AN7 input | — | — | ±5 | LSB |
| — | A/D conversion clock | 4.0 V ≤ AVcc ≤ 5.5 V (2) | | 2 | — | 20 | MHz |
| | | 3.2 V ≤ AVcc ≤ 5.5 V (2) | | 2 | — | 16 | MHz |
| | | 2.7 V ≤ AVcc ≤ 5.5 V (2) | | 2 | — | 10 | MHz |
| | | 1.8 V ≤ AVcc ≤ 5.5 V (2) | | 2 | — | 5 | MHz |
| — | Permissible signal source impedance | | | | 3 | | kΩ |
| $t_{CONV}$ | Conversion time | AVcc = 5.0 V, A/D conversion clock = 20 MHz | | 2.20 | — | — | µs |
| $t_{SAMP}$ | Sampling time | A/D conversion clock = 20 MHz | | 0.80 | — | — | µs |
| $V_{IA}$ | Analog input voltage | | | 0 | — | AVcc | V |

Notes:
1. Vcc/AVcc = 1.8 V to 5.5 V and Vss = 0 V and Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version), unless otherwise specified.
2. The A/D conversion result will be undefined in stop mode, or when the flash memory is in low-current-consumption read mode or stopped. Do not perform A/D conversion in these states. Do not enter these states during A/D conversion.

**Table 4.4 Comparator B Electrical Characteristics**

| Symbol | Parameter | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $V_{ref}$ | IVREF1, IVREF3 input reference voltage | | 0 | — | Vcc - 1.4 | V |
| $V_I$ | IVCMP1, IVCMP3 input voltage | | -0.3 | — | Vcc + 0.3 | V |
| — | Offset | | — | 5 | 100 | mV |
| $t_d$ | Comparator output delay time (2) | $V_I$ = Vref ± 100 mV | — | 0.1 | — | µs |
| $I_{CMP}$ | Comparator operating current | Vcc = 5.0 V | — | 17.5 | — | µA |

Notes:
1. Vcc = 2.7 V to 5.5 V and Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version), unless otherwise specified.
2. When the digital filter is disabled.

**Table 4.7 Voltage Detection 0 Circuit Electrical Characteristics**

| Symbol | Parameter | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $V_{det0}$ | Voltage detection level Vdet0_0 (2) | | 1.80 | 1.90 | 2.05 | V |
| | Voltage detection level Vdet0_1 (2) | | 2.15 | 2.35 | 2.50 | V |
| | Voltage detection level Vdet0_2 (2) | | 2.70 | 2.85 | 3.05 | V |
| | Voltage detection level Vdet0_3 (2) | | 3.55 | 3.80 | 4.05 | V |
| — | Voltage detection 0 circuit response time (3) | When Vcc decreases from 5 V to (Vdet0_0 - 0.1) V | — | 30 | — | µs |
| — | Self power consumption in voltage detection circuit | VC0E = 1, Vcc = 5.0 V | — | 1.5 | — | µA |
| $t_{d(E-A)}$ | Wait time until voltage detection circuit operation starts (4) | | — | — | 100 | µs |

Notes:
1. The measurement condition is Vcc = 1.8 V to 5.5 V and Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version).
2. Select the voltage detection level with bits VDSEL0 and VDSEL1 in the OFS register.
3. The response time is from when the voltage passes Vdet0 until the voltage monitor 0 reset is generated.
4. The wait time is necessary for the voltage detection circuit to operate when the VC0E bit in the VCA2 register is set to 0 and then 1.

