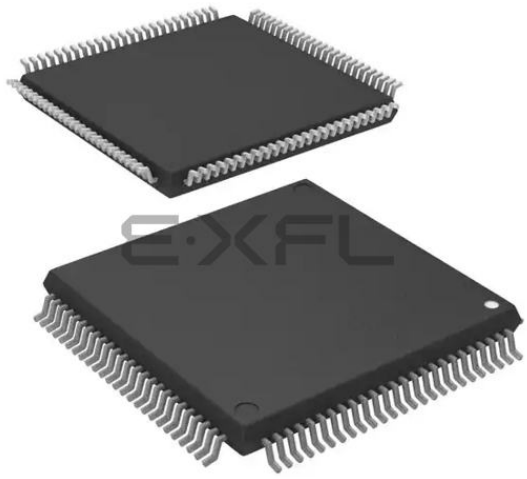
Renesas Electronics America Inc - R5F56104VDFP#V0 Datasheet



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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	Not For New Designs
Core Processor	RX
Core Size	32-Bit Single-Core
Speed	100MHz
Connectivity	EBI/EMI, I²C, SCI
Peripherals	DMA, POR, PWM, WDT
Number of I/O	117
Program Memory Size	768KB (768K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	128K x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 3.6V
Data Converters	A/D 16x10b; D/A 2x10b
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	100-LQFP
Supplier Device Package	100-LFQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f56104vdfp-v0

Classification	Module/Function	Description
Interrupt	Interrupt control unit	• Peripheral function interrupts: 116 • External interrupts: 16 (pins IRQ15 to IRQ0) • Non-maskable interrupt: 1 (the NMI pin) • Eight priority orders specifiable
External bus extension		• The external address space can be divided into eight areas (CS0 to CS7), each of which is independently controllable. Capacity of each area: 16 Mbytes Chip-select signals (CS0# to CS7#) can be output for each area. 8-bit or 16-bit bus space can be specified for each area. The data arrangement is selectable as little endian or big endian for each area. (only for data) • Separate bus system • Wait control • Write buffer programming
DMA	DMA controller	• 4-channel DMA transfer available • Activation sources: Software trigger, external interrupts, and interrupt requests from peripheral functions
	Data transfer controller	• Three transfer modes: Normal transfer, repeat transfer, and block transfer • Activated by interrupt requests (chain transfer enabled)
I/O ports	Programmable I/O ports	• I/O pins: 117 (144-pin LQFP), 140 (176-pin LFBGA) • Pull-up resistors: 40 • Open-drain outputs: 16 • 5-V tolerance: 10
Timer	16-bit timer pulse unit	• (16 bits x 6 channels) x 2 units • Up to 16 pulse inputs and outputs • Select from among 7 or 8 counter-input clocks for each channel • Input capture/output compare function • Maximum of 15-phase PWM output possible in PWM mode • Buffered operation, phase counting mode (two-phase encoder input), and cascaded operation (32 bits x 2 channels) settable for each channel • PPG output trigger can be generated • Conversion start trigger for the A/D converter can be generated
	Programmable pulse generator	• (4 bits x 4 groups) x 2 units • Provides pulse outputs by using the TPU output as a trigger • Maximum of 32-bit pulse output possible
	8-bit timer	• (8 bits x 2 channels) x 2 units • Select from among 8 clock sources (7 internal clocks and 1 external clock) • Allows the output of pulse trains with a desired duty cycle or PWM signals • Cascading of 2 channels enables it to be used as a 16-bit timer • Generation of trigger to start A/D converter conversion • Capable of generating baud rate clock for SCI5 and SCI6
	Compare match timer	• (16 bits x 2 channels) x 2 units • Select from among 4 counter-input clocks

Watchdog timer		• 8 bits x 1 channel • Select from among 8 counter-input clocks • Switchable between watchdog timer mode and interval timer mode
Communication function	Serial communication interface	• 7 channels • Serial communication mode: Asynchronous, clock synchronous, and smart card interface • On-chip baud rate generator allows any bit rate to be selected • Choice of LSB-first or MSB-first transfer • Enables average transfer rate clock input from TMR (SCI5, SCI6)
	I^2C bus interface	• 2 channels • Communication format I^2C bus format/SMBus format Master/slave selectable (For multi-master operation) • Maximum transfer rate: 1 Mbps
A/D converter		• 4 units (1 unit x 4 channels) • 10-bit resolution • Conversion time: 1.0 μs per channel (at 50-MHz (PCLK) operation) • Two kinds of operating modes Single mode and scan mode (single scan mode or continuous scan mode) • Sample-and-hold function • Three types of A/D conversion start Conversion can be started by software, a conversion start trigger by the timer (TPU or TMR), or an external trigger signal.
D/A converter		• 2 channels • 10-bit resolution • Output voltage: 0 V to VREFH
CRC calculator		• CRC code generation for arbitrary data lengths in 8-bit units • One of three generating polynomials selectable $X^8 + X^2 + X + 1$, $X^{16} + X^{15} + X^2 + 1$, $X^{16} + X^{12} + X^5 + 1$ • CRC code generation for LSB-first or MSB-first communication selectable
Operating frequency		8 to 100 MHz
Power supply voltage		V_{CC} = $PLLV_{CC}$ = AV_{CC} = 3.0 to 3.6V, VREFH = 3.0 to AV_{CC}
Supply current		50 mA (typ.) (regular specifications)
Operating temperature		−20 to +85°C (regular specifications), −40 to +85°C (wide-range specifications)
Package		176-pin LFBGA (PLBG0176GA-A) 144-pin LQFP (PLQP0144KA-A)

