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What is "Embedded - Microcontrollers"?

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

Applications of "<u>Embedded - Microcontrollers</u>"

Details	
Product Status	Active
Core Processor	R8C
Core Size	16-Bit
Speed	20MHz
Connectivity	LINbus, SIO, UART/USART
Peripherals	POR, PWM, Voltage Detect, WDT
Number of I/O	25
Program Memory Size	16KB (16K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1.5K x 8
Voltage - Supply (Vcc/Vdd)	2.2V ~ 5.5V
Data Converters	A/D 9x10b
Oscillator Type	Internal
Operating Temperature	-20°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	32-LQFP
Supplier Device Package	32-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f212k4snfp-x6

Email: info@E-XFL.COM

Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong

Table 1.3 Specifications for R8C/2L Group (1)

Item	Function	Specification
CPU	Central processing	R8C/Tiny series core
	unit	Number of fundamental instructions: 89
		Minimum instruction execution time:
		50 ns (f(XIN) = 20 MHz, VCC = 3.0 to 5.5 V)
		100 ns (f(XIN) = 10 MHz, VCC = 2.7 to 5.5 V)
		200 ns (f(XIN) = 5 MHz, VCC = 2.2 to 5.5 V)
		Multiplier: 16 bits × 16 bits → 32 bits
		<ul> <li>Multiply-accumulate instruction: 16 bits x 16 bits + 32 bits → 32 bits</li> </ul>
		Operation mode: Single-chip mode (address space: 1 Mbyte)
Memory	ROM, RAM	Refer to Table 1.6 Product List for R8C/2L Group.
Power Supply	Voltage detection	Power-on reset
Voltage	circuit	Voltage detection 3
Detection		
I/O Ports	Programmable I/O	Input-only: 3 pins
	ports	CMOS I/O ports: 25, selectable pull-up resistor
		High current drive ports: 8
Clock	Clock generation	2 circuits: XIN clock oscillation circuit (with on-chip feedback resistor),
	circuits	On-chip oscillator (high-speed, low-speed)
		(high-speed on-chip oscillator has a frequency adjustment function)
		Oscillation stop detection: XIN clock oscillation stop detection function
		• Frequency divider circuit: Dividing selectable 1, 2, 4, 8, and 16
		• Low power consumption modes:
		Standard operating mode (high-speed clock, high-speed on-chip oscillator,
		low-speed on-chip oscillator), wait mode, stop mode
Interrupts		External: 4 sources, Internal: 15 sources, Software: 4 sources
into in apto		Priority levels: 7 levels
Watchdog Tim	er	15 bits × 1 (with prescaler), reset start selectable
Timer	Timer RA	8 bits × 1 (with 8-bit prescaler)
111101		Timer mode (period timer), pulse output mode (output level inverted every
		period), event counter mode, pulse width measurement mode, pulse period
		measurement mode
	Timer RB	8 bits x 1 (with 8-bit prescaler)
		Timer mode (period timer), programmable waveform generation mode (PWM
		output), programmable one-shot generation mode, programmable wait one-
		shot generation mode
	Timer RC	16 bits × 1 (with 4 capture/compare registers)
		Timer mode (input capture function, output compare function), PWM mode
		(output 3 pins), PWM2 mode (PWM output pin)
	Timer RD	16 bits × 2 (with 4 capture/compare registers)
		Timer mode (input capture function, output compare function), PWM mode
		(output 6 pins), reset synchronous PWM mode (output three-phase
		waveforms (6 pins), sawtooth wave modulation), complementary PWM mode
		(output three-phase waveforms (6 pins), triangular wave modulation), PWM3
		mode (PWM output 2 pins with fixed period)

Specifications for R8C/2L Group (2) Table 1.4

Item	Function	Specification		
Serial	UARTO, UART2	Clock synchronous serial I/O/UART x 2		
Interface	,			
LIN Module		Hardware LIN: 1 (timer RA, UART0)		
A/D Converter		10-bit resolution × 9 channels, includes sample and hold function		
Flash Memory		Programming and erasure voltage: VCC = 2.7 to 5.5 V		
		<ul> <li>Programming and erasure endurance: 10,000 times (data flash)</li> </ul>		
		1,000 times (program ROM)		
		Program security: ROM code protect, ID code check		
		Debug functions: On-chip debug, on-board flash rewrite function		
Operating Fred Voltage	quency/Supply	f(XIN) = 20 MHz (VCC = 3.0 to 5.5 V) f(XIN) = 10 MHz (VCC = 2.7 to 5.5 V) f(XIN) = 5 MHz (VCC = 2.2 to 5.5 V) (VCC = 2.7 to 5.5 V for A/D converter only)		
Current consumption		Typ. 10 mA (VCC = 5.0 V, f(XIN) = 20 MHz) Typ. 6 mA (VCC = 3.0 V, f(XIN) = 10 MHz) Typ. 23 $\mu$ A (VCC = 3.0 V, wait mode, low-speed on-chip oscillator used) Typ. 0.7 $\mu$ A (VCC = 3.0 V, stop mode)		
Operating Ambient Temperature		-20 to 85°C (N version) -40 to 85°C (D version) <sup>(1)</sup> -20 to 105°C (Y version) <sup>(2)</sup>		
Package		32-pin LQFP • Package code: PLQP0032GB-A (previous code: 32P6U-A)		

# NOTES:

- 1. Specify the D version if D version functions are to be used.
- 2. Please contact Renesas Technology sales offices for the Y version.

# 1.2 Product List

Table 1.5 lists the Product List for R8C/2K Group, Figure 1.1 shows a Part Number, Memory Size, and Package of R8C/2K Group, Table 1.6 lists the Product List for R8C/2L Group, and Figure 1.2 shows a Part Number, Memory Size, and Package of R8C/2L Group.

Table 1.5 Product List for R8C/2K Group

Current of Dec. 2007

Part No.	ROM Capacity	RAM Capacity	Package Type	Remarks
R5F212K2SNFP	8 Kbytes	1 Kbyte	PLQP0032GB-A	N version
R5F212K4SNFP	16 Kbytes	1.5 Kbytes	PLQP0032GB-A	
R5F212K2SDFP	8 Kbytes	1 Kbyte	PLQP0032GB-A	D version
R5F212K4SDFP	16 Kbytes	1.5 Kbytes	PLQP0032GB-A	
R5F212K2SNXXXFP (D)	8 Kbytes	1 Kbyte	PLQP0032GB-A	N version
R5F212K4SNXXXFP (D)	16 Kbytes	1.5 Kbytes	PLQP0032GB-A	Factory programming product <sup>(1)</sup>
R5F212K2SDXXXFP (D)	8 Kbytes	1 Kbyte	PLQP0032GB-A	D version
R5F212K4SDXXXFP (D)	16 Kbytes	1.5 Kbytes	PLQP0032GB-A	Factory programming product <sup>(1)</sup>