**Table 4.8 Voltage Detection 1 Circuit Electrical Characteristics**

| Symbol | Parameter | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $V_{det1}$ | Voltage detection level Vdet1_1 (2) | When Vcc decreases | 2.15 | 2.35 | 2.55 | V |
| | Voltage detection level Vdet1_3 (2) | When Vcc decreases | 2.45 | 2.65 | 2.85 | V |
| | Voltage detection level Vdet1_5 (2) | When Vcc decreases | 2.75 | 2.95 | 3.15 | V |
| | Voltage detection level Vdet1_7 (2) | When Vcc decreases | 3.00 | 3.25 | 3.55 | V |
| | Voltage detection level Vdet1_9 (2) | When Vcc decreases | 3.30 | 3.55 | 3.85 | V |
| | Voltage detection level Vdet1_B (2) | When Vcc decreases | 3.60 | 3.85 | 4.15 | V |
| | Voltage detection level Vdet1_D (2) | When Vcc decreases | 3.90 | 4.15 | 4.45 | V |
| | Voltage detection level Vdet1_F (2) | When Vcc decreases | 4.20 | 4.45 | 4.75 | V |
| — | Hysteresis width at the rising of Vcc in voltage detection 1 circuit | Vdet1_1 to Vdet1_5 selected | — | 0.07 | — | V |
| | | Vdet1_7 to Vdet1_F selected | — | 0.10 | — | V |
| — | Voltage detection 1 circuit response time (3) | When Vcc decreases from 5 V to (Vdet1_0 - 0.1) V | — | 60 | 150 | µs |
| — | Self power consumption in voltage detection circuit | VC1E = 1, Vcc = 5.0 V | — | 1.7 | — | µA |
| $t_{d(E-A)}$ | Wait time until voltage detection circuit operation starts (4) | | — | — | 100 | µs |

Notes:
1. The measurement condition is Vcc = 1.8 V to 5.5 V and Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version).
2. Select the voltage detection level with bits VD1S1 to VD1S3 in the VD1LS register.
3. The response time is from when the voltage passes Vdet1 until the voltage monitor 1 interrupt request is generated.
4. The wait time is necessary for the voltage detection circuit to operate when the VC1E bit in the VCA2 register is set to 0 and then 1.

### Table 4.10 High-Speed On-Chip Oscillator Circuit Electrical Characteristics

| Symbol | Parameter | Package | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| — | High-speed on-chip oscillator frequency after reset is cleared | 14-pin TSSOP<br>20-pin LSSOP | Vcc = 1.8 V to 5.5 V,<br>-20 °C ≤ Topr ≤ 85 °C | 19.2 | 20.0 | 20.8 | MHz |
| | | 14-pin DIP<br>20-pin DIP | | 19.0 | 20.0 | 21.0 | MHz |
| | | 14-pin TSSOP<br>20-pin LSSOP | Vcc = 1.8 V to 5.5 V,<br>-40 °C ≤ Topr ≤ 85 °C | 19.0 | 20.0 | 21.0 | MHz |
| | High-speed on-chip oscillator frequency when the FR18S0 register adjustment value is written into the FRV1 register and the FR18S1 register adjustment value into the FRV2 register (2) | 14-pin TSSOP<br>20-pin LSSOP | Vcc = 1.8 V to 5.5 V,<br>-20 °C ≤ Topr ≤ 85 °C | 17.694 | 18.432 | 19.169 | MHz |
| | | 14-pin DIP<br>20-pin DIP | | 17.510 | 18.432 | 19.353 | MHz |
| | | 14-pin TSSOP<br>20-pin LSSOP | Vcc = 1.8 V to 5.5 V,<br>-40 °C ≤ Topr ≤ 85 °C | 17.510 | 18.432 | 19.353 | MHz |
| — | Oscillation stabilization time | — | | — | — | 30 | µs |
| — | Self power consumption at oscillation | — | Vcc = 5.0 V, Topr = 25 °C | — | 530 | — | µA |

Notes:
1. Vcc = 1.8 V to 5.5 V, Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version), unless otherwise specified.
2. This enables the setting errors of bit rates such as 9600 bps and 38400 bps to be 0 % when the serial interface is used in UART mode.

### Table 4.11 Low-Speed On-Chip Oscillator Circuit Electrical Characteristics

| Symbol | Parameter | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| fLOCO | Low-speed on-chip oscillator frequency | | 60 | 125 | 250 | kHz |
| — | Oscillation stabilization time | | — | — | 35 | µs |
| — | Self power consumption at oscillation | Vcc = 5.0 V, Topr = 25 °C | — | 2 | — | µA |

Note:
1. Vcc = 1.8 V to 5.5 V, Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version), unless otherwise specified.

