

# MITSUBISHI MICROCOMPUTERS M37902FCMHP, M37902FGMHP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

## DESCRIPTION

These are single-chip microcomputers designed with high-performance CMOS silicon gate technology, including the internal flash memory. These microcomputers support the 7900 Series instruction set, which are enhanced and expanded instruction set and are up-per-compatible with the 7700/7751 Series instruction set.

The CPU of these microcomputers is a 16-bit parallel processor that can also be switched to perform 8-bit parallel processing. Also, the bus interface unit of these microcomputers enhances the memory access efficiency to execute instructions fast. Therefore, these microcomputers are suitable for office, business, and industrial equipment controller that require high-speed processing of large data.

For the internal flash memory, single-power-supply programming and erasure, using a PROM programmer or the control by the central processing unit (CPU), is supported. Also, each of these microcomputers has the memory area dedicated for storing a certain software which controls programming and erasure (reprogramming control software). Therefore, on these microcomputers, the program can easily be changed even after they are mounted on the board.

## APPLICATION

Control devices for personal computer peripheral equipment such as CD-ROM drives, DVD-ROM drives, hard disk drives, high density FDD, printers

## DISTINCTIVE FEATURES

<Microcomputer mode>

- Number of basic machine instructions ..... 203
- Memory
  - [M37902FCMHP]
    - Flash memory (User ROM area) ..... 120 Kbytes
    - RAM ..... 4096 bytes
  - [M37902FGMHP]
    - Flash memory (User ROM area) ..... 248 Kbytes
    - RAM ..... 6144 bytes
  - [All of the above computers]
    - Flash memory (Boot ROM area) ..... 16 Kbytes
- Instruction execution time
  - The fastest instruction at 20 MHz frequency ..... 50 ns
- Single power supply ..... 3.3 V  $\pm$  0.3 V
- Interrupts ..... 6 external sources, 16 internal sources, 7 levels
- Multi-functional 16-bit timer ..... 5 + 3
- Serial I/O (UART or Clock synchronous) ..... 2
- 10-bit A-D converter ..... 8-channel inputs
- 8-bit D-A converter ..... 3-channel outputs
- Real-time output
  - .... 4 bits  $\times$  2 channels, or 6 bits  $\times$  1 channel + 2 bits  $\times$  1 channel
- 12-bit watchdog timer
- Programmable input/output (ports P0–P8, P10, P11) ..... 84

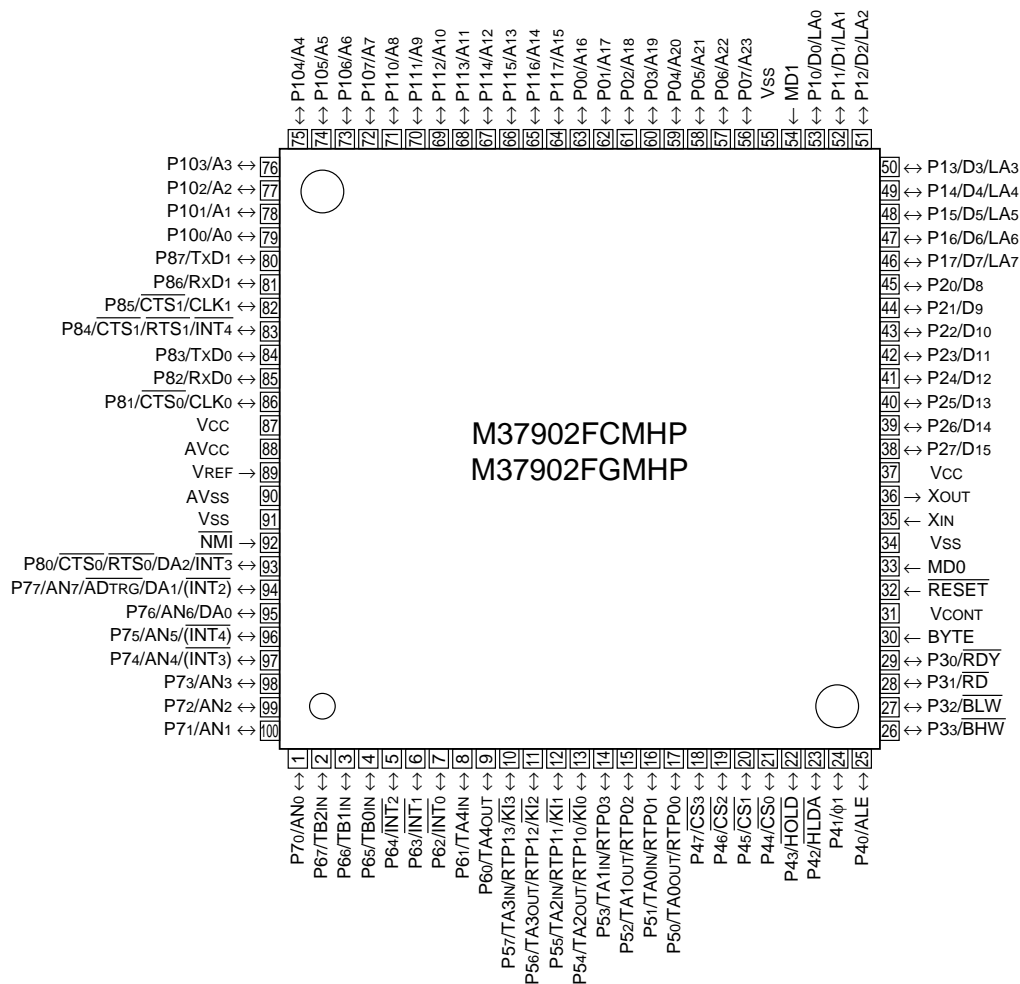
<Flash memory mode>

- Power supply voltage ..... 3.3 V  $\pm$  0.3 V
- Programming/Erase voltage ..... 3.3 V  $\pm$  0.3 V
- Programming method ..... Programming in a unit of 256 bytes
- Erase method ..... Block erase or Total erase  
(Data protection per block is enabled.)
- Programming/Erase control by software command
- Maximum number of reprograms ..... 100

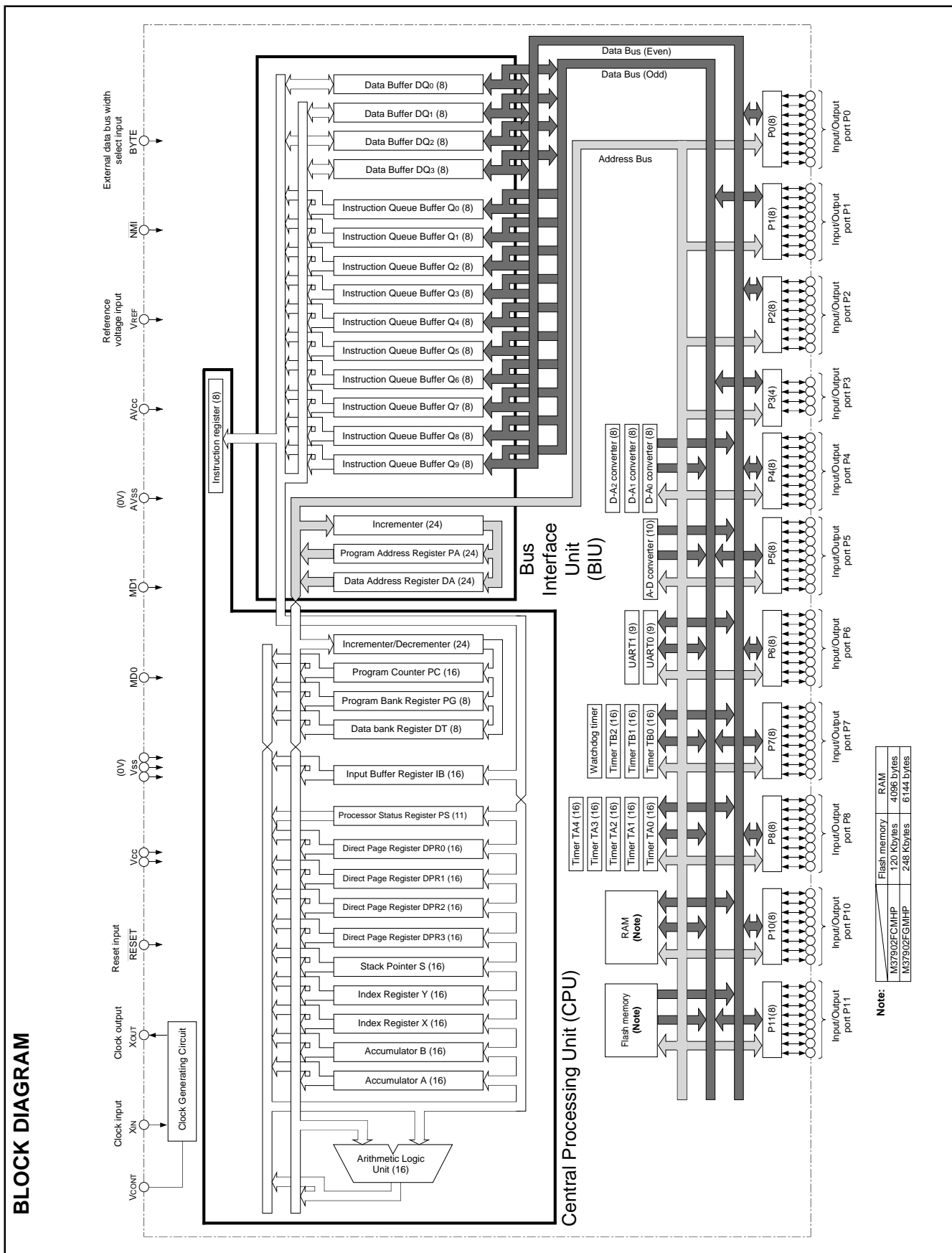
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**M37902FxMHP PIN CONFIGURATION (TOP VIEW)**



**Outline 100P6Q-A**



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**FUNCTIONS (Microcomputer mode)**

| Parameter                               |                                | Functions  |
|---|--------------------------------|--|
| Number of basic machine instructions    |                                | 203  |
| Instruction execution time              |                                | 50 ns (the fastest instruction at $f(f_{sys}) = 20$ MHz)   |
| External clock input frequency $f(XIN)$ |                                | 20 MHz (Max.)  |
| System clock frequency $f_{sys}$        |                                | 20 MHz (Max.)  |
| Memory size                             | Flash memory (User ROM area)   | <b>(Note)</b>  |
|   | RAM                            | <b>(Note)</b>  |
|   | Flash memory (Boot ROM area)   | 16 Kbytes  |
| Programmable input/output ports         | P0–P2, P4–P8, P10, P11         | 8-bit X 10   |
|   | P3                             | 4-bit X 1  |
| Multi-functional timers                 | TA0–TA4                        | 16-bit X 5   |
|   | TB0–TB2                        | 16-bit X 3   |
| Serial I/O                              | UART0 and UART1                | (UART or Clock synchronous serial I/O) X 2   |
| A-D converter                           |                                | 10-bit successive approximation method X 1 (8 channels)  |
| D-A converter                           |                                | 8-bit X 3  |
| Watchdog timer                          |                                | 12-bit X 1   |
| Chip-select wait control                |                                | Chip select area X 4 ( $\overline{CS}_0$ – $\overline{CS}_3$ ). A bus cycle type and bus width can be set for each chip select area. |
| Real-time output                        |                                | 4 bits X 2 channels; or 6 bits X 1 channel + 2 bits X 1 channel  |
| Interrupts                              | Maskable interrupts            | 5 external types, 13 internal types. Each interrupt can be set to a priority level within the range of 0–7 by software.              |
|   | Non-maskable interrupts        | 1 external type, 3 internal types.   |
| Clock generating circuit                |                                | Built-in (externally connected to a ceramic resonator or quartz crystal resonator).  |
| PLL frequency multiplier                |                                | The following multiplication methods are available: double, triple, and quadruple.   |
| Power supply voltage                    |                                | 3.3 V $\pm$ 0.3 V  |
| Power dissipation                       |                                | 39.6 mW (at $f(f_{sys}) = 20$ MHz, Typ., PLL frequency multiplier stopped)   |
| Ports' input/output characteristics     | Input/Output withstand voltage | 3.3 V  |
|   | Output current                 | 5 mA   |
| Memory expansion                        |                                | Up to 16 Mbytes. Note that bank FF16 is a reserved area.   |
| Operating ambient temperature range     |                                | –20 to 85 °C   |
| Device structure                        |                                | CMOS high-performance silicon gate process   |
| Package                                 |                                | 100-pin plastic molded QFP   |

**Note:**

|                              |             |            |
|------------------------------|-------------|------------|
| Flash memory (User ROM area) | M37902FCMHP | 120 Kbytes |
|                              | M37902FGMHP | 248 Kbytes |
| RAM                          | M37902FCMHP | 4096 bytes |
|                              | M37902FGMHP | 6144 bytes |

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**FUNCTIONS (Flash memory mode)**

| Parameter                    |   | Functions  |
|------------------------------|---|--|
| Power supply voltage         |   | 3.3 V±0.3 V  |
| Programming/Erase voltage    |   | 3.3 V±0.3 V  |
| Flash memory mode            |   | 3 modes: parallel I/O, serial I/O, and CPU reprogramming modes |
| Block division for erasure   | User ROM area                                 | <b>(Note 1)</b>  |
|                              | Boot ROM area                                 | 1 block (16 Kbytes X 1) <b>(Note 2)</b>                        |
| Programming method           | Programmed per page (in a unit of 256 Kbytes) |  |
|                              | Flash memory parallel I/O mode                | User ROM area + Boot ROM area                                  |
|                              | Flash memory serial I/O mode                  | User ROM area  |
|                              | Flash memory CPU reprogramming mode           | User ROM area  |
| Erase method                 | Total erase/Block erase                       |  |
|                              | Flash memory parallel I/O mode                | User ROM area + Boot ROM area                                  |
|                              | Flash memory serial I/O mode                  | User ROM area  |
|                              | Flash memory CPU reprogramming mode           | User ROM area  |
| Programming/Erase control    |   | Programming/Erase control by software commands                 |
| Data protection method       |   | Protected per block, by using a lock bit.                      |
| Number of commands           |   | 8 commands   |
| Maximum number of reprograms |   | 100  |

**Notes 1:**

|               |             |   |
|---------------|-------------|---|
| User ROM area | M37902FCMHP | 5 blocks (8 Kbytes X 3, 32 Kbytes X 1, 64 Kbytes X 1), total 120 Kbytes |
|               | M37902FGMHP | 7 blocks (8 Kbytes X 3, 32 Kbytes X 1, 64 Kbytes X 3), total 248 Kbytes |

**2:** On shipment, our reprogramming control firmware for the flash memory serial I/O mode has been stored into the boot ROM area. Note that the boot ROM area can be erased/programmed only in the flash memory parallel I/O mode.

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**PIN DESCRIPTION (MICROCOMPUTER MODE)**

| Pin                       | Name                                 | Input/<br>Output | Functions  |
|---------------------------|--------------------------------------|------------------|--|
| Vcc, Vss                  | Power supply input                   | —                | Apply 3.3 V±0.3 V to Vcc, and 0 V to Vss.  |
| MD0                       | MD0                                  | Input            | This pin controls the processor mode. Connect this pin to Vss for the single-chip mode or memory expansion mode, and Vcc for the microprocessor mode.  |
| MD1                       | MD1                                  | Input            | Connect this pin to Vss.   |
| $\overline{\text{RESET}}$ | Reset input                          | Input            | The microcomputer is reset when "L" level is applied to this pin.  |
| XIN                       | Clock input                          | Input            | These are input and output pins of the internal clock generating circuit. Connect a ceramic or quartz- crystal resonator between the XIN and XOUT pins. When an external clock is used, the clock source should be connected to the XIN pin, and the XOUT pin should be left open.   |
| XOUT                      | Clock output                         | Output           |  |
| BYTE                      | External data bus width select input | Input            | This pin determines whether the external data bus has an 8-bit width or 16-bit width for the memory expansion mode or microprocessor mode. The width is 16 bits when "L" signal is input, and 8 bits when "H" signal is input. When BYTE = Vss level, by the register setting, the external data bus for each of areas $\overline{\text{CS}}_1$ to $\overline{\text{CS}}_3$ can have a width of 8 bits.  |
| VCONT                     | Filter circuit connection            | —                | When using the PLL frequency multiplier, connect this pin to the filter circuit. When not using, this pin should be left open.   |
| AVcc, AVss                | Analog power supply input            | —                | Power supply input pins for the A-D converter and the D-A converter. Connect AVcc to Vcc, and AVss to Vss externally.  |
| VREF                      | Reference voltage input              | Input            | This is the reference voltage input pin for the A-D converter and the D-A converter.   |
| P00–P07                   | I/O port P0                          | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>Port P0 is an 8-bit I/O port. This port has an I/O direction register, and each pin can be programmed for input or output. These pins enter the input mode at reset.</li> <li>■ In memory expansion and microprocessor modes<br/>Address (A16–A23) is output. These pins also function as I/O port pins according to the register setting.</li> </ul>   |
| P10–P17                   | I/O port P1                          | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>These pins have the same functions as port P0.</li> <li>■ In memory expansion and microprocessor modes<br/>The low-order 8 bits of data (D0–D7) are input/output. When the external data bus has an 8-bit width, address (LA0–LA7) output and data (D0–D7) input/output can be performed with the time-sharing method, according to the register setting.</li> </ul>  |
| P20–P27                   | I/O port P2                          | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode or When 8-bit external data bus is used in memory expansion mode and microprocessor mode<br/>These pins have the same functions as port P0.</li> <li>■ When the 16-bit external data bus is used in memory expansion or microprocessor mode<br/>The high-order 8 bits of data (D8–D15) are input or output.</li> </ul>  |
| P30–P33                   | I/O port P3                          | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>These pins have the same functions as port P0.</li> <li>■ In memory expansion mode<br/>P30 functions as an I/O port pin; and P31, P32, and P33 function as the output pins of RD, BLW, BHW, respectively. P30 also functions as an output pin of RDY according to the register setting. When the external data bus has a width of 8 bits, the BHW pin functions as an I/O port pin (P33).</li> <li>■ In microprocessor mode<br/>P30 functions as an input pin of <math>\overline{\text{RDY}}</math>; and P31, P32, P33 function as the output pins of RD, BLW, BHW, respectively. P30 also functions as an I/O port pin according to the register setting. When the external data bus has a width of 8 bits, the BHW pin functions as an I/O port pin (P33).</li> </ul> |
| P40–P47                   | I/O port P4                          | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>These pins have the same functions as port P0.</li> <li>■ In memory expansion mode<br/>P40–P47 function as I/O port pins. According to the register setting, these pins function as output pins or input pins of ALE, <math>\phi_1</math>, HLDA, HOLD, <math>\overline{\text{CS}}_0</math>–<math>\overline{\text{CS}}_3</math>, respectively.</li> <li>■ In microprocessor mode<br/>P40–P44 function as output or input pins of ALE, <math>\phi_1</math>, HLDA, HOLD, <math>\overline{\text{CS}}_0</math>, and P45–P47 as I/O port pins, respectively. According to the register setting, P40–P43 also function as I/O port pins, and P45–P47 as output pins of <math>\overline{\text{CS}}_1</math>–<math>\overline{\text{CS}}_3</math>.</li> </ul>                     |

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| Pin                     | Name                   | Input/<br>Output | Functions  |
|-------------------------|------------------------|------------------|--|
| P50–P57                 | I/O port P5            | I/O              | In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for timers A0–A3, output pins for the real-time output, and input pins for the key-input interrupt.  |
| P60–P67                 | I/O port P6            | I/O              | In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for timer A4, input pins for external interrupt inputs $\overline{\text{INT}}_0$ – $\overline{\text{INT}}_2$ , and input pins for timers B0–B2.                                |
| P70–P77                 | I/O port P7            | I/O              | In addition to having the same functions as port P0 in the single-chip mode, these pins also function as input pins for the A-D converter, output pins for the D-A converter, and input pins for $\overline{\text{INT}}_2$ , $\overline{\text{INT}}_3$ , and $\overline{\text{INT}}_4$ .         |
| P80–P87                 | I/O port P8            | I/O              | In addition to having the same functions as port P0 in the single-chip mode, these pins also function as I/O pins for $\overline{\text{UART}}_0$ , $\overline{\text{UART}}_1$ , output pins for D-A converter, and input pins for $\overline{\text{INT}}_3$ and $\overline{\text{INT}}_4$ .      |
| P100–P107               | I/O port P10           | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>These pins have the same functions as port P0.</li> <li>■ In memory expansion and microprocessor modes<br/>Address (A0–A7) is output.</li> </ul>  |
| P110–P117               | I/O port P11           | I/O              | <ul style="list-style-type: none"> <li>■ In single-chip mode<br/>These pins have the same functions as port P0.</li> <li>■ In memory expansion and microprocessor modes<br/>Address (A8–A15) is output. Also, these pins function as I/O port pins according to the register setting.</li> </ul> |
| $\overline{\text{NMI}}$ | Non-maskable interrupt | Input            | This pin is for a non-maskable interrupt.  |

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**PIN DESCRIPTION (FLASH MEMORY SERIAL I/O MODE)**

| Pin              | Name                      | Input /Output | Functions   |
|------------------|---------------------------|---------------|---|
| Vcc, Vss         | Power supply input        | —             | Apply 3.3 V $\pm$ 0.3 V to Vcc, and 0 V to Vss.   |
| MD0              | MD0                       | Input         | Connect this pin to Vss.  |
| MD1              | MD1                       | Input         | Connect this pin to Vss via a resistor of 10 k $\Omega$ to 100 k $\Omega$ .   |
| RESET            | Reset input               | Input         | The reset input pin.  |
| XIN              | Clock input               | Input         | Connect a ceramic resonator between the XIN and XOUT pins, or input an external clock from the XIN pin with the XOUT pin left open. |
| XOUT             | Clock output              | Output        |   |
| BYTE             | BYTE                      | Input         | Connect this pin to Vcc or Vss. (This is not used in the flash memory serial I/O mode.)   |
| VCONT            | Filter circuit connection | —             | Connect this pin to the filter circuit, or leave this pin open. (This is not used in the flash memory serial I/O mode.)             |
| AVcc, AVss       | Analog supply input       | —             | Connect AVcc to Vcc, and AVss to Vss.   |
| VREF             | Reference voltage input   | Input         | Input an arbitrary level within the range of Vss–Vcc. (This is not used in the flash memory serial I/O mode.)                       |
| P00–P07          | Input port P0             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P10–P17          | Input port P1             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P20–P27          | Input port P2             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P30–P33          | Input port P3             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P40,<br>P44– P47 | Input port P4             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P41              | SCLK input                | Input         | This is an input pin for a serial clock.  |
| P42              | SDA I/O                   | I/O           | This is an I/O pin for serial data. Connect this pin to Vcc via a resistor (about 1 k $\Omega$ ).                                   |
| P43              | BUSY output               | Output        | This is an output pin for the BUSY signal.  |
| P50–P57          | Input port P5             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P60–P67          | Input port P6             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P70–P77          | Input port P7             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P80–P87          | Input port P8             | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P100–P107        | Input port P10            | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| P110–P117        | Input port P11            | Input         | Input “H” or “L”, or leave them open. (This is not used in the flash memory serial I/O mode.)                                       |
| NMI              | Non-maskable interrupt    | Input         | Input “H”, or leave this pin open.  |



### BASIC FUNCTION BLOCKS

These microcomputers have the same functions as the M37902FCCHP.

