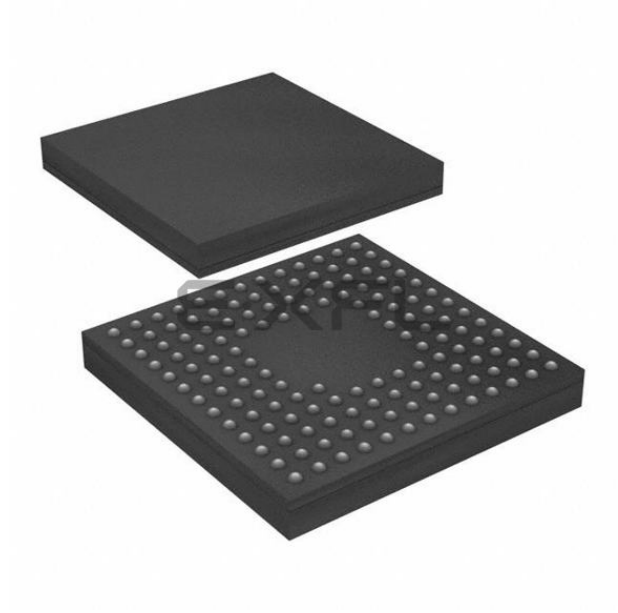
Renesas Electronics America Inc - R5F5210BBDLK#U0 Datasheet



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What is "Embedded - Microcontrollers"?

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

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Not For New Designs
Core Processor	RX
Core Size	32-Bit Single-Core
Speed	50MHz
Connectivity	EBI/EMI, I²C, SCI, SPI
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	122
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	8K x 8
RAM Size	96K x 8
Voltage - Supply (Vcc/Vdd)	1.62V ~ 5.5V
Data Converters	A/D 16x12b; D/A 2x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	145-TFLGA
Supplier Device Package	145-TFLGA (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f5210bbdlk-u0

1.5 Pin Assignments

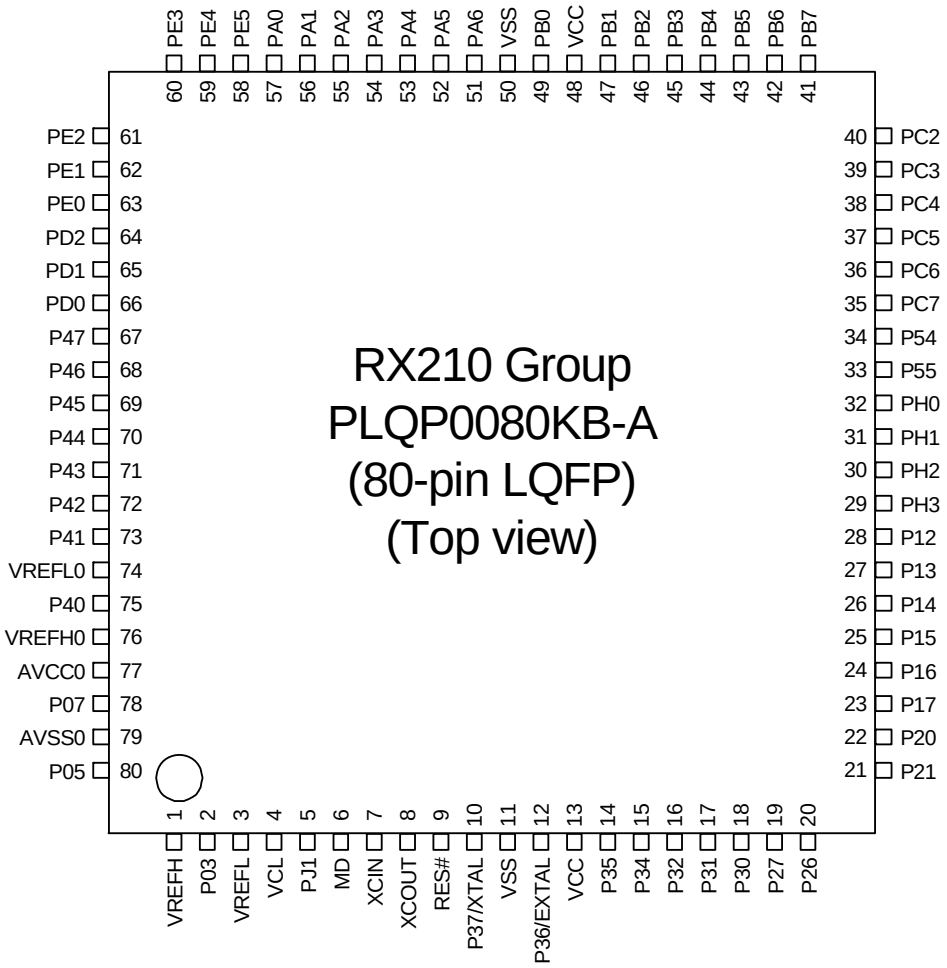
Figure 1.3 to Figure 1.11 show the pin assignments. Table 1.9 to Table 1.17 show the lists of pins and pin functions.

	A	B	C	D	E	F	G	H	J	K	L	M	N	
13	PE3	PE4	PK4	PE6	P67	PA2	PA4	PA7	PB1	PB5	PL0	PL1	P74	13
12	PE1	PE2	P70	PE5	P65	PA1	VCC	PB0	PB2	PB6	P73	PC1	P75	12
11	P62	P61	PE0	PK5	P66	VSS	PA6	P71	PB4	PB7	PC2	PC0	PC3	11
10	PK3	PK2	P63	PE7	PA0	PA3	PA5	P72	PB3	P76	PC4	P77	P82	10
9	PD6	PD4	PD7	P64						P80	PC5	P81	PC7	9
8	PD2	PD0	PD3	P60						VCC	P83	PC6	VSS	8
7	P92	P91	PD1	PD5						P51	P52	P50	P55	7
6	P90	P47	VSS	P93						P53	P56	PH0	PH1	6
5	P45	P43	P46	VCC	P44					P54	P13	PH3	PH2	5
4	P42	VREFL0	P41	P01	NC	PJ1	NC	P35	P30	P15	P24	P12	P14	4
3	P40	P05	VREFH0	P03	PJ5	PJ3	MD	VSS	P32	P31	P16	P86	P87	3
2	P07	AVCC0	P02	PF5	VCL	XCOUT	RES#	VCC	P33	P26	P23	P17	P20	2
1	AVSS0	VREFH	VREFL	P00	VSS	XCIN	XTAL	EXTAL	P34	P27	P25	P22	P21	1
	A	B	C	D	E	F	G	H	J	K	L	M	N	

RX210 Group
PTLG0145KA-A
(145-pin TFLGA)
(Upper perspective view)

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 (145-Pin TFLGA)”.
Note: • For the position of A1 pin in the package, see “Package Dimensions”.

