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# M32C/84 Group (M32C/84, M32C/84T)

## SINGLE-CHIP 16/32-BIT CMOS MICROCOMPUTER

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REJ03B0047-0121

Rev.1.21

Jul. 08, 2005

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## 1. Overview

The M32C/84 group (M32C/84, M32C/84T) microcomputer is a single-chip control unit that utilizes high-performance silicon gate CMOS technology with the M32C/80 series CPU core. The M32C/84 group (M32C/84, M32C/84T) is available in 144-pin and 100-pin plastic molded LQFP/QFP packages.

With a 16-Mbyte address space, this microcomputer combines advanced instruction manipulation capabilities to process complex instructions by less bytes and execute instructions at higher speed.

It includes a multiplier and DMAC adequate for office automation, communication devices and industrial equipments, and other high-speed processing applications.

### 1.1 Applications

Automobiles, audio, cameras, office equipment, communications equipment, portable equipment, etc.

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## 1.2 Performance Overview

Tables 1.1 and 1.2 list performance overview of the M32C/84 group (M32C/84, M32C/84T).

**Table 1.1 M32C/84 Group (M32C/84, M32C/84T) Performance (144-Pin Package)**

Characteristic		Performance	
		M32C/84	M32C/84T
CPU	Basic Instructions	108 instructions	
	Shortest Instruction Execution Time	31.3 ns (f(BCLK)=32 MHz, VCC1=4.2 V to 5.5 V) 41.7 ns (f(BCLK)=24 MHz, VCC1=3.0 V to 5.5 V)	31.3 ns (f(BCLK)=32 MHz, VCC1=4.2 V to 5.5 V)
	Operation Mode	Single-chip mode, Memory expansion mode and Microprocessor mode	Single-chip mode
	Address Space	16 Mbytes	
	Memory Capacity	See Table 1.3	
Peripheral Function	I/O Port	123 I/O pins and 1 input pin	
	Multifunction Timer	Timer A: 16 bits x 5 channels, Timer B: 16 bits x 6 channels Three-phase motor control circuit	
	Intelligent I/O	Time measurement function or Waveform generating function: 16 bits x 8 channels Communication function (Clock synchronous serial I/O, Clock asynchronous serial I/O, HDLC data processing)	
	Serial I/O	5 Channels Clock synchronous serial I/O, Clock asynchronous serial I/O, IEBus <sup>(1)</sup> , I <sup>2</sup> C bus <sup>(2)</sup>	
	CAN Module	1 channel Supporting CAN 2.0B specification	
	A/D Converter	10-bit A/D converter: 1 circuit, 34 channels	
	D/A Converter	8 bits x 2 channels	
	DMAC	4 channels	
	DMAC II	Can be activated by all peripheral function interrupt sources Immediate transfer, Calculation transfer and Chain transfer functions	
	CRC Calculation Circuit	CRC-CCITT	
	X/Y Converter	16 bits x 16 bits	
	Watchdog Timer	15 bits x 1 channel (with prescaler)	
	Interrupt	38 internal and 8 external sources, 5 software sources Interrupt priority level: 7	
	Clock Generation Circuit	4 circuits Main clock oscillation circuit(*), Sub clock oscillation circuit(*), On-chip oscillator, PLL frequency synthesizer (* )Equipped with a built-in feedback resistor. Ceramic resonator or crystal oscillator must be connected externally	
	Oscillation Stop Detect Function	Main clock oscillation stop detect function	
Voltage Detection Circuit	Available (optional)	Not available <sup>(4)</sup>	
Electrical Characteristics	Supply Voltage	VCC1=4.2 V to 5.5 V, VCC2=3.0 V to VCC1 (f(BCLK)=32 MHz) VCC1=3.0 V to 5.5 V, VCC2=3.0 V to VCC1 (f(BCLK)=24 MHz)	VCC1=VCC2=4.2 V to 5.5 V, (f(BCLK)=32 MHz) <sup>(3)</sup>
	Power Consumption	28 mA (VCC1=VCC2=5 V, f(BCLK)=32 MHz) 22 mA (VCC1=VCC2=3.3 V, f(BCLK)=24 MHz) 10µA (VCC1=VCC2=5 V, f(BCLK)=32 kHz, in wait mode)	28 mA (VCC1=VCC2=5 V, f(BCLK)=32 MHz) 10µA (VCC1=VCC2=5 V, f(BCLK)=32 kHz, in wait mode)
Flash Memory	Program/Erase Supply Voltage	3.3 V ± 0.3 V or 5.0 V ± 0.5 V	
	Program and Erase Endurance	100 times (all space)	
Operating Ambient Temperature		-20 to 85°C	-40 to 85°C (T version)
		-40 to 85°C (optional)	
Package	144-pin plastic molded LQFP		

NOTES:

1. IEBus is a trademark of NEC Electronics Corporation.
2. I<sup>2</sup>C bus is a trademark of Koninklijke Philips Electronics N. V.
3. The supply voltage of M32C/84T (High-reliability version) must be VCC1=VCC2.
4. The cold start-up/warm start-up determine function is available only at the user's option.

**Table 1.2 M32C/84 Group (M32C/84, M32C/84T) Performance (100-Pin Package)**

Characteristic		Performance	
		M32C/84	M32C/84T
CPU	Basic Instructions	108 instructions	
	Shortest Instruction Execution Time	31.3 ns (f(BCLK)=32 MHz, VCC1=4.2 V to 5.5 V) 41.7 ns (f(BCLK)=24 MHz, VCC1=3.0 V to 5.5 V)	31.3 ns (f(BCLK)=32 MHz, VCC1=4.2 V to 5.5 V)
	Operation Mode	Single-chip mode, Memory expansion mode and Microprocessor mode	Single-chip mode
	Address Space	16 Mbytes	
	Memory Capacity	See Table 1.3	
Peripheral Function	I/O Port	87 I/O pins and 1 input pin	
	Multifunction Timer	Timer A: 16 bits x 5 channels, Timer B: 16 bits x 6 channels Three-phase motor control circuit	
	Intelligent I/O	Time measurement function or Waveform generating function: 16 bits x 8 channels Communication function (Clock synchronous serial I/O, Clock asynchronous serial I/O, HDLC data processing)	
	Serial I/O	5 Channels Clock synchronous serial I/O, Clock asynchronous serial I/O, IEBus <sup>(1)</sup> , I <sup>2</sup> C bus <sup>(2)</sup>	
	CAN Module	1 channel Supporting CAN 2.0B specification	
	A/D Converter	10-bit A/D converter: 1 circuit, 26 channels	
	D/A Converter	8 bits x 2 channels	
	DMAC	4 channels	
	DMAC II	Can be activated by all peripheral function interrupt sources Immediate transfer, Calculation transfer and Chain transfer functions	
	CRC Calculation Circuit	CRC-CCITT	
	X/Y Converter	16 bits x 16 bits	
	Watchdog Timer	15 bits x 1 channel (with prescaler)	
	Interrupt	38 internal and 8 external sources, 5 software sources Interrupt priority level: 7	
	Clock Generation Circuit	4 circuits Main clock oscillation circuit(*), Sub clock oscillation circuit(*), On-chip oscillator, PLL frequency synthesizer (* )Equipped with a built-in feedback resistor. Ceramic resonator or crystal oscillator must be connected externally	
	Oscillation Stop Detect Function	Main clock oscillation stop detect function	
	Electrical Characteristics	Supply Voltage	VCC1=4.2 V to 5.5 V, VCC2=3.0 V to VCC1 (f(BCLK)=32 MHz) VCC1=3.0 V to 5.5 V, VCC2=3.0 V to VCC1 (f(BCLK)=24 MHz)
Power Consumption		28 mA (VCC1=VCC2=5 V, f(BCLK)=32 MHz) 22 mA (VCC1=VCC2=3.3 V, f(BCLK)=24 MHz) 10µA (VCC1=VCC2=5 V, f(BCLK)=32 kHz, in wait mode)	28 mA (VCC1=VCC2=5 V, f(BCLK)=32 MHz) 10µA (VCC1=VCC2=5 V, f(BCLK)=32 kHz, in wait mode)
Flash Memory	Program/Erase Supply Voltage	3.3 V ± 0.3 V or 5.0 V ± 0.5 V	
	Program and Erase Endurance	100 times (all space)	
Operating Ambient Temperature		-20 to 85°C	-40 to 85°C (T version)
		-40 to 85°C (optional)	
Package	100-pin plastic molded LQFP/QFP		

## NOTES:

1. IEBus is a trademark of NEC Electronics Corporation.
2. I<sup>2</sup>C bus is a trademark of Koninklijke Philips Electronics N. V.
3. The supply voltage of M32C/84T (High-reliability version) must be VCC1=VCC2.
4. The cold start-up/warm start-up determine function is available only at the user's option.

All options are on a request basis.

### 1.3 Block Diagram

Figure 1.1 shows a block diagram of the M32C/84 group (M32C/84, M32C/84T) microcomputer.

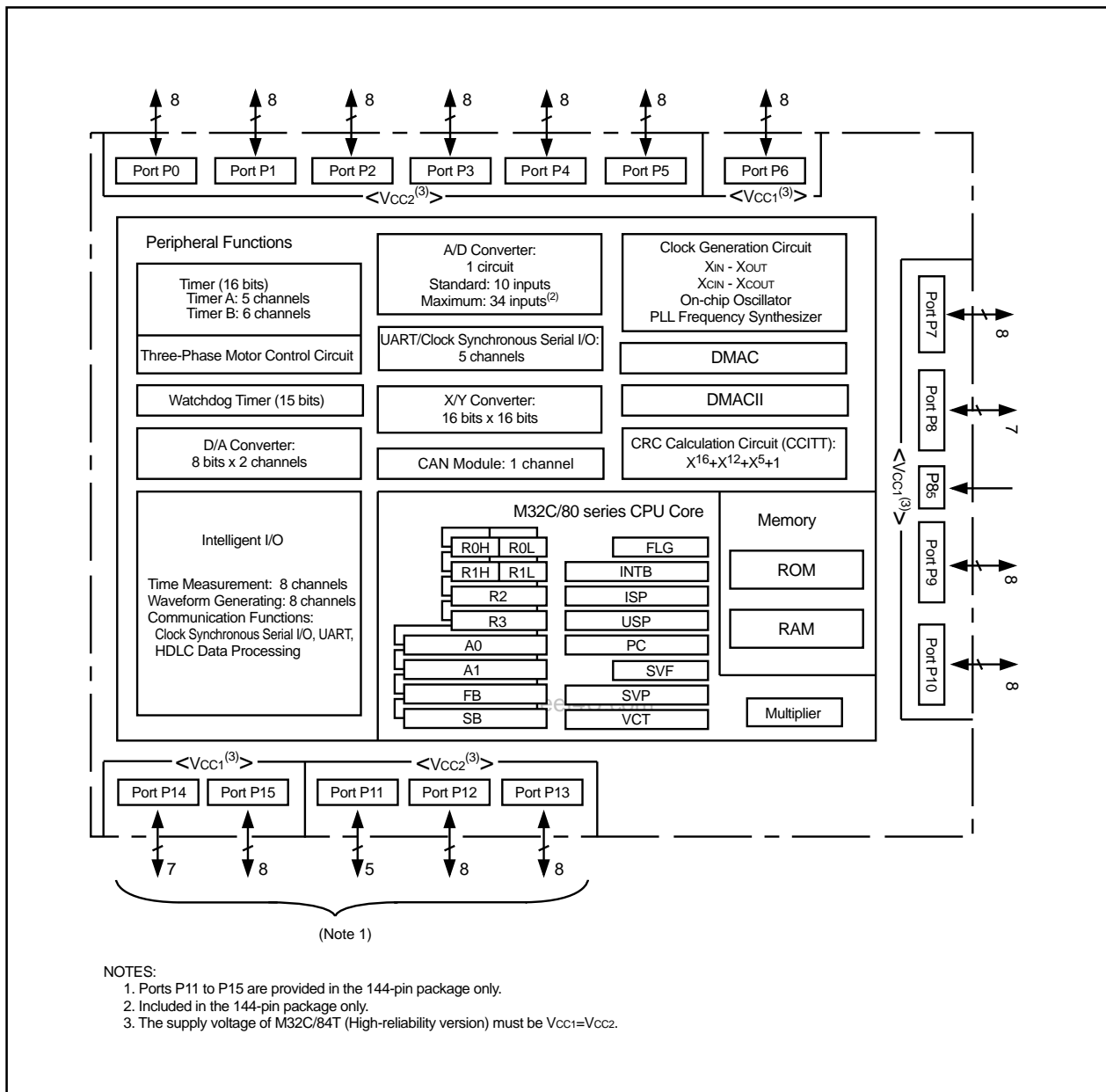


Figure 1.1 M32C/84 Group (M32C/84, M32C/84T) Block Diagram

## 1.4 Product Information

Table 1.3 lists product information. Figure 1.2 shows the product numbering system.

**Table 1.3 M32C/84 Group (1) (M32C/84)**

**As of July, 2005**

Type Number	Package	ROM Capacity	RAM Capacity	Remarks	
M30845FJGP	PLQP0144KA-A (144P6Q-A)	512K+4K	24K	Flash Memory	
M30843FJGP	PLQP0100KB-A (100P6Q-A)				
M30843FJFP	PRQP0100JB-A (100P6S-A)				
M30845FHGP	PLQP0144KA-A (144P6Q-A)	384K+4K			
M30843FHGP	PLQP0100KB-A (100P6Q-A)				
M30843FHFP	PRQP0100JB-A (100P6S-A)				
M30845FWGP	PLQP0144KA-A (144P6Q-A)	320K+4K		16K	Mask ROM
M30843FWGP	PLQP0100KB-A (100P6Q-A)				
M30845MW-XXXGP	PLQP0144KA-A (144P6Q-A)	320K			
M30843MW-XXXGP	PLQP0100KB-A (100P6Q-A)				
M30843MW-XXXFP	PRQP0100JB-A (100P6S-A)				
M30842ME-XXXGP	PLQP0144KA-A (144P6Q-A)	192K	10K		
M30840ME-XXXGP	PLQP0100KB-A (100P6Q-A)				
M30840ME-XXXFP	PRQP0100JB-A (100P6S-A)				
M30842MC-XXXGP	PLQP0144KA-A (144P6Q-A)	128K			
M30840MC-XXXGP	PLQP0100KB-A (100P6Q-A)				
M30840MC-XXXFP	PRQP0100JB-A (100P6S-A)				
M30842SGP (D)	PLQP0144KA-A (144P6Q-A)	---		10K	ROMless
M30840SGP (D)	PLQP0100KB-A (100P6Q-A)				
M30840SFP (D)	PRQP0100JB-A (100P6S-A)				

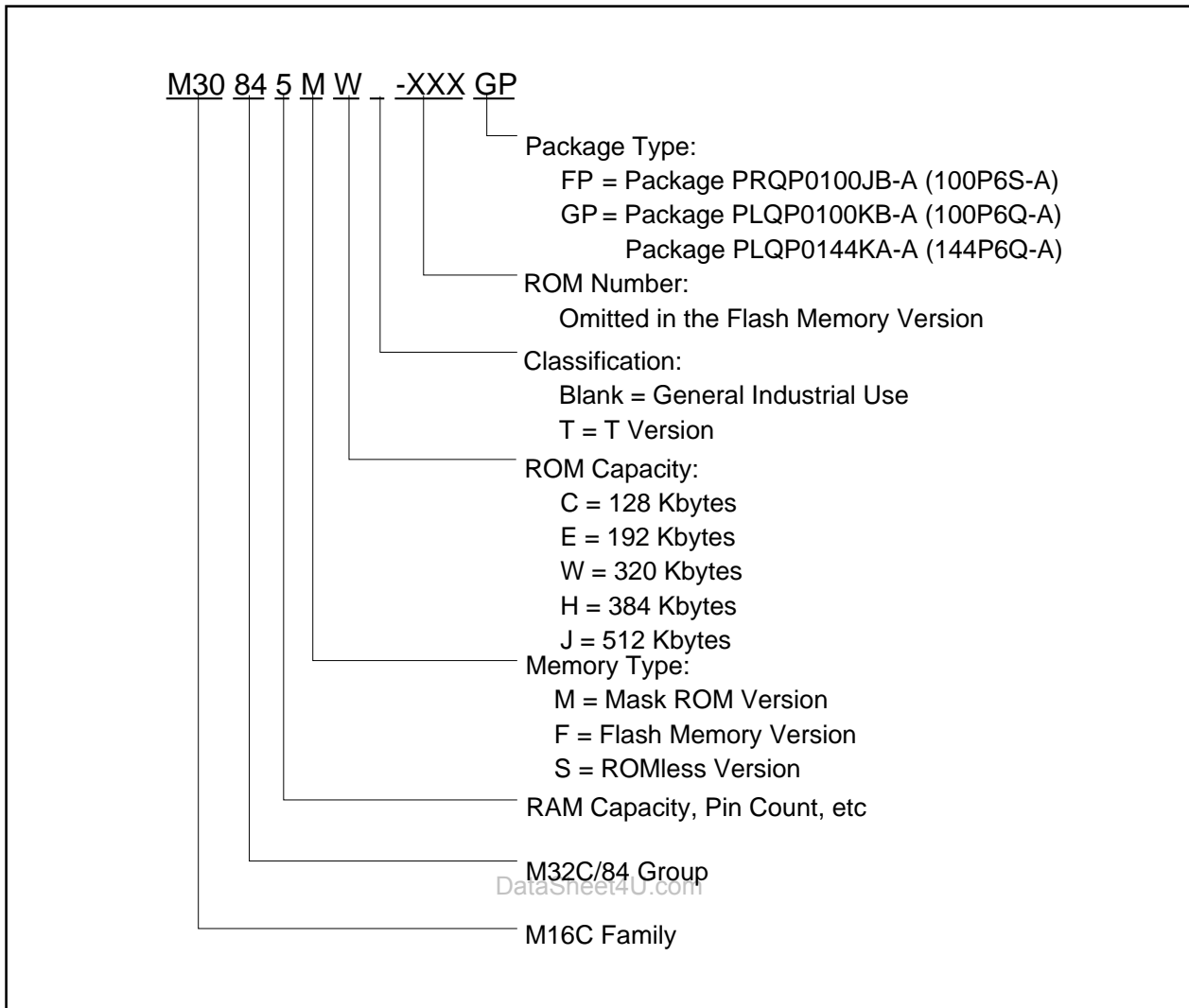
(D): Under Development

**Table 1.3 M32C/84 Group (2) (T Version, M32C/84T)**

**As of July, 2005**

Type Number	Package	ROM Capacity	RAM Capacity	Remarks
M30845FJTGP	PLQP0144KA-A (144P6Q-A)	512K+4K	24K	Flash Memory T Version (High-releability 85° C Version)
M30843FJTGP	PLQP0100KB-A (100P6Q-A)			
M30845FHTGP	PLQP0144KA-A (144P6Q-A)	384K+4K		
M30843FHTGP	PLQP0100KB-A (100P6Q-A)			
M30843FWTGP	PLQP0100KB-A (100P6Q-A)	320K+4K		
M30842MCT-XXXGP (D)	PLQP0144KA-A (144P6Q-A)	128K		
M30840MCT-XXXGP (D)	PLQP0100KB-A (100P6Q-A)			

(D): Under Development



**Figure 1.2 Product Numbering System**

### 1.5 Pin Assignments and Descriptions

Figures 1.3 to 1.5 show pin assignments (top view).

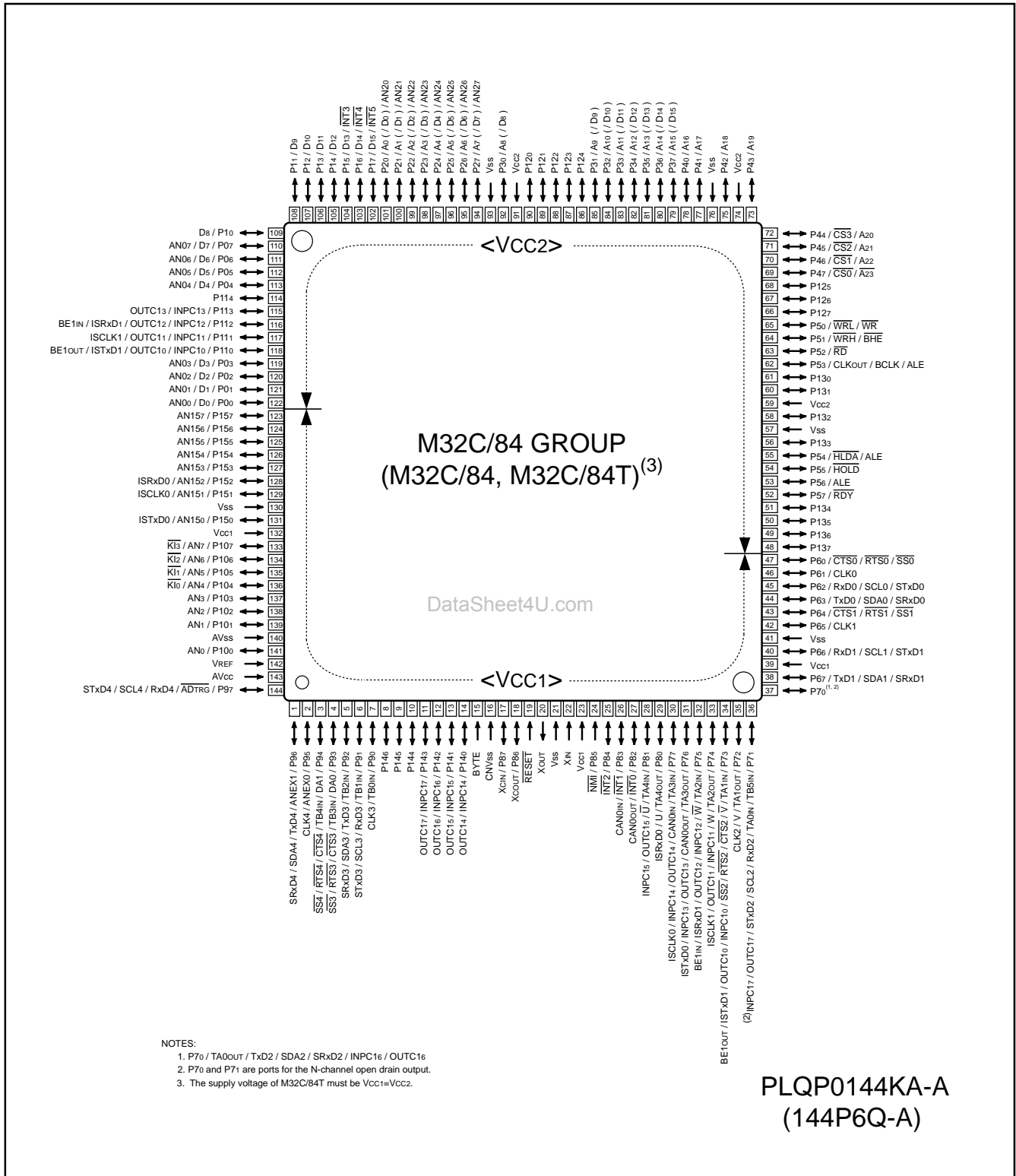


Figure 1.3 Pin Assignment for 144-Pin Package

Table 1.4 Pin Characteristics for 144-Pin Package

Pin No.	Control Pin	Port	Interrupt Pin	Timer Pin	UART/CAN Pin	Intelligent I/O Pin	Analog Pin	Bus Control Pin <sup>(1)</sup>
1		P96			TxD4/SDA4/SRx4		ANEX1	
2		P95			CLK4		ANEX0	
3		P94		TB4IN	CTS4/RTS4/SS4		DA1	
4		P93		TB3IN	CTS3/RTS3/SS3		DA0	
5		P92		TB2IN	TxD3/SDA3/SRx3			
6		P91		TB1IN	RxD3/SCL3/STxD3			
7		P90		TB0IN	CLK3			
8		P146						
9		P145						
10		P144						
11		P143				INPC17/OUTC17		
12		P142				INPC16/OUTC16		
13		P141				INPC15/OUTC15		
14		P140				INPC14/OUTC14		
15	BYTE							
16	CNVSS							
17	X <sub>CIN</sub>	P87						
18	X <sub>COU</sub>	P86						
19	RESET							
20	X <sub>OUT</sub>							
21	V <sub>SS</sub>							
22	X <sub>IN</sub>							
23	V <sub>CC1</sub>							
24		P85	NMI					
25		P84	INT2					
26		P83	INT1		CAN0IN			
27		P82	INT0		CAN0OUT			
28		P81		TA4IN/U		INPC15/OUTC15		
29		P80		TA4OUT/U		ISRxD0		
30		P77		TA3IN	CAN0IN	INPC14/OUTC14/ISCLK0		
31		P76		TA3OUT	CAN0OUT	INPC13/OUTC13/ISTxD0		
32		P75		TA2IN/W		INPC12/OUTC12/ISRxD1/BE1IN		
33		P74		TA2OUT/W		INPC11/OUTC11/ISCLK1		
34		P73		TA1IN/V	CTS2/RTS2/SS2	INPC10/OUTC10/ISTxD1/BE1OUT		
35		P72		TA1OUT/V	CLK2			
36		P71		TB5IN/TA0IN	RxD2/SCL2/STxD2	INPC17/OUTC17		
37		P70		TA0OUT	TxD2/SDA2/SRx2	INPC16/OUTC16		
38		P67			TxD1/SDA1/SRx1			
39	V <sub>CC1</sub>							
40		P66			RxD1/SCL1/STxD1			
41	V <sub>SS</sub>							
42		P65			CLK1			
43		P64			CTS1/RTS1/SS1			
44		P63			TxD0/SDA0/SRx0			
45		P62			RxD0/SCL0/STxD0			
46		P61			CLK0			
47		P60			CTS0/RTS0/SS0			
48		P137						

## NOTES:

1. Bus control pins in M32C/84T cannot be used.



Table 1.4 Pin Characteristics for 144-Pin Package (Continued)

Pin No.	Control Pin	Port	Interrupt Pin	Timer Pin	UART/CAN Pin	Intelligent I/O Pin	Analog Pin	Bus Control Pin
49		P13 <sub>6</sub>						
50		P13 <sub>5</sub>						
51		P13 <sub>4</sub>						
52		P5 <sub>7</sub>						$\overline{\text{RDY}}$
53		P5 <sub>6</sub>						$\overline{\text{ALE}}$
54		P5 <sub>5</sub>						$\overline{\text{HOLD}}$
55		P5 <sub>4</sub>						$\overline{\text{HLDA/ALE}}$
56		P13 <sub>3</sub>						
57	V <sub>ss</sub>							
58		P13 <sub>2</sub>						
59	V <sub>cc2</sub>							
60		P13 <sub>1</sub>						
61		P13 <sub>0</sub>						
62		P5 <sub>3</sub>						$\overline{\text{CLKout/BCLK/ALE}}$
63		P5 <sub>2</sub>						$\overline{\text{RD}}$
64		P5 <sub>1</sub>						$\overline{\text{WRH/BHE}}$
65		P5 <sub>0</sub>						$\overline{\text{WRL/WR}}$
66		P12 <sub>7</sub>						
67		P12 <sub>6</sub>						
68		P12 <sub>5</sub>						
69		P4 <sub>7</sub>						$\overline{\text{CS0/A23}}$
70		P4 <sub>6</sub>						$\overline{\text{CS1/A22}}$
71		P4 <sub>5</sub>						$\overline{\text{CS2/A21}}$
72		P4 <sub>4</sub>						$\overline{\text{CS3/A20}}$
73		P4 <sub>3</sub>						A <sub>19</sub>
74	V <sub>cc2</sub>							
75		P4 <sub>2</sub>						A <sub>18</sub>
76	V <sub>ss</sub>							
77		P4 <sub>1</sub>						A <sub>17</sub>
78		P4 <sub>0</sub>						A <sub>16</sub>
79		P3 <sub>7</sub>						A <sub>15</sub> (/D <sub>15</sub> )
80		P3 <sub>6</sub>						A <sub>14</sub> (/D <sub>14</sub> )
81		P3 <sub>5</sub>						A <sub>13</sub> (/D <sub>13</sub> )
82		P3 <sub>4</sub>						A <sub>12</sub> (/D <sub>12</sub> )
83		P3 <sub>3</sub>						A <sub>11</sub> (/D <sub>11</sub> )
84		P3 <sub>2</sub>						A <sub>10</sub> (/D <sub>10</sub> )
85		P3 <sub>1</sub>						A <sub>9</sub> (/D <sub>9</sub> )
86		P12 <sub>4</sub>						
87		P12 <sub>3</sub>						
88		P12 <sub>2</sub>						
89		P12 <sub>1</sub>						
90		P12 <sub>0</sub>						
91	V <sub>cc2</sub>							
92		P3 <sub>0</sub>						A <sub>8</sub> (/D <sub>8</sub> )
93	V <sub>ss</sub>							
94		P2 <sub>7</sub>					AN2 <sub>7</sub>	A <sub>7</sub> (/D <sub>7</sub> )
95		P2 <sub>6</sub>					AN2 <sub>6</sub>	A <sub>6</sub> (/D <sub>6</sub> )
96		P2 <sub>5</sub>					AN2 <sub>5</sub>	A <sub>5</sub> (/D <sub>5</sub> )

## NOTES:

1. Bus control pins in M32C/84T cannot be used.

Table 1.4 Pin Characteristics for 144-Pin Package (Continued)

Pin No.	Control Pin	Port	Interrupt Pin	Timer Pin	UART/CAN Pin	Intelligent I/O Pin	Analog Pin	Bus Control Pin <sup>(1)</sup>
97		P24					AN24	A4(/D4)
98		P23					AN23	A3(/D3)
99		P22					AN22	A2(/D2)
100		P21					AN21	A1(/D1)
101		P20					AN20	A0(/D0)
102		P17	INT5					D15
103		P16	INT4					D14
104		P15	INT3					D13
105		P14						D12
106		P13						D11
107		P12						D10
108		P11						D9
109		P10						D8
110		P07					AN07	D7
111		P06					AN06	D6
112		P05					AN05	D5
113		P04					AN04	D4
114		P114						
115		P113				INPC13/OUTC13		
116		P112				INPC12/OUTC12/ISRxD1/BE1IN		
117		P111				INPC11/OUTC11/ISCLK1		
118		P110				INPC10/OUTC10/ISTxD1/BE1OUT		
119		P03					AN03	D3
120		P02					AN02	D2
121		P01					AN01	D1
122		P00					AN00	D0
123		P157					AN157	
124		P156					AN156	
125		P155					AN155	
126		P154					AN154	
127		P153					AN153	
128		P152				ISRxD0	AN152	
129		P151				ISCLK0	AN151	
130	Vss							
131		P150				ISTxD0	AN150	
132	VCC1							
133		P107	KI3				AN7	
134		P106	KI2				AN6	
135		P105	KI1				AN5	
136		P104	KI0				AN4	
137		P103					AN3	
138		P102					AN2	
139		P101					AN1	
140	AVss							
141		P100					AN0	
142	VREF							
143	AVCC							
144		P97			RxD4/SCL4/STxD4		ADTRG	