Therefore, refer to the datasheet of the M37902FCCHP.

### MEMORY

Figures 1 and 2 show the memory maps. The address space is 16 Mbytes from address 016 to FFFFFFF16. The address space is divided into 64-Kbyte units called banks. The banks are numbered from 016 to FF16. Bank FF16 is a reserved area for the development support tool. Therefore, do not use bank FF16.

Internal flash memory and internal RAM are assigned as shown in Figures 1 and 2.

Addresses FFC016 to FFFF16 contain the RESET and the interrupt vector addresses, and the interrupt vectors are stored there.

For details, refer to the section on interrupts.

Assigned to addresses 016 to FF16 are peripheral devices such as I/O ports, A-D converter, D-A converter, UART, timers, interrupt control registers, etc. Figures 7 and 8 show the location of SFRs. For the flash memory in the boot ROM area, refer to the section on the flash memory mode.

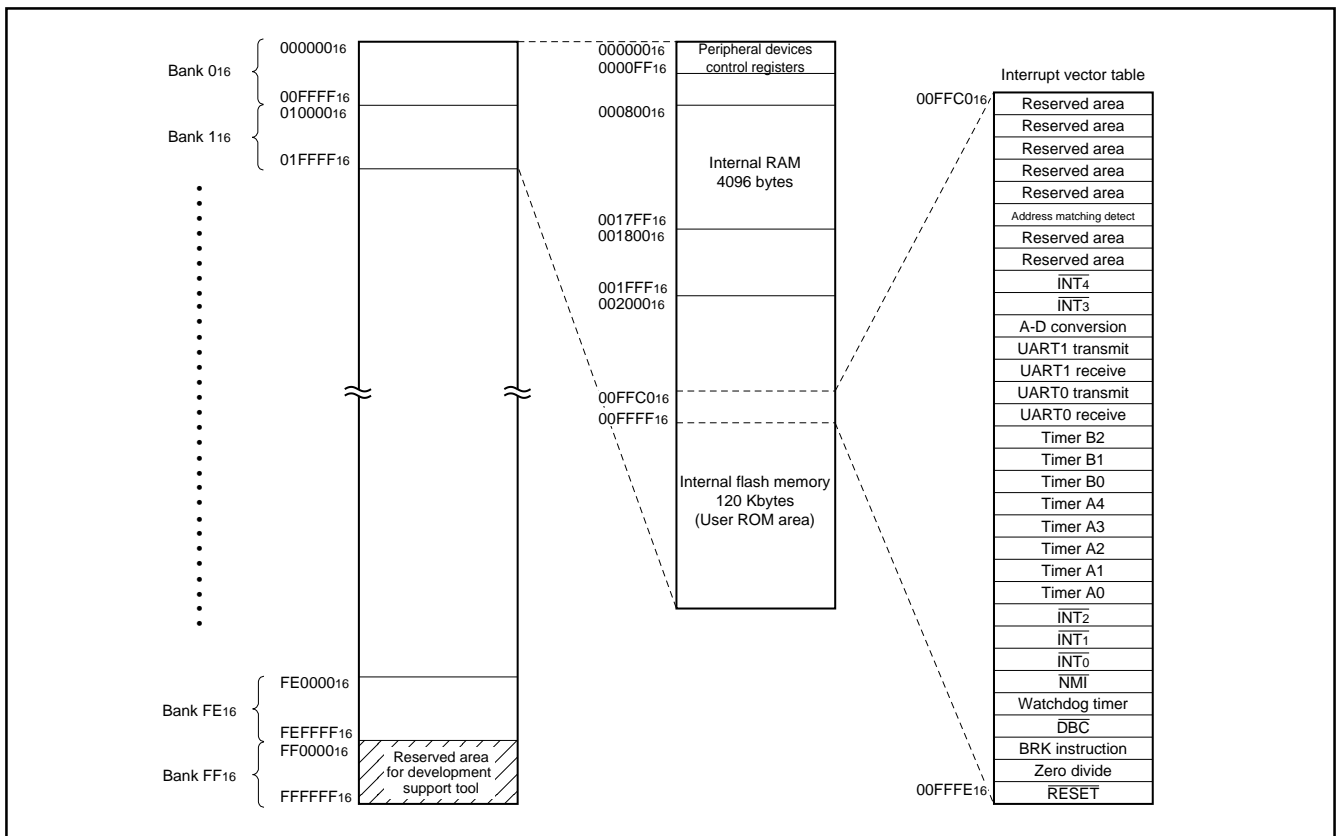


Fig. 1 Memory map of M37902FCMHP (Single-chip mode)

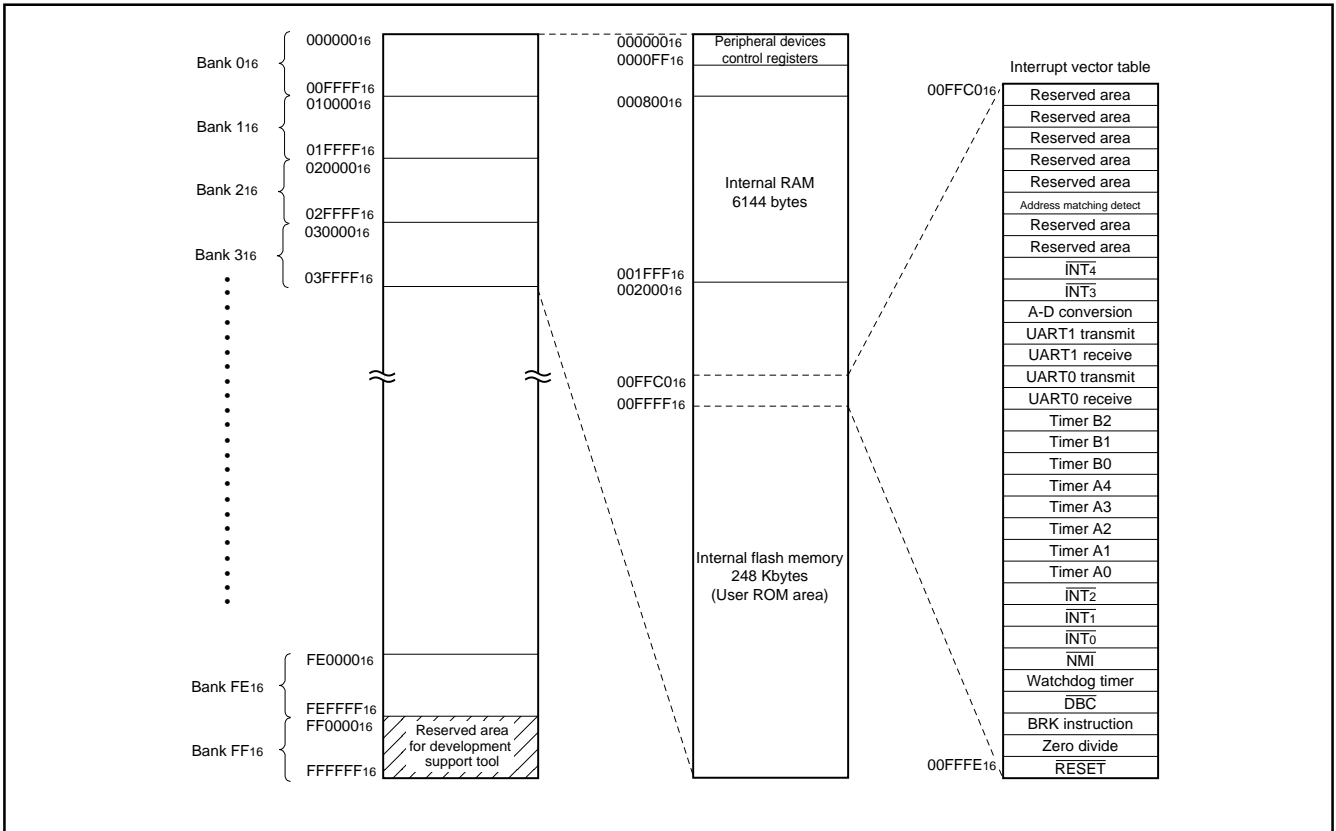


Fig. 2 Memory map of M37902FGMHP (Single-chip mode)

| Address (Hexadecimal notation) |   | Address (Hexadecimal notation) |   |
|--------------------------------|---|--------------------------------|---|
| 000000 <sup>16</sup>           | Reserved area ( <b>Note</b> )             | 000040 <sup>16</sup>           | Count start register                        |
| 000001 <sup>16</sup>           | Reserved area ( <b>Note</b> )             | 000041 <sup>16</sup>           |   |
| 000002 <sup>16</sup>           | Port P0 register                          | 000042 <sup>16</sup>           | One-shot start register                     |
| 000003 <sup>16</sup>           | Port P1 register                          | 000043 <sup>16</sup>           |   |
| 000004 <sup>16</sup>           | Port P0 direction register                | 000044 <sup>16</sup>           | Up-down register                            |
| 000005 <sup>16</sup>           | Port P1 direction register                | 000045 <sup>16</sup>           | Timer A clock division select register      |
| 000006 <sup>16</sup>           | Port P2 register                          | 000046 <sup>16</sup>           |   |
| 000007 <sup>16</sup>           | Port P3 register                          | 000047 <sup>16</sup>           | Timer A0 register                           |
| 000008 <sup>16</sup>           | Port P2 direction register                | 000048 <sup>16</sup>           |   |
| 000009 <sup>16</sup>           | Port P3 direction register                | 000049 <sup>16</sup>           | Timer A1 register                           |
| 00000A <sup>16</sup>           | Port P4 register                          | 00004A <sup>16</sup>           |   |
| 00000B <sup>16</sup>           | Port P5 register                          | 00004B <sup>16</sup>           | Timer A2 register                           |
| 00000C <sup>16</sup>           | Port P4 direction register                | 00004C <sup>16</sup>           |   |
| 00000D <sup>16</sup>           | Port P5 direction register                | 00004D <sup>16</sup>           | Timer A3 register                           |
| 00000E <sup>16</sup>           | Port P6 register                          | 00004E <sup>16</sup>           |   |
| 00000F <sup>16</sup>           | Port P7 register                          | 00004F <sup>16</sup>           | Timer A4 register                           |
| 000010 <sup>16</sup>           | Port P6 direction register                | 000050 <sup>16</sup>           |   |
| 000011 <sup>16</sup>           | Port P7 direction register                | 000051 <sup>16</sup>           | Timer B0 register                           |
| 000012 <sup>16</sup>           | Port P8 register                          | 000052 <sup>16</sup>           |   |
| 000013 <sup>16</sup>           |   | 000053 <sup>16</sup>           | Timer B1 register                           |
| 000014 <sup>16</sup>           | Port P8 direction register                | 000054 <sup>16</sup>           |   |
| 000015 <sup>16</sup>           |   | 000055 <sup>16</sup>           | Timer B2 register                           |
| 000016 <sup>16</sup>           | Port P10 register                         | 000056 <sup>16</sup>           | Timer A0 mode register                      |
| 000017 <sup>16</sup>           | Port P11 register                         | 000057 <sup>16</sup>           | Timer A1 mode register                      |
| 000018 <sup>16</sup>           | Port P10 direction register               | 000058 <sup>16</sup>           | Timer A2 mode register                      |
| 000019 <sup>16</sup>           | Port P11 direction register               | 000059 <sup>16</sup>           | Timer A3 mode register                      |
| 00001A <sup>16</sup>           |   | 00005A <sup>16</sup>           | Timer A4 mode register                      |
| 00001B <sup>16</sup>           |   | 00005B <sup>16</sup>           | Timer B0 mode register                      |
| 00001C <sup>16</sup>           |   | 00005C <sup>16</sup>           | Timer B1 mode register                      |
| 00001D <sup>16</sup>           |   | 00005D <sup>16</sup>           | Timer B2 mode register                      |
| 00001E <sup>16</sup>           | A-D control register 0                    | 00005E <sup>16</sup>           | Processor mode register 0                   |
| 00001F <sup>16</sup>           | A-D control register 1                    | 00005F <sup>16</sup>           | Processor mode register 1                   |
| 000020 <sup>16</sup>           | A-D register 0                            | 000060 <sup>16</sup>           | Watchdog timer register                     |
| 000021 <sup>16</sup>           |   | 000061 <sup>16</sup>           | Watchdog timer frequency select register    |
| 000022 <sup>16</sup>           | A-D register 1                            | 000062 <sup>16</sup>           | Particular function select register 0       |
| 000023 <sup>16</sup>           |   | 000063 <sup>16</sup>           | Particular function select register 1       |
| 000024 <sup>16</sup>           | A-D register 2                            | 000064 <sup>16</sup>           | Particular function select register 2       |
| 000025 <sup>16</sup>           |   | 000065 <sup>16</sup>           | Reserved area ( <b>Note</b> )               |
| 000026 <sup>16</sup>           | A-D register 3                            | 000066 <sup>16</sup>           | Debug control register 0                    |
| 000027 <sup>16</sup>           |   | 000067 <sup>16</sup>           | Debug control register 1                    |
| 000028 <sup>16</sup>           | A-D register 4                            | 000068 <sup>16</sup>           |   |
| 000029 <sup>16</sup>           |   | 000069 <sup>16</sup>           | Address comparison register 0               |
| 00002A <sup>16</sup>           | A-D register 5                            | 00006A <sup>16</sup>           |   |
| 00002B <sup>16</sup>           |   | 00006B <sup>16</sup>           |   |
| 00002C <sup>16</sup>           | A-D register 6                            | 00006C <sup>16</sup>           | Address comparison register 1               |
| 00002D <sup>16</sup>           |   | 00006D <sup>16</sup>           |   |
| 00002E <sup>16</sup>           | A-D register 7                            | 00006E <sup>16</sup>           | INT <sub>3</sub> interrupt control register |
| 00002F <sup>16</sup>           |   | 00006F <sup>16</sup>           | INT <sub>4</sub> interrupt control register |
| 000030 <sup>16</sup>           | UART0 transmit/receive mode register      | 000070 <sup>16</sup>           | A-D conversion interrupt control register   |
| 000031 <sup>16</sup>           | UART0 baud rate register (BRG0)           | 000071 <sup>16</sup>           | UART0 transmit interrupt control register   |
| 000032 <sup>16</sup>           | UART0 transmit buffer register            | 000072 <sup>16</sup>           | UART0 receive interrupt control register    |
| 000033 <sup>16</sup>           |   | 000073 <sup>16</sup>           | UART1 transmit interrupt control register   |
| 000034 <sup>16</sup>           | UART0 transmit/receive control register 0 | 000074 <sup>16</sup>           | UART1 receive interrupt control register    |
| 000035 <sup>16</sup>           | UART0 transmit/receive control register 1 | 000075 <sup>16</sup>           | Timer A0 interrupt control register         |
| 000036 <sup>16</sup>           | UART0 receive buffer register             | 000076 <sup>16</sup>           | Timer A1 interrupt control register         |
| 000037 <sup>16</sup>           |   | 000077 <sup>16</sup>           | Timer A2 interrupt control register         |
| 000038 <sup>16</sup>           | UART1 transmit/receive mode register      | 000078 <sup>16</sup>           | Timer A3 interrupt control register         |
| 000039 <sup>16</sup>           | UART1 baud rate register (BRG1)           | 000079 <sup>16</sup>           | Timer A4 interrupt control register         |
| 00003A <sup>16</sup>           | UART1 transmit buffer register            | 00007A <sup>16</sup>           | Timer B0 interrupt control register         |
| 00003B <sup>16</sup>           |   | 00007B <sup>16</sup>           | Timer B1 interrupt control register         |
| 00003C <sup>16</sup>           | UART1 transmit/receive control register 0 | 00007C <sup>16</sup>           | Timer B2 interrupt control register         |
| 00003D <sup>16</sup>           | UART1 transmit/receive control register 1 | 00007D <sup>16</sup>           | INT <sub>0</sub> interrupt control register |
| 00003E <sup>16</sup>           | UART1 receive buffer register             | 00007E <sup>16</sup>           | INT <sub>1</sub> interrupt control register |
| 00003F <sup>16</sup>           |   | 00007F <sup>16</sup>           | INT <sub>2</sub> interrupt control register |