Figure 1.3 Pin Assignments of the 145-Pin TFLGA (Upper Perspective View)



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 (80-Pin LQFP)”.

Figure 1.7 Pin Assignments of the 80-Pin LQFP

Table 1.13 List of Pins and Pin Functions (80-Pin LQFP) (2 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIc, SCId, RSPI, RIIC)	Others
45		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
46		PB2		CTS6#/RTS6#/SS6#	
47		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4-DS
48	VCC				
49		PB0	MTIC5W	RXD6/SMISO6/SSCL6/RSPCKA	
50	VSS				
51		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
52		PA5		RSPCKA	
53		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/SSLA0	IRQ5-DS/CVREFB1
54		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5	IRQ6-DS/CMPB1
55		PA2		RXD5/SMISO5/SSCL5/SSLA3	
56		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
57		PA0	MTIOC4A	SSLA1	CACREF
58		PE5	MTIOC4C/MTIOC2B		IRQ5/AN013
59		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
60		PE3	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
61		PE2	MTIOC4A	RXD12/RXDX12/SMISO12/ SSCL12	IRQ7-DS/AN010/ CVREFB0
62		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009/CMPB0
63		PE0		SCK12	AN008
64		PD2	MTIOC4D		IRQ2
65		PD1	MTIOC4B		IRQ1
66		PD0			IRQ0
67		P47			AN007
68		P46			AN006
69		P45			AN005
70		P44			AN004
71		P43			AN003
72		P42			AN002
73		P41			AN001
74	VREFL0				
75		P40			AN000
76	VREFH0				
77	AVCC0				
78		P07			ADTRG0#
79	AVSS0				
80		P05			DA1

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

Table 1.14 List of Pins and Pin Functions (69-Pin WLBGA) (1 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIc, SCId, RSPI, RIIC)	Others
A1	NC				
A2		PE2	MTIOC4A	RXD12/RXDX12/SMISO12/ SSCL12	IRQ7-DS/AN010/ CVREFB0
A3	VREFL				
A4	VREFH				
A5		P43			AN003
A6	VREFL0				
A7	AVCC0				
A8	AVSS0				
A9	AVSS0				
B1		PE5	MTIOC4C/MTIOC2B		IRQ5/AN013
B2		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
B3		PE3	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
B4		P46			AN006
B5		P44			AN004
B6		P41			AN001
B7	VREFH0				
B8		P05			DA1
B9	VCL				
C1		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5	IRQ6-DS/CMPB1
C2		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/SSLA0	IRQ5-DS/CVREFB1
C3		PA0	MTIOC4A	SSLA1	CACREF
C4		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009/CMPB0
C5		PE0		SCK12	AN008
C6		P42			AN002
C7		P40			AN000
C8		P03			DA0
C9	XCIN				
D1		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
D2		PB0	MTIC5W	RXD6/SMISO6/SSCL6/ RSPCKA	
D3		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
D7	MD				FINED
D8	RES#				
D9	XCOUT				
E1	VSS				
E2		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4-DS
E8	XTAL	P37			
E9	VSS				
F1	VCC				
F2		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
F7		P31	MTIOC4D/TMCI2	CTS1#/RTS1#/SS1#	IRQ1-DS/RTCIC1
F8	EXTAL	P36			
F9	VCC				
G1		PB5	MTIOC2A/MTIOC1B/TMRI1/ POE1#	SCK9	
G2		PB6	MTIOC3D	RXD9/SMISO9/SSCL9	

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

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIc, SCId, RSPI, RIIC)	Others
F5		P15	MTIOC0B/MTCLKB/TMCI2	RXD1/SMISO1/SSCL1	IRQ5
F6		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4-DS
F7		PB5	MTIOC2A/MTIOC1B/TMRI1/ POE1#	SCK9	
F8		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
G1	EXTAL	P36			
G2		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
G3		PH3	TMCI0		
G4		PH0			CACREF
G5		PC7	MTIOC3A/TMO2/MTCLKB	TXD8/SMOSI8/SSDA8/MISOA	CACREF
G6		PC6	MTIOC3C/MTCLKA/TMCI2	RXD8/SMISO8/SSCL8/MOSIA	
G7		PC3	MTIOC4D	TXD5/SMOSI5/SSDA5	
G8		PB6	MTIOC3D	RXD9/SMISO9/SSCL9	
H1	XTAL	P37			
H2		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA-DS	IRQ7
H3		PH2	TMRI0		IRQ1
H4		PH1	TMO0		IRQ0
H5		P55	MTIOC4D/TMO3		
H6		P54	MTIOC4B/TMCI1		
H7		PC2	MTIOC4B	RXD5/SMISO5/SSCL5/SSLA3	
H8		PB7	MTIOC3B	TXD9/SMOSI9/SSDA9	