### Table 4.12 Power Supply Circuit Timing Characteristics

| Symbol | Parameter | Condition | Standard | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $t_{d(P-R)}$ | Time for internal power supply stabilization during power-on (2) | | — | — | 2,000 | µs |

Notes:
1. The measurement condition is Vcc = 1.8 V to 5.5 V and Topr = 25 °C.
2. Wait time until the internal power supply generation circuit stabilizes during power-on.

**Timing Requirements (Vcc = 5 V, Vss = 0 V at Topr = 25 °C, unless otherwise specified)**

**Table 4.15 External Clock Input (XIN)**

| Symbol | Parameter | Standard | | Unit |
|---|---|---|---|---|
| | | Min. | Max. | |
| $t_{c(XIN)}$ | XIN input cycle time | 50 | — | ns |
| $t_{WH(XIN)}$ | XIN input high width | 24 | — | ns |
| $t_{WL(XIN)}$ | XIN input low width | 24 | — | ns |

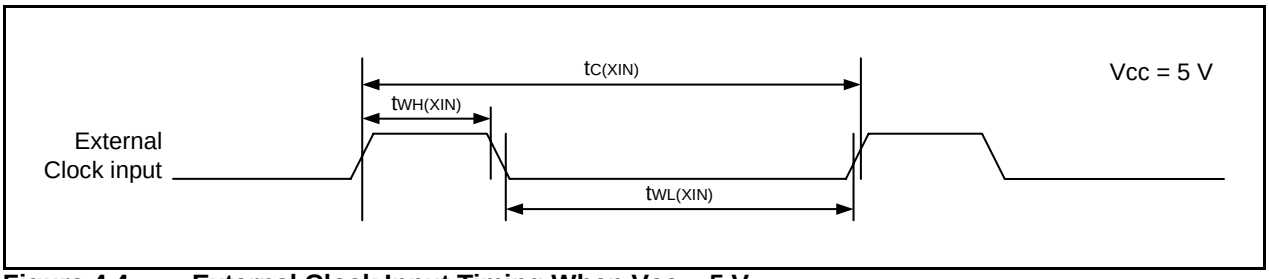



**Figure 4.4 External Clock Input Timing When Vcc = 5 V**

**Table 4.16 TRJIO Input**

| Symbol | Parameter | Standard | | Unit |
|---|---|---|---|---|
| | | Min. | Max. | |
| $t_{c(TRJIO)}$ | TRJIO input cycle time | 100 | — | ns |
| $t_{WH(TRJIO)}$ | TRJIO input high width | 40 | — | ns |
| $t_{WL(TRJIO)}$ | TRJIO input low width | 40 | — | ns |

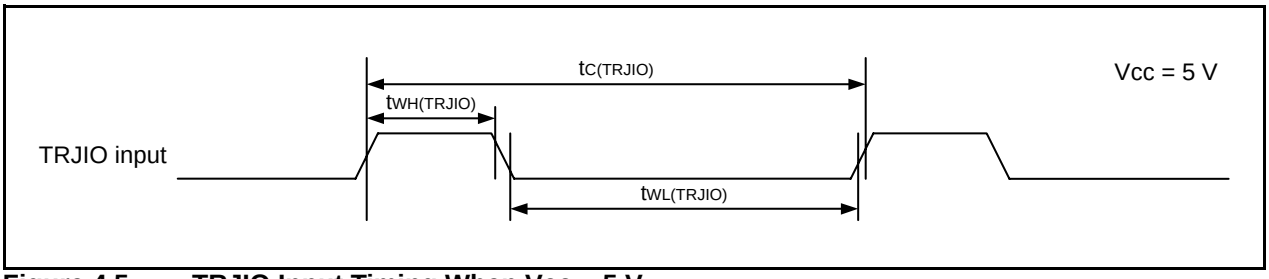



**Figure 4.5 TRJIO Input Timing When Vcc = 5 V**

**Table 4.20 DC Characteristics (4) [2.7 V ≤ Vcc < 4.0 V] (Topr = -20 °C to 85 °C (N version)/-40 °C to 85 °C (D version), unless otherwise specified)**

