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April 1st, 2010
Renesas Electronics Corporation

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

Usage Notes Reference Book

16

M16C/62 (M16C/62A, M16C/62M) Group

Usage Notes Reference Book

Renesas 16-BIT SINGLE-CHIP MICROCOMPUTER M16C FAMILY / M16C/60 SERIES

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Preface

This book describes the M16C/62 (M16C/62A, M16C/62M) group's precautions for use, which contains paragraphs describing precautions of the user's manual and technical news relevant to these paragraphs. Please refer to this book when developing your systems. However, all of precautions are not contained in this book, please perform sufficient evaluation under systems development.

Precautions for Interrupts

(1) Reading address 00000$_{16}$

- When maskable interrupt is occurred, CPU reads the interrupt information (the interrupt number and interrupt request level) in the interrupt sequence.
  The interrupt request bit of the certain interrupt written in address 00000$_{16}$ will then be set to "0".
  Even if the address 00000$_{16}$ is read out by software, "0" is set to the enabled highest priority interrupt source request bit. Therefore interrupt can be canceled and unexpected interrupt can occur.
  Do not read address 00000$_{16}$ by software.

(2) Setting the stack pointer

- The value of the stack pointer immediately after reset is initialized to 0000$_{16}$. Accepting an interrupt before setting a value in the stack pointer may become a factor of runaway. Be sure to set a value in the stack pointer before accepting an interrupt. When using the $\overline{\text{NMI}}$ interrupt, initialize the stack pointer at the beginning of a program. Concerning the first instruction immediately after reset, generating any interrupts including the $\overline{\text{NMI}}$ interrupt is prohibited.

(3) The $\overline{\text{NMI}}$ interrupt

- The $\overline{\text{NMI}}$ interrupt can not be disabled. Be sure to connect $\overline{\text{NMI}}$ pin to Vcc via a pull-up resistor if unused. Be sure to work on it.
- The $\overline{\text{NMI}}$ pin also serves as P8$_5$, which is exclusively input. Reading the contents of the P8 register allows reading the pin value. Use the reading of this pin only for establishing the pin level at the time when the $\overline{\text{NMI}}$ interrupt is input.
- Do not reset the CPU with the input to the $\overline{\text{NMI}}$ pin being in the "L" state.
- Do not attempt to go into stop mode with the input to the $\overline{\text{NMI}}$ pin being in the "L" state. With the input to the $\overline{\text{NMI}}$ being in the "L" state, the CM10 is fixed to "0", so attempting to go into stop mode is turned down.
- Do not attempt to go into wait mode with the input to the $\overline{\text{NMI}}$ pin being in the "L" state. With the input to the $\overline{\text{NMI}}$ pin being in the "L" state, the CPU stops but the oscillation does not stop, so no power is saved. In this instance, the CPU is returned to the normal state by a later interrupt.
- Signals input to the $\overline{\text{NMI}}$ pin require an "L" level of 1 clock or more, from the operation clock of the CPU.

(4) External interrupt

- Either an "L" level or an "H" level of at least 250 ns width is necessary for the signal input to pins $\overline{\text{INT}_0}$ through $\overline{\text{INT}_5}$ regardless of the CPU operation clock.
- When the polarity of the $\overline{\text{INT}_0}$ to $\overline{\text{INT}_5}$ pins is changed, the interrupt request bit is sometimes set to "1". After changing the polarity, set the interrupt request bit to "0". Figure 1.11.13 shows the procedure for changing the $\overline{\text{INT}}$ interrupt generate factor.

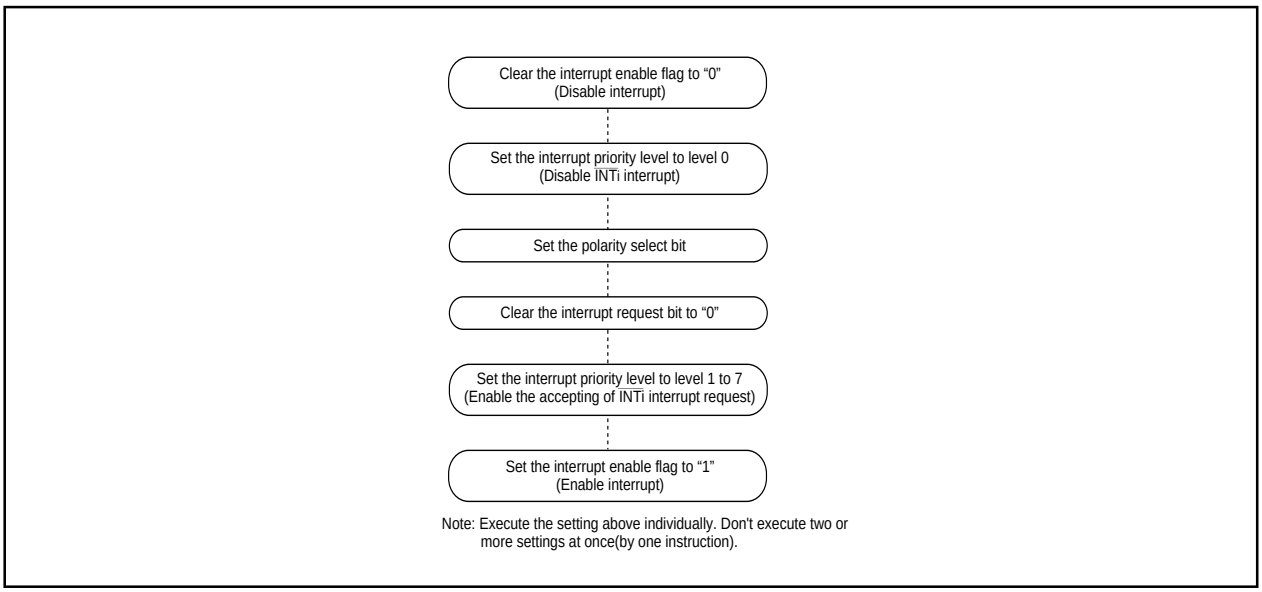


Figure 1.11.13. Switching condition of $\overline{\text{INT}}$ interrupt request

(5) Rewrite the interrupt control register

• To rewrite the interrupt control register, do so at a point that does not generate the interrupt request for that register. If there is possibility of the interrupt request occur, rewrite the interrupt control register after the interrupt is disabled. The program examples are described as follow:

Example 1:

```
INT_SWITCH1:
    FCLR    I               ; Disable interrupts.
    AND.B   #00h, 0055h     ; Clear TA0IC int. priority level and int. request bit.
    NOP                     ; Four NOP instructions are required when using HOLD function.
    NOP
    FSET    I               ; Enable interrupts.
```

Example 2:

```
INT_SWITCH2:
    FCLR    I               ; Disable interrupts.
    AND.B   #00h, 0055h     ; Clear TA0IC int. priority level and int. request bit.
    MOV.W   MEM, R0         ; Dummy read.
    FSET    I               ; Enable interrupts.
```

Example 3:

```
INT_SWITCH3:
    PUSHC   FLG             ; Push Flag register onto stack
    FCLR    I               ; Disable interrupts.
    AND.B   #00h, 0055h     ; Clear TA0IC int. priority level and int. request bit.
    POPC    FLG             ; Enable interrupts.
```

The reason why two NOP instructions (four when using the HOLD function) or dummy read are inserted before FSET I in Examples 1 and 2 is to prevent the interrupt enable flag I from being set before the interrupt control register is rewritten due to effects of the instruction queue.

• When a instruction to rewrite the interrupt control register is executed but the interrupt is disabled, the interrupt request bit is not set sometimes even if the interrupt request for that register has been generated. This will depend on the instruction. If this creates problems, use the below instructions to change the register.
Instructions : AND, OR, BCLR, BSET

Precautions on CPU Rewrite Mode

Described below are the precautions to be observed when rewriting the flash memory in CPU rewrite mode.

(1) Operation speed

During CPU rewrite mode, set the BCLK as shown below using the main clock divide ratio select bit (bit 6 at address 0006_{16} and bits 6 and 7 at address 0007_{16}):

6.25 MHz or less when wait bit (bit 7 at address 0005_{16}) = 0 (without internal access wait state)

12.5 MHz or less when wait bit (bit 7 at address 0005_{16}) = 1 (with internal access wait state)

(2) Instructions inhibited against use

The instructions listed below cannot be used during CPU rewrite mode because they refer to the internal data of the flash memory:

UND instruction, INTO instruction, JMPS instruction, JSRS instruction, and BRK instruction

(3) Interrupts inhibited against use

The address match interrupt cannot be used during CPU rewrite mode because they refer to the internal data of the flash memory. If interrupts have their vector in the variable vector table, they can be used by transferring the vector into the RAM area. The $\overline{\text{NMI}}$ and watchdog timer interrupts can be used because the flash memory conterol register 0 and 1 is forcibly initialized and return to normal mode when each interrupt occurs. But it is needed that the jump addresses for each interrupt are set in the fixed vector table and there is an interrupt program. Since the rewrite operation is halted when the $\overline{\text{NMI}}$ and watchdog timer interrupts occur, it is needed that CPU rewriting mode select bit is set to “1” and the erase/program operation is performed over again.

(4) Internal reserved area expansion bit (Bit 3 at address 0005_{16})

The reserved area of the internal memory can be changed by using the internal reserved area expansion bit (bit 3 at address 0005_{16}). However, if the CPU rewrite mode select bit (bit 1 at address $03B7_{16}$) is set to 1, the internal reserved area expansion bit (bit 3 at address 0005_{16}) also is set to 1 automatically. Similarly, if the CPU rewrite mode select bit (bit 1 at address $03B7_{16}$) is set to 0, the internal reserved area expansion bit (bit 3 at address 0005_{16}) also is set to 0 automatically.

The precautions above apply to the products which RAM size is over 15 Kbytes or flash memory size is over 192 Kbytes.

(5) Reset

Reset input is always accepted. After a reset, the addresses $0C0000_{16}$ through $0CFFFF_{16}$ are made a reserved area and cannot be accessed. Therefore, if your product has this area in the user ROM area, do not write any address of this area to the reset vector. This area is made accessible by changing the internal reserved area expansion bit (bit 3 at address 0005_{16}) in a program.

(6) Access disable

Write CPU rewrite mode select bit, flash memory power supply-OFF bit and user ROM area select bit only when executing out of an area other than the internal flash memory.

(7) How to access

For CPU rewrite mode select bit, lock bit disable select bit, and flash memory power supply-OFF bit to be set to “1”, the user needs to write a “0” and then a “1” to it in succession. When it is not this procedure, it is not enacted in “1”. This is necessary to ensure that no interrupt or DMA transfer will be executed during the interval.

Write CPU rewrite mode select bit only when executing out of an area other than the internal flash memory. Also only when $\overline{\text{NMI}}$ pin is “H” level.

(8) Writing in the user ROM area

If power is lost while rewriting blocks that contain the flash rewrite program with the CPU rewrite mode, those blocks may not be correctly rewritten and it is possible that the flash memory can no longer be rewritten after that. Therefore, it is recommended to use the standard serial I/O mode or parallel I/O mode to rewrite these blocks.

(9) Using the lock bit

To use the CPU rewrite mode, use a boot program that can set and cancel the lock command.

2.1.3 Precaution for Protect

(1) The write-enable bit of port 9 direction register and SI/Oi control register (i=3,4) goes to “0” when the next write instruction is executed after write-enabled state is readied. Make changes in input/output and SI/Oi control register (i=3,4) immediately after the instruction that sets “1” in the write-enable bit of port P9 direction register and SI/Oi control register (i=3,4)(avoid causing an interrupt). Also take measures to prevent DMA transfer from being executed.

2.2.13 Precautions for Timer A (timer mode)

(1) To clear reset, the count start flag is set to “0”. Set a value in the timer Ai register, then set the flag to “1”.

(2) Reading the timer Ai register while a count is in progress allows reading, with arbitrary timing, the value of the counter. Reading the timer Ai register with the reload timing shown in Figure 2.2.28 gets “FFFF16”. Reading the timer Ai register after setting a value in the timer Ai register with a count halted but before the counter starts counting gets a proper value.

