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### What is "[Embedded - Microcontrollers](#)"?

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

### Applications of "[Embedded - Microcontrollers](#)"

#### Details

|                            |                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status             | Discontinued at Digi-Key                                                                                                                                                        |
| Core Processor             | RX                                                                                                                                                                              |
| Core Size                  | 32-Bit Single-Core                                                                                                                                                              |
| Speed                      | 100MHz                                                                                                                                                                          |
| Connectivity               | EBI/EMI, I <sup>2</sup> C, SCI, SPI, USB                                                                                                                                        |
| Peripherals                | DMA, LVD, POR, PWM, WDT                                                                                                                                                         |
| Number of I/O              | 103                                                                                                                                                                             |
| Program Memory Size        | 384KB (384K x 8)                                                                                                                                                                |
| Program Memory Type        | FLASH                                                                                                                                                                           |
| EEPROM Size                | -                                                                                                                                                                               |
| RAM Size                   | 64K x 8                                                                                                                                                                         |
| Voltage - Supply (Vcc/Vdd) | 2.7V ~ 3.6V                                                                                                                                                                     |
| Data Converters            | A/D 8x10/12b; D/A 2x10b                                                                                                                                                         |
| Oscillator Type            | Internal                                                                                                                                                                        |
| Operating Temperature      | -40°C ~ 85°C (TA)                                                                                                                                                               |
| Mounting Type              | Surface Mount                                                                                                                                                                   |
| Package / Case             | 144-LQFP                                                                                                                                                                        |
| Supplier Device Package    | 144-LFQFP (20x20)                                                                                                                                                               |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f562n7adfb-v0">https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f562n7adfb-v0</a> |

## 1.2 List of Products

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

**Table 1.3 List of Products**

| Group | Part No.     | Package      | ROM Capacity | RAM Capacity | Data Flash | Operating Frequency (Max.) |
|-------|--------------|--------------|--------------|--------------|------------|----------------------------|
| RX62N | R5F562N8BDBG | PLBG0176GA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8BDLE | PTLG0145JB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8BDFB | PLQP0144KA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8BDFF | PLQP0100KB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7BDBG | PLBG0176GA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7BDLE | PTLG0145JB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7BDFB | PLQP0144KA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7BDFF | PLQP0100KB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8ADBG | PLBG0176GA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8ADLE | PTLG0145JB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8ADFB | PLQP0144KA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N8ADFF | PLQP0100KB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7ADBG | PLBG0176GA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7ADLE | PTLG0145JB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7ADFB | PLQP0144KA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F562N7ADFF | PLQP0100KB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
| RX621 | R5F56218BDBG | PLBG0176GA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56218BDLE | PTLG0145JB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56218BDFB | PLQP0144KA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56218BDFF | PLQP0100KB-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56218BDLD | PTLG0085JA-A | 512 Kbytes   | 96 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56217BDBG | PLBG0176GA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56217BDLE | PTLG0145JB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56217BDFB | PLQP0144KA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56217BDFF | PLQP0100KB-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56217BDLD | PTLG0085JA-A | 384 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56216BDBG | PLBG0176GA-A | 256 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56216BDLE | PTLG0145JB-A | 256 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56216BDFB | PLQP0144KA-A | 256 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56216BDFF | PLQP0100KB-A | 256 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |
|       | R5F56216BDLD | PTLG0085JA-A | 256 Kbytes   | 64 Kbytes    | 32 Kbytes  | 100 MHz                    |