**Note:** Do not write to this address.

Fig. 7 Location of SFRs (1)

| Address (Hexadecimal notation) |   | Address (Hexadecimal notation) |  |
|--------------------------------|---|--------------------------------|--|
| 000080 <sub>16</sub>           | $\overline{CS}_0$ control register L          | 0000C0 <sub>16</sub>           |  |
| 000081 <sub>16</sub>           | $\overline{CS}_0$ control register H          | 0000C1 <sub>16</sub>           |  |
| 000082 <sub>16</sub>           | $\overline{CS}_1$ control register L          | 0000C2 <sub>16</sub>           |  |
| 000083 <sub>16</sub>           | $\overline{CS}_1$ control register H          | 0000C3 <sub>16</sub>           |  |
| 000084 <sub>16</sub>           | $\overline{CS}_2$ control register L          | 0000C4 <sub>16</sub>           |  |
| 000085 <sub>16</sub>           | $\overline{CS}_2$ control register H          | 0000C5 <sub>16</sub>           |  |
| 000086 <sub>16</sub>           | $\overline{CS}_3$ control register L          | 0000C6 <sub>16</sub>           |  |
| 000087 <sub>16</sub>           | $\overline{CS}_3$ control register H          | 0000C7 <sub>16</sub>           |  |
| 000088 <sub>16</sub>           |   | 0000C8 <sub>16</sub>           |  |
| 000089 <sub>16</sub>           |   | 0000C9 <sub>16</sub>           |  |
| 00008A <sub>16</sub>           | Area $\overline{CS}_0$ start address register | 0000CA <sub>16</sub>           |  |
| 00008B <sub>16</sub>           |   | 0000CB <sub>16</sub>           |  |
| 00008C <sub>16</sub>           | Area $\overline{CS}_1$ start address register | 0000CC <sub>16</sub>           |  |
| 00008D <sub>16</sub>           |   | 0000CD <sub>16</sub>           |  |
| 00008E <sub>16</sub>           | Area $\overline{CS}_2$ start address register | 0000CE <sub>16</sub>           |  |
| 00008F <sub>16</sub>           |   | 0000CF <sub>16</sub>           |  |
| 000090 <sub>16</sub>           | Area $\overline{CS}_3$ start address register | 0000D0 <sub>16</sub>           |  |
| 000091 <sub>16</sub>           |   | 0000D1 <sub>16</sub>           |  |
| 000092 <sub>16</sub>           | Port function control register                | 0000D2 <sub>16</sub>           |  |
| 000093 <sub>16</sub>           |   | 0000D3 <sub>16</sub>           |  |
| 000094 <sub>16</sub>           | External interrupt input control register     | 0000D4 <sub>16</sub>           |  |
| 000095 <sub>16</sub>           | External interrupt input read-out register    | 0000D5 <sub>16</sub>           |  |
| 000096 <sub>16</sub>           | D-A control register                          | 0000D6 <sub>16</sub>           |  |
| 000097 <sub>16</sub>           |   | 0000D7 <sub>16</sub>           |  |
| 000098 <sub>16</sub>           | D-A register 0                                | 0000D8 <sub>16</sub>           |  |
| 000099 <sub>16</sub>           | D-A register 1                                | 0000D9 <sub>16</sub>           |  |
| 00009A <sub>16</sub>           | D-A register 2                                | 0000DA <sub>16</sub>           |  |
| 00009B <sub>16</sub>           |   | 0000DB <sub>16</sub>           |  |
| 00009C <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000DC <sub>16</sub>           |  |
| 00009D <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000DD <sub>16</sub>           |  |
| 00009E <sub>16</sub>           | Flash memory control register                 | 0000DE <sub>16</sub>           |  |
| 00009F <sub>16</sub>           |   | 0000DF <sub>16</sub>           |  |
| 0000A0 <sub>16</sub>           | Real-time output control register             | 0000E0 <sub>16</sub>           |  |
| 0000A1 <sub>16</sub>           |   | 0000E1 <sub>16</sub>           |  |
| 0000A2 <sub>16</sub>           | Pulse output data register 0                  | 0000E2 <sub>16</sub>           |  |
| 0000A3 <sub>16</sub>           |   | 0000E3 <sub>16</sub>           |  |
| 0000A4 <sub>16</sub>           | Pulse output data register 1                  | 0000E4 <sub>16</sub>           |  |
| 0000A5 <sub>16</sub>           |   | 0000E5 <sub>16</sub>           |  |
| 0000A6 <sub>16</sub>           |   | 0000E6 <sub>16</sub>           |  |
| 0000A7 <sub>16</sub>           |   | 0000E7 <sub>16</sub>           |  |
| 0000A8 <sub>16</sub>           |   | 0000E8 <sub>16</sub>           |  |
| 0000A9 <sub>16</sub>           |   | 0000E9 <sub>16</sub>           |  |
| 0000AA <sub>16</sub>           |   | 0000EA <sub>16</sub>           |  |
| 0000AB <sub>16</sub>           |   | 0000EB <sub>16</sub>           |  |
| 0000AC <sub>16</sub>           | Serial I/O pin control register               | 0000EC <sub>16</sub>           |  |
| 0000AD <sub>16</sub>           |   | 0000ED <sub>16</sub>           |  |
| 0000AE <sub>16</sub>           |   | 0000EE <sub>16</sub>           |  |
| 0000AF <sub>16</sub>           |   | 0000EF <sub>16</sub>           |  |
| 0000B0 <sub>16</sub>           |   | 0000F0 <sub>16</sub>           |  |
| 0000B1 <sub>16</sub>           |   | 0000F1 <sub>16</sub>           |  |
| 0000B2 <sub>16</sub>           |   | 0000F2 <sub>16</sub>           |  |
| 0000B3 <sub>16</sub>           |   | 0000F3 <sub>16</sub>           |  |
| 0000B4 <sub>16</sub>           |   | 0000F4 <sub>16</sub>           |  |
| 0000B5 <sub>16</sub>           |   | 0000F5 <sub>16</sub>           |  |
| 0000B6 <sub>16</sub>           |   | 0000F6 <sub>16</sub>           |  |
| 0000B7 <sub>16</sub>           |   | 0000F7 <sub>16</sub>           |  |
| 0000B8 <sub>16</sub>           |   | 0000F8 <sub>16</sub>           |  |
| 0000B9 <sub>16</sub>           |   | 0000F9 <sub>16</sub>           |  |
| 0000BA <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000FA <sub>16</sub>           |  |
| 0000BB <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000FB <sub>16</sub>           |  |
| 0000BC <sub>16</sub>           | Clock control register                        | 0000FC <sub>16</sub>           |  |
| 0000BD <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000FD <sub>16</sub>           |  |
| 0000BE <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000FE <sub>16</sub>           |  |
| 0000BF <sub>16</sub>           | Reserved area ( <b>Note</b> )                 | 0000FF <sub>16</sub>           |  |

**Note:** Do not write to this address.

Fig. 8 Location of SFRs (2)

### FLASH MEMORY MODE

These microcomputers contain the DINOR (Divided bit line NOR)-type flash memory; and single-power-supply reprogramming is available to this. These microcomputers have the following three modes, enabling reading/programming/erasure for the flash memory:

- Flash memory parallel I/O mode and Flash memory serial I/O mode, where the flash memory is handled by using an external programmer.
- CPU reprogramming mode, where the flash memory is handled by the central processing unit (CPU).

For each modes, refer to the datasheet M37902FCCHP.

Figures 9 and 10 shows the block configuration of the internal flash memory of each microcomputer.

These microcomputers have the same functions as the M37902FCCHP except for the following:

- (1) Power supply voltage (3.3 V ± 0.3 V)
- (2) Electrical characteristics

Therefore, for the flash memory mode except for the above, refer to the datasheet M37902FCCHP.

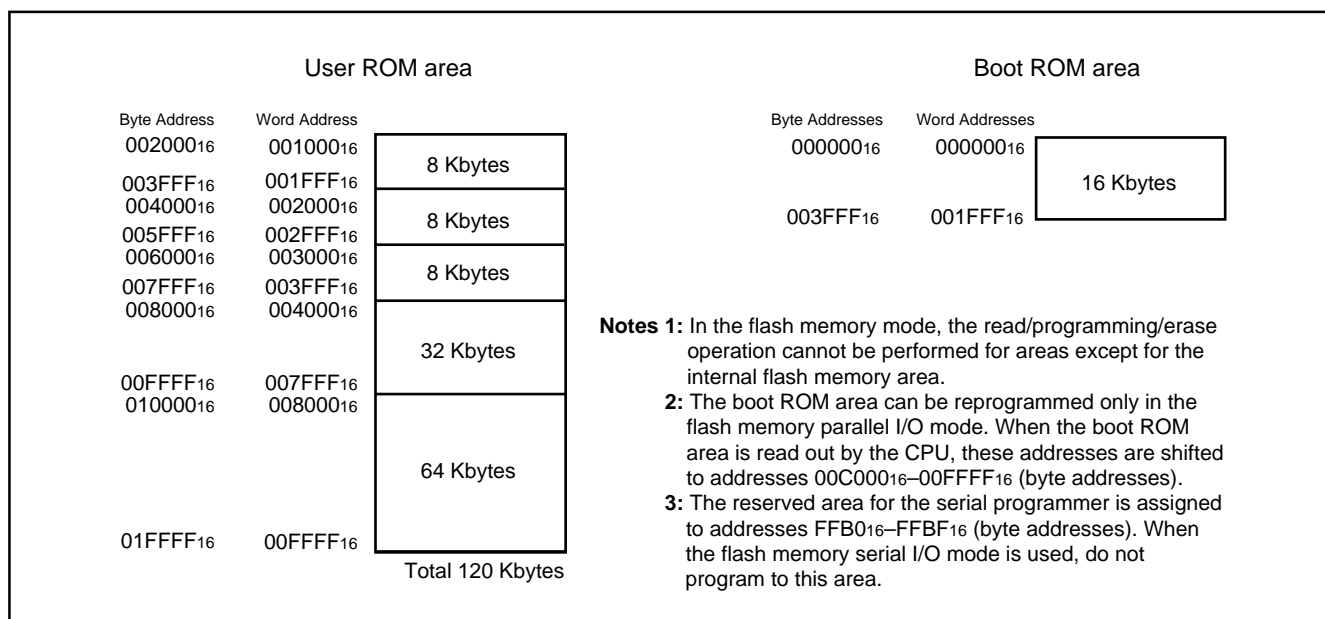


Fig 9. M37902FCMHP: block configuration of internal flash memory

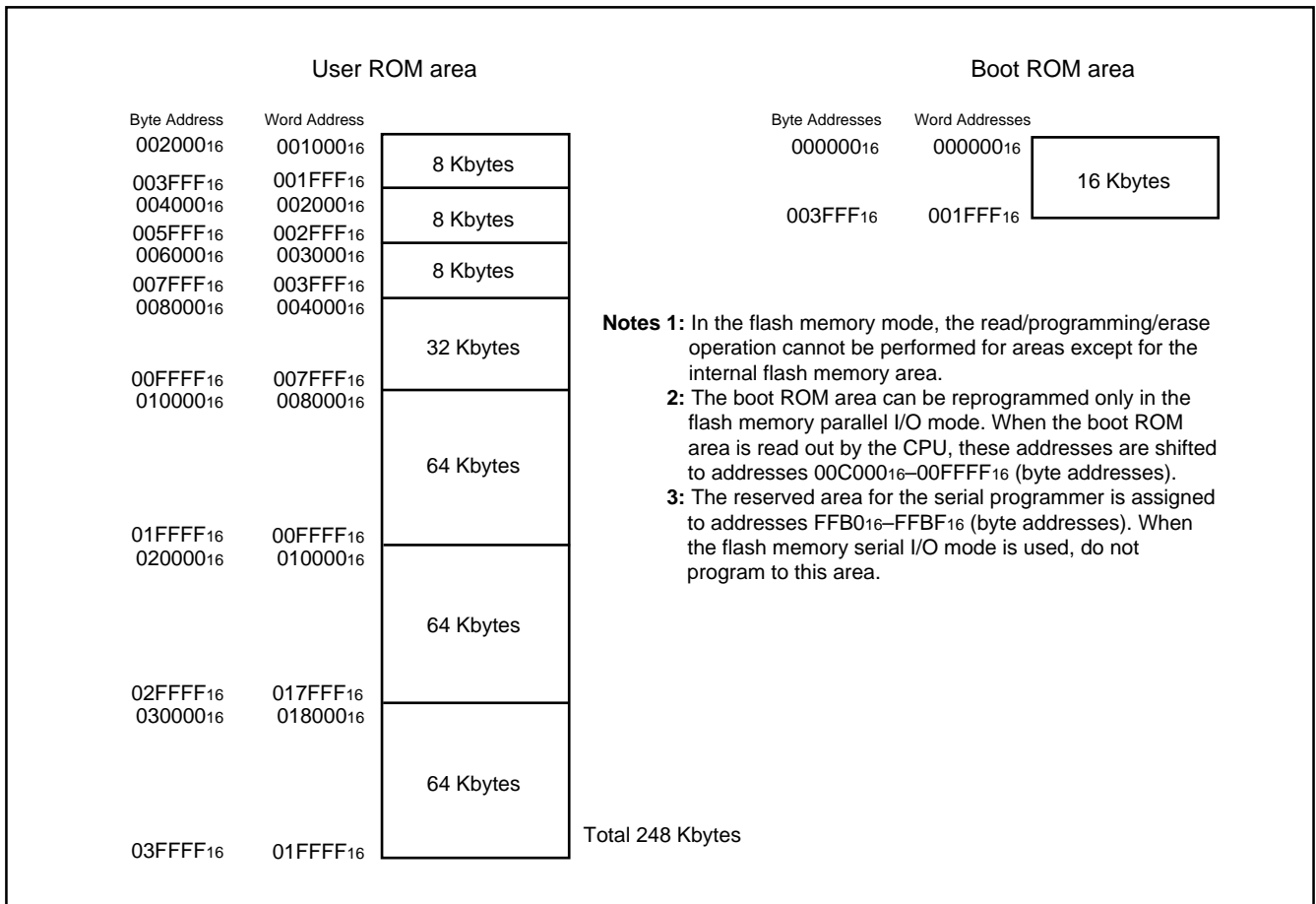


Fig 10. M37902FGMHP: block configuration of internal flash memory

**DC Electrical Characteristics (VCC = 3.3 V ± 0.3 V, Ta = 0 to 60 °C, f(fs<sub>sys</sub>) = 20 MHz (Note))**

| Symbol           | Parameter                                 | Limits |      |      | Unit |
|------------------|---|--------|------|------|------|
|                  |   | Min.   | Typ. | Max. |      |
| I <sub>cc1</sub> | VCC power source current (at read)        |        | 19   | 40   | mA   |
| I <sub>cc2</sub> | VCC power source current (at write)       |        |      | 40   | mA   |
| I <sub>cc3</sub> | VCC power source current (at programming) |        |      | 48   | mA   |
| I <sub>cc4</sub> | VCC power source current (at erasing)     |        |      | 48   | mA   |

Limits of V<sub>IH</sub>, V<sub>IL</sub>, V<sub>OH</sub>, V<sub>OL</sub>, I<sub>IH</sub>, and I<sub>IL</sub> for each pin are the same as those in the microcomputer mode.

**Note:** f(fs<sub>sys</sub>) indicates the system clock (fsys) frequency.

**AC Electrical Characteristics (VCC = 3.3 V ± 0.3 V, Ta = 0 to 60 °C, f(fs<sub>sys</sub>) = 20 MHz (Note))**

| Parameter                     | Limits |        |         | Unit |
|-------------------------------|--------|--------|---------|------|
|                               | Min.   | Typ.   | Max.    |      |
| Page programming time         |        | 8      | 120     | ms   |
| Block erase time              |        | 50     | 600     | ms   |
| Erase all unlocked block time |        | 50 X n | 600 X n | ms   |
| Lock bit programming time     |        | 8      | 120     | ms   |

n = Number of blocks to be erased

The limits of parameters other than the above are same as those in the microcomputer mode.

**Note:** f(fs<sub>sys</sub>) indicates the system clock (fsys) frequency.

**mitsubishi MICROCOMPUTERS**  
**M37902FCMHP, M37902FGMHP**

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

**ABSOLUTE MAXIMUM RATINGS**

| Symbol           | Parameter   | Ratings                      | Unit |
|------------------|---|------------------------------|------|
| V <sub>CC</sub>  | Power source voltage  | -0.3 to 4.6                  | V    |
| AV <sub>CC</sub> | Analog power source voltage   | -0.3 to 4.6                  | V    |
| V <sub>I</sub>   | Input voltage P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117, VREF, XIN, RESET, BYTE, MD0, MD1, NMI, VCONT | -0.3 to V <sub>CC</sub> +0.3 | V    |
| V <sub>O</sub>   | Output voltage P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117, XOUT  | -0.3 to V <sub>CC</sub> +0.3 | V    |
| P <sub>d</sub>   | Power dissipation   | 400                          | mW   |
| T <sub>opr</sub> | Operating ambient temperature   | -20 to 85                    | °C   |
| T <sub>stg</sub> | Storage temperature   | -40 to 150                   | °C   |

**RECOMMENDED OPERATING CONDITIONS** (V<sub>CC</sub> = 3.3 V, T<sub>a</sub> = -20 to 85 °C, unless otherwise noted)

| Symbol                | Parameter   | Limits              |                 |                      | Unit |
|-----------------------|---|---------------------|-----------------|----------------------|------|
|                       |   | Min.                | Typ.            | Max.                 |      |
| V <sub>CC</sub>       | Power source voltage  | 3.0                 | 3.3             | 3.6                  | V    |
| AV <sub>CC</sub>      | Analog power source voltage   |                     | V <sub>CC</sub> |                      | V    |
| V <sub>SS</sub>       | Power source voltage  |                     | 0               |                      | V    |
| AV <sub>SS</sub>      | Analog power source voltage   |                     | 0               |                      | V    |
| V <sub>IH</sub>       | High-level input voltage XIN, RESET, BYTE, MD0, MD1   | 0.8 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117                           | 0.7 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage P00-P07 (When the port P0 input level select bit = "0")  | 0.7 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage P00-P07 (When the port P0 input level select bit = "1")  | 0.5 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage D0-D7, D8-D15  | 0.5 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage RDY, HOLD, TA0IN-TA4IN, TA0OUT-TA4OUT, TB0IN-TB2IN, KI0-KI3, INT0-INT4, NMI, ADTRG, CTS0, CTS1, CLK0, CLK1, RxD0, RxD1 | 0.5 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IH</sub>       | High-level input voltage SCLK, SDA ( <b>Note 1</b> )  | 0.5 V <sub>CC</sub> |                 | V <sub>CC</sub>      | V    |
| V <sub>IL</sub>       | Low-level input voltage XIN, RESET, BYTE, MD0, MD1  | 0                   |                 | 0.2 V <sub>CC</sub>  | V    |
| V <sub>IL</sub>       | Low-level input voltage P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117                            | 0                   |                 | 0.2 V <sub>CC</sub>  | V    |
| V <sub>IL</sub>       | Low-level input voltage P00-P07 (When the port P0 input level select bit = "0")   | 0                   |                 | 0.2 V <sub>CC</sub>  | V    |
| V <sub>IL</sub>       | Low-level input voltage P00-P07 (When the port P0 input level select bit = "1")   | 0                   |                 | 0.16 V <sub>CC</sub> | V    |
| V <sub>IL</sub>       | Low-level input voltage D0-D7, D8-D15   | 0                   |                 | 0.22 V <sub>CC</sub> | V    |
| V <sub>IL</sub>       | Low-level input voltage RDY, HOLD, TA0IN-TA4IN, TA0OUT-TA4OUT, TB0IN-TB2IN, KI0-KI3, INT0-INT4, NMI, ADTRG, CTS0, CTS1, CLK0, CLK1, RxD0, RxD1  | 0                   |                 | 0.16 V <sub>CC</sub> | V    |
| V <sub>IL</sub>       | Low-level input voltage SCLK, SDA ( <b>Note 1</b> )   | 0                   |                 | 0.16 V <sub>CC</sub> | V    |
| I <sub>OH(peak)</sub> | High-level peak output current P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117            |                     |                 | -10                  | mA   |
| I <sub>OH(avg)</sub>  | High-level average output current P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117         |                     |                 | -5                   | mA   |
| I <sub>OL(peak)</sub> | Low-level peak output current P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117             |                     |                 | 10                   | mA   |
| I <sub>OL(avg)</sub>  | Low-level average output current P00-P07, P10-P17, P20-P27, P30-P33, P40-P47, P50-P57, P60-P67, P70-P77, P80-P87, P100-P107, P110-P117          |                     |                 | 5                    | mA   |
| f(XIN)                | External clock input frequency ( <b>Note 2</b> )  |                     |                 | 20                   | MHz  |
| f(f <sub>sys</sub> )  | System clock frequency  |                     |                 | 20                   | MHz  |

**Notes 1:** Pins SCLK and SDA are used only in the flash memory serial I/O mode.

**2:** When using the PLL frequency multiplier, be sure that f(f<sub>sys</sub>) = 20 MHz or less.

**3:** Average output current is the average value of an interval of 100 ms.

**4:** The sum of I<sub>OL(peak)</sub> for ports P0-P2, P8, P10, and P11 must be 80 mA or less, the sum of I<sub>OH(peak)</sub> for ports P0-P2, P8, P10, and P11 must be 80 mA or less, the sum of I<sub>OL(peak)</sub> for ports P3-P7 must be 80 mA or less, the sum of I<sub>OH(peak)</sub> for ports P3-P7 must be 80 mA or less.