(D): Under development

NOTE:

1. The user ROM is programmed before shipment.

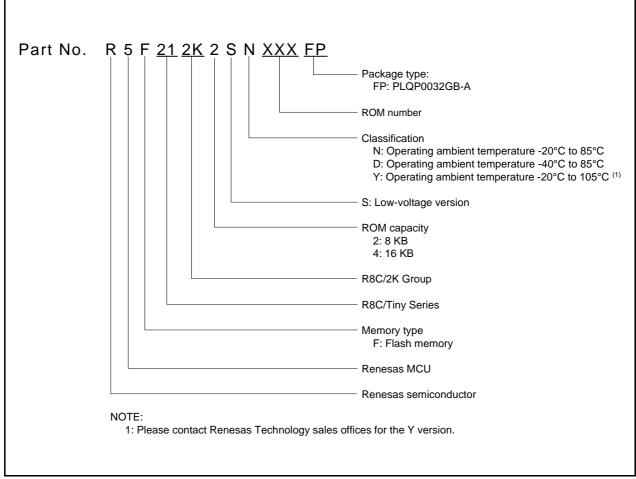


Figure 1.1 Part Number, Memory Size, and Package of R8C/2K Group

SFR Information (5)<sup>(1)</sup> Table 4.5

Address	Register	Symbol	After reset
0100h	Timer RA Control Register	TRACR	00h
0100h	Timer RA I/O Control Register	TRAIOC	00h
010111 0102h	Timer RA Mode Register	TRAMR	00h
0103h	Timer RA Prescaler Register	TRAPRE	FFh
0104h	Timer RA Register	TRA	FFh
0105h	LIN Control Register 2	LINCR2	00h
0106h	LIN Control Register	LINCR	00h
0107h	LIN Status Register	LINST	00h
0108h	Timer RB Control Register	TRBCR	00h
0109h	Timer RB One-Shot Control Register	TRBOCR	00h
010Ah	Timer RB I/O Control Register	TRBIOC	00h
010Bh	Timer RB Mode Register	TRBMR	00h
010Ch	Timer RB Prescaler Register	TRBPRE	FFh
010Dh	Timer RB Secondary Register	TRBSC	FFh
010Eh	Timer RB Primary Register	TRBPR	FFh
	Timer RB Primary Register	IRBPR	FFN
010Fh			
0110h			
0111h			
0112h			
0113h			
0114h			
0115h			
0116h			
0117h		+	
0118h		+	
0119h		+	
011Ah			
011Bh			
-			
011Ch			
011Dh			
011Eh			
011Fh			
0120h	Timer RC Mode Register	TRCMR	01001000b
0121h	Timer RC Control Register 1	TRCCR1	00h
0122h	Timer RC Interrupt Enable Register	TRCIER	01110000b
0123h	Timer RC Status Register	TRCSR	01110000b
0124h	Timer RC I/O Control Register 0	TRCIOR0	10001000b
0125h	Timer RC I/O Control Register 1	TRCIOR1	10001000b
0126h	Timer RC Counter	TRC	00h
0120H	Time No Counter	TINO	00h
0127H	Timer RC General Register A	TRCGRA	FFh
0128h	Tilliel RC Gellelal Registel A	IRCGRA	
		TDOODD	FFh
012Ah	Timer RC General Register B	TRCGRB	FFh
012Bh			FFh
012Ch	Timer RC General Register C	TRCGRC	FFh
012Dh		<u> </u>	FFh
012Eh	Timer RC General Register D	TRCGRD	FFh
012Fh			FFh
0130h	Timer RC Control Register 2	TRCCR2	00011111b
0131h	Timer RC Digital Filter Function Select Register	TRCDF	00h
0132h	Timer RC Output Master Enable Register	TRCOER	01111111b
0133h	. 1	1	-
	1	+	
0134h			
0134h 0135h			
0135h			
0135h 0136h	Timor PD Start Pagistar	TENSTE	11111100b
0135h 0136h 0137h	Timer RD Start Register	TRDSTR	11111100b
0135h 0136h 0137h 0138h	Timer RD Mode Register	TRDMR	00001110b
0135h 0136h 0137h 0138h 0139h	Timer RD Mode Register Timer RD PWM Mode Register	TRDMR TRDPMR	00001110b 10001000b
0135h 0136h 0137h 0138h 0139h 013Ah	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register	TRDMR TRDPMR TRDFCR	00001110b 10001000b 10000000b
0135h 0136h 0137h 0138h 0139h 013Ah 013Bh	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register Timer RD Output Master Enable Register 1	TRDMR TRDPMR TRDFCR TRDOER1	00001110b 10001000b 10000000b FFh
0135h 0136h 0137h 0138h 0139h 013Ah 013Bh 013Ch	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register Timer RD Output Master Enable Register 1 Timer RD Output Master Enable Register 2	TRDMR TRDPMR TRDFCR TRDOER1 TRDOER2	00001110b 10001000b 10000000b FFh 01111111b
0135h 0136h 0137h 0138h 0139h 013Ah 013Bh	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register Timer RD Output Master Enable Register 1 Timer RD Output Master Enable Register 2 Timer RD Output Control Register	TRDMR TRDPMR TRDFCR TRDOER1 TRDOER2 TRDOCR	00001110b 10001000b 10000000b FFh
0135h 0136h 0137h 0138h 0139h 013Ah 013Bh 013Ch	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register Timer RD Output Master Enable Register 1 Timer RD Output Master Enable Register 2	TRDMR TRDPMR TRDFCR TRDOER1 TRDOER2	00001110b 10001000b 10000000b FFh 01111111b
0135h 0136h 0137h 0138h 0139h 013Ah 013Bh 013Ch 013Dh	Timer RD Mode Register Timer RD PWM Mode Register Timer RD Function Control Register Timer RD Output Master Enable Register 1 Timer RD Output Master Enable Register 2 Timer RD Output Control Register	TRDMR TRDPMR TRDFCR TRDOER1 TRDOER2 TRDOCR	00001110b 10001000b 10000000b FFh 01111111b

NOTE:

1. The blank regions are reserved. Do not access locations in these regions

SFR Information (6)<sup>(1)</sup> Table 4.6

Address	Register	Symbol	After reset
0140h	Timer RD Control Register 0	TRDCR0	00h
0141h	Timer RD I/O Control Register A0	TRDIORA0	10001000b
0142h	Timer RD I/O Control Register C0	TRDIORC0	10001000b
0143h	Timer RD Status Register 0	TRDSR0	11100000b
0144h	Timer RD Interrupt Enable Register 0	TRDIER0	11100000b
0145h	Timer RD PWM Mode Output Level Control Register 0	TRDPOCR0	11111000b
0146h	Timer RD Counter 0	TRD0	00h
0147h			00h
0148h	Timer RD General Register A0	TRDGRA0	FFh
0149h			FFh
014Ah	Timer RD General Register B0	TRDGRB0	FFh
014Bh			FFh
014Ch	Timer RD General Register C0	TRDGRC0	FFh
014Dh			FFh
014Eh	Timer RD General Register D0	TRDGRD0	FFh
014Fh			FFh
0150h	Timer RD Control Register 1	TRDCR1	00h
0151h	Timer RD I/O Control Register A1	TRDIORA1	10001000b
0152h	Timer RD I/O Control Register C1	TRDIORC1	10001000b
0153h	Timer RD Status Register 1	TRDSR1	11000000b
0154h	Timer RD Interrupt Enable Register 1	TRDIER1	11100000b
0155h	Timer RD PWM Mode Output Level Control Register 1	TRDPOCR1	11111000b
0156h	Timer RD Counter 1	TRD1	00h
0157h			00h
0158h	Timer RD General Register A1	TRDGRA1	FFh
0159h			FFh
015Ah	Timer RD General Register B1	TRDGRB1	FFh
015Bh			FFh
015Ch	Timer RD General Register C1	TRDGRC1	FFh
015Dh			FFh
015Eh	Timer RD General Register D1	TRDGRD1	FFh
015Fh			FFh
0160h	UART2 Transmit/Receive Mode Register	U2MR	00h
0161h	UART2 Bit Rate Register	U2BRG	XXh
0162h	UART2 Transmit Buffer Register	U2TB	XXh
0163h			XXh
0164h	UART2 Transmit/Receive Control Register 0	U2C0	00001000b
0165h	UART2 Transmit/Receive Control Register 1	U2C1	00000010b
0166h	UART2 Receive Buffer Register	U2RB	XXh
0167h			XXh
0168h			
0169h			
016Ah			
016Bh			
016Ch			
016Dh			
016Eh			
016Fh			
0170h			
0171h			
0172h			
0173h			
0174h			
0175h			
0176h			
0177h			
0178h			
0179h			
017Ah			
017Bh			
017Ch			
017Dh			
	1		
017Eh 017Fh			

X: Undefined NOTE:

1. The blank regions are reserved. Do not access locations in these regions.

SFR Information (7)<sup>(1)</sup> Table 4.7

0180h 0182h 0182h 0182h 0182h 0183h 0183h 0188h 018h 01	Address	Register	Symbol	After reset
0181h	0180h	rogistor	Cymbol	71101 10001
0183h 0183h 0186h 0186h 0186h 0187h 0187h 0188h 0186h 0196h	0181h			
0183h 0183h 0186h 0186h 0186h 0187h 0187h 0188h 0186h 0196h				
0186h 0187h 0188h 0198h 0199h 0199h 0199h 0199h 0199h 0199h 0199h 0199h 0199h 0198h	0183h			
0188h	0184h			
0187h 0188h				
0189h 018An 018An 018An 018An 018Ch 018Ch 018Ch 018Ch 018Ch 018Eh 018Ch 018Eh 019Ch 019Ch 019Ch 019Sh 01ASh	0186h			
0188h 0188h 0188h 0188h 0188h 018b 018ch 019ch 0	0187h			
018Ah 018Ch 018Ch 018Ch 018Eh 018Eh 018Eh 019M 019M 019M 019M 019M 019M 019M 019M	0188h			
018Bh 018Ch 018Ch 018Ch 018Eh 018Fh 019Ph 0190h 0191h 0193h 0193h 0198h 0143h 0143h 0143h 0144h 0142h 0143h 0148h 0158h 0158h 0158h 0158h	0189h			
018Ch	018Ah			
018Dh 018Ph 018Ph 0190h 0191h 0191h 0192h 0193h 0194h 0196h 0197h 0198h 014Ah	018Bh			
018Eh 0199h 0199h 0192h 0192h 0192h 0193h 0194h 0198h 0197ch 017A2h 017A2h 017A3h 017A4h 017A2h 017A3h 017A4h 017A5h 017A6h 017A7h 017A8h	018Ch			
018Fh         0191h           0191h         0192h           0192h         0193h           0194h         0195h           0195h         0196h           0197h         0198h           0199h         0199h           019Ch         019Bh           019Ch         019Bh           019Fh         019Fh           014Ah         014Ah           014Bh         014Ah           014Bh <td></td> <td></td> <td></td> <td></td>				
0190h         0192h           0192h         0192h           0193h         0194h           0195h         0196h           0197h         0198h           0198h         0199h           0198h         0199h           0192h         0192h           0142h         0142h           0142h <td>010EII</td> <td></td> <td></td> <td></td>	010EII			
0191h         0193h           0193h         0193h           0194h         0195h           0195h         0195h           0197h         0197h           0198h         0199h           0199h         0199h           019Ch         019Dh           019Eh         019Fh           014Ah         014Ah           014Bh         014Ah           014Bh         014Ah           014Bh         014Ah           014Bh         014Bh           014Bh         014Bh           014Bh         016Bh           01Bh         016Bh           01Bh         016Bh           01Bh				
0192h         0194h           0194h         0195h           0196h         0197h           0197h         0198h           0199h         0199h           0191h         0191h           0192h         0192h           014th         0192h           014th         014th           014th <td></td> <td></td> <td></td> <td></td>				
0193h         0195h           0195h         0196h           0197h         0197h           0198h         0199h           0199h         0199h           019Dh         019Dh           019Eh         019Dh           019Fh         019Fh           01A3h         0141h           01A3h         01A3h           01A3h         01A3h           01A3h         01A3h           01A3h         01A4h           01A7h         01A8h           01A8h         01A8h           01A8h         01A8h           01ABh         01ABh           01ACh         01ABh           01APh         01Bh           01Bh         01Bh	0192h			
0194h         0196h           0197h         0188h           0197h         0198h           0199h         0199h           0190h         0198h           0190h         0198h           0190h         0199h           0190h         0199h           0190h         0199h           0191h         0199h           0192h         0199h           0197h         0100000000000000000000000000000000000	0193h			
0195h 0197h 0197h 0198h 0199h 0199h 0199h 0199h 0190h 019Dh 019Dh 019Eh 019Eh 013Eh 01Alh	0194h			
0196h 0198h 0199h 0199h 0199h 0199h 0198h 0190h 0190h 0190h 0190h 0190h 0190h 0190h 0190h 0190h 0100h	0195h			
0198h	0196h			
0199h				
019Ah         019Bh           019Ch         019Dh           019Eh         019Fh           019Fh         01A0h           01A1h         01A2h           01A2h         01A3h           01A3h         01A8h           01A6h         01A8h           01A8h         01A8h           01A8h         01A8h           01AAh         01A8h           01ACh         01ACh           01ACh         01ACh           01ACh         01ACh           01ACh         01ACh           01AEh         01ACh           01AEh         01BCh           01B3h         Flash Memory Control Register 4           01B3h         Flash Memory Control Register 1           01B6h         01B8h           01B8h         01B8h           01B8h         01B8h           01B8h         01B8h           01B8h         01B8h           01B8h         01B8h           01B6h         01B6h           01B6h         01B6h           01B6h         01B6h           01B8h         01B6h           01B8h         01B6h           01B8h <t< td=""><td></td><td></td><td></td><td></td></t<>				
019Bh         019Dh           019Ch         019Bh           019Fh         019Fh           01A0h         01A1h           01A1h         01A2h           01A3h         01A3h           01A6h         01A6h           01A8h         01A8h           01A8h         01A8h           01A8h         01A8h           01A8h         01A8h           01ABh         01ABh           01ACh         01ABh           01ACh         01ABh           01ABh         01ABh           01Bh         01Bh           01Bh         01Bh           01Bh         01Bh           01Bh         10Bh           01Bh         10Bh <td></td> <td></td> <td></td> <td></td>				
019Ch         019Eh           019Eh         019Eh           019Fh         01000           01A0h         01A1h           01A2h         01A3h           01A3h         01A3h           01A6h         01A7h           01A8h         01A7h           01A8h         01A8h           01AAh         01A8h           01AAh         01ABh           01ACh         01ACh           01ACh         01ACh           01ABh         01ACh           01ABh         01ACh           01ABh         01ACh           01Bh         01Bh           01Bh         01Bh           01Bh         01Bh           01Bh         01Bh           01Bh         1Bh           01Bh         Flash Memory Control Register 1           01Bh         1Bh           01Bh         01Bh           01Bh				
019Ch	019Bh			
019Eh	019Ch			
019Fh	019Dh			
0140h 0142h 0142h 0143h 0143h 0144h 0145h 0146h 0147h 0148h 0148h 0148h 0148h 0148h 0148h 0148h 0148h 0148h 0158h 0168h 0168h 0187h 0188h	019En			
0142h 0142h 0143h 0144h 0145h 0146h 0146h 0147h 0148h 0158h 0168h 0168h 0189h 0188h				
01A2h 01A3h 01A4h 01A5h 01A5h 01A7h 01A8h 01A8h 01A9h 01A8h 01A8h 01ABh 01ABh 01ABh 01ABh 01ABh 01ABh 01Bh 01ABh 01Bh 01Bh 01Bh 01Bh 01Bh 01Bh 01Bh 01	01A011			
01A3h	01A111			
01A4h 01A5h 01A6h 01A7h 01A8h 01A9h 01AAh 01ABh 01ABh 01ACh 01ABh 01ABh 01ABh 01ABh 01ABh 01BBh	01A3h			
0145h 0146h 0147h 0148h 0149h 014Ah 014Ah 014Ah 014Ah 014Ah 014Ch 014ACh 014AFh 014Fh 018Dh 018Bh 018Bh Flash Memory Control Register 4 FMR4 018Bh 018Bh Flash Memory Control Register 1 FMR1 1000000Xb 01B7h Flash Memory Control Register 0 FMR0 01000001b 01B8h				
01A6h         01A7h           01A8h         01A8h           01A9h         01AAh           01ABh         01ABh           01ACh         01ADh           01AEh         01AEh           01AFh         01BDh           01B0h         01B1h           01B2h         01B3h           01B3h         Flash Memory Control Register 4           01B5h         Flash Memory Control Register 1           01B6h         01B6h           01B8h         01B9h           01B9h         01B9h           01BCh         01BCh           01BCh         01BCh           01BFh         01BEh           01BFh         01BEh	01A5h			
01A7h 01A8h 01A9h 01AAh 01ABh 01ACh 01ACh 01ACh 01AFh 01B1h 01B2h 01B2h 01B3h 01B4h 01B5h 01B5h Flash Memory Control Register 4 01B6h 01B7h Flash Memory Control Register 0 FMR0 01B9h 01B7h 01B8h 01B8h 01B8h 01B8h 01B9h 01B8h 01B9h 01B9h 01BBh 01BBh 01BBh 01BBCh 01BCh 01BCh 01BEh	01A6h			
01A9h         01AAh           01ABh            01ACh            01ACh            01AEh            01AFh            01B0h            01B1h            01B2h            01B3h         Flash Memory Control Register 4           01B4h            01B5h         Flash Memory Control Register 1           01B6h            01B7h         Flash Memory Control Register 0           01B8h            01B9h            01BAh            01BCh            01BCh            01BFh				
01AAh       01ABh         01ACh       01ACh         01ADh       01AEh         01AFh       01B0h         01B0h       01B1h         01B2h       01B3h         01B3h       Flash Memory Control Register 4       FMR4       01000000b         01B4h       01B5h       Flash Memory Control Register 1       FMR1       1000000Xb         01B6h       01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       01B9h       01BAh       01BBh       01BCh         01BCh       01BCh       01BCh       01BCh         01BFh       01BFh       01BFh       01BFh	01A8h			
01ABh       01ACh         01ADh       01ADh         01AEh       01AFh         01AFh       01B0h         01B0h       01B1h         01B2h       01B2h         01B3h       Flash Memory Control Register 4       FMR4       01000000b         01B4h       01B5h       Flash Memory Control Register 1       FMR1       1000000Xb         01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       01B8h       01B8h       01B8h         01BBh       01BCh       01BCh       01BCh         01BCh       01BFh       01BFh       01BFh	01A9h			
01ACh         01ADh           01AEh         01AFh           01B0h         01B0h           01B1h         01B2h           01B3h         Flash Memory Control Register 4         FMR4         010000000b           01B4h         01B5h         Flash Memory Control Register 1         FMR1         1000000Xb           01B6h         01B7h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B9h         01BAh         01BBh           01BCh         01BCh         01BCh         01BCh           01BFh         01BFh         01BFh         01BFh	01AAh			
01ADh         01AEh           01AFh            01B0h            01B1h            01B2h            01B3h         Flash Memory Control Register 4         FMR4            01B4h            01B5h         Flash Memory Control Register 1         FMR1            01B6h             01B7h         Flash Memory Control Register 0         FMR0            01B8h             01B8h             01BBh             01BCh             01BFh             01BFh	01ABh			
01AEh         01AFh           01B0h         01B1h           01B2h         01B2h           01B3h         Flash Memory Control Register 4         FMR4         010000000b           01B4h         01B5h         FMR1         1000000Xb           01B6h         FMR1         1000000Xb           01B7h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B8h         01BAh         01BAh           01BCh         01BCh         01BCh         01BCh           01BFh         01BFh         01BFh         01BFh	01ACh			
01AFh       01B0h       01B1h       01B1h       01B2h       01B2h       01B3h       Flash Memory Control Register 4       FMR4       010000000b       010000000b       010000000b       010000000b       010000000b       0100000000b       0100000000b       0100000000b       0100000000b       0100000000b       0100000000b       0100000000b       010000000000b       0100000000b       0100000000b       0100000000b       0100000000b       0100000000b       0100000000b       010000000b       0100000000b       0100000000b        0100000000b       010000000b       0100000000b       010000000b       01000000b       0100000b       0100000b       0100000b       0100000b       01000000b       01000000b       0100000b       0100000b <t< td=""><td></td><td></td><td></td><td></td></t<>				
01B0h       01B1h         01B2h       01B3h         01B3h       Flash Memory Control Register 4       FMR4       01000000b         01B4h       01B5h       Flash Memory Control Register 1       FMR1       10000000xb         01B6h       01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       01B9h       01B9h       01B9h       01B9h         01BBh       01BCh       01BCh       01BCh       01BCh       01BCh       01BFh         01BFh <td></td> <td></td> <td></td> <td></td>				
01B1h       01B2h         01B3h       Flash Memory Control Register 4       FMR4       01000000b         01B4h       01B5h       Flash Memory Control Register 1       FMR1       10000000xb         01B6h       01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       0       01B9h       00000001b         01BAh       0       00000001b         01BBh       0       00000001b         01BCh       000000000000000000000000000000000000	01AFN			
01B2h         01B3h         Flash Memory Control Register 4         FMR4         01000000b           01B4h         01B5h         Flash Memory Control Register 1         FMR1         1000000Xb           01B6h         01B7h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B9h         01B9h         01BBh         01BBh           01BBh         01BCh         01BCh         01BCh         01BBh           01BFh         01BFh         01BFh         01BFh	01B0H			
01B3h         Flash Memory Control Register 4         FMR4         010000000b           01B4h         01B5h         Flash Memory Control Register 1         FMR1         10000000xb           01B6h         01B7h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B9h         01B9h         01B9h         01B9h           01BBh         01BCh         01BDh         01BDh         01BBh           01BFh         01BFh         01BFh         01BFh         01BFh	01B1II			
01B4h       01B5h       Flash Memory Control Register 1       FMR1       1000000Xb         01B6h       01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       01B9h       01B9h       01B9h       01B9h         01BBh       01BCh		Flash Memory Control Register 4	FMR4	01000000b
01B5h         Flash Memory Control Register 1         FMR1         1000000Xb           01B6h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B9h         01B9h         01B9h         01B9h           01BBh         01BCh         01BCh         01BDh         01BDh           01BFh         01BFh         01BFh         01BFh	01B4h			
01B6h       01B7h       Flash Memory Control Register 0       FMR0       00000001b         01B8h       01B9h	01B5h	Flash Memory Control Register 1	FMR1	1000000Xb
01B7h         Flash Memory Control Register 0         FMR0         00000001b           01B8h         01B9h         01B4h         01B4h         01B6h         <	01B6h			
01B8h 01B9h 01BAh 01BAh 01BBh 01BCh 01BCh 01BDh 01BEh 01BFh	01B7h	Flash Memory Control Register 0	FMR0	00000001b
01BAh 01BBh 01BCh 01BDh 01BDh 01BEh 01BFh	01B8h			
01BBh 01BCh 01BDh 01BEh 01BFh	01B9h			
01BCh 01BDh 01BEh 01BFh	01BAh			
01BDh 01BEh 01BFh	01BBh			
01BEh 01BFh	01BCh			
01BFh	01BDh			
	01BEh			
	UIBFh			
L ELEED LODGED Eurotion Soloot Pogistor LAST 1/Note 01	CCCCh	Option Function Select Register	I OES	(Note 2)
FFFFh Option Function Select Register OFS (Note 2)	FFFFN	Option Function Select Register	UFO	(NOTE 2)