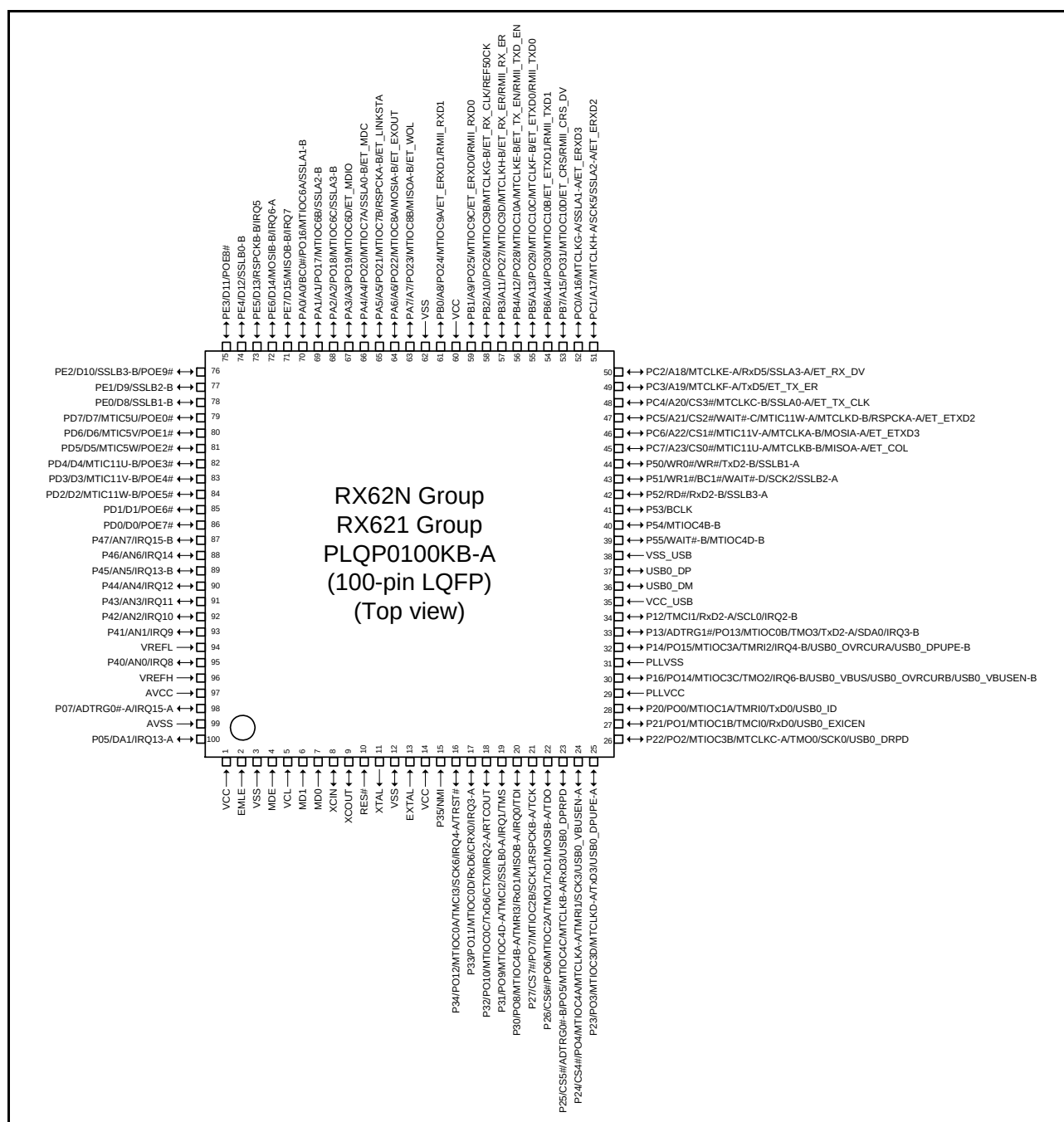


Figure 1.7 Pin Assignment of the 100-Pin LQFP

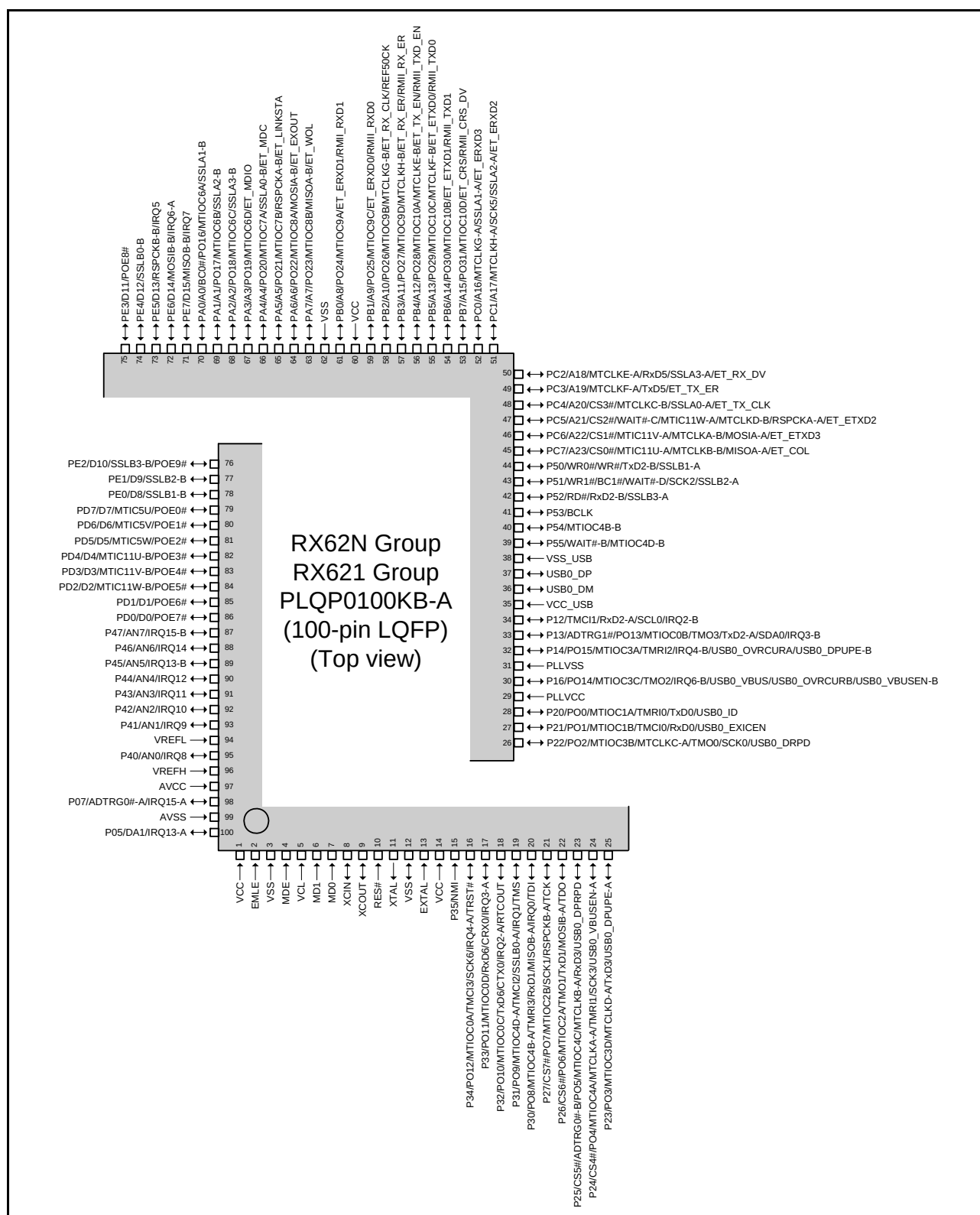


Figure 1.8 Pin Assignment of the 100-Pin LQFP (Assistance Diagram)

**Table 1.4 List of Pins and Pin Functions (176-Pin LFBGA) (1 / 6)**

| Pin No.<br>176-Pin<br>LFBGA | Power Supply<br>Clock<br>System<br>Control | I/O<br>Port | External<br>Bus<br>EXDMAC | ETHERC<br>EDMAC | USB | Timers<br>(MTU, TMR,<br>PPG, POE,<br>WDT) | Communi-<br>cation<br>(SCI, CAN,<br>RSPI, RIIC) | Others                |
|-----------------------------|--------------------------------------------|-------------|---------------------------|-----------------|-----|-------------------------------------------|-------------------------------------------------|-----------------------|
| A1                          | AVSS                                       |             |                           |                 |     |                                           |                                                 |                       |
| A2                          | AVCC                                       |             |                           |                 |     |                                           |                                                 |                       |
| A3                          |                                            | P42         |                           |                 |     |                                           |                                                 | IRQ10-B/AN2           |
| A4                          |                                            | P45         |                           |                 |     |                                           |                                                 | IRQ13-B/AN5           |
| A5                          |                                            | P46         |                           |                 |     |                                           |                                                 | IRQ14/AN6             |
| A6                          |                                            | P90         | D16/A16-B                 |                 |     |                                           |                                                 |                       |
| A7                          |                                            | PD0         | D0                        |                 |     | POE7#                                     |                                                 |                       |
| A8                          |                                            | PD2         | D2                        |                 |     | MTIC11W-B/<br>POE5#                       |                                                 |                       |
| A9                          |                                            | PD3         | D3                        |                 |     | MTIC11V-B/<br>POE4#                       |                                                 |                       |
| A10                         |                                            | PD4         | D4                        |                 |     | MTIC11U-B/<br>POE3#                       |                                                 |                       |
| A11                         |                                            | PG0         | D24                       |                 |     |                                           |                                                 |                       |
| A12                         |                                            | PD7         | D7                        |                 |     | MTIC5U-B/<br>POE0#                        |                                                 |                       |
| A13                         |                                            | P61         | CS1#-A/<br>SDCS#          |                 |     |                                           |                                                 |                       |
| A14                         |                                            | P63         | CS3#-A/<br>CAS#           |                 |     |                                           |                                                 |                       |
| A15                         |                                            | PE1         | D9                        |                 |     |                                           | SSLB2-B                                         |                       |
| B1                          |                                            | P02         |                           |                 |     | TMC1-A                                    | SCK6-A                                          | IRQ10-A               |
| B2                          | VREFH                                      |             |                           |                 |     |                                           |                                                 |                       |
| B3                          | VREFL                                      |             |                           |                 |     |                                           |                                                 |                       |
| B4                          |                                            | P44         |                           |                 |     |                                           |                                                 | IRQ12/AN4             |
| B5                          |                                            | P47         |                           |                 |     |                                           |                                                 | IRQ15-B/AN7           |
| B6                          |                                            | P91         | D17/A17-B                 |                 |     |                                           |                                                 |                       |
| B7                          |                                            | PD1         | D1                        |                 |     | POE6#                                     |                                                 |                       |
| B8                          |                                            | P96         | D22/A22-B                 |                 |     |                                           |                                                 |                       |
| B9                          |                                            | P97         | D23/A23-B                 |                 |     |                                           |                                                 |                       |
| B10                         |                                            | PD6         | D6                        |                 |     | MTIC5V-B/<br>POE1#                        |                                                 |                       |
| B11                         |                                            | P60         | CS0#-A                    |                 |     |                                           |                                                 |                       |
| B12                         |                                            | P62         | CS2#-A/<br>RAS#           |                 |     |                                           |                                                 |                       |
| B13                         |                                            | P64         | CS4#-A/<br>WE#            |                 |     |                                           |                                                 |                       |
| B14                         |                                            | PE2         | D10                       |                 |     | POE9#                                     | SSLB3-B                                         |                       |
| B15                         | SDCLK                                      | P70         |                           |                 |     |                                           |                                                 |                       |
| C1                          |                                            | P00         |                           |                 |     | TMRI0-A                                   | TxD6-A                                          | IRQ8-A                |
| C2                          |                                            | P03         |                           |                 |     |                                           |                                                 | IRQ11-A/DA0           |
| C3                          |                                            | P05         |                           |                 |     |                                           |                                                 | IRQ13-A/DA1           |
| C4                          |                                            | P07         |                           |                 |     |                                           |                                                 | IRQ15-A/<br>ADTRG0#-A |
| C5                          |                                            | P40         |                           |                 |     |                                           |                                                 | IRQ8-B/AN0            |

**Table 1.6 List of Pins and Pin Functions (144-Pin LQFP) (1 / 5)**

| Pin No.<br>144-Pin<br>LQFP | Power<br>Supply<br>Clock<br>System<br>Control | I/O<br>Port | External Bus<br>EXDMAC | ETHERC<br>EDMAC | USB | Timers<br>(MTU, TMR,<br>PPG, POE,<br>WDT) | Communi-<br>cation<br>(SCI, CAN,<br>RSPI, RIIC) | Others           |
|----------------------------|-----------------------------------------------|-------------|------------------------|-----------------|-----|-------------------------------------------|-------------------------------------------------|------------------|
| 1                          | AVSS                                          |             |                        |                 |     |                                           |                                                 |                  |
| 2                          |                                               | P05         |                        |                 |     |                                           |                                                 | IRQ13-A/DA1      |
| 3                          | VCC                                           |             |                        |                 |     |                                           |                                                 |                  |
| 4                          |                                               | P03         |                        |                 |     |                                           |                                                 | IRQ11-A/DA0      |
| 5                          | VSS                                           |             |                        |                 |     |                                           |                                                 |                  |
| 6                          |                                               | P02         |                        |                 |     | TMCI1-A                                   | SCK6-A                                          | IRQ10-A          |
| 7                          |                                               | P01         |                        |                 |     | TMCI0-A                                   | RxD6-A                                          | IRQ9-A           |
| 8                          |                                               | P00         |                        |                 |     | TMRI0-A                                   | TxD6-A                                          | IRQ8-A           |
| 9                          | BSCANP                                        |             |                        |                 |     |                                           |                                                 |                  |
| 10                         | EMLE                                          |             |                        |                 |     |                                           |                                                 |                  |
| 11                         |                                               |             |                        |                 |     | WDTOVF#                                   |                                                 |                  |
| 12                         | VSS                                           |             |                        |                 |     |                                           |                                                 |                  |
| 13                         | MDE                                           |             |                        |                 |     |                                           |                                                 |                  |
| 14                         | VCL                                           |             |                        |                 |     |                                           |                                                 |                  |
| 15                         | MD1                                           |             |                        |                 |     |                                           |                                                 |                  |
| 16                         | MD0                                           |             |                        |                 |     |                                           |                                                 |                  |
| 17                         | XCIN                                          |             |                        |                 |     |                                           |                                                 |                  |
| 18                         | XCOUT                                         |             |                        |                 |     |                                           |                                                 |                  |
| 19                         | RES#                                          |             |                        |                 |     |                                           |                                                 |                  |
| 20                         | XTAL                                          |             |                        |                 |     |                                           |                                                 |                  |
| 21                         | VSS                                           |             |                        |                 |     |                                           |                                                 |                  |
| 22                         | EXTAL                                         |             |                        |                 |     |                                           |                                                 |                  |
| 23                         | VCC                                           |             |                        |                 |     |                                           |                                                 |                  |
| 24                         |                                               | P35         |                        |                 |     |                                           |                                                 | NMI              |
| 25                         |                                               | P34         |                        |                 |     | MTIOC0A/<br>TMCI3/<br>PO12                | SCK6-B                                          | IRQ4-A/<br>TRST# |
| 26                         |                                               | P33         |                        |                 |     | MTIOC0D/<br>PO11                          | CRX0/<br>RxD6-B                                 | IRQ3-A           |
| 27                         |                                               | P32         |                        |                 |     | MTIOC0C/<br>PO10/<br>RTCOUT               | CTX0/<br>TxD6-B                                 | IRQ2-A           |
| 28                         |                                               | P31         |                        |                 |     | MTIOC4D-<br>A/<br>TMCI2-B/<br>PO9         | SSLB0-A                                         | IRQ1/<br>TMS     |
| 29                         |                                               | P30         |                        |                 |     | MTIOC4B-A/<br>TMRI3/<br>PO8               | RxD1/<br>MISOB-A                                | IRQ0/<br>TDI     |
| 30                         |                                               | P27         | CS7#-C                 |                 |     | MTIOC2B/<br>PO7                           | RSPCKB-A/<br>SCK1                               | TCK              |
| 31                         |                                               | P26         | CS6#-C                 |                 |     | MTIOC2A/<br>TMO1/<br>PO6                  | MOSIB-A/<br>TxD1                                | TDO              |