**DC ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 3.3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = -20\text{ to }85\text{ }^\circ\text{C}$ ,  $f(f_{\text{sys}}) = 20\text{ MHz}$  (Note))

| Symbol   | Parameter  | Test conditions  | Limits  |       |       | Unit          |
|----------|--|--|---|-------|-------|---------------|
|          |  |  | Min.  | Typ.  | Max.  |               |
| VOH      | High-level output voltage P00–P07, P10–P17, P20–P27, P30, P40–P47, P50–P57, P60–P67, P70–P77, P80–P87, P100–P107, P110–P117  | IOH = –1 mA  | 2.5   |       |       | V             |
| VOH      | High-level output voltage P31–P33  | IOH = –1 mA  | 2.6   |       |       | V             |
| VOL      | Low-level output voltage P00–P07, P10–P17, P20–P27, P30, P40–P47, P50–P57, P60–P67, P70–P77, P80–P87, P100–P107, P110–P117   | IOL = 1 mA   |   |       | 0.5   | V             |
| VOL      | Low-level output voltage P31–P33   | IOL = 1 mA   |   |       | 0.4   | V             |
| VT+ –VT– | Hysteresis $\overline{\text{RDY}}$ , $\overline{\text{HOLD}}$ , TA0IN–TA4IN, TA0OUT–TA4OUT, TB0IN–TB2IN, KI0–KI3, INT0–INT4, NMI, ADTRG, CTS0, CTS1, CLK0, CLK1, RxD0, RxD1          |  | 0.08  |       | 0.5   | V             |
| VT+ –VT– | Hysteresis $\overline{\text{RESET}}$   |  | 0.3   |       | 1     | V             |
| VT+ –VT– | Hysteresis XIN   |  | 0.05  |       | 0.26  | V             |
| IIH      | High-level input current P00–P07, P10–P17, P20–P27, P30–P33, P40–P47, P50–P57, P60–P67, P70–P77, P80–P87, P100–P107, P110–P117, XIN, $\overline{\text{RESET}}$ , BYTE, MD0, MD1, NMI | VI = 3.3 V   |   |       | 4     | V             |
| IIL      | Low-level input current P00–P07, P10–P17, P20–P27, P30–P33, P40–P43, P50–P53, P60–P67, P70–P77, P80–P87, P100–P107, P110–P117, XIN, $\overline{\text{RESET}}$ , BYTE, MD0, MD1       | VI = 0 V   |   |       | –4    | $\mu\text{A}$ |
| IIL      | Low-level input current P44–P47, P54–P57, $\overline{\text{NMI}}$  | VI = 0 V, No pullup transistor   |   |       | –4    | $\mu\text{A}$ |
|          |  | VI = 0 V, Pullup transistor used   | –0.20   | –0.36 | –0.54 | mA            |
| VRAM     | RAM hold voltage   | When clock is stopped.   | 2   |       |       | V             |
| ICC      | Power source current   | Output-only pins are open, and the other pins are connected to Vss or Vcc. An external square-waveform clock is input. (Pin Xout is open.) The PLL frequency multiplier stops its operation. | $f(f_{\text{sys}}) = 20\text{ MHz}$ . CPU operates. | 12    | 24    | mA            |
|          |  |  | Ta = 25 °C when clock is stopped.                   |       | 1     | $\mu\text{A}$ |
|          |  |  | Ta = 85 °C when clock is stopped.                   |       | 20    |               |

### A-D CONVERTER CHARACTERISTICS

( $V_{CC} = AV_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_{SS} = AV_{SS} = 0\text{ V}$ ,  $T_a = -20$  to  $85\text{ }^\circ\text{C}$ , unless otherwise noted)

| Symbol            | Parameter            | Test conditions                 | Limits                 |                  | Unit          |
|-------------------|----------------------|---------------------------------|------------------------|------------------|---------------|
|                   |                      |                                 | Min.                   | Max.             |               |
| —                 | Resolution           | $V_{REF} = V_{CC}$              |                        | 10               | Bits          |
| —                 | Absolute accuracy    | $V_{REF} = V_{CC}$              | 10-bit resolution mode | $\pm 3$          | LSB           |
|                   |                      |                                 | 8-bit resolution mode  | $\pm 2$          | LSB           |
| RLADDER           | Ladder resistance    | $V_{REF} = V_{CC}$              | 5                      |                  | k $\Omega$    |
| t <sub>CONV</sub> | Conversion time      | $f(f_{sys}) \leq 20\text{ MHz}$ | 10-bit resolution mode | 5.90             | $\mu\text{s}$ |
|                   |                      |                                 | 8-bit resolution mode  | 2.45 (Note)      |               |
| V <sub>REF</sub>  | Reference voltage    |                                 | 2.7                    | $V_{CC}$         | V             |
| V <sub>IA</sub>   | Analog input voltage |                                 | 0                      | V <sub>REF</sub> | V             |

**Note:** This is applied when A-D conversion frequency ( $\phi_{AD}$ ) =  $f_1$ .

### D-A CONVERTER CHARACTERISTICS

( $V_{CC} = 3.3\text{ V}$ ,  $V_{SS} = AV_{SS} = 0\text{ V}$ ,  $V_{REF} = 3.3\text{ V}$ ,  $T_a = -20$  to  $85\text{ }^\circ\text{C}$ , unless otherwise noted)

| Symbol            | Parameter                            | Test conditions | Limits |      |           | Unit          |
|-------------------|--------------------------------------|-----------------|--------|------|-----------|---------------|
|                   |                                      |                 | Min.   | Typ. | Max.      |               |
| —                 | Resolution                           |                 |        |      | 8         | Bits          |
| —                 | Absolute accuracy                    |                 |        |      | $\pm 1.0$ | %             |
| t <sub>su</sub>   | Set time                             |                 |        |      | 3         | $\mu\text{s}$ |
| R <sub>O</sub>    | Output resistance                    |                 | 1      | 2.5  | 4         | k $\Omega$    |
| I <sub>VREF</sub> | Reference power source input current | (Note)          |        |      | 3.2       | mA            |

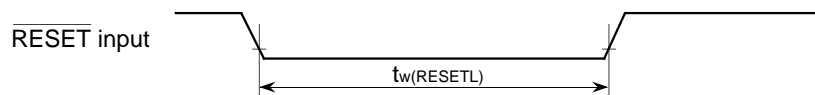
**Note:** The test conditions are as follows:

- One D-A converter is used.
- The D-A register value of the unused D-A converter is "0016."
- The reference power source input current for the ladder resistance of the A-D converter is excluded.

### RESET INPUT

**Reset input timing requirements** ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ,  $T_a = -20$  to  $85\text{ }^\circ\text{C}$ , unless otherwise noted)

| Symbol                  | Parameter                         | Limits |      |      | Unit          |
|-------------------------|-----------------------------------|--------|------|------|---------------|
|                         |                                   | Min.   | Typ. | Max. |               |
| t <sub>w</sub> (RESETL) | RESET input low-level pulse width | 2      |      |      | $\mu\text{s}$ |



### PERIPHERAL DEVICE INPUT/OUTPUT TIMING

(VCC = 3.3 V±0.3 V, VSS = 0 V, Ta = -20 to 85 °C, f(fs<sub>ys</sub>) = 20 MHz unless otherwise noted)

\* For limits depending on f(fs<sub>ys</sub>), their calculation formulas are shown below. Also, the values at f(fs<sub>ys</sub>) = 20 MHz are shown in ( ).

#### Timer A input (Count input in event counter mode)

| Symbol               | Parameter                          | Limits |      | Unit |
|----------------------|------------------------------------|--------|------|------|
|                      |                                    | Min.   | Max. |      |
| t <sub>c</sub> (TA)  | TAiIN input cycle time             | 80     |      | ns   |
| t <sub>w</sub> (TAH) | TAiIN input high-level pulse width | 40     |      | ns   |
| t <sub>w</sub> (TAL) | TAiIN input low-level pulse width  | 40     |      | ns   |

#### Timer A input (Gating input in timer mode)

| Symbol               | Parameter                          |                               | Limits                                    |      | Unit |
|----------------------|------------------------------------|-------------------------------|---|------|------|
|                      |                                    |                               | Min.                                      | Max. |      |
| t <sub>c</sub> (TA)  | TAiIN input cycle time             | f(fs <sub>ys</sub> ) ≤ 20 MHz | $\frac{16 \times 10^9}{f(fs_{ys})}$ (800) |      | ns   |
| t <sub>w</sub> (TAH) | TAiIN input high-level pulse width | f(fs <sub>ys</sub> ) ≤ 20 MHz | $\frac{8 \times 10^9}{f(fs_{ys})}$ (400)  |      | ns   |
| t <sub>w</sub> (TAL) | TAiIN input low-level pulse width  | f(fs <sub>ys</sub> ) ≤ 20 MHz | $\frac{8 \times 10^9}{f(fs_{ys})}$ (400)  |      | ns   |

**Note** : The TAiIN input cycle time requires 4 or more cycles of a count source. The TAiIN input high-level pulse width and the TAiIN input low-level pulse width respectively require 2 or more cycles of a count source. The limits in this table are applied when the count source = f<sub>2</sub> at f(fs<sub>ys</sub>) ≤ 20 MHz.

#### Timer A input (External trigger input in one-shot pulse mode)

| Symbol               | Parameter                          |                               | Limits                                   |      | Unit |
|----------------------|------------------------------------|-------------------------------|--|------|------|
|                      |                                    |                               | Min.                                     | Max. |      |
| t <sub>c</sub> (TA)  | TAiIN input cycle time             | f(fs <sub>ys</sub> ) ≤ 20 MHz | $\frac{8 \times 10^9}{f(fs_{ys})}$ (400) |      | ns   |
| t <sub>w</sub> (TAH) | TAiIN input high-level pulse width |                               | 80                                       |      | ns   |
| t <sub>w</sub> (TAL) | TAiIN input low-level pulse width  |                               | 80                                       |      | ns   |

#### Timer A input (External trigger input in pulse width modulation mode)

| Symbol               | Parameter                          | Limits |      | Unit |
|----------------------|------------------------------------|--------|------|------|
|                      |                                    | Min.   | Max. |      |
| t <sub>w</sub> (TAH) | TAiIN input high-level pulse width | 80     |      | ns   |
| t <sub>w</sub> (TAL) | TAiIN input low-level pulse width  | 80     |      | ns   |

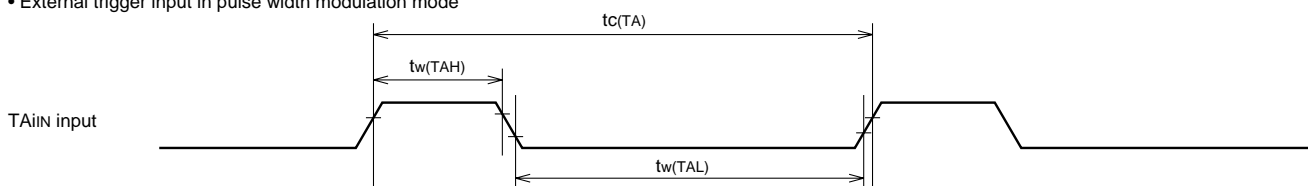
#### Timer A input (Up-down input and Count input in event counter mode)

| Symbol                   | Parameter                           | Limits |      | Unit |
|--------------------------|-------------------------------------|--------|------|------|
|                          |                                     | Min.   | Max. |      |
| t <sub>c</sub> (UP)      | TAiOUT input cycle time             | 2000   |      | ns   |
| t <sub>w</sub> (UPH)     | TAiOUT input high-level pulse width | 1000   |      | ns   |
| t <sub>w</sub> (UPL)     | TAiOUT input low-level pulse width  | 1000   |      | ns   |
| t <sub>su</sub> (UP-TiN) | TAiOUT input setup time             | 400    |      | ns   |
| t <sub>h</sub> (TiN-UP)  | TAiOUT input hold time              | 400    |      | ns   |

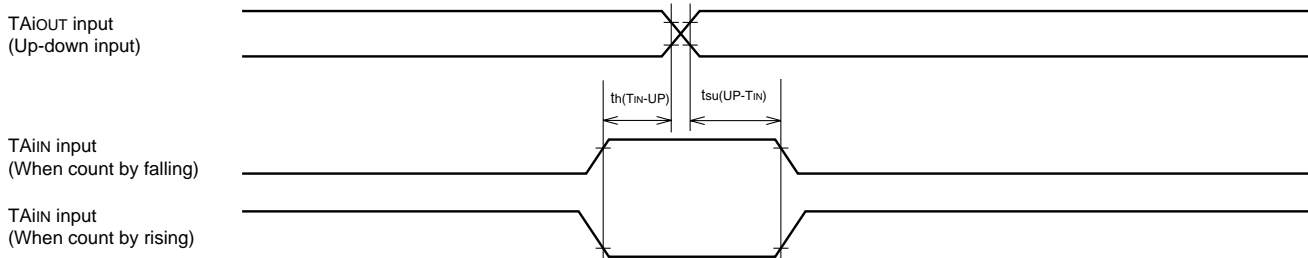
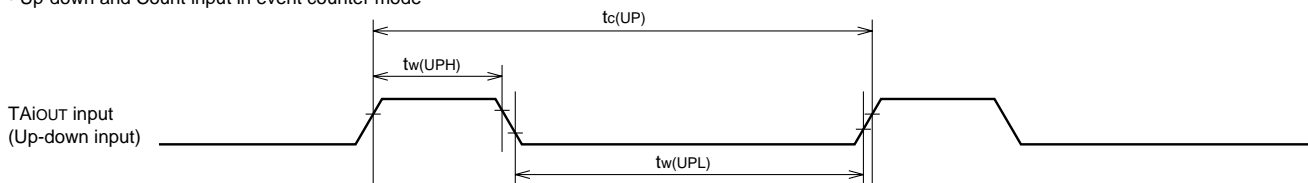
**Timer A input** (Two-phase pulse input in event counter mode)

| Symbol                       | Parameter               | Limits |      | Unit |
|------------------------------|-------------------------|--------|------|------|
|                              |                         | Min.   | Max. |      |
| $t_c(TA)$                    | TAiIN input cycle time  | 800    |      | ns   |
| $t_{su}(TA_{jIN}-TA_{jOUT})$ | TAjIN input setup time  | 200    |      | ns   |
| $t_{su}(TA_{jOUT}-TA_{jIN})$ | TAjOUT input setup time | 200    |      | ns   |

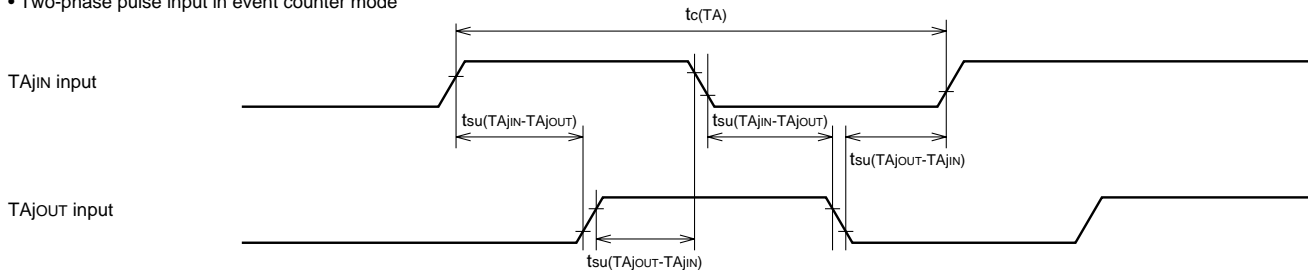
- Gating input in timer mode
- Count input in event counter mode
- External trigger input in one-shot pulse mode
- External trigger input in pulse width modulation mode



- Up-down and Count input in event counter mode



- Two-phase pulse input in event counter mode



Test conditions

- $V_{CC} = 3.3 V \pm 0.3 V$ ,  $T_a = -20$  to  $85^\circ C$
- Input timing voltage :  $V_{IL} = 0.53 V$ ,  $V_{IH} = 1.65 V$

**Timer B input** (Count input in event counter mode)

| Symbol       | Parameter  | Limits |      | Unit |
|--------------|--|--------|------|------|
|              |  | Min.   | Max. |      |
| $t_{c(TB)}$  | TBiIn input cycle time (one edge count)              | 80     |      | ns   |
| $t_{w(TBH)}$ | TBiIn input high-level pulse width (one edge count)  | 40     |      | ns   |
| $t_{w(TBL)}$ | TBiIn input low-level pulse width (one edge count)   | 40     |      | ns   |
| $t_{c(TB)}$  | TBiIn input cycle time (both edge count)             | 160    |      | ns   |
| $t_{w(TBH)}$ | TBiIn input high-level pulse width (both edge count) | 80     |      | ns   |
| $t_{w(TBL)}$ | TBiIn input low-level pulse width (both edge count)  | 80     |      | ns   |

**Timer B input** (Pulse period measurement mode)

| Symbol       | Parameter                          |                                  | Limits                                    |      | Unit |
|--------------|------------------------------------|----------------------------------|---|------|------|
|              |                                    |                                  | Min.                                      | Max. |      |
| $t_{c(TB)}$  | TBiIn input cycle time             | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (800) |      | ns   |
| $t_{w(TBH)}$ | TBiIn input high-level pulse width | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400)  |      | ns   |
| $t_{w(TBL)}$ | TBiIn input low-level pulse width  | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400)  |      | ns   |

**Note:** The TBiIn input cycle time requires 4 or more cycles of a count source. The TBiIn input high-level pulse width and the TBiIn input low-level pulse width respectively require 2 or more cycles of a count source. The limits in this table are applied when the count source =  $f_2$  at  $f(f_{sys}) \leq 20 \text{ MHz}$ .

**Timer B input** (Pulse width measurement mode)

| Symbol       | Parameter                          |                                  | Limits                                    |      | Unit |
|--------------|------------------------------------|----------------------------------|---|------|------|
|              |                                    |                                  | Min.                                      | Max. |      |
| $t_{c(TB)}$  | TBiIn input cycle time             | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (800) |      | ns   |
| $t_{w(TBH)}$ | TBiIn input high-level pulse width | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400)  |      | ns   |
| $t_{w(TBL)}$ | TBiIn input low-level pulse width  | $f(f_{sys}) \leq 20 \text{ MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400)  |      | ns   |

**Note:** The TBiIn input cycle time requires 4 or more cycles of a count source. The TBiIn input high-level pulse width and the TBiIn input low-level pulse width respectively require 2 or more cycles of a count source. The limits in this table are applied when the count source =  $f_2$  at  $f(f_{sys}) \leq 20 \text{ MHz}$ .

**A-D trigger input**

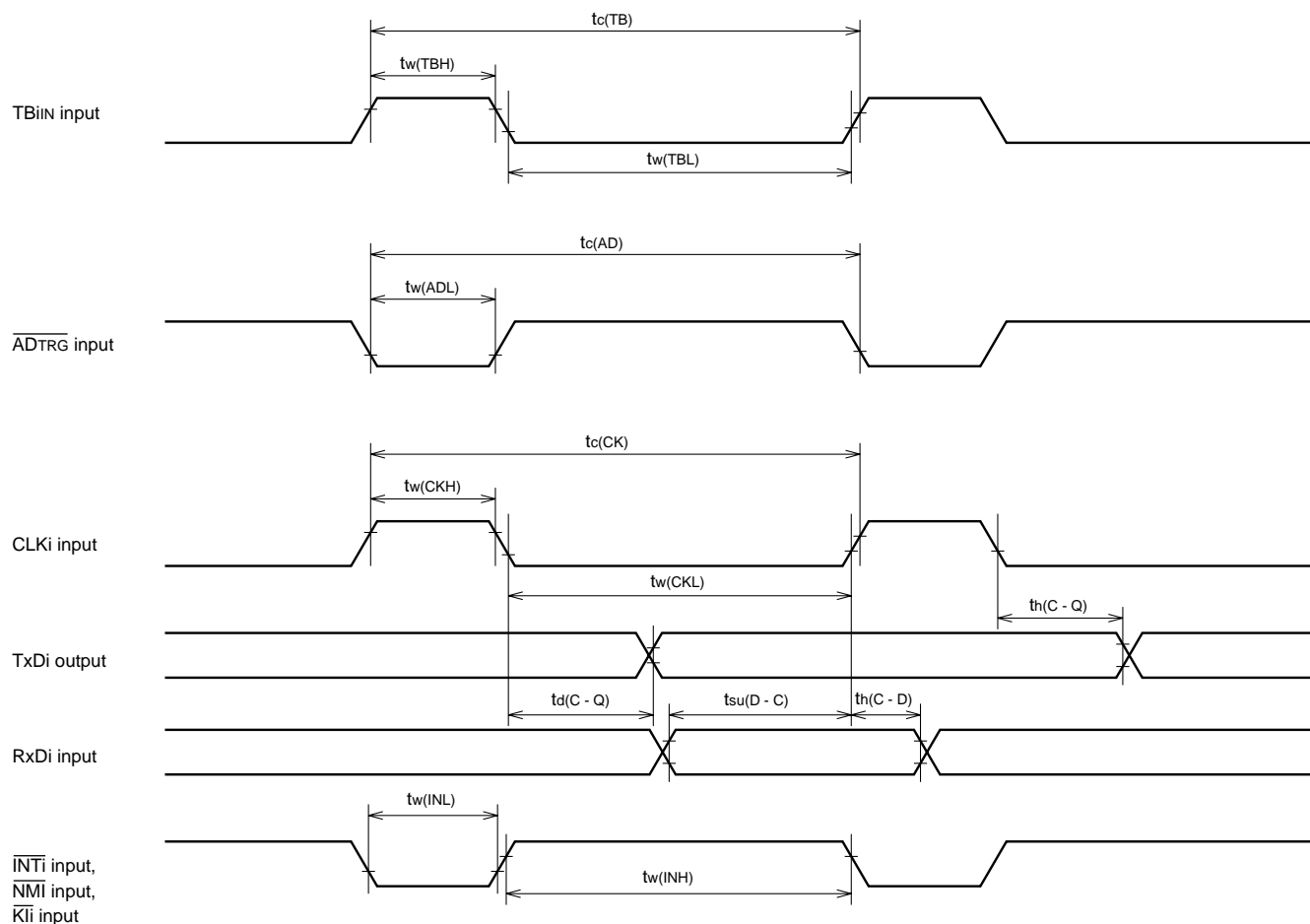
| Symbol       | Parameter  | Limits |      | Unit |
|--------------|--|--------|------|------|
|              |  | Min.   | Max. |      |
| $t_{c(AD)}$  | ADTRG input cycle time (minimum allowable trigger) | 1000   |      | ns   |
| $t_{w(ADL)}$ | ADTRG input low-level pulse width                  | 125    |      | ns   |

### Serial I/O

| Symbol               | Parameter                         | Limits |      | Unit |
|----------------------|-----------------------------------|--------|------|------|
|                      |                                   | Min.   | Max. |      |
| $t_c(\text{CK})$     | CLKi input cycle time             | 200    |      | ns   |
| $t_w(\text{CKH})$    | CLKi input high-level pulse width | 100    |      | ns   |
| $t_w(\text{CKL})$    | CLKi input low-level pulse width  | 100    |      | ns   |
| $t_d(\text{C-Q})$    | TxDi output delay time            |        | 80   | ns   |
| $t_h(\text{C-Q})$    | TxDi hold time                    | 0      |      | ns   |
| $t_{su}(\text{D-C})$ | RxDi input setup time             | 20     |      | ns   |
| $t_h(\text{C-D})$    | RxDi input hold time              | 90     |      | ns   |

