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"[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	R8C
Core Size	16-Bit
Speed	20MHz
Connectivity	I ² C, LINbus, SIO, SSU, UART/USART
Peripherals	LCD, POR, PWM, Voltage Detect, WDT
Number of I/O	68
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	10K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 16x10b; D/A 2x8b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	80-LQFP
Supplier Device Package	80-LQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f2l38cmdfa-v0

Table 1.5 Specifications (2)

Item	Function	Specification	
Timer	Timer RA	8 bits × 1 (with 8-bit prescaler) Timer mode (period timer), pulse output mode (output level inverted every period), event counter mode, pulse width measurement mode, pulse period measurement mode	
	Timer RB	8 bits × 1 (with 8-bit prescaler) Timer mode (period timer), 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) Timer mode (input capture function, output compare function), PWM mode (output: 3 pins), PWM2 mode (PWM output: 1 pin)	
	Timer RD	16 bits × 2 (with 4 capture/compare registers) Timer mode (input capture function, output compare function), PWM mode (output: 6 pins), reset synchronous PWM mode (three-phase waveform output: 6 pins, sawtooth wave modulation), complementary PWM mode (three-phase waveform output: 6 pins, triangular wave modulation), PWM3 mode (PWM output with fixed period: 2 pins)	
	Timer RE	8 bits × 1 Real-time clock mode (counting of seconds, minutes, hours, days of week), output compare mode	
	Timer RG	16 bits × 1 Phase-counting mode, timer mode (output compare function, input capture function), PWM mode (output: 1 pin)	
Serial Interface	UART0, UART1	Clock synchronous serial I/O/UART × 2 channels	
	UART2	Clock synchronous serial I/O/UART, I ² C mode (I ² C-bus), multiprocessor communication function	
Synchronous Serial Communication Unit (SSU)		1 (shared with I ² C-bus)	
I ² C bus		1 (shared with SSU)	
LIN Module		Hardware LIN: 1 channel (timer RA, UART0 used)	
A/D Converter	R8C/L35M Group	10-bit resolution × 12 channels, including sample and hold function, with sweep mode	
	R8C/L36M Group	10-bit resolution × 12 channels, including sample and hold function, with sweep mode	
	R8C/L38M Group	10-bit resolution × 16 channels, including sample and hold function, with sweep mode	
	R8C/L3AM Group	10-bit resolution × 20 channels, including sample and hold function, with sweep mode	
D/A Converter		8-bit resolution × 2 circuits	
Comparator A		• 2 circuits (sheared with voltage monitor 1 and voltage monitor 2) • External reference voltage input available	
Comparator B		2 circuits	
LCD Drive Control Circuit	R8C/L35M Group	Common output: Max. 4 pins Segment output: Max. 24 pins	Bias: 1/2, 1/3 Duty: static, 1/2, 1/3, 1/4
	R8C/L36M Group	Common output: Max. 8 pins Segment output: Max. 32 pins ⁽¹⁾	Bias: 1/2, 1/3, 1/4 Duty: static, 1/2, 1/3, 1/4, 1/8
	R8C/L38M Group	Common output: Max. 8 pins Segment output: Max. 48 pins ⁽¹⁾	
	R8C/L3AM Group	Common output: Max. 8 pins Segment output: Max. 56 pins ⁽¹⁾	
	Voltage multiplier and dedicated regulator integrated		

Note:

1. This applies when four pins are selected for common output.

Table 1.8 Product List for R8C/L36M Group**Current of Jun 2011**

Part No.	Internal ROM Capacity		Internal RAM Capacity	Package Type	Remarks
	Program ROM	Data Flash			
R5F2L367MNFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0064KB-A	N Version
R5F2L367MNFA	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0064GA-A	
R5F2L368MNFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0064KB-A	
R5F2L368MNFA	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0064GA-A	
R5F2L36AMNFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064KB-A	
R5F2L36AMNFA	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064GA-A	
R5F2L36CMNFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064KB-A	
R5F2L36CMNFA	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064GA-A	
R5F2L367MDFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0064KB-A	D Version
R5F2L367MDFA	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0064GA-A	
R5F2L368MDFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0064KB-A	
R5F2L368MDFA	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0064GA-A	
R5F2L36AMDFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064KB-A	
R5F2L36AMDFA	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064GA-A	
R5F2L36CMDFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064KB-A	
R5F2L36CMDFA	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0064GA-A	

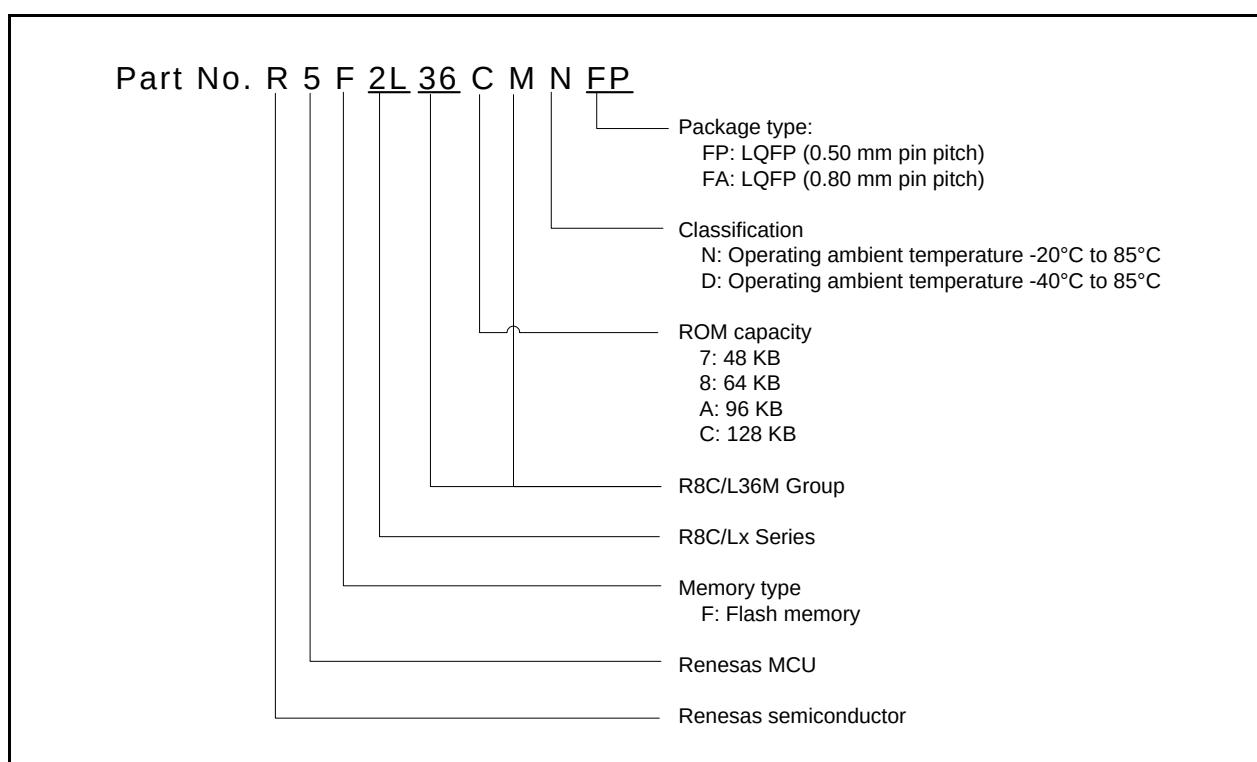
**Figure 1.2 Correspondence of Part No., with Memory Size and Package of R8C/L36M Group**