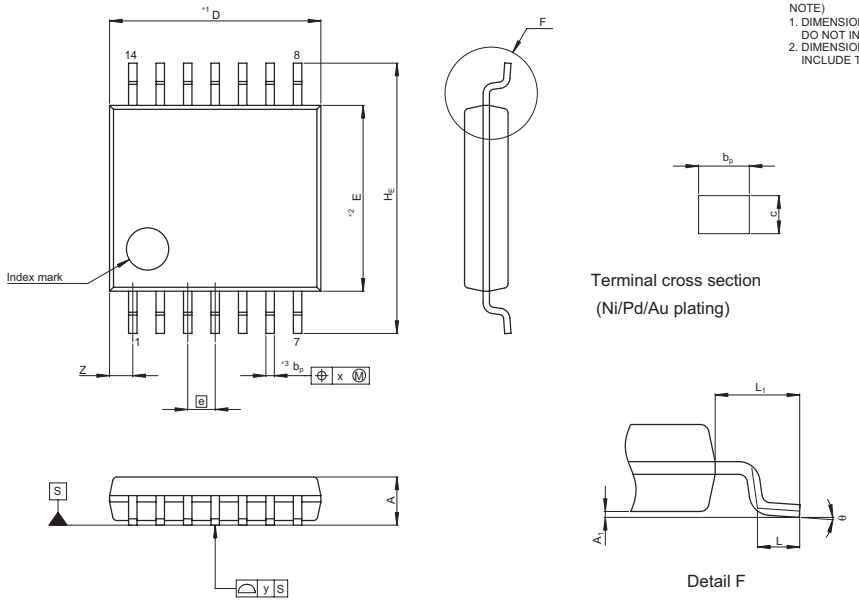
| Symbol | Parameter | Condition | | | | | | | Standard | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Oscillation Circuit | On-Chip Oscillator | | CPU Clock | Low-Power-Consumption Setting | Other | | | | |
| | | | XIN (2) | High-Speed | Low-Speed | | | | Min. | Typ. (3) | Max. | |
| Icc | Power supply current (1) | High-speed clock mode | 20 MHz | Off | 125 kHz | No division | — | | — | 3.0 | 7.0 | mA |
| | | | 16 MHz | Off | 125 kHz | No division | — | | — | 2.5 | 6.0 | mA |
| | | | 10 MHz | Off | 125 kHz | No division | — | | — | 1.6 | 5.0 | mA |
| | | | 20 MHz | Off | 125 kHz | Division by 8 | — | | — | 1.5 | — | mA |
| | | | 16 MHz | Off | 125 kHz | Division by 8 | — | | — | 1.2 | — | mA |
| | | | 10 MHz | Off | 125 kHz | Division by 8 | — | | — | 0.9 | 4.5 | mA |
| | | High-speed on-chip oscillator mode | Off | 20 MHz | 125 kHz | No division | | | — | 3.5 | 7.5 | mA |
| | | | Off | 20 MHz | 125 kHz | Division by 8 | | | — | 2.0 | — | mA |
| | | | Off | 10 MHz (4) | 125 kHz | No division | | | — | 2.2 | — | mA |
| | | | Off | 10 MHz (4) | 125 kHz | Division by 8 | | | — | 1.4 | — | mA |
| | | | Off | 4 MHz (4) | 125 kHz | Division by 16 | MSTTRC = 1 | | — | 1.0 | — | mA |
| | | Low-speed on-chip oscillator mode | Off | Off | 125 kHz | Division by 8 | FMR27 = 1<br>LPE = 0 | | — | 60 | 260 | µA |
| | | Wait mode | Off | Off | 125 kHz | — | VC1E = 0<br>VC0E = 0<br>LPE = 1 | Peripheral clock supplied during WAIT instruction execution | — | 15 | 90 | µA |
| | | | Off | Off | 125 kHz | — | VC1E = 0<br>VC0E = 0<br>LPE = 1<br>WCKSTP = 1 | Peripheral clock stopped during WAIT instruction execution | — | 4.0 | 80 | µA |
| | | Stop mode | Off | Off | Off | — | VC1E = 0<br>VC0E = 0<br>STPM = 1 | Topr = 25 °C<br>Peripheral clock stopped | — | 1.0 | 4.0 | µA |
| | | | Off | Off | Off | — | VC1E = 0<br>VC0E = 0<br>STPM = 1 | Topr = 85 °C<br>Peripheral clock stopped | — | 1.5 | — | µA |