Note: • Pin names to which -DS is appended are for pins that can be used to trigger release from deep software standby 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) (16 / 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 8896h	MTU5	Timer I/O control register V	TIORV	8	8	2, 3 PCLKB	2 ICLK
0008 88A0h	MTU5	Timer counter W	TCNTW	16	16	2, 3 PCLKB	2 ICLK
0008 88A2h	MTU5	Timer general register W	TGRW	16	16	2, 3 PCLKB	2 ICLK
0008 88A4h	MTU5	Timer control register W	TCRW	8	8	2, 3 PCLKB	2 ICLK
0008 88A6h	MTU5	Timer I/O control register W	TIORW	8	8	2, 3 PCLKB	2 ICLK
0008 88B2h	MTU5	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 88B4h	MTU5	Timer start register	TSTR	8	8	2, 3 PCLKB	2 ICLK
0008 88B6h	MTU5	Timer compare match clear register	TCNTCMPCLR	8	8	2, 3 PCLKB	2 ICLK
0008 8900h	POE	Input level control/status register 1	ICSR1	16	8, 16	2, 3 PCLKB	2 ICLK
0008 8902h	POE	Output level control/status register 1	OCSR1	16	8, 16	2, 3 PCLKB	2 ICLK
0008 8908h	POE	Input level control/status register 2	ICSR2	16	8, 16	2, 3 PCLKB	2 ICLK
0008 890Ah	POE	Software port output enable register	SPOER	8	8	2, 3 PCLKB	2 ICLK
0008 890Bh	POE	Port output enable control register 1	POECR1	8	8	2, 3 PCLKB	2 ICLK
0008 890Ch	POE	Port output enable control register 2	POECR2	8	8	2, 3 PCLKB	2 ICLK
0008 890Eh	POE	Input level control/status register 3	ICSR3	16	8, 16	2, 3 PCLKB	2 ICLK
0008 9000h	S12AD	A/D control register	ADCSR	16	16	2, 3 PCLKB	2 ICLK
0008 9004h	S12AD	A/D channel select register A	ADANSA	16	16	2, 3 PCLKB	2 ICLK
0008 9008h	S12AD	A/D-converted value addition mode select register	ADADS	16	16	2, 3 PCLKB	2 ICLK
0008 900Ch	S12AD	A/D-converted value addition count select register	ADADC	8	8	2, 3 PCLKB	2 ICLK
0008 900Eh	S12AD	A/D control extended register	ADCER	16	16	2, 3 PCLKB	2 ICLK
0008 9010h	S12AD	A/D start trigger select register	ADSTRGR	16	16	2, 3 PCLKB	2 ICLK
0008 9012h	S12AD	A/D converted extended input control register	ADEXICR	16	16	2, 3 PCLKB	2 ICLK
0008 9014h	S12AD	A/D channel select register B	ADANSB	16	16	2, 3 PCLKB	2 ICLK
0008 9018h	S12AD	A/D double register	ADDBLDR	16	16	2, 3 PCLKB	2 ICLK
0008 901Ah	S12AD	A/D temperature sensor data register	ADTSDR	16	16	2, 3 PCLKB	2 ICLK
0008 901Ch	S12AD	A/D internal reference voltage data register	ADOCDR	16	16	2, 3 PCLKB	2 ICLK
0008 901Eh	S12AD	A/D self-diagnosis data register	ADRD	16	16	2, 3 PCLKB	2 ICLK
0008 9020h	S12AD	A/D data register 0	ADDR0	16	16	2, 3 PCLKB	2 ICLK
0008 9022h	S12AD	A/D data register 1	ADDR1	16	16	2, 3 PCLKB	2 ICLK
0008 9024h	S12AD	A/D data register 2	ADDR2	16	16	2, 3 PCLKB	2 ICLK
0008 9026h	S12AD	A/D data register 3	ADDR3	16	16	2, 3 PCLKB	2 ICLK
0008 9028h	S12AD	A/D data register 4	ADDR4	16	16	2, 3 PCLKB	2 ICLK
0008 902Ah	S12AD	A/D data register 5	ADDR5	16	16	2, 3 PCLKB	2 ICLK
0008 902Ch	S12AD	A/D data register 6	ADDR6	16	16	2, 3 PCLKB	2 ICLK
0008 902Eh	S12AD	A/D data register 7	ADDR7	16	16	2, 3 PCLKB	2 ICLK
0008 9030h	S12AD	A/D data register 8	ADDR8	16	16	2, 3 PCLKB	2 ICLK
0008 9032h	S12AD	A/D data register 9	ADDR9	16	16	2, 3 PCLKB	2 ICLK
0008 9034h	S12AD	A/D data register 10	ADDR10	16	16	2, 3 PCLKB	2 ICLK
0008 9036h	S12AD	A/D data register 11	ADDR11	16	16	2, 3 PCLKB	2 ICLK
0008 9038h	S12AD	A/D data register 12	ADDR12	16	16	2, 3 PCLKB	2 ICLK
0008 903Ah	S12AD	A/D data register 13	ADDR13	16	16	2, 3 PCLKB	2 ICLK
0008 903Ch	S12AD	A/D data register 14	ADDR14	16	16	2, 3 PCLKB	2 ICLK
0008 903Eh	S12AD	A/D data register 15	ADDR15	16	16	2, 3 PCLKB	2 ICLK
0008 9060h	S12AD	A/D sampling state register 0	ADSSTR0	8	8	2, 3 PCLKB	2 ICLK
0008 9061h	S12AD	A/D sampling state register L	ADSSTRL	8	8	2, 3 PCLKB	2 ICLK
0008 9066h	S12AD	A/D sample and hold circuit register	ADSHCR	16	16	2, 3 PCLKB	2 ICLK
0008 9070h	S12AD	A/D sampling state register T	ADSSTRT	8	8	2, 3 PCLKB	2 ICLK
0008 9071h	S12AD	A/D sampling state register O	ADSSTRO	8	8	2, 3 PCLKB	2 ICLK
0008 9073h	S12AD	A/D sampling state register 1	ADSSTR1	8	8	2, 3 PCLKB	2 ICLK
0008 9074h	S12AD	A/D sampling state register 2	ADSSTR2	8	8	2, 3 PCLKB	2 ICLK
0008 9075h	S12AD	A/D sampling state register 3	ADSSTR3	8	8	2, 3 PCLKB	2 ICLK

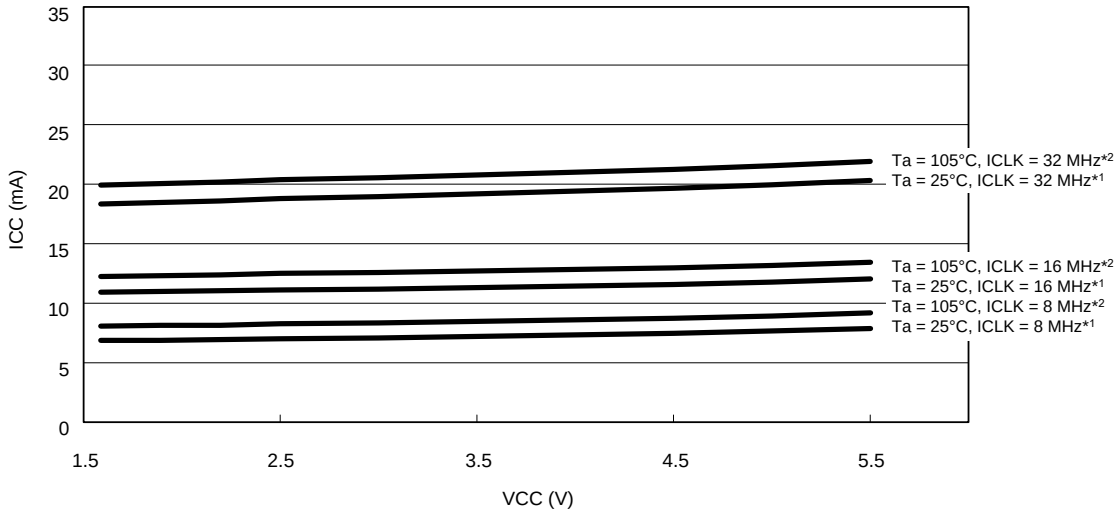
Table 4.1 List of I/O Registers (Address Order) (24 / 29)

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

Table 4.1 List of I/O Registers (Address Order) (28 / 29)