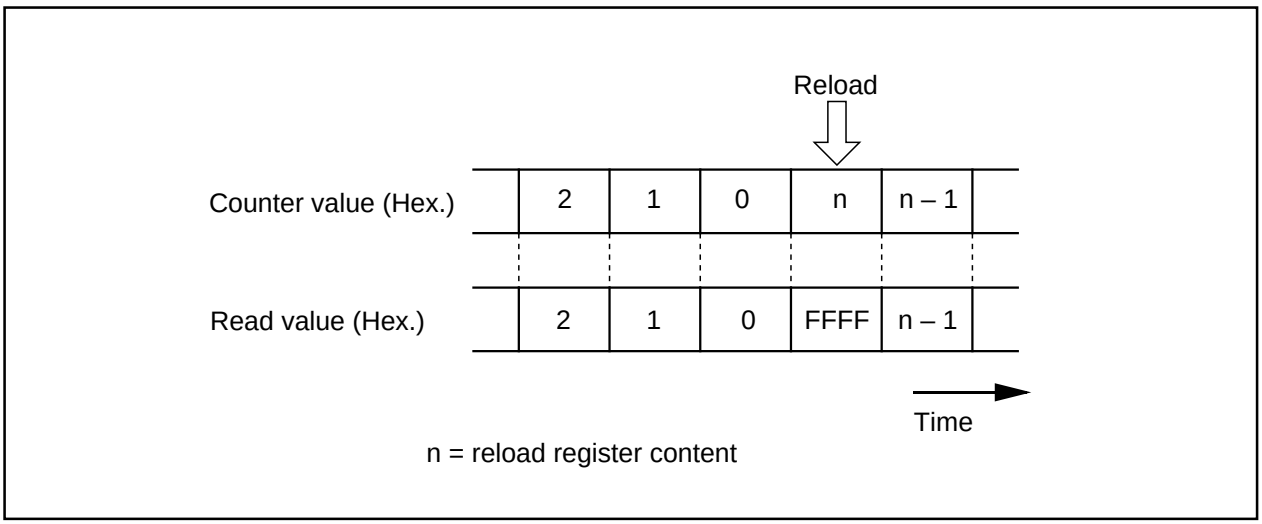


Figure 2.2.28. Reading timer Ai register

2.2.14 Precautions for Timer A (event counter mode)

(1) To clear reset, the count start flag is set to “0”. Set a value in the timer Ai register, then set the flag to “1”.

(2) Reading the timer Ai register while a count is in progress allows reading, with arbitrary timing, the value of the counter. Reading the timer Ai register with the reload timing shown in Figure 2.2.29 gets “FFFF16” by underflow or “000016” by overflow. Reading the timer Ai register after setting a value in the timer Ai register with a count halted but before the counter starts counting gets a proper value.

(3) Please note the standards for the differences between the 2 pulses used in the 2-phase pulse signals input signals to the TAiIN pin and TAiOUT pin (i = 2, 3, 4), as shown in Figure 2.2.30.

(4) When free run type is selected, if count is stopped, set a value in the timer Ai register again.