Table 1.9 Product List for R8C/L38M Group**Current of Jun 2011**

Part No.	Internal ROM Capacity		Internal RAM Capacity	Package Type	Remarks
	Program ROM	Data Flash			
R5F2L387MNFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0080KB-A	N Version
R5F2L387MNFA	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0080JA-A	
R5F2L388MNFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0080KB-A	
R5F2L388MNFA	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0080JA-A	
R5F2L38AMNFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080KB-A	
R5F2L38AMNFA	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080JA-A	
R5F2L38CMNFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080KB-A	
R5F2L38CMNFA	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080JA-A	
R5F2L387MDFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0080KB-A	D Version
R5F2L387MDFA	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0080JA-A	
R5F2L388MDFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0080KB-A	
R5F2L388MDFA	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0080JA-A	
R5F2L38AMDFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080KB-A	
R5F2L38AMDFA	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080JA-A	
R5F2L38CMDFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080KB-A	
R5F2L38CMDFA	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0080JA-A	

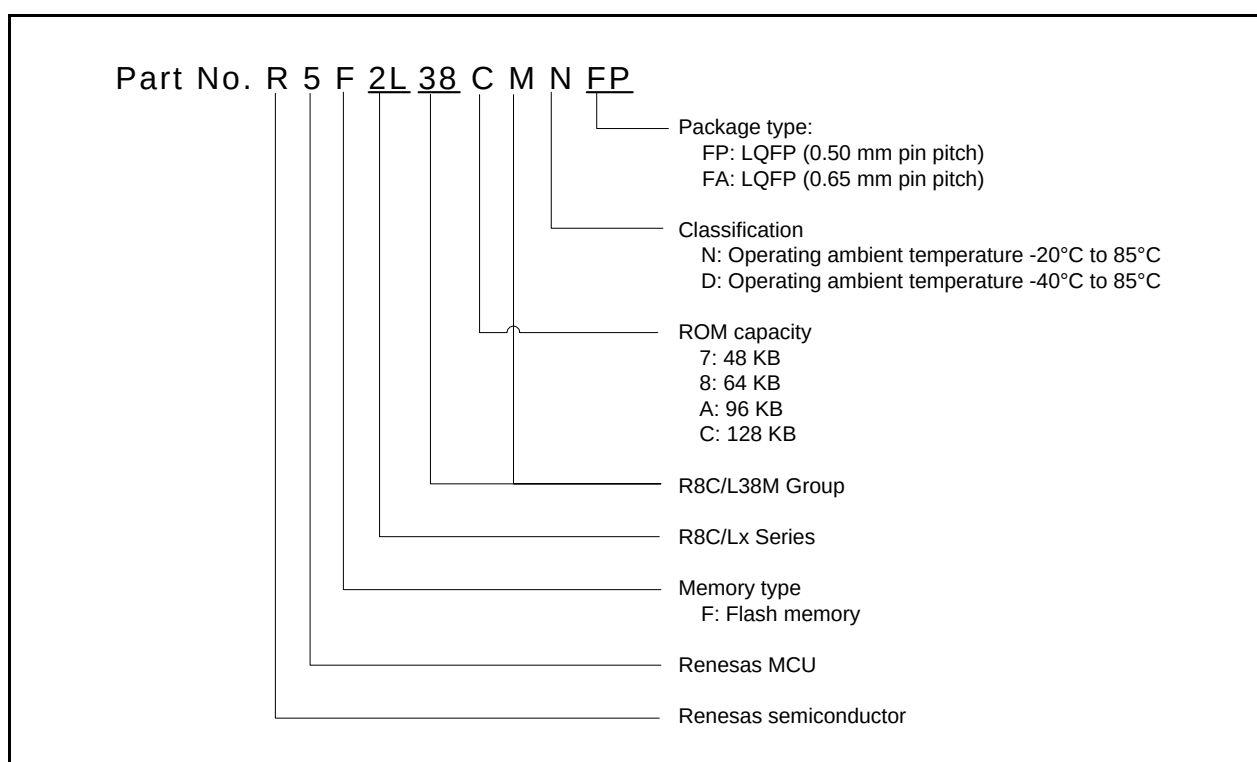
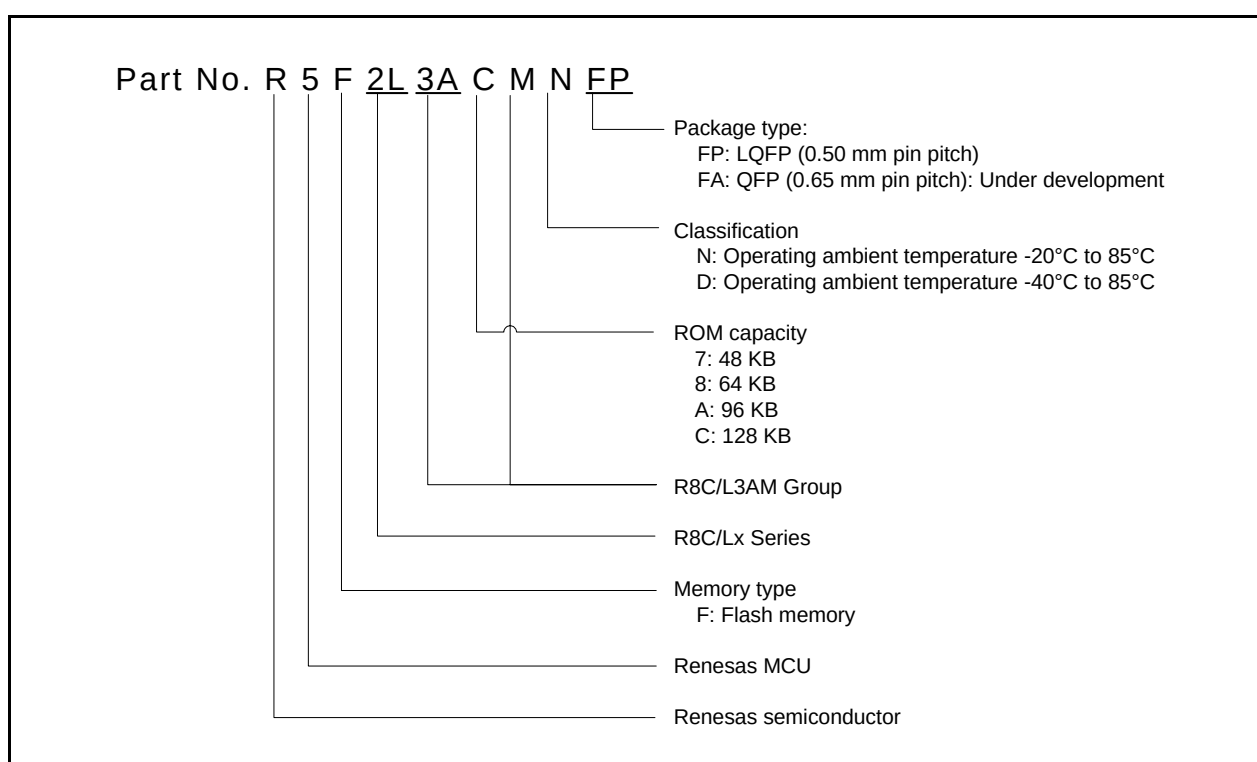
**Figure 1.3 Correspondence of Part No., with Memory Size and Package of R8C/L38M Group**