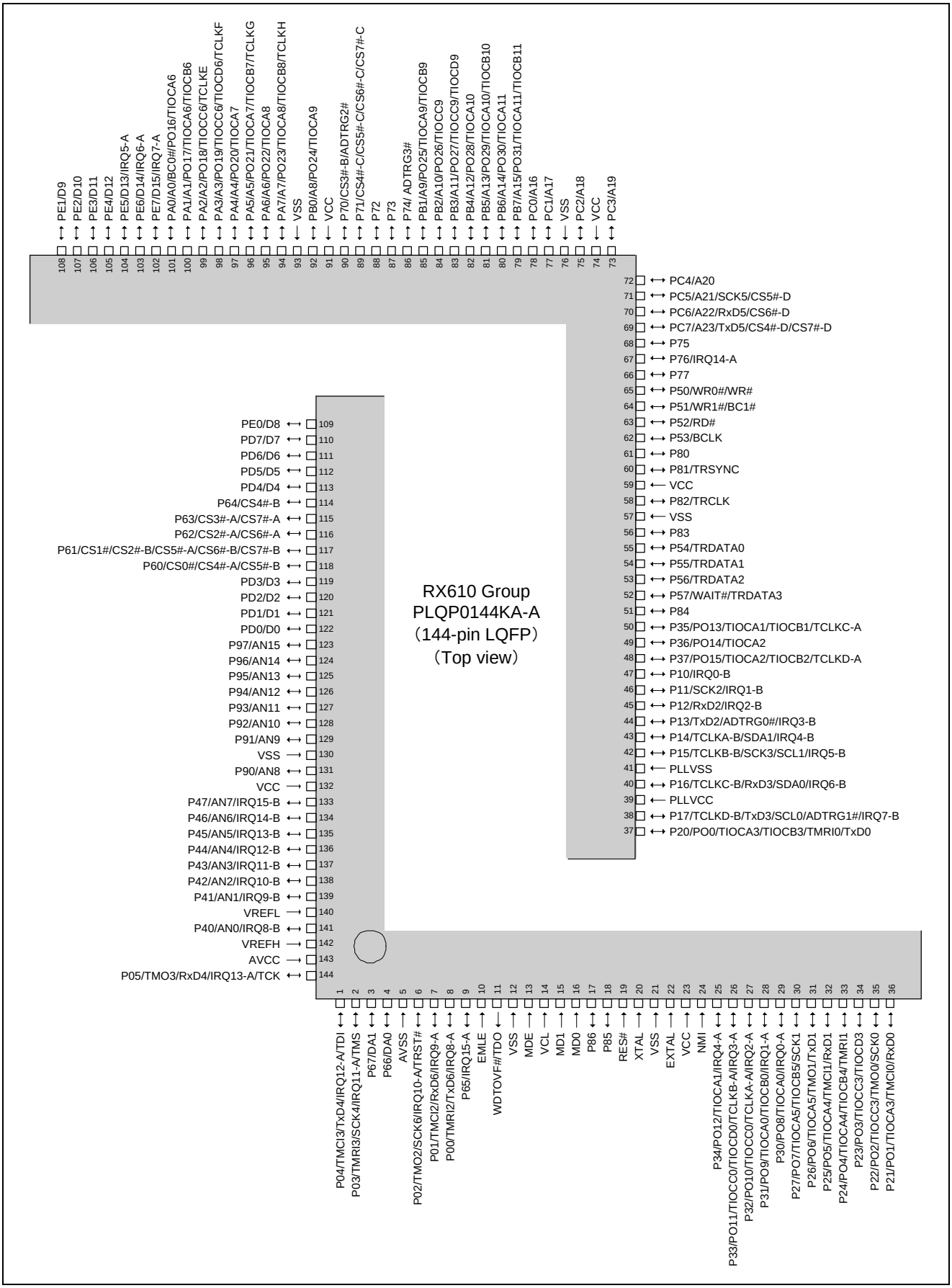
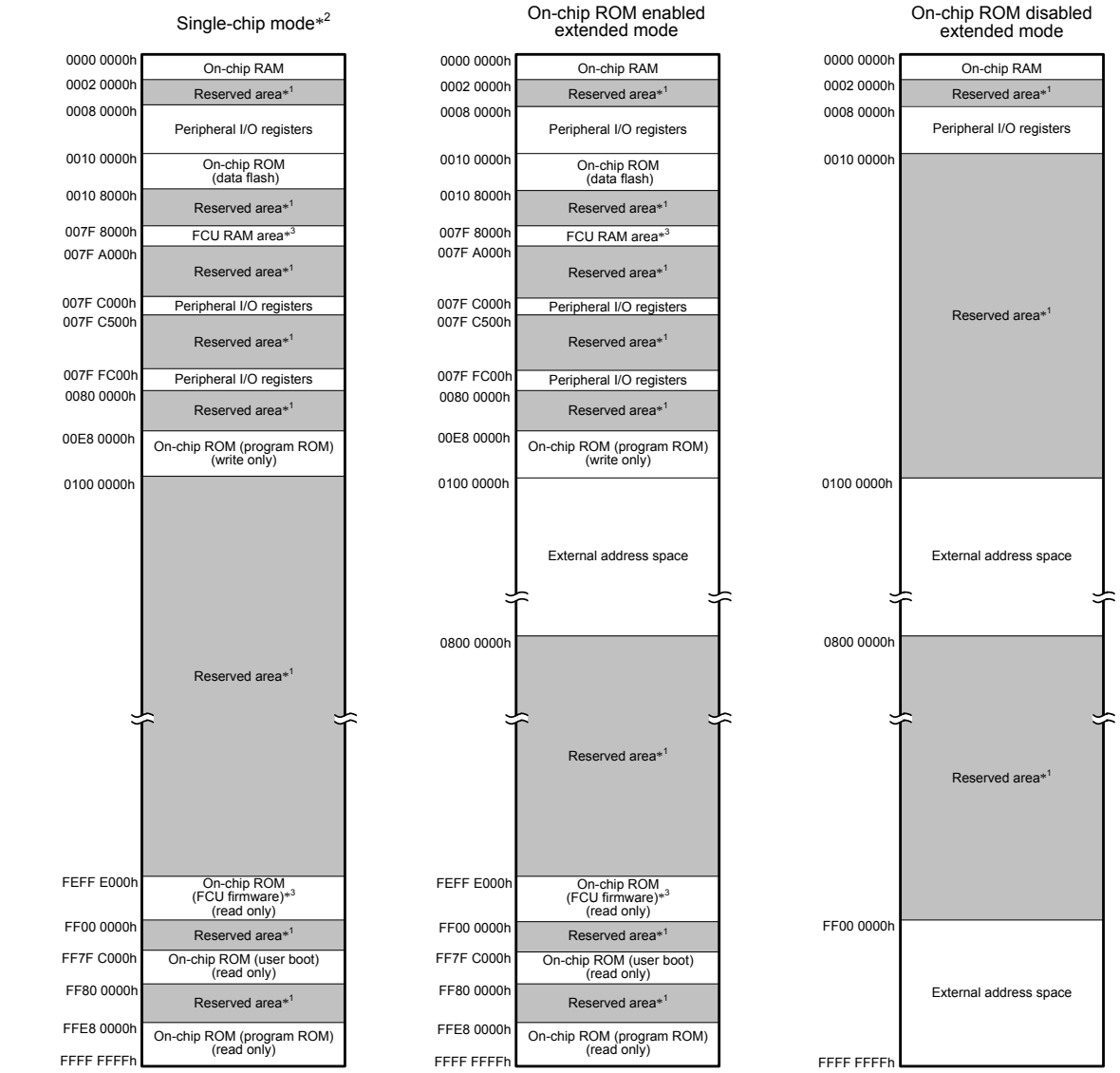
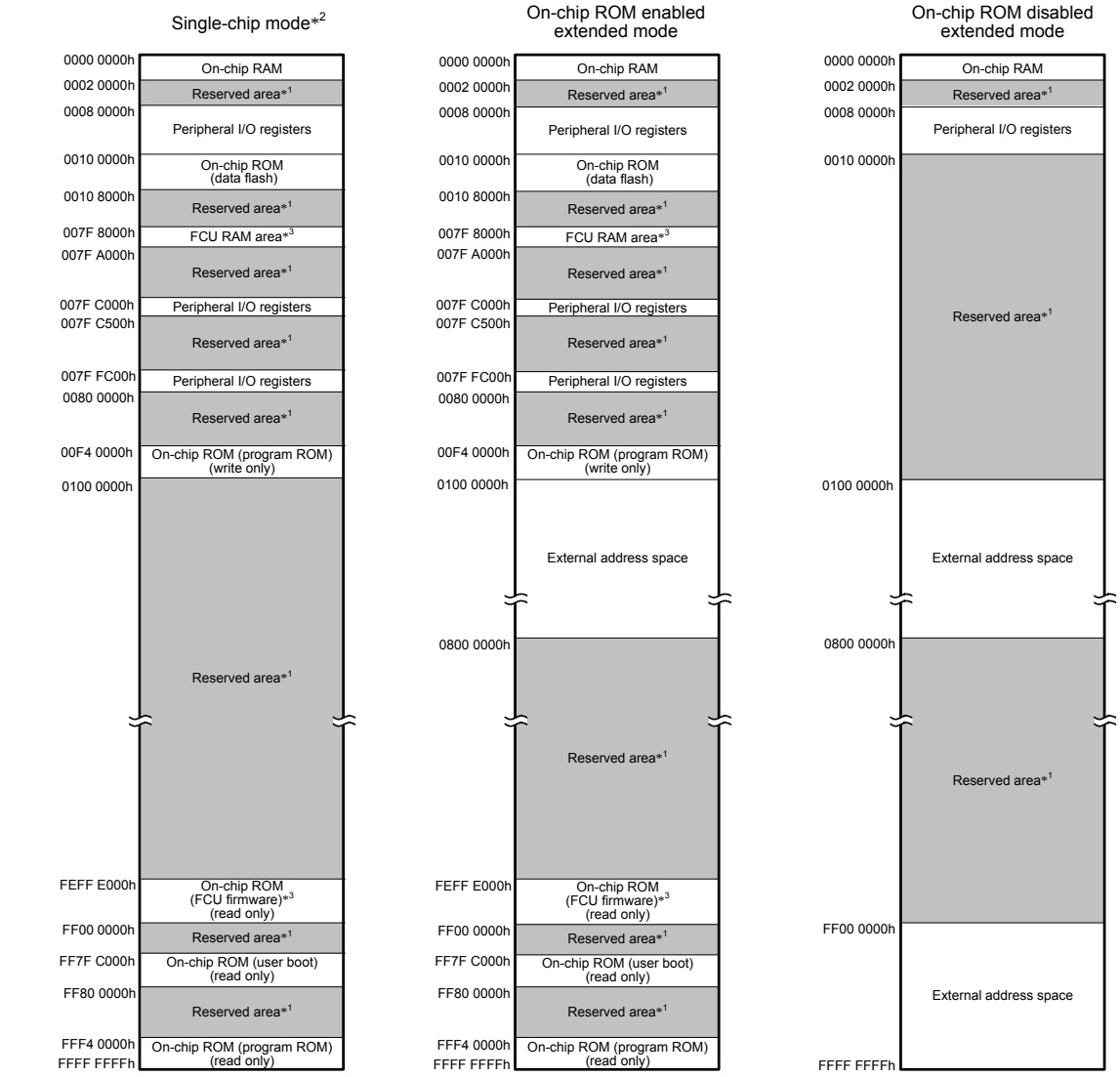


Figure 1.5 Pin Assignment (Assistance Diagram) of the 144-Pin LQFP



Notes: 1. A reserved area should not be accessed.
2. The address space in boot mode and user boot mode is the same as the address space in single-chip mode.
3. For details on the FCU, see section 26, ROM (Flash Memory for Code Storage) and section 27, Data Flash (Flash Memory for Data Storage) in the User's manual: Hardware.

Figure 3.2 Memory Map of the R5F56107



Notes: 1. A reserved area should not be accessed.
2. The address space in boot mode and user boot mode is the same as the address space in single-chip mode.
3. For details on the FCU, see section 26, ROM (Flash Memory for Code Storage) and section 27, Data Flash (Flash Memory for Data Storage) in the User's manual: Hardware.