### External interrupt ( $\overline{\text{INTi}}$ ) input, $\overline{\text{NMI}}$ input, Key input interrupt ( $\overline{\text{Kli}}$ ) input

| Symbol            | Parameter   | Limits |      | Unit |
|-------------------|---|--------|------|------|
|                   |   | Min.   | Max. |      |
| $t_w(\text{INH})$ | $\overline{\text{INTi}}$ input/ $\overline{\text{NMI}}$ input/ $\overline{\text{Kli}}$ input high-level pulse width | 250    |      | ns   |
| $t_w(\text{INL})$ | $\overline{\text{INTi}}$ input/ $\overline{\text{NMI}}$ input/ $\overline{\text{Kli}}$ input low-level pulse width  | 250    |      | ns   |



Test conditions

- $V_{cc} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $T_a = -20 \text{ to } 85^\circ\text{C}$
- Input timing voltage :  $V_{IL} = 0.53 \text{ V}$ ,  $V_{IH} = 1.65 \text{ V}$
- Output timing voltage :  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 50 \text{ pF}$

## READY, HOLD TIMING

**Timing requirements** ( $V_{CC} = 3.3 V \pm 0.3 V$ ,  $V_{SS} = 0 V$ ,  $T_a = -20$  to  $85\text{ }^\circ\text{C}$ ,  $f(f_{sys}) = 20\text{ MHz}$ , unless otherwise noted)

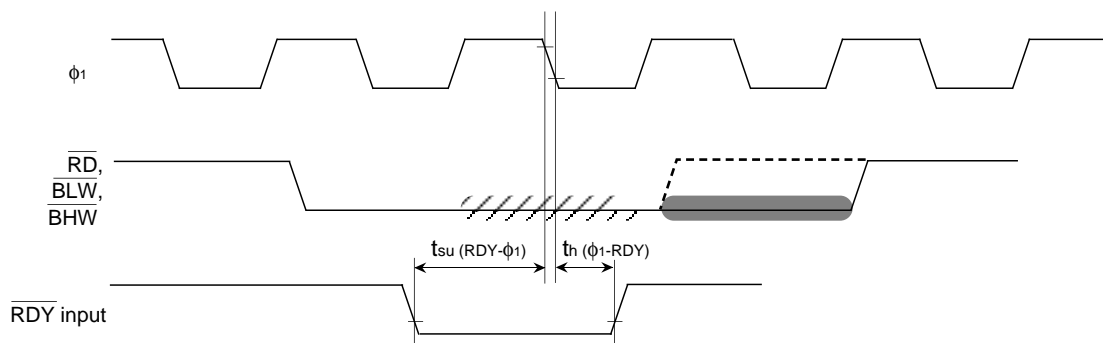
| Symbol                | Parameter             | Limits |      | Unit |
|-----------------------|-----------------------|--------|------|------|
|                       |                       | Min.   | Max. |      |
| $t_{su}(RDY-\phi 1)$  | RDY input setup time  | 40     |      | ns   |
| $t_{su}(HOLD-\phi 1)$ | HOLD input setup time | 40     |      | ns   |
| $t_h(\phi 1-RDY)$     | RDY input hold time   | 0      |      | ns   |
| $t_h(\phi 1-HOLD)$    | HOLD input hold time  | 0      |      | ns   |



**Switching characteristics** ( $V_{CC} = 3.3 V \pm 0.3 V$ ,  $V_{SS} = 0 V$ ,  $T_a = -20$  to  $85\text{ }^\circ\text{C}$ ,  $f(f_{sys}) = 20\text{ MHz}$ , unless otherwise noted)

| Symbol                | Parameter   | Limits            |      | Unit |
|-----------------------|---|-------------------|------|------|
|                       |   | Min.              | Max. |      |
| $t_d(\phi 1-HLDAL)$   | $\overline{HLD\bar{A}}$ output delay time                       |                   | 20   | ns   |
| $t_d(RDH-HLDAL)$      | $\overline{HLD\bar{A}}$ low-level output delay time after read  | $t_c - 15$ (Note) |      | ns   |
| $t_d(BXWH-HLDAL)$     | $\overline{HLD\bar{A}}$ low-level output delay time after write | $t_c - 15$ (Note) |      | ns   |
| $t_{pxz}(HLDAL-RDZ)$  | Floating start delay time                                       | -15               | 10   | ns   |
| $t_{pxz}(HLDAL-BXWZ)$ | Floating start delay time                                       | -15               | 10   | ns   |
| $t_{pxz}(HLDAL-CSiZ)$ | Floating start delay time                                       | -15               | 10   | ns   |
| $t_{pxz}(HLDAL-ALEZ)$ | Floating start delay time                                       | -15               | 10   | ns   |
| $t_{pxz}(HLDAL-AZ)$   | Floating start delay time                                       | -15               | 10   | ns   |
| $t_{pzx}(HLDAL-RDZ)$  | Floating release delay time                                     | 0                 |      | ns   |
| $t_{pzx}(HLDAL-BXWZ)$ | Floating release delay time                                     | 0                 |      | ns   |
| $t_{pzx}(HLDAL-CSiZ)$ | Floating release delay time                                     | 0                 |      | ns   |
| $t_{pzx}(HLDAL-ALEZ)$ | Floating release delay time                                     | 0                 |      | ns   |
| $t_{pzx}(HLDAL-AZ)$   | Floating release delay time                                     | 0                 |      | ns   |

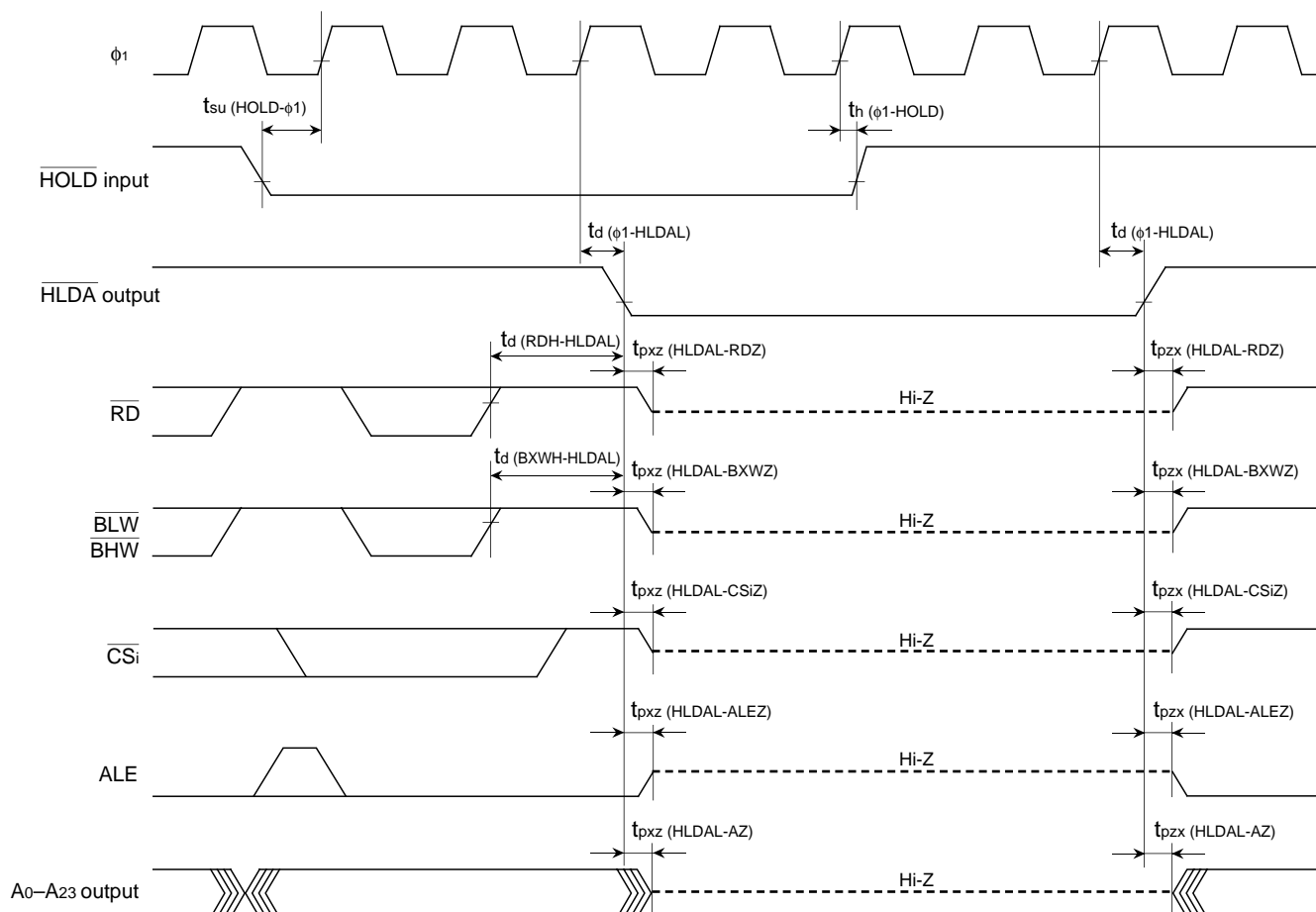
Note:  $t_c = 1/f(f_{sys})$ .

$\overline{\text{RDY}}$  input



 : Wait inserted by software (The above is applied when bus cycle =  $1\phi + 2\phi$ )  
 : Wait inserted by ready function

$\overline{\text{HOLD}}$  input



Test conditions

- $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $T_a = -20$  to  $85 \text{ }^\circ\text{C}$
- $\overline{\text{RDY}}$  input,  $\overline{\text{HOLD}}$  input:  $V_{IL} = 0.53 \text{ V}$ ,  $V_{IH} = 1.65 \text{ V}$
- $\overline{\text{HLDA}}$  output :  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 50 \text{ pF}$



### External bus timing

For limits depending on  $f(f_{sys})$ , their calculation formulas are shown below.

| Bus cycle       | WH | WL | Bus cycle       | WH | WL |
|-----------------|----|----|-----------------|----|----|
| $1\phi + 1\phi$ | 1  | 1  | $2\phi + 3\phi$ | 2  | 3  |
| $1\phi + 2\phi$ | 1  | 2  | $2\phi + 4\phi$ | 2  | 4  |
| $1\phi + 3\phi$ | 1  | 3  | $3\phi + 3\phi$ | 3  | 3  |
| $2\phi + 2\phi$ | 2  | 2  | $3\phi + 4\phi$ | 3  | 4  |

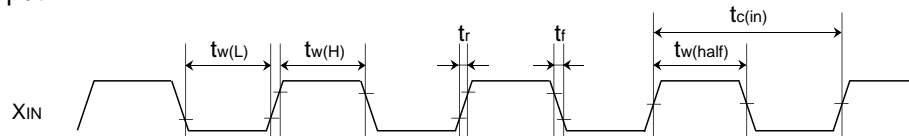
$$t_c = 1/f(f_{sys}).$$

**Timing Requirements** ( $V_{CC} = 3.3 V \pm 0.3 V$ ,  $V_{SS} = 0 V$ ,  $T_a = -20$  to  $85^\circ C$ ,  $f(X_{IN}) = 20$  MHz, unless otherwise noted)

| Symbol          | Parameter  | Limits        |                                     | Unit |
|-----------------|--|---------------|-------------------------------------|------|
|                 |  | Min.          | Max.                                |      |
| $t_{c(in)}$     | External clock input cycle time                          | 50            |                                     | ns   |
| $t_{w(half)}$   | External clock input pulse width with half input-voltage | $0.45 t_c$    | $0.55 t_c$                          | ns   |
| $t_{w(H)}$      | External clock input high-level pulse width              | $0.5 t_c - 6$ |                                     | ns   |
| $t_{w(L)}$      | External clock input low-level pulse width               | $0.5 t_c - 6$ |                                     | ns   |
| $t_r$           | External clock input rise time                           | 6             |                                     | ns   |
| $t_f$           | External clock input fall time                           | 6             |                                     | ns   |
| $t_a(A-D)$      | Address access time (the address output select bit = 0)  |               | $(W_H + W_L) t_c - 45$              | ns   |
| $t_a(A-D)$      | Address access time (the address output select bit = 1)  |               | $(W_H + W_L - 0.5) t_c - 35$        | ns   |
| $t_a(CSIL-D)$   | Chip select access time                                  |               | $(W_H + W_L - 0.5) t_c - 35$        | ns   |
| $t_a(RDL-D)$    | Read access time   |               | $W_L \times t_c - 30$               | ns   |
| $t_{su}(D-RDL)$ | Read data setup time                                     | 15            |                                     | ns   |
| $t_h(RDH-D)$    | Data input hold time after read                          | 0             |                                     | ns   |
| $t_a(BA-D)$     | Address access time at burst ROM access                  |               | $W_L \times t_c - 35$               | ns   |
| $t_h(BA-D)$     | Data hold time after address at burst ROM access         | 8             |                                     | ns   |
| $t_a(LA-D)$     | Address access time (the multiplexed bus select bit = 1) |               | $(W_H + W_L - 0.5) t_c - 35$ (Note) | ns   |

**Note:** This is independent of the value of the address output select bit's contents.

### External clock input



### Test conditions

- $V_{CC} = 3.3 V \pm 0.3 V$ ,  $T_a = -20$  to  $85^\circ C$
- Input timing voltage :  $V_{IL} = 0.66 V$ ,  $V_{IH} = 2.64 V$  ( $t_{w(H)}$ ,  $t_{w(L)}$ ,  $t_r$ ,  $t_f$ )
- Output timing voltage :  $1.65 V$  ( $t_{c(in)}$ ,  $t_{w(half)}$ )

**MITSUBISHI MICROCOMPUTERS**  
**M37902FCMHP, M37902FGMHP**

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

**Switching characteristics** ( $V_{CC} = 3.3 V \pm 0.3 V$ ,  $V_{SS} = 0 V$ ,  $T_a = -20$  to  $85^\circ C$ ,  $f(f_{sys}) = 20$  MHz, unless otherwise noted)

| Symbol              | Parameter  |   | Limits             |            | Unit |
|---------------------|--|---|--------------------|------------|------|
|                     |  |   | Min.               | Max.       |      |
| td( $\phi$ 1-RDL)   | Read low-level output delay time   |   | -18                | 0          | ns   |
| td( $\phi$ 1-RDH)   | Read high-level output delay time  |   | -18                | 0          | ns   |
| td( $\phi$ 1-BXWL)  | Write low-level output delay time  |   | -18                | 0          | ns   |
| td( $\phi$ 1-BXWH)  | Write high-level output delay time   |   | -18                | 0          | ns   |
| td( $\phi$ 1L-CSiL) | Chip select low-level output delay time  |   | -20                | 0          | ns   |
| td( $\phi$ 1L-CSiH) | Chip select high-level output delay time   |   | -22                | 10         | ns   |
| td( $\phi$ 1H-A)    | Address output delay time (the address output select bit = 0)                                  |   | -5                 | 25         | ns   |
| td( $\phi$ 1L-A)    | Address output delay time (the address output select bit = 1)                                  |   | -20                | 16         | ns   |
| tw(ALEH)            | ALE pulse width  | Bus cycle = $1\phi + 1\phi$ , $1\phi + 2\phi$ , $1\phi + 3\phi$                   | 0.5tc-19           |            | ns   |
|                     |  | Bus cycle = $2\phi + 2\phi$   | tc-20              |            | ns   |
|                     |  | Bus cycle = $2\phi + 3\phi$ , $2\phi + 4\phi$ , $3\phi + 3\phi$ , $3\phi + 4\phi$ | 1.5tc-20           |            | ns   |
| td(A-ALEL)          | ALE completion delay time after address stabilization (when the address output select bit = 0) | Bus cycle = $1\phi + 1\phi$ , $1\phi + 2\phi$ , $1\phi + 3\phi$                   | tc-30              |            | ns   |
|                     |  | Bus cycle = $2\phi + 2\phi$   | 1.5tc-30           |            | ns   |
|                     |  | Bus cycle = $2\phi + 3\phi$ , $2\phi + 4\phi$ , $3\phi + 3\phi$ , $3\phi + 4\phi$ | 2tc-30             |            | ns   |
|                     | ALE completion delay time after address stabilization (when the address output select bit = 1) | Bus cycle = $1\phi + 1\phi$ , $1\phi + 2\phi$ , $1\phi + 3\phi$                   | 0.5tc-19           |            | ns   |
|                     |  | Bus cycle = $2\phi + 2\phi$   | tc-20              |            | ns   |
|                     |  | Bus cycle = $2\phi + 3\phi$ , $2\phi + 4\phi$ , $3\phi + 3\phi$ , $3\phi + 4\phi$ | 1.5tc-20           |            | ns   |
| tw(RDL)             | Read output pulse width  |   | WL X tc-15         |            | ns   |
| tw(RDH)             | Read output high-level width (Note 1)  |   | WH X tc-15         |            | ns   |
| td(RDH-BXWH)        | Write disable valid time after read (Note 2)   |   | tc-15              |            | ns   |
| td(A-RDH)           | Address valid time before read (when the address output select bit = 0)                        |   | WH X tc-30         |            | ns   |
| td(A-RDH)           | Address valid time before read (when the address output select bit = 1)                        |   | (WH-0.5)tc-19      |            | ns   |
| th(RDH-A)           | Address hold time after read (when the address output select bit = 0) (Note 2)                 |   | 8                  |            | ns   |
| th(RDH-A)           | Address hold time after read (when the address output select bit = 1) (Note 2)                 |   | 0.5tc-10           |            | ns   |
| td(RDH-ALEL)        | ALE completion delay time after read start   |   |                    | 20         | ns   |
| td(ALEL-RDH)        | Read disable valid time after ALE completion   | Bus cycle = $2\phi + 2\phi$   | 0.5tc-19           |            | ns   |
|                     |  | Bus cycle = $3\phi + 3\phi$ , $3\phi + 4\phi$                                     | tc-15              |            | ns   |
| td(CSiL-RDH)        | Chip select valid time before read   |   | (WH-0.5)tc-19      |            | ns   |
| td(CSiL-RDL)        | Chip select output valid time before read completion   |   | (WH + WL-0.5)tc-20 |            | ns   |
| th(RDH-CSiL)        | Chip select hold time after read   |   | 0.5tc-14           |            | ns   |
| td(RDH-D)           | Next write cycle data output delay time after read (Note 2)                                    |   | tc-15              |            | ns   |
| tw(BXWL)            | Write output pulse width   |   | WL X tc-15         |            | ns   |
| tw(BXWH)            | Write output high-level width (Note 1)   |   | WH X tc-15         |            | ns   |
| td(BXWH-RDH)        | Read disable valid time after write (Note 2)   |   | tc-15              |            | ns   |
| td(A-BXWH)          | Address valid time before write (when the address output select bit = 0)                       |   | WH X tc-30         |            | ns   |
| td(A-BXWH)          | Address valid time before write (when the address output select bit = 1)                       |   | (WH-0.5)tc-19      |            | ns   |
| th(BXWH-A)          | Address hold time after write (when the address output select bit = 0) (Note 2)                |   | 8                  |            | ns   |
| th(BXWH-A)          | Address hold time after write (when the address output select bit = 1) (Note 2)                |   | 0.5tc-10           |            | ns   |
| td(BXWH-ALEL)       | ALE completion delay time after write start  |   |                    | 20         | ns   |
| td(ALEL-BXWH)       | Write disable valid time after ALE completion  | Bus cycle = $2\phi + 2\phi$   | 0.5tc-19           |            | ns   |
|                     |  | Bus cycle = $2\phi + 3\phi$ , $2\phi + 4\phi$ , $3\phi + 3\phi$ , $3\phi + 4\phi$ | tc-15              |            | ns   |
| td(CSiL-BXWH)       | Chip select valid time before write  |   | (WH-0.5)tc-19      |            | ns   |
| td(CSiL-BXWL)       | Chip select output valid time before write completion  |   | (WH + WL-0.5)tc-20 |            | ns   |
| th(BXWH-CSiL)       | Chip select hold time after write  |   | 0.5tc-14           |            | ns   |
| td(D-BXWL)          | Data output valid time before write completion   |   | WL X tc-20         |            | ns   |
| th(BXWH-D)          | Data hold time after write (Note 3)  |   | 0.5tc-10           |            | ns   |
| tpxz(BXWH-DZ)       | Floating start delay time after write (Note 3)   |   |                    | 0.5tc + 10 | ns   |

**Notes 1:** When the bus cycle just before this parameter is for the area where the recovery cycle insertion is selected, this parameter is extended by tc (ns: one recovery cycle is inserted.) or by 2tc (ns: two recovery cycles are inserted.).

**2:** When accessing the area where the recovery cycle insertion is selected, this parameter is extended by tc (ns: one recovery cycle is inserted.) or by 2tc (ns: two recovery cycles are inserted.).

**3:** This parameter is extended by tc (ns) when both of the following conditions are satisfied:

- When accessing the area where the recovery cycle insertion is selected.
- When two recovery cycles are inserted.

