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April 1st, 2010
Renesas Electronics Corporation

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1. Overview

The M32C/85 group (M32C/85, M32C/85T) microcomputer is a single-chip control unit that utilizes high-performance silicon gate CMOS technology with the M32C/80 series CPU core. The M32C/85 group (M32C/85, M32C/85T) 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.

1.2 Performance Overview

Tables 1.1 and 1.2 list performance overview of the M32C/85 group (M32C/85, M32C/85T).

Table 1.1 M32C/85 Group (M32C/85, M32C/85T) Performance (144-Pin Package)

| Characteristic | | Performance | |
|-------------------------------|------------------------------------|--|--|
| | | M32C/85 | M32C/85T |
| CPU | Basic Instructions | 108 instructions | |
| | Minimum 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) |
| | Operating 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 ⁽¹⁾ , I ² C bus ⁽²⁾ | |
| | CAN Module | 2 channels 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 | 39 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 ⁽⁴⁾ |
| | 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 (optional) | -40 to 85°C (T version) |
| | Package | 144-pin plastic molded LQFP | |

NOTES:

1. IEBus is a trademark of NEC Electronics Corporation.
2. I²C bus is a trademark of Koninklijke Philips Electronics N. V.
3. The supply voltage of M32C/85T (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.

Table 1.2 M32C/85 Group (M32C/85, M32C/85T) Performance (100-Pin Package)

| Characteristic | | Performance | |
|-------------------------------|------------------------------------|--|---|
| | | M32C/85 | M32C/85T |
| CPU | Basic Instructions | 108 instructions | |
| | Minimum Instruction Execution Time | 31.3 ns (f(BCLK)=32 MHz, V _{CC1} =4.2 V to 5.5 V) 41.7 ns (f(BCLK)=24 MHz, V _{CC1} =3.0 V to 5.5 V) | 31.3 ns (f(BCLK)=32 MHz, V _{CC1} =4.2 V to 5.5 V) |
| | Operating 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 ⁽¹⁾ , I ² C bus ⁽²⁾ | |
| | CAN Module | 2 channels 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 | 39 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 ⁽⁴⁾ |
| Electrical Characteristics | Supply Voltage | V _{CC1} =4.2 V to 5.5 V, V _{CC2} =3.0 V to V _{CC1} (f(BCLK)=32 MHz) V _{CC1} =3.0 V to 5.5 V, V _{CC2} =3.0 V to V _{CC1} (f(BCLK)=24 MHz) | V _{CC1} =V _{CC2} =4.2 V to 5.5 V, (f(BCLK)=32 MHz) ⁽³⁾ |
| | Power Consumption | 28 mA (V _{CC1} =V _{CC2} =5 V, f(BCLK)=32 MHz) 22 mA (V _{CC1} =V _{CC2} =3.3 V, f(BCLK)=24 MHz) 10μA (V _{CC1} =V _{CC2} =5 V, f(BCLK)=32 kHz, in wait mode) | 28 mA (V _{CC1} =V _{CC2} =5 V, f(BCLK)=32 MHz) 10μA (V _{CC1} =V _{CC2} =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. I²C bus is a trademark of Koninklijke Philips Electronics N. V.
3. The supply voltage of M32C/85T (High-reliability version) must be V_{CC1}=V_{CC2}.
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/85 group (M32C/85, M32C/85T) microcomputer.

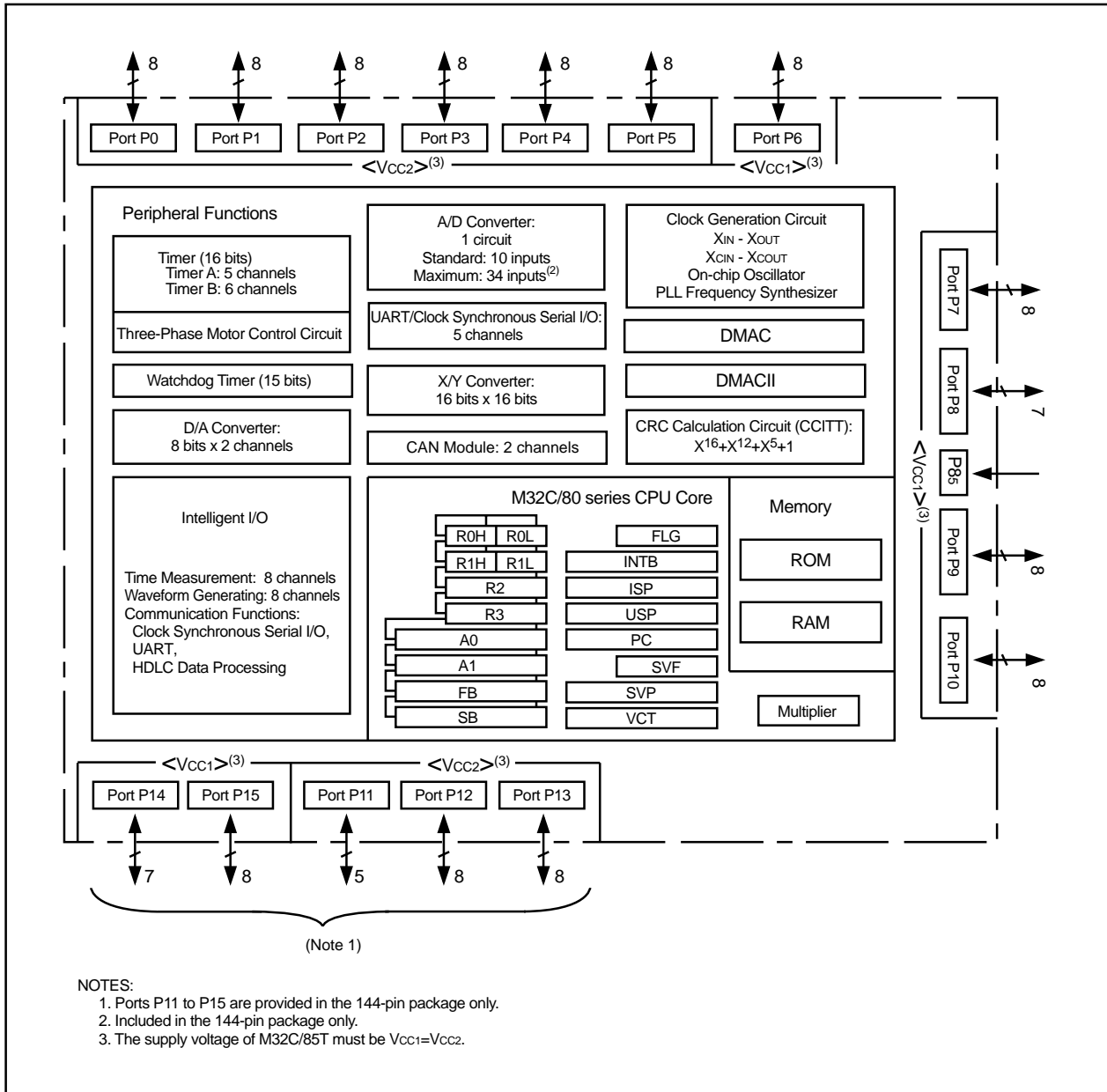


Figure 1.1 M32C/85 Group (M32C/85, M32C/85T) Block Diagram

1.4 Product Information

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

Table 1.3 M32C/85 Group (1) (M32C/85)

As of July, 2005

| Type Number | Package Type | ROM Capacity | RAM Capacity | Remarks |
|----------------|-------------------------|--------------|--------------|--------------|
| M30855FJGP | PLQP0144KA-A (144P6Q-A) | 512K+4K | 24K | Flash Memory |
| M30853FJGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30853FJFP | PRQP0100JB-A (100P6S-A) | | | |
| M30855FHGP | PLQP0144KA-A (144P6Q-A) | 384K+4K | | |
| M30853FHGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30853FHFP | PRQP0100JB-A (100P6S-A) | | | |
| M30855FWGP | PLQP0144KA-A (144P6Q-A) | 320K+4K | | |
| M30853FWGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30853FWFP | PRQP0100JB-A (100P6S-A) | | | |
| M30855MW-XXXGP | PLQP0144KA-A (144P6Q-A) | 320K | | Mask ROM |
| M30853MW-XXXGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30853MW-XXXFP | PRQP0100JB-A (100P6S-A) | | | |

Table 1.3 M32C/85 Group (2) (T Version, M32C/85T)

As of July, 2005

| Type Number | Package Type | ROM Capacity | RAM Capacity | Remarks |
|-------------|-------------------------|--------------|--------------|---|
| M30855FJTGP | PLQP0144KA-A (144P6Q-A) | 512K+4K | 24K | Flash Memory T Version (High-reliability 85°C Version) |
| M30853FJTGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30855FHTGP | PLQP0144KA-A (144P6Q-A) | 384K+4K | | |
| M30853FHTGP | PLQP0100KB-A (100P6Q-A) | | | |
| M30855FWTGP | PLQP0144KA-A (144P6Q-A) | 320K+4K | | |
| M30853FWTGP | PLQP0100KB-A (100P6Q-A) | | | |

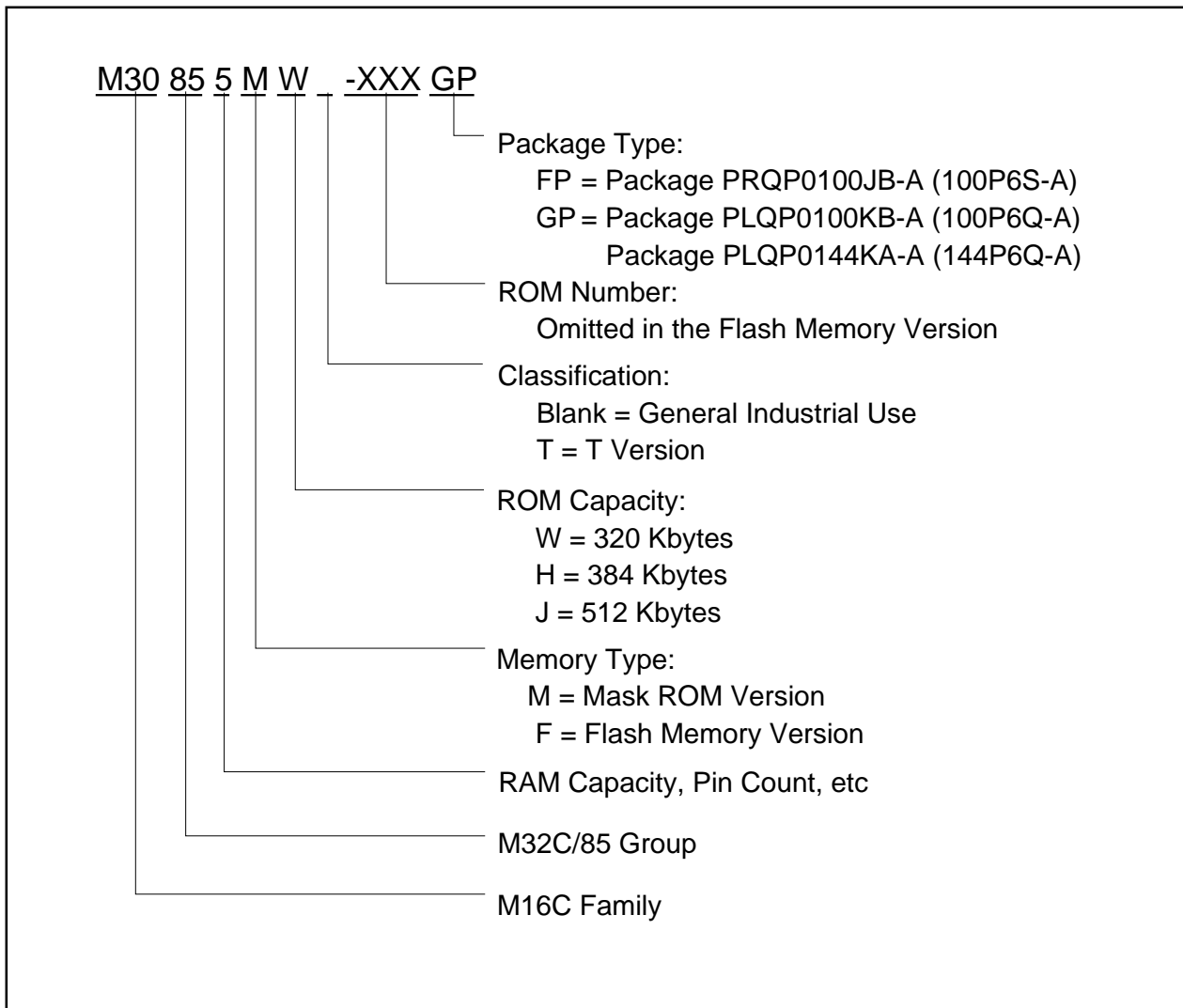


Figure 1.2 Product Numbering System

1.5 Pin Assignments and Descriptions

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

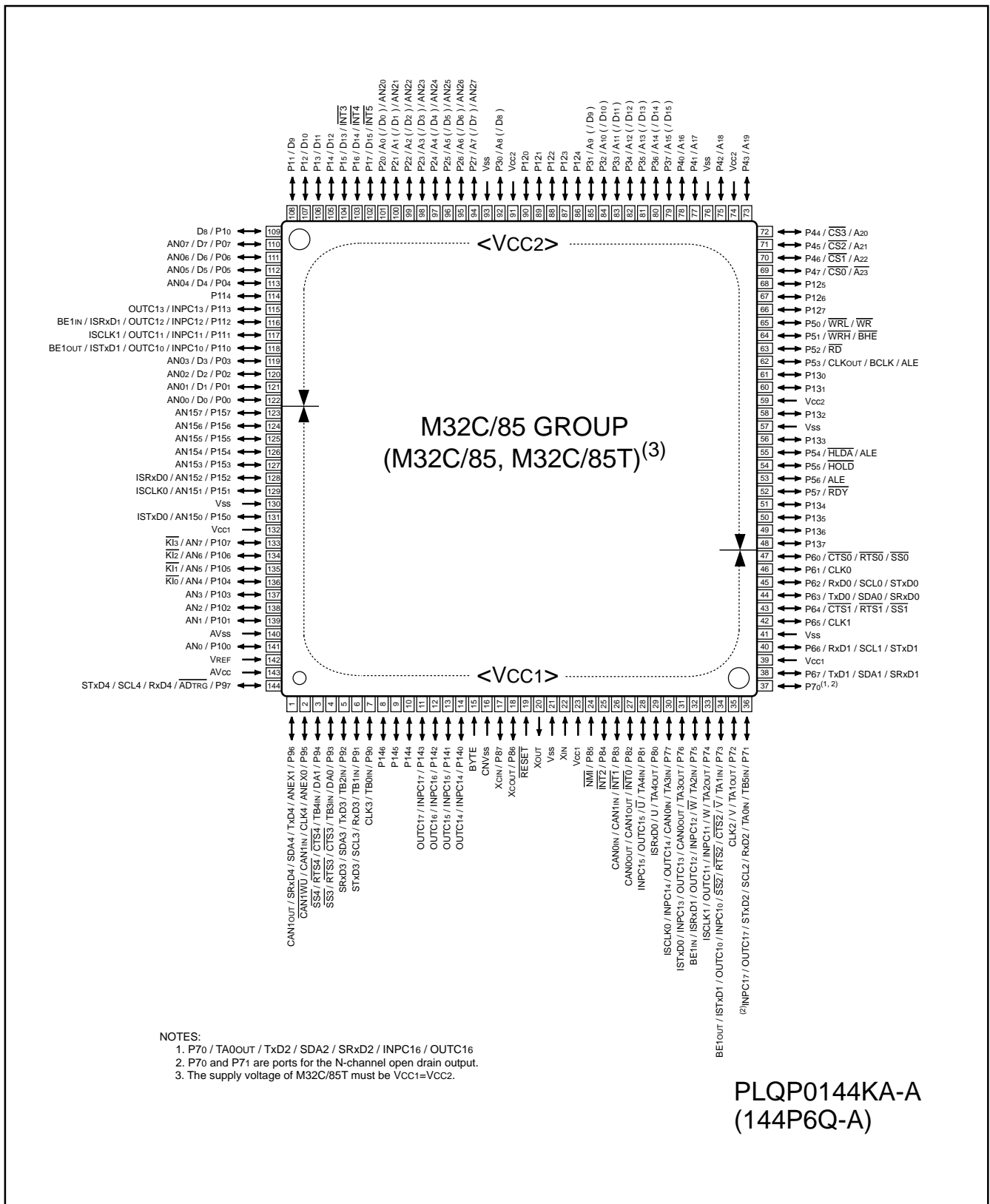


Figure 1.3 Pin Assignment for 144-Pin Package

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 ⁽¹⁾ |
|---------|-------------|------|---------------|-------------|-------------------------|-----------------------------|------------|--------------------------------|
| 1 | | P96 | | | TxD4/SDA4/SRxD4/CAN1out | | ANEX1 | |
| 2 | | P95 | | | CLK4/CAN1in/CAN1WU | | ANEX0 | |
| 3 | | P94 | | TB4IN | CTS4/RTS4/SS4 | | DA1 | |
| 4 | | P93 | | TB3IN | CTS3/RTS3/SS3 | | DA0 | |
| 5 | | P92 | | TB2IN | TxD3/SDA3/SRxD3 | | | |
| 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 | XCIN | P87 | | | | | | |
| 18 | XCOU | P86 | | | | | | |
| 19 | RESET | | | | | | | |
| 20 | XOUT | | | | | | | |
| 21 | Vss | | | | | | | |
| 22 | XIN | | | | | | | |
| 23 | Vcc1 | | | | | | | |
| 24 | | P85 | NMI | | | | | |
| 25 | | P84 | INT2 | | | | | |
| 26 | | P83 | INT1 | | CAN0in/CAN1in | | | |
| 27 | | P82 | INT0 | | CAN0out/CAN1out | | | |
| 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/SRxD2 | INPC16/OUTC16 | | |
| 38 | | P67 | | | TxD1/SDA1/SRxD1 | | | |
| 39 | Vcc1 | | | | | | | |
| 40 | | P66 | | | RxD1/SCL1/STxD1 | | | |
| 41 | Vss | | | | | | | |
| 42 | | P65 | | | CLK1 | | | |
| 43 | | P64 | | | CTS1/RTS1/SS1 | | | |
| 44 | | P63 | | | TxD0/SDA0/SRxD0 | | | |
| 45 | | P62 | | | RxD0/SCL0/STxD0 | | | |
| 46 | | P61 | | | CLK0 | | | |
| 47 | | P60 | | | CTS0/RTS0/SS0 | | | |
| 48 | | P137 | | | | | | |

NOTES:

1. Bus control pins in M32C/85T 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 ⁽¹⁾ |
|---------|-------------|------|---------------|-----------|--------------|---------------------|------------|-------------------------------------|
| 49 | | P136 | | | | | | |
| 50 | | P135 | | | | | | |
| 51 | | P134 | | | | | | |
| 52 | | P57 | | | | | | $\overline{\text{RDY}}$ |
| 53 | | P56 | | | | | | $\overline{\text{ALE}}$ |
| 54 | | P55 | | | | | | $\overline{\text{HOLD}}$ |
| 55 | | P54 | | | | | | $\overline{\text{HLDA/ALE}}$ |
| 56 | | P133 | | | | | | |
| 57 | Vss | | | | | | | |
| 58 | | P132 | | | | | | |
| 59 | Vcc2 | | | | | | | |
| 60 | | P131 | | | | | | |
| 61 | | P130 | | | | | | |
| 62 | | P53 | | | | | | $\overline{\text{CLKOUT/BCLK/ALE}}$ |
| 63 | | P52 | | | | | | $\overline{\text{RD}}$ |
| 64 | | P51 | | | | | | $\overline{\text{WRH/BHE}}$ |
| 65 | | P50 | | | | | | $\overline{\text{WRL/WR}}$ |
| 66 | | P127 | | | | | | |
| 67 | | P126 | | | | | | |
| 68 | | P125 | | | | | | |
| 69 | | P47 | | | | | | $\overline{\text{CS0/A23}}$ |
| 70 | | P46 | | | | | | $\overline{\text{CS1/A22}}$ |
| 71 | | P45 | | | | | | $\overline{\text{CS2/A21}}$ |
| 72 | | P44 | | | | | | $\overline{\text{CS3/A20}}$ |
| 73 | | P43 | | | | | | A19 |
| 74 | Vcc2 | | | | | | | |
| 75 | | P42 | | | | | | A18 |
| 76 | Vss | | | | | | | |
| 77 | | P41 | | | | | | A17 |
| 78 | | P40 | | | | | | A16 |
| 79 | | P37 | | | | | | A15(/D15) |
| 80 | | P36 | | | | | | A14(/D14) |
| 81 | | P35 | | | | | | A13(/D13) |
| 82 | | P34 | | | | | | A12(/D12) |
| 83 | | P33 | | | | | | A11(/D11) |
| 84 | | P32 | | | | | | A10(/D10) |
| 85 | | P31 | | | | | | A9(/D9) |
| 86 | | P124 | | | | | | |
| 87 | | P123 | | | | | | |
| 88 | | P122 | | | | | | |
| 89 | | P121 | | | | | | |
| 90 | | P120 | | | | | | |
| 91 | Vcc2 | | | | | | | |
| 92 | | P30 | | | | | | A8(/D8) |
| 93 | Vss | | | | | | | |
| 94 | | P27 | | | | | AN27 | A7(/D7) |
| 95 | | P26 | | | | | AN26 | A6(/D6) |
| 96 | | P25 | | | | | AN25 | A5(/D5) |

NOTES:

1. Bus control pins in M32C/85T 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 ⁽¹⁾ |
|---------|-------------|------|---------------|-----------|-----------------|-----------------------------|------------|--------------------------------|
| 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 | K13 | | | | AN7 | |
| 134 | | P106 | K12 | | | | AN6 | |
| 135 | | P105 | K11 | | | | AN5 | |
| 136 | | P104 | K10 | | | | 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/85T cannot be used,