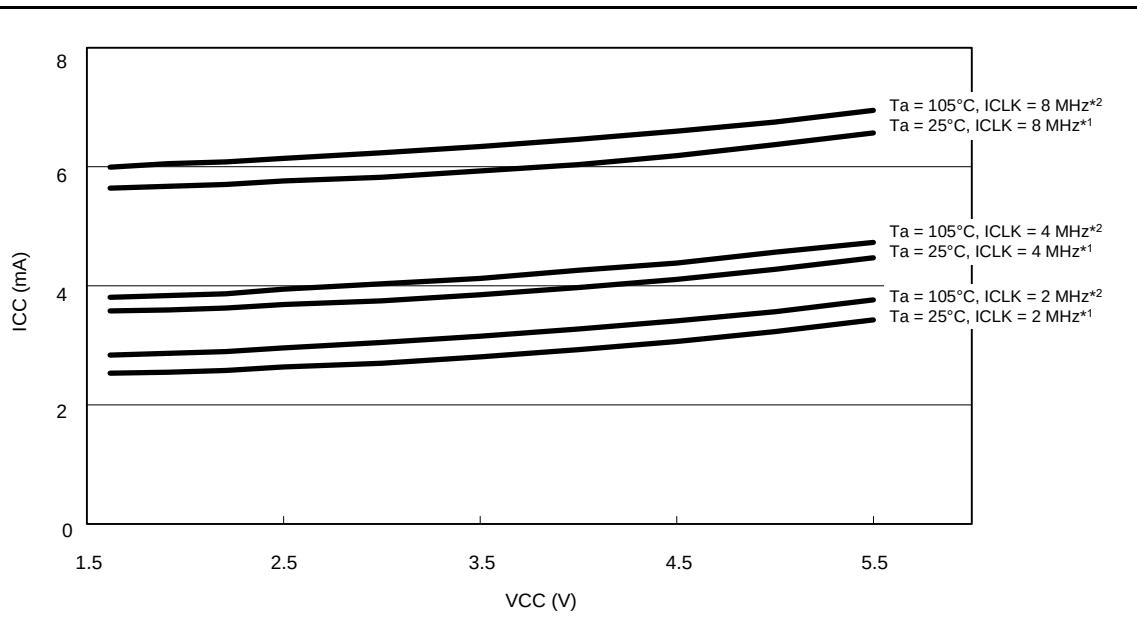
Address	Module Symbol	Register Name	Register Symbol	Number of Bits	Access Size	Number of Access Cycles: ICLK ≥ PCLK	Number of Access Cycles: ICLK < PCLK
0008 C1B0h	MPC	PE0 pin function control register	PE0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B1h	MPC	PE1 pin function control register	PE1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B2h	MPC	PE2 pin function control register	PE2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B3h	MPC	PE3 pin function control register	PE3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B4h	MPC	PE4 pin function control register	PE4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B5h	MPC	PE5 pin function control register	PE5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B6h	MPC	PE6 pin function control register	PE6PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1B7h	MPC	PE7 pin function control register	PE7PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1BDh	MPC	PF5 pin function control register	PF5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1C8h	MPC	PH0 pin function control register	PH0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1C9h	MPC	PH1 pin function control register	PH1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1CAh	MPC	PH2 pin function control register	PH2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1CBh	MPC	PH3 pin function control register	PH3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1D1h	MPC	PJ1 pin function control register	PJ1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1D3h	MPC	PJ3 pin function control register	PJ3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1DAh	MPC	PK2 pin function control register	PK2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1DBh	MPC	PK3 pin function control register	PK3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1DCh	MPC	PK4 pin function control register	PK4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1DDh	MPC	PK5 pin function control register	PK5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C280h	SYSTEM	Deep standby control register	DPSBYCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C282h	SYSTEM	Deep standby interrupt enable register 0	DPSIER0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C284h	SYSTEM	Deep standby interrupt enable register 2	DPSIER2	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C286h	SYSTEM	Deep standby interrupt flag register 0	DPSIFR0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C288h	SYSTEM	Deep standby interrupt flag register 2	DPSIFR2	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C28Ah	SYSTEM	Deep standby interrupt edge register 0	DPSIEGR0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C28Ch	SYSTEM	Deep standby interrupt edge register 2	DPSIEGR2	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C28Fh	SYSTEM	Flash HOCO software standby control register	FHSSBYCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C290h	SYSTEM	Reset status register 0	RSTSR0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C291h	SYSTEM	Reset status register 1	RSTSR1	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C293h	SYSTEM	Main clock oscillator forced oscillation control register	MOFCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C294h	SYSTEM	High-speed clock oscillator power supply control register	HOCOPCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C295h	SYSTEM	PLL power control register	PLLPCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C296h	FLASH	Flash write erase protection register	FWEPROR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C297h	SYSTEM	Voltage monitoring circuit/comparator A control register	LVCMPCR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C298h	SYSTEM	Voltage detection level select register	LVDLVLR	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C29Ah	SYSTEM	Voltage monitoring 1 circuit/comparator A1 control register 0	LVD1CR0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C29Bh	SYSTEM	Voltage monitoring 2 circuit/comparator A2 control register 0	LVD2CR0	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C2A0h to 0008 C2BFh	SYSTEM	Deep standby backup register 0 to 31	DPSBKR0 to DPSBKR31	8	8	4, 5 PCLKB	2, 3 ICLK
0008 C400h	RTC	64-Hz counter	R64CNT	8	8	2, 3 PCLKB	2 ICLK
0008 C402h	RTC	Second counter	RSECCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C404h	RTC	Minute counter	RMINCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C406h	RTC	Hour counter	RHRCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C408h	RTC	Day-of-week counter	RWKCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C40Ah	RTC	Date counter	RDAYCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C40Ch	RTC	Month counter	RMONCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C40Eh	RTC	Year counter	RYRCNT	16	16	2, 3 PCLKB	2 ICLK
0008 C410h	RTC	Second alarm register	RSECAR	8	8	2, 3 PCLKB	2 ICLK
0008 C412h	RTC	Minute alarm register	RMINAR	8	8	2, 3 PCLKB	2 ICLK
0008 C414h	RTC	Hour alarm register	RHRAR	8	8	2, 3 PCLKB	2 ICLK
0008 C416h	RTC	Day-of-week alarm register	RWKAR	8	8	2, 3 PCLKB	2 ICLK
0008 C418h	RTC	Date alarm register	RDAYAR	8	8	2, 3 PCLKB	2 ICLK

Note 5. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 40 MHz. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 6. This is the increase if data is programmed to or erasing from the ROM or E2 DataFlash during program execution.
Note 7. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 32 MHz. BCLK, FCLK, and PCLK are set to divided by 64.
Note 8. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 32 MHz. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 9. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is the sub oscillation circuit. BCLK, FCLK, and PCLK are set to divided by 64.
Note 10. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is the sub oscillation circuit. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 11. Value when the main clock continues oscillating at 12.5 MHz.