## NOTES:

1. Bus control pins in M32C/84T cannot be used.

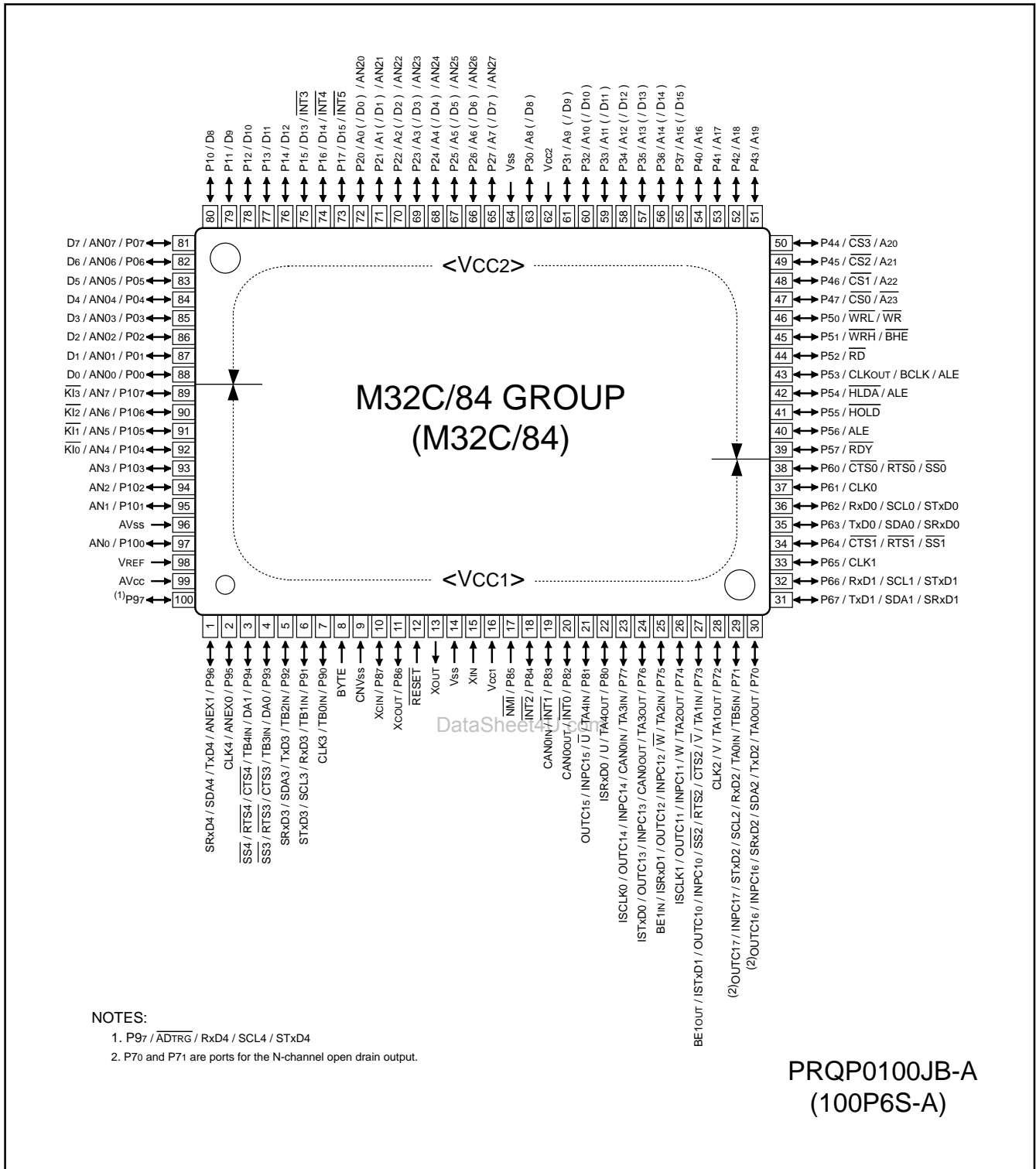


Figure 1.4 Pin Assignment for 100-Pin Package

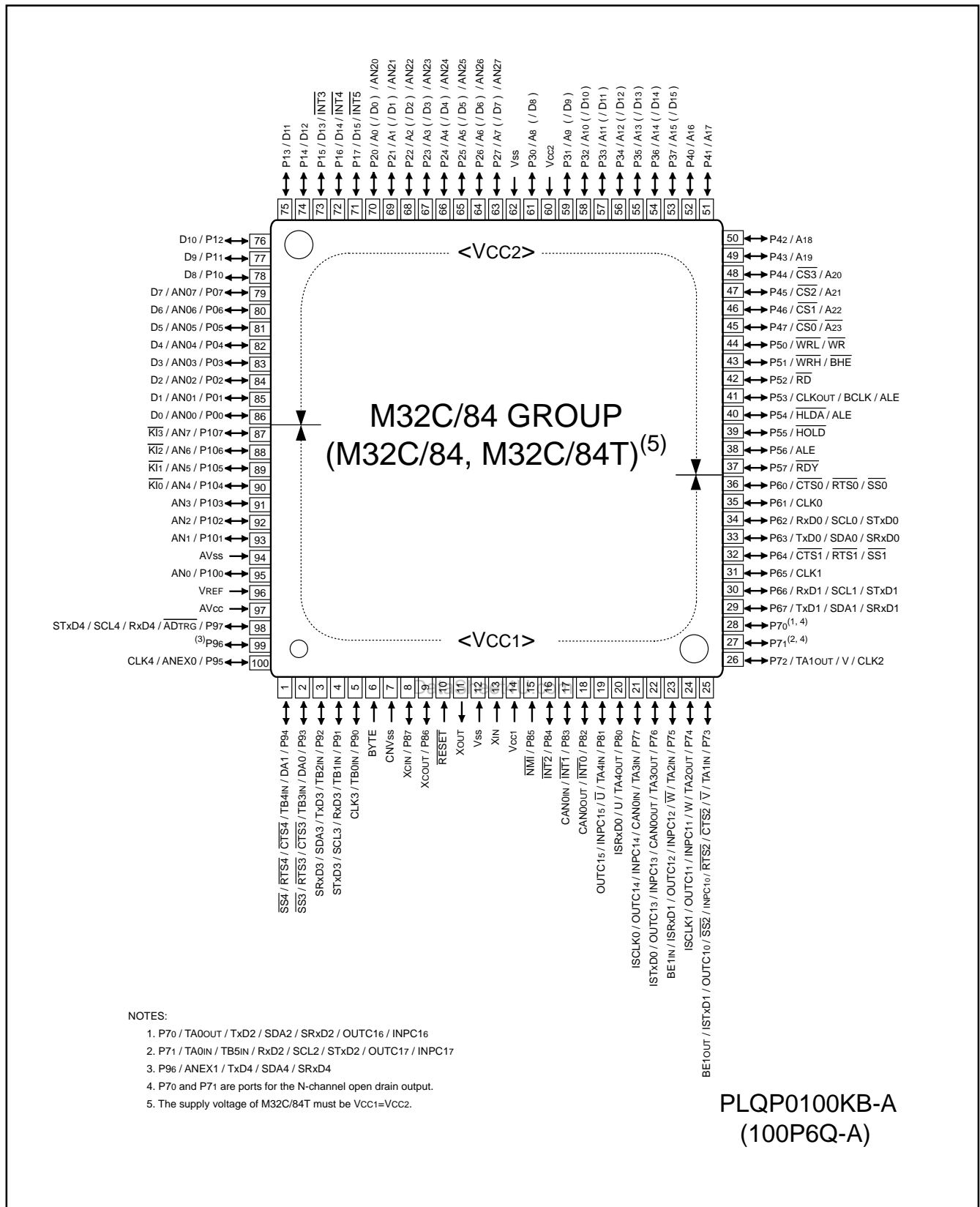


Figure 1.5 Pin Assignment for 100-Pin Package

Table 1.5 Pin Characteristics for 100-Pin Package

Package Pin No.		Control Pin	Port	Interrupt Pin	Timer Pin	UART/CAN Pin	Intelligent I/O Pin	Analog Pin	Bus Control Pin <sup>(1)</sup>
FP	GP								
1	99		P96			TxD4/SDA4/SRx4D4		ANEX1	
2	100		P95			CLK4		ANEX0	
3	1		P94		TB4IN	CTS4/RTS4/SS4		DA1	
4	2		P93		TB3IN	CTS3/RTS3/SS3		DA0	
5	3		P92		TB2IN	TxD3/SDA3/SRx3D3			
6	4		P91		TB1IN	RxD3/SCL3/STxD3			
7	5		P90		TB0IN	CLK3			
8	6	BYTE							
9	7	CNVss							
10	8	XCIN	P87						
11	9	XCOU $\bar{T}$	P86						
12	10	RESET							
13	11	XOUT							
14	12	Vss							
15	13	XIN							
16	14	VCC1							
17	15		P85	NMI					
18	16		P84	INT2					
19	17		P83	INT1		CAN0IN			
20	18		P82	INT0		CAN0OUT			
21	19		P81		TA4IN/ $\bar{U}$		INPC15/OUTC15		
22	20		P80		TA4OUT/ $\bar{U}$		ISRxD0		
23	21		P77		TA3IN	CAN0IN	INPC14/OUTC14/ISCLK0		
24	22		P76		TA3OUT	CAN0OUT	INPC13/OUTC13/ISTxD0		
25	23		P75		TA2IN/ $\bar{W}$		INPC12/OUTC12/ISRxD1/BE1IN		
26	24		P74		TA2OUT/ $\bar{W}$		INPC11/OUTC11/ISCLK1		
27	25		P73		TA1IN/ $\bar{V}$	CTS2/RTS2/SS2	INPC10/OUTC10/ISTxD1/BE1OUT		
28	26		P72		TA1OUT/ $\bar{V}$	CLK2			
29	27		P71		TB5IN/TA0IN	RxD2/SCL2/STxD2	INPC17/OUTC17		
30	28		P70		TA0OUT	TxD2/SDA2/SRx2D2	INPC16/OUTC16		
31	29		P67			TxD1/SDA1/SRx1D1			
32	30		P66			RxD1/SCL1/STxD1			
33	31		P65			CLK1			
34	32		P64			CTS1/RTS1/SS1			
35	33		P63			TxD0/SDA0/SRx0D0			
36	34		P62			RxD0/SCL0/STxD0			
37	35		P61			CLK0			
38	36		P60			CTS0/RTS0/SS0			
39	37		P57					RDY	
40	38		P56					ALE	
41	39		P55					HOLD	
42	40		P54					HLDA/ALE	
43	41		P53					CLKout/BCLK/ALE	
44	42		P52					RD	
45	43		P51					WRH/BHE	
46	44		P50					WRL/WR	
47	45		P47					CS0/A23	
48	46		P46					CS1/A22	
49	47		P45					CS2/A21	
50	48		P44					CS3/A20	

## NOTES:

1. Bus control pins in M32C/84T cannot be used.

Table 1.5 Pin Characteristics for 100-Pin Package (Continued)

Package Pin No.		Control Pin	Port	Interrupt Pin	Timer Pin	UART/CAN Pin	Intelligent I/O Pin	Analog Pin	Bus Control Pin
FP	GP								
51	49		P43						A19
52	50		P42						A18
53	51		P41						A17
54	52		P40						A16
55	53		P37						A15(/D15)
56	54		P36						A14(/D14)
57	55		P35						A13(/D13)
58	56		P34						A12(/D12)
59	57		P33						A11(/D11)
60	58		P32						A10(/D10)
61	59		P31						A9(/D9)
62	60	Vcc2							
63	61		P30						A8(/D8)
64	62	Vss							
65	63		P27				AN27		A7(/D7)
66	64		P26				AN26		A6(/D6)
67	65		P25				AN25		A5(/D5)
68	66		P24				AN24		A4(/D4)
69	67		P23				AN23		A3(/D3)
70	68		P22				AN22		A2(/D2)
71	69		P21				AN21		A1(/D1)
72	70		P20				AN20		A0(/D0)
73	71		P17	INT5					D15
74	72		P16	INT4					D14
75	73		P15	INT3					D13
76	74		P14						D12
77	75		P13						D11
78	76		P12						D10
79	77		P11						D9
80	78		P10						D8
81	79		P07				AN07		D7
82	80		P06				AN06		D6
83	81		P05				AN05		D5
84	82		P04				AN04		D4
85	83		P03				AN03		D3
86	84		P02				AN02		D2
87	85		P01				AN01		D1
88	86		P00				AN00		D0
89	87		P107	KI3			AN7		
90	88		P106	KI2			AN6		
91	89		P105	KI1			AN5		
92	90		P104	KI0			AN4		
93	91		P103				AN3		
94	92		P102				AN2		
95	93		P101				AN1		
96	94	AVss							
97	95		P100				AN0		
98	96	VREF							
99	97	AVcc							
100	98		P97			RxD4/SCL4/STxD4		ADTRG	

## NOTES:

1. Bus control pins in M32C/84T cannot be used.

## 1.6 Pin Description

**Table 1.6 Pin Description (100-Pin and 144-Pin Packages)**

Classification	Symbol	I/O Type	Supply Voltage	Function
Power Supply	VCC1, VCC2 VSS	I	-	Apply 3.0 to 5.5V to both VCC1 and VCC2 pins. Apply 0V to the VSS pin. $VCC1 \geq VCC2^{(1, 2)}$
Analog Power Supply	AVCC AVSS	I	VCC1	Supplies power to the A/D converter. Connect the AVCC pin to VCC1 and the AVSS pin to VSS
Reset Input	RESET	I	VCC1	The microcomputer is in a reset state when "L" is applied to the RESET pin
CNVSS	CNVSS	I	VCC1	Switches processor mode. Connect the CNVSS pin to VSS to start up in single-chip mode or to VCC1 to start up in microprocessor mode
Input to Switch External Data Bus Width <sup>(3)</sup>	BYTE	I	VCC1	Switches data bus width in external memory space 3. The data bus is 16 bits wide when the BYTE pin is held "L" and 8 bits wide when it is held "H". Set to either. Connect the BYTE pin to VSS to use the microcomputer in single-chip mode
Bus Control Pins <sup>(3)</sup>	D0 to D7	I/O	VCC2	Inputs and outputs data (D0 to D7) while accessing an external memory space with separate bus
	D8 to D15	I/O	VCC2	Inputs and outputs data (D8 to D15) while accessing an external memory space with 16-bit separate bus
	A0 to A22	O	VCC2	Outputs address bits A0 to A22
	A $\bar{23}$	O	VCC2	Outputs inversed address bit A23
	A0/D0 to A7/D7	I/O	VCC2	Inputs and outputs data (D0 to D7) and outputs 8 low-order address bits (A0 to A7) by time-sharing while accessing an external memory space with multiplexed bus
	A8/D8 to A15/D15	I/O	VCC2	Inputs and outputs data (D8 to D15) and outputs 8 middle-order address bits (A8 to A15) by time-sharing while accessing an external memory space with 16-bit multiplexed bus
	CS0 to CS3	O	VCC2	Outputs CS0 to CS3 that are chip-select signals specifying an external space
	WRL / WR WRH / BHE RD	O	VCC2	Outputs WRL, WRH, (WR, BHE) and RD signals. WRL and WRH can be switched with WR and BHE by program <ul style="list-style-type: none"> <li>■ WRL, WRH and RD selected: If external data bus is 16 bits wide, data is written to an even address in external memory space when WRL is held "L". Data is written to an odd address when WRH is held "L". Data is read when RD is held "L".</li> <li>■ WR, BHE and RD selected: Data is written to external memory space when WR is held "L". Data in an external memory space is read when RD is held "L". An odd address is accessed when BHE is held "L". Select WR, BHE and RD for external 8-bit data bus.</li> </ul>
	ALE	O	VCC2	ALE is a signal latching the address
	HOLD	I	VCC2	The microcomputer is placed in a hold state while the HOLD pin is held "L"
HLDA	O	VCC2	Outputs an "L" signal while the microcomputer is placed in a hold state	
RDY	I	VCC2	Bus is placed in a wait state while the RDY pin is held "L"	

I : Input    O : Output    I/O : Input and output

**NOTES:**

1. VCC1 is hereinafter referred to as VCC unless otherwise noted.
2. Apply 4.2 to 5.5V to the VCC1 and VCC2 pins when using M32C/84T.  $VCC1 = VCC2$ .
3. Bus control pins in M32C/84T cannot be used.

**Table 1.6 Pin Description (100-Pin and 144-Pin Packages) (Continued)**

Classification	Symbol	I/O Type	Supply Voltage	Function
Main Clock Input	XIN	I	VCC1	I/O pins for the main clock oscillation circuit. Connect a ceramic resonator or crystal oscillator between XIN and XOUT. To apply external clock, apply it to XIN and leave XOUT open
Main Clock Output	XOUT	O	VCC1	
Sub Clock Input	XCIN	I	VCC1	I/O pins for the sub clock oscillation circuit. Connect a crystal oscillator between XCIN and XCOUT. To apply external clock, apply it to XCIN and leave XCOUT open
Sub Clock Output	XCOUT	O	VCC1	
BCLK Output <sup>(1)</sup>	BCLK	O	VCC2	Outputs BCLK signal
Clock Output	CLKOUT	O	VCC2	Outputs the clock having the same frequency as fc, f8 or f32
INT Interrupt Input	INT0 to INT2	I	VCC1	Input pins for the INT interrupt
	INT3 to INT5	I	VCC2	
NMI Interrupt Input	NMI	I	VCC1	Input pin for the NMI interrupt
Key Input Interrupt	KI0 to KI3	I	VCC1	Input pins for the key input interrupt
Timer A	TA0OUT to TA4OUT	I/O	VCC1	I/O pins for the timer A0 to A4 (TA0OUT is a pin for the N-channel open drain output.)
	TA0IN to TA4IN	I	VCC1	Input pins for the timer A0 to A4
Timer B	TB0IN to TB5IN	I	VCC1	Input pins for the timer B0 to B5
Three-phase Motor Control Timer Output	U, $\bar{U}$ , V, $\bar{V}$ , W, $\bar{W}$	O	VCC1	Output pins for the three-phase motor control timer
Serial I/O	CTS0 to CTS4	I	VCC1	Input pins for data transmission control
	RTS0 to RTS4	O	VCC1	Output pins for data reception control
	CLK0 to CLK4	I/O	VCC1	Inputs and outputs the transfer clock
	RxD0 to RxD4	I	VCC1	Inputs serial data
	TxD0 to TxD4	O	VCC1	Outputs serial data (TxD2 is a pin for the N-channel open drain output.)
I <sup>2</sup> C Mode	SDA0 to SDA4	I/O	VCC1	Inputs and outputs serial data (SDA2 is a pin for the N-channel open drain output.)
	SCL0 to SCL4	I/O	VCC1	Inputs and outputs the transfer clock (SCL2 is a pin for the N-channel open drain output.)
Serial I/O Special Function	STxD0 to STxD4	O	VCC1	Outputs serial data when slave mode is selected (STxD2 is a pin for the N-channel open drain output.)
	SRxD0 to SRxD4	I	VCC1	Inputs serial data when slave mode is selected
	SS0 to SS4	I	VCC1	Input pins to control serial I/O special function

I : Input    O : Output    I/O : Input and output

## NOTES:

1. Bus control pins in M32C/84T cannot be used.



**Table 1.6 Pin Description (100-Pin and 144-Pin Packages) (Continued)**

Classification	Symbol	I/O Type	Supply Voltage	Function
Reference Voltage Input	VREF	I	-	Applies reference voltage to the A/D converter and D/A converter
A/D Converter	AN0 to AN7 AN00 to AN07 AN20 to AN27	I	VCC1	Analog input pins for the A/D converter
	ADTRG	I	VCC1	Input pin for an external A/D trigger
	ANEX0	I/O	VCC1	Extended analog input pin for the A/D converter and output pin in external op-amp connection mode
	ANEX1	I	VCC1	Extended analog input pin for the A/D converter
D/A Converter	DA0, DA1	O	VCC1	Output pin for the D/A converter
Intelligent I/O	INPC10 to INPC13	I	VCC1/VCC2 <sup>(1)</sup>	Input pins for the time measurement function
	INPC14 to INPC17	I	VCC1	
	OUTC10 to OUTC13	O	VCC1/VCC2 <sup>(1)</sup>	Output pins for the waveform generating function (OUTC16 and OUTC17 assigned to P70 and P71 are pins for the N-channel open drain output.)
	OUTC14 to OUTC17	O	VCC1	
	ISCLK0	I/O	VCC1	Inputs and outputs the clock for the intelligent I/O communication function
	ISCLK1	I/O	VCC1/VCC2 <sup>(1)</sup>	
	ISRXD0	I	VCC1	Inputs data for the intelligent I/O communication function
	ISRXD1	I	VCC1/VCC2 <sup>(1)</sup>	
	ISTXD0	O	VCC1	Outputs data for the intelligent I/O communication function
	ISTXD1	O	VCC1/VCC2 <sup>(1)</sup>	
	BE1IN	I	VCC1/VCC2 <sup>(1)</sup>	Inputs data for the intelligent I/O communication function
	BE1OUT	O	VCC1/VCC2 <sup>(1)</sup>	
CAN	CAN0IN	I	VCC1	Input pin for the CAN communication function
	CAN0OUT	O	VCC1	Output pin for the CAN communication function
I/O Ports	P00 to P07 P10 to P17 P20 to P27 P30 to P37 P40 to P47 P50 to P57	I/O	VCC2	I/O ports for CMOS. Each port can be programmed for input or output under the control of the direction register. An input port can be set, by program, for a pull-up resistor available or for no pull-up resistor available in 4-bit units
	P60 to P67 P70 to P77 P90 to P97 P100 to P107	I/O	VCC1	I/O ports having equivalent functions to P0 (P70 and P71 are ports for the N-channel open drain output.)
	P80 to P84 P86, P87	I/O	VCC1	I/O ports having equivalent functions to P0
	Input Port	P85	I	VCC1

I : Input    O : Output    I/O : Input and output

NOTES:

1. Vcc2 is not available in the 100-pin package. Vcc1 only available.

**Table 1.6 Pin Description (144-Pin Package only) (Continued)**

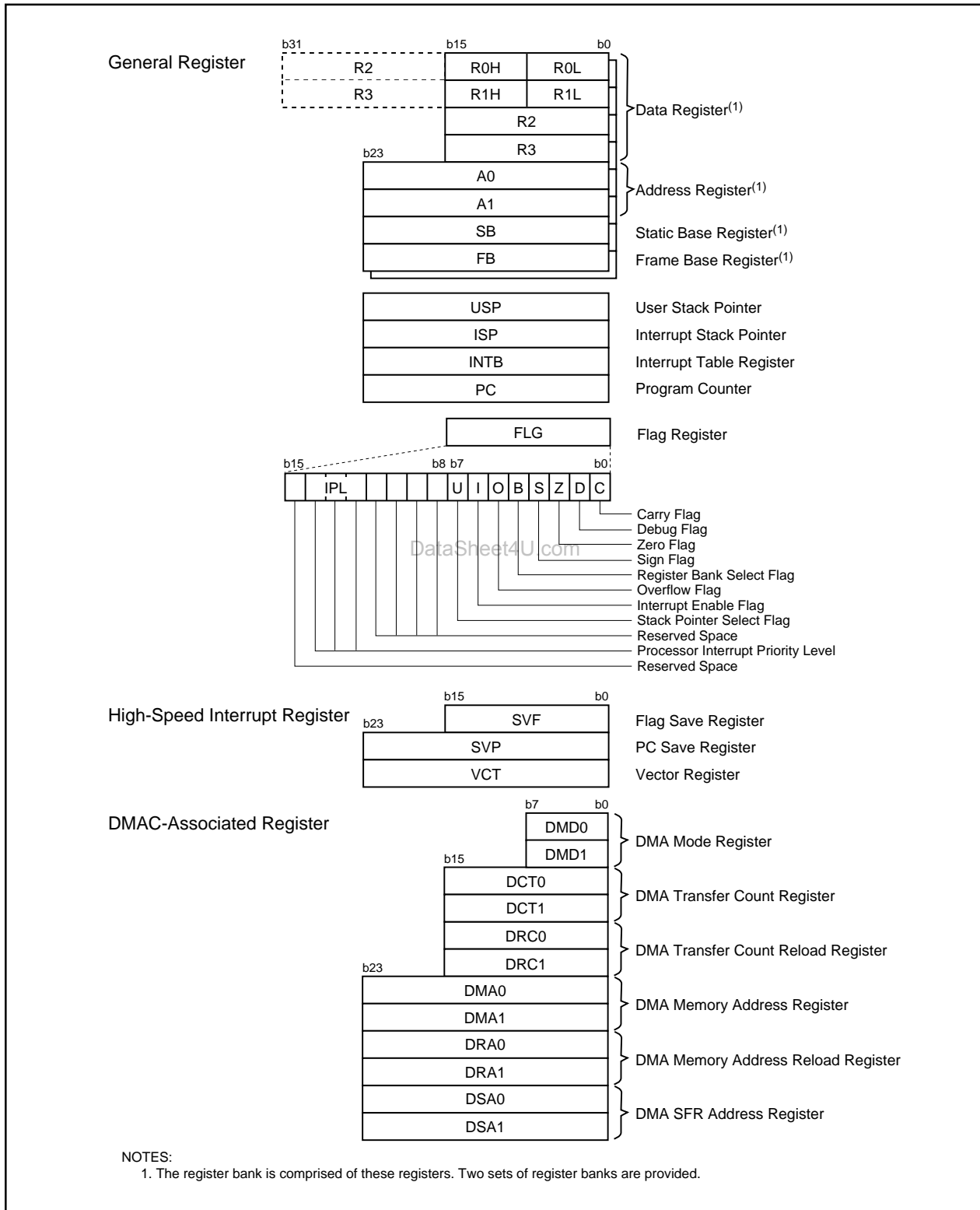
Classification	Symbol	I/O Type	Supply Voltage	Function
A/D Converter	AN150 to AN157	I	VCC1	Analog input pins for the A/D converter
I/O Ports	P110 to P114 P120 to P127 P130 to P137	I/O	VCC2	I/O ports having equivalent functions to P0
	P140 to P146 P150 to P157	I/O	VCC1	I/O ports having equivalent functions to P0

I : Input    O : Output    I/O : Input and output

## 2. Central Processing Unit (CPU)

Figure 2.1 shows the CPU registers.

The register bank is comprised of 8 registers (R0, R1, R2, R3, A0, A1, SB and FB) out of 28 CPU registers. Two sets of register banks are provided.



**Figure 2.1 CPU Register**

## 2.1 General Registers

### 2.1.1 Data Registers (R0, R1, R2 and R3)

R0, R1, R2 and R3 are 16-bit registers for transfer, arithmetic and logic operations. R0 and R1 can be split into high-order bits (R0H) and low-order bits (R0L) to be used separately as 8-bit data registers. R0 can be combined with R2 to be used as a 32-bit data register (R2R0). The same applies to R1 and R3.

### 2.1.2 Address Registers (A0 and A1)

A0 and A1 are 24-bit registers for A0-/A1-indirect addressing, A0-/A1-relative addressing, transfer, arithmetic and logic operations.

### 2.1.3 Static Base Register (SB)

SB is a 24-bit register for SB-relative addressing.

### 2.1.4 Frame Base Register (FB)

FB is a 24-bit register for FB-relative addressing.

### 2.1.5 Program Counter (PC)

PC, 24 bits wide, indicates the address of an instruction to be executed.

### 2.1.6 Interrupt Table Register (INTB)

INTB is a 24-bit register indicating the starting address of an relocatable interrupt vector table.

### 2.1.7 User Stack Pointer (USP), Interrupt Stack Pointer (ISP)

The stack pointers (SP), USP and ISP, are 24 bits wide each. The U flag is used to switch between USP and ISP. Refer to **2.1.8 Flag Register (FLG)** for details on the U flag. Set USP and ISP to even addresses to execute an interrupt sequence efficiently.

### 2.1.8 Flag Register (FLG)

FLG is a 16-bit register indicating a CPU state.

#### 2.1.8.1 Carry Flag (C)

The C flag indicates whether carry or borrow has occurred after executing an instruction.

#### 2.1.8.2 Debug Flag (D)

The D flag is for debug only. Set to "0".

#### 2.1.8.3 Zero Flag (Z)

The Z flag is set to "1" when the value of zero is obtained from an arithmetic operation; otherwise "0".

#### 2.1.8.4 Sign Flag (S)

The S flag is set to "1" when a negative value is obtained from an arithmetic operation; otherwise "0".

### 2.1.8.5 Register Bank Select Flag (B)

The register bank 0 is selected when the B flag is set to "0". The register bank 1 is selected when this flag is set to "1".

### 2.1.8.6 Overflow Flag (O)

The O flag is set to "1" when the result of an arithmetic operation overflows; otherwise "0".

### 2.1.8.7 Interrupt Enable Flag (I)

The I flag enables a maskable interrupt.

Interrupt is disabled when the I flag is set to "0" and enabled when the I flag is set to "1". The I flag is set to "0" when an interrupt is acknowledged.

### 2.1.8.8 Stack Pointer Select Flag (U)

ISP is selected when the U flag is set to "0". USP is selected when this flag is set to "1".

The U flag is set to "0" when a hardware interrupt is acknowledged or the INT instruction of software interrupt numbers 0 to 31 is executed.

### 2.1.8.9 Processor Interrupt Priority Level (IPL)

IPL, 3 bits wide, assigns processor interrupt priority levels from level 0 to level 7.

If a requested interrupt has greater priority than IPL, the interrupt is enabled.

### 2.1.8.10 Reserved Space

When writing to a reserved space, set to "0". When reading, its content is indeterminate.

## 2.2 High-Speed Interrupt Registers

Registers associated with the high-speed interrupt are as follows:

- Flag save register (SVF)
- PC save register (SVP)
- Vector register (VCT)

## 2.3 DMAC-Associated Registers

Registers associated with DMAC are as follows:

- DMA mode register (DMD0, DMD1)
- DMA transfer count register (DCT0, DCT1)
- DMA transfer count reload register (DRC0, DRC1)
- DMA memory address register (DMA0, DMA1)
- DMA SFR address register (DSA0, DSA1)
- DMA memory address reload register (DRA0, DRA1)

### 3. Memory

Figure 3.1 shows a memory map of the M32C/84 group (M32C/84, M32C/84T).

The M32C/84 group (M32C/84, M32C/84T) provides 16-Mbyte address space from addresses 000000<sub>16</sub> to FFFFFFF<sub>16</sub>.

The internal ROM is allocated lower addresses beginning with address FFFFFFF<sub>16</sub>. For example, a 64-Kbyte internal ROM is allocated in addresses FF0000<sub>16</sub> to FFFFFFF<sub>16</sub>.

The fixed interrupt vectors are allocated addresses FFFFDC<sub>16</sub> to FFFFFFF<sub>16</sub>. It stores the starting address of each interrupt routine.

The internal RAM is allocated higher addresses beginning with address 000400<sub>16</sub>. For example, a 10-Kbyte internal RAM is allocated addresses 000400<sub>16</sub> to 002BFF<sub>16</sub>. Besides storing data, it becomes stacks when the subroutine is called or an interrupt is acknowledged.

SFR, consisting of control registers for peripheral functions such as I/O port, A/D converter, serial I/O, and timers, is allocated addresses 000000<sub>16</sub> to 0003FF<sub>16</sub>. All blank spaces within SFR are reserved and cannot be accessed by users.

The special page vectors are allocated addresses FFFE00<sub>16</sub> to FFFFDB<sub>16</sub>. It is used for the JMPS instruction and JSRS instruction. Refer to the Renesas publication **M32C/80 Series Software Manual** for details. In memory expansion mode and microprocessor mode, some spaces are reserved and cannot be accessed by users.

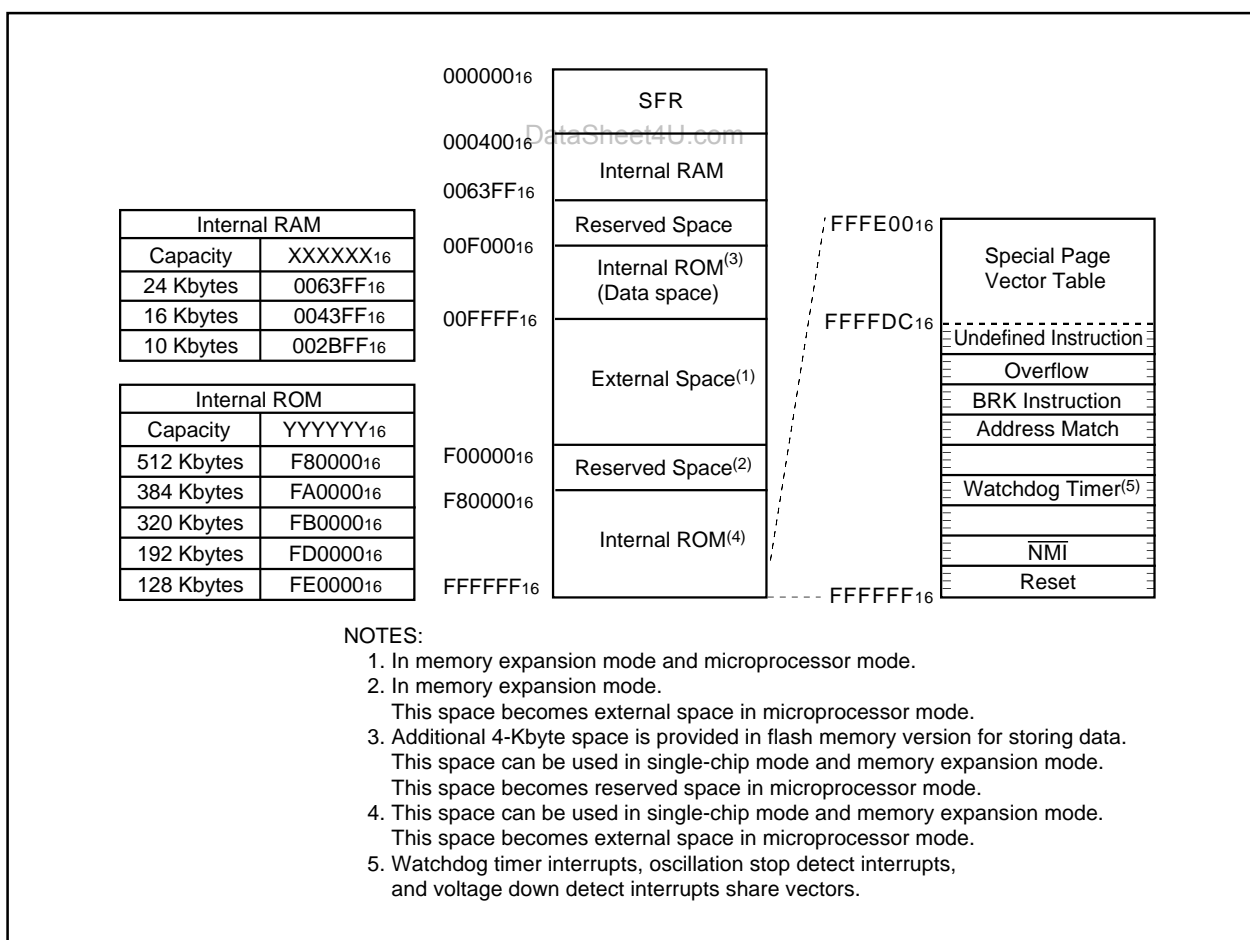


Figure 3.1 Memory Map

## 4. Special Function Registers (SFR)

Address	Register	Symbol	Value after RESET
0000 <sub>16</sub>			
0001 <sub>16</sub>			
0002 <sub>16</sub>			
0003 <sub>16</sub>			
0004 <sub>16</sub>	Processor Mode Register 0 <sup>(1)</sup>	PM0	1000 0000 <sub>2</sub> (CNVss pin ="L") 0000 0011 <sub>2</sub> (CNVss pin ="H")
0005 <sub>16</sub>	Processor Mode Register 1	PM1	00 <sub>16</sub>
0006 <sub>16</sub>	System Clock Control Register 0	CM0	0000 1000 <sub>2</sub>
0007 <sub>16</sub>	System Clock Control Register 1	CM1	0010 0000 <sub>2</sub>
0008 <sub>16</sub>			
0009 <sub>16</sub>	Address Match Interrupt Enable Register	AIER	00 <sub>16</sub>
000A <sub>16</sub>	Protect Register	PRCR	XXXX 0000 <sub>2</sub>
000B <sub>16</sub>	External Data Bus Width Control Register <sup>(2)</sup>	DS	XXXX 1000 <sub>2</sub> (BYTE pin ="L") XXXX 0000 <sub>2</sub> (BYTE pin ="H")
000C <sub>16</sub>	Main Clock Division Register	MCD	XXX0 1000 <sub>2</sub>
000D <sub>16</sub>	Oscillation Stop Detection Register	CM2	00 <sub>16</sub>
000E <sub>16</sub>	Watchdog Timer Start Register	WDTS	XX <sub>16</sub>
000F <sub>16</sub>	Watchdog Timer Control Register	WDC	000X XXXX <sub>2</sub>
0010 <sub>16</sub>			
0011 <sub>16</sub>			
0012 <sub>16</sub>	Address Match Interrupt Register 0	RMAD0	000000 <sub>16</sub>
0013 <sub>16</sub>	Processor Mode Register 2	PM2	00 <sub>16</sub>
0014 <sub>16</sub>			
0015 <sub>16</sub>			
0016 <sub>16</sub>	Address Match Interrupt Register 1	RMAD1	000000 <sub>16</sub>
0017 <sub>16</sub>	Voltage Detection Register 2 <sup>(2)</sup>	VCR2	00 <sub>16</sub>
0018 <sub>16</sub>			
0019 <sub>16</sub>			
001A <sub>16</sub>	Address Match Interrupt Register 2	RMAD2	000000 <sub>16</sub>
001B <sub>16</sub>	Voltage Detection Register 1 <sup>(2)</sup>	VCR1	0000 1000 <sub>2</sub>
001C <sub>16</sub>			
001D <sub>16</sub>			
001E <sub>16</sub>	Address Match Interrupt Register 3	RMAD3	000000 <sub>16</sub>
001F <sub>16</sub>			
0020 <sub>16</sub>			
0021 <sub>16</sub>			
0022 <sub>16</sub>			
0023 <sub>16</sub>			
0024 <sub>16</sub>			
0025 <sub>16</sub>			
0026 <sub>16</sub>	PLL Control Register 0	PLC0	0001 X010 <sub>2</sub>
0027 <sub>16</sub>	PLL Control Register 1	PLC1	000X 0000 <sub>2</sub>
0028 <sub>16</sub>			
0029 <sub>16</sub>			
002A <sub>16</sub>	Address Match Interrupt Register 4	RMAD4	000000 <sub>16</sub>
002B <sub>16</sub>			
002C <sub>16</sub>			
002D <sub>16</sub>			
002E <sub>16</sub>	Address Match Interrupt Register 5	RMAD5	000000 <sub>16</sub>
002F <sub>16</sub>	Voltage Down Detection Interrupt Register <sup>(2)</sup>	D4INT	00 <sub>16</sub>

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

1. The PM01 and PM00 bits in the PM1 register maintain values set before reset even if software reset or watchdog timer reset is performed.