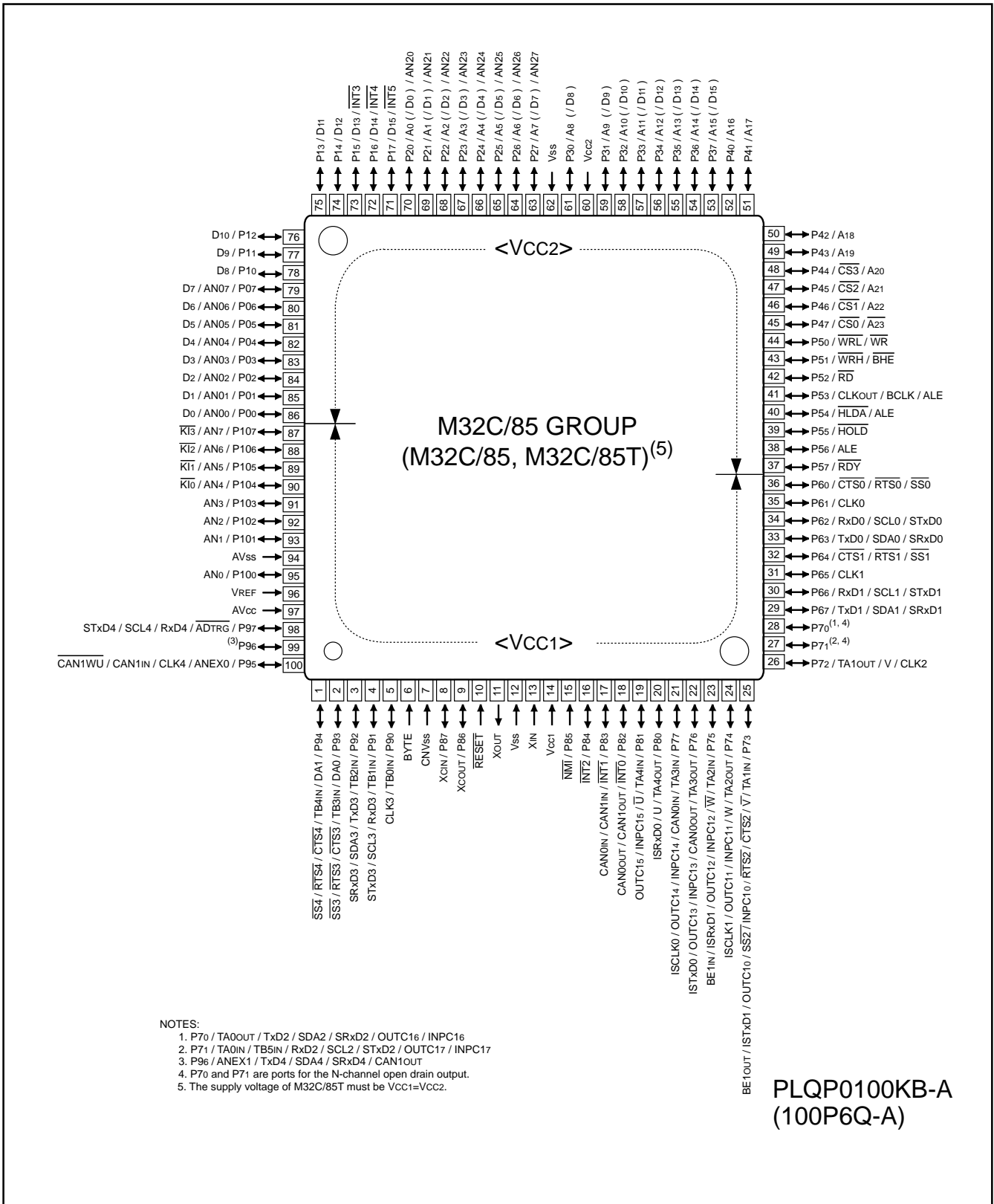


Figure 1.4 Pin Assignment for 100-Pin Package

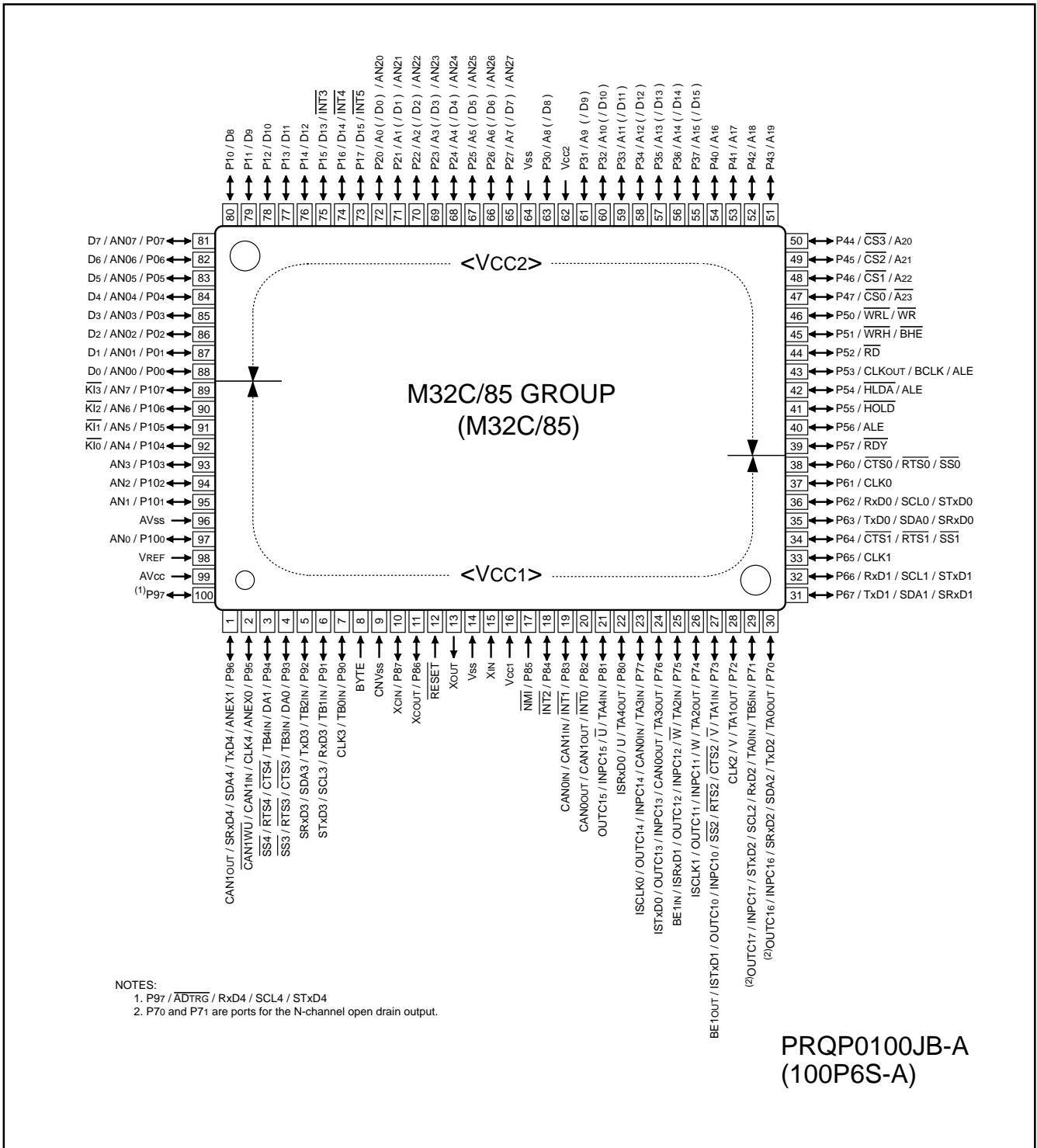


Figure 1.5 Pin Assignment for 100-Pin Package

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 ⁽¹⁾ |
|-----------------|-----|-------------|------|---------------|-----------------|------------------------|-----------------------------|------------|--------------------------------|
| FP | GP | | | | | | | | |
| 1 | 99 | | P96 | | | TxD4/SDA4/SRx4/CAN1OUT | | ANEX1 | |
| 2 | 100 | | P95 | | | CLK4/CAN1IN/CAN1WU | | ANEX0 | |
| 3 | 1 | | P94 | | TB4IN | CTS4/RTS4/SS4 | | DA1 | |
| 4 | 2 | | P93 | | TB3IN | CTS3/RTS3/SS3 | | DA0 | |
| 5 | 3 | | P92 | | TB2IN | TxD3/SDA3/SRx3 | | | |
| 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 | 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/CAN1IN | | | |
| 20 | 18 | | P82 | INT0 | | CAN0OUT/CAN1OUT | | | |
| 21 | 19 | | P81 | TA4IN/U | | | INPC15/OUTC15 | | |
| 22 | 20 | | P80 | TA4OUT/U | | | ISRxD0 | | |
| 23 | 21 | | P77 | TA3IN | CAN0IN | | INPC14/OUTC14/ISCLK0 | | |
| 24 | 22 | | P76 | TA3OUT | CAN0OUT | | INPC13/OUTC13/ISTxD0 | | |
| 25 | 23 | | P75 | TA2IN/W | | | INPC12/OUTC12/ISRxD1/BE1IN | | |
| 26 | 24 | | P74 | TA2OUT/W | | | INPC11/OUTC11/ISCLK1 | | |
| 27 | 25 | | P73 | TA1IN/V | CTS2/RTS2/SS2 | | INPC10/OUTC10/ISTxD1/BE1OUT | | |
| 28 | 26 | | P72 | TA1OUT/V | CLK2 | | | | |
| 29 | 27 | | P71 | TB5IN/TA0IN | RxD2/SCL2/STxD2 | | INPC17/OUTC17 | | |
| 30 | 28 | | P70 | TA0OUT | TxD2/SDA2/SRx2 | | INPC16/OUTC16 | | |
| 31 | 29 | | P67 | | TxD1/SDA1/SRx1 | | | | |
| 32 | 30 | | P66 | | RxD1/SCL1/STxD1 | | | | |
| 33 | 31 | | P65 | | CLK1 | | | | |
| 34 | 32 | | P64 | | CTS1/RTS1/SS1 | | | | |
| 35 | 33 | | P63 | | TxD0/SDA0/SRx0 | | | | |
| 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/85T 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 ⁽¹⁾ |
|-----------------|----|-------------|------|--------------------------|-----------------|--------------|---------------------------|------------|--------------------------------|
| 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 | $\overline{\text{INT5}}$ | | | | D15 | |
| 74 | 72 | | P16 | $\overline{\text{INT4}}$ | | | | D14 | |
| 75 | 73 | | P15 | $\overline{\text{INT3}}$ | | | | 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 | $\overline{\text{KI3}}$ | | | AN7 | | |
| 90 | 88 | | P106 | $\overline{\text{KI2}}$ | | | AN6 | | |
| 91 | 89 | | P105 | $\overline{\text{KI1}}$ | | | AN5 | | |
| 92 | 90 | | P104 | $\overline{\text{KI0}}$ | | | 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 | | $\overline{\text{ADTRG}}$ | | |

NOTES:

1. Bus control pins in M32C/85T 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. $V_{CC1} \geq V_{CC2}^{(1, 2)}$ |
| 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 ⁽³⁾ | 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 ⁽³⁾ | 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 |
| | A23 | 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"> ■ 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". ■ 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. |
| | 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/85T. $V_{CC1}=V_{CC2}$.
3. Bus control pins in M32C/85T 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 ⁽¹⁾ | 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 | | 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 ² 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 | | | 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 | | 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/85T 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 ⁽¹⁾ | Input pins for the time measurement function |
| | INPC14 to INPC17 | | VCC1 | |
| | OUTC10 to OUTC13 | O | VCC1/VCC2 ⁽¹⁾ | 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 | | VCC1 | |
| | ISCLK0 | I/O | VCC1 | Inputs and outputs the clock for the intelligent I/O communication function |
| | ISCLK1 | | VCC1/VCC2 ⁽¹⁾ | |
| | ISRXD0 | I | VCC1 | Inputs data for the intelligent I/O communication function |
| | ISRXD1 | | VCC1/VCC2 ⁽¹⁾ | |
| | ISTXD0 | O | VCC1 | Outputs data for the intelligent I/O communication function |
| | ISTXD1 | | VCC1/VCC2 ⁽¹⁾ | |
| | BE1IN | I | VCC1/VCC2 ⁽¹⁾ | Inputs data for the intelligent I/O communication function |
| | BE1OUT | O | VCC1/VCC2 ⁽¹⁾ | Outputs data for the intelligent I/O communication function |
| CAN | CAN0IN | I | VCC1 | Input pin for the CAN communication function |
| | CAN1IN | | | |
| | CAN0OUT | O | | Output pin for the CAN communication function |
| | CAN1OUT | | | |
| | CAN1WU | I | | Input pin for the CAN1 wake-up interrupt |
| 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.

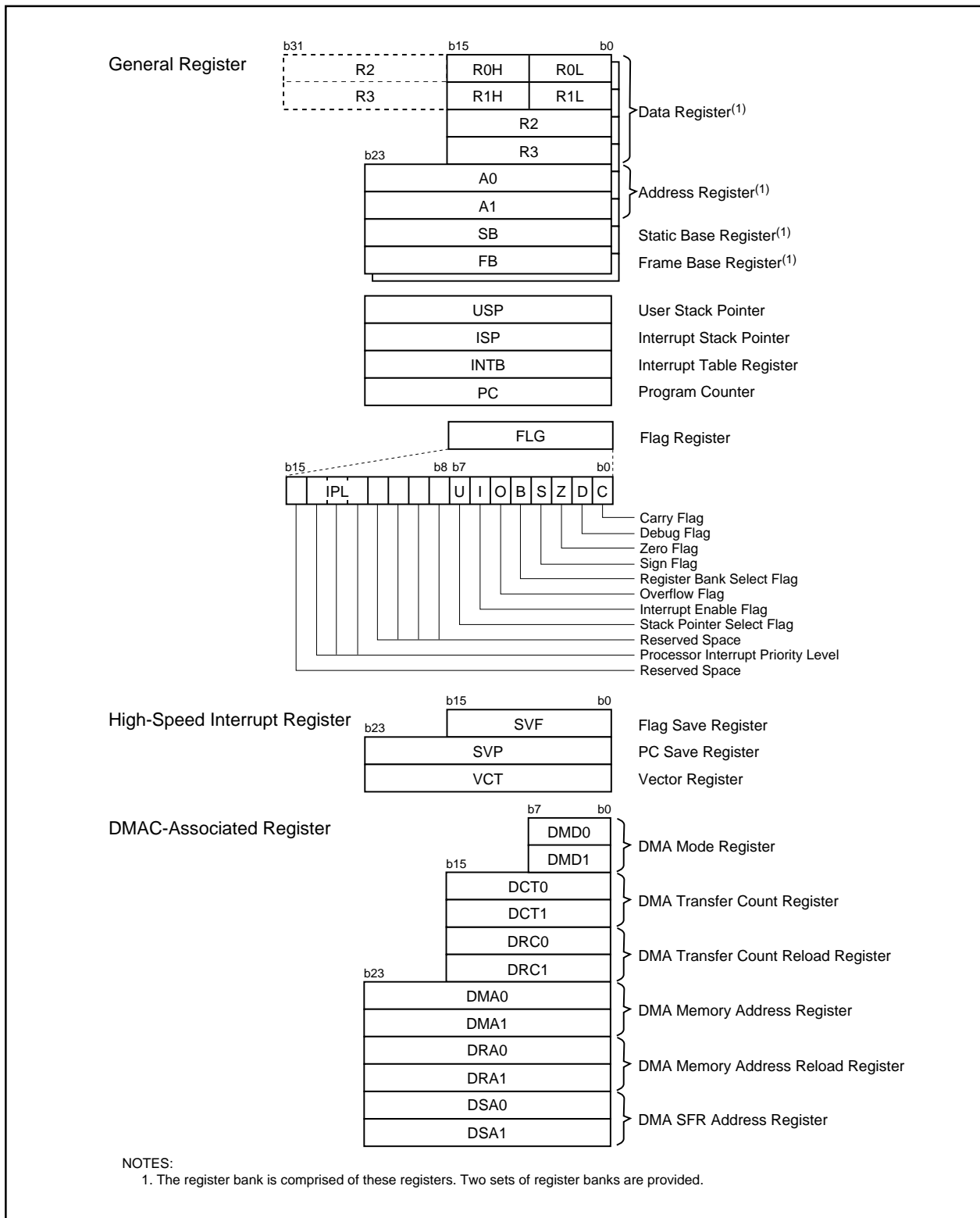


Figure 2.1 CPU Register

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/85 group (M32C/85, M32C/85T).

The M32C/85 group (M32C/85, M32C/85T) provides 16-Mbyte address space from addresses 000000₁₆ to FFFFFFF₁₆.

The internal ROM is allocated lower addresses beginning with address FFFFFFF₁₆. For example, a 64-Kbyte internal ROM is allocated addresses FF0000₁₆ to FFFFFFF₁₆.

The fixed interrupt vectors are allocated addresses FFFFDC₁₆ to FFFFFFF₁₆. It stores the starting address of each interrupt routine.

The internal RAM is allocated higher addresses beginning with address 000400₁₆. For example, a 10-Kbyte internal RAM is allocated addresses 000400₁₆ to 002BFF₁₆. 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, timers, is allocated addresses 000000₁₆ to 0003FF₁₆. All blank spaces within SFR are reserved and cannot be accessed by users.

The special page vectors are allocated addresses FFFE00₁₆ to FFFFDB₁₆. 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.

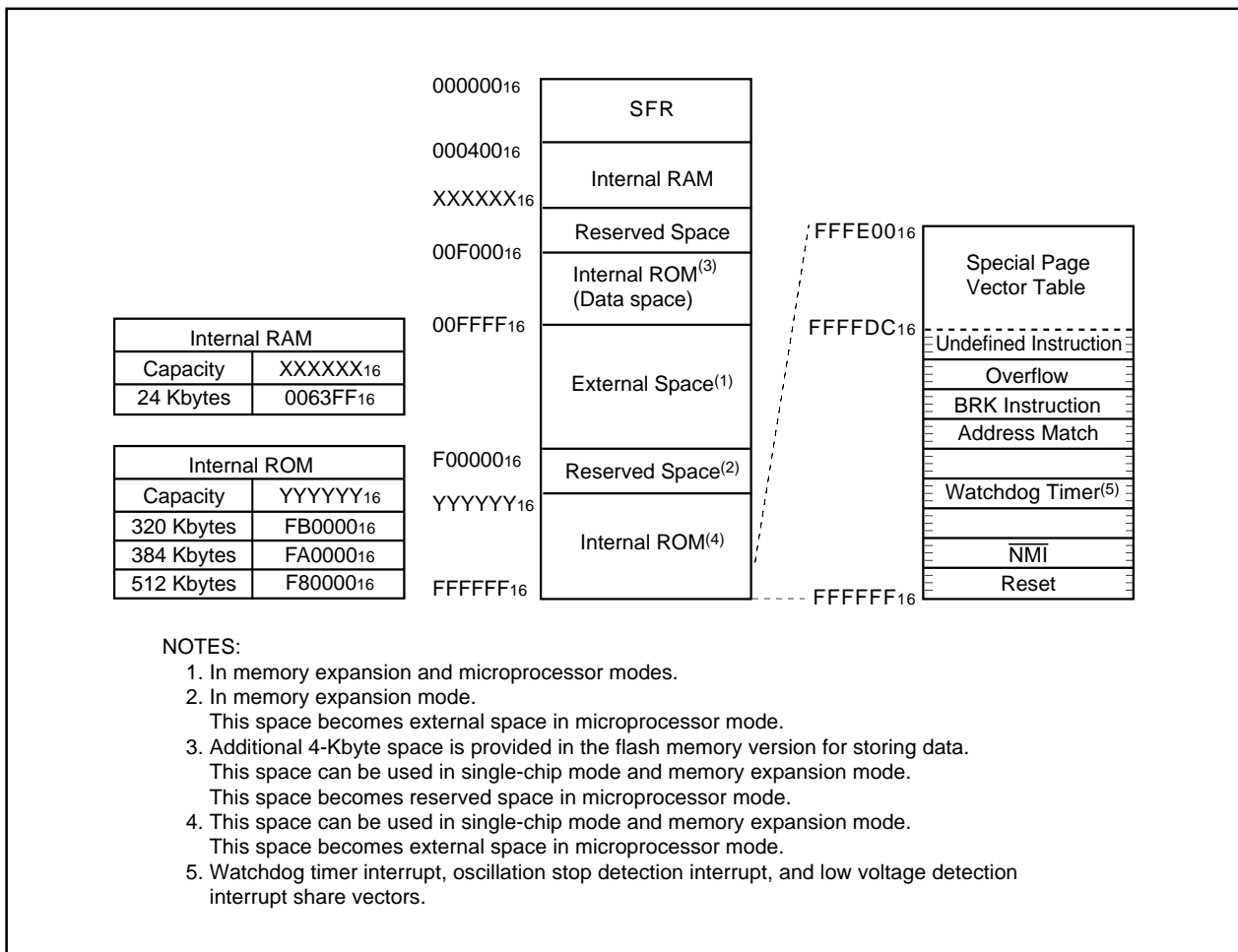


Figure 3.1 Memory Map

4. Special Function Registers (SFR)

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

1. The PM01 and PM00 bits in the PM0 register maintain values set before reset, even after software reset or watchdog timer reset has been performed.
2. These registers in M32C/85T cannot be used.

| Address | Register | Symbol | Value after RESET |
|--|---|--------|--|
| 0030 ₁₆ | | | |
| 0031 ₁₆ | | | |
| 0032 ₁₆ | | | |
| 0033 ₁₆ | | | |
| 0034 ₁₆ | | | |
| 0035 ₁₆ | | | |
| 0036 ₁₆ | | | |
| 0037 ₁₆ | | | |
| 0038 ₁₆ 0039 ₁₆ 003A ₁₆ | Address Match Interrupt Register 6 | RMAD6 | 000000 ₁₆ |
| 003B ₁₆ | | | |
| 003C ₁₆ 003D ₁₆ 003E ₁₆ | Address Match Interrupt Register 7 | RMAD7 | 000000 ₁₆ |
| 003F ₁₆ | | | |
| 0040 ₁₆ | | | |
| 0041 ₁₆ | | | |
| 0042 ₁₆ | | | |
| 0043 ₁₆ | | | |
| 0044 ₁₆ | | | |
| 0045 ₁₆ | | | |
| 0046 ₁₆ | | | |
| 0047 ₁₆ | | | |
| 0048 ₁₆ | External Space Wait Control Register 0 ⁽¹⁾ | EWCR0 | X0X0 0011 ₂ |
| 0049 ₁₆ | External Space Wait Control Register 1 ⁽¹⁾ | EWCR1 | X0X0 0011 ₂ |
| 004A ₁₆ | External Space Wait Control Register 2 ⁽¹⁾ | EWCR2 | X0X0 0011 ₂ |
| 004B ₁₆ | External Space Wait Control Register 3 ⁽¹⁾ | EWCR3 | X0X0 0011 ₂ |
| 004C ₁₆ | | | |
| 004D ₁₆ | | | |
| 004E ₁₆ | | | |
| 004F ₁₆ | | | |
| 0050 ₁₆ | | | |
| 0051 ₁₆ | | | |
| 0052 ₁₆ | | | |
| 0053 ₁₆ | | | |
| 0054 ₁₆ | | | |
| 0055 ₁₆ 0056 ₁₆ | Flash Memory Control Register 1 | FMR1 | 0000 0101 ₂ |
| 0057 ₁₆ | Flash Memory Control Register 0 | FMR0 | 0000 0001 ₂ (Flash memory version) XXXX XXX0 ₂ (Masked ROM version) |
| 0058 ₁₆ | | | |
| 0059 ₁₆ | | | |
| 005A ₁₆ | | | |
| 005B ₁₆ | | | |
| 005C ₁₆ | | | |
| 005D ₁₆ | | | |
| 005E ₁₆ | | | |
| 005F ₁₆ | | | |