**Table 1.6 List of Pins and Pin Functions (144-Pin LQFP) (5 / 5)**

| Pin No. | Power Supply Clock System Control | I/O Port | External Bus EXDMAC | ETHERC EDMAC | USB | Timers (MTU, TMR, PPG, POE, WDT) | Communication (SCI, CAN, RSPI, IIC) | Others                |
|---------|-----------------------------------|----------|---------------------|--------------|-----|----------------------------------|-------------------------------------|-----------------------|
| 112     |                                   | P64      | CS4#-A/<br>WE#      |              |     |                                  |                                     |                       |
| 113     |                                   | P63      | CS3#-A/<br>CAS#     |              |     |                                  |                                     |                       |
| 114     |                                   | P62      | CS2#-A/<br>RAS#     |              |     |                                  |                                     |                       |
| 115     |                                   | P61      | CS1#-A/<br>SDCS#    |              |     |                                  |                                     |                       |
| 116     | VSS                               |          |                     |              |     |                                  |                                     |                       |
| 117     |                                   | P60      | CS0#-A              |              |     |                                  |                                     |                       |
| 118     | VCC                               |          |                     |              |     |                                  |                                     |                       |
| 119     |                                   | PD7      | D7                  |              |     | MTIC5U/<br>POE0#                 |                                     |                       |
| 120     |                                   | PD6      | D6                  |              |     | MTIC5V/<br>POE1#                 |                                     |                       |
| 121     |                                   | PD5      | D5                  |              |     | MTIC5W/<br>POE2#                 |                                     |                       |
| 122     |                                   | PD4      | D4                  |              |     | MTIC11U-B/<br>POE3#              |                                     |                       |
| 123     |                                   | PD3      | D3                  |              |     | MTIC11V-B/<br>POE4#              |                                     |                       |
| 124     |                                   | PD2      | D2                  |              |     | MTIC11W-B/<br>POE5#              |                                     |                       |
| 125     |                                   | PD1      | D1                  |              |     | POE6#                            |                                     |                       |
| 126     |                                   | PD0      | D0                  |              |     | POE7#                            |                                     |                       |
| 127     |                                   | P93      | A19-B               |              |     |                                  |                                     |                       |
| 128     |                                   | P92      | A18-B               |              |     |                                  |                                     |                       |
| 129     |                                   | P91      | A17-B               |              |     |                                  |                                     |                       |
| 130     | VSS                               |          |                     |              |     |                                  |                                     |                       |
| 131     |                                   | P90      | A16-B               |              |     |                                  |                                     |                       |
| 132     | VCC                               |          |                     |              |     |                                  |                                     |                       |
| 133     |                                   | P47      |                     |              |     |                                  |                                     | IRQ15-B/AN7           |
| 134     |                                   | P46      |                     |              |     |                                  |                                     | IRQ14/AN6             |
| 135     |                                   | P45      |                     |              |     |                                  |                                     | IRQ13-B/AN5           |
| 136     |                                   | P44      |                     |              |     |                                  |                                     | IRQ12/AN4             |
| 137     |                                   | P43      |                     |              |     |                                  |                                     | IRQ11-B/AN3           |
| 138     |                                   | P42      |                     |              |     |                                  |                                     | IRQ10-B/AN2           |
| 139     |                                   | P41      |                     |              |     |                                  |                                     | IRQ9-B/AN1            |
| 140     | VREFL                             |          |                     |              |     |                                  |                                     |                       |
| 141     |                                   | P40      |                     |              |     |                                  |                                     | IRQ8-B/AN0            |
| 142     | VREFH                             |          |                     |              |     |                                  |                                     |                       |
| 143     | AVCC                              |          |                     |              |     |                                  |                                     |                       |
| 144     |                                   | P07      |                     |              |     |                                  |                                     | IRQ15-A/<br>ADTRG0#-A |

**Table 4.1 List of I/O Registers (Address Order) (15 / 36)**

| Address      | Module Abbreviation | Register Name                 | Register Abbreviation | Number of Bits | Access Size | Number of Access Cycles |
|--------------|---------------------|-------------------------------|-----------------------|----------------|-------------|-------------------------|
| 0008 8053h   | AD0                 | A/D sampling state register   | ADSSTR                | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 805Fh   | AD0                 | A/D self-diagnostic register  | ADDIAGR               | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8060h   | AD1                 | A/D data register A           | ADDRA                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 8062h   | AD1                 | A/D data register B           | ADDRB                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 8064h   | AD1                 | A/D data register C           | ADDRC                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 8066h   | AD1                 | A/D data register D           | ADDRD                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 8070h   | AD1                 | A/D control/status register   | ADCSR                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8071h   | AD1                 | A/D control register          | ADCR                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8072h   | AD1                 | ADDRn format select register  | ADDPR                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8073h   | AD1                 | A/D sampling state register   | ADSSTR                | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 807Fh   | AD1                 | A/D self-diagnostic register  | ADDIAGR               | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 80C0h   | DA                  | D/A data register 0           | DADR0                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 80C2h   | DA                  | D/A data register 1           | DADR1                 | 16             | 16          | 2 to 3 PCLK*8           |
| 0008 80C4h   | DA                  | D/A control register          | DACR                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 80C5h   | DA                  | DADRM format select register  | DADPR                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81E6h   | PPG0                | PPG output control register   | PCR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81E7h   | PPG0                | PPG output mode register      | PMR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81E8h   | PPG0                | Next data enable register H   | NDERH                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81E9h   | PPG0                | Next data enable register L   | NDERL                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81EAh   | PPG0                | Output data register H        | PODRH                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81EBh   | PPG0                | Output data register L        | PODRL                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81ECh*1 | PPG0                | Next data register H          | NDRH                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81EDh*2 | PPG0                | Next data register L          | NDRL                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81EEh*1 | PPG0                | Next data register H2         | NDRH2                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81EFh*2 | PPG0                | Next data register L2         | NDRL2                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81F0h   | PPG1                | PPG trigger select register   | PTRSLR                | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81F6h   | PPG1                | PPG output control register   | PCR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81F7h   | PPG1                | PPG output mode register      | PMR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81F8h   | PPG1                | Next data enable register H   | NDERH                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81F9h   | PPG1                | Next data enable register L   | NDERL                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FAh   | PPG1                | Output data register H        | PODRH                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FBh   | PPG1                | Output data register L        | PODRL                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FCh*3 | PPG1                | Next data register H          | NDRH                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FDh*4 | PPG1                | Next data register L          | NDRL                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FEh*3 | PPG1                | Next data register H2         | NDRH2                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 81FFh*4 | PPG1                | Next data register L2         | NDRL2                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8200h   | TMR0                | Timer control register        | TCR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8201h   | TMR1                | Timer control register        | TCR                   | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8202h   | TMR0                | Timer control/status register | TCSR                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8203h   | TMR1                | Timer control/status register | TCSR                  | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8204h   | TMR0                | Time constant register A      | TCORA                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8205h   | TMR1                | Time constant register A      | TCORA                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8206h   | TMR0                | Time constant register B      | TCORB                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8207h   | TMR1                | Time constant register B      | TCORB                 | 8              | 8           | 2 to 3 PCLK*8           |
| 0008 8208h   | TMR0                | Timer counter                 | TCNT                  | 8              | 8           | 2 to 3 PCLK*8           |