2. These registers in M32C/84T cannot be used.

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Address	Register	Symbol	Value after RESET
0030 <sub>16</sub>			
0031 <sub>16</sub>			
0032 <sub>16</sub>			
0033 <sub>16</sub>			
0034 <sub>16</sub>			
0035 <sub>16</sub>			
0036 <sub>16</sub>			
0037 <sub>16</sub>			
0038 <sub>16</sub> 0039 <sub>16</sub> 003A <sub>16</sub>	Address Match Interrupt Register 6	RMAD6	000000 <sub>16</sub>
003B <sub>16</sub>			
003C <sub>16</sub> 003D <sub>16</sub> 003E <sub>16</sub>	Address Match Interrupt Register 7	RMAD7	000000 <sub>16</sub>
003F <sub>16</sub>			
0040 <sub>16</sub>			
0041 <sub>16</sub>			
0042 <sub>16</sub>			
0043 <sub>16</sub>			
0044 <sub>16</sub>			
0045 <sub>16</sub>			
0046 <sub>16</sub>			
0047 <sub>16</sub>			
0048 <sub>16</sub>	External Space Wait Control Register 0 <sup>(1)</sup>	EWCR0	X0X0 0011 <sub>2</sub>
0049 <sub>16</sub>	External Space Wait Control Register 1 <sup>(1)</sup>	EWCR1	X0X0 0011 <sub>2</sub>
004A <sub>16</sub>	External Space Wait Control Register 2 <sup>(1)</sup>	EWCR2	X0X0 0011 <sub>2</sub>
004B <sub>16</sub>	External Space Wait Control Register 3 <sup>(1)</sup>	EWCR3	X0X0 0011 <sub>2</sub>
004C <sub>16</sub>	Page Mode Wait Control Register 0 <sup>(2)</sup>	PWCR0	0001 0001 <sub>2</sub>
004D <sub>16</sub>	Page Mode Wait Control Register 1 <sup>(2)</sup>	PWCR1	0001 0001 <sub>2</sub>
004E <sub>16</sub>			
004F <sub>16</sub>			
0050 <sub>16</sub>			
0051 <sub>16</sub>			
0052 <sub>16</sub>			
0053 <sub>16</sub>			
0054 <sub>16</sub>			
0055 <sub>16</sub>	Flash Memory Control Register 1	FMR1	0000 0101 <sub>2</sub>
0056 <sub>16</sub>			
0057 <sub>16</sub>	Flash Memory Control Register 0	FMRO	0000 0001 <sub>2</sub> (Flash memory version) XXXX XXX0 <sub>2</sub> (Masked ROM version)
0058 <sub>16</sub>			
0059 <sub>16</sub>			
005A <sub>16</sub>			
005B <sub>16</sub>			
005C <sub>16</sub>			
005D <sub>16</sub>			
005E <sub>16</sub>			
005F <sub>16</sub>			

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

1. These registers in M32C/84T cannot be used.
2. These registers can be used only in the ROMless version.



Address	Register	Symbol	Value after RESET
0060 <sub>16</sub>			
0061 <sub>16</sub>			
0062 <sub>16</sub>			
0063 <sub>16</sub>			
0064 <sub>16</sub>			
0065 <sub>16</sub>			
0066 <sub>16</sub>			
0067 <sub>16</sub>			
0068 <sub>16</sub>	DMA0 Interrupt Control Register	DM0IC	XXXX X0002
0069 <sub>16</sub>	Timer B5 Interrupt Control Register	TB5IC	XXXX X0002
006A <sub>16</sub>	DMA2 Interrupt Control Register	DM2IC	XXXX X0002
006B <sub>16</sub>	UART2 Receive /ACK Interrupt Control Register	S2RIC	XXXX X0002
006C <sub>16</sub>	Timer A0 Interrupt Control Register	TA0IC	XXXX X0002
006D <sub>16</sub>	UART3 Receive /ACK Interrupt Control Register	S3RIC	XXXX X0002
006E <sub>16</sub>	Timer A2 Interrupt Control Register	TA2IC	XXXX X0002
006F <sub>16</sub>	UART4 Receive /ACK Interrupt Control Register	S4RIC	XXXX X0002
0070 <sub>16</sub>	Timer A4 Interrupt Control Register	TA4IC	XXXX X0002
0071 <sub>16</sub>	UART0/UART3 Bus Conflict Detect Interrupt Control Register	BCN0IC/BCN3IC	XXXX X0002
0072 <sub>16</sub>	UART0 Receive/ACK Interrupt Control Register	S0RIC	XXXX X0002
0073 <sub>16</sub>	A/D0 Conversion Interrupt Control Register	AD0IC	XXXX X0002
0074 <sub>16</sub>	UART1 Receive/ACK Interrupt Control Register	S1RIC	XXXX X0002
0075 <sub>16</sub>	Intelligent I/O Interrupt Control Register 0	IIO0IC	XXXX X0002
0076 <sub>16</sub>	Timer B1 Interrupt Control Register	TB1IC	XXXX X0002
0077 <sub>16</sub>	Intelligent I/O Interrupt Control Register 2	IIO2IC	XXXX X0002
0078 <sub>16</sub>	Timer B3 Interrupt Control Register	TB3IC	XXXX X0002
0079 <sub>16</sub>	Intelligent I/O Interrupt Control Register 4	IIO4IC	XXXX X0002
007A <sub>16</sub>	INT5 Interrupt Control Register	INT5IC	XX00 X0002
007B <sub>16</sub>			
007C <sub>16</sub>	INT3 Interrupt Control Register	INT3IC	XX00 X0002
007D <sub>16</sub>	Intelligent I/O Interrupt Control Register 8	IIO8IC	XXXX X0002
007E <sub>16</sub>	INT1 Interrupt Control Register	INT1IC	XX00 X0002
007F <sub>16</sub>	Intelligent I/O Interrupt Control Register 10/ CAN Interrupt 1 Control Register	IIO10IC CAN1IC	XXXX X0002
0080 <sub>16</sub>			
0081 <sub>16</sub>	CAN Interrupt 2 Control Register	CAN2IC	XXXX X0002
0082 <sub>16</sub>			
0083 <sub>16</sub>			
0084 <sub>16</sub>			
0085 <sub>16</sub>			
0086 <sub>16</sub>			
0087 <sub>16</sub>			
0088 <sub>16</sub>	DMA1 Interrupt Control Register	DM1IC	XXXX X0002
0089 <sub>16</sub>	UART2 Transmit /NACK Interrupt Control Register	S2TIC	XXXX X0002
008A <sub>16</sub>	DMA3 Interrupt Control Register	DM3IC	XXXX X0002
008B <sub>16</sub>	UART3 Transmit /NACK Interrupt Control Register	S3TIC	XXXX X0002
008C <sub>16</sub>	Timer A1 Interrupt Control Register	TA1IC	XXXX X0002
008D <sub>16</sub>	UART4 Transmit /NACK Interrupt Control Register	S4TIC	XXXX X0002
008E <sub>16</sub>	Timer A3 Interrupt Control Register	TA3IC	XXXX X0002
008F <sub>16</sub>	UART2 Bus Conflict Detect Interrupt Control Register	BCN2IC	XXXX X0002

X: Indeterminate

Blank spaces are reserved. No access is allowed.

Address	Register	Symbol	Value after RESET
0090 <sub>16</sub>	UART0 Transmit /NACK Interrupt Control Register	S0TIC	XXXX X000 <sub>2</sub>
0091 <sub>16</sub>	UART1/UART4 Bus Conflict Detect Interrupt Control Register	BCN1IC/BCN4IC	XXXX X000 <sub>2</sub>
0092 <sub>16</sub>	UART1 Transmit/NACK Interrupt Control Register	S1TIC	XXXX X000 <sub>2</sub>
0093 <sub>16</sub>	Key Input Interrupt Control Register	KUPIC	XXXX X000 <sub>2</sub>
0094 <sub>16</sub>	Timer B0 Interrupt Control Register	TB0IC	XXXX X000 <sub>2</sub>
0095 <sub>16</sub>	Intelligent I/O Interrupt Control Register 1	IIO1IC	XXXX X000 <sub>2</sub>
0096 <sub>16</sub>	Timer B2 Interrupt Control Register	TB2IC	XXXX X000 <sub>2</sub>
0097 <sub>16</sub>	Intelligent I/O Interrupt Control Register 3	IIO3IC	XXXX X000 <sub>2</sub>
0098 <sub>16</sub>	Timer B4 Interrupt Control Register	TB4IC	XXXX X000 <sub>2</sub>
0099 <sub>16</sub>			
009A <sub>16</sub>	INT4 Interrupt Control Register	INT4IC	XX00 X000 <sub>2</sub>
009B <sub>16</sub>			
009C <sub>16</sub>	INT2 Interrupt Control Register	INT2IC	XX00 X000 <sub>2</sub>
009D <sub>16</sub>	Intelligent I/O Interrupt Control Register 9/ CAN Interrupt 0 Control Register	IIO9IC CAN0IC	XXXX X000 <sub>2</sub>
009E <sub>16</sub>	INT0 Interrupt Control Register	INT0IC	XX00 X000 <sub>2</sub>
009F <sub>16</sub>	Exit Priority Control Register	RLVL	XXXX 0000 <sub>2</sub>
00A0 <sub>16</sub>	Interrupt Request Register 0	IIO0IR	0000 000X <sub>2</sub>
00A1 <sub>16</sub>	Interrupt Request Register 1	IIO1IR	0000 000X <sub>2</sub>
00A2 <sub>16</sub>	Interrupt Request Register 2	IIO2IR	0000 000X <sub>2</sub>
00A3 <sub>16</sub>	Interrupt Request Register 3	IIO3IR	0000 000X <sub>2</sub>
00A4 <sub>16</sub>	Interrupt Request Register 4	IIO4IR	0000 000X <sub>2</sub>
00A5 <sub>16</sub>			
00A6 <sub>16</sub>			
00A7 <sub>16</sub>			
00A8 <sub>16</sub>	Interrupt Request Register 8	IIO8IR	0000 000X <sub>2</sub>
00A9 <sub>16</sub>	Interrupt Request Register 9	IIO9IR	0000 000X <sub>2</sub>
00AA <sub>16</sub>	Interrupt Request Register 10	IIO10IR	0000 000X <sub>2</sub>
00AB <sub>16</sub>	Interrupt Request Register 11	IIO11IR	0000 000X <sub>2</sub>
00AC <sub>16</sub>			
00AD <sub>16</sub>			
00AE <sub>16</sub>			
00AF <sub>16</sub>			
00B0 <sub>16</sub>	Interrupt Enable Register 0	IIO0IE	00 <sub>16</sub>
00B1 <sub>16</sub>	Interrupt Enable Register 1	IIO1IE	00 <sub>16</sub>
00B2 <sub>16</sub>	Interrupt Enable Register 2	IIO2IE	00 <sub>16</sub>
00B3 <sub>16</sub>	Interrupt Enable Register 3	IIO3IE	00 <sub>16</sub>
00B4 <sub>16</sub>	Interrupt Enable Register 4	IIO4IE	00 <sub>16</sub>
00B5 <sub>16</sub>			
00B6 <sub>16</sub>			
00B7 <sub>16</sub>			
00B8 <sub>16</sub>	Interrupt Enable Register 8	IIO8IE	00 <sub>16</sub>
00B9 <sub>16</sub>	Interrupt Enable Register 9	IIO9IE	00 <sub>16</sub>
00BA <sub>16</sub>	Interrupt Enable Register 10	IIO10IE	00 <sub>16</sub>
00BB <sub>16</sub>	Interrupt Enable Register 11	IIO11IE	00 <sub>16</sub>
00BC <sub>16</sub>			
00BD <sub>16</sub>			
00BE <sub>16</sub>			
00BF <sub>16</sub>			

X: Indeterminate

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Address	Register	Symbol	Value after RESET
00C0 <sub>16</sub>			
00C1 <sub>16</sub>			
00C2 <sub>16</sub>			
00C3 <sub>16</sub>			
00C4 <sub>16</sub>			
00C5 <sub>16</sub>			
00C6 <sub>16</sub>			
00C7 <sub>16</sub>			
00C8 <sub>16</sub>			
00C9 <sub>16</sub>			
00CA <sub>16</sub>			
00CB <sub>16</sub>			
00CC <sub>16</sub>			
00CD <sub>16</sub>			
00CE <sub>16</sub>			
00CF <sub>16</sub>			
00D0 <sub>16</sub>			
00D1 <sub>16</sub>			
00D2 <sub>16</sub>			
00D3 <sub>16</sub>			
00D4 <sub>16</sub>			
00D5 <sub>16</sub>			
00D6 <sub>16</sub>			
00D7 <sub>16</sub>			
00D8 <sub>16</sub>			
00D9 <sub>16</sub>			
00DA <sub>16</sub>			
00DB <sub>16</sub>			
00DC <sub>16</sub>			
00DD <sub>16</sub>			
00DE <sub>16</sub>			
00DF <sub>16</sub>			
00E0 <sub>16</sub>			
00E1 <sub>16</sub>			
00E2 <sub>16</sub>			
00E3 <sub>16</sub>			
00E4 <sub>16</sub>			
00E5 <sub>16</sub>			
00E6 <sub>16</sub>			
00E7 <sub>16</sub>			
00E8 <sub>16</sub> 00E9 <sub>16</sub>	SI/O Receive Buffer Register 0	G0RB	XXXX XXXX <sub>2</sub> X000 XXXX <sub>2</sub>
00EA <sub>16</sub> 00EB <sub>16</sub>	Transmit Buffer/Receive Data Register 0	G0TB/G0DR	XX <sub>16</sub>
00EC <sub>16</sub>	Receive Input Register 0	G0RI	XX <sub>16</sub>
00ED <sub>16</sub>	SI/O Communication Mode Register 0	G0MR	00 <sub>16</sub>
00EE <sub>16</sub>	Transmit Output Register 0	G0TO	XX <sub>16</sub>
00EF <sub>16</sub>	SI/O Communication Control Register 0	G0CR	0000 X011 <sub>2</sub>

X: Indeterminate

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Address	Register	Symbol	Value after RESET
00F0 <sub>16</sub>	Data Compare Register 00	G0CMP0	XX <sub>16</sub>
00F1 <sub>16</sub>	Data Compare Register 01	G0CMP1	XX <sub>16</sub>
00F2 <sub>16</sub>	Data Compare Register 02	G0CMP2	XX <sub>16</sub>
00F3 <sub>16</sub>	Data Compare Register 03	G0CMP3	XX <sub>16</sub>
00F4 <sub>16</sub>	Data Mask Register 00	G0MSK0	XX <sub>16</sub>
00F5 <sub>16</sub>	Data Mask Register 01	G0MSK1	XX <sub>16</sub>
00F6 <sub>16</sub>	Communication Clock Select Register	CCS	XXXX 0000 <sub>2</sub>
00F7 <sub>16</sub>			
00F8 <sub>16</sub> 00F9 <sub>16</sub>	Receive CRC Code Register 0	G0RCRC	XX <sub>16</sub> XX <sub>16</sub>
00FA <sub>16</sub> 00FB <sub>16</sub>	Transmit CRC Code Register 0	G0TCRC	00 <sub>16</sub> 00 <sub>16</sub>
00FC <sub>16</sub>	SI/O Extended Mode Register 0	G0EMR	00 <sub>16</sub>
00FD <sub>16</sub>	SI/O Extended Receive Control Register 0	G0ERC	00 <sub>16</sub>
00FE <sub>16</sub>	SI/O Special Communication Interrupt Detect Register 0	G0IRF	00 <sub>16</sub>
00FF <sub>16</sub>	SI/O Extended Transmit Control Register 0	G0ETC	0000 0XXX <sub>2</sub>
0100 <sub>16</sub> 0101 <sub>16</sub>	Time Measurement/Waveform Generating Register 10	G1TM0/G1PO0	XX <sub>16</sub> XX <sub>16</sub>
0102 <sub>16</sub> 0103 <sub>16</sub>	Time Measurement/Waveform Generating Register 11	G1TM1/G1PO1	XX <sub>16</sub> XX <sub>16</sub>
0104 <sub>16</sub> 0105 <sub>16</sub>	Time Measurement/Waveform Generating Register 12	G1TM2/G1PO2	XX <sub>16</sub> XX <sub>16</sub>
0106 <sub>16</sub> 0107 <sub>16</sub>	Time Measurement/Waveform Generating Register 13	G1TM3/G1PO3	XX <sub>16</sub> XX <sub>16</sub>
0108 <sub>16</sub> 0109 <sub>16</sub>	Time Measurement/Waveform Generating Register 14	G1TM4/G1PO4	XX <sub>16</sub> XX <sub>16</sub>
010A <sub>16</sub> 010B <sub>16</sub>	Time Measurement/Waveform Generating Register 15	G1TM5/G1PO5	XX <sub>16</sub> XX <sub>16</sub>
010C <sub>16</sub> 010D <sub>16</sub>	Time Measurement/Waveform Generating Register 16	G1TM6/G1PO6	XX <sub>16</sub> XX <sub>16</sub>
010E <sub>16</sub> 010F <sub>16</sub>	Time Measurement/Waveform Generating Register 17	G1TM7/G1PO7	XX <sub>16</sub> XX <sub>16</sub>
0110 <sub>16</sub>	Waveform Generating Control Register 10	G1POCR0	0000 X000 <sub>2</sub>
0111 <sub>16</sub>	Waveform Generating Control Register 11	G1POCR1	0X00 X000 <sub>2</sub>
0112 <sub>16</sub>	Waveform Generating Control Register 12	G1POCR2	0X00 X000 <sub>2</sub>
0113 <sub>16</sub>	Waveform Generating Control Register 13	G1POCR3	0X00 X000 <sub>2</sub>
0114 <sub>16</sub>	Waveform Generating Control Register 14	G1POCR4	0X00 X000 <sub>2</sub>
0115 <sub>16</sub>	Waveform Generating Control Register 15	G1POCR5	0X00 X000 <sub>2</sub>
0116 <sub>16</sub>	Waveform Generating Control Register 16	G1POCR6	0X00 X000 <sub>2</sub>
0117 <sub>16</sub>	Waveform Generating Control Register 17	G1POCR7	0X00 X000 <sub>2</sub>
0118 <sub>16</sub>	Time Measurement Control Register 10	G1TMCR0	00 <sub>16</sub>
0119 <sub>16</sub>	Time Measurement Control Register 11	G1TMCR1	00 <sub>16</sub>
011A <sub>16</sub>	Time Measurement Control Register 12	G1TMCR2	00 <sub>16</sub>
011B <sub>16</sub>	Time Measurement Control Register 13	G1TMCR3	00 <sub>16</sub>
011C <sub>16</sub>	Time Measurement Control Register 14	G1TMCR4	00 <sub>16</sub>
011D <sub>16</sub>	Time Measurement Control Register 15	G1TMCR5	00 <sub>16</sub>
011E <sub>16</sub>	Time Measurement Control Register 16	G1TMCR6	00 <sub>16</sub>
011F <sub>16</sub>	Time Measurement Control Register 17	G1TMCR7	00 <sub>16</sub>

X: Indeterminate

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Address	Register	Symbol	Value after RESET
0120 <sub>16</sub> 0121 <sub>16</sub>	Base Timer Register 1	G1BT	XX <sub>16</sub> XX <sub>16</sub>
0122 <sub>16</sub>	Base Timer Control Register 10	G1BCR0	00 <sub>16</sub>
0123 <sub>16</sub>	Base Timer Control Register 11	G1BCR1	X000 000X <sub>2</sub>
0124 <sub>16</sub>	Time Measurement Prescaler Register 16	G1TPR6	00 <sub>16</sub>
0125 <sub>16</sub>	Time Measurement Prescaler Register 17	G1TPR7	00 <sub>16</sub>
0126 <sub>16</sub>	Function Enable Register 1	G1FE	00 <sub>16</sub>
0127 <sub>16</sub>	Function Select Register 1	G1FS	00 <sub>16</sub>
0128 <sub>16</sub> 0129 <sub>16</sub>	SI/O Receive Buffer Register 1	G1RB	XXXX XXXX <sub>2</sub> X000 XXXX <sub>2</sub>
012A <sub>16</sub> 012B <sub>16</sub>	Transmit Buffer/Receive Data Register 1	G1TB/G1DR	XX <sub>16</sub>
012C <sub>16</sub>	Receive Input Register 1	G1RI	XX <sub>16</sub>
012D <sub>16</sub>	SI/O Communication Mode Register 1	G1MR	00 <sub>16</sub>
012E <sub>16</sub>	Transmit Output Register 1	G1TO	XX <sub>16</sub>
012F <sub>16</sub>	SI/O Communication Control Register 1	G1CR	0000 X011 <sub>2</sub>
0130 <sub>16</sub>	Data Compare Register 10	G1CMP0	XX <sub>16</sub>
0131 <sub>16</sub>	Data Compare Register 11	G1CMP1	XX <sub>16</sub>
0132 <sub>16</sub>	Data Compare Register 12	G1CMP2	XX <sub>16</sub>
0133 <sub>16</sub>	Data Compare Register 13	G1CMP3	XX <sub>16</sub>
0134 <sub>16</sub>	Data Mask Register 10	G1MSK0	XX <sub>16</sub>
0135 <sub>16</sub>	Data Mask Register 11	G1MSK1	XX <sub>16</sub>
0136 <sub>16</sub>			
0137 <sub>16</sub>			
0138 <sub>16</sub> 0139 <sub>16</sub>	Receive CRC Code Register 1	G1RCRC	XX <sub>16</sub> XX <sub>16</sub>
013A <sub>16</sub> 013B <sub>16</sub>	Transmit CRC Code Register 1	G1TCRC	00 <sub>16</sub> 00 <sub>16</sub>
013C <sub>16</sub>	SI/O Extended Mode Register 1	G1EMR	00 <sub>16</sub>
013D <sub>16</sub>	SI/O Extended Receive Control Register 1	G1ERC	00 <sub>16</sub>
013E <sub>16</sub>	SI/O Special Communication Interrupt Detect Register 1	G1IRF	00 <sub>16</sub>
013F <sub>16</sub>	SI/O Extended Transmit Control Register 1	G1ETC	0000 0XXX <sub>2</sub>
0140 <sub>16</sub>			
0141 <sub>16</sub>			
0142 <sub>16</sub>			
0143 <sub>16</sub>			
0144 <sub>16</sub>			
0145 <sub>16</sub>			
0146 <sub>16</sub>			
0147 <sub>16</sub>			
0148 <sub>16</sub>			
0149 <sub>16</sub>			
014A <sub>16</sub>			
014B <sub>16</sub>			
014C <sub>16</sub>			
014D <sub>16</sub>			
014E <sub>16</sub>			
014F <sub>16</sub>			

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Address	Register	Symbol	Value after RESET
0150 <sub>16</sub>			
0151 <sub>16</sub>			
0152 <sub>16</sub>			
0153 <sub>16</sub>			
0154 <sub>16</sub>			
0155 <sub>16</sub>			
0156 <sub>16</sub>			
0157 <sub>16</sub>			
0158 <sub>16</sub>			
0159 <sub>16</sub>			
015A <sub>16</sub>			
015B <sub>16</sub>			
015C <sub>16</sub>			
015D <sub>16</sub>			
015E <sub>16</sub>			
015F <sub>16</sub>			
0160 <sub>16</sub>			
0161 <sub>16</sub>			
0162 <sub>16</sub>			
0163 <sub>16</sub>			
0164 <sub>16</sub>			
0165 <sub>16</sub>			
0166 <sub>16</sub>			
0167 <sub>16</sub>			
0168 <sub>16</sub>			
0169 <sub>16</sub>			
016A <sub>16</sub>			
016B <sub>16</sub>			
016C <sub>16</sub>			
016D <sub>16</sub>			
016E <sub>16</sub>			
016F <sub>16</sub>			
0170 <sub>16</sub>			
0171 <sub>16</sub>			
0172 <sub>16</sub>			
0173 <sub>16</sub>			
0174 <sub>16</sub>			
0175 <sub>16</sub>			
0176 <sub>16</sub>			
0177 <sub>16</sub>			
0178 <sub>16</sub>	Input Function Select Register	IPS	00 <sub>16</sub>
0179 <sub>16</sub>	Input Function Select Register A	IPSA	00 <sub>16</sub>
017A <sub>16</sub>			
017B <sub>16</sub>			
017C <sub>16</sub>			
017D <sub>16</sub> to 01DF <sub>16</sub>			

X: Indeterminate

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Address	Register	Symbol	Value after RESET
01E0 <sub>16</sub>	CAN0 Message Slot Buffer 0 Standard ID0	C0SLOT0_0	XX <sub>16</sub>
01E1 <sub>16</sub>	CAN0 Message Slot Buffer 0 Standard ID1	C0SLOT0_1	XX <sub>16</sub>
01E2 <sub>16</sub>	CAN0 Message Slot Buffer 0 Extended ID0	C0SLOT0_2	XX <sub>16</sub>
01E3 <sub>16</sub>	CAN0 Message Slot Buffer 0 Extended ID1	C0SLOT0_3	XX <sub>16</sub>
01E4 <sub>16</sub>	CAN0 Message Slot Buffer 0 Extended ID2	C0SLOT0_4	XX <sub>16</sub>
01E5 <sub>16</sub>	CAN0 Message Slot Buffer 0 Data Length Code	C0SLOT0_5	XX <sub>16</sub>
01E6 <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 0	C0SLOT0_6	XX <sub>16</sub>
01E7 <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 1	C0SLOT0_7	XX <sub>16</sub>
01E8 <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 2	C0SLOT0_8	XX <sub>16</sub>
01E9 <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 3	C0SLOT0_9	XX <sub>16</sub>
01EA <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 4	C0SLOT0_10	XX <sub>16</sub>
01EB <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 5	C0SLOT0_11	XX <sub>16</sub>
01EC <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 6	C0SLOT0_12	XX <sub>16</sub>
01ED <sub>16</sub>	CAN0 Message Slot Buffer 0 Data 7	C0SLOT0_13	XX <sub>16</sub>
01EE <sub>16</sub>	CAN0 Message Slot Buffer 0 Time Stamp High-Order	C0SLOT0_14	XX <sub>16</sub>
01EF <sub>16</sub>	CAN0 Message Slot Buffer 0 Time Stamp Low-Order	C0SLOT0_15	XX <sub>16</sub>
01F0 <sub>16</sub>	CAN0 Message Slot Buffer 1 Standard ID0	C0SLOT1_0	XX <sub>16</sub>
01F1 <sub>16</sub>	CAN0 Message Slot Buffer 1 Standard ID1	C0SLOT1_1	XX <sub>16</sub>
01F2 <sub>16</sub>	CAN0 Message Slot Buffer 1 Extended ID0	C0SLOT1_2	XX <sub>16</sub>
01F3 <sub>16</sub>	CAN0 Message Slot Buffer 1 Extended ID1	C0SLOT1_3	XX <sub>16</sub>
01F4 <sub>16</sub>	CAN0 Message Slot Buffer 1 Extended ID2	C0SLOT1_4	XX <sub>16</sub>
01F5 <sub>16</sub>	CAN0 Message Slot Buffer 1 Data Length Code	C0SLOT1_5	XX <sub>16</sub>
01F6 <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 0	C0SLOT1_6	XX <sub>16</sub>
01F7 <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 1	C0SLOT1_7	XX <sub>16</sub>
01F8 <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 2	C0SLOT1_8	XX <sub>16</sub>
01F9 <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 3	C0SLOT1_9	XX <sub>16</sub>
01FA <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 4	C0SLOT1_10	XX <sub>16</sub>
01FB <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 5	C0SLOT1_11	XX <sub>16</sub>
01FC <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 6	C0SLOT1_12	XX <sub>16</sub>
01FD <sub>16</sub>	CAN0 Message Slot Buffer 1 Data 7	C0SLOT1_13	XX <sub>16</sub>
01FE <sub>16</sub>	CAN0 Message Slot Buffer 1 Time Stamp High-Order	C0SLOT1_14	XX <sub>16</sub>
01FF <sub>16</sub>	CAN0 Message Slot Buffer 1 Time Stamp Low-Order	C0SLOT1_15	XX <sub>16</sub>
0200 <sub>16</sub> 0201 <sub>16</sub>	CAN0 Control Register 0	C0CTRL0	XX01 0X01 <sub>2</sub> <sup>(1)</sup> XXXX 0000 <sub>2</sub> <sup>(1)</sup>
0202 <sub>16</sub> 0203 <sub>16</sub>	CAN0 Status Register	C0STR	0000 0000 <sub>2</sub> <sup>(1)</sup> X000 0X01 <sub>2</sub> <sup>(1)</sup>
0204 <sub>16</sub> 0205 <sub>16</sub>	CAN0 Extended ID Register	C0IDR	00 <sub>16</sub> <sup>(1)</sup> 00 <sub>16</sub> <sup>(1)</sup>
0206 <sub>16</sub> 0207 <sub>16</sub>	CAN0 Configuration Register	C0CONR	0000 XXXX <sub>2</sub> <sup>(1)</sup> 0000 0000 <sub>2</sub> <sup>(1)</sup>
0208 <sub>16</sub> 0209 <sub>16</sub>	CAN0 Time Stamp Register	C0TSR	00 <sub>16</sub> <sup>(1)</sup> 00 <sub>16</sub> <sup>(1)</sup>
020A <sub>16</sub>	CAN0 Transmit Error Count Register	C0TEC	00 <sub>16</sub> <sup>(1)</sup>
020B <sub>16</sub>	CAN0 Receive Error Count Register	C0REC	00 <sub>16</sub> <sup>(1)</sup>
020C <sub>16</sub> 020D <sub>16</sub>	CAN0 Slot Interrupt Status Register	C0SISTR	00 <sub>16</sub> <sup>(1)</sup> 00 <sub>16</sub> <sup>(1)</sup>
020E <sub>16</sub>			
020F <sub>16</sub>			

X: Indeterminate

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NOTES:

1. Values are obtained by setting the SLEEP bit in the C0SLPR register to "1" (sleep mode exited) after reset and supplying the clock to the CAN module.

Address	Register	Symbol	Value after RESET
0210 <sub>16</sub>	CAN0 Slot Interrupt Mask Register	C0SIMKR	00 <sub>16</sub> <sup>(2)</sup>
0211 <sub>16</sub>			00 <sub>16</sub> <sup>(2)</sup>
0212 <sub>16</sub>			
0213 <sub>16</sub>			
0214 <sub>16</sub>	CAN0 Error Interrupt Mask Register	C0EIMKR	XXXX X000 <sub>2</sub> <sup>(2)</sup>
0215 <sub>16</sub>	CAN0 Error Interrupt Status Register	C0EISTR	XXXX X000 <sub>2</sub> <sup>(2)</sup>
0216 <sub>16</sub>	CAN0 Error Cause Register	C0EFR	00 <sub>16</sub> <sup>(2)</sup>
0217 <sub>16</sub>	CAN0 Baud Rate Prescaler	C0BRP	0000 0001 <sub>2</sub> <sup>(2)</sup>
0218 <sub>16</sub>			
0219 <sub>16</sub>	CAN0 Mode Register	C0MDR	XXXX XX00 <sub>2</sub> <sup>(2)</sup>
021A <sub>16</sub>			
021B <sub>16</sub>			
021C <sub>16</sub>			
021D <sub>16</sub>			
021E <sub>16</sub>			
021F <sub>16</sub>			
0220 <sub>16</sub>	CAN0 Single-Shot Control Register	C0SSCTLR	00 <sub>16</sub> <sup>(2)</sup>
0221 <sub>16</sub>			00 <sub>16</sub> <sup>(2)</sup>
0222 <sub>16</sub>			
0223 <sub>16</sub>			
0224 <sub>16</sub>	CAN0 Single-Shot Status Register	C0SSSTR	00 <sub>16</sub> <sup>(2)</sup>
0225 <sub>16</sub>			00 <sub>16</sub> <sup>(2)</sup>
0226 <sub>16</sub>			
0227 <sub>16</sub>			
0228 <sub>16</sub>	CAN0 Global Mask Register Standard ID0	C0GMR0	XXX0 0000 <sub>2</sub> <sup>(2)</sup>
0229 <sub>16</sub>	CAN0 Global Mask Register Standard ID1	C0GMR1	XX00 0000 <sub>2</sub> <sup>(2)</sup>
022A <sub>16</sub>	CAN0 Global Mask Register Extended ID0	C0GMR2	XXXX 0000 <sub>2</sub> <sup>(2)</sup>
022B <sub>16</sub>	CAN0 Global Mask Register Extended ID1	C0GMR3	00 <sub>16</sub> <sup>(2)</sup>
022C <sub>16</sub>	CAN0 Global Mask Register Extended ID2	C0GMR4	XX00 0000 <sub>2</sub> <sup>(2)</sup>
022D <sub>16</sub>			
022E <sub>16</sub>			
022F <sub>16</sub>			
0230 <sub>16</sub>	CAN0 Message Slot 0 Control Register /	C0MCTL0/	0000 0000 <sub>2</sub> <sup>(2)</sup>
	CAN0 Local Mask Register A Standard ID0	C0LMAR0	XXX0 0000 <sub>2</sub> <sup>(2)</sup>
0231 <sub>16</sub>	CAN0 Message Slot 1 Control Register /	C0MCTL1/	0000 0000 <sub>2</sub> <sup>(2)</sup>
	CAN0 Local Mask Register A Standard ID1	C0LMAR1	XX00 0000 <sub>2</sub> <sup>(2)</sup>
0232 <sub>16</sub>	CAN0 Message Slot 2 Control Register /	C0MCTL2/	0000 0000 <sub>2</sub> <sup>(2)</sup>
	CAN0 Local Mask Register A Extended ID0	C0LMAR2	XXXX 0000 <sub>2</sub> <sup>(2)</sup>
0233 <sub>16</sub>	CAN0 Message Slot 3 Control Register /	C0MCTL3/	00 <sub>16</sub> <sup>(2)</sup>
	CAN0 local Mask Register A Extended ID1	C0LMAR3	00 <sub>16</sub> <sup>(2)</sup>
0234 <sub>16</sub>	CAN0 Message Slot 4 Control Register /	C0MCTL4/	0000 0000 <sub>2</sub> <sup>(2)</sup>
	CAN0 Local Mask Register A Extended ID2	C0LMAR4	XX00 0000 <sub>2</sub> <sup>(2)</sup>
0235 <sub>16</sub>	CAN0 Message Slot 5 Control Register	C0MCTL5	00 <sub>16</sub> <sup>(2)</sup>
0236 <sub>16</sub>	CAN0 Message Slot 6 Control Register	C0MCTL6	00 <sub>16</sub> <sup>(2)</sup>
0237 <sub>16</sub>	CAN0 Message Slot 7 Control Register	C0MCTL7	00 <sub>16</sub> <sup>(2)</sup>
0238 <sub>16</sub>	CAN0 Message Slot 8 Control Register /	C0MCTL8/	0000 0000 <sub>2</sub> <sup>(2)</sup>
	CAN0 Local Mask Register B Standard ID0	C0LMBR0	XXX0 0000 <sub>2</sub> <sup>(2)</sup>

(Note 1)

X: Indeterminate

Blank spaces are reserved. No access is allowed.