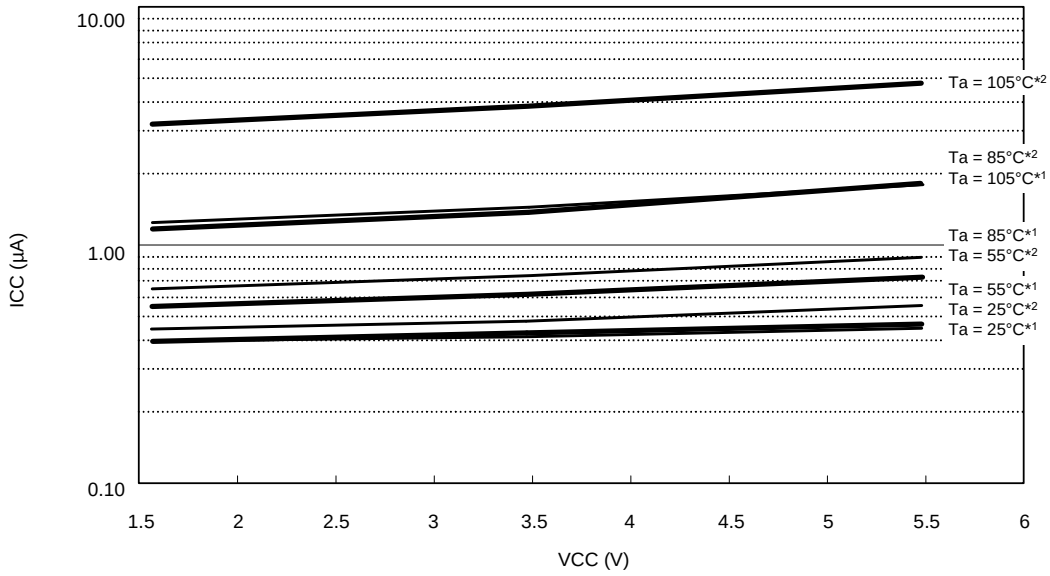
Note 1. All peripheral operation is normal. This does not include BGO operation.
Average value of the tested middle samples during product evaluation.
Note 2. All peripheral operation is maximum. This does not include BGO operation.
Average value of the tested upper-limit samples during product evaluation.

Figure 5.19 Voltage Dependency in Middle-Speed Operating Modes 2A and 2B (Reference Data) for Chip Version B with 256 Kbytes or Less of Flash Memory and 48 to 100 Pins



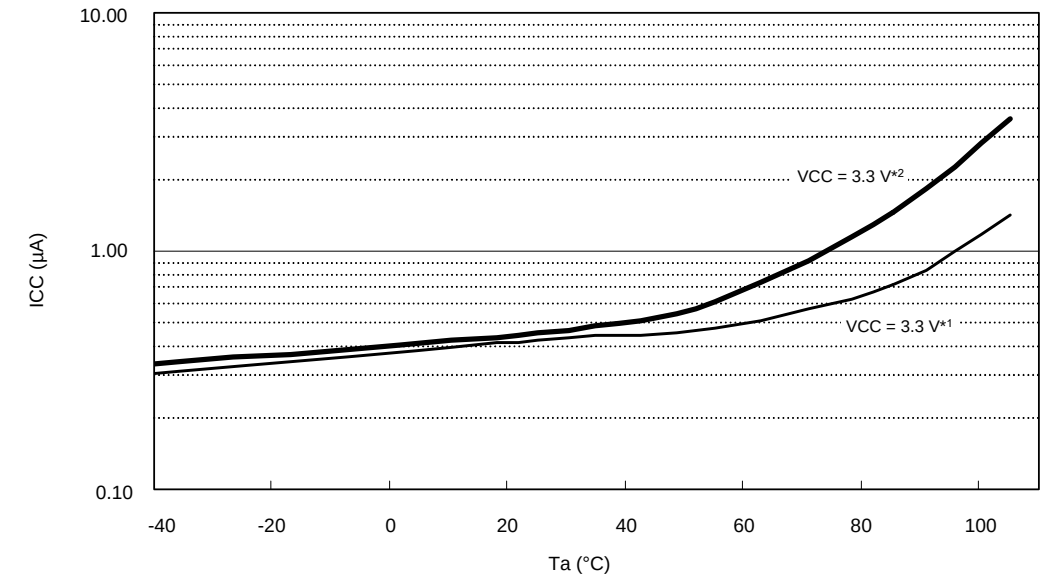
Note 1. All peripheral operation is normal.
Average value of the tested middle samples during product evaluation.
Note 2. All peripheral operation is maximum.
Average value of the tested upper-limit samples during product evaluation.

Figure 5.20 Voltage Dependency in Low-Speed Operating Mode 1 (Reference Data) for Chip Version B with 256 Kbytes or Less of Flash Memory and 48 to 100 Pins



Note 1. Average value of the tested middle samples during product evaluation.
Note 2. Average value of the tested upper-limit samples during product evaluation.

Figure 5.24 Voltage Dependency in Deep Software Standby Mode (DEEPCUT1 Bit = 1) (Reference Data) for Chip Version B with 256 Kbytes or Less of Flash Memory and 48 to 100 Pins



Note 1. Average value of the tested middle samples during product evaluation.
Note 2. Average value of the tested upper-limit samples during product evaluation.

Figure 5.25 Temperature Dependency in Deep Software Standby Mode (DEEPCUT1 Bit = 1) (Reference Data) for Chip Version B with 256 Kbytes or Less of Flash Memory and 48 to 100 Pins

Item					Symbol	Typ.	Max.	Unit	Test Conditions
Supply current*1	Low-speed operating mode 1	Normal operating mode	No peripheral operation*7	ICLK = 8 MHz	I_{CC}	2.1	—	mA	
				ICLK = 4 MHz		1.7	—		
				ICLK = 2 MHz		1.5	—		
			All peripheral operation: Normal*8	ICLK = 8 MHz		7.3	—		
				ICLK = 4 MHz		4.5	—		
				ICLK = 2 MHz		3.1	—		
			All peripheral operation: Max.*7	ICLK = 8 MHz		—	12		
				ICLK = 4 MHz		—	—		
				ICLK = 2 MHz		—	—		
		Sleep mode	No peripheral operation	ICLK = 8 MHz		1.5	—		
				ICLK = 4 MHz		1.4	—		
				ICLK = 2 MHz		1.3	—		
			All peripheral operation: Normal	ICLK = 8 MHz		4.1	—		
				ICLK = 4 MHz		3.0	—		
				ICLK = 2 MHz		2.3	—		
		All-module clock stop mode		ICLK = 8 MHz		1.4	—		
				ICLK = 4 MHz		1.3	—		
				ICLK = 2 MHz		1.2	—		
	Low-speed operating mode 2	Normal operating mode	No peripheral operation*9	ICLK = 32 kHz		0.022	—		
			All peripheral operation: Normal*10	ICLK = 32 kHz		0.06	—		
			All peripheral operation: Max.*10	ICLK = 32 kHz		—	3*11		
		Sleep mode	No peripheral operation	ICLK = 32 kHz		0.017	—		
			All peripheral operation: Normal	ICLK = 32 kHz		0.036	—		
		All-module clock stop mode				0.017	—		