**Table 4.1 List of I/O Registers (Address Order) (31 / 36)**

| Address    | Module Abbreviation | Register Name                              | Register Abbreviation | Number of Bits | Access Size | Number of Access Cycles |
|------------|---------------------|--------------------------------------------|-----------------------|----------------|-------------|-------------------------|
| 000A 0060h | USB0                | DCP control register                       | DCPCTR                | 16             | 16          | at least 9 PCLK*9       |
| 000A 0064h | USB0                | Pipe window select register                | PIPESEL               | 16             | 16          | at least 9 PCLK*9       |
| 000A 0068h | USB0                | Pipe configuration register                | PIPECFG               | 16             | 16          | at least 9 PCLK*9       |
| 000A 006Ch | USB0                | Pipe maximum packet size register          | PIPEMAXP              | 16             | 16          | at least 9 PCLK*9       |
| 000A 006Eh | USB0                | Pipe cycle control register                | PIPEPERI              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0070h | USB0                | Pipe 1 control register                    | PIPE1CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0072h | USB0                | Pipe 2 control register                    | PIPE2CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0074h | USB0                | Pipe 3 control register                    | PIPE3CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0076h | USB0                | Pipe 4 control register                    | PIPE4CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0078h | USB0                | Pipe 5 control register                    | PIPE5CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 007Ah | USB0                | Pipe 6 control register                    | PIPE6CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 007Ch | USB0                | Pipe 7 control register                    | PIPE7CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 007Eh | USB0                | Pipe 8 control register                    | PIPE8CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0080h | USB0                | Pipe 9 control register                    | PIPE9CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0090h | USB0                | Pipe 1 transaction counter enable register | PIPE1TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0092h | USB0                | Pipe 1 transaction counter register        | PIPE1TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0094h | USB0                | Pipe 2 transaction counter enable register | PIPE2TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0096h | USB0                | Pipe 2 transaction counter register        | PIPE2TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0098h | USB0                | Pipe 3 transaction counter enable register | PIPE3TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 009Ah | USB0                | Pipe 3 transaction counter register        | PIPE3TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 009Ch | USB0                | Pipe 4 transaction counter enable register | PIPE4TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 009Eh | USB0                | Pipe 4 transaction counter register        | PIPE4TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 00A0h | USB0                | Pipe 5 transaction counter enable register | PIPE5TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 00A2h | USB0                | Pipe 5 transaction counter register        | PIPE5TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 00D0h | USB0                | Device address 0 configuration register    | DEVADD0               | 16             | 16          | at least 9 PCLK*9       |
| 000A 00D2h | USB0                | Device address 1 configuration register    | DEVADD1               | 16             | 16          | at least 9 PCLK*9       |

**Table 4.1 List of I/O Registers (Address Order) (33 / 36)**

| Address    | Module Abbreviation | Register Name                              | Register Abbreviation | Number of Bits | Access Size | Number of Access Cycles |
|------------|---------------------|--------------------------------------------|-----------------------|----------------|-------------|-------------------------|
| 000A 0254h | USB1                | USB request type register                  | USBREQ                | 16             | 16          | at least 9 PCLK*9       |
| 000A 0256h | USB1                | USB request value register                 | USBVAL                | 16             | 16          | at least 9 PCLK*9       |
| 000A 0258h | USB1                | USB request index register                 | USBINDX               | 16             | 16          | at least 9 PCLK*9       |
| 000A 025Ah | USB1                | USB request length register                | USBLENG               | 16             | 16          | at least 9 PCLK*9       |
| 000A 025Ch | USB1                | DCP configuration register                 | DCPCFG                | 16             | 16          | at least 9 PCLK*9       |
| 000A 025Eh | USB1                | DCP maximum packet size register           | DCPMAXP               | 16             | 16          | at least 9 PCLK*9       |
| 000A 0260h | USB1                | DCP control register                       | DCPCTR                | 16             | 16          | at least 9 PCLK*9       |
| 000A 0264h | USB1                | Pipe window select register                | PIPESEL               | 16             | 16          | at least 9 PCLK*9       |
| 000A 0268h | USB1                | Pipe configuration register                | PIPECFG               | 16             | 16          | at least 9 PCLK*9       |
| 000A 026Ch | USB1                | Pipe maximum packet size register          | PIPEMAXP              | 16             | 16          | at least 9 PCLK*9       |
| 000A 026Eh | USB1                | Pipe cycle control register                | PIPEPERI              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0270h | USB1                | Pipe 1 control register                    | PIPE1CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0272h | USB1                | Pipe 2 control register                    | PIPE2CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0274h | USB1                | Pipe 3 control register                    | PIPE3CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0276h | USB1                | Pipe 4 control register                    | PIPE4CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0278h | USB1                | Pipe 5 control register                    | PIPE5CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 027Ah | USB1                | Pipe 6 control register                    | PIPE6CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 027Ch | USB1                | Pipe 7 control register                    | PIPE7CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 027Eh | USB1                | Pipe 8 control register                    | PIPE8CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0280h | USB1                | Pipe 9 control register                    | PIPE9CTR              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0290h | USB1                | Pipe 1 transaction counter enable register | PIPE1TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0292h | USB1                | Pipe 1 transaction counter register        | PIPE1TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0294h | USB1                | Pipe 2 transaction counter enable register | PIPE2TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0296h | USB1                | Pipe 2 transaction counter register        | PIPE2TRN              | 16             | 16          | at least 9 PCLK*9       |
| 000A 0298h | USB1                | Pipe 3 transaction counter enable register | PIPE3TRE              | 16             | 16          | at least 9 PCLK*9       |
| 000A 029Ah | USB1                | Pipe 3 transaction counter register        | PIPE3TRN              | 16             | 16          | at least 9 PCLK*9       |

**Table 5.4 DC Characteristics (3)**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

T<sub>a</sub> = -40 to +85°C

| Item                                    |                                         |                              |                                            |                              | Symbol             | Min.              | Typ. | Max. | Unit | Test Conditions                                  |
|-----------------------------------------|-----------------------------------------|------------------------------|--------------------------------------------|------------------------------|--------------------|-------------------|------|------|------|--------------------------------------------------|
| Supply current*2                        | In operation                            | Max.*3                       |                                            |                              | I <sub>CC</sub> *4 | —                 | —    | 100  | mA   | ICLK = 100 MHz<br>PCLK = 50 MHz<br>BCLK = 50 MHz |
|                                         |                                         | Normal operation             | Peripheral function: Clocks supplied*5     |                              |                    | —                 | 48   | —    |      |                                                  |
|                                         |                                         |                              | Peripheral function: Clocks not supplied*5 |                              |                    | —                 | 35   | —    |      |                                                  |
|                                         |                                         | Increased by BGO operation*6 |                                            |                              |                    | —                 | 15   | —    |      |                                                  |
|                                         | Sleep                                   |                              |                                            | —                            |                    | 20                | 60   |      |      |                                                  |
|                                         | All-module-clock-stop mode*7            |                              |                                            | —                            |                    | 14                | 28   |      |      |                                                  |
|                                         | Standby mode                            | Software standby mode        |                                            |                              |                    | —                 | 0.12 | 3.0  | mA   |                                                  |
|                                         |                                         | Deep software standby mode   | RTC in operation                           | RAM, USB retained            |                    | —                 | 30   | 206  | μA   |                                                  |
|                                         |                                         |                              |                                            | RAM, USB power supply halted |                    | —                 | 26   | 66   | μA   |                                                  |
|                                         |                                         |                              | RTC halted                                 | RAM, USB retained            |                    | —                 | 25   | 200  | μA   |                                                  |
|                                         |                                         |                              |                                            | RAM, USB power supply halted |                    | —                 | 21   | 60   | μA   |                                                  |
|                                         |                                         | Analog power supply current  | During 12-bit A/D conversion (per unit)    |                              |                    | A <sub>I</sub> CC | —    | 2.5  | 3.0  | mA                                               |
| During 10-bit A/D conversion (per unit) |                                         |                              | —                                          | 0.8                          | 1.2                |                   | mA   |      |      |                                                  |
| During D/A conversion (per channel)     |                                         |                              | —                                          | 0.3                          | 2.0                |                   | μA   |      |      |                                                  |
| Idle (all units)                        |                                         |                              | —                                          | 30                           | 35                 |                   | μA   |      |      |                                                  |
| During A/D or D/A standby (all units)   |                                         |                              | —                                          | 0.1                          | 4.0                |                   | μA   |      |      |                                                  |
| Reference power supply current          | During 12-bit A/D conversion (per unit) |                              |                                            | A <sub>I</sub> CC            | —                  | 0.5               | 0.7  | mA   |      |                                                  |
|                                         | During 10-bit A/D conversion (per unit) |                              |                                            |                              | —                  | 0.06              | 0.1  | mA   |      |                                                  |
|                                         | During D/A conversion (per channel)     |                              |                                            |                              | —                  | 0.6               | 1.0  | mA   |      |                                                  |
|                                         | Idle (all units)                        |                              |                                            |                              | —                  | 0.4               | 0.6  | mA   |      |                                                  |
|                                         | During A/D or D/A standby (all units)   |                              |                                            |                              | —                  | 0.1               | 2.0  | μA   |      |                                                  |
| RAM standby voltage                     |                                         |                              |                                            |                              | V <sub>RAM</sub>   | 2.48              | —    | —    | V    |                                                  |
| VCC rising gradient                     |                                         |                              |                                            |                              | SVCC               | —                 | —    | 20   | ms/V |                                                  |

Note 1. The V<sub>IH</sub> characteristic of the pins multiplexed with 5-V tolerant ports 00 to 02, 07, 12, 13, 16, 17, 20, 21, and 33 is the same as the V<sub>IH</sub> characteristic of 5-V tolerant ports.

