Renesas Electronics America Inc - R5F52105BDFM#30 Datasheet

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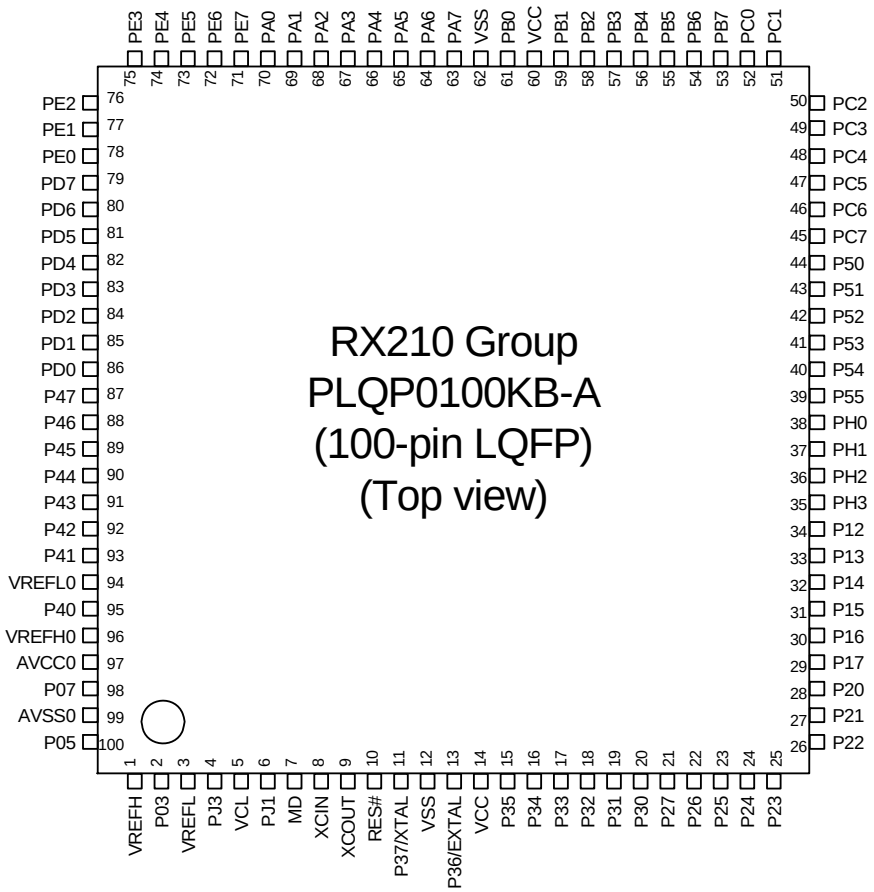
Applications of "Embedded - Microcontrollers"

Details	
Product Status	Discontinued at Digi-Key
Core Processor	RX
Core Size	32-Bit Single-Core
Speed	50MHz
Connectivity	I²C, SCI, SPI
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	48
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	8K x 8
RAM Size	20K x 8
Voltage - Supply (Vcc/Vdd)	1.62V ~ 5.5V
Data Converters	A/D 12x12b; D/A 2x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LFQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f52105bdfm-30

Table 1.1 Outline of Specifications (3 / 5)

Classification	Module/Function	Description
Timers	16-bit timer pulse unit (TPUa)	• (16 bits × 6 channels) × 1 unit • Maximum of 16 pulse-input/output possible • Select from among seven or eight counter-input clock signals for each channel • Supports the input capture/output compare function • Output of PWM waveforms in up to 15 phases in PWM mode • Support for buffered operation, phase-counting mode (two-phase encoder input) and cascade-connected operation (32 bits × 2 channels) depending on the channel. • Capable of generating conversion start triggers for the A/D converters • Signals from the input capture pins are input via a digital filter • Clock frequency measuring method (Products with 144 or more pins incorporate a TPU.)
	Multi-function timer pulse unit 2 (MTU2a)	• (16 bits × 6 channels) × 1 unit • Up to 16 pulse-input/output lines and three pulse-input lines are available with six 16-bit timer channels • Select from among eight or seven counter-input clock signals for each channel (PCLK/1, PCLK/4, PCLK/16, PCLK/64, PCLK/256, PCLK/1024, MTCLKA, MTCLKB, MTCLKC, MTCLKD) other than channel 5, for which only four signals are available. • Input capture function • 21 output compare/input capture registers • Pulse output mode • Complementary PWM output mode • Reset synchronous PWM mode • Phase-counting mode • Generation of triggers for A/D converter conversion
	Port output enable 2 (POE2a)	Controls the high-impedance state of the MTU's waveform output pins
	8-bit timer (TMR)	• (8 bits × 2 channels) × 2 units • Select from among seven internal clock signals (PCLK1, PCLK/2, PCLK/8, PCLK/32, PCLK/64, PCLK/1024, PCLK/8192) and one external clock signal • Capable of output of pulse trains with desired duty cycles or of PWM signals • The 2 channels of each unit can be cascaded to create a 16-bit timer • Capable of generating baud-rate clocks for SCI5, SCI6, and SCI12
	Compare match timer (CMT)	• (16 bits × 2 channels) × 2 units • Select from among four clock signals (PCLK/8, PCLK/32, PCLK/128, PCLK/512)
	Watchdog timer (WDTA)	• 14 bits × 1 channel • Select from among six counter-input clock signals (PCLK/4, PCLK/64, PCLK/128, PCLK/512, PCLK/2048, PCLK/8192)
	Independent watchdog timer (IWDTa)	• 14 bits × 1 channel • Counter-input clock: IWDT-dedicated on-chip oscillator Frequency divided by 1, 16, 32, 64, 128, or 256
	Realtime clock (RTCb)	• Clock source: Sub-clock • Time/calendar • Interrupt sources: Alarm interrupt, periodic interrupt, and carry interrupt • Time-capture facility for three values



Note: • This figure indicates the power supply pins and I/O port pins. For the pin configuration, see the table “List of Pins and Pin Functions (100-Pin LQFP)”.

Figure 1.6 Pin Assignments of the 100-Pin LQFP

Table 1.9 List of Pins and Pin Functions (145-Pin TFLGA) (1 / 4)

Pin No.	Power Supply, Clock, System Control	I/O Port	External Bus	Timers (MTU, TMR, POE)	Communications (SCIc, SCId, RSPI, RIIC)	Others
A1	AVSS0					
A2		P07				ADTRG0#
A3		P40				AN000
A4		P42				AN002
A5		P45				AN005
A6		P90			TXD7/SMOSI7/SSDA7	
A7		P92			RXD7/SMISO7/SSCL7	
A8		PD2	D2[A2/D2]	MTIOC4D		IRQ2
A9		PD6	D6[A6/D6]	MTIC5V/POE1#		IRQ6
A10		PK3			RXD9/SMISO9/SSCL9	
A11		P62				
A12		PE1	D9[A9/D9]	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009/CMPB0
A13		PE3	D11[A11/D11]	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
B1	VREFH					
B2	AVCC0					
B3		P05				DA1
B4	VREFL0					
B5		P43				AN003
B6		P47				AN007
B7		P91			SCK7	
B8		PD0	D0[A0/D0]			IRQ0
B9		PD4	D4[A4/D4]	POE3#		IRQ4
B10		PK2			TXD9/SMOSI9/SSDA9	
B11		P61			CTS9#/RTS9#/SS9#	
B12		PE2	D10[A10/D10]	MTIOC4A	RXD12/RXDX12/ SMISO12/SSCL12	IRQ7-DS/AN010/ CVREFB0
B13		PE4	D12[A12/D12]	MTIOC4D/MTIOC1A		AN012/CMPA2
C1	VREFL					
C2		P02		TMCI1	SCK6	
C3	VREFH0					
C4		P41				AN001
C5		P46				AN006
C6	VSS					
C7		PD1	D1[A1/D1]	MTIOC4B		IRQ1
C8		PD3	D3[A3/D3]	POE8#		IRQ3
C9		PD7	D7[A7/D7]	MTIC5U/POE0#		IRQ7
C10		P63				
C11		PE0	D8[A8/D8]		SCK12	AN008
C12		P70			SCK4	
C13		PK4			RXD4/SMISO4/SSCL4	
D1		P00		TMRI0	TXD6/SMOSI6/SSDA6	
D2		PF5				IRQ4
D3		P03				DA0
D4		P01		TMCI0	RXD6/SMISO6/SSCL6	
D5	VCC					
D6		P93			CTS7#/RTS7#/SS7#	
D7		PD5	D5[A5/D5]	MTIC5W/POE2#		IRQ5
D8		P60			SCK9	
D9		P64				
D10		PE7	D15[A15/D15]			IRQ7/AN015

