Renesas Electronics America Inc - R5F2L368CDFA#30 Datasheet

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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	I²C, LINbus, SIO, SSU, UART/USART
Peripherals	LCD, POR, PWM, Voltage Detect, WDT
Number of I/O	52
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 10x10b; D/A 2x8b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f2l368cdfa-30

1.2 Product Lists

Tables 1.7 to 1.10 list Product List for Each Group. Figures 1.1 to 1.4 show the Correspondence of Part No., with Memory Size and Package for Each Group.

Table 1.7 Product List for R8C/L35C Group **Current of Apr 2011**

Part No.	Internal ROM Capacity		Internal RAM Capacity	Package Type	Remarks
	Program ROM	Data Flash			
R5F2L357CNFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0052JA-A	N Version
R5F2L358CNFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0052JA-A	
R5F2L35ACNFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0052JA-A	
R5F2L35CCNFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0052JA-A	
R5F2L357CDFP	48 Kbytes	1 Kbyte × 4	6 Kbytes	PLQP0052JA-A	D Version
R5F2L358CDFP	64 Kbytes	1 Kbyte × 4	8 Kbytes	PLQP0052JA-A	
R5F2L35ACDFP	96 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0052JA-A	
R5F2L35CCDFP	128 Kbytes	1 Kbyte × 4	10 Kbytes	PLQP0052JA-A	

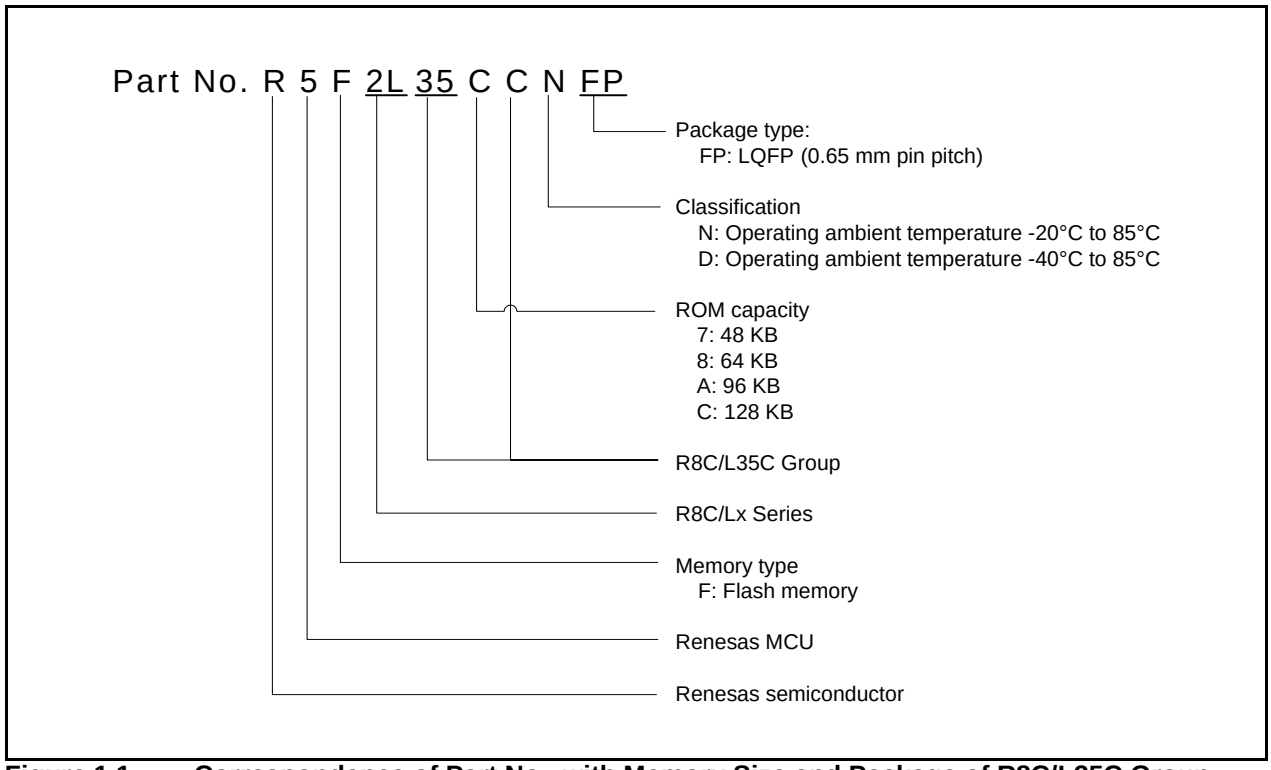


Figure 1.1 Correspondence of Part No., with Memory Size and Package of R8C/L35C Group

1.3 Block Diagrams

Figure 1.5 shows a Block Diagram of R8C/L35C Group. Figure 1.6 shows a Block Diagram of R8C/L36C Group. Figure 1.7 shows a Block Diagram of R8C/L38C Group. Figure 1.8 shows a Block Diagram of R8C/L3AC Group.