X: Undefined
NOTES:

1. The blank regions are reserved. Do not access locations in these regions.
2. The OFS register cannot be changed by a program. Use a flash programmer to write to it.

# 5. Electrical Characteristics

The electrical characteristics of N version (Topr =  $-20^{\circ}$ C to  $85^{\circ}$ C) and D version (Topr =  $-40^{\circ}$ C to  $85^{\circ}$ C) are listed below.

Please contact Renesas Technology sales offices for the electrical characteristics in the Y version (Topr =  $-20^{\circ}$ C to  $105^{\circ}$ C).

Table 5.1 Absolute Maximum Ratings

Symbol	Parameter	Condition	Rated Value	Unit
Vcc/AVcc	Supply voltage		-0.3 to 6.5	V
Vı	Input voltage		-0.3 to Vcc + 0.3	V
Vo	Output voltage		-0.3 to Vcc + 0.3	V
Pd	Power dissipation	Topr = 25°C	500	mW
Topr	Operating ambient temperature		-20 to 85 (N version) / -40 to 85 (D version)	°C
Tstg	Storage temperature		-65 to 150	°C

Table 5.5 Flash Memory (Data flash Block A, Block B) Electrical Characteristics(4)

Symbol	Parameter	Conditions		Unit		
Symbol	Parameter	Conditions	Min. Typ. Max.		Max.	Unit
_	Program/erase endurance <sup>(2)</sup>		10,000(3)	-	-	times
_	Byte program time (program/erase endurance ≤ 1,000 times)		_	50	400	μS
_	Byte program time (program/erase endurance > 1,000 times)		_	65	_	μS
_	Block erase time (program/erase endurance ≤ 1,000 times)		_	0.2	9	S
_	Block erase time (program/erase endurance > 1,000 times)		_	0.3	-	S
td(SR-SUS)	Time delay from suspend request until suspend		=	-	97+CPU clock × 6 cycles	μS
_	Interval from erase start/restart until following suspend request		650	-	_	μS
_	Interval from program start/restart until following suspend request		0	-	-	ns
_	Time from suspend until program/erase restart		_	-	3+CPU clock × 4 cycles	μS
-	Program, erase voltage		2.7	_	5.5	V
_	Read voltage		2.2	_	5.5	V
=	Program, erase temperature		-20 <sup>(8)</sup>	-	85	°C
_	Data hold time <sup>(9)</sup>	Ambient temperature = 55 °C	20	_	-	year

#### NOTES:

- 1. Vcc = 2.7 to 5.5 V at Topr = -20 to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.
- 2. Definition of programming/erasure endurance

The programming and erasure endurance is defined on a per-block basis.

If the programming and erasure endurance is n (n = 100 or 10,000), each block can be erased n times. For example, if 1,024 1-byte writes are performed to block A, a 1 Kbyte block, and then the block is erased, the programming/erasure endurance

However, the same address must not be programmed more than once per erase operation (overwriting prohibited).