Figure 3.4 Memory Map of the R5F56104

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 2400h	DMAC0	DMA control register A	DMCRA	32	32	3 ICLK
0008 2404h	DMAC0	DMA control register B	DMCRB	8	8	3 ICLK
0008 2405h	DMAC0	DMA control register C	DMCRC	8	8	3 ICLK
0008 2406h	DMAC0	DMA control register D	DMCRD	8	8	3 ICLK
0008 2407h	DMAC0	DMA control register E	DMCRE	8	8	3 ICLK
0008 2408h	DMAC1	DMA control register A	DMCRA	32	32	3 ICLK
0008 240Ch	DMAC1	DMA control register B	DMCRB	8	8	3 ICLK
0008 240Dh	DMAC1	DMA control register C	DMCRC	8	8	3 ICLK
0008 240Eh	DMAC1	DMA control register D	DMCRD	8	8	3 ICLK
0008 240Fh	DMAC1	DMA control register E	DMCRE	8	8	3 ICLK
0008 2410h	DMAC2	DMA control register A	DMCRA	32	32	3 ICLK
0008 2414h	DMAC2	DMA control register B	DMCRB	8	8	3 ICLK
0008 2415h	DMAC2	DMA control register C	DMCRC	8	8	3 ICLK
0008 2416h	DMAC2	DMA control register D	DMCRD	8	8	3 ICLK
0008 2417h	DMAC2	DMA control register E	DMCRE	8	8	3 ICLK
0008 2418h	DMAC3	DMA control register A	DMCRA	32	32	3 ICLK
0008 241Ch	DMAC3	DMA control register B	DMCRB	8	8	3 ICLK
0008 241Dh	DMAC3	DMA control register C	DMCRC	8	8	3 ICLK
0008 241Eh	DMAC3	DMA control register D	DMCRD	8	8	3 ICLK
0008 241Fh	DMAC3	DMA control register E	DMCRE	8	8	3 ICLK
0008 2502h	DMAC common	DMA start control register	DMSCNT	8	8	3 ICLK
0008 250Bh	DMAC common	DMA interrupt control register	DMICNT	8	8	3 ICLK
0008 2517h	DMAC common	DMA transfer end detect register	DMEDET	8	8	3 ICLK
0008 251Bh	DMAC common	DMA arbitration status register	DMASTS	8	8	3 ICLK
0008 3002h	BSC	CS0 mode register	CS0MOD	16	16	1 to 2 BCLK *7
0008 3004h	BSC	CS0 wait control register 1	CS0WCNT1	32	32	1 to 2 BCLK *7
0008 3008h	BSC	CS0 wait control register 2	CS0WCNT2	32	32	1 to 2 BCLK *7
0008 3012h	BSC	CS1 mode register	CS1MOD	16	16	1 to 2 BCLK *7
0008 3014h	BSC	CS1 wait control register 1	CS1WCNT1	32	32	1 to 2 BCLK *7
0008 3018h	BSC	CS1 wait control register 2	CS1WCNT2	32	32	1 to 2 BCLK *7
0008 3022h	BSC	CS2 mode register	CS2MOD	16	16	1 to 2 BCLK *7
0008 3024h	BSC	CS2 wait control register 1	CS2WCNT1	32	32	1 to 2 BCLK *7
0008 3028h	BSC	CS2 wait control register 2	CS2WCNT2	32	32	1 to 2 BCLK *7
0008 3032h	BSC	CS3 mode register	CS3MOD	16	16	1 to 2 BCLK *7
0008 3034h	BSC	CS3 wait control register 1	CS3WCNT1	32	32	1 to 2 BCLK *7
0008 3038h	BSC	CS3 wait control register 2	CS3WCNT2	32	32	1 to 2 BCLK *7
0008 3042h	BSC	CS4 mode register	CS4MOD	16	16	1 to 2 BCLK *7
0008 3044h	BSC	CS4 wait control register 1	CS4WCNT1	32	32	1 to 2 BCLK *7
0008 3048h	BSC	CS4 wait control register 2	CS4WCNT2	32	32	1 to 2 BCLK *7
0008 3052h	BSC	CS5 mode register	CS5MOD	16	16	1 to 2 BCLK *7
0008 3054h	BSC	CS5 wait control register 1	CS5WCNT1	32	32	1 to 2 BCLK *7
0008 3058h	BSC	CS5 wait control register 2	CS5WCNT2	32	32	1 to 2 BCLK *7
0008 3062h	BSC	CS6 mode register	CS6MOD	16	16	1 to 2 BCLK *7
0008 3064h	BSC	CS6 wait control register 1	CS6WCNT1	32	32	1 to 2 BCLK *7
0008 3068h	BSC	CS6 wait control register 2	CS6WCNT2	32	32	1 to 2 BCLK *7

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 3072h	BSC	CS7 mode register	CS7MOD	16	16	1 to 2 BCLK *7
0008 3074h	BSC	CS7 wait control register 1	CS7WCNT1	32	32	1 to 2 BCLK *7
0008 3078h	BSC	CS7 wait control register 2	CS7WCNT2	32	32	1 to 2 BCLK *7
0008 3802h	BSC	CS0 control register	CS0CNT	16	16	1 to 2 BCLK *7
0008 380Ah	BSC	CS0 recovery cycle register	CS0REC	16	16	1 to 2 BCLK *7
0008 3812h	BSC	CS1 control register	CS1CNT	16	16	1 to 2 BCLK *7
0008 381Ah	BSC	CS1 recovery cycle register	CS1REC	16	16	1 to 2 BCLK *7
0008 3822h	BSC	CS2 control register	CS2CNT	16	16	1 to 2 BCLK *7
0008 382Ah	BSC	CS2 recovery cycle register	CS2REC	16	16	1 to 2 BCLK *7
0008 3832h	BSC	CS3 control register	CS3CNT	16	16	1 to 2 BCLK *7
0008 383Ah	BSC	CS3 recovery cycle register	CS3REC	16	16	1 to 2 BCLK *7
0008 3842h	BSC	CS4 control register	CS4CNT	16	16	1 to 2 BCLK *7
0008 384Ah	BSC	CS4 recovery cycle register	CS4REC	16	16	1 to 2 BCLK *7
0008 3852h	BSC	CS5 control register	CS5CNT	16	16	1 to 2 BCLK *7
0008 385Ah	BSC	CS5 recovery cycle register	CS5REC	16	16	1 to 2 BCLK *7
0008 3862h	BSC	CS6 control register	CS6CNT	16	16	1 to 2 BCLK *7
0008 386Ah	BSC	CS6 recovery cycle register	CS6REC	16	16	1 to 2 BCLK *7
0008 3872h	BSC	CS7 control register	CS7CNT	16	16	1 to 2 BCLK *7
0008 387Ah	BSC	CS7 recovery cycle register	CS7REC	16	16	1 to 2 BCLK *7
0008 7010h	ICU	Interrupt request register 016	IR016	8	8	2 ICLK
0008 7015h	ICU	Interrupt request register 021	IR021	8	8	2 ICLK
0008 7017h	ICU	Interrupt request register 023	IR023	8	8	2 ICLK
0008 701Ch	ICU	Interrupt request register 028	IR028	8	8	2 ICLK
0008 701Dh	ICU	Interrupt request register 029	IR029	8	8	2 ICLK
0008 701Eh	ICU	Interrupt request register 030	IR030	8	8	2 ICLK
0008 701Fh	ICU	Interrupt request register 031	IR031	8	8	2 ICLK
0008 7040h	ICU	Interrupt request register 064	IR064	8	8	2 ICLK
0008 7041h	ICU	Interrupt request register 065	IR065	8	8	2 ICLK
0008 7042h	ICU	Interrupt request register 066	IR066	8	8	2 ICLK
0008 7043h	ICU	Interrupt request register 067	IR067	8	8	2 ICLK
0008 7044h	ICU	Interrupt request register 068	IR068	8	8	2 ICLK
0008 7045h	ICU	Interrupt request register 069	IR069	8	8	2 ICLK
0008 7046h	ICU	Interrupt request register 070	IR070	8	8	2 ICLK
0008 7047h	ICU	Interrupt request register 071	IR071	8	8	2 ICLK
0008 7048h	ICU	Interrupt request register 072	IR072	8	8	2 ICLK
0008 7049h	ICU	Interrupt request register 073	IR073	8	8	2 ICLK
0008 704Ah	ICU	Interrupt request register 074	IR074	8	8	2 ICLK
0008 704Bh	ICU	Interrupt request register 075	IR075	8	8	2 ICLK
0008 704Ch	ICU	Interrupt request register 076	IR076	8	8	2 ICLK
0008 704Dh	ICU	Interrupt request register 077	IR077	8	8	2 ICLK
0008 704Eh	ICU	Interrupt request register 078	IR078	8	8	2 ICLK
0008 704Fh	ICU	Interrupt request register 079	IR079	8	8	2 ICLK
0008 7060h	ICU	Interrupt request register 096	IR096	8	8	2 ICLK
0008 7062h	ICU	Interrupt request register 098	IR098	8	8	2 ICLK
0008 7063h	ICU	Interrupt request register 099	IR099	8	8	2 ICLK

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 70A0h	ICU	Interrupt request register 160	IR160	8	8	2 ICLK
0008 70A1h	ICU	Interrupt request register 161	IR161	8	8	2 ICLK
0008 70A2h	ICU	Interrupt request register 162	IR162	8	8	2 ICLK
0008 70A5h	ICU	Interrupt request register 165	IR165	8	8	2 ICLK
0008 70A6h	ICU	Interrupt request register 166	IR166	8	8	2 ICLK
0008 70A7h	ICU	Interrupt request register 167	IR167	8	8	2 ICLK
0008 70A8h	ICU	Interrupt request register 168	IR168	8	8	2 ICLK
0008 70AAh	ICU	Interrupt request register 170	IR170	8	8	2 ICLK
0008 70ABh	ICU	Interrupt request register 171	IR171	8	8	2 ICLK
0008 70AEh	ICU	Interrupt request register 174	IR174	8	8	2 ICLK
0008 70AFh	ICU	Interrupt request register 175	IR175	8	8	2 ICLK
0008 70B0h	ICU	Interrupt request register 176	IR176	8	8	2 ICLK
0008 70B1h	ICU	Interrupt request register 177	IR177	8	8	2 ICLK
0008 70B2h	ICU	Interrupt request register 178	IR178	8	8	2 ICLK
0008 70B3h	ICU	Interrupt request register 179	IR179	8	8	2 ICLK
0008 70B4h	ICU	Interrupt request register 180	IR180	8	8	2 ICLK
0008 70B5h	ICU	Interrupt request register 181	IR181	8	8	2 ICLK
0008 70B6h	ICU	Interrupt request register 182	IR182	8	8	2 ICLK
0008 70B7h	ICU	Interrupt request register 183	IR183	8	8	2 ICLK
0008 70B8h	ICU	Interrupt request register 184	IR184	8	8	2 ICLK
0008 70B9h	ICU	Interrupt request register 185	IR185	8	8	2 ICLK
0008 70C6h	ICU	Interrupt request register 198	IR198	8	8	2 ICLK
0008 70C7h	ICU	Interrupt request register 199	IR199	8	8	2 ICLK
0008 70C8h	ICU	Interrupt request register 200	IR200	8	8	2 ICLK
0008 70C9h	ICU	Interrupt request register 201	IR201	8	8	2 ICLK
0008 70D6h	ICU	Interrupt request register 214	IR214	8	8	2 ICLK
0008 70D7h	ICU	Interrupt request register 215	IR215	8	8	2 ICLK
0008 70D8h	ICU	Interrupt request register 216	IR216	8	8	2 ICLK
0008 70D9h	ICU	Interrupt request register 217	IR217	8	8	2 ICLK
0008 70DAh	ICU	Interrupt request register 218	IR218	8	8	2 ICLK
0008 70DBh	ICU	Interrupt request register 219	IR219	8	8	2 ICLK
0008 70DCh	ICU	Interrupt request register 220	IR220	8	8	2 ICLK
0008 70DDh	ICU	Interrupt request register 221	IR221	8	8	2 ICLK
0008 70DEh	ICU	Interrupt request register 222	IR222	8	8	2 ICLK
0008 70DFh	ICU	Interrupt request register 223	IR223	8	8	2 ICLK
0008 70E0h	ICU	Interrupt request register 224	IR224	8	8	2 ICLK
0008 70E1h	ICU	Interrupt request register 225	IR225	8	8	2 ICLK
0008 70E2h	ICU	Interrupt request register 226	IR226	8	8	2 ICLK
0008 70E3h	ICU	Interrupt request register 227	IR227	8	8	2 ICLK
0008 70E4h	ICU	Interrupt request register 228	IR228	8	8	2 ICLK
0008 70E5h	ICU	Interrupt request register 229	IR229	8	8	2 ICLK
0008 70E6h	ICU	Interrupt request register 230	IR230	8	8	2 ICLK
0008 70E7h	ICU	Interrupt request register 231	IR231	8	8	2 ICLK
0008 70E8h	ICU	Interrupt request register 232	IR232	8	8	2 ICLK
0008 70E9h	ICU	Interrupt request register 233	IR233	8	8	2 ICLK