Table 1.12 List of Pins and Pin Functions (100-Pin LQFP) (2 / 3)

Pin No.	Power Supply, Clock, System Control	I/O Port	External Bus	Timers (MTU, TMR, POE)	Communications (SCIc, SCId, RSPI, RIIC)	Others
42		P52	RD#			
43		P51	WR1#/BC1#/WAIT#			
44		P50	WR0#/WR#			
45		PC7	A23/CS0#	MTIOC3A/TMO2/ MTCLKB	TXD8/SMOSI8/SSDA8/ MISOA	CACREF
46		PC6	A22/CS1#	MTIOC3C/MTCLKA/ TMCI2	RXD8/SMISO8/SSCL8/ MOSIA	
47		PC5	A21/CS2#/WAIT#	MTIOC3B/MTCLKD/ TMRI2	SCK8/RSPCKA	
48		PC4	A20/CS3#	MTIOC3D/MTCLKC/ TMCI1/POE0#	SCK5/CTS8#/RTS8#/ SS8#/SSLA0	
49		PC3	A19	MTIOC4D	TXD5/SMOSI5/SSDA5	
50		PC2	A18	MTIOC4B	RXD5/SMISO5/SSCL5/ SSLA3	
51		PC1	A17	MTIOC3A	SCK5/SSLA2	
52		PC0	A16	MTIOC3C	CTS5#/RTS5#/SS5#/ SSLA1	
53		PB7	A15	MTIOC3B	TXD9/SMOSI9/SSDA9	
54		PB6	A14	MTIOC3D	RXD9/SMISO9/SSCL9	
55		PB5	A13	MTIOC2A/MTIOC1B/ TMRI1/POE1#	SCK9	
56		PB4	A12		CTS9#/RTS9#/SS9#	
57		PB3	A11	MTIOC0A/MTIOC4A/ TMO0/POE3#	SCK6	
58		PB2	A10		CTS6#/RTS6#/SS6#	
59		PB1	A9	MTIOC0C/MTIOC4C/ TMCI0	TXD6/SMOSI6/SSDA6	IRQ4-DS
60	VCC					
61		PB0	A8	MTIC5W	RXD6/SMISO6/SSCL6/ RSPCKA	
62	VSS					
63		PA7	A7		MISOA	
64		PA6	A6	MTIC5V/MTCLKB/ TMCI3/POE2#	CTS5#/RTS5#/SS5#/ MOSIA	
65		PA5	A5		RSPCKA	
66		PA4	A4	MTIC5U/MTCLKA/ TMRI0	TXD5/SMOSI5/SSDA5/ SSLA0	IRQ5-DS/CVREFB1
67		PA3	A3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5	IRQ6-DS/CMPB1
68		PA2	A2		RXD5/SMISO5/SSCL5/ SSLA3	
69		PA1	A1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
70		PA0	A0/BC0#	MTIOC4A	SSLA1	CACREF
71		PE7	D15[A15/D15]			IRQ7/AN015
72		PE6	D14[A14/D14]			IRQ6/AN014
73		PE5	D13[A13/D13]	MTIOC4C/MTIOC2B		IRQ5/AN013
74		PE4	D12[A12/D12]	MTIOC4D/MTIOC1A		AN012/CMPA2
75		PE3	D11[A11/D11]	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
76		PE2	D10[A10/D10]	MTIOC4A	RXD12/RXDX12/ SMISO12/SSCL12	IRQ7-DS/AN010/ CVREFB0
77		PE1	D9[A9/D9]	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009/CMPB0
78		PE0	D8[A8/D8]		SCK12	AN008
79		PD7	D7[A7/D7]	MTIC5U/POE0#		IRQ7

Table 1.14 List of Pins and Pin Functions (69-Pin WLBGA) (2 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIc, SCId, RSPI, RIIC)	Others
G3	NC				
G4		P54	MTIOC4B/TMCI1		
G5		PH1	TMO0		IRQ0
G6		P14	MTIOC3A/MTCLKA/TMRI2	CTS1#/RTS1#/SS1#	IRQ4
G7		P27	MTIOC2B/TMCI3	SCK1	
G8		P32	MTIOC0C/TMO3	TXD6/SMOSI6/SSDA6	IRQ2-DS/RTCOUT/ RTCIC2
G9		P35			NMI
H1		PB7	MTIOC3B	TXD9/SMOSI9/SSDA9	
H2		PC3	MTIOC4D	TXD5/SMOSI5/SSDA5	
H3		PC5	MTIOC3B/MTCLKD/TMRI2	SCK8/RSPCKA	
H4		PC6	MTIOC3C/MTCLKA/TMCI2	RXD8/SMISO8/SSCL8/MOSIA	
H5		P55	MTIOC4D/TMO3		
H6		PH3	TMCI0		
H7		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA-DS	IRQ7
H8		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
H9		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0-DS/RTCIC0
J1	NC				
J2		PC2	MTIOC4B	RXD5/SMISO5/SSCL5/SSLA3	
J3		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/CTS8#/RTS8#/SS8#/ SSLA0	
J4		PC7	MTIOC3A/TMO2/MTCLKB	TXD8/SMOSI8/SSDA8/MISOA	CACREF
J5		PH0			CACREF
J6		PH2	TMRI0		IRQ1
J7		P15	MTIOC0B/MTCLKB/TMCI2	RXD1/SMISO1/SSCL1	IRQ5
J8		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/ MOSIA/SCL-DS	IRQ6/RTCOUT/ ADTRG0#
J9	NC				

Note: • Pin names to which –DS is appended are for pins that can be used to trigger release from deep software standby mode.
Note: • Leave the NC pin open.