- Endurance to guarantee all electrical characteristics after program and erase. (1 to Min. value can be guaranteed).
- Standard of block A and block B when program and erase endurance exceeds 1,000 times. Byte program time to 1,000 times is the same as that in program ROM.
- 5. In a system that executes multiple programming operations, the actual erasure count can be reduced by writing to sequential addresses in turn so that as much of the block as possible is used up before performing an erase operation. For example, when programming groups of 16 bytes, the effective number of rewrites can be minimized by programming up to 128 groups before erasing them all in one operation. It is also advisable to retain data on the erase count of each block and limit the number of erase operations to a certain number.
- 6. If an error occurs during block erase, attempt to execute the clear status register command, then execute the block erase command at least three times until the erase error does not occur.
- 7. Customers desiring program/erase failure rate information should contact their Renesas technical support representative.
- 8. -40°C for D version.
- 9. The data hold time includes time that the power supply is off or the clock is not supplied.

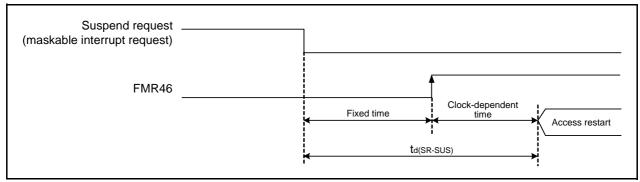


Figure 5.2 Time delay until Suspend

Table 5.6 Voltage Detection 0 Circuit Electrical Characteristics

Symbol	Parameter	Condition	Standard			Unit
Symbol	Farameter	Condition	Min.	Тур.	Max.	Offic
Vdet0	Voltage detection level		2.2	2.3	2.4	V
-	Voltage detection circuit self power consumption	VCA25 = 1, Vcc = 5.0 V	-	0.9	-	μΑ
td(E-A)	Waiting time until voltage detection circuit operation starts <sup>(2)</sup>		=	=	300	μS
Vccmin	MCU operating voltage minimum value		2.2	=	=	V

#### NOTES:

- 1. The measurement condition is Vcc = 2.2 to 5.5 V and Topr = -20 to  $85^{\circ}C$  (N version) / -40 to  $85^{\circ}C$  (D version).
- 2. Necessary time until the voltage detection circuit operates when setting to 1 again after setting the VCA25 bit in the VCA2 register to 0.

Table 5.7 Voltage Detection 1 Circuit Electrical Characteristics

Symbol	Parameter	Condition		Unit		
Syllibol	Faranietei	Condition	Min.	Тур.	Max.	Offic
Vdet1	Voltage detection level <sup>(4)</sup>		2.70	2.85	3.00	V
=	Voltage monitor 1 interrupt request generation time <sup>(2)</sup>		-	40	_	μS
=	Voltage detection circuit self power consumption	VCA26 = 1, Vcc = 5.0 V	=	0.6	=	μΑ
td(E-A)	Waiting time until voltage detection circuit operation starts <sup>(3)</sup>		-	-	100	μS

### NOTES:

- 1. The measurement condition is Vcc = 2.2 to 5.5 V and Topr = -20 to 85°C (N version) / -40 to 85°C (D version).
- 2. Time until the voltage monitor 1 interrupt request is generated after the voltage passes Vdet1.
- 3. Necessary time until the voltage detection circuit operates when setting to 1 again after setting the VCA26 bit in the VCA2 register to 0.
- 4. This parameter shows the voltage detection level when the power supply drops. The voltage detection level when the power supply rises is higher than the voltage detection level when the power supply drops by approximately 0.1 V.

Table 5.8 Voltage Detection 2 Circuit Electrical Characteristics

Symbol	Parameter	Condition	Standard			Unit
Symbol	Farameter	Condition	Min.	Тур.	Max.	Offic
Vdet2	Voltage detection level		3.3	3.6	3.9	V
-	Voltage monitor 2 interrupt request generation time <sup>(2)</sup>		_	40	_	μS
=	Voltage detection circuit self power consumption	VCA27 = 1, Vcc = 5.0 V	=	0.6	=	μΑ
td(E-A)	Waiting time until voltage detection circuit operation starts <sup>(3)</sup>		=	=	100	μ\$

#### NOTES:

- 1. The measurement condition is Vcc = 2.2 to 5.5 V and Topr = -20 to 85°C (N version) / -40 to 85°C (D version).
- $2. \quad \text{Time until the voltage monitor 2 interrupt request is generated after the voltage passes $V_{\text{det}2}$.}$
- 3. Necessary time until the voltage detection circuit operates after setting to 1 again after setting the VCA27 bit in the VCA2 register to 0.



Table 5.14 Electrical Characteristics (2) [Vcc = 5 V] (Topr = -20 to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.)

Symbol	Doromatar		Condition		Standard		
Symbol	Parameter		Condition	Min.	Тур.	Max.	Unit
Icc	Power supply current (Vcc = 3.3 to 5.5 V)  High-speed clock mode (Vcc = 3.3 to 5.5 V)  XIN = 20 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz No division	High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz	-	10	17	mA	
Single-chip mode, output pins are open, other pins are Vss		XIN = 16 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz No division	-	9	15	mA	
	XIN = 10 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz No division	-	6	-	mA		
			XIN = 20 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8	-	5	-	mA
			XIN = 16 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8	-	4		mA
			XIN = 10 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8	-	2.5		mA
		High-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator on fOCO = 20 MHz Low-speed on-chip oscillator on = 125 kHz No division	-	10	15	mA
			XIN clock off High-speed on-chip oscillator on fOCO = 20 MHz Low-speed on-chip oscillator on = 125 kHz Divide-by-8	-	4	=	mA
			XIN clock off High-speed on-chip oscillator on fOCO = 10 MHz Low-speed on-chip oscillator on = 125 kHz No division	-	5.5	10	mA
			XIN clock off High-speed on-chip oscillator on fOCO = 10 MHz Low-speed on-chip oscillator on = 125 kHz Divide-by-8	-	2.5	_	mA
		Low-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8, FMR47 = 1	-	130	300	μА

Table 5.15 Electrical Characteristics (3) [Vcc = 5 V] (Topr = -20 to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.)