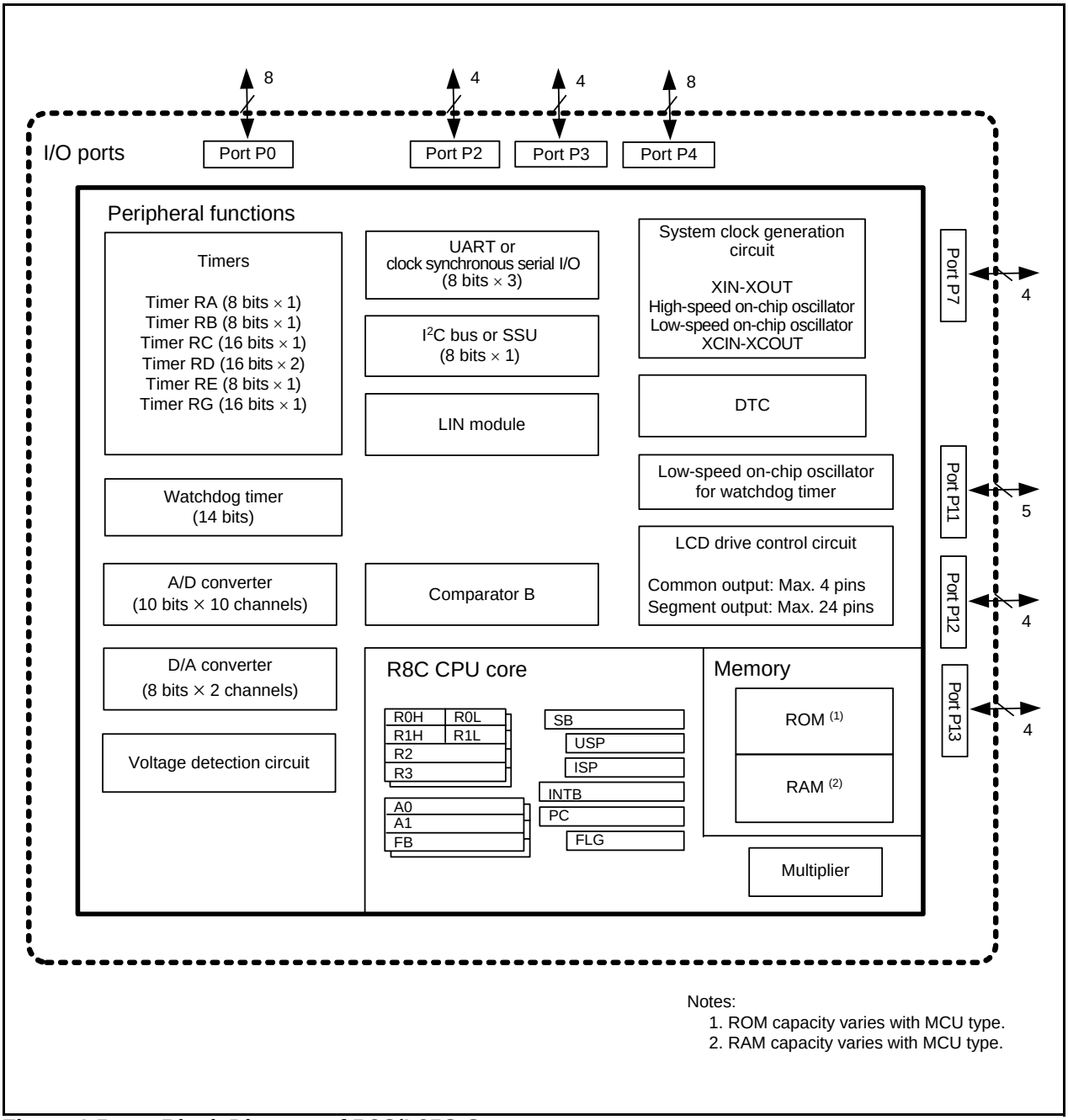


Figure 1.5 Block Diagram of R8C/L35C Group

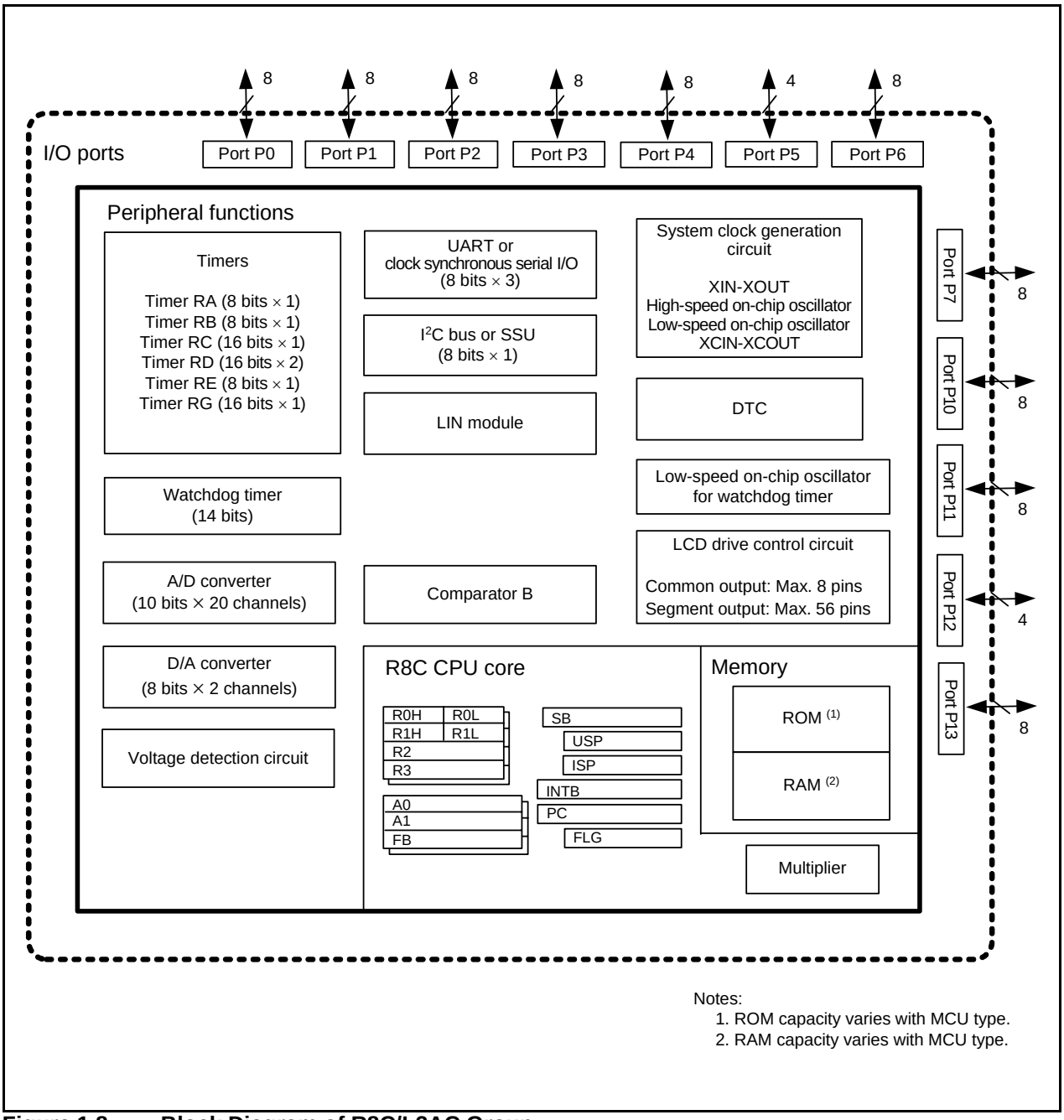


Figure 1.8 Block Diagram of R8C/L3AC Group

Table 1.13 Pin Name Information by Pin Number (3)