## NOTES:

1. The BANKSEL bit in the C0CTLR1 register switches functions for addresses 0220<sub>16</sub> to 023F<sub>16</sub>.
2. Values are obtained by setting the SLEEP bit in the C0SLPR register to "1" (sleep mode exited) after reset and supplying the clock to the CAN module.



Address	Register	Symbol	Value after RESET
0239 <sub>16</sub>	CAN0 Message Slot 9 Control Register / CAN0 Local Mask Register B Standard ID1	C0MCTL9/ C0LMBR1	0000 0000 <sub>2</sub> <sup>(2)</sup> XX00 0000 <sub>2</sub> <sup>(2)</sup>
023A <sub>16</sub>	CAN0 Message Slot 10 Control Register / CAN0 Local Mask Register B Extended ID0	C0MCTL10/ C0LMBR2	0000 0000 <sub>2</sub> <sup>(2)</sup> XXXX 0000 <sub>2</sub> <sup>(2)</sup>
023B <sub>16</sub>	CAN0 Message Slot 11 Control Register / CAN0 Local Mask Register B Extended ID1	C0MCTL11/ C0LMBR3	00 <sub>16</sub> <sup>(2)</sup> 00 <sub>16</sub> <sup>(2)</sup>
023C <sub>16</sub>	CAN0 Message Slot 12 Control Register / CAN0 Local Mask Register B Extended ID2	C0MCTL12/ C0LMBR4	0000 0000 <sub>2</sub> <sup>(2)</sup> XX00 0000 <sub>2</sub> <sup>(2)</sup>
023D <sub>16</sub>	CAN0 Message Slot 13 Control Register	C0MCTL13	00 <sub>16</sub> <sup>(2)</sup>
023E <sub>16</sub>	CAN0 Message Slot 14 Control Register	C0MCTL14	00 <sub>16</sub> <sup>(2)</sup>
023F <sub>16</sub>	CAN0 Message Slot 15 Control Register	C0MCTL15	00 <sub>16</sub> <sup>(2)</sup>
0240 <sub>16</sub>	CAN0 Slot Buffer Select Register	C0SBS	00 <sub>16</sub> <sup>(2)</sup>
0241 <sub>16</sub>	CAN0 Control Register 1	C0CTLR1	X000 00XX <sub>2</sub> <sup>(2)</sup>
0242 <sub>16</sub>	CAN0 Sleep Control Register	C0SLPR	XXXX XXX0 <sub>2</sub>
0243 <sub>16</sub>			
0244 <sub>16</sub>	CAN0 Acceptance Filter Support Register	C0AFS	00 <sub>16</sub> <sup>(2)</sup>
0245 <sub>16</sub>			01 <sub>16</sub> <sup>(2)</sup>
0246 <sub>16</sub>			
0247 <sub>16</sub>			
0248 <sub>16</sub>			
0249 <sub>16</sub>			
024A <sub>16</sub>			
024B <sub>16</sub>			
024C <sub>16</sub>			
024D <sub>16</sub>			
024E <sub>16</sub>			
024F <sub>16</sub>			
0250 <sub>16</sub>			
0251 <sub>16</sub>			
0252 <sub>16</sub>			
0253 <sub>16</sub>			
0254 <sub>16</sub>			
0255 <sub>16</sub>			
0256 <sub>16</sub>			
0257 <sub>16</sub>			
0258 <sub>16</sub>			
0259 <sub>16</sub>			
025A <sub>16</sub>			
025B <sub>16</sub>			
025C <sub>16</sub>			
025D <sub>16</sub> to 02BF <sub>16</sub>			

(Note 1)

X: Indeterminate

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## NOTES:

1. The BANKSEL bit in the C0CTLR1 register switches functions for addresses 0220<sub>16</sub> to 023F<sub>16</sub>.
2. Values are obtained by setting the SLEEP bit in the C0SLPR register to "1" (sleep mode exited) after reset and supplying the clock to the CAN module.

Address	Register	Symbol	Value after RESET
02C0 <sup>16</sup> 02C1 <sup>16</sup>	X0 Register Y0 Register	X0R,Y0R	XX <sup>16</sup> XX <sup>16</sup>
02C2 <sup>16</sup> 02C3 <sup>16</sup>	X1 Register Y1 Register	X1R,Y1R	XX <sup>16</sup> XX <sup>16</sup>
02C4 <sup>16</sup> 02C5 <sup>16</sup>	X2 Register Y2 Register	X2R,Y2R	XX <sup>16</sup> XX <sup>16</sup>
02C6 <sup>16</sup> 02C7 <sup>16</sup>	X3 Register Y3 Register	X3R,Y3R	XX <sup>16</sup> XX <sup>16</sup>
02C8 <sup>16</sup> 02C9 <sup>16</sup>	X4 Register Y4 Register	X4R,Y4R	XX <sup>16</sup> XX <sup>16</sup>
02CA <sup>16</sup> 02CB <sup>16</sup>	X5 Register Y5 Register	X5R,Y5R	XX <sup>16</sup> XX <sup>16</sup>
02CC <sup>16</sup> 02CD <sup>16</sup>	X6 Register Y6 Register	X6R,Y6R	XX <sup>16</sup> XX <sup>16</sup>
02CE <sup>16</sup> 02CF <sup>16</sup>	X7 Register Y7 Register	X7R,Y7R	XX <sup>16</sup> XX <sup>16</sup>
02D0 <sup>16</sup> 02D1 <sup>16</sup>	X8 Register Y8 Register	X8R,Y8R	XX <sup>16</sup> XX <sup>16</sup>
02D2 <sup>16</sup> 02D3 <sup>16</sup>	X9 Register Y9 Register	X9R,Y9R	XX <sup>16</sup> XX <sup>16</sup>
02D4 <sup>16</sup> 02D5 <sup>16</sup>	X10 Register Y10 Register	X10R,Y10R	XX <sup>16</sup> XX <sup>16</sup>
02D6 <sup>16</sup> 02D7 <sup>16</sup>	X11 Register Y11 Register	X11R,Y11R	XX <sup>16</sup> XX <sup>16</sup>
02D8 <sup>16</sup> 02D9 <sup>16</sup>	X12 Register Y12 Register	X12R,Y12R	XX <sup>16</sup> XX <sup>16</sup>
02DA <sup>16</sup> 02DB <sup>16</sup>	X13 Register Y13 Register	X13R,Y13R	XX <sup>16</sup> XX <sup>16</sup>
02DC <sup>16</sup> 02DD <sup>16</sup>	X14 Register Y14 Register	X14R,Y14R	XX <sup>16</sup> XX <sup>16</sup>
02DE <sup>16</sup> 02DF <sup>16</sup>	X15 Register Y15 Register	X15R,Y15R	XX <sup>16</sup> XX <sup>16</sup>
02E0 <sup>16</sup>	X/Y Control Register	XYC	XXXX XX00 <sub>2</sub>
02E1 <sup>16</sup>			
02E2 <sup>16</sup>			
02E3 <sup>16</sup>			
02E4 <sup>16</sup>	UART1 Special Mode Register 4	U1SMR4	00 <sup>16</sup>
02E5 <sup>16</sup>	UART1 Special Mode Register 3	U1SMR3	00 <sup>16</sup>
02E6 <sup>16</sup>	UART1 Special Mode Register 2	U1SMR2	00 <sup>16</sup>
02E7 <sup>16</sup>	UART1 Special Mode Register	U1SMR	00 <sup>16</sup>
02E8 <sup>16</sup>	UART1 Transmit/Receive Mode Register	U1MR	00 <sup>16</sup>
02E9 <sup>16</sup>	UART1 Bit Rate Register	U1BRG	XX <sup>16</sup>
02EA <sup>16</sup> 02EB <sup>16</sup>	UART1 Transmit Buffer Register	U1TB	XX <sup>16</sup> XX <sup>16</sup>
02EC <sup>16</sup>	UART1 Transmit/Receive Control Register 0	U1C0	0000 1000 <sub>2</sub>
02ED <sup>16</sup>	UART1 Transmit/Receive Control Register 1	U1C1	0000 0010 <sub>2</sub>
02EE <sup>16</sup> 02EF <sup>16</sup>	UART1 Receive Buffer Register	U1RB	XX <sup>16</sup> XX <sup>16</sup>

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Address	Register	Symbol	Value after RESET
02F0 <sub>16</sub>			
02F1 <sub>16</sub>			
02F2 <sub>16</sub>			
02F3 <sub>16</sub>			
02F4 <sub>16</sub>	UART4 Special Mode Register 4	U4SMR4	00 <sub>16</sub>
02F5 <sub>16</sub>	UART4 Special Mode Register 3	U4SMR3	00 <sub>16</sub>
02F6 <sub>16</sub>	UART4 Special Mode Register 2	U4SMR2	00 <sub>16</sub>
02F7 <sub>16</sub>	UART4 Special Mode Register	U4SMR	00 <sub>16</sub>
02F8 <sub>16</sub>	UART4 Transmit/Receive Mode Register	U4MR	00 <sub>16</sub>
02F9 <sub>16</sub>	UART4 Bit Rate Register	U4BRG	XX <sub>16</sub>
02FA <sub>16</sub>	UART4 Transmit Buffer Register	U4TB	XX <sub>16</sub>
02FB <sub>16</sub>			XX <sub>16</sub>
02FC <sub>16</sub>	UART4 Transmit/Receive Control Register 0	U4C0	0000 1000 <sub>2</sub>
02FD <sub>16</sub>	UART4 Transmit/Receive Control Register 1	U4C1	0000 0010 <sub>2</sub>
02FE <sub>16</sub>	UART4 Receive Buffer Register	U4RB	XX <sub>16</sub>
02FF <sub>16</sub>			XX <sub>16</sub>
0300 <sub>16</sub>	Timer B3, B4, B5 Count Start Flag	TBSR	000X XXXX <sub>2</sub>
0301 <sub>16</sub>			
0302 <sub>16</sub>	Timer A1-1 Register	TA11	XX <sub>16</sub>
0303 <sub>16</sub>			XX <sub>16</sub>
0304 <sub>16</sub>	Timer A2-1 Register	TA21	XX <sub>16</sub>
0305 <sub>16</sub>			XX <sub>16</sub>
0306 <sub>16</sub>	Timer A4-1 Register	TA41	XX <sub>16</sub>
0307 <sub>16</sub>			XX <sub>16</sub>
0308 <sub>16</sub>	Three-Phase PWM Control Register 0	INVC0	00 <sub>16</sub>
0309 <sub>16</sub>	Three-Phase PWM Control Register 1	INVC1	00 <sub>16</sub>
030A <sub>16</sub>	Three-Phase Output Buffer Register 0	IDB0	XX11 1111 <sub>2</sub>
030B <sub>16</sub>	Three-Phase Output Buffer Register 1	IDB1	XX11 1111 <sub>2</sub>
030C <sub>16</sub>	Dead Time Timer	DTT	XX <sub>16</sub>
030D <sub>16</sub>	Timer B2 Interrupt Generation Frequency Set Counter	ICTB2	XX <sub>16</sub>
030E <sub>16</sub>			
030F <sub>16</sub>			
0310 <sub>16</sub>	Timer B3 Register	TB3	XX <sub>16</sub>
0311 <sub>16</sub>			XX <sub>16</sub>
0312 <sub>16</sub>	Timer B4 Register	TB4	XX <sub>16</sub>
0313 <sub>16</sub>			XX <sub>16</sub>
0314 <sub>16</sub>	Timer B5 Register	TB5	XX <sub>16</sub>
0315 <sub>16</sub>			XX <sub>16</sub>
0316 <sub>16</sub>			
0317 <sub>16</sub>			
0318 <sub>16</sub>			
0319 <sub>16</sub>			
031A <sub>16</sub>			
031B <sub>16</sub>	Timer B3 Mode Register	TB3MR	00XX 0000 <sub>2</sub>
031C <sub>16</sub>	Timer B4 Mode Register	TB4MR	00XX 0000 <sub>2</sub>
031D <sub>16</sub>	Timer B5 Mode Register	TB5MR	00XX 0000 <sub>2</sub>
031E <sub>16</sub>			
031F <sub>16</sub>	External Interrupt Cause Select Register	IFSR	00 <sub>16</sub>

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Address	Register	Symbol	Value after RESET
0320 <sub>16</sub>			
0321 <sub>16</sub>			
0322 <sub>16</sub>			
0323 <sub>16</sub>			
0324 <sub>16</sub>	UART3 Special Mode Register 4	U3SMR4	00 <sub>16</sub>
0325 <sub>16</sub>	UART3 Special Mode Register 3	U3SMR3	00 <sub>16</sub>
0326 <sub>16</sub>	UART3 Special Mode Register 2	U3SMR2	00 <sub>16</sub>
0327 <sub>16</sub>	UART3 Special Mode Register	U3SMR	00 <sub>16</sub>
0328 <sub>16</sub>	UART3 Transmit/Receive Mode Register	U3MR	00 <sub>16</sub>
0329 <sub>16</sub>	UART3 Bit Rate Register	U3BRG	XX <sub>16</sub>
032A <sub>16</sub>	UART3 Transmit Buffer Register	U3TB	XX <sub>16</sub>
032B <sub>16</sub>			XX <sub>16</sub>
032C <sub>16</sub>	UART3 Transmit/Receive Control Register 0	U3C0	0000 1000 <sub>2</sub>
032D <sub>16</sub>	UART3 Transmit/Receive Control Register 1	U3C1	0000 0010 <sub>2</sub>
032E <sub>16</sub>	UART3 Receive Buffer Register	U3RB	XX <sub>16</sub>
032F <sub>16</sub>			XX <sub>16</sub>
0330 <sub>16</sub>			
0331 <sub>16</sub>			
0332 <sub>16</sub>			
0333 <sub>16</sub>			
0334 <sub>16</sub>	UART2 Special Mode Register 4	U2SMR4	00 <sub>16</sub>
0335 <sub>16</sub>	UART2 Special Mode Register 3	U2SMR3	00 <sub>16</sub>
0336 <sub>16</sub>	UART2 Special Mode Register 2	U2SMR2	00 <sub>16</sub>
0337 <sub>16</sub>	UART2 Special Mode Register	U2SMR	00 <sub>16</sub>
0338 <sub>16</sub>	UART2 Transmit/Receive Mode Register	U2MR	00 <sub>16</sub>
0339 <sub>16</sub>	UART2 Bit Rate Register	U2BRG	XX <sub>16</sub>
033A <sub>16</sub>	UART2 Transmit Buffer Register	U2TB	XX <sub>16</sub>
033B <sub>16</sub>			XX <sub>16</sub>
033C <sub>16</sub>	UART2 Transmit/Receive Control Register 0	U2C0	0000 1000 <sub>2</sub>
033D <sub>16</sub>	UART2 Transmit/Receive Control Register 1	U2C1	0000 0010 <sub>2</sub>
033E <sub>16</sub>	UART2 Receive Buffer Register	U2RB	XX <sub>16</sub>
033F <sub>16</sub>			XX <sub>16</sub>
0340 <sub>16</sub>	Count Start Flag	TABSR	00 <sub>16</sub>
0341 <sub>16</sub>	Clock Prescaler Reset Flag	CPSRF	0XXX XXXX <sub>2</sub>
0342 <sub>16</sub>	One-Shot Start Flag	ONSF	00 <sub>16</sub>
0343 <sub>16</sub>	Trigger Select Register	TRGSR	00 <sub>16</sub>
0344 <sub>16</sub>	Up/Down Flag	UDF	00 <sub>16</sub>
0345 <sub>16</sub>			
0346 <sub>16</sub>	Timer A0 Register	TA0	XX <sub>16</sub>
0347 <sub>16</sub>			XX <sub>16</sub>
0348 <sub>16</sub>	Timer A1 Register	TA1	XX <sub>16</sub>
0349 <sub>16</sub>			XX <sub>16</sub>
034A <sub>16</sub>	Timer A2 Register	TA2	XX <sub>16</sub>
034B <sub>16</sub>			XX <sub>16</sub>
034C <sub>16</sub>	Timer A3 Register	TA3	XX <sub>16</sub>
034D <sub>16</sub>			XX <sub>16</sub>
034E <sub>16</sub>	Timer A4 Register	TA4	XX <sub>16</sub>
034F <sub>16</sub>			XX <sub>16</sub>

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Address	Register	Symbol	Value after RESET
0350 <sub>16</sub> 0351 <sub>16</sub>	Timer B0 Register	TB0	XX <sub>16</sub> XX <sub>16</sub>
0352 <sub>16</sub> 0353 <sub>16</sub>	Timer B1 Register	TB1	XX <sub>16</sub> XX <sub>16</sub>
0354 <sub>16</sub> 0355 <sub>16</sub>	Timer B2 Register	TB2	XX <sub>16</sub> XX <sub>16</sub>
0356 <sub>16</sub>	Timer A0 Mode Register	TA0MR	00 <sub>16</sub>
0357 <sub>16</sub>	Timer A1 Mode Register	TA1MR	00 <sub>16</sub>
0358 <sub>16</sub>	Timer A2 Mode Register	TA2MR	00 <sub>16</sub>
0359 <sub>16</sub>	Timer A3 Mode Register	TA3MR	00 <sub>16</sub>
035A <sub>16</sub>	Timer A4 Mode Register	TA4MR	00 <sub>16</sub>
035B <sub>16</sub>	Timer B0 Mode Register	TB0MR	00XX 0000 <sub>2</sub>
035C <sub>16</sub>	Timer B1 Mode Register	TB1MR	00XX 0000 <sub>2</sub>
035D <sub>16</sub>	Timer B2 Mode Register	TB2MR	00XX 0000 <sub>2</sub>
035E <sub>16</sub>	Timer B2 Special Mode Register	TB2SC	XXXX XXX0 <sub>2</sub>
035F <sub>16</sub>	Count Source Prescaler Register <sup>(1)</sup>	TCSPR	0XXX 0000 <sub>2</sub>
0360 <sub>16</sub>			
0361 <sub>16</sub>			
0362 <sub>16</sub>			
0363 <sub>16</sub>			
0364 <sub>16</sub>	UART0 Special Mode Register 4	U0SMR4	00 <sub>16</sub>
0365 <sub>16</sub>	UART0 Special Mode Register 3	U0SMR3	00 <sub>16</sub>
0366 <sub>16</sub>	UART0 Special Mode Register 2	U0SMR2	00 <sub>16</sub>
0367 <sub>16</sub>	UART0 Special Mode Register	U0SMR	00 <sub>16</sub>
0368 <sub>16</sub>	UART0 Transmit/Receive Mode Register	U0MR	00 <sub>16</sub>
0369 <sub>16</sub>	UART0 Bit Rate Register	U0BRG	XX <sub>16</sub>
036A <sub>16</sub> 036B <sub>16</sub>	UART0 Transmit Buffer Register	U0TB	XX <sub>16</sub> XX <sub>16</sub>
036C <sub>16</sub>	UART0 Transmit/Receive Control Register 0	U0C0	0000 1000 <sub>2</sub>
036D <sub>16</sub>	UART0 Transmit/Receive Control Register 1	U0C1	0000 0010 <sub>2</sub>
036E <sub>16</sub> 036F <sub>16</sub>	UART0 Receive Buffer Register	U0RB	XX <sub>16</sub> XX <sub>16</sub>
0370 <sub>16</sub>			
0371 <sub>16</sub>			
0372 <sub>16</sub>			
0373 <sub>16</sub>			
0374 <sub>16</sub>			
0375 <sub>16</sub>			
0376 <sub>16</sub>			
0377 <sub>16</sub>			
0378 <sub>16</sub>	DMA0 Request Source Select Register	DM0SL	0X00 0000 <sub>2</sub>
0379 <sub>16</sub>	DMA1 Request Source Select Register	DM1SL	0X00 0000 <sub>2</sub>
037A <sub>16</sub>	DMA2 Request Source Select Register	DM2SL	0X00 0000 <sub>2</sub>
037B <sub>16</sub>	DMA3 Request Source Select Register	DM3SL	0X00 0000 <sub>2</sub>
037C <sub>16</sub> 037D <sub>16</sub>	CRC Data Register	CRCD	XX <sub>16</sub> XX <sub>16</sub>
037E <sub>16</sub> 037F <sub>16</sub>	CRC Input Register	CRCIN	XX <sub>16</sub> XX <sub>16</sub>

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NOTES:

1. The TCSPR register maintains values set before reset, even after software reset or watchdog timer reset has been performed.

Address	Register	Symbol	Value after RESET
0380 <sub>16</sub> 0381 <sub>16</sub>	A/D0 Register 0	AD00	XXXX XXXX <sub>2</sub> 0000 0000 <sub>2</sub>
0382 <sub>16</sub> 0383 <sub>16</sub>	A/D0 Register 1	AD01	XX <sub>16</sub> XX <sub>16</sub>
0384 <sub>16</sub> 0385 <sub>16</sub>	A/D0 Register 2	AD02	XX <sub>16</sub> XX <sub>16</sub>
0386 <sub>16</sub> 0387 <sub>16</sub>	A/D0 Register 3	AD03	XX <sub>16</sub> XX <sub>16</sub>
0388 <sub>16</sub> 0389 <sub>16</sub>	A/D0 Register 4	AD04	XX <sub>16</sub> XX <sub>16</sub>
038A <sub>16</sub> 038B <sub>16</sub>	A/D0 Register 5	AD05	XX <sub>16</sub> XX <sub>16</sub>
038C <sub>16</sub> 038D <sub>16</sub>	A/D0 Register 6	AD06	XX <sub>16</sub> XX <sub>16</sub>
038E <sub>16</sub> 038F <sub>16</sub>	A/D0 Register 7	AD07	XX <sub>16</sub> XX <sub>16</sub>
0390 <sub>16</sub>			
0391 <sub>16</sub>			
0392 <sub>16</sub> 0393 <sub>16</sub>	A/D0 Control Register 4	AD0CON4	XXXX 00XX <sub>2</sub>
0394 <sub>16</sub> 0395 <sub>16</sub>	A/D0 Control Register 2	AD0CON2	XX0X X000 <sub>2</sub>
0396 <sub>16</sub> 0397 <sub>16</sub>	A/D0 Control Register 3	AD0CON3	XXXX X000 <sub>2</sub>
0398 <sub>16</sub> 0399 <sub>16</sub>	A/D0 Control Register 0	AD0CON0	00 <sub>16</sub>
039A <sub>16</sub> 039B <sub>16</sub>	A/D0 Control Register 1	AD0CON1	00 <sub>16</sub>
039C <sub>16</sub> 039D <sub>16</sub>	D/A Register 0	DA0	XX <sub>16</sub>
039E <sub>16</sub> 039F <sub>16</sub>	D/A Register 1	DA1	XX <sub>16</sub>
	D/A Control Register	DACON	XXXX XX00 <sub>2</sub>

X: Indeterminate

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## &lt;144-pin Package&gt;

Address	Register	Symbol	Value after RESET
03A0 <sub>16</sub>	Function Select Register A8	PS8	X000 0000 <sub>2</sub>
03A1 <sub>16</sub>	Function Select Register A9	PS9	00 <sub>16</sub>
03A2 <sub>16</sub>			
03A3 <sub>16</sub>			
03A4 <sub>16</sub>			
03A5 <sub>16</sub>			
03A6 <sub>16</sub>			
03A7 <sub>16</sub>	Function Select Register D1	PSD1	X0XX XX00 <sub>2</sub>
03A8 <sub>16</sub>			
03A9 <sub>16</sub>			
03AA <sub>16</sub>			
03AB <sub>16</sub>			
03AC <sub>16</sub>	Function Select Register C2	PSC2	XXXX X00X <sub>2</sub>
03AD <sub>16</sub>	Function Select Register C3	PSC3	X0XX XXXX <sub>2</sub>
03AE <sub>16</sub>			
03AF <sub>16</sub>	Function Select Register C	PSC	00X0 0000 <sub>2</sub>
03B0 <sub>16</sub>	Function Select Register A0	PS0	00 <sub>16</sub>
03B1 <sub>16</sub>	Function Select Register A1	PS1	00 <sub>16</sub>
03B2 <sub>16</sub>	Function Select Register B0	PSL0	00 <sub>16</sub>
03B3 <sub>16</sub>	Function Select Register B1	PSL1	00 <sub>16</sub>
03B4 <sub>16</sub>	Function Select Register A2	PS2	00X0 0000 <sub>2</sub>
03B5 <sub>16</sub>	Function Select Register A3	PS3	00 <sub>16</sub>
03B6 <sub>16</sub>	Function Select Register B2	PSL2	00X0 0000 <sub>2</sub>
03B7 <sub>16</sub>	Function Select Register B3	PSL3	00 <sub>16</sub>
03B8 <sub>16</sub>			
03B9 <sub>16</sub>	Function Select Register A5	PS5	XXX0 0000 <sub>2</sub>
03BA <sub>16</sub>			
03BB <sub>16</sub>			
03BC <sub>16</sub>			
03BD <sub>16</sub>			
03BE <sub>16</sub>			
03BF <sub>16</sub>			
03C0 <sub>16</sub>	Port P6 Register	P6	XX <sub>16</sub>
03C1 <sub>16</sub>	Port P7 Register	P7	XX <sub>16</sub>
03C2 <sub>16</sub>	Port P6 Direction Register	PD6	00 <sub>16</sub>
03C3 <sub>16</sub>	Port P7 Direction Register	PD7	00 <sub>16</sub>
03C4 <sub>16</sub>	Port P8 Register	P8	XX <sub>16</sub>
03C5 <sub>16</sub>	Port P9 Register	P9	XX <sub>16</sub>
03C6 <sub>16</sub>	Port P8 Direction Register	PD8	00X0 0000 <sub>2</sub>
03C7 <sub>16</sub>	Port P9 Direction Register	PD9	00 <sub>16</sub>
03C8 <sub>16</sub>	Port P10 Register	P10	XX <sub>16</sub>
03C9 <sub>16</sub>	Port P11 Register	P11	XX <sub>16</sub>
03CA <sub>16</sub>	Port P10 Direction Register	PD10	00 <sub>16</sub>
03CB <sub>16</sub>	Port P11 Direction Register	PD11	XXX0 0000 <sub>2</sub>
03CC <sub>16</sub>	Port P12 Register	P12	XX <sub>16</sub>
03CD <sub>16</sub>	Port P13 Register	P13	XX <sub>16</sub>
03CE <sub>16</sub>	Port P12 Direction Register	PD12	00 <sub>16</sub>
03CF <sub>16</sub>	Port P13 Direction Register	PD13	00 <sub>16</sub>

X: Indeterminate

Blank spaces are reserved. No access is allowed.

## &lt;144-pin Package&gt;

Address	Register	Symbol	Value after RESET
03D0 <sub>16</sub>	Port P14 Register	P14	XX <sub>16</sub>
03D1 <sub>16</sub>	Port P15 Register	P15	XX <sub>16</sub>
03D2 <sub>16</sub>	Port P14 Direction Register	PD14	X000 0000 <sub>2</sub>
03D3 <sub>16</sub>	Port P15 Direction Register	PD15	00 <sub>16</sub>
03D4 <sub>16</sub>			
03D5 <sub>16</sub>			
03D6 <sub>16</sub>			
03D7 <sub>16</sub>			
03D8 <sub>16</sub>			
03D9 <sub>16</sub>			
03DA <sub>16</sub>	Pull-Up Control Register 2	PUR2	00 <sub>16</sub>
03DB <sub>16</sub>	Pull-Up Control Register 3	PUR3	00 <sub>16</sub>
03DC <sub>16</sub>	Pull-Up Control Register 4	PUR4	XXXX 0000 <sub>2</sub>
03DD <sub>16</sub>			
03DE <sub>16</sub>			
03DF <sub>16</sub>			
03E0 <sub>16</sub>	Port P0 Register	P0	XX <sub>16</sub>
03E1 <sub>16</sub>	Port P1 Register	P1	XX <sub>16</sub>
03E2 <sub>16</sub>	Port P0 Direction Register	PD0	00 <sub>16</sub>
03E3 <sub>16</sub>	Port P1 Direction Register	PD1	00 <sub>16</sub>
03E4 <sub>16</sub>	Port P2 Register	P2	XX <sub>16</sub>
03E5 <sub>16</sub>	Port P3 Register	P3	XX <sub>16</sub>
03E6 <sub>16</sub>	Port P2 Direction Register	PD2	00 <sub>16</sub>
03E7 <sub>16</sub>	Port P3 Direction Register	PD3	00 <sub>16</sub>
03E8 <sub>16</sub>	Port P4 Register	P4	XX <sub>16</sub>
03E9 <sub>16</sub>	Port P5 Register	P5	XX <sub>16</sub>
03EA <sub>16</sub>	Port P4 Direction Register	PD4	00 <sub>16</sub>
03EB <sub>16</sub>	Port P5 Direction Register	PD5	00 <sub>16</sub>
03EC <sub>16</sub>			
03ED <sub>16</sub>			
03EE <sub>16</sub>			
03EF <sub>16</sub>			
03F0 <sub>16</sub>	Pull-Up Control Register 0	PUR0	00 <sub>16</sub>
03F1 <sub>16</sub>	Pull-Up Control Register 1	PUR1	XXXX 0000 <sub>2</sub>
03F2 <sub>16</sub>			
03F3 <sub>16</sub>			
03F4 <sub>16</sub>			
03F5 <sub>16</sub>			
03F6 <sub>16</sub>			
03F7 <sub>16</sub>			
03F8 <sub>16</sub>			
03F9 <sub>16</sub>			
03FA <sub>16</sub>			
03FB <sub>16</sub>			
03FC <sub>16</sub>			
03FD <sub>16</sub>			
03FE <sub>16</sub>			
03FF <sub>16</sub>	Port Control Register	PCR	XXXX XXX0 <sub>2</sub>

X: Indeterminate

Blank spaces are reserved. No access is allowed.