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

1. These registers cannot be used in M32C/85T.

| Address | Register | Symbol | Value after RESET |
|--------------------|--|--------------------|-------------------|
| 0060 ₁₆ | | | |
| 0061 ₁₆ | | | |
| 0062 ₁₆ | | | |
| 0063 ₁₆ | | | |
| 0064 ₁₆ | | | |
| 0065 ₁₆ | | | |
| 0066 ₁₆ | | | |
| 0067 ₁₆ | | | |
| 0068 ₁₆ | DMA0 Interrupt Control Register | DM0IC | XXXX X0002 |
| 0069 ₁₆ | Timer B5 Interrupt Control Register | TB5IC | XXXX X0002 |
| 006A ₁₆ | DMA2 Interrupt Control Register | DM2IC | XXXX X0002 |
| 006B ₁₆ | UART2 Receive /ACK Interrupt Control Register | S2RIC | XXXX X0002 |
| 006C ₁₆ | Timer A0 Interrupt Control Register | TA0IC | XXXX X0002 |
| 006D ₁₆ | UART3 Receive /ACK Interrupt Control Register | S3RIC | XXXX X0002 |
| 006E ₁₆ | Timer A2 Interrupt Control Register | TA2IC | XXXX X0002 |
| 006F ₁₆ | UART4 Receive /ACK Interrupt Control Register | S4RIC | XXXX X0002 |
| 0070 ₁₆ | Timer A4 Interrupt Control Register | TA4IC | XXXX X0002 |
| 0071 ₁₆ | UART0/UART3 Bus Conflict Detect Interrupt Control Register | BCN0IC/BCN3IC | XXXX X0002 |
| 0072 ₁₆ | UART0 Receive/ACK Interrupt Control Register | S0RIC | XXXX X0002 |
| 0073 ₁₆ | A/D0 Conversion Interrupt Control Register | AD0IC | XXXX X0002 |
| 0074 ₁₆ | UART1 Receive/ACK Interrupt Control Register | S1RIC | XXXX X0002 |
| 0075 ₁₆ | Intelligent I/O Interrupt Control Register 0/ CAN Interrupt 3 Control Register | IIO0IC/ CAN3IC | XXXX X0002 |
| 0076 ₁₆ | Timer B1 Interrupt Control Register | TB1IC | XXXX X0002 |
| 0077 ₁₆ | Intelligent I/O Interrupt Control Register 2 | IIO2IC | XXXX X0002 |
| 0078 ₁₆ | Timer B3 Interrupt Control Register | TB3IC | XXXX X0002 |
| 0079 ₁₆ | Intelligent I/O Interrupt Control Register 4 | IIO4IC | XXXX X0002 |
| 007A ₁₆ | INT5 Interrupt Control Register | INT5IC | XX00 X0002 |
| 007B ₁₆ | | | |
| 007C ₁₆ | INT3 Interrupt Control Register | INT3IC | XX00 X0002 |
| 007D ₁₆ | Intelligent I/O Interrupt Control Register 8 | IIO8IC | XXXX X0002 |
| 007E ₁₆ | INT1 Interrupt Control Register | INT1IC | XX00 X0002 |
| 007F ₁₆ | Intelligent I/O Interrupt Control Register 10/ CAN Interrupt 1 Control Register | IIO10IC/ CAN1IC | XXXX X0002 |
| 0080 ₁₆ | | | |
| 0081 ₁₆ | CAN Interrupt 2 Control Register | CAN2IC | XXXX X0002 |
| 0082 ₁₆ | | | |
| 0083 ₁₆ | | | |
| 0084 ₁₆ | | | |
| 0085 ₁₆ | | | |
| 0086 ₁₆ | | | |
| 0087 ₁₆ | | | |
| 0088 ₁₆ | DMA1 Interrupt Control Register | DM1IC | XXXX X0002 |
| 0089 ₁₆ | UART2 Transmit /NACK Interrupt Control Register | S2TIC | XXXX X0002 |
| 008A ₁₆ | DMA3 Interrupt Control Register | DM3IC | XXXX X0002 |
| 008B ₁₆ | UART3 Transmit /NACK Interrupt Control Register | S3TIC | XXXX X0002 |
| 008C ₁₆ | Timer A1 Interrupt Control Register | TA1IC | XXXX X0002 |
| 008D ₁₆ | UART4 Transmit /NACK Interrupt Control Register | S4TIC | XXXX X0002 |
| 008E ₁₆ | Timer A3 Interrupt Control Register | TA3IC | XXXX X0002 |
| 008F ₁₆ | UART2 Bus Conflict Detect Interrupt Control Register | BCN2IC | XXXX X0002 |

X: Indeterminate

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| Address | Register | Symbol | Value after RESET |
|--------------------|---|-------------------|-------------------|
| 0090 ₁₆ | UART0 Transmit /NACK Interrupt Control Register | S0TIC | XXXX X0002 |
| 0091 ₁₆ | UART1/UART4 Bus Conflict Detect Interrupt Control Register | BCN1IC/BCN4IC | XXXX X0002 |
| 0092 ₁₆ | UART1 Transmit/NACK Interrupt Control Register | S1TIC | XXXX X0002 |
| 0093 ₁₆ | Key Input Interrupt Control Register | KUPIC | XXXX X0002 |
| 0094 ₁₆ | Timer B0 Interrupt Control Register | TB0IC | XXXX X0002 |
| 0095 ₁₆ | Intelligent I/O Interrupt Control Register 1/ CAN Interrupt 4 Control Register | IIO1IC/ CAN4IC | XXXX X0002 |
| 0096 ₁₆ | Timer B2 Interrupt Control Register | TB2IC | XXXX X0002 |
| 0097 ₁₆ | Intelligent I/O Interrupt Control Register 3 | IIO3IC | XXXX X0002 |
| 0098 ₁₆ | Timer B4 Interrupt Control Register | TB4IC | XXXX X0002 |
| 0099 ₁₆ | CAN Interrupt 5 Control Register | CAN5IC | XXXX X0002 |
| 009A ₁₆ | INT4 Interrupt Control Register | INT4IC | XX00 X0002 |
| 009B ₁₆ | | | |
| 009C ₁₆ | INT2 Interrupt Control Register | INT2IC | XX00 X0002 |
| 009D ₁₆ | Intelligent I/O Interrupt Control Register 9/ CAN Interrupt 0 Control Register | IIO9IC/ CAN0IC | XXXX X0002 |
| 009E ₁₆ | INT0 Interrupt Control Register | INT0IC | XX00 X0002 |
| 009F ₁₆ | Exit Priority Control Register | RLVL | XXXX 00002 |
| 00A0 ₁₆ | Interrupt Request Register 0 | IIO0IR | 0000 000X2 |
| 00A1 ₁₆ | Interrupt Request Register 1 | IIO1IR | 0000 000X2 |
| 00A2 ₁₆ | Interrupt Request Register 2 | IIO2IR | 0000 000X2 |
| 00A3 ₁₆ | Interrupt Request Register 3 | IIO3IR | 0000 000X2 |
| 00A4 ₁₆ | Interrupt Request Register 4 | IIO4IR | 0000 000X2 |
| 00A5 ₁₆ | Interrupt Request Register 5 | IIO5IR | 0000 000X2 |
| 00A6 ₁₆ | | | |
| 00A7 ₁₆ | | | |
| 00A8 ₁₆ | Interrupt Request Register 8 | IIO8IR | 0000 000X2 |
| 00A9 ₁₆ | Interrupt Request Register 9 | IIO9IR | 0000 000X2 |
| 00AA ₁₆ | Interrupt Request Register 10 | IIO10IR | 0000 000X2 |
| 00AB ₁₆ | Interrupt Request Register 11 | IIO11IR | 0000 000X2 |
| 00AC ₁₆ | | | |
| 00AD ₁₆ | | | |
| 00AE ₁₆ | | | |
| 00AF ₁₆ | | | |
| 00B0 ₁₆ | Interrupt Enable Register 0 | IIO0IE | 00 ₁₆ |
| 00B1 ₁₆ | Interrupt Enable Register 1 | IIO1IE | 00 ₁₆ |
| 00B2 ₁₆ | Interrupt Enable Register 2 | IIO2IE | 00 ₁₆ |
| 00B3 ₁₆ | Interrupt Enable Register 3 | IIO3IE | 00 ₁₆ |
| 00B4 ₁₆ | Interrupt Enable Register 4 | IIO4IE | 00 ₁₆ |
| 00B5 ₁₆ | Interrupt Enable Register 5 | IIO5IE | 00 ₁₆ |
| 00B6 ₁₆ | | | |
| 00B7 ₁₆ | | | |
| 00B8 ₁₆ | Interrupt Enable Register 8 | IIO8IE | 00 ₁₆ |
| 00B9 ₁₆ | Interrupt Enable Register 9 | IIO9IE | 00 ₁₆ |
| 00BA ₁₆ | Interrupt Enable Register 10 | IIO10IE | 00 ₁₆ |
| 00BB ₁₆ | Interrupt Enable Register 11 | IIO11IE | 00 ₁₆ |
| 00BC ₁₆ | | | |
| 00BD ₁₆ | | | |
| 00BE ₁₆ | | | |
| 00BF ₁₆ | | | |

X: Indeterminate

Blank spaces are reserved. No access is allowed.

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

X: Indeterminate

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

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

X: Indeterminate

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

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

| Address | Register | Symbol | Value after RESET |
|--------------------|---|---------------------|--|
| 0210 ₁₆ | CAN0 Slot Interrupt Mask Register | C0SIMKR | 00 ₁₆ ⁽²⁾ |
| 0211 ₁₆ | | | 00 ₁₆ ⁽²⁾ |
| 0212 ₁₆ | | | |
| 0213 ₁₆ | | | |
| 0214 ₁₆ | CAN0 Error Interrupt Mask Register | C0EIMKR | XXXX X000 ₂ ⁽²⁾ |
| 0215 ₁₆ | CAN0 Error Interrupt Status Register | C0EISTR | XXXX X000 ₂ ⁽²⁾ |
| 0216 ₁₆ | CAN0 Error Cause Register | C0EFR | 00 ₁₆ ⁽²⁾ |
| 0217 ₁₆ | CAN0 Baud Rate Prescaler | C0BRP | 0000 0001 ₂ ⁽²⁾ |
| 0218 ₁₆ | | | |
| 0219 ₁₆ | CAN0 Mode Register | C0MDR | XXXX XX00 ₂ ⁽²⁾ |
| 021A ₁₆ | | | |
| 021B ₁₆ | | | |
| 021C ₁₆ | | | |
| 021D ₁₆ | | | |
| 021E ₁₆ | | | |
| 021F ₁₆ | | | |
| 0220 ₁₆ | CAN0 Single Shot Control Register | C0SSCTLR | 00 ₁₆ ⁽²⁾ |
| 0221 ₁₆ | | | 00 ₁₆ ⁽²⁾ |
| 0222 ₁₆ | | | |
| 0223 ₁₆ | | | |
| 0224 ₁₆ | CAN0 Single Shot Status Register | C0SSSTR | 00 ₁₆ ⁽²⁾ |
| 0225 ₁₆ | | | 00 ₁₆ ⁽²⁾ |
| 0226 ₁₆ | | | |
| 0227 ₁₆ | | | |
| 0228 ₁₆ | CAN0 Global Mask Register Standard ID0 | C0GMR0 | XXX0 0000 ₂ ⁽²⁾ |
| 0229 ₁₆ | CAN0 Global Mask Register Standard ID1 | C0GMR1 | XX00 0000 ₂ ⁽²⁾ |
| 022A ₁₆ | CAN0 Global Mask Register Extended ID0 | C0GMR2 | XXXX 0000 ₂ ⁽²⁾ |
| 022B ₁₆ | CAN0 Global Mask Register Extended ID1 | C0GMR3 | 00 ₁₆ ⁽²⁾ |
| 022C ₁₆ | CAN0 Global Mask Register Extended ID2 | C0GMR4 | XX00 0000 ₂ ⁽²⁾ |
| 022D ₁₆ | | | |
| 022E ₁₆ | | | |
| 022F ₁₆ | | | |
| 0230 ₁₆ | CAN0 Message Slot 0 Control Register / CAN0 Local Mask Register A Standard ID0 | C0MCTL0/ C0LMAR0 | 0000 0000 ₂ ⁽²⁾ XXX0 0000 ₂ ⁽²⁾ |
| 0231 ₁₆ | CAN0 Message Slot 1 Control Register / CAN0 Local Mask Register A Standard ID1 | C0MCTL1/ C0LMAR1 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 0232 ₁₆ | CAN0 Message Slot 2 Control Register / CAN0 Local Mask Register A Extended ID0 | C0MCTL2/ C0LMAR2 | 0000 0000 ₂ ⁽²⁾ XXXX 0000 ₂ ⁽²⁾ |
| 0233 ₁₆ | CAN0 Message Slot 3 Control Register / CAN0 local Mask Register A Extended ID1 | C0MCTL3/ C0LMAR3 | 00 ₁₆ ⁽²⁾ 00 ₁₆ ⁽²⁾ |
| 0234 ₁₆ | CAN0 Message Slot 4 Control Register / CAN0 Local Mask Register A Extended ID2 | C0MCTL4/ C0LMAR4 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 0235 ₁₆ | CAN0 Message Slot 5 Control Register | C0MCTL5 | 00 ₁₆ ⁽²⁾ |
| 0236 ₁₆ | CAN0 Message Slot 6 Control Register | C0MCTL6 | 00 ₁₆ ⁽²⁾ |
| 0237 ₁₆ | CAN0 Message Slot 7 Control Register | C0MCTL7 | 00 ₁₆ ⁽²⁾ |
| 0238 ₁₆ | CAN0 Message Slot 8 Control Register / CAN0 Local Mask Register B Standard ID0 | C0MCTL8/ C0LMBR0 | 0000 0000 ₂ ⁽²⁾ XXX0 0000 ₂ ⁽²⁾ |
| 0239 ₁₆ | CAN0 Message Slot 9 Control Register / CAN0 Local Mask Register B Standard ID1 | C0MCTL9/ C0LMBR1 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |

(Note 1)

X: Indeterminate

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NOTES:

1. The BANKSEL bit in the C0CTLR1 register switches functions for addresses 0220₁₆ to 023F₁₆.
2. Values are obtained by setting the SLEEP bit in the C0SLPR register to "1" (sleep mode exited) after reset and applying the clock to the CAN module.

| Address | Register | Symbol | Value after RESET |
|--------------------|--|----------------------|--|
| 023A ₁₆ | CAN0 Message Slot 10 Control Register / CAN0 Local Mask Register B Extended ID0 | C0MCTL10/ C0LMBR2 | 0000 0000 ₂ ⁽²⁾ XXXX 0000 ₂ ⁽²⁾ |
| 023B ₁₆ | CAN0 Message Slot 11 Control Register / CAN0 Local Mask Register B Extended ID1 | C0MCTL11/ C0LMBR3 | 00 ₁₆ ⁽²⁾ 00 ₁₆ ⁽²⁾ |
| 023C ₁₆ | CAN0 Message Slot 12 Control Register / CAN0 Local Mask Register B Extended ID2 | C0MCTL12/ C0LMBR4 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 023D ₁₆ | CAN0 Message Slot 13 Control Register | C0MCTL13 | 00 ₁₆ ⁽²⁾ |
| 023E ₁₆ | CAN0 Message Slot 14 Control Register | C0MCTL14 | 00 ₁₆ ⁽²⁾ |
| 023F ₁₆ | CAN0 Message Slot 15 Control Register | C0MCTL15 | 00 ₁₆ ⁽²⁾ |
| 0240 ₁₆ | CAN0 Slot Buffer Select Register | C0SBS | 00 ₁₆ ⁽²⁾ |
| 0241 ₁₆ | CAN0 Control Register 1 | C0CTLR1 | X000 00XX ₂ ⁽²⁾ |
| 0242 ₁₆ | CAN0 Sleep Control Register | C0SLPR | XXXX XXX0 ₂ |
| 0243 ₁₆ | | | |
| 0244 ₁₆ | CAN0 Acceptance Filter Support Register | C0AFS | 00 ₁₆ ⁽²⁾ |
| 0245 ₁₆ | | | 01 ₁₆ ⁽²⁾ |
| 0246 ₁₆ | | | |
| 0247 ₁₆ | | | |
| 0248 ₁₆ | | | |
| 0249 ₁₆ | | | |
| 024A ₁₆ | | | |
| 024B ₁₆ | | | |
| 024C ₁₆ | | | |
| 024D ₁₆ | | | |
| 024E ₁₆ | | | |
| 024F ₁₆ | | | |
| 0250 ₁₆ | CAN1 Slot Buffer Select Register | C1SBS | 00 ₁₆ ⁽³⁾ |
| 0251 ₁₆ | CAN1 Control Register 1 | C1CTLR1 | X000 00XX ₂ ⁽³⁾ |
| 0252 ₁₆ | CAN1 Sleep Control Register | C1SLPR | XXXX XXX0 ₂ |
| 0253 ₁₆ | | | |
| 0254 ₁₆ | CAN1 Acceptance Filter Support Register | C1AFS | 00 ₁₆ ⁽³⁾ |
| 0255 ₁₆ | | | 01 ₁₆ ⁽³⁾ |
| 0256 ₁₆ | | | |
| 0257 ₁₆ | | | |
| 0258 ₁₆ | | | |
| 0259 ₁₆ | | | |
| 025A ₁₆ | | | |
| 025B ₁₆ | | | |
| 025C ₁₆ | | | |
| 025D ₁₆ | | | |
| 025E ₁₆ | | | |
| 025F ₁₆ | | | |

(Note 1)

X: Indeterminate

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NOTES:

1. The BANKSEL bit in the C0CTLR1 register switches functions for addresses 0220₁₆ to 023F₁₆.
2. Values are obtained by setting the SLEEP bit in the C0SLPR register to "1" (sleep mode exited) after reset and applying the clock to the CAN module.
3. Values are obtained by setting the SLEEP bit in the C1SLPR register to "1" (sleep mode exited) after reset and applying the clock to the CAN module.

| Address | Register | Symbol | Value after RESET |
|--|--|------------|--|
| 0260 ₁₆ | CAN1 Message Slot Buffer 0 Standard ID0 | C1SLOT0_0 | XX ₁₆ |
| 0261 ₁₆ | CAN1 Message Slot Buffer 0 Standard ID1 | C1SLOT0_1 | XX ₁₆ |
| 0262 ₁₆ | CAN1 Message Slot Buffer 0 Extended ID0 | C1SLOT0_2 | XX ₁₆ |
| 0263 ₁₆ | CAN1 Message Slot Buffer 0 Extended ID1 | C1SLOT0_3 | XX ₁₆ |
| 0264 ₁₆ | CAN1 Message Slot Buffer 0 Extended ID2 | C1SLOT0_4 | XX ₁₆ |
| 0265 ₁₆ | CAN1 Message Slot Buffer 0 Data Length Code | C1SLOT0_5 | XX ₁₆ |
| 0266 ₁₆ | CAN1 Message Slot Buffer 0 Data 0 | C1SLOT0_6 | XX ₁₆ |
| 0267 ₁₆ | CAN1 Message Slot Buffer 0 Data 1 | C1SLOT0_7 | XX ₁₆ |
| 0268 ₁₆ | CAN1 Message Slot Buffer 0 Data 2 | C1SLOT0_8 | XX ₁₆ |
| 0269 ₁₆ | CAN1 Message Slot Buffer 0 Data 3 | C1SLOT0_9 | XX ₁₆ |
| 026A ₁₆ | CAN1 Message Slot Buffer 0 Data 4 | C1SLOT0_10 | XX ₁₆ |
| 026B ₁₆ | CAN1 Message Slot Buffer 0 Data 5 | C1SLOT0_11 | XX ₁₆ |
| 026C ₁₆ | CAN1 Message Slot Buffer 0 Data 6 | C1SLOT0_12 | XX ₁₆ |
| 026D ₁₆ | CAN1 Message Slot Buffer 0 Data 7 | C1SLOT0_13 | XX ₁₆ |
| 026E ₁₆ | CAN1 Message Slot Buffer 0 Time Stamp High-Order | C1SLOT0_14 | XX ₁₆ |
| 026F ₁₆ | CAN1 Message Slot Buffer 0 Time Stamp Low-Order | C1SLOT0_15 | XX ₁₆ |
| 0270 ₁₆ | CAN1 Message Slot Buffer 1 Standard ID0 | C1SLOT1_0 | XX ₁₆ |
| 0271 ₁₆ | CAN1 Message Slot Buffer 1 Standard ID1 | C1SLOT1_1 | XX ₁₆ |
| 0272 ₁₆ | CAN1 Message Slot Buffer 1 Extended ID0 | C1SLOT1_2 | XX ₁₆ |
| 0273 ₁₆ | CAN1 Message Slot Buffer 1 Extended ID1 | C1SLOT1_3 | XX ₁₆ |
| 0274 ₁₆ | CAN1 Message Slot Buffer 1 Extended ID2 | C1SLOT1_4 | XX ₁₆ |
| 0275 ₁₆ | CAN1 Message Slot Buffer 1 Data Length Code | C1SLOT1_5 | XX ₁₆ |
| 0276 ₁₆ | CAN1 Message Slot Buffer 1 Data 0 | C1SLOT1_6 | XX ₁₆ |
| 0277 ₁₆ | CAN1 Message Slot Buffer 1 Data 1 | C1SLOT1_7 | XX ₁₆ |
| 0278 ₁₆ | CAN1 Message Slot Buffer 1 Data 2 | C1SLOT1_8 | XX ₁₆ |
| 0279 ₁₆ | CAN1 Message Slot Buffer 1 Data 3 | C1SLOT1_9 | XX ₁₆ |
| 027A ₁₆ | CAN1 Message Slot Buffer 1 Data 4 | C1SLOT1_10 | XX ₁₆ |
| 027B ₁₆ | CAN1 Message Slot Buffer 1 Data 5 | C1SLOT1_11 | XX ₁₆ |
| 027C ₁₆ | CAN1 Message Slot Buffer 1 Data 6 | C1SLOT1_12 | XX ₁₆ |
| 027D ₁₆ | CAN1 Message Slot Buffer 1 Data 7 | C1SLOT1_13 | XX ₁₆ |
| 027E ₁₆ | CAN1 Message Slot Buffer 1 Time Stamp High-Order | C1SLOT1_14 | XX ₁₆ |
| 027F ₁₆ | CAN1 Message Slot Buffer 1 Time Stamp Low-Order | C1SLOT1_15 | XX ₁₆ |
| 0280 ₁₆ 0281 ₁₆ | CAN1 Control Register 0 | C1CTLR0 | XX01 0X01 ₂ ⁽¹⁾ XXXX 0000 ₂ ⁽¹⁾ |
| 0282 ₁₆ 0283 ₁₆ | CAN1 Status Register | C1STR | 0000 0000 ₂ ⁽¹⁾ X000 0X01 ₂ ⁽¹⁾ |
| 0284 ₁₆ 0285 ₁₆ | CAN1 Extended ID Register | C1IDR | 00 ₁₆ ⁽¹⁾ 00 ₁₆ ⁽¹⁾ |
| 0286 ₁₆ 0287 ₁₆ | CAN1 Configuration Register | C1CONR | 0000 XXXX ₂ ⁽¹⁾ 0000 0000 ₂ ⁽¹⁾ |
| 0288 ₁₆ 0289 ₁₆ | CAN1 Time Stamp Register | C1TSR | 00 ₁₆ ⁽¹⁾ 00 ₁₆ ⁽¹⁾ |
| 028A ₁₆ | CAN1 Transmit Error Count Register | C1TEC | 00 ₁₆ ⁽¹⁾ |
| 028B ₁₆ | CAN1 Receive Error Count Register | C1REC | 00 ₁₆ ⁽¹⁾ |
| 028C ₁₆ 028D ₁₆ | CAN1 Slot Interrupt Status Register | C1SISTR | 00 ₁₆ ⁽¹⁾ 00 ₁₆ ⁽¹⁾ |
| 028E ₁₆ | | | |
| 028F ₁₆ | | | |