Note 2. Supply current values are with all output pins unloaded and all input pull-up MOSs in the off state.

Note 3. Measured with clocks supplied to the peripheral functions. This does not include the BGO operation.

Note 4. ICC depends on f (ICLK) as follows. (ICLK: PCLK: BCLK: BCLK pin = 8 : 4: 8: 4)

ICC max. = 0.89 × f + 11 (max.)

ICC typ. = 0.43 × f + 5 (normal operation, peripheral function: clocks supplied)

ICC typ. = 0.30 × f + 5 (normal operation, peripheral function: clocks not supplied)

ICC max. = 0.48 × f + 12 (sleep mode)

Note 5. This does not include the BGO operation.

Note 6. Incremented if data is written to or erased from the ROM or data flash for data storage during the program execution.

Note 7. The values are for reference.

## 5.3.1 Clock Timing

**Table 5.8 Clock Timing**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

T<sub>a</sub> = -40 to +85°C

| Item                                                                         | Symbol                | Min.   | Max.  | Unit | Test Conditions |
|------------------------------------------------------------------------------|-----------------------|--------|-------|------|-----------------|
| BCLK pin output cycle time<br>[176-pin LFBGA/145-pin TFLGA/144-pin LQFP]     | t <sub>Bcyc</sub>     | 20     | 125   | ns   | Figure 5.1      |
| BCLK pin output cycle time<br>[100-pin LQFP/85-pin TFLGA]                    | t <sub>Bcyc</sub>     | 40     | 125   | ns   |                 |
| BCLK pin output high pulse width                                             | t <sub>CH</sub>       | 5      | —     | ns   |                 |
| BCLK pin output low pulse width                                              | t <sub>CL</sub>       | 5      | —     | ns   |                 |
| BCLK pin output rising time                                                  | t <sub>Cr</sub>       | —      | 5     | ns   |                 |
| BCLK pin output falling time                                                 | t <sub>Cf</sub>       | —      | 5     | ns   |                 |
| SDCLK pin output cycle time                                                  | t <sub>SDcyc</sub>    | 20     | 125   | ns   |                 |
| SDCLK pin output high pulse width                                            | t <sub>CH</sub>       | 5      | —     | ns   |                 |
| SDCLK pin output low pulse width                                             | t <sub>CL</sub>       | 5      | —     | ns   |                 |
| SDCLK pin output rising time                                                 | t <sub>Cr</sub>       | —      | 5     | ns   |                 |
| SDCLK pin output falling time                                                | t <sub>Cf</sub>       | —      | 5     | ns   |                 |
| Oscillation settling time after reset (crystal)                              | t <sub>OSC1</sub>     | 10     | —     | ms   | Figure 5.2      |
| Oscillation settling time after leaving software standby mode (crystal)      | t <sub>OSC2</sub>     | 10     | —     | ms   | Figure 5.3      |
| Oscillation settling time after leaving deep software standby mode (crystal) | t <sub>OSC3</sub>     | 10     | —     | ms   | Figure 5.4      |
| EXTAL external clock output delay settling time                              | t <sub>DEXT</sub>     | 1      | —     | ms   | Figure 5.2      |
| EXTAL external clock input low pulse width                                   | t <sub>EXL</sub>      | 30.71  | —     | ns   | Figure 5.5      |
| EXTAL external clock input high pulse width                                  | t <sub>EXH</sub>      | 30.71  | —     | ns   |                 |
| EXTAL external clock rising time                                             | t <sub>EXr</sub>      | —      | 5     | ns   |                 |
| EXTAL external clock falling time                                            | t <sub>EXf</sub>      | —      | 5     | ns   |                 |
| XCIN sub-clock oscillation settling time                                     | t <sub>SUBOSC</sub>   | 2      | —     | s    | Figure 5.6      |
| XCIN sub-clock oscillation frequency                                         | f <sub>SUB</sub>      | 32.768 | —     | kHz  |                 |
| On-chip oscillator (IWDTCCLK) oscillation frequency                          | f <sub>IWDTCCLK</sub> | 62.5   | 187.5 | kHz  |                 |