Table 1.10 Product List for R8C/L3AM Group**Current of Jun 2011**

Part No.	Internal ROM Capacity		Internal RAM Capacity	Package Type	Remarks
	Program ROM	Data Flash			
R5F2L3A7MNFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0100KB-A	N Version
R5F2L3A7MNFA (D)	48 Kbytes	1 Kbyte × 4	6 Kbytes	PRQP0100JD-B	
R5F2L3A8MNFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0100KB-A	
R5F2L3A8MNFA (D)	64 Kbytes	1 Kbyte × 4	8 Kbytes	PRQP0100JD-B	
R5F2L3AAMNFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0100KB-A	
R5F2L3AAMNFA (D)	96 Kbytes	1 Kbyte × 4	10 Kbytes	PRQP0100JD-B	
R5F2L3ACMNFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0100KB-A	
R5F2L3ACMNFA (D)	128 Kbytes	1 Kbyte × 4	10 Kbytes	PRQP0100JD-B	
R5F2L3A7MDFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0100KB-A	D Version
R5F2L3A7MDFA (D)	48 Kbytes	1 Kbyte × 4	6 Kbytes	PRQP0100JD-B	
R5F2L3A8MDFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0100KB-A	
R5F2L3A8MDFA (D)	64 Kbytes	1 Kbyte × 4	8 Kbytes	PRQP0100JD-B	
R5F2L3AAMDFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0100KB-A	
R5F2L3AAMDFA (D)	96 Kbytes	1 Kbyte × 4	10 Kbytes	PRQP0100JD-B	
R5F2L3ACMDFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0100KB-A	
R5F2L3ACMDFA (D)	128 Kbytes	1 Kbyte × 4	10 Kbytes	PRQP0100JD-B	

(D): Under development

**Figure 1.4 Correspondence of Part No., with Memory Size and Package of R8C/L3AM Group**

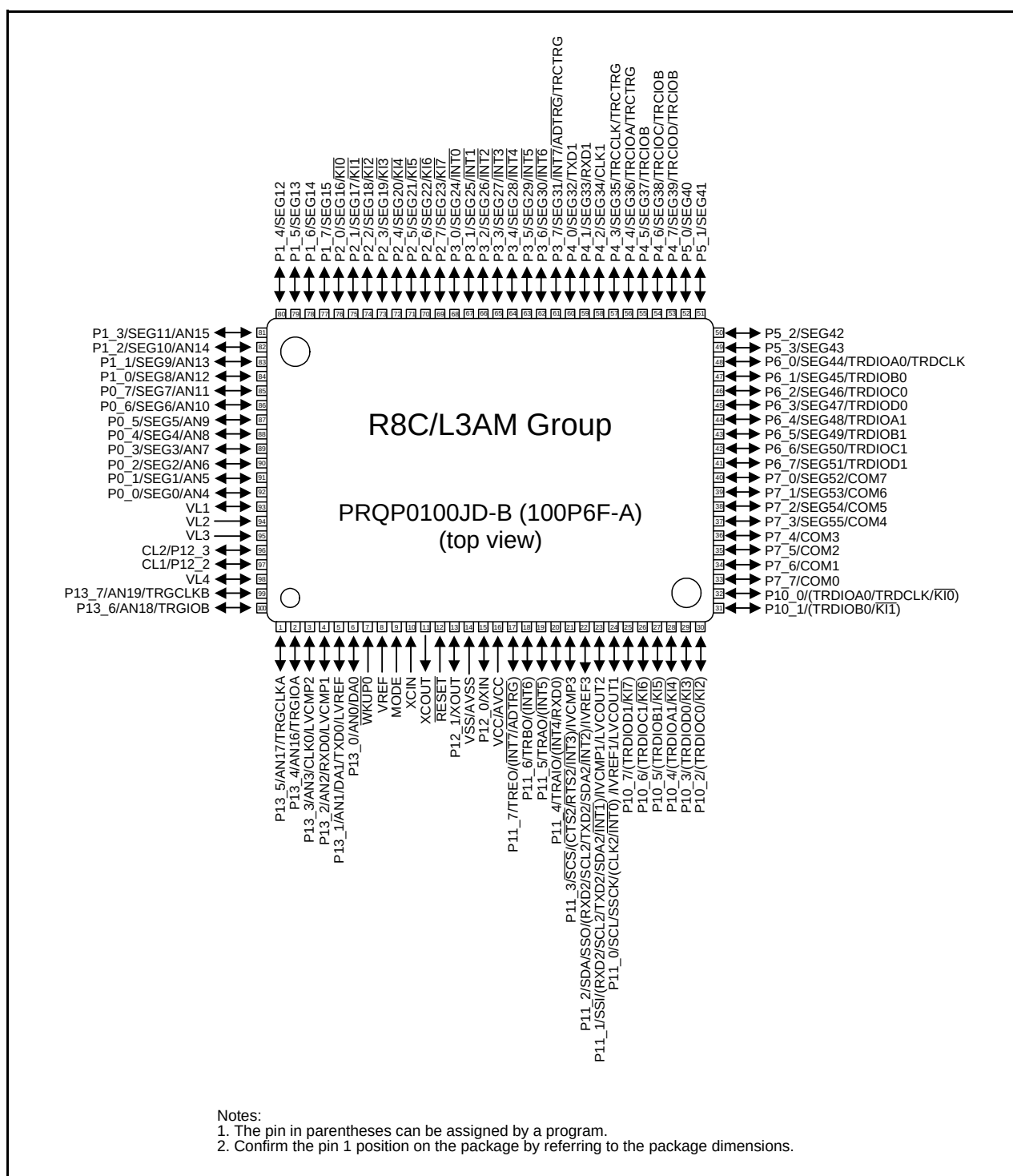


Figure 1.13 Pin Assignment (Top View) of PRQP0100JD-B Package

Table 1.11 Pin Name Information by Pin Number (1)

Pin Number				Control Pin	Port	I/O Pin Functions for Peripheral Modules						
L3AM (Note 2)	L38M	L36M	L35M			Interrupt	Timer	Serial Interface	SSU	I ² C bus	A/D Converter, D/A Converter, Comparator A, Comparator B, Voltage Detection Circuit	LCD drive control circuit
1 [3]	80	61	51		P13_3			CLK0			AN3/LVCMP2	
2 [4]	1	62	52		P13_2			RXD0			AN2/LVCMP1	
3 [5]	2	63	1		P13_1			TXD0			AN1/DA1/LVREF	
4 [6]	3	64	2		P13_0						AN0/DA0	
5 [7]	4	1	3	WKUP0								
6 [8]	5	2	4	VREF								
7 [9]	6	3	5	MODE								
8 [10]	7	4	6	XCIN								
9 [11]	8	5	7	XCOU								
10 [12]	9	6	8	RESET								
11 [13]	10	7	9	XOUT	P12_1							
12 [14]	11	8	10	VSS/ AVSS								
13 [15]	12	9	11	XIN	P12_0							
14 [16]	13	10	12	VCC/ AVCC								
15 [17]	14	11			P11_7	(INT7)	TREO				(ADTRG)	
16 [18]	15	12			P11_6	(INT6)	TRBO					
17 [19]	16	13			P11_5	(INT5)	TRA0					
18 [20]	17	14	13		P11_4	(INT4)	TRAIO	(RXD0)				
19 [21]	18	15	14		P11_3	(INT3)		(CTS2/RTS2)	SCS		IVCMP3	
20 [22]	19	16	15		P11_2	(INT2)		(RXD2/SCL2/ TXD2/SDA2)	SSO	SDA	IVREF3	
21 [23]	20	17	16		P11_1	(INT1)		(RXD2/SCL2/ TXD2/SDA2)	SSI		IVCMP1/LVCOUT2	
22 [24]	21	18	17		P11_0	(INT0)		(CLK2)	SSCK	SCL	IVREF1/LVCOUT1	
23 [25]					P10_7	(KI7)	(TRDIOD1)					
24 [26]					P10_6	(KI6)	(TRDIOD1)					
25 [27]					P10_5	(KI5)	(TRDIOB1)					
26 [28]					P10_4	(KI4)	(TRDIOA1)					
27 [29]					P10_3	(KI3)	(TRDIOD0)					
28 [30]					P10_2	(KI2)	(TRDIOD0)					
29 [31]					P10_1	(KI1)	(TRDIOB0)					
30 [32]					P10_0	(KI0)	(TRDIOA0/ TRDCLK)					
31 [33]	22	19	18		P7_7							COM0
32 [34]	23	20	19		P7_6							COM1
33 [35]	24	21	20		P7_5							COM2
34 [36]	25	22	21		P7_4							COM3
35 [37]	26	23			P7_3							SEG55/ COM4
36 [38]	27	24			P7_2							SEG54/ COM5
37 [39]	28	25			P7_1							SEG53/ COM6
38 [40]	29	26			P7_0							SEG52/ COM7
39 [41]	30				P6_7		TRDIOD1					SEG51

Notes:

1. The pin in parentheses can be assigned by a program.
2. The number in brackets indicates the pin number for the 100P6F package.