Table 1.15 List of Pins and Pin Functions (64-Pin TFLGA) (1 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIc, SCId, RSPI, RIIC)	Others
A1		P05			DA1
A2	AVCC0				
A3	VREFH0				
A4	VREFL0				
A5	VREFH				
A6	VREFL				
A7		PE2	MTIOC4A	RXD12/RXDX12/SMISO12/ SSCL12	IRQ7-DS/AN010/ CVREFB0
A8		PE3	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
B1	VCL				
B2	AVSS0				
B3		P40			AN000
B4		P42			AN002
B5		P44			AN004
B6		P46			AN006
B7		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009/CMPB0
B8		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
C1	XCIN				
C2	MD				FINED
C3		P03			DA0
C4		P41			AN001
C5		P43			AN003
C6		PE0		SCK12	AN008
C7		PE5	MTIOC4C/MTIOC2B		IRQ5/AN013
C8		PA0	MTIOC4A	SSLA1	CACREF
D1	XCOUT				
D2	RES#				
D3		P27	MTIOC2B/TMCI3	SCK1	
D4		P14	MTIOC3A/MTCLKA/TMRI2	CTS1#/RTS1#/SS1#	IRQ4
D5		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
D6		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/SSLA0	IRQ5-DS/CVREFB1
D7		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
D8		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5	IRQ6-DS/CMPB1
E1	VSS				
E2		P32	MTIOC0C/TMO3	TXD6/SMOSI6/SSDA6	IRQ2-DS/RTCOUT/ RTCIC2
E3		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0-DS/RTCIC0
E4		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/MOSIA/ SCL-DS	IRQ6/RTCOUT/ ADTRG0#
E5		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/CTS8#/RTS8#/SS8#/ SSLA0	
E6	VCC				
E7	VSS				
E8		PB0	MTIC5W	RXD6/SMISO6/SSCL6/RSPCKA	
F1	VCC				
F2		P35			NMI
F3		P31	MTIOC4D/TMCI2	CTS1#/RTS1#/SS1#	IRQ1-DS/RTCIC1
F4		PC5	MTIOC3B/MTCLKD/TMRI2	SCK8/RSPCKA	

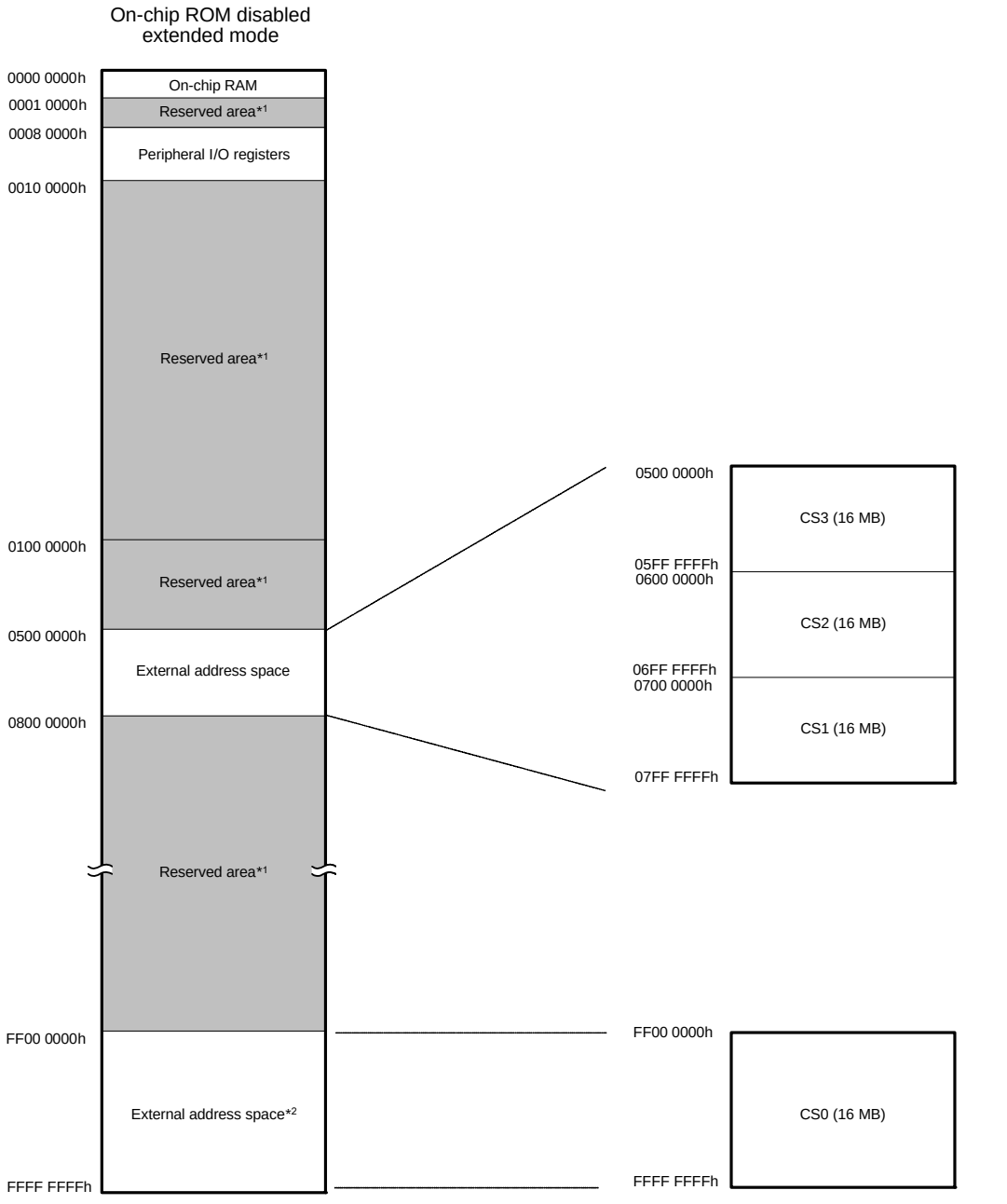
Table 1.17 List of Pins and Pin Functions (48-Pin LQFP) (1 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIc, SCId, RSPI, RIIC)	Others
1	VCL				
2	MD				FINED
3	RES#				
4	XTAL	P37			
5	VSS				
6	EXTAL	P36			
7	VCC				
8		P35			NMI
9		P31	MTIOC4D/TMCI2	CTS1#/RTS1#/SS1#	IRQ1-DS
10		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0-DS
11		P27	MTIOC2B/TMCI3	SCK1	
12		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
13		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA-DS	IRQ7
14		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/MOSIA/ SCL-DS	IRQ6/ADTRG0#
15		P15	MTIOC0B/MTCLKB/TMCI2	RXD1/SMISO1/SSCL1	IRQ5
16		P14	MTIOC3A/MTCLKA/TMRI2	CTS1#/RTS1#/SS1#	IRQ4
17		PH3	TMCI0		
18		PH2	TMRI0		IRQ1
19		PH1	TMO0		IRQ0
20		PH0			CACREF
21		PC7	MTIOC3A/TMO2/MTCLKB	TXD8/SMOSI8/SSDA8/MISOA	CACREF
22		PC6	MTIOC3C/MTCLKA/TMCI2	RXD8/SMISO8/SSCL8/MOSIA	
23		PC5	MTIOC3B/MTCLKD/TMRI2	SCK8/RSPCKA	
24		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/CTS8#/RTS8#/SS8#/ SSLA0	
25		PB5	MTIOC2A/MTIOC1B/TMRI1/ POE1#		
26		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
27		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4-DS
28	VCC				
29		PB0	MTIC5W	RXD6/SMISO6/SSCL6/RSPCKA	
30	VSS				
31		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
32		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/SSLA0	IRQ5-DS/CVREFB1
33		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5	IRQ6-DS/CMPB1
34		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
35		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
36		PE3	MTIOC4B/POE8#	CTS12#/RTS12#	AN011/CMPA1
37		PE2	MTIOC4A	RXD12/RXDX12/SSCL12	IRQ7-DS/AN010/ CVREFB0
38		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SSDA12	AN009/CMPB0
39	VREFL				
40		P46			AN006
41	VREFH				
42		P42			AN002
43		P41			AN001

3.2 External Address Space

The external address space is divided into up to four CS areas (CS0 to CS3), each corresponding to the CSn# signal output from a CSn# (n = 0 to 3) pin.

Figure 3.2 shows the address ranges corresponding to the individual CS areas (CS0 to CS3) in on-chip ROM disabled extended mode.



Note 1. Reserved areas should not be accessed.

Note 2. The CS0 area is disabled in on-chip ROM enabled extended mode. In this mode, the address space for addresses above 0800 0000h is as shown in figure on this section “Memory Map in Each Operating Mode”.