Note 1. Supply current values do not include output charge/discharge current from all pins. The values apply when internal pull-up MOSs are in the off state.
Note 2. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is PLL and the VCO oscillation frequency is 64 MHz. BCLK, FCLK, and PCLK are set to divided by 64.
Note 3. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 40 MHz. BCLK, FCLK, and PCLK are set to divided by 64.
Note 4. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is PLL and the VCO oscillation frequency is 64 MHz. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 5. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 40 MHz. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 6. This is the increase if data is programmed to or erasing from the ROM or E2 DataFlash during program execution.
Note 7. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 32 MHz. BCLK, FCLK, and PCLK are set to divided by 64.
Note 8. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO and the oscillation frequency is 32 MHz. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 9. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is the sub oscillation circuit. BCLK, FCLK, and PCLK are set to divided by 64.
Note 10. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is the sub oscillation circuit. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 11. Value when the main clock continues oscillating at 12.5 MHz.

[Chip version B]

Table 5.36 Operation Frequency Value (Middle-Speed Operating Mode 2A)

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

Item		Symbol	VCC			Unit
			1.62 to 1.8 V	1.8 to 2.7 V	2.7 to 5.5 V	
Maximum operating frequency	System clock (ICLK)	f_{max}	8	16	32	MHz
	FlashIF clock (FCLK)*1		8	16	32	
	Peripheral module clock (PCLKB)		8	16	32	
	Peripheral module clock (PCLKD)*2		8	16	32	
	External bus clock (BCLK)		8	16	25	
	BCLK pin output		8	8	12.5	

Note 1. The VCC is 2.7 to 5.5 V and the lower-limit frequency of FCLK is 4 MHz during programming or erasing of the flash memory.
Note 2. The lower-limit frequency of PCLKD is 1 MHz when the A/D converter is in use.

[Chip version B]

Table 5.37 Operation Frequency Value (Middle-Speed Operating Mode 2B)

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

Item		Symbol	VCC			Unit
			1.62 to 1.8 V	1.8 to 2.7 V	2.7 to 5.5 V	
Maximum operating frequency	System clock (ICLK)	f_{max}	8	16	32	MHz
	FlashIF clock (FCLK)*1		8	16	32	
	Peripheral module clock (PCLKB)		8	16	32	
	Peripheral module clock (PCLKD)*2		8	16	32	
	External bus clock (BCLK)		8	16	25	
	BCLK pin output		8	8	12.5	

Note 1. The VCC is 1.62 to 3.6 V and the lower-limit frequency of FCLK is 4 MHz during programming or erasing of the flash memory.
Note 2. The lower-limit frequency of PCLKD is 1 MHz when the A/D converter is in use.

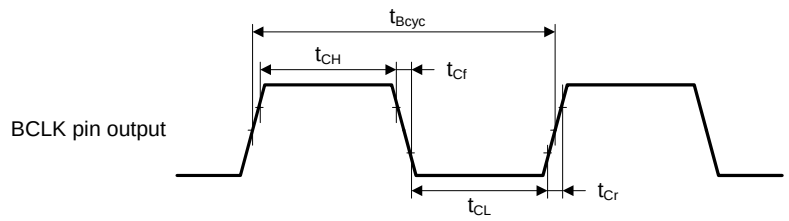
[Chip versions A and C]

Table 5.38 Operation Frequency Value (Low-Speed Operating Mode 1)

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

Item		Symbol	VCC			Unit
			1.62 to 1.8 V	1.8 to 2.7 V	2.7 to 5.5 V	
Maximum operating frequency	System clock (ICLK)	f_{max}	1	1	1	MHz
	FlashIF clock (FCLK)*1		1	1	1	
	Peripheral module clock (PCLKB)		1	1	1	
	Peripheral module clock (PCLKD)*2		1	1	1	
	External bus clock (BCLK)		1	1	1	
	BCLK pin output		1	1	1	

Note 1. Programming and erasing the flash memory is impossible.
Note 2. The lower-limit frequency of PCLKD is 1 MHz when the A/D converter is in use.



Test conditions: VOH = VCC × 0.7, VOL = VCC × 0.3, IOH = –1.0 mA, IOL = 1.0 mA, C = 30 pF