1.5 Pin Functions

Tables 1.14 and 1.15 list Pin Functions for R8C/L3AM Group.

Table 1.14 Pin Functions for R8C/L3AM Group (1)

Item	Pin Name	I/O Type	Description
Power supply input	VCC, VSS	–	Apply 1.8 V to 5.5 V to the VCC pin. Apply 0 V to the VSS pin.
Analog power supply input	AVCC, AVSS	–	Power supply for the A/D converter. Connect a capacitor between AVCC and AVSS.
Reset input	$\overline{\text{RESET}}$	I	Driving this pin low resets the MCU.
MODE	MODE	I	Connect this pin to VCC via a resistor.
Power-off mode exit input	$\overline{\text{WKUP0}}$	I	This pin is provided for input to exit the mode used in power-off mode. Connect to VSS when not using power-off mode.
XIN clock input	XIN	I	These pins are provided for XIN clock generation circuit I/O. Connect a ceramic oscillator or a crystal oscillator between pins XIN and XOUT. ⁽¹⁾ To use an external clock, input it to the XIN pin and leave the XOUT pin open.
XIN clock output	XOUT	O	
XCIN clock input	XCIN	I	These pins are provided for XCIN clock generation circuit I/O. Connect a crystal oscillator between pins XCIN and XCOU. ⁽¹⁾ To use an external clock, input it to the XCIN pin and leave the XCOU pin open.
XCIN clock output	XCOU	O	
$\overline{\text{INT}}$ interrupt input	$\overline{\text{INT0}}$ to $\overline{\text{INT7}}$	I	$\overline{\text{INT}}$ interrupt input pins.
Key input interrupt	$\overline{\text{KI0}}$ to $\overline{\text{KI7}}$	I	Key input interrupt input pins
Timer RA	TRAIO	I/O	Timer RA I/O pin
	TRA0	O	Timer RA output pin
Timer RB	TRBO	O	Timer RB output pin
Timer RC	TRCLK	I	External clock input pin
	TRCTRG	I	External trigger input pin
	TRCIOA, TRCIOB, TRCIO, TRCIOD	I/O	Timer RC I/O pins
Timer RD	TRDIOA0, TRDIOA1, TRDIOB0, TRDIOB1, TRDIOC0, TRDIOC1, TRDIOD0, TRDIOD1	I/O	Timer RD I/O pins
	TRDCLK	I	External clock input pin
Timer RE	TREO	O	Divided clock output pin
Timer RG	TRGCLKA, TRGCLKB	I	Timer RG input pins
	TRGIOA, TRGIOB	I/O	Timer RG I/O pins
Serial interface	CLK0, CLK1, CLK2	I/O	Transfer clock I/O pins
	RXD0, RXD1, RXD2	I	Serial data input pins
	TXD0, TXD1, TXD2	O	Serial data output pins
	$\overline{\text{CTS2}}$	I	Transmission control input pin
	$\overline{\text{RTS2}}$	O	Reception control output pin
	SCL2	I/O	I ² C mode clock I/O pin
	SDA2	I/O	I ² C mode data I/O pin

I: Input O: Output I/O: Input and output

Note:

1. Contact the oscillator manufacturer for oscillation characteristics.

Table 1.15 Pin Functions for R8C/L3AM Group (2)

Item	Pin Name	I/O Type	Description
I ² C bus	SCL	I/O	Clock I/O pin
	SDA	I/O	Data I/O pin
SSU	SSI	I/O	Data I/O pin
	$\overline{\text{SCS}}$	I/O	Chip-select signal I/O pin
	SSCK	I/O	Clock I/O pin
	SSO	I/O	Data I/O pin
Reference voltage input	VREF	I	Reference voltage input pin for the A/D converter and the D/A converter
A/D converter	AN0 to AN11	I	A/D converter analog input pins
	ADTRG	I	A/D external trigger input pin
D/A converter	DA0, DA1	O	D/A converter output pins
Comparator A	LVCMP1, LVCMP2	I	Comparator A analog voltage input pins
	LVREF	I	Comparator A reference voltage input pin
	LVCOUT1, LVCOUT2	O	Comparator A analog output pins
Comparator B	IVCMP1, IVCMP3	I	Comparator B analog voltage input pins
	IVREF1, IVREF3	I	Comparator B reference voltage input pins
Voltage detection circuit	LVCMP2	I	Detection target voltage input pin for voltage detection 2
I/O ports	P0_0 to P0_7, P1_0 to P1_7, P2_0 to P2_7, P3_0 to P3_7, P4_0 to P4_7, P5_0, P5_3, P6_0 to P6_7, P7_0 to P7_7, P10_0 to P10_7, P11_0 to P11_7, P12_0 to P12_3, P13_0 to P13_7	I/O	CMOS I/O ports. Each port has an I/O select direction register, allowing each pin in the port to be directed for input or output individually. Any port set to input can be set to use a pull-up resistor or not by a program. Ports P10_0 to P10_7 and P11_0 to P11_7 can be used as LED drive ports.
Segment output	SEG0 to SEG55	O	LCD segment output pins
Common output	COM0 to COM7	O	LCD common output pins
Voltage multiplier capacity connect pins	CL1, CL2	O	Connect pins for the LCD control voltage multiplier
LCD power supply	VL1	I/O	Apply the voltage: $0 \leq \text{VL1} \leq \text{VL2} \leq \text{VL3} \leq \text{VL4}$.
	VL2 to VL4	I	VL1 can be used as the reference potential input or output pin when setting the voltage multiplier.

I: Input O: Output I/O: Input and output

Note:

1. Contact the oscillator manufacturer for oscillation characteristics.

3. Memory

Figure 3.1 is a Memory Map of each group. Each group has a 1-Mbyte address space from addresses 00000h to FFFFh. For example, a 48-Kbyte internal ROM area is allocated addresses 04000h to 0FFFFh.

The fixed interrupt vector table is allocated addresses 0FFDCh to 0FFFFh. The starting address of each interrupt routine is stored here.

The internal ROM (data flash) is allocated addresses 03000h to 03FFFh.

The internal RAM is allocated higher addresses, beginning with address 00400h. For example, a 6-Kbyte internal RAM area is allocated addresses 00400h to 01BFFh. 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 addresses 00000h to 002FFh and 02C00h to 02FFFh. Peripheral function control registers are allocated here. All unallocated spaces within the SFRs are reserved and cannot be accessed by users.