Figure 3.2 Correspondence between External Address Spaces and CS Areas (In On-Chip ROM Disabled Extended Mode)

- Longword-size I/O registers

```
MOV.L  #SFR_ADDR, R1
MOV.L  #SFR_DATA, [R1]
CMP    [R1].L, R1
;; Next process
```

If multiple registers are written to and a subsequent instruction should be executed after the write operations are entirely completed, only read the I/O register that was last written to and execute the operation using the value; it is not necessary to read or execute operation for all the registers that were written to.

(3) Number of Access Cycles to I/O Registers

For numbers of clock cycles for access to I/O registers, see Table 4.1, List of I/O Registers (Address Order).
The number of access cycles to I/O registers is obtained by following equation.*1

Number of access cycles to I/O registers = Number of bus cycles for internal main bus 1 +
Number of divided clock synchronization cycles +
Number of bus cycles for internal peripheral bus 1 to 6

The number of bus cycles of internal peripheral bus 1 to 6 differs according to the register to be accessed.
When peripheral functions connected to internal peripheral bus 2 to 6 or registers for the external bus control unit (except for bus error related registers) are accessed, the number of divided clock synchronization cycles is added.
The number of divided clock synchronization cycles differs depending on the frequency ratio between ICLK and PCLK (or FCLK, BCLK) or bus access timing.
In the peripheral function unit, when the frequency ratio of ICLK is equal to or greater than that of PCLK (or FCLK), the sum of the number of bus cycles for internal main bus 1 and the number of the divided clock synchronization cycles will be one cycle of PCLK (or FCLK) at a maximum. Therefore, one PCLK (or FCLK) has been added to the number of access cycles shown in Table 4.1.
When the frequency ratio of ICLK is lower than that of PCLK (or FCLK), the subsequent bus access is started from the ICLK cycle following the completion of the access to the peripheral functions. Therefore, the access cycles are described on an ICLK basis.
In the external bus control unit, the sum of the number of bus cycles for internal main bus 1 and the number of divided clock synchronization cycles will be one cycle of BCLK at a maximum. Therefore, one BCLK is added to the number of access cycles shown in Table 4.1.

Note 1. This applies to the number of cycles when the access from the CPU does not conflict with the instruction fetching to the external memory or bus access from the different bus master (DMAC or DTC).

Table 4.1 List of I/O Registers (Address Order) (10 / 29)

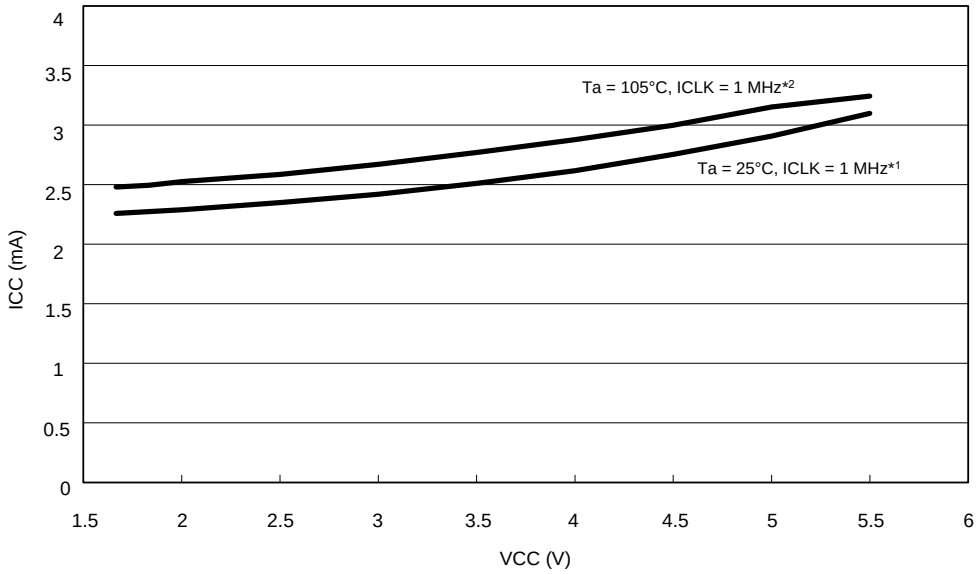
Address	Module Symbol	Register Name	Register Symbol	Number of Bits	Access Size	Number of Access Cycles: ICLK ≥ PCLK	Number of Access Cycles: ICLK < PCLK
0008 738A2	ICU	Interrupt source priority register 162	IPR162	8	8		2 ICLK
0008 73A4h	ICU	Interrupt source priority register 164	IPR164	8	8		2 ICLK
0008 73A6h	ICU	Interrupt source priority register 166	IPR166	8	8		2 ICLK
0008 73AAh	ICU	Interrupt source priority register 170	IPR170	8	8		2 ICLK
0008 73ABh	ICU	Interrupt source priority register 171	IPR171	8	8		2 ICLK
0008 73AEh	ICU	Interrupt source priority register 174	IPR174	8	8		2 ICLK
0008 73B1h	ICU	Interrupt source priority register 177	IPR177	8	8		2 ICLK
0008 73B4h	ICU	Interrupt source priority register 180	IPR180	8	8		2 ICLK
0008 73B7h	ICU	Interrupt source priority register 183	IPR183	8	8		2 ICLK
0008 73BAh	ICU	Interrupt source priority register 186	IPR186	8	8		2 ICLK
0008 73BEh	ICU	Interrupt source priority register 190	IPR190	8	8		2 ICLK
0008 73C2h	ICU	Interrupt source priority register 194	IPR194	8	8		2 ICLK
0008 73C6h	ICU	Interrupt source priority register 198	IPR198	8	8		2 ICLK
0008 73C7h	ICU	Interrupt source priority register 199	IPR199	8	8		2 ICLK
0008 73C8h	ICU	Interrupt source priority register 200	IPR200	8	8		2 ICLK
0008 73C9h	ICU	Interrupt source priority register 201	IPR201	8	8		2 ICLK
0008 73CEh	ICU	Interrupt source priority register 206	IPR206	8	8		2 ICLK
0008 73D2h	ICU	Interrupt source priority register 210	IPR210	8	8		2 ICLK
0008 73D6h	ICU	Interrupt source priority register 214	IPR214	8	8		2 ICLK
0008 73DAh	ICU	Interrupt source priority register 218	IPR218	8	8		2 ICLK
0008 73DEh	ICU	Interrupt source priority register 222	IPR222	8	8		2 ICLK
0008 73E2h	ICU	Interrupt source priority register 226	IPR226	8	8		2 ICLK
0008 73E6h	ICU	Interrupt source priority register 230	IPR230	8	8		2 ICLK
0008 73EAh	ICU	Interrupt source priority register 234	IPR234	8	8		2 ICLK
0008 73EEh	ICU	Interrupt source priority register 238	IPR238	8	8		2 ICLK
0008 73F2h	ICU	Interrupt source priority register 242	IPR242	8	8		2 ICLK
0008 73F3h	ICU	Interrupt source priority register 243	IPR243	8	8		2 ICLK
0008 73F4h	ICU	Interrupt source priority register 244	IPR244	8	8		2 ICLK
0008 73F5h	ICU	Interrupt source priority register 245	IPR245	8	8		2 ICLK
0008 73F6h	ICU	Interrupt source priority register 246	IPR246	8	8		2 ICLK
0008 73F7h	ICU	Interrupt source priority register 247	IPR247	8	8		2 ICLK
0008 73F8h	ICU	Interrupt source priority register 248	IPR248	8	8		2 ICLK
0008 73F9h	ICU	Interrupt source priority register 249	IPR249	8	8		2 ICLK
0008 73FAh	ICU	Interrupt source priority register 250	IPR250	8	8		2 ICLK
0008 7400h	ICU	DMAC activation request select register 0	DMRSR0	8	8		2 ICLK
0008 7404h	ICU	DMAC activation request select register 1	DMRSR1	8	8		2 ICLK
0008 7408h	ICU	DMAC activation request select register 2	DMRSR2	8	8		2 ICLK
0008 740Ch	ICU	DMAC activation request select register 3	DMRSR3	8	8		2 ICLK
0008 7500h	ICU	IRQ control register 0	IRQCR0	8	8		2 ICLK
0008 7501h	ICU	IRQ control register 1	IRQCR1	8	8		2 ICLK
0008 7502h	ICU	IRQ control register 2	IRQCR2	8	8		2 ICLK
0008 7503h	ICU	IRQ control register 3	IRQCR3	8	8		2 ICLK
0008 7504h	ICU	IRQ control register 4	IRQCR4	8	8		2 ICLK
0008 7505h	ICU	IRQ control register 5	IRQCR5	8	8		2 ICLK
0008 7506h	ICU	IRQ control register 6	IRQCR6	8	8		2 ICLK
0008 7507h	ICU	IRQ control register 7	IRQCR7	8	8		2 ICLK
0008 7510h	ICU	IRQ pin digital filter enable register 0	IRQFLTE0	8	8		2 ICLK
0008 7514h	ICU	IRQ pin digital filter setting register 0	IRQFLTC0	16	16		2 ICLK
0008 7580h	ICU	Non-maskable interrupt status register	NMISR	8	8		2 ICLK
0008 7581h	ICU	Non-maskable interrupt enable register	NMIER	8	8		2 ICLK
0008 7582h	ICU	Non-maskable interrupt clear register	NMICLR	8	8		2 ICLK