Figure 5.59 BCLK Pin Output Timing

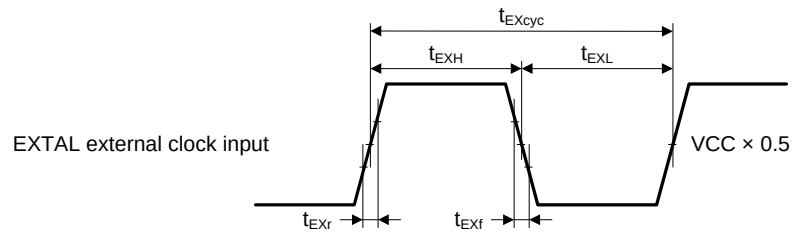


Figure 5.60 EXTAL External Clock Input Timing

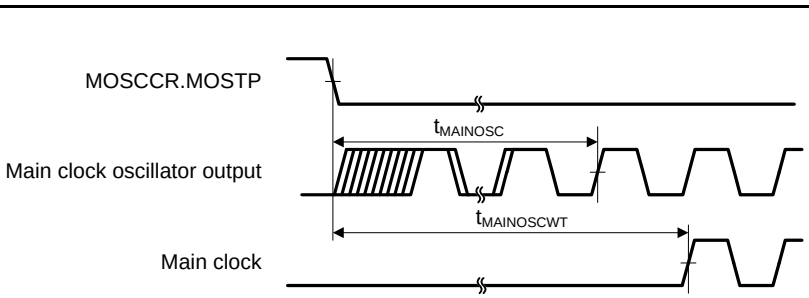


Figure 5.61 Main Clock Oscillation Start Timing

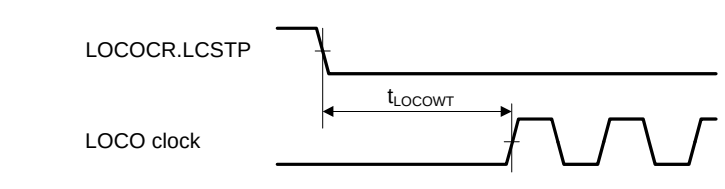


Figure 5.62 LOCO Clock Oscillation Start Timing

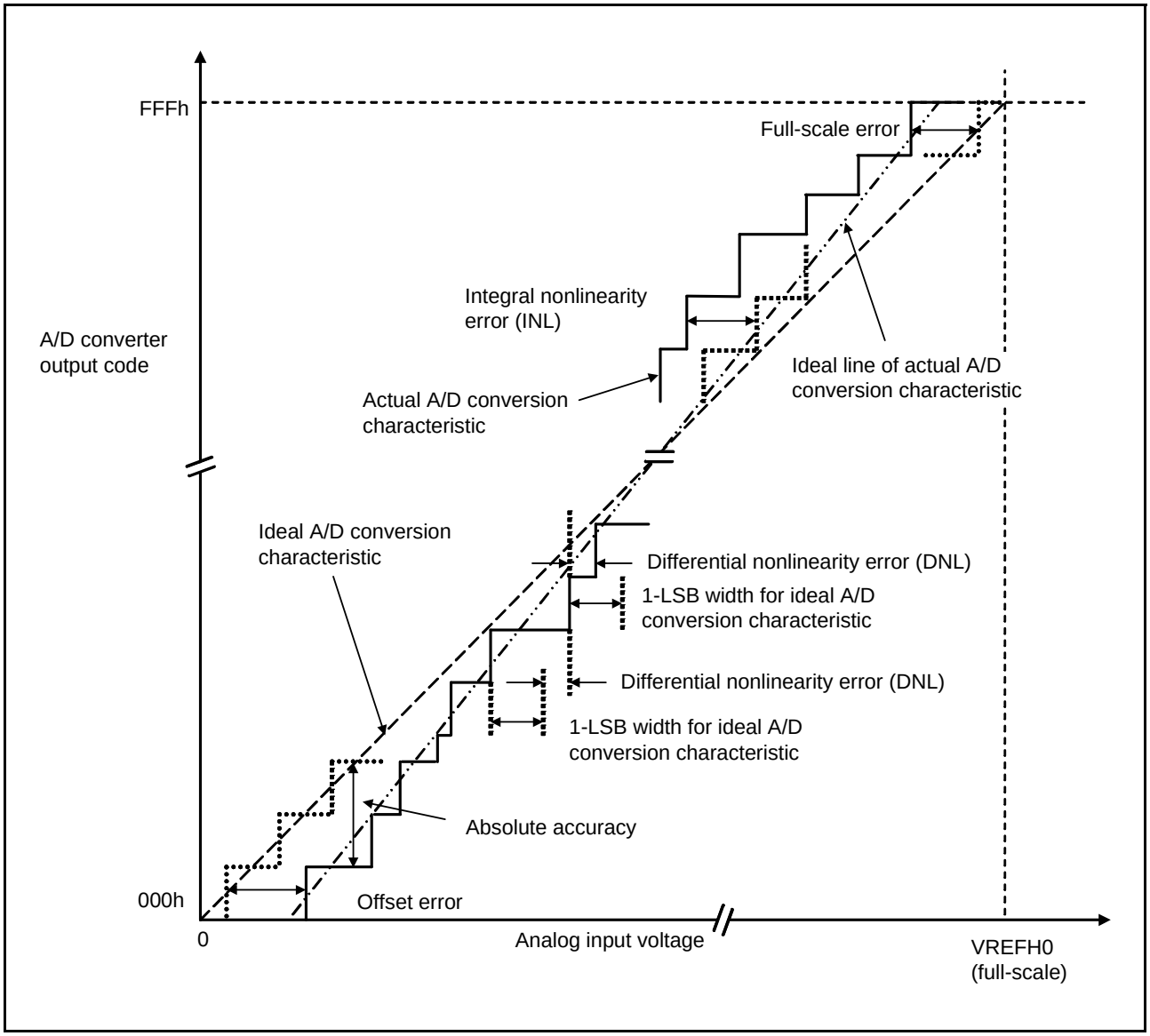


Figure 5.101 Illustration of A/D Converter Characteristic Terms

Absolute accuracy

Absolute accuracy is the difference between output code based on the theoretical A/D conversion characteristics, and the actual A/D conversion result. When measuring absolute accuracy, the voltage at the midpoint of the width of analog input voltage (1-LSB width), that can meet the expectation of outputting an equal code based on the theoretical A/D conversion characteristics, is used as an analog input voltage. For example, if 12-bit resolution is used and if reference voltage (VREFH0 = 5.12 V), then 1-LSB width becomes 1.25 mV, and 0 mV, 1.25 mV, 2.5 mV, ... are used as analog input voltages.

If analog input voltage is 10 mV, absolute accuracy = ±5 LSB means that the actual A/D conversion result is in the range of 003h to 00Dh though an output code, 008h, can be expected from the theoretical A/D conversion characteristics.

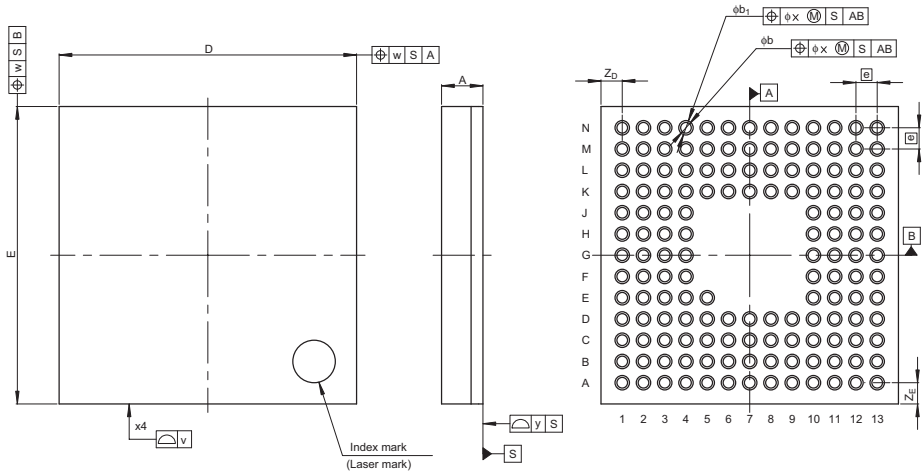
Integral nonlinearity error (INL)

Integral nonlinearity error is the maximum deviation between the ideal line when the measured offset and full-scale errors are zeroed, and the actual output code.

Appendix 1. Package Dimensions

Information on the latest version of the package dimensions or mountings has been displayed in “Packages” on Renesas Electronics Corporation website.