X: Indeterminate

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NOTES:

1. Values are obtained by setting the SLEEP bit in the C1SLPR register to "1" (sleep mode exited) after reset and supplying the clock to the CAN module.

| Address | Register | Symbol | Value after RESET |
|--------------------|---|---------------------|--|
| 0290 ₁₆ | CAN1 Slot Interrupt Mask Register | C1SIMKR | 00 ₁₆ |
| 0291 ₁₆ | | | 00 ₁₆ |
| 0292 ₁₆ | | | |
| 0293 ₁₆ | | | |
| 0294 ₁₆ | CAN1 Error Interrupt Mask Register | C1EIMKR | XXXX X000 ₂ ⁽²⁾ |
| 0295 ₁₆ | CAN1 Error Interrupt Status Register | C1EISTR | XXXX X000 ₂ ⁽²⁾ |
| 0296 ₁₆ | CAN1 Error Factor Register | C1EFR | 00 ₁₆ ⁽²⁾ |
| 0297 ₁₆ | CAN1 Baud Rate Prescaler | C1BRP | 0000 0001 ₂ ⁽²⁾ |
| 0298 ₁₆ | | | |
| 0299 ₁₆ | CAN1 Mode Register | C1MDR | XXXX XX00 ₂ ⁽²⁾ |
| 029A ₁₆ | | | |
| 029B ₁₆ | | | |
| 029C ₁₆ | | | |
| 029D ₁₆ | | | |
| 029E ₁₆ | | | |
| 029F ₁₆ | | | |
| 02A0 ₁₆ | CAN1 Single Shot Control Register | C1SSCTLR | 00 ₁₆ ⁽²⁾ |
| 02A1 ₁₆ | | | 00 ₁₆ ⁽²⁾ |
| 02A2 ₁₆ | | | |
| 02A3 ₁₆ | | | |
| 02A4 ₁₆ | CAN1 Single Shot Status Register | C1SSSTR | 00 ₁₆ ⁽²⁾ |
| 02A5 ₁₆ | | | 00 ₁₆ ⁽²⁾ |
| 02A6 ₁₆ | | | |
| 02A7 ₁₆ | | | |
| 02A8 ₁₆ | CAN1 Global Mask Register Standard ID0 | C1GMR0 | XXX0 0000 ₂ ⁽²⁾ |
| 02A9 ₁₆ | CAN1 Global Mask Register Standard ID1 | C1GMR1 | XX00 0000 ₂ ⁽²⁾ |
| 02AA ₁₆ | CAN1 Global Mask Register Extended ID0 | C1GMR2 | XXXX 0000 ₂ ⁽²⁾ |
| 02AB ₁₆ | CAN1 Global Mask Register Extended ID1 | C1GMR3 | 00 ₁₆ ⁽²⁾ |
| 02AC ₁₆ | CAN1 Global Mask Register Extended ID2 | C1GMR4 | XX00 0000 ₂ ⁽²⁾ |
| 02AD ₁₆ | | | |
| 02AE ₁₆ | | | |
| 02AF ₁₆ | | | |
| 02B0 ₁₆ | CAN1 Message Slot 0 Control Register / CAN1 Local Mask Register A Standard ID0 | C1MCTL0/ C1LMAR0 | 0000 0000 ₂ ⁽²⁾ XXX0 0000 ₂ ⁽²⁾ |
| 02B1 ₁₆ | CAN1 Message Slot 1 Control Register / CAN1 Local Mask Register A Standard ID1 | C1MCTL1/ C1LMAR1 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 02B2 ₁₆ | CAN1 Message Slot 2 Control Register / CAN1 Local Mask Register A Extended ID0 | C1MCTL2/ C1LMAR2 | 0000 0000 ₂ ⁽²⁾ XXXX 0000 ₂ ⁽²⁾ |
| 02B3 ₁₆ | CAN1 Message Slot 3 Control Register / CAN1 Local Mask Register A Extended ID1 | C1MCTL3/ C1LMAR3 | 00 ₁₆ ⁽²⁾ 00 ₁₆ ⁽²⁾ |
| 02B4 ₁₆ | CAN1 Message Slot 4 Control Register / CAN1 Local Mask Register A Extended ID2 | C1MCTL4/ C1LMAR4 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 02B5 ₁₆ | CAN1 Message Slot 5 Control Register | C1MCTL5 | 00 ₁₆ ⁽²⁾ |
| 02B6 ₁₆ | CAN1 Message Slot 6 Control Register | C1MCTL6 | 00 ₁₆ ⁽²⁾ |
| 02B7 ₁₆ | CAN1 Message Slot 7 Control Register | C1MCTL7 | 00 ₁₆ ⁽²⁾ |
| 02B8 ₁₆ | CAN1 Message Slot 8 Control Register / CAN1 Local Mask Register B Standard ID0 | C1MCTL8/ C1LMBR0 | 0000 0000 ₂ ⁽²⁾ XXX0 0000 ₂ ⁽²⁾ |
| 02B9 ₁₆ | CAN1 Message Slot 9 Control Register / CAN1 Local Mask Register B Standard ID1 | C1MCTL9/ C1LMBR1 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |

(Note 1)

X: Indeterminate

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NOTES:

1. The BANKSEL bit in the C1CTLR1 register switches functions for addresses 02A0₁₆ to 02BF₁₆.
2. Values are obtained by setting the SLEEP bit in the C1SLPR register to "1" (sleep mode exited) after reset and applying the clock to the CAN module.

| Address | Register | Symbol | Value after RESET |
|--|--|----------------------|--|
| 02BA ₁₆ | CAN1 Message Slot 10 Control Register / CAN1 Local Mask Register B Extended ID0 | C1MCTL10/ C1LMBR2 | 0000 0000 ₂ ⁽²⁾ XXXX 0000 ₂ ⁽²⁾ |
| 02BB ₁₆ | CAN1 Message Slot 11 Control Register / CAN1 Local Mask Register B Extended ID1 | C1MCTL11/ C1LMBR3 | 00 ₁₆ ⁽²⁾ 00 ₁₆ ⁽²⁾ |
| 02BC ₁₆ | CAN1 Message Slot 12 Control Register / CAN1 Local Mask Register B Extended ID2 | C1MCTL12/ C1LMBR4 | 0000 0000 ₂ ⁽²⁾ XX00 0000 ₂ ⁽²⁾ |
| 02BD ₁₆ | CAN1 Message Slot 13 Control Register | C1MCTL13 | 00 ₁₆ ⁽²⁾ |
| 02BE ₁₆ | CAN1 Message Slot 14 Control Register | C1MCTL14 | 00 ₁₆ ⁽²⁾ |
| 02BF ₁₆ | CAN1 Message Slot 15 Control Register | C1MCTL15 | 00 ₁₆ ⁽²⁾ |
| 02C0 ₁₆ 02C1 ₁₆ | X0 Register Y0 Register | X0R,Y0R | XX ₁₆ XX ₁₆ |
| 02C2 ₁₆ 02C3 ₁₆ | X1 Register Y1 Register | X1R,Y1R | XX ₁₆ XX ₁₆ |
| 02C4 ₁₆ 02C5 ₁₆ | X2 Register Y2 Register | X2R,Y2R | XX ₁₆ XX ₁₆ |
| 02C6 ₁₆ 02C7 ₁₆ | X3 Register Y3 Register | X3R,Y3R | XX ₁₆ XX ₁₆ |
| 02C8 ₁₆ 02C9 ₁₆ | X4 Register Y4 Register | X4R,Y4R | XX ₁₆ XX ₁₆ |
| 02CA ₁₆ 02CB ₁₆ | X5 Register Y5 Register | X5R,Y5R | XX ₁₆ XX ₁₆ |
| 02CC ₁₆ 02CD ₁₆ | X6 Register Y6 Register | X6R,Y6R | XX ₁₆ XX ₁₆ |
| 02CE ₁₆ 02CF ₁₆ | X7 Register Y7 Register | X7R,Y7R | XX ₁₆ XX ₁₆ |
| 02D0 ₁₆ 02D1 ₁₆ | X8 Register Y8 Register | X8R,Y8R | XX ₁₆ XX ₁₆ |
| 02D2 ₁₆ 02D3 ₁₆ | X9 Register Y9 Register | X9R,Y9R | XX ₁₆ XX ₁₆ |
| 02D4 ₁₆ 02D5 ₁₆ | X10 Register Y10 Register | X10R,Y10R | XX ₁₆ XX ₁₆ |
| 02D6 ₁₆ 02D7 ₁₆ | X11 Register Y11 Register | X11R,Y11R | XX ₁₆ XX ₁₆ |
| 02D8 ₁₆ 02D9 ₁₆ | X12 Register Y12 Register | X12R,Y12R | XX ₁₆ XX ₁₆ |
| 02DA ₁₆ 02DB ₁₆ | X13 Register Y13 Register | X13R,Y13R | XX ₁₆ XX ₁₆ |
| 02DC ₁₆ 02DD ₁₆ | X14 Register Y14 Register | X14R,Y14R | XX ₁₆ XX ₁₆ |
| 02DE ₁₆ 02DF ₁₆ | X15 Register Y15 Register | X15R,Y15R | XX ₁₆ XX ₁₆ |

(Note 1)

X: Indeterminate

Blank spaces are reserved. No access is allowed.

NOTES:

1. The BANKSEL bit in the C1CTLR1 register switches functions for addresses 02A0₁₆ to 02BF₁₆.
2. Values are obtained by setting the SLEEP bit in the C1SLPR register to "1" (sleep mode exited) after reset and applying the clock to the CAN module.

| Address | Register | Symbol | Value after RESET |
|--------------------|---|--------|------------------------|
| 02E0 ₁₆ | X/Y Control Register | XYC | XXXX XX00 ₂ |
| 02E1 ₁₆ | | | |
| 02E2 ₁₆ | | | |
| 02E3 ₁₆ | | | |
| 02E4 ₁₆ | UART1 Special Mode Register 4 | U1SMR4 | 00 ₁₆ |
| 02E5 ₁₆ | UART1 Special Mode Register 3 | U1SMR3 | 00 ₁₆ |
| 02E6 ₁₆ | UART1 Special Mode Register 2 | U1SMR2 | 00 ₁₆ |
| 02E7 ₁₆ | UART1 Special Mode Register | U1SMR | 00 ₁₆ |
| 02E8 ₁₆ | UART1 Transmit/Receive Mode Register | U1MR | 00 ₁₆ |
| 02E9 ₁₆ | UART1 Bit Rate Register | U1BRG | XX ₁₆ |
| 02EA ₁₆ | UART1 Transmit Buffer Register | U1TB | XX ₁₆ |
| 02EB ₁₆ | | | XX ₁₆ |
| 02EC ₁₆ | UART1 Transmit/Receive Control Register 0 | U1C0 | 0000 1000 ₂ |
| 02ED ₁₆ | UART1 Transmit/Receive Control Register 1 | U1C1 | 0000 0010 ₂ |
| 02EE ₁₆ | UART1 Receive Buffer Register | U1RB | XX ₁₆ |
| 02EF ₁₆ | | | XX ₁₆ |
| 02F0 ₁₆ | | | |
| 02F1 ₁₆ | | | |
| 02F2 ₁₆ | | | |
| 02F3 ₁₆ | | | |
| 02F4 ₁₆ | UART4 Special Mode Register 4 | U4SMR4 | 00 ₁₆ |
| 02F5 ₁₆ | UART4 Special Mode Register 3 | U4SMR3 | 00 ₁₆ |
| 02F6 ₁₆ | UART4 Special Mode Register 2 | U4SMR2 | 00 ₁₆ |
| 02F7 ₁₆ | UART4 Special Mode Register | U4SMR | 00 ₁₆ |
| 02F8 ₁₆ | UART4 Transmit/Receive Mode Register | U4MR | 00 ₁₆ |
| 02F9 ₁₆ | UART4 Bit Rate Register | U4BRG | XX ₁₆ |
| 02FA ₁₆ | UART4 Transmit Buffer Register | U4TB | XX ₁₆ |
| 02FB ₁₆ | | | XX ₁₆ |
| 02FC ₁₆ | UART4 Transmit/Receive Control Register 0 | U4C0 | 0000 1000 ₂ |
| 02FD ₁₆ | UART4 Transmit/Receive Control Register 1 | U4C1 | 0000 0010 ₂ |
| 02FE ₁₆ | UART4 Receive Buffer Register | U4RB | XX ₁₆ |
| 02FF ₁₆ | | | XX ₁₆ |
| 0300 ₁₆ | Timer B3, B4, B5 Count Start Flag | TBSR | 000X XXXX ₂ |
| 0301 ₁₆ | | | |
| 0302 ₁₆ | Timer A1-1 Register | TA11 | XX ₁₆ |
| 0303 ₁₆ | | | XX ₁₆ |
| 0304 ₁₆ | Timer A2-1 Register | TA21 | XX ₁₆ |
| 0305 ₁₆ | | | XX ₁₆ |
| 0306 ₁₆ | Timer A4-1 Register | TA41 | XX ₁₆ |
| 0307 ₁₆ | | | XX ₁₆ |
| 0308 ₁₆ | Three-Phase PWM Control Register 0 | INVC0 | 00 ₁₆ |
| 0309 ₁₆ | Three-Phase PWM Control Register 1 | INVC1 | 00 ₁₆ |
| 030A ₁₆ | Three-Phase Output Buffer Register 0 | IDB0 | XX11 1111 ₂ |
| 030B ₁₆ | Three-Phase Output Buffer Register 1 | IDB1 | XX11 1111 ₂ |
| 030C ₁₆ | Dead Time Timer | DTT | XX ₁₆ |
| 030D ₁₆ | Timer B2 Interrupt Generation Frequency Set Counter | ICTB2 | XX ₁₆ |
| 030E ₁₆ | | | |
| 030F ₁₆ | | | |

X: Indeterminate

Blank spaces are reserved. No access is allowed.

| Address | Register | Symbol | Value after RESET |
|--|---|--------|--------------------------------------|
| 0310 ₁₆ 0311 ₁₆ | Timer B3 Register | TB3 | XX ₁₆ XX ₁₆ |
| 0312 ₁₆ 0313 ₁₆ | Timer B4 Register | TB4 | XX ₁₆ XX ₁₆ |
| 0314 ₁₆ 0315 ₁₆ | Timer B5 Register | TB5 | XX ₁₆ XX ₁₆ |
| 0316 ₁₆ | | | |
| 0317 ₁₆ | | | |
| 0318 ₁₆ | | | |
| 0319 ₁₆ | | | |
| 031A ₁₆ | | | |
| 031B ₁₆ | Timer B3 Mode Register | TB3MR | 00XX 0000 ₂ |
| 031C ₁₆ | Timer B4 Mode Register | TB4MR | 00XX 0000 ₂ |
| 031D ₁₆ | Timer B5 Mode Register | TB5MR | 00XX 0000 ₂ |
| 031E ₁₆ | | | |
| 031F ₁₆ | External Interrupt Request Source Select Register | IFSR | 00 ₁₆ |
| 0320 ₁₆ | | | |
| 0321 ₁₆ | | | |
| 0322 ₁₆ | | | |
| 0323 ₁₆ | | | |
| 0324 ₁₆ | UART3 Special Mode Register 4 | U3SMR4 | 00 ₁₆ |
| 0325 ₁₆ | UART3 Special Mode Register 3 | U3SMR3 | 00 ₁₆ |
| 0326 ₁₆ | UART3 Special Mode Register 2 | U3SMR2 | 00 ₁₆ |
| 0327 ₁₆ | UART3 Special Mode Register | U3SMR | 00 ₁₆ |
| 0328 ₁₆ | UART3 Transmit/Receive Mode Register | U3MR | 00 ₁₆ |
| 0329 ₁₆ | UART3 Bit Rate Register | U3BRG | XX ₁₆ |
| 032A ₁₆ 032B ₁₆ | UART3 Transmit Buffer Register | U3TB | XX ₁₆ XX ₁₆ |
| 032C ₁₆ | UART3 Transmit/Receive Control Register 0 | U3C0 | 0000 1000 ₂ |
| 032D ₁₆ | UART3 Transmit/Receive Control Register 1 | U3C1 | 0000 0010 ₂ |
| 032E ₁₆ 032F ₁₆ | UART3 Receive Buffer Register | U3RB | XX ₁₆ XX ₁₆ |
| 0330 ₁₆ | | | |
| 0331 ₁₆ | | | |
| 0332 ₁₆ | | | |
| 0333 ₁₆ | | | |
| 0334 ₁₆ | UART2 Special Mode Register 4 | U2SMR4 | 00 ₁₆ |
| 0335 ₁₆ | UART2 Special Mode Register 3 | U2SMR3 | 00 ₁₆ |
| 0336 ₁₆ | UART2 Special Mode Register 2 | U2SMR2 | 00 ₁₆ |
| 0337 ₁₆ | UART2 Special Mode Register | U2SMR | 00 ₁₆ |
| 0338 ₁₆ | UART2 Transmit/Receive Mode Register | U2MR | 00 ₁₆ |
| 0339 ₁₆ | UART2 Bit Rate Register | U2BRG | XX ₁₆ |
| 033A ₁₆ 033B ₁₆ | UART2 Transmit Buffer Register | U2TB | XX ₁₆ XX ₁₆ |
| 033C ₁₆ | UART2 Transmit/Receive Control Register 0 | U2C0 | 0000 1000 ₂ |
| 033D ₁₆ | UART2 Transmit/Receive Control Register 1 | U2C1 | 0000 0010 ₂ |
| 033E ₁₆ 033F ₁₆ | UART2 Receive Buffer Register | U2RB | XX ₁₆ XX ₁₆ |

X: Indeterminate

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| Address | Register | Symbol | Value after RESET |
|--|--|--------|--------------------------------------|
| 0340 ₁₆ | Count Start Flag | TABSR | 00 ₁₆ |
| 0341 ₁₆ | Clock Prescaler Reset Flag | CPSRF | 0XXX XXXX ₂ |
| 0342 ₁₆ | One-Shot Start Flag | ONSF | 00 ₁₆ |
| 0343 ₁₆ | Trigger Select Register | TRGSR | 00 ₁₆ |
| 0344 ₁₆ | Up/Down Flag | UDF | 00 ₁₆ |
| 0345 ₁₆ | | | |
| 0346 ₁₆ 0347 ₁₆ | Timer A0 Register | TA0 | XX ₁₆ XX ₁₆ |
| 0348 ₁₆ 0349 ₁₆ | Timer A1 Register | TA1 | XX ₁₆ XX ₁₆ |
| 034A ₁₆ 034B ₁₆ | Timer A2 Register | TA2 | XX ₁₆ XX ₁₆ |
| 034C ₁₆ 034D ₁₆ | Timer A3 Register | TA3 | XX ₁₆ XX ₁₆ |
| 034E ₁₆ 034F ₁₆ | Timer A4 Register | TA4 | XX ₁₆ XX ₁₆ |
| 0350 ₁₆ 0351 ₁₆ | Timer B0 Register | TB0 | XX ₁₆ XX ₁₆ |
| 0352 ₁₆ 0353 ₁₆ | Timer B1 Register | TB1 | XX ₁₆ XX ₁₆ |
| 0354 ₁₆ 0355 ₁₆ | Timer B2 Register | TB2 | XX ₁₆ XX ₁₆ |
| 0356 ₁₆ | Timer A0 Mode Register | TA0MR | 00 ₁₆ |
| 0357 ₁₆ | Timer A1 Mode Register | TA1MR | 00 ₁₆ |
| 0358 ₁₆ | Timer A2 Mode Register | TA2MR | 00 ₁₆ |
| 0359 ₁₆ | Timer A3 Mode Register | TA3MR | 00 ₁₆ |
| 035A ₁₆ | Timer A4 Mode Register | TA4MR | 00 ₁₆ |
| 035B ₁₆ | Timer B0 Mode Register | TB0MR | 00XX 0000 ₂ |
| 035C ₁₆ | Timer B1 Mode Register | TB1MR | 00XX 0000 ₂ |
| 035D ₁₆ | Timer B2 Mode Register | TB2MR | 00XX 0000 ₂ |
| 035E ₁₆ | Timer B2 Special Mode Register | TB2SC | XXXX XXX0 ₂ |
| 035F ₁₆ | Count Source Prescaler Register ⁽¹⁾ | TCSPR | 0XXX 0000 ₂ |
| 0360 ₁₆ | | | |
| 0361 ₁₆ | | | |
| 0362 ₁₆ | | | |
| 0363 ₁₆ | | | |
| 0364 ₁₆ | UART0 Special Mode Register 4 | U0SMR4 | 00 ₁₆ |
| 0365 ₁₆ | UART0 Special Mode Register 3 | U0SMR3 | 00 ₁₆ |
| 0366 ₁₆ | UART0 Special Mode Register 2 | U0SMR2 | 00 ₁₆ |
| 0367 ₁₆ | UART0 Special Mode Register | U0SMR | 00 ₁₆ |
| 0368 ₁₆ | UART0 Transmit/Receive Mode Register | U0MR | 00 ₁₆ |
| 0369 ₁₆ | UART0 Bit Rate Register | U0BRG | XX ₁₆ |
| 036A ₁₆ 036B ₁₆ | UART0 Transmit Buffer Register | U0TB | XX ₁₆ XX ₁₆ |
| 036C ₁₆ | UART0 Transmit/Receive Control Register 0 | U0C0 | 0000 1000 ₂ |
| 036D ₁₆ | UART0 Transmit/Receive Control Register 1 | U0C1 | 0000 0010 ₂ |
| 036E ₁₆ 036F ₁₆ | UART0 Receive Buffer Register | U0RB | XX ₁₆ XX ₁₆ |

X: Indeterminate

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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 |
|--------------------|-------------------------------------|---------|------------------------|
| 0370 ₁₆ | | | |
| 0371 ₁₆ | | | |
| 0372 ₁₆ | | | |
| 0373 ₁₆ | | | |
| 0374 ₁₆ | | | |
| 0375 ₁₆ | | | |
| 0376 ₁₆ | | | |
| 0377 ₁₆ | | | |
| 0378 ₁₆ | DMA0 Request Source Select Register | DM0SL | 0X00 0000 ₂ |
| 0379 ₁₆ | DMA1 Request Source Select Register | DM1SL | 0X00 0000 ₂ |
| 037A ₁₆ | DMA2 Request Source Select Register | DM2SL | 0X00 0000 ₂ |
| 037B ₁₆ | DMA3 Request Source Select Register | DM3SL | 0X00 0000 ₂ |
| 037C ₁₆ | CRC Data Register | CRCD | XX ₁₆ |
| 037D ₁₆ | | | XX ₁₆ |
| 037E ₁₆ | CRC Input Register | CRCIN | XX ₁₆ |
| 037F ₁₆ | | | |
| 0380 ₁₆ | A/D0 Register 0 | AD00 | XXXX XXXX ₂ |
| 0381 ₁₆ | | | 0000 0000 ₂ |
| 0382 ₁₆ | A/D0 Register 1 | AD01 | XX ₁₆ |
| 0383 ₁₆ | | | XX ₁₆ |
| 0384 ₁₆ | A/D0 Register 2 | AD02 | XX ₁₆ |
| 0385 ₁₆ | | | XX ₁₆ |
| 0386 ₁₆ | A/D0 Register 3 | AD03 | XX ₁₆ |
| 0387 ₁₆ | | | XX ₁₆ |
| 0388 ₁₆ | A/D0 Register 4 | AD04 | XX ₁₆ |
| 0389 ₁₆ | | | XX ₁₆ |
| 038A ₁₆ | A/D0 Register 5 | AD05 | XX ₁₆ |
| 038B ₁₆ | | | XX ₁₆ |
| 038C ₁₆ | A/D0 Register 6 | AD06 | XX ₁₆ |
| 038D ₁₆ | | | XX ₁₆ |
| 038E ₁₆ | A/D0 Register 7 | AD07 | XX ₁₆ |
| 038F ₁₆ | | | XX ₁₆ |
| 0390 ₁₆ | | | |
| 0391 ₁₆ | | | |
| 0392 ₁₆ | A/D0 Control Register 4 | AD0CON4 | XXXX 00XX ₂ |
| 0393 ₁₆ | | | |
| 0394 ₁₆ | A/D0 Control Register 2 | AD0CON2 | XX0X X000 ₂ |
| 0395 ₁₆ | A/D0 Control Register 3 | AD0CON3 | XXXX X000 ₂ |
| 0396 ₁₆ | A/D0 Control Register 0 | AD0CON0 | 00 ₁₆ |
| 0397 ₁₆ | A/D0 Control Register 1 | AD0CON1 | 00 ₁₆ |
| 0398 ₁₆ | D/A Register 0 | DA0 | XX ₁₆ |
| 0399 ₁₆ | | | |
| 039A ₁₆ | D/A Register 1 | DA1 | XX ₁₆ |
| 039B ₁₆ | | | |
| 039C ₁₆ | D/A Control Register | DACON | XXXX XX00 ₂ |
| 039D ₁₆ | | | |
| 039E ₁₆ | | | |
| 039F ₁₆ | | | |

X: Indeterminate

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<144-pin package>

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

X: Indeterminate

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<144-pin package>

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

<100-pin package>

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

X: Indeterminate

Blank spaces are reserved. No access is allowed.