Table 4.1 List of I/O Registers (Address Order) (20 / 29)

Address	Module Symbol	Register Name	Register Symbol	Number of Bits	Access Size	Number of Access Cycles: ICLK ≥ PCLK	Number of Access Cycles: ICLK < PCLK
0008 A148h	SCI10	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A149h	SCI10	I²C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A14Ah	SCI10	I²C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A14Bh	SCI10	I²C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A14Ch	SCI10	I²C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A14Dh	SCI10	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK
0008 A160h	SCI11	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 A161h	SCI11	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 A162h	SCI11	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 A163h	SCI11	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 A164h	SCI11	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 A165h	SCI11	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 A166h	SCI11	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 A167h	SCI11	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 A168h	SCI11	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A169h	SCI11	I²C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A16Ah	SCI11	I²C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A16Bh	SCI11	I²C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A16Ch	SCI11	I²C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A16Dh	SCI11	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK
0008 B000h	CAC	CAC control register 0	CACR0	8	8	2, 3 PCLKB	2 ICLK
0008 B001h	CAC	CAC control register 1	CACR1	8	8	2, 3 PCLKB	2 ICLK
0008 B002h	CAC	CAC control register 2	CACR2	8	8	2, 3 PCLKB	2 ICLK
0008 B003h	CAC	CAC interrupt control register	CAICR	8	8	2, 3 PCLKB	2 ICLK
0008 B004h	CAC	CAC status register	CASTR	8	8	2, 3 PCLKB	2 ICLK
0008 B006h	CAC	CAC upper-limit value setting register	CAULVR	16	16	2, 3 PCLKB	2 ICLK
0008 B008h	CAC	CAC lower-limit value setting register	CALLVR	16	16	2, 3 PCLKB	2 ICLK
0008 B00Ah	CAC	CAC counter buffer register	CACNTBR	16	16	2, 3 PCLKB	2 ICLK
0008 B080h	DOC	DOC control register	DOCR	8	8	2, 3 PCLKB	2 ICLK
0008 B082h	DOC	DOC data input register	DODIR	16	16	2, 3 PCLKB	2 ICLK
0008 B084h	DOC	DOC data setting register	DODSR	16	16	2, 3 PCLKB	2 ICLK
0008 B100h	ELC	Event link control register	ELCR	8	8	2, 3 PCLKB	2 ICLK
0008 B102h	ELC	Event link setting register 1	ELSR1	8	8	2, 3 PCLKB	2 ICLK
0008 B103h	ELC	Event link setting register 2	ELSR2	8	8	2, 3 PCLKB	2 ICLK
0008 B104h	ELC	Event link setting register 3	ELSR3	8	8	2, 3 PCLKB	2 ICLK
0008 B105h	ELC	Event link setting register 4	ELSR4	8	8	2, 3 PCLKB	2 ICLK
0008 B108h	ELC	Event link setting register 7	ELSR7	8	8	2, 3 PCLKB	2 ICLK
0008 B10Bh	ELC	Event link setting register 10	ELSR10	8	8	2, 3 PCLKB	2 ICLK
0008 B10Dh	ELC	Event link setting register 12	ELSR12	8	8	2, 3 PCLKB	2 ICLK
0008 B110h	ELC	Event link setting register 15	ELSR15	8	8	2, 3 PCLKB	2 ICLK
0008 B111h	ELC	Event link setting register 16	ELSR16	8	8	2, 3 PCLKB	2 ICLK
0008 B113h	ELC	Event link setting register 18	ELSR18	8	8	2, 3 PCLKB	2 ICLK
0008 B114h	ELC	Event link setting register 19	ELSR19	8	8	2, 3 PCLKB	2 ICLK
0008 B115h	ELC	Event link setting register 20	ELSR20	8	8	2, 3 PCLKB	2 ICLK
0008 B116h	ELC	Event link setting register 21	ELSR21	8	8	2, 3 PCLKB	2 ICLK
0008 B117h	ELC	Event link setting register 22	ELSR22	8	8	2, 3 PCLKB	2 ICLK
0008 B118h	ELC	Event link setting register 23	ELSR23	8	8	2, 3 PCLKB	2 ICLK
0008 B119h	ELC	Event link setting register 24	ELSR24	8	8	2, 3 PCLKB	2 ICLK
0008 B11Ah	ELC	Event link setting register 25	ELSR25	8	8	2, 3 PCLKB	2 ICLK
0008 B11Bh	ELC	Event link setting register 26	ELSR26	8	8	2, 3 PCLKB	2 ICLK
0008 B11Ch	ELC	Event link setting register 27	ELSR27	8	8	2, 3 PCLKB	2 ICLK

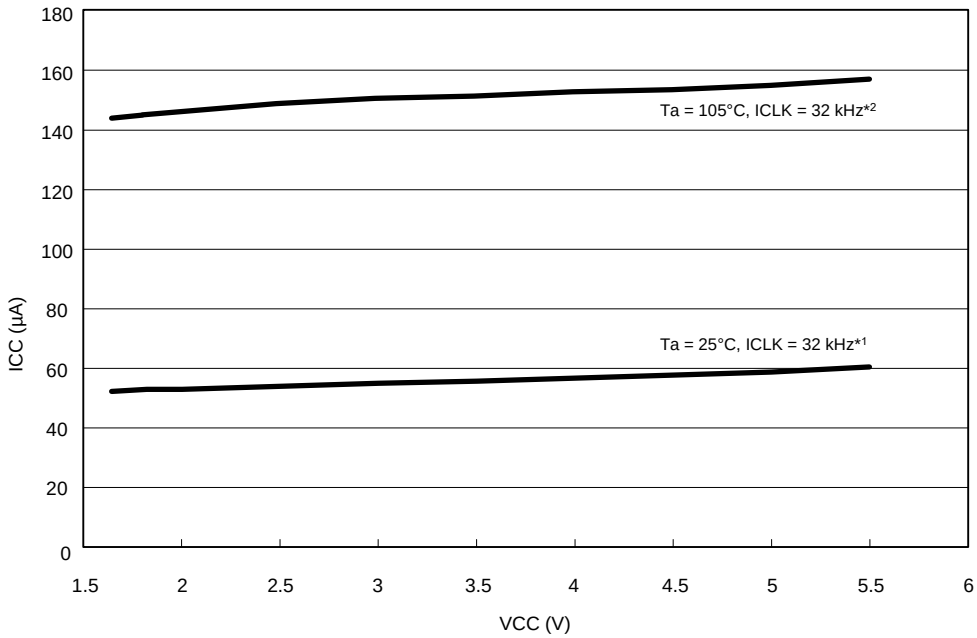
Table 4.1 List of I/O Registers (Address Order) (24 / 29)