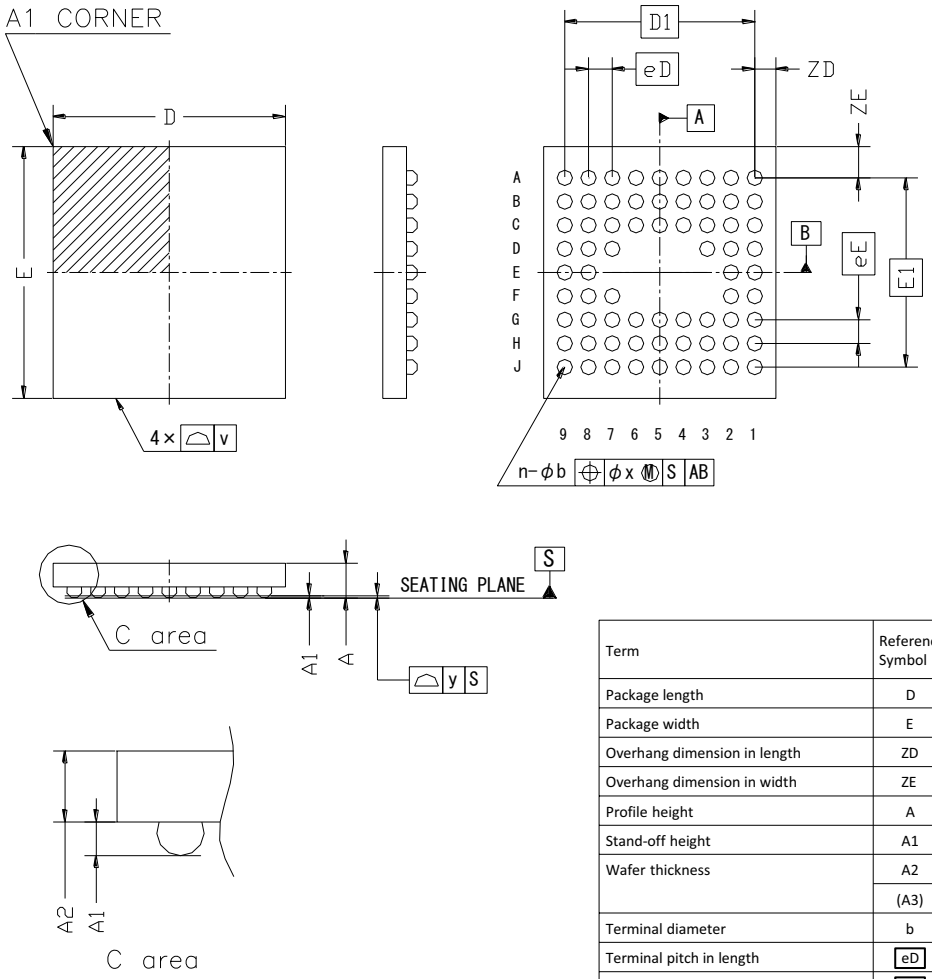
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TFLGA145-7x7-0.50	PTLG0145KA-A	145F0G	0.1g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	7.0	—
E	—	7.0	—
v	—	—	0.15
w	—	—	0.20
A	—	—	1.05
e	—	0.5	—
b	0.21	0.25	0.29
b_1	0.29	0.34	0.39
x	—	—	0.08
y	—	—	0.08
Z_D	—	0.5	—
Z_E	—	0.5	—

Figure A 145-Pin TFLGA (PTLG0145KA-A)

JEITA Package code	RENESAS Code	Previous Code	MASS(TYP.)[g]
S-WFBGA69-3.91x4.26-0.40	SWBG0069LA-A	—	0.02



注記:
1. 端子ﾋﾟｯﾁは端子中央部の位置で規定する。
2. ﾃﾞｰﾀﾑA及びBは、ﾎﾞｰﾙｸﾞﾘｯﾄﾞｾﾝﾀを称す。

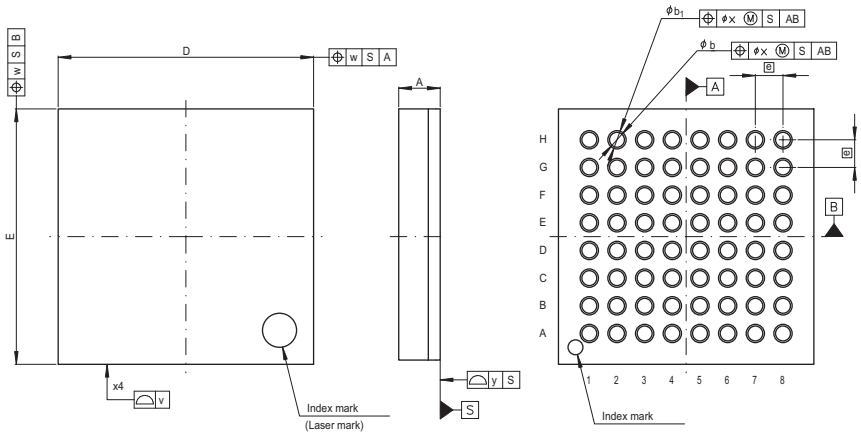
Note:
1. Ball pitch dimension is specified with the center of balls.
2. Datum A and B are axes defined by the ball grid array, not by the PKG outline.

Dimensions in millimeters

Term	Reference Symbol	Specification		
		Min	Nom	Max
Package length	D	3.86	3.91	3.96
Package width	E	4.21	4.26	4.31
Overhang dimension in length	ZD	0.305	0.355	0.405
Overhang dimension in width	ZE	0.48	0.53	0.58
Profile height	A	—	—	0.70
Stand-off height	A1	0.15	0.19	0.23
Wafer thickness	A2	0.36	0.40	0.44
	(A3)	—	—	—
Terminal diameter	b	0.22	0.27	0.32
Terminal pitch in length	eD		0.4	(BSC)
Terminal pitch in width	eE		0.4	(BSC)
Center terminal position in D-direction	SD		—	(BSC)
Center terminal position in E-direction	SE		—	(BSC)
Edge ball center to center in D-direction	D1		3.2	(BSC)
Edge ball center to center in D-direction	E1		3.2	(BSC)
Number of terminals	n		69	
Tolerance of package lateral profile	v		0.05	
Positional tolerance of terminals	x		0.05	
Coplanarity	y		0.08	

Figure E 69-Pin WLBGA (SWBG0069LA-A)

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TFLGA64-6x6-0.65	PTLG0064JA-A	64F0G	0.07g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	6.0	—
E	—	6.0	—
v	—	—	0.15
w	—	—	0.20
A	—	—	1.05
e	—	0.65	—
b	0.31	0.35	0.39
b_1	0.39	0.43	0.47
x	—	—	0.08
y	—	—	0.10

Figure F 64-Pin TFLGA (PTLG0064JA-A)

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 document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

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 a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.