Pin Number				Control Pin	Port	I/O Pin Functions for Peripheral Modules						
L3AC (Note 2)	L38C	L36C	L35C			Interrupt	Timer	Serial Interface	SSU	I^2C bus	A/D Converter, D/A Converter, Comparator B	LCD drive control circuit
85 [87]	68	49	40		P0_5						AN9	SEG5
86 [88]	69	50	41		P0_4						AN8	SEG4
87 [89]	70	51	42		P0_3						AN7	SEG3
88 [90]	71	52	43		P0_2						AN6	SEG2
89 [91]	72	53	44		P0_1						AN5	SEG1
90 [92]	73	54	45		P0_0						AN4	SEG0
91 [93]	74	55	46									VL1
92 [94]	75	56	47									VL2
93 [95]	76	57										VL3
94 [96]	77	58	48		P12_3							CL2
95 [97]	78	59	49		P12_2							CL1
96 [98]	79	60	50									VL4
97 [99]					P13_7		TRGCLKB				AN19	
98 [100]					P13_6		TRGIOB				AN18	
99 [1]					P13_5		TRGCLKA				AN17	
100 [2]					P13_4		TRGIOA				AN16	

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/L3AC Group.

Table 1.14 Pin Functions for R8C/L3AC 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 XCOUT. (1) To use an external clock, input it to the XCIN pin and leave the XCOUT pin open.
XCIN clock output	XCOUT	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
	TRAO	O	Timer RA output pin
Timer RB	TRBO	O	Timer RB output pin
Timer RC	TRCCLK	I	External clock input pin
	TRCTRG	I	External trigger input pin
	TRCIOA, TRCIOB, TRCIOC, 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^2C mode clock I/O pin
	SDA2	I/O	I^2C mode data I/O pin

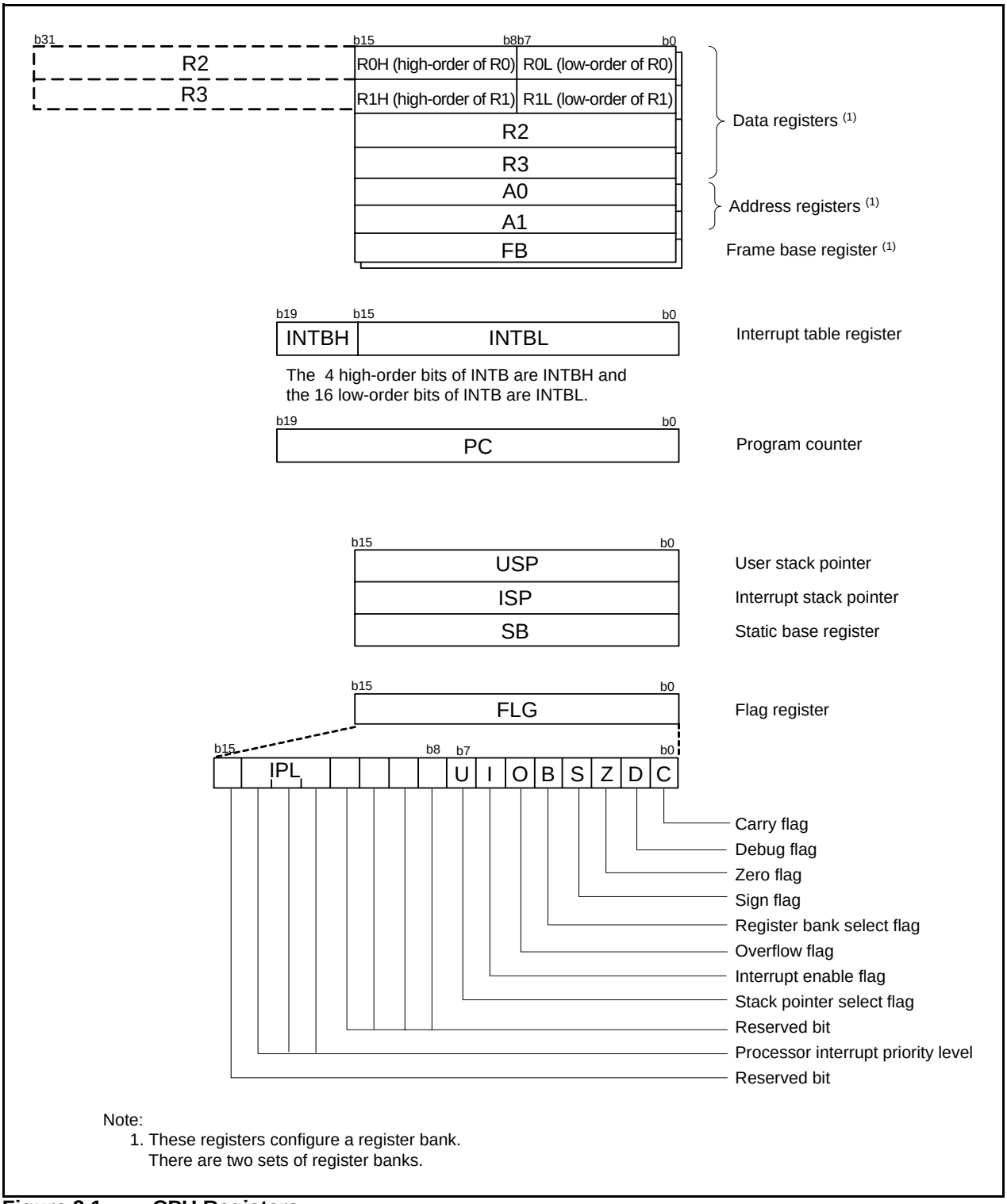
I: Input O: Output I/O: Input and output

Note:

1. Contact the oscillator manufacturer for oscillation characteristics.

2. Central Processing Unit (CPU)

Figure 2.1 shows the CPU Registers. The CPU contains 13 registers. R0, R1, R2, R3, A0, A1, and FB configure a register bank. There are two sets of register banks.