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 70EAh	ICU	Interrupt request register 234	IR234	8	8	2 ICLK
0008 70EBh	ICU	Interrupt request register 235	IR235	8	8	2 ICLK
0008 70ECh	ICU	Interrupt request register 236	IR236	8	8	2 ICLK
0008 70EDh	ICU	Interrupt request register 237	IR237	8	8	2 ICLK
0008 70EEh	ICU	Interrupt request register 238	IR238	8	8	2 ICLK
0008 70EFh	ICU	Interrupt request register 239	IR239	8	8	2 ICLK
0008 70F0h	ICU	Interrupt request register 240	IR240	8	8	2 ICLK
0008 70F1h	ICU	Interrupt request register 241	IR241	8	8	2 ICLK
0008 70F6h	ICU	Interrupt request register 246	IR246	8	8	2 ICLK
0008 70F7h	ICU	Interrupt request register 247	IR247	8	8	2 ICLK
0008 70F8h	ICU	Interrupt request register 248	IR248	8	8	2 ICLK
0008 70F9h	ICU	Interrupt request register 249	IR249	8	8	2 ICLK
0008 70FAh	ICU	Interrupt request register 250	IR250	8	8	2 ICLK
0008 70FBh	ICU	Interrupt request register 251	IR251	8	8	2 ICLK
0008 70FCh	ICU	Interrupt request register 252	IR252	8	8	2 ICLK
0008 70FDh	ICU	Interrupt request register 253	IR253	8	8	2 ICLK
0008 711Ch	ICU	Interrupt request destination setting register 028	ISELR028	8	8	2 ICLK
0008 711Dh	ICU	Interrupt request destination setting register 029	ISELR029	8	8	2 ICLK
0008 711Eh	ICU	Interrupt request destination setting register 030	ISELR030	8	8	2 ICLK
0008 711Fh	ICU	Interrupt request destination setting register 031	ISELR031	8	8	2 ICLK
0008 7140h	ICU	Interrupt request destination setting register 064	ISELR064	8	8	2 ICLK
0008 7141h	ICU	Interrupt request destination setting register 065	ISELR065	8	8	2 ICLK
0008 7142h	ICU	Interrupt request destination setting register 066	ISELR066	8	8	2 ICLK
0008 7143h	ICU	Interrupt request destination setting register 067	ISELR067	8	8	2 ICLK
0008 7144h	ICU	Interrupt request destination setting register 068	ISELR068	8	8	2 ICLK
0008 7145h	ICU	Interrupt request destination setting register 069	ISELR069	8	8	2 ICLK
0008 7146h	ICU	Interrupt request destination setting register 070	ISELR070	8	8	2 ICLK
0008 7147h	ICU	Interrupt request destination setting register 071	ISELR071	8	8	2 ICLK
0008 7148h	ICU	Interrupt request destination setting register 072	ISELR072	8	8	2 ICLK
0008 7149h	ICU	Interrupt request destination setting register 073	ISELR073	8	8	2 ICLK
0008 714Ah	ICU	Interrupt request destination setting register 074	ISELR074	8	8	2 ICLK
0008 714Bh	ICU	Interrupt request destination setting register 075	ISELR075	8	8	2 ICLK
0008 714Ch	ICU	Interrupt request destination setting register 076	ISELR076	8	8	2 ICLK
0008 714Dh	ICU	Interrupt request destination setting register 077	ISELR077	8	8	2 ICLK
0008 714Eh	ICU	Interrupt request destination setting register 078	ISELR078	8	8	2 ICLK
0008 714Fh	ICU	Interrupt request destination setting register 079	ISELR079	8	8	2 ICLK
0008 7162h	ICU	Interrupt request destination setting register 098	ISELR098	8	8	2 ICLK
0008 7163h	ICU	Interrupt request destination setting register 099	ISELR099	8	8	2 ICLK
0008 7164h	ICU	Interrupt request destination setting register 100	ISELR100	8	8	2 ICLK
0008 7165h	ICU	Interrupt request destination setting register 101	ISELR101	8	8	2 ICLK
0008 7168h	ICU	Interrupt request destination setting register 104	ISELR104	8	8	2 ICLK
0008 7169h	ICU	Interrupt request destination setting register 105	ISELR105	8	8	2 ICLK
0008 716Ah	ICU	Interrupt request destination setting register 106	ISELR106	8	8	2 ICLK
0008 716Bh	ICU	Interrupt request destination setting register 107	ISELR107	8	8	2 ICLK
0008 716Fh	ICU	Interrupt request destination setting register 111	ISELR111	8	8	2 ICLK

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0008 7170h	ICU	Interrupt request destination setting register 112	ISELR112	8	8	2 ICLK
0008 7175h	ICU	Interrupt request destination setting register 117	ISELR117	8	8	2 ICLK
0008 7176h	ICU	Interrupt request destination setting register 118	ISELR118	8	8	2 ICLK
0008 717Ah	ICU	Interrupt request destination setting register 122	ISELR122	8	8	2 ICLK
0008 717Bh	ICU	Interrupt request destination setting register 123	ISELR123	8	8	2 ICLK
0008 717Ch	ICU	Interrupt request destination setting register 124	ISELR124	8	8	2 ICLK
0008 717Dh	ICU	Interrupt request destination setting register 125	ISELR125	8	8	2 ICLK
0008 717Fh	ICU	Interrupt request destination setting register 127	ISELR127	8	8	2 ICLK
0008 7180h	ICU	Interrupt request destination setting register 128	ISELR128	8	8	2 ICLK
0008 7185h	ICU	Interrupt request destination setting register 133	ISELR133	8	8	2 ICLK
0008 7186h	ICU	Interrupt request destination setting register 134	ISELR134	8	8	2 ICLK
0008 718Ah	ICU	Interrupt request destination setting register 138	ISELR138	8	8	2 ICLK
0008 718Bh	ICU	Interrupt request destination setting register 139	ISELR139	8	8	2 ICLK
0008 718Ch	ICU	Interrupt request destination setting register 140	ISELR140	8	8	2 ICLK
0008 718Dh	ICU	Interrupt request destination setting register 141	ISELR141	8	8	2 ICLK
0008 7191h	ICU	Interrupt request destination setting register 145	ISELR145	8	8	2 ICLK
0008 7192h	ICU	Interrupt request destination setting register 146	ISELR146	8	8	2 ICLK
0008 7197h	ICU	Interrupt request destination setting register 151	ISELR151	8	8	2 ICLK
0008 7198h	ICU	Interrupt request destination setting register 152	ISELR152	8	8	2 ICLK
0008 719Ch	ICU	Interrupt request destination setting register 156	ISELR156	8	8	2 ICLK
0008 719Dh	ICU	Interrupt request destination setting register 157	ISELR157	8	8	2 ICLK
0008 719Eh	ICU	Interrupt request destination setting register 158	ISELR158	8	8	2 ICLK
0008 719Fh	ICU	Interrupt request destination setting register 159	ISELR159	8	8	2 ICLK
0008 71A1h	ICU	Interrupt request destination setting register 161	ISELR161	8	8	2 ICLK
0008 71A2h	ICU	Interrupt request destination setting register 162	ISELR162	8	8	2 ICLK
0008 71A7h	ICU	Interrupt request destination setting register 167	ISELR167	8	8	2 ICLK
0008 71A8h	ICU	Interrupt request destination setting register 168	ISELR168	8	8	2 ICLK
0008 71AEh	ICU	Interrupt request destination setting register 174	ISELR174	8	8	2 ICLK
0008 71AFh	ICU	Interrupt request destination setting register 175	ISELR175	8	8	2 ICLK
0008 71B1h	ICU	Interrupt request destination setting register 177	ISELR177	8	8	2 ICLK
0008 71B2h	ICU	Interrupt request destination setting register 178	ISELR178	8	8	2 ICLK
0008 71B4h	ICU	Interrupt request destination setting register 180	ISELR180	8	8	2 ICLK
0008 71B5h	ICU	Interrupt request destination setting register 181	ISELR181	8	8	2 ICLK
0008 71B7h	ICU	Interrupt request destination setting register 183	ISELR183	8	8	2 ICLK
0008 71B8h	ICU	Interrupt request destination setting register 184	ISELR184	8	8	2 ICLK
0008 71C6h	ICU	Interrupt request destination setting register 198	ISELR198	8	8	2 ICLK
0008 71C7h	ICU	Interrupt request destination setting register 199	ISELR199	8	8	2 ICLK
0008 71C8h	ICU	Interrupt request destination setting register 200	ISELR200	8	8	2 ICLK
0008 71C9h	ICU	Interrupt request destination setting register 201	ISELR201	8	8	2 ICLK
0008 71D7h	ICU	Interrupt request destination setting register 215	ISELR215	8	8	2 ICLK
0008 71D8h	ICU	Interrupt request destination setting register 216	ISELR216	8	8	2 ICLK
0008 71DBh	ICU	Interrupt request destination setting register 219	ISELR219	8	8	2 ICLK
0008 71DCh	ICU	Interrupt request destination setting register 220	ISELR220	8	8	2 ICLK
0008 71DFh	ICU	Interrupt request destination setting register 223	ISELR223	8	8	2 ICLK
0008 71E0h	ICU	Interrupt request destination setting register 224	ISELR224	8	8	2 ICLK

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 8116h	TPU0	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 8118h	TPU0	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 811Ah	TPU0	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 811Ch	TPU0	Timer general register C	TGRC	16	16	2 to 3 PCLK *7
0008 811Eh	TPU0	Timer general register D	TGRD	16	16	2 to 3 PCLK *7
0008 8120h	TPU1	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8121h	TPU1	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 8122h	TPU1	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 8124h	TPU1	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 8125h	TPU1	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 8126h	TPU1	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 8128h	TPU1	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 812Ah	TPU1	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 8130h	TPU2	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8131h	TPU2	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 8132h	TPU2	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 8134h	TPU2	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 8135h	TPU2	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 8136h	TPU2	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 8138h	TPU2	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 813Ah	TPU2	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 8140h	TPU3	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8141h	TPU3	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 8142h	TPU3	Timer I/O control register H	TIORH	8	8	2 to 3 PCLK *7
0008 8143h	TPU3	Timer I/O control register L	TIORL	8	8	2 to 3 PCLK *7
0008 8144h	TPU3	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 8145h	TPU3	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 8146h	TPU3	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 8148h	TPU3	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 814Ah	TPU3	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 814Ch	TPU3	Timer general register C	TGRC	16	16	2 to 3 PCLK *7
0008 814Eh	TPU3	Timer general register D	TGRD	16	16	2 to 3 PCLK *7
0008 8150h	TPU4	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8151h	TPU4	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 8152h	TPU4	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 8154h	TPU4	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 8155h	TPU4	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 8156h	TPU4	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 8158h	TPU4	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 815Ah	TPU4	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 8160h	TPU5	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8161h	TPU5	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 8162h	TPU5	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 8164h	TPU5	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 8165h	TPU5	Timer status register	TSR	8	8	2 to 3 PCLK *7

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 81C2h	TPU10	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 81C4h	TPU10	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 81C5h	TPU10	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 81C6h	TPU10	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 81C8h	TPU10	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 81CAh	TPU10	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 81D0h	TPU11	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 81D1h	TPU11	Timer mode register	TMDR	8	8	2 to 3 PCLK *7
0008 81D2h	TPU11	Timer I/O control register	TIOR	8	8	2 to 3 PCLK *7
0008 81D4h	TPU11	Timer interrupt enable register	TIER	8	8	2 to 3 PCLK *7
0008 81D5h	TPU11	Timer status register	TSR	8	8	2 to 3 PCLK *7
0008 81D6h	TPU11	Timer counter	TCNT	16	16	2 to 3 PCLK *7
0008 81D8h	TPU11	Timer general register A	TGRA	16	16	2 to 3 PCLK *7
0008 81DAh	TPU11	Timer general register B	TGRB	16	16	2 to 3 PCLK *7
0008 81E6h	PPG0	PPG output control register	PCR	8	8	2 to 3 PCLK *7
0008 81E7h	PPG0	PPG output mode register	PMR	8	8	2 to 3 PCLK *7
0008 81E8h	PPG0	Next data enable register H	NDERH	8	8	2 to 3 PCLK *7
0008 81E9h	PPG0	Next data enable register L	NDERL	8	8	2 to 3 PCLK *7
0008 81EAh	PPG0	Output data register H	PODRH	8	8	2 to 3 PCLK *7
0008 81EBh	PPG0	Output data register L	PODRL	8	8	2 to 3 PCLK *7
0008 81ECh*1	PPG0	Next data register H	NDRH	8	8	2 to 3 PCLK *7
0008 81EDh*2	PPG0	Next data register L	NDRL	8	8	2 to 3 PCLK *7
0008 81EEh*1	PPG0	Next data register H	NDRH	8	8	2 to 3 PCLK *7
0008 81EFh*2	PPG0	Next data register L	NDRL	8	8	2 to 3 PCLK *7
0008 81F0h	PPG1	PPG trigger select register	PTRSLR	8	8	2 to 3 PCLK *7
0008 81F6h	PPG1	PPG output control register	PCR	8	8	2 to 3 PCLK *7
0008 81F7h	PPG1	PPG output mode register	PMR	8	8	2 to 3 PCLK *7
0008 81F8h	PPG1	Next data enable register H	NDERH	8	8	2 to 3 PCLK *7
0008 81F9h	PPG1	Next data enable register L	NDERL	8	8	2 to 3 PCLK *7
0008 81FAh	PPG1	Output data register H	PODRH	8	8	2 to 3 PCLK *7
0008 81FBh	PPG1	Output data register L	PODRL	8	8	2 to 3 PCLK *7
0008 81FCh*3	PPG1	Next data register H	NDRH	8	8	2 to 3 PCLK *7
0008 81FDh*4	PPG1	Next data register L	NDRL	8	8	2 to 3 PCLK *7
0008 81FEh*3	PPG1	Next data register H	NDRH	8	8	2 to 3 PCLK *7
0008 81FFh*4	PPG1	Next data register L	NDRL	8	8	2 to 3 PCLK *7
0008 8200h	TMR0	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8201h	TMR1	Timer control register	TCR	8	8	2 to 3 PCLK *7
0008 8202h	TMR0	Timer control/status register	TCSR	8	8	2 to 3 PCLK *7
0008 8203h	TMR1	Timer control/status register	TCSR	8	8	2 to 3 PCLK *7
0008 8204h	TMR0	Time constant register A	TCORA	8	8 or 16	2 to 3 PCLK *7
0008 8205h	TMR1	Time constant register A	TCORA	8	8 or 16*5	2 to 3 PCLK *7
0008 8206h	TMR0	Time constant register B	TCORB	8	8 or 16	2 to 3 PCLK *7
0008 8207h	TMR1	Time constant register B	TCORB	8	8 or 16*5	2 to 3 PCLK *7
0008 8208h	TMR0	Timer counter	TCNT	8	8 or 16	2 to 3 PCLK *7
0008 8209h	TMR1	Timer counter	TCNT	8	8 or 16*5	2 to 3 PCLK *7

Address	Module Abbreviation	Register Name	Register Abbreviation	Number of Bits	Access Size	Number of Access Cycles
0008 C069h	P9	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Ah	PA	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Bh	PB	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Ch	PC	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Dh	PD	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Eh	PE	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C06Fh	PF	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C070h	PG	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C071h	PH	Input buffer control register	ICR	8	8	2 to 3 PCLK *7
0008 C082h	P2	Open drain control register	ODR	8	8	2 to 3 PCLK *7
0008 C08Ch	PC	Open drain control register	ODR	8	8	2 to 3 PCLK *7
0008 C0CAh	PA	Pull-Up resistor control register	PCR	8	8	2 to 3 PCLK *7
0008 C0CBh	PB	Pull-Up resistor control register	PCR	8	8	2 to 3 PCLK *7
0008 C0CCh	PC	Pull-Up resistor control register	PCR	8	8	2 to 3 PCLK *7
0008 C0CDh	PD	Pull-Up resistor control register	PCR	8	8	2 to 3 PCLK *7
0008 C0CEh	PE	Pull-Up resistor control register	PCR	8	8	2 to 3 PCLK *7
0008 C100h	I/O PORT	Port function control register 0	PFCR0	8	8	2 to 3 PCLK *7
0008 C101h	I/O PORT	Port function control register 1	PFCR1	8	8	2 to 3 PCLK *7
0008 C102h	I/O PORT	Port function control register 2	PFCR2	8	8	2 to 3 PCLK *7
0008 C103h	I/O PORT	Port function control register 3	PFCR3	8	8	2 to 3 PCLK *7
0008 C104h	I/O PORT	Port function control register 4	PFCR4	8	8	2 to 3 PCLK *7
0008 C105h	I/O PORT	Port function control register 5	PFCR5	8	8	2 to 3 PCLK *7
0008 C106h	I/O PORT	Port function control register 6	PFCR6	8	8	2 to 3 PCLK *7
0008 C107h	I/O PORT	Port function control register 7	PFCR7	8	8	2 to 3 PCLK *7
0008 C108h	I/O PORT	Port function control register 8	PFCR8	8	8	2 to 3 PCLK *7
0008 C109h	I/O PORT	Port function control register 9	PFCR9	8	8	2 to 3 PCLK *7
0008 C280h	SYSTEM	Deep standby control register	DPSBYCR	8	8	4 to 5 PCLK *7
0008 C281h	SYSTEM	Deep standby wait control register	DPSWCR	8	8	4 to 5 PCLK *7
0008 C282h	SYSTEM	Deep standby interrupt enable register	DPSIER	8	8	4 to 5 PCLK *7
0008 C283h	SYSTEM	Deep standby interrupt flag register	DPSIFR	8	8	4 to 5 PCLK *7
0008 C284h	SYSTEM	Deep standby interrupt edge register	DPSIEGR	8	8	4 to 5 PCLK *7
0008 C285h	SYSTEM	Reset status register	RSTSR	8	8	4 to 5 PCLK *7
0008 C289h	FLASH	Flash write erase protection register	FWEPROR	8	8	4 to 5 PCLK *7
0008 C290h	SYSTEM	Deep standby backup register 0	DPSBKR0	8	8	4 to 5 PCLK *7
0008 C291h	SYSTEM	Deep standby backup register 1	DPSBKR1	8	8	4 to 5 PCLK *7
0008 C292h	SYSTEM	Deep standby backup register 2	DPSBKR2	8	8	4 to 5 PCLK *7
0008 C293h	SYSTEM	Deep standby backup register 3	DPSBKR3	8	8	4 to 5 PCLK *7
0008 C294h	SYSTEM	Deep standby backup register 4	DPSBKR4	8	8	4 to 5 PCLK *7
0008 C295h	SYSTEM	Deep standby backup register 5	DPSBKR5	8	8	4 to 5 PCLK *7
0008 C296h	SYSTEM	Deep standby backup register 6	DPSBKR6	8	8	4 to 5 PCLK *7
0008 C297h	SYSTEM	Deep standby backup register 7	DPSBKR7	8	8	4 to 5 PCLK *7
0008 C298h	SYSTEM	Deep standby backup register 8	DPSBKR8	8	8	4 to 5 PCLK *7
0008 C299h	SYSTEM	Deep standby backup register 9	DPSBKR9	8	8	4 to 5 PCLK *7
0008 C29Ah	SYSTEM	Deep standby backup register 10	DPSBKR10	8	8	4 to 5 PCLK *7
0008 C29Bh	SYSTEM	Deep standby backup register 11	DPSBKR11	8	8	4 to 5 PCLK *7

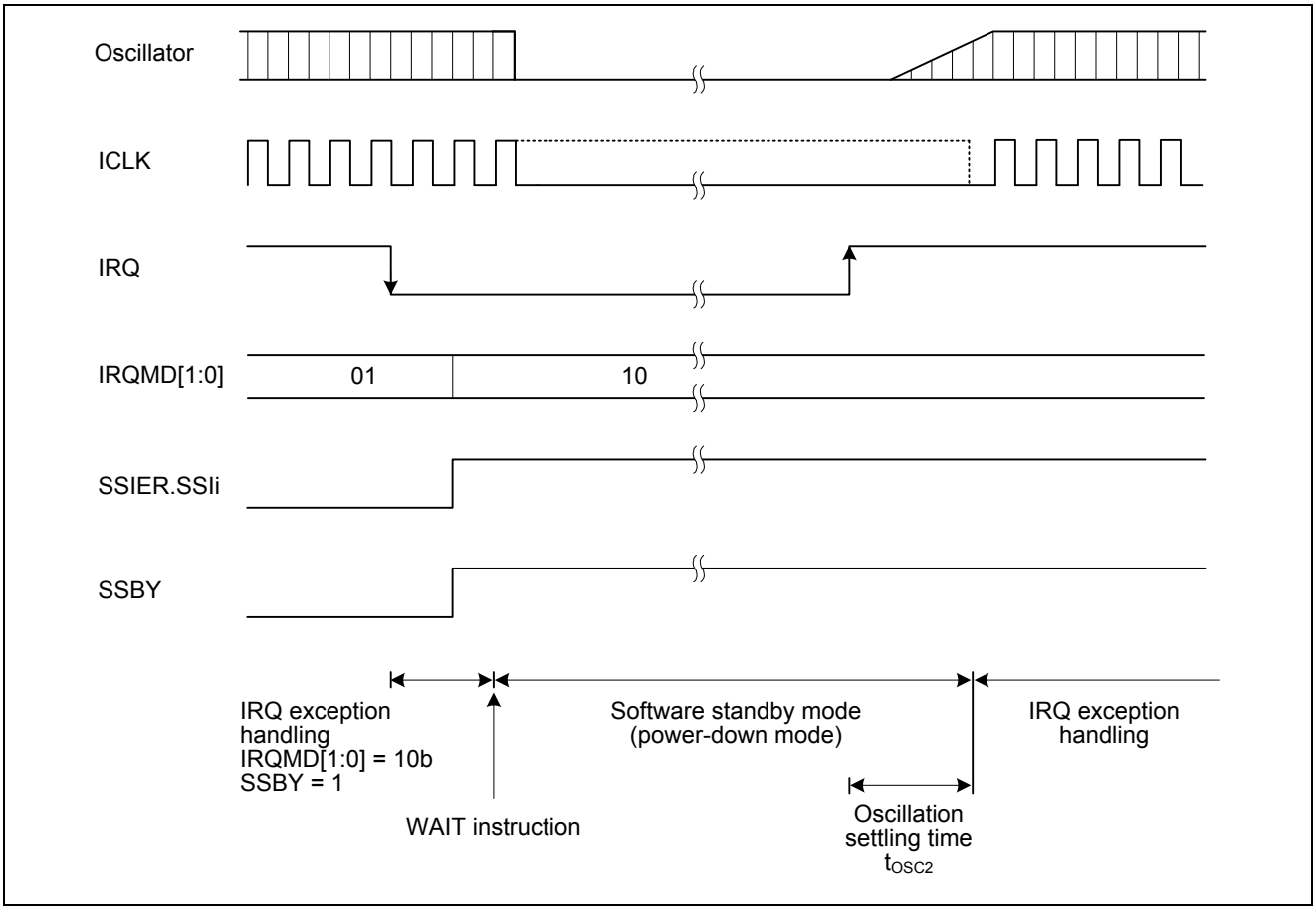


Figure 5.2 Oscillation Settling Timing after Software Standby Mode

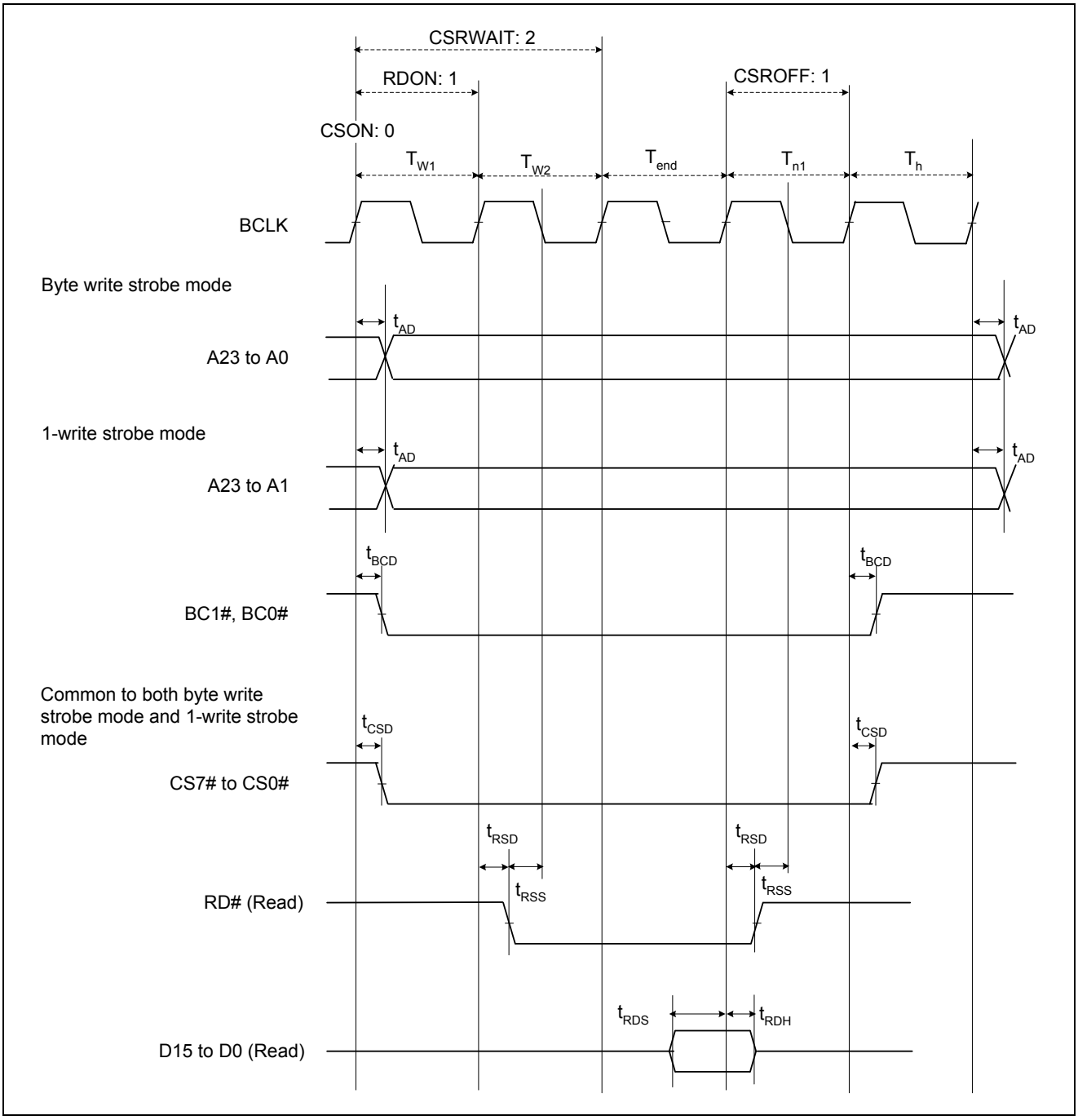
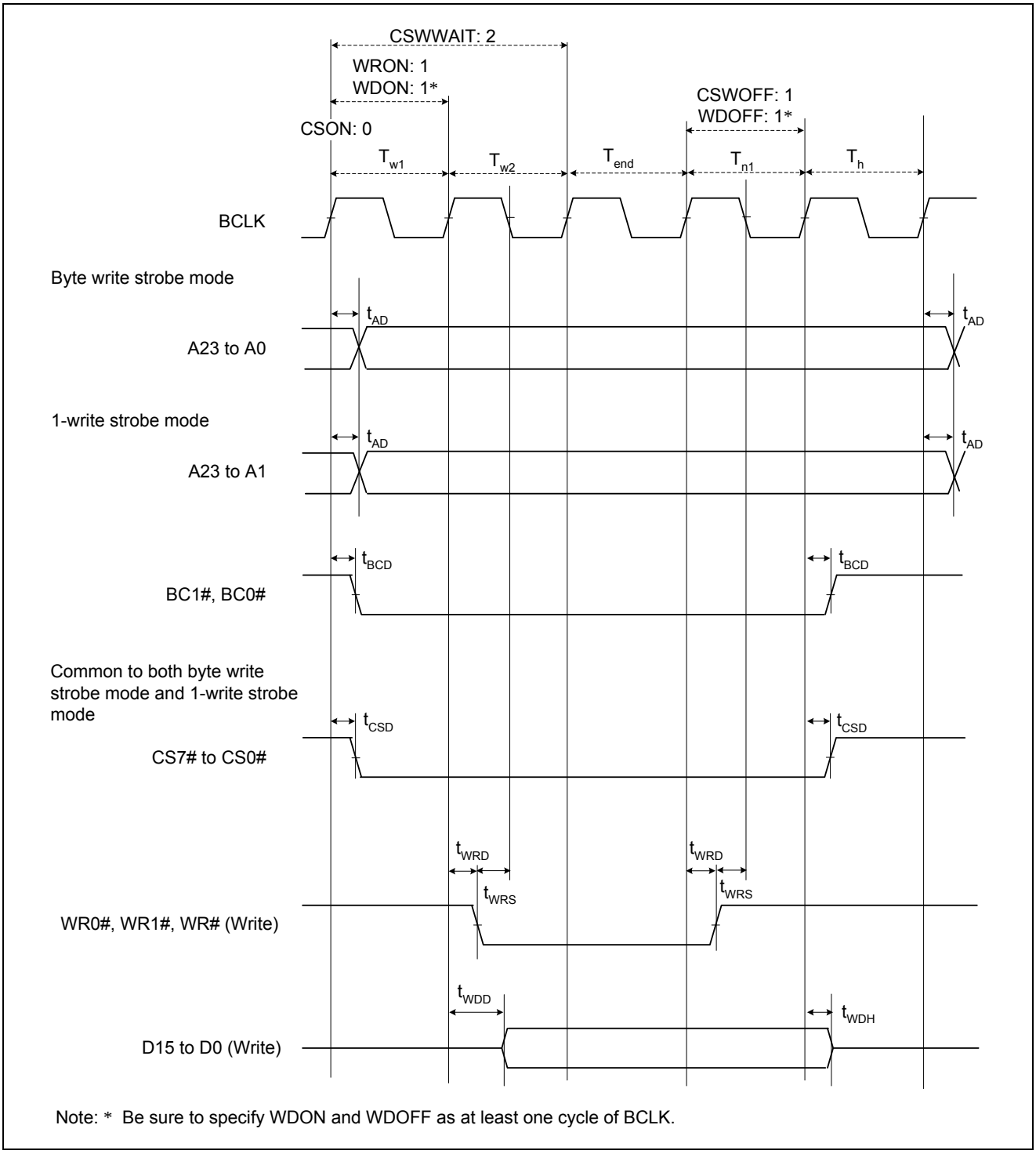


Figure 5.9 External Bus Timing/Normal Read Cycle (Bus Clock Synchronized)



Note: * Be sure to specify WDON and WDOFF as at least one cycle of BCLK.

Figure 5.10 External Bus Timing/Normal Write Cycle (Bus Clock Synchronized)

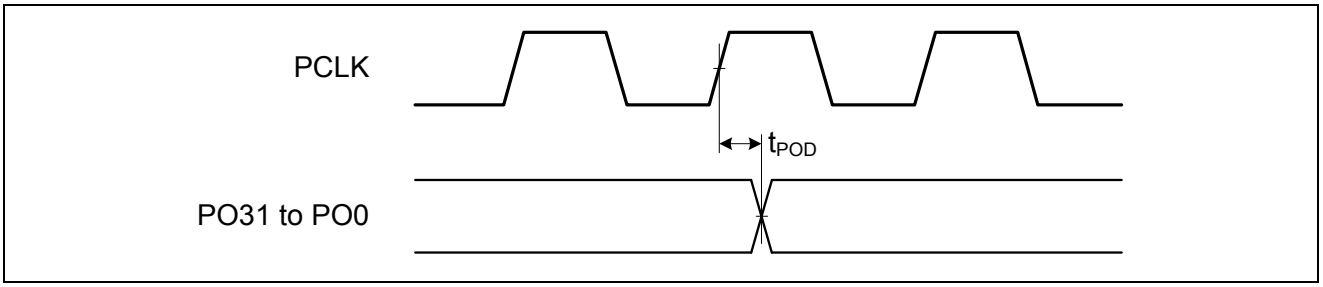


Figure 5.17 PPG Output Timing

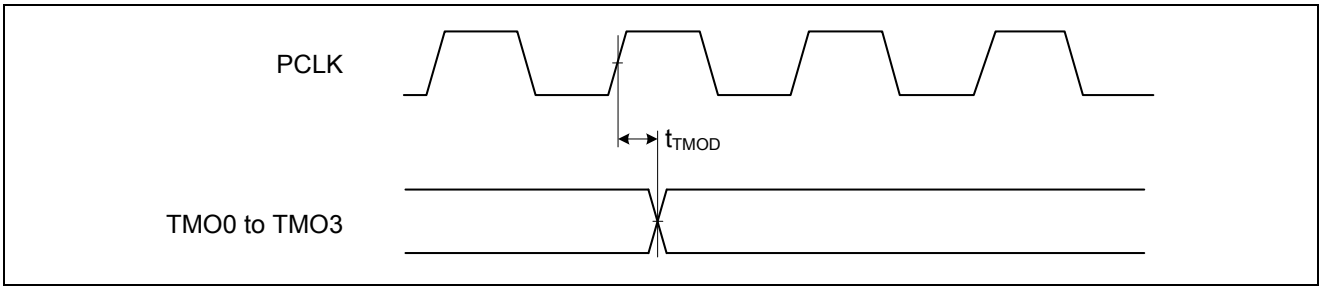


Figure 5.18 8-Bit Timer Output Timing

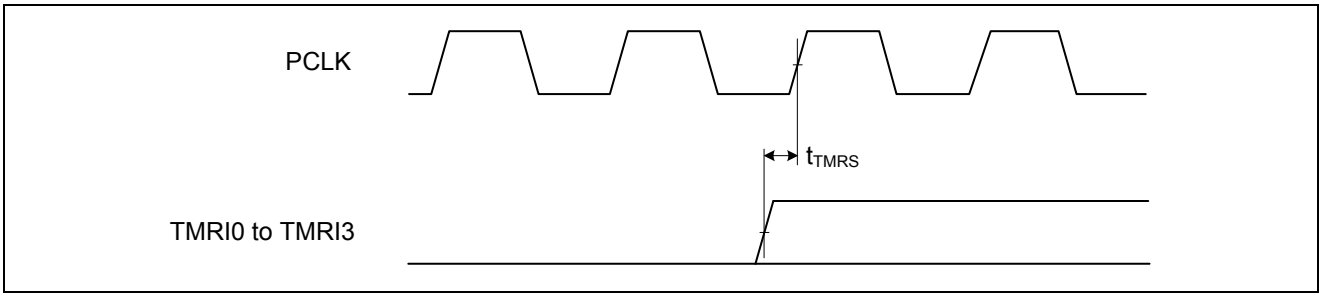


Figure 5.19 8-Bit Timer Reset Input Timing

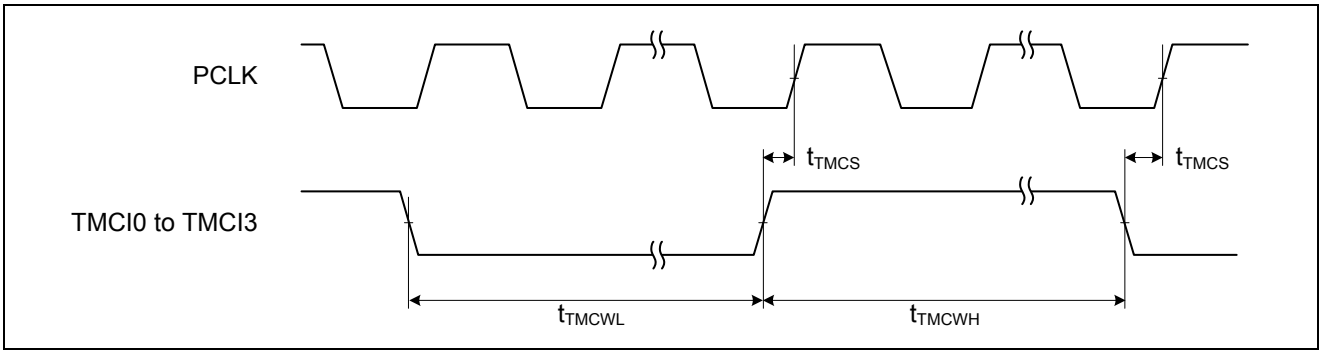


Figure 5.20 8-Bit Timer Clock Input Timing

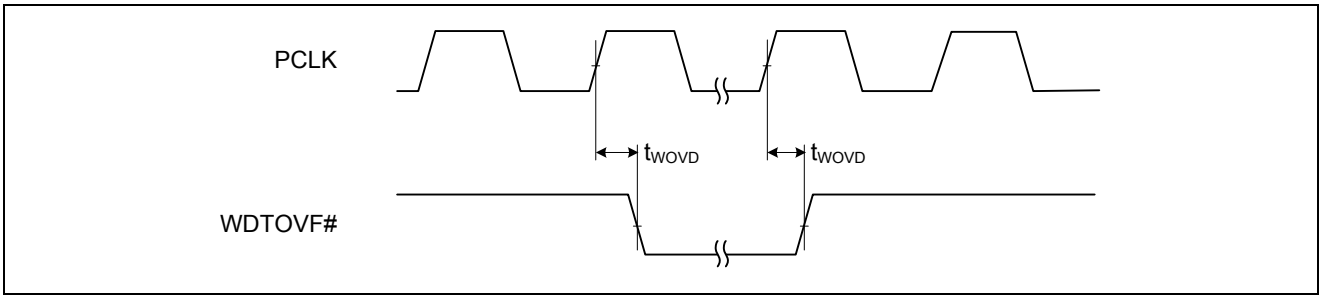


Figure 5.21 WDT Output Timing

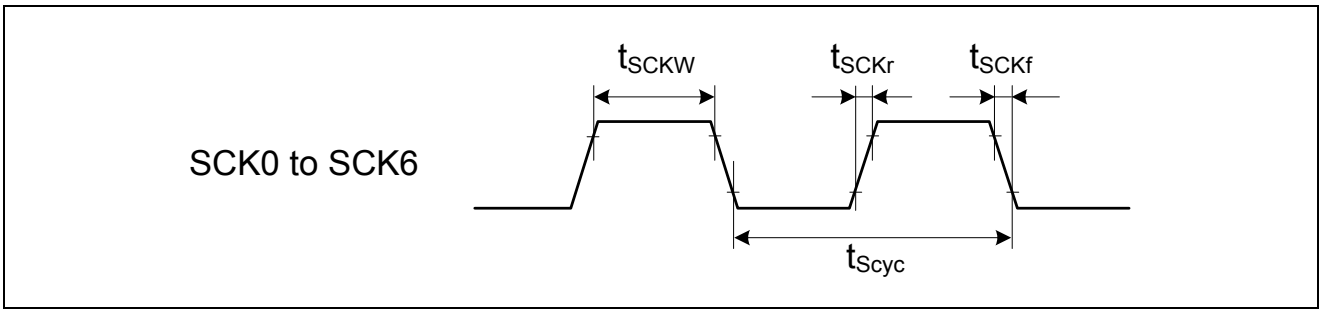


Figure 5.22 SCK Clock Input Timing

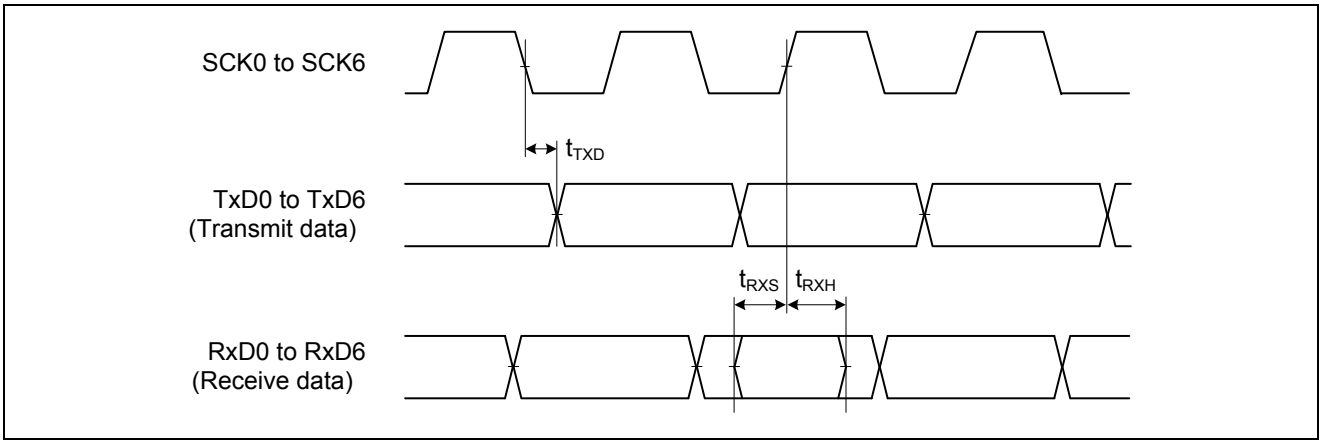


Figure 5.23 SCI Input/Output Timing: Clock Synchronous Mode

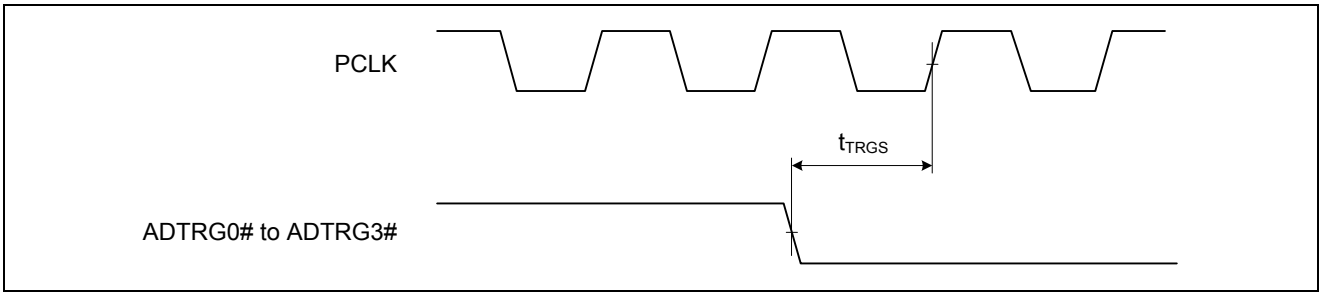


Figure 5.24 A/D Converter External Trigger Input Timing

5.4 A/D Conversion Characteristics

Table 5.9 A/D Conversion Characteristics

Conditions: V_{CC} = $PLLV_{CC}$ = AV_{CC} = 3.0 to 3.6 V, V_{REFH} = 3.0 V to AV_{CC}, V_{SS} = $PLLV_{SS}$ = V_{REFL} = 0 V, PCLK = 8 to 50 MHz, ADCLK = 4 to 50 MHz
T_a = -20 to +85°C (regular specifications), T_a = -40 to +85°C (wide-range specifications)

Item			Min.	Typ.	Max.	Unit	Test Conditions
Resolution			10	10	10	Bit	
Conversion time*1 (ADCLK = 50-MHz operation)	With 0.1-µF external capacitor	When the capacitor is charged enough*2	0.8 (0.3)*3	—	—	µs	Sampling 15 states
	Without external capacitor	Permissible signal source impedance (max.) = 1.0 kΩ	1.0 (0.5)*3	—	—		Sampling 25 states
		Permissible signal source impedance (max.) = 5.0 kΩ	2.6 (2.1)*3	—	—		Sampling 105 states
Analog input capacitance			—	—	6.0	pF	
INL integral nonlinearity error (INL)			—	±1.5	±3.0	LSB	
Offset error			—	±1.5	±3.0	LSB	
Full-scale error			—	±1.5	±3.0	LSB	
Quantization error			—	±0.5	—	LSB	
Absolute accuracy			—	±1.5	±3.0	LSB	
DNL differential nonlinearity error (DNL)			—	±0.5	±1.0	LSB	

Notes: 1. The conversion time includes the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.
2. The scanning is not supported.
3. The value in parentheses indicates the sampling time.

5.5 D/A Conversion Characteristics

Table 5.10 D/A Conversion Characteristics

Conditions: V_{CC} = $PLLV_{CC}$ = AV_{CC} = 3.0 to 3.6 V, V_{REFH} = 3.0 V to AV_{CC}, V_{SS} = $PLLV_{SS}$ = V_{REFL} = 0 V, PCLK = 8 to 50 MHz
T_a = -20 to +85°C (regular specifications), T_a = -40 to +85°C (wide-range specifications)

Item	Min.	Typ.	Max.	Unit	Test Conditions
Resolution	10	10	10	Bit	
Conversion time	—	—	3	µs	20-pF capacitive load
Absolute accuracy	—	±2.0	±4.0	LSB	2-MΩ resistive load
	—	—	±3.0	LSB	4-MΩ resistive load
	—	—	±2.0	LSB	10-MΩ resistive load
RO output resistance	—	3.6	—	kΩ	

REVISION HISTORY — RX610 Group Datasheet

		Description	
Rev.	**Data**	**Page**	**Summary**
0.50	Mar. 24, 2009	–	First edition issued
1.00	Apr. 22, 2011		1. Overview
		6	Figure 1.2 Block Diagram: Ports F to H added
		7	Figure 1.3 Pin Assignment of the 176-pin LFBGA, added
		10 to 15	Table 1.3 List of Pins and Pin Functions (176-Pin LFBGA), added
			Table 1.5 Pin Functions:
		21, 25	Description on the BSCANP, PF0 to PF6, PG0 to PG7, and PH0 to PH7 pins added
			4. I/O Registers
		34 to 54	Table 4.1 List of I/O Registers (Address Order), changed
			5. Electrical Characteristics
		58	Table 5.3 Permissible Output Currents, changed
		59	Table 5.5 Clock Timing: Oscillation settling time after leaving deep software standby mode (crystal), $t_{OSC3,}$ added
		60	Figure 5.2 Oscillation Settling Timing after Software Standby Mode, changed
		61	Figure 5.3 Oscillation Settling Timing after Deep Software Standby Mode, added
		71	Table 5.8 Timing of On-Chip Peripheral Modules (3), changed
		75	Figure 5.26 Boundary Scan TCK Timing, added
		75	Figure 5.27 Boundary Scan TRST# Timing, added
		76	Figure 5.28 Boundary Scan Input/Output Timing, added
1.20	Feb.20, 2013		1. Overview
		5	Table 1.2 List of Products, product lineup added
		23, 26	Table 1.5 Pin Functions, description on bus control changed, note added
			5. I/O register
		35 to 55	Table 5.1 List of I/O Registers (Address Order), changed