## &lt;100-pin Package&gt;

Address	Register	Symbol	Value after RESET
03A0 <sub>16</sub>			
03A1 <sub>16</sub>			
03A2 <sub>16</sub>			
03A3 <sub>16</sub>			
03A4 <sub>16</sub>			
03A5 <sub>16</sub>			
03A6 <sub>16</sub>			
03A7 <sub>16</sub>	Function Select Register D1	PSD1	X0XX XX00 <sub>2</sub>
03A8 <sub>16</sub>			
03A9 <sub>16</sub>			
03AA <sub>16</sub>			
03AB <sub>16</sub>			
03AC <sub>16</sub>	Function Select Register C2	PSC2	XXXX X00X <sub>2</sub>
03AD <sub>16</sub>	Function Select Register C3	PSC3	X0XX XXXX <sub>2</sub>
03AE <sub>16</sub>			
03AF <sub>16</sub>	Function Select Register C	PSC	00X0 0000 <sub>2</sub>
03B0 <sub>16</sub>	Function Select Register A0	PS0	00 <sub>16</sub>
03B1 <sub>16</sub>	Function Select Register A1	PS1	00 <sub>16</sub>
03B2 <sub>16</sub>	Function Select Register B0	PSL0	00 <sub>16</sub>
03B3 <sub>16</sub>	Function Select Register B1	PSL1	00 <sub>16</sub>
03B4 <sub>16</sub>	Function Select Register A2	PS2	00X0 0000 <sub>2</sub>
03B5 <sub>16</sub>	Function Select Register A3	PS3	00 <sub>16</sub>
03B6 <sub>16</sub>	Function Select Register B2	PSL2	00X0 0000 <sub>2</sub>
03B7 <sub>16</sub>	Function Select Register B3	PSL3	00 <sub>16</sub>
03B8 <sub>16</sub>			
03B9 <sub>16</sub>			
03BA <sub>16</sub>			
03BB <sub>16</sub>			
03BC <sub>16</sub>			
03BD <sub>16</sub>			
03BE <sub>16</sub>			
03BF <sub>16</sub>			
03C0 <sub>16</sub>	Port P6 Register	P6	XX <sub>16</sub>
03C1 <sub>16</sub>	Port P7 Register	P7	XX <sub>16</sub>
03C2 <sub>16</sub>	Port P6 Direction Register	PD6	00 <sub>16</sub>
03C3 <sub>16</sub>	Port P7 Direction Register	PD7	00 <sub>16</sub>
03C4 <sub>16</sub>	Port P8 Register	P8	XX <sub>16</sub>
03C5 <sub>16</sub>	Port P9 Register	P9	XX <sub>16</sub>
03C6 <sub>16</sub>	Port P8 Direction Register	PD8	00X0 0000 <sub>2</sub>
03C7 <sub>16</sub>	Port P9 Direction Register	PD9	00 <sub>16</sub>
03C8 <sub>16</sub>	Port P10 Register	P10	XX <sub>16</sub>
03C9 <sub>16</sub>			
03CA <sub>16</sub>	Port P10 Direction Register	PD10	00 <sub>16</sub>
03CB <sub>16</sub>	Set default value to "FF <sub>16</sub> "		
03CC <sub>16</sub>			
03CD <sub>16</sub>			
03CE <sub>16</sub>	Set default value to "FF <sub>16</sub> "		
03CF <sub>16</sub>	Set default value to "FF <sub>16</sub> "		

X: Indeterminate

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## &lt;100-pin Package&gt;

Address	Register	Symbol	Value after RESET
03D0 <sub>16</sub>			
03D1 <sub>16</sub>			
03D2 <sub>16</sub>	Set default value to "FF <sub>16</sub> "		
03D3 <sub>16</sub>	Set default value to "FF <sub>16</sub> "		
03D4 <sub>16</sub>			
03D5 <sub>16</sub>			
03D6 <sub>16</sub>			
03D7 <sub>16</sub>			
03D8 <sub>16</sub>			
03D9 <sub>16</sub>			
03DA <sub>16</sub>	Pull-Up Control Register 2	PUR2	00 <sub>16</sub>
03DB <sub>16</sub>	Pull-Up Control Register 3	PUR3	00 <sub>16</sub>
03DC <sub>16</sub>	Set default value to "00 <sub>16</sub> "		
03DD <sub>16</sub>			
03DE <sub>16</sub>			
03DF <sub>16</sub>			
03E0 <sub>16</sub>	Port P0 Register	P0	XX <sub>16</sub>
03E1 <sub>16</sub>	Port P1 Register	P1	XX <sub>16</sub>
03E2 <sub>16</sub>	Port P0 Direction Register	PD0	00 <sub>16</sub>
03E3 <sub>16</sub>	Port P1 Direction Register	PD1	00 <sub>16</sub>
03E4 <sub>16</sub>	Port P2 Register	P2	XX <sub>16</sub>
03E5 <sub>16</sub>	Port P3 Register	P3	XX <sub>16</sub>
03E6 <sub>16</sub>	Port P2 Direction Register	PD2	00 <sub>16</sub>
03E7 <sub>16</sub>	Port P3 Direction Register	PD3	00 <sub>16</sub>
03E8 <sub>16</sub>	Port P4 Register	P4	XX <sub>16</sub>
03E9 <sub>16</sub>	Port P5 Register	P5	XX <sub>16</sub>
03EA <sub>16</sub>	Port P4 Direction Register	PD4	00 <sub>16</sub>
03EB <sub>16</sub>	Port P5 Direction Register	PD5	00 <sub>16</sub>
03EC <sub>16</sub>			
03ED <sub>16</sub>			
03EE <sub>16</sub>			
03EF <sub>16</sub>			
03F0 <sub>16</sub>	Pull-up Control Register 0	PUR0	00 <sub>16</sub>
03F1 <sub>16</sub>	Pull-up Control Register 1	PUR1	XXXX 0000 <sub>2</sub>
03F2 <sub>16</sub>			
03F3 <sub>16</sub>			
03F4 <sub>16</sub>			
03F5 <sub>16</sub>			
03F6 <sub>16</sub>			
03F7 <sub>16</sub>			
03F8 <sub>16</sub>			
03F9 <sub>16</sub>			
03FA <sub>16</sub>			
03FB <sub>16</sub>			
03FC <sub>16</sub>			
03FD <sub>16</sub>			
03FE <sub>16</sub>			
03FF <sub>16</sub>	Port Control Register	PCR	XXXX XXX0 <sub>2</sub>

X: Indeterminate

Blank spaces are reserved. No access is allowed.

## 5. Electrical Characteristics

### 5.1 Electrical Characteristics (M32C/84)

**Table 5.1 Absolute Maximum Ratings**

Symbol	Parameter		Condition	Value	Unit
V <sub>CC1</sub> , V <sub>CC2</sub>	Supply Voltage		V <sub>CC1</sub> =AV <sub>CC</sub>	-0.3 to 6.0	V
V <sub>CC2</sub>	Supply Voltage		-	-0.3 to V <sub>CC1</sub>	V
AV <sub>CC</sub>	Analog Supply Voltage		V <sub>CC1</sub> =AV <sub>CC</sub>	-0.3 to 6.0	V
V <sub>i</sub>	Input Voltage	RESET, CNV <sub>SS</sub> , BYTE, P60-P67, P72-P77, P80-P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup> , V <sub>REF</sub> , X <sub>IN</sub>		-0.3 to V <sub>CC1</sub> +0.3	V
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(1)</sup>		-0.3 to V <sub>CC2</sub> +0.3	
		P70, P71		-0.3 to 6.0	
V <sub>o</sub>	Output Voltage	P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>OUT</sub>		-0.3 to V <sub>CC1</sub> +0.3	V
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(1)</sup>		-0.3 to V <sub>CC2</sub> +0.3	
		P70, P71		-0.3 to 6.0	
P <sub>d</sub>	Power Dissipation		T <sub>opr</sub> =25° C	500	mW
T <sub>opr</sub>	Operating Ambient Temperature	during CPU operation		-20 to 85/ -40 to 85 <sup>(2)</sup>	° C
		during flash memory program and erase operation		0 to 60	
T <sub>stg</sub>	Storage Temperature			-65 to 150	° C

**NOTES:**

- P11 to P15 are provided in the 144-pin package only.
- Contact Renesas Technology Sales Co., Ltd, if temperature range of -40 to 85° C is required.

**Table 5.2 Recommended Operating Conditions**  
(VCC1= VCC2=3.0V to 5.5V at Topr=– 20 to 85°C unless otherwise specified)

Symbol	Parameter	Standard			Unit	
		Min.	Typ.	Max.		
VCC1, VCC2	Supply Voltage (VCC1≥ VCC2)	3.0	5.0	5.5	V	
AVCC	Analog Supply Voltage		VCC1		V	
VSS	Supply Voltage		0		V	
AVSS	Analog Supply Voltage		0		V	
VIH	Input High ("H") Voltage	P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(4)</sup>	0.8VCC2		VCC2	V
		P60-P67, P72-P77, P80-P87 <sup>(3)</sup> , P90-P97, P100-P107, P140-P146, P150-P157 <sup>(4)</sup> , XIN, RESET, CNVSS, BYTE	0.8VCC1		VCC1	
		P70, P71	0.8VCC1		6.0	
		P00-P07, P10-P17 (in single-chip mode)	0.8VCC2		VCC2	
		P00-P07, P10-P17 (in memory expansion mode and microprocessor mode)	0.5VCC2		VCC2	
VIL	Input Low ("L") Voltage	P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(4)</sup>	0		0.2VCC2	V
		P60-P67, P70-P77, P80-P87 <sup>(3)</sup> , P90-P97, P100-P107, P140-P146, P150-P157 <sup>(4)</sup> , XIN, RESET, CNVSS, BYTE	0		0.2VCC1	
		P00-P07, P10-P17 (in single-chip mode)	0		0.2VCC2	
		P00-P07, P10-P17 (in memory expansion mode and microprocessor mode)	0		0.16VCC2	
IOH(peak)	Peak Output High ("H") Current <sup>(2)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			-10.0	mA
IOH(avg)	Average Output High ("H") Current <sup>(1)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			-5.0	mA
IOL(peak)	Peak Output Low ("L") Current <sup>(2)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			10.0	mA
IOL(avg)	Average Output Low ("L") Current <sup>(1)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			5.0	mA

## NOTES:

1. Typical values when average output current is 100ms.
2. Total IOL(peak) for P0, P1, P2, P86, P87, P9, P10, P11, P14 and P15 must be 80mA or less.  
Total IOL(peak) for P3, P4, P5, P6, P7, P80 to P84, P12 and P13 must be 80mA or less.  
Total IOH(peak) for P0, P1, P2, and P11 must be -40mA or less.  
Total IOH(peak) for P86, P87, P9, P10, P14 and P15 must be -40mA or less.  
Total IOH(peak) for P3, P4, P5, P12 and P13 must be -40mA or less.  
Total IOH(peak) for P6, P7, and P80 to P84 must be -40mA or less.
3. VIH and VIL reference for P87 applies when P87 is used as a programmable input port.  
It does not apply when P87 is used as XCIN.
4. P11 to P15 are provided in the 144-pin package only.

**Table 5.2 Recommended Operating Conditions (Continued)**  
**(V<sub>CC1</sub>=V<sub>CC2</sub>=3.0V to 5.5V at Topr=-20 to 85°C unless otherwise specified)**

Symbol	Parameter		Standard			Unit
			Min.	Typ.	Max.	
f(BCLK)	CPU Clock Frequency	V <sub>CC1</sub> =4.2 to 5.5V	0		32	MHz
		V <sub>CC1</sub> =3.0 to 5.5V	0		24	MHz
f(XIN)	Main Clock Input Frequency	V <sub>CC1</sub> =4.2 to 5.5V	0		32	MHz
		V <sub>CC1</sub> =3.0 to 5.5V	0		24	MHz
f(XCIN)	Sub Clock Frequency		32.768	50	kHz	
f(Ring)	On-chip Oscillator Frequency (V <sub>CC1</sub> =V <sub>CC2</sub> =5.0V, Topr=25° C)		0.5	1	2	MHz
f(PLL)	PLL Clock Frequency	V <sub>CC1</sub> =4.2 to 5.5V	10		32	MHz
		V <sub>CC1</sub> =3.0 to 5.5V	10		24	MHz
t <sub>SU(PLL)</sub>	Wait Time to Stabilize PLL Frequency Synthesizer	V <sub>CC1</sub> =5.0V			5	ms
		V <sub>CC1</sub> =3.3V			10	ms

$$V_{CC1}=V_{CC2}=5V$$

**Table 5.3 Electrical Characteristics**

( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$ ,  $f(BCLK)=32MHz$  unless otherwise specified)

Symbol	Parameter		Condition	Standard			Unit	
				Min.	Typ.	Max.		
V <sub>OH</sub>	Output High ("H") Voltage	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137	I <sub>OH</sub> =-5mA	V <sub>CC2</sub> -2.0		V <sub>CC2</sub>	V	
		P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OH</sub> =-5mA	V <sub>CC1</sub> -2.0		V <sub>CC1</sub>		
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137	I <sub>OH</sub> =-200μA	V <sub>CC2</sub> -0.3		V <sub>CC2</sub>	V	
		P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OH</sub> =-200μA	V <sub>CC1</sub> -0.3		V <sub>CC1</sub>		
		X <sub>OUT</sub>	I <sub>OH</sub> =-1mA	3.0		V <sub>CC1</sub>	V	
		X <sub>COUT</sub>	High Power	No load applied		2.5		V
		Low Power	No load applied		1.6			
V <sub>OL</sub>	Output Low ("L") Voltage	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OL</sub> =5mA			2.0	V	
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OL</sub> =200μA			0.45	V	
		X <sub>OUT</sub>	I <sub>OL</sub> =1mA			2.0	V	
		X <sub>COUT</sub>	High Power	No load applied		0		V
			Low Power	No load applied		0		
V <sub>T+</sub> -V <sub>T-</sub>	Hysteresis	HOLD, RDY, TA0IN-TA4IN, TB0IN-TB5IN, INT0-INT5, AD <sub>TRG</sub> , CTS0-CTS4, CLK0-CLK4, TA0OUT-TA4OUT, NMI, KI0-KI3, RxD0-RxD4, SCL0-SCL4, SDA0-SDA4		0.2		1.0	V	
		RESET		0.2		1.8	V	
I <sub>IH</sub>	Input High ("H") Current	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =5V			5.0	μA	
I <sub>IL</sub>	Input Low ("L") Current	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =0V			-5.0	μA	
R <sub>PULLUP</sub>	Pull-up Resistance	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	V <sub>I</sub> =0V	Flash Memory	30	50	167	kΩ
				Masked ROM	20	40	167	
R <sub>fXIN</sub>	Feedback Resistance	X <sub>IN</sub>				1.5	MΩ	
R <sub>fXCIN</sub>	Feedback Resistance	X <sub>CIN</sub>				10	MΩ	
V <sub>RAM</sub>	RAM Standby Voltage	In stop mode				2.0	V	

## NOTES:

1. P11 to P15 are provided in the 144-pin package only.

$V_{CC1}=V_{CC2}=5V$

**Table 5.3 Electrical Characteristics (Continued)****( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$ ,  $f(BCLK)=32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition	Standard			Unit		
			Min.	Typ.	Max.			
I <sub>cc</sub>	Power Supply Current	In single-chip mode, output pins are left open and other pins are connected to V <sub>SS</sub> .	f(BCLK)=32 MHz, Square wave, No division		28	45	mA	
			f(BCLK)=32 kHz, In low-power consumption mode, Program running on ROM	Flash Memory		430		μA
				Masked ROM		25		
			f(BCLK)=32 kHz, In low-power consumption mode, Program running on RAM <sup>(1)</sup>		25		μA	
			f(BCLK)=32 kHz, In wait mode, T <sub>opr</sub> =25° C		10		μA	
			While clock stops, T <sub>opr</sub> =25° C		0.8	5	μA	
While clock stops, T <sub>opr</sub> =85° C			50	μA				

## NOTES:

- Value is obtained when setting the FMSTP bit in the FMR0 register to "1" (flash memory stopped).

$V_{CC1}=V_{CC2}=5V$

**Table 5.4 A/D Conversion Characteristics ( $V_{CC1}=V_{CC2}=AV_{CC}=V_{REF}=4.2$  to  $5.5V$ ,  $V_{SS}=AV_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$ ,  $f(BCLK) = 32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition		Standard			Unit
				Min.	Typ.	Max.	
-	Resolution	$V_{REF}=V_{CC1}$				10	Bits
INL	Integral Nonlinearity Error	$V_{REF}=V_{CC1}=V_{CC2}=5V$	AN <sub>0</sub> to AN <sub>7</sub> , AN <sub>00</sub> to AN <sub>07</sub> , AN <sub>20</sub> to AN <sub>27</sub> , AN <sub>150</sub> to AN <sub>157</sub> , ANEX <sub>0</sub> , ANEX <sub>1</sub>			±3	LSB
			External op-amp connection mode			±7	LSB
DNL	Differential Nonlinearity Error					±1	LSB
-	Offset Error					±3	LSB
-	Gain Error					±3	LSB
RLADDER	Resistor Ladder	$V_{REF}=V_{CC1}$		8		40	kΩ
t <sub>CONV</sub>	10-bit Conversion Time <sup>(1, 2)</sup>			2.06			μs
t <sub>CONV</sub>	8-bit Conversion Time <sup>(1, 2)</sup>			1.75			μs
t <sub>SAMP</sub>	Sampling Time <sup>(1)</sup>			0.188			μs
V <sub>REF</sub>	Reference Voltage			2		V <sub>CC1</sub>	V
V <sub>IA</sub>	Analog Input Voltage			0		V <sub>REF</sub>	V

## NOTES:

1. Divide  $f(X_{IN})$ , if exceeding 16 MHz, to keep  $\phi_{AD}$  frequency at 16 MHz or less.
2. With using the sample and hold function.

**Table 5.5 D/A Conversion Characteristics ( $V_{CC1}=V_{CC2}=V_{REF}=4.2$  to  $5.5V$ ,  $V_{SS}=AV_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$ ,  $f(BCLK) = 32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition		Standard			Unit
				Min.	Typ.	Max.	
-	Resolution					8	Bits
-	Absolute Accuracy					1.0	%
t <sub>SU</sub>	Setup Time					3	μs
R <sub>O</sub>	Output Resistance			4	10	20	kΩ
I <sub>VREF</sub>	Reference Power Supply Input Current	(Note 1)				1.5	mA

## NOTES:

1. Measurement when using one D/A converter. The DA<sub>i</sub> register (i=0, 1) of the D/A converter, not being used, is set to "00<sub>16</sub>". The resistor ladder in the A/D converter is excluded.  
I<sub>VREF</sub> flows even if the VCUT bit in the AD0CON1 register is set to "0" (no V<sub>REF</sub> connection).



$V_{CC1}=V_{CC2}=5V$

**Table 5.6 Flash Memory Version Electrical Characteristics (V<sub>CC1</sub>=4.5 to 5.5V, 3.3 to 3.6V at  
T<sub>opr</sub>=0 to 60°C unless otherwise specified)**

Symbol	Parameter	Standard			Unit	
		Min.	Typ.	Max.		
-	Program and Erase Endurance <sup>(2)</sup>	100			cycles	
-	Word Program Time (V <sub>CC1</sub> =5.0V, T <sub>opr</sub> =25° C)		25	200	μs	
-	Lock Bit Program Time		25	200	μs	
-	Block Erase Time (V <sub>CC1</sub> =5.0V, T <sub>opr</sub> =25° C)	4-Kbyte Block		0.3	4	s
		8-Kbyte Block		0.3	4	s
		32-Kbyte Block		0.5	4	s
		64-Kbyte Block		0.8	4	s
-	All-Unlocked-Block Erase Time <sup>(1)</sup>			4 x <i>n</i>	s	
t <sub>PS</sub>	Wait Time to Stabilize Flash Memory Circuit			15	μs	
-	Data Hold Time (T <sub>opr</sub> =-40 to 85 ° C)	10			years	

**NOTES:**

1. *n* denotes the number of block to be erased.

2. Number of program-erase cycles per block.

If Program and Erase Endurance is *n* cycle (*n*≠100), each block can be erased and programmed *n* cycles. For example, if a 4-Kbyte block A is erased after programming a word data 2,048 times, each to a different address, this counts as one program and erase endurance. Data can not be programmed to the same address more than once without erasing the block. (rewrite prohibited).

$V_{CC1}=V_{CC2}=5V$

**Table 5.7 Voltage Detection Circuit Electrical Characteristics ( $V_{CC1}=V_{CC2}=3.0$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=25^{\circ}C$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition	Standard			Unit
			Min.	Typ.	Max.	
Vdet4	Low Voltage Detection Voltage <sup>(1)</sup>	$V_{CC1}=3.0$ to $5.5V$		3.8		V
Vdet3	Reset Space Detection Voltage <sup>(1)</sup>			3.0		V
Vdet3s	Low Voltage Reset Hold Voltage		2.0			V
Vdet3r	Low Voltage Reset Release Voltage <sup>(2)</sup>			3.1		V

NOTES:

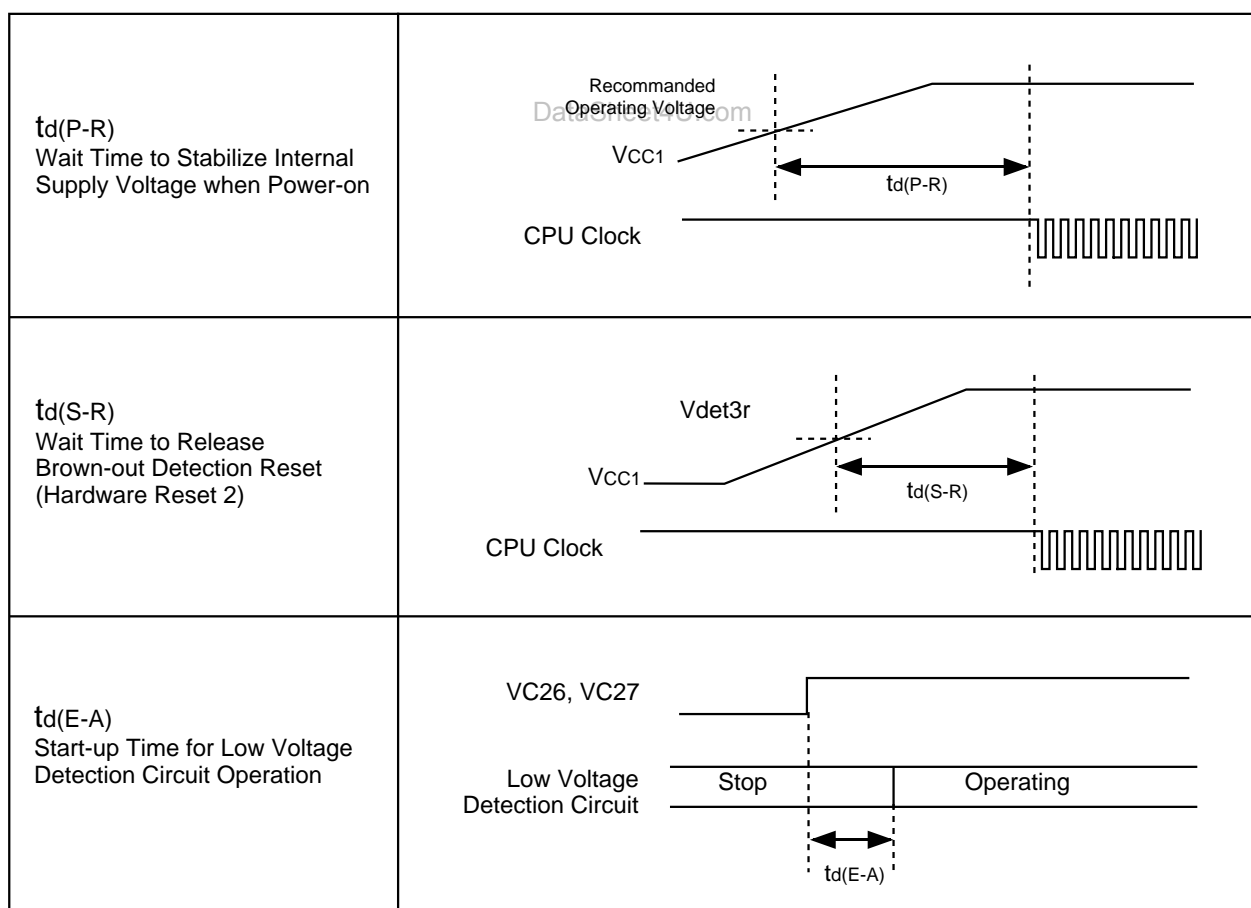
1.  $V_{det4} > V_{det3}$
2.  $V_{det3r} > V_{det3}$  is not guaranteed.

**Table 5.8 Power Supply Timing**

Symbol	Parameter	Measurement Condition	Standard			Unit
			Min.	Typ.	Max.	
td(P-R)	Wait Time to Stabilize Internal Supply Voltage when Power-on	$V_{CC1}=3.0$ to $5.5V$			2	ms
td(S-R)	Wait Time to Release Brown-out. Detection Reset	$V_{CC1}=V_{det3r}$ to $5.5V$		6 <sup>(1)</sup>	20	ms
td(E-A)	Start-up Time for Low Voltage Detection Circuit Operation	$V_{CC1}=3.0$ to $5.5V$			20	$\mu s$

NOTES:

1.  $V_{CC1}=5V$

**Figure 5.1 Power Supply Timing Diagram**

$$V_{CC1}=V_{CC2}=5V$$

### Timing Requirements

( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.9 External Clock Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_c$	External Clock Input Cycle Time	31.25		ns
$t_{w(H)}$	External Clock Input High ("H") Width	13.75		ns
$t_{w(L)}$	External Clock Input Low ("L") Width	13.75		ns
$t_r$	External Clock Rise Time		5	ns
$t_f$	External Clock Fall Time		5	ns

**Table 5.10 Memory Expansion Mode and Microprocessor Mode**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{ac1(RD-DB)}$	Data Input Access Time (RD standard)		(Note 1)	ns
$t_{ac1(AD-DB)}$	Data Input Access Time (AD standard, CS standard)		(Note 1)	ns
$t_{ac2(RD-DB)}$	Data Input Access Time (RD standard, when accessing a space with the multiplexrd bus)		(Note 1)	ns
$t_{ac2(AD-DB)}$	Data Input Access Time (AD standard, when accessing a space with the multiplexed bus)		(Note 1)	ns
$t_{su(DB-BCLK)}$	Data Input Setup Time	26		ns
$t_{su(RDY-BCLK)}$	$\overline{RDY}$ Input Setup Time	26		ns
$t_{su(HOLD-BCLK)}$	HOLD Input Setup Time	30		ns
$t_{h(RD-DB)}$	Data Input Hold Time	0		ns
$t_{h(BCLK-RDY)}$	$\overline{RDY}$ Input Hold Time	0		ns
$t_{h(BCLK-HOLD)}$	HOLD Input Hold Time	0		ns
$t_{d(BCLK-HLDA)}$	$\overline{HLDA}$ Output Delay Time		25	ns

**NOTES:**

1. Values can be obtained from the following equations, according to BCLK frequency and external bus cycles. Insert a wait state or lower the operation frequency,  $f_{(BCLK)}$ , if the calculated value is negative.

$$t_{ac1(RD-DB)} = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)+1)$$

$$t_{ac1(AD-DB)} = \frac{10^9 \times n}{f_{(BCLK)}} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, n=a+b)$$

$$t_{ac2(RD-DB)} = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)-1)$$

$$t_{ac2(AD-DB)} = \frac{10^9 \times p}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, p=\{(a+b-1) \times 2\} + 1)$$

$V_{CC1}=V_{CC2}=5V$

**Timing Requirements****( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$  unless otherwise specified)****Table 5.11 Timer A Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TA)}$	TAiIN Input Cycle Time	100		ns
$t_{w(TAH)}$	TAiIN Input High ("H") Width	40		ns
$t_{w(TAL)}$	TAiIN Input Low ("L") Width	40		ns

**Table 5.12 Timer A Input (Gate Input in Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TA)}$	TAiIN Input Cycle Time	400		ns
$t_{w(TAH)}$	TAiIN Input High ("H") Width	200		ns
$t_{w(TAL)}$	TAiIN Input Low ("L") Width	200		ns

**Table 5.13 Timer A Input (External Trigger Input in One-Shot Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TA)}$	TAiIN Input Cycle Time	200		ns
$t_{w(TAH)}$	TAiIN Input High ("H") Width	100		ns
$t_{w(TAL)}$	TAiIN Input Low ("L") Width	100		ns

**Table 5.14 Timer A Input (External Trigger Input in Pulse Width Modulation Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{w(TAH)}$	TAiIN Input High ("H") Width	100		ns
$t_{w(TAL)}$	TAiIN Input Low ("L") Width	100		ns

**Table 5.15 Timer A Input (Counter Increment/Decrement Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(UP)}$	TAiOUT Input Cycle Time	2000		ns
$t_{w(UPH)}$	TAiOUT Input High ("H") Width	1000		ns
$t_{w(UPL)}$	TAiOUT Input Low ("L") Width	1000		ns
$t_{su(UP-TIN)}$	TAiOUT Input Setup Time	400		ns
$t_{h(TIN-UP)}$	TAiOUT Input Hold Time	400		ns

$$V_{CC1}=V_{CC2}=5V$$

**Timing Requirements**

( $V_{CC1} = V_{CC2} = 4.2$  to  $5.5V$ ,  $V_{SS} = 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.16 Timer B Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time (counted on one edge)	100		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width (counted on one edge)	40		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width (counted on one edge)	40		ns
$t_{c(TB)}$	TBiIN Input Cycle Time (counted on both edges)	200		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width (counted on both edges)	80		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width (counted on both edges)	80		ns

**Table 5.17 Timer B Input (Pulse Period Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time	400		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width	200		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width	200		ns

**Table 5.18 Timer B Input (Pulse Width Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time	400		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width	200		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width	200		ns

**Table 5.19 A/D Trigger Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(AD)}$	ADTRG Input Cycle Time (required for trigger)	1000		ns
$t_{w(ADL)}$	ADTRG Input Low ("L") Width	125		ns

**Table 5.20 Serial I/O**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(CK)}$	CLKi Input Cycle Time	200		ns
$t_{w(CKH)}$	CLKi Input High ("H") Width	100		ns
$t_{w(CKL)}$	CLKi Input Low ("L") Width	100		ns
$t_{d(C-Q)}$	TxDi Output Delay Time		80	ns
$t_{h(C-Q)}$	TxDi Hold Time	0		ns
$t_{su(D-C)}$	RxDi Input Setup Time	30		ns
$t_{h(C-Q)}$	RxDi Input Hold Time	90		ns

**Table 5.21 External Interrupt INTi Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{w(INH)}$	INTi Input High ("H") Width	250		ns
$t_{w(INL)}$	INTi Input Low ("L") Width	250		ns

$$V_{CC1}=V_{CC2}=5V$$

### Switching Characteristics

( $V_{CC1} = V_{CC2} = 4.2$  to  $5.5V$ ,  $V_{SS} = 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.22 Memory Expansion Mode and Microprocessor Mode  
(when accessing external memory space)**

Symbol	Parameter	Measurement Condition	Standard		Unit
			Min.	Max.	
td(BCLK-AD)	Address Output Delay Time	See Figure 5.2		18	ns
th(BCLK-AD)	Address Output Hold Time (BCLK standard)		-3		ns
th(RD-AD)	Address Output Hold Time (RD standard) <sup>(3)</sup>		0		ns
th(WR-AD)	Address Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
td(BCLK-CS)	Chip-Select Signal Output Delay Time			18	ns
th(BCLK-CS)	Chip-Select Signal Output Hold Time (BCLK standard)		-3		ns
th(RD-CS)	Chip-Select Signal Output Hold Time (RD standard) <sup>(3)</sup>		0		ns
th(WR-CS)	Chip-Select Signal Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
td(BCLK-RD)	RD Signal Output Delay Time			18	ns
th(BCLK-RD)	RD Signal Output Hold Time		-5		ns
td(BCLK-WR)	WR Signal Output Delay Time			18	ns
th(BCLK-WR)	WR Signal Output Hold Time		-5		ns
td(DB-WR)	Data Output Delay Time (WR standard)		(Note 2)		ns
th(WR-DB)	Data Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
tW(WR)	WR Output Width		(Note 2)		ns

#### NOTES:

1. Values can be obtained from the following equations, according to BCLK frequency.

$$t_{h(WR-DB)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-AD)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-CS)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

2. Values can be obtained from the following equations, according to BCLK frequency and external bus cycles.

$$t_{W(WR)} = \frac{10^9 \times n}{f_{(BCLK)} \times 2} - 15 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n=(bx2)-1)$$

$$t_{d(DB-WR)} = \frac{10^9 \times m}{f_{(BCLK)}} - 20 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, m= b)$$

3.  $t_c$  ns is added when recovery cycle is inserted.

$$V_{CC1}=V_{CC2}=5V$$

### Switching Characteristics

( $V_{CC} = 4.2$  to  $5.5V$ ,  $V_{SS} = 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.23 Memory Expansion Mode and Microprocessor Mode**  
(when accessing an external memory space with the multiplexed bus)

Symbol	Parameter	Measurement Condition	Standard		Unit
			Min.	Max.	
$t_{d(BCLK-AD)}$	Address Output Delay Time	See Figure 5.2		18	ns
$t_{h(BCLK-AD)}$	Address Output Hold Time (BCLK standard)		-3		ns
$t_{h(RD-AD)}$	Address Output Hold Time (RD standard) <sup>(5)</sup>		(Note 1)		ns
$t_{h(WR-AD)}$	Address Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
$t_{d(BCLK-CS)}$	Chip-Select Signal Output Delay Time			18	ns
$t_{h(BCLK-CS)}$	Chip-Select Signal Output Hold Time (BCLK standard)		-3		ns
$t_{h(RD-CS)}$	Chip-Select Signal Output Hold Time (RD standard) <sup>(5)</sup>		(Note 1)		ns
$t_{h(WR-CS)}$	Chip-Select Signal Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
$t_{d(BCLK-RD)}$	RD Signal Output Delay Time			18	ns
$t_{h(BCLK-RD)}$	RD Signal Output Hold Time		-5		ns
$t_{d(BCLK-WR)}$	WR Signal Output Delay Time			18	ns
$t_{h(BCLK-WR)}$	WR Signal Output Hold Time		-5		ns
$t_{d(DB-WR)}$	Data Output Delay Time (WR standard)		(Note 2)		ns
$t_{h(WR-DB)}$	Data Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
$t_{d(BCLK-ALE)}$	ALE Signal Output Delay Time (BCLK standard)			18	ns
$t_{h(BCLK-ALE)}$	ALE Signal Output Hold Time (BCLK standard)		-2		ns
$t_{d(AD-ALE)}$	ALE Signal Output Delay Time (address standard)		(Note 3)		ns
$t_{h(ALE-AD)}$	ALE Signal Output Hold Time (address standard)		(Note 4)		ns
$t_{dZ(RD-AD)}$	Address Output Float Start Time			8	ns

#### NOTES:

1. Values can be obtained from the following equations, according to BCLK frequency.

$$t_{h(RD-AD)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-AD)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(RD-CS)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-CS)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-DB)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

2. Values can be obtained from the following equations, according to BCLK frequency and external bus cycle.

$$t_{d(DB-WR)} = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 25 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, m = (bx2)-1)$$

3. Values can be obtained from the following equations, according to BCLK frequency and external bus cycle.

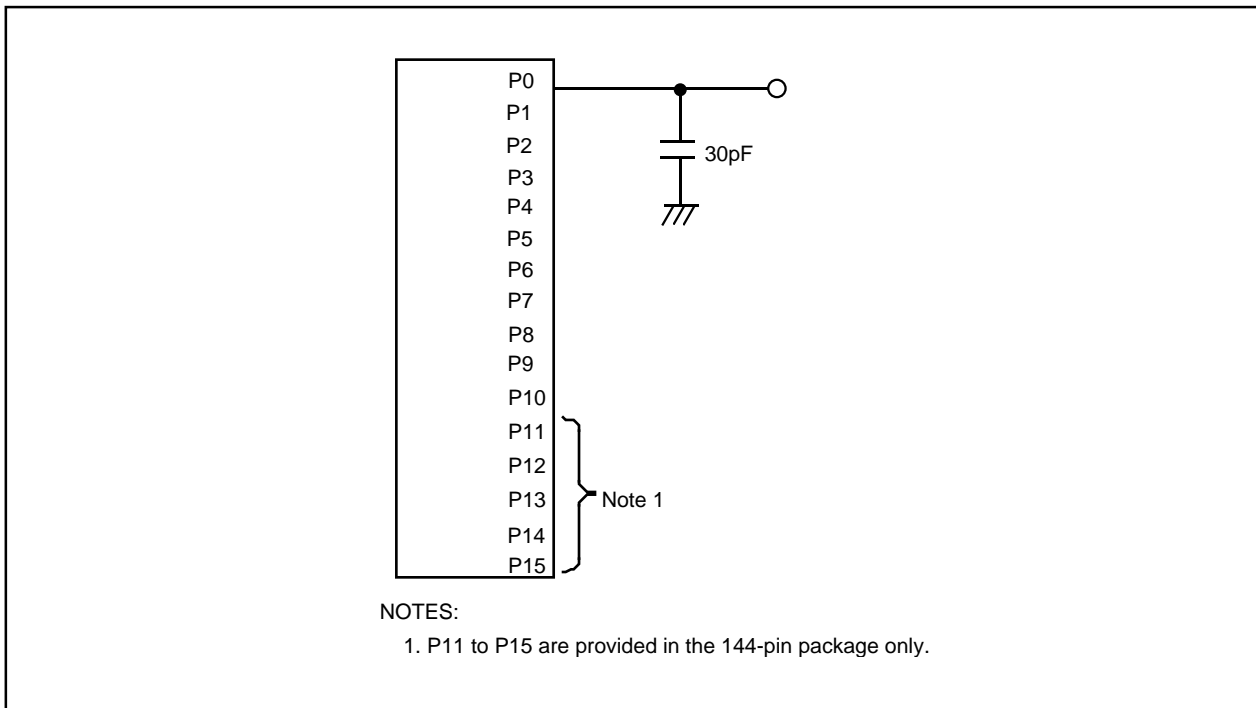
$$t_{d(AD-ALE)} = \frac{10^9 \times n}{f_{(BCLK)} \times 2} - 20 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n = a)$$

4. Values can be obtained from the following equations, according to BCLK frequency and external bus cycle.

$$t_{h(ALE-AD)} = \frac{10^9 \times n}{f_{(BCLK)} \times 2} - 10 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n = a)$$

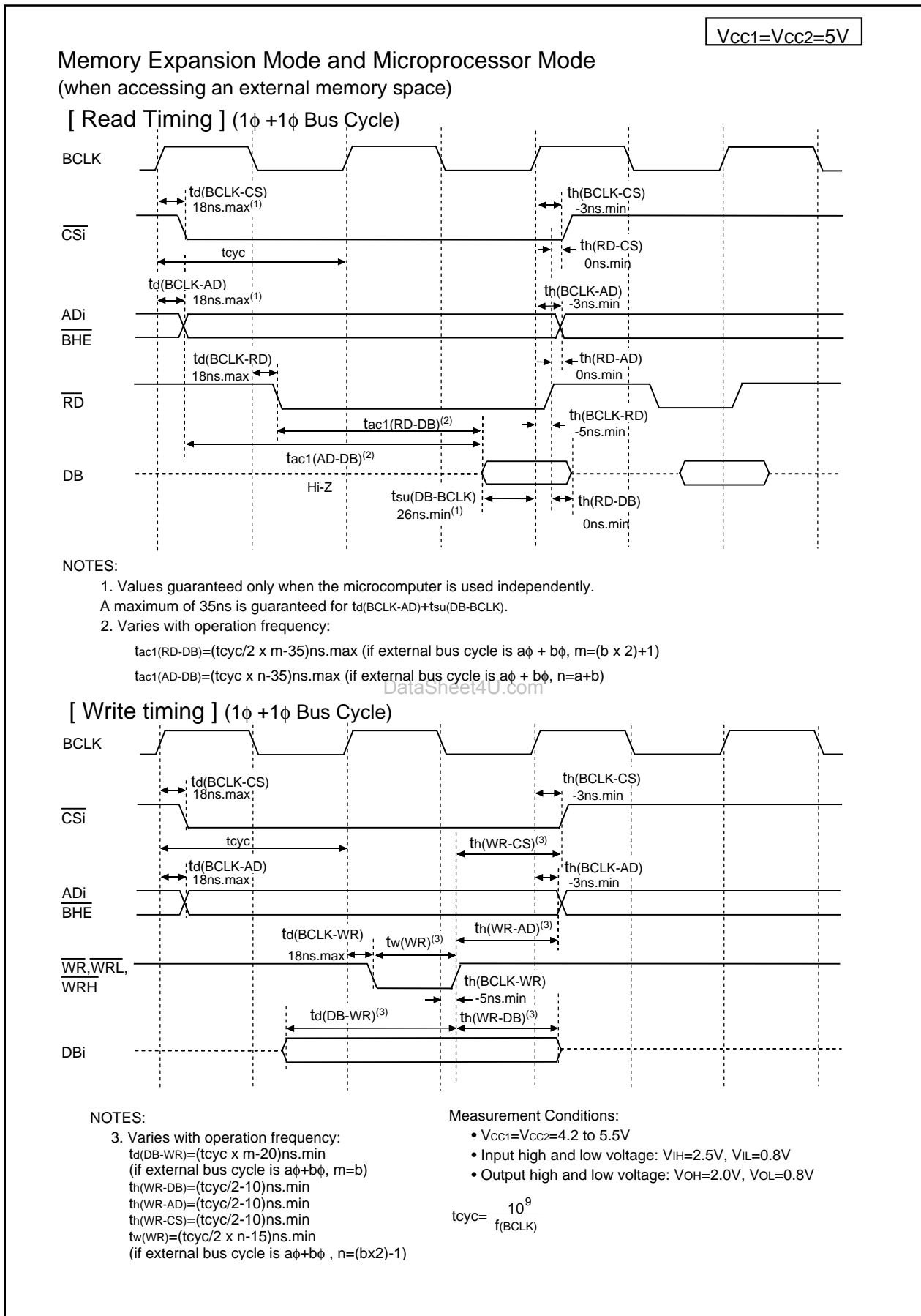
5.  $t_c$  ns is added when recovery cycle is inserted.