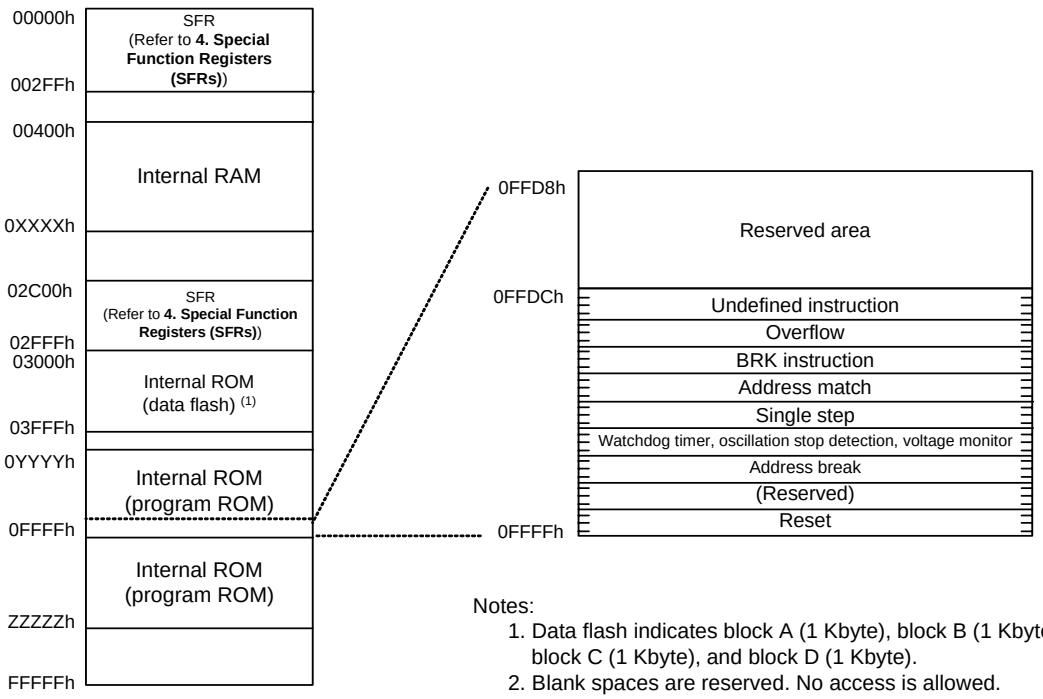


Note:
1. These registers configure a register bank.
There are two sets of register banks.

Figure 2.1 CPU Registers

3. Memory

Figure 3.1 is a Memory Map of each group. Each group has a 1-Mbyte address space from addresses 00000h to FFFFFh. 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.



Notes:
1. Data flash indicates block A (1 Kbyte), block B (1 Kbyte), block C (1 Kbyte), and block D (1 Kbyte).
2. Blank spaces are reserved. No access is allowed.

Part Number	Internal ROM			Internal RAM	
	Capacity	Address 0YYYYh	Address ZZZZZh	Capacity	Address 0XXXXh
R5F2L357C***, R5F2L367C***, R5F2L387C***, R5F2L3A7C***	48 Kbytes	04000h	–	6 Kbytes	01BFFh
R5F2L358C***, R5F2L368C***, R5F2L388C***, R5F2L3A8C***	64 Kbytes	04000h	13FFFh	8 Kbytes	023FFh
R5F2L35AC***, R5F2L36AC***, R5F2L38AC***, R5F2L3AAC***	96 Kbytes	04000h	1BFFFh	10 Kbytes	02BFFh
R5F2L35CC***, R5F2L36CC***, R5F2L38CC***, R5F2L3ACC***	128 Kbytes	04000h	23FFFh	10 Kbytes	02BFFh

Figure 3.1 Memory Map

Table 4.5 SFR Information (5) (1)

Address	Register	Symbol	After Reset
0100h	Timer RA Control Register	TRACR	00h
0101h	Timer RA I/O Control Register	TRAIOC	00h
0102h	Timer RA Mode Register	TRAMR	00h
0103h	Timer RA Prescaler Register	TRAPRE	FFh
0104h	Timer RA Register	TRA	FFh
0105h	LIN Control Register 2	LINCR2	00h
0106h	LIN Control Register	LINCR	00h
0107h	LIN Status Register	LINST	00h
0108h	Timer RB Control Register	TRBCR	00h
0109h	Timer RB One-Shot Control Register	TRBOCR	00h
010Ah	Timer RB I/O Control Register	TRBIOC	00h
010Bh	Timer RB Mode Register	TRBMR	00h
010Ch	Timer RB Prescaler Register	TRBPRE	FFh
010Dh	Timer RB Secondary Register	TRBSC	FFh
010Eh	Timer RB Primary Register	TRBPR	FFh
010Fh			
0110h			
0111h			
0112h			
0113h			
0114h			
0115h			
0116h			
0117h			
0118h	Timer RE Second Data Register / Timer RE Counter Data Register	TRESEC	XXh
0119h	Timer RE Minute Data Register / Timer RE Compare Data Register	TREMIN	XXh
011Ah	Timer RE Hour Data Register	TREHR	XXh
011Bh	Timer RE Day of Week Data Register	TREWK	XXh
011Ch	Timer RE Control Register 1	TRECR1	XXXXX0XXb
011Dh	Timer RE Control Register 2	TRECR2	XXh
011Eh	Timer RE Count Source Select Register	TRECSR	00001000b
011Fh			
0120h	Timer RC Mode Register	TRCMR	01001000b
0121h	Timer RC Control Register 1	TRCCR1	00h
0122h	Timer RC Interrupt Enable Register	TRCIER	01110000b
0123h	Timer RC Status Register	TRCSR	01110000b
0124h	Timer RC I/O Control Register 0	TRCIOR0	10001000b
0125h	Timer RC I/O Control Register 1	TRCIOR1	10001000b
0126h	Timer RC Counter	TRC	00h
0127h			00h
0128h	Timer RC General Register A	TRCGRA	FFh
0129h			FFh
012Ah	Timer RC General Register B	TRCGRB	FFh
012Bh			FFh
012Ch	Timer RC General Register C	TRCGRC	FFh
012Dh			FFh
012Eh	Timer RC General Register D	TRCGRD	FFh
012Fh			FFh
0130h	Timer RC Control Register 2	TRCCR2	00011000b
0131h	Timer RC Digital Filter Function Select Register	TRCDF	00h
0132h	Timer RC Output Master Enable Register	TRCOER	01111111b
0133h	Timer RC Trigger Control Register	TRCADCR	00h
0134h			
0135h	Timer RD Control Expansion Register	TRDECR	00h
0136h	Timer RD Trigger Control Register	TRDADCR	00h
0137h	Timer RD Start Register	TRDSTR	11111100b
0138h	Timer RD Mode Register	TRDMR	00001110b
0139h	Timer RD PWM Mode Register	TRDPMR	10001000b
013Ah	Timer RD Function Control Register	TRDFCR	10000000b
013Bh	Timer RD Output Master Enable Register 1	TRDOER1	FFh
013Ch	Timer RD Output Master Enable Register 2	TRDOER2	01111111b
013Dh	Timer RD Output Control Register	TRDOCR	00h
013Eh	Timer RD Digital Filter Function Select Register 0	TRDDF0	00h
013Fh	Timer RD Digital Filter Function Select Register 1	TRDDF1	00h