Address	Module Symbol	Register Name	Register Symbol	Number of Bits	Access Size	Number of Access Cycles: ICLK ≥ PCLK	Number of Access Cycles: ICLK < PCLK
0008 C04Ch	PORTC	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C04Dh	PORTD	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C04Eh	PORTE	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C04Fh	PORTF	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C051h	PORTH	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C052h	PORTJ	Port input data register	PIDR	8	8	3 or 4 PCLKB cycles when reading, 2 or 3 PCLKB cycles when writing	3 ICLK cycles when reading, 2 ICLK cycles when writing
0008 C053h	PORTK	Port input data register	PIDR	8	8	2, 3 PCLKB	2 ICLK
0008 C054h	PORTL	Port input data register	PIDR	8	8	2, 3 PCLKB	2 ICLK
0008 C060h	PORT0	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C061h	PORT1	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C062h	PORT2	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C063h	PORT3	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C064h	PORT4	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C065h	PORT5	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C066h	PORT6	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C067h	PORT7	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C068h	PORT8	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C069h	PORT9	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Ah	PORTA	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Bh	PORTB	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Ch	PORTC	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Dh	PORTD	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Eh	PORTE	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C06Fh	PORTF	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C071h	PORTH	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C072h	PORTJ	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C073h	PORTK	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK
0008 C074h	PORTL	Port mode register	PMR	8	8	2, 3 PCLKB	2 ICLK



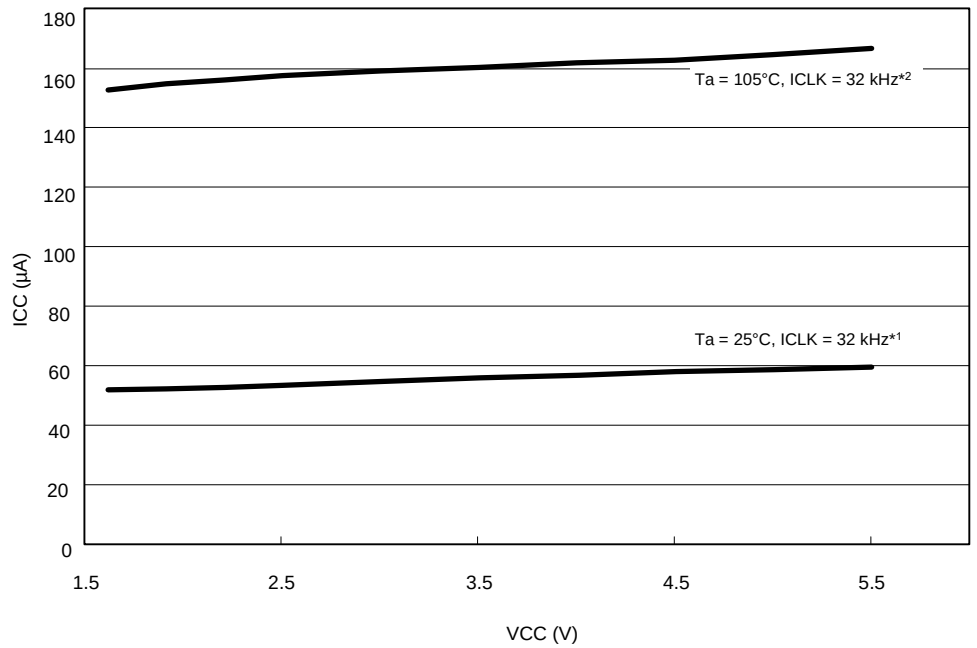
Note 1. All peripheral operation is normal.
Average value of the tested middle samples during product evaluation.
Note 2. All peripheral operation is maximum.
Average value of the tested upper-limit samples during product evaluation.

Figure 5.11 Voltage Dependency in Low-Speed Operating Mode 1 (Reference Data) for Chip Version C



Note 1. All peripheral operation is normal.
Average value of the tested middle samples during product evaluation.
Note 2. All peripheral operation is maximum.
Average value of the tested upper-limit samples during product evaluation.

Figure 5.12 Voltage Dependency in Low-Speed Operating Mode 2 (Reference Data) for Chip Version C



Note 1. All peripheral operation is normal.
Average value of the tested middle samples during product evaluation.
Note 2. All peripheral operation is maximum.
Average value of the tested upper-limit samples during product evaluation.

Figure 5.30 Voltage Dependency in Low-Speed Operating Mode 2 (Reference Data) for Chip Version B with 768 Kbytes/1 Mbyte of Flash Memory and 100 to 145 Pins

Table 5.21 DC Characteristics (20)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = VREFL = VREFL0 = 0 V, T_a = –40 to +105°C

Item	Symbol	Typ.	Max.	Unit	Test Conditions
Permissible total consumption power*1	Pd	—	350	mW	Ta = –40 to 85°C
		—	150		85°C < Ta ≤ 105°C

Note: • Please contact Renesas Electronics sales office for derating of operation under Ta = +85°C to +105°C. Derating is the systematic reduction of load for the sake of improved reliability.
Note 1. Total power dissipated by the entire chip (including output currents)

Table 5.22 DC Characteristics (21)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VREFH = 1.8 to AVCC0, VREFH0 = 1.62 to AVCC0,
VSS = AVSS0 = VREFL = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Analog power supply current	During A/D conversion	I_{AVCC0}	—	1.0	3.2	mA	
	Temperature sensor operating, waiting for A/D conversion		—	60	200	µA	
	During D/A conversion (per channel)	I_{VREFH}*1	—	0.25	0.75	mA	
	Waiting for A/D, D/A conversion (all units)*2	—	—	0.2	5.0	µA	
Reference power supply current	During A/D conversion	I_{VREFH0}	—	0.1	0.2	mA	
	Waiting for A/D conversion		—	0.2	0.4	µA	

Note: • The values for A/D conversion apply when the sample and hold circuit is not in use.
Note 1. The reference power supply current is included in the power supply current value for D/A conversion.
Note 2. The value is the total value of I_{AVCC0} and I_{VREFH}.