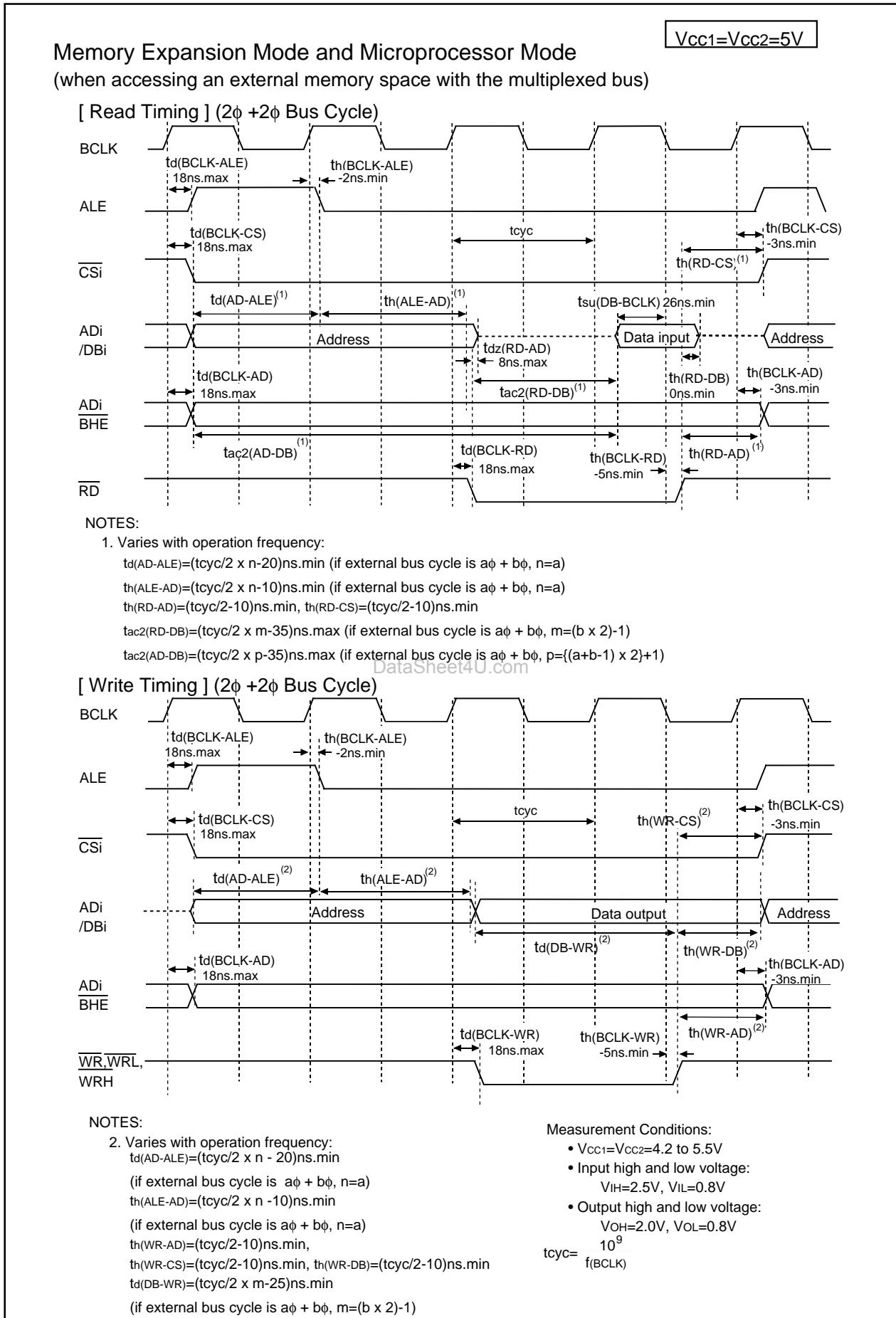
$$V_{CC1}=V_{CC2}=5V$$

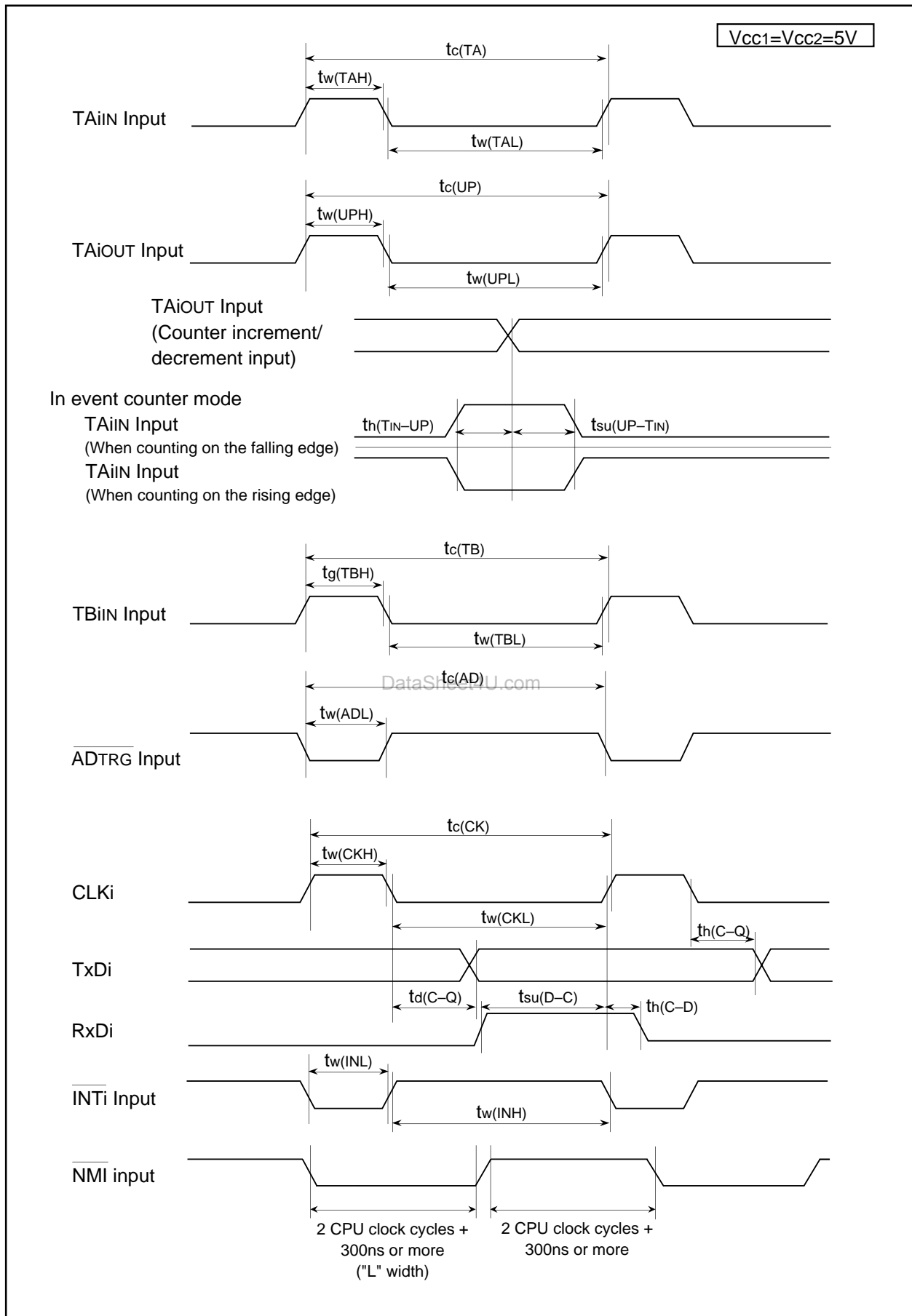


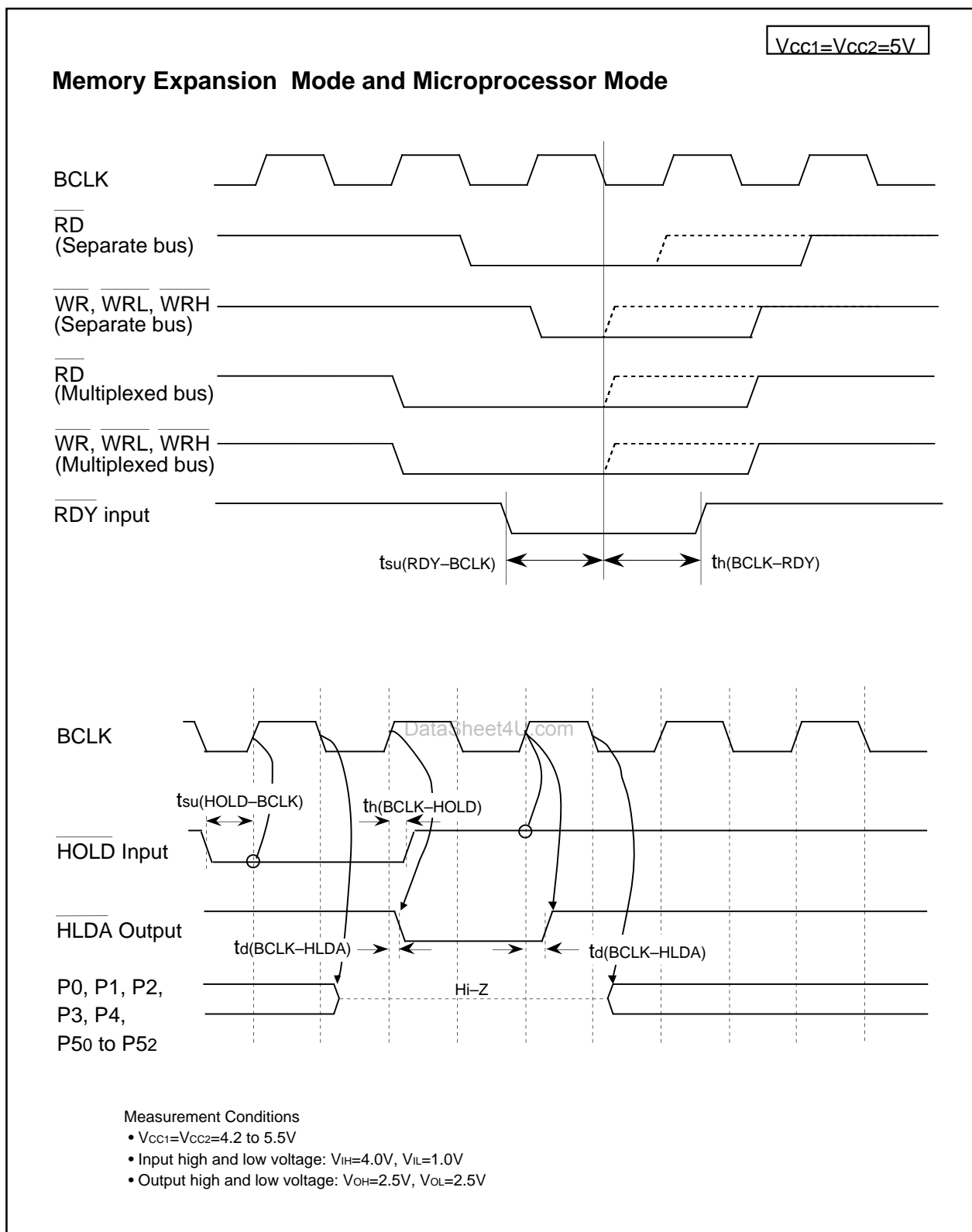
**Figure 5.2 P0 to P15 Measurement Circuit**



Figure 5.3 V<sub>CC1</sub>=V<sub>CC2</sub>=5V Timing Diagram (1)

Figure 5.4 V<sub>CC1</sub>=V<sub>CC2</sub>=5V Timing Diagram (2)

Figure 5.5  $V_{CC1}=V_{CC2}=5V$  Timing Diagram (3)

Figure 5.6  $V_{CC1}=V_{CC2}=5V$  Timing Diagram (4)

$V_{CC1}=V_{CC2}=3.3V$

**Table 5.24 Electrical Characteristics ( $V_{CC1}=V_{CC2}=3.0$  to  $3.6V$ ,  $V_{SS}=0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$ ,  $f(BCLK)=24MHz$  unless otherwise specified)**

Symbol	Parameter		Condition	Standard			Unit	
				Min.	Typ.	Max.		
V <sub>OH</sub>	Output High ("H") Voltage	P0 <sub>0</sub> -P0 <sub>7</sub> , P1 <sub>0</sub> -P1 <sub>7</sub> , P2 <sub>0</sub> -P2 <sub>7</sub> , P3 <sub>0</sub> -P3 <sub>7</sub> , P4 <sub>0</sub> -P4 <sub>7</sub> , P5 <sub>0</sub> -P5 <sub>7</sub> , P11 <sub>0</sub> -P11 <sub>4</sub> , P12 <sub>0</sub> -P12 <sub>7</sub> , P13 <sub>0</sub> -P13 <sub>7</sub>	IOH=-1mA	V <sub>CC2</sub> -0.6		V <sub>CC2</sub>	V	
		P6 <sub>0</sub> -P6 <sub>7</sub> , P7 <sub>2</sub> -P7 <sub>7</sub> , P8 <sub>0</sub> -P8 <sub>4</sub> , P8 <sub>6</sub> , P8 <sub>7</sub> , P9 <sub>0</sub> -P9 <sub>7</sub> , P10 <sub>0</sub> -P10 <sub>7</sub> , P14 <sub>0</sub> -P14 <sub>6</sub> , P15 <sub>0</sub> -P15 <sub>7</sub> <sup>(1)</sup>		V <sub>CC1</sub> -0.6		V <sub>CC1</sub>	V	
	X <sub>OUT</sub>	IOH=-0.1mA	2.7		V <sub>CC1</sub>	V		
	X <sub>COUT</sub>	High Power	No load applied		2.5		V	
		Low Power	No load applied		1.6		V	
V <sub>OL</sub>	Output Low ("L") Voltage	P0 <sub>0</sub> -P0 <sub>7</sub> , P1 <sub>0</sub> -P1 <sub>7</sub> , P2 <sub>0</sub> -P2 <sub>7</sub> , P3 <sub>0</sub> -P3 <sub>7</sub> , P4 <sub>0</sub> -P4 <sub>7</sub> , P5 <sub>0</sub> -P5 <sub>7</sub> , P6 <sub>0</sub> -P6 <sub>7</sub> , P7 <sub>0</sub> -P7 <sub>7</sub> , P8 <sub>0</sub> -P8 <sub>4</sub> , P8 <sub>6</sub> , P8 <sub>7</sub> , P9 <sub>0</sub> -P9 <sub>7</sub> , P10 <sub>0</sub> -P10 <sub>7</sub> , P11 <sub>0</sub> -P11 <sub>4</sub> , P12 <sub>0</sub> -P12 <sub>7</sub> , P13 <sub>0</sub> -P13 <sub>7</sub> , P14 <sub>0</sub> -P14 <sub>6</sub> , P15 <sub>0</sub> -P15 <sub>7</sub> <sup>(1)</sup>	IO <sub>L</sub> =1mA			0.5	V	
		X <sub>OUT</sub>	IO <sub>L</sub> =0.1mA			0.5	V	
	X <sub>COUT</sub>	High Power	No load applied		0		V	
		Low Power	No load applied		0		V	
	V <sub>T+</sub> -V <sub>T-</sub>	Hysteresis	HOLD, RDY, TA0 <sub>IN</sub> -TA4 <sub>IN</sub> , TB0 <sub>IN</sub> -TB5 <sub>IN</sub> , INT0-INT5, AD <sub>TRG</sub> , CTS0-CTS4, CLK0-CLK4, TA0 <sub>OUT</sub> -TA4 <sub>OUT</sub> , NMI, KI0-KI3, RxD0-RxD4, SCL0-SCL4, SDA0-SDA4		0.2		1.0	V
RESET				0.2		1.8	V	
I <sub>IH</sub>	Input High ("H") Current	P0 <sub>0</sub> -P0 <sub>7</sub> , P1 <sub>0</sub> -P1 <sub>7</sub> , P2 <sub>0</sub> -P2 <sub>7</sub> , P3 <sub>0</sub> -P3 <sub>7</sub> , P4 <sub>0</sub> -P4 <sub>7</sub> , P5 <sub>0</sub> -P5 <sub>7</sub> , P6 <sub>0</sub> -P6 <sub>7</sub> , P7 <sub>0</sub> -P7 <sub>7</sub> , P8 <sub>0</sub> -P8 <sub>7</sub> , P9 <sub>0</sub> -P9 <sub>7</sub> , P10 <sub>0</sub> -P10 <sub>7</sub> , P11 <sub>0</sub> -P11 <sub>4</sub> , P12 <sub>0</sub> -P12 <sub>7</sub> , P13 <sub>0</sub> -P13 <sub>7</sub> , P14 <sub>0</sub> -P14 <sub>6</sub> , P15 <sub>0</sub> -P15 <sub>7</sub> <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =3V			4.0	μA	
I <sub>IL</sub>	Input Low ("L") Current	P0 <sub>0</sub> -P0 <sub>7</sub> , P1 <sub>0</sub> -P1 <sub>7</sub> , P2 <sub>0</sub> -P2 <sub>7</sub> , P3 <sub>0</sub> -P3 <sub>7</sub> , P4 <sub>0</sub> -P4 <sub>7</sub> , P5 <sub>0</sub> -P5 <sub>7</sub> , P6 <sub>0</sub> -P6 <sub>7</sub> , P7 <sub>0</sub> -P7 <sub>7</sub> , P8 <sub>0</sub> -P8 <sub>7</sub> , P9 <sub>0</sub> -P9 <sub>7</sub> , P10 <sub>0</sub> -P10 <sub>7</sub> , P11 <sub>0</sub> -P11 <sub>4</sub> , P12 <sub>0</sub> -P12 <sub>7</sub> , P13 <sub>0</sub> -P13 <sub>7</sub> , P14 <sub>0</sub> -P14 <sub>6</sub> , P15 <sub>0</sub> -P15 <sub>7</sub> <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =0V			-4.0	μA	
R <sub>PULLUP</sub>	Pull-up Resistance	P0 <sub>0</sub> -P0 <sub>7</sub> , P1 <sub>0</sub> -P1 <sub>7</sub> , P2 <sub>0</sub> -P2 <sub>7</sub> , P3 <sub>0</sub> -P3 <sub>7</sub> , P4 <sub>0</sub> -P4 <sub>7</sub> , P5 <sub>0</sub> -P5 <sub>7</sub> , P6 <sub>0</sub> -P6 <sub>7</sub> , P7 <sub>2</sub> -P7 <sub>7</sub> , P8 <sub>0</sub> -P8 <sub>4</sub> , P8 <sub>6</sub> , P8 <sub>7</sub> , P9 <sub>0</sub> -P9 <sub>7</sub> , P10 <sub>0</sub> -P10 <sub>7</sub> , P11 <sub>0</sub> -P11 <sub>4</sub> , P12 <sub>0</sub> -P12 <sub>7</sub> , P13 <sub>0</sub> -P13 <sub>7</sub> , P14 <sub>0</sub> -P14 <sub>6</sub> , P15 <sub>0</sub> -P15 <sub>7</sub> <sup>(1)</sup>	V <sub>I</sub> =0V	Flash Memory	66	120	500	kΩ
				Masked ROM	40	70	500	kΩ
R <sub>fXIN</sub>	Feedback Resistance	X <sub>IN</sub>				3.0	MΩ	
R <sub>fXCIN</sub>	Feedback Resistance	X <sub>CIN</sub>				20.0	MΩ	
V <sub>RAM</sub>	RAM Standby Voltage	in stop mode		2.0			V	
I <sub>CC</sub>	Power Supply Current	Measurement condition: In single-chip mode, output pins are left open and other pins are connected to V <sub>SS</sub> .	f(BCLK)=24 MHz, Square wave, No division		22	35	mA	
			f(BCLK)=32 kHz, In wait mode, T <sub>opr</sub> =25° C		10		μA	
			While clock stops, T <sub>opr</sub> =25° C		0.8	5	μA	
			While clock stops, T <sub>opr</sub> =85° C			50	μA	

## NOTES:

- P11 to P15 are provided in the 144-pin package only.

$V_{CC1}=V_{CC2}=3.3V$

**Table 5.25 A/D Conversion Characteristics ( $V_{CC1}=V_{CC2}=AV_{CC}=V_{REF}=3.0$  to  $3.6V$ ,  $V_{SS}=AV_{SS}=0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$ ,  $f(BCLK) = 24MHz$  unless otherwise specified)**

Symbol	Parameter		Measurement Condition	Standard			Unit
				Min.	Typ.	Max.	
-	Resolution		$V_{REF}=V_{CC1}$			10	Bits
INL	Integral Nonlinearity Error	No S&H (8-bit)	$V_{CC1}=V_{CC2}=V_{REF}=3.3V$			$\pm 2$	LSB
DNL	Differential Nonlinearity Error	No S&H (8-bit)				$\pm 1$	LSB
-	Offset Error	No S&H (8-bit)				$\pm 2$	LSB
-	Gain Error	No S&H (8-bit)				$\pm 2$	LSB
RLADDER	Resistor Ladder		$V_{REF}=V_{CC1}$	8		40	k $\Omega$
tCONV	8-bit Conversion Time <sup>(1, 2)</sup>			6.1			$\mu s$
VREF	Reference Voltage			3		$V_{CC1}$	V
VIA	Analog Input Voltage			0		$V_{REF}$	V

S&amp;H: Sample and Hold

## NOTES:

1. Divide  $f(X_{IN})$ , if exceeding 10 MHz, to keep  $\phi AD$  frequency at 10 MHz or less.
2. S&H not available.

**Table 5.26 D/A Conversion Characteristics ( $V_{CC1}=V_{CC2}=V_{REF}=3.0$  to  $3.6V$ ,  $V_{SS}=AV_{SS}=0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$ ,  $f(BCLK) = 24MHz$  unless otherwise specified)**

Symbol	Parameter		Measurement Condition	Standard			Unit
				Min.	Typ.	Max.	
-	Resolution					8	Bits
-	Absolute Accuracy					1.0	%
tsu	Setup Time					3	$\mu s$
Ro	Output Resistance			4	10	20	k $\Omega$
IvREF	Reference Power Supply Input Current		(Note 1)			1.0	mA

## NOTES:

1. Measurement results when using one D/A converter. The DAi register (i=0, 1) of the D/A converter, not being used, is set to "00<sub>16</sub>". The resistor ladder in the A/D converter is excluded.  
IvREF flows even if the VCUT bit in the AD0CON1 register is set to "0" (no VREF connection).

$$V_{CC1}=V_{CC2}=3.3V$$

### Timing Requirements

( $V_{CC1}=V_{CC2}=3.0$  to  $3.6V$ ,  $V_{SS}=0V$  at  $T_{opr}=-20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.27 External Clock Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
tc	External Clock Input Cycle Time	41		ns
tw(H)	External Clock Input High ("H") Width	18		ns
tw(L)	External Clock Input Low ("L") Width	18		ns
tr	External Clock Rise Time		5	ns
tf	External Clock Fall Time		5	ns

**Table 5.28 Memory Expansion Mode and Microprocessor Mode**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
tac1(RD-DB)	Data Input Access Time (RD standard)		(Note 1)	ns
tac1(AD-DB)	Data Input Access Time (AD standard, CS standard)		(Note 1)	ns
tac2(RD-DB)	Data Input Access Time (RD standard, when accessing a space with the multiplexed bus)		(Note 1)	ns
tac2(AD-DB)	Data Input Access Time (AD standard, when accessing a space with the multiplexed bus)		(Note 1)	ns
tsu(DB-BCLK)	Data Input Setup Time	30		ns
tsu(RDY-BCLK)	RDY Input Setup Time	40		ns
tsu(HOLD-BCLK)	HOLD Input Setup Time	60		ns
th(RD-DB)	Data Input Hold Time	0		ns
th(BCLK-RDY)	RDY Input Hold Time	0		ns
th(BCLK-HOLD)	HOLD Input Hold Time	0		ns
td(BCLK-HLDA)	HLDA Output Delay Time		25	ns

**NOTES:**

- Values can be obtained from the following equations, according to BCLK frequency and external bus cycles. Insert a wait state or lower the operation frequency,  $f_{(BCLK)}$ , if the calculated value is negative.

$$t_{ac1(RD-DB)} = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)+1)$$

$$t_{ac1(AD-DB)} = \frac{10^9 \times n}{f_{(BCLK)}} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, n=a+b)$$

$$t_{ac2(RD-DB)} = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)-1)$$

$$t_{ac2(AD-DB)} = \frac{10^9 \times p}{f_{(BCLK)} \times 2} - 35 \quad [\text{ns}] \text{ (if external bus cycle is } a\phi + b\phi, p=((a+b-1)x2)+1)$$

$V_{CC1}=V_{CC2}=3.3V$

**Timing Requirements****( $V_{CC1}=V_{CC2}= 3.0$  to  $3.6V$ ,  $V_{SS}= 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)****Table 5.29 Timer A Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{C(TA)}$	TAiIN Input Cycle Time	100		ns
$t_{W(TAH)}$	TAiIN Input High ("H") Width	40		ns
$t_{W(TAL)}$	TAiIN Input Low ("L") Width	40		ns

**Table 5.30 Timer A Input (Gate Input in Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{C(TA)}$	TAiIN Input Cycle Time	400		ns
$t_{W(TAH)}$	TAiIN Input High ("H") Width	200		ns
$t_{W(TAL)}$	TAiIN Input Low ("L") Width	200		ns

**Table 5.31 Timer A Input (External Trigger Input in One-Shot Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{C(TA)}$	TAiIN Input Cycle Time	200		ns
$t_{W(TAH)}$	TAiIN Input High ("H") Width	100		ns
$t_{W(TAL)}$	TAiIN Input Low ("L") Width	100		ns

**Table 5.32 Timer A Input (External Trigger Input in Pulse Width Modulation Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{W(TAH)}$	TAiIN Input High ("H") Width	100		ns
$t_{W(TAL)}$	TAiIN Input Low ("L") Width	100		ns

**Table 5.33 Timer A Input (Counter Increment/decrement Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{C(UP)}$	TAiOUT Input Cycle Time	2000		ns
$t_{W(UPH)}$	TAiOUT Input High ("H") Width	1000		ns
$t_{W(UPL)}$	TAiOUT Input Low ("L") Width	1000		ns
$t_{SU(UP-TIN)}$	TAiOUT Input Setup Time	400		ns
$t_{H(TIN-UP)}$	TAiOUT Input Hold Time	400		ns



$$V_{CC1}=V_{CC2}=3.3V$$

### Timing Requirements

( $V_{CC1}=V_{CC2}=3.0$  to  $3.6V$ ,  $V_{SS}=0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.34 Timer B Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TB <sub>iIN</sub> Input Cycle Time (counted on one edge)	100		ns
$t_{w(TBH)}$	TB <sub>iIN</sub> Input High ("H") Width (counted on one edge)	40		ns
$t_{w(TBL)}$	TB <sub>iIN</sub> Input Low ("L") Width (counted on one edge)	40		ns
$t_{c(TB)}$	TB <sub>iIN</sub> Input Cycle Time (counted on both edges)	200		ns
$t_{w(TBH)}$	TB <sub>iIN</sub> Input High ("H") Width (counted on both edges)	80		ns
$t_{w(TBL)}$	TB <sub>iIN</sub> Input Low ("L") Width (counted on both edges)	80		ns

**Table 5.35 Timer B Input (Pulse Period Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TB <sub>iIN</sub> Input Cycle Time	400		ns
$t_{w(TBH)}$	TB <sub>iIN</sub> Input High ("H") Width	200		ns
$t_{w(TBL)}$	TB <sub>iIN</sub> Input Low ("L") Width	200		ns

**Table 5.36 Timer B Input (Pulse Width Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TB <sub>iIN</sub> Input Cycle Time	400		ns
$t_{w(TBH)}$	TB <sub>iIN</sub> Input High ("H") Width	200		ns
$t_{w(TBL)}$	TB <sub>iIN</sub> Input Low ("L") Width	200		ns

**Table 5.37 A/D Trigger Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(AD)}$	$\overline{AD}_{TRG}$ Input Cycle Time (required for trigger)	1000		ns
$t_{w(ADL)}$	$\overline{AD}_{TRG}$ Input Low ("L") Width	125		ns

**Table 5.38 Serial I/O**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(CK)}$	CLK <sub>i</sub> Input Cycle Time	200		ns
$t_{w(CKH)}$	CLK <sub>i</sub> Input High ("H") Width	100		ns
$t_{w(CKL)}$	CLK <sub>i</sub> Input Low ("L") Width	100		ns
$t_{d(C-Q)}$	TxD <sub>i</sub> Output Delay Time		80	ns
$t_{h(C-Q)}$	TxD <sub>i</sub> Hold Time	0		ns
$t_{su(D-C)}$	RxD <sub>i</sub> Input Setup Time	30		ns
$t_{h(C-Q)}$	RxD <sub>i</sub> Input Hold Time	90		ns

**Table 5.39 External Interrupt  $\overline{INT}_i$  Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{w(INH)}$	$\overline{INT}_i$ Input High ("H") Width	250		ns
$t_{w(INL)}$	$\overline{INT}_i$ Input Low ("L") Width	250		ns

$$V_{CC1}=V_{CC2}=3.3V$$

### Switching Characteristics

( $V_{CC1}=V_{CC2}=3.0$  to  $3.6V$ ,  $V_{SS} = 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.40 Memory Expansion Mode and Microprocessor Mode  
(when accessing external memory space)**