X: Undefined
Note:
1. 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:

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

Table 4.10 SFR Information (10) (1)

Address	Register	Symbol	After Reset
0240h	LCD Display Data Register	LRA48L	XXh
0241h		LRA49L	XXh
0242h		LRA50L	XXh
0243h		LRA51L	XXh
0244h		LRA52L	XXh
0245h		LRA53L	XXh
0246h		LRA54L	XXh
0247h		LRA55L	XXh
0248h			
0249h			
024Ah			
024Bh			
024Ch			
024Dh			
024Eh			
024Fh			
0250h			
0251h			
0252h			
0253h			
0254h			
0255h			
0256h			
0257h			
0258h			
0259h			
025Ah			
025Bh			
025Ch			
025Dh			
025Eh			
025Fh			
0260h			
0261h			
0262h			
0263h			
0264h			
0265h			
0266h			
0267h			
0268h			
0269h			
026Ah			
026Bh			
026Ch			
026Dh			
026Eh			
026Fh			
0270h	LCD Display Control Data Register	LRA0H	XXh
0271h		LRA1H	XXh
0272h		LRA2H	XXh
0273h		LRA3H	XXh
0274h		LRA4H	XXh
0275h		LRA5H	XXh
0276h		LRA6H	XXh
0277h		LRA7H	XXh
0278h		LRA8H	XXh
0279h		LRA9H	XXh
027Ah		LRA10H	XXh
027Bh		LRA11H	XXh
027Ch		LRA12H	XXh
027Dh		LRA13H	XXh
027Eh		LRA14H	XXh
027Fh		LRA15H	XXh

X: Undefined

Note:

1. Blank spaces are reserved. No access is allowed.

Table 4.14 SFR Information (14) (1)

Address	Register	Symbol	After Reset
2C70h	DTC Control Data 6	DTCD6	XXh
2C71h			XXh
2C72h			XXh
2C73h			XXh
2C74h			XXh
2C75h			XXh
2C76h			XXh
2C77h			XXh
2C78h	DTC Control Data 7	DTCD7	XXh
2C79h			XXh
2C7Ah			XXh
2C7Bh			XXh
2C7Ch			XXh
2C7Dh			XXh
2C7Eh			XXh
2C7Fh			XXh
2C80h	DTC Control Data 8	DTCD8	XXh
2C81h			XXh
2C82h			XXh
2C83h			XXh
2C84h			XXh
2C85h			XXh
2C86h			XXh
2C87h			XXh
2C88h	DTC Control Data 9	DTCD9	XXh
2C89h			XXh
2C8Ah			XXh
2C8Bh			XXh
2C8Ch			XXh
2C8Dh			XXh
2C8Eh			XXh
2C8Fh			XXh
2C90h	DTC Control Data 10	DTCD10	XXh
2C91h			XXh
2C92h			XXh
2C93h			XXh
2C94h			XXh
2C95h			XXh
2C96h			XXh
2C97h			XXh
2C98h	DTC Control Data 11	DTCD11	XXh
2C99h			XXh
2C9Ah			XXh
2C9Bh			XXh
2C9Ch			XXh
2C9Dh			XXh
2C9Eh			XXh
2C9Fh			XXh
2CA0h	DTC Control Data 12	DTCD12	XXh
2CA1h			XXh
2CA2h			XXh
2CA3h			XXh
2CA4h			XXh
2CA5h			XXh
2CA6h			XXh
2CA7h			XXh
2CA8h	DTC Control Data 13	DTCD13	XXh
2CA9h			XXh
2CAAh			XXh
2CABh			XXh
2CACh			XXh
2CADh			XXh
2CAEh			XXh
2CAFh			XXh

X: Undefined
Note:
1. 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:
1. 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:
1. 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.
2. 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.