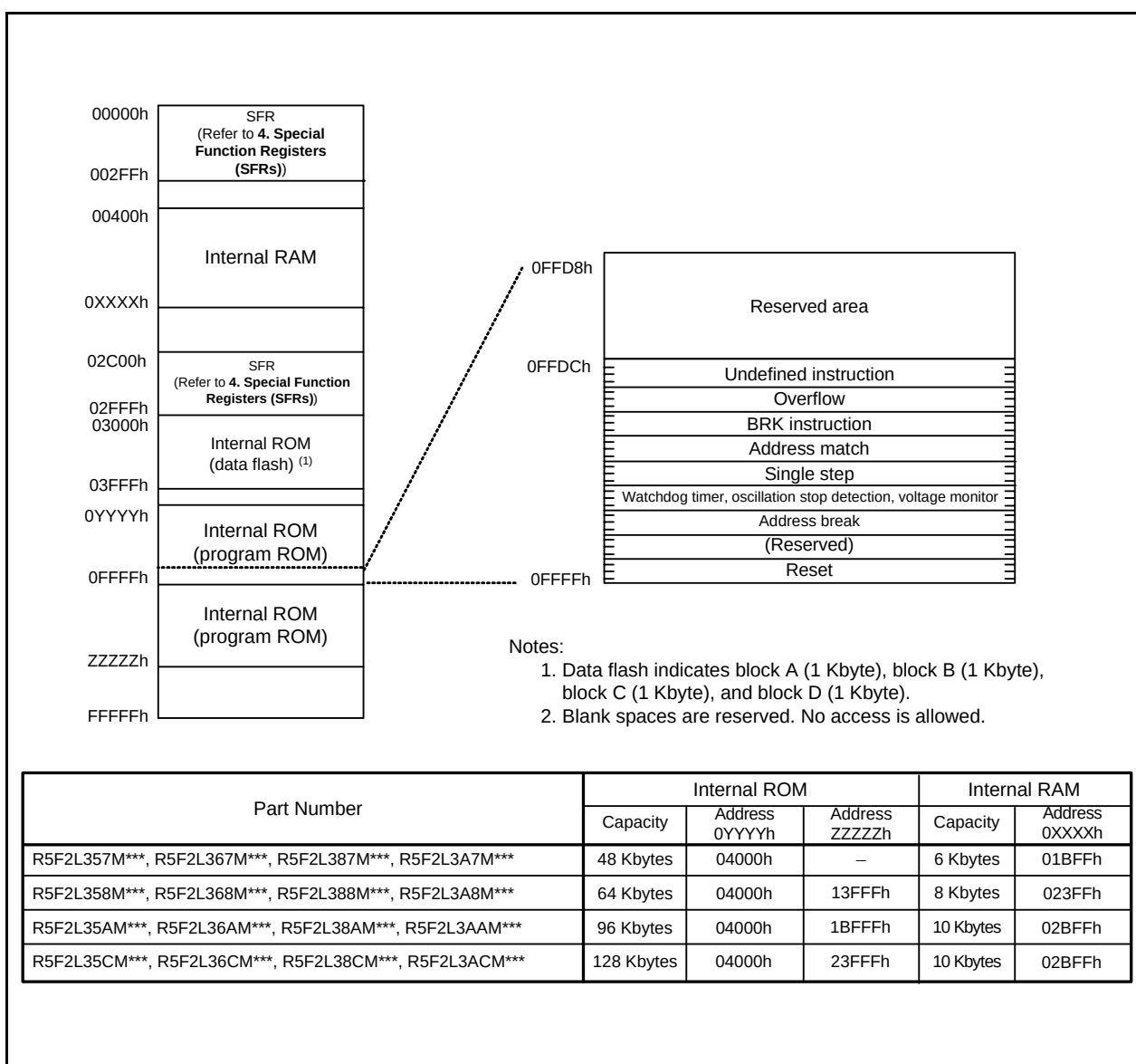


Figure 3.1 Memory Map

Table 4.2 SFR Information (2) (1)

Address	Register	Symbol	After Reset
003Ah	Voltage Monitor 2 Circuit Control Register	VW2C	10000010b
003Bh			
003Ch			
003Dh			
003Eh			
003Fh			
0040h			
0041h	Flash Memory Ready Interrupt Control Register	FMRDYIC	XXXXX000b
0042h			
0043h	INT7 Interrupt Control Register	INT7IC	XX00X000b
0044h	INT6 Interrupt Control Register	INT6IC	XX00X000b
0045h	INT5 Interrupt Control Register	INT5IC	XX00X000b
0046h	INT4 Interrupt Control Register	INT4IC	XX00X000b
0047h	Timer RC Interrupt Control Register	TRCIC	XXXXX000b
0048h	Timer RD0 Interrupt Control Register	TRD0IC	XXXXX000b
0049h	Timer RD1 Interrupt Control Register	TRD1IC	XXXXX000b
004Ah	Timer RE Interrupt Control Register	TREIC	XXXXX000b
004Bh	UART2 Transmit Interrupt Control Register	S2TIC	XXXXX000b
004Ch	UART2 Receive Interrupt Control Register	S2RIC	XXXXX000b
004Dh	Key Input Interrupt Control Register	KUPIC	XXXXX000b
004Eh	A/D Conversion Interrupt Control Register	ADIC	XXXXX000b
004Fh	SSU Interrupt Control Register / IIC bus Interrupt Control Register (2)	SSUIC/IICIC	XXXXX000b
0050h			
0051h	UART0 Transmit Interrupt Control Register	S0TIC	XXXXX000b
0052h	UART0 Receive Interrupt Control Register	S0RIC	XXXXX000b
0053h	UART1 Transmit Interrupt Control Register	S1TIC	XXXXX000b
0054h	UART1 Receive Interrupt Control Register	S1RIC	XXXXX000b
0055h	INT2 Interrupt Control Register	INT2IC	XX00X000b
0056h	Timer RA Interrupt Control Register	TRAIC	XXXXX000b
0057h			
0058h	Timer RB Interrupt Control Register	TRBIC	XXXXX000b
0059h	INT1 Interrupt Control Register	INT1IC	XX00X000b
005Ah	INT3 Interrupt Control Register	INT3IC	XX00X000b
005Bh			
005Ch			
005Dh	INT0 Interrupt Control Register	INT0IC	XX00X000b
005Eh	UART2 Bus Collision Detection Interrupt Control Register	U2BCNIC	XXXXX000b
005Fh			
0060h			
0061h			
0062h			
0063h			
0064h			
0065h			
0066h			
0067h			
0068h			
0069h			
006Ah			
006Bh	Timer RG Interrupt Control Register	TRGIC	XXXXX000b
006Ch			
006Dh			
006Eh			
006Fh			
0070h			
0071h			
0072h	Voltage monitor 1 / Comparator A1 Interrupt Control Register	VCMP1IC	XXXXX000b
0073h	Voltage monitor 2 / Comparator A2 Interrupt Control Register	VCMP2IC	XXXXX000b
0074h			
0075h			
0076h			
0077h			
0078h			
0079h			
007Ah			
007Bh			
007Ch			
007Dh			
007Eh			
007Fh			

X: Undefined

Notes:

- Blank spaces are reserved. No access is allowed.
- Selectable by the IICSEL bit in the SSUICSR register.