Symbol	Parameter	Measurement Condition	Standard		Unit
			Min.	Max.	
$t_{d(BCLK-AD)}$	Address Output Delay Time	See Figure 5.2		18	ns
$t_{h(BCLK-AD)}$	Address Output Hold Time (BCLK standard)		0		ns
$t_{h(RD-AD)}$	Address Output Hold Time (RD standard) <sup>(3)</sup>		0		ns
$t_{h(WR-AD)}$	Address Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
$t_{d(BCLK-CS)}$	Chip-Select Signal Output Delay Time			18	ns
$t_{h(BCLK-CS)}$	Chip-Select Signal Output Hold Time (BCLK standard)		0		ns
$t_{h(RD-CS)}$	Chip-Select Signal Output Hold Time (RD standard) <sup>(3)</sup>		0		ns
$t_{h(WR-CS)}$	Chip-Select Signal Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
$t_{d(BCLK-RD)}$	RD Signal Output Delay Time			18	ns
$t_{h(BCLK-RD)}$	RD Signal Output Hold Time		-3		ns
$t_{d(BCLK-WR)}$	WR Signal Output Delay Time			18	ns
$t_{h(BCLK-WR)}$	WR Signal Output Hold Time		0		ns
$t_{d(DB-WR)}$	Data Output Delay Time (WR standard)		(Note 2)		ns
$t_{h(WR-DB)}$	Data Output Hold Time (WR standard) <sup>(3)</sup>		(Note 1)		ns
$t_{w(WR)}$	WR Output Width		(Note 2)		ns

#### NOTES:

1. Values can be obtained from the following equations, according to BCLK frequency.

$$t_{h(WR-DB)} = \frac{10^9}{f_{(BCLK)} \times 2} - 20 \quad [ns]$$

$$t_{h(WR-AD)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

$$t_{h(WR-CS)} = \frac{10^9}{f_{(BCLK)} \times 2} - 10 \quad [ns]$$

2. Values can be obtained from the following equations, according to BCLK frequency and external bus cycles.

$$t_{w(WR)} = \frac{10^9 \times n}{f_{(BCLK)} \times 2} - 15 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n=(b \times 2)-1)$$

$$t_{d(DB-WR)} = \frac{10^9 \times m}{f_{(BCLK)}} - 20 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, m=b)$$

3.  $t_{cns}$  is added when recovery cycle is inserted.

$$V_{CC1}=V_{CC2}=3.3V$$

### Switching Characteristics

( $V_{CC1} = V_{CC2} = 3.0$  to  $3.6V$ ,  $V_{SS} = 0V$  at  $T_{opr} = -20$  to  $85^{\circ}C$  unless otherwise specified)

**Table 5.41 Memory Expansion Mode and Microprocessor Mode**  
(when accessing an external memory space with the multiplexed bus)

Symbol	Parameter	Measurement Condition	Standard		Unit
			Min.	Max.	
td(BCLK-AD)	Address Output Delay Time	See Figure 5.2		18	ns
th(BCLK-AD)	Address Output Hold Time (BCLK standard)		0		ns
th(RD-AD)	Address Output Hold Time (RD standard) <sup>(5)</sup>		(Note 1)		ns
th(WR-AD)	Address Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
td(BCLK-CS)	Chip-Select Signal Output Delay Time			18	ns
th(BCLK-CS)	Chip-Select Signal Output Hold Time (BCLK standard)		0		ns
th(RD-CS)	Chip-Select Signal Output Hold Time (RD standard) <sup>(5)</sup>		(Note 1)		ns
th(WR-CS)	Chip-Select Signal Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
td(BCLK-RD)	RD Signal Output Delay Time			18	ns
th(BCLK-RD)	RD Signal Output Hold Time		-3		ns
td(BCLK-WR)	WR Signal Output Delay Time			18	ns
th(BCLK-WR)	WR Signal Output Hold Time		0		ns
td(DB-WR)	Data Output delay Time (WR standard)		(Note 2)		ns
th(WR-DB)	Data Output Hold Time (WR standard) <sup>(5)</sup>		(Note 1)		ns
td(BCLK-ALE)	ALE Signal Output Delay Time (BCLK standard)			18	ns
th(BCLK-ALE)	ALE Signal Output Hold Time (BCLK standard)		-2		ns
td(AD-ALE)	ALE Signal Output Delay Time (address standard)		(Note 3)		ns
th(ALE-AD)	ALE Signal Output Hold Time (address standard)		(Note 4)		ns
tdz(RD-AD)	Address Output Float Start Time			8	ns

#### NOTES:

1. Values can be obtained by the following equations, according to BCLK frequency.

$$th(RD - AD) = \frac{10^9}{f(BCLK) \times 2} - 10 \quad [ns]$$

$$th(WR - AD) = \frac{10^9}{f(BCLK) \times 2} - 10 \quad [ns]$$

$$th(RD - CS) = \frac{10^9}{f(BCLK) \times 2} - 10 \quad [ns]$$

$$th(WR - CS) = \frac{10^9}{f(BCLK) \times 2} - 10 \quad [ns]$$

$$th(WR - DB) = \frac{10^9}{f(BCLK) \times 2} - 20 \quad [ns]$$

2. Values can be obtained by the following equations, according to BCLK frequency and external bus cycles.

$$td(DB - WR) = \frac{10^9 \times m}{f(BCLK) \times 2} - 25 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, m=(b+2)-1)$$

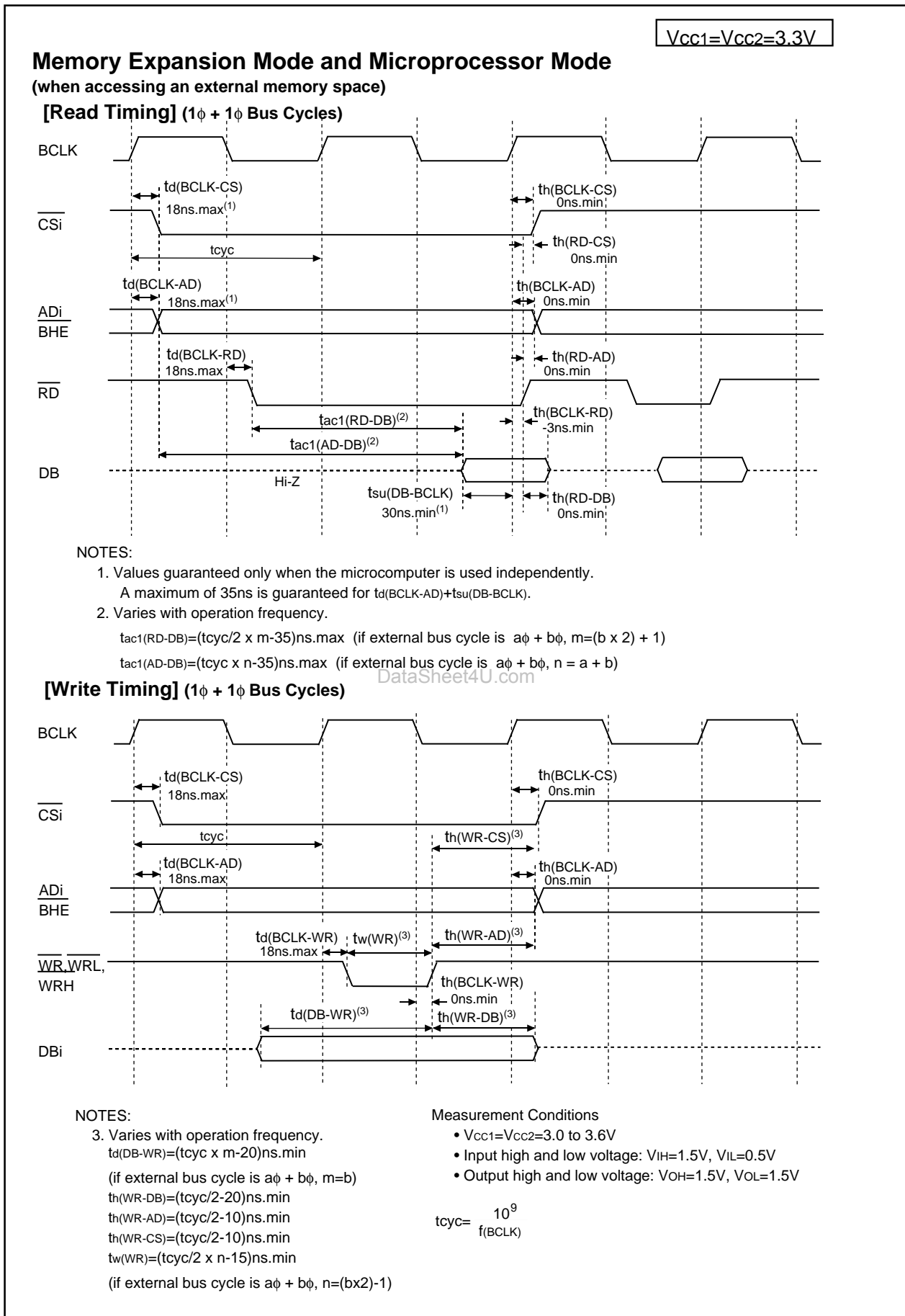
3. Values can be obtained by the following equations, according to BCLK frequency and external bus cycles.

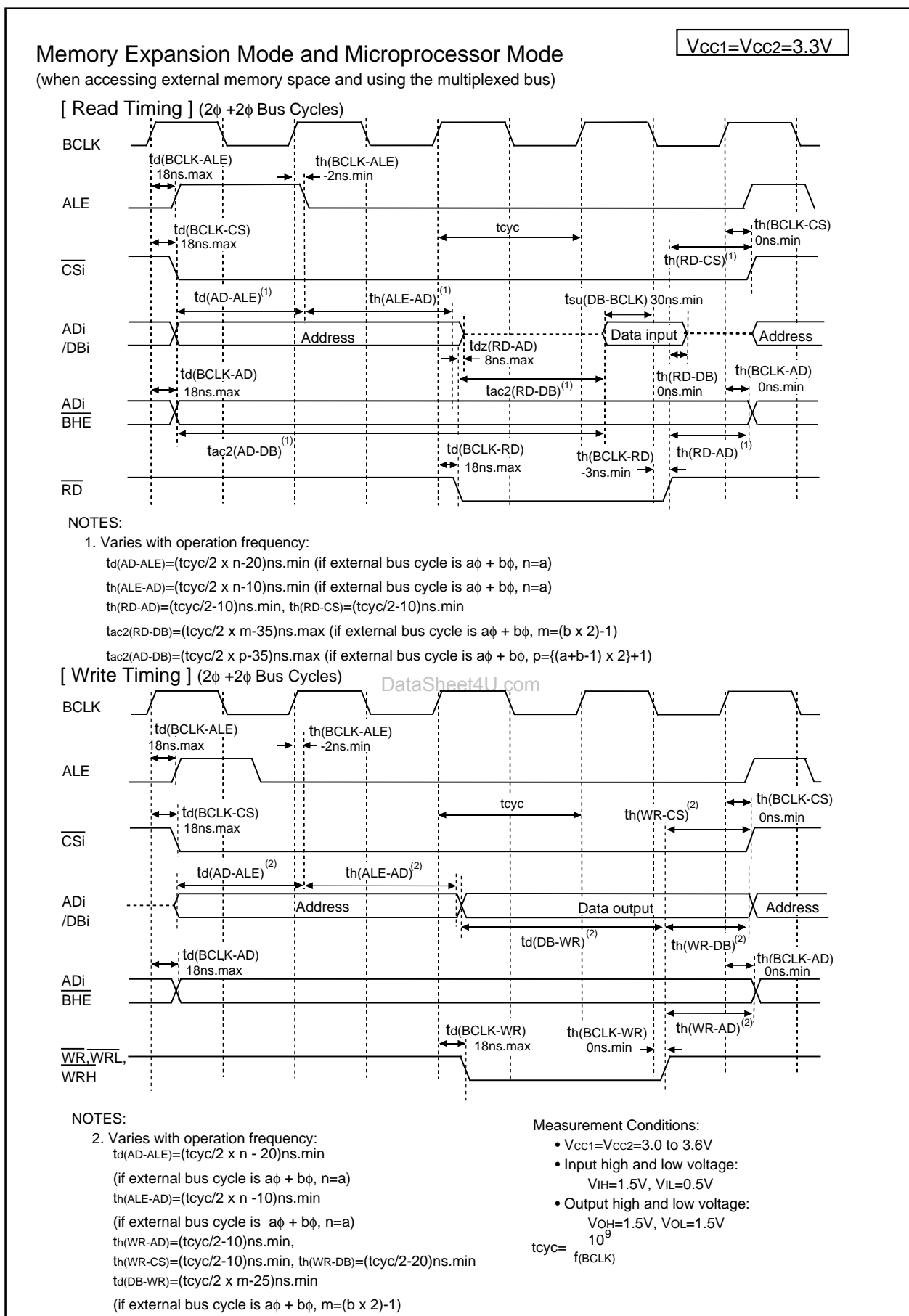
$$td(AD - ALE) = \frac{10^9 \times n}{f(BCLK) \times 2} - 20 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n=a)$$

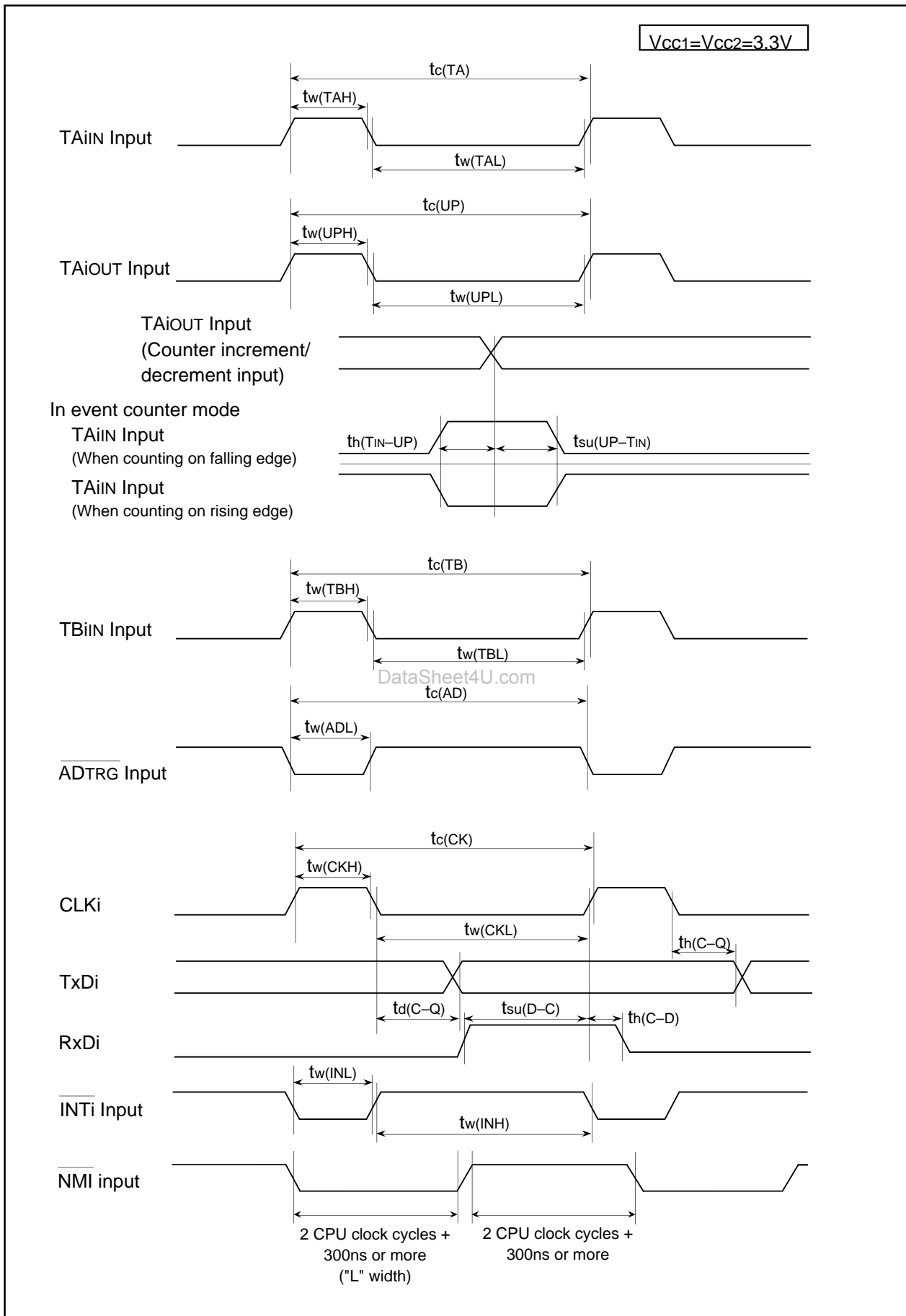
4. Values can be obtained by the following equations, according to BCLK frequency and external bus cycles.

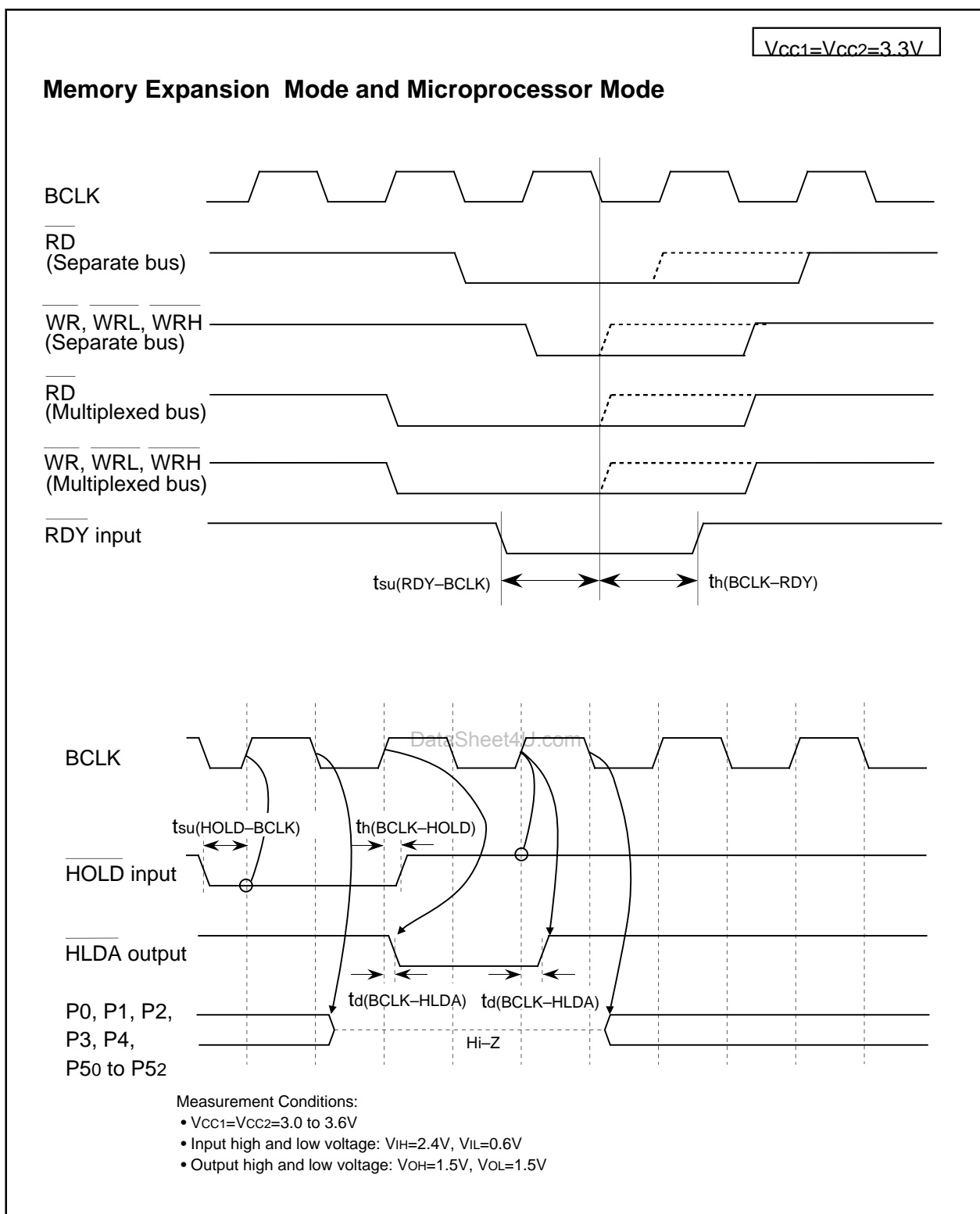
$$th(ALE - AD) = \frac{10^9 \times n}{f(BCLK) \times 2} - 10 \quad [ns] \quad (\text{if external bus cycle is } a\phi + b\phi, n=a)$$

5. tc ns is added when recovery cycle is inserted.

Figure 5.7 V<sub>CC1</sub>=V<sub>CC2</sub>=3.3V Timing Diagram (1)

Figure 5.8 V<sub>CC1</sub>=V<sub>CC2</sub>=3.3V Timing Diagram (2)

Figure 5.9  $V_{CC1}=V_{CC2}=3.3V$  Timing Diagram (3)

Figure 5.10  $V_{CC1}=V_{CC2}=3.3V$  Timing Diagram (4)

## 5.2 Electrical Characteristics (M32C/84T)

**Table 5.42 Absolute Maximum Ratings**

Symbol	Parameter		Condition	Value	Unit
V <sub>CC1</sub> , V <sub>CC2</sub>	Supply Voltage		V <sub>CC1</sub> =V <sub>CC2</sub> =AV <sub>CC</sub>	-0.3 to 6.0	V
AV <sub>CC</sub>	Analog Supply Voltage		V <sub>CC1</sub> =V <sub>CC2</sub> =AV <sub>CC</sub>	-0.3 to 6.0	V
V <sub>I</sub>	Input Voltage	RESET, CNV <sub>SS</sub> , BYTE, P60-P67, P72-P77, P80-P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup> , V <sub>REF</sub> , X <sub>IN</sub>		-0.3 to V <sub>CC1</sub> +0.3	V
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(1)</sup>		-0.3 to V <sub>CC2</sub> +0.3	
		P70, P71		-0.3 to 6.0	
V <sub>O</sub>	Output Voltage	P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>OUT</sub>		-0.3 to V <sub>CC1</sub> +0.3	V
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(1)</sup>		-0.3 to V <sub>CC2</sub> +0.3	
		P70, P71		-0.3 to 6.0	
P <sub>d</sub>	Power Dissipation		T <sub>opr</sub> =25° C	500	mW
T <sub>opr</sub>	Operating Ambient Temperature	during CPU operation	T version	-40 to 85	° C
		during flash memory program and erase operation		0 to 60	
T <sub>stg</sub>	Storage Temperature			-65 to 150	° C

**NOTES:**

1. P11 to P15 are provided in the 144-pin package only.



**Table 5.43 Recommended Operating Conditions****(V<sub>CC1</sub>=V<sub>CC2</sub>=4.2 to 5.5V, V<sub>SS</sub>=0V at Topr = -40 to 85°C (T version) unless otherwise specified)**

Symbol	Parameter		Standard			Unit
			Min.	Typ.	Max.	
V <sub>CC1</sub> , V <sub>CC2</sub>	Supply Voltage (V <sub>CC1</sub> ≥ V <sub>CC2</sub> )		4.2	5.0	5.5	V
A <sub>VCC</sub>	Analog Supply Voltage			V <sub>CC1</sub>		V
V <sub>SS</sub>	Supply Voltage			0		V
A <sub>VSS</sub>	Analog Supply Voltage			0		V
V <sub>IH</sub>	Input High ("H") Voltage	P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(4)</sup>	0.8V <sub>CC2</sub>		V <sub>CC2</sub>	V
		P60-P67, P72-P77, P80-P87 <sup>(3)</sup> , P90-P97, P100-P107, P140-P146, P150-P157 <sup>(4)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	0.8V <sub>CC1</sub>		V <sub>CC1</sub>	
		P70, P71	0.8V <sub>CC1</sub>		6.0	
		P00-P07, P10-P17	0.8V <sub>CC2</sub>		V <sub>CC2</sub>	
V <sub>IL</sub>	Input Low ("L") Voltage	P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 <sup>(4)</sup>	0		0.2V <sub>CC2</sub>	V
		P60-P67, P70-P77, P80-P87 <sup>(3)</sup> , P90-P97, P100-P107, P140-P146, P150-P157 <sup>(4)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	0		0.2V <sub>CC1</sub>	
		P00-P07, P10-P17	0		0.2V <sub>CC2</sub>	
I <sub>OH(peak)</sub>	Peak Output High ("H") Current <sup>(2)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			-10.0	mA
I <sub>OH(avg)</sub>	Average Output High ("H") Current <sup>(1)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			-5.0	mA
I <sub>OL(peak)</sub>	Peak Output Low ("L") Current <sup>(2)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			10.0	mA
I <sub>OL(avg)</sub>	Average Output Low ("L") Current <sup>(1)</sup>	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(4)</sup>			5.0	mA

## NOTES:

- Typical values when average output current is 100ms.
- Total I<sub>OL(peak)</sub> for P0, P1, P2, P86, P87, P9, P10, P11, P14 and P15 must be 80mA or less.  
Total I<sub>OL(peak)</sub> for P3, P4, P5, P6, P7, P80 to P84, P12 and P13 must be 80mA or less.  
Total I<sub>OH(peak)</sub> for P0, P1, P2, and P11 must be -40mA or less.  
Total I<sub>OH(peak)</sub> for P86, P87, P9, P10, P14 and P15 must be -40mA or less.  
Total I<sub>OH(peak)</sub> for P3, P4, P5, P12 and P13 must be -40mA or less.  
Total I<sub>OH(peak)</sub> for P6, P7, and P80 to P84 must be -40mA or less.
- V<sub>IH</sub> and V<sub>IL</sub> reference for P87 applies when P87 is used as a programmable input port.  
It does not apply when P87 is used as X<sub>CIN</sub>.
- P11 to P15 are provided in the 144-pin package only.

**Table 5.43 Recommended Operating Conditions (Continued)**  
**(V<sub>CC1</sub>=V<sub>CC2</sub>=4.2 to 5.5V, V<sub>SS</sub>=0V at Topr = -40 to 85°C (T version) unless otherwise specified)**

Symbol	Parameter		Standard			Unit
			Min.	Typ.	Max.	
f(BCLK)	CPU Input Frequency	V <sub>CC1</sub> =4.2 to 5.5V	0		32	MHz
f(XIN)	Main Clock Input Frequency	V <sub>CC1</sub> =4.2 to 5.5V	0		32	MHz
f(XCIN)	Sub Clock Frequency			32.768	50	kHz
f(Ring)	On-chip Oscillator Frequency (V <sub>CC1</sub> =V <sub>CC2</sub> =5.0V, Topr=25° C)		0.5	1	2	MHz
f(PLL)	PLL Clock Frequency	V <sub>CC1</sub> =4.2 to 5.5V	10		32	MHz
tsu(PLL)	Wait Time to Stabilize PLL Frequency Synthesizer	V <sub>CC1</sub> =5.0V			5	ms

$V_{CC1}=V_{CC2}=5V$

**Table 5.44 Electrical Characteristics****( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr} = -40$  to  $85^{\circ}C$  (T version),** **$f(BCLK)=32MHz$  unless otherwise specified)**

Symbol	Parameter		Condition	Standard			Unit	
				Min.	Typ.	Max.		
V <sub>OH</sub>	Output High ("H") Voltage	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137	I <sub>OH</sub> =-5mA	V <sub>CC2</sub> -2.0		V <sub>CC2</sub>	V	
		P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OH</sub> =-5mA	V <sub>CC1</sub> -2.0		V <sub>CC1</sub>		
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137	I <sub>OH</sub> =-200μA	V <sub>CC2</sub> -0.3		V <sub>CC2</sub>	V	
		P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OH</sub> =-200μA	V <sub>CC1</sub> -0.3		V <sub>CC1</sub>		
		X <sub>OUT</sub>	I <sub>OH</sub> =-1mA	3.0			V	
		X <sub>COUT</sub>	High Power	No load applied		2.5		V
		Low Power	No load applied		1.6			
V <sub>OL</sub>	Output Low ("L") Voltage	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OL</sub> =5mA			2.0	V	
		P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	I <sub>OL</sub> =200μA			0.45	V	
		X <sub>OUT</sub>	I <sub>OL</sub> =1mA			2.0	V	
		X <sub>COUT</sub>	High Power	No load applied		0		V
			Low Power	No load applied		0		
V <sub>T+</sub> -V <sub>T-</sub>	Hysteresis	HOLD, RDY, TA0 <sub>IN</sub> -TA4 <sub>IN</sub> , TB0 <sub>IN</sub> -TB5 <sub>IN</sub> , INT0-INT5, AD <sub>TRG</sub> , CTS0-CTS4, CLK0-CLK4, TA0 <sub>OUT</sub> -TA4 <sub>OUT</sub> , NMI, K10-K13, RxD0-RxD4, SCL0-SCL4, SDA0-SDA4		0.2		1.0	V	
		RESET		0.2		1.8	V	
I <sub>IH</sub>	Input High ("H") Current	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =5V			5.0	μA	
I <sub>IL</sub>	Input Low ("L") Current	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup> , X <sub>IN</sub> , RESET, CNV <sub>SS</sub> , BYTE	V <sub>I</sub> =0V			-5.0	μA	
R <sub>PULLUP</sub>	Pull-up Resistance	P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P110-P114, P120-P127, P130-P137, P140-P146, P150-P157 <sup>(1)</sup>	V <sub>I</sub> =0V	Flash Memory	30	50	167	kΩ
R <sub>fXIN</sub>	Feedback Resistance	X <sub>IN</sub>				1.5	MΩ	
R <sub>fXCIN</sub>	Feedback Resistance	X <sub>CIN</sub>				10	MΩ	
V <sub>RAM</sub>	RAM Standby Voltage	In stop mode			2.0		V	

## NOTES:

- P11 to P15 are provided in the 144-pin package only.

$V_{CC1}=V_{CC2}=5V$

**Table 5.44 Electrical Characteristics (Continued)**  
**( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr} = -40$  to  $85^{\circ}C$  (T version),  
 $f(BCLK)=32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition	Standard			Unit	
			Min.	Typ.	Max.		
I <sub>cc</sub>	Power Supply Current	In single-chip mode, output pins are left open and other pins are connected to V <sub>ss</sub> .	f(BCLK)=32 MHz, Square wave, No division		28	50	mA
			f(BCLK)=32 kHz, In low-power consumption mode, Program running on ROM		430		μA
			f(BCLK)=32 kHz, In low-power consumption mode, Program running on RAM <sup>(1)</sup>		25		μA
			f(BCLK)=32 kHz, In wait mode, T <sub>opr</sub> =25° C		10		μA
			While clock stops, T <sub>opr</sub> =25° C		0.8	5	μA
			While clock stops, T <sub>opr</sub> =85° C			50	μA

## NOTES:

- Value is obtained when setting the FMSTP bit in the FMR0 register to "1" (flash memory stopped).

$V_{CC1}=V_{CC2}=5V$

**Table 5.45 A/D Conversion Characteristics ( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=-40$  to  $85^{\circ}C$  (T version),  $f(BCLK)=32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition		Standard			Unit
				Min.	Typ.	Max.	
-	Resolution	$V_{REF}=V_{CC1}$				10	Bits
INL	Integral Nonlinearity Error	$V_{REF}=V_{CC1}=V_{CC2}=5V$	AN <sub>0</sub> to AN <sub>7</sub> , AN <sub>00</sub> to AN <sub>07</sub> , AN <sub>20</sub> to AN <sub>27</sub> , AN <sub>150</sub> to AN <sub>157</sub> , ANEX <sub>0</sub> , ANEX <sub>1</sub>			±3	LSB
			External op-amp connection mode			±7	LSB
DNL	Differential Nonlinearity Error					±1	LSB
-	Offset Error					±3	LSB
-	Gain Error					±3	LSB
RLADDER	Resistor Ladder	$V_{REF}=V_{CC1}$		8		40	kΩ
t <sub>CONV</sub>	10-bit Conversion Time <sup>(1, 2)</sup>			2.06			μs
t <sub>CONV</sub>	8-bit Conversion Time <sup>(1, 2)</sup>			1.75			μs
t <sub>SAMP</sub>	Sampling Time <sup>(1)</sup>			0.188			μs
V <sub>REF</sub>	Reference Voltage			2		V <sub>CC1</sub>	V
V <sub>IA</sub>	Analog Input Voltage			0		V <sub>REF</sub>	V

## NOTES:

1. Divide  $f(X_{IN})$ , if exceeding 16 MHz, to keep  $\phi_{AD}$  frequency at 16 MHz or less.
2. With using the sample and hold function.

**Table 5.46 D/A Conversion Characteristics ( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}=-40$  to  $85^{\circ}C$  (T version),  $f(BCLK)=32MHz$  unless otherwise specified)**

Symbol	Parameter	Measurement Condition	Standard			Unit
			Min.	Typ.	Max.	
-	Resolution				8	Bits
-	Absolute Accuracy				1.0	%
t <sub>SU</sub>	Setup Time				3	μs
R <sub>O</sub>	Output Resistance		4	10	20	kΩ
I <sub>VREF</sub>	Reference Power Supply Input Current	(Note 1)			1.5	mA

## NOTES:

1. Measurement when using one D/A converter. The DA<sub>i</sub> register (i=0, 1) of the D/A converter, not being used, is set to "00<sub>16</sub>". The resistor ladder in the A/D converter is excluded.  
I<sub>VREF</sub> flows even if the VCUT bit in the AD0CON1 register is set to "0" (no V<sub>REF</sub> connection).

$V_{CC1}=V_{CC2}=5V$

**Table 5.47 Flash Memory Version Electrical Characteristics**  
**( $V_{CC1}=4.5$  to  $5.5V$ ,  $3.3$  to  $3.6V$  at  $T_{opr}=0$  to  $60^{\circ}C$  unless otherwise specified)**

Symbol	Parameter		Standard			Unit
			Min.	Typ.	Max.	
-	Program and Erase Endurance <sup>(2)</sup>		100			cycles
-	Word Program Time ( $V_{CC1}=5.0V$ , $T_{opr}=25^{\circ}C$ )			25	200	$\mu s$
-	Lock Bit Program Time			25	200	$\mu s$
-	Block Erase Time ( $V_{CC1}=5.0V$ , $T_{opr}=25^{\circ}C$ )	4-Kbyte Block		0.3	4	s
		8-Kbyte Block		0.3	4	s
		32-Kbyte Block		0.5	4	s
		64-Kbyte Block		0.8	4	s
-	All-Unlocked-Block Erase Time <sup>(1)</sup>				$4 \times n$	s
tps	Wait Time to Stabilize Flash Memory Circuit				15	$\mu s$
-	Data Hold Time ( $T_{opr}=-40$ to $85^{\circ}C$ )		10			years

## NOTES:

1.  $n$  denotes the number of block to be erased.