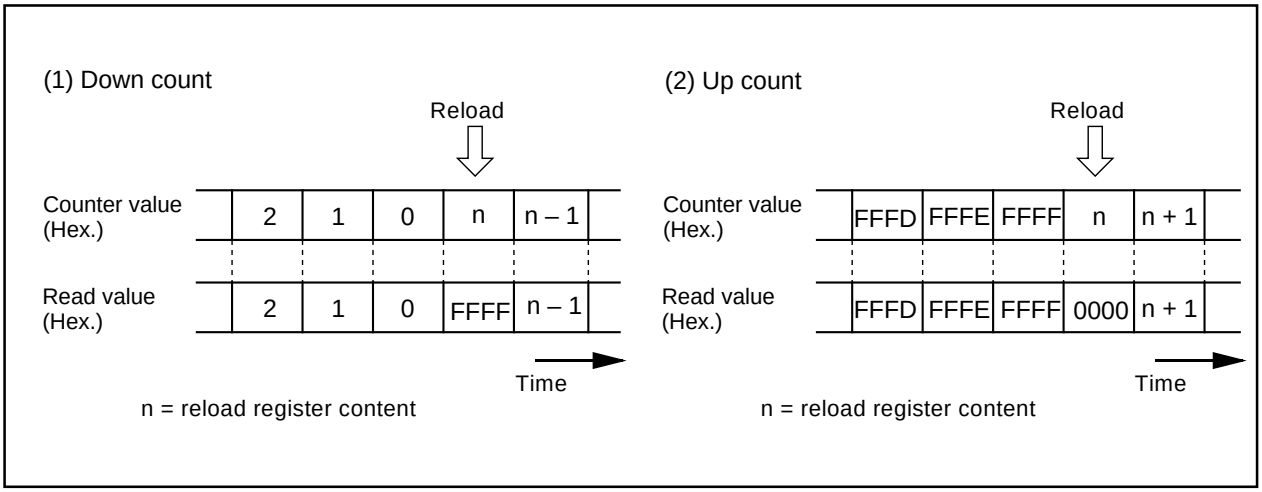


Figure 2.2.29. Reading timer Ai register

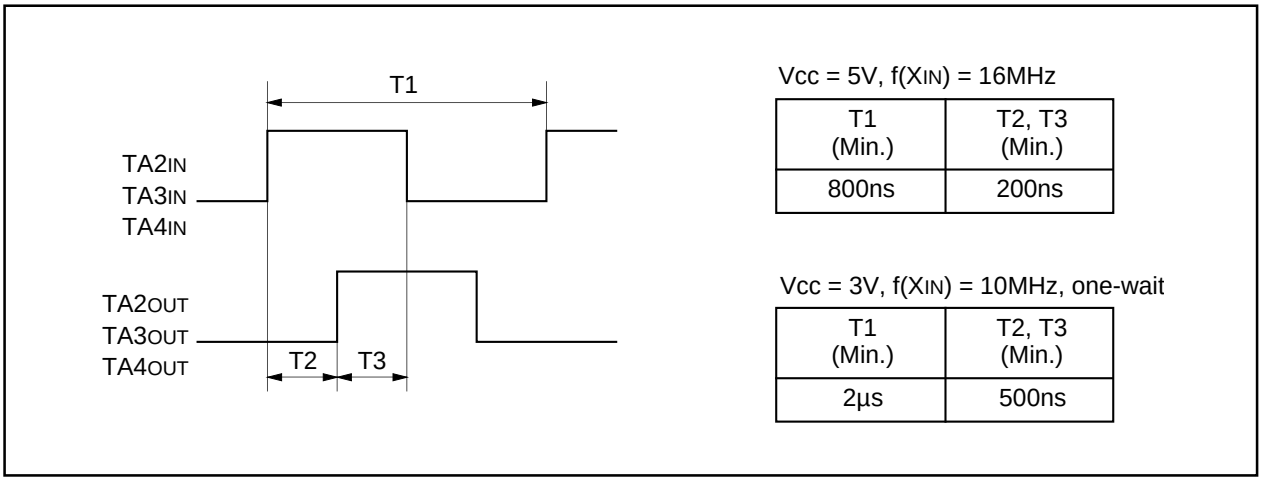


Figure 2.2.30. Standard of 2-phase pulses

2.2.15 Precautions for Timer A (one-shot timer mode)

(1) At reset, the count start flag is set to “0”. Set a value in the timer Ai register, then set the flag to “1”.

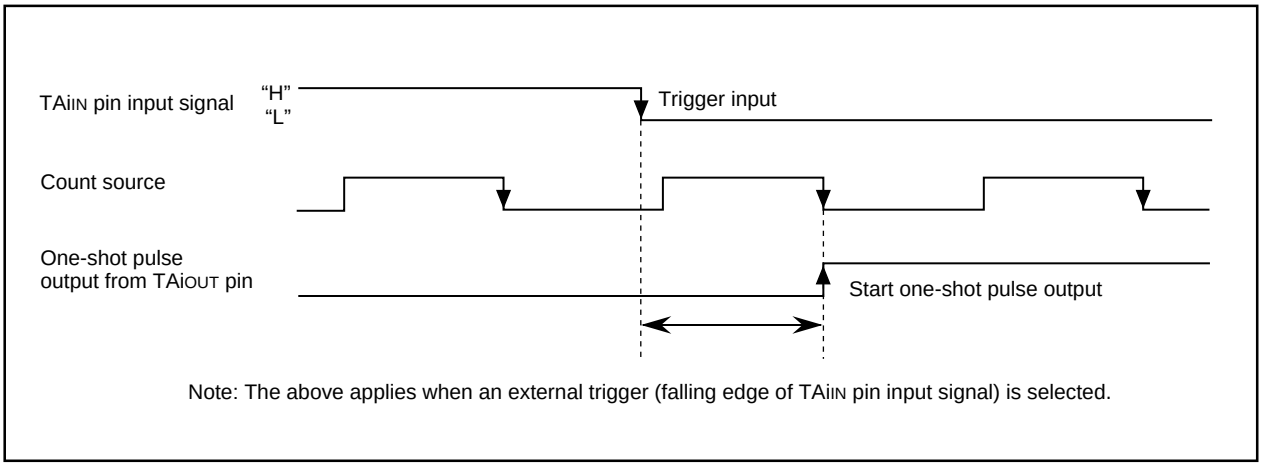
(2) Setting the count start flag to “0” while a count is in progress causes as follows:
- The counter stops counting and a content of reload register is reloaded.
- The TAiOUT pin outputs “L” level.
- The interrupt request generated and the timer Ai interrupt request bit goes to “1”.

(3) The output from the one-shot timer synchronizes with the count source generated internally. Therefore, when an external trigger has been selected, a delay of one cycle of the maximum count source occurs between the trigger input to the TAiIN pin and the one-shot timer output.

(4) The timer Ai interrupt request bit goes to “1” if the timer's operation mode is set using any of the following procedures:
- Selecting one-shot timer mode after reset.
- Changing operation mode from timer mode to one-shot timer mode.
- Changing operation mode from event counter mode to one-shot timer mode.

Therefore, to use timer Ai interrupt (interrupt request bit), set timer Ai interrupt request bit to “0” after the above listed changes have been made.

(5) If a trigger occurs while a count is in progress, after the counter performs one down count following the reoccurrence of a trigger, the reload register contents are reloaded, and the count continues. To generate a trigger while a count is in progress, generate the second trigger after an elapse longer than one cycle of the timer's count source after the previous trigger occurred.



Note: The above applies when an external trigger (falling edge of TAiIN pin input signal) is selected.

Figure 2.2.31. One-shot timer delay

2.2.16 Precautions for Timer A (pulse width modulation mode)

(1) To clear reset, the count start flag is set to “0”. Set a value in the timer Ai register, then set the flag to “1”.

(2) The timer Ai interrupt request bit becomes “1” if setting operation mode of the timer in compliance with any of the following procedures:
- Selecting PWM mode after reset.
- Changing operation mode from timer mode to PWM mode.
- Changing operation mode from event counter mode to PWM mode.

Therefore, to use timer Ai interrupt (interrupt request bit), set timer Ai interrupt request bit to “0” after the above listed changes have been made.

(3) Setting the count start flag to “0” while PWM pulses are being output causes the counter to stop counting. If the TAiOUT pin is outputting an “H” level in this instance, the output level goes to “L”, and the timer Ai interrupt request bit goes to “1”. If the TAiOUT pin is outputting an “L” level in this instance, the level does not change, and the timer Ai interrupt request bit does not becomes “1”.

2.3.6 Precautions for Timer B (timer mode, event counter mode)

(1) To clear reset, the count start flag is set to “0”. Set a value in the timer Bi register, then set the flag to “1”.

(2) Reading the timer Bi register while a count is in progress allows reading, with arbitrary timing, the value of the counter. Reading the timer Bi register with the reload timing shown in Figure 2.3.12 gets “FFFF16”. Reading the timer Bi register after setting a value in the timer Bi register with a count halted but before the counter starts counting gets a proper value.