5. Electrical Characteristics

5.1 Electrical Characteristics (M32C/85)

Table 5.1 Absolute Maximum Ratings

| Symbol | Parameter | | Condition | Value | Unit |
|-------------------------------------|-------------------------------|--|------------------------------------|--|------|
| V _{CC1} , V _{CC2} | Supply Voltage | | V _{CC1} =AV _{CC} | -0.3 to 6.0 | V |
| V _{CC2} | Supply Voltage | | - | -0.3 to V _{CC1} | V |
| AV _{CC} | Analog Supply Voltage | | V _{CC1} =AV _{CC} | -0.3 to 6.0 | V |
| V _i | Input Voltage | RESET, CNV _{SS} , BYTE, P60-P67, P72-P77, P80-P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ , V _{REF} , X _{IN} | | -0.3 to V _{CC1} +0.3 | V |
| | | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 ⁽¹⁾ | | -0.3 to V _{CC2} +0.3 | |
| | | P70, P71 | | -0.3 to 6.0 | |
| V _o | Output Voltage | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ , X _{OUT} | | -0.3 to V _{CC1} +0.3 | V |
| | | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 ⁽¹⁾ | | -0.3 to V _{CC2} +0.3 | |
| | | P70, P71 | | -0.3 to 6.0 | |
| P _d | Power Dissipation | | T _{opr} =25° C | 500 | mW |
| T _{opr} | Operating Ambient Temperature | during CPU operation | | -20 to 85/ -40 to 85 ⁽²⁾ | ° C |
| | | during flash memory program and erase operation | | 0 to 60 | |
| T _{stg} | 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 ⁽⁴⁾ | 0.8VCC2 | | VCC2 | V |
| | | P60-P67, P72-P77, P80-P87 ⁽³⁾ , P90-P97, P100-P107, P140-P146, P150-P157 ⁽⁴⁾ , 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 ⁽⁴⁾ | 0 | | 0.2VCC2 | V |
| | | P60-P67, P70-P77, P80-P87 ⁽³⁾ , P90-P97, P100-P107, P140-P146, P150-P157 ⁽⁴⁾ , 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 ⁽²⁾ | 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 ⁽⁴⁾ | | | -10.0 | mA |
| IOH(avg) | Average Output High ("H") Current ⁽¹⁾ | 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 ⁽⁴⁾ | | | -5.0 | mA |
| IOL(peak) | Peak Output Low ("L") Current ⁽²⁾ | 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 ⁽⁴⁾ | | | 10.0 | mA |
| IOL(avg) | Average Output Low ("L") Current ⁽¹⁾ | 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 ⁽⁴⁾ | | | 5.0 | mA |

NOTES:

- Typical values when average output current is 100ms.
- 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.
- 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.
- P11 to P15 are provided in the 144-pin package only.

Table 5.2 Recommended Operating Conditions (Continued)
(V_{CC1}=V_{CC2}=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 _{CC1} =4.2 to 5.5V | 0 | | 32 | MHz |
| | | V _{CC1} =3.0 to 5.5V | 0 | | 24 | MHz |
| f(X _{IN}) | Main Clock Input Frequency | V _{CC1} =4.2 to 5.5V | 0 | | 32 | MHz |
| | | V _{CC1} =3.0 to 5.5V | 0 | | 24 | MHz |
| f(X _{CIN}) | Sub Clock Frequency | | 32.768 | 50 | kHz | |
| f(Ring) | On-chip Oscillator Frequency (V _{CC1} =V _{CC2} =5.0V, Topr=25° C) | | 0.5 | 1 | 2 | MHz |
| f(PLL) | PLL Clock Frequency | V _{CC1} =4.2 to 5.5V | 10 | | 32 | MHz |
| | | V _{CC1} =3.0 to 5.5V | 10 | | 24 | MHz |
| t _{SU(PLL)} | Wait Time to Stabilize PLL Frequency Synthesizer | V _{CC1} =5.0V | | | 5 | ms |
| | | V _{CC1} =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 _{OH} | Output High ("H") Voltage | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 | I _{OH} =-5mA | V _{CC2} -2.0 | | V _{CC2} | V | |
| | | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ | I _{OH} =-5mA | V _{CC1} -2.0 | | V _{CC1} | | |
| | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 | I _{OH} =-200μA | V _{CC2} -0.3 | | V _{CC2} | V | | |
| | | | V _{CC1} -0.3 | | V _{CC1} | | | |
| | X _{OUT} | I _{OH} =-1mA | 3.0 | | V _{CC1} | V | | |
| | X _{COUT} | High Power | No load applied | | 2.5 | | V | |
| Low Power | | No load applied | | 1.6 | | | | |
| V _{OL} | 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 ⁽¹⁾ | I _{OL} =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 ⁽¹⁾ | I _{OL} =200μA | | | 0.45 | V | |
| | X _{OUT} | I _{OL} =1mA | | | 2.0 | V | | |
| | X _{COUT} | High Power | No load applied | | 0 | | V | |
| | | Low Power | No load applied | | 0 | | | |
| V _{T+} -V _{T-} | Hysteresis | HOLD, RDY, TA0IN-TA4IN, TB0IN-TB5IN, INT0-INT5, AD _{TRG} , CTS0-CTS4, CLK0-CLK4, TA0OUT-TA4OUT, NMI, K10-K13, RxD0-RxD4, SCL0-SCL4, SDA0-SDA4 | | 0.2 | | 1.0 | V | |
| | | RESET | | 0.2 | | 1.8 | V | |
| I _{IH} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =5V | | | 5.0 | μA | |
| I _{IL} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =0V | | | -5.0 | μA | |
| R _{PULLUP} | 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 ⁽¹⁾ | V _I =0V | Flash Memory | 30 | 50 | 167 | kΩ |
| | | | | Masked ROM | 20 | 40 | 167 | |
| R _{fXIN} | Feedback Resistance | X _{IN} | | | | 1.5 | MΩ | |
| R _{fXCIN} | Feedback Resistance | X _{CIN} | | | | 10 | MΩ | |
| V _{RAM} | 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 _{cc} | Power Supply Current | In single-chip mode, output pins are left open and other pins are connected to V _{SS} . | 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 ⁽¹⁾ | | 25 | | μA | |
| | | | f(BCLK)=32 kHz, In wait mode, T _{opr} =25° C | | 10 | | μA | |
| | | | While clock stops, T _{opr} =25° C | | 0.8 | 5 | μA | |
| While clock stops, T _{opr} =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 ₀ to AN ₇ , AN ₀₀ to AN ₀₇ , AN ₂₀ to AN ₂₇ , AN ₁₅₀ to AN ₁₅₇ , ANEX ₀ , ANEX ₁ | | | ±3 | LSB |
| | | | | | | | LSB |
| | | | External op-amp connection mode | | | ±7 | LSB |
| | | | | | | 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 _{CONV} | 10-bit Conversion Time ^(1, 2) | | 2.06 | | | μs | |
| t _{CONV} | 8-bit Conversion Time ^(1, 2) | | 1.75 | | | μs | |
| t _{SAMP} | Sampling Time ⁽¹⁾ | | 0.188 | | | μs | |
| V _{REF} | Reference Voltage | | 2 | | V _{CC1} | V | |
| V _{IA} | Analog Input Voltage | | 0 | | V _{REF} | V | |

NOTES:

1. Divide f(X_{IN}), if exceeding 16 MHz, to keep φ_{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 _{SU} | Setup Time | | | | 3 | μs |
| R _O | Output Resistance | | 4 | 10 | 20 | kΩ |
| I _{VREF} | Reference Power Supply Input Current | (Note 1) | | | 1.5 | mA |

NOTES:

1. Measurement when using one D/A converter. The DA_i register (i=0, 1) of the D/A converter, not being used, is set to "00₁₆". The resistor ladder in the A/D converter is excluded.
I_{VREF} flows even if the VCUT bit in the AD0CON1 register is set to "0" (no V_{REF} connection).

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

Table 5.6 Flash Memory Version Electrical Characteristics ($V_{CC1}=4.5$ to $5.5V$, 3.0 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 ⁽²⁾ | | 100 | | | cycles |
| - | Word Program Time ($V_{CC1}=5.0V$, $T_{opr}=25^{\circ}C$) | | | 25 | 200 | μs |
| - | Lock Bit Program Time | | | 25 | 200 | μs |
| - | 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 ⁽¹⁾ | | | | 4 x // | s |
| t_{PS} | Wait Time to Stabilize Flash Memory Circuit | | | | 15 | μs |
| - | Data Hold Time ($T_{opr}=-40$ to $85^{\circ}C$) | | 10 | | | years |

NOTES:

- //denotes the number of block to be erased.
- Number of program-erase cycles per block.

If Program and Erase Endurance is //cycle ($// \neq 100$), each block can be erased and programmed //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 ⁽¹⁾ | $V_{CC1}=3.0$ to $5.5V$ | | 3.8 | | V |
| Vdet3 | Reset Space Detection Voltage ⁽¹⁾ | | | 3.0 | | V |
| Vdet3s | Low Voltage Reset Hold Voltage | | 2.0 | | | V |
| Vdet3r | Low Voltage Reset Release Voltage ⁽²⁾ | | | 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 ⁽¹⁾ | 20 | ms |
| td(E-A) | Start-up Time for Low Voltage Detection Circuit Operation | $V_{CC1}=3.0$ to $5.5V$ | | | 20 | μs |

NOTES:

1. $V_{CC1}=5V$

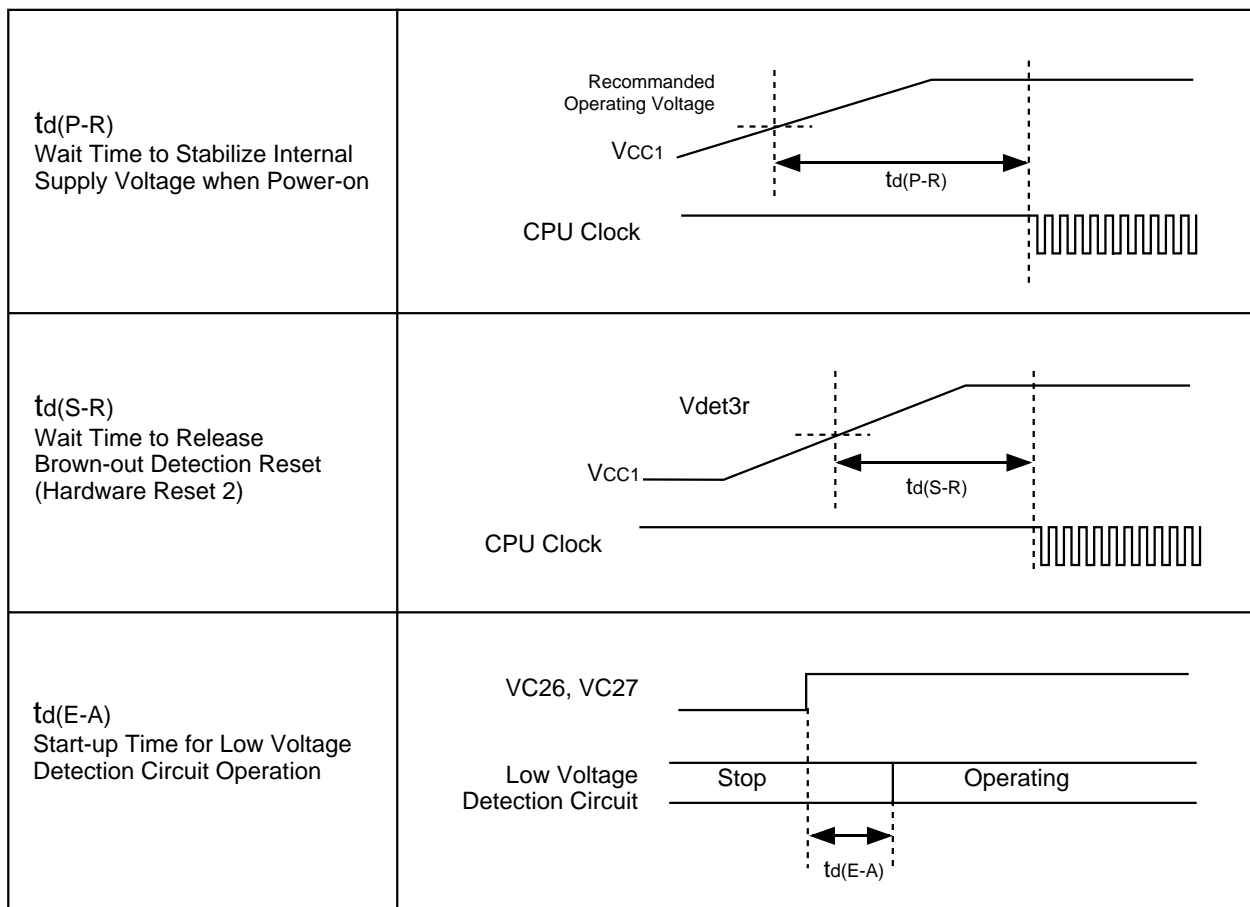


Figure 5.1 Power Supply Timing Diagram

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

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 multiplexed 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 |
| $t_{su(HOLD-BCLK)}$ | \overline{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 |
| $t_{h(BCLK-HOLD)}$ | \overline{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.

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

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

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

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

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

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. | |
| $t_{c(TB)}$ | TB _{iIN} Input Cycle Time (counted on one edge) | 100 | | ns |
| $t_{w(TBH)}$ | TB _{iIN} Input High ("H") Width (counted on one edge) | 40 | | ns |
| $t_{w(TBL)}$ | TB _{iIN} Input Low ("L") Width (counted on one edge) | 40 | | ns |
| $t_{c(TB)}$ | TB _{iIN} Input Cycle Time (counted on both edges) | 200 | | ns |
| $t_{w(TBH)}$ | TB _{iIN} Input High ("H") Width (counted on both edges) | 80 | | ns |
| $t_{w(TBL)}$ | TB _{iIN} 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. | |
| $t_{c(TB)}$ | TB _{iIN} Input Cycle Time | 400 | | ns |
| $t_{w(TBH)}$ | TB _{iIN} Input High ("H") Width | 200 | | ns |
| $t_{w(TBL)}$ | TB _{iIN} Input Low ("L") Width | 200 | | ns |

Table 5.18 Timer B Input (Pulse Width Measurement Mode)

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

Table 5.19 A/D Trigger Input

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

Table 5.20 Serial I/O

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

Table 5.21 External Interrupt INT_i Input

| Symbol | Parameter | Standard | | Unit |
|--------------|---|----------|------|------|
| | | Min. | Max. | |
| $t_{w(INH)}$ | INT _i Input High ("H") Width | 250 | | ns |
| $t_{w(INL)}$ | INT _i 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) ⁽³⁾ | | 0 | | ns |
| th(WR-AD) | Address Output Hold Time (WR standard) ⁽³⁾ | | (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) ⁽³⁾ | | 0 | | ns |
| th(WR-CS) | Chip-Select Signal Output Hold Time (WR standard) ⁽³⁾ | | (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) ⁽³⁾ | | (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) ⁽⁵⁾ | | (Note 1) | | ns |
| $t_{h(WR-AD)}$ | Address Output Hold Time (WR standard) ⁽⁵⁾ | | (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) ⁽⁵⁾ | | (Note 1) | | ns |
| $t_{h(WR-CS)}$ | Chip-Select Signal Output Hold Time (WR standard) ⁽⁵⁾ | | (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) ⁽⁵⁾ | | (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_{cns} is added when recovery cycle is inserted.

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

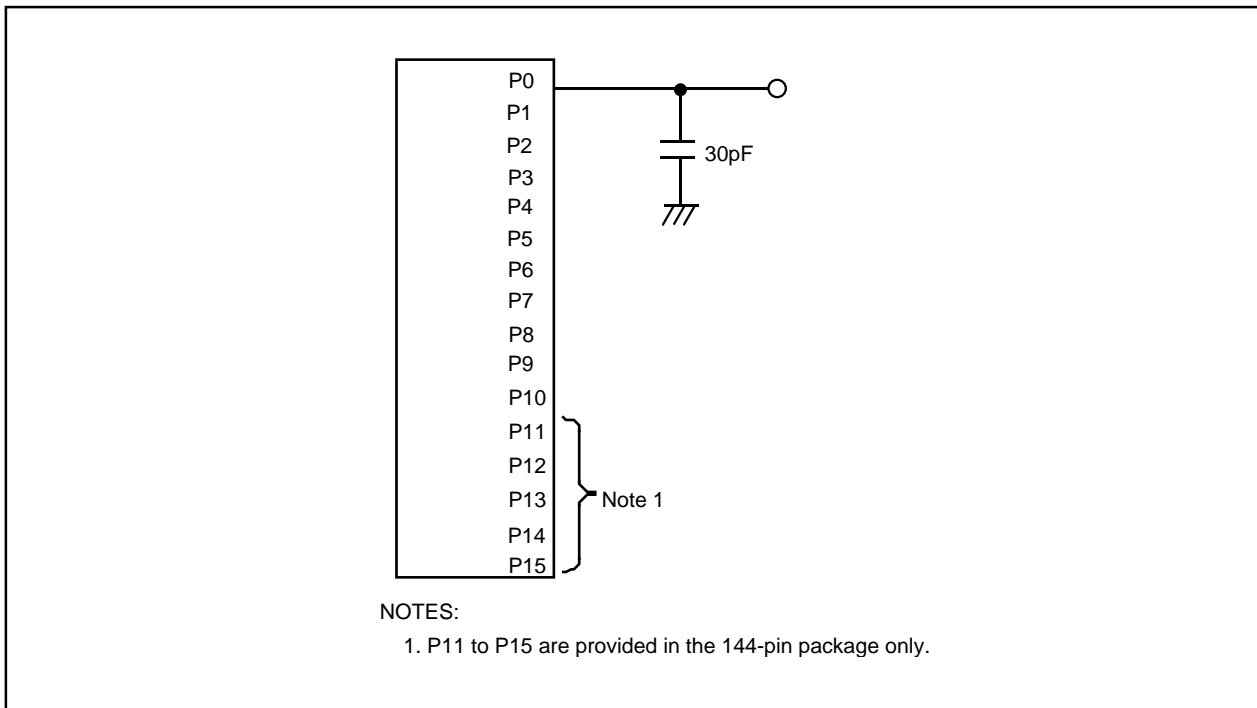


Figure 5.2 P0 to P15 Measurement Circuit

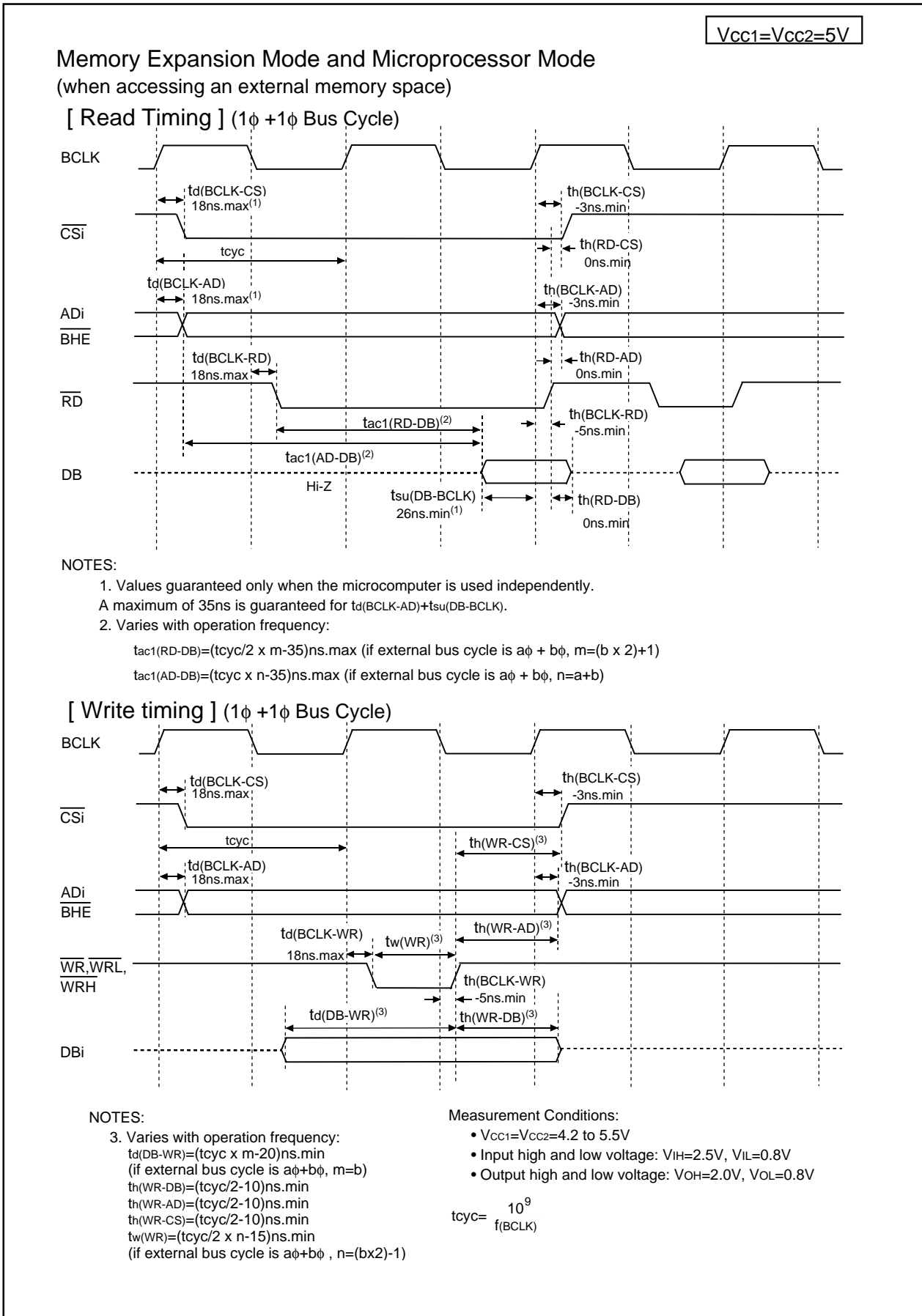


Figure 5.3 V_{CC1}=V_{CC2}=5V Timing Diagram (1)