Cumbal	Doromotor		Condition		Standard	d	Unit
Symbol	Parameter	Condition	Min.	Тур.	Max.	Unit	
Icc	Power supply current (Vcc = 3.3 to 5.5 V) Single-chip mode, output pins are open, other pins	Wait mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock operation VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	_	25	75	μА
	are Vss		XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock off VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	-	23	60	μА
		Stop mode	XIN clock off, Topr = 25°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	=	0.8	3.0	μА
			XIN clock off, Topr = 85°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	-	1.2	-	μΑ

# **Timing Requirements**

(Unless Otherwise Specified: Vcc = 5 V, Vss = 0 V at Topr = 25°C) [Vcc = 5 V]

Table 5.16 XIN Input

Symbol	Parameter		Standard		
Symbol	Faranietei	Min.	Max.	Unit	
tc(XIN)	XIN input cycle time	50	-	ns	
twh(xin)	XIN input "H" width	25	-	ns	
twl(xin)	XIN input "L" width	25	-	ns	

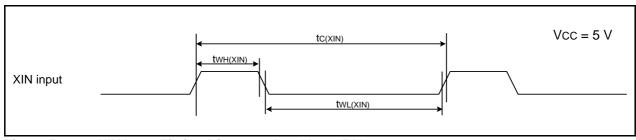


Figure 5.4 XIN Input Timing Diagram when Vcc = 5 V

Table 5.17 TRAIO Input

Symbol	Parameter		Standard		
Symbol			Max.	Unit	
tc(TRAIO)	TRAIO input cycle time	100	=	ns	
tWH(TRAIO)	TRAIO input "H" width	40	=	ns	
tWL(TRAIO)	TRAIO input "L" width	40	-	ns	

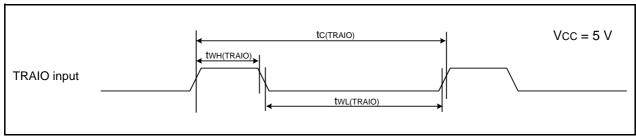


Figure 5.5 TRAIO Input Timing Diagram when Vcc = 5 V

Table 5.18 Serial Interface	<b>Table</b>	5.18	Serial	Interface
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Symbol	Parameter		Standard		
Symbol			Max.	Unit	
tc(CK)	CLKi input cycle time	200	-	ns	
tW(CKH)	CLKi input "H" width	100	-	ns	
tW(CKL)	CLKi input "L" width	100	-	ns	
td(C-Q)	TXDi output delay time	-	50	ns	
th(C-Q)	TXDi hold time	0	-	ns	
tsu(D-C)	RXDi input setup time	50	=	ns	
th(C-D)	RXDi input hold time	90	-	ns	

i = 0, 2

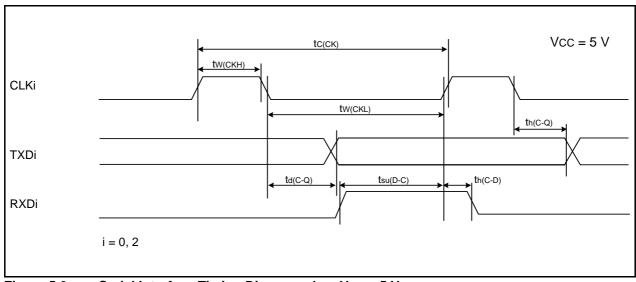


Figure 5.6 Serial Interface Timing Diagram when Vcc = 5 V

Table 5.19 External Interrupt INTi (i = 0, 1, 3) Input

Symbol	Symbol Parameter -		Standard		
Symbol			Max.	Unit	
tW(INH)	ĪNTi input "H" width	250 <sup>(1)</sup>	-	ns	
tW(INL)	INTi input "L" width	250 <sup>(2)</sup>	-	ns	

### NOTES:

- 1. When selecting the digital filter by the INTi input filter select bit, use an INTi input HIGH width of either (1/digital filter clock frequency x 3) or the minimum value of standard, whichever is greater.
- 2. When selecting the digital filter by the INTi input filter select bit, use an INTi input LOW width of either (1/digital filter clock frequency × 3) or the minimum value of standard, whichever is greater.

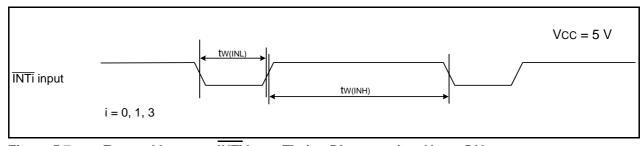


Figure 5.7 External Interrupt INTi Input Timing Diagram when Vcc = 5 V

Table 5.20 Electrical Characteristics (1) [Vcc = 3 V]

Symbol	Por	Parameter		Condition		Standard		
Symbol	Pal	ameter	Conc	IIIOII	Min.	Тур.	Max.	Unit
Vон	Output "H" voltage	Except P2_0 to P2_7, XOUT	Iон = −1 mA		Vcc - 0.5	_	Vcc	V
		P2_0 to P2_7	Drive capacity HIGH	Iон = −5 mA	Vcc - 0.5	_	Vcc	V
			Drive capacity LOW	Iон = −1 mA	Vcc - 0.5	_	Vcc	V
		XOUT	Drive capacity HIGH	Iон = −0.1 mA	Vcc - 0.5	_	Vcc	V
			Drive capacity LOW	IOH = -50 μA	Vcc - 0.5	_	Vcc	V
VoL Output	Output "L" voltage	Except P2_0 to P2_7, XOUT	IoL = 1 mA	•	-	_	0.5	V
		P2_0 to P2_7	Drive capacity HIGH	IOL = 5 mA	-	-	0.5	V
			Drive capacity LOW	IoL = 1 mA	-	_	0.5	V
		XOUT	Drive capacity HIGH	IOL = 0.1 mA	-	-	0.5	V
			Drive capacity LOW	IOL = 50 μA	-	_	0.5	V
VT+-VT-	Hysteresis	INT0, INT1, INT3, KI0, KI1, KI2, KI3, TRAIO, RXD0, RXD2, CLK0, CLK2		•	0.1	0.3	-	V
		RESET			0.1	0.4	-	V
lін	Input "H" current	1	VI = 3 V, Vcc = 3	V	_	_	4.0	μΑ
lı∟	Input "L" current		VI = 0 V, Vcc = 3	V	-	-	-4.0	μΑ
RPULLUP	Pull-up resistance		VI = 0 V, $Vcc = 3$	V	66	160	500	kΩ
RfXIN	Feedback resistance	XIN			-	3.0	-	ΜΩ
VRAM	RAM hold voltage		During stop mode	e	1.8	_	_	V

NOTE:

<sup>1.</sup> Vcc = 2.7 to 3.3 V at Topr = -20 to  $85^{\circ}C$  (N version) / -40 to  $85^{\circ}C$  (D version), f(XIN) = 10 MHz, unless otherwise specified.

Table 5.21 Electrical Characteristics (2) [Vcc = 3 V] (Topr = -20 to 85°C (N version) / -40 to 85°C (D version), unless otherwise specified.)