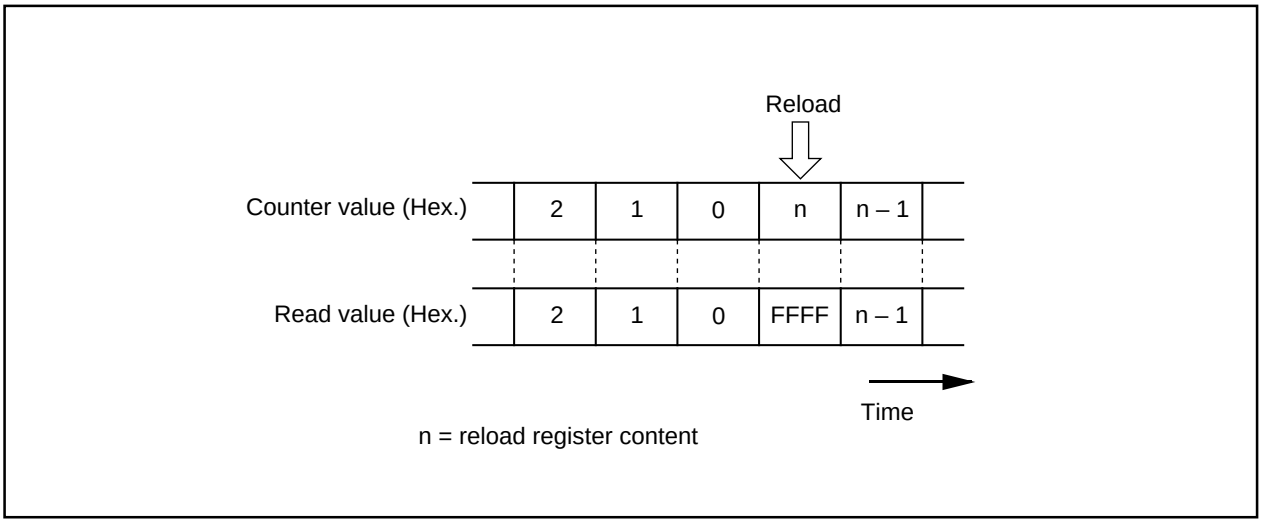


Figure 2.3.12. Reading timer Bi register

2.3.7 Precautions for Timer B (pulse period/pulse width measurement mode)

(1) The timer Bi interrupt request bit goes to “1” when an effective edge of a measurement pulse is input or timer Bi is overflowed. The factor of interrupt request can be determined by use of the timer Bi overflow flag within the interrupt routine.

(2) If the timer overflow occurs simultaneously with the input of a measurement pulse, and if the interrupt factor cannot be determined from the timer Bi overflow flag, connect the timers and count the number of overflows.

(3) When reset, the timer Bi overflow flag goes to “1”. This flag can be set to “0” by writing to the timer Bi mode register when the count start flag is “1”.

(4) Use the timer Bi interrupt request bit to detect only overflows. Use the timer Bi overflow flag only to determine the interrupt factor within the interrupt routine.

(5) When the first effective edge is input after a count is started, an indeterminate value is transferred to the reload register. At this time, timer Bi interrupt request is not generated.

(6) The value of the counter is indeterminate at the beginning of a count. Therefore, the timer Bi overflow flag may go to “1” and timer Bi interrupt request may be generated during the interval between a count start and an effective edge input.

(7) If changing the measurement mode select bits are set after a count is started, the timer Bi interrupt request bit goes to “1”. Note that the timer Bi interrupt request bit does not change if the same value as before is written to the measurement mode select bits.

(8) If the input signal to the TBiIN pin is affected by noise, precise measurement may not be performed in some cases. It is recommended to see that measurements fall within a specific range by use of software.

(9) For pulse width measurement, pulse widths are successively measured. Use software to check whether the measurement result is an “H” level width or an “L” level width.

2.4.5 Precautions for Serial I/O (in clock-synchronous serial I/O)

Transmission/reception

(1) With an external clock selected, and choosing the $\overline{RTS}$ function, the output level of the $\overline{RTSi}$ pin goes to “L” when the data-receivable status becomes ready, which informs the transmission side that the reception has become ready. The output level of the $\overline{RTSi}$ pin goes to “H” when reception starts. So if the $\overline{RTSi}$ pin is connected to the $\overline{CTSi}$ pin on the transmission side, the circuit can transmission and reception data with consistent timing. With the internal clock, the $\overline{RTS}$ function has no effect. Figure 2.4.16 shows an example of wiring.

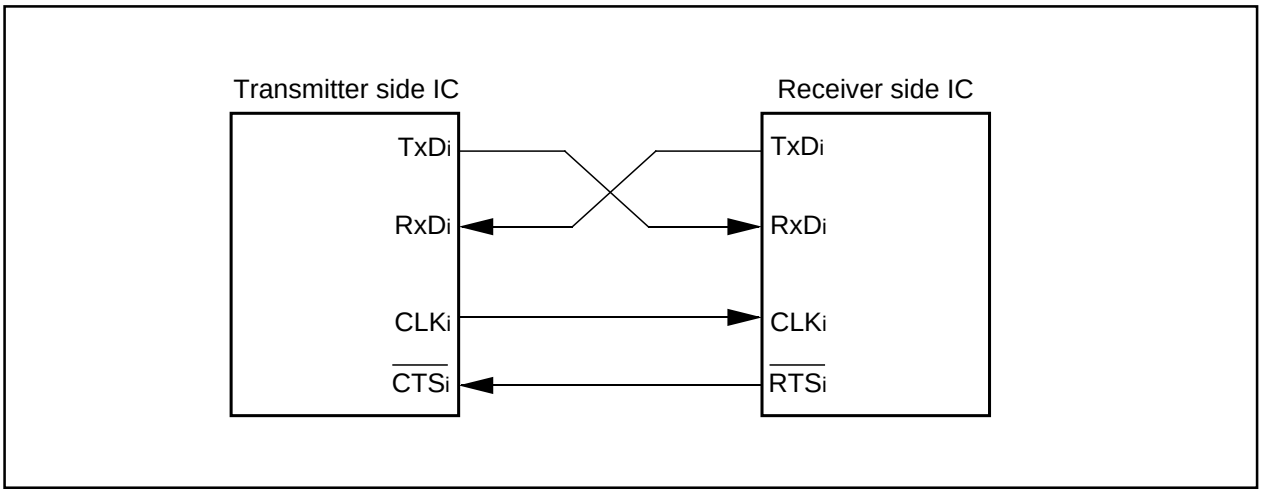


Figure 2.4.16. Example of wiring

Transmission

(1) With an external clock selected, perform the following set-up procedure with the CLKi pin input level = “H” if the CLK polarity select bit = “0” or with the CLKi pin input level = “L” if the CLK polarity select bit = “1”:
   1. Set the transmit enable bit (to “1”)
   2. Write transmission data to the UARTi transmit buffer register
   3. “L” level input to the $\overline{\text{CTSi}}$ pin (when the $\overline{\text{CTS}}$ function is selected)

Reception (1) In operating the clock-synchronous serial I/O, operating a transmitter generates a shift clock. Fix settings for transmission even when using the device only for reception. Dummy data is output to the outside from the TxDi pin (transmission pin) when receiving data.