Table 4.6 SFR Information (6) ⁽¹⁾

Address	Register	Symbol	After Reset
0140h	Timer RD Control Register 0	TRDCR0	00h
0141h	Timer RD I/O Control Register A0	TRDIOA0	10001000b
0142h	Timer RD I/O Control Register C0	TRDIORC0	10001000b
0143h	Timer RD Status Register 0	TRDSR0	11100000b
0144h	Timer RD Interrupt Enable Register 0	TRDIER0	11100000b
0145h	Timer RD PWM Mode Output Level Control Register 0	TRDPOCR0	11111000b
0146h	Timer RD Counter 0	TRD0	00h
0147h			00h
0148h	Timer RD General Register A0	TRDGRA0	FFh
0149h			FFh
014Ah	Timer RD General Register B0	TRDGRB0	FFh
014Bh			FFh
014Ch	Timer RD General Register C0	TRDGRC0	FFh
014Dh			FFh
014Eh	Timer RD General Register D0	TRDGRD0	FFh
014Fh			FFh
0150h	Timer RD Control Register 1	TRDCR1	00h
0151h	Timer RD I/O Control Register A1	TRDIOA1	10001000b
0152h	Timer RD I/O Control Register C1	TRDIORC1	10001000b
0153h	Timer RD Status Register 1	TRDSR1	11000000b
0154h	Timer RD Interrupt Enable Register 1	TRDIER1	11100000b
0155h	Timer RD PWM Mode Output Level Control Register 1	TRDPOCR1	11111000b
0156h	Timer RD Counter 1	TRD1	00h
0157h			00h
0158h	Timer RD General Register A1	TRDGRA1	FFh
0159h			FFh
015Ah	Timer RD General Register B1	TRDGRB1	FFh
015Bh			FFh
015Ch	Timer RD General Register C1	TRDGRC1	FFh
015Dh			FFh
015Eh	Timer RD General Register D1	TRDGRD1	FFh
015Fh			FFh
0160h	UART1 Transmit/Receive Mode Register	U1MR	00h
0161h	UART1 Bit Rate Register	U1BRG	XXh
0162h	UART1 Transmit Buffer Register	U1TB	XXh
0163h			XXh
0164h	UART1 Transmit/Receive Control Register 0	U1C0	00001000b
0165h	UART1 Transmit/Receive Control Register 1	U1C1	00000010b
0166h	UART1 Receive Buffer Register	U1RB	XXh
0167h			XXh
0168h			
0169h			
016Ah			
016Bh			
016Ch			
016Dh			
016Eh			
016Fh			
0170h	Timer RG Mode Register	TRGMR	01000000b
0171h	Timer RG Count Control Register	TRGCNTC	00h
0172h	Timer RG Control Register	TRGCR	10000000b
0173h	Timer RG Interrupt Enable Register	TRGIER	11110000b
0174h	Timer RG Status Register	TRGSR	11100000b
0175h	Timer RG I/O Control Register	TRGIOR	00h
0176h	Timer RG Counter	TRG	00h
0177h			00h
0178h	Timer RG General Register A	TRGGRA	FFh
0179h			FFh
017Ah	Timer RG General Register B	TRGGRB	FFh
017Bh			FFh
017Ch	Timer RG General Register C	TRGGRC	FFh
017Dh			FFh
017Eh	Timer RG General Register D	TRGGRD	FFh
017Fh			FFh

X: Undefined

Note:

- Blank spaces are reserved. No access is allowed.

Table 4.7 SFR Information (7) ⁽¹⁾

Address	Register	Symbol	After Reset
0180h	Timer RA Pin Select Register	TRASR	00h
0181h	Timer RB/RC Pin Select Register	TRBRCSR	00h
0182h	Timer RC Pin Select Register 0	TRCPSR0	00h
0183h	Timer RC Pin Select Register 1	TRCPSR1	00h
0184h	Timer RD Pin Select Register 0	TRDPSR0	00h
0185h	Timer RD Pin Select Register 1	TRDPSR1	00h
0186h			
0187h	Timer RG Pin Select Register	TRGPSR	00h
0188h	UART0 Pin Select Register	U0SR	00h
0189h	UART1 Pin Select Register	U1SR	00h
018Ah	UART2 Pin Select Register 0	U2SR0	00h
018Bh	UART2 Pin Select Register 1	U2SR1	00h
018Ch	SSU/IIC Pin Select Register	SSUIICSR	00h
018Dh	Key Input Pin Select Register	KISR	00h
018Eh	INT Interrupt Input Pin Select Register	INTSR	00h
018Fh	I/O Function Pin Select Register	PINSR	00h
0190h			
0191h			
0192h			
0193h	SS Bit Counter Register	SSBR	11111000b
0194h	SS Transmit Data Register L / IIC bus Transmit Data Register ⁽²⁾	SSTDR/ICDRT	FFh
0195h	SS Transmit Data Register H ⁽²⁾	SSTDRH	FFh
0196h	SS Receive Data Register L / IIC bus Receive Data Register ⁽²⁾	SSRDR/ICDRR	FFh
0197h	SS Receive Data Register H ⁽²⁾	SSRDRH	FFh
0198h	SS Control Register H / IIC bus Control Register 1 ⁽²⁾	SSCRH/ICCR1	00h
0199h	SS Control Register L / IIC bus Control Register 2 ⁽²⁾	SSCRL/ICCR2	01111101b
019Ah	SS Mode Register / IIC bus Mode Register ⁽²⁾	SSMR/ICMR	00010000b/00011000b
019Bh	SS Enable Register / IIC bus Interrupt Enable Register ⁽²⁾	SSER/ICIER	00h
019Ch	SS Status Register / IIC bus Status Register ⁽²⁾	SSSR/ICSR	00h/0000X000b
019Dh	SS Mode Register 2 / Slave Address Register ⁽²⁾	SSMR2/SAR	00h
019Eh			
019Fh			
01A0h			
01A1h			
01A2h			
01A3h			
01A4h			
01A5h			
01A6h			
01A7h			
01A8h			
01A9h			
01AAh			
01ABh			
01ACh			
01ADh			
01AEh			
01AFh			
01B0h			
01B1h			
01B2h	Flash Memory Status Register	FST	10000X00b
01B3h			
01B4h	Flash Memory Control Register 0	FMR0	00h
01B5h	Flash Memory Control Register 1	FMR1	00h
01B6h	Flash Memory Control Register 2	FMR2	00h
01B7h			
01B8h			
01B9h			
01BAh			
01BBh			
01BCh			
01BDh			
01BEh			
01BFh			

X: Undefined

Notes:

- Blank spaces are reserved. No access is allowed.
- Selectable by the IICSEL bit in the SSUIICSR register.

Table 4.8 SFR Information (8) (1)

Address	Register	Symbol	After Reset
01C0h	Address Match Interrupt Register 0	RMAD0	XXh
01C1h			XXh
01C2h			0000XXXXb
01C3h	Address Match Interrupt Enable Register 0	AIER0	00h
01C4h	Address Match Interrupt Register 1	RMAD1	XXh
01C5h			XXh
01C6h			0000XXXXb
01C7h	Address Match Interrupt Enable Register 1	AIER1	00h
01C8h			
01C9h			
01CAh			
01CBh			
01CCh			
01CDh			
01CEh			
01CFh			
01D0h			
01D1h			
01D2h			
01D3h			
01D4h			
01D5h			
01D6h			
01D7h			
01D8h			
01D9h			
01DAh			
01DBh			
01DCh			
01DDh			
01DEh			
01DFh			
01E0h	Port P0 Pull-Up Control Register	P0PUR	00h
01E1h	Port P1 Pull-Up Control Register	P1PUR	00h
01E2h	Port P2 Pull-Up Control Register	P2PUR	00h
01E3h	Port P3 Pull-Up Control Register	P3PUR	00h
01E4h	Port P4 Pull-Up Control Register	P4PUR	00h
01E5h	Port P5 Pull-Up Control Register	P5PUR	00h
01E6h	Port P6 Pull-Up Control Register	P6PUR	00h
01E7h	Port P7 Pull-Up Control Register	P7PUR	00h
01E8h			
01E9h			
01EAh	Port 10 Pull-Up Control Register	P10PUR	00h
01EBh	Port 11 Pull-Up Control Register	P11PUR	00h
01ECh	Port 12 Pull-Up Control Register	P12PUR	00h
01EDh	Port 13 Pull-Up Control Register	P13PUR	00h
01EEh			
01EFh			
01F0h	Port P10 Drive Capacity Control Register	P10DRR	00h
01F1h	Port P11 Drive Capacity Control Register	P11DRR	00h
01F2h			
01F3h			
01F4h			
01F5h	Input Threshold Control Register 0	VLT0	00h
01F6h	Input Threshold Control Register 1	VLT1	00h
01F7h	Input Threshold Control Register 2	VLT2	00h
01F8h	Comparator B Control Register 0	INTCMP	00h
01F9h			
01FAh	External Input Enable Register 0	INTEN	00h
01FBh	External Input Enable Register 1	INTEN1	00h
01FCh	INT Input Filter Select Register 0	INTF	00h
01FDh	INT Input Filter Select Register 1	INTF1	00h
01FEh	Key Input Enable Register 0	KIEN	00h
01FFh	Key Input Enable Register 1	KIEN1	00h

X: Undefined

Note:

- Blank spaces are reserved. No access is allowed.