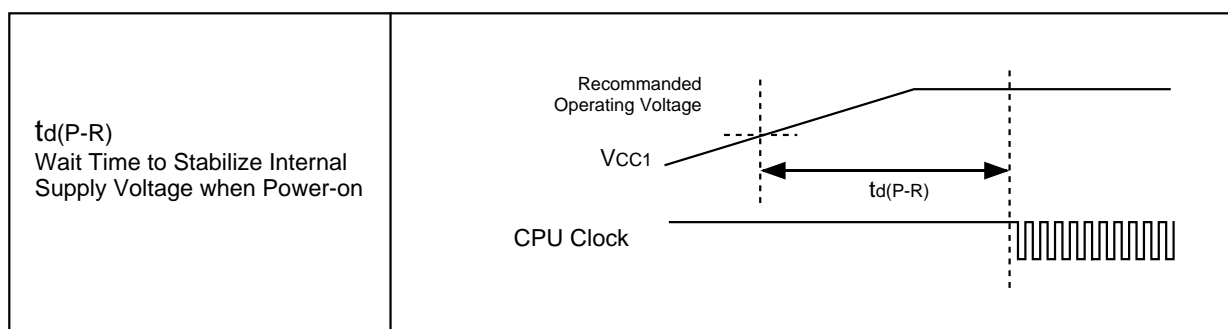
2. Number of program-erase cycles per block.

If Program and Erase Endurance is  $n$  cycle ( $n \neq 100$ ), each block can be erased and programmed  $n$  cycles.

For example, if a 4-Kbyte block A is erased after programming a word data 2,048 times, each to a different address, this counts as one program and erase endurance. Data can not be programmed to the same address more than once without erasing the block. (rewrite prohibited).

**Table 5.48 Power Supply Timing**

Symbol	Parameter	Measurement Condition	Standard			Unit
			Min.	Typ.	Max.	
td(P-R)	Wait Time to Stabilize Internal Supply Voltage when Power-on	$V_{CC1}=3.0$ to $5.5V$			2	ms



**Figure 5.11 Power Supply Timing Diagram**

$V_{CC1}=V_{CC2}=5V$

**Timing Requirements****( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr}= -40$  to  $85^{\circ}C$  (T version) unless otherwise specified)****Table 5.49 External Clock Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_c$	External Clock Input Cycle Time	31.25		ns
$t_{w(H)}$	External Clock Input High ("H") Width	13.75		ns
$t_{w(L)}$	External Clock Input Low ("L") Width	13.75		ns
$t_r$	External Clock Rise Time		5	ns
$t_f$	External Clock Fall Time		5	ns

$V_{CC1}=V_{CC2}=5V$

**Timing Requirements**(V<sub>CC1</sub>=V<sub>CC2</sub>=4.2 to 5.5V, V<sub>SS</sub>=0V at T<sub>opr</sub>= -40 to 85°C (T version) unless otherwise specified)**Table 5.50 Timer A Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
t <sub>c(TA)</sub>	TA <sub>iIN</sub> Input Cycle Time	100		ns
t <sub>w(TAH)</sub>	TA <sub>iIN</sub> Input High ("H") Width	40		ns
t <sub>w(TAL)</sub>	TA <sub>iIN</sub> Input Low ("L") Width	40		ns

**Table 5.51 Timer A Input (Gate Input in Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
t <sub>c(TA)</sub>	TA <sub>iIN</sub> Input Cycle Time	400		ns
t <sub>w(TAH)</sub>	TA <sub>iIN</sub> Input High ("H") Width	200		ns
t <sub>w(TAL)</sub>	TA <sub>iIN</sub> Input Low ("L") Width	200		ns

**Table 5.52 Timer A Input (External Trigger Input in One-Shot Timer Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
t <sub>c(TA)</sub>	TA <sub>iIN</sub> Input Cycle Time	200		ns
t <sub>w(TAH)</sub>	TA <sub>iIN</sub> Input High ("H") Width	100		ns
t <sub>w(TAL)</sub>	TA <sub>iIN</sub> Input Low ("L") Width	100		ns

**Table 5.53 Timer A Input (External Trigger Input in Pulse Width Modulation Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
t <sub>w(TAH)</sub>	TA <sub>iIN</sub> Input High ("H") Width	100		ns
t <sub>w(TAL)</sub>	TA <sub>iIN</sub> Input Low ("L") Width	100		ns

**Table 5.54 Timer A Input (Counter Increment/Decrement Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
t <sub>c(UP)</sub>	TA <sub>iOUT</sub> Input Cycle Time	2000		ns
t <sub>w(UPH)</sub>	TA <sub>iOUT</sub> Input High ("H") Width	1000		ns
t <sub>w(UPL)</sub>	TA <sub>iOUT</sub> Input Low ("L") Width	1000		ns
t <sub>su(UP-TIN)</sub>	TA <sub>iOUT</sub> Input Setup Time	400		ns
t <sub>h(TIN-UP)</sub>	TA <sub>iOUT</sub> Input Hold Time	400		ns



$V_{CC1}=V_{CC2}=5V$

**Timing Requirements****( $V_{CC1}=V_{CC2}=4.2$  to  $5.5V$ ,  $V_{SS}=0V$  at  $T_{opr} = -40$  to  $85^{\circ}C$  (T version) unless otherwise specified)****Table 5.55 Timer B Input (Count Source Input in Event Counter Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time (counted on one edge)	100		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width (counted on one edge)	40		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width (counted on one edge)	40		ns
$t_{c(TB)}$	TBiIN Input Cycle Time (counted on both edges)	200		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width (counted on both edges)	80		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width (counted on both edges)	80		ns

**Table 5.56 Timer B Input (Pulse Period Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time	400		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width	200		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width	200		ns

**Table 5.57 Timer B Input (Pulse Width Measurement Mode)**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(TB)}$	TBiIN Input Cycle Time	400		ns
$t_{w(TBH)}$	TBiIN Input High ("H") Width	200		ns
$t_{w(TBL)}$	TBiIN Input Low ("L") Width	200		ns

**Table 5.58 A/D Trigger Input**

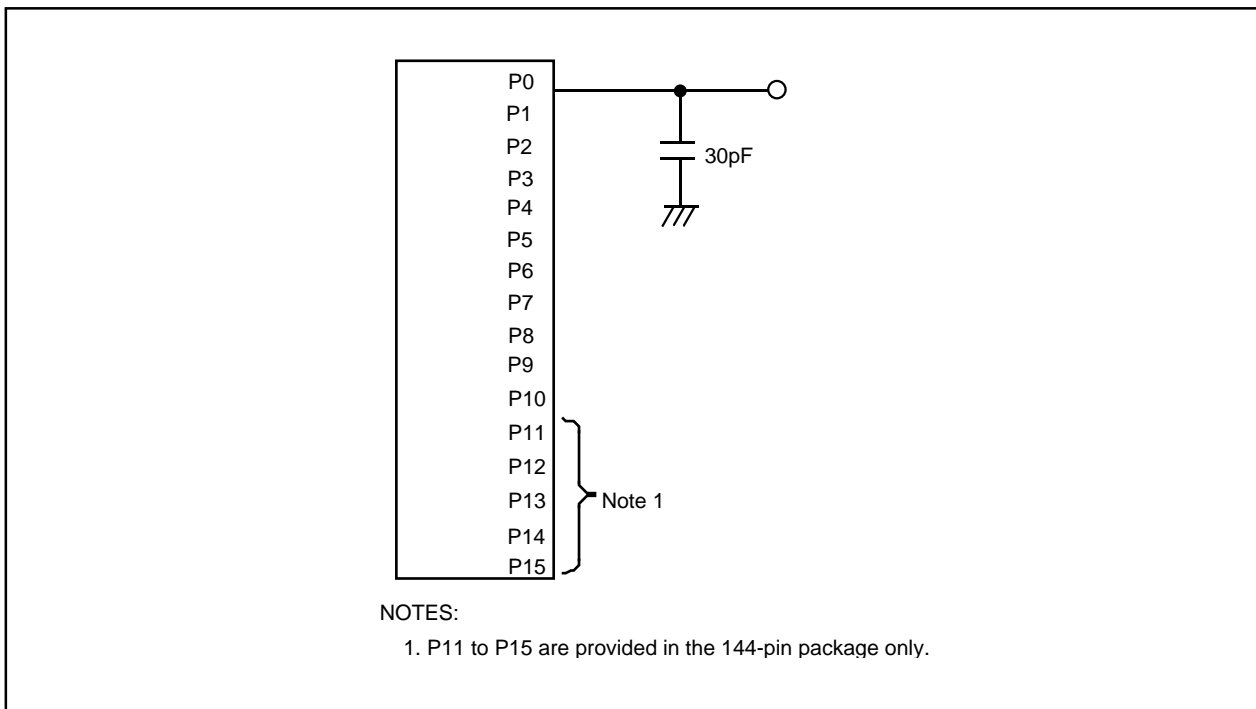
Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(AD)}$	ADTRG Input Cycle Time (required for trigger)	1000		ns
$t_{w(ADL)}$	ADTRG Input Low ("L") Pulse Width	125		ns

**Table 5.59 Serial I/O**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{c(CK)}$	CLKi Input Cycle Time	200		ns
$t_{w(CKH)}$	CLKi Input High ("H") Width	100		ns
$t_{w(CKL)}$	CLKi Input Low ("L") Width	100		ns
$t_{d(C-Q)}$	TxDi Output Delay Time		80	ns
$t_{h(C-Q)}$	TxDi Hold Time	0		ns
$t_{su(D-C)}$	RxDi Input Setup Time	30		ns
$t_{h(C-Q)}$	RxDi Input Hold Time	90		ns

**Table 5.60 External Interrupt INTi Input**

Symbol	Parameter	Standard		Unit
		Min.	Max.	
$t_{w(INH)}$	INTi Input High ("H") Width	250		ns
$t_{w(INL)}$	INTi Input Low ("L") Width	250		ns

**Figure 5.12 P0 to P15 Measurement Circuit**

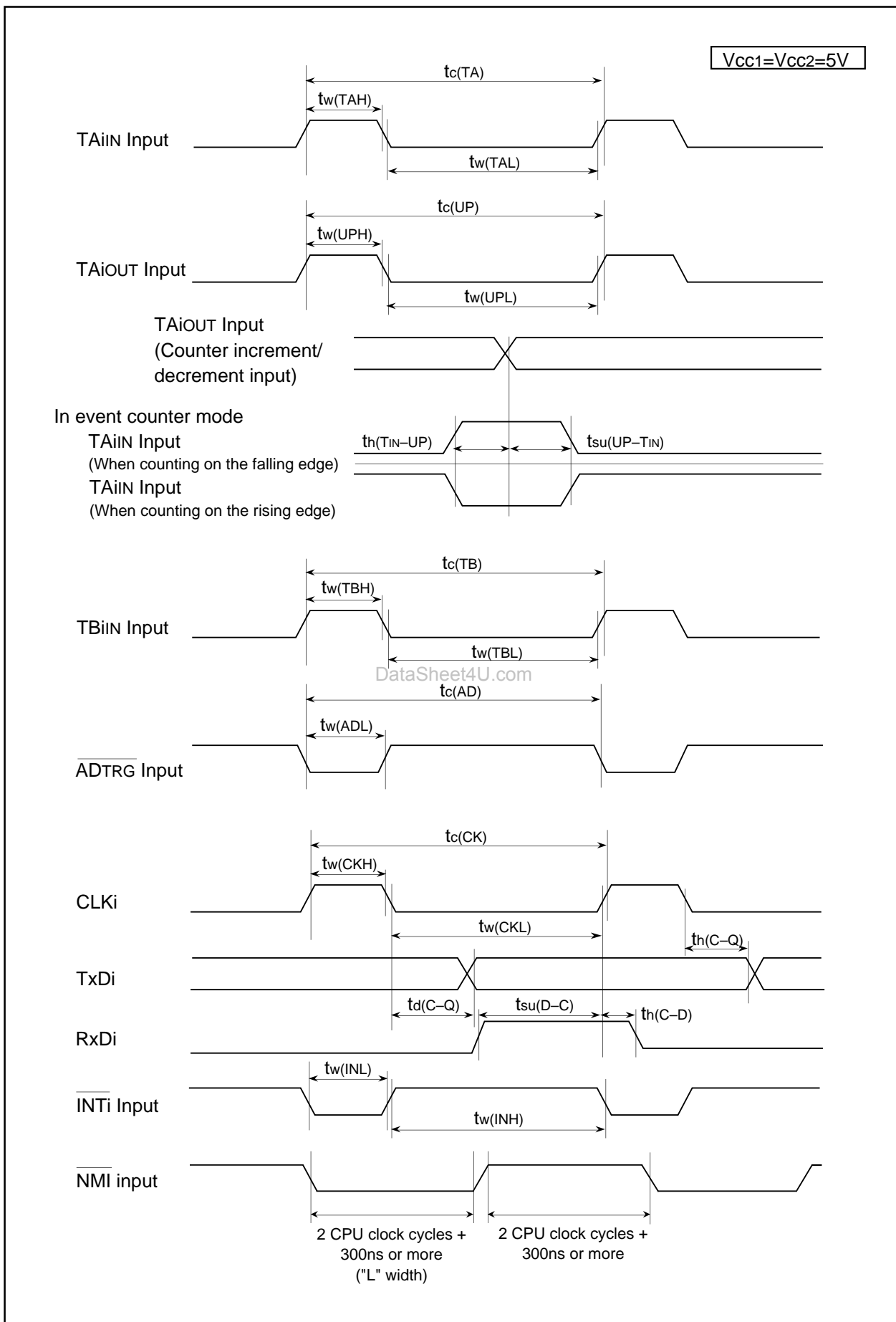


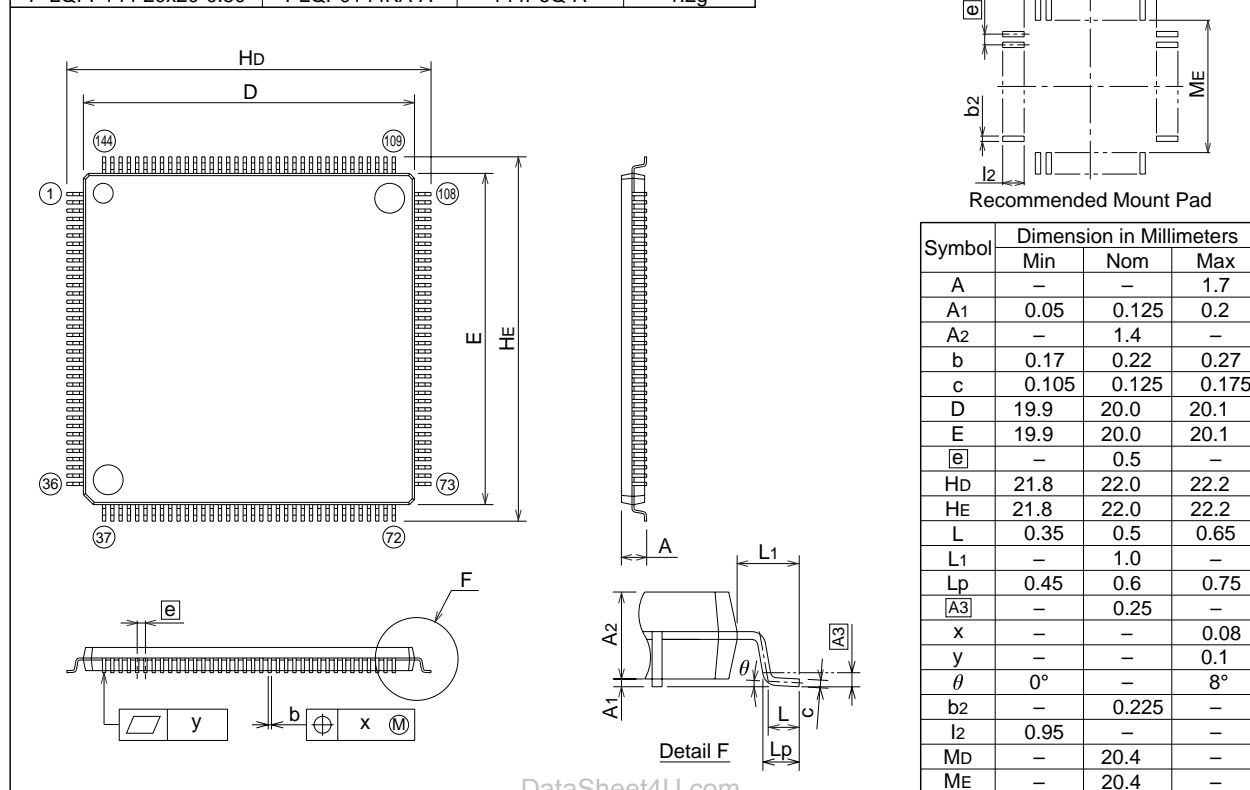
Figure 5.13 Vcc1=Vcc2=5V Timing Diagram

# Package Dimensions

## PLQP0144KA-A (144P6Q-A)

Plastic 144pin 20X20mm body LQFP

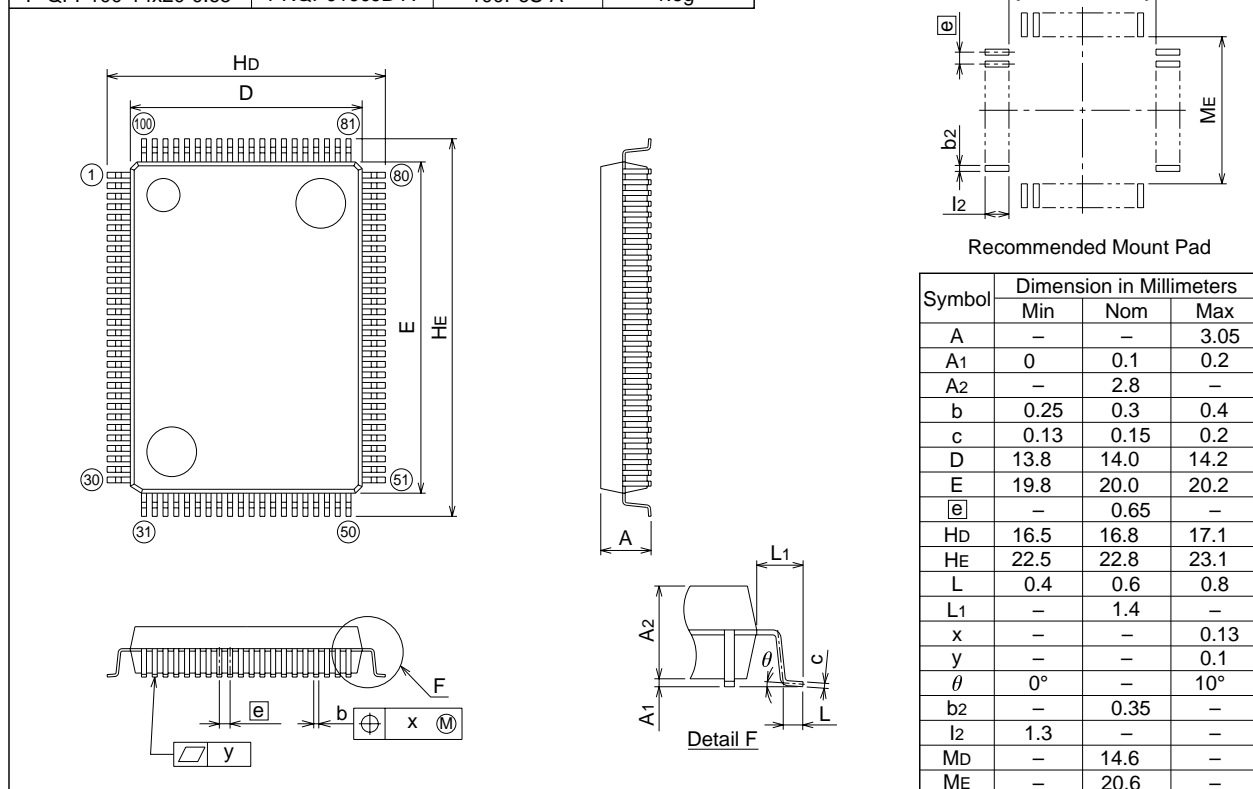
JEITA Package Code	RENESAS Code	Previous Code	Mass[Typ.]
P-LQFP144-20x20-0.50	PLQP0144KA-A	144P6Q-A	1.2g



## PRQP0100JB-A (100P6S-A)

Plastic 100pin 14X20mm body QFP

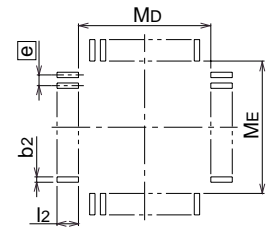
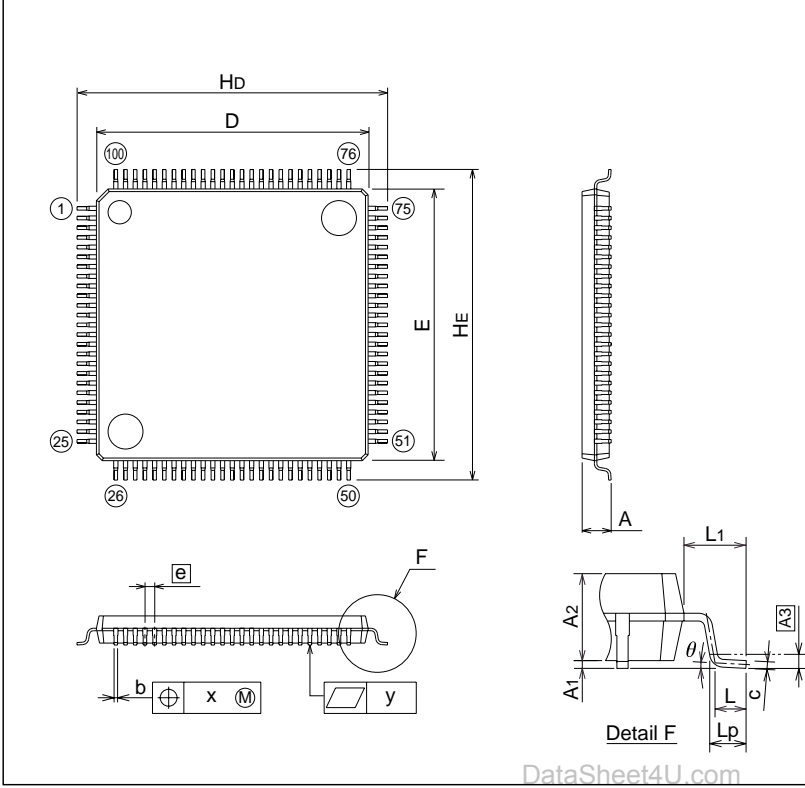
JEITA Package Code	RENESAS Code	Previous Code	Mass[Typ.]
P-QFP100-14x20-0.65	PRQP0100JB-A	100P6S-A	1.6g



**PLQP0100KB-A (100P6Q-A)**

**Plastic 100pin 14X14mm body LQFP**

JEITA Package Code	RENESAS Code	Previous Code	Mass[Typ.]
P-LQFP100-14x14-0.50	PLQP0100KB-A	100P6Q-A	0.6g



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	-	-	1.7
A1	0	0.1	0.2
A2	-	1.4	-
b	0.13	0.18	0.28
c	0.105	0.125	0.175
D	13.9	14.0	14.1
E	13.9	14.0	14.1
e	-	0.5	-
Hd	15.8	16.0	16.2
HE	15.8	16.0	16.2
L	0.3	0.5	0.7
L1	-	1.0	-
Lp	0.45	0.6	0.75
A3	-	0.25	-
x	-	-	0.08
y	-	-	0.1
theta	0°	-	10°
b2	-	0.225	-
l2	0.9	-	-
Md	-	14.4	-
ME	-	14.4	-

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Rev.	Date	Description	
		Page	Summary
0.40	Sep. 30, 2003	–	New Document
0.50	Feb. 05, 2004	2, 3	<b>Overview</b> • <b>Table 1.1 and Table 1.2 M32C/84 Group Performance</b> Values for Shortest Instruction Execution Time and Power Consumption” modified
		5	• <b>Figure 1.2 ROM/RAM Capacity</b> Products added
		6	• <b>Table 1.3 M32C/84 Group</b> Products added
		6	• <b>Figure 1.3 Product Numbering System</b> 128-Kbytes added to ROM capacity Memory
		23	• <b>Figure 3.1 Memory Map</b> Diagram modified; products added
		24	<b>SFR</b> • “Values after RESET” for the PM1, PM2, D4INT, G0IRF, G1IRF, IDB0 to IDB1, TA0MR to TA4MR, TCSPR, DM0SL to DM3SL registers revised • The IPSA register added to address 017916 • NOTES added to the PM0 and TCSPR register
		44	<b>Electrical Characteristics</b> • Newly added
0.51	Feb. 09, 2004		<b>Electrical Characteristics</b>
		50	• <b>Table 5.6 Flash Memory Version Electrical Characteristics</b> Note 4 revised
		57	• <b>Figure 5.2 Vcc1=Vcc2=5V Timing Diagram (1)</b> Notes 1 and 2 revised
		68	• <b>Figure 5.3 Vcc1=Vcc2=5V Timing Diagram (2)</b> Notes 1, 2, and 3 revised
		68	• <b>Figure 5.6 Vcc1=Vcc2=3.3V Timing Diagram (1)</b> Notes 1, 2, and 3 revised
69	• <b>Figure 5.7 Vcc1=Vcc2=3.3V Timing Diagram (2)</b> Notes 1 and 2 revised		
0.52	Mar. 12, 2004	2, 3	<b>Overview</b> • <b>Table 1.1 and 1.2 M32C/84 Group Performance</b> Values for Power Consumption modified
		48	<b>Electrical Characteristics</b> • <b>Table 5.3 Electrical Characteristics</b> Maximum values for Power Supply Current modified
		50	• <b>Table 5.6 Flash Memory Version Electrical Characteristics</b> Note 1. 100-cycle Products (D3, D5, U3, U5) deleted; Note 4 modified
		61	• <b>Table 5.7 Flash Memory Version Program and Erase Voltage and Read Operation Voltage Characteristics (at Topr=0 to 60°C)</b> deleted • <b>Table 5.22 Electrical Characteristics</b> Maximum values for Power Supply Consumption modified and standard values when “Topr=85°C while clock is stopped” deleted

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Rev.	Date	Description	
		Page	Summary
1.00	Jun.01, 2004	-	<b>M32C/84T (High-reliability version)</b> added
		All Pages	Words standardized: On-chip oscillator, A/D converter and D/A converter
		1	<b>Overview</b>
		2, 3	<ul style="list-style-type: none"> <li>• <b>1.1 Applications</b> Automobiles added</li> <li>• <b>Table 1.1 and Table 1.2 M32C/84 Group (M32C/84, M32C/84T) Performance</b> M32C/84T added; note 3 added</li> </ul>
		4	• <b>Figure 1.1 M32C/84 Group (M32C/84, M32C/84T) Block Diagram</b> Note 3 added
		5	<ul style="list-style-type: none"> <li>• <b>1.4 Product Information</b> Description modified</li> <li>• <b>Figure 1.2 ROM/RAM Capacity</b> figure modified</li> </ul>
		6	• <b>Table 1.3 M32C/84 Group</b> M32C/84T added
		6	• <b>Figure 1.3 Product Numbering System</b> M32C/84T added
		7	• <b>Figure 1.4 Pin Assignment for 144-Pin Package</b> Note 3 added
		12	• <b>Figure 1.6 Pin Assignment for 100-Pin Package</b> Note 5 added
8 to 10	• <b>Table 1.5 Pin Characteristics for 144-Pin Package</b> Note 1 added		
13, 14	• <b>Table 1.6 Pin Characteristics for 100-Pin Package</b> Note 1 added		
15 to 18	• <b>Table 1.7 Pin Description</b> Notes added		
			<b>Memory</b>
		22	• <b>Figure 3.1 Memory Map</b> Tables of internal ROM/internal RAM modified; note 2 modified; notes 4 and 5 added
			<b>SFR</b>
		23	• Note 2 added
		24	<ul style="list-style-type: none"> <li>• PWCR0 and PWCR1 registers deleted</li> <li>• "Values after RESET" of the masked ROM version added to the FMR0 register</li> <li>• Note 1 added</li> </ul>
			<b>Electrical Characteristics</b>
		44	• <b>Table 5.2 Recommended Operating Conditions</b> $f_{\text{ripple}}$ , $V_{p-p(\text{ripple})}$ , $V_{CC}$ , $SV_{CC}$ and note 1 deleted
		47	• <b>Table 5.3 Electrical Characteristics</b> $R_{PULLUP}$ value for the masked ROM version added
		48	• <b>Table 5.4 A/D Conversion Characteristics</b> $t_{SMP}$ value modified; note 1 added
		50	<ul style="list-style-type: none"> <li>• <b>Table 5.7 Low Voltage Detect Circuit Electrical Characteristics</b> added</li> <li>• <b>Table 5.8 Power Supply Timing</b> added</li> <li>• <b>Figure 5.1 Power Supply Timing Diagram</b> added</li> </ul>
		55	• <b>Table 5.23 Memory Expansion Mode and Microprocessor Mode</b> $t_{h(\text{BCLK-ALE})}$ value modified
		61	• <b>Table 5.24 Electrical Characteristics</b> $R_{PULLUP}$ value for the masked ROM version added
		62	• <b>Table 5.25 A/D Conversion Characteristics</b> $t_{CONV}$ value modified

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Rev.	Date	Description	
		Page	Summary
		63	• <b>Table 5.28 Memory Expansion Mode and Microprocessor Mode</b> $t_{su}(DB-BCLK)$ , $t_{su}(RDY-BCLK)$ and $t_{su}(HOLD-BCLK)$ value modified
		66	• <b>Table 5.40 Memory Expansion Mode and Microprocessor Mode</b> equation of $t_h(WR-DB)$ modified
		67	• <b>Table 5.41 Memory Expansion Mode and Microprocessor Mode</b> $t_h(BCLK-ALE)$ value modified; equation of $t_h(WR-DB)$ modified
		72	• <b>5.2 Electrical Characteristics (M32C/84T)</b> added
1.10	Jun.28, 2004	-	<b>High-reliability version (U version)</b> deleted
		5	• <b>Table 1.3 M32C/84 Group (1) (2)</b> development status modified
		6	• <b>Figure 1.2 Product Numbering System</b> figure modified
1.20	Apr.18, 2005		<b>Overview</b>
		2, 3	• <b>Table 1.1 and Table 1.2 M32C/84 Group (M32C/84, M32C/84T) Performance</b> Note 4 added
		6	• <b>Table 1.3 M32C/84 Group (1) (2)</b> Information updated
		16, 17	• <b>Table 1.6 Pin Description</b> Note 2 deleted
			<b>Memory</b>
		22	• <b>Figure 3.1 Memory Map</b> Description added to Note 3
			<b>SFR</b>
		24	• The PWCR0 and PWCR1 registers newly added to address 004C16 and 004D16 • "Values after RESET" for the G0RB, G1BCR1, G1RB, IDB0, IDB1, DM0SL to DM3SL and PSC registers revised
			<b>Electrical Characteristics</b>
		46	• <b>Table 5.3 Electrical Characteristics</b> $I_{CC}$ standard value revised
		49	• <b>Table 5.6 Flash Memory Electrical Characteristics</b> $T_{opr}$ value modified
		50	• <b>Table 5.7 Voltage Detection Circuit Electrical Characteristics</b> $V_{CC1}$ value modified
		58	• <b>Figure 5.4 <math>V_{CC1}=V_{CC2}=5V</math> Timing Diagram (2)</b> Diagram modified
		61	• <b>Table 5.24 Electrical Characteristics</b> $I_{CC}$ standard value revised
		63	• <b>Table 5.28 Memory Expansion Mode and Microprocessor Mode</b> $t_{ac1}(AD-DB)$ expression modified
		75	• <b>Table 5.44 Electrical Characteristics</b> $I_{CC}$ standard value revised
		78	• <b>Table 5.47 Flash Memory Electrical Characteristics</b> $T_{opr}$ value modified
1.21	Jul.08, 2005		<b>Special Function Register (SFR)</b>
		37	• The TCSPR register Value after reset modified
			<b>Electrical Characteristics</b>
		45	• <b>Table 5.2 Electrical Characteristics</b> Parameter $f(BCLK)$ and its values added
		51	• <b>Table 5.10 Memory Expansion Mode and Microprocessor Mode</b> $t_{ac1}(RD-DB)$ expression on Note 1 modified; $t_{ac2}(RD-DB)$ expression on Note 1 added



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Rev.	Date	Description	
		Page	Summary
		57	• <b>Figure 5.3 Vcc1=Vcc2=5V Timing Diagram (1)</b> $t_{W(ER)}$ expression on Note 3 modified; $t_{CYC}$ expression added
		58	• <b>Figure 5.4 Vcc1=Vcc2=5V Timing Diagram (2)</b> $t_{AC2(AD-DB)}$ expression on Note 1 modified; $t_{H(ALE-AD)}$ expressions on Notes 1 and 2 modified; $t_{CYC}$ expression added
		63	• <b>Table 5.28 Memory Expansion Mode and Microprocessor Mode</b> $t_{AC1(RD-DB)}$ expression on Note 1 modified; $t_{AC2(RD-DB)}$ expression on Note 1 added
		68	• <b>Figure 5.7 Vcc1=Vcc2=3.3V Timing Diagram (1)</b> $t_{W(ER)}$ expression on Note 3 modified; $t_{CYC}$ expression added
		69	• <b>Figure 5.8 Vcc1=Vcc2=3.3V Timing Diagram (2)</b> $t_{AC2(RD-DB)}$ expression on Note 1 modified; $t_{H(ALE-AD)}$ expressions on Notes 1 and 2 modified; $t_{H(WR-CS)}$ expression on Note 2 modified; $t_{CYC}$ expression added
		74	• <b>Table 5.43 Electrical Characteristics</b> Parameter $f(BCLK)$ and its values added
		78	• <b>Table 5.47 Flash Memory Version Electrical Characteristics</b> Measurement condition changed
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