(2) With the internal clock selected, setting the transmit enable bit to “1” (transmission-enabled status) and setting dummy data in the UARTi transmission buffer register generates a shift clock.
With the external clock selected, a shift clock is generated when the transmit enable bit is set to “1”, dummy data is set in the UARTi transmit buffer register, and the external clock is input to the CLKi pin.

(3) In receiving data in succession, an overrun error occurs when the next reception data is made ready in the UARTi receive register with the receive complete flag set to “1” (before the content of the UARTi receive buffer register is read), and overrun error flag is set to “1”. In this instance, the next data is written to the UARTi receive buffer register, so handle with this problem by writing programs on transmission side and reception side so that the previous data is transmitted again.
If an overrun error occurs, the UARTi receive interrupt request bit does not change.

(4) To receive data in succession, set dummy data in the lower-order byte of the UARTi transmit buffer register every time reception is made.

(5) With an external clock selected, perform the following set-up procedure with the CLKi pin input level = “H” if the CLK polarity select bit = “0” or with the CLKi pin input level = “L” if the CLK polarity select bit = “1”:
   1. Set receive enable bit (to “1”)
   2. Set transmit enable bit (to “1”)
   3. Write dummy data to the UARTi transmit buffer register

(6) Output from the $\overline{\text{RTS}}$ pin goes to “L” level as soon as the receive enable bit is set to “1”. This is not related to the content of the transmit buffer empty flag or the content of the transmit enable bit.
Output from the $\overline{\text{RTS}}$ pin goes to “H” level when reception starts, and goes to “L” level when reception is completed. This is not related to the content of the transmit buffer empty flag or the content of the receive complete flag.

2.7.10 Precautions for A-D Converter

(1) Write to each bit (except bit 6) of A-D control register 0, to each bit of A-D control register 1, and to bit 0 of A-D control register 2 when A-D conversion is stopped (before a trigger occurs). In particular, when the Vref connection bit is changed from 0 to 1, start A-D conversion after an elapse of 1 μs or longer.

(2) To reduce conversion error due to noise, connect a voltage to the AVcc pin and to the Vref pin from an independent source. It is recommended to connect a capacitor between the AVss pin and the AVcc pin, between the AVss pin and the Vref pin, and between the AVss pin and the analog input pin (ANi). Figure 2.7.22 shows the an example of connecting the capacitors to these pins.

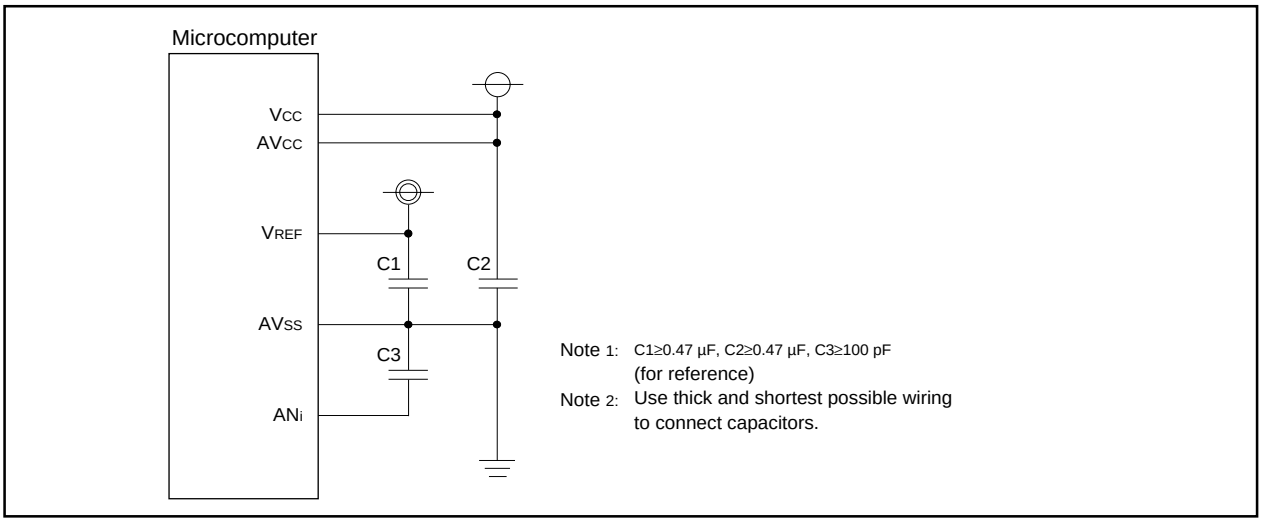


Figure 2.7.22. Use of capacitors to reduce noise

(3) Set the direction register of the following ports to input: the port corresponding to a pin to be used as an analog input pin and external trigger input pin (P97).

(4) In using a key-input interrupt, none of the 4 pins (AN4 through AN7) can be used as an A-D conversion port (if the A-D input voltage goes to “L” level, a key-input interrupt occurs).

(5) If using the A-D converter with Vcc = 2.7V to 4.0 V:
Use only a divided frequency for fAD (undivided fAD is not allowed).
Select without the Sample & Hold feature.
Select 8-bit mode.

(6) Rewrite to analog input pin select bits after changing A-D operation mode.

(7) When using the one-shot or single sweep mode
Confirm that A-D conversion is complete before reading the A-D register.
(Note: When A-D conversion interrupt request bit is set, it shows that A-D conversion is completed.)

(8) When using the repeat mode or repeat sweep mode 0 or 1
Use the undivided main clock as the internal CPU clock.

(9) Use ϕAD under 10 MHz. When XIN is over 10 MHz, divide it.