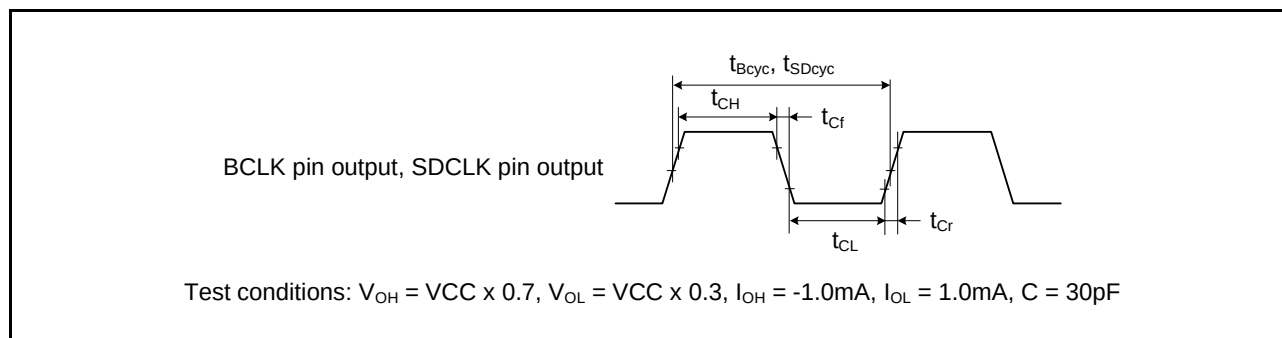


Figure 5.1 BCLK Pin Output, SDCLK Pin Output Timing

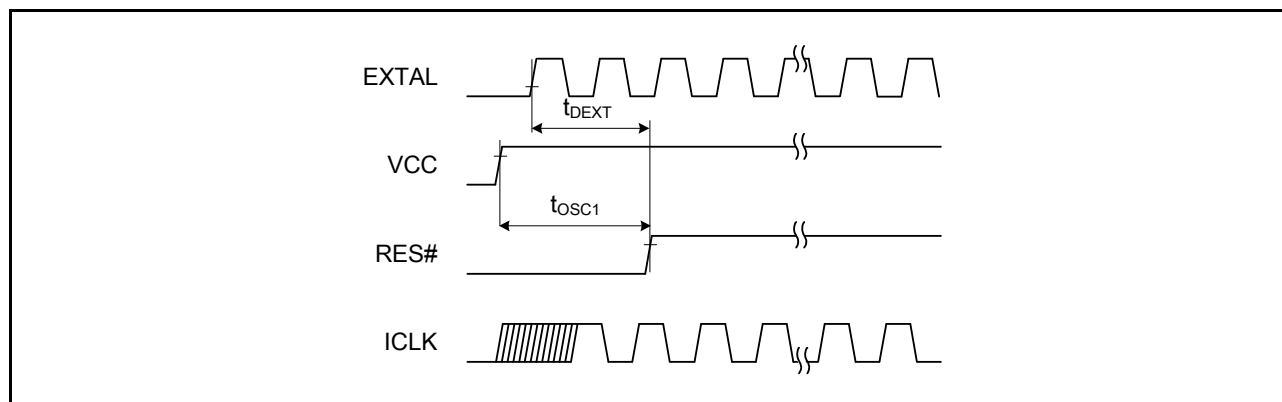


Figure 5.2 Oscillation Settling Timing

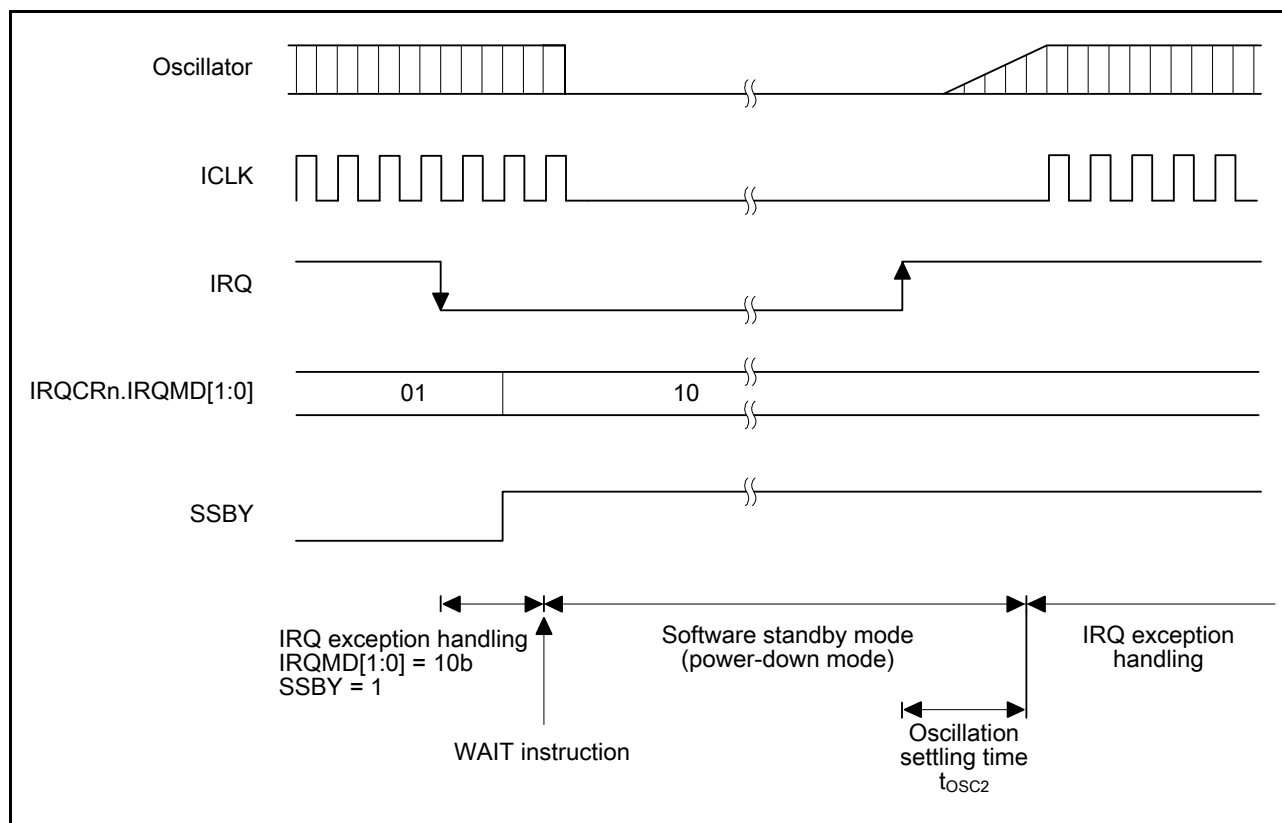


Figure 5.3 Oscillation Settling Timing after Software Standby Mode

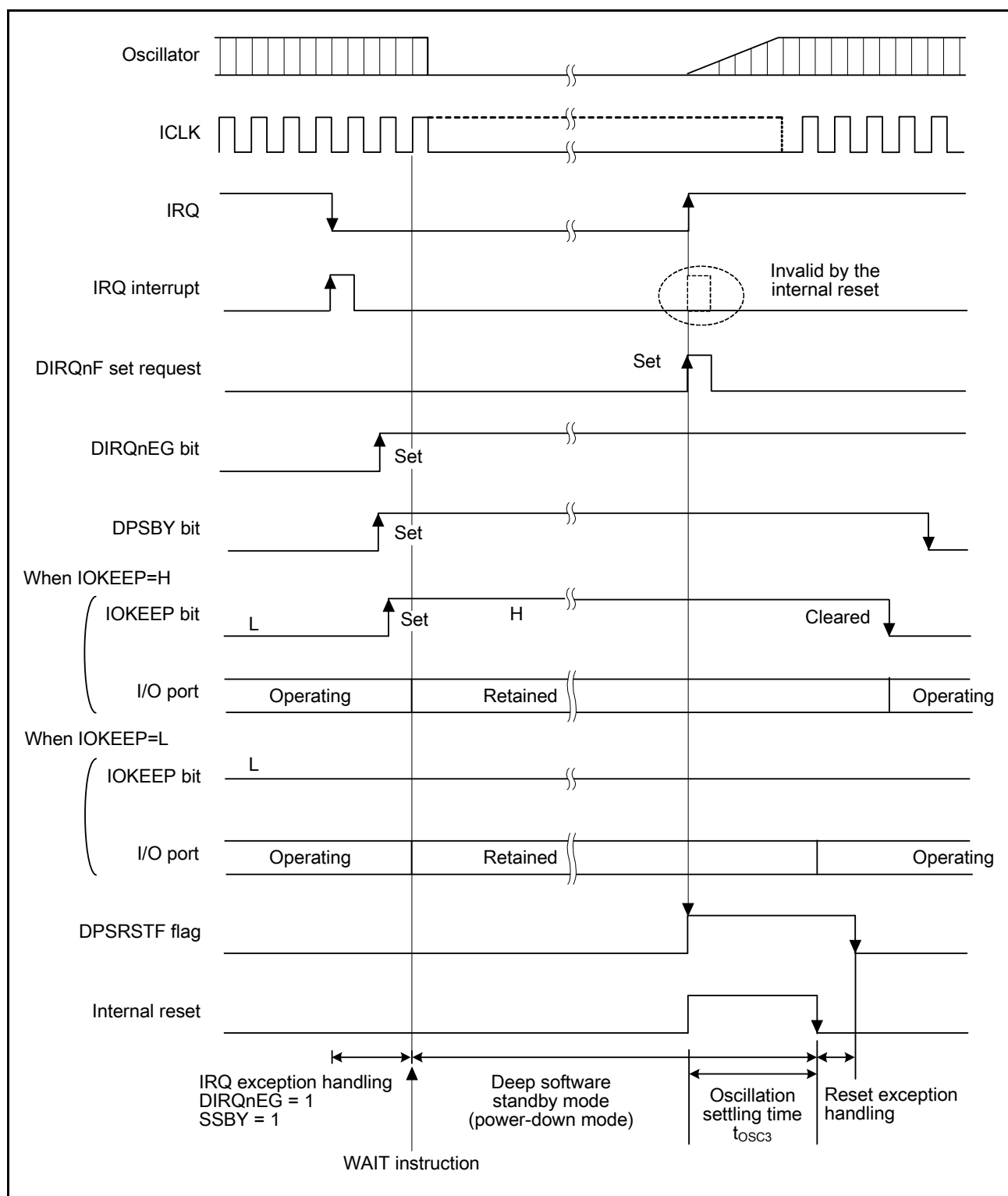
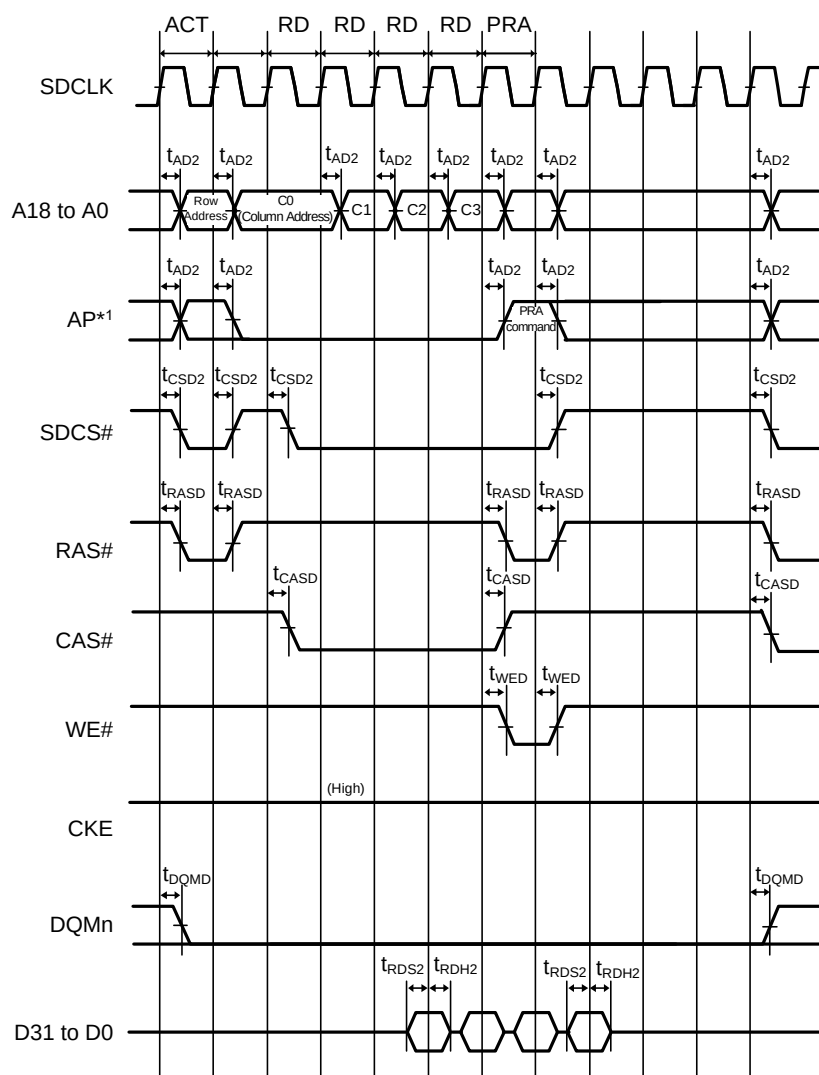


Figure 5.4 Oscillation Settling Timing after Deep Software Standby Mode



Note 1: Address pins for output of the precharge-setting command (Precharge-sel) for SDRAM.