Symbol	Darameter		Condition		Standar	d	Unit
Symbol	Parameter		Condition		Тур.	Max.	Unit
Icc	Power supply current (Vcc = 2.7 to 3.3 V) Single-chip mode, output pins are open,	High-speed clock mode	XIN = 10 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz No division	_	6	_	mA
other pins are Vss		XIN = 10 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8		2	_	mA	
		High-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator on fOCO = 10 MHz Low-speed on-chip oscillator on = 125 kHz No division	=	5	9	mA
		mode	XIN clock off High-speed on-chip oscillator on fOCO = 10 MHz Low-speed on-chip oscillator on = 125 kHz Divide-by-8	=	2	-	mA
		Low-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8, FMR47 = 1	-	130	300	μА
		Wait mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock operation VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	-	25	70	μА
			XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock off VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	=	23	55	μА
		Stop mode	XIN clock off, Topr = 25°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	-	0.7	3.0	μА
			XIN clock off, Topr = 85°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	-	1.1	-	μА

# **Timing requirements**

(Unless Otherwise Specified: Vcc = 3 V, Vss = 0 V at Topr = 25°C) [Vcc = 3 V]

Table 5.22 XIN Input

Symbol	Parameter		Standard		
Symbol	Faranietei	Min.	Max.	Unit	
tc(XIN)	XIN input cycle time	100	-	ns	
twh(xin)	XIN input "H" width	40	=	ns	
twl(xin)	XIN input "L" width	40	-	ns	

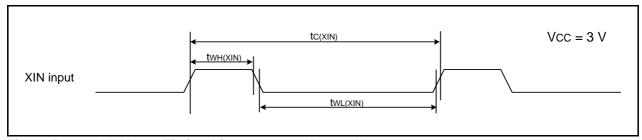


Figure 5.8 XIN Input Timing Diagram when Vcc = 3 V

Table 5.23 TRAIO Input

Symbol	Parameter		Standard		
Symbol			Max.	Unit	
tc(TRAIO)	TRAIO input cycle time	300	=	ns	
tWH(TRAIO)	TRAIO input "H" width	120	=	ns	
tWL(TRAIO)	TRAIO input "L" width	120	-	ns	

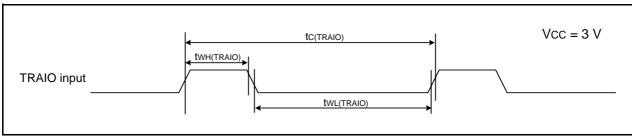


Figure 5.9 TRAIO Input Timing Diagram when Vcc = 3 V

Table 5.27 Electrical Characteristics (2) [Vcc = 2.2 V]  $(Topr = -20 \text{ to } 85^{\circ}\text{C (N version)} / -40 \text{ to } 85^{\circ}\text{C (D version)}, \text{ unless otherwise specified.})$ 

Symbol	Parameter		Condition		Standar	d	Unit
Symbol	Farameter		Condition	Min.	Тур.	Max.	5
Icc	Power supply current (Vcc = 2.2 to 2.7 V) Single-chip mode, output pins are open.	High-speed clock mode	XIN = 5 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz No division	_	3.5	_	mA
	other pins are Vss		XIN = 5 MHz (square wave) High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8	_	1.5	_	mA
		High-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator on fOCO = 5 MHz Low-speed on-chip oscillator on = 125 kHz No division	_	3.5	_	mA
		mode	XIN clock off High-speed on-chip oscillator on fOCO = 5 MHz Low-speed on-chip oscillator on = 125 kHz Divide-by-8	_	1.5	_	mA
	on- osc	Low-speed on-chip oscillator mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz Divide-by-8, FMR47 = 1	_	100	230	μА
		Wait mode	XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock operation VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	_	22	60	μА
			XIN clock off High-speed on-chip oscillator off Low-speed on-chip oscillator on = 125 kHz While a WAIT instruction is executed Peripheral clock off VCA27 = VCA26 = VCA25 = 0 VCA20 = 1	_	20	55	μΑ
		Stop mode	XIN clock off, Topr = 25°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	_	0.7	3.0	μА
			XIN clock off, Topr = 85°C High-speed on-chip oscillator off Low-speed on-chip oscillator off CM10 = 1 Peripheral clock off VCA27 = VCA26 = VCA25 = 0	_	1.1	-	μА

# **Timing requirements**

(Unless Otherwise Specified: Vcc = 2.2 V, Vss = 0 V at  $Topr = 25^{\circ}C$ ) [Vcc = 2.2 V]

Table 5.28 XIN Input

Symbol	Parameter	Standard		Unit
		Min.	Max.	Offic
tc(XIN)	XIN input cycle time	200	-	ns
twh(xin)	XIN input "H" width	90	-	ns
twl(XIN)	XIN input "L" width	90	-	ns

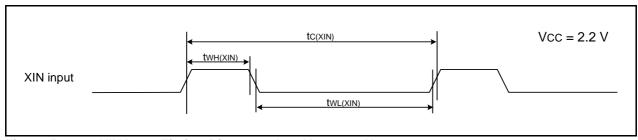


Figure 5.12 XIN Input Timing Diagram when Vcc = 2.2 V

Table 5.29 TRAIO Input

Symbol	Parameter	Standard		Unit
		Min.	Max.	Offic
tc(TRAIO)	TRAIO input cycle time	500	=	ns
tWH(TRAIO)	TRAIO input "H" width	200	=	ns
tWL(TRAIO)	TRAIO input "L" width	200	-	ns

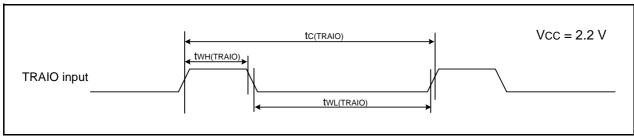
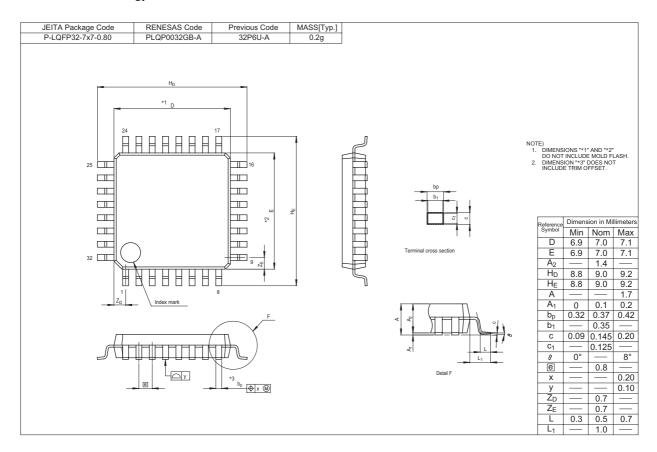


Figure 5.13 TRAIO Input Timing Diagram when Vcc = 2.2 V

# **Package Dimensions**

Diagrams showing the latest package dimensions and mounting information are available in the "Packages" section of the Renesas Technology website.



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### Renesas Technology America, Inc.

450 Holger Way, San Jose, CA 95134-1368, U.S.A Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
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Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120 Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

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Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632 Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd. Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia Tel: <603> 7955-9390, Fax: <603> 7955-9510