2.15.4 Precautions in Power Control

(1) The processor does not switch to stop mode when the $\overline{NMI}$ pin is at "L" level.

(2) When returning from stop mode by hardware reset, $\overline{RESET}$ pin must be set to "L" level until main clock oscillation is stabilized.

(3) When switching to either wait mode or stop mode, instructions occupying four bytes either from the WAIT instruction or from the instruction that sets the all clock stop control bit to "1" within the instruction queue are prefetched and then the program stops. So put at least four NOPs in succession either to the WAIT instruction or to the instruction that sets the all clock stop control bit to "1".

(4) Before the count source for BCLK can be changed from XIN to XCIN or vice versa, the clock to which the count source is going to be switched must be oscillating stably. Allow a wait time in software for the oscillation to stabilize before switching over the clock.

(5) Suggestions to reduce power consumption

(a) Ports

The processor retains the state of each programmable I/O port even when it goes to wait mode or to stop mode. A current flows in active I/O ports. A pass current flows in input ports that float. When entering wait mode or stop mode, set non-used ports to input and stabilize the potential.

(b) A-D converter

A current always flows in the VREF pin. When entering wait mode or stop mode, set the Vref connection bit to "0" so that no current flows into the VREF pin.

(c) D-A converter

The processor retains the D-A state even when entering wait mode or stop mode. Disable the output from the D-A converter then work on the programmable I/O ports. Set D-A register to "00_{16}".

(d) Stopping peripheral functions

In wait mode, stop non-used peripheral functions using the WAIT peripheral function clock stop bit. However, peripheral function clock f_{C32} does not stop so that the peripherals using f_{C32} do not contribute to the power saving. When the MCU running in low-speed or low power dissipation mode, do not enter WAIT mode with this bit set to "1".

(e) Switching the oscillation-driving capacity

Set the driving capacity to "LOW" when oscillation is stable.

(f) External clock

When using an external clock input for the CPU clock, set the main clock stop bit to "1". Setting the main clock stop bit to "1" causes the XOUT pin not to operate and the power consumption goes down (when using an external clock input, the clock signal is input regardless of the content of the main clock stop bit).

4.6 Precautions for External Bus

(1) The external ROM version can operate only in the microprocessor mode, so be sure to perform the following:

• Connect the CNVSS pin to Vcc.

GRADE A

MSC TECHNICAL NEWS

No.M16C-09-9705

Note on using the A-D converter of the M16C/60 series MCU

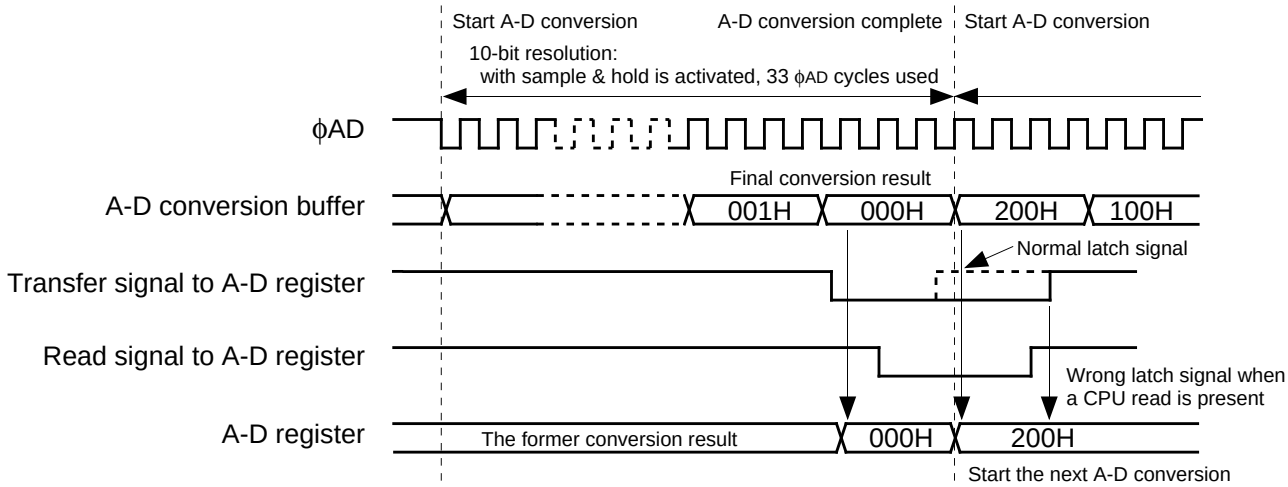
1. Related devices

M16C/60 series

2. Symptoms

After A-D conversion is complete, if the CPU reads the A-D register at the same time as the A-D conversion result is being saved to A-D register, wrong A-D conversion value is saved into the A-D register. This happens when the internal CPU clock is selected from divided main clock or sub-clock.

(When connected an A-D input port and GND)



Normally, A-D conversion value is saved at the rising edge (dashed rising edge) of the latch signal. However, when the CPU is doing a read to A-D register at this time, the A-D register latch signal is delayed, and wrong value is stored at A-D conversion register.

3. Precaution

(1) When using the one-shot or single sweep mode

Confirm that A-D conversion is complete before reading the A-D register.
(Note: When A-D conversion interrupt request bit is set, it shows that A-D conversion is completed.)

(2) When using the repeat mode or repeat sweep mode 0 or 1

Use the undivided main clock as the internal CPU clock.

GRADE A

MESC TECHNICAL NEWS

No.M16C-11-9710

Note on dedicated input pin of the M16C/60 series MCU

1. Related devices

M16C/60 series

2. Note on dedicated input pin

When different power supplied to the system as shown in figure 1, and input voltage of unused dedicated input pin is larger than voltage of VCC pin, do not connect dedicated input pin and power supply directly. Connect to VCC via resistor (approximately 1kohm) as shown in figure 2. This note is also applicable when VINPUT exceeds VCC during power-up.