5.2 Recommended Operating Conditions

Table 5.2 Recommended Operating Conditions
(Vcc = 1.8 to 5.5 V and Topr = −20 to 85°C (N version) / −40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter				Conditions	Standard			Unit
						Min.	Typ.	Max.	
Vcc/AVcc	Supply voltage					1.8	—	5.5	V
Vss/AVss	Supply voltage					—	0	—	V
VIH	Input “H” voltage	Other than CMOS input			4.0 V ≤ Vcc ≤ 5.5 V	0.8 Vcc	—	Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0.8 Vcc	—	Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0.9 Vcc	—	Vcc	V
		CMOS input	Input level switching function (I/O port)	Input level selection : 0.35 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0.5 Vcc	—	Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0.55 Vcc	—	Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0.65 Vcc	—	Vcc	V
				Input level selection : 0.5 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0.65 Vcc	—	Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0.7 Vcc	—	Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0.8 Vcc	—	Vcc	V
				Input level selection : 0.7 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0.85 Vcc	—	Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0.85 Vcc	—	Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0.85 Vcc	—	Vcc	V
VIL	Input “L” voltage	Other than CMOS input			4.0 V ≤ Vcc ≤ 5.5 V	0	—	0.2 Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0	—	0.2 Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0	—	0.05 Vcc	V
		CMOS input	Input level switching function (I/O port)	Input level selection : 0.35 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0	—	0.2 Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0	—	0.2 Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0	—	0.2 Vcc	V
				Input level selection : 0.5 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0	—	0.4 Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0	—	0.3 Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0	—	0.2 Vcc	V
				Input level selection : 0.7 Vcc	4.0 V ≤ Vcc ≤ 5.5 V	0	—	0.55 Vcc	V
					2.7 V ≤ Vcc < 4.0 V	0	—	0.45 Vcc	V
					1.8 V ≤ Vcc < 2.7 V	0	—	0.35 Vcc	V
IOH(sum)	Peak sum output “H” current	Sum of all pins IOH(peak)				—	—	−160	mA
IOH(sum)	Average sum output “H” current	Sum of all pins IOH(avg)				—	—	−80	mA
IOH(peak)	Peak output “H” current	Port P10, P11 (2)				—	—	−40	mA
		Other pins				—	—	−10	mA
IOH(avg)	Average output “H” current (1)	Port P10, P11 (2)				—	—	−20	mA
		Other pins				—	—	−5	mA
IOL(sum)	Peak sum output “L” current	Sum of all pins IOL(peak)				—	—	160	mA
IOL(sum)	Average sum output “L” current	Sum of all pins IOL(avg)				—	—	80	mA
IOL(peak)	Peak output “L” current	Port P10, P11 (2)				—	—	40	mA
		Other pins				—	—	10	mA
IOL(avg)	Average output “L” current (1)	Port P10, P11 (2)				—	—	20	mA
		Other pins				—	—	5	mA
f(XIN)	XIN clock input oscillation frequency				2.7 V ≤ Vcc ≤ 5.5 V	—	—	20	MHz
					1.8 V ≤ Vcc < 2.7 V	—	—	5	MHz
f(XCIN)	XCIN clock input oscillation frequency				1.8 V ≤ Vcc ≤ 5.5 V	—	32.768	50	kHz
fOCO40M	When used as the count source for timer RC, timer RD, or timer RG (3)				2.7 V ≤ Vcc ≤ 5.5 V	32	—	40	MHz
fOCO-F	fOCO-F frequency				2.7 V ≤ Vcc ≤ 5.5 V	—	—	20	MHz
					1.8 V ≤ Vcc < 2.7 V	—	—	5	MHz
—	System clock frequency				2.7 V ≤ Vcc ≤ 5.5 V	—	—	20	MHz
					1.8 V ≤ Vcc < 2.7 V	—	—	5	MHz
f(BCLK)	CPU clock frequency				2.7 V ≤ Vcc ≤ 5.5 V	—	—	20	MHz
					1.8 V ≤ Vcc < 2.7 V	—	—	5	MHz

Notes:
1. The average output current indicates the average value of current measured during 100 ms.
2. This applies when the drive capacity of the output transistor is set to High by registers P10DRR and P11DRR. When the drive capacity is set to Low, the value of any other pin applies.
3. fOCO40M can be used as the count source for timer RC, timer RD, or timer RG in the range of Vcc = 2.7 V to 5.5V.

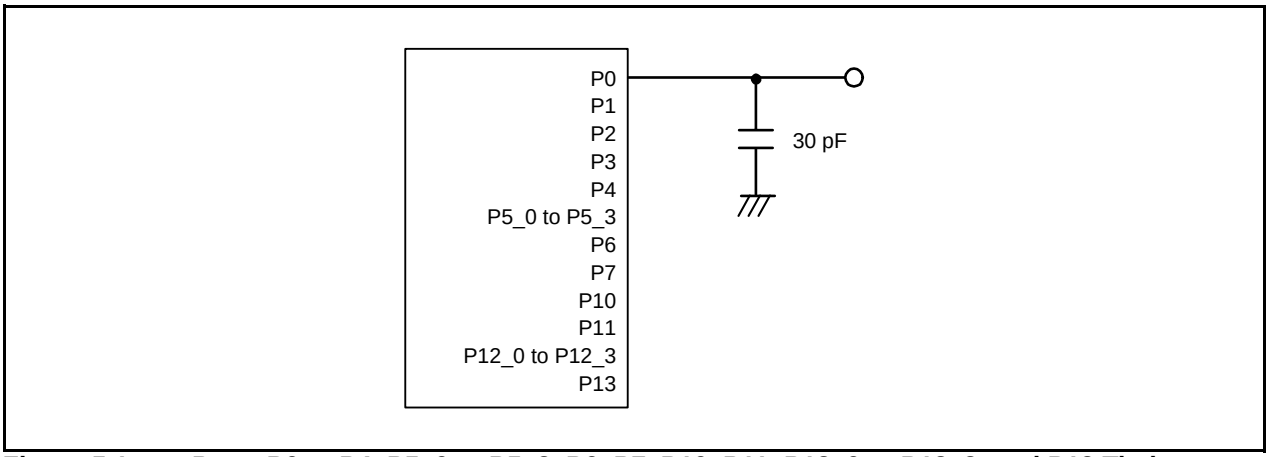


Figure 5.1 Ports P0 to P4, P5_0 to P5_3, P6, P7, P10, P11, P12_0 to P12_3, and P13 Timing Measurement Circuit

Table 5.18 DC Characteristics (2) [4.0 V ≤ Vcc ≤ 5.5 V]
(Topr = –20 to 85°C (N version) / –40 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	Min.	Typ. (3)	Max.	
			XIN (2)	XCIN	High-Speed (fOCO-F)	Low-Speed							
Icc	Power supply current (1)	High-speed clock mode	20 MHz	Off	Off	125 kHz	No division	—		—	7.0	15	mA
			16 MHz	Off	Off	125 kHz	No division	—		—	5.6	12.5	mA
			10 MHz	Off	Off	125 kHz	No division	—		—	3.6	—	mA
			20 MHz	Off	Off	125 kHz	Divide-by-8	—		—	3.0	—	mA
			16 MHz	Off	Off	125 kHz	Divide-by-8	—		—	2.2	—	mA
			10 MHz	Off	Off	125 kHz	Divide-by-8	—		—	1.5	—	mA
		High-speed on-chip oscillator mode	Off	Off	20 MHz	125 kHz	No division	—		—	7.0	15	mA
			Off	Off	20 MHz	125 kHz	Divide-by-8	—		—	3.0	—	mA
			Off	Off	4 MHz	125 kHz	Divide-by-16	MSTIIC = 1 MSTTRD = 1 MSTTRC = 1 MSTTRG = 1		—	1	—	mA
		Low-speed on-chip oscillator mode	Off	Off	Off	125 kHz	Divide-by-8	FMR27 = 1 VCA20 = 0		—	90	400	µA
		Low-speed clock mode	Off	32 kHz	Off	Off	No division	FMR27 = 1 VCA20 = 0		—	100	400	µA
			Off	32 kHz	Off	Off	No division	FMSTP = 1 VCA20 = 0	Flash memory off Program operation on RAM	—	55	—	µA
		Wait mode	Off	Off	Off	125 kHz	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1	While a WAIT instruction is executed Peripheral clock operation	—	15	100	µA
			Off	Off	Off	125 kHz	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 1	While a WAIT instruction is executed Peripheral clock off	—	4	90	µA
			Off	32 kHz	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 0	While a WAIT instruction is executed Peripheral clock off Timer RE operation in real-time clock mode	LCD drive control circuit (4) When external division resistors are used	—	7	—	µA
										LCD drive control circuit (5) When the internal voltage multiplier is used	—	12	—	µA
			Off	32 kHz	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 1	While a WAIT instruction is executed Peripheral clock off Timer RE operation in real-time clock mode		—	3.5	—	µA
		Stop mode	Off	Off	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 CM10 = 1	Topr = 25°C Peripheral clock off		—	2.0	5.0	µA
			Off	Off	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 CM10 = 1	Topr = 85°C Peripheral clock off		—	15	—	µA
		Power-off mode	Off	Off	Off	Off	—	—	Topr = 25°C		—	0.02	0.2	µA
			Off	Off	Off	Off	—	—	Topr = 85°C		—	0.4	—	µA