Table 5.23 DC Characteristics (22)

Conditions: VCC = AVCC0, VSS = AVSS0 = VREFL = VREFL0 = 0 V, T_a = –40 to +105°C

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
RAM standby voltage	V_{RAM}	1.62	—	—	V	

Table 5.24 DC Characteristics (23)

Conditions: VCC = AVCC0 = 0 to 5.5 V, VREFH = VREFH0 = 0 to AVCC0, VSS = AVSS0 = VREFL = VREFL0 = 0 V,
T_a = –40 to +105°C

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
VCC rising gradient	SrVCC	0.02	—	20	ms/V	At cold start

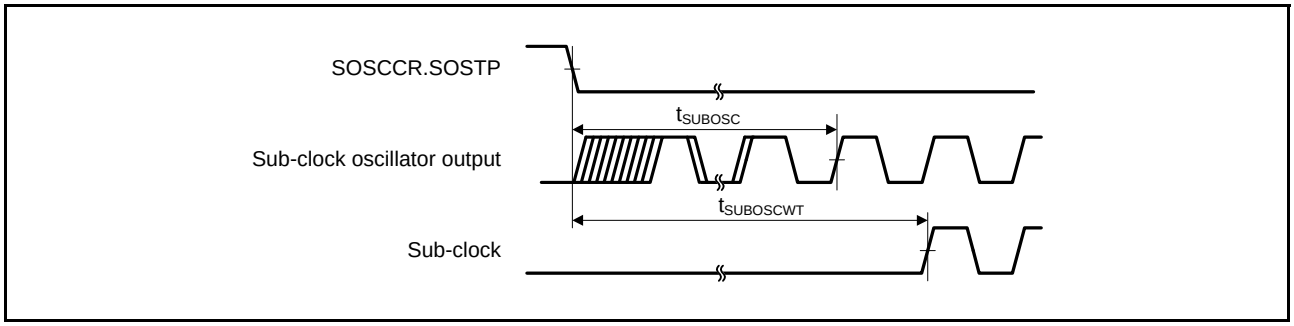


Figure 5.69 Sub-clock Oscillation Start Timing

5.3.2 Reset Timing

Table 5.45 Reset Timing

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = VREFL = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
RES# pulse width	Power-on	t_{RESWP}	8	—	—	ms	Figure 5.70
	Deep software standby mode	t_{RESWD}	8	—	—	ms	Figure 5.71
	Software standby mode, low-speed operating modes 1 and 2	t_{RESWS}	1	—	—	ms	
	Programming or erasure of the ROM or E2 DataFlash memory or blank checking of the E2 DataFlash memory	t_{RESWF}	200	—	—	µs	
	Other than above	t_{RESW}	200	—	—	µs	
Wait time after RES# cancellation		t_{RESWT}	—	—	912	µs	Figure 5.70
Internal reset time (independent watchdog timer reset, watchdog timer reset, software reset)		t_{RESW2}	—	—	1.4	ms	

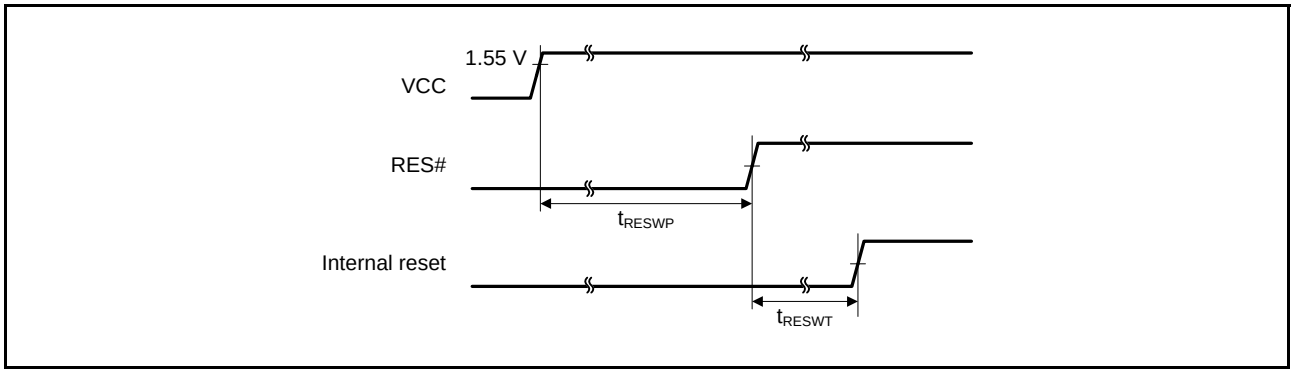


Figure 5.70 Reset Input Timing at Power-On

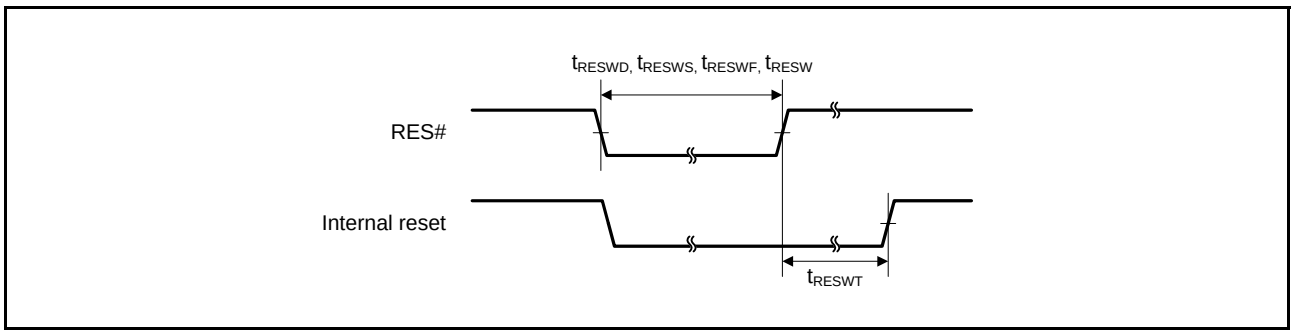


Figure 5.71 Reset Input Timing

Item				Symbol	Min.	Max.	Unit*1	Test Conditions
RSPI	Data input setup time	Master	2.7 V ≤ VCC ≤ 5.5 V	t_{SU}	10	—	ns	C = 30pF Figure 5.92 to Figure 5.97
			1.8 V ≤ VCC < 2.7 V		25	—		
			1.62 V ≤ VCC < 1.8 V		30	—		
		Slave			25 – t_{Pcyc}	—		
	Data input hold time	Master	PCLKB set to a division ratio other than divided by 2	t_H	t_{Pcyc}	—	ns	
			PCLKB set to divided by 2*2	t_{HF}	0	—		
		Slave		t_H	20 + 2 × t_{Pcyc}	—		
	SSL setup time	Master		t_{LEAD}	1	8	t_{SPcyc}	
		Slave			4	—	t_{Pcyc}	
	SSL hold time	Master		t_{LAG}	1	8	t_{SPcyc}	
		Slave			4	—	t_{Pcyc}	
	Data output delay time	Master	2.7 V ≤ VCC ≤ 5.5 V	t_{OD}	—	14	ns	
			1.8 V ≤ VCC < 2.7 V		—	20		
			1.62 V ≤ VCC < 1.8 V		—	25		
		Slave	2.7 V ≤ VCC ≤ 5.5 V		—	3 × t_{Pcyc} + 65		
			1.8 V ≤ VCC < 2.7 V		—	3 × tPcyc +85		
			1.62 V ≤ VCC < 1.8 V		—	3 × tPcyc +95		
	Data output hold time	Master		t_{OH}	0	—	ns	
		Slave			0	—		
	Successive transmission delay time	Master		t_{TD}	t_{SPcyc} + 2 × t_{Pcyc}	8 × t_{SPcyc} + 2 × t_{Pcyc}	ns	
		Slave			4 × t_{Pcyc}	—		
	MOSI and MISO rise/fall time	Output	2.7 V ≤ VCC ≤ 5.5 V	t_{Dr}, t_{Df}	—	10	ns	
			1.8 V ≤ VCC < 2.7 V		—	15		
			1.62 V ≤ VCC < 1.8 V		—	20		
		Input			—	1	µs	
	SSL rise/fall time	Output	2.7 V ≤ VCC ≤ 5.5 V	t_{SSLr}, t_{SSLf}	—	10	ns	
			1.8 V ≤ VCC < 2.7 V		—	15		
			1.62 V ≤ VCC < 1.8 V		—	20		
		Input			—	1	µs	
	Slave access time		2.7 V ≤ VCC ≤ 5.5 V	t_{SA}	—	6	t_{Pcyc}	C = 30pF Figure 5.96 and Figure 5.97
			1.8 V ≤ VCC < 2.7 V		—	7		
			1.62 V ≤ VCC < 1.8 V		—	7		
	Slave output release time		2.7 V ≤ VCC ≤ 5.5 V	t_{REL}	—	5	t_{Pcyc}	
			1.8 V ≤ VCC < 2.7 V		—	6		
			1.62 V ≤ VCC < 1.8 V		—	6		

Note 1. t_{Pcyc}: PCLK cycle
Note 2. Divided by 2 can be set only in packages with 768 Kbytes/1 Mbyte of flash memory or 144/145 pins.