**Figure 5.17 SDRAM Space Multiple Read Bus Timing**

## 5.3.4 EXDMAC Timing

**Table 5.12 EXDMAC Timing**

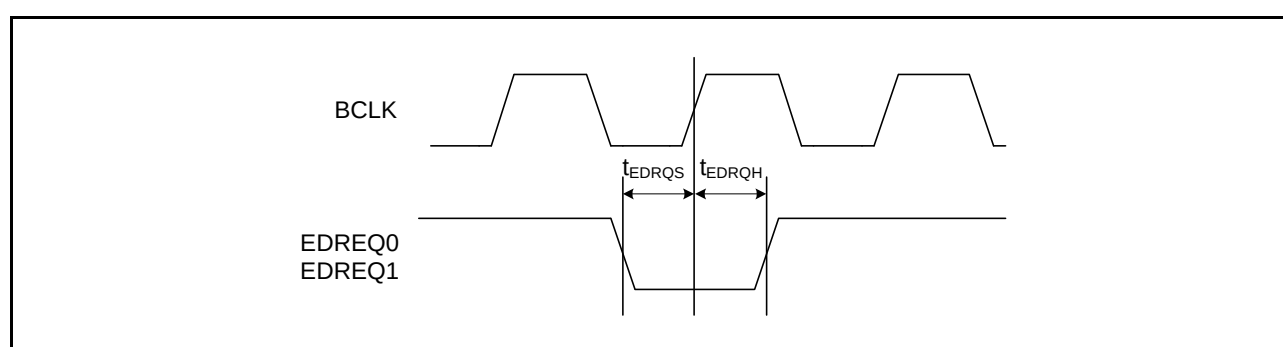
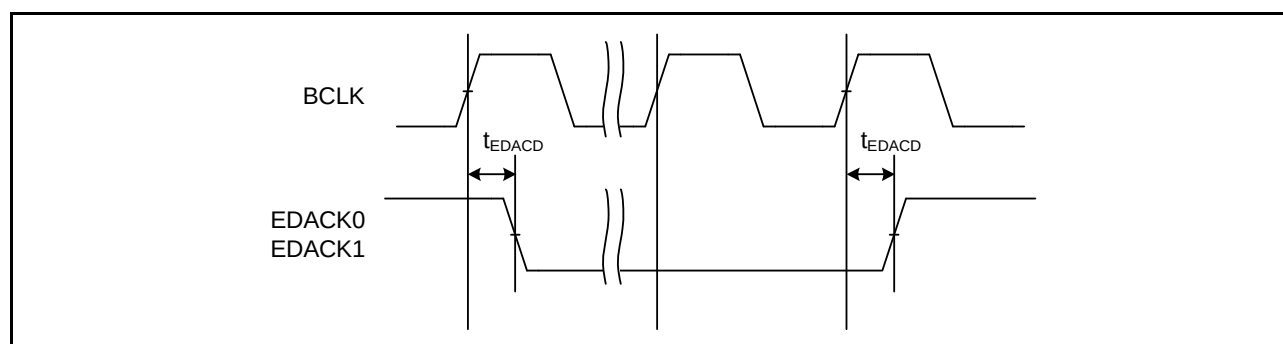
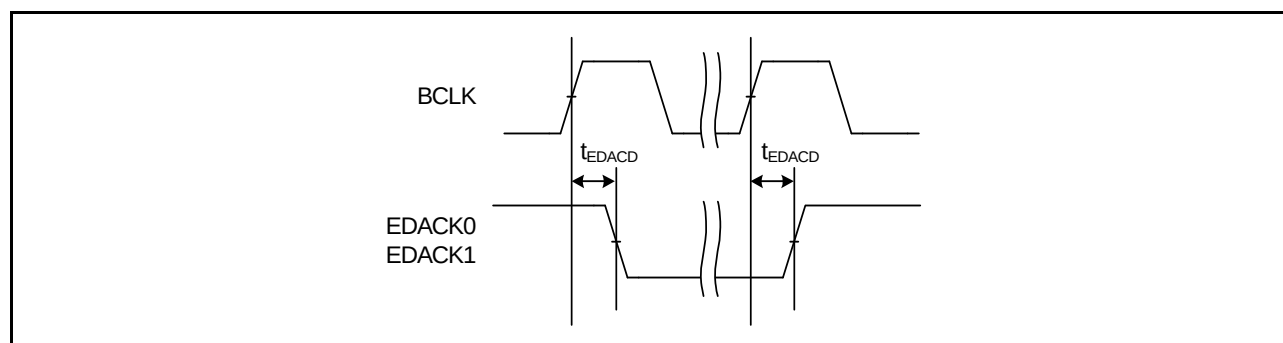
Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

ICLK = 8 to 100 MHz, PCLK = 8 to 50 MHz, BCLK = 8 to 100 MHz, SDCLK = 8 to 50 MHz

T<sub>a</sub> = -40 to +85°C

| Item   |                  | Symbol      | Min. | Max. | Unit | Test Conditions             |
|--------|------------------|-------------|------|------|------|-----------------------------|
| EXDMAC | EDREQ setup time | $t_{EDRQS}$ | 20   | —    | ns   | Figure 5.22                 |
|        | EDREQ hold time  | $t_{EDRQH}$ | 5    | —    | ns   |                             |
|        | EDACK delay time | $t_{EDACD}$ | —    | 15   | ns   | Figure 5.23 and Figure 5.24 |

**Figure 5.22 EDREQ0 and EDREQ1 Input Timing****Figure 5.23 EDACK0 and EDACK1 Single-Address Transfer Timing (for a CS Area)****Figure 5.24 EDACK0 and EDACK1 Single-Address Transfer Timing (for SDRAM)**



**Table 5.15 Timing of On-Chip Peripheral Modules (5)**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

PCLK = 8 to 50 MHz

T<sub>a</sub> = -40 to +85°C

| Item |                                    |                                                     | Symbol                  | Min.                          | Max.                                   | Unit       | Test Conditions             |
|------|------------------------------------|-----------------------------------------------------|-------------------------|-------------------------------|----------------------------------------|------------|-----------------------------|
| RSPi | Data output hold time              | Master                                              | $t_{OH}$                | 0                             | —                                      | ns         | Figure 5.39 to Figure 5.42  |
|      |                                    | Slave                                               |                         | 0                             | —                                      |            |                             |
|      | Successive transmission delay time | Master                                              | $t_{TD}$                | $t_{SPCyc}+2 \times t_{PCyc}$ | $8 \times t_{SPCyc}+2 \times t_{PCyc}$ | ns         |                             |
|      |                                    | Slave                                               |                         | $4 \times t_{PCyc}$           | —                                      |            |                             |
|      | MOSI, MISO rise/fall time          | Output [176-pin LFBGA/ 145-pin TFLGA/ 144-pin LQFP] | $t_{Dr}$ , $t_{Df}$     | —                             | 5                                      | ns         |                             |
|      |                                    | Output [100-pin LQFP/ 85-pin TFLGA]                 |                         | —                             | 10                                     |            |                             |
|      |                                    | Input                                               |                         | —                             | 1                                      | μs         |                             |
|      | SSL rise/fall time                 | Output [176-pin LFBGA 145-pin TFLGA 144-pin LQFP]   | $t_{SSLr}$ , $t_{SSLf}$ | —                             | 5                                      | ns         |                             |
|      |                                    | Output [100-pin LQFP/ 85-pin TFLGA]                 |                         | —                             | 10                                     |            |                             |
|      |                                    | Input                                               |                         | —                             | 1                                      | μs         |                             |
|      | Slave access time                  |                                                     | $t_{SA}$                | —                             | 4                                      | $t_{PCyc}$ | Figure 5.41 and Figure 5.42 |
|      | Slave output release time          |                                                     | $t_{REL}$               | —                             | 3                                      | $t_{PCyc}$ |                             |