Notes:
1. Vcc = 4.0 V to 5.5 V, single chip mode, output pins are open, and other pins are Vss.
2. XIN is set to square wave input.
3. Vcc = 5.0 V
4. VLCD = Vcc, external division resistors are used for VL4 to VL1, 1/3 bias, 1/4 duty, f(FR) = 64 Hz, SEG0 to SEG55 are selected, and segment and common output pins are open. The standard value does not include the current that flows through external division resistors.
5. The internal voltage multiplier is used, bits LVLS3 to LVLS0 in the LCR1 register = 1011b, 1/3 bias, 1/4 duty, f(FR) = 64 Hz, SEG0 to SEG55 are selected, and segment and common output pins are open.

Table 5.21 DC Characteristics (5) [1.8 V ≤ Vcc < 2.7 V]
(Topr = –20 to 85°C (N version) / –40 to 85°C (D version), unless otherwise specified.)

Symbol	Parameter		Condition	Standard			Unit
				Min.	Typ.	Max.	
V_{OH}	Output “H” voltage	Port P10, P11 (1)	I_{OH} = –2 mA	V_{CC} – 0.5	—	V_{CC}	V
		Other pins	I_{OH} = –1 mA	V_{CC} – 0.5	—	V_{CC}	V
		XOUT	I_{OH} = –200 μA	1.0	—	—	V
V_{OL}	Output “L” voltage	Port P10, P11 (1)	I_{OL} = 2 mA	—	—	0.5	V
		Other pins	I_{OL} = 1 mA	—	—	0.5	V
		XOUT	I_{OL} = 200 μA	—	—	0.5	V
V_{T+}-V_{T-}	Hysteresis	$\overline{INT0}$, $\overline{INT1}$, $\overline{INT2}$, $\overline{INT3}$, $\overline{INT4}$, INT5, $\overline{INT6}$, INT7, $\overline{KI0}$, $\overline{KI1}$, $\overline{KI2}$, $\overline{KI3}$, $\overline{KI4}$, $\overline{KI5}$, $\overline{KI6}$, $\overline{KI7}$, TRAIO, TRCIOA, TRCIOB, TRCIOC, TRCIOD, TRDIOA0, TRDIOB0, TRDIOC0, TRDIOD0, TRDIOA1, TRDIOB1, TRDIOC1, TRDIOD1, TRCTRG, TRCCLK, TRGCLKA, TRGCLKB, $\overline{TRGIOA}$, TRGIOB, $\overline{ADTRG}$, RXD0, RXD1, RXD2, CLK0, CLK1, CLK2, SSI, SCL, SDA, SSO		0.05	0.4	—	V
		$\overline{RESET}$, $\overline{WKUP0}$		0.1	0.8	—	V
I_{IH}	Input “H” current		VI = 1.8 V, V_{CC} = 1.8 V	—	—	4.0	μA
I_{IL}	Input “L” current		VI = 0 V, V_{CC} = 1.8 V	—	—	–4.0	μA
R_{PULLUP}	Pull-up resistance		VI = 0 V, V_{CC} = 1.8 V	60	160	420	kΩ
R_{fXIN}	Feedback resistance	XIN		—	0.3	—	MΩ
R_{fXCIN}	Feedback resistance	XCIN		—	14	—	MΩ
V_{RAM}	RAM hold voltage		During stop mode	1.8	—	—	V

Note:
1. This applies when the drive capacity of the output transistor is set to High by registers P10DRR and P11DRR. When the drive capacity is set to Low, the value of any other pin applies.

Table 5.22 DC Characteristics (6) [1.8 V ≤ Vcc < 2.7 V]
(Topr = –20 to 85°C (N version) / –40 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		Min.	Typ. (3)	Max.	
			XIN (2)	XCIN	High-Speed (fOCO-F)	Low-Speed								
Icc	Power supply current (1)	High-speed clock mode	5 MHz	Off	Off	125 kHz	No division	—			—	2.2	—	mA
			5 MHz	Off	Off	125 kHz	Divide-by-8	—			—	0.8	—	mA
		High-speed on-chip oscillator mode	Off	Off	5 MHz	125 kHz	No division	—			—	2.5	10	mA
			Off	Off	5 MHz	125 kHz	Divide-by-8	—			—	1.7	—	mA
			Off	Off	4 MHz	125 kHz	Divide-by-16	MSTIIC = 1 MSTTRD = 1 MSTTRC = 1 MSTTRG = 1			—	1	—	mA
		Low-speed on-chip oscillator mode	Off	Off	Off	125 kHz	Divide-by-8	FMR27 = 1 VCA20 = 0			—	90	300	µA
		Low-speed clock mode	Off	32 kHz	Off	Off	No division	FMR27 = 1 VCA20 = 0			—	90	400	µA
			Off	32 kHz	Off	Off	No division	FMSTP = 1 VCA20 = 0	Flash memory off Program operation on RAM		—	45	—	µA
		Wait mode	Off	Off	Off	125 kHz	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1	While a WAIT instruction is executed Peripheral clock operation		—	15	90	µA
			Off	Off	Off	125 kHz	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 1	While a WAIT instruction is executed Peripheral clock off		—	4	80	µA
			Off	32 kHz	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 0	While a WAIT instruction is executed Peripheral clock off Timer RE operation in real-time clock mode	LCD drive control circuit (4) When external division resistors are used	—	4	—	µA
										LCD drive control circuit (5) When the internal voltage multiplier is used	—	11	—	µA
			Off	32 kHz	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 VCA20 = 1 CM02 = 1 CM01 = 1	While a WAIT instruction is executed Peripheral clock off Timer RE operation in real-time clock mode		—	3.5	—	µA
		Stop mode	Off	Off	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 CM10 = 1	Topr = 25°C Peripheral clock off		—	2.0	5.0	µA
			Off	Off	Off	Off	—	VCA27 = 0 VCA26 = 0 VCA25 = 0 CM10 = 1	Topr = 85°C Peripheral clock off		—	13	—	µA
		Power-off mode	Off	Off	Off	Off	—	—	Topr = 25°C		—	0.02	0.2	µA
			Off	Off	Off	Off	—	—	Topr = 85°C		—	0.3	—	µA