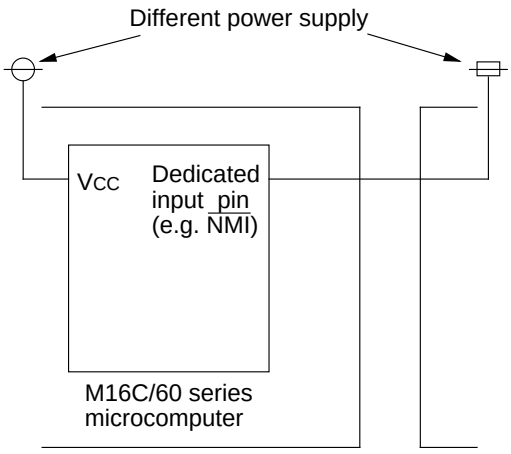


Figure 1. Circuit diagram

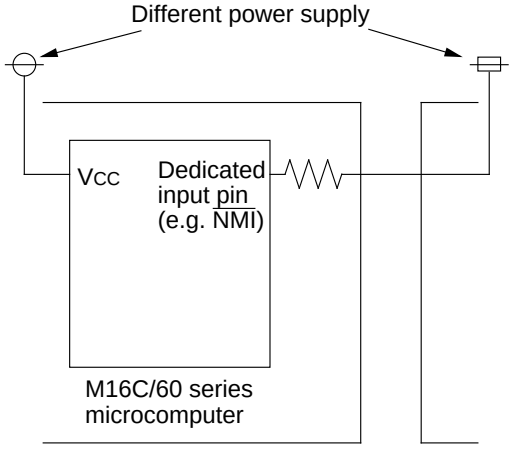


Figure 2. Improved circuit diagram

* The resistor is not necessary when VCC pin voltage is same or larger than dedicated input pin voltage.

3. Cause

When dedicated input pin voltage is larger than VCC pin voltage, latch up occurs.

GRADE A

MESC TECHNICAL NEWS No.M16C-12-9711

Note on the interrupt control register of the M16C/60 series MCU

1. Related devices

M16C/60 series

2. Note

Do not rewrite to interrupt control register when the interrupt enable flag is enable state (I flag = "1"). A rewrite instruction includes read modify write instructions such as BSET.

3. Cause

If the interrupt request bit is cleared ("0") or the interrupt priority level is changed after the interrupt request bit is set ("1"), the interrupt information may not be read correctly when reading address 00000_{16} in interrupt sequence. As a result, another interrupt(e.g. BRK instruction interrupt) may occur.

4. Solution

When you want to rewrite to interrupt control register, clear interrupt enable flag (I flag = "0") before rewriting interrupt control register.

GRADE A

MESC TECHNICAL NEWS No.M16C-13-9802

Supplemental Description of DMAC for the M16C/60, M16C/61 and M16C/62 Group MCUs

1. Related devices

M16C/60, M16C/61 and M16C/62 groups

2. DMA enable bit

The DMA enable bit is bit 3 of both DMA0 and DMA1 control registers.
When the DMA enable bit is set to "1" the DMAC is in an active state and the following occurs:

a. The value of whichever of the source or destination pointer that is set up as the forward pointer is reloaded into the forward address pointer.
b. The value in the transfer counter reload register is reloaded into the transfer counter.

Therefore, the DMAC will start from the initial conditions once again if the DMA enable bit is set to "1" while in the active state.

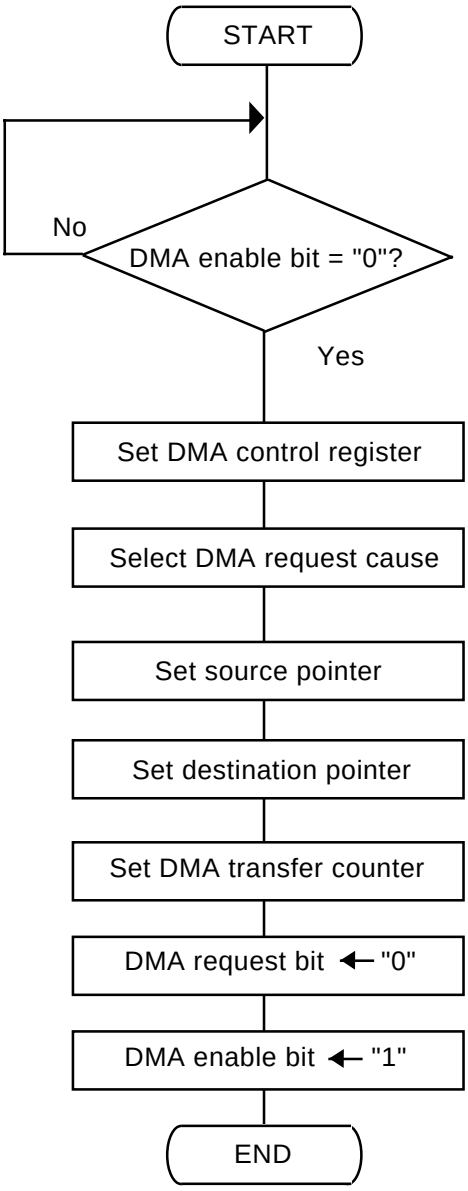
3. DMA request bit

The DMA request bit is bit 2 of both DMA0 and DMA1 control registers.
Regardless of the DMAC status (enable bit set or clear), the request bit is set to "1" when a request signal for a DMA transfer occurs, based on the DMA request factor. The bit is cleared to "0" when data transfer begins. Further, the user can clear ("0") the DMA request bit but not set it.

It is possible that the DMA request bit may become "1" due to the DMA request cause select bits being changed. Therefore the DMA request bit should be cleared ("0") after changing the DMA request cause select bits.

If DMAC is in the active state (enable bit set) when the request bit becomes "1", the data transfer begins immediately. That in turn immediately causes the DMA request bit to be cleared ("0"). Therefore, to best judge the state of the DMAC, the DMA enable bit should be read instead of the request bit.

4. Initialization of DMA-related registers



GRADE A

MESC TECHNICAL NEWS No.M16C-14-9805

Precautions Regarding Writing to M16C/60, M16C/61, M16C/62 and M16C/63 Group MCUs Interrupt Control Registers

1. Related devices

M16C/60, M16C/61, M16C/62 and M16C/63 groups

With the M16C/60 series MCU, setting the interrupt priority level and clearing the interrupt request bit in the interrupt control registers should be done with interrupt disabled.
Executing these operations while interrupt is enabled may result in unintended CPU operations.

2. Symptom

Changing the Interrupt priority LeVeL select bit (ILVL) and clearing the Interrