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Datasheet

RX220 Group
Renesas MCUs

R01DS0130EJ0110
Rev.1.10
Dec 20, 2013

32-MHz 32-bit RX MCUs, 49 DMIPS, up to 256-KB flash memory, 12-bit A/D, ELC, MPC, IrDA, RTC, up to 7 comms channels; incorporating functions for IEC60730 compliance

Features

■ 32-bit RX CPU core
- Max. operating frequency: 32 MHz
- Capable of 49 DMIPS in operation at 32 MHz
- Accumulator handles 64-bit results (for a single instruction) from 32- × 32-bit operations
- Multiplication and division unit handles 32- × 32-bit operations (multiplication instructions take one CPU clock cycle)
- Fast interrupt
- CISC Harvard architecture with 5-stage pipeline
- Variable-length instructions, ultra-compact code
- On-chip debugging circuit

■ Low-power design and architecture
- Operation from a single 1.62-V to 5.5-V supply
- 1.62-V operation available (at up to 8 MHz)
- Three low-power modes

■ On-chip flash memory for code, no wait states
- 32-MHz operation, 31.25-ns read cycle
- No wait states for reading at full CPU speed
- Up to 256-Kbyte capacity
- User code programmable via the SCI
- Programmable at 1.62 V
- For instructions and operands

■ On-chip data flash memory
- 8 Kbytes (Number of times of reprogramming: 100,000)
- Erasing and programming impose no load on the CPU.

■ On-chip SRAM, no wait states
- Up to 16-Kbyte size capacity

■ DMA
- DMAC: Incorporates four channels
- DTC: Four transfer modes

■ ELC
- Module operation can be initiated by event signals without going through interrupts.
- Modules can operate while the CPU is sleeping.

■ Reset and supply management
- Seven types of reset, including the power-on reset (POR)
- Low voltage detection (LVD) with voltage settings

■ Clock functions
- Frequency of external clock: Up to 20 MHz
- Frequency of the oscillator for sub-clock generation: 32.768 kHz
- On-chip low- and high-speed oscillators, dedicated on-chip low-speed oscillator for the IWDT
- Generation of a dedicated 32.768-kHz clock for the RTC
- Clock frequency accuracy measurement circuit (CAC)

■ Real-time clock
- Adjustment functions (30 seconds, leap year, and error)
- Year and month display or 32-bit second display (binary counter) is selectable



PLQP0100KB-A 14 × 14 mm, 0.5-mm pitch
PLQP0064KB-A 10 × 10 mm, 0.5-mm pitch
PLQP0048KB-A 7 × 7 mm, 0.5-mm pitch
PLQP0064GA-A 14 × 14 mm, 0.8-mm pitch

■ Independent watchdog timer
- 125-kHz on-chip oscillator produces a dedicated clock signal to drive IWDT operation.

■ Useful functions for IEC60730 compliance
- Self-diagnostic and disconnection-detection assistance functions for the A/D converter, clock-frequency accuracy-measurement circuit, independent watchdog timer, functions to assist in RAM testing, etc.

■ Up to seven communications channels
- SCI with many useful functions (up to five channels) Asynchronous mode, clock synchronous mode, smart card interface mode
- IrDA Interface (one channel, in cooperation with the SCI5)
- I^2C bus interface: Transfer at up to 400 kbps, capable of SMBus operation (one channel)
- RSPI (one channel)

■ Up to 14 extended-function timers
- 16-bit MTU: input capture, output capture, complementary PWM output, phase counting mode (six channels)
- 8-bit TMR (four channels)
- 16-bit compare-match timers (four channels)

■ 12-bit A/D converter
- Capable of conversion within 1.56 µs
- Self-diagnostic function and analog input disconnection detection assistance function

■ Analog comparator

■ General I/O ports
- 5-V tolerant, open drain, input pull-up, switching of driving ability

■ MPC
- Multiple locations are selectable for I/O pins of peripheral functions

■ Operating temp. range
- –40°C to +85°C
- –40°C to +105°C

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1. Overview

1.1 Outline of Specifications

Table 1.1 lists the specifications in outline, and Table 1.2 gives a comparison of the functions of products in different packages.
Table 1.1 is for products with the greatest number of functions, so numbers of peripheral modules and channels will differ in accord with the package. For details, see Table 1.2, Comparison of Functions for Different Packages.

Table 1.1 Outline of Specifications (1 / 3)

Classification	Module/Function	Description
CPU	CPU	• Maximum operating frequency: 32 MHz • 32-bit RX CPU • Minimum instruction execution time: One instruction per state (cycle of the system clock) • Address space: 4-Gbyte linear • Register General purpose: Sixteen 32-bit registers Control: Eight 32-bit registers Accumulator: One 64-bit register • Basic instructions: 73 • DSP instructions: 9 • Addressing modes: 10 • Data arrangement Instructions: Little endian Data: Selectable as little endian or big endian • On-chip 32-bit multiplier: 32 × 32 → 64 bits • On-chip divider: 32 / 32 → 32 bits • Barrel shifter: 32 bits
Memory	ROM	• Capacity: 32 K/64 K/128 K/256 Kbytes • 32 MHz, no-wait memory access • On-board programming: 3 types
	RAM	• Capacity: 4 K/8 K/16 Kbytes • 32 MHz, no-wait memory access
	E2 DataFlash	E2 DataFlash capacity: 8 Kbytes
MCU operating mode		Single-chip mode
Clock	Clock generation circuit	• Main clock oscillator, sub-clock oscillator, low-speed on-chip oscillator, high-speed on-chip oscillator, and IWDT-dedicated on-chip oscillator • Oscillation stop detection • Measuring circuit for accuracy of clock frequency (clock-accuracy check: CAC) • Independent settings for the system clock (ICLK), peripheral module clock (PCLK), and flashIF clock (FCLK) The CPU and system sections such as other bus masters run in synchronization with the system clock (ICLK): 32 MHz (at max.) Peripheral modules run in synchronization with the peripheral module clock (PCLK): 32 MHz (at max.) The flash peripheral circuit runs in synchronization with the flash peripheral clock (FCLK): 32 MHz (at max.)
Reset		RES# pin reset, power-on reset, voltage monitoring reset, independent watchdog timer reset, and software reset
Voltage detection	Voltage detection circuit (LVDAa)	• When the voltage on VCC falls below the voltage detection level, an internal reset or internal interrupt is generated. Voltage detection circuit 0 is capable of selecting the detection voltage from 4 levels Voltage detection circuit 1 is capable of selecting the detection voltage from 16 levels Voltage detection circuit 2 is capable of selecting the detection voltage from 16 levels
Low power consumption	Low power consumption facilities	• Module stop function • Three low power consumption modes Sleep mode, all-module clock stop mode, and software standby mode
	Function for lower operating power consumption	• Four operating power control modes Middle-speed operating mode 1A, middle-speed operating mode 1B, low-speed operating mode 1, low-speed operating mode 2
Interrupt	Interrupt controller (ICUb)	• Interrupt vectors: 106 • External interrupts: 9 (NMI, IRQ0 to IRQ7 pins) • Non-maskable interrupts: 5 (the NMI pin, oscillation stop detection interrupt, voltage monitoring 1 interrupt, voltage monitoring 2 interrupt, and IWDT interrupt) • 16 levels specifiable for the order of priority

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Table 1.1 Outline of Specifications (2 / 3)

Classification	Module/Function	Description
DMA	DMA controller (DMACA)	• 4 channels • Three transfer modes: Normal transfer, repeat transfer, and block transfer • Activation sources: Software trigger, external interrupts, and interrupt requests from peripheral functions
	Data transfer controller (DTCa)	• Three transfer modes: Normal transfer, repeat transfer, and block transfer • Activation sources: Interrupts • Chain transfer function
I/O ports	General I/O ports	100-pin/64-pin/48-pin • I/O pin: 84/48/34 • Input: 1/1/1 • Pull-up resistors: 84/48/34 • Open-drain outputs: 35/26/20 • 5-V tolerance: 4/2/2 • 8-bit port switching function: Not supported/supported/supported
Event link controller (ELC)		• Event signals of 46 types can be directly connected to the module • Operations of timer modules are selectable at event input • Capable of event link operation for port B
Multi-function pin controller (MPC)		• Capable of selecting input/output function from multiple pins
Timers	Multi-function timer pulse unit 2 (MTU2a)	• (16 bits × 6 channels) × 1 unit • Time bases for the six 16-bit timer channels can be provided via up to 16 pulse-input/output lines and three pulse-input lines • 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 (PCLK/1, 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)
	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 (RTCc)	• Clock source: Sub-clock • Time count or 32-bit binary count in second units basis selectable • Time/calendar • Interrupt sources: Alarm interrupt, periodic interrupt, and carry interrupt

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Table 1.1 Outline of Specifications (3 / 3)

Classification	Module/Function	Description
Communication function	Serial communications interfaces (SCIe, SCIf)	• 5 channels (channel 1, 5, 6, and 9: SCIe, channel 12: SCIf) (including one channel for IrDA) • Serial communications modes: Asynchronous, clock synchronous, and smart-card interface • On-chip baud rate generator allows selection of the desired bit rate • Choice of LSB-first or MSB-first transfer • Average transfer rate clock can be input from TMR timers (SCI5, SCI6, and SCI12) • Simple IIC • Simple SPI • Master/slave mode supported (SCIf only) • Start frame and information frame are included (SCIf only) • Detection of a start bit in asynchronous mode: Low level or falling edge is selectable (SCIe/SCIf)
	IrDA interface (IRDA)	• 1 channel (SCI5 is used) • Supports encoding/decoding the waveforms conforming to the IrDA specification version 1.0
	I^2C bus interface (RIIC)	• 1 channel • Communications formats: I^2C bus format/SMBus format • Master/slave selectable • Supports the fast mode
	Serial peripheral interface (RSPI)	• 1 channel • Transfer facility Using the MOSI (master out, slave in), MISO (master in, slave out), SSL (slave select), and RSPCK (RSPI clock) signals enables serial transfer through SPI operation (four lines) or clock-synchronous operation (three lines) • Capable of handling serial transfer as a master or slave • Data formats • Choice of LSB-first or MSB-first transfer The number of bits in each transfer can be changed to any number of bits from 8 to 16, 20, 24, or 32 bits. 128-bit buffers for transmission and reception Up to four frames can be transmitted or received in a single transfer operation (with each frame having up to 32 bits) • Double buffers for both transmission and reception
12-bit A/D converter (S12ADb)		• 12 bits (16 channels × 1 unit) • 12-bit resolution • Minimum conversion time: 1.56 μs per channel (in operation with ADCLK at 32 MHz) • Operating modes Scan mode (single scan mode, continuous scan mode, and group scan mode) • Sample-and-hold function • Self-diagnosis for the A/D converter • Assistance in detecting disconnected analog inputs • Double-trigger mode (duplication of A/D conversion data) • A/D conversion start conditions A software trigger, a trigger from a timer (MTU), an external trigger signal, or ELC
CRC calculator (CRC)		• CRC code generation for any desired data in 8-bit units • Select any of three generating polynomials: $X^8 + X^2 + X + 1$, $X^{16} + X^{15} + X^2 + 1$, or $X^{16} + X^{12} + X^5 + 1$ • Generation of CRC codes for use with LSB-first or MSB-first communications is selectable.
Comparator A (CMPA)		• 2 channels • Comparison of reference voltage and analog input voltage
Data Operation Circuit (DOC)		Comparison, addition, and subtraction of 16-bit data
Power supply voltage/Operating frequency		VCC = 1.62 to 2.7 V: 8 MHz, VCC = 2.7 to 5.5 V: 32 MHz
Operating temperature		D version: −40 to +85°C, G version: −40 to +105°C*1
Package		100-pin LQFP (PLQP0100KB-A) 64-pin LQFP (PLQP0064KB-A) 64-pin LQFP (PLQP0064GA-A) 48-pin LQFP (PLQP0048KB-A)

Note 1. 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.

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Table 1.2 Comparison of Functions for Different Packages

Module/Functions		RX220 Group		
		100 Pins	**64 Pins**	**48 Pins**
Interrupt	External interrupts	NMI, IRQ0 to IRQ7	NMI, IRQ0 to IRQ2, IRQ4 to IRQ7	NMI, IRQ0, IRQ1, IRQ4 to IRQ7
DMA	DMA controller	4 channels (DMAC0 to DMAC3)		
	Data transfer controller	Supported		
Timers	Multi-function timer pulse unit 2	6 channels (MTU0 to MTU5)		
	Port output enable 2	POE0# to POE3#, POE8#		
	8-bit timer	2 channels × 2 units		
	Compare match timer	2 channels × 2 units		
	Realtime clock	Supported		Not supported
	Independent watchdog timer	Supported		
Communication function	Serial communications interface (SCIe)	4 channels (SCI1, 5, 6, 9) (including one channel for IrDA)		3 channels (SCI1, 5, 6) (including one channel for IrDA)
	Serial communications interface (SCIf)	1 channel (SCI12)		
	I^2C bus interface	1 channel		
	Serial peripheral interface	1 channel		
12-bit A/D converter		16 channels (AN000 to AN015)	12 channels (AN000 to AN004, AN006, AN008 to AN013)	8 channels (AN000, AN003, AN004, AN006, AN009 to AN012)
CRC calculator		Supported		
Event link controller		Supported		
Comparator A		2 channels		
8-bit port switching function		Not supported in 100-pin packages	Supported in 64-pin packages Switches PB6 to PC0 and PB7 to PC1	Supported in 48-pin packages Switches PB0 to PC0, PB1 to PC1, PB3 to PC2, and PB5 to PC3
Package		100-pin LQFP	64-pin LQFP	48-pin LQFP

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1.2 List of Products

Table 1.3 is a list of products, and Figure 1.1 shows how to read the product part no., memory capacity, and package type.

Table 1.3 List of Products

Group	Part No.	Package	ROM Capacity	RAM Capacity	Operating Frequency (Max.)	Operating temperature
RX220	R5F52206BDFP	PLQP0100KB-A	256 Kbytes	16 Kbytes	32 MHz	–40 to +85°C
	R5F52206BDFM	PLQP0064KB-A				
	R5F52206BDFK	PLQP0064GA-A				
	R5F52206BDFL	PLQP0048KB-A				
	R5F52205BDFP	PLQP0100KB-A	128 Kbytes	8 Kbytes		
	R5F52205BDFM	PLQP0064KB-A				
	R5F52205BDFK	PLQP0064GA-A				
	R5F52205BDFL	PLQP0048KB-A				
	R5F52203BDFP	PLQP0100KB-A	64 Kbytes			
	R5F52203BDFM	PLQP0064KB-A				
	R5F52203BDFK	PLQP0064GA-A				
	R5F52203BDFL	PLQP0048KB-A				
	R5F52201BDFM	PLQP0064KB-A	32 Kbytes	4Kbytes		
	R5F52201BDFK	PLQP0064GA-A				
	R5F52201BDFL	PLQP0048KB-A				
	R5F52206BGFP	PLQP0100KB-A	256 Kbytes	16 Kbytes	32 MHz	–40 to +105°C
	R5F52206BGFM	PLQP0064KB-A				
	R5F52206BGFK	PLQP0064GA-A				
	R5F52206BGFL	PLQP0048KB-A				
	R5F52205BGFP	PLQP0100KB-A	128 Kbytes	8 Kbytes		
	R5F52205BGFM	PLQP0064KB-A				
	R5F52205BGFK	PLQP0064GA-A				
	R5F52205BGFL	PLQP0048KB-A				
	R5F52203BGFP	PLQP0100KB-A	64 Kbytes			
	R5F52203BGFM	PLQP0064KB-A				
	R5F52203BGFK	PLQP0064GA-A				
	R5F52203BGFL	PLQP0048KB-A				
	R5F52201BGFM	PLQP0064KB-A	32 Kbytes	4Kbytes		
	R5F52201BGFK	PLQP0064GA-A				
	R5F52201BGFL	PLQP0048KB-A				

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.

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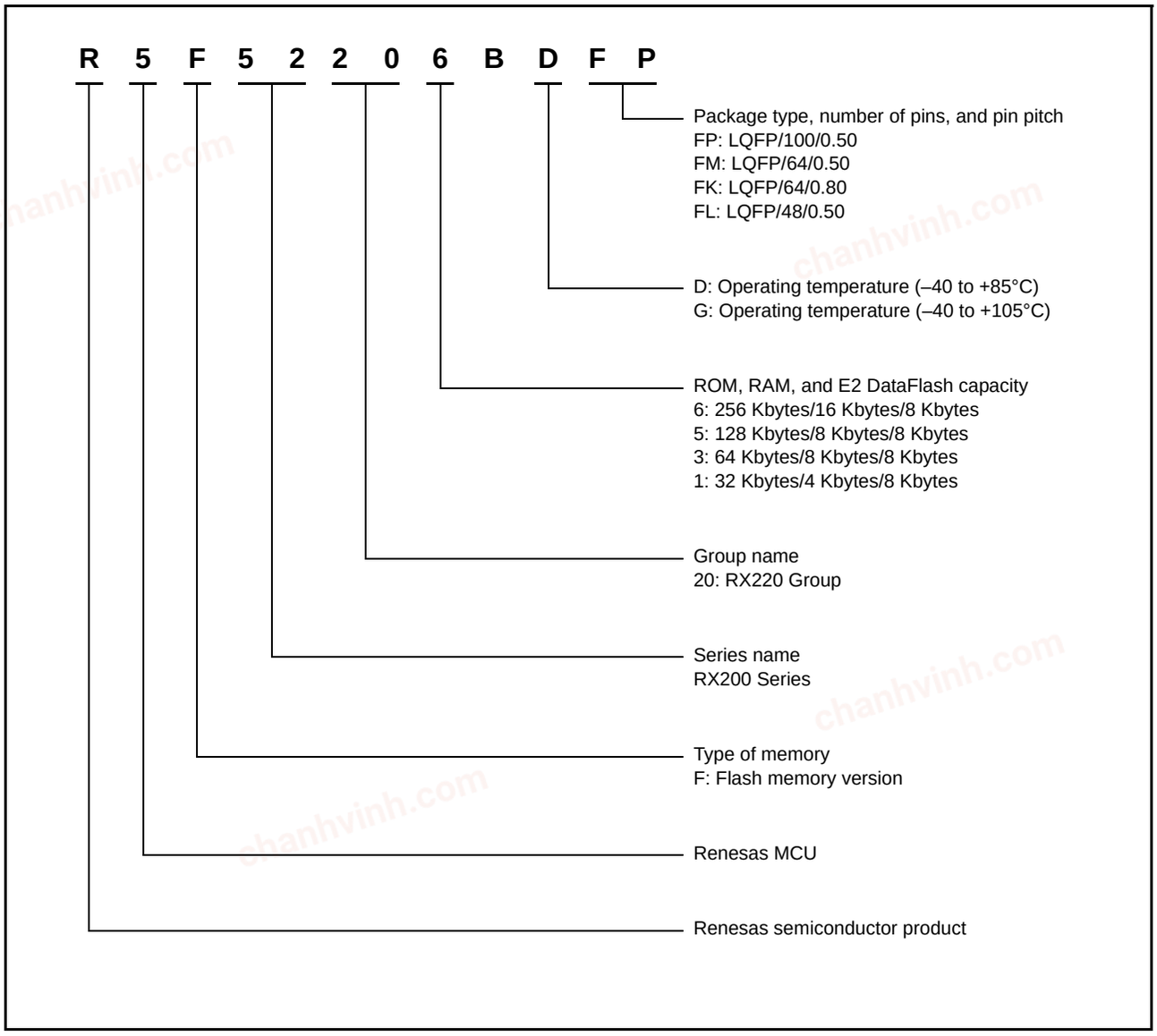
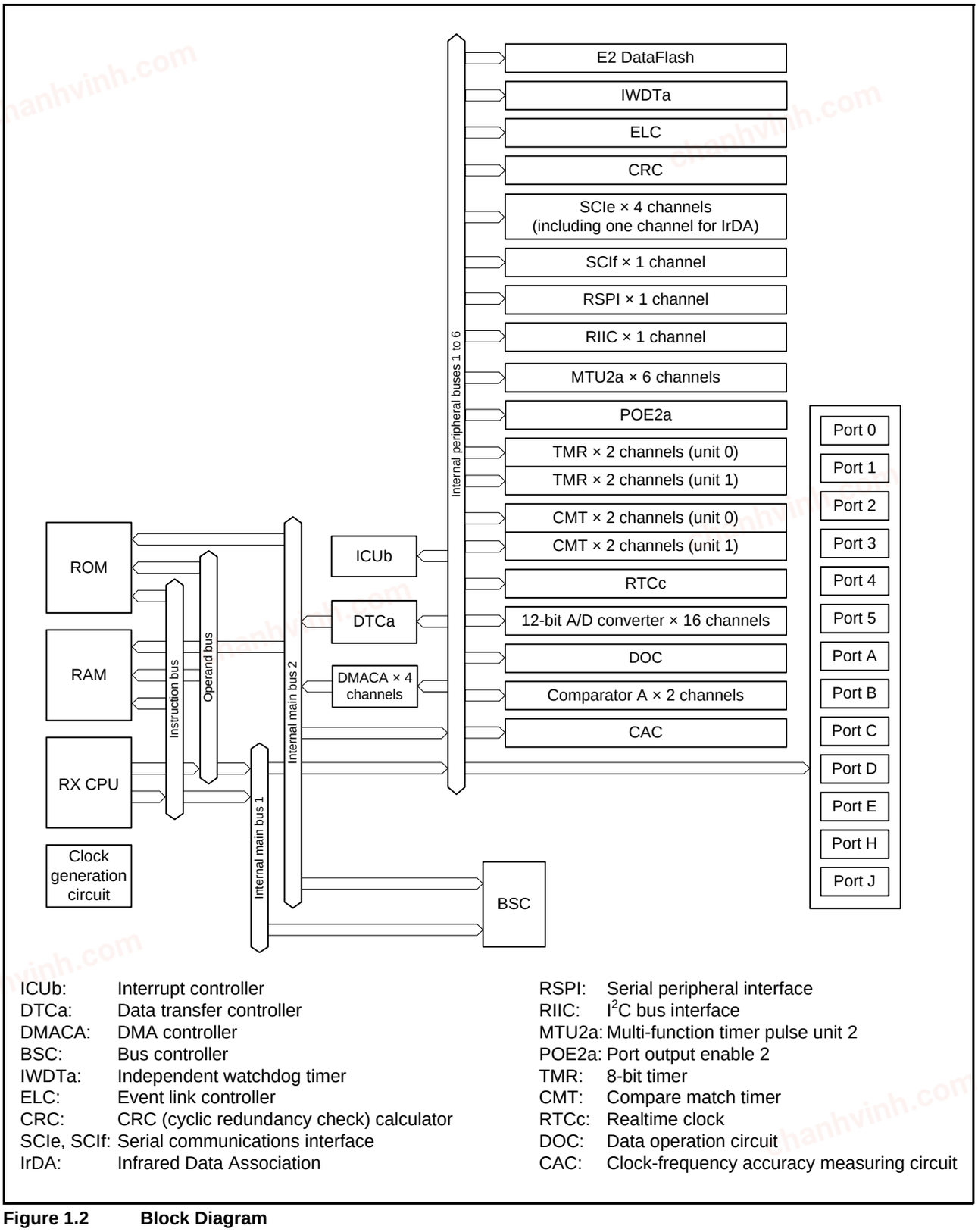


Figure 1.1 How to Read the Product Part No., Memory Capacity, and Package Type

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1.3 Block Diagram

Figure 1.2 shows a block diagram.



ICUb: Interrupt controller
DTCa: Data transfer controller
DMACA: DMA controller
BSC: Bus controller
IWDTa: Independent watchdog timer
ELC: Event link controller
CRC: CRC (cyclic redundancy check) calculator
SCIe, SCIf: Serial communications interface
IrDA: Infrared Data Association

RSPI: Serial peripheral interface
RIIC: I^2C bus interface
MTU2a: Multi-function timer pulse unit 2
POE2a: Port output enable 2
TMR: 8-bit timer
CMT: Compare match timer
RTCc: Realtime clock
DOC: Data operation circuit
CAC: Clock-frequency accuracy measuring circuit

Figure 1.2 Block Diagram

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1.4 Pin Functions

Table 1.4 lists the pin functions.

Table 1.4 Pin Functions (1 / 3)

Classifications	Pin Name	I/O	Description
Power supply	VCC	Input	Power supply pin. Connect it to the system power supply.
	VCL	—	Connect this pin to the VSS pin via the 0.1 μF smoothing capacitor used to stabilize the internal power supply. Place the capacitor close to the pin.
	VSS	Input	Ground pin. Connect it to the system power supply (0 V).
Clock	XTAL	Output	Pins for connecting a crystal resonator. An external clock signal can be input through the EXTAL pin.
	EXTAL	Input	
	XCIN	Input	Input/output pins for the sub-clock generation circuit. Connect a crystal resonator between XCIN and XCOUT.
	XCOUT	Output	
Operating mode control	MD	Input	Pin for setting the operating mode. The signal levels on this pin must not be changed during operation.
System control	RES#	Input	Reset signal input pin. This LSI enters the reset state when this signal goes low.
CAC	CACREF	Input	Input pin for the measuring circuit for clock frequency precision.
On-chip emulator	FINED	I/O	FINE interface pin.
Interrupt	NMI	Input	Non-maskable interrupt request pin.
	IRQ0 to IRQ7	Input	Interrupt request pins.
Multi-function timer pulse unit	MTIOC0A, MTIOC0B MTIOC0C, MTIOC0D	I/O	The TGRA0 to TGRD0 input capture input/output compare output/ PWM output pins.
	MTIOC1A, MTIOC1B	I/O	The TGRA1 and TGRB1 input capture input/output compare output/ PWM output pins.
	MTIOC2A, MTIOC2B	I/O	The TGRA2 and TGRB2 input capture input/output compare output/ PWM output pins.
	MTIOC3A, MTIOC3B MTIOC3C, MTIOC3D	I/O	The TGRA3 to TGRD3 input capture input/output compare output/ PWM output pins.
	MTIOC4A, MTIOC4B MTIOC4C, MTIOC4D	I/O	The TGRA4 to TGRD4 input capture input/output compare output/ PWM output pins.
	MTIC5U, MTIC5V, MTIC5W	Input	The TGRU5, TGRV5, and TGRW5 input capture input/external pulse input pins.
	MTCLKA, MTCLKB, MTCLKC, MTCLKD	Input	Input pins for external clock.
Port output enable	POE0# to POE3#, POE8#	Input	Input pins for request signals to place the MTU pins in the high impedance state.
8-bit timer	TMO0 to TMO3	Output	Compare match output pins.
	TMCI0 to TMCI3	Input	Input pins for external clocks to be input to the counter.
	TMRI0 to TMRI3	Input	Input pins for the counter reset.
Realtime clock	RTCOUT	Output	Output pin for 1-Hz clock.

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Table 1.4 Pin Functions (2 / 3)

Classifications	Pin Name	I/O	Description
Serial communications interface (SCIe)	• Asynchronous mode/clock synchronous mode		
	SCK1, SCK5, SCK6, SCK9	I/O	Input/output pins for clock
	RXD1, RXD5, RXD6, RXD9	Input	Input pins for received data
	TXD1, TXD5, TXD6, TXD9	Output	Output pins for transmitted data
	CTS1#, CTS5#, CTS6#, CTS9#	Input	Input pins for controlling the start of transmission and reception
	RTS1#, RTS5#, RTS6#, RTS9#	Output	Output pins for controlling the start of transmission and reception
	• Simple I^2C mode		
	SSCL1, SSCL5, SSCL6, SSCL9	I/O	Input/output pins for the I^2C clock
	SSDA1, SSDA5, SSDA6, SSDA9	I/O	Input/output pins for the I^2C data
	• Simple SPI mode		
	SCK1, SCK5, SCK6, SCK9	I/O	Input/output pins for the clock
	SMISO1, SMISO5, SMISO6, SMISO9	I/O	Input/output pins for slave transmission of data
	SMOSI1, SMOSI5, SMOSI6, SMOSI9	I/O	Input/output pins for master transmission of data
	SS1#, SS5#, SS6#, SS9#	Input	Chip-select input pins
	• IrDA Interface		
	IRTXD5	Output	Data output pin in the IrDA format
	IRRXD5	Input	Data input pin in the IrDA format
Serial communications interface (SCIf)	• Asynchronous mode/clock synchronous mode		
	SCK12	I/O	Input/output pin for the clock
	RXD12	Input	Input pin for received data
	TXD12	Output	Output pin for transmitted data
	CTS12#	Input	Input pin for controlling the start of transmission and reception
	RTS12#	Output	Output pin for controlling the start of transmission and reception
	• Simple I^2C mode		
	SSCL12	I/O	Input/output pin for the I^2C clock
	SSDA12	I/O	Input/output pin for the I^2C data
	• Simple SPI mode		
	SCK12	I/O	Input/output pin for the clock
	SMISO12	I/O	Input/output pin for slave transmit data
	SMOSI12	I/O	Input/output pin for master transmit data
	SS12#	Input	Chip-select input pin
	• Extended serial mode		
	RXDX12	Input	Input pin for data reception by SCIf
	TXDX12	Output	Output pin for data transmission by SCIf
	SIOX12	I/O	Input/output pin for data reception or transmission by SCIf
I^2C bus interface	SCL	I/O	Input/output pin for I^2C bus interface clocks. Bus can be directly driven by the N-channel open-drain output.
	SDA	I/O	Input/output pin for I^2C bus interface data. Bus can be directly driven by the N-channel open-drain output.

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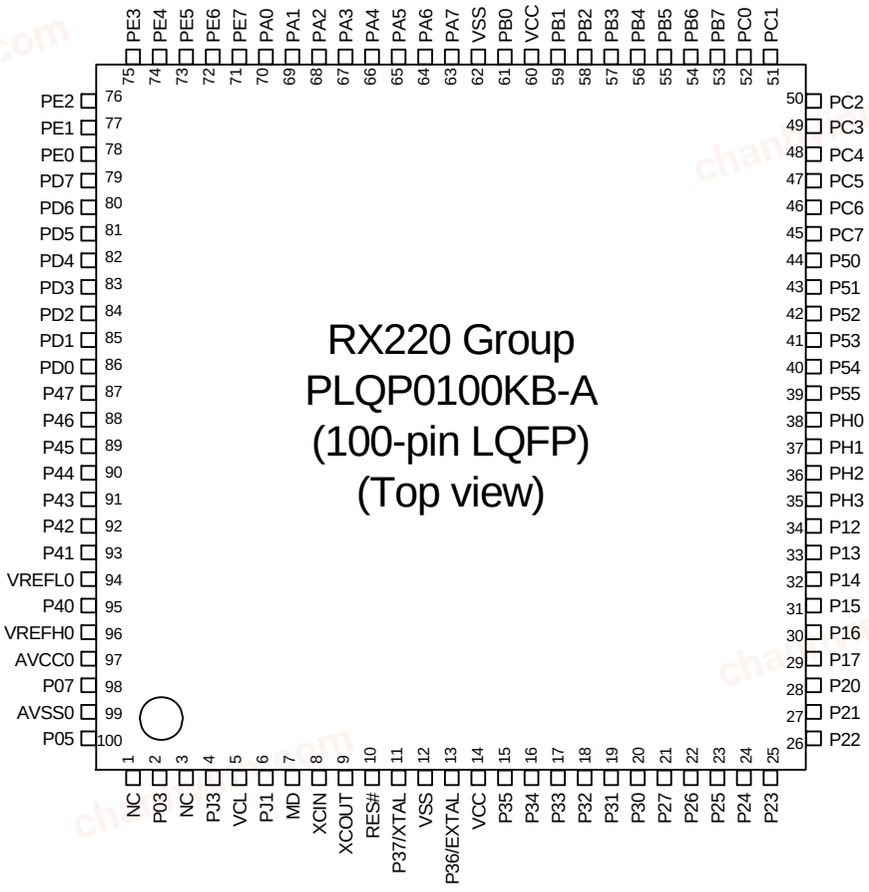
Table 1.4 Pin Functions (3 / 3)

Classifications	Pin Name	I/O	Description
Serial peripheral interface	RSPCKA	I/O	Clock input/output pin for the RSPI.
	MOSIA	I/O	Input or output data output from the master for the RSPI.
	MISOA	I/O	Input or output data output from the slave for the RSPI.
	SSLA0	I/O	Input/output pin to select the slave for the RSPI.
	SSLA1 to SSLA3	Output	Output pins to select the slave for the RSPI.
12-bit A/D converter	AN000 to AN015	Input	Input pin for the analog signals to be processed by the A/D converter.
	ADTRG0#	Input	Input pin for the external trigger signals that start the A/D conversion.
Comparator A	CMPA1	Input	Input analog pin for the comparator A1.
	CMPA2	Input	Input analog pin for the comparator A2.
	CVREFA	Input	Input pin for the comparator reference voltage.
Analog power supply	AVCC0	Input	Analog voltage supply pin for the 12-bit A/D converter. Connect this pin to VCC if the 12-bit A/D converter is not to be used.
	AVSS0	Input	Analog ground pin for the 12-bit A/D converter. Connect this pin to VSS if the 12-bit A/D converter is not to be used.
	VREFH0	Input	Analog reference voltage supply pin for the 12-bit A/D converter. Connect this pin to VCC if the 12-bit A/D converter is not to be used.
	VREFL0	Input	Analog reference ground pin for the 12-bit A/D converter. Connect this pin to VSS if the 12-bit A/D converter is not to be used.
I/O ports	P03, P05, P07	I/O	3-bit input/output pins.
	P12 to P17	I/O	6-bit input/output pins.
	P20 to P27	I/O	8-bit input/output pins.
	P30 to P37	I/O	8-bit input/output pins. (P35 input pin)
	P40 to P47	I/O	8-bit input/output pins.
	P50 to P55	I/O	6-bit input/output pins.
	PA0 to PA7	I/O	8-bit input/output pins.
	PB0 to PB7	I/O	8-bit input/output pins.
	PC0 to PC7	I/O	8-bit input/output pins.
	PD0 to PD7	I/O	8-bit input/output pins.
	PE0 to PE7	I/O	8-bit input/output pins.
	PH0 to PH3	I/O	4-bit input/output pins.
	PJ1, PJ3	I/O	2-bit input/output pins.

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1.5 Pin Assignments

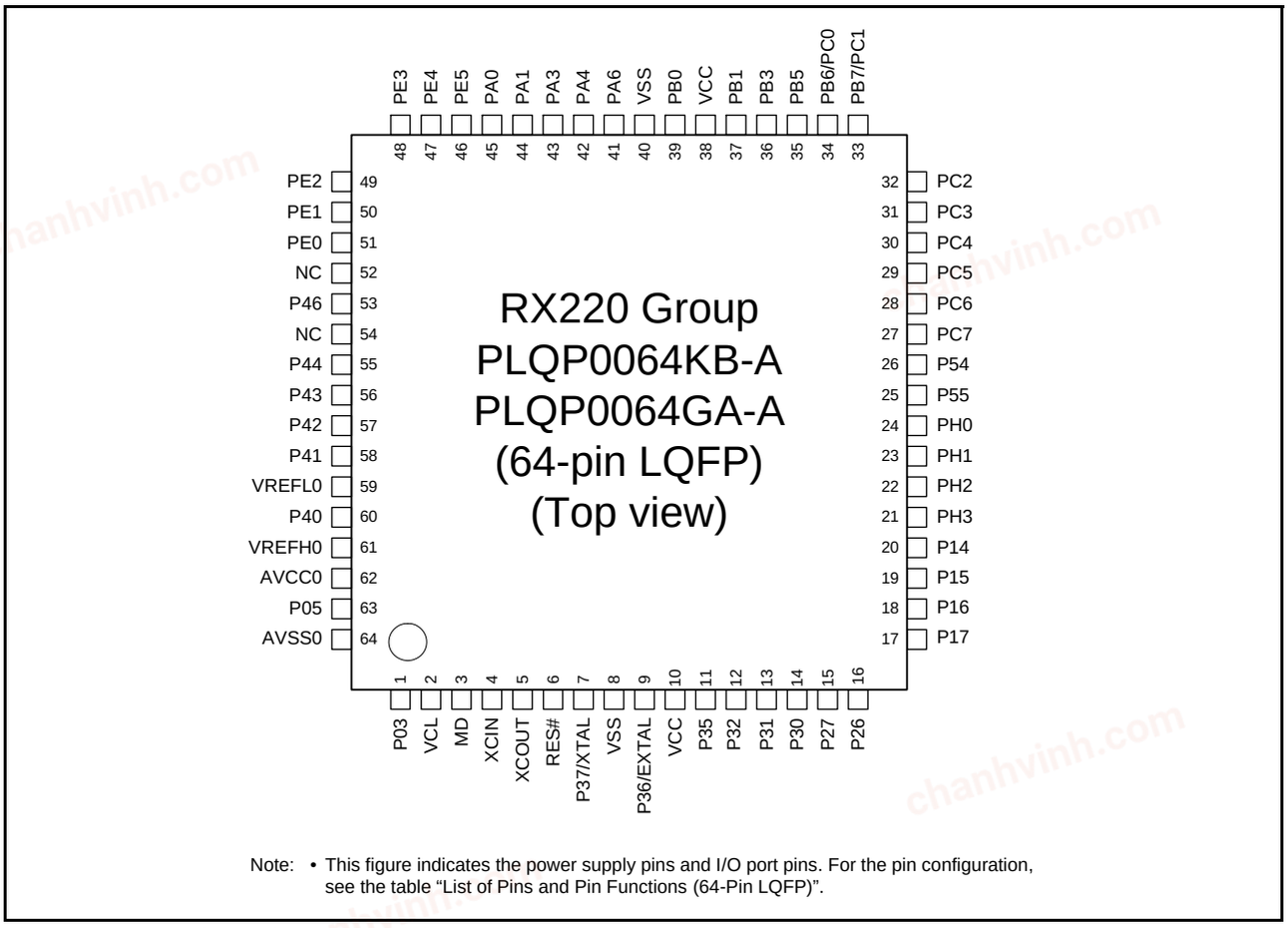
Figure 1.3 to Figure 1.5 show the pin assignments. Table 1.5 to Table 1.7 show the lists of pins and pin functions.



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)”.

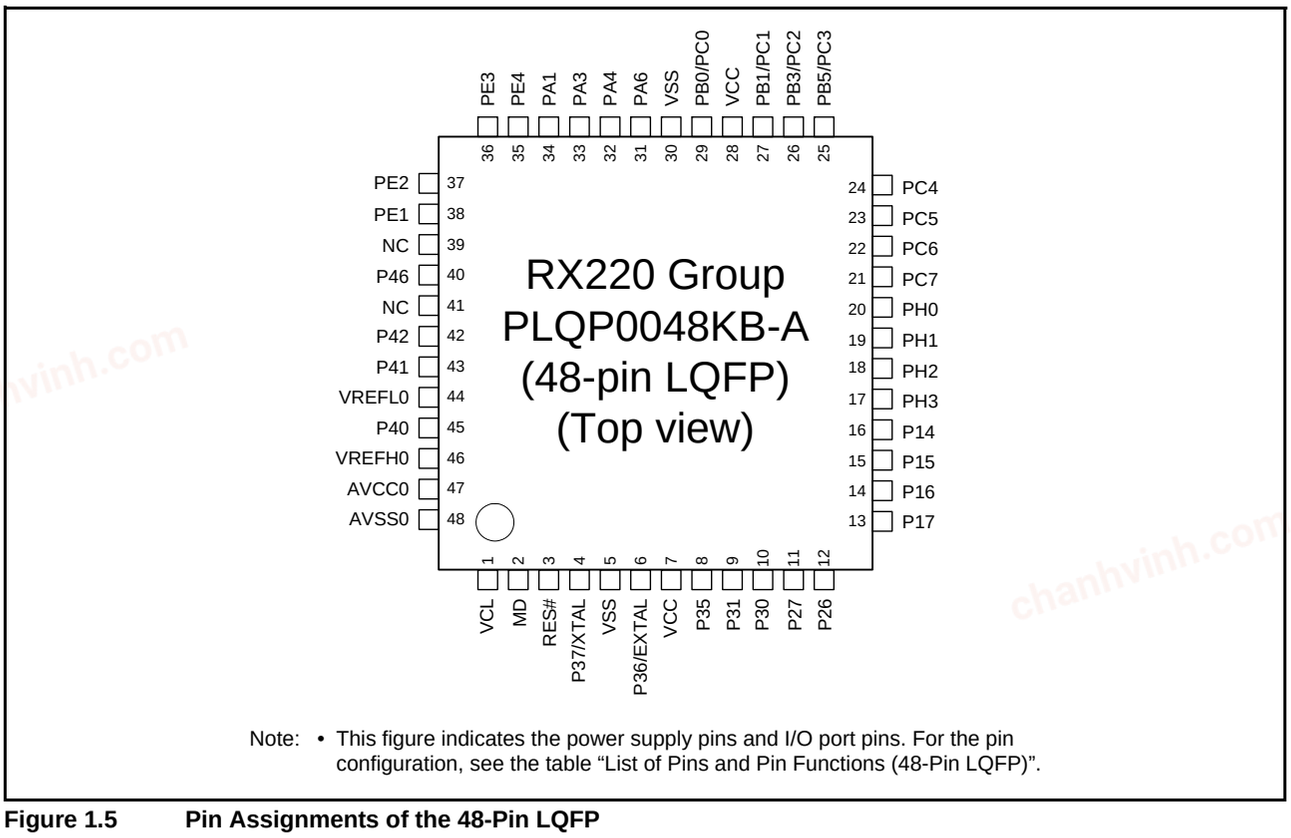
Figure 1.3 Pin Assignments of the 100-Pin LQFP

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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 (64-Pin LQFP)”.

Figure 1.4 Pin Assignments of the 64-Pin LQFP



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 (48-Pin LQFP)”.

Figure 1.5 Pin Assignments of the 48-Pin LQFP

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Table 1.5 List of Pins and Pin Functions (100-Pin LQFP) (1 / 3)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIe, SCIf, RSPI, RIIC)	Others
1	NC (Non-Connection)				
2		P03			
3	NC (Non-Connection)				
4		PJ3	MTIOC3C	CTS6#/RTS6#/SS6#	
5	VCL				
6		PJ1	MTIOC3A		
7	MD				FINED
8	XCIN				
9	XCOUT				
10	RES#				
11	XTAL	P37			
12	VSS				
13	EXTAL	P36			
14	VCC				
15		P35			NMI
16		P34	MTIOC0A/TMCI3/POE2#	SCK6	IRQ4
17		P33	MTIOC0D/TMRI3/POE3#	RXD6/SMISO6/SSCL6	IRQ3
18		P32	MTIOC0C/TMO3	TXD6/SMOSI6/SSDA6	IRQ2/RTCOUT
19		P31	MTIOC4D/TMCI2	CTS1#/RTS1#/SS1#	IRQ1
20		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0
21		P27	MTIOC2B/TMCI3	SCK1	
22		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
23		P25	MTIOC4C/MTCLKB		ADTRG0#
24		P24	MTIOC4A/MTCLKA/TMRI1		
25		P23	MTIOC3D/MTCLKD		
26		P22	MTIOC3B/MTCLKC/TMO0		
27		P21	MTIOC1B/TMCI0		
28		P20	MTIOC1A/TMRI0		
29		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA	IRQ7
30		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/MOSIA/ SCL	IRQ6/RTCOUT/ADTRG0#
31		P15	MTIOC0B/MTCLKB/TMCI2	RXD1/SMISO1/SSCL1	IRQ5
32		P14	MTIOC3A/MTCLKA/TMRI2	CTS1#/RTS1#/SS1#	IRQ4
33		P13	MTIOC0B/TMO3	SDA	IRQ3
34		P12	TMCI1	SCL	IRQ2
35		PH3	TMCI0		
36		PH2	TMRI0		IRQ1
37		PH1	TMO0		IRQ0
38		PH0			CACREF
39		P55	MTIOC4D/TMO3		
40		P54	MTIOC4B/TMCI1		
41		P53			
42		P52			
43		P51			
44		P50			
45		PC7	MTIOC3A/TMO2/MTCLKB	MISOA	CACREF
46		PC6	MTIOC3C/MTCLKA/TMCI2	MOSIA	
47		PC5	MTIOC3B/MTCLKD/TMRI2	RSPCKA	

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Table 1.5 List of Pins and Pin Functions (100-Pin LQFP) (2 / 3)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIe, SCIf, RSPI, RIIC)	Others
48		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/SSLA0	
49		PC3	MTIOC4D	TXD5/SMOSI5/SSDA5/IRTXD5	
50		PC2	MTIOC4B	RXD5/SMISO5/SSCL5/IRRXD5/ SSLA3	
51		PC1	MTIOC3A	SCK5/SSLA2	
52		PC0	MTIOC3C	CTS5#/RTS5#/SS5#/SSLA1	
53		PB7	MTIOC3B	TXD9/SMOSI9/SSDA9	
54		PB6	MTIOC3D	RXD9/SMISO9/SSCL9	
55		PB5	MTIOC2A/MTIOC1B/TMRI1/ POE1#	SCK9	
56		PB4		CTS9#/RTS9#/SS9#	
57		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
58		PB2		CTS6#/RTS6#/SS6#	
59		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4
60	VCC				
61		PB0	MTIC5W	RXD6/SMISO6/SSCL6/RSPCKA	
62	VSS				
63		PA7		MISOA	
64		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
65		PA5		RSPCKA	
66		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/IRTXD5/ SSLA0	IRQ5
67		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5/IRRXD5	IRQ6
68		PA2		RXD5/SMISO5/SSCL5/SSLA3/ IRRXD5	
69		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
70		PA0	MTIOC4A	SSLA1	CACREF
71		PE7			IRQ7/AN015
72		PE6			IRQ6/AN014
73		PE5	MTIOC4C/MTIOC2B		IRQ5/AN013
74		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
75		PE3	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
76		PE2	MTIOC4A	RXD12/RXDX12/SMISO12/ SSCL12	IRQ7/AN010
77		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009
78		PE0		SCK12	AN008
79		PD7	MTIC5U/POE0#		IRQ7
80		PD6	MTIC5V/POE1#		IRQ6
81		PD5	MTIC5W/POE2#		IRQ5
82		PD4	POE3#		IRQ4
83		PD3	POE8#		IRQ3
84		PD2	MTIOC4D		IRQ2
85		PD1	MTIOC4B		IRQ1
86		PD0			IRQ0
87		P47			AN007
88		P46			AN006
89		P45			AN005
90		P44			AN004

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Table 1.5 List of Pins and Pin Functions (100-Pin LQFP) (3 / 3)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communications (SCIe, SCIf, RSPI, RIIC)	Others
91		P43			AN003
92		P42			AN002
93		P41			AN001
94	VREFL0				
95		P40			AN000
96	VREFH0				
97	AVCC0				
98		P07			ADTRG0#
99	AVSS0				
100		P05			

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Table 1.6 List of Pins and Pin Functions (64-Pin LQFP) (1 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIe, SCIf, RSPI, RIIC)	Others
1		P03			
2	VCL				
3	MD				FINED
4	XCIN				
5	XCOUT				
6	RES#				
7	XTAL	P37			
8	VSS				
9	EXTAL	P36			
10	VCC				
11		P35			NMI
12		P32	MTIOC0C/TMO3	TXD6/SMOSI6/SSDA6	IRQ2/RTCOUT
13		P31	MTIOC4D/TMCI2	CTS1#/RTS1#/SS1#	IRQ1
14		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0
15		P27	MTIOC2B/TMCI3	SCK1	
16		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
17		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA	IRQ7
18		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/MOSIA/ SCL	IRQ6/RTCOUT/ADTRG0#
19		P15	MTIOC0B/MTCLKB/TMCI2	RXD1/SMISO1/SSCL1	IRQ5
20		P14	MTIOC3A/MTCLKA/TMRI2	CTS1#/RTS1#/SS1#	IRQ4
21		PH3	TMCI0		
22		PH2	TMRI0		IRQ1
23		PH1	TMO0		IRQ0
24		PH0			CACREF
25		P55	MTIOC4D/TMO3		
26		P54	MTIOC4B/TMCI1		
27		PC7	MTIOC3A/TMO2/MTCLKB	MISOA	CACREF
28		PC6	MTIOC3C/MTCLKA/TMCI2	MOSIA	
29		PC5	MTIOC3B/MTCLKD/TMRI2	RSPCKA	
30		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/SSLA0	
31		PC3	MTIOC4D	TXD5/SMOSI5/SSDA5/IRTXD5	
32		PC2	MTIOC4B	RXD5/SMISO5/SSCL5/IRRXD5/ SSLA3	
33		PB7/PC1	MTIOC3B	TXD9/SMOSI9/SSDA9	
34		PB6/PC0	MTIOC3D	RXD9/SMISO9/SSCL9	
35		PB5	MTIOC2A/MTIOC1B/TMRI1/ POE1#	SCK9	
36		PB3	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
37		PB1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4
38	VCC				
39		PB0	MTIC5W	RXD6/SMISO6/SSCL6/RSPCKA	
40	VSS				
41		PA6	MTIC5V/MTCLKB/TMCI3/ POE2#	CTS5#/RTS5#/SS5#/MOSIA	
42		PA4	MTIC5U/MTCLKA/TMRI0	TXD5/SMOSI5/SSDA5/IRTXD5/ SSLA0	IRQ5
43		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5/IRRXD5	IRQ6

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Table 1.6 List of Pins and Pin Functions (64-Pin LQFP) (2 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIe, SCIf, RSPI, RIIC)	Others
44		PA1	MTIOC0B/MTCLKC	SCK5/SSLA2	CVREFA
45		PA0	MTIOC4A	SSLA1	CACREF
46		PE5	MTIOC4C/MTIOC2B		IRQ5/AN013
47		PE4	MTIOC4D/MTIOC1A		AN012/CMPA2
48		PE3	MTIOC4B/POE8#	CTS12#/RTS12#/SS12#	AN011/CMPA1
49		PE2	MTIOC4A	RXD12/RXDX12/SMISO12/ SSCL12	IRQ7/AN010
50		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SMOSI12/SSDA12	AN009
51		PE0		SCK12	AN008
52	NC (Non-Connection)				
53		P46			AN006
54	NC (Non-Connection)				
55		P44			AN004
56		P43			AN003
57		P42			AN002
58		P41			AN001
59	VREFL0				
60		P40			AN000
61	VREFH0				
62	AVCC0				
63		P05			
64	AVSS0				

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Table 1.7 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 (SCIe, SCIf, 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
10		P30	MTIOC4B/TMRI3/POE8#	RXD1/SMISO1/SSCL1	IRQ0
11		P27	MTIOC2B/TMCI3	SCK1	
12		P26	MTIOC2A/TMO1	TXD1/SMOSI1/SSDA1	
13		P17	MTIOC3A/MTIOC3B/TMO1/ POE8#	SCK1/MISOA/SDA	IRQ7
14		P16	MTIOC3C/MTIOC3D/TMO2	TXD1/SMOSI1/SSDA1/MOSIA/ SCL	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	MISOA	CACREF
22		PC6	MTIOC3C/MTCLKA/TMCI2	MOSIA	
23		PC5	MTIOC3B/MTCLKD/TMRI2	RSPCKA	
24		PC4	MTIOC3D/MTCLKC/TMCI1/ POE0#	SCK5/SSLA0	
25		PB5/PC3	MTIOC2A/MTIOC1B/TMRI1/ POE1#		
26		PB3/PC2	MTIOC0A/MTIOC4A/TMO0/ POE3#	SCK6	
27		PB1/PC1	MTIOC0C/MTIOC4C/TMCI0	TXD6/SMOSI6/SSDA6	IRQ4
28	VCC				
29		PB0/PC0	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/IRTXD5/ SSLA0	IRQ5
33		PA3	MTIOC0D/MTCLKD	RXD5/SMISO5/SSCL5/IRRXD5	IRQ6
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/AN010
38		PE1	MTIOC4C	TXD12/TXDX12/SIOX12/ SSDA12	AN009
39	NC (Non-Connection)				
40		P46			AN006
41	NC (Non-Connection)				
42		P42			AN002
43		P41			AN001

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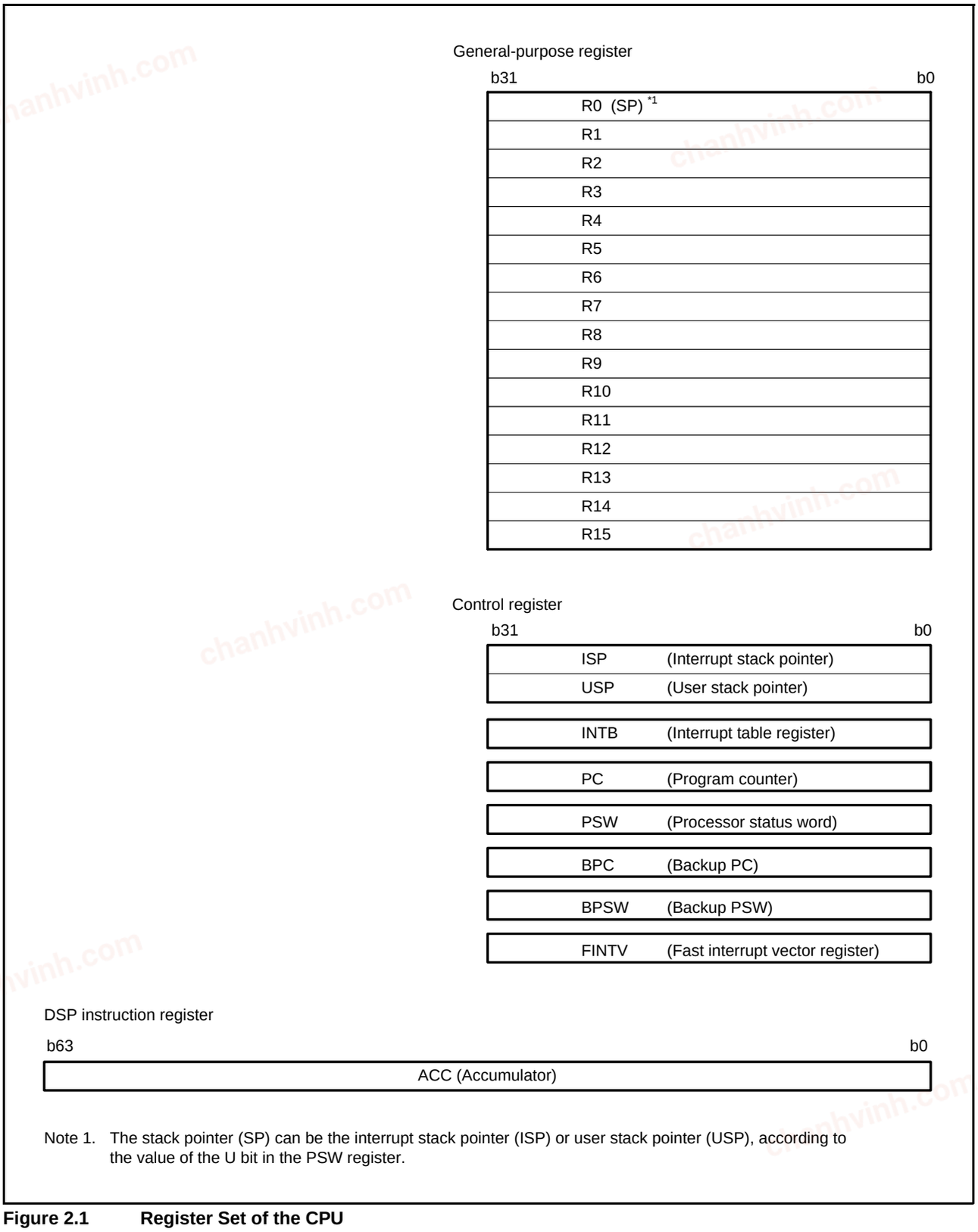
Table 1.7 List of Pins and Pin Functions (48-Pin LQFP) (2 / 2)

Pin No.	Power Supply, Clock, System Control	I/O Port	Timers (MTU, TMR, POE)	Communication (SCIe, SCIf, RSPI, RIIC)	Others
44	VREFL0				
45		P40			AN000
46	VREFH0				
47	AVCC0				
48	AVSS0				

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2. CPU

Figure 2.1 shows the register set of the CPU.



Note 1. The stack pointer (SP) can be the interrupt stack pointer (ISP) or user stack pointer (USP), according to the value of the U bit in the PSW register.

Figure 2.1 Register Set of the CPU

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2.1 General-Purpose Registers (R0 to R15)

This CPU has sixteen general-purpose registers (R0 to R15). R1 to R15 can be used as data registers or address registers. R0, a general-purpose register, also functions as the stack pointer (SP). The stack pointer is switched to operate as the interrupt stack pointer (ISP) or user stack pointer (USP) by the value of the stack pointer select bit (U) in the processor status word (PSW).

2.2 Control Registers

(1) Interrupt Stack Pointer (ISP)/User Stack Pointer (USP)

The stack pointer (SP) can be either of two types, the interrupt stack pointer (ISP) or the user stack pointer (USP). Whether the stack pointer operates as the ISP or USP depends on the value of the stack pointer select bit (U) in the processor status word (PSW).
Set the ISP or USP to a multiple of four, as this reduces the numbers of cycles required to execute interrupt sequences and instructions entailing stack manipulation.

(2) Interrupt Table Register (INTB)

The interrupt table register (INTB) specifies the address where the relocatable vector table starts.

(3) Program Counter (PC)

The program counter (PC) indicates the address of the instruction being executed.

(4) Processor Status Word (PSW)

The processor status word (PSW) indicates the results of instruction execution or the state of the CPU.

(5) Backup PC (BPC)

The backup PC (BPC) is provided to speed up response to interrupts.
After a fast interrupt has been generated, the contents of the program counter (PC) are saved in the BPC register.

(6) Backup PSW (BPSW)

The backup PSW (BPSW) is provided to speed up response to interrupts.
After a fast interrupt has been generated, the contents of the processor status word (PSW) are saved in the BPSW. The allocation of bits in the BPSW corresponds to that in the PSW.

(7) Fast Interrupt Vector Register (FINTV)

The fast interrupt vector register (FINTV) is provided to speed up response to interrupts.
The FINTV register specifies a branch destination address when a fast interrupt has been generated.

2.3 Register Associated with DSP Instructions

(1) Accumulator (ACC)

The accumulator (ACC) is a 64-bit register used for DSP instructions. The accumulator is also used for the multiply and multiply-and-accumulate instructions; EMUL, EMULU, MUL, and RMPA, in which case the prior value in the accumulator is modified by execution of the instruction.
Use the MVTACHI and MVTACLO instructions for writing to the accumulator. The MVTACHI and MVTACLO instructions write data to the higher-order 32 bits (bits 63 to 32) and the lower-order 32 bits (bits 31 to 0), respectively.
Use the MVFACHI and MVFACMI instructions for reading data from the accumulator. The MVFACHI and MVFACMI instructions read data from the higher-order 32 bits (bits 63 to 32) and the middle 32 bits (bits 47 to 16), respectively.

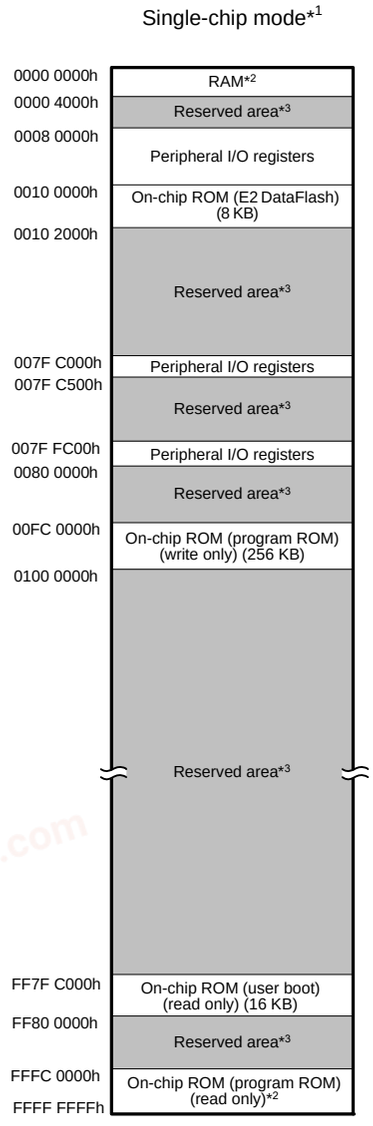
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3. Address Space

3.1 Address Space

This LSI has a 4-Gbyte address space, consisting of the range of addresses from 0000 0000h to FFFF FFFFh. That is, linear access to an address space of up to 4 Gbytes is possible, and this contains both program and data areas.
Figure 3.1 shows the memory map.

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Note 1. The address space in boot mode and user boot mode is the same as the address space in single-chip mode.
Note 2. The capacity of ROM/RAM differs depending on the products.

ROM (bytes)		RAM (bytes)	
Capacity	**Address**	**Capacity**	**Address**
256 K	FFFC 0000h to FFFF FFFFh	16 K	0000 0000h to 0000 3FFFh
128 K	FFFE 0000h to FFFF FFFFh	8 K	0000 0000h to 0000 1FFFh
64K	FFFF 0000h to FFFF FFFFh		
32 K	FFFF 8000h to FFFF FFFFh	4 K	0000 0000h to 0000 0FFFh

Note:•See Table 1.3, List of Products, for the product type name.

Note 3. Reserved areas should not be accessed.

Figure 3.1 Memory Map

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4. I/O Registers

This section provides information on the on-chip I/O register addresses and bit configuration. The information is given as shown below. Notes on writing to registers are also given below.

(1) I/O register addresses (address order)

- Registers are listed from the lower allocation addresses.
- Registers are classified according to module symbols.
- Numbers of cycles for access indicate numbers of cycles of the given base clock.
- Among the internal I/O register area, addresses not listed in the list of registers are reserved. Reserved addresses must not be accessed. Do not access these addresses; otherwise, the operation when accessing these bits and subsequent operations cannot be guaranteed.

(2) Notes on writing to I/O registers

When writing to an I/O register, the CPU starts executing the subsequent instruction before completing I/O register write. This may cause the subsequent instruction to be executed before the post-update I/O register value is reflected on the operation.
As described in the following examples, special care is required for the cases in which the subsequent instruction must be executed after the post-update I/O register value is actually reflected.

[Examples of cases requiring special care]

- The subsequent instruction must be executed while an interrupt request is disabled with the IENj bit in IERn of the ICU (interrupt request enable bit) cleared to 0.
- A WAIT instruction is executed immediately after the preprocessing for causing a transition to the low power consumption state.

In the above cases, after writing to an I/O register, wait until the write operation is completed using the following procedure and then execute the subsequent instruction.

(a) Write to an I/O register.
(b) Read the value from the I/O register to a general register.
(c) Execute the operation using the value read.
(d) Execute the subsequent instruction.

[Instruction examples]

- Byte-size I/O registers

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

- Word-size I/O registers

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

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- 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 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) 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.

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

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4.1 I/O Register Addresses (Address Order)

Table 4.1 List of I/O Registers (Address Order) (1 / 20)

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 0000h	SYSTEM	Mode monitor register	MDMONR	16	16		3 ICLK
0008 0002h	SYSTEM	Mode status register	MDSR	16	16		3 ICLK
0008 0008h	SYSTEM	System control register 1	SYSCR1	16	16		3 ICLK
0008 000Ch	SYSTEM	Standby control register	SBYCR	16	16		3 ICLK
0008 0010h	SYSTEM	Module stop control register A	MSTPCRA	32	32		3 ICLK
0008 0014h	SYSTEM	Module stop control register B	MSTPCRB	32	32		3 ICLK
0008 0018h	SYSTEM	Module stop control register C	MSTPCRC	32	32		3 ICLK
0008 0020h	SYSTEM	System clock control register	SCKCR	32	32		3 ICLK
0008 0026h	SYSTEM	System clock control register 3	SCKCR3	16	16		3 ICLK
0008 0032h	SYSTEM	Main clock oscillator control register	MOSCCR	8	8		3 ICLK
0008 0033h	SYSTEM	Sub-clock oscillator control register	SOSCCR	8	8		3 ICLK
0008 0035h	SYSTEM	IWDT-dedicated on-chip oscillator control register	ILOCOCR	8	8		3 ICLK
0008 0036h	SYSTEM	High-speed on-chip oscillator control register	HOCOCR	8	8		3 ICLK
0008 0037h	SYSTEM	High-speed on-chip oscillator control register 2	HOCOCR2	8	8		3 ICLK
0008 0040h	SYSTEM	Oscillation stop detection control register	OSTDCR	8	8		3 ICLK
0008 0041h	SYSTEM	Oscillation stop detection status register	OSTDSR	8	8		3 ICLK
0008 00A0h	SYSTEM	Operating power control register	OPCCR	8	8		3 ICLK
0008 00A1h	SYSTEM	Sleep mode return clock source switching register	RSTCKCR	8	8		3 ICLK
0008 00A2h	SYSTEM	Main clock oscillator wait control register	MOSCWTCR	8	8		3 ICLK
0008 00A3h	SYSTEM	Sub-clock oscillator wait control register	SOSCWTCR	8	8		3 ICLK
0008 00A9h	SYSTEM	HOCO wait control register 2	HOCOWTCR2	8	8		3 ICLK
0008 00C0h	SYSTEM	Reset status register 2	RSTSR2	8	8		3 ICLK
0008 00C2h	SYSTEM	Software reset register	SWRR	16	16		3 ICLK
0008 00E0h	SYSTEM	Voltage monitoring 1 circuit/comparator A1 control register 1	LVD1CR1	8	8		3 ICLK
0008 00E1h	SYSTEM	Voltage monitoring 1 circuit/comparator A1 status register	LVD1SR	8	8		3 ICLK
0008 00E2h	SYSTEM	Voltage monitoring 2 circuit/comparator A2 control register 1	LVD2CR1	8	8		3 ICLK
0008 00E3h	SYSTEM	Voltage monitoring 2 circuit/comparator A2 status register	LVD2SR	8	8		3 ICLK
0008 03FEh	SYSTEM	Protect register	PRCR	16	16		3 ICLK
0008 1300h	BSC	Bus error status clear register	BERCLR	8	8		2 ICLK
0008 1304h	BSC	Bus error monitoring enable register	BEREN	8	8		2 ICLK
0008 1308h	BSC	Bus error status register 1	BERSR1	8	8		2 ICLK
0008 130Ah	BSC	Bus error status register 2	BERSR2	16	16		2 ICLK
0008 1310h	BSC	Bus priority control register	BUSPRI	16	16		2 ICLK
0008 2000h	DMAC0	DMA source address register	DMSAR	32	32		2 ICLK
0008 2004h	DMAC0	DMA destination address register	DMDAR	32	32		2 ICLK
0008 2008h	DMAC0	DMA transfer count register	DMCRA	32	32		2 ICLK
0008 200Ch	DMAC0	DMA block transfer count register	DMCRB	16	16		2 ICLK
0008 2010h	DMAC0	DMA transfer mode register	DMTMD	16	16		2 ICLK
0008 2013h	DMAC0	DMA interrupt setting register	DMINT	8	8		2 ICLK
0008 2014h	DMAC0	DMA address mode register	DMAMD	16	16		2 ICLK
0008 2018h	DMAC0	DMA offset register	DMOFR	32	32		2 ICLK
0008 201Ch	DMAC0	DMA transfer enable register	DMCNT	8	8		2 ICLK
0008 201Dh	DMAC0	DMA software start register	DMREQ	8	8		2 ICLK
0008 201Eh	DMAC0	DMA status register	DMSTS	8	8		2 ICLK
0008 201Fh	DMAC0	DMA activation source flag control register	DMCSL	8	8		2 ICLK
0008 2040h	DMAC1	DMA source address register	DMSAR	32	32		2 ICLK
0008 2044h	DMAC1	DMA destination address register	DMDAR	32	32		2 ICLK
0008 2048h	DMAC1	DMA transfer count register	DMCRA	32	32		2 ICLK
0008 204Ch	DMAC1	DMA block transfer count register	DMCRB	16	16		2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (2 / 20)

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 2050h	DMAC1	DMA transfer mode register	DMTMD	16	16		2 ICLK
0008 2053h	DMAC1	DMA interrupt setting register	DMINT	8	8		2 ICLK
0008 2054h	DMAC1	DMA address mode register	DMAMD	16	16		2 ICLK
0008 205Ch	DMAC1	DMA transfer enable register	DMCNT	8	8		2 ICLK
0008 205Dh	DMAC1	DMA software start register	DMREQ	8	8		2 ICLK
0008 205Eh	DMAC1	DMA status register	DMSTS	8	8		2 ICLK
0008 205Fh	DMAC1	DMA activation source flag control register	DMCSL	8	8		2 ICLK
0008 2080h	DMAC2	DMA source address register	DMSAR	32	32		2 ICLK
0008 2084h	DMAC2	DMA destination address register	DMDAR	32	32		2 ICLK
0008 2088h	DMAC2	DMA transfer count register	DMCRA	32	32		2 ICLK
0008 208Ch	DMAC2	DMA block transfer count register	DMCRB	16	16		2 ICLK
0008 2090h	DMAC2	DMA transfer mode register	DMTMD	16	16		2 ICLK
0008 2093h	DMAC2	DMA interrupt setting register	DMINT	8	8		2 ICLK
0008 2094h	DMAC2	DMA address mode register	DMAMD	16	16		2 ICLK
0008 209Ch	DMAC2	DMA transfer enable register	DMCNT	8	8		2 ICLK
0008 209Dh	DMAC2	DMA software start register	DMREQ	8	8		2 ICLK
0008 209Eh	DMAC2	DMA status register	DMSTS	8	8		2 ICLK
0008 209Fh	DMAC2	DMA activation source flag control register	DMCSL	8	8		2 ICLK
0008 20C0h	DMAC3	DMA source address register	DMSAR	32	32		2 ICLK
0008 20C4h	DMAC3	DMA destination address register	DMDAR	32	32		2 ICLK
0008 20C8h	DMAC3	DMA transfer count register	DMCRA	32	32		2 ICLK
0008 20CCh	DMAC3	DMA block transfer count register	DMCRB	16	16		2 ICLK
0008 20D0h	DMAC3	DMA transfer mode register	DMTMD	16	16		2 ICLK
0008 20D3h	DMAC3	DMA interrupt setting register	DMINT	8	8		2 ICLK
0008 20D4h	DMAC3	DMA address mode register	DMAMD	16	16		2 ICLK
0008 20DCh	DMAC3	DMA transfer enable register	DMCNT	8	8		2 ICLK
0008 20DDh	DMAC3	DMA software start register	DMREQ	8	8		2 ICLK
0008 20DEh	DMAC3	DMA status register	DMSTS	8	8		2 ICLK
0008 20DFh	DMAC3	DMA activation source flag control register	DMCSL	8	8		2 ICLK
0008 2200h	DMAC	DMA module activation register	DMAST	8	8		2 ICLK
0008 2400h	DTC	DTC control register	DTCCR	8	8		2 ICLK
0008 2404h	DTC	DTC vector base register	DTCVBR	32	32		2 ICLK
0008 2408h	DTC	DTC address mode register	DTCADMOD	8	8		2 ICLK
0008 240Ch	DTC	DTC module start register	DTCST	8	8		2 ICLK
0008 240Eh	DTC	DTC status register	DTCSTS	16	16		2 ICLK
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 701Bh	ICU	Interrupt request register 027	IR027	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 7020h	ICU	Interrupt request register 032	IR032	8	8		2 ICLK
0008 7021h	ICU	Interrupt request register 033	IR033	8	8		2 ICLK
0008 7022h	ICU	Interrupt request register 034	IR034	8	8		2 ICLK
0008 702Ch	ICU	Interrupt request register 044	IR044	8	8		2 ICLK
0008 702Dh	ICU	Interrupt request register 045	IR045	8	8		2 ICLK
0008 702Eh	ICU	Interrupt request register 046	IR046	8	8		2 ICLK
0008 702Fh	ICU	Interrupt request register 047	IR047	8	8		2 ICLK
0008 7039h	ICU	Interrupt request register 057	IR057	8	8		2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (3 / 20)

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 703Fh	ICU	Interrupt request register 063	IR063	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 7058h	ICU	Interrupt request register 088	IR088	8	8		2 ICLK
0008 7059h	ICU	Interrupt request register 089	IR089	8	8		2 ICLK
0008 705Ch	ICU	Interrupt request register 092	IR092	8	8		2 ICLK
0008 705Dh	ICU	Interrupt request register 093	IR093	8	8		2 ICLK
0008 7066h	ICU	Interrupt request register 102	IR102	8	8		2 ICLK
0008 7067h	ICU	Interrupt request register 103	IR103	8	8		2 ICLK
0008 706Ah	ICU	Interrupt request register 106	IR106	8	8		2 ICLK
0008 7072h	ICU	Interrupt request register 114	IR114	8	8		2 ICLK
0008 7073h	ICU	Interrupt request register 115	IR115	8	8		2 ICLK
0008 7074h	ICU	Interrupt request register 116	IR116	8	8		2 ICLK
0008 7075h	ICU	Interrupt request register 117	IR117	8	8		2 ICLK
0008 7076h	ICU	Interrupt request register 118	IR118	8	8		2 ICLK
0008 7077h	ICU	Interrupt request register 119	IR119	8	8		2 ICLK
0008 7078h	ICU	Interrupt request register 120	IR120	8	8		2 ICLK
0008 7079h	ICU	Interrupt request register 121	IR121	8	8		2 ICLK
0008 707Ah	ICU	Interrupt request register 122	IR122	8	8		2 ICLK
0008 707Bh	ICU	Interrupt request register 123	IR123	8	8		2 ICLK
0008 707Ch	ICU	Interrupt request register 124	IR124	8	8		2 ICLK
0008 707Dh	ICU	Interrupt request register 125	IR125	8	8		2 ICLK
0008 707Eh	ICU	Interrupt request register 126	IR126	8	8		2 ICLK
0008 707Fh	ICU	Interrupt request register 127	IR127	8	8		2 ICLK
0008 7080h	ICU	Interrupt request register 128	IR128	8	8		2 ICLK
0008 7081h	ICU	Interrupt request register 129	IR129	8	8		2 ICLK
0008 7082h	ICU	Interrupt request register 130	IR130	8	8		2 ICLK
0008 7083h	ICU	Interrupt request register 131	IR131	8	8		2 ICLK
0008 7084h	ICU	Interrupt request register 132	IR132	8	8		2 ICLK
0008 7085h	ICU	Interrupt request register 133	IR133	8	8		2 ICLK
0008 7086h	ICU	Interrupt request register 134	IR134	8	8		2 ICLK
0008 7087h	ICU	Interrupt request register 135	IR135	8	8		2 ICLK
0008 7088h	ICU	Interrupt request register 136	IR136	8	8		2 ICLK
0008 7089h	ICU	Interrupt request register 137	IR137	8	8		2 ICLK
0008 708Ah	ICU	Interrupt request register 138	IR138	8	8		2 ICLK
0008 708Bh	ICU	Interrupt request register 139	IR139	8	8		2 ICLK
0008 708Ch	ICU	Interrupt request register 140	IR140	8	8		2 ICLK
0008 708Dh	ICU	Interrupt request register 141	IR141	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

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Table 4.1 List of I/O Registers (Address Order) (4 / 20)

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 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 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 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 70F2h	ICU	Interrupt request register 242	IR242	8	8		2 ICLK
0008 70F3h	ICU	Interrupt request register 243	IR243	8	8		2 ICLK
0008 70F4h	ICU	Interrupt request register 244	IR244	8	8		2 ICLK
0008 70F5h	ICU	Interrupt request register 245	IR245	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 711Bh	ICU	DTC activation enable register 027	DTCER027	8	8		2 ICLK
0008 711Ch	ICU	DTC activation enable register 028	DTCER028	8	8		2 ICLK
0008 711Dh	ICU	DTC activation enable register 029	DTCER029	8	8		2 ICLK
0008 711Eh	ICU	DTC activation enable register 030	DTCER030	8	8		2 ICLK
0008 711Fh	ICU	DTC activation enable register 031	DTCER031	8	8		2 ICLK
0008 712Dh	ICU	DTC activation enable register 045	DTCER045	8	8		2 ICLK
0008 712Eh	ICU	DTC activation enable register 046	DTCER046	8	8		2 ICLK
0008 7140h	ICU	DTC activation enable register 064	DTCER064	8	8		2 ICLK
0008 7141h	ICU	DTC activation enable register 065	DTCER065	8	8		2 ICLK
0008 7142h	ICU	DTC activation enable register 066	DTCER066	8	8		2 ICLK
0008 7143h	ICU	DTC activation enable register 067	DTCER067	8	8		2 ICLK
0008 7144h	ICU	DTC activation enable register 068	DTCER068	8	8		2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (5 / 20)

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 7145h	ICU	DTC activation enable register 069	DTCER069	8	8		2 ICLK
0008 7146h	ICU	DTC activation enable register 070	DTCER070	8	8		2 ICLK
0008 7147h	ICU	DTC activation enable register 071	DTCER071	8	8		2 ICLK
0008 7166h	ICU	DTC activation enable register 102	DTCER102	8	8		2 ICLK
0008 7167h	ICU	DTC activation enable register 103	DTCER103	8	8		2 ICLK
0008 716Ah	ICU	DTC activation enable register 106	DTCER106	8	8		2 ICLK
0008 7172h	ICU	DTC activation enable register 114	DTCER114	8	8		2 ICLK
0008 7173h	ICU	DTC activation enable register 115	DTCER115	8	8		2 ICLK
0008 7174h	ICU	DTC activation enable register 116	DTCER116	8	8		2 ICLK
0008 7175h	ICU	DTC activation enable register 117	DTCER117	8	8		2 ICLK
0008 7179h	ICU	DTC activation enable register 121	DTCER121	8	8		2 ICLK
0008 717Ah	ICU	DTC activation enable register 122	DTCER122	8	8		2 ICLK
0008 717Dh	ICU	DTC activation enable register 125	DTCER125	8	8		2 ICLK
0008 717Eh	ICU	DTC activation enable register 126	DTCER126	8	8		2 ICLK
0008 7181h	ICU	DTC activation enable register 129	DTCER129	8	8		2 ICLK
0008 7182h	ICU	DTC activation enable register 130	DTCER130	8	8		2 ICLK
0008 7183h	ICU	DTC activation enable register 131	DTCER131	8	8		2 ICLK
0008 7184h	ICU	DTC activation enable register 132	DTCER132	8	8		2 ICLK
0008 7186h	ICU	DTC activation enable register 134	DTCER134	8	8		2 ICLK
0008 7187h	ICU	DTC activation enable register 135	DTCER135	8	8		2 ICLK
0008 7188h	ICU	DTC activation enable register 136	DTCER136	8	8		2 ICLK
0008 7189h	ICU	DTC activation enable register 137	DTCER137	8	8		2 ICLK
0008 718Ah	ICU	DTC activation enable register 138	DTCER138	8	8		2 ICLK
0008 718Bh	ICU	DTC activation enable register 139	DTCER139	8	8		2 ICLK
0008 718Ch	ICU	DTC activation enable register 140	DTCER140	8	8		2 ICLK
0008 718Dh	ICU	DTC activation enable register 141	DTCER141	8	8		2 ICLK
0008 71AEh	ICU	DTC activation enable register 174	DTCER174	8	8		2 ICLK
0008 71AFh	ICU	DTC activation enable register 175	DTCER175	8	8		2 ICLK
0008 71B1h	ICU	DTC activation enable register 177	DTCER177	8	8		2 ICLK
0008 71B2h	ICU	DTC activation enable register 178	DTCER178	8	8		2 ICLK
0008 71B4h	ICU	DTC activation enable register 180	DTCER180	8	8		2 ICLK
0008 71B5h	ICU	DTC activation enable register 181	DTCER181	8	8		2 ICLK
0008 71B7h	ICU	DTC activation enable register 183	DTCER183	8	8		2 ICLK
0008 71B8h	ICU	DTC activation enable register 184	DTCER184	8	8		2 ICLK
0008 71C6h	ICU	DTC activation enable register 198	DTCER198	8	8		2 ICLK
0008 71C7h	ICU	DTC activation enable register 199	DTCER199	8	8		2 ICLK
0008 71C8h	ICU	DTC activation enable register 200	DTCER200	8	8		2 ICLK
0008 71C9h	ICU	DTC activation enable register 201	DTCER201	8	8		2 ICLK
0008 71DBh	ICU	DTC activation enable register 219	DTCER219	8	8		2 ICLK
0008 71DCh	ICU	DTC activation enable register 220	DTCER220	8	8		2 ICLK
0008 71DFh	ICU	DTC activation enable register 223	DTCER223	8	8		2 ICLK
0008 71E0h	ICU	DTC activation enable register 224	DTCER224	8	8		2 ICLK
0008 71E3h	ICU	DTC activation enable register 227	DTCER227	8	8		2 ICLK
0008 71E4h	ICU	DTC activation enable register 228	DTCER228	8	8		2 ICLK
0008 71EBh	ICU	DTC activation enable register 235	DTCER235	8	8		2 ICLK
0008 71ECh	ICU	DTC activation enable register 236	DTCER236	8	8		2 ICLK
0008 71EFh	ICU	DTC activation enable register 239	DTCER239	8	8		2 ICLK
0008 71F0h	ICU	DTC activation enable register 240	DTCER240	8	8		2 ICLK
0008 71F7h	ICU	DTC activation enable register 247	DTCER247	8	8		2 ICLK
0008 71F8h	ICU	DTC activation enable register 248	DTCER248	8	8		2 ICLK
0008 7202h	ICU	Interrupt request enable register 02	IER02	8	8		2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (6 / 20)

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 7203h	ICU	Interrupt request enable register 03	IER03	8	8		2 ICLK
0008 7204h	ICU	Interrupt request enable register 04	IER04	8	8		2 ICLK
0008 7205h	ICU	Interrupt request enable register 05	IER05	8	8		2 ICLK
0008 7207h	ICU	Interrupt request enable register 07	IER07	8	8		2 ICLK
0008 7208h	ICU	Interrupt request enable register 08	IER08	8	8		2 ICLK
0008 720Bh	ICU	Interrupt request enable register 0B	IER0B	8	8		2 ICLK
0008 720Ch	ICU	Interrupt request enable register 0C	IER0C	8	8		2 ICLK
0008 720Dh	ICU	Interrupt request enable register 0D	IER0D	8	8		2 ICLK
0008 720Eh	ICU	Interrupt request enable register 0E	IER0E	8	8		2 ICLK
0008 720Fh	ICU	Interrupt request enable register 0F	IER0F	8	8		2 ICLK
0008 7210h	ICU	Interrupt request enable register 10	IER10	8	8		2 ICLK
0008 7211h	ICU	Interrupt request enable register 11	IER11	8	8		2 ICLK
0008 7215h	ICU	Interrupt request enable register 15	IER15	8	8		2 ICLK
0008 7216h	ICU	Interrupt request enable register 16	IER16	8	8		2 ICLK
0008 7217h	ICU	Interrupt request enable register 17	IER17	8	8		2 ICLK
0008 7218h	ICU	Interrupt request enable register 18	IER18	8	8		2 ICLK
0008 7219h	ICU	Interrupt request enable register 19	IER19	8	8		2 ICLK
0008 721Bh	ICU	Interrupt request enable register 1B	IER1B	8	8		2 ICLK
0008 721Ch	ICU	Interrupt request enable register 1C	IER1C	8	8		2 ICLK
0008 721Dh	ICU	Interrupt request enable register 1D	IER1D	8	8		2 ICLK
0008 721Eh	ICU	Interrupt request enable register 1E	IER1E	8	8		2 ICLK
0008 721Fh	ICU	Interrupt request enable register 1F	IER1F	8	8		2 ICLK
0008 72E0h	ICU	Software interrupt activation register	SWINTR	8	8		2 ICLK
0008 72F0h	ICU	Fast interrupt set register	FIR	16	16		2 ICLK
0008 7300h	ICU	Interrupt source priority register 000	IPR000	8	8		2 ICLK
0008 7301h	ICU	Interrupt source priority register 001	IPR001	8	8		2 ICLK
0008 7302h	ICU	Interrupt source priority register 002	IPR002	8	8		2 ICLK
0008 7303h	ICU	Interrupt source priority register 003	IPR003	8	8		2 ICLK
0008 7304h	ICU	Interrupt source priority register 004	IPR004	8	8		2 ICLK
0008 7305h	ICU	Interrupt source priority register 005	IPR005	8	8		2 ICLK
0008 7306h	ICU	Interrupt source priority register 006	IPR006	8	8		2 ICLK
0008 7307h	ICU	Interrupt source priority register 007	IPR007	8	8		2 ICLK
0008 7320h	ICU	Interrupt source priority register 032	IPR032	8	8		2 ICLK
0008 7321h	ICU	Interrupt source priority register 033	IPR033	8	8		2 ICLK
0008 7322h	ICU	Interrupt source priority register 034	IPR034	8	8		2 ICLK
0008 732Ch	ICU	Interrupt source priority register 044	IPR044	8	8		2 ICLK
0008 7339h	ICU	Interrupt source priority register 057	IPR057	8	8		2 ICLK
0008 733Fh	ICU	Interrupt source priority register 063	IPR063	8	8		2 ICLK
0008 7340h	ICU	Interrupt source priority register 064	IPR064	8	8		2 ICLK
0008 7341h	ICU	Interrupt source priority register 065	IPR065	8	8		2 ICLK
0008 7342h	ICU	Interrupt source priority register 066	IPR066	8	8		2 ICLK
0008 7343h	ICU	Interrupt source priority register 067	IPR067	8	8		2 ICLK
0008 7344h	ICU	Interrupt source priority register 068	IPR068	8	8		2 ICLK
0008 7345h	ICU	Interrupt source priority register 069	IPR069	8	8		2 ICLK
0008 7346h	ICU	Interrupt source priority register 070	IPR070	8	8		2 ICLK
0008 7347h	ICU	Interrupt source priority register 071	IPR071	8	8		2 ICLK
0008 7358h	ICU	Interrupt source priority register 088	IPR088	8	8		2 ICLK
0008 7359h	ICU	Interrupt source priority register 089	IPR089	8	8		2 ICLK
0008 735Ch	ICU	Interrupt source priority register 092	IPR092	8	8		2 ICLK
0008 735Dh	ICU	Interrupt source priority register 093	IPR093	8	8		2 ICLK
0008 7366h	ICU	Interrupt source priority register 102	IPR102	8	8		2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (7 / 20)

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 7367h	ICU	Interrupt source priority register 103	IPR103	8	8		2 ICLK
0008 736Ah	ICU	Interrupt source priority register 106	IPR106	8	8		2 ICLK
0008 7372h	ICU	Interrupt source priority register 114	IPR114	8	8		2 ICLK
0008 7376h	ICU	Interrupt source priority register 118	IPR118	8	8		2 ICLK
0008 7379h	ICU	Interrupt source priority register 121	IPR121	8	8		2 ICLK
0008 737Bh	ICU	Interrupt source priority register 123	IPR123	8	8		2 ICLK
0008 737Dh	ICU	Interrupt source priority register 125	IPR125	8	8		2 ICLK
0008 737Fh	ICU	Interrupt source priority register 127	IPR127	8	8		2 ICLK
0008 7381h	ICU	Interrupt source priority register 129	IPR129	8	8		2 ICLK
0008 7385h	ICU	Interrupt source priority register 133	IPR133	8	8		2 ICLK
0008 7386h	ICU	Interrupt source priority register 134	IPR134	8	8		2 ICLK
0008 738Ah	ICU	Interrupt source priority register 138	IPR138	8	8		2 ICLK
0008 738Bh	ICU	Interrupt source priority register 139	IPR139	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 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 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 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 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

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Table 4.1 List of I/O Registers (Address Order) (8 / 20)

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 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	
0008 7583h	ICU	NMI pin interrupt control register	NMICR	8	8	2 ICLK	
0008 7590h	ICU	NMI pin digital filter enable register	NMIFLTE	8	8	2 ICLK	
0008 7594h	ICU	NMI pin digital filter setting register	NMIFLTC	8	8	2 ICLK	
0008 8000h	CMT	Compare match timer start register 0	CMSTR0	16	16	2, 3 PCLKB	2 ICLK
0008 8002h	CMT0	Compare match timer control register	CMCR	16	16	2, 3 PCLKB	2 ICLK
0008 8004h	CMT0	Compare match timer counter	CMCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8006h	CMT0	Compare match timer constant register	CMCOR	16	16	2, 3 PCLKB	2 ICLK
0008 8008h	CMT1	Compare match timer control register	CMCR	16	16	2, 3 PCLKB	2 ICLK
0008 800Ah	CMT1	Compare match timer counter	CMCNT	16	16	2, 3 PCLKB	2 ICLK
0008 800Ch	CMT1	Compare match timer constant register	CMCOR	16	16	2, 3 PCLKB	2 ICLK
0008 8010h	CMT	Compare match timer start register 1	CMSTR1	16	16	2, 3 PCLKB	2 ICLK
0008 8012h	CMT2	Compare match timer control register	CMCR	16	16	2, 3 PCLKB	2 ICLK
0008 8014h	CMT2	Compare match timer counter	CMCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8016h	CMT2	Compare match timer constant register	CMCOR	16	16	2, 3 PCLKB	2 ICLK
0008 8018h	CMT3	Compare match timer control register	CMCR	16	16	2, 3 PCLKB	2 ICLK
0008 801Ah	CMT3	Compare match timer counter	CMCNT	16	16	2, 3 PCLKB	2 ICLK
0008 801Ch	CMT3	Compare match timer constant register	CMCOR	16	16	2, 3 PCLKB	2 ICLK
0008 8030h	IWDT	IWDT refresh register	IWDTRR	8	8	2, 3 PCLKB	2 ICLK
0008 8032h	IWDT	IWDT control register	IWDTCR	16	16	2, 3 PCLKB	2 ICLK
0008 8034h	IWDT	IWDT status register	IWDTSR	16	16	2, 3 PCLKB	2 ICLK
0008 8036h	IWDT	IWDT reset control register	IWDTRCR	8	8	2, 3 PCLKB	2 ICLK
0008 8038h	IWDT	IWDT count stop control register	IWDTCSTPR	8	8	2, 3 PCLKB	2 ICLK
0008 8200h	TMR0	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8201h	TMR1	Timer counter control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8202h	TMR0	Timer control/status register	TCSR	8	8	2, 3 PCLKB	2 ICLK
0008 8203h	TMR1	Timer control/status register	TCSR	8	8	2, 3 PCLKB	2 ICLK
0008 8204h	TMR0	Time constant register A	TCORA	8	8	2, 3 PCLKB	2 ICLK
0008 8205h	TMR1	Time constant register A	TCORA	8	8*1	2, 3 PCLKB	2 ICLK
0008 8206h	TMR0	Time constant register B	TCORB	8	8	2, 3 PCLKB	2 ICLK
0008 8207h	TMR1	Time constant register B	TCORB	8	8*1	2, 3 PCLKB	2 ICLK
0008 8208h	TMR0	Timer counter	TCNT	8	8	2, 3 PCLKB	2 ICLK
0008 8209h	TMR1	Timer counter	TCNT	8	8*1	2, 3 PCLKB	2 ICLK
0008 820Ah	TMR0	Timer counter control register	TCCR	8	8	2, 3 PCLKB	2 ICLK
0008 820Bh	TMR1	Timer counter control register	TCCR	8	8*1	2, 3 PCLKB	2 ICLK
0008 820Ch	TMR0	Time count start register	TCSTR	8	8	2, 3 PCLKB	2 ICLK
0008 8210h	TMR2	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8211h	TMR3	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8212h	TMR2	Timer control/status register	TCSR	8	8	2, 3 PCLKB	2 ICLK
0008 8213h	TMR3	Timer control/status register	TCSR	8	8	2, 3 PCLKB	2 ICLK
0008 8214h	TMR2	Time constant register A	TCORA	8	8	2, 3 PCLKB	2 ICLK
0008 8215h	TMR3	Time constant register A	TCORA	8	8*1	2, 3 PCLKB	2 ICLK
0008 8216h	TMR2	Time constant register B	TCORB	8	8	2, 3 PCLKB	2 ICLK
0008 8217h	TMR3	Time constant register B	TCORB	8	8*1	2, 3 PCLKB	2 ICLK
0008 8218h	TMR2	Timer counter	TCNT	8	8	2, 3 PCLKB	2 ICLK
0008 8219h	TMR3	Timer counter	TCNT	8	8*1	2, 3 PCLKB	2 ICLK
0008 821Ah	TMR2	Timer counter control register	TCCR	8	8	2, 3 PCLKB	2 ICLK
0008 821Bh	TMR3	Timer counter control register	TCCR	8	8*1	2, 3 PCLKB	2 ICLK
0008 821Ch	TMR2	Time count start register	TCSTR	8	8	2, 3 PCLKB	2 ICLK
0008 8280h	CRC	CRC control register	CRCCR	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (9 / 20)

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 8281h	CRC	CRC data input register	CRCDIR	8	8	2, 3 PCLKB	2 ICLK
0008 8282h	CRC	CRC data output register	CRCDOR	16	16	2, 3 PCLKB	2 ICLK
0008 8300h	RIIC0	I2C bus control register 1	ICCR1	8	8	2, 3 PCLKB	2 ICLK
0008 8301h	RIIC0	I2C bus control register 2	ICCR2	8	8	2, 3 PCLKB	2 ICLK
0008 8302h	RIIC0	I2C bus mode register 1	ICMR1	8	8	2, 3 PCLKB	2 ICLK
0008 8303h	RIIC0	I2C bus mode register 2	ICMR2	8	8	2, 3 PCLKB	2 ICLK
0008 8304h	RIIC0	I2C bus mode register 3	ICMR3	8	8	2, 3 PCLKB	2 ICLK
0008 8305h	RIIC0	I2C bus function enable register	ICFER	8	8	2, 3 PCLKB	2 ICLK
0008 8306h	RIIC0	I2C bus status enable register	ICSER	8	8	2, 3 PCLKB	2 ICLK
0008 8307h	RIIC0	I2C bus interrupt enable register	ICIER	8	8	2, 3 PCLKB	2 ICLK
0008 8308h	RIIC0	I2C bus status register 1	ICSR1	8	8	2, 3 PCLKB	2 ICLK
0008 8309h	RIIC0	I2C bus status register 2	ICSR2	8	8	2, 3 PCLKB	2 ICLK
0008 830Ah	RIIC0	Slave address register L0	SARL0	8	8	2, 3 PCLKB	2 ICLK
0008 830Ah	RIIC0	Timeout internal counter L	TMOCNTL	8	8	2, 3 PCLKB	2 ICLK
0008 830Bh	RIIC0	Slave address register U0	SARU0	8	8	2, 3 PCLKB	2 ICLK
0008 830Bh	RIIC0	Timeout internal counter U	TMOCNTU	8	8*2	2, 3 PCLKB	2 ICLK
0008 830Ch	RIIC0	Slave address register L1	SARL1	8	8	2, 3 PCLKB	2 ICLK
0008 830Dh	RIIC0	Slave address register U1	SARU1	8	8	2, 3 PCLKB	2 ICLK
0008 830Eh	RIIC0	Slave address register L2	SARL2	8	8	2, 3 PCLKB	2 ICLK
0008 830Fh	RIIC0	Slave address register U2	SARU2	8	8	2, 3 PCLKB	2 ICLK
0008 8310h	RIIC0	I2C bus bit rate low-level register	ICBRL	8	8	2, 3 PCLKB	2 ICLK
0008 8311h	RIIC0	I2C bus bit rate high-level register	ICBRH	8	8	2, 3 PCLKB	2 ICLK
0008 8312h	RIIC0	I2C bus transmit data register	ICDRT	8	8	2, 3 PCLKB	2 ICLK
0008 8313h	RIIC0	I2C bus receive data register	ICDRR	8	8	2, 3 PCLKB	2 ICLK
0008 8380h	RSPI0	RSPI control register	SPCR	8	8	2, 3 PCLKB	2 ICLK
0008 8381h	RSPI0	RSPI slave select polarity register	SSLP	8	8	2, 3 PCLKB	2 ICLK
0008 8382h	RSPI0	RSPI pin control register	SPPCR	8	8	2, 3 PCLKB	2 ICLK
0008 8383h	RSPI0	RSPI status register	SPSR	8	8	2, 3 PCLKB	2 ICLK
0008 8384h	RSPI0	RSPI data register	SPDR	32	16, 32	2, 3 PCLKB	2 ICLK
0008 8388h	RSPI0	RSPI sequence control register	SPSCR	8	8	2, 3 PCLKB	2 ICLK
0008 8389h	RSPI0	RSPI sequence status register	SPSSR	8	8	2, 3 PCLKB	2 ICLK
0008 838Ah	RSPI0	RSPI bit rate register	SPBR	8	8	2, 3 PCLKB	2 ICLK
0008 838Bh	RSPI0	RSPI data control register	SPDCR	8	8	2, 3 PCLKB	2 ICLK
0008 838Ch	RSPI0	RSPI clock delay register	SPCKD	8	8	2, 3 PCLKB	2 ICLK
0008 838Dh	RSPI0	RSPI slave select negation delay register	SSLND	8	8	2, 3 PCLKB	2 ICLK
0008 838Eh	RSPI0	RSPI next-access delay register	SPND	8	8	2, 3 PCLKB	2 ICLK
0008 838Fh	RSPI0	RSPI control register 2	SPCR2	8	8	2, 3 PCLKB	2 ICLK
0008 8390h	RSPI0	RSPI command register 0	SPCMD0	16	16	2, 3 PCLKB	2 ICLK
0008 8392h	RSPI0	RSPI command register 1	SPCMD1	16	16	2, 3 PCLKB	2 ICLK
0008 8394h	RSPI0	RSPI command register 2	SPCMD2	16	16	2, 3 PCLKB	2 ICLK
0008 8396h	RSPI0	RSPI command register 3	SPCMD3	16	16	2, 3 PCLKB	2 ICLK
0008 8398h	RSPI0	RSPI command register 4	SPCMD4	16	16	2, 3 PCLKB	2 ICLK
0008 839Ah	RSPI0	RSPI command register 5	SPCMD5	16	16	2, 3 PCLKB	2 ICLK
0008 839Ch	RSPI0	RSPI command register 6	SPCMD6	16	16	2, 3 PCLKB	2 ICLK
0008 839Eh	RSPI0	RSPI command register 7	SPCMD7	16	16	2, 3 PCLKB	2 ICLK
0008 8410h	IRDA	IrDA control register	IRCR	8	8	2, 3 PCLKB	2 ICLK
0008 8600h	MTU3	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8601h	MTU4	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8602h	MTU3	Timer mode register	TMDR	8	8	2, 3 PCLKB	2 ICLK
0008 8603h	MTU4	Timer mode register	TMDR	8	8	2, 3 PCLKB	2 ICLK
0008 8604h	MTU3	Timer I/O control register H	TIORH	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (10 / 20)

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 8605h	MTU3	Timer I/O control register L	TIORL	8	8	2, 3 PCLKB	2 ICLK
0008 8606h	MTU4	Timer I/O control register H	TIORH	8	8	2, 3 PCLKB	2 ICLK
0008 8607h	MTU4	Timer I/O control register L	TIORL	8	8	2, 3 PCLKB	2 ICLK
0008 8608h	MTU3	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 8609h	MTU4	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 860Ah	MTU	Timer output master enable register	TOER	8	8	2, 3 PCLKB	2 ICLK
0008 860Dh	MTU	Timer gate control register	TGCR	8	8	2, 3 PCLKB	2 ICLK
0008 860Eh	MTU	Timer output control register 1	TOCR1	8	8	2, 3 PCLKB	2 ICLK
0008 860Fh	MTU	Timer output control register 2	TOCR2	8	8	2, 3 PCLKB	2 ICLK
0008 8610h	MTU3	Timer counter	TCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8612h	MTU4	Timer counter	TCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8614h	MTU	Timer cycle data register	TCDR	16	16	2, 3 PCLKB	2 ICLK
0008 8616h	MTU	Timer dead time data register	TDDR	16	16	2, 3 PCLKB	2 ICLK
0008 8618h	MTU3	Timer general register A	TGRA	16	16	2, 3 PCLKB	2 ICLK
0008 861Ah	MTU3	Timer general register B	TGRB	16	16	2, 3 PCLKB	2 ICLK
0008 861Ch	MTU4	Timer general register A	TGRA	16	16	2, 3 PCLKB	2 ICLK
0008 861Eh	MTU4	Timer general register B	TGRB	16	16	2, 3 PCLKB	2 ICLK
0008 8620h	MTU	Timer subcounter	TCNTS	16	16	2, 3 PCLKB	2 ICLK
0008 8622h	MTU	Timer cycle buffer register	TCBR	16	16	2, 3 PCLKB	2 ICLK
0008 8624h	MTU3	Timer general register C	TGRC	16	16	2, 3 PCLKB	2 ICLK
0008 8626h	MTU3	Timer general register D	TGRD	16	16	2, 3 PCLKB	2 ICLK
0008 8628h	MTU4	Timer general register C	TGRC	16	16	2, 3 PCLKB	2 ICLK
0008 862Ah	MTU4	Timer general register D	TGRD	16	16	2, 3 PCLKB	2 ICLK
0008 862Ch	MTU3	Timer status register	TSR	8	8	2, 3 PCLKB	2 ICLK
0008 862Dh	MTU4	Timer status register	TSR	8	8	2, 3 PCLKB	2 ICLK
0008 8630h	MTU	Timer interrupt skipping set register	TITCR	8	8	2, 3 PCLKB	2 ICLK
0008 8631h	MTU	Timer interrupt skipping counter	TITCNT	8	8	2, 3 PCLKB	2 ICLK
0008 8632h	MTU	Timer buffer transfer set register	TBTER	8	8	2, 3 PCLKB	2 ICLK
0008 8634h	MTU	Timer dead time enable register	TDER	8	8	2, 3 PCLKB	2 ICLK
0008 8636h	MTU	Timer output level buffer register	TOLBR	8	8	2, 3 PCLKB	2 ICLK
0008 8638h	MTU3	Timer buffer operation transfer mode register	TBTM	8	8	2, 3 PCLKB	2 ICLK
0008 8639h	MTU4	Timer buffer operation transfer mode register	TBTM	8	8	2, 3 PCLKB	2 ICLK
0008 8640h	MTU4	Timer A/D converter start request control register	TADCR	16	16	2, 3 PCLKB	2 ICLK
0008 8644h	MTU4	Timer A/D converter start request cycle set register A	TADCORA	16	16	2, 3 PCLKB	2 ICLK
0008 8646h	MTU4	Timer A/D converter start request cycle set register B	TADCORB	16	16	2, 3 PCLKB	2 ICLK
0008 8648h	MTU4	Timer A/D converter start request cycle set buffer register A	TADCOBRA	16	16	2, 3 PCLKB	2 ICLK
0008 864Ah	MTU4	Timer A/D converter start request cycle set buffer register B	TADCOBRB	16	16	2, 3 PCLKB	2 ICLK
0008 8660h	MTU	Timer waveform control register	TWCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8680h	MTU	Timer start register	TSTR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8681h	MTU	Timer synchronous register	TSYR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8684h	MTU	Timer read/write enable register	TRWER	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8690h	MTU0	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8691h	MTU1	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8692h	MTU2	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8693h	MTU3	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8694h	MTU4	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8695h	MTU5	Noise filter control register	NFCR	8	8, 16	2, 3 PCLKB	2 ICLK
0008 8700h	MTU0	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8701h	MTU0	Timer mode register	TMDR	8	8	2, 3 PCLKB	2 ICLK
0008 8702h	MTU0	Timer I/O control register H	TIORH	8	8	2, 3 PCLKB	2 ICLK
0008 8703h	MTU0	Timer I/O control register L	TIORL	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (11 / 20)

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 8704h	MTU0	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 8705h	MTU0	Timer status register	TSR	8	8	2, 3 PCLKB	2 ICLK
0008 8706h	MTU0	Timer counter	TCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8708h	MTU0	Timer general register A	TGRA	16	16	2, 3 PCLKB	2 ICLK
0008 870Ah	MTU0	Timer general register B	TGRB	16	16	2, 3 PCLKB	2 ICLK
0008 870Ch	MTU0	Timer general register C	TGRC	16	16	2, 3 PCLKB	2 ICLK
0008 870Eh	MTU0	Timer general register D	TGRD	16	16	2, 3 PCLKB	2 ICLK
0008 8720h	MTU0	Timer general register E	TGRE	16	16	2, 3 PCLKB	2 ICLK
0008 8722h	MTU0	Timer general register F	TGRF	16	16	2, 3 PCLKB	2 ICLK
0008 8724h	MTU0	Timer interrupt enable register 2	TIER2	8	8	2, 3 PCLKB	2 ICLK
0008 8726h	MTU0	Timer buffer operation transfer mode register	TBTM	8	8	2, 3 PCLKB	2 ICLK
0008 8780h	MTU1	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8781h	MTU1	Timer mode register	TMDR	8	8	2, 3 PCLKB	2 ICLK
0008 8782h	MTU1	Timer I/O control register	TIOR	8	8	2, 3 PCLKB	2 ICLK
0008 8784h	MTU1	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 8785h	MTU1	Timer status register	TSR	8	8	2, 3 PCLKB	2 ICLK
0008 8786h	MTU1	Timer counter	TCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8788h	MTU1	Timer general register A	TGRA	16	16	2, 3 PCLKB	2 ICLK
0008 878Ah	MTU1	Timer general register B	TGRB	16	16	2, 3 PCLKB	2 ICLK
0008 8790h	MTU1	Timer input capture control register	TICCR	8	8	2, 3 PCLKB	2 ICLK
0008 8800h	MTU2	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 8801h	MTU2	Timer mode register	TMDR	8	8	2, 3 PCLKB	2 ICLK
0008 8802h	MTU2	Timer I/O control register	TIOR	8	8	2, 3 PCLKB	2 ICLK
0008 8804h	MTU2	Timer interrupt enable register	TIER	8	8	2, 3 PCLKB	2 ICLK
0008 8805h	MTU2	Timer status register	TSR	8	8	2, 3 PCLKB	2 ICLK
0008 8806h	MTU2	Timer counter	TCNT	16	16	2, 3 PCLKB	2 ICLK
0008 8808h	MTU2	Timer general register A	TGRA	16	16	2, 3 PCLKB	2 ICLK
0008 880Ah	MTU2	Timer general register B	TGRB	16	16	2, 3 PCLKB	2 ICLK
0008 8880h	MTU5	Timer counter U	TCNTU	16	16	2, 3 PCLKB	2 ICLK
0008 8882h	MTU5	Timer general register U	TGRU	16	16	2, 3 PCLKB	2 ICLK
0008 8884h	MTU5	Timer control register U	TCRU	8	8	2, 3 PCLKB	2 ICLK
0008 8886h	MTU5	Timer I/O control register U	TIORU	8	8	2, 3 PCLKB	2 ICLK
0008 8890h	MTU5	Timer counter V	TCNTV	16	16	2, 3 PCLKB	2 ICLK
0008 8892h	MTU5	Timer general register V	TGRV	16	16	2, 3 PCLKB	2 ICLK
0008 8894h	MTU5	Timer control register V	TCRV	8	8	2, 3 PCLKB	2 ICLK
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

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Table 4.1 List of I/O Registers (Address Order) (12 / 20)

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 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 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 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
0008 9076h	S12AD	A/D sampling state register 4	ADSSTR4	8	8	2, 3 PCLKB	2 ICLK
0008 9077h	S12AD	A/D sampling state register 5	ADSSTR5	8	8	2, 3 PCLKB	2 ICLK
0008 9078h	S12AD	A/D sampling state register 6	ADSSTR6	8	8	2, 3 PCLKB	2 ICLK
0008 9079h	S12AD	A/D sampling state register 7	ADSSTR7	8	8	2, 3 PCLKB	2 ICLK
0008 907Ah	S12AD	A/D disconnecting detection control register	ADDISCR	8	8	2, 3 PCLKB	2 ICLK
0008 A020h	SCI1	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 A021h	SCI1	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 A022h	SCI1	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 A023h	SCI1	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 A024h	SCI1	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 A025h	SCI1	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 A026h	SCI1	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 A027h	SCI1	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 A028h	SCI1	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A029h	SCI1	I^2C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A02Ah	SCI1	I^2C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A02Bh	SCI1	I^2C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A02Ch	SCI1	I^2C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A02Dh	SCI1	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (13 / 20)

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 A0A0h	SCI5	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A1h	SCI5	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A2h	SCI5	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A3h	SCI5	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A4h	SCI5	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A5h	SCI5	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A6h	SCI5	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A7h	SCI5	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A8h	SCI5	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A0A9h	SCI5	I^2C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A0AAh	SCI5	I^2C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A0ABh	SCI5	I^2C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A0ACh	SCI5	I^2C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A0ADh	SCI5	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C0h	SCI6	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C1h	SCI6	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C2h	SCI6	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C3h	SCI6	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C4h	SCI6	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C5h	SCI6	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C6h	SCI6	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C7h	SCI6	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C8h	SCI6	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A0C9h	SCI6	I^2C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A0CAh	SCI6	I^2C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A0CBh	SCI6	I^2C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A0CCh	SCI6	I^2C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A0CDh	SCI6	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK
0008 A120h	SCI9	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 A121h	SCI9	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 A122h	SCI9	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 A123h	SCI9	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 A124h	SCI9	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 A125h	SCI9	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 A126h	SCI9	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 A127h	SCI9	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 A128h	SCI9	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 A129h	SCI9	I^2C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 A12Ah	SCI9	I^2C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 A12Bh	SCI9	I^2C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 A12Ch	SCI9	I^2C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 A12Dh	SCI9	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

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Table 4.1 List of I/O Registers (Address Order) (14 / 20)

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 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 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 B113h	ELC	Event link setting register 18	ELSR18	8	8	2, 3 PCLKB	2 ICLK
0008 B115h	ELC	Event link setting register 20	ELSR20	8	8	2, 3 PCLKB	2 ICLK
0008 B117h	ELC	Event link setting register 22	ELSR22	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 B11Fh	ELC	Event link option setting register A	ELOPA	8	8	2, 3 PCLKB	2 ICLK
0008 B120h	ELC	Event link option setting register B	ELOPB	8	8	2, 3 PCLKB	2 ICLK
0008 B122h	ELC	Event link option setting register D	ELOPD	8	8	2, 3 PCLKB	2 ICLK
0008 B123h	ELC	Port group setting register 1	PGR1	8	8	2, 3 PCLKB	2 ICLK
0008 B125h	ELC	Port group control register 1	PGC1	8	8	2, 3 PCLKB	2 ICLK
0008 B127h	ELC	Port buffer register 1	PDBF1	8	8	2, 3 PCLKB	2 ICLK
0008 B129h	ELC	Event link port setting register 0	PEL0	8	8	2, 3 PCLKB	2 ICLK
0008 B12Ah	ELC	Event link port setting register 1	PEL1	8	8	2, 3 PCLKB	2 ICLK
0008 B12Dh	ELC	Event link software event generation register	ELSEGR	8	8	2, 3 PCLKB	2 ICLK
0008 B300h	SCI12	Serial mode register	SMR	8	8	2, 3 PCLKB	2 ICLK
0008 B301h	SCI12	Bit rate register	BRR	8	8	2, 3 PCLKB	2 ICLK
0008 B302h	SCI12	Serial control register	SCR	8	8	2, 3 PCLKB	2 ICLK
0008 B303h	SCI12	Transmit data register	TDR	8	8	2, 3 PCLKB	2 ICLK
0008 B304h	SCI12	Serial status register	SSR	8	8	2, 3 PCLKB	2 ICLK
0008 B305h	SCI12	Receive data register	RDR	8	8	2, 3 PCLKB	2 ICLK
0008 B306h	SCI12	Smart card mode register	SCMR	8	8	2, 3 PCLKB	2 ICLK
0008 B307h	SCI12	Serial extended mode register	SEMR	8	8	2, 3 PCLKB	2 ICLK
0008 B308h	SCI12	Noise filter setting register	SNFR	8	8	2, 3 PCLKB	2 ICLK
0008 B309h	SCI12	I^2C mode register 1	SIMR1	8	8	2, 3 PCLKB	2 ICLK
0008 B30Ah	SCI12	I^2C mode register 2	SIMR2	8	8	2, 3 PCLKB	2 ICLK
0008 B30Bh	SCI12	I^2C mode register 3	SIMR3	8	8	2, 3 PCLKB	2 ICLK
0008 B30Ch	SCI12	I^2C status register	SISR	8	8	2, 3 PCLKB	2 ICLK
0008 B30Dh	SCI12	SPI mode register	SPMR	8	8	2, 3 PCLKB	2 ICLK
0008 B320h	SCI12	Extended serial mode enable register	ESMER	8	8	2, 3 PCLKB	2 ICLK
0008 B321h	SCI12	Control register 0	CR0	8	8	2, 3 PCLKB	2 ICLK
0008 B322h	SCI12	Control register 1	CR1	8	8	2, 3 PCLKB	2 ICLK
0008 B323h	SCI12	Control register 2	CR2	8	8	2, 3 PCLKB	2 ICLK
0008 B324h	SCI12	Control register 3	CR3	8	8	2, 3 PCLKB	2 ICLK
0008 B325h	SCI12	Port control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 B326h	SCI12	Interrupt control register	ICR	8	8	2, 3 PCLKB	2 ICLK
0008 B327h	SCI12	Status register	STR	8	8	2, 3 PCLKB	2 ICLK
0008 B328h	SCI12	Status clear register	STCR	8	8	2, 3 PCLKB	2 ICLK
0008 B329h	SCI12	Control Field 0 data register	CF0DR	8	8	2, 3 PCLKB	2 ICLK
0008 B32Ah	SCI12	Control Field 0 compare enable register	CF0CR	8	8	2, 3 PCLKB	2 ICLK
0008 B32Bh	SCI12	Control Field 0 receive data register	CF0RR	8	8	2, 3 PCLKB	2 ICLK
0008 B32Ch	SCI12	Primary control field 1 data register	PCF1DR	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (15 / 20)

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 B32Dh	SCI12	Secondary control field 1 data register	SCF1DR	8	8	2, 3 PCLKB	2 ICLK
0008 B32Eh	SCI12	Control field 1 compare enable register	CF1CR	8	8	2, 3 PCLKB	2 ICLK
0008 B32Fh	SCI12	Control field 1 receive data register	CF1RR	8	8	2, 3 PCLKB	2 ICLK
0008 B330h	SCI12	Timer control register	TCR	8	8	2, 3 PCLKB	2 ICLK
0008 B331h	SCI12	Timer mode register	TMR	8	8	2, 3 PCLKB	2 ICLK
0008 B332h	SCI12	Timer prescaler register	TPRE	8	8	2, 3 PCLKB	2 ICLK
0008 B333h	SCI12	Timer count register	TCNT	8	8	2, 3 PCLKB	2 ICLK
0008 C000h	PORT0	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C001h	PORT1	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C002h	PORT2	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C003h	PORT3	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C004h	PORT4	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C005h	PORT5	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C00Ah	PORTA	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C00Bh	PORTB	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C00Ch	PORTC	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C00Dh	PORTD	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C00Eh	PORTE	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C011h	PORTH	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C012h	PORTJ	Port direction register	PDR	8	8	2, 3 PCLKB	2 ICLK
0008 C020h	PORT0	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C021h	PORT1	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C022h	PORT2	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C023h	PORT3	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C024h	PORT4	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C025h	PORT5	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C02Ah	PORTA	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C02Bh	PORTB	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C02Ch	PORTC	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C02Dh	PORTD	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C02Eh	PORTE	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C031h	PORTH	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C032h	PORTJ	Port output data register	PODR	8	8	2, 3 PCLKB	2 ICLK
0008 C040h	PORT0	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 C041h	PORT1	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 C042h	PORT2	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

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Table 4.1 List of I/O Registers (Address Order) (16 / 20)

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 C043h	PORT3	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 C044h	PORT4	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 C045h	PORT5	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 C04Ah	PORTA	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 C04Bh	PORTB	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 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 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 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

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Table 4.1 List of I/O Registers (Address Order) (17 / 20)

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 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 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 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 C082h	PORT1	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C083h	PORT1	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C085h	PORT2	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C086h	PORT3	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C087h	PORT3	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C094h	PORTA	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C095h	PORTA	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C096h	PORTB	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C097h	PORTB	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C098h	PORTC	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C099h	PORTC	Open drain control register 1	ODR1	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C09Ch	PORTE	Open drain control register 0	ODR0	8	8, 16	2, 3 PCLKB	2 ICLK
0008 C0C0h	PORT0	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0C1h	PORT1	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0C2h	PORT2	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0C3h	PORT3	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0C4h	PORT4	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0C5h	PORT5	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0CAh	PORTA	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0CBh	PORTB	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0CCh	PORTC	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0CDh	PORTD	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0CEh	PORTE	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0D1h	PORTH	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0D2h	PORTJ	Pull-up control register	PCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0E1h	PORT1	Drive capacity control register	DSCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0EBh	PORTB	Drive capacity control register	DSCR	8	8	2, 3 PCLKB	2 ICLK
0008 C0ECh	PORTC	Drive capacity control register	DSCR	8	8	2, 3 PCLKB	2 ICLK
0008 C11Fh	MPC	Write-protect register	PWPR	8	8	2, 3 PCLKB	2 ICLK
0008 C120h	PORT	Port switching register B	PSRB	8	8	2, 3 PCLKB	2 ICLK
0008 C121h	PORT	Port switching register A	PSRA	8	8	2, 3 PCLKB	2 ICLK
0008 C147h	MPC	P07 pin function control register	P07PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Ah	MPC	P12 pin function control register	P12PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Bh	MPC	P13 pin function control register	P13PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Ch	MPC	P14 pin function control register	P14PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Dh	MPC	P15 pin function control register	P15PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Eh	MPC	P16 pin function control register	P16PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C14Fh	MPC	P17 pin function control register	P17PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C150h	MPC	P20 pin function control register	P20PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C151h	MPC	P21 pin function control register	P21PFS	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (18 / 20)

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 C152h	MPC	P22 pin function control register	P22PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C153h	MPC	P23 pin function control register	P23PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C154h	MPC	P24 pin function control register	P24PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C155h	MPC	P25 pin function control register	P25PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C156h	MPC	P26 pin function control register	P26PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C157h	MPC	P27 pin function control register	P27PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C158h	MPC	P30 pin function control register	P30PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C159h	MPC	P31 pin function control register	P31PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C15Ah	MPC	P32 pin function control register	P32PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C15Bh	MPC	P33 pin function control register	P33PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C15Ch	MPC	P34 pin function control register	P34PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C160h	MPC	P40 pin function control register	P40PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C161h	MPC	P41 pin function control register	P41PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C162h	MPC	P42 pin function control register	P42PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C163h	MPC	P43 pin function control register	P43PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C164h	MPC	P44 pin function control register	P44PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C165h	MPC	P45 pin function control register	P45PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C166h	MPC	P46 pin function control register	P46PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C167h	MPC	P47 pin function control register	P47PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C16Ch	MPC	P54 pin function control register	P54PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C16Dh	MPC	P55 pin function control register	P55PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C190h	MPC	PA0 pin function control register	PA0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C191h	MPC	PA1 pin function control register	PA1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C192h	MPC	PA2 pin function control register	PA2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C193h	MPC	PA3 pin function control register	PA3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C194h	MPC	PA4 pin function control register	PA4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C195h	MPC	PA5 pin function control register	PA5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C196h	MPC	PA6 pin function control register	PA6PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C197h	MPC	PA7 pin function control register	PA7PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C198h	MPC	PB0 pin function control register	PB0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C199h	MPC	PB1 pin function control register	PB1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Ah	MPC	PB2 pin function control register	PB2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Bh	MPC	PB3 pin function control register	PB3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Ch	MPC	PB4 pin function control register	PB4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Dh	MPC	PB5 pin function control register	PB5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Eh	MPC	PB6 pin function control register	PB6PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C19Fh	MPC	PB7 pin function control register	PB7PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A0h	MPC	PC0 pin function control register	PC0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A1h	MPC	PC1 pin function control register	PC1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A2h	MPC	PC2 pin function control register	PC2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A3h	MPC	PC3 pin function control register	PC3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A4h	MPC	PC4 pin function control register	PC4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A5h	MPC	PC5 pin function control register	PC5PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A6h	MPC	PC6 pin function control register	PC6PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A7h	MPC	PC7 pin function control register	PC7PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A8h	MPC	PD0 pin function control register	PD0PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1A9h	MPC	PD1 pin function control register	PD1PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1AAh	MPC	PD2 pin function control register	PD2PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1ABh	MPC	PD3 pin function control register	PD3PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1ACh	MPC	PD4 pin function control register	PD4PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1ADh	MPC	PD5 pin function control register	PD5PFS	8	8	2, 3 PCLKB	2 ICLK

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Table 4.1 List of I/O Registers (Address Order) (19 / 20)

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 C1AEh	MPC	PD6 pin function control register	PD6PFS	8	8	2, 3 PCLKB	2 ICLK
0008 C1AFh	MPC	PD7 pin function control register	PD7PFS	8	8	2, 3 PCLKB	2 ICLK
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 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 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 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 C400h	RTC	64-Hz counter	R64CNT	8	8	2, 3 PCLKB	2 ICLK
0008 C402h	RTC	Second counter/Binary counter 0	RSECCNT/ BCNT0	8	8	2, 3 PCLKB	2 ICLK
0008 C404h	RTC	Minute counter/Binary counter 1	RMINCNT/ BCNT1	8	8	2, 3 PCLKB	2 ICLK
0008 C406h	RTC	Hour counter/Binary counter 2	RHRCNT/ BCNT2	8	8	2, 3 PCLKB	2 ICLK
0008 C408h	RTC	Day-of-week counter/Binary counter 3	RWKCNT/ BCNT3	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/Binary counter 0 alarm register	RSECAR/ BCNT0AR	8	8	2, 3 PCLKB	2 ICLK
0008 C412h	RTC	Minute alarm register/Binary counter 1 alarm register	RMINAR/ BCNT1AR	8	8	2, 3 PCLKB	2 ICLK
0008 C414h	RTC	Hour alarm register/Binary counter 2 alarm register	RHRAR/ BCNT2AR	8	8	2, 3 PCLKB	2 ICLK
0008 C416h	RTC	Day-of-week alarm register/Binary counter 3 alarm register	RWKAR/ BCNT3AR	8	8	2, 3 PCLKB	2 ICLK
0008 C418h	RTC	Date alarm register/Binary counter 0 alarm enable register	RDAYAR/ BCNT0AER	8	8	2, 3 PCLKB	2 ICLK
0008 C41Ah	RTC	Month alarm register/Binary counter 1 alarm enable register	RMONAR/ BCNT1AER	8	8	2, 3 PCLKB	2 ICLK
0008 C41Ch	RTC	Year alarm register/Binary counter 2 alarm enable register	RYRAR/ BCNT2AER	16	16	2, 3 PCLKB	2 ICLK
0008 C41Eh	RTC	Year alarm enable register/Binary counter 3 alarm enable register	RYRAREN/ BCNT3AER	8	8	2, 3 PCLKB	2 ICLK
0008 C422h	RTC	RTC control register 1	RCR1	8	8	2, 3 PCLKB	2 ICLK
0008 C424h	RTC	RTC control register 2	RCR2	8	8	2, 3 PCLKB	2 ICLK
0008 C426h	RTC	RTC control register 3	RCR3	8	8	2, 3 PCLKB	2 ICLK

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

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 C42Eh	RTC	Time error adjustment register	RADJ	8	8	2, 3 PCLKB	2 ICLK
007F C402h	FLASH	Flash mode register	FMODR	8	8	2, 3 FCLK	2 ICLK
007F C410h	FLASH	Flash access status register	FASTAT	8	8	2, 3 FCLK	2 ICLK
007F C411h	FLASH	Flash access error interrupt enable register	FAEINT	8	8	2, 3 FCLK	2 ICLK
007F C412h	FLASH	Flash ready interrupt enable register	FRDYIE	8	8	2, 3 FCLK	2 ICLK
007F C440h	FLASH	E2 DataFlash read enable register 0	DFLRE0	16	16	2, 3 FCLK	2 ICLK
007F C450h	FLASH	E2 DataFlash programming/erasure enable register 0	DFLWE0	16	16	2, 3 FCLK	2 ICLK
007F FFB0h	FLASH	Flash status register 0	FSTATR0	8	8	2, 3 FCLK	2 ICLK
007F FFB1h	FLASH	Flash status register 1	FSTATR1	8	8	2, 3 FCLK	2 ICLK
007F FFB2h	FLASH	Flash P/E mode entry register	FENTRYR	16	16	2, 3 FCLK	2 ICLK
007F FFB4h	FLASH	Flash protection register	FPROTR	16	16	2, 3 FCLK	2 ICLK
007F FFB6h	FLASH	Flash reset register	FRESETR	16	16	2, 3 FCLK	2 ICLK
007F FFBAh	FLASH	FCU command register	FCMDR	16	16	2, 3 FCLK	2 ICLK
007F FFC8h	FLASH	FCU processing switching register	FCPSR	16	16	2, 3 FCLK	2 ICLK
007F FFCAh	FLASH	E2 DataFlash blank check control register	DFLBCCNT	16	16	2, 3 FCLK	2 ICLK
007F FFCCh	FLASH	Flash P/E status register	FPESTAT	16	16	2, 3 FCLK	2 ICLK
007F FFCEh	FLASH	E2 DataFlash blank check status register	DFLBCSTAT	16	16	2, 3 FCLK	2 ICLK
007F FFE8h	FLASH	Peripheral clock notification register	PCKAR	16	16	2, 3 FCLK	2 ICLK

Note 1. Odd addresses cannot be accessed in 16-bit units. When accessing a register in 16-bit units, access the address of the TMR0 or TMR2 register.
Note 2. Odd addresses cannot be accessed in 16-bit units. When accessing a register in 16-bit units, access the address of the TMOCNTL register.

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5. Electrical Characteristics

5.1 Absolute Maximum Ratings

Table 5.1 Absolute Maximum Ratings

Conditions: VSS = AVSS0 = VREFL0 = 0 V

Item	Symbol	Value	Unit
Power supply voltage	VCC	–0.3 to +6.5	V
Input voltage (except for ports for 5V tolerant*1 and port 4)	V_{in}	–0.3 to VCC +0.3*3	V
Input voltage (port 4)	V_{in}	–0.3 to AVCC0 +0.3*3	V
Input voltage (ports for 5 V tolerant*1)	V_{in}	–0.3 to +6.5	V
Analog power supply voltage	AVCC0*2	–0.3 to +6.5	V
Reference power supply voltage	VREFH0*2	–0.3 to AVCC0 +0.3*3	V
Analog input voltage (except for port 4)	V_{AN}	–0.3 to VCC +0.3*3	V
Analog input voltage (port 4)	V_{AN}	–0.3 to AVCC0 +0.3*3	V
Operating temperature	T_{opr}	–40 to +105	°C
Storage temperature	T_{stg}	–55 to +125	°C

Caution: Permanent damage to the LSI may result if absolute maximum ratings are exceeded.

To preclude any malfunctions due to noise interferences, insert capacitors of high frequency characteristics between the VCC and VSS pins, between the AVCC0 and AVSS0 pins, and between the VREFH0 and VREFL0 pins. Place capacitors of 0.1 µF or so as close to every power pin and use the shortest and heaviest possible traces.

Connect the VCL pin to a VSS pin via a 0.1 µF (±20% accuracy) capacitor. The capacitor must be placed as close to the pin as possible.

Note 1. Ports 12, 13, 16, and 17 are 5 V tolerant.

Note 2. Set to the same potential as VCC. When the A/D converter is not used, do not leave the AVCC0, VREFH0, AVSS0, and VREFL0 pins open. Connect the AVCC0 and VREFH0 pins to VCC, and the AVSS0 and VREFL0 pins to VSS, respectively.

Note 3. The maximum value is 6.5 V.

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5.2 DC Characteristics

Table 5.2 DC Characteristics (1)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Schmitt trigger input voltage	RIIC input pin (except for SMBus, 5 V tolerant)	V_{IH}	VCC × 0.7	—	5.8	V	
	Ports 12, 13, 16, and 17 (5 V tolerant)		VCC × 0.8	—	5.8		
	Ports 0, 14, 15, 2, 3, 4, 5, A, B, C, D, E, H, J, and RES#		VCC × 0.8	—	VCC + 0.3		
	RIIC input pin (except for SMBus)	V_{IL}	–0.3	—	VCC × 0.3		
	Other than RIIC input pin		–0.3	—	VCC × 0.2		
	RIIC input pin (except for SMBus)	ΔV_T	VCC × 0.05	—	—		
	Other than RIIC input pin		VCC × 0.1	—	—		
Input level voltage (except for Schmitt trigger input pins)	MD pin	V_{IH}	VCC × 0.9	—	VCC + 0.3	V	
	EXTAL		VCC × 0.8	—	VCC + 0.3		
	RIIC input pin (SMBus)		2.1	—	VCC + 0.3		
	MD pin	V_{IL}	–0.3	—	VCC × 0.1		
	EXTAL		–0.3	—	VCC × 0.2		
	RIIC input pin (SMBus)		–0.3	—	0.8		

Table 5.3 DC Characteristics (2)

Conditions: VCC = AVCC0 = 1.62 to 2.7 V, VSS = AVSS0 = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Schmitt trigger input voltage	Ports 12, 13, 16, and 17 (5 V tolerant)	V_{IH}	VCC × 0.8	—	5.8	V	
	Ports 0, 14, 15, 2, 3, 4, 5, A, B, C, D, E, H, and J		VCC × 0.8	—	VCC + 0.3		
	RES#		VCC × 0.9	—	VCC + 0.3		
	Ports 0, 1, 2, 3, 4, 5, A, B, C, D, E, H, and J	V_{IL}	–0.3	—	VCC × 0.2		
	RES#		–0.3	—	VCC × 0.1		
	All input pins	ΔV_T	VCC × 0.01	—	—		
Input level voltage (except for Schmitt trigger input pins)	MD pin	V_{IH}	VCC × 0.9	—	VCC + 0.3	V	
	EXTAL		VCC × 0.8	—	VCC + 0.3		
	MD pin	V_{IL}	–0.3	—	VCC × 0.1		
	EXTAL		–0.3	—	VCC × 0.2		

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Table 5.4 DC Characteristics (3)

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

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Input leakage current	RES#, MD pin, P35/NMI	$\lvert I_{in} \rvert$	—	—	1.0	µA	V_{in} = 0 V, VCC
Three-state leakage current (off-state)	Other pins except for ports for 5 V tolerant	$\lvert I_{TSI} \rvert$	—	—	0.2	µA	V_{in} = 0 V, VCC
	Ports for 5 V tolerant		—	—	1.0		V_{in} = 0 V, 5.8 V
Input capacitance	All input pins (except for XCIN and XCOUT)	C_{in}	—	—	15	pF	V_{in} = 0 V, f = 1 MHz, T_a = 25°C
	XCIN and XCOUT		—	—	3		

Table 5.5 DC Characteristics (4)

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

Item		Symbol	VCC						Unit	Test Conditions
			1.62 to 2.7 V		2.7 to 4.0 V		4.0 to 5.5 V			
			Min.	Max.	Min.	Max.	Min.	Max.		
Input pull-up MOS current	All ports (except for port 35)	I_p	–150	–5	–200	–10	–400	–50	µA	V_{in} = 0 V

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Table 5.6 DC Characteristics (5)

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

Item					Symbol	Typ.*9	Max.	Unit	Test Conditions
Supply current*1	Medium-speed operating modes 1A and 1B	Normal operating mode	No peripheral operation*2	ICLK = 32 MHz	I_{CC}	4.6	—	mA	
				ICLK = 20 MHz		3.2	—		
			All peripheral operation: Normal*3	ICLK = 32 MHz		14	—		
				ICLK = 20 MHz		9.5	—		
			All peripheral operation: Max.*3	ICLK = 32 MHz		—	25		
				ICLK = 20 MHz		—	19		
		Sleep mode	No peripheral operation*2	ICLK = 32 MHz		3.8	—		
				ICLK = 20 MHz		3.0	—		
			All peripheral operation: Normal*3	ICLK = 32 MHz		10	—		
				ICLK = 20 MHz		7	—		
		All-module clock stop mode		ICLK = 32 MHz		2.5	—		
				ICLK = 20 MHz		2.0	—		
		Increase during BGO operation*4	Medium-speed operating mode 1A			17	—		
			Medium-speed operating mode 1B			17	—		
	Low-speed operating mode 1	Normal operating mode	No peripheral operation*5	ICLK = 8 MHz		1.4	—		
				ICLK = 4 MHz		0.9	—		
				ICLK = 2 MHz		0.7	—		
			All peripheral operation: Normal*6	ICLK = 8 MHz		4.2	—		
				ICLK = 4 MHz		2.6	—		
				ICLK = 2 MHz		1.8	—		
			All peripheral operation: Max.*6	ICLK = 8 MHz		—	6.5		
				ICLK = 4 MHz		—	3.7		
				ICLK = 2 MHz		—	2.4		
		Sleep mode	No peripheral operation*5	ICLK = 8 MHz		1.5	—		
				ICLK = 4 MHz		1.2	—		
				ICLK = 2 MHz		1.1	—		
			All peripheral operation: Normal*6	ICLK = 8 MHz		3.1	—		
				ICLK = 4 MHz		2.1	—		
				ICLK = 2 MHz		1.5	—		
		All-module clock stop mode		ICLK = 8 MHz		1.4	—		
				ICLK = 4 MHz		1.1	—		
				ICLK = 2 MHz		1.0	—		
	Low-speed operating mode 2	Normal operating mode	No peripheral operation*7	ICLK = 32 kHz		0.027	—		
			All peripheral operation: Normal*8	ICLK = 32 kHz		0.04	—		
			All peripheral operation: Max.*8	ICLK = 32 kHz		—	0.23		
		Sleep mode	No peripheral operation*7	ICLK = 32 kHz		0.024	—		
			All peripheral operation: Normal*8	ICLK = 32 kHz		0.034	—		
		All-module clock stop mode				0.016	—		

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.

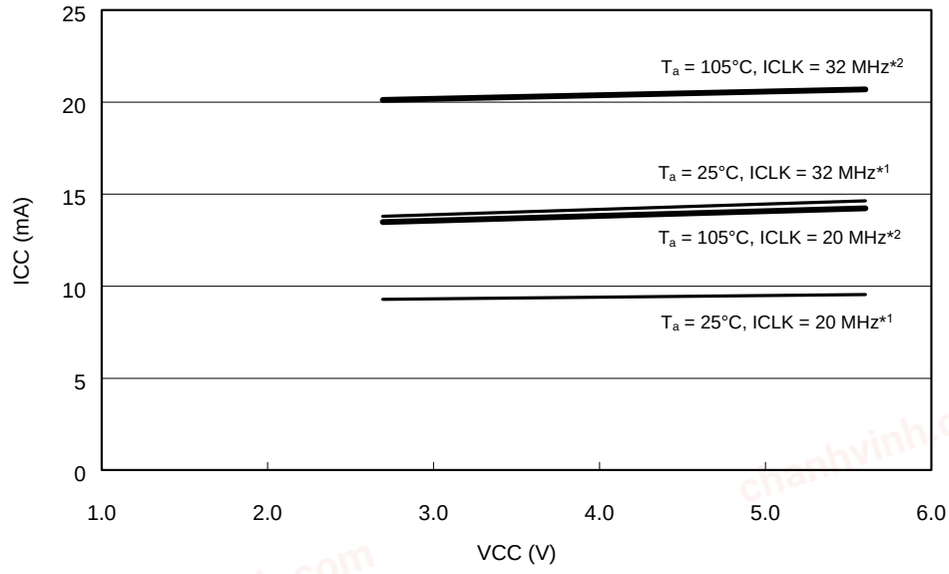
Note 2. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is HOCO. BCLK, FCLK, and PCLK are set to divided by 64.

Note 3. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO. BCLK, FCLK, and PCLK are ICLK divided by 1.

Note 4. This is the increase if data is programmed to or erasing from the ROM or E2 DataFlash during program execution.

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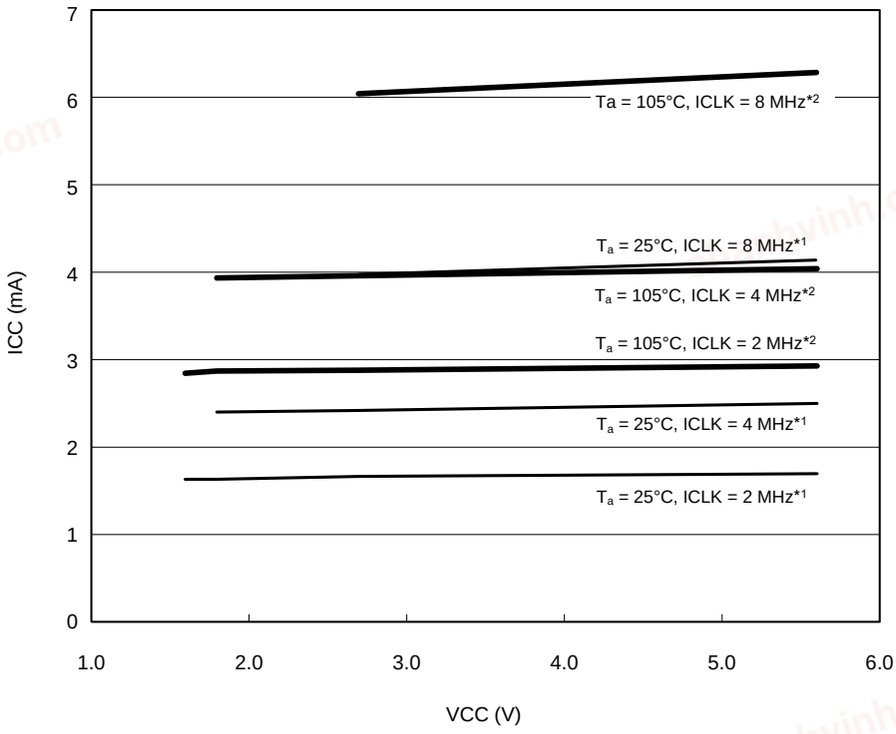
Note 5. Clock supply to the peripheral functions is stopped. This does not include BGO operation. The clock source is HOCO. BCLK, FCLK, and PCLK are set to divided by 64.
Note 6. Clocks are supplied to the peripheral functions. This does not include BGO operation. The clock source is HOCO. BCLK, FCLK, and PCLK are ICLK divided by 1.
Note 7. 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 8. 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 9. VCC = 3.3 V.



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.

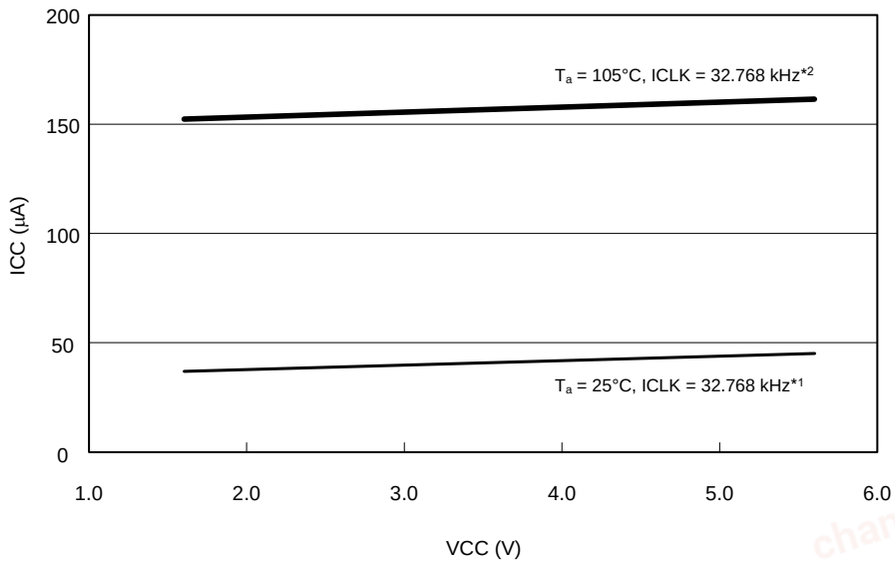
Figure 5.1 Voltage Dependency in Medium-Speed Operating Modes 1A and 1B (Reference Data)

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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 5.2 Voltage Dependency in Low-Speed Operating Mode 1 (Reference Data)



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 5.3 Voltage Dependency in Low-Speed Operating Mode 2 (Reference Data)

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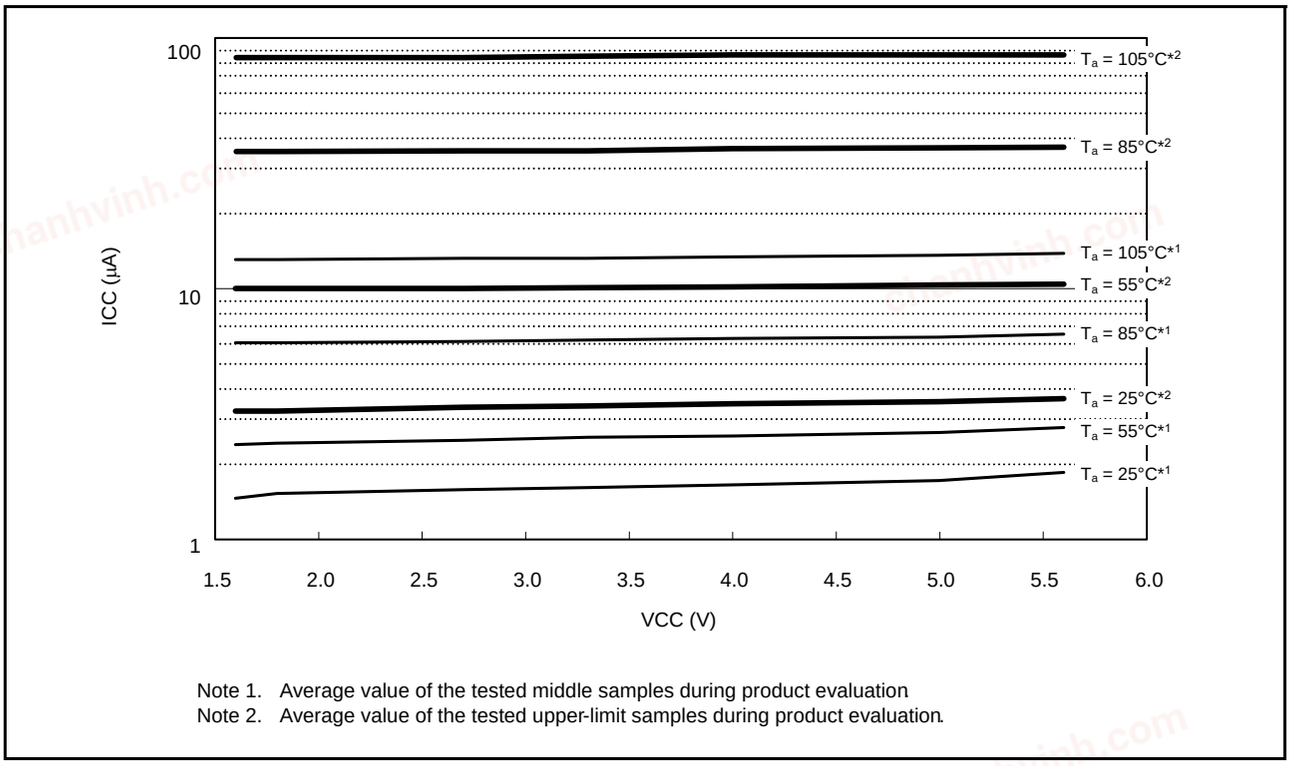
Table 5.7 DC Characteristics (6)

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

Item				Symbol	Typ.*3	Max.	Unit	Test Conditions
Supply current*1	Software standby mode*2	Flash memory power supplied, HOCO power supplied, POR low power consumption function disabled (SOFTCUT bit = 000b)	T_a = 25°C	I_{CC}	9.3	16.4	µA	
			T_a = 55°C		11.3	25		
			T_a = 85°C		16	62		
			T_a = 105°C		25	127		
		Flash memory power not supplied, HOCO power not supplied, POR low power consumption function enabled (SOFTCUT bit = 11xb)	T_a = 25°C		1.7	7.0		
			T_a = 55°C		2.6	15		
			T_a = 85°C		6.3	51		
			T_a = 105°C		14.2	115		
	Increments produced by running voltage detection circuits and disabling the POR low power consumption function				1.4	—		
	Increment for RTC operation (low CL)				0.6	—		
	Increment for RTC operation (standard CL)				1.4	—		

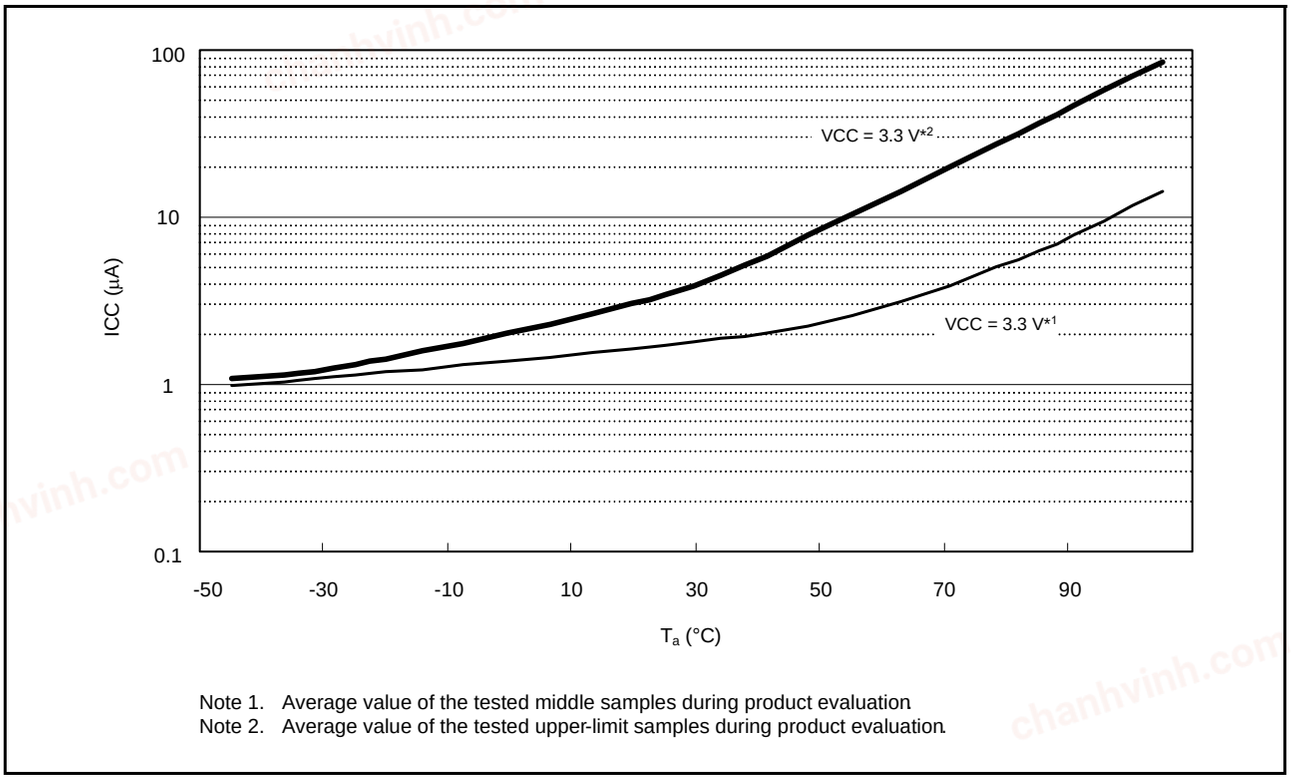
Note 1. Supply current values are with all output pins unloaded and all input pull-up MOSs in the off state.
Note 2. The IWDT and LVD are stopped.
Note 3. VCC = 3.3 V.

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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 5.4 Voltage Dependency in Software Standby Mode (SOFTCUT Bit = 11xb) (Reference Data)



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 5.5 Temperature Dependency in Software Standby Mode (SOFTCUT Bit = 11xb) (Reference Data)

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Table 5.8 DC Characteristics (7)

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

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

Note: • Please contact Renesas Electronics sales office for derating of operation under T_a = +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 5.9 DC Characteristics (8)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VREFH0 = 1.62 to AVCC0, VSS = AVSS0 = 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	Conversion time = 1.56 µs	AI_{CC}	—	1.0	3.0	mA	
	Waiting for A/D conversion (all units)			—	0.2	3.0	µA	
Reference power supply current	During A/D conversion	Conversion time = 1.56 µs	I_{REFH0}	—	0.1	0.2	mA	
	Waiting for A/D conversion (all units)			—	0.2	0.4	µA	

Table 5.10 DC Characteristics (9)

Conditions: VCC = AVCC0, VSS = AVSS0 = 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 5.11 DC Characteristics (10)

Conditions: VCC = AVCC0 = 0 to 5.5 V, VREFH0 = 0 to AVCC0, VSS = AVSS0 = 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

Table 5.12 DC Characteristics (11)

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

The ripple voltage must meet the allowable ripple frequency $f_{r(VCC)}$ within the range between the VCC upper limit (5.5 V) and lower limit (1.62 V).

When VCC change exceeds VCC ±10%, the allowable voltage change rising/falling gradient dt/dVCC must be met.

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Allowable ripple frequency	$f_{r(VCC)}$	—	—	10	kHz	VCC × 0.1 < $V_{r(VCC)}$ ≤ VCC × 0.2
		—	—	1	MHz	VCC × 0.05 < $V_{r(VCC)}$ ≤ VCC × 0.1
		—	—	10	MHz	$V_{r(VCC)}$ ≤ VCC × 0.05
Allowable voltage change rising/ falling gradient	dt/dVCC	1.0	—	—	ms/V	When VCC change exceeds VCC ±10%

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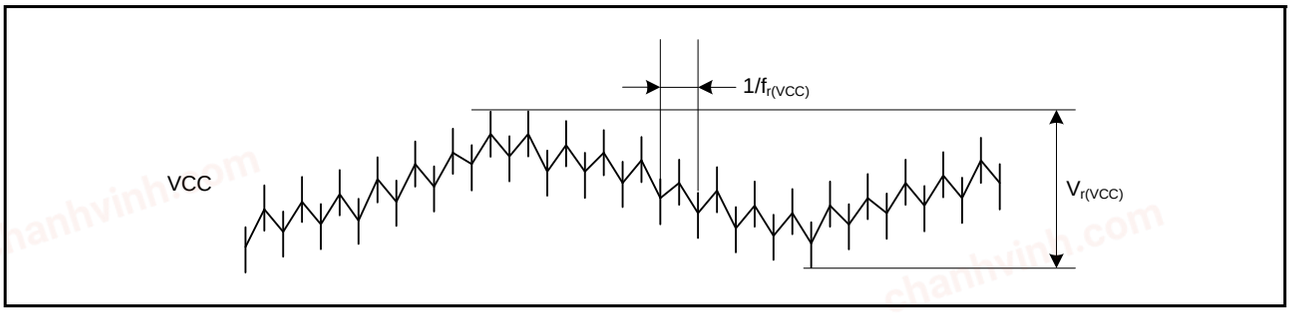


Figure 5.6 Ripple Waveform

Table 5.13 Permissible Output Currents (1)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, when total power (mW) < 1000 – 10 × T_a

Item		Symbol	Max.	Unit
Permissible output low current (average value per 1 pin)	Normal output mode	I_{OL}	4.0	mA
	High-drive output mode		16.0	
Permissible output low current (maximum value per 1 pin)	Normal output mode		4.0	mA
	High-drive output mode		16.0	
Permissible output low current (total)	Total of all output pins	ΣI_{OL}	80	mA
Permissible output high current (average value per 1 pin)	Normal output mode	I_{OH}	–4.0	mA
	High-drive output mode		–8.0	
Permissible output high current (maximum value per 1 pin)	Normal output mode		–4.0	mA
	High-drive output mode		–8.0	
Permissible output high current (total)	Total of all output pins	ΣI_{OH}	–60	mA

Table 5.14 Permissible Output Currents (2)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, when total power (mW) ≥ 1000 – 10 × T_a

Item		Symbol	Max.	Unit
Permissible output low current (average value per 1 pin)	Normal output mode	I_{OL}	2.0	mA
	High-drive output mode		8.0	
Permissible output low current (maximum value per 1 pin)	Normal output mode		2.0	mA
	High-drive output mode		8.0	
Permissible output low current (total)	Total of all output pins	ΣI_{OL}	40	mA
Permissible output high current (average value per 1 pin)	Normal output mode	I_{OH}	–2.0	mA
	High-drive output mode		–4.0	
Permissible output high current (maximum value per 1 pin)	Normal output mode		–2.0	mA
	High-drive output mode		–4.0	
Permissible output high current (total)	Total of all output pins	ΣI_{OH}	–30	mA

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Table 5.15 Output Values of Voltage (1)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, when total power (mW) < 1000 – 10 × T_a

Item			Symbol	Min.	Max.	Unit	Test Conditions	
							VCC = 2.7 to 4.0 V	VCC = 4.0 to 5.5 V
Output low	All output pins (other than RIIC)	Normal output mode	V_{OL}	—	1.0	V	I_{OL} = 3.0 mA	I_{OL} = 4.0 mA
		High-drive output mode		—	1.0		I_{OL} = 8.0 mA	I_{OL} = 16.0 mA
	RIIC pins			—	0.4		I_{OL} = 3.0 mA	
				—	0.6		I_{OL} = 6.0 mA	
Output high	All output pins	Normal output mode	V_{OH}	VCC – 1.0	—	V	I_{OH} = – 3.0 mA	I_{OH} = – 4.0 mA
		High-drive output mode		VCC – 1.0	—		I_{OH} = – 5.0 mA	I_{OH} = – 8.0 mA

Table 5.16 Output Values of Voltage (2)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, when total power (mW) ≥ 1000 – 10 × T_a

Item			Symbol	Min.	Max.	Unit	Test Conditions	
							VCC = 2.7 to 4.0 V	VCC = 4.0 to 5.5 V
Output low	All output pins (other than RIIC)	Normal output mode	V_{OL}	—	1.0	V	I_{OL} = 2.0 mA	I_{OL} = 2.0 mA
		High-drive output mode		—	1.0		I_{OL} = 8.0 mA	I_{OL} = 8.0 mA
	RIIC pins			—	0.4		I_{OL} = 3.0 mA	
				—	0.6		I_{OL} = 6.0 mA	
Output high	All output pins	Normal output mode	V_{OH}	VCC – 1.0	—	V	I_{OH} = – 2.0 mA	I_{OH} = – 2.0 mA
		High-drive output mode		VCC – 1.0	—		I_{OH} = – 4.0 mA	I_{OH} = – 4.0 mA

Table 5.17 Output Values of Voltage (3)

Conditions: VCC = AVCC0 = 1.62 to 2.7 V, VSS = AVSS0 = VREFL0 = 0 V, T_a = –40 to +105°C

Item			Symbol	Min.	Max.	Unit	Test Conditions
Output low	All output pins (other than RIIC)	Normal output mode	V_{OL}	—	0.4	V	I_{OL} = 0.5 mA
		High-drive output mode		—	0.4		I_{OL} = 2.0 mA
Output high	All output pins	Normal output mode	V_{OH}	VCC – 0.4	—	V	I_{OH} = –0.5 mA
		High-drive output mode		VCC – 0.4	—		I_{OH} = –1.0 mA

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5.2.1 Standard I/O Pin Output Characteristics (1)

Figure 5.7 to Figure 5.11 show the characteristics when normal output is selected by the drive capacity control register.

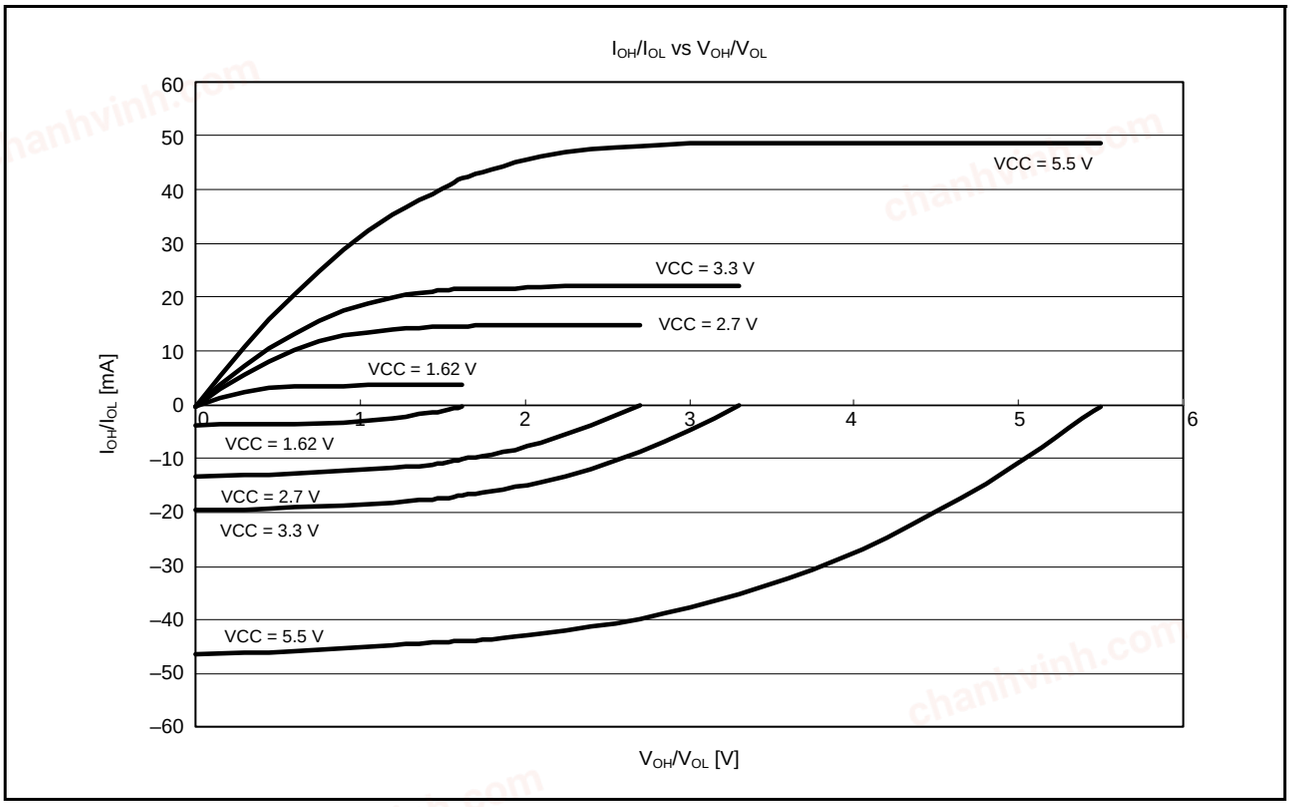


Figure 5.7 V_{OH}/V_{OL} and I_{OH}/I_{OL} Voltage Characteristics at T_a = 25°C when Normal Output is Selected (Reference Data)

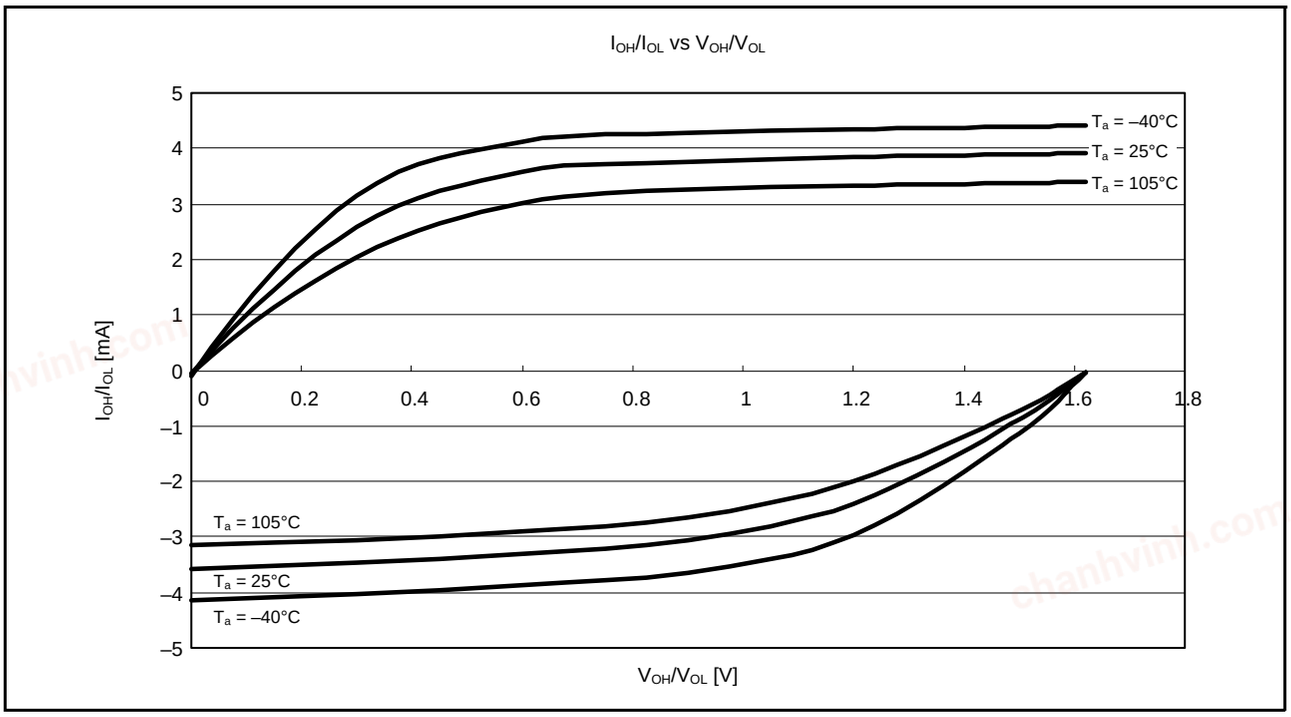


Figure 5.8 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 1.62 V when Normal Output is Selected (Reference Data)

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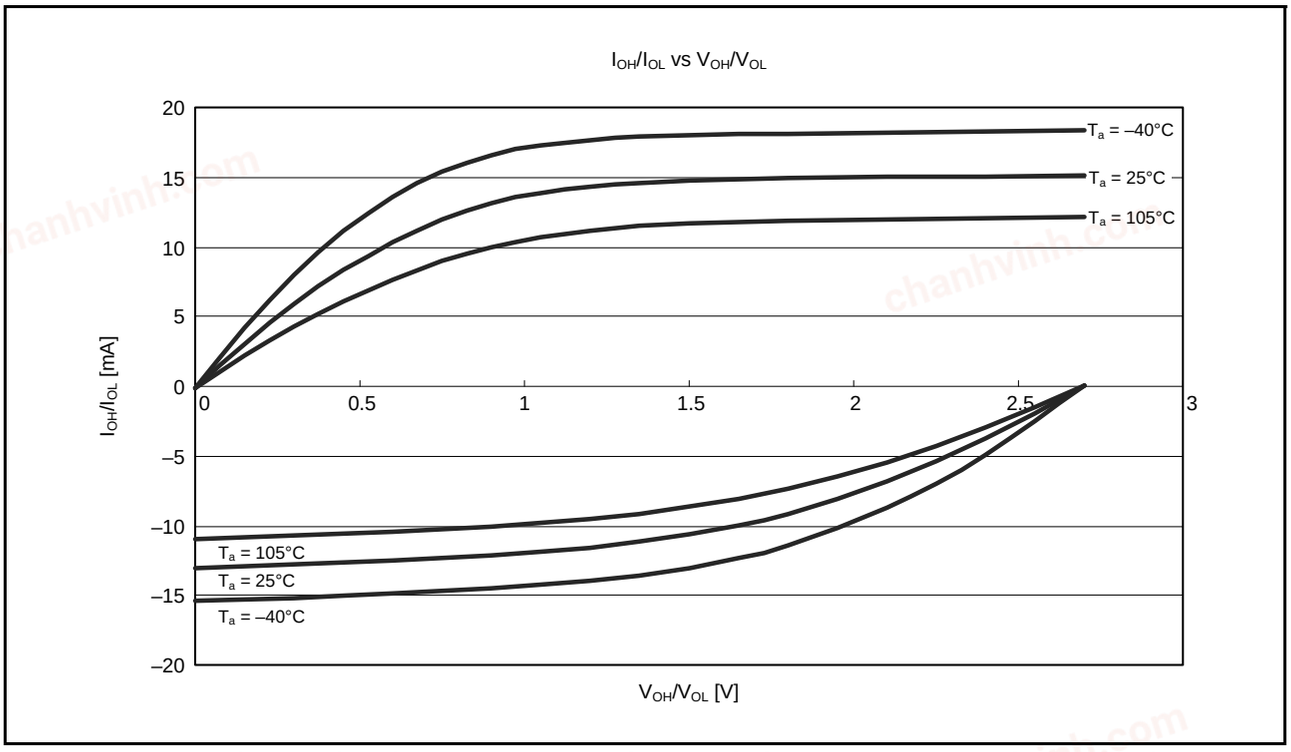


Figure 5.9 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 2.7 V when Normal Output is Selected (Reference Data)

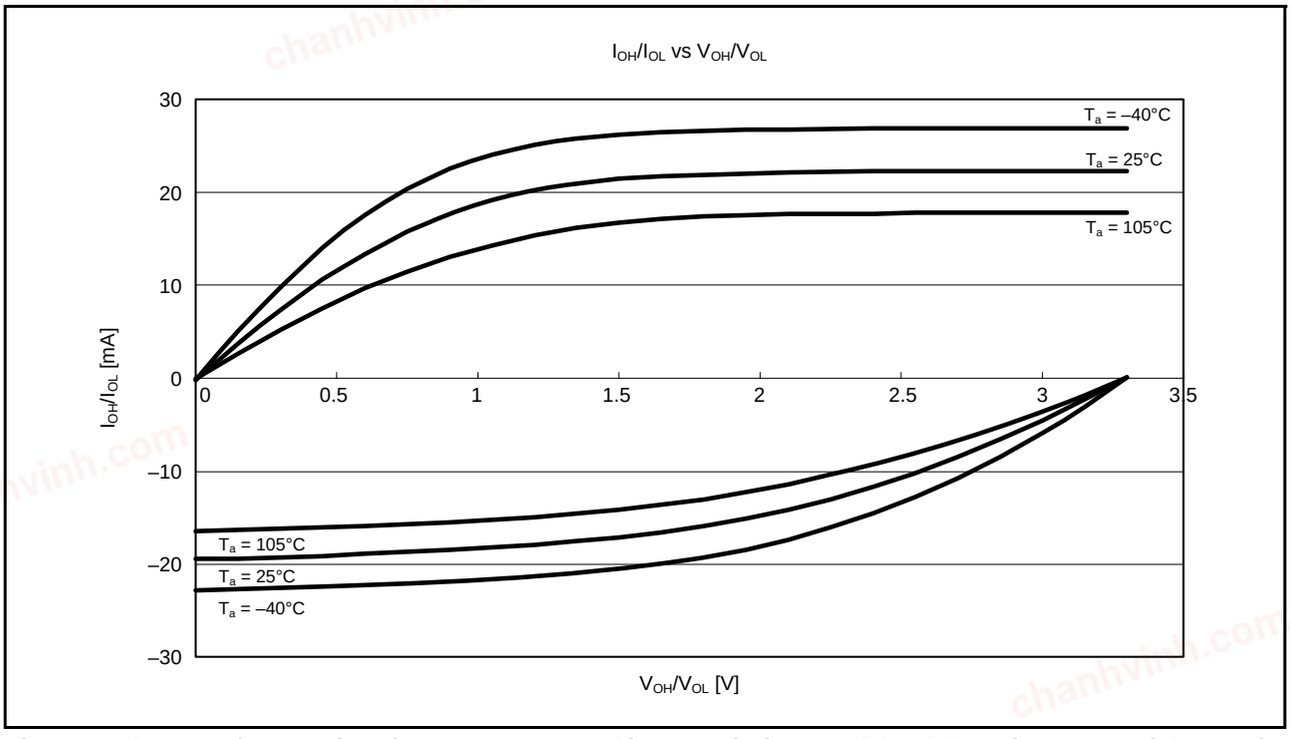


Figure 5.10 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 3.3 V when Normal Output is Selected (Reference Data)

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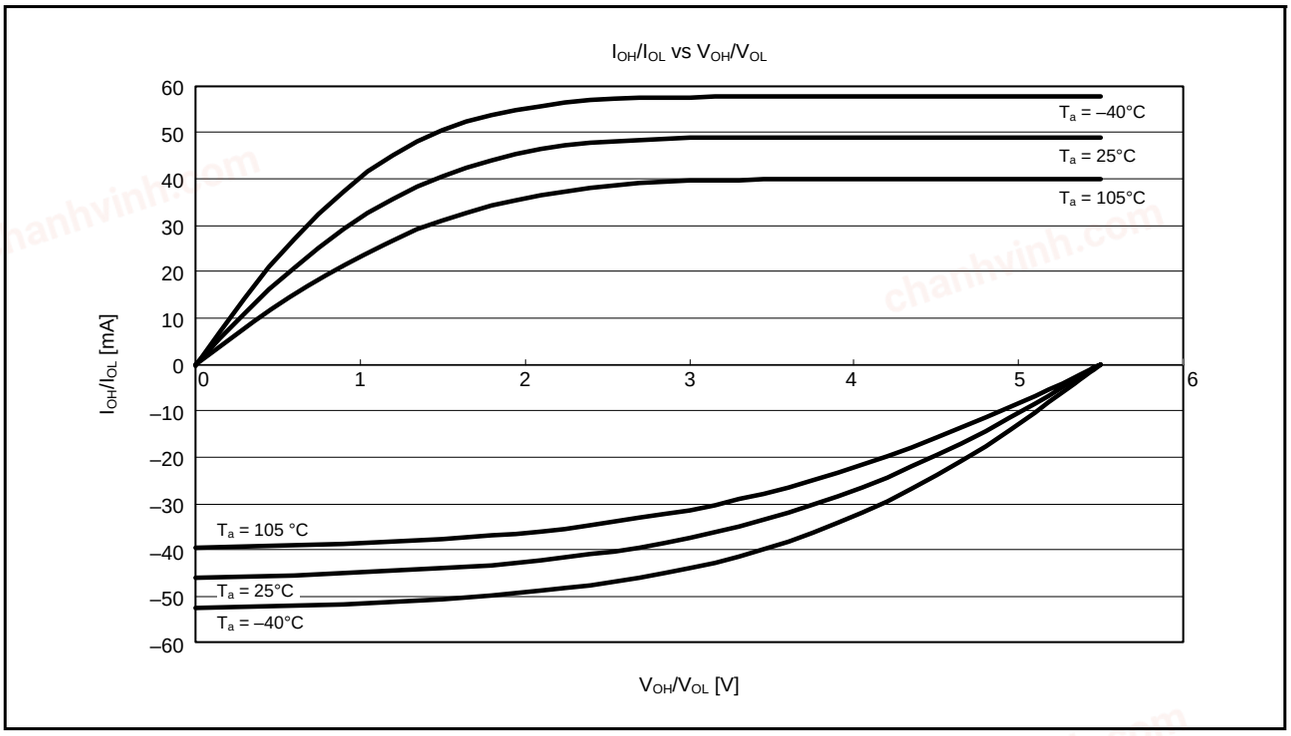


Figure 5.11 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 5.5 V when Normal Output is Selected (Reference Data)

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5.2.2 Standard I/O Pin Output Characteristics (2)

Figure 5.12 to Figure 5.16 show the characteristics when high-drive output is selected by the drive capacity control register.

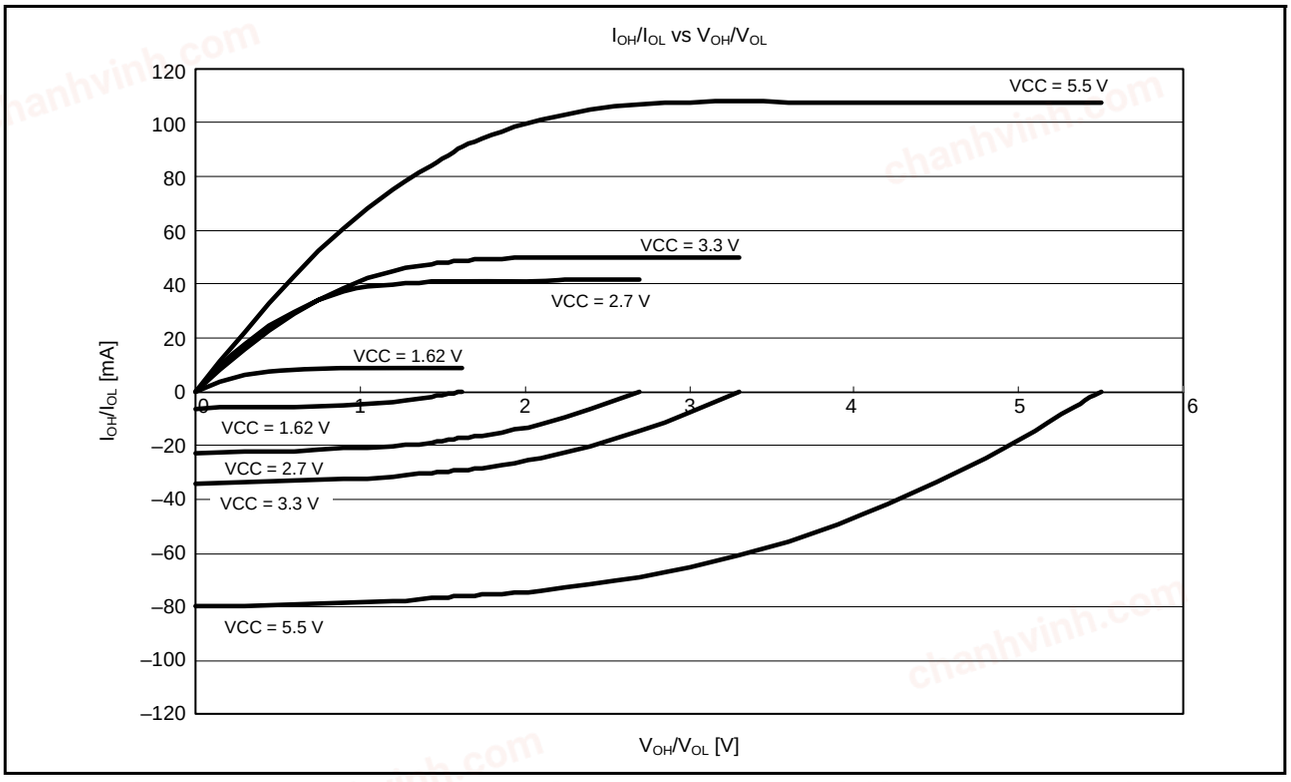


Figure 5.12 V_{OH}/V_{OL} and I_{OH}/I_{OL} Voltage Characteristics at T_a = 25°C when High-Drive Output is Selected (Reference Data)

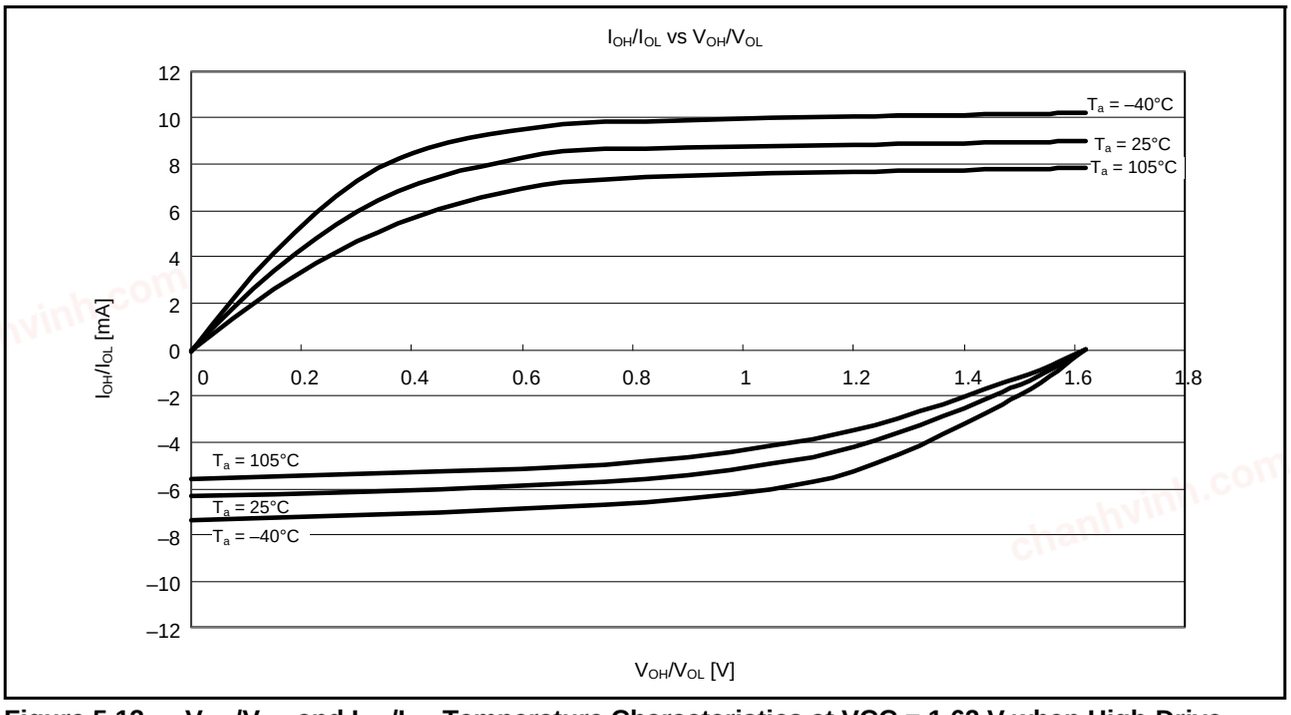


Figure 5.13 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 1.62 V when High-Drive Output is Selected (Reference Data)

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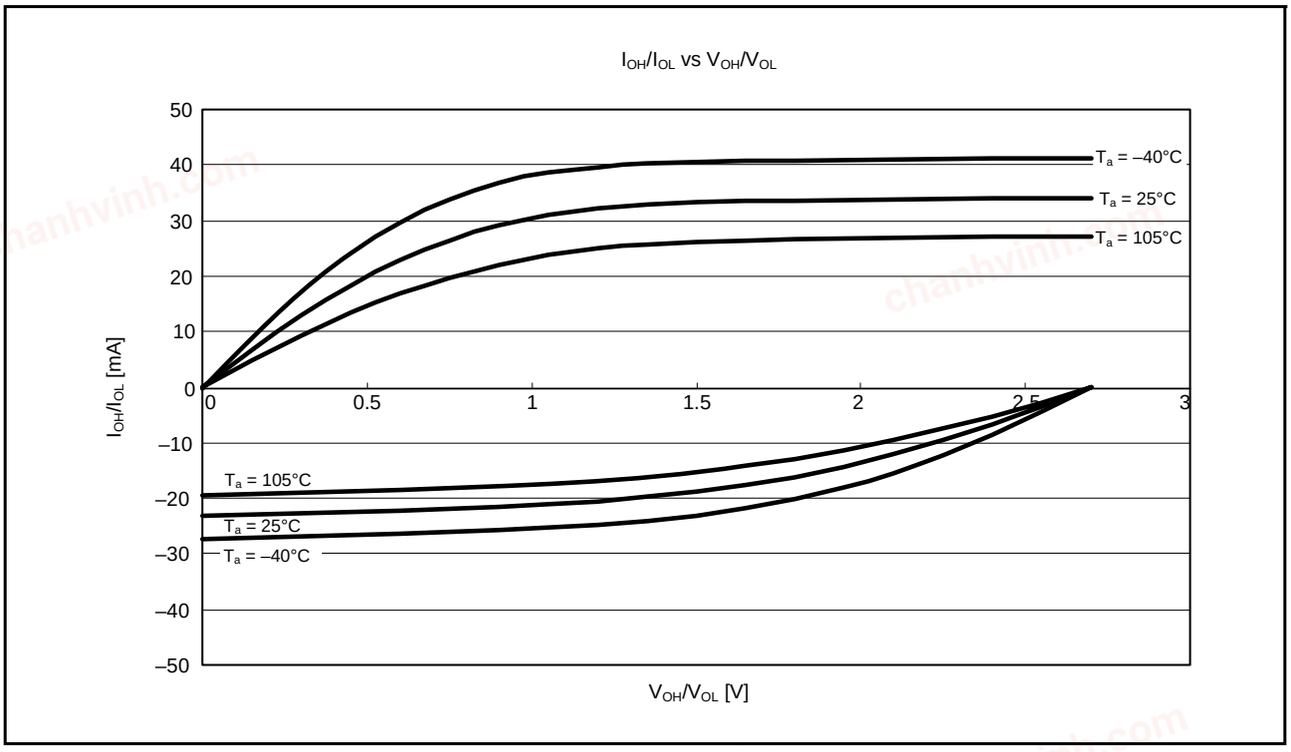


Figure 5.14 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 2.7 V when High-Drive Output is Selected (Reference Data)

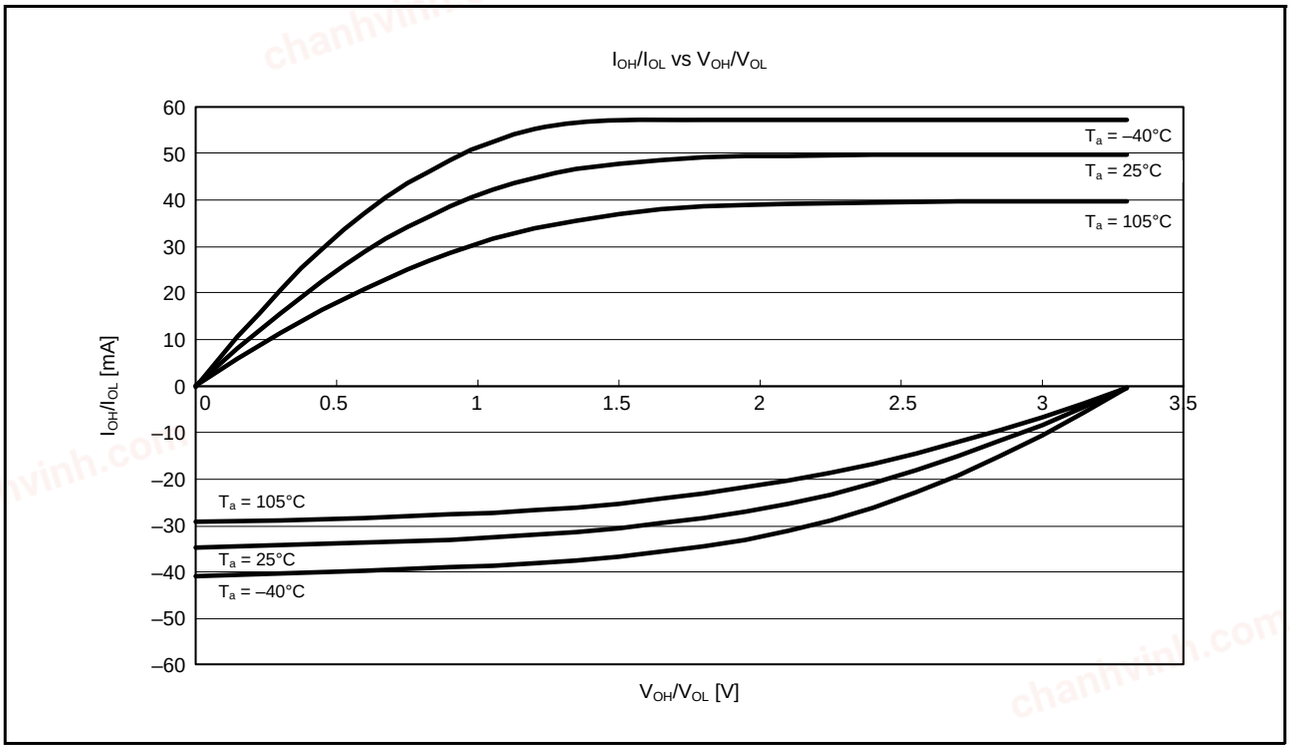


Figure 5.15 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 3.3 V when High-Drive Output is Selected (Reference Data)

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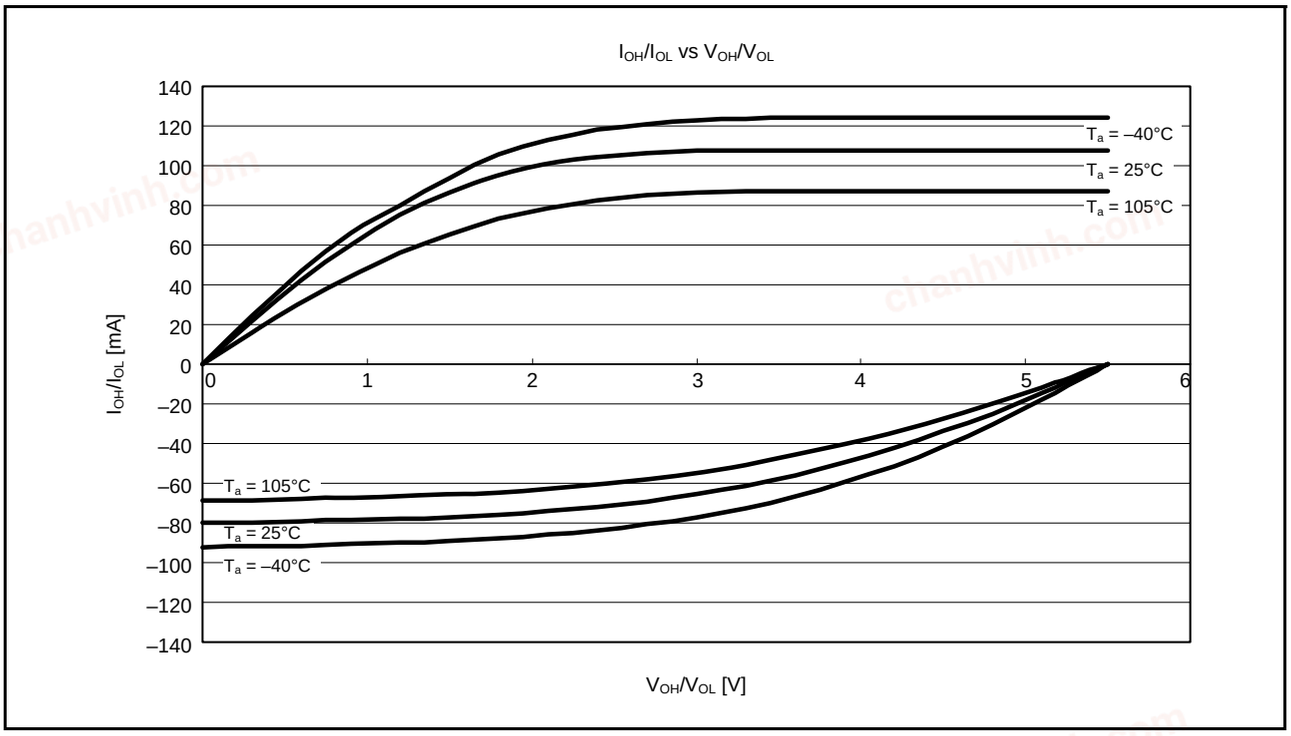


Figure 5.16 V_{OH}/V_{OL} and I_{OH}/I_{OL} Temperature Characteristics at VCC = 5.5 V when High-Drive Output is Selected (Reference Data)

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5.2.3 RIIC Pin Output Characteristics

Figure 5.17 to Figure 5.20 show the output characteristics of the RIIC pin.

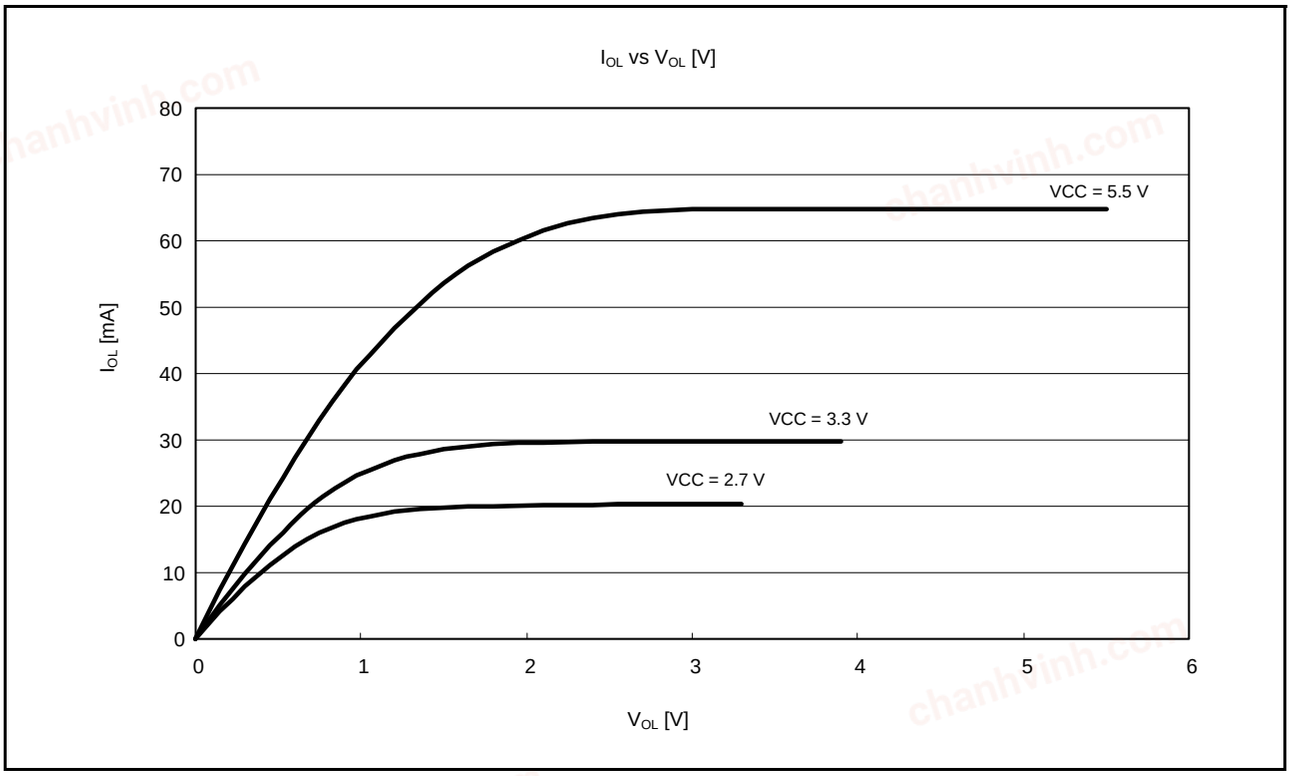


Figure 5.17 V_{OL} and I_{OL} Voltage Characteristics of RIIC Output Pin at T_a = 25°C (Reference Data)

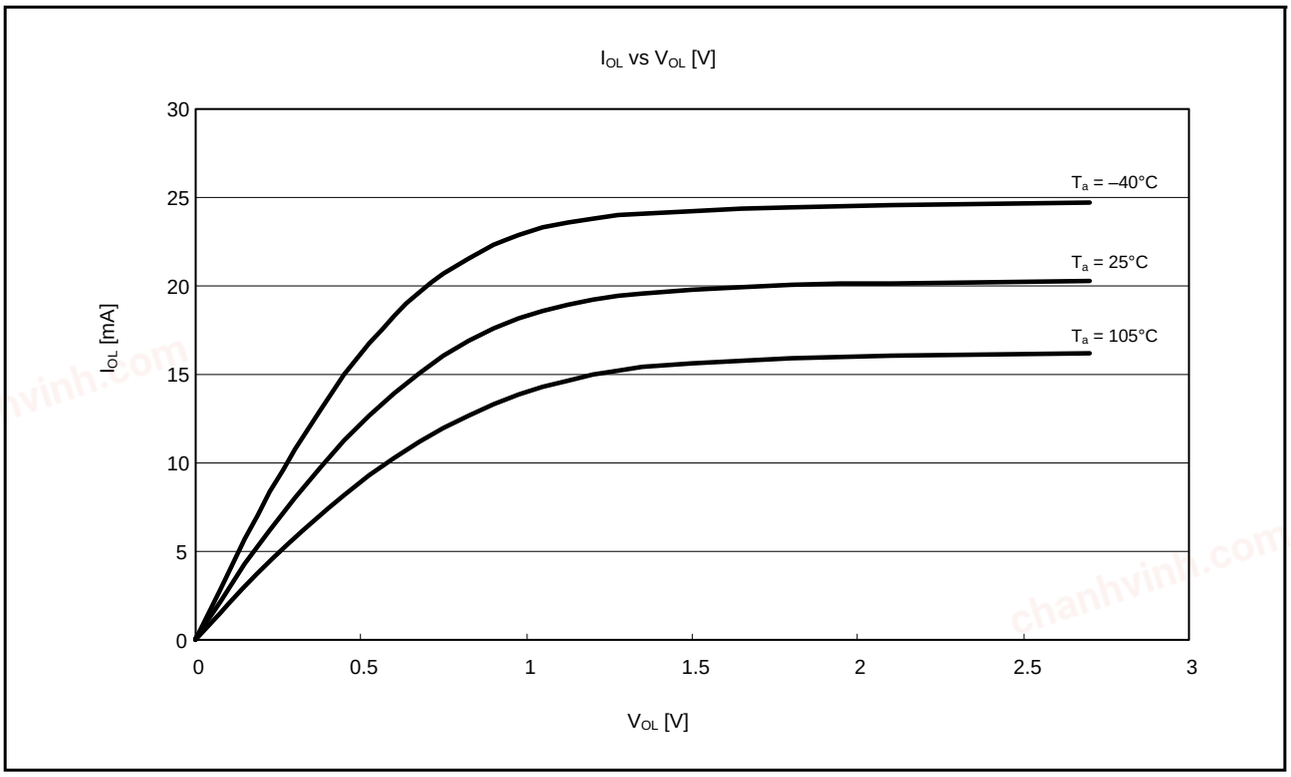


Figure 5.18 V_{OL} and I_{OL} Temperature Characteristics of RIIC Output Pin at VCC = 2.7 V (Reference Data)

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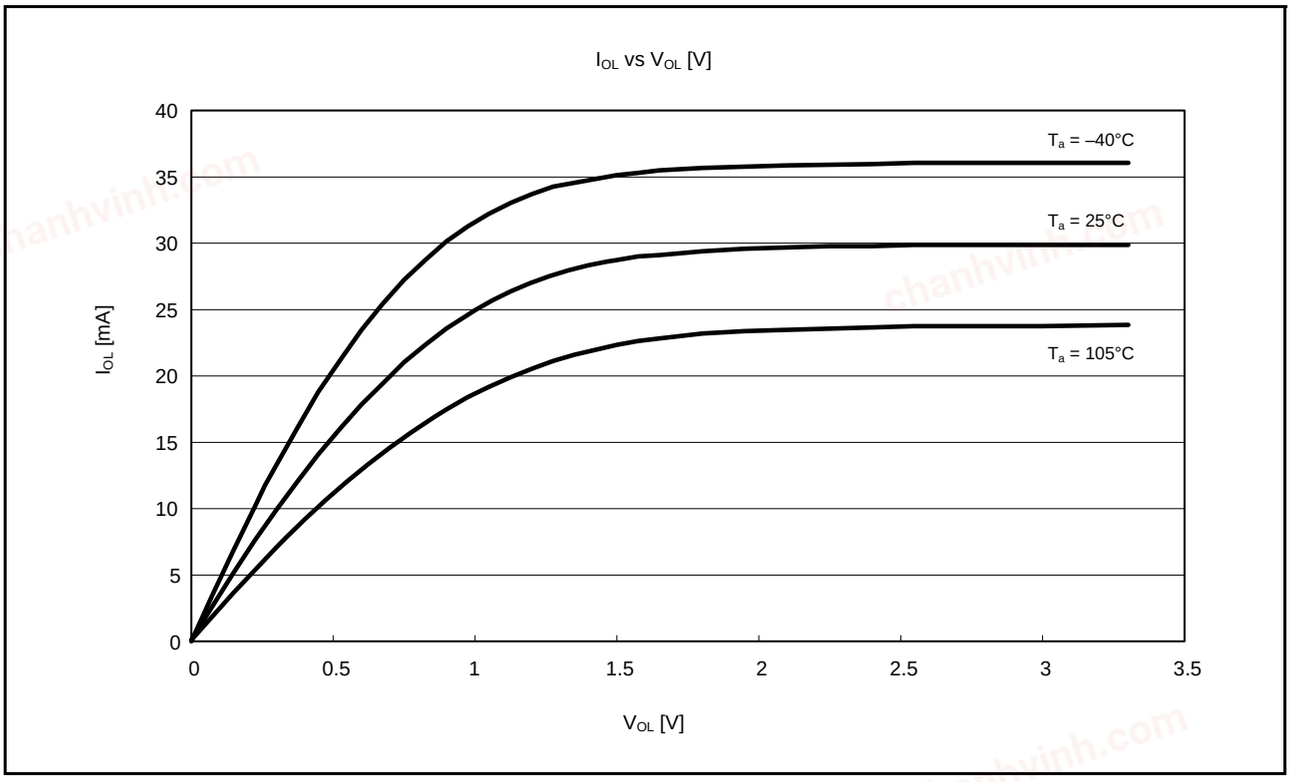


Figure 5.19 V_{OL} and I_{OL} Temperature Characteristics of RIIC Output Pin at VCC = 3.3 V (Reference Data)

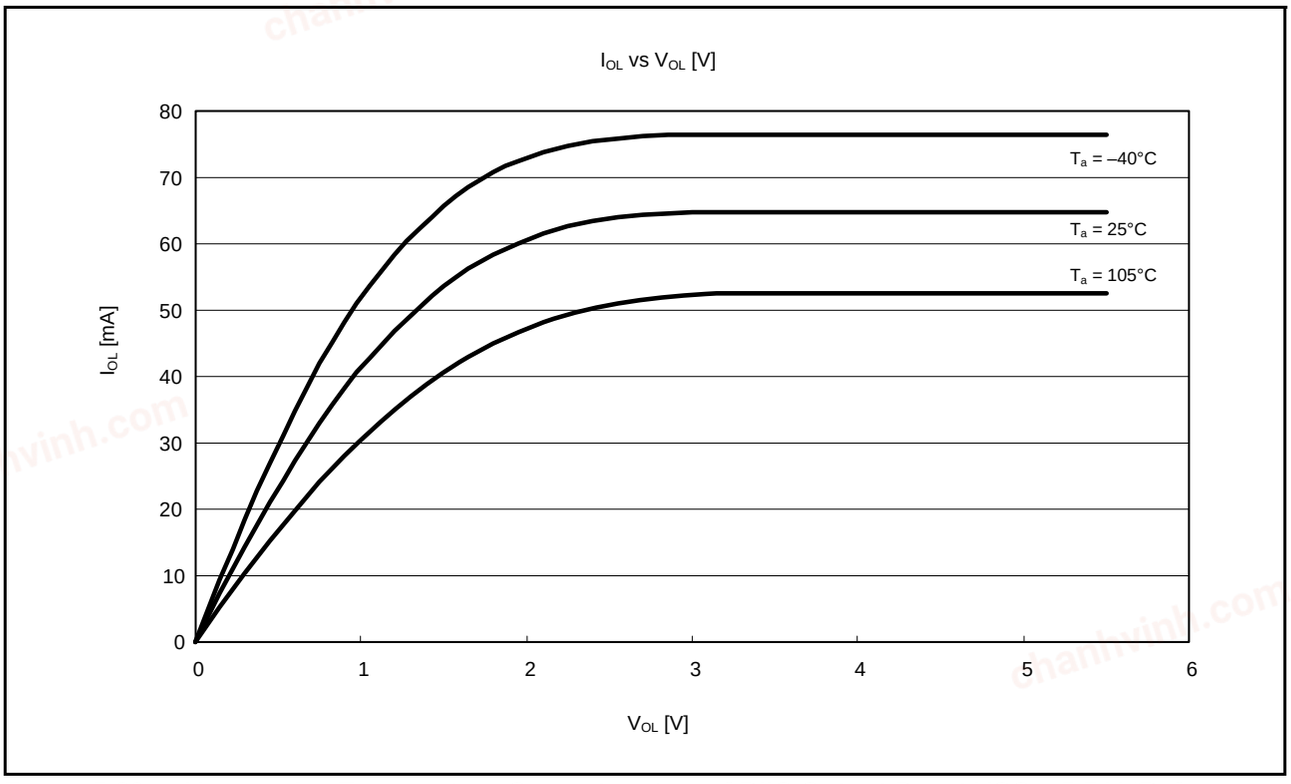


Figure 5.20 V_{OL} and I_{OL} Temperature Characteristics of RIIC Output Pin at VCC = 5.5 V (Reference Data)

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5.3 AC Characteristics

Table 5.18 Operation Frequency Value (Medium-Speed Operating Mode 1A)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = 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	8	32	MHz
	FlashIF clock (FCLK)*1		8	8	32	
	Peripheral module clock (PCLKB)		8	8	32	
	Peripheral module clock (PCLKD)*2		8	8	32	

Note 1. The VCC is 2.7 to 5.5 V and the FCLK must be running at a frequency of at least 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.

Table 5.19 Operation Frequency Value (Medium-Speed Operating Mode 1B)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 =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	8	32	MHz
	FlashIF clock (FCLK)*1		8	8	32	
	Peripheral module clock (PCLKB)		8	8	32	
	Peripheral module clock (PCLKD)*2		8	8	32	

Note 1. The VCC is 1.62 to 3.6 V and the FCLK must be running at a frequency of at least 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.

Table 5.20 Operation Frequency Value (Low-Speed Operating Mode 1)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = 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}	2	4	8	MHz
	FlashIF clock (FCLK)*1		2	4	8	
	Peripheral module clock (PCLKB)		2	4	8	
	Peripheral module clock (PCLKD)*2		2	4	8	

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.

Table 5.21 Operation Frequency Value (Low-Speed Operating Mode 2)

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = 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}	32.768	32.768	32.768	kHz
	FlashIF clock (FCLK)*1		32.768	32.768	32.768	
	Peripheral module clock (PCLKB)		32.768	32.768	32.768	
	Peripheral module clock (PCLKD)*2		32.768	32.768	32.768	

Note 1. Programming and erasing the flash memory is impossible.
Note 2. The A/D converter cannot be used.

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5.3.1 Clock Timing

Table 5.22 Clock Timing

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

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
EXTAL external clock input cycle time	t_{EXcyc}	50	—	—	ns	Figure 5.21
EXTAL external clock input high pulse width	t_{EXH}	20	—	—	ns	
EXTAL external clock input low pulse width	t_{EXL}	20	—	—	ns	
EXTAL external clock rising time	t_{EXr}	—	—	5	ns	
EXTAL external clock falling time	t_{EXf}	—	—	5	ns	
EXTAL external clock input wait time*1	t_{EXWT}	1	—	—	ms	
Main clock oscillator oscillation frequency*2	f_{MAIN}	1	—	20	MHz	
Main clock oscillation stabilization time (crystal)*2	$t_{MAINOSC}$	—	3	—	ms	Figure 5.22
Main clock oscillation stabilization time (ceramic resonator)*2	$t_{MAINOSC}$	—	50	—	µs	
Main clock oscillation stabilization wait time (crystal)*2	$t_{MAINOSCWT}$	—	6	—	ms	
Main clock oscillation stabilization wait time (ceramic resonator)*2	$t_{MAINOSCWT}$	—	100	—	µs	
LOCO clock cycle time	t_{cyc}	7.27	8	8.89	µs	
LOCO clock oscillation frequency	f_{LOCO}	112.5	125	137.5	kHz	
LOCO clock oscillation stabilization wait time	t_{LOCOWT}	—	—	20	µs	Figure 5.23
HOCO clock oscillation frequency	f_{HOCO}	31.680	32	32.320	MHz	T_a = 0 to 50°C
		36.495	36.864	37.233		
		39.600	40	40.400		
		49.500	50	50.500		
		31.520	32	32.480		T_a = -40 to 105°C
		36.311	36.864	37.417		
		39.400	40	40.600		
		49.250	50	50.750		
HOCO clock oscillation stabilization time 1	t_{HOCO1}	—	—	50	µs	Figure 5.24
HOCO clock oscillation stabilization time 2	t_{HOCO2}	—	—	10	µs	Figure 5.25
HOCO clock oscillation stabilization wait time	t_{HOCOWT}	—	—	20	µs	Figure 5.25
HOCO clock power supply stabilization time	t_{HOCOP}	—	—	350	µs	Figure 5.26
Sub-clock oscillator oscillation frequency	f_{SUB}	—	32.768	—	kHz	
Sub-clock oscillation stabilization time*3	t_{SUBOSC}	2	—	—	s	Figure 5.27
Sub-clock oscillation stabilization wait time*3	$t_{SUBOSCWT}$	4	—	—	s	

Note 1. The time interval from the time P36 and P37 are configured for input and the main clock oscillator stopping bit (MOSCCR.MOSTP) is set to 0 (operating) until the clock becomes available.

Note 2. When specifying the main clock oscillator stabilization time, load MOSCWTCR register with a stabilization time value that is greater than the resonator-vendor-recommended value. When determining the main lock oscillation stabilization wait time, allow an adequate margin (2 times is recommended) for the main clock oscillation stabilization time.
Start using the main clock in the main clock oscillation stabilization wait time (tMAINOSCWT) after setting up the main clock oscillator for operation with the MOSCCR.MOSTP bit.
The indicated value is a reference value that is measured for an 8 MHz resonator.

Note 3. When specifying the sub-clock oscillation stabilization time, load SOSCWTCR register with the resonator-vendor-recommended stabilization time value minus 2 seconds. When determining the sub-clock oscillation stabilization wait time, allow an adequate margin (2 times is recommended) for the sub-clock oscillation stabilization time. Start using the sub-clock in the sub-clock oscillation stabilization wait time (tSUBOSCWT) after setting up the sub-clock oscillator for operation with the SOSCCR.SOSTP or RCR3.RTCEN bit.

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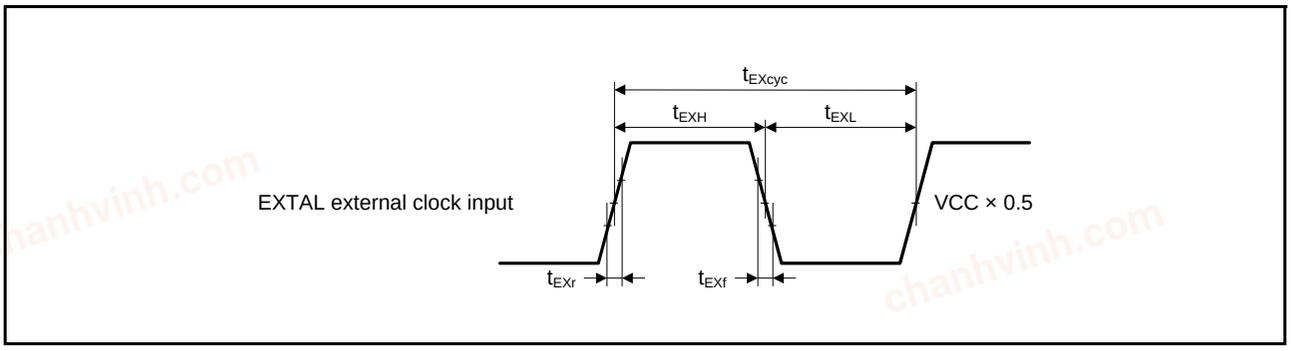


Figure 5.21 EXTAL External Clock Input Timing

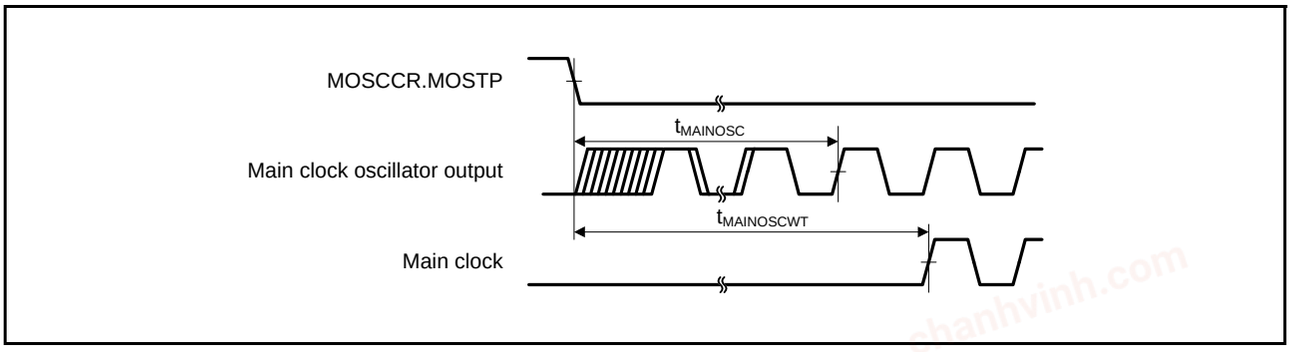


Figure 5.22 Main Clock Oscillation Start Timing

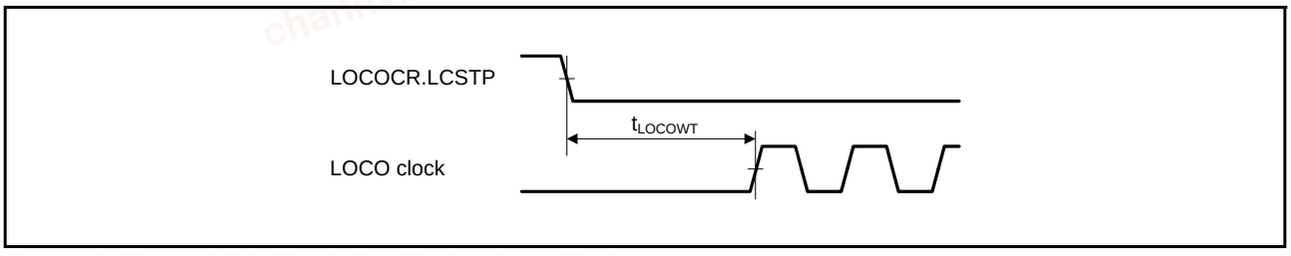


Figure 5.23 LOCO Clock Oscillation Start Timing

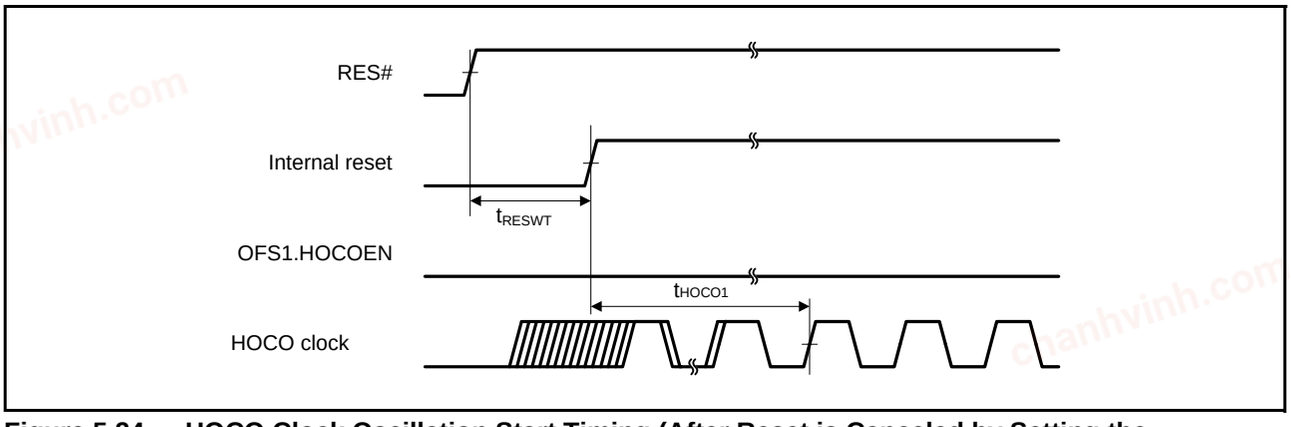


Figure 5.24 HOCO Clock Oscillation Start Timing (After Reset is Canceled by Setting the OFS1.HOCOEN Bit to 0)

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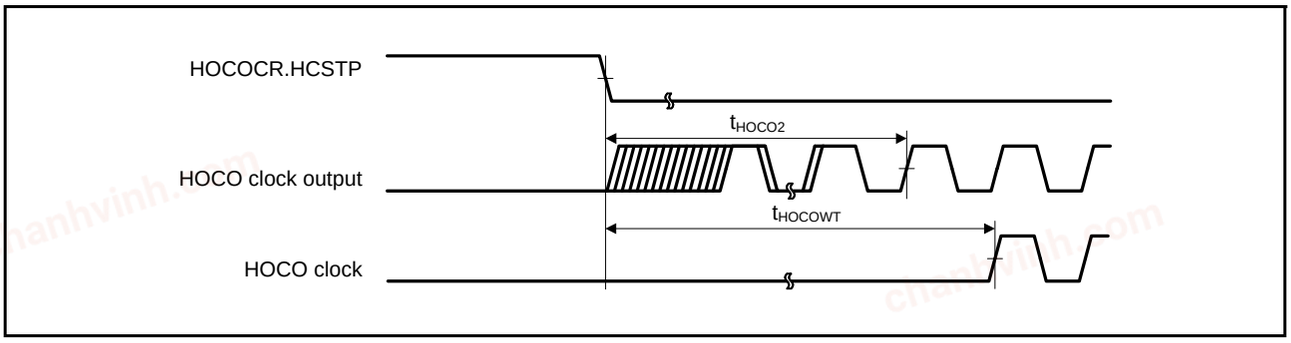


Figure 5.25 HOCO Clock Oscillation Start Timing (Oscillation is Started by Setting the HOCOCR.HCSTP Bit)

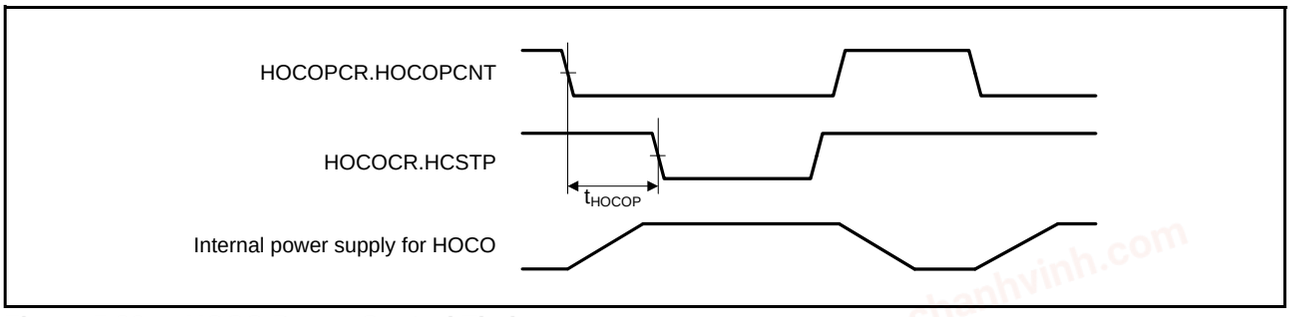


Figure 5.26 HOCO Power Control Timing

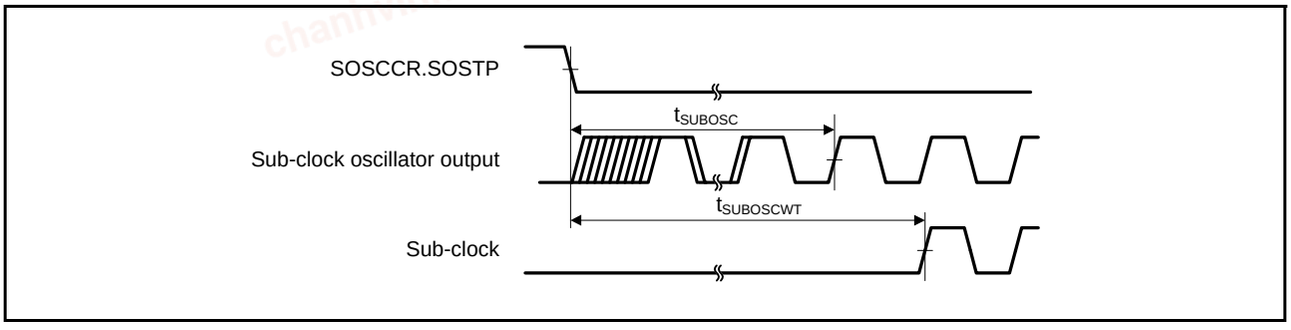


Figure 5.27 Sub-clock Oscillation Start Timing

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5.3.2 Reset Timing

Table 5.23 Reset Timing

Conditions: VCC = AVCC0 = 1.62 to 5.5 V, VSS = AVSS0 = 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 5.28
	Software standby mode, low-speed operating modes 1 and 2	t_{RESWS}	1	—	—	ms	Figure 5.29
	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 5.28
Internal reset time (independent watchdog timer reset, software reset)		t_{RESW2}	—	—	1.4	ms	

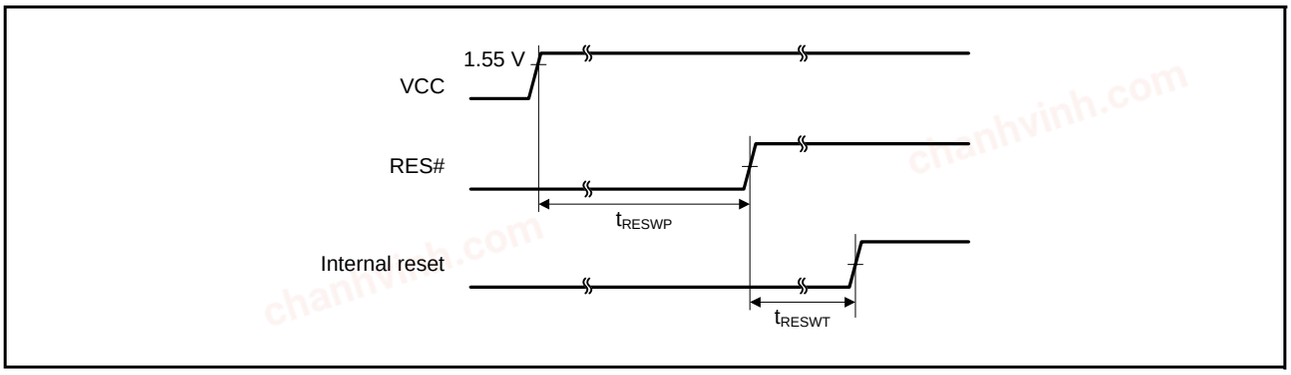


Figure 5.28 Reset Input Timing at Power-On

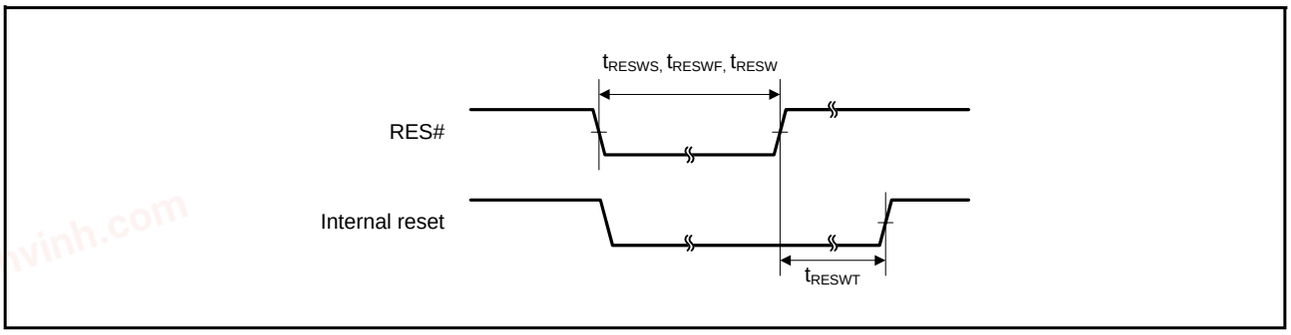


Figure 5.29 Reset Input Timing

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5.3.3 Timing of Recovery from Low Power Consumption Modes

Table 5.24 Timing of Recovery from Low Power Consumption Modes

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

Item			Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Recovery time after cancellation of software standby mode (HOCO power supplied) (SOFTCUT[2:0] bits = 000b)*1	Crystal resonator connected to main clock oscillator*2	Main clock oscillator operating	t_{SBYMC}	—	3	—	ms	Figure 5.30
	External clock input to main clock oscillator*4	Main clock oscillator operating	t_{SBYEX}	7	—	—	µs	
	Sub-clock oscillator operating*5		t_{SBYSC}	2*3	—	—	s	
	HOCO clock oscillator operating*6		t_{SBYHO}	—	—	50	µs	
	LOCO clock oscillator operating*5		t_{SBYLO}	—	—	90	µs	
Recovery time after cancellation of software standby mode (HOCO power not supplied) (SOFTCUT[2:0] bits = 11xb)*1	Crystal resonator connected to main clock oscillator*2	Main clock oscillator operating	t_{SBYMC}	—	3	—	ms	Figure 5.30
	External clock input to main clock oscillator*4	Main clock oscillator operating	t_{SBYEX}	40	—	—	µs	
	Sub-clock oscillator operating*5		t_{SBYSC}	2*3	—	—	s	
	HOCO clock oscillator operating*6		t_{SBYHO}	—	—	0.8	ms	
	LOCO clock oscillator operating*5		t_{SBYLO}	—	—	90	µs	

Note 1. The recovery time varies depending on the state of each oscillator when the WAIT instruction is executed. The recovery time when multiple oscillators are operating varies depending on the operating state of the oscillators that are not selected as the system clock source, and depends on the time set in the wait control registers corresponding to the oscillators.
Note 2. The indicated value is measured for an 8 MHz crystal resonator. ICLK is set to divided by 1.
Note 3. When RCR3.RTCEN = 1, the time will be the time set in the SOSCWTCR register minus 2 s.
Note 4. When the external clock frequency is 20 MHz. ICLK is set to divided by 1.
Note 5. ICLK is set to divided by 1.
Note 6. When the frequency is 50 MHz, HOCOWTCR2.HSTS2[4:0] = 10101b and ICLK is set to divided by 2.
When the frequency is 32 MHz, HOCOWTCR2.HSTS2[4:0] = 10100b and ICLK is set to divided by 1.

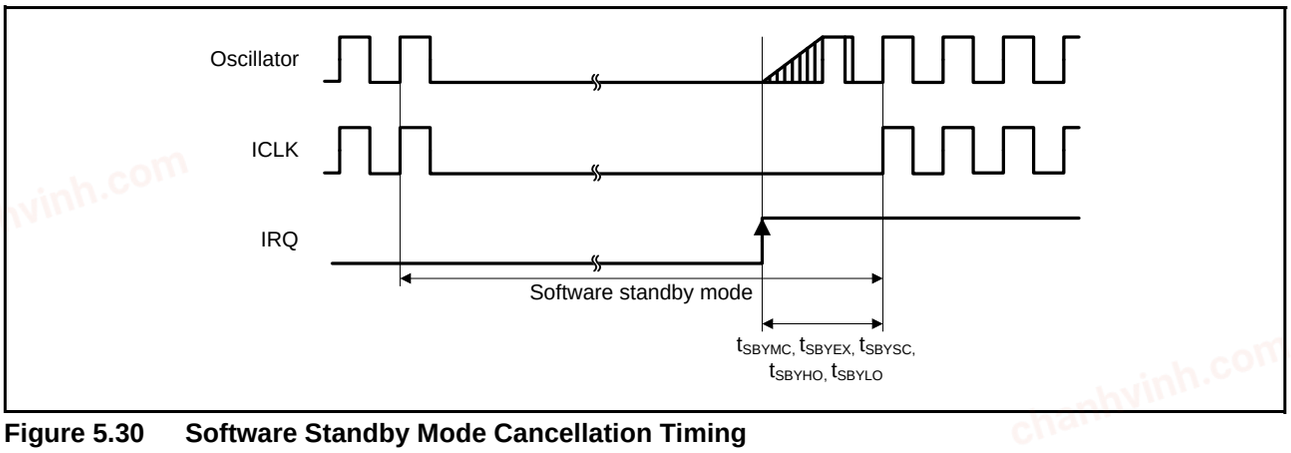


Figure 5.30 Software Standby Mode Cancellation Timing

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5.3.4 Control Signal Timing

Table 5.25 Control Signal Timing

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

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
NMI pulse width	t_{NMIW}	200	—	—	ns	$t_{c(PCLKB)} \times 2 \leq 200$ ns, Figure 5.31
		$t_{c(PCLKB)} \times 2$	—	—	ns	$t_{c(PCLKB)} \times 2 > 200$ ns, Figure 5.31
IRQ pulse width	t_{IRQW}	200	—	—	ns	$t_{c(PCLKB)} \times 2 \leq 200$ ns, Figure 5.32
		$t_{c(PCLKB)} \times 2$	—	—	ns	$t_{c(PCLKB)} \times 2 > 200$ ns, Figure 5.32

Note: • 200 ns minimum in software standby mode.

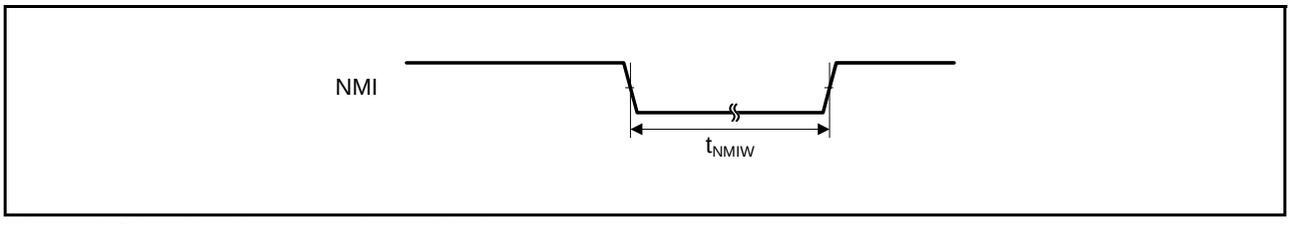


Figure 5.31 NMI Interrupt Input Timing

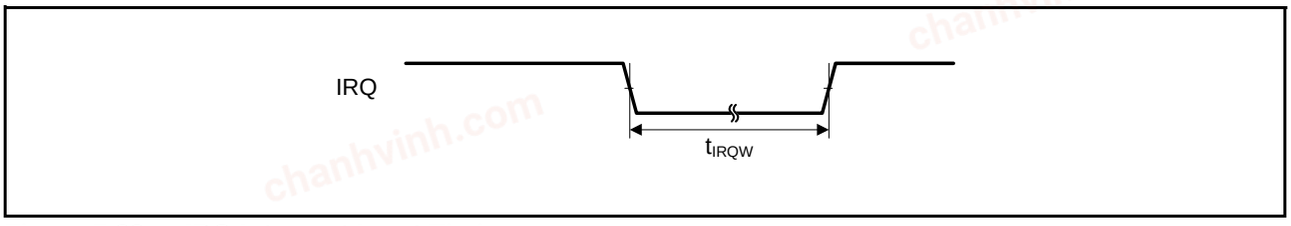


Figure 5.32 IRQ Interrupt Input Timing

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5.3.5 Timing of On-Chip Peripheral Modules

Table 5.26 Timing of On-Chip Peripheral Modules (1)

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

Item			Symbol	Min.	Max.	Unit*1	Test Conditions
I/O ports	Input data pulse width		t_{PRW}	1.5	—	t_{Pcyc}	Figure 5.33
MTU	Input capture input pulse width	Single-edge setting	t_{TICW}	1.5	—	t_{Pcyc}	Figure 5.34
		Both-edge setting		2.5	—		
	Timer clock pulse width	Single-edge setting	t_{TCKWH}, t_{TCKWL}	1.5	—	t_{Pcyc}	Figure 5.35
		Both-edge setting		2.5	—		
		Phase counting mode		2.5	—		
POE	POE# input pulse width		t_{POEW}	1.5	—	t_{Pcyc}	Figure 5.36
8-bit timer	Timer clock pulse width	Single-edge setting	t_{TMCWH}, t_{TMCWL}	1.5	—	t_{Pcyc}	Figure 5.37
		Both-edge setting		2.5	—		
SCI	Input clock cycle	Asynchronous	t_{Scyc}	4	—	t_{Pcyc}	Figure 5.38
		Clock synchronous		6	—		
	Input clock pulse width		t_{SCKW}	0.4	0.6	t_{Scyc}	
	Input clock rise time		t_{SCKr}	—	20	ns	
	Input clock fall time		t_{SCKf}	—	20	ns	
	Output clock cycle*2	Asynchronous	t_{Scyc}	16	—	t_{Pcyc}	C = 30 pF Figure 5.39
		Clock synchronous		4	—		
	Output clock pulse width*2		t_{SCKW}	0.4	0.6	t_{Scyc}	
	Output clock rise time*2		t_{SCKr}	—	20	ns	
	Output clock fall time*2		t_{SCKf}	—	20	ns	
	Transmit data delay time*3	Clock synchronous	2.7 V ≤ VCC ≤ 5.5 V	t_{TXD}	—	40	ns
			1.62 V ≤ VCC < 2.7 V		—	80	
	Receive data setup time	Clock synchronous	2.7 V ≤ VCC ≤ 5.5 V	t_{RXS}	40	—	ns
			1.62 V ≤ VCC < 2.7 V		80	—	
	Receive data hold time		Clock synchronous	t_{RXH}	40	—	ns
A/D converter	Trigger input pulse width			t_{TRGW}	1.5	—	t_{Pcyc}	Figure 5.40
CAC	CACREF input pulse width		$t_{Pcyc} \le t_{cac}$*4	t_{CACREF}	4.5 t_{cac} + 3 t_{Pcyc}	—	ns	
			$t_{Pcyc} > t_{cac}$*4		5 t_{cac} + 6.5 t_{Pcyc}			

Note 1. t_{Pcyc}: PCLKB cycle
Note 2. Value when the drive capacity of clock output ports is set to normal output.
Note 3. Value when the drive capacity of data output ports is set to normal output.
Note 4. t_{cac}: CAC count clock source cycle

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Table 5.27 Timing of On-Chip Peripheral Modules (2)

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

Item				Symbol	Min.	Max.	Unit*1	Test Conditions
RSPI	RSPCK clock cycle*2	Master		t_{SPcyc}	2	4096	t_{Pcyc}	C = 30 pF Figure 5.41
		Slave			8	4096		
	RSPCK clock high pulse width*2	Master		t_{SPCKWH}	$(t_{SPcyc} - t_{SPCKr} - t_{SPCKf})/2 - 3$	—	ns	
		Slave			$(t_{SPcyc} - t_{SPCKr} - t_{SPCKf})/2$	—		
	RSPCK clock low pulse width*2	Master		t_{SPCKWL}	$(t_{SPcyc} - t_{SPCKr} - t_{SPCKf})/2 - 3$	—	ns	
		Slave			$(t_{SPcyc} - t_{SPCKr} - t_{SPCKf})/2$	—		
	RSPCK clock rise/fall time*2	Output	2.7 V ≤ VCC ≤ 5.5 V	t_{SPCKr}, t_{SPCKf}	—	10	ns	
			1.62 V ≤ VCC < 2.7 V		—	20		
		Input			—	1	µs	
	Data input setup time	Master		t_{SU}	4	—	ns	C = 30 pF Figure 5.42 to Figure 5.47
		Slave			$20 - t_{Pcyc}$	—		
	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	t_{HF}	0	—		
		Slave		t_H	$20 + 2 \times t_{Pcyc}$	—		
	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	
			1.62 V ≤ VCC < 2.7 V		—	28		
		Slave	2.7 V ≤ VCC ≤ 5.5 V		—	$3 \times t_{Pcyc} + 40$		
			1.62 V ≤ VCC < 2.7 V		—	$3 \times t_{Pcyc} + 80$		
	Data output hold time	Master		t_{OH}	0	—	ns	
		Slave			0	—		
	Successive transmission delay time	Master		t_{TD}	$t_{SPcyc} + 2 \times t_{Pcyc}$	$8 \times t_{SPcyc} + 2 \times t_{Pcyc}$	ns	
		Slave			$4 \times t_{Pcyc}$	—		
	MOSI and MISO rise/fall time	Output	2.7 V ≤ VCC ≤ 5.5 V	t_{Dr}, t_{Df}	—	10	ns	
			1.62 V ≤ VCC < 2.7 V		—	20		
		Input			—	1	µs	
	SSL rise/fall time	Output		t_{SSLr}, t_{SSLf}	—	20	ns	
		Input			—	1	µs	
	Slave access time			t_{SA}	—	4	t_{Pcyc}	C = 30 pF Figure 5.45 and Figure 5.47
	Slave output release time			t_{REL}	—	3	t_{Pcyc}	

Note 1. t_{Pcyc}: PCLKB cycle
Note 2. Value when the drive capacity of clock output ports is set to normal output.

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Table 5.28 Timing of On-Chip Peripheral Modules (3)

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

Item			Symbol	Min.	Max.	Unit*1	Test Conditions
Simple SPI	SCK clock cycle output (master)*2		t_{SPcyc}	4	65536	t_{Pcyc}	C = 30 pF Figure 5.41
	SCK clock cycle input (slave)			6	65536		
	SCK clock high pulse width*2		t_{SPCKWH}	0.4	0.6	t_{SPcyc}	
	SCK clock low pulse width*2		t_{SPCKWL}	0.4	0.6	t_{SPcyc}	
	SCK clock rise/fall time		t_{SPCKr}, t_{SPCKf}	—	20	ns	
	Data input setup time	2.7 V ≤ VCC ≤ 5.5 V	t_{SU}	40	—	ns	C = 30 pF Figure 5.42 to Figure 5.47
		1.62 V ≤ VCC < 2.7 V		80	—		
	Data input hold time		t_H	40	—	ns	
	SS input setup time		t_{LEAD}	6	—	t_{Pcyc}	
	SS input hold time		t_{LAG}	6	—	t_{Pcyc}	
	Data output delay time	2.7 V ≤ VCC ≤ 5.5 V	t_{OD}	—	40	ns	
		1.62 V ≤ VCC < 2.7 V		—	80		
	Data output hold time		t_{OH}	0	—	ns	
	Data rise/fall time		t_{Dr}, t_{Df}	—	20	ns	
	SS input rise/fall time		t_{SSLr}, t_{SSLf}	—	20	ns	
	Slave access time		t_{SA}	—	5	t_{Pcyc}	C = 30 pF Figure 5.45 and Figure 5.47
	Slave output release time		t_{REL}	—	5	t_{Pcyc}	

Note 1. t_{Pcyc}: PCLKB cycle
Note 2. Value when the drive capacity of clock output ports is set to normal output.

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Table 5.29 Timing of On-Chip Peripheral Modules (4)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, fPCLKB = up to 32 MHz, T_a = –40 to +105°C

Item		Symbol	Min.*1,*2	Max.	Unit	Test Conditions
RIIC (Standard mode, SMBus)	SCL input cycle time	t_{SCL}	6 (12) × t_{IICcyc} + 1300	—	ns	Figure 5.48
	SCL input high pulse width	t_{SCLH}	3 (6) × t_{IICcyc} + 300	—	ns	
	SCL input low pulse width	t_{SCLL}	3 (6) × t_{IICcyc} + 300	—	ns	
	SCL, SDA input rise time	t_{Sr}	—	1000	ns	
	SCL, SDA input fall time	t_{Sf}	—	300	ns	
	SCL, SDA input spike pulse removal time	t_{SP}	0	1 (5) × t_{IICcyc}	ns	
	SDA input bus free time	t_{BUF}	3 (6) × t_{IICcyc} + 300	—	ns	
	Start condition input hold time	t_{STAH}	t_{IICcyc} + 300	—	ns	
	Restart condition input setup time	t_{STAS}	1000	—	ns	
	Stop condition input setup time	t_{STOS}	1000	—	ns	
	Data input setup time	t_{SDAS}	t_{IICcyc} + 50	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load	C_b	—	400	pF	
RIIC (Fast mode)	SCL input cycle time	t_{SCL}	6 (12) × t_{IICcyc} + 600	—	ns	Figure 5.48
	SCL input high pulse width	t_{SCLH}	3 (6) × t_{IICcyc} + 300	—	ns	
	SCL input low pulse width	t_{SCLL}	3 (6) × t_{IICcyc} + 300	—	ns	
	SCL, SDA input rise time	t_{Sr}	20 + 0.1C_b	300	ns	
	SCL, SDA input fall time	t_{Sf}	20 + 0.1C_b	300	ns	
	SCL, SDA input spike pulse removal time	t_{SP}	0	1 (4) × t_{IICcyc}	ns	
	SDA input bus free time	t_{BUF}	3 (6) × t_{IICcyc} + 300	—	ns	
	Start condition input hold time	t_{STAH}	t_{IICcyc} + 300	—	ns	
	Restart condition input setup time	t_{STAS}	300	—	ns	
	Stop condition input setup time	t_{STOS}	300	—	ns	
	Data input setup time	t_{SDAS}	t_{IICcyc} + 50	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load	C_b	—	400	pF	

Note: • t_{IICcyc}: RIIC internal reference count clock (IICφ) cycle
Note 1. The value in parentheses is used when ICMR3.NF[1:0] are set to 11b while a digital filter is enabled with ICFER.NFE = 1.
Note 2. C_b indicates the total capacity of the bus line.

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Table 5.30 Timing of On-Chip Peripheral Modules (5)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V, fPCLKB = up to 32 MHz, T_a = –40 to +105°C

Item		Symbol	Min.*1	Max.	Unit	Test Conditions
Simple IIC (Standard mode)	SDA input rise time	t_{Sr}	—	1000	ns	Figure 5.48
	SDA input fall time	t_{Sf}	—	300	ns	
	SDA input spike pulse removal time	t_{SP}	0	$4 \times t_{Pcyc}$*2	ns	
	Data input setup time	t_{SDAS}	250	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load	C_b	—	400	pF	
Simple IIC (Fast mode)	SCL, SDA input rise time	t_{Sr}	$20 + 0.1C_b$	300	ns	Figure 5.48
	SCL, SDA input fall time	t_{Sf}	$20 + 0.1C_b$	300	ns	
	SCL, SDA input spike pulse removal time	t_{SP}	0	$4 \times t_{Pcyc}$*2	ns	
	Data input setup time	t_{SDAS}	100	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load	C_b	—	400	pF	

Note: • t_{Pcyc}: PCLKB cycle
Note 1. C_b indicates the total capacity of the bus line.
Note 2. This applies when the SMR.CKS[1:0] bits = 00b and the SNFR.NFCS[2:0] bits = 010b while the SNFR.NFE bit = 1 and the digital filter is enabled.

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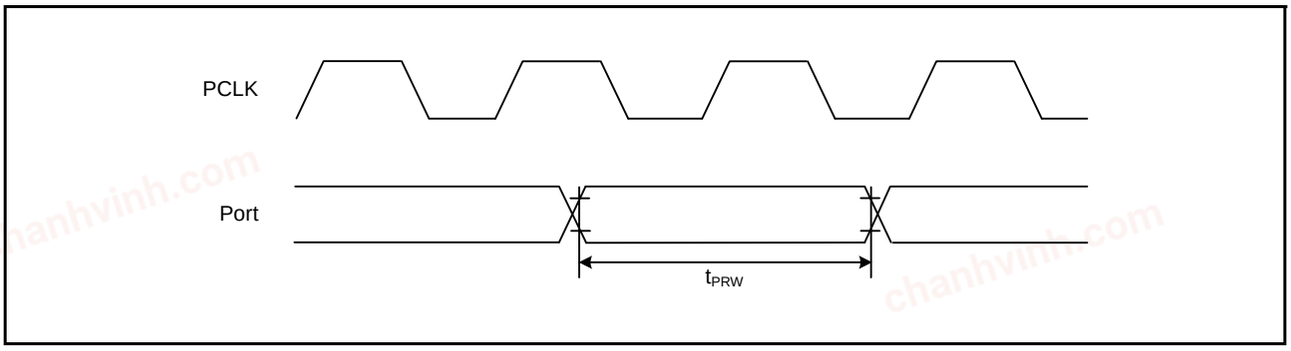


Figure 5.33 I/O Port Input Timing

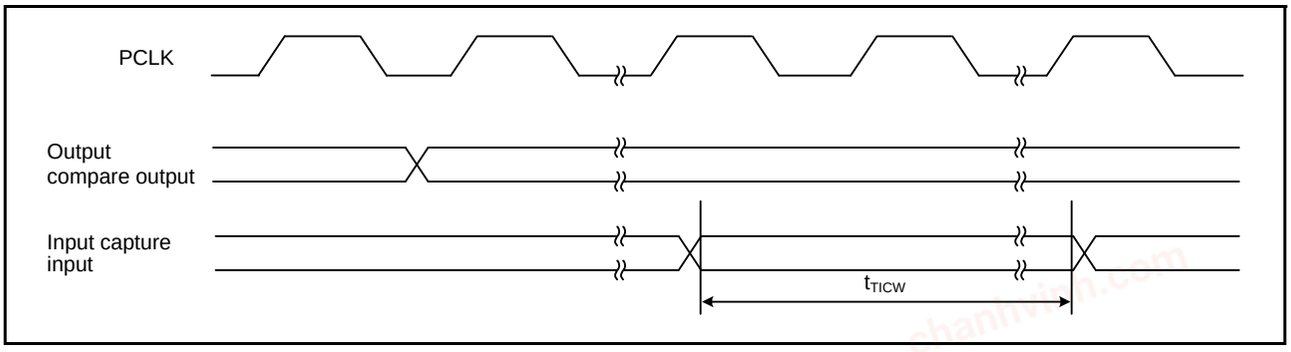


Figure 5.34 MTU Input/Output Timing

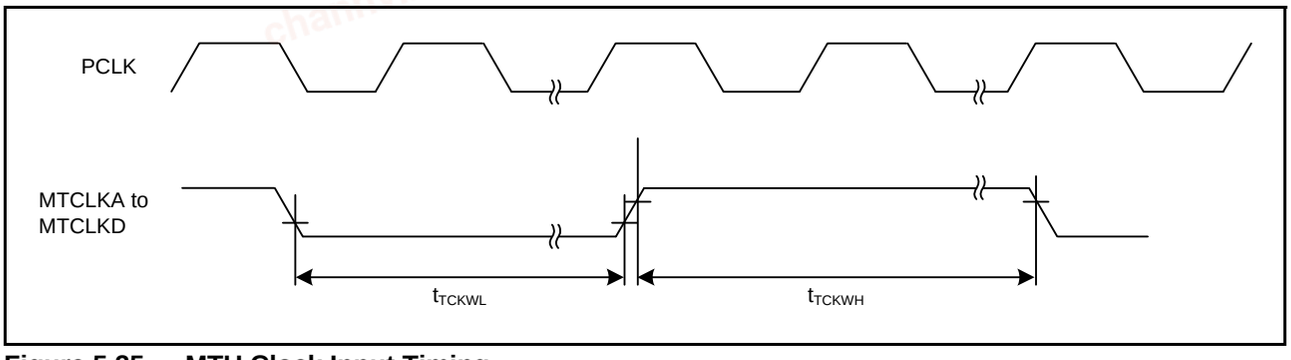


Figure 5.35 MTU Clock Input Timing

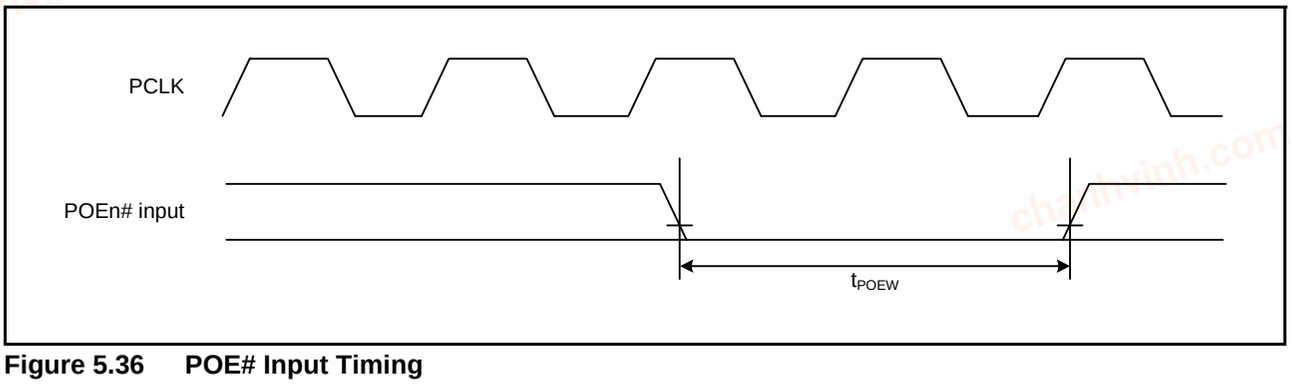


Figure 5.36 POE# Input Timing

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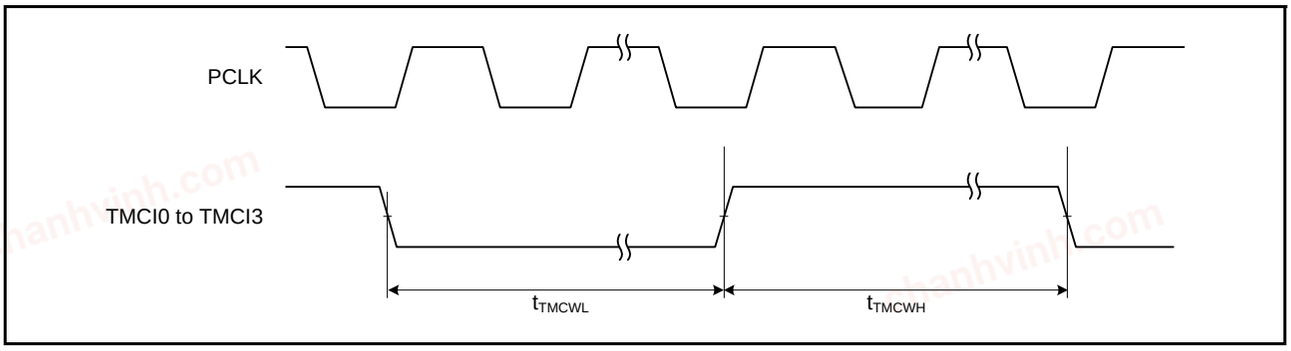


Figure 5.37 8-Bit Timer Clock Input Timing

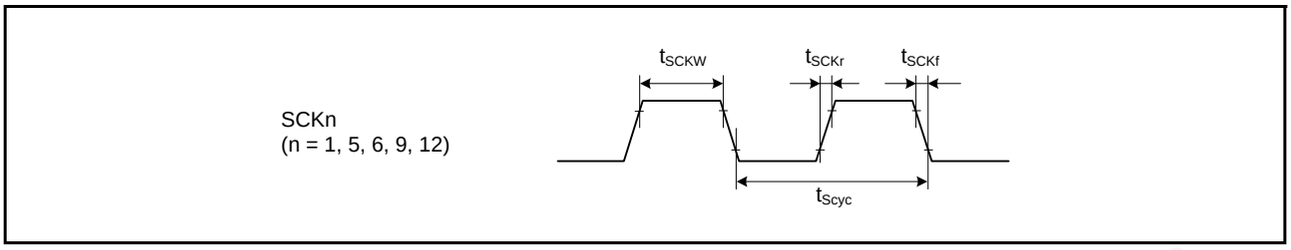


Figure 5.38 SCK Clock Input Timing

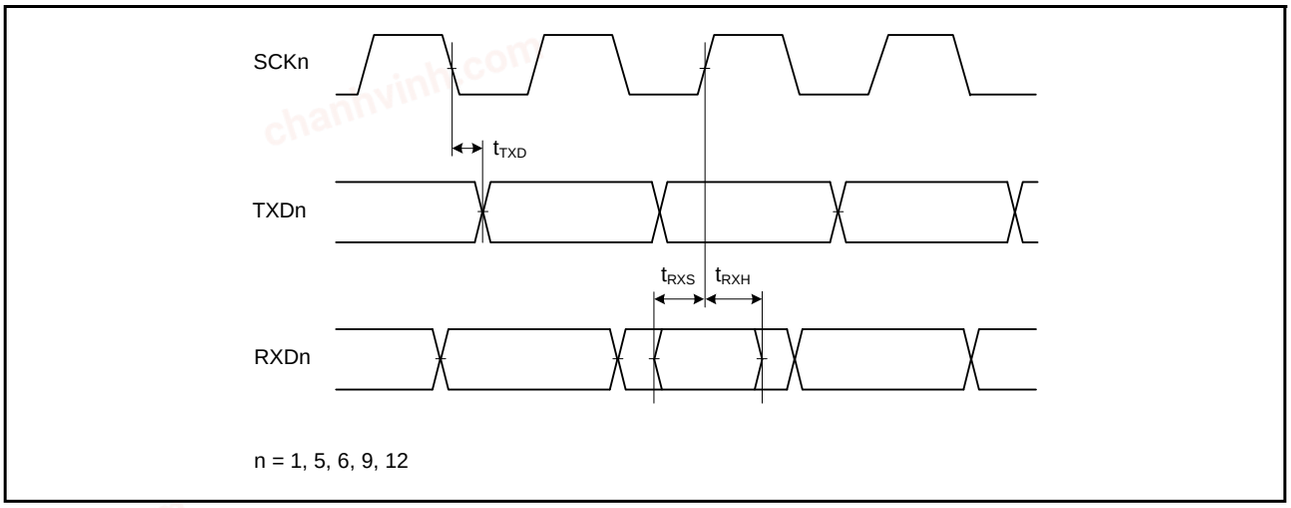


Figure 5.39 SCI Input/Output Timing: Clock Synchronous Mode

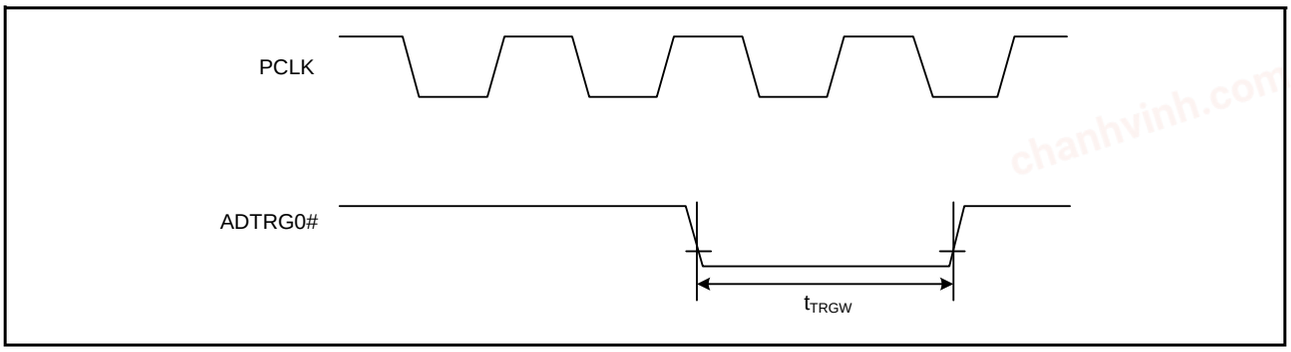


Figure 5.40 A/D Converter External Trigger Input Timing

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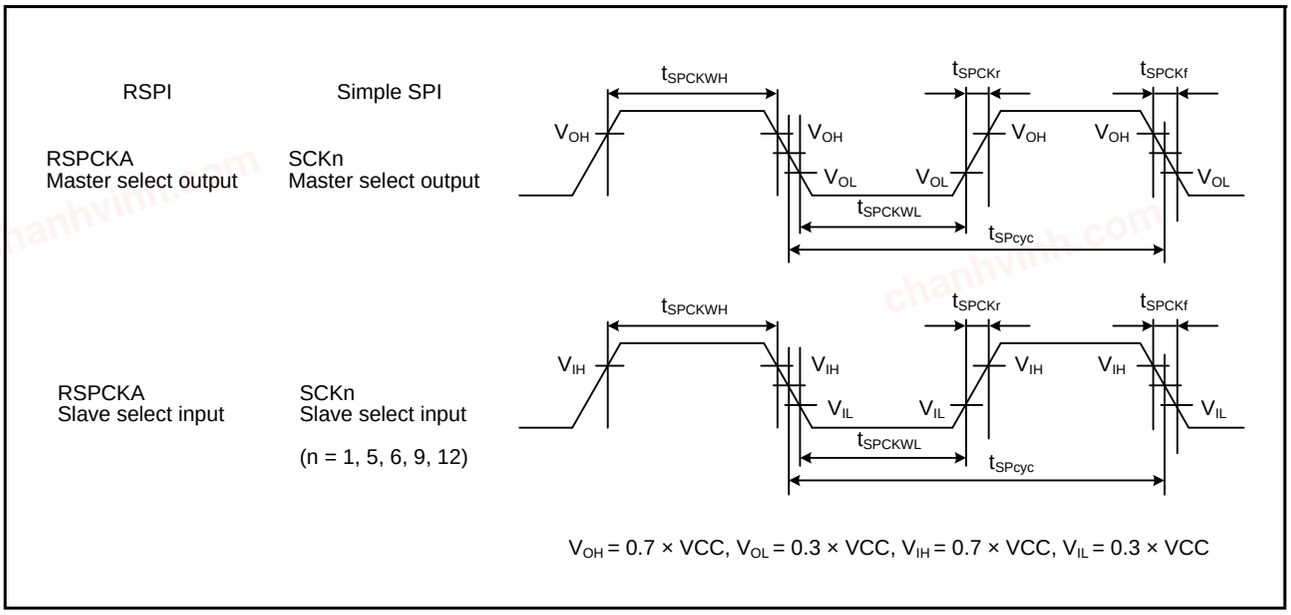


Figure 5.41 RSPI Clock Timing and Simple SPI Clock Timing

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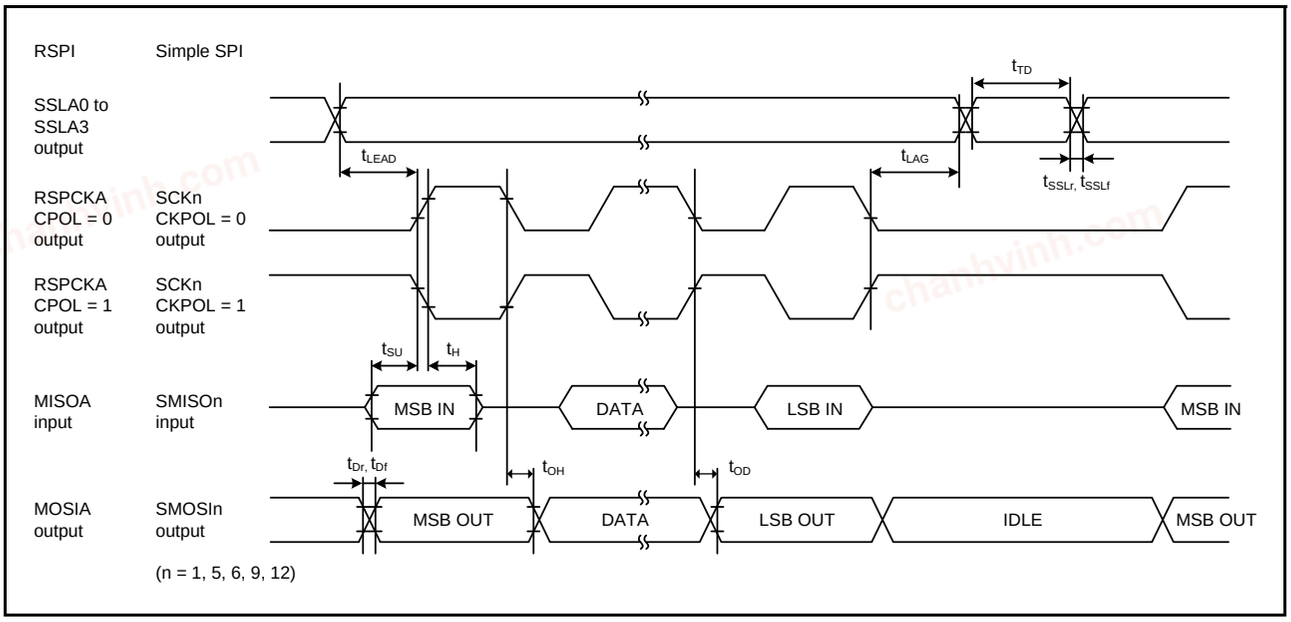


Figure 5.42 RSPI Timing (Master, CPHA = 0) (Bit Rate: PCLKB Set to Division Ratio Other Than Divided by 2) and Simple SPI Timing (Master, CKPH = 1)

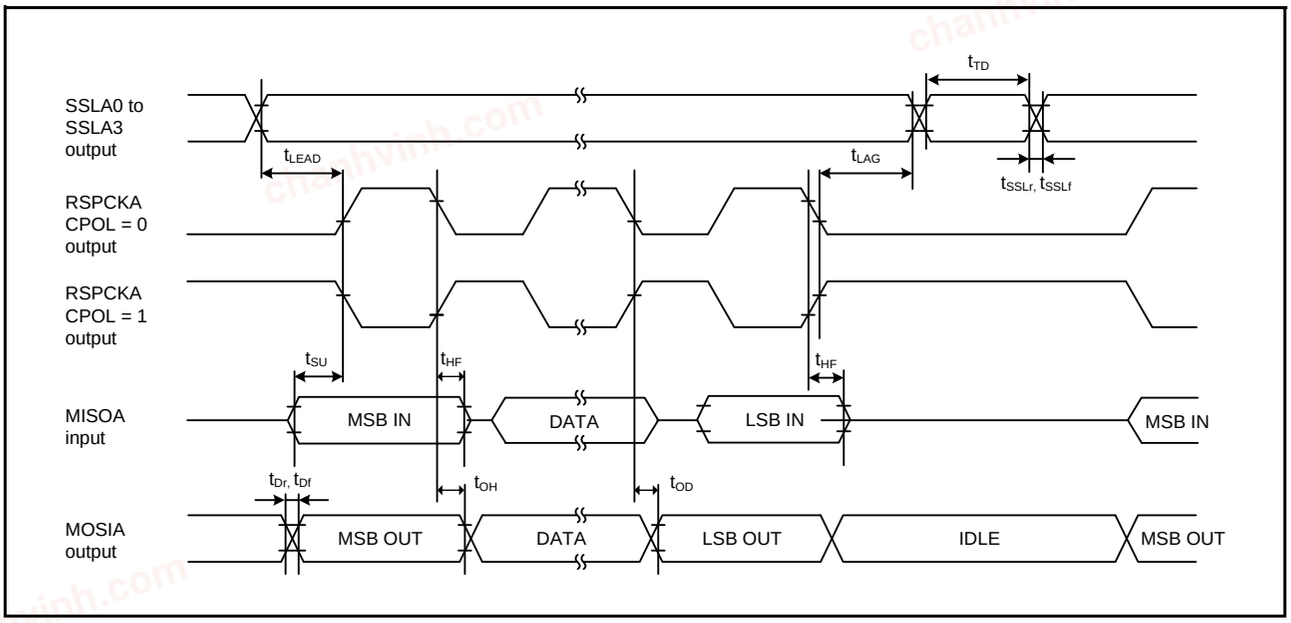


Figure 5.43 RSPI Timing (Master, CPHA = 0) (Bit Rate: PCLKB Set to Divided by 2)

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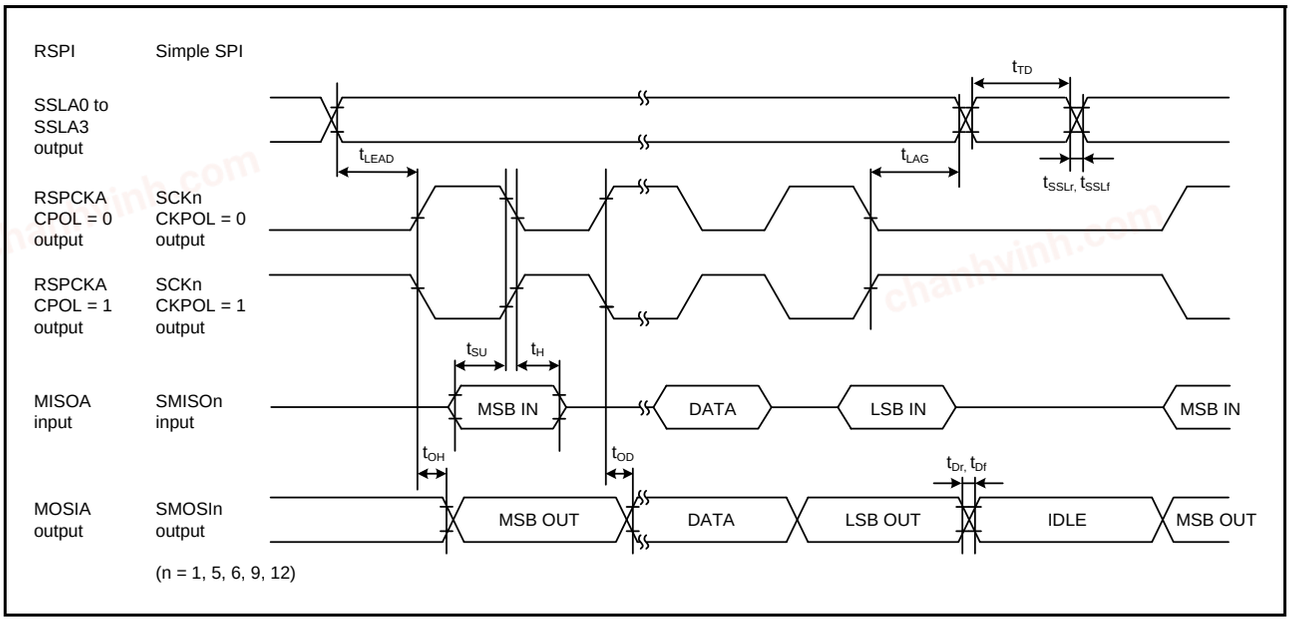


Figure 5.44 RSPI Timing (Master, CPHA = 1) (Bit Rate: PCLKB Set to Division Ratio Other Than Divided by 2) and Simple SPI Timing (Master, CKPH = 0)

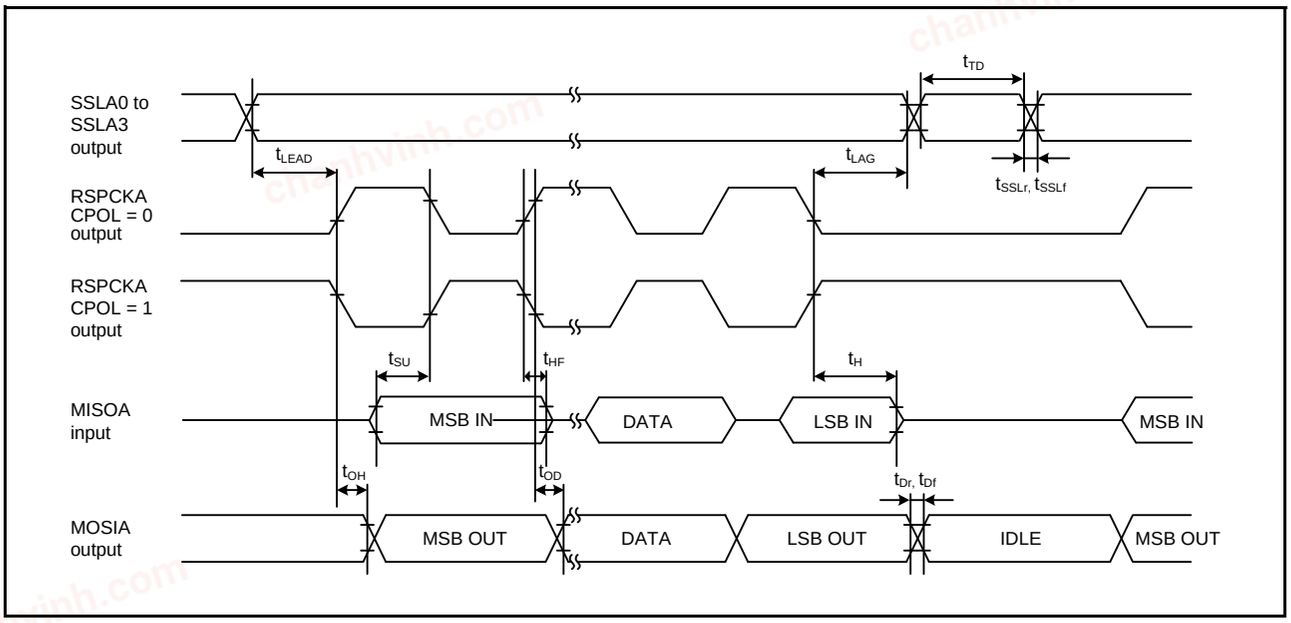


Figure 5.45 RSPI Timing (Master, CPHA = 1) (Bit Rate: PCLKB Set to Divided by 2)

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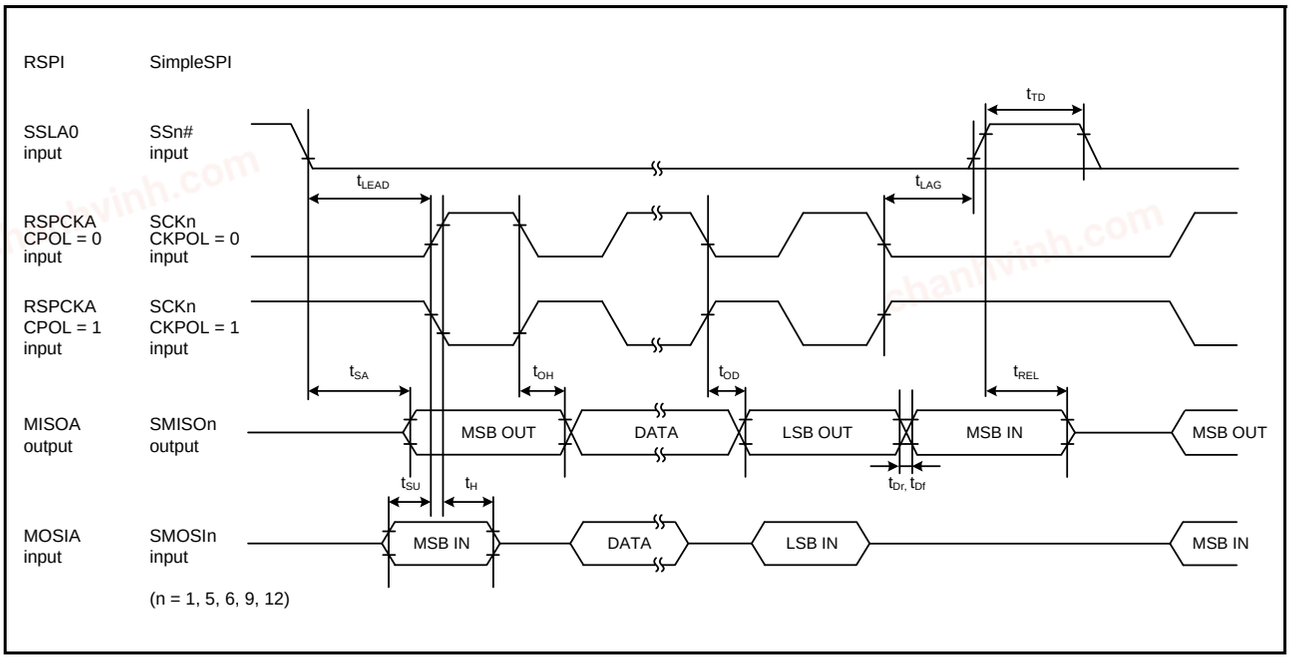


Figure 5.46 RSPI Timing (Slave, CPHA = 0) and Simple SPI Timing (Slave, CKPH = 1)

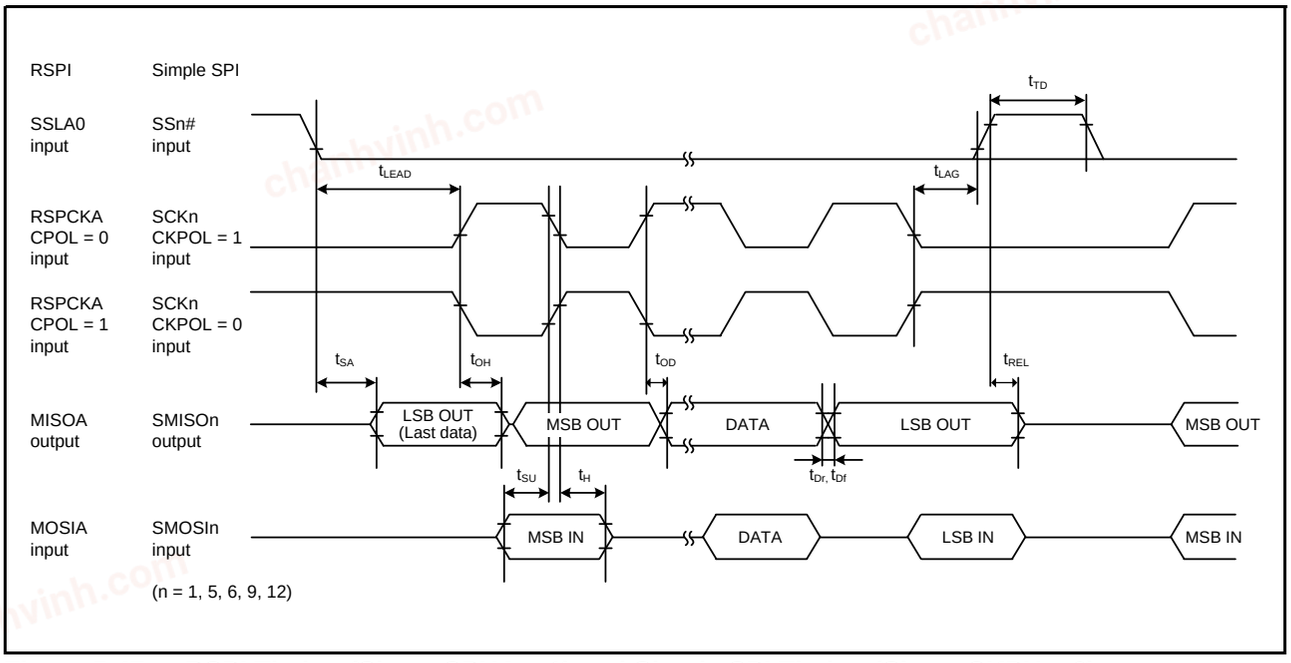
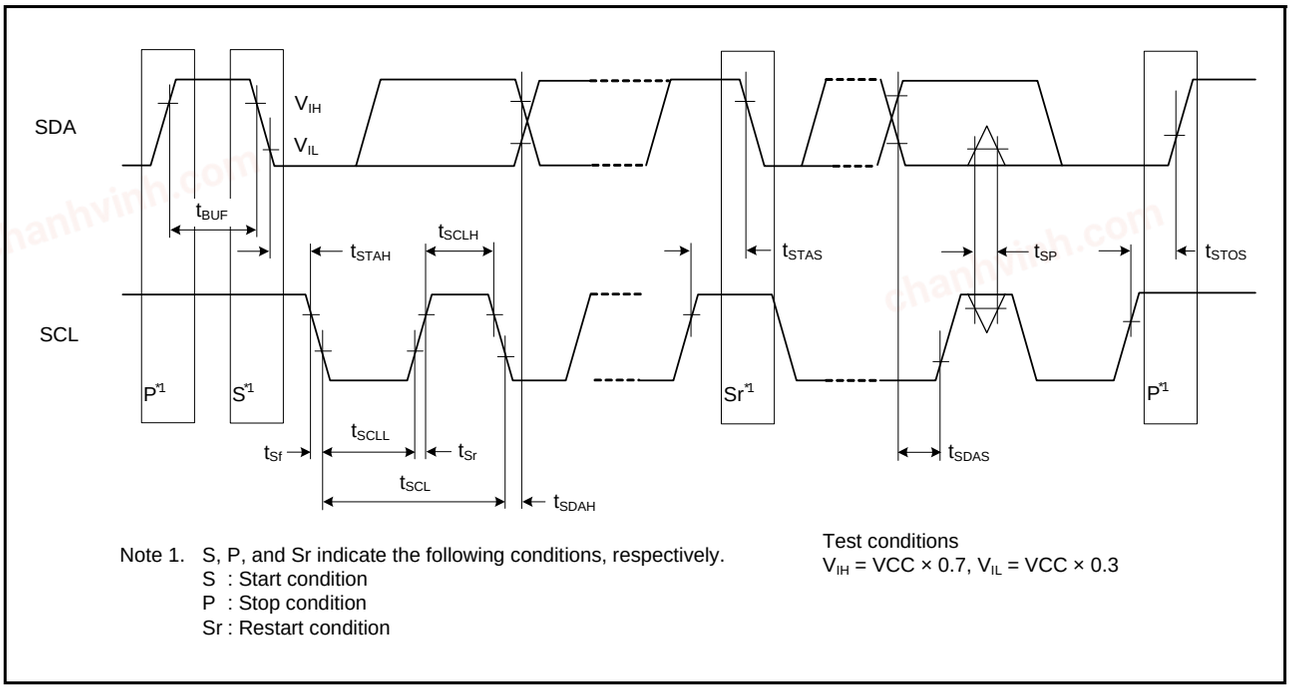


Figure 5.47 RSPI Timing (Slave, CPHA = 1) and Simple SPI Timing (Slave, CKPH = 0)

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Note 1. S, P, and Sr indicate the following conditions, respectively.
S : Start condition
P : Stop condition
Sr : Restart condition

Test conditions
V_{IH} = VCC × 0.7, V_{IL} = VCC × 0.3

Figure 5.48 RIIC Bus Interface Input/Output Timing and Simple IIC Bus Interface Input/Output Timing

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5.4 A/D Conversion Characteristics

Table 5.31 A/D Conversion Characteristics (1)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, 2.7 ≤ VREFH0 ≤ 5.5 V, AVCC0 – 0.9 V ≤ VREFH0 ≤ AVCC0,
VSS = AVSS0 = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Min.	Typ.	Max.	Unit	Test Conditions
A/D conversion clock frequency (fPCLKD)		1	—	32	MHz	
Resolution		—	—	12	Bit	
Conversion time*1 (Operation at fPCLKD = 32 MHz)	Permissible signal source impedance (Max.) = 1 kΩ	1.56 (0.652)*2	—	—	µs	Sampling in 20 states
	Permissible signal source impedance (Max.) = 5 kΩ	3.29 (2.35)*2	—	—		Sampling in 75 states
Analog input capacitance		—	—	30	pF	
Offset error		—	±0.5	±4.5	LSB	High-precision channel
				±7.5		Normal-precision channel
Full-scale error		—	±0.75	±4.5	LSB	High-precision channel
				±7.5		Normal-precision channel
Quantization error		—	±0.5	—	LSB	
Absolute accuracy		—	±1.25	±5.0	LSB	High-precision channel
		—	±1.25	±8.0	LSB	Normal-precision channel
DNL differential nonlinearity error		—	±1.0	—	LSB	
INL integral nonlinearity error		—	±1.0	±3.0	LSB	High-precision channel
		—	±1.0	±5.0	LSB	Normal-precision channel

Note: • The characteristics apply when no pin functions other than A/D converter input are used. Absolute accuracy includes quantization errors. Offset error, full-scale error, DNL differential nonlinearity error, and INL integral nonlinearity error do not include quantization errors.

Note 1. The conversion time is the sum of the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.

Note 2. The value in parentheses indicates the sampling time.

Table 5.32 Channel Classification for A/D Converter

Classification	Channel	
High-precision channel	AN000 to AN007	It is disallowed to use pins AN000 to AN007 as digital outputs when the A/D converter is used.
Normal-precision channel	AN008 to AN015	

Table 5.33 A/D Internal Reference Voltage Characteristics

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

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

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Table 5.34 A/D Conversion Characteristics (2)

Conditions: VCC = AVCC0 = 1.62 to 3.6 V, 1.62 ≤ VREFH0 ≤ 2.7 V, AVCC0 – 0.9 V ≤ VREFH0 ≤ AVCC0,
VSS = AVSS0 = VREFL0 = 0 V, T_a = –40 to +105°C

Item		Min.	Typ.	Max.	Unit	Test Conditions
A/D conversion clock frequency (fPCLKD)		1	—	8	MHz	
Resolution		—	—	12	Bit	
Conversion time*1 (Operation at fPCLKD = 8 MHz)	Permissible signal source impedance (Max.) = 1 kΩ	5.25 (1.5)*2	—	—	µs	Sampling in 12 states
	Permissible signal source impedance (Max.) = 5 kΩ	6.25 (2.5)*2	—	—		Sampling in 20 states
Analog input capacitance		—	—	30	pF	
Offset error		—	±0.5	±7.5	LSB	
Full-scale error		—	±1.25	±7.5	LSB	
Quantization error		—	±0.5	—	LSB	
Absolute accuracy		—	±3.0	±8.0	LSB	
DNL differential nonlinearity error		—	±1.25	—	LSB	
INL integral nonlinearity error		—	±1.5	±5.0	LSB	

Note: • The characteristics apply when no pin functions other than A/D converter input are used. Absolute accuracy includes quantization errors. Offset error, full-scale error, DNL differential nonlinearity error, and INL integral nonlinearity error do not include quantization errors.

Note 1. The conversion time is the sum of the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.

Note 2. The value in parentheses indicates the sampling time.

Table 5.35 Sampling Time

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

Item		Symbol	Typ.	Unit	Test Conditions
Sampling time	High-precision channel	Ts	0.208 + 0.417 × R0 (kΩ)	µs	Figure 5.49
	Normal-precision channel				

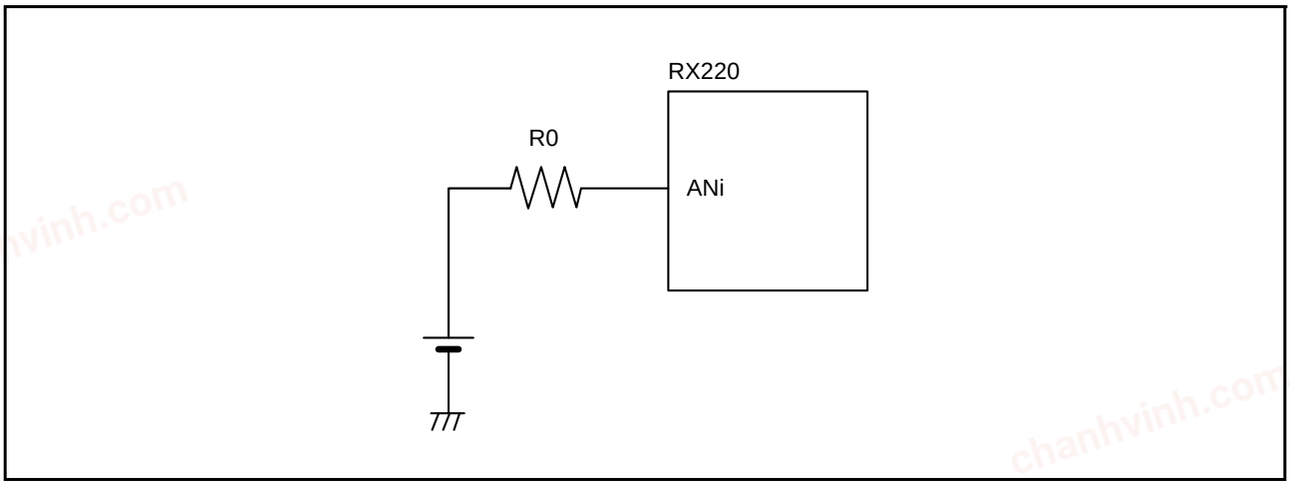


Figure 5.49 Internal Equivalent Circuit of Analog Input Pin

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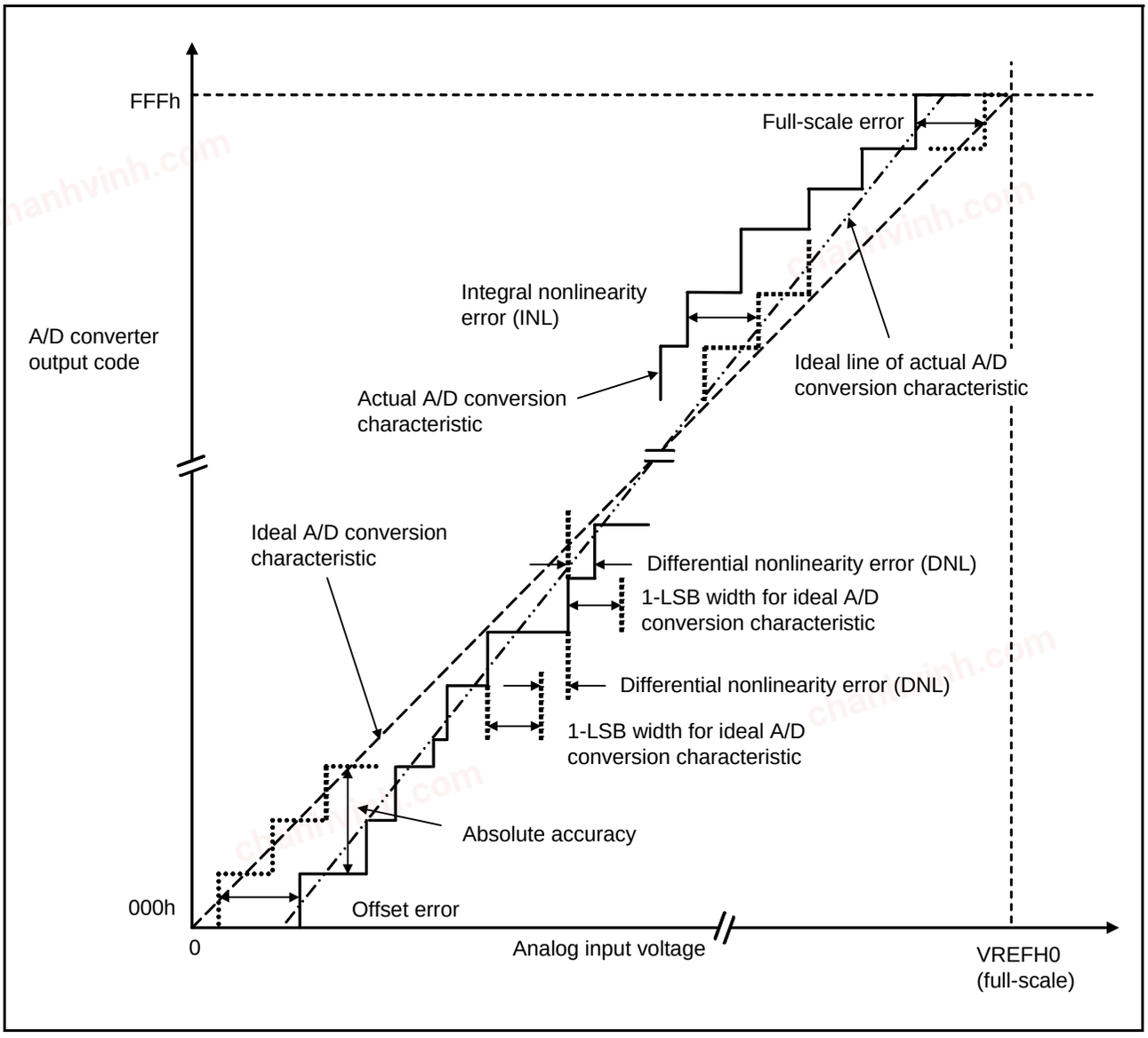


Figure 5.50 Illustration of A/D Converter Characteristic Terms

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.

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Differential nonlinearity error (DNL)

Differential nonlinearity error is the difference between 1-LSB width based on the ideal A/D conversion characteristics and the width of the actually output code.

Offset error

Offset error is the difference between a transition point of the ideal first output code and the actual first output code.

Full-scale error

Full-scale error is the difference between a transition point of the ideal last output code and the actual last output code.

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5.5 Comparator Characteristics

Table 5.36 Comparator Characteristics

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

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Comparator A	External standard voltage input range	LVREF	1.4	—	VCC	V	
	External comparison voltage*1 (CMPA1, CMPA2) input range	VI	–0.3	—	VCC + 0.3	V	
	Offset	—	—	±50	±150	mV	
	Comparator output delay time*2	—	—	3	—	µs	At falling edge VI = LVREF – 110 mV
			—	2	—	µs	At falling edge VI < LVREF – 1 V
			—	3	—	µs	At rising edge VI = LVREF + 160 mV
			—	1.5	—	µs	At rising edge VI > LVREF + 1 V
	Comparator operating current	ICMPA	—	0.5	—	µA	VCC = 5.0 V

Note 1. VCC does not include ripple.
Note 2. When the digital filter is disabled.

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5.6 Power-on Reset Circuit and Voltage Detection Circuit Characteristics

Table 5.37 Power-on Reset Circuit and Voltage Detection Circuit Characteristics (1)

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

Item			Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Voltage detection level	Power-on reset (POR)	Low power consumption function disabled*1	V_{POR}	1.30	1.40	1.55	V	Figure 5.51 and Figure 5.52
		Low power consumption function enabled*2		1.00	1.20	1.45		
	Voltage detection circuit (LVD0)*3		V_{det0_0}	3.65	3.80	3.95	V	Figure 5.53
			V_{det0_1}	2.70	2.80	2.90		
			V_{det0_2}	1.80	1.90	2.00		
			V_{det0_3}	1.62	1.72	1.82		
	Voltage detection circuit (LVD1)*4		V_{det1_0}	4.00	4.15	4.30	V	Figure 5.54
			V_{det1_1}	3.85	4.00	4.15		
			V_{det1_2}	3.70	3.85	4.00		At falling edge VCC
			V_{det1_3}	3.55	3.70	3.85		
			V_{det1_4}	3.40	3.55	3.70		
			V_{det1_5}	3.25	3.40	3.55		
			V_{det1_6}	3.10	3.25	3.40		
			V_{det1_7}	2.95	3.10	3.25		
			V_{det1_8}	2.85	2.95	3.05		
			V_{det1_9}	2.70	2.80	2.90		
			V_{det1_A}	2.55	2.65	2.75		
			V_{det1_B}	2.40	2.50	2.60		
			V_{det1_C}	2.25	2.35	2.45		
			V_{det1_D}	2.10	2.20	2.30		
			V_{det1_E}	1.95	2.05	2.15		
			V_{det1_F}	1.80	1.90	2.00		

Note: • These characteristics apply when noise is not superimposed on the power supply.
Note 1. When the CPU is in a mode other than software standby mode, when the CPU transits to software standby mode with the FHSSBYCR.SOFTCUT[2] bit set to 0.
Note 2. When the CPU transits to software standby mode with the FHSSBYCR.SOFTCUT[2] bit set to 1.
Note 3. # in the symbol Vdet0_# denotes the value of the OFS1.VDSEL[1:0] bits.
Note 4. # in the symbol Vdet1_# denotes the value of the LVDLVLR.LVD1LVL[3:0] bits.

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Table 5.38 Power-on Reset Circuit and Voltage Detection Circuit Characteristics (2)

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

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Voltage detection level	Voltage detection circuit (LVD2)*1	V_{det2_0}	4.00	4.15	4.30	V	Figure 5.55
		V_{det2_1}	3.85	4.00	4.15		At falling edge VCC
		V_{det2_2}	3.70	3.85	4.00		
		V_{det2_3}	3.55	3.70	3.85		
		V_{det2_4}	3.40	3.55	3.70		
		V_{det2_5}	3.25	3.40	3.55		
		V_{det2_6}	3.10	3.25	3.40		
		V_{det2_7}	2.95	3.10	3.25		
		V_{det2_8}	2.85	2.95	3.05		
		V_{det2_9}	2.70	2.80	2.90		
		V_{det2_A}	2.55	2.65	2.75		
		V_{det2_B}	2.40	2.50	2.60		
		V_{det2_C}	2.25	2.35	2.45		
		V_{det2_D}	2.10	2.20	2.30		
		V_{det2_E}	1.95	2.05	2.15		
		V_{det2_F}	1.80	1.90	2.00		
		V_{CMPA2}	1.18	1.33	1.48		EXVCCINP2 = 1
Internal reset time	Power-on reset time	t_{POR}	—	9	—	ms	Figure 5.52
	Voltage monitoring 0 reset time	t_{LVD0}	—	9	—		Figure 5.53
	Voltage monitoring 1 reset time	t_{LVD1}	—	1.4	—		Figure 5.54
	Voltage monitoring 2 reset time	t_{LVD2}	—	1.4	—		Figure 5.55
Minimum VCC down time*2		t_{VOFF}	200	—	—	µs	Figure 5.51
Response delay time		t_{det}	—	—	200	µs	Figure 5.52
LVD operation stabilization time (after LVD is enabled)		$Td_{(E-A)}$	—	—	15	µs	Figure 5.54 and Figure 5.55
Power-on reset enable time		$t_{W(POR)}$	1	—	—	ms	Figure 5.52 VCC = 0.9 V or lower
Hysteresis width (LVD1 and LVD2)		V_{LVH}	—	100	—	mV	When selection is from among VdetX_0 to 7.
			—	50	—		When selection is from among VdetX_8 to F.

Note: • These characteristics apply when noise is not superimposed on the power supply.
Note 1. # in the symbol Vdet2_# denotes the value of the LVDLVLR.LVD2LVL[3:0] bits.
Note 2. The minimum VCC down time indicates the time when VCC is below the minimum value of voltage detection levels V_{POR}, V_{det0}, V_{det1}, and V_{det2} for the POR/ LVD.

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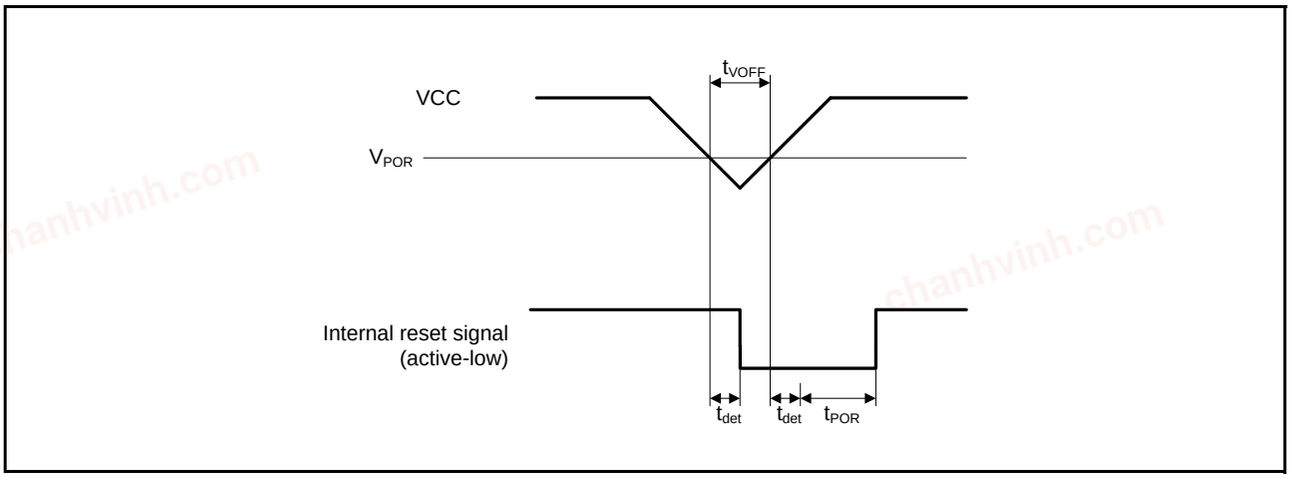
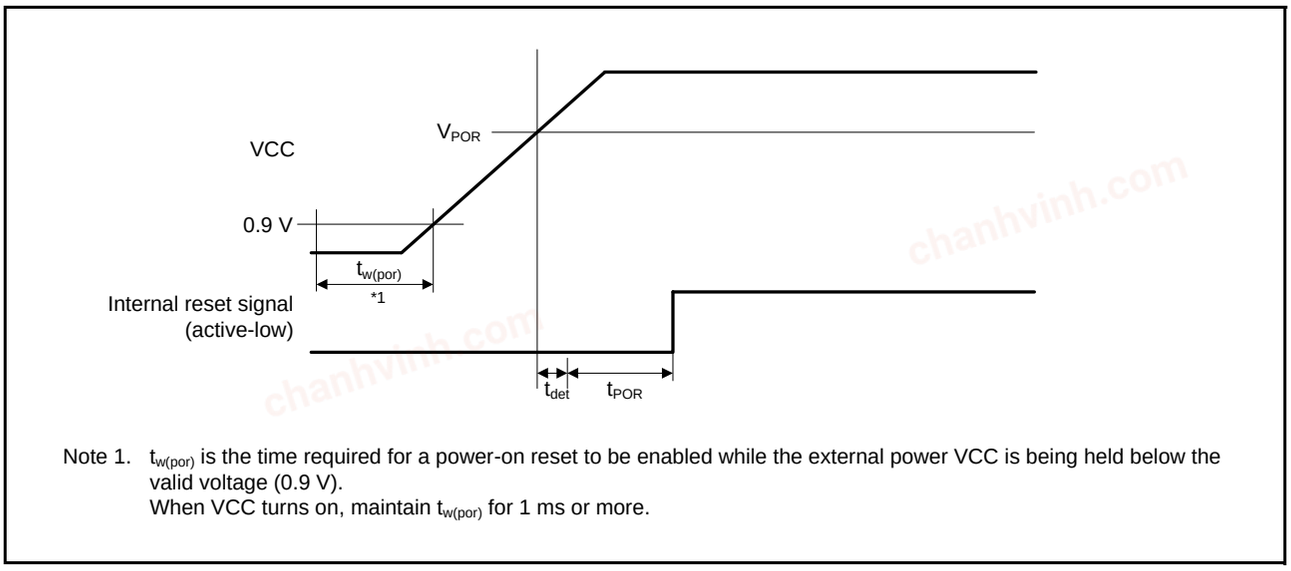


Figure 5.51 Voltage Detection Reset Timing



Note 1. $t_{w(por)}$ is the time required for a power-on reset to be enabled while the external power VCC is being held below the valid voltage (0.9 V).
When VCC turns on, maintain $t_{w(por)}$ for 1 ms or more.