Notes:
1. Vcc = 1.8 V to 2.7 V, single chip mode, output pins are open, and other pins are Vss.
2. XIN is set to square wave input.
3. Vcc = 2.2 V
4. VLCD = Vcc, external division resistors are used for VL4 to VL1, 1/3 bias, 1/4 duty, f(FR) = 64 Hz, SEG0 to SEG55 are selected, and segment and common output pins are open.The standard value does not include the current that flows through external division resistors.
5. The internal voltage multiplier is used, bits LVLS3 to LVLS0 in the LCR1 register = 1011b, 1/3 bias, 1/4 duty, f(FR) = 64 Hz, SEG0 to SEG55 are selected, and segment and common output pins are open.

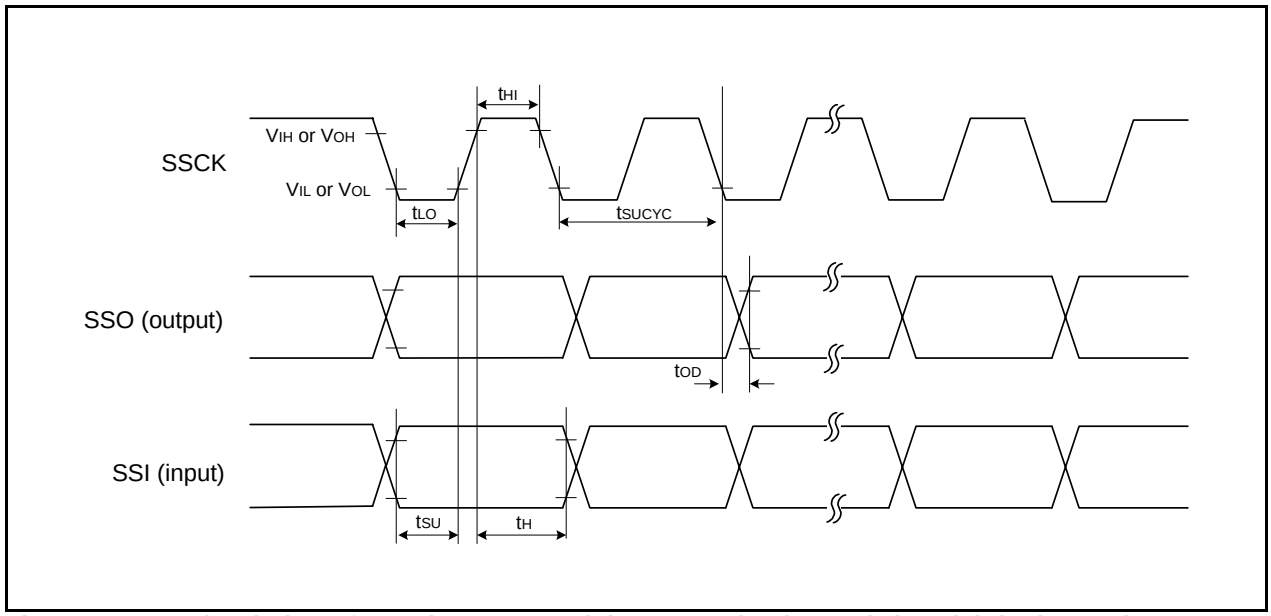


Figure 5.6 I/O Timing of Synchronous Serial Communication Unit (SSU) (Clock Synchronous Communication Mode)

REVISION HISTORY	R8C/L35C Group, R8C/L36C Group, R8C/L38C Group, R8C/L3AC Group Datasheet

Rev.	Date	Description	
		Page	Summary
0.10	Oct 30, 2009	—	First Edition issued
0.20	Apr 15, 2011	6	Table 1.6 Function deleted, Current consumption revised
		7	1.2 “of R8C/Lx Series” → “for Each Group”
		7 to 10	Tables 1.7 to 1.10 revised
		24	Table 1.15 “Voltage detection circuit” deleted
		29	4. Special Function Registers (SFRs) “The description offered in this chapter is based on the R8C/L3AC Group.” added
		45 to 68	5. Electrical Characteristics added
1.00	Jun 25, 2010	—	“Preliminary” and “Under development” deleted
		1	1.1 revised
		7 to 10	Tables 1.7 to 1.10 revised
		45	Tables 5.1 Note 2 added
		55	Table 5.15 Note 3 added
		69 to 72	Package Dimensions revised
1.01	Apr 15, 2011	2	Table 1.1 revised
		3	Table 1.2 Note 2, Table 1.3 Note 1 revised
		6	Table 1.6 “Flash Memory” revised
		11 to 14	Figure 1.5 to Figure 1.8 revised
		20 to 22	Table 1.11 to Table 1.13 “Voltage Detection Circuit” deleted
		23, 24	Table 1.14 and Table 1.15 title “for R8C/L3AC Group” added
		28	3. “The internal ROM ... with address 0FFFFh.” deleted
		38 to 40	Table 4.10 to Table 4.12 “0248h to 026Fh”, “02A8h to 02BFh”, “02C0h to 02CFh” revised
		48	Table 5.3 “t_{CONV}”, “t_{SAMP}” revised
		57, 59, 61	Table 5.18, Table 5.20, Table 5.22 “High-Speed” → “High-Speed (fOCO-F)”

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.