Note 1. t<sub>PCyc</sub>: PCLK cycle

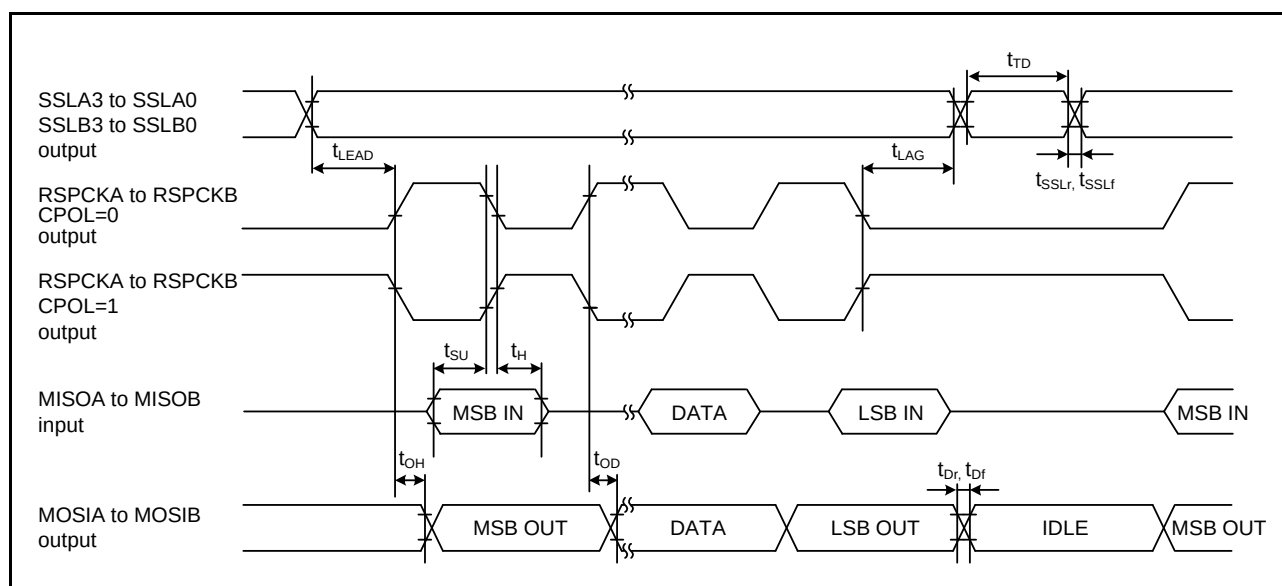


Figure 5.40 RSPI Timing (Master, CPHA = 1)

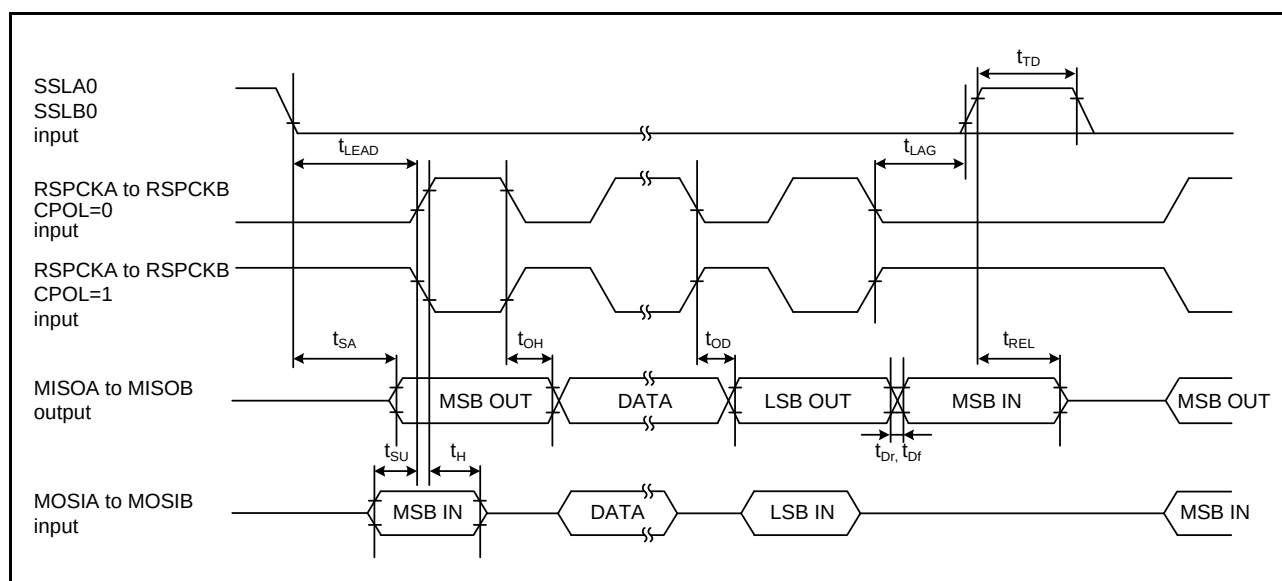


Figure 5.41 RSPI Timing (Slave, CPHA = 0)

## 5.5 A/D Conversion Characteristics

**Table 5.20 10-Bit A/D Conversion Characteristics**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

PCLK = 8 to 50 MHz

T<sub>a</sub> = -40 to +85°C

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

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

Note 2. The scanning is not supported.

Note 3. The value in parentheses indicates the sampling time.

**Table 5.21 12-Bit A/D Conversion Characteristics**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

PCLK = 8 to 50 MHz

T<sub>a</sub> = -40 to +85°C

| Item                     | Min. | Typ. | Max. | Unit | Test Conditions |
|--------------------------|------|------|------|------|-----------------|
| Resolution               | 12   | 12   | 12   | bits |                 |
| Conversion time*1        | 1.0  | —    | —    | μs   | AVCC ≥ 3.0      |
|                          | 2.0  | —    | —    | μs   | AVCC ≥ 2.7      |
| Analog input capacitance | —    | —    | 30   | pF   |                 |
| Offset error             | —    | ±2.0 | ±7.5 | LSB  |                 |
| Full-scale error         | —    | ±2.0 | ±7.5 | LSB  |                 |
| Quantization error       | —    | ±0.5 | —    | LSB  |                 |
| Absolute accuracy        | —    | ±2.5 | ±8.0 | LSB  |                 |
| Nonlinearity error       | —    | ±2.0 | ±4.0 | LSB  |                 |

Note 1. The time conversion takes is the sum of the sampling interval and the time comparison takes (permissible signal-source impedance is up to 1.0 kΩ)

## 5.6 D/A Conversion Characteristics

**Table 5.22 D/A Conversion Characteristics**

Conditions: VCC = PLLVCC = AVCC = VCC\_USB = 2.7 to 3.6 V, VREFH = 2.7 V to AVCC

VSS = PLLVSS = AVSS = VREFL = VSS\_USB = 0 V

T<sub>a</sub> = -40 to +85°C

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

|                  |                                    |
|------------------|------------------------------------|
| REVISION HISTORY | RX62N Group, RX621 Group Datasheet |
|------------------|------------------------------------|

| Rev. | Date       | Description |                                                                                       |
|------|------------|-------------|---------------------------------------------------------------------------------------|
|      |            | Page        | Summary                                                                               |
| 1.00 | 2011.02.04 | —           | First Edition issued                                                                  |
| 1.10 | 2011.02.10 | —           | Features reviewed                                                                     |
| 1.20 | 2011.06.10 |             | 1. Overview                                                                           |
|      |            | 2 to 5      | Table 1.1 Outline of Specification, Description changed                               |
|      |            | 40 to 46    | Table 1.9 Pin Functions, Description changed                                          |
|      |            |             | 4. I/O Registers                                                                      |
|      |            | 52 to 86    | Table 4.1 List of I/O Registers (Address Order), Description changed                  |
|      |            |             | 5. Electrical Characteristics                                                         |
|      |            | 90          | Table 5.2 DC Characteristics (3) , changed                                            |
|      |            | 111         | Figure 5.23 EDACK0 and EDACK1 Single-Address Transfer Timing (for a CS Area), changed |
|      |            | 111         | Figure 5.24 EDACK0 and EDACK1 Single-Address Transfer Timing (for SDRAM), changed     |
|      |            |             |                                                                                       |
| 1.30 | 2012.01.11 |             | 1. Overview                                                                           |
|      |            | 2           | Table 1.1 Outline of Specifications (1/4), changed, note 1, note 2 deleted            |
|      |            | 13          | Figure 1.6 Pin Assignment of the 144-Pin LQFP (Assistance Diagram), changed           |
|      |            | 15          | Figure 1.8 Pin Assignment of the 100-Pin LQFP (Assistance Diagram), changed           |
|      |            | 33          | Table 1.7 List of Pins and Pin Functions (100-Pin LQFP) (1/4), changed                |
|      |            | 37          | Table 1.8 List of Pins and Pin Functions (85-Pin TFLGA) (2/3), changed                |
|      |            |             | 4. I/O Registers                                                                      |
|      |            | 52 to 87    | Table 4.1 List of I/O Registers (Address Order), Description changed                  |
|      |            |             | 5. Electrical Characteristics                                                         |
|      |            | 91          | Table 5.4 DC Characteristics (3), specification added                                 |
|      |            | 98          | Table 5.9 Control Signal Timing, note changed                                         |
|      |            | 122         | Table 5.18 Timing of On-Chip Peripheral Modules (6), conditions changed               |