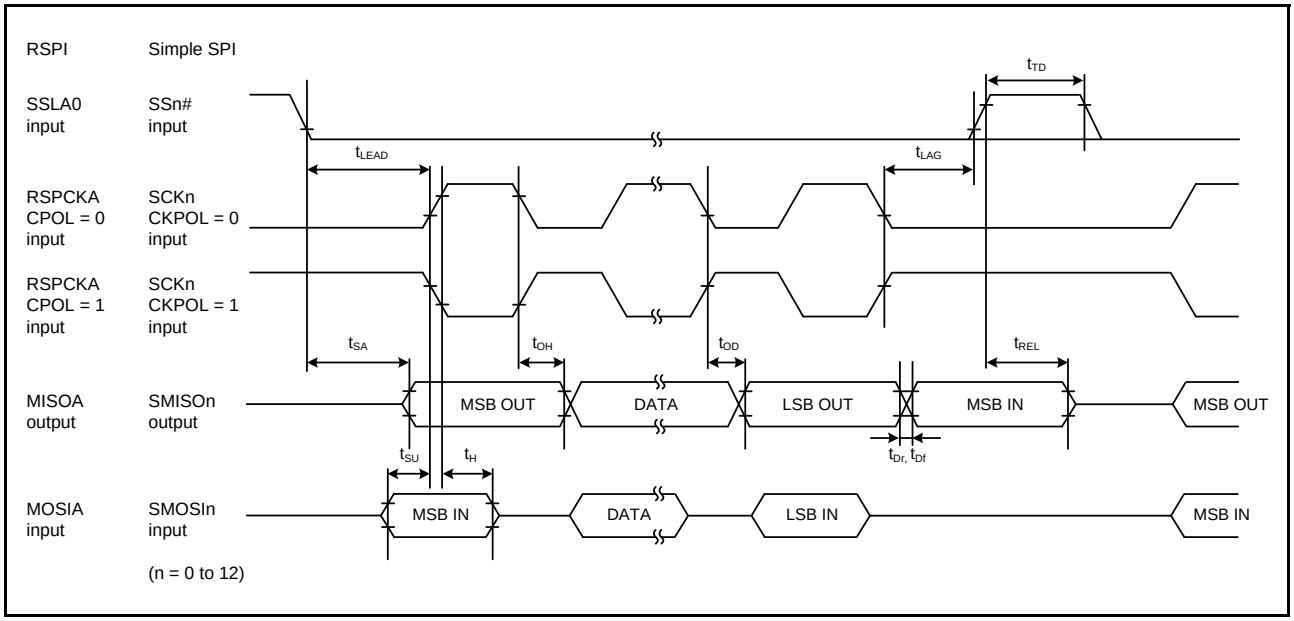


Figure 5.96 RSPI Timing (Slave, CPHA = 0) and Simple SPI Timing (Slave, CKPH = 1)

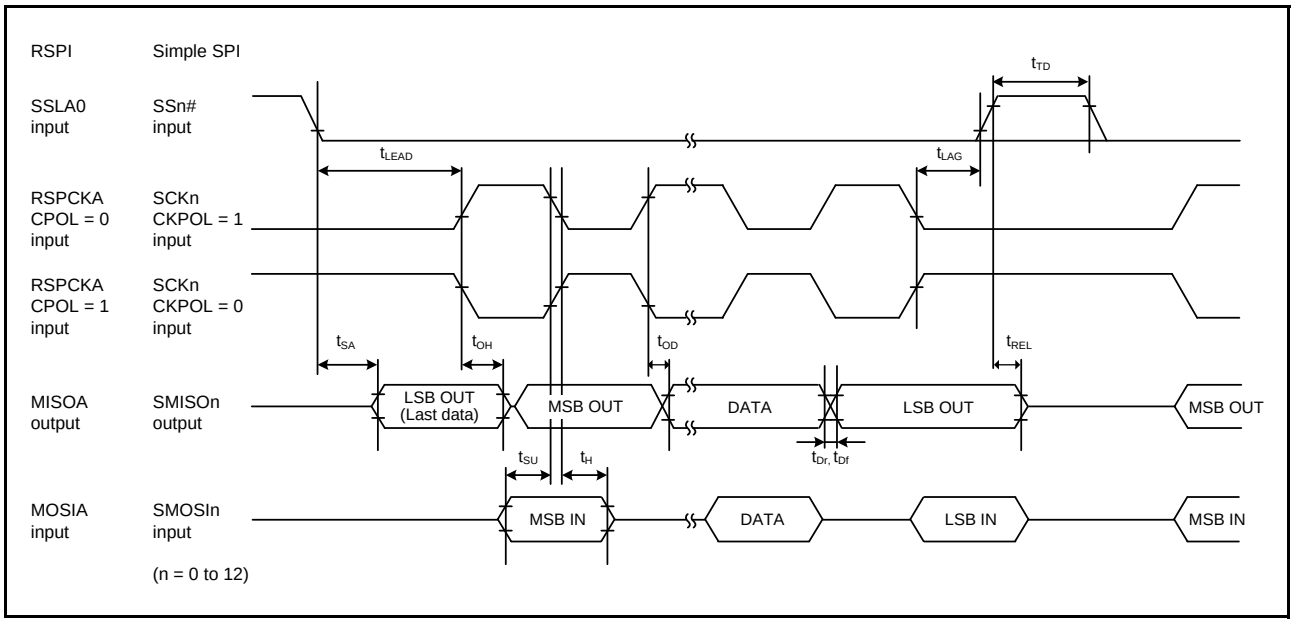


Figure 5.97 RSPI Timing (Slave, CPHA = 1) and Simple SPI Timing (Slave, CKPH = 0)

Table 5.62 Channel Classification for A/D Converter

Classification	Channel	Channel-Dedicated Sample-and-Hold Circuit	Conditions	
High-precision channel	AN000 to AN002	Used	AVCC0 = 2.7 to 5.5 V AVCC0 - 0.9 V ≤ VREFH0 ≤ AVCC0 VREFH0 ≥ 2.7 V AVSS0 = VREFL0 = 0 V 0.25 V ≤ V_{AN} ≤ AVCC0 - 0.25 V V_{AN} ≤ VREFH0	It is disallowed to use pins AN000 to AN007 as digital outputs when the A/D converter is used.
		Not used	AVCC0 = 1.62 to 5.5 V When AVCC0 ≥ 1.8 V, AVCC0 - 0.9 V ≤ VREFH0 ≤ AVCC0 VREFH0 ≥ 1.8 V When AVCC0 < 1.8 V, VREFH0 = AVCC0 AVSS0 = VREFL0 = 0 V 0 V ≤ V_{AN} ≤ VREFH0	
	AN003 to AN007	—		
Normal-precision channel	AN008 to AN015	—		

Table 5.63 A/D Internal Reference Voltage Characteristics

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = VREFL = VREFL0 = 0 V, Ta = −40 to +105°C

Item	Min.	Typ.	Max.	Unit	Test Conditions
A/D internal reference voltage	1.35	1.50	1.65	V	