**MITSUBISHI MICROCOMPUTERS**  
**M37902FCMHP, M37902FGMHP**

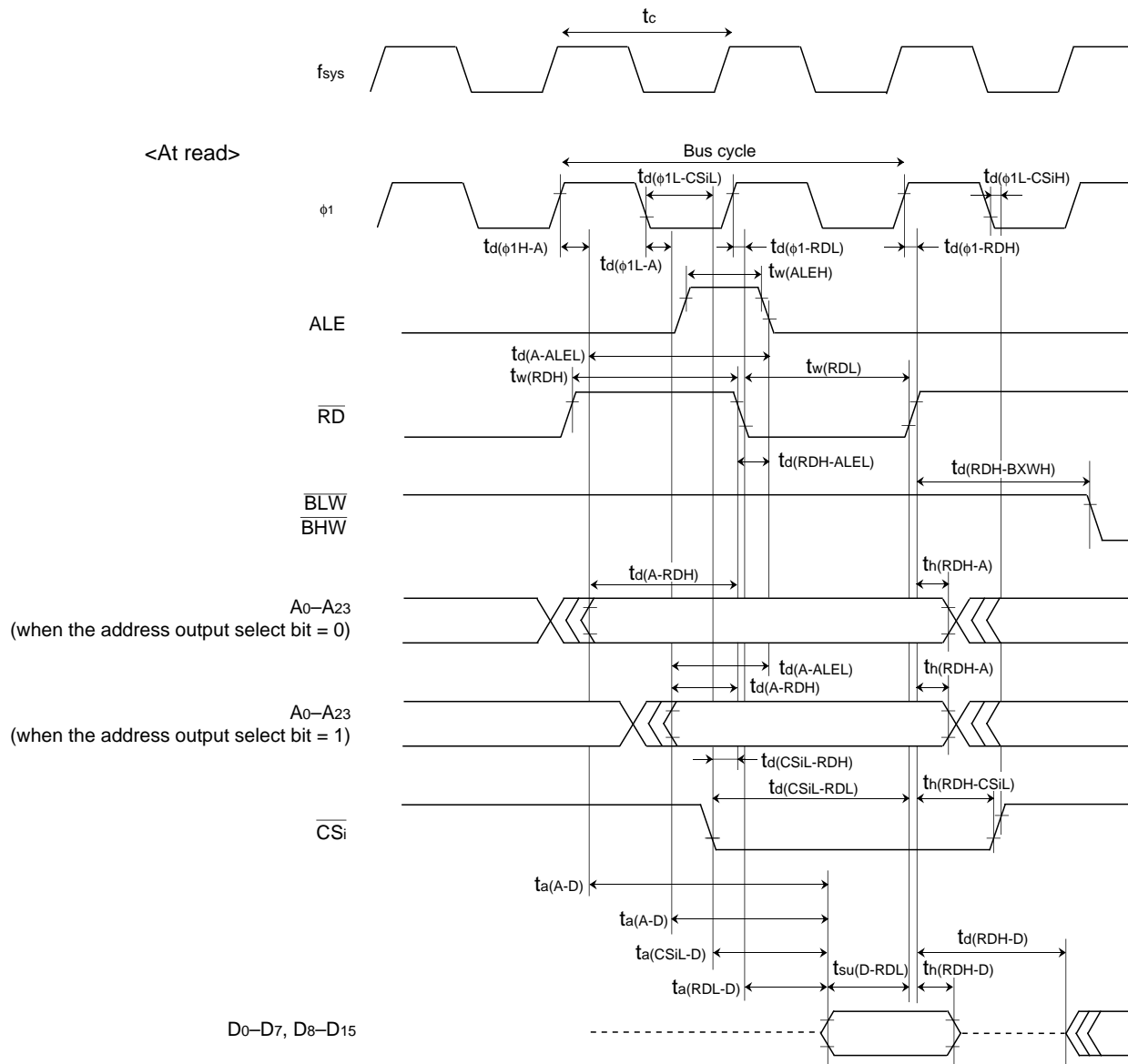
SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

**Switching characteristics** ( $V_{CC} = 3.3 V \pm 0.3 V$ ,  $V_{SS} = 0 V$ ,  $T_a = -20$  to  $85$  °C,  $f(f_{sys}) = 20$  MHz, unless otherwise noted)

| Symbol             | Parameter   |   | Limits                  |      | Unit |
|--------------------|---|---|-------------------------|------|------|
|                    |   |   | Min.                    | Max. |      |
| $t_d(LA-RDH)$      | Address valid time before read                        |   | $(WH-0.5)t_c-19$ (Note) |      | ns   |
| $t_d(LA-ALEL)$     | ALE completion delay time after address stabilization | Bus cycle = $2\phi + 2\phi$                   | $t_c-20$ (Note)         |      | ns   |
|                    |   | Bus cycle = $3\phi + 3\phi$ , $3\phi + 4\phi$ | $1.5t_c-20$ (Note)      |      | ns   |
| $t_h(ALEL-LA)$     | Address hold time after ALE completion                | Bus cycle = $2\phi + 2\phi$                   | $0.5t_c-19$             |      | ns   |
|                    |   | Bus cycle = $3\phi + 3\phi$ , $3\phi + 4\phi$ | $t_c-15$                |      | ns   |
| $t_{pxz}(RDH-LAZ)$ | Floating start delay time                             |   |                         | 5    | ns   |
| $t_d(LA-BXWH)$     | Address valid time before write                       |   | $(WH-0.5)t_c-19$ (Note) |      | ns   |
| $t_{pzx}(RDH-DZ)$  | Floating release delay time                           |   | $0.5t_c-19$ (Note)      |      | ns   |

**Note:** This is independent of the address output select bit's contents.

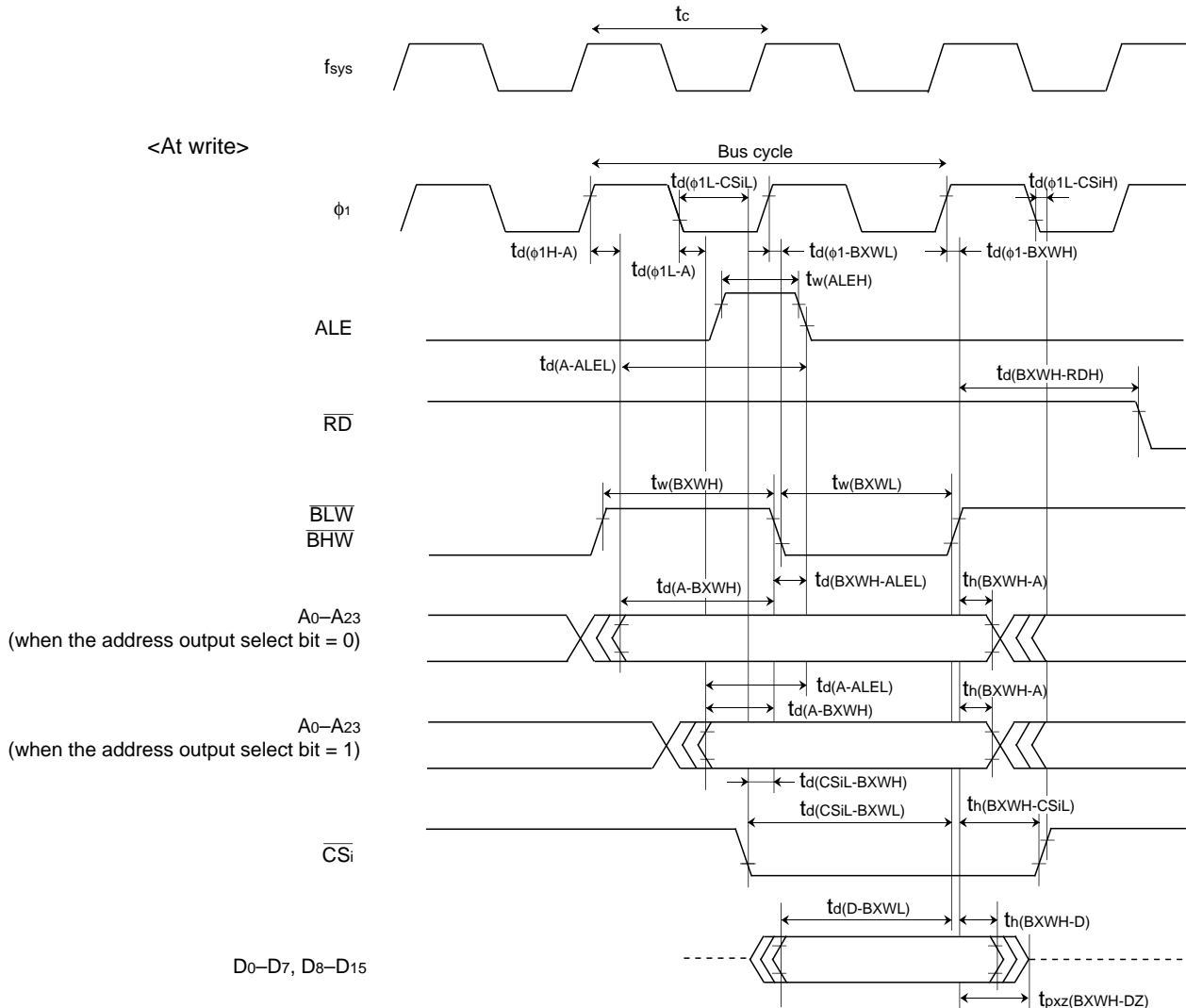
Normal access: bus cycle =  $1\phi + 1\phi$ ,  $1\phi + 2\phi$ ,  $1\phi + 3\phi$ ,  
 $2\phi + 3\phi$ , or  $2\phi + 4\phi$



**Test conditions**

- $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $T_a = -20\text{ to }85\text{ }^\circ\text{C}$
- Input timing voltage :  $V_{IL}=0.53\text{ V}$ ,  $V_{IH}=1.65\text{ V}$
- Output timing voltage:  $V_{OL}=0.8\text{ V}$ ,  $V_{OH}=2.0\text{ V}$ ,  $C_L=15\text{ pF}$  ( $\overline{CSi}$ )
- Output timing voltage:  $V_{OL}=0.8\text{ V}$ ,  $V_{OH}=2.0\text{ V}$ ,  $C_L=50\text{ pF}$  (except for  $\overline{CSi}$ )

Normal access: bus cycle =  $1\phi + 1\phi$ ,  $1\phi + 2\phi$ ,  $1\phi + 3\phi$ ,  
 $2\phi + 3\phi$ , or  $2\phi + 4\phi$



**Test conditions**

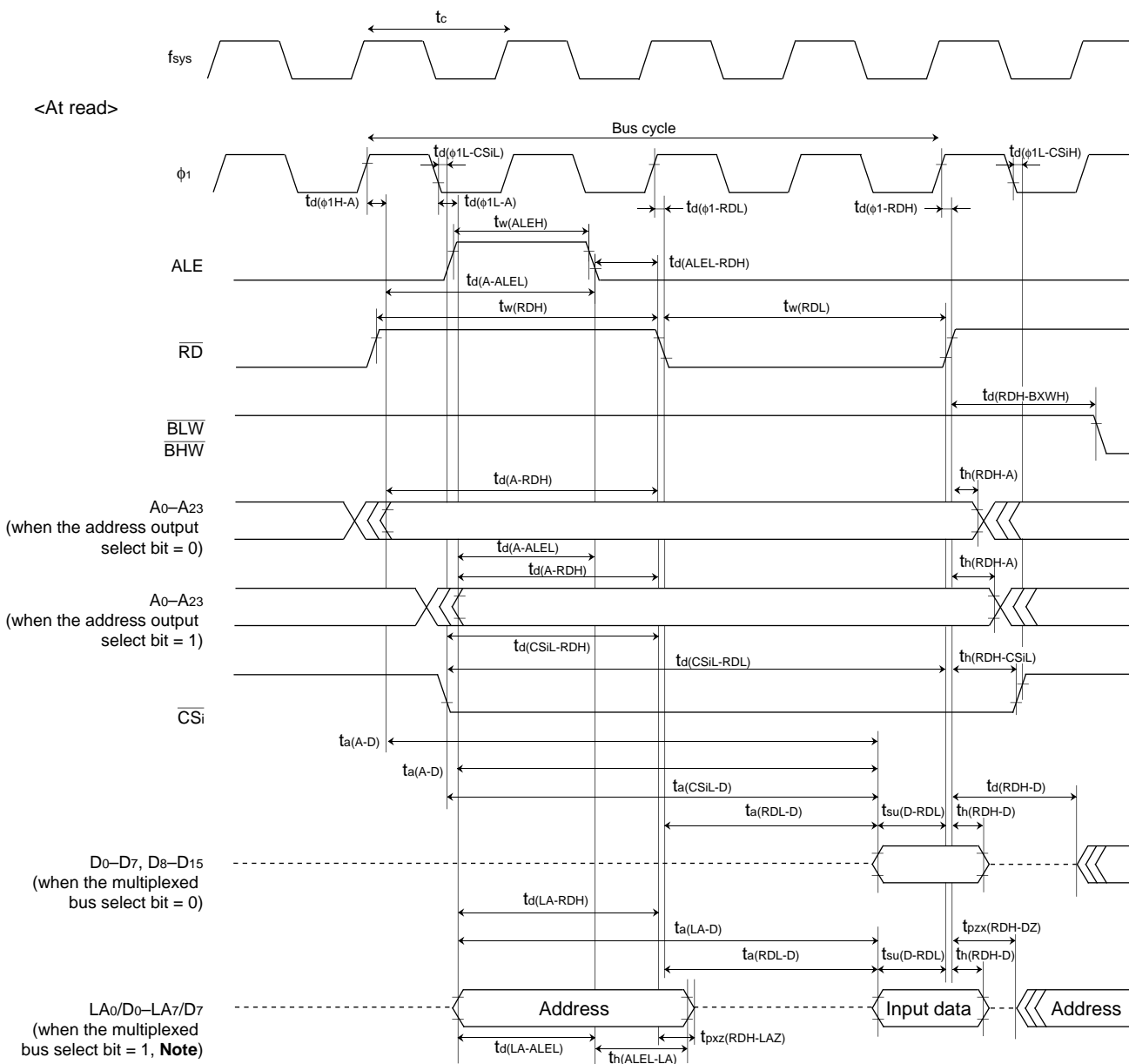
- $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $T_a = -20 \text{ to } 85 \text{ }^\circ\text{C}$
- Input timing voltage :  $V_{IL}=0.53 \text{ V}$ ,  $V_{IH}=1.65 \text{ V}$
- Output timing voltage:  $V_{OL}=0.8 \text{ V}$ ,  $V_{OH}=2.0 \text{ V}$ ,  $C_L=15 \text{ pF}$  ( $\overline{CS}_i$ )
- Output timing voltage:  $V_{OL}=0.8 \text{ V}$ ,  $V_{OH}=2.0 \text{ V}$ ,  $C_L=50 \text{ pF}$  (except for  $\overline{CS}_i$ )

# MITSUBISHI MICROCOMPUTERS

## M37902FCMHP, M37902FGMHP

SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

Normal access: bus cycle =  $2\phi + 2\phi, 3\phi + 3\phi, 3\phi + 4\phi$

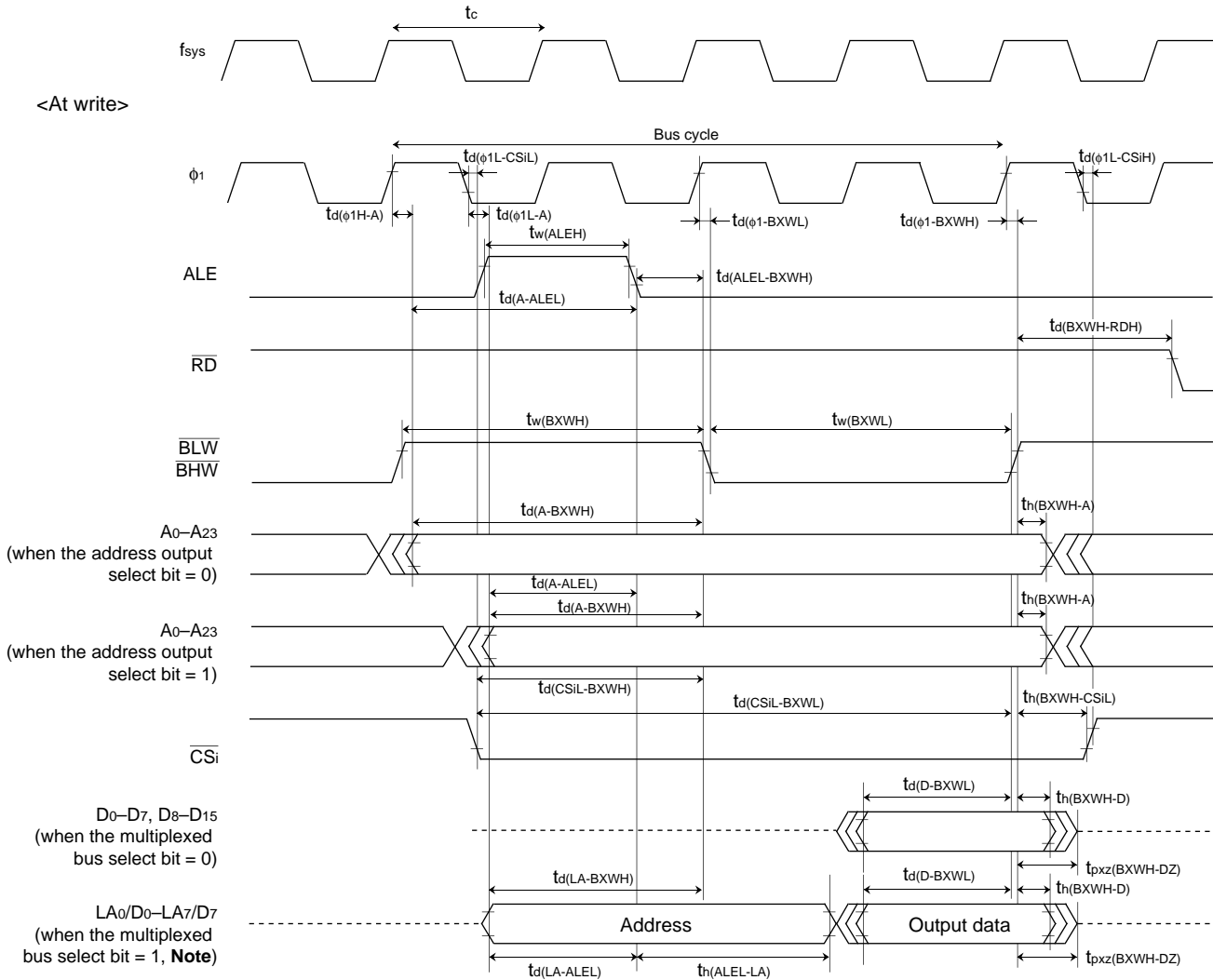


**Note:** Valid only when area  $\overline{CS}_2$  is accessed with the external data bus width = 8 bits.

### Test conditions

- $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $T_a = -20 \text{ to } 85 \text{ }^\circ\text{C}$
- Input timing voltage :  $V_{IL} = 0.53 \text{ V}$ ,  $V_{IH} = 1.65 \text{ V}$
- Output timing voltage:  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 15 \text{ pF}$  ( $\overline{CS}_i$ )
- Output timing voltage:  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 50 \text{ pF}$  (except for  $\overline{CS}_i$ )

Normal access: bus cycle =  $2\phi + 2\phi, 3\phi + 3\phi, 3\phi + 4\phi$

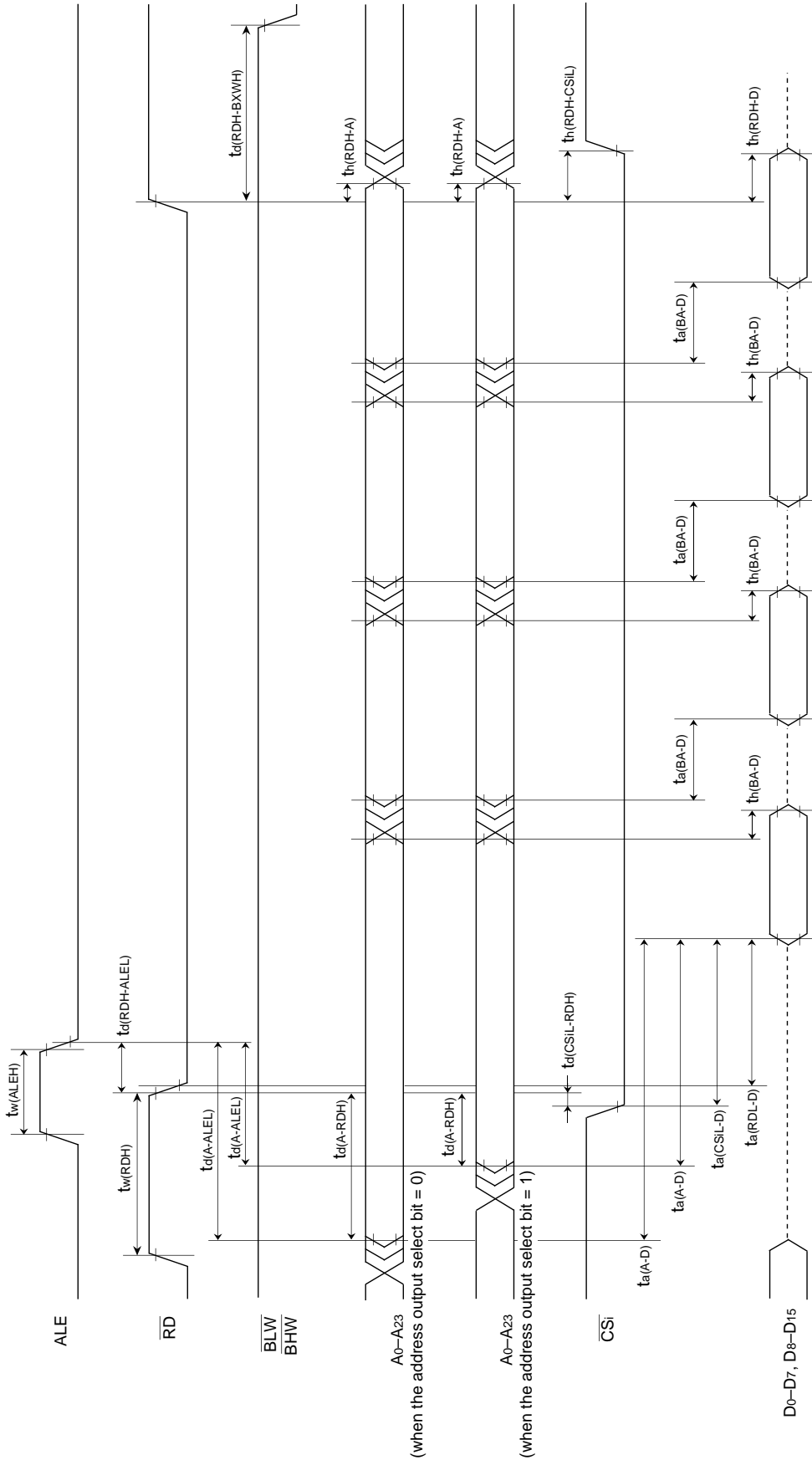


**Note:** Valid only when area  $\overline{CS}_2$  is accessed with the external data bus width = 8 bits.

Test conditions

- $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $T_a = -20\text{ to }85\text{ }^\circ\text{C}$
- Input timing voltage :  $V_{IL}=0.53\text{ V}$ ,  $V_{IH}=1.65\text{ V}$
- Output timing voltage:  $V_{OL}=0.8\text{ V}$ ,  $V_{OH}=2.0\text{ V}$ ,  $C_L=15\text{ pF}$  ( $\overline{CS}_i$ )
- Output timing voltage:  $V_{OL}=0.8\text{ V}$ ,  $V_{OH}=2.0\text{ V}$ ,  $C_L=50\text{ pF}$  (except for  $\overline{CS}_i$ )