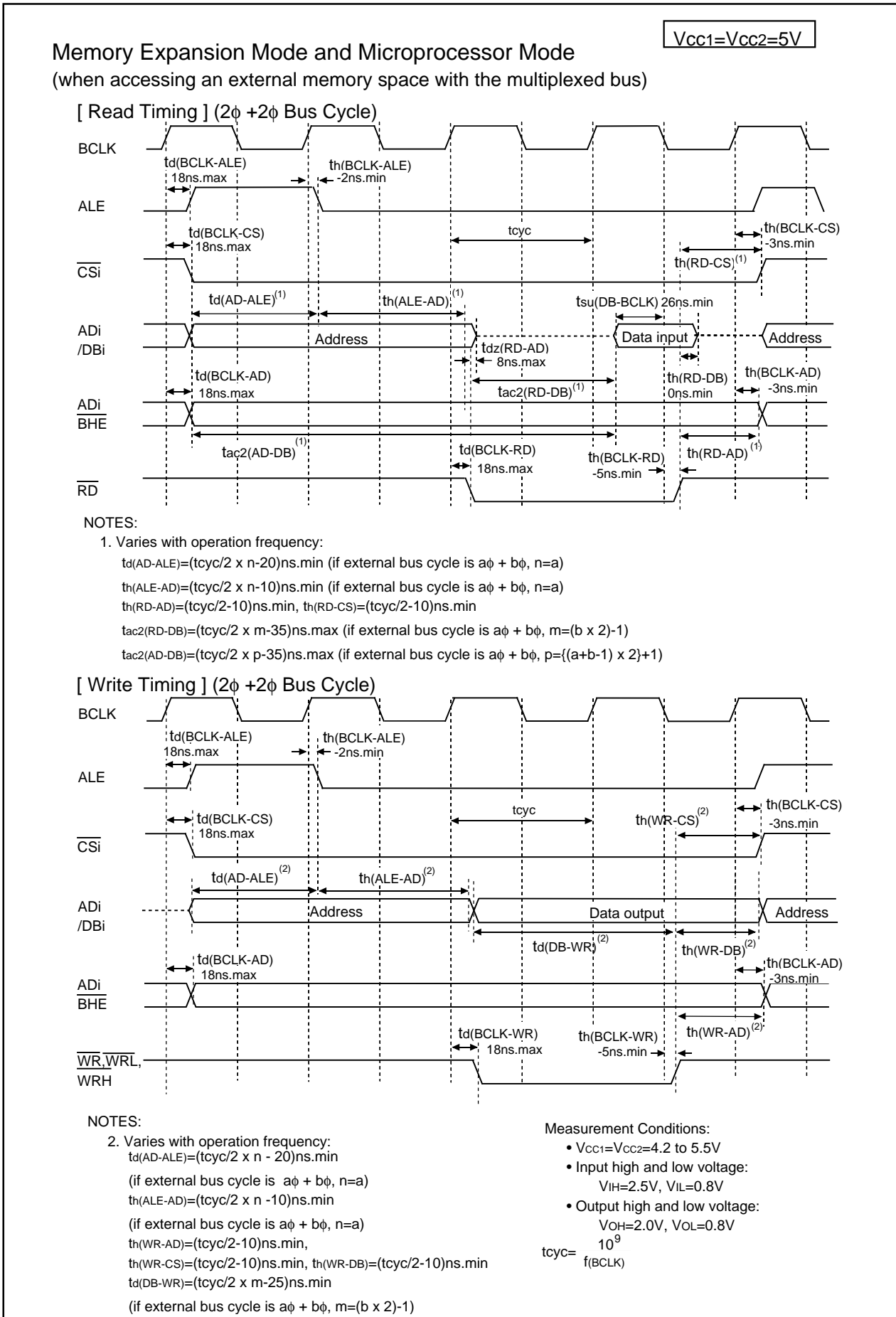


Figure 5.4 V_{CC1}=V_{CC2}=5V Timing Diagram (2)

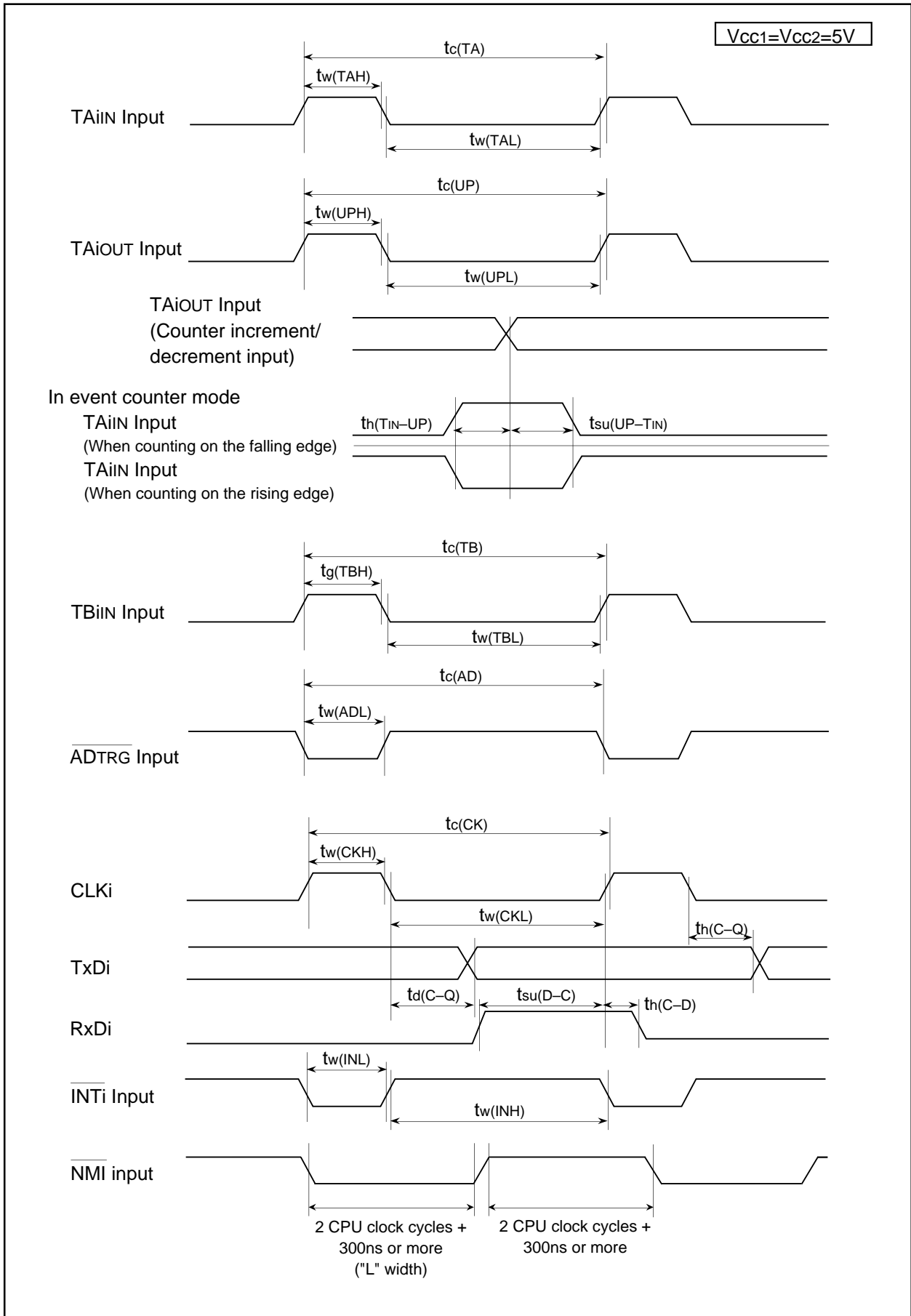


Figure 5.5 VCC1=VCC2=5V Timing Diagram (3)

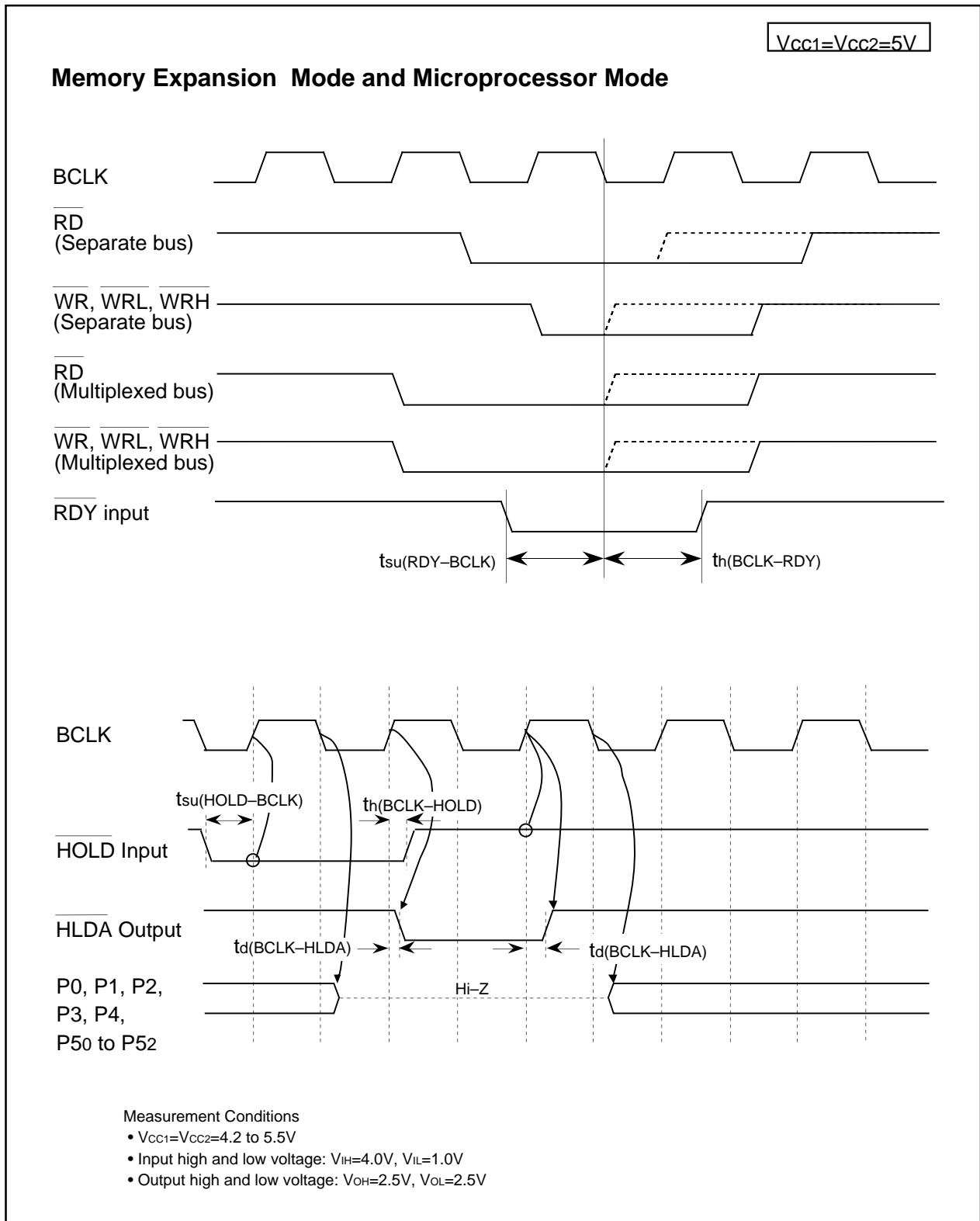


Figure 5.6 $V_{CC1}=V_{CC2}=5V$ Timing Diagram (4)

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

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 _{OH} | Output High ("H") Voltage | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 | I _{OH} =-1mA | V _{CC2} -0.6 | | V _{CC2} | V | |
| | | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ | | V _{CC1} -0.6 | | V _{CC1} | V | |
| | X _{OUT} | I _{OH} =-0.1mA | 2.7 | | V _{CC1} | V | | |
| | X _{COUT} | High Power | No load applied | | 2.5 | | V | |
| | | Low Power | No load applied | | 1.6 | | V | |
| V _{OL} | 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 ⁽¹⁾ | I _{OL} =1mA | | | 0.5 | V | |
| | | X _{OUT} | I _{OL} =0.1mA | | | 0.5 | V | |
| | X _{COUT} | High Power | No load applied | | 0 | | V | |
| | | Low Power | No load applied | | 0 | | V | |
| | V _{T+} -V _{T-} | Hysteresis | HOLD, RDY, TA0IN-TA4IN, TB0IN-TB5IN, INT0-INT5, ADTRG, 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 _{IH} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =3V | | | 4.0 | μA | |
| I _{IL} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =0V | | | -4.0 | μA | |
| R _{PULLUP} | 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 ⁽¹⁾ | V _I =0V | Flash Memory | 66 | 120 | 500 | kΩ |
| | | | | Masked ROM | 40 | 70 | 500 | kΩ |
| R _{fXIN} | Feedback Resistance | X _{IN} | | | | 3.0 | MΩ | |
| R _{fXCIN} | Feedback Resistance | X _{CIN} | | | | 20.0 | MΩ | |
| V _{RAM} | RAM Standby Voltage | in stop mode | | | 2.0 | | V | |
| I _{CC} | Power Supply Current | Measurement condition: In single-chip mode, output pins are left open and other pins are connected to V _{SS} . | f(BCLK)=24 MHz, Square wave, No division | | 22 | 35 | mA | |
| | | | f(BCLK)=32 kHz, In wait mode, T _{opr} =25° C | | 10 | | μA | |
| | | | While clock stops, T _{opr} =25° C | | 0.8 | 5 | μA | |
| | | | While clock stops, T _{opr} =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) | $V_{CC1}=V_{CC2}=V_{REF}=3.3V$ | | | ± 2 | LSB |
| DNL | Differential Nonlinearity Error | No S&H (8-bit) | | | | ± 1 | LSB |
| - | Offset Error | No S&H (8-bit) | | | | ± 2 | LSB |
| - | Gain Error | No S&H (8-bit) | | | | ± 2 | LSB |
| RLADDER | Resistor Ladder | | $V_{REF}=V_{CC1}$ | 8 | | 40 | k Ω |
| tCONV | 8-bit Conversion Time ^(1, 2) | | | 6.1 | | | μs |
| VREF | Reference Voltage | | | 3 | | V_{CC1} | V |
| VIA | Analog Input Voltage | | | 0 | | V_{REF} | V |

S&H: Sample and Hold

NOTES:

1. Divide $f(X_{IN})$, if exceeding 10 MHz, to keep ϕAD 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 | μs |
| Ro | Output Resistance | | | 4 | 10 | 20 | k Ω |
| I _{VREF} | Reference Power Supply Input Current | | (Note 1) | | | 1.0 | mA |

NOTES:

1. Measurement results when using one D/A converter. The DA_i register (i=0, 1) of the D/A converter, not being used, is set to "00₁₆". The resistor ladder in the A/D converter is excluded.
I_{VREF} flows even if the VCUT bit in the AD0CON1 register is set to "0" (no V_{REF} 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:

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.

$$tac1(RD-DB) = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [ns] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)+1)$$

$$tac1(AD-DB) = \frac{10^9 \times n}{f_{(BCLK)}} - 35 \quad [ns] \text{ (if external bus cycle is } a\phi + b\phi, n=a+b)$$

$$tac2(RD-DB) = \frac{10^9 \times m}{f_{(BCLK)} \times 2} - 35 \quad [ns] \text{ (if external bus cycle is } a\phi + b\phi, m=(bx2)-1)$$

$$tac2(AD-DB) = \frac{10^9 \times p}{f_{(BCLK)} \times 2} - 35 \quad [ns] \text{ (if external bus cycle is } a\phi + b\phi, p=\{(a+b-1)x2\}+1)$$

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

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 Topr = –20 to 85°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 _{iIN} Input Cycle Time (counted on one edge) | 100 | | ns |
| t _{w(TBH)} | TB _{iIN} Input High ("H") Width (counted on one edge) | 40 | | ns |
| t _{w(TBL)} | TB _{iIN} Input Low ("L") Width (counted on one edge) | 40 | | ns |
| t _{c(TB)} | TB _{iIN} Input Cycle Time (counted on both edges) | 200 | | ns |
| t _{w(TBH)} | TB _{iIN} Input High ("H") Width (counted on both edges) | 80 | | ns |
| t _{w(TBL)} | TB _{iIN} 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 _{iIN} Input Cycle Time | 400 | | ns |
| t _{w(TBH)} | TB _{iIN} Input High ("H") Width | 200 | | ns |
| t _{w(TBL)} | TB _{iIN} 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 _{iIN} Input Cycle Time | 400 | | ns |
| t _{w(TBH)} | TB _{iIN} Input High ("H") Width | 200 | | ns |
| t _{w(TBL)} | TB _{iIN} 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 _i Input Cycle Time | 200 | | ns |
| t _{w(CKH)} | CLK _i Input High ("H") Width | 100 | | ns |
| t _{w(CKL)} | CLK _i Input Low ("L") Width | 100 | | ns |
| t _{d(C-Q)} | TxD _i Output Delay Time | | 80 | ns |
| t _{h(C-Q)} | TxD _i Hold Time | 0 | | ns |
| t _{su(D-C)} | RxD _i Input Setup Time | 30 | | ns |
| t _{h(C-Q)} | RxD _i 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) ⁽³⁾ | | 0 | | ns |
| $t_{h(WR-AD)}$ | Address Output Hold Time (WR standard) ⁽³⁾ | | (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) ⁽³⁾ | | 0 | | ns |
| $t_{h(WR-CS)}$ | Chip-Select Signal Output Hold Time (WR standard) ⁽³⁾ | | (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) ⁽³⁾ | | (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) ⁽⁵⁾ | | (Note 1) | | ns |
| th(WR-AD) | Address Output Hold Time (WR standard) ⁽⁵⁾ | | (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) ⁽⁵⁾ | | (Note 1) | | ns |
| th(WR-CS) | Chip-Select Signal Output Hold Time (WR standard) ⁽⁵⁾ | | (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) ⁽⁵⁾ | | (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. t_c ns is added when recovery cycle is inserted.

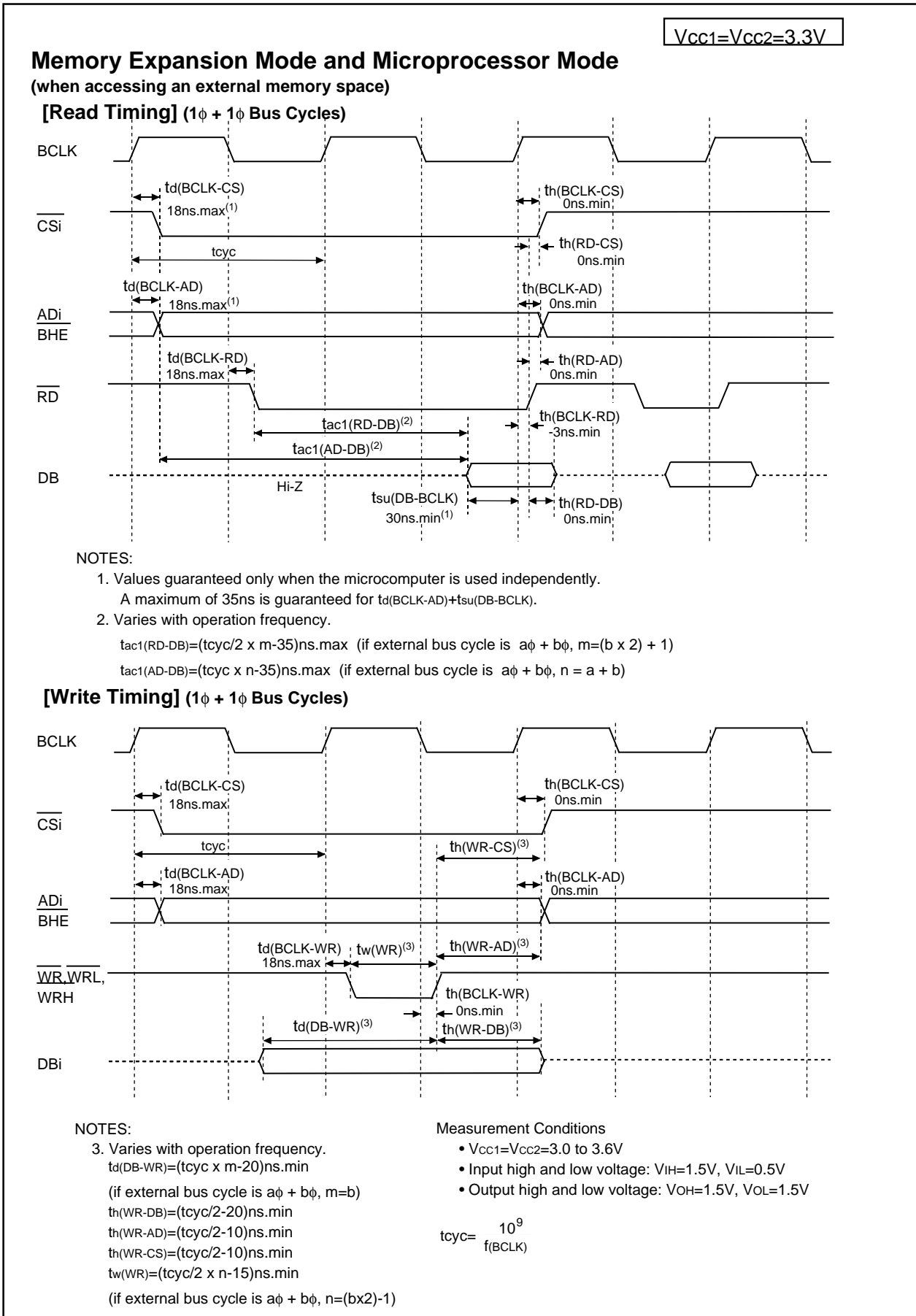


Figure 5.7 V_{CC1}=V_{CC2}=3.3V Timing Diagram (1)