Notes:
1. Vcc = 2.7 V to 4.0 V, single-chip mode, output pins are open, and other pins are connected to Vss.
2. When the XIN input is a square wave.
3. Vcc = 3.0 V
4. Set the system clock to 10 MHz or 4 MHz with the PHISEL register.

# Package Dimensions

Diagrams showing the latest package dimensions and mounting information are available in the “Packages” section of the Renesas Electronics website.

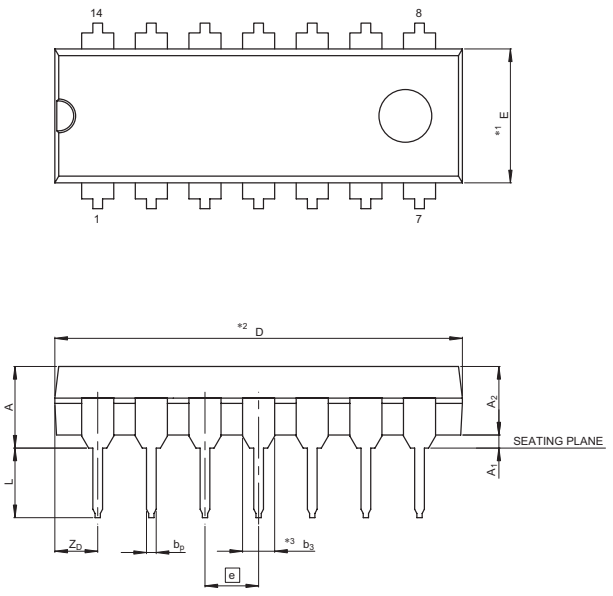
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-TSSOP14-4.4x5-0.65 | PTSP0014JA-B | TTP-14DV | 0.05g |




NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | — | 5.00 | 5.30 |
| E | — | 4.40 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.03 | 0.07 | 0.10 |
| A | — | — | 1.10 |
| $b_p$ | 0.15 | 0.20 | 0.25 |
| $b_1$ | — | — | — |
| c | 0.10 | 0.15 | 0.20 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 6.20 | 6.40 | 6.60 |
| e | — | 0.65 | — |
| x | — | — | 0.13 |
| y | — | — | 0.10 |
| Z | — | — | 0.83 |
| L | 0.4 | 0.5 | 0.6 |
| $L_1$ | — | 1.0 | — |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-DIP14-6.35x19.3-2.54 | PRDP0014AC-A | 14P4X-A | 0.94g |




NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| e1 | — | 7.69 | — |
| D | 19.2 | 19.3 | 19.4 |
| E | 6.25 | 6.35 | 6.45 |
| A | — | — | 4.8 |
| $A_1$ | 0.5 | — | — |
| $A_2$ | 3.05 | 3.25 | 3.45 |
| $b_p$ | 0.38 | — | 0.55 |
| $b_3$ | 1.47 | 1.52 | 1.57 |
| c | 0.21 | — | 0.35 |
| θ | 0° | — | 15° |
| e | — | 2.54 | — |
| $Z_D$ | — | 2.03 | — |
| L | 2.92 | — | — |

## General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.

   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.

   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to one with a different part number, confirm that the change will not lead to problems.

   — The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

# Notice

1. 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.
2. 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.
3. 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.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "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 etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). 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 for which it is not intended. 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 which the product is not intended by Renesas Electronics.
6. 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.
7. 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 systems manufactured by you.
8. 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.
9. 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. You should not use Renesas Electronics products or 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. When exporting the Renesas Electronics 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.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
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 2.0