Table 4.11 SFR Information (11) ⁽¹⁾

Address	Register	Symbol	After Reset
0280h	LCD Display Control Data Register	LRA16H	XXh
0281h		LRA17H	XXh
0282h		LRA18H	XXh
0283h		LRA19H	XXh
0284h		LRA20H	XXh
0285h		LRA21H	XXh
0286h		LRA22H	XXh
0287h		LRA23H	XXh
0288h		LRA24H	XXh
0289h		LRA25H	XXh
028Ah		LRA26H	XXh
028Bh		LRA27H	XXh
028Ch		LRA28H	XXh
028Dh		LRA29H	XXh
028Eh		LRA30H	XXh
028Fh		LRA31H	XXh
0290h		LRA32H	XXh
0291h		LRA33H	XXh
0292h		LRA34H	XXh
0293h		LRA35H	XXh
0294h		LRA36H	XXh
0295h		LRA37H	XXh
0296h		LRA38H	XXh
0297h		LRA39H	XXh
0298h		LRA40H	XXh
0299h		LRA41H	XXh
029Ah		LRA42H	XXh
029Bh		LRA43H	XXh
029Ch		LRA44H	XXh
029Dh		LRA45H	XXh
029Eh		LRA46H	XXh
029Fh		LRA47H	XXh
02A0h		LRA48H	XXh
02A1h		LRA49H	XXh
02A2h		LRA50H	XXh
02A3h		LRA51H	XXh
02A4h		LRA52H	XXh
02A5h		LRA53H	XXh
02A6h		LRA54H	XXh
02A7h		LRA55H	XXh
02A8h			
02A9h			
02AAh			
02ABh			
02ACh			
02ADh			
02AEh			
02AFh			
02B0h			
02B1h			
02B2h			
02B3h			
02B4h			
02B5h			
02B6h			
02B7h			
02B8h			
02B9h			
02BAh			
02BBh			
02BCh			
02BDh			
02BEh			
02BFh			

X: Undefined

Note:

- Blank spaces are reserved. No access is allowed.

Table 4.16 SFR Information (16) ⁽¹⁾

Address	Register	Symbol	After Reset
2CF0h	DTC Control Data 22	DTCD22	XXh
2CF1h			XXh
2CF2h			XXh
2CF3h			XXh
2CF4h			XXh
2CF5h			XXh
2CF6h			XXh
2CF7h			XXh
2CF8h	DTC Control Data 23	DTCD23	XXh
2CF9h			XXh
2CFAh			XXh
2CFBh			XXh
2CFCh			XXh
2CFDh			XXh
2CFEh			XXh
2CFFh			XXh
2D00h			
:			
2FFFh			

X: Undefined

Note:

- Blank spaces are reserved. No access is allowed.

Table 4.17 ID Code Areas and Option Function Select Area

Address	Area Name	Symbol	After Reset
:			
FFDBh	Option Function Select Register 2	OFS2	(Note 1)
:			
FFDFh	ID1		(Note 2)
:			
FFE3h	ID2		(Note 2)
:			
FFEBh	ID3		(Note 2)
:			
FFEFh	ID4		(Note 2)
:			
FFF3h	ID5		(Note 2)
:			
FFF7h	ID6		(Note 2)
:			
FFFBh	ID7		(Note 2)
:			
FFFFh	Option Function Select Register	OFS	(Note 1)

Notes:

- The option function select area is allocated in the flash memory, not in the SFRs. Set appropriate values as ROM data by a program. Do not write additions to the option function select area. If the block including the option function select area is erased, the option function select area is set to FFh.
When blank products are shipped, the option function select area is set to FFh. It is set to the written value after written by the user.
When factory-programming products are shipped, the value of the option function select area is the value programmed by the user.
- The ID code areas are allocated in the flash memory, not in the SFRs. Set appropriate values as ROM data by a program. Do not write additions to the ID code areas. If the block including the ID code areas is erased, the ID code areas are set to FFh.
When blank products are shipped, the ID code areas are set to FFh. They are set to the written value after written by the user.
When factory-programming products are shipped, the value of the ID code areas is the value programmed by the user.

Table 5.7 Flash Memory (Program ROM) Characteristics
(V_{CC} = 2.7 to 5.5 V and T_{opr} = 0 to 60°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Standard			Unit
			Min.	Typ.	Max.	
—	Program/erase endurance ⁽¹⁾		1,000 ⁽²⁾	—	—	times
—	Byte program time		—	80	500	μs
—	Word program time		—	120	750	μs
—	Block erase time		—	0.3	—	s
t _d (SR-SUS)	Time delay from suspend request until suspend		—	—	5 + CPU clock × 3 cycles	ms
—	Interval from erase start/restart until following suspend request		0	—	—	ms
—	Time from suspend until erase restart		—	—	30+CPU clock × 1 cycle	μs
t _d (CMDRST-READY)	Time from when command is forcibly terminated until reading is enabled		—	—	30+CPU clock × 1 cycle	μs
—	Program, erase voltage		2.7	—	5.5	V
—	Read voltage		1.8	—	5.5	V
—	Program, erase temperature		0	—	60	°C
—	Data hold time ⁽⁶⁾	Ambient temperature = 55°C	20	—	—	year

Notes:

1. Definition of programming/erasure endurance
 The programming and erasure endurance is defined on a per-block basis.
 If the programming and erasure endurance is n (n = 1,000), each block can be erased n times. For example, if 1,024 1-byte writes are performed to different addresses in block A, a 1 Kbyte block, and then the block is erased, the programming/erasure endurance still stands at one.
 However, the same address must not be programmed more than once per erase operation (overwriting prohibited).
2. Endurance to guarantee all electrical characteristics after program and erase. (1 to Min. value can be guaranteed).
3. In a system that executes multiple programming operations, the actual erasure count can be reduced by writing to sequential addresses in turn so that as much of the block as possible is used up before performing an erase operation. For example, when programming groups of 16 bytes, the effective number of rewrites can be minimized by programming up to 128 groups before erasing them all in one operation. It is also advisable to retain data on the erasure endurance of each block and limit the number of erase operations to a certain number.
4. If an error occurs during block erase, attempt to execute the clear status register command, then execute the block erase command at least three times until the erase error does not occur.
5. Customers desiring program/erase failure rate information should contact their Renesas technical support representative.
6. The data hold time includes time that the power supply is off or the clock is not supplied.

Table 5.26 External Clock Input (XIN, XCIN)
($V_{CC} = 1.8$ to 5.5 V, $V_{SS} = 0$ V, and $T_{opr} = -20$ to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter	Standard						Unit
		Vcc = 2.2V, Topr = 25°C		Vcc = 3V, Topr = 25°C		Vcc = 5V, Topr = 25°C		
		Min.	Max.	Min.	Max.	Min.	Max.	
tc(XIN)	XIN input cycle time	200	—	50	—	50	—	ns
tWH(XIN)	XIN input “H” width	90	—	24	—	24	—	ns
tWL(XIN)	XIN input “L” width	90	—	24	—	24	—	ns
tc(XCIN)	XCIN input cycle time	14	—	14	—	14	—	μs
tWH(XCIN)	XCIN input “H” width	7	—	7	—	7	—	μs
tWL(XCIN)	XCIN input “L” width	7	—	7	—	7	—	μs