Burst ROM access: bus cycle =  $1\phi + 1\phi, 1\phi + 2\phi, 1\phi + 3\phi, 2\phi + 3\phi, 2\phi + 4\phi$



Test conditions

- $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $T_a = -20 \text{ to } 85^\circ\text{C}$
- Input timing voltage:  $V_{IL} = 0.53 \text{ V}$ ,  $V_{IH} = 1.65 \text{ V}$
- Output timing voltage:  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 15 \text{ pF}$  (CSi)
- Output timing voltage:  $V_{OL} = 0.8 \text{ V}$ ,  $V_{OH} = 2.0 \text{ V}$ ,  $C_L = 50 \text{ pF}$  (except for CSi)



# MITSUBISHI MICROCOMPUTERS

## M37902FCMHP, M37902FGMHP

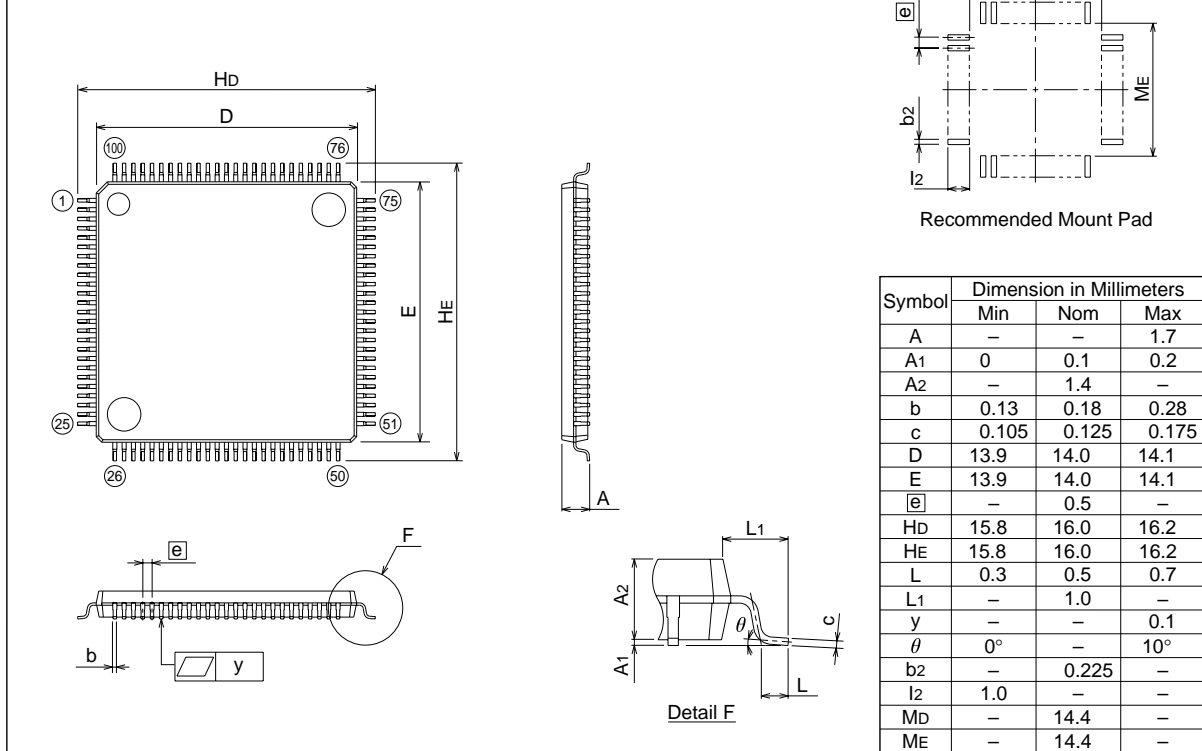
SINGLE-CHIP 16-BIT CMOS MICROCOMPUTER

### PACKAGE OUTLINE

#### 100P6Q-A

Plastic 100pin 14X14mm body LQFP

|                     |            |           |               |
|---------------------|------------|-----------|---------------|
| EIAJ Package Code   | JEDEC Code | Weight(g) | Lead Material |
| LQFP100-P-1414-0.50 | -          |           | Cu Alloy      |



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|                  |                       |
|------------------|-----------------------|
| Revision History | M37902FxmHP Datasheet |
|------------------|-----------------------|

| Rev. No.     | Revision Description   | Rev. date    |  |          |             |  |          |        |
|--------------|--|--------------|--|----------|-------------|--|----------|--------|
| 1.0          | First Edition  | 990305       |  |          |             |  |          |        |
| 2.0          | Refer to <b>Corrections and Supplementary Explanation for “M37902Fxm Datasheet (REV.A)”</b> .  | 990625       |  |          |             |  |          |        |
| 3.0          | <p>The following are revised/added points in this edition:</p> <ul style="list-style-type: none"> <li>• Page 20; <b>RECOMMENDED OPERATING CONDITIONS</b></li> </ul> <p>&lt;Error&gt;</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><math>f(f_{sys})</math></td> <td style="width: 60%;">External clock input frequency (<b>Note 2</b>)</td> <td style="width: 30%; text-align: center;">●●●●●●●●</td> </tr> </table> <p>&lt;Correction&gt;</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><math>f(X_{IN})</math></td> <td style="width: 60%;">External clock input frequency (<b>Note 2</b>)</td> <td style="width: 30%; text-align: center;">●●●●●●●●</td> </tr> </table> <ul style="list-style-type: none"> <li>• Page 21; the maximum value of <math>I_{CC}</math> is revised.</li> </ul> <p>&lt;Error&gt; <math>T_a = 25\text{ °C}</math> when clock is stopped : —<br/> <math>T_a = 85\text{ °C}</math> when clock is stopped : —</p> <p>&lt;Correction&gt; <math>T_a = 25\text{ °C}</math> when clock is stopped : <u>1</u><br/> <math>T_a = 85\text{ °C}</math> when clock is stopped : <u>20</u> </p> | $f(f_{sys})$ | External clock input frequency ( <b>Note 2</b> ) | ●●●●●●●● | $f(X_{IN})$ | External clock input frequency ( <b>Note 2</b> ) | ●●●●●●●● | 990917 |
| $f(f_{sys})$ | External clock input frequency ( <b>Note 2</b> )   | ●●●●●●●●     |  |          |             |  |          |        |
| $f(X_{IN})$  | External clock input frequency ( <b>Note 2</b> )   | ●●●●●●●●     |  |          |             |  |          |        |
| 4.0          | <p>Refer to <b>Corrections and Supplementary Explanation for “M37902Fxm Datasheet (REV.B)”</b>.</p> <p><b>Notes 1:</b> ★ represents the new information added in Rev.4.0.</p> <p><b>2:</b> The revised/added points informed in Rev.3.0 are included in <b>Corrections and Supplementary Explanation for “M37902Fxm Datasheet (REV.B)”</b>.</p>  | 000609       |  |          |             |  |          |        |
|              |  |              |  |          |             |  |          |        |

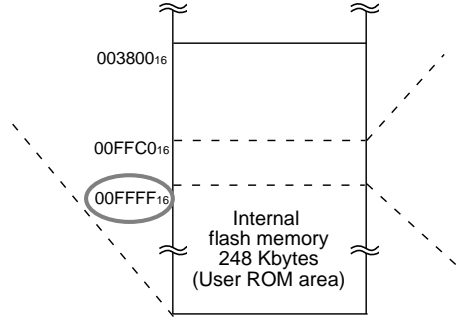
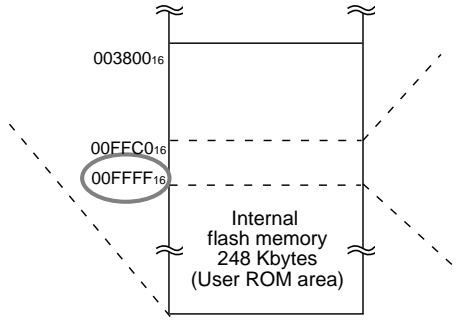
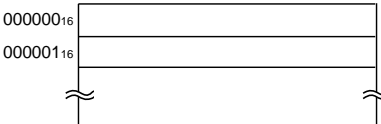
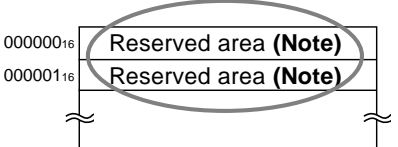
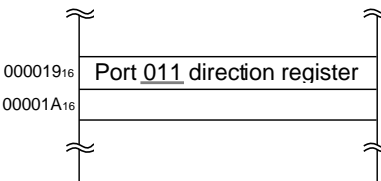
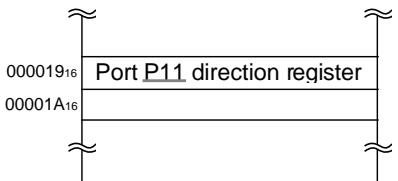
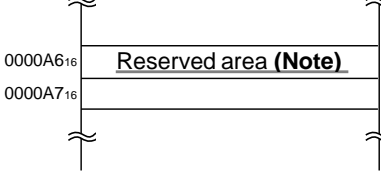
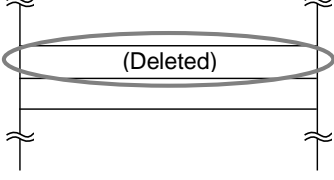
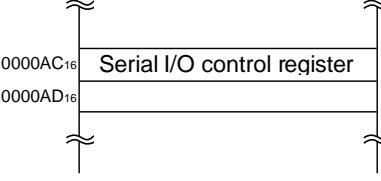
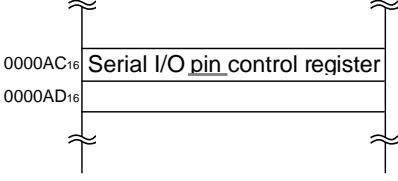
# Corrections and Supplementary Explanation for M37902Fxm Datasheet (REV.B) NO.1

| Page   | Error  | Correction   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|--|--|--|--------------|-----|-------------|-----------|------------|-------------|------------|------------|-------------|------------|------------|-------------|------------|------------|-------------|------------|-------------|-------------|------------|-------------|---|--|--------------|-----|-------------|------------|------------|-------------|------------|------------|
| ★ All pages, Header  | PRELIMINARY<br>Notice: This is not a final specification.<br>Some parametric limits are subject to change.   | (Deleted)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|  | <u>M37902F8MHP</u> , <u>M37902FCMHP</u> , <u>M37902FEMHP</u> ,<br><u>M37902FGMHP</u> , <u>M37902FHMHP</u> , <u>M37902FJMHP</u>   | M37902FCMHP, M37902FGMHP   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 1, DISTINCTIVE FEATURES ; Memory  | [M37902F8MHP]<br>Flash memory (User ROM area) .....60 Kbytes<br>RAM.....2048 bytes   | (Deleted)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|  | [M37902FEMHP]<br>Flash memory (User ROM area) .....184 Kbytes<br>RAM.....6144 bytes  | (Deleted)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|  | [M37902FHMHP]<br>Flash memory (User ROM area) .....370 Kbytes<br>RAM.....12288 bytes   | (Deleted)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|  | [M37902FJMHP]<br>Flash memory (User ROM area) .....498 Kbytes<br>RAM.....12288 bytes   | (Deleted)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 1, DISTINCTIVE FEATURES ; Instruction execution time                          | The fastest instruction at 26 MHz frequency .....38 ns   | The fastest instruction at 20 MHz frequency .....50 ns   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 1, APPLICATION  | Control devices for personal computer peripheral equipment such as CD-ROM drives, DVD-ROM drives, hard disk drives, high density FDD, printers<br>Control devices for office equipment such as copiers and facsimiles<br>Control devices for industrial equipment such as communication and measuring instruments  | Control devices for personal computer peripheral equipment such as CD-ROM drives, DVD-ROM drives, hard disk drives, high density FDD, printers |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 2, PIN CONFIGURATION  | <u>P63/INT2</u><br><br>(Type)<br><br>M37902F8MHP<br>M37902FCMHP<br>M37902FEMHP<br>M37902FGMHP<br>M37902FHMHP<br>M37902FJMHP  | <u>P64/INT2</u><br><br>(Type)<br><br>M37902FCMHP<br>M37902FGMHP  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 3, BLOCK DIAGRAM, Note:   | <b>Note:</b><br><table border="1"> <thead> <tr> <th></th> <th>Flash memory</th> <th>RAM</th> </tr> </thead> <tbody> <tr> <td>M37902F8MHP</td> <td>60 Kbytes</td> <td>2048 bytes</td> </tr> <tr> <td>M37902FCMHP</td> <td>120 Kbytes</td> <td>4096 bytes</td> </tr> <tr> <td>M37902FEMHP</td> <td>184 Kbytes</td> <td>6144 bytes</td> </tr> <tr> <td>M37902FGMHP</td> <td>248 Kbytes</td> <td>6144 bytes</td> </tr> <tr> <td>M37902FHMHP</td> <td>370 Kbytes</td> <td>12288 bytes</td> </tr> <tr> <td>M37902FJMHP</td> <td>498 Kbytes</td> <td>12288 bytes</td> </tr> </tbody> </table> |  | Flash memory | RAM | M37902F8MHP | 60 Kbytes | 2048 bytes | M37902FCMHP | 120 Kbytes | 4096 bytes | M37902FEMHP | 184 Kbytes | 6144 bytes | M37902FGMHP | 248 Kbytes | 6144 bytes | M37902FHMHP | 370 Kbytes | 12288 bytes | M37902FJMHP | 498 Kbytes | 12288 bytes | <b>Note:</b><br><table border="1"> <thead> <tr> <th></th> <th>Flash memory</th> <th>RAM</th> </tr> </thead> <tbody> <tr> <td>M37902FCMHP</td> <td>120 Kbytes</td> <td>4096 bytes</td> </tr> <tr> <td>M37902FGMHP</td> <td>248 Kbytes</td> <td>6144 bytes</td> </tr> </tbody> </table> |  | Flash memory | RAM | M37902FCMHP | 120 Kbytes | 4096 bytes | M37902FGMHP | 248 Kbytes | 6144 bytes |
|  | Flash memory   | RAM  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902F8MHP  | 60 Kbytes  | 2048 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FCMHP  | 120 Kbytes   | 4096 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FEMHP  | 184 Kbytes   | 6144 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FGMHP  | 248 Kbytes   | 6144 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FHMHP  | 370 Kbytes   | 12288 bytes  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FJMHP  | 498 Kbytes   | 12288 bytes  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
|  | Flash memory   | RAM  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FCMHP  | 120 Kbytes   | 4096 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| M37902FGMHP  | 248 Kbytes   | 6144 bytes   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 4, Instruction execution time   | 38 ns (the fastest instruction at $f(f_{sys}) = 26$ MHz)   | 50 ns (the fastest instruction at $f(f_{sys}) = 20$ MHz)   |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| ★ Page 4, External clock input frequency $f(XIN)$ , System clock frequency $f_{sys}$ | 26 MHz (Max.)  | 20 MHz (Max.)  |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |
| Page 4, Chip-select wait control   | Chip select area X 4 ( $\overline{CS0}-\overline{CS3}$ ). A wait number and bus width can be set for each chip select area.  | Chip select area X 4 ( $\overline{CS0}-\overline{CS3}$ ). A bus cycle type and bus width can be set for each chip select area.                 |              |     |             |           |            |             |            |            |             |            |            |             |            |            |             |            |             |             |            |             |   |  |              |     |             |            |            |             |            |            |

# Corrections and Supplementary Explanation for M37902F<sub>x</sub>M Datasheet (REV.B) NO.2

| Page                                       | Error   | Correction  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|--|---|---|----------------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|-----------------|---|---------------|-------------|----------------|-------------|----------------|------------|-------------|------------|-------------|-------------|-------------|-------------|--|------------------------------|-------------|------------|-------------|------------|-----|-------------|------------|-------------|------------|
| ★ Page 4, Power dissipation                | 51.5 mW (at f(f <sub>sys</sub> ) = 26 MHz, Typ., .....  | 39.6 mW (at f(f <sub>sys</sub> ) = 20 MHz, Typ., .....  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ Page 4, Operating temperature range      | Operating temperature range   | Operating <u>ambient</u> temperature range  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ Page 4, Note:                            | <p><b>Note:</b></p> <table border="1"> <tr><td rowspan="5">Flash memory (User ROM area)</td><td>M37902F8MHP</td><td>60 Kbytes</td></tr> <tr><td>M37902FCMHP</td><td>120 Kbytes</td></tr> <tr><td>M37902FEMHP</td><td>184 Kbytes</td></tr> <tr><td>M37902FGMHP</td><td>248 Kbytes</td></tr> <tr><td>M37902FHMHP</td><td>370 Kbytes</td></tr> <tr><td rowspan="5">RAM</td><td>M37902FJMHP</td><td>498 Kbytes</td></tr> <tr><td>M37902F8MHP</td><td>2048 bytes</td></tr> <tr><td>M37902FCMHP</td><td>4096 bytes</td></tr> <tr><td>M37902FEMHP</td><td>6144 bytes</td></tr> <tr><td>M37902FGMHP</td><td>6144 bytes</td></tr> <tr><td>M37902FHMHP</td><td>12288 bytes</td></tr> <tr><td>M37902FJMHP</td><td>12288 bytes</td></tr> </table> | Flash memory (User ROM area)  | M37902F8MHP    | 60 Kbytes      | M37902FCMHP | 120 Kbytes     | M37902FEMHP | 184 Kbytes     | M37902FGMHP | 248 Kbytes     | M37902FHMHP | 370 Kbytes     | RAM         | M37902FJMHP     | 498 Kbytes  | M37902F8MHP   | 2048 bytes  | M37902FCMHP    | 4096 bytes  | M37902FEMHP    | 6144 bytes | M37902FGMHP | 6144 bytes | M37902FHMHP | 12288 bytes | M37902FJMHP | 12288 bytes | <p><b>Note:</b></p> <table border="1"> <tr><td rowspan="2">Flash memory (User ROM area)</td><td>M37902FCMHP</td><td>120 Kbytes</td></tr> <tr><td>M37902FGMHP</td><td>248 Kbytes</td></tr> <tr><td rowspan="2">RAM</td><td>M37902FCMHP</td><td>4096 bytes</td></tr> <tr><td>M37902FGMHP</td><td>6144 bytes</td></tr> </table> | Flash memory (User ROM area) | M37902FCMHP | 120 Kbytes | M37902FGMHP | 248 Kbytes | RAM | M37902FCMHP | 4096 bytes | M37902FGMHP | 6144 bytes |
| Flash memory (User ROM area)               | M37902F8MHP   |   | 60 Kbytes      |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FCMHP   |   | 120 Kbytes     |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FEMHP   |   | 184 Kbytes     |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   |   | 248 Kbytes     |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FHMHP   | 370 Kbytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| RAM  | M37902FJMHP   | 498 Kbytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902F8MHP   | 2048 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FCMHP   | 4096 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FEMHP   | 6144 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   | 6144 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| M37902FHMHP                                | 12288 bytes   |   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| M37902FJMHP                                | 12288 bytes   |   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| Flash memory (User ROM area)               | M37902FCMHP   | 120 Kbytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   | 248 Kbytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| RAM  | M37902FCMHP   | 4096 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   | 6144 bytes  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ Page 5, Notes 1:                         | <table border="1"> <tr><td rowspan="6">User ROM area</td><td>M37902F8MHP</td><td>4 blocks .....</td></tr> <tr><td>M37902FCMHP</td><td>5 blocks .....</td></tr> <tr><td>M37902FEMHP</td><td>6 blocks .....</td></tr> <tr><td>M37902FGMHP</td><td>7 blocks .....</td></tr> <tr><td>M37902FHMHP</td><td>9 blocks .....</td></tr> <tr><td>M37902FJMHP</td><td>11 blocks .....</td></tr> </table>  | User ROM area   | M37902F8MHP    | 4 blocks ..... | M37902FCMHP | 5 blocks ..... | M37902FEMHP | 6 blocks ..... | M37902FGMHP | 7 blocks ..... | M37902FHMHP | 9 blocks ..... | M37902FJMHP | 11 blocks ..... | <table border="1"> <tr><td rowspan="2">User ROM area</td><td>M37902FCMHP</td><td>5 blocks .....</td></tr> <tr><td>M37902FGMHP</td><td>7 blocks .....</td></tr> </table> | User ROM area | M37902FCMHP | 5 blocks ..... | M37902FGMHP | 7 blocks ..... |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| User ROM area                              | M37902F8MHP   |   | 4 blocks ..... |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FCMHP   |   | 5 blocks ..... |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FEMHP   |   | 6 blocks ..... |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   |   | 7 blocks ..... |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FHMHP   |   | 9 blocks ..... |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FJMHP   | 11 blocks .....   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| User ROM area                              | M37902FCMHP   | 5 blocks .....  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | M37902FGMHP   | 7 blocks .....  |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ Page 6, P4 <sub>0</sub> –P4 <sub>7</sub> | <p>.....</p> <p>■ In microprocessor mode</p> <p>..... According to the register setting, P4<sub>0</sub>–P4<sub>4</sub> also .....</p>   | <p>.....</p> <p>■ In microprocessor mode</p> <p>..... According to the register setting, P4<sub>0</sub>–P4<sub>3</sub> also .....</p> |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ ———                                      | Memory map of M37902F8MHP (Single-chip mode)  | (Deleted)   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ Page 9, Fig. 1                           | <p>Fig. 2. Memory map of M37902FCMHP (Single-chip mode)</p>   | <p>Fig. 1. Memory map of M37902FCMHP (Single-chip mode)</p>   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
| ★ ———                                      | Memory map of M37902FEMHP (Single-chip mode)  | (Deleted)   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | Memory map of M37902FHMHP (Single-chip mode)  | (Deleted)   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |
|  | Memory map of M37902FJMHP (Single-chip mode)  | (Deleted)   |                |                |             |                |             |                |             |                |             |                |             |                 |   |               |             |                |             |                |            |             |            |             |             |             |             |  |                              |             |            |             |            |     |             |            |             |            |