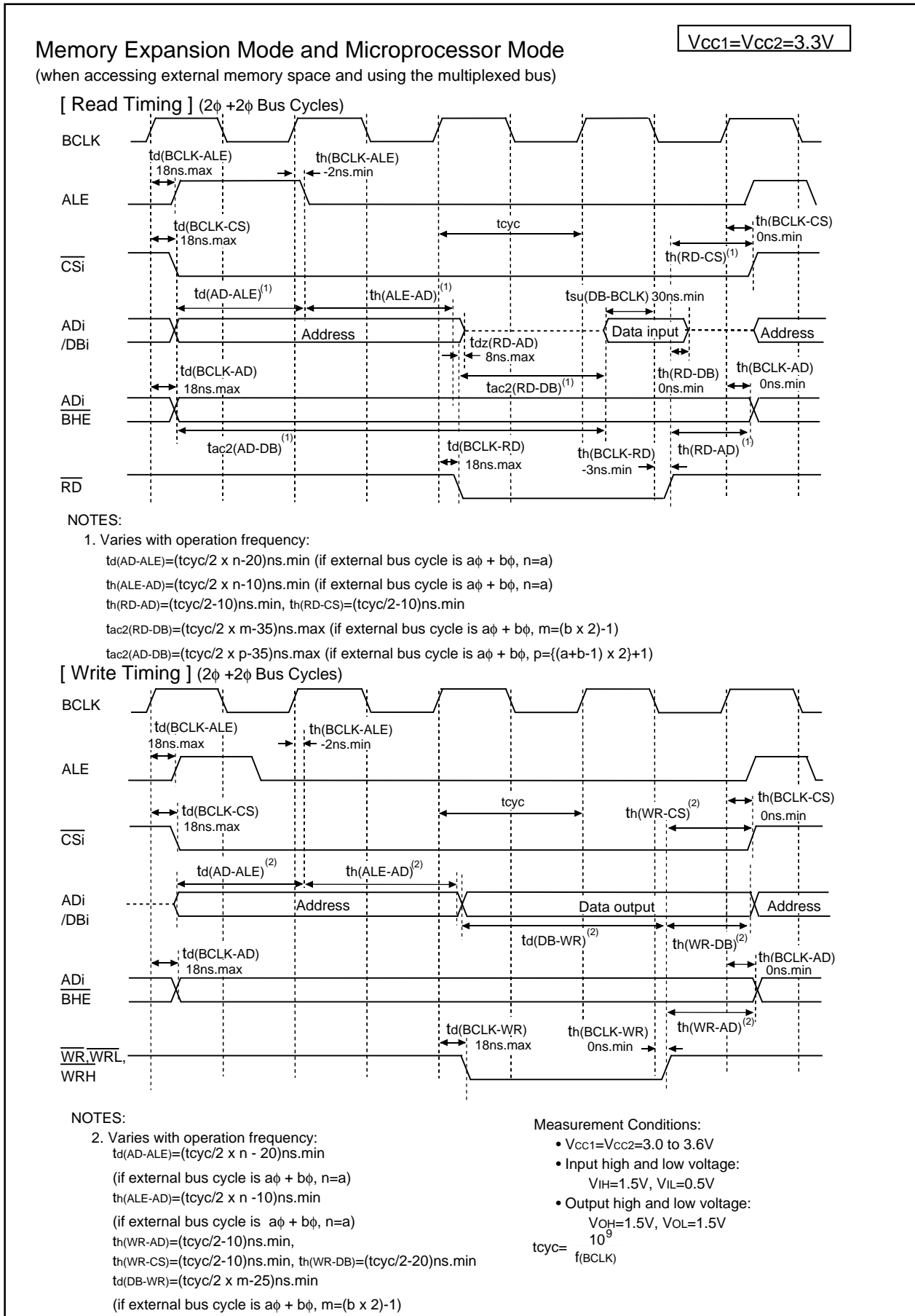


Figure 5.8 V_{CC1}=V_{CC2}=3.3V Timing Diagram (2)

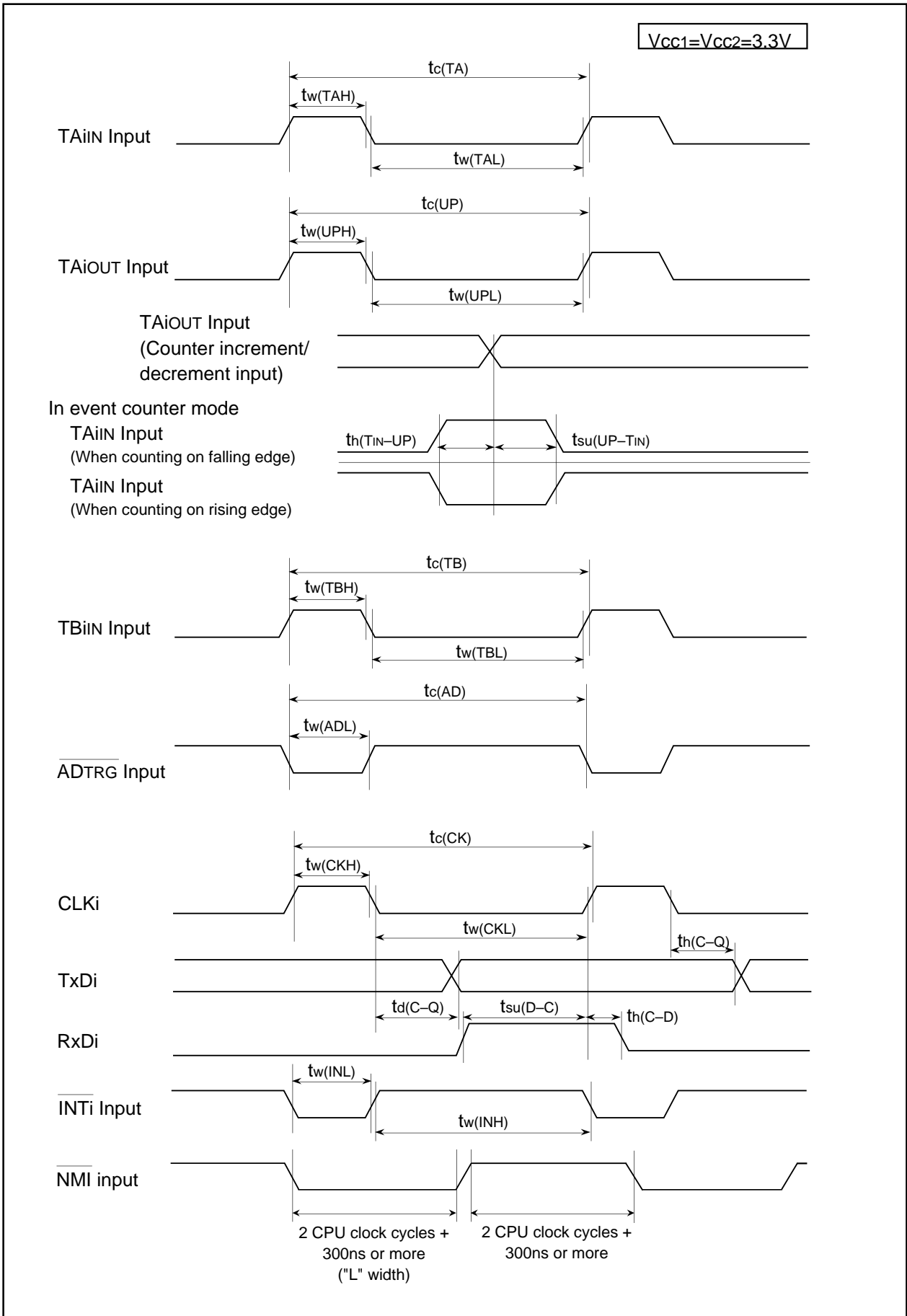


Figure 5.9 Vcc1=Vcc2=3.3V Timing Diagram (3)

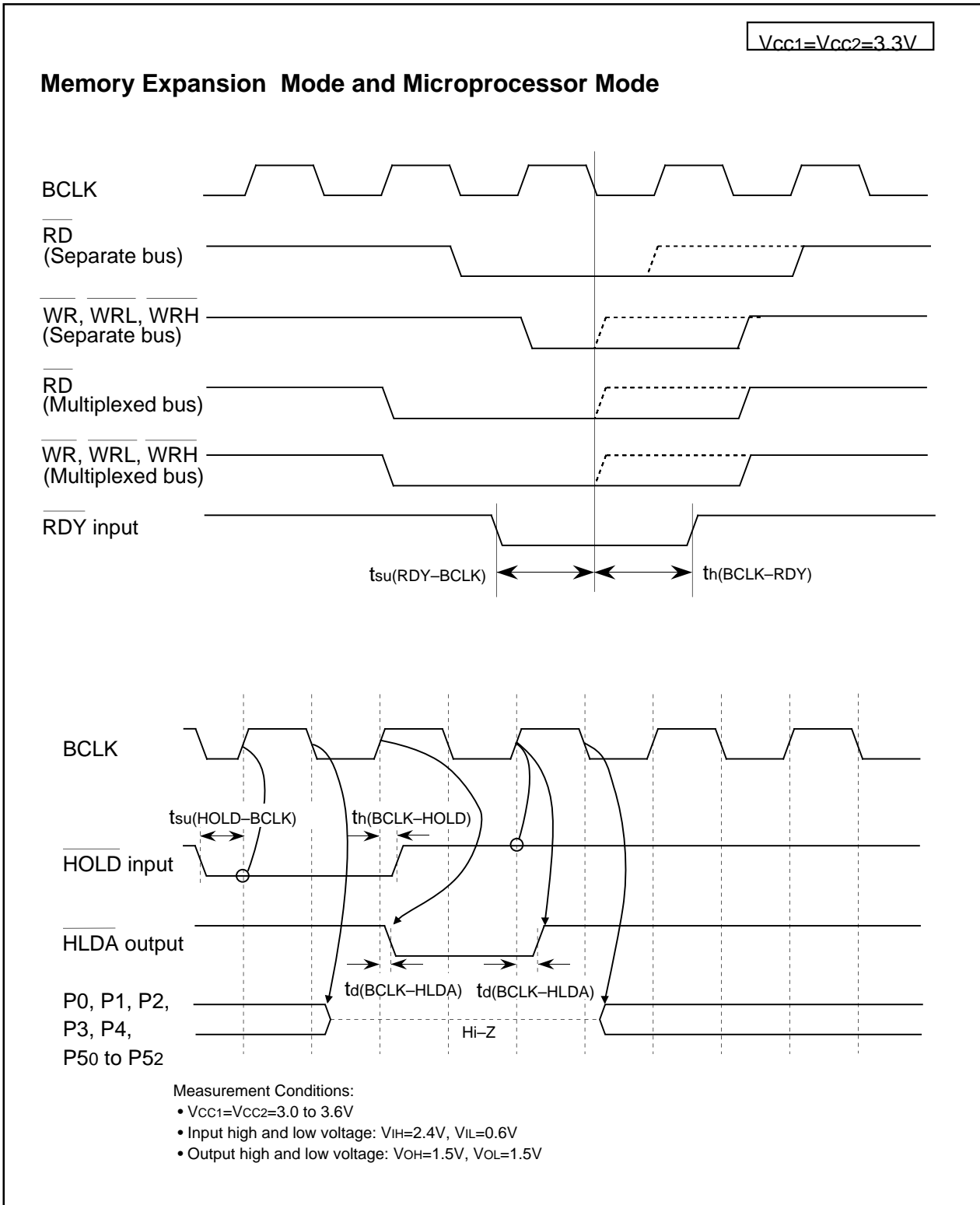


Figure 5.10 $V_{CC1}=V_{CC2}=3.3V$ Timing Diagram (4)

5.2 Electrical Characteristics (M32C/85T)

Table 5.42 Absolute Maximum Ratings

| Symbol | Parameter | | Condition | Value | Unit |
|-------------------------------------|-------------------------------|--|--|-------------------------------|------|
| V _{CC1} , V _{CC2} | Supply Voltage | | V _{CC1} =V _{CC2} =AV _{CC} | -0.3 to 6.0 | V |
| AV _{CC} | Analog Supply Voltage | | V _{CC1} =V _{CC2} =AV _{CC} | -0.3 to 6.0 | V |
| V _I | Input Voltage | RESET, CNV _{SS} , BYTE, P60-P67, P72-P77, P80-P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ , V _{REF} , X _{IN} | | -0.3 to V _{CC1} +0.3 | V |
| | | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 ⁽¹⁾ | | -0.3 to V _{CC2} +0.3 | |
| | | P70, P71 | | -0.3 to 6.0 | |
| V _O | Output Voltage | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ , X _{OUT} | | -0.3 to V _{CC1} +0.3 | V |
| | | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 ⁽¹⁾ | | -0.3 to V _{CC2} +0.3 | |
| | | P70, P71 | | -0.3 to 6.0 | |
| P _d | Power Dissipation | | T _{opr} =25° C | 500 | mW |
| T _{opr} | Operating Ambient Temperature | during CPU operation | T version | -40 to 85 | ° C |
| | | during flash memory program and erase operation | | 0 to 60 | |
| T _{stg} | 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_{CC1}=V_{CC2}=4.2 to 5.5V, V_{SS}=0V at Topr = -40 to 85°C (T version) unless otherwise specified)**

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

NOTES:

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

Table 5.43 Recommended Operating Conditions (Continued)
(V_{CC1}=V_{CC2}=4.2 to 5.5V, V_{SS}=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 _{CC1} =4.2 to 5.5V | 0 | | 32 | MHz |
| f(XIN) | Main Clock Input Frequency | V _{CC1} =4.2 to 5.5V | 0 | | 32 | MHz |
| f(XCIN) | Sub Clock Frequency | | | 32.768 | 50 | kHz |
| f(Ring) | On-chip Oscillator Frequency (V _{CC1} =V _{CC2} =5.0V, Topr=25° C) | | 0.5 | 1 | 2 | MHz |
| f(PLL) | PLL Clock Frequency | V _{CC1} =4.2 to 5.5V | 10 | | 32 | MHz |
| tsu(PLL) | Wait Time to Stabilize PLL Frequency Synthesizer | V _{CC1} =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 _{OH} | Output High ("H") Voltage | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 | I _{OH} =-5mA | V _{CC2} -2.0 | | V _{CC2} | V | |
| | | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ | I _{OH} =-5mA | V _{CC1} -2.0 | | V _{CC1} | | |
| | | P00-P07, P10-P17, P20-P27, P30-P37, P40-P47, P50-P57, P110-P114, P120-P127, P130-P137 | I _{OH} =-200μA | V _{CC2} -0.3 | | V _{CC2} | V | |
| | | P60-P67, P72-P77, P80-P84, P86, P87, P90-P97, P100-P107, P140-P146, P150-P157 ⁽¹⁾ | I _{OH} =-200μA | V _{CC1} -0.3 | | V _{CC1} | | |
| | | X _{OUT} | I _{OH} =-1mA | 3.0 | | | V | |
| | | X _{COUT} | High Power | No load applied | | 2.5 | | V |
| | Low Power | No load applied | | 1.6 | | | | |
| V _{OL} | 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 ⁽¹⁾ | I _{OL} =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 ⁽¹⁾ | I _{OL} =200μA | | | 0.45 | V | |
| | | X _{OUT} | I _{OL} =1mA | | | 2.0 | V | |
| | | X _{COUT} | High Power | No load applied | | 0 | | V |
| | Low Power | No load applied | | 0 | | | | |
| V _{T+} -V _{T-} | Hysteresis | HOLD, RDY, TA0IN-TA4IN, TB0IN-TB5IN, INT0-INT5, ADTRG, 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 _{IH} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =5V | | | 5.0 | μA | |
| I _{IL} | 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 ⁽¹⁾ , X _{IN} , RESET, CNV _{SS} , BYTE | V _I =0V | | | -5.0 | μA | |
| R _{PULLUP} | 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 ⁽¹⁾ | V _I =0V | Flash Memory | 30 | 50 | 167 | kΩ |
| R _{fXIN} | Feedback Resistance | X _{IN} | | | | 1.5 | | MΩ |
| R _{fXCIN} | Feedback Resistance | X _{CIN} | | | | 10 | | MΩ |
| V _{RAM} | 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 _{cc} | Power Supply Current | In single-chip mode, output pins are left open and other pins are connected to V _{ss} . | 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 ⁽¹⁾ | | 25 | | μA |
| | | | f(BCLK)=32 kHz, In wait mode, T _{opr} =25° C | | 10 | | μA |
| | | | While clock stops, T _{opr} =25° C | | 0.8 | 5 | μA |
| | | | While clock stops, T _{opr} =85° C | | | 50 | μA |

NOTES:

1. 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 ₀ to AN ₇ , AN ₀₀ to AN ₀₇ , AN ₂₀ to AN ₂₇ , AN ₁₅₀ to AN ₁₅₇ , ANEX ₀ , ANEX ₁ | | | ±3 | LSB |
| | | | | | | | LSB |
| | | | External op-amp connection mode | | | ±7 | LSB |
| | | | | | | 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 _{CONV} | 10-bit Conversion Time ^(1, 2) | | 2.06 | | | μs | |
| t _{CONV} | 8-bit Conversion Time ^(1, 2) | | 1.75 | | | μs | |
| t _{SAMP} | Sampling Time ⁽¹⁾ | | 0.188 | | | μs | |
| V _{REF} | Reference Voltage | | 2 | | V _{CC1} | V | |
| V _{IA} | Analog Input Voltage | | 0 | | V _{REF} | V | |

NOTES:

1. Divide $f(X_{IN})$, if exceeding 16 MHz, to keep ϕ_{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 _{SU} | Setup Time | | | | 3 | μs |
| R _O | Output Resistance | | 4 | 10 | 20 | kΩ |
| I _{VREF} | Reference Power Supply Input Current | (Note 1) | | | 1.5 | mA |

NOTES:

1. Measurement when using one D/A converter. The DA_i register (i=0, 1) of the D/A converter, not being used, is set to "00₁₆". The resistor ladder in the A/D converter is excluded.
I_{VREF} flows even if the VCUT bit in the AD0CON1 register is set to "0" (no V_{REF} connection).

Table 5.47 Flash Memory Version Electrical Characteristics
(VCC1=4.5 to 5.5V, 3.0 to 3.6V at Topr= 0 to 60°C unless otherwise specified)

| Symbol | Parameter | | Standard | | | Unit |
|-----------------|--|----------------|----------|------|--------------|--------|
| | | | Min. | Typ. | Max. | |
| - | Program and Erase Endurance ⁽²⁾ | | 100 | | | cycles |
| - | Word Program Time (VCC1=5.0V, Topr=25° C) | | | 25 | 200 | µs |
| - | Lock Bit Program Time | | | 25 | 200 | µs |
| - | Block Erase Time (VCC1=5.0V, Topr=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 ⁽¹⁾ | | | | 4 x <i>n</i> | s |
| t _{PS} | Wait Time to Stabilize Flash Memory Circuit | | | | 15 | µs |
| - | Data Hold Time (Topr=-40 to 85 ° C) | | 10 | | | years |

NOTES:

- n* denotes the number of block to be erased.
- 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).

Table 5.48 Power Supply Timing

| Symbol | Parameter | Measurement Condition | Standard | | | Unit |
|---------------------|--|-----------------------|----------|------|------|------|
| | | | Min. | Typ. | Max. | |
| t _{d(P-R)} | Wait Time to Stabilize Internal Supply Voltage when Power-on | VCC1=3.0 to 5.5V | | | 2 | ms |

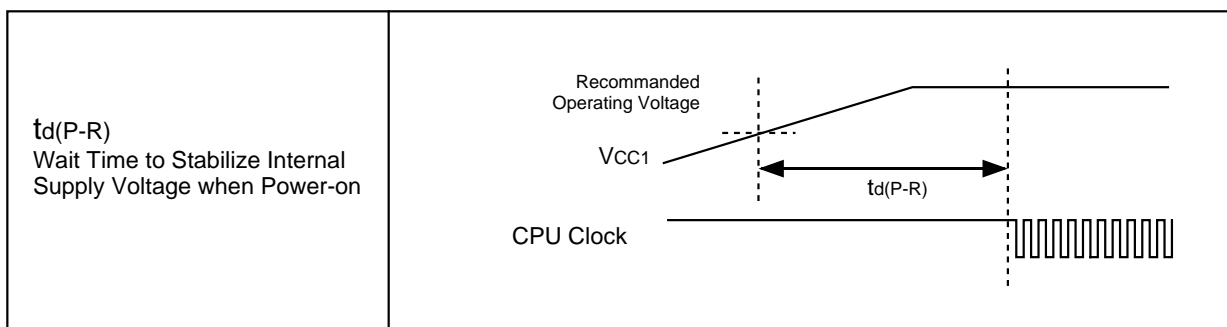


Figure 5.11 Power Supply Timing Diagram

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

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**($V_{CC1}=V_{CC2}=4.2$ to $5.5V$, $V_{SS}=0V$ at $T_{opr}= -40$ to $85^{\circ}C$ (T version) unless otherwise specified)****Table 5.50 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 5.51 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 5.52 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 5.53 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 5.54 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 $T_{opr} = -40$ 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

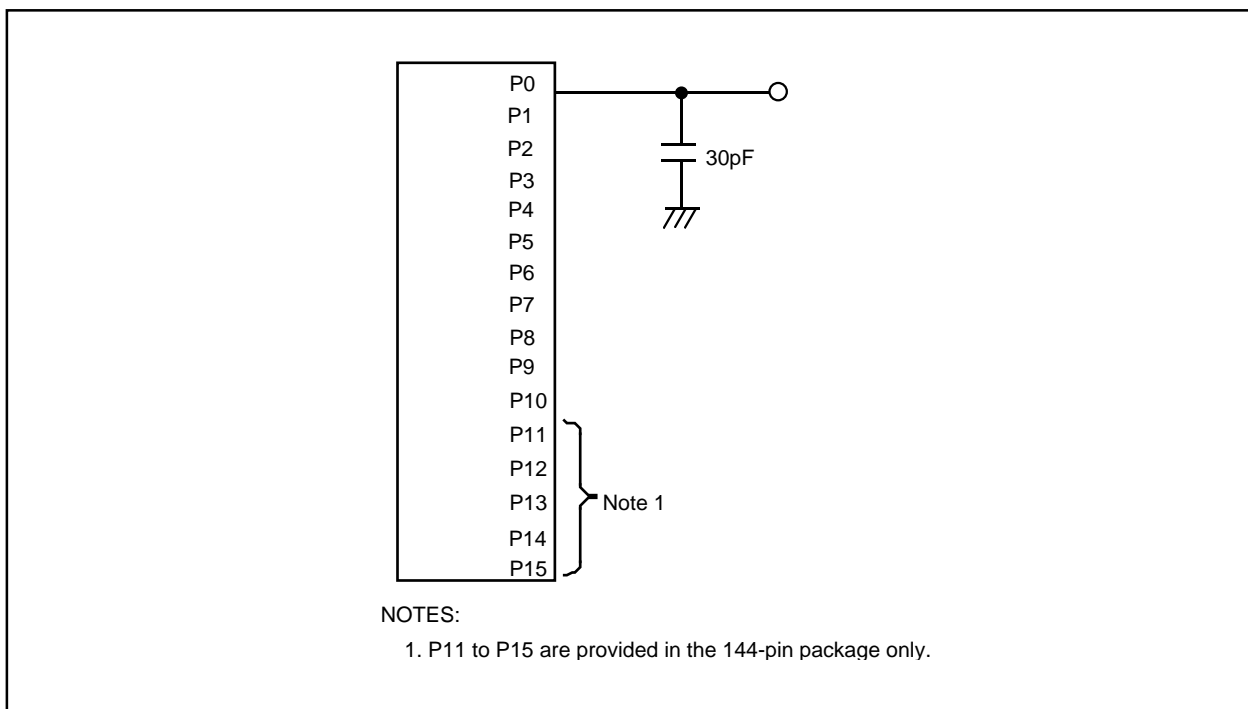
| Symbol | Parameter | Standard | | Unit |
|--------------|---|----------|------|------|
| | | Min. | Max. | |
| $t_{c(AD)}$ | ADTRG Input Cycle Time (required for trigger) | 1000 | | ns |
| $t_{w(ADL)}$ | ADTRG Input Low ("L") Pulse Width | 125 | | ns |