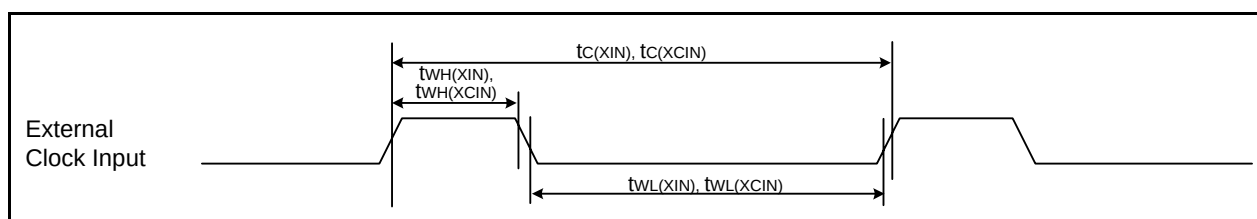


Figure 5.8 External Clock Input Timing Diagram

Table 5.27 Timing Requirements of TRAIO
($V_{CC} = 1.8$ to 5.5 V, $V_{SS} = 0$ V and $T_{opr} = -20$ to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter	Standard						Unit
		VCC = 2.2V, Topr = 25°C		VCC = 3V, Topr = 25°C		VCC = 5V, Topr = 25°C		
		Min.	Max.	Min.	Max.	Min.	Max.	
tc(TRAIO)	TRAIO input cycle time	500	—	300	—	100	—	ns
tWH(TRAIO)	TRAIO input "H" width	200	—	120	—	40	—	ns
tWL(TRAIO)	TRAIO input "L" width	200	—	120	—	40	—	ns

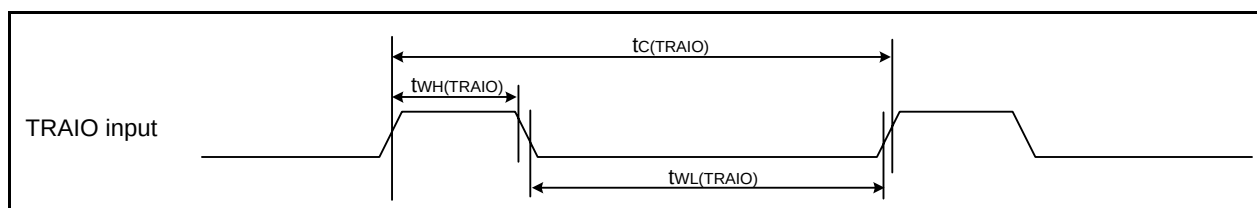


Figure 5.9 Input Timing of TRAIO

Table 5.28 Timing Requirements of Serial Interface
(V_{CC} = 1.8 to 5.5 V, V_{SS} = 0 V, and T_{opr} = –20 to 85°C (N version) / –40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter	Standard						Unit
		V _{CC} = 2.2V, T _{opr} = 25°C		V _{CC} = 3V, T _{opr} = 25°C		V _{CC} = 5V, T _{opr} = 25°C		
		Min.	Max.	Min.	Max.	Min.	Max.	
t _c (CK)	CLKi input cycle time	800	—	300	—	200	—	ns
t _w (CKH)	CLKi input “H” width	400	—	150	—	100	—	ns
t _w (CKL)	CLKi input “L” width	400	—	150	—	100	—	ns
t _d (C-Q)	TXDi output delay time	—	200	—	80	—	50	ns
t _h (C-Q)	TXDi hold time	0	—	0	—	0	—	ns
t _{su} (D-C)	RXDi input setup time	150	—	70	—	50	—	ns
t _h (C-D)	RXDi input hold time	90	—	90	—	90	—	ns

i = 0 to 2

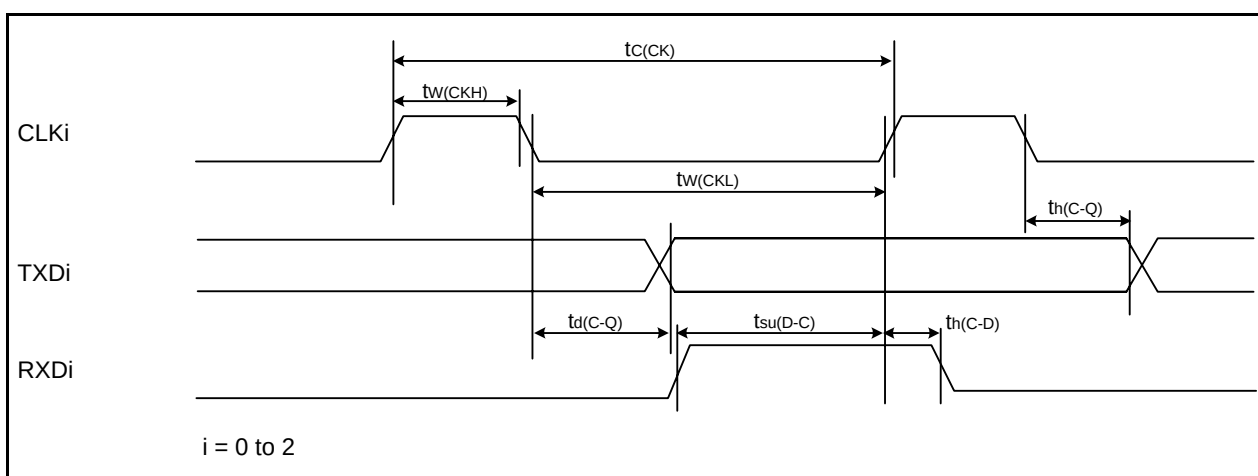


Figure 5.10 Input and Output Timing of Serial Interface

Table 5.29 Timing Requirements of External Interrupt $\overline{\text{INTi}}$ (i = 0 to 7) and Key Input Interrupt $\overline{\text{Kli}}$ (i = 0 to 7)
(V_{CC} = 1.8 to 5.5 V, V_{SS} = 0 V, and T_{opr} = –20 to 85°C (N version) / –40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter	Standard						Unit
		V _{CC} = 2.2V, T _{opr} = 25°C		V _{CC} = 3V, T _{opr} = 25°C		V _{CC} = 5V, T _{opr} = 25°C		
		Min.	Max.	Min.	Max.	Min.	Max.	
t _w (INH)	$\overline{\text{INTi}}$ input “H” width, $\overline{\text{Kli}}$ input “H” width	1000 (1)	—	380 (1)	—	250 (1)	—	ns
t _w (INL)	$\overline{\text{INTi}}$ input “L” width, $\overline{\text{Kli}}$ input “L” width	1000 (2)	—	380 (2)	—	250 (2)	—	ns

Notes:

- When selecting the digital filter by the $\overline{\text{INTi}}$ input filter select bit, use an $\overline{\text{INTi}}$ input HIGH width of either (1/digital filter clock frequency × 3) or the minimum value of standard, whichever is greater.
- When selecting the digital filter by the $\overline{\text{INTi}}$ input filter select bit, use an $\overline{\text{INTi}}$ input LOW width of either (1/digital filter clock frequency × 3) or the minimum value of standard, whichever is greater.

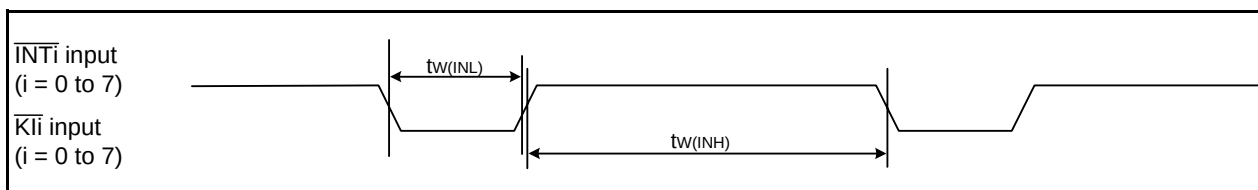


Figure 5.11 Input Timing of External Interrupt $\overline{\text{INTi}}$ and Key Input Interrupt $\overline{\text{Kli}}$

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