# Corrections and Supplementary Explanation for M37902Fxm Datasheet (REV.B) NO.3

| Page                     | Error   | Correction   |
|--------------------------|---|--|
| ★<br>Page 10,<br>Fig. 2  | Fig. 4. Memory map of M37902FGMHP (Single-chip mode)<br> | Fig. 2. Memory map of M37902FGMHP (Single-chip mode)<br> |
| ★<br>Page 11,<br>Fig. 7  | address 00 <sub>16</sub> , 01 <sub>16</sub><br>          |    |
|                          | address 19 <sub>16</sub><br>                            |   |
| ★<br>Page 12,<br>Fig. 8  | address A6 <sub>16</sub><br>                           |   |
|                          | address AC <sub>16</sub> , AD <sub>16</sub><br>        |    |
| ★                        | M37902F8MHP : block configuration of internal flash memory  | (Deleted)  |
|                          | M37902FEMHP : block configuration of internal flash memory  | (Deleted)  |
| ★<br>Page 13,<br>Fig. 9  | Fig. 10. M37902FCMHP : block configuration of internal flash memory   | Fig. 9. M37902FCMHP : block configuration of internal flash memory   |
| ★<br>Page 14,<br>Fig. 10 | Fig. 12. M37902FGMHP : block configuration of internal flash memory   | Fig. 10. M37902FGMHP : block configuration of internal flash memory  |
| ★                        | M37902FHMHP : block configuration of internal flash memory  | (Deleted)  |
|                          | M37902FJMHP : block configuration of internal flash memory  | (Deleted)  |

# Corrections and Supplementary Explanation for M37902FxM Datasheet (REV.B) NO.4

| Page  | Error  | Correction   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|---|--|--|-----------------|---------|------|----------------|-------------------|-------------------|-------------------------------|---------------------|---|--|-------|---|----------------------|---|---------|-----------------|----------------|---|------------------------|-----------|-------------------|-------------------------------|------|------------------------|------|-------|---------------------|---|--------|-----------------|--------|----------------------|------------------------|------|------|------|-----------------|---|--|----|----|-----------------|-------|--|--|--|--|------------------------|--|---|----|--|------------------------|--|----|--|
| ★ Page 15<br>DC Electrical Characteristics;<br>AC Electrical Characteristics                | (V <sub>CC</sub> = 3.3 V ± 0.3 V, T <sub>a</sub> = 0 to 60 °C, f(f <sub>sys</sub> ) = 26 MHz (Note))   | (V <sub>CC</sub> = 3.3 V ± 0.3 V, T <sub>a</sub> = 0 to 60 °C, f(f <sub>sys</sub> ) = 20 MHz (Note))   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| ★ Page 16,<br>ABSOLUTE<br>MAXIMUM<br>RATINGS  | <table border="1"> <thead> <tr> <th>Symbol</th> <th>Parameter</th> <th>Ratings</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>P<sub>d</sub></td> <td>Power dissipation</td> <td>300</td> <td>mW</td> </tr> <tr> <td>T<sub>opr</sub></td> <td>Operating temperature</td> <td></td> <td></td> </tr> </tbody> </table>  | Symbol   | Parameter       | Ratings | Unit | P <sub>d</sub> | Power dissipation | 300               | mW                            | T <sub>opr</sub>    | Operating temperature                           |  |       | <table border="1"> <thead> <tr> <th>Symbol</th> <th>Parameter</th> <th>Ratings</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>P<sub>d</sub></td> <td>Power dissipation</td> <td>400</td> <td>mW</td> </tr> <tr> <td>T<sub>opr</sub></td> <td>Operating ambient temperature</td> <td></td> <td></td> </tr> </tbody> </table> | Symbol               | Parameter   | Ratings | Unit            | P <sub>d</sub> | Power dissipation   | 400                    | mW        | T <sub>opr</sub>  | Operating ambient temperature |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Parameter  | Ratings  | Unit            |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| P <sub>d</sub>  | Power dissipation  | 300  | mW              |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| T <sub>opr</sub>  | Operating temperature  |  |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Parameter  | Ratings  | Unit            |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| P <sub>d</sub>  | Power dissipation  | 400  | mW              |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| T <sub>opr</sub>  | Operating ambient temperature  |  |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| ★ Page 16,<br>RECOMMENDED<br>OPERATING<br>CONDITIONS  | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="3">Limits</th> </tr> <tr> <th>Max.</th> <th>Typ.</th> <th>Min.</th> </tr> </thead> <tbody> <tr> <td>f(X<sub>IN</sub>)</td> <td>External clock input frequency<br/>(Note 2)</td> <td></td> <td></td> <td>26</td> </tr> <tr> <td>f(f<sub>sys</sub>)</td> <td>System clock frequency</td> <td></td> <td></td> <td>26</td> </tr> </tbody> </table> <p>2: ....., be sure that f(f<sub>sys</sub>) = 26 MHz or less.</p>  | Symbol   | Parameter       | Limits  |      |                | Max.              | Typ.              | Min.                          | f(X <sub>IN</sub> ) | External clock input frequency<br>(Note 2)      |  |       | 26  | f(f <sub>sys</sub> ) | System clock frequency  |         |                 | 26             | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="3">Limits</th> </tr> <tr> <th>Max.</th> <th>Typ.</th> <th>Min.</th> </tr> </thead> <tbody> <tr> <td>f(X<sub>IN</sub>)</td> <td>External clock input frequency<br/>(Note 2)</td> <td></td> <td></td> <td>20</td> </tr> <tr> <td>f(f<sub>sys</sub>)</td> <td>System clock frequency</td> <td></td> <td></td> <td>20</td> </tr> </tbody> </table> <p>2: ....., be sure that f(f<sub>sys</sub>) = 20 MHz or less.</p> | Symbol                 | Parameter | Limits            |                               |      | Max.                   | Typ. | Min.  | f(X <sub>IN</sub> ) | External clock input frequency<br>(Note 2)  |        |                 | 20     | f(f <sub>sys</sub> ) | System clock frequency |      |      | 20   |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Parameter  |  |                 | Limits  |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Max.   | Typ.            | Min.    |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| f(X <sub>IN</sub> )   | External clock input frequency<br>(Note 2)   |  |                 | 26      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| f(f <sub>sys</sub> )  | System clock frequency   |  |                 | 26      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Parameter  | Limits   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Max.   | Typ.            | Min.    |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| f(X <sub>IN</sub> )   | External clock input frequency<br>(Note 2)   |  |                 | 20      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| f(f <sub>sys</sub> )  | System clock frequency   |  |                 | 20      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| ★ Page 17,<br>DC ELECTRICAL<br>CHARACTERISTICS  | <p>(V<sub>CC</sub> = 3.3 V, V<sub>SS</sub> = 0 V, ..... f(f<sub>sys</sub>) = 26 MHz (Note))</p> <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Test conditions</th> <th colspan="3">Limits</th> </tr> <tr> <th>Min.</th> <th>Typ.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>I<sub>CC</sub></td> <td>f(f<sub>sys</sub>) = 26 MHz,<br/>CPU operates.</td> <td></td> <td>15.6</td> <td>31.2</td> </tr> </tbody> </table> <table border="1"> <tbody> <tr> <td>I<sub>CC</sub></td> <td>.....</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>T<sub>a</sub> = 25 °C</td> <td></td> <td>—</td> <td>μA</td> </tr> <tr> <td></td> <td>T<sub>a</sub> = 85 °C</td> <td></td> <td>—</td> <td></td> </tr> </tbody> </table> | Symbol   | Test conditions | Limits  |      |                | Min.              | Typ.              | Max.                          | I <sub>CC</sub>     | f(f <sub>sys</sub> ) = 26 MHz,<br>CPU operates. |  | 15.6  | 31.2  | I <sub>CC</sub>      | .....   |         |                 |                |   | T <sub>a</sub> = 25 °C |           | —                 | μA                            |      | T <sub>a</sub> = 85 °C |      | —     |                     | <p>(V<sub>CC</sub> = 3.3 V, V<sub>SS</sub> = 0 V, ..... f(f<sub>sys</sub>) = 20 MHz (Note))</p> <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Test conditions</th> <th colspan="3">Limits</th> </tr> <tr> <th>Min.</th> <th>Typ.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>I<sub>CC</sub></td> <td>f(f<sub>sys</sub>) = 20 MHz,<br/>CPU operates.</td> <td></td> <td>12</td> <td>24</td> </tr> </tbody> </table> <table border="1"> <tbody> <tr> <td>I<sub>CC</sub></td> <td>.....</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>T<sub>a</sub> = 25 °C</td> <td></td> <td>1</td> <td>μA</td> </tr> <tr> <td></td> <td>T<sub>a</sub> = 85 °C</td> <td></td> <td>20</td> <td></td> </tr> </tbody> </table> | Symbol | Test conditions | Limits |                      |                        | Min. | Typ. | Max. | I <sub>CC</sub> | f(f <sub>sys</sub> ) = 20 MHz,<br>CPU operates. |  | 12 | 24 | I <sub>CC</sub> | ..... |  |  |  |  | T <sub>a</sub> = 25 °C |  | 1 | μA |  | T <sub>a</sub> = 85 °C |  | 20 |  |
| Symbol  | Test conditions  |  |                 | Limits  |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Min.   | Typ.            | Max.    |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| I <sub>CC</sub>   | f(f <sub>sys</sub> ) = 26 MHz,<br>CPU operates.  |  | 15.6            | 31.2    |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| I <sub>CC</sub>   | .....  |  |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | T <sub>a</sub> = 25 °C   |  | —               | μA      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | T <sub>a</sub> = 85 °C   |  | —               |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Test conditions  | Limits   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Min.   | Typ.            | Max.    |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| I <sub>CC</sub>   | f(f <sub>sys</sub> ) = 20 MHz,<br>CPU operates.  |  | 12              | 24      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| I <sub>CC</sub>   | .....  |  |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | T <sub>a</sub> = 25 °C   |  | 1               | μA      |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | T <sub>a</sub> = 85 °C   |  | 20              |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| ★ Page 18,<br>A-D CONVERTER<br>CHARACTERISTICS;<br>the minium value of<br>t <sub>CONV</sub> | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Test conditions</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>t<sub>CONV</sub></td> <td>f(f<sub>sys</sub>) ≤ 26 MHz</td> <td>4.54</td> <td></td> </tr> <tr> <td></td> <td>.....</td> <td>1.89<br/>(Note)</td> <td></td> </tr> </tbody> </table>  | Symbol   | Test conditions | Limits  |      | Min.           | Max.              | t <sub>CONV</sub> | f(f <sub>sys</sub> ) ≤ 26 MHz | 4.54                |   |  | ..... | 1.89<br>(Note)  |                      | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Test conditions</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>t<sub>CONV</sub></td> <td>f(f<sub>sys</sub>) ≤ 20 MHz</td> <td>5.90</td> <td></td> </tr> <tr> <td></td> <td>.....</td> <td>2.45<br/>(Note)</td> <td></td> </tr> </tbody> </table> | Symbol  | Test conditions | Limits         |   | Min.                   | Max.      | t <sub>CONV</sub> | f(f <sub>sys</sub> ) ≤ 20 MHz | 5.90 |                        |      | ..... | 2.45<br>(Note)      |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Test conditions  |  |                 | Limits  |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Min.   | Max.            |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| t <sub>CONV</sub>   | f(f <sub>sys</sub> ) ≤ 26 MHz  | 4.54   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | .....  | 1.89<br>(Note)   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| Symbol  | Test conditions  | Limits   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   |  | Min.   | Max.            |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| t <sub>CONV</sub>   | f(f <sub>sys</sub> ) ≤ 20 MHz  | 5.90   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
|   | .....  | 2.45<br>(Note)   |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |
| ★ Page 19<br>PERIPHERAL<br>DEVICE<br>INPUT/OUTPUT<br>TIMING                                 | <p>(V<sub>CC</sub> = 3.3 V ± 0.3 V, ..... f(f<sub>sys</sub>) = 26 MHz, unless otherwise noted)</p> <p>* ..... at f(f<sub>sys</sub>) = 26 MHz are shown in ( ).</p>   | <p>(V<sub>CC</sub> = 3.3 V ± 0.3 V, ..... f(f<sub>sys</sub>) = 20 MHz, unless otherwise noted)</p> <p>* ..... at f(f<sub>sys</sub>) = 20 MHz are shown in ( ).</p> |                 |         |      |                |                   |                   |                               |                     |   |  |       |   |                      |   |         |                 |                |   |                        |           |                   |                               |      |                        |      |       |                     |   |        |                 |        |                      |                        |      |      |      |                 |   |  |    |    |                 |       |  |  |  |  |                        |  |   |    |  |                        |  |    |  |

# Corrections and Supplementary Explanation for M37902Fxm Datasheet (REV.B) NO.5

| Page  | Error   | Correction   |           |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
|---|---|--|-----------|--------|--|------|------|-------------|--------------------------------------|---|--|---|--------------------------------------|--|--------|--------------|--------------------------------------|--|-------------|---|--|-----------|--------|--|------|------|-------------|--------------------------------------|---|--|--------------|--------------------------------------|--|--|--------------|--------------------------------------|--|--|
| ★ Page 19, Timer A input; (Gating input in timer mode)                                    | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TA)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{16 \times 10^9}{f(f_{sys})}</math> (615)</td> <td></td> </tr> <tr> <td><math>t_{w(TAH)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (307)</td> <td></td> </tr> <tr> <td><math>t_{w(TAL)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (307)</td> <td></td> </tr> </tbody> </table> <p><b>Note:</b> ..... the count source = f2 at <math>f(f_{sys}) \leq 26\text{ MHz}</math>.</p> | Symbol   | Parameter | Limits |  | Min. | Max. | $t_{c(TA)}$ | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (615) |  | $t_{w(TAH)}$  | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (307) |        | $t_{w(TAL)}$ | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (307) |             | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TA)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{16 \times 10^9}{f(f_{sys})}</math> (800)</td> <td></td> </tr> <tr> <td><math>t_{w(TAH)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (400)</td> <td></td> </tr> <tr> <td><math>t_{w(TAL)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (400)</td> <td></td> </tr> </tbody> </table> <p><b>Note:</b> ..... the count source = f2 at <math>f(f_{sys}) \leq 20\text{ MHz}</math>.</p> | Symbol                                   | Parameter | Limits |  | Min. | Max. | $t_{c(TA)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (800) |  | $t_{w(TAH)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400) |  | $t_{w(TAL)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400) |  |
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| ★ Page 19, Timer A input; (External trigger input in one-shot pulse mode)                 | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TA)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (307)</td> <td></td> </tr> </tbody> </table>   | Symbol   | Parameter | Limits |  | Min. | Max. | $t_{c(TA)}$ | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (307)  |  | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TA)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (400)</td> <td></td> </tr> </tbody> </table> | Symbol                               | Parameter                                | Limits |              | Min.                                 | Max.                                     | $t_{c(TA)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$  | $\frac{8 \times 10^9}{f(f_{sys})}$ (400) |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
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| ★ Page 21, Timer B input; (Pulse period measurement mode), (Pulse width measurement mode) | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TB)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{16 \times 10^9}{f(f_{sys})}</math> (615)</td> <td></td> </tr> <tr> <td><math>t_{w(TBH)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (307)</td> <td></td> </tr> <tr> <td><math>t_{w(TBL)}</math></td> <td>..... <math>f(f_{sys}) \leq 26\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (307)</td> <td></td> </tr> </tbody> </table> <p><b>Note:</b> ..... the count source = f2 at <math>f(f_{sys}) \leq 26\text{ MHz}</math>.</p> | Symbol   | Parameter | Limits |  | Min. | Max. | $t_{c(TB)}$ | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (615) |  | $t_{w(TBH)}$  | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (307) |        | $t_{w(TBL)}$ | ..... $f(f_{sys}) \leq 26\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (307) |             | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(TB)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{16 \times 10^9}{f(f_{sys})}</math> (800)</td> <td></td> </tr> <tr> <td><math>t_{w(TBH)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (400)</td> <td></td> </tr> <tr> <td><math>t_{w(TBL)}</math></td> <td>..... <math>f(f_{sys}) \leq 20\text{MHz}</math></td> <td><math>\frac{8 \times 10^9}{f(f_{sys})}</math> (400)</td> <td></td> </tr> </tbody> </table> <p><b>Note:</b> ..... the count source = f2 at <math>f(f_{sys}) \leq 20\text{ MHz}</math>.</p> | Symbol                                   | Parameter | Limits |  | Min. | Max. | $t_{c(TB)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{16 \times 10^9}{f(f_{sys})}$ (800) |  | $t_{w(TBH)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400) |  | $t_{w(TBL)}$ | ..... $f(f_{sys}) \leq 20\text{MHz}$ | $\frac{8 \times 10^9}{f(f_{sys})}$ (400) |  |
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| ★ Page 23, READY, HOLD TIMING; Timing requirements, Switching characteristics             | (Vcc = 3.3 V ± 0.3 V, ..... $f(f_{sys}) = 26\text{ MHz}$ , unless otherwise noted)  | (Vcc = 3.3 V ± 0.3 V, ..... $f(f_{sys}) = 20\text{ MHz}$ , unless otherwise noted) |           |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
| ★ Pages 25,26,27, External bus timing; (Timing requirements), (Switching characteristics) |   |  |           |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
| ★ Page 26, External bus timing; (Timing requirements)                                     | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(in)}</math></td> <td>External clock .....</td> <td>38</td> <td></td> </tr> </tbody> </table>   | Symbol   | Parameter | Limits |  | Min. | Max. | $t_{c(in)}$ | External clock .....                 | 38  |  | <table border="1"> <thead> <tr> <th rowspan="2">Symbol</th> <th rowspan="2">Parameter</th> <th colspan="2">Limits</th> </tr> <tr> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td><math>t_{c(in)}</math></td> <td>External clock .....</td> <td>50</td> <td></td> </tr> </tbody> </table>   | Symbol                               | Parameter                                | Limits |              | Min.                                 | Max.                                     | $t_{c(in)}$ | External clock .....  | 50                                       |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
| Symbol  | Parameter   |  |           | Limits |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
|   |   | Min.   | Max.      |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
| $t_{c(in)}$   | External clock .....  | 38   |           |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |
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| $t_{c(in)}$   | External clock .....  | 50   |           |        |  |      |      |             |                                      |   |  |   |                                      |  |        |              |                                      |  |             |   |  |           |        |  |      |      |             |                                      |   |  |              |                                      |  |  |              |                                      |  |  |