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**

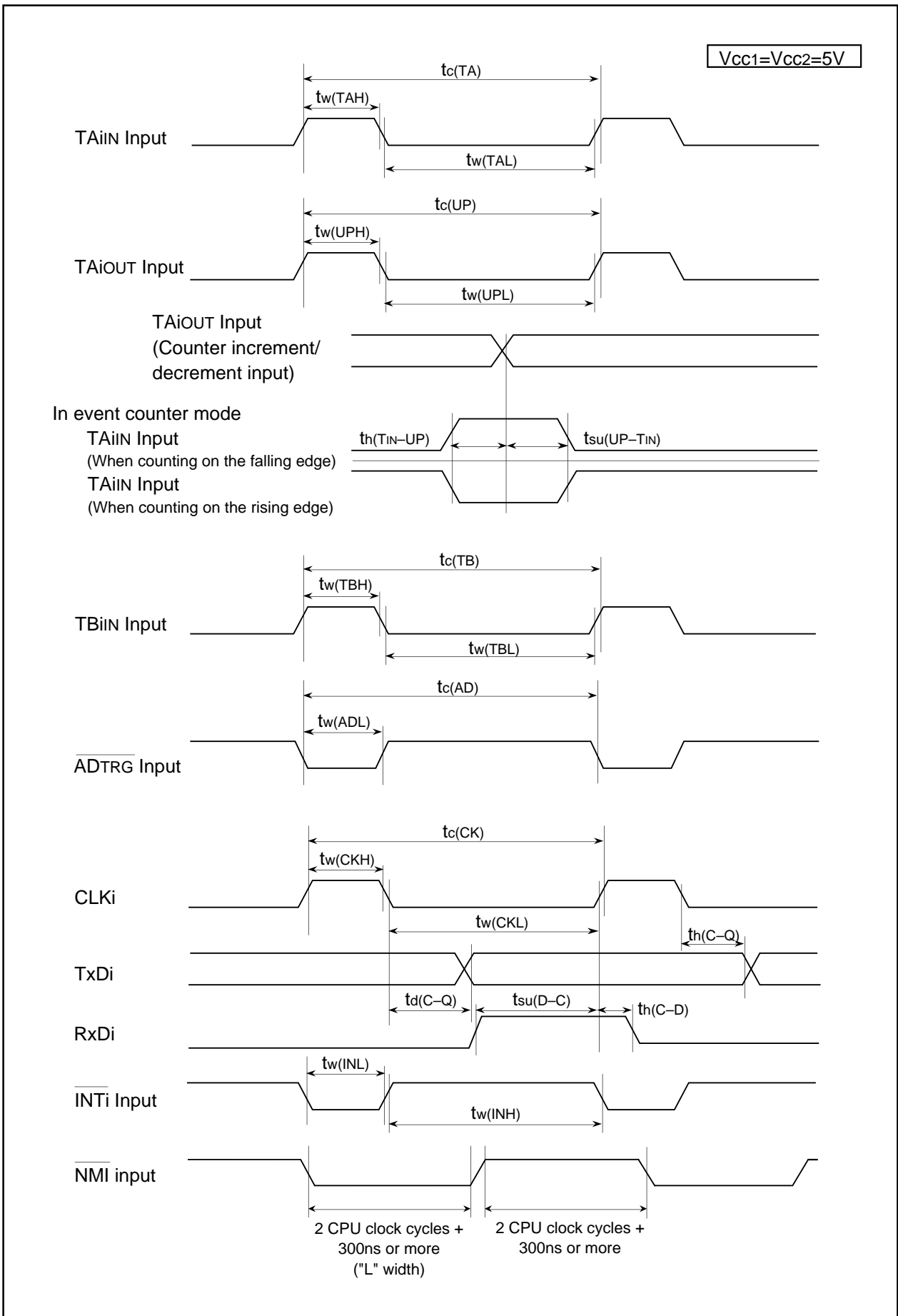


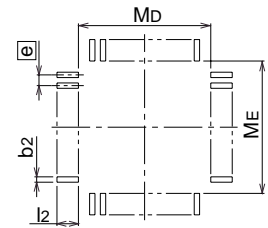
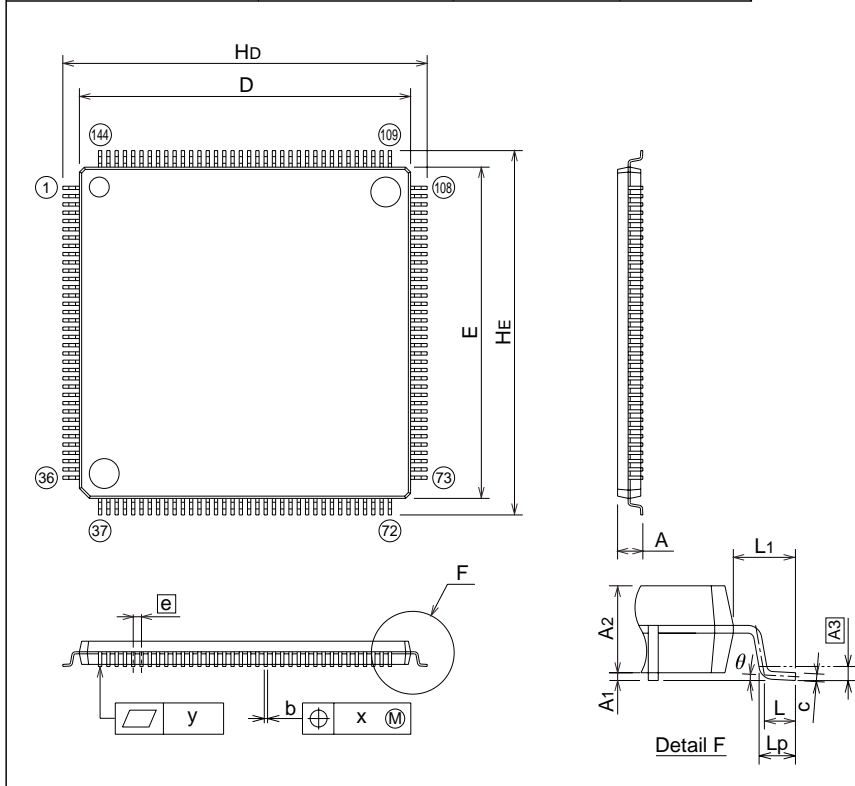
Figure 5.13 Vcc1=Vcc2=5V Timing Diagram

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 |



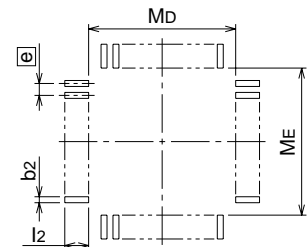
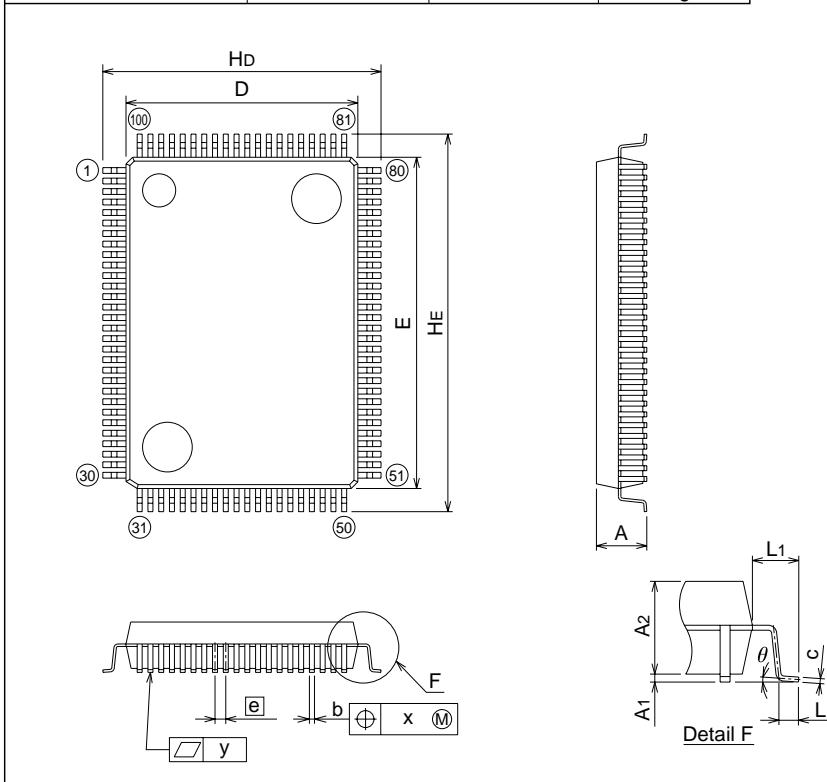
Recommended Mount Pad

| Symbol | Dimension in Millimeters | | |
|--------|--------------------------|-------|-------|
| | Min | Nom | Max |
| A | - | - | 1.7 |
| A1 | 0.05 | 0.125 | 0.2 |
| A2 | - | 1.4 | - |
| b | 0.17 | 0.22 | 0.27 |
| c | 0.105 | 0.125 | 0.175 |
| D | 19.9 | 20.0 | 20.1 |
| E | 19.9 | 20.0 | 20.1 |
| e | - | 0.5 | - |
| HD | 21.8 | 22.0 | 22.2 |
| HE | 21.8 | 22.0 | 22.2 |
| L | 0.35 | 0.5 | 0.65 |
| L1 | - | 1.0 | - |
| Lp | 0.45 | 0.6 | 0.75 |
| A3 | - | 0.25 | - |
| x | - | - | 0.08 |
| y | - | - | 0.1 |
| theta | 0° | - | 8° |
| b2 | - | 0.225 | - |
| l2 | 0.95 | - | - |
| MD | - | 20.4 | - |
| ME | - | 20.4 | - |

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 |



Recommended Mount Pad

| Symbol | Dimension in Millimeters | | |
|--------|--------------------------|------|------|
| | Min | Nom | Max |
| A | - | - | 3.05 |
| A1 | 0 | 0.1 | 0.2 |
| A2 | - | 2.8 | - |
| b | 0.25 | 0.3 | 0.4 |
| c | 0.13 | 0.15 | 0.2 |
| D | 13.8 | 14.0 | 14.2 |
| E | 19.8 | 20.0 | 20.2 |
| e | - | 0.65 | - |
| HD | 16.5 | 16.8 | 17.1 |
| HE | 22.5 | 22.8 | 23.1 |
| L | 0.4 | 0.6 | 0.8 |
| L1 | - | 1.4 | - |
| x | - | - | 0.13 |
| y | - | - | 0.1 |
| theta | 0° | - | 10° |
| b2 | - | 0.35 | - |
| l2 | 1.3 | - | - |
| MD | - | 14.6 | - |
| ME | - | 20.6 | - |

REVISION HISTORY

M32C/85 Group (M32C/85, M32C/85T) Datasheet

| Rev. | Date | Description | |
|------|--------------|-------------|--|
| | | Page | Summary |
| 0.30 | Jul.18, 2003 | – | New Document |
| 0.40 | Sep.30, 2003 | 2 to 3 | Overview • Tables 1.1 and 1.2 M32C/85 Performance “Oscillator Stop Detect Function” added |
| | | 5 | • Figure 1.2 ROM/RAM Capacity and Table 1.3. M32C/85 Group M30852ME-XXXGP and M30850ME-XXXGP/FP deleted |
| | | 6 | • ROM capacity “192 Kbytes” deleted |
| | | 7, 11, 12 | • Figures 1.4 to 1.6 Pin Assignments Note 2 added |
| | | 10,14 | - VREF pin changed from analog input pins to control pins. |
| | | 16 to 18 | - SDA0 to SDA4 pins changed from output pins to I/O pins. |
| | | 17 | - TA4OUT changed from input pin to I/O pin. - TA4IN pin changed from output pin to input pin. |
| | | 18 | - DA0 and DA1 pins changed from input pins to output pins. |
| | | 19 | - Symbol “P117” modified to “P114” and description from “8-bit” to “5-bit”. - Descriptions of ISTxD1 and BE1IN modified from “received data” to “transmit data”. |
| | | 44,45 | SFR - Notes written directly in the Tables. |
| 0.50 | Feb.05, 2004 | 2, 3 | Overview • Tables 1.1 and 1.2 M32C/85 Performance “Shortest Instruction Execution Time” and “Power Consumption” values modified |
| | | 23 | Memory • Figure 3.1 Memory Map Diagram modified |
| | | 24 | • “After RESET” values of PM 1, PM 2, D4INT, G0IRF, G1IRF, IDB0 to IDB1, TA0MR to TA4MR, TCSPR, DM0SL to DM3SL registers corrected • NOTES added to PM0 and TCSPR registers |
| | | | Electrical Characteristics • Newly added |
| 0.51 | Feb.09, 2004 | 52 | Electrical Characteristics • Table 5.6 Flash Memory Version Electrical Characteristics Note 4 changed |
| | | 59 | • Figure 5.2 Vcc1=Vcc2=5V Timing Diagram (1) Notes 1 and 2 changed |
| | | 60 | • Figure 5.3 Vcc1=Vcc2=5V Timing Diagram (2) Notes 1, 2, and 3 changed |
| | | 70 | • Figure 5.6 Vcc1=Vcc2=3.3V Timing Diagram (1) Notes 1, 2, and 3 changed |
| | | 71 | • Figure 5.7 Vcc1=Vcc2=3.3V Timing Diagram (2) Notes 1 and 2 changed |
| 0.52 | Mar.12, 2004 | 2, 3 | Overview • Table 1.1 and 1.2 M32C/85 Group Performance Value of Power Consumption modified |

REVISION HISTORY

M32C/85 Group (M32C/85, M32C/85T) Datasheet

| Rev. | Date | Description | |
|----------|---|-------------|---|
| | | Page | Summary |
| | | 50 | Electrical Characteristics • Table 5.3 Electrical Characteristics Maximum values for Power Supply Current modified |
| | | 52 | • Table 5.6 Flash Memory Version Electrical Characteristics Note 1. 100-cycle Products (D3, D5, U3, U5) deleted; Note 4 modified |
| | | 63 | • Table 5.7 Flash Memory Version Program and Erase Voltage and Read Operation Voltage Characteristics (at Topr=0 to 60°C) deleted • Table 5.22 Electrical Characteristics Maximum values for Power Supply Consumption modified and standard values when “Topr=85°C while clock is stopped” deleted |
| 1.00 | Jun.01, 2004 | - | M32C/85T (High-reliability version) added |
| | | All Pages | Words standardized: On-chip oscillator, A/D converter and D/A converter |
| | | 1 | Overview • 1.1 Applications Automobiles added |
| | | 2, 3 | • Table 1.1 and Table 1.2 M32C/85 Group (M32C/85, M32C/85T) Performance M32C/85T added; note 3 added |
| | | 4 | • Figure 1.1 M32C/85 Group (M32C/85, M32C/85T) Block Diagram Note 3 added |
| | | 5 | • 1.4 Product Information Description modified • Figure 1.2 ROM/RAM Capacity figure modified |
| | | 5, 6 | • Table 1.3 M32C/85 Group M32C/85T added |
| | | 6 | • Figure 1.3 Product Numbering System M32C/85T added |
| | | 7 | • Figure 1.4 Pin Assignment for 144-Pin Package Note 3 added |
| | | 12 | • Figure 1.6 Pin Assignment for 100-Pin Package Note 5 added |
| 8 to 10 | • Table 1.5 Pin Characteristics for 144-Pin Package Note 1 added | | |
| 13, 14 | • Table 1.6 Pin Characteristics for 100-Pin Package Note 1 added | | |
| 15 to 18 | • Table 1.7 Pin Description Notes added | | |
| | | 22 | Memory • Figure 3.1 Memory Map Tables of internal ROM/internal RAM modified; note 2 modified; notes 4 and 5 added |
| | | 23 | SFR • Note 2 added |
| | | 24 | • PWCR0 and PWCR1 registers deleted • “Values after RESET” of the masked ROM version added to the FMR0 register • Note 1 added |
| | | 46 | Electrical Characteristics • Table 5.2 Recommended Operating Conditions f(ripple), Vp-p(ripple), VCC, SVcc and note 1 deleted |
| | | 47 | • Table 5.3 Electrical Characteristics RPULLUP value for the masked ROM version added |

REVISION HISTORY

M32C/85 Group (M32C/85, M32C/85T) Datasheet

| Rev. | Date | Description | |
|------|--------------|-------------|---|
| | | Page | Summary |
| | | 49 | • Table 5.3 Electrical Characteristics Maximum ICC value modified |
| | | 50 | • Table 5.4 A/D Conversion Characteristics tSMP value modified; note 1 added |
| | | 52 | • Table 5.7 Low Voltage Detect Circuit Electrical Characteristics added |
| | | | • Table 5.8 Power Supply Timing added |
| | | | • Figure 5.1 Power Supply Timing Diagram added |
| | | 57 | • Table 5.23 Memory Expansion Mode and Microprocessor Mode th(BCLK-ALE) value modified |
| | | 63 | • Table 5.24 Electrical Characteristics Maximum ICC value modified |
| | | 61 | • Table 5.24 Electrical Characteristics RPULLUP value for the masked ROM version added |
| | | 64 | • Table 5.25 A/D Conversion Characteristics tCONV value modified |
| | | 65 | • Table 5.28 Memory Expansion Mode and Microprocessor Mode tsu(DB-BCLK), tsu(RDY-BCLK) and tsu(HOLD-BCLK) value modified |
| | | 68 | • Table 5.40 Memory Expansion Mode and Microprocessor Mode equation of th(WR-DB) modified |
| | | 69 | • Table 5.41 Memory Expansion Mode and Microprocessor Mode th(BCLK-ALE) value modified; equation of th(WR-DB) modified |
| | | 74 | • 5.2 Electrical Characteristics (M32C/85T) added |
| 1.10 | Jun.28, 2004 | - | High-reliability version (U version) deleted |
| | | | Overview |
| | | 5 | • Table 1.3 M32C/85 Group (1) (2) development status modified |
| | | 6 | • Figure 1.2 Product Numbering System figure modified |
| 1.20 | Mar.30, 2005 | | Memory |
| | | | • Figure 3.1 Memory Map A sentence added to Note 3 |
| | | | SFR |
| | | 24 | • Value after reset of the RLVL register revised |
| | | 27 | • Value after reset of the G0RB register revised |
| | | 29 | • Value after reset of the G1BCR1 register revised |
| | | | • Value after reset of the G1RB register revised |
| | | 37 | • Value after reset of the IDB0 register revised |
| | | | • Value after reset of the IDB1 register revised |
| | | 43 | • Value after reset of the PSC register revised |
| | | | Electrical Characteristics |
| | | 49 | • Table 5.3 Electrical Characteristics ICC standard value revised |
| | | 51 | • Table 5.6 Flash Memory Electrical Characteristics Topr value modified |
| | | 52 | • Table 5.7 Voltage Detection Circuit Electrical Characteristics VCC1 value modified |
| | | 60 | • Figure 5.4 VCC1=VCC2=5V Timing Diagram (2) Diagram modified |
| | | 63 | • Table 5.24 Electrical Characteristics ICC standard value revised |

REVISION HISTORY

M32C/85 Group (M32C/85, M32C/85T) Datasheet

| Rev. | Date | Description | |
|------|---|-------------|---|
| | | Page | Summary |
| | | 65 | <ul style="list-style-type: none"> • Table 5.28 Memory Expansion Mode and Microprocessor Mode $t_{ac1(AD-DB)}$ expression modified |
| | | 77 | <ul style="list-style-type: none"> • Table 5.44 Electrical Characteristics I_{CC} standard value revised |
| | | 80 | <ul style="list-style-type: none"> • Table 5.47 Flash Memory Electrical Characteristics T_{opr} value modified |
| 1.21 | Jul.01, 2005 | All pages | Package code changed: 144P6Q-A to PLQP0144KA-A, 100P6Q-A to PLQP0100KB-A, 100P6S-A to PRQP0100JB-A |
| | | All pages | "Low Voltage Detection Reset" changed to "Brown-out Detection Reset" |
| | | | Special Function Register (SFR) |
| | | 27 | • The G0RB register Value after reset modified |
| | | 39 | • The TCSPR register Value after reset modified |
| | | | Electrical Characteristics |
| | | 47 | • Table 5.2 Electrical Characteristics Parameter $f(BCLK)$ and its values added |
| | | 51 | • Table 5.6 Flash Memory Version Electrical Characteristics Measurement condition changed |
| | | 53 | • Table 5.10 Memory Expansion Mode and Microprocessor Mode $t_{ac1(RD-DB)}$ expression on Note 1 modified; $t_{ac2(RD-DB)}$ expression on Note 1 added |
| | | 59 | • Figure 5.3 Vcc1=Vcc2=5V Timing Diagram (1) $t_{w(ER)}$ expression on Note 3 modified; t_{cyc} expression added |
| 60 | • Figure 5.4 Vcc1=Vcc2=5V Timing Diagram (2) $t_{ac2(AD-DB)}$ expression on Note 1 modified; $t_{h(ALE-AD)}$ expressions on Notes 1 and 2 modified; t_{cyc} expression added | | |
| 65 | • Table 5.28 Memory Expansion Mode and Microprocessor Mode $t_{ac1(RD-DB)}$ expression on Note 1 modified; $t_{ac2(RD-DB)}$ expression on Note 1 added | | |
| 70 | • Figure 5.7 Vcc1=Vcc2=3.3V Timing Diagram (1) $t_{w(ER)}$ expression on Note 3 modified; t_{cyc} expression added | | |
| 71 | • Figure 5.8 Vcc1=Vcc2=3.3V Timing Diagram (2) $t_{ac2(RD-DB)}$ 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 | | |
| 76 | • Table 5.43 Electrical Characteristics Parameter $f(BCLK)$ and its values added | | |
| 80 | • Table 5.47 Flash Memory Version Electrical Characteristics Measurement condition changed | | |

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