Figure 5.52 Power-on Reset Timing

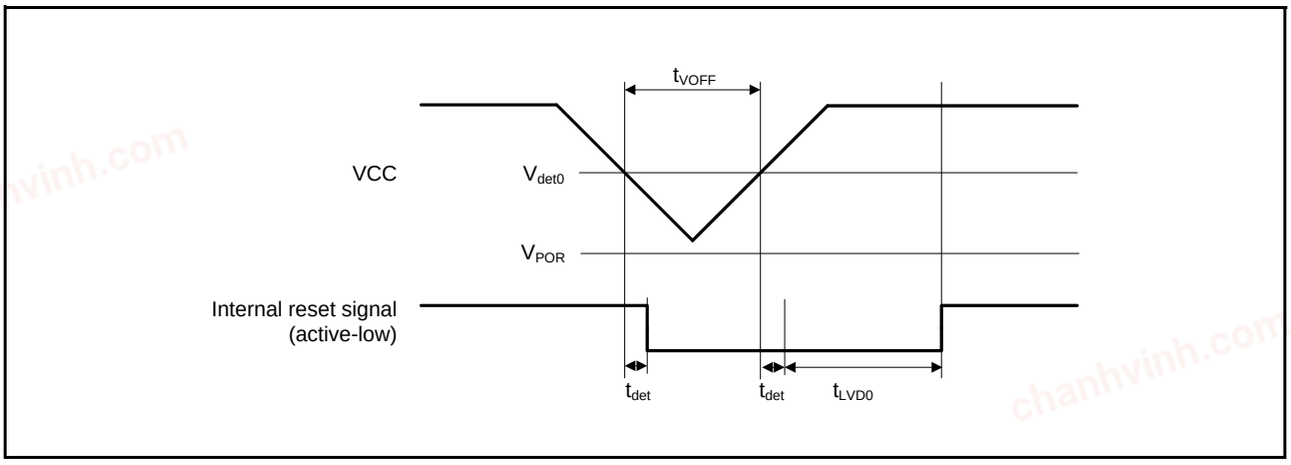


Figure 5.53 Voltage Detection Circuit Timing (V_{det0})

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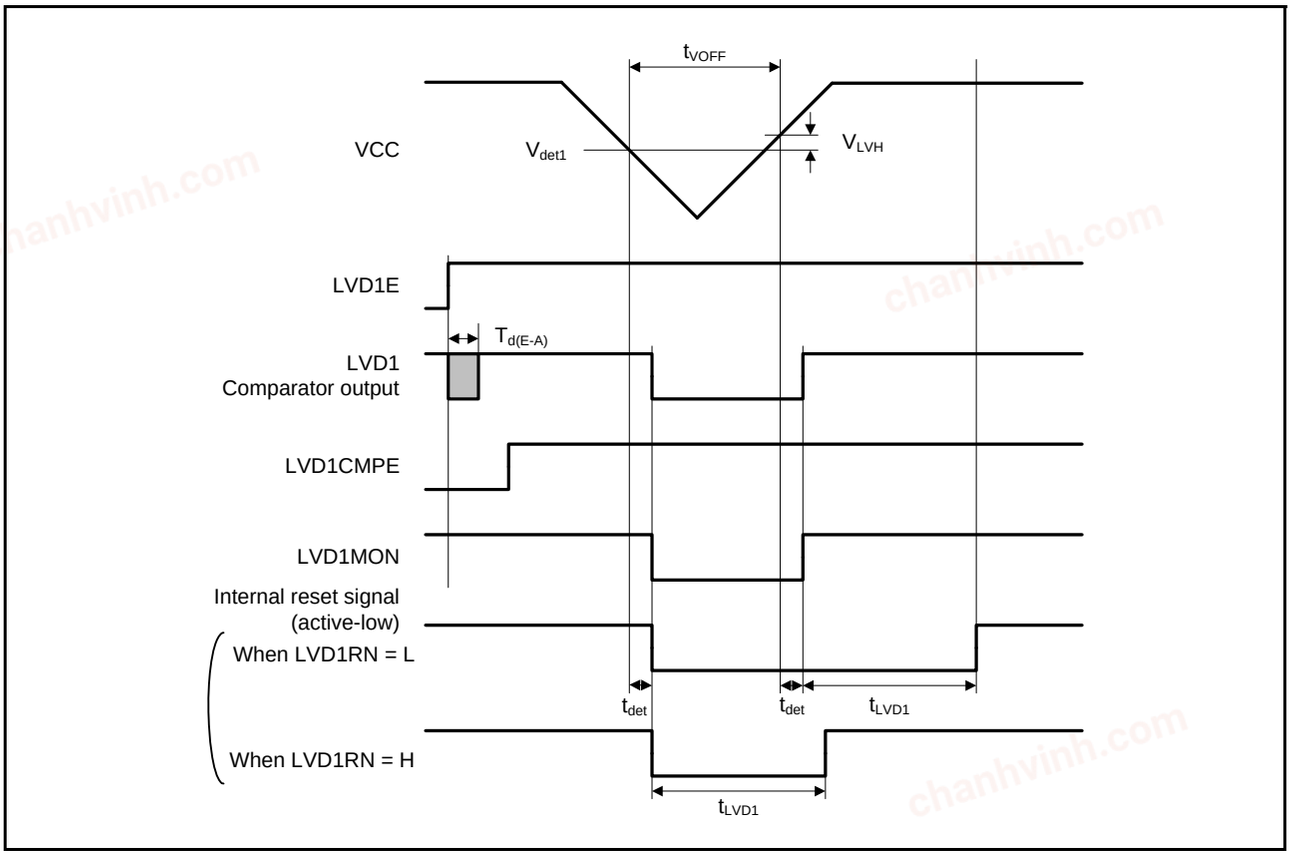


Figure 5.54 Voltage Detection Circuit Timing (V_{det1})

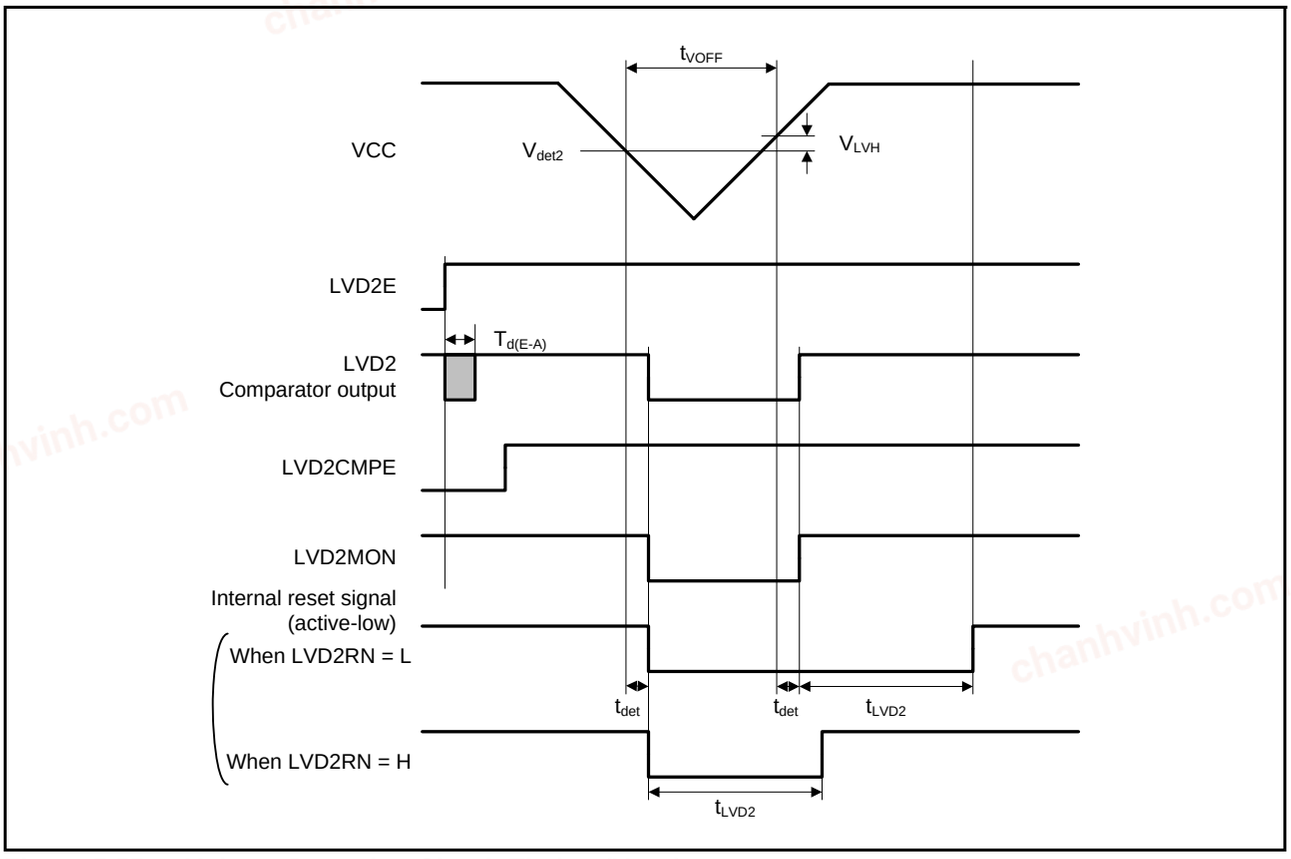


Figure 5.55 Voltage Detection Circuit Timing (V_{det2})

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5.7 Oscillation Stop Detection Timing

Table 5.39 Oscillation Stop Detection Circuit Characteristics

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

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Detection time	t_{dr}	—	—	1	ms	Figure 5.56

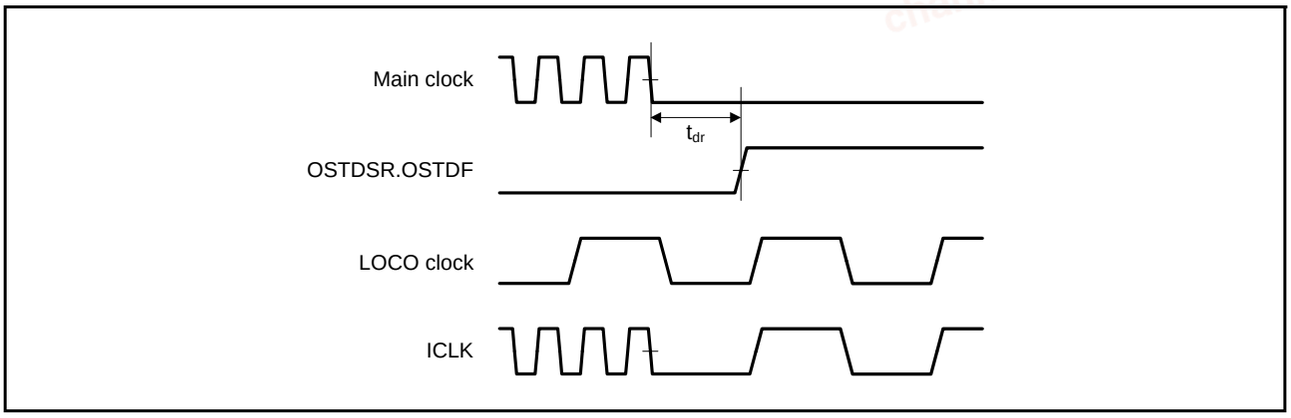


Figure 5.56 Oscillation Stop Detection Timing

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5.8 ROM (Flash Memory for Code Storage) Characteristics

Table 5.40 ROM (Flash Memory for Code Storage) Characteristics (1)

Item		Symbol	Min.	Typ.	Max.	Unit	Conditions
Reprogramming/erasure cycle*1		N_{PEC}	10000	—	—	Times	
Data hold time	After 1000 times of N_{PEC}	t_{DRP}	30*2	—	—	Year	T_a = +85°C
	After 10000 times of N_{PEC}		1*2	—	—	Year	

Note 1. Definition of reprogram/erase cycle: The reprogram/erase cycle is the number of erasing for each block. When the reprogram/erase cycle is n times (n = 10000), erasing can be performed n times for each block. For instance, when 128-byte programming is performed 16 times for different addresses in 2-Kbyte block and then the entire block is erased, the reprogram/erase cycle is counted as one. However, programming the same address for several times as one erasing is not enabled (overwriting is prohibited).

Note 2. This result is obtained from reliability testing.

Table 5.41 ROM (Flash Memory for Code Storage) Characteristics (2)

Item	Symbol	FCLK = 4 MHz			FCLK = 32 MHz			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Peripheral clock notification command wait time	t_{PCKA}	—	—	960	—	—	120	µs

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Table 5.42 ROM (Flash Memory for Code Storage) Characteristics (3) medium-speed operating mode 1A

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VSS = AVSS0 = VREFL0 = 0 V
Temperature range for the programming/erasure operation: T_a = –40 to +105°C

Item		Symbol	FCLK = 4 MHz			FCLK = 32 MHz			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Programming time when N_{PEC} ≤ 100 times	2 bytes	t_{P2}	—	0.19	4.3	—	0.12	2.0	ms
	8 bytes	t_{P8}	—	0.19	4.4	—	0.12	2.0	
	128 bytes	t_{P128}	—	0.67	10.7	—	0.41	4.8	
Programming time when N_{PEC} > 100 times	2 bytes	t_{P2}	—	0.23	5.3	—	0.15	2.5	ms
	8 bytes	t_{P8}	—	0.23	5.4	—	0.15	2.5	
	128 bytes	t_{P128}	—	0.80	13.2	—	0.48	6.0	
Erasure time when N_{PEC} ≤ 100 times	2 Kbytes	t_{E2K}	—	13.0	92.8	—	10.5	29	ms
Erasure time when N_{PEC} > 100 times	2 Kbytes	t_{E2K}	—	15.9	176.9	—	12.8	60	ms
Suspend delay time during programming (in programming/erasure priority mode)		t_{SPD}	—	—	0.9	—	—	0.8	ms
First suspend delay time during programming (in suspend priority mode)		t_{SPSD1}	—	—	220	—	—	120	µs
Second suspend delay time during programming (in suspend priority mode)		t_{SPSD2}	—	—	0.9	—	—	0.8	ms
Suspend delay time during erasing (in programming/erasure priority mode)		t_{SED}	—	—	0.9	—	—	0.8	ms
First suspend delay time during erasing (in suspend priority mode)		t_{SESD1}	—	—	220	—	—	120	µs
Second suspend delay time during erasing (in suspend priority mode)		t_{SESD2}	—	—	0.9	—	—	0.8	ms
FCU reset time		t_{FCUR}	20 µs or longer and FCLK × 6 or greater	—	—	20 µs or longer and FCLK × 6 or greater	—	—	µs

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Table 5.43 ROM (Flash Memory for Code Storage) Characteristics (4) medium-speed operating mode 1B

Conditions: VCC = AVCC0 = 1.62 to 3.6 V, VSS = AVSS0 = VREFL0 = 0 V
Temperature range for the programming/erasure operation: T_a = –40 to +105°C

Item		Symbol	FCLK = 4 MHz			FCLK = 32 MHz*1			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Programming time when N_{PEC} ≤ 100 times	2 bytes	t_{P2}	—	0.25	5.0	—	0.21	2.8	ms
	8 bytes	t_{P8}	—	0.25	5.3	—	0.21	3.0	
	128 bytes	t_{P128}	—	0.92	14.0	—	0.65	8.3	
Programming time when N_{PEC} > 100 times	2 bytes	t_{P2}	—	0.31	6.2	—	0.26	3.5	ms
	8 bytes	t_{P8}	—	0.31	6.6	—	0.26	3.7	
	128 bytes	t_{P128}	—	1.09	17.5	—	0.77	10.0	
Erasure time when N_{PEC} ≤ 100 times	2 Kbytes	t_{E2K}	—	21.0	113.6	—	18.5	46	ms
Erasure time when N_{PEC} > 100 times	2 Kbytes	t_{E2K}	—	25.6	220.6	—	22.5	90 (1000 times ≥ N_{PEC} > 100 times), 98 (10000 times ≥ N_{PEC} > 1000 times)	ms
Suspend delay time during programming (in programming/erasure priority mode)		t_{SPD}	—	—	1.7	—	—	1.6	ms
First suspend delay time during programming (in suspend priority mode)		t_{SPSD1}	—	—	220	—	—	120	µs
Second suspend delay time during programming (in suspend priority mode)		t_{SPSD2}	—	—	1.7	—	—	1.6	ms
Suspend delay time during erasing (in programming/erasure priority mode)		t_{SED}	—	—	1.7	—	—	1.6	ms
First suspend delay time during erasing (in suspend priority mode)		t_{SESD1}	—	—	220	—	—	120	µs
Second suspend delay time during erasing (in suspend priority mode)		t_{SESD2}	—	—	1.7	—	—	1.6	ms
FCU reset time		t_{FCUR}	20 µs or longer and FCLK × 6 or greater	—	—	20 µs or longer and FCLK × 6 or greater	—	—	µs

Note 1. The operating frequency is 8 MHz (max.) when the voltage is in the range from 1.62 V to less than 2.7 V.

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5.9 E2 DataFlash (Flash Memory for Data Storage) Characteristics

Table 5.44 E2 DataFlash Characteristics (1)

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Reprogramming/erasure cycle*1		N_{DPEC}	100000	—	—	Times	
Data hold time	After 100000 times of N_{DPEC}	t_{DRP}	30*2	—	—	Year	T_a = +85°C

Note 1. The reprogram/erase cycle is the number of erasing for each block. When the reprogram/erase cycle is n times (n = 100000), erasing can be performed n times for each block. For instance, when 8-byte programming is performed 16 times for different addresses in 128-byte block and then the entire block is erased, the reprogram/erase cycle is counted as one. However, programming the same address for several times as one erasing is not enabled (overwriting is prohibited).
Note 2. This result is obtained from reliability testing.

Table 5.45 E2 DataFlash Characteristics (2)

Item	Symbol	FCLK = 4 MHz			FCLK = 32 MHz			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Peripheral clock notification command wait time	t_{PCKA}	—	—	960	—	—	120	µs

Table 5.46 E2 DataFlash Characteristics (3) medium-speed operating mode 1A

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VREFH0 = AVCC0, VSS = AVSS0 = VREFL0 = 0 V
Temperature range for the programming/erasure operation: T_a = –40 to +105°C

Item		Symbol	FCLK = 4 MHz			FCLK = 32 MHz			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Programming time when N_{DPEC} ≤ 100 times	2 bytes	t_{DP2}	—	0.19	4.4	—	0.13	2.0	ms
	8 bytes	t_{DP8}	—	0.24	5.1	—	0.13	2.2	
Programming time when N_{DPEC} > 100 times	2 bytes	t_{DP2}	—	0.25	6.4	—	0.17	3.0	ms
	8 bytes	t_{DP8}	—	0.32	7.5	—	0.18	3.2	
Erasure time when N_{DPEC} ≤ 100 times	128 bytes	t_{DE128}	—	3.3	27.1	—	2.5	8	ms
Erasure time when N_{DPEC} > 100 times	128 bytes	t_{DE128}	—	4.0	45.1	—	3.0	12	ms
Blank check time	2 bytes	t_{DBC2}	—	—	98	—	—	35	µs
	2 Kbytes	t_{DBC2K}	—	—	16	—	—	2.5	ms
Suspend delay time during programming (in programming/erasure priority mode)		t_{DSPD}	—	—	0.9	—	—	0.8	ms
First suspend delay time during programming (in suspend priority mode)		t_{DSPSD1}	—	—	220	—	—	120	µs
Second suspend delay time during programming (in suspend priority mode)		t_{DSPSD2}	—	—	0.9	—	—	0.8	ms
Suspend delay time during erasing (in programming/erasure priority mode)		t_{DSED}	—	—	0.9	—	—	0.8	ms
First suspend delay time during erasing (in suspend priority mode)		t_{DSESD1}	—	—	220	—	—	120	µs
Second suspend delay time during erasing (in suspend priority mode)		t_{DSESD2}	—	—	0.9	—	—	0.8	ms

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**Table 5.47 E2 DataFlash Characteristics (4)
medium-speed operating mode 1B**

Conditions: VCC = AVCC0 = 1.62 to 3.6 V, VSS = AVSS0 = VREFL0 = 0 V
Temperature range for the programming/erasure operation: T_a = –40 to +105°C

Item		Symbol	FCLK = 4 MHz			FCLK = 32 MHz*1			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Programming time when N_{DPEC} ≤ 100 times	2 bytes	t_{DP2}	—	0.28	5.1	—	0.20	2.8	ms
	8 bytes	t_{DP8}	—	0.32	6.0	—	0.22	3.2	
Programming time when N_{DPEC} > 100 times	2 bytes	t_{DP2}	—	0.36	7.6	—	0.25	4.2	ms
	8 bytes	t_{DP8}	—	0.40	8.8	—	0.28	4.5	
Erasure time when N_{DPEC} ≤ 100 times	128 bytes	t_{DE128}	—	4.8	32.3	—	4.1	12	ms
Erasure time when N_{DPEC} > 100 times	128 bytes	t_{DE128}	—	5.8	51.4	—	4.9	17	ms
Blank check time	2 bytes	t_{DBC2}	—	—	110	—	—	40	µs
	2 Kbytes	t_{DBC2K}	—	—	16.3	—	—	2.6	ms
Suspend delay time during programming (in programming/erasure priority mode)		t_{DSPD}	—	—	1.7	—	—	1.6	ms
First suspend delay time during programming (in suspend priority mode)		t_{DSPSD1}	—	—	220	—	—	120	µs
Second suspend delay time during programming (in suspend priority mode)		t_{DSPSD2}	—	—	1.7	—	—	1.6	ms
Suspend delay time during erasing (in programming/erasure priority mode)		t_{DSED}	—	—	1.7	—	—	1.6	ms
First suspend delay time during erasing (in suspend priority mode)		t_{DSESD1}	—	—	220	—	—	120	µs
Second suspend delay time during erasing (in suspend priority mode)		t_{DSESD2}	—	—	1.7	—	—	1.6	ms

Note 1. The operating frequency is 8 MHz (max.) when the voltage is in the range from 1.62 V to less than 2.7 V.

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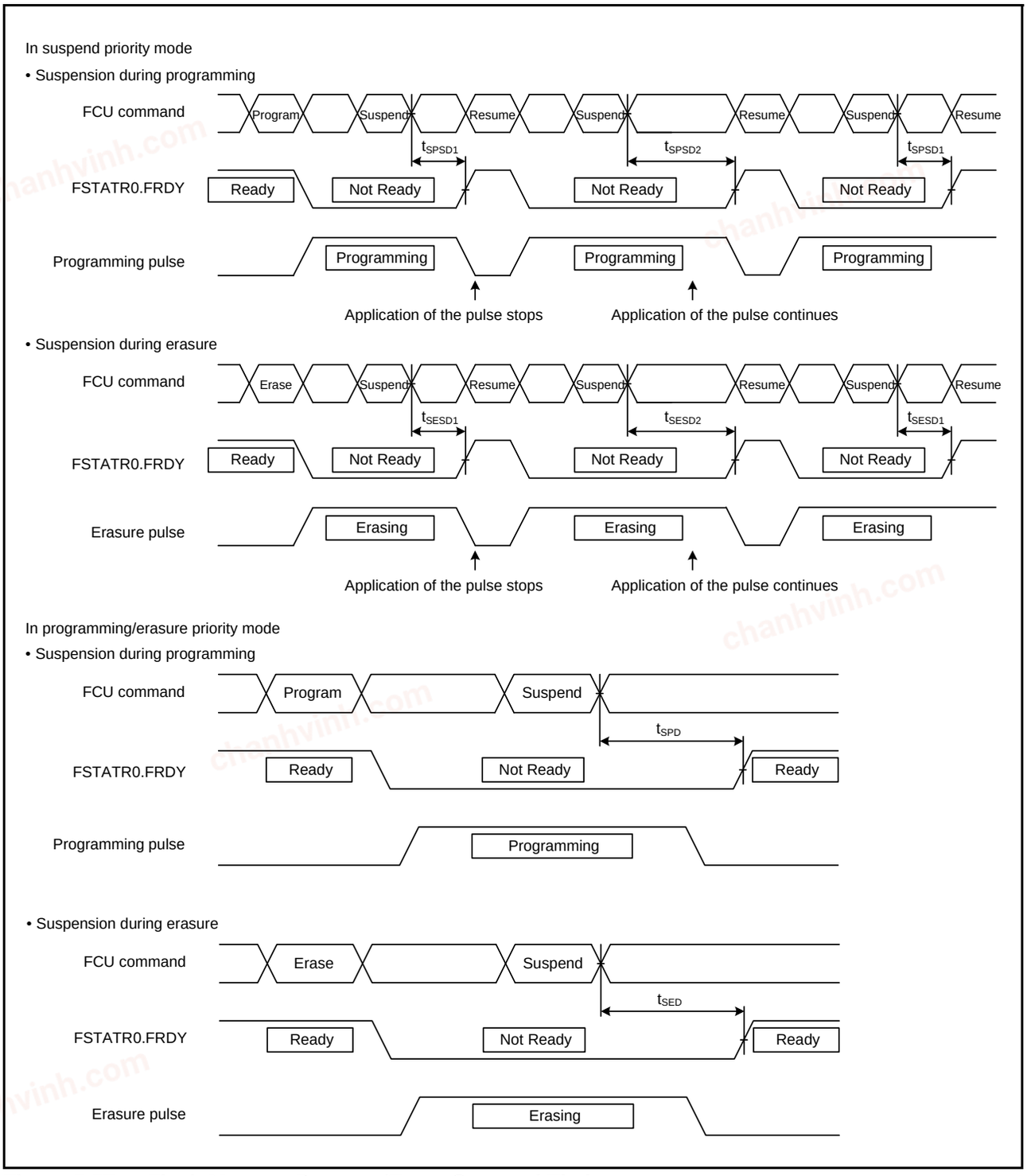


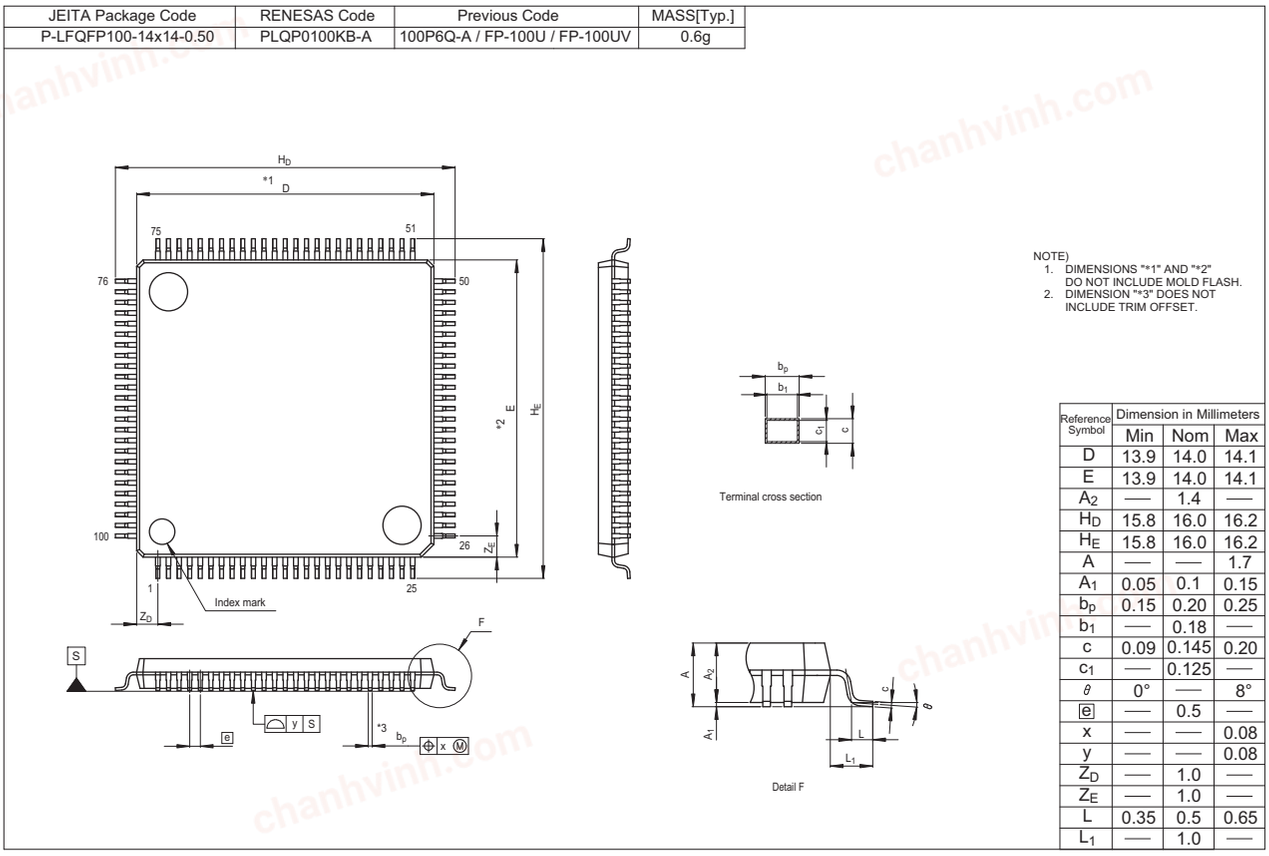
Figure 5.57 Flash Memory Program/Erase Suspend Timing

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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-LFQFP100-14x14-0.50	PLQP0100KB-A	100P6Q-A / FP-100U / FP-100UV	0.6g

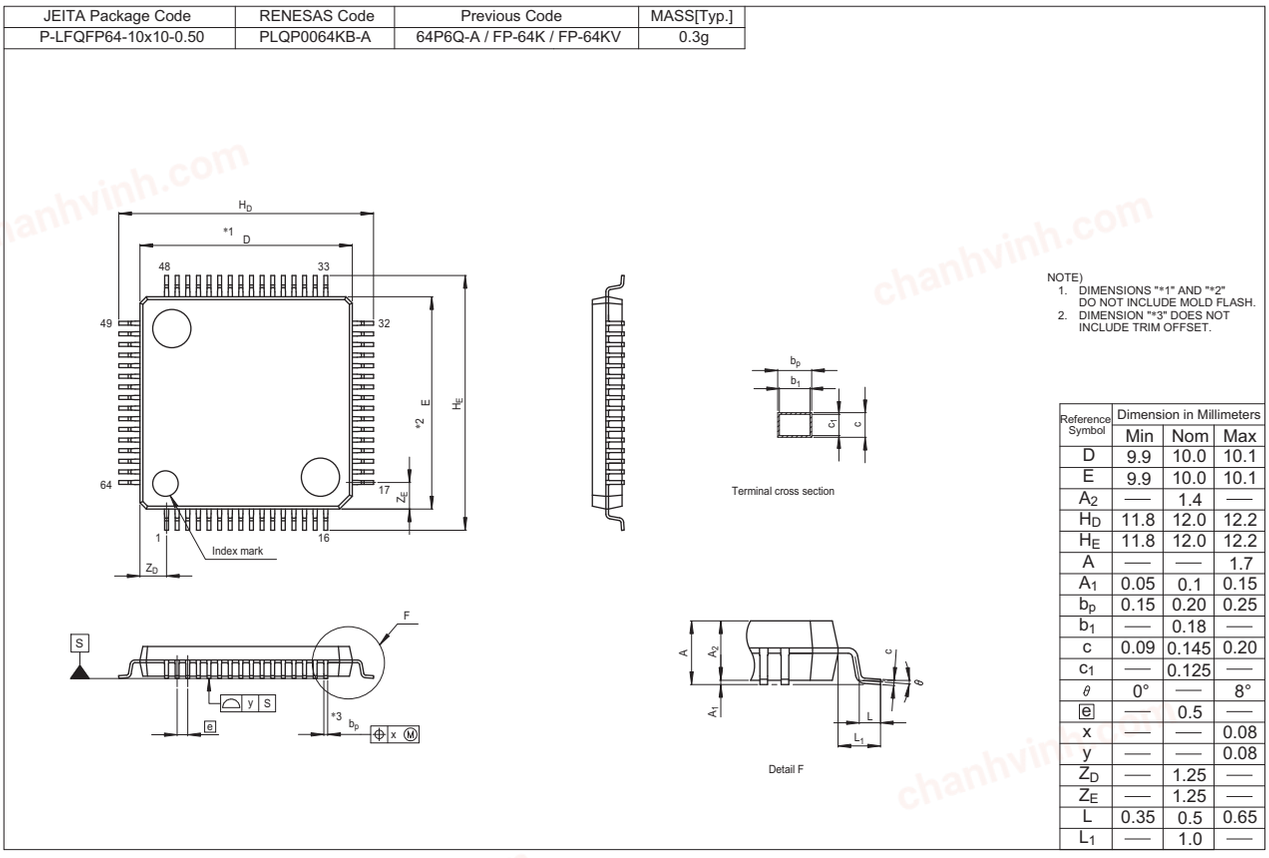


Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	13.9	14.0	14.1
E	13.9	14.0	14.1
A_2	—	1.4	—
H_D	15.8	16.0	16.2
H_E	15.8	16.0	16.2
A	—	—	1.7
A_1	0.05	0.1	0.15
b_p	0.15	0.20	0.25
b_1	—	0.18	—
c	0.09	0.145	0.20
c_1	—	0.125	—
θ	0°	—	8°
e	—	0.5	—
x	—	—	0.08
y	—	—	0.08
Z_D	—	1.0	—
Z_E	—	1.0	—
L	0.35	0.5	0.65
L_1	—	1.0	—

Figure A 100-Pin LQFP (PLQP0100KB-A)

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JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LFQFP64-10x10-0.50	PLQP0064KB-A	64P6Q-A / FP-64K / FP-64KV	0.3g

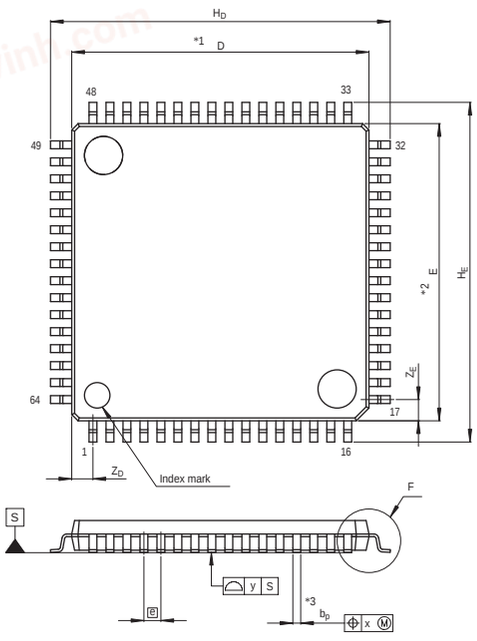


Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	9.9	10.0	10.1
E	9.9	10.0	10.1
A_2	—	1.4	—
H_D	11.8	12.0	12.2
H_E	11.8	12.0	12.2
A	—	—	1.7
A_1	0.05	0.1	0.15
b_p	0.15	0.20	0.25
b_1	—	0.18	—
c	0.09	0.145	0.20
c_1	—	0.125	—
θ	0°	—	8°
e	—	0.5	—
x	—	—	0.08
y	—	—	0.08
Z_D	—	1.25	—
Z_E	—	1.25	—
L	0.35	0.5	0.65
L_1	—	1.0	—

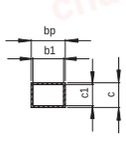
Figure B 64-Pin LQFP (PLQP0064KB-A)

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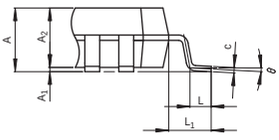
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LQFP64-14x14-0.80	PLQP0064GA-A	64P6U-A/ —	0.7g







Terminal cross section



Detail F

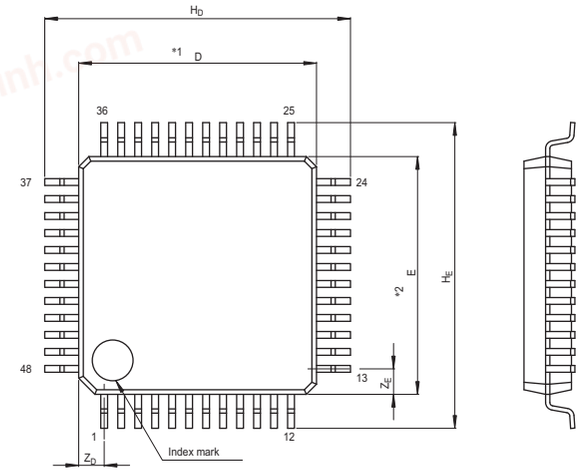
NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	13.9	14.0	14.1
E	13.9	14.0	14.1
A_2	—	1.4	—
H_D	15.8	16.0	16.2
H_E	15.8	16.0	16.2
A	—	—	1.7
A_1	0	0.1	0.2
b_p	0.32	0.37	0.42
b_1	—	0.35	—
c	0.09	0.145	0.20
c_1	—	0.125	—
θ	0°	—	8°
e	—	0.8	—
x	—	—	0.20
y	—	—	0.10
Z_D	—	1.0	—
Z_E	—	1.0	—
L	0.3	0.5	0.7
L_1	—	1.0	—

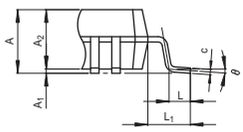
Figure C 64-Pin LQFP (PLQP0064GA-A)

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JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-LFQFP48-7x7-0.50	PLQP0048KB-A	48P6Q-A	0.2g



Terminal cross section



Detail F

NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	6.9	7.0	7.1
E	6.9	7.0	7.1
A_2	—	1.4	—
H_D	8.8	9.0	9.2
H_E	8.8	9.0	9.2
A	—	—	1.7
A_1	0	0.1	0.2
b_p	0.17	0.22	0.27
b_1	—	0.20	—
c	0.09	0.145	0.20
c_1	—	0.125	—
θ	0°	—	8°
e	—	0.5	—
x	—	—	0.08
y	—	—	0.10
Z_D	—	0.75	—
Z_E	—	0.75	—
L	0.35	0.5	0.65
L_1	—	1.0	—

Figure D 48-Pin LQFP (PLQP0048KB-A)

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REVISION HISTORY	RX220 Group Datasheet

Rev.	Date	Description	
		Page	Summary
0.51	May 24, 2012	—	First edition, issued
1.00	Dec 25, 2012	Feature	
		1	IrDA, added Low-power design and architecture, Real-time clock, Up to seven communications channels, Operating temp. range, changed
		1. Overview	
		3, 4	Table 1.1 Outline of Specifications: General I/O ports, Event link controller (ELC), Realtime clock (RTCc), Serial communications interfaces (SCIe, SCIf), IrDA, Power supply voltage/ Operating frequency, Supply current, Operating temperature, changed
		5	Table 1.2 Comparison of Functions for Different Packages, changed
		6	Table 1.3 List of Products, changed Note 1, added
		7	Figure 1.1 How to Read the Product Part No., Memory Capacity, and Package Type, changed
		8	Figure 1.2 Block Diagram, changed
		9, 10	Table 1.4 Pin Functions: Power supply, On-chip emulator, Serial communications interface (SCIe), changed
		13	Figure 1.4 Pin Assignments of the 64-Pin LQFP, Figure 1.5 Pin Assignments of the 48-Pin LQFP, changed
		14, 15	Table 1.5 List of Pins and Pin Functions (100-Pin LQFP), chaned
		17	Table 1.6 List of Pins and Pin Functions (64-Pin LQFP), chaned
		19	Table 1.7 List of Pins and Pin Functions (48-Pin LQFP), chaned
		4. I/O Registers	
		32 to 46	Table 4.1 List of I/O Registers, changed Notes 1 and 2, added
		5. Electrical Characteristics	
		47 to 99	Added
1.10	Dec 20, 2013	All	PLQP0064GA-A 14×14 mm, 0.8-mm pitch added
		Features	
		1	■ Operating temp. range changed
		1. Overview	
		4	Table 1.1 Outline of Specifications changed, Note 1 added
		6	Table 1.3 List of Products changed, Note added
		7	Figure 1.1 How to Read the Product Part No., Memory Capacity, and Package Type changed
		5. Electrical Characteristics	
		49	Table 5.4 DC Characteristics (3) changed
		55	Table 5.8 DC Characteristics (7) added
		56	Table 5.13 Permissible Output Currents (1) changed, Table 5.14 Permissible Output Currents (2) added
		57	Table 5.15 Output Values of Voltage (1) changed, Table 5.16 Output Values of Voltage (2) added
		73	Table 5.26 Timing of On-Chip Peripheral Modules (1) changed
		85	Table 5.31 A/D Conversion Characteristics (1) changed
		86	Table 5.34 A/D Conversion Characteristics (2) changed
		91	Table 5.38 Power-on Reset Circuit and Voltage Detection Circuit Characteristics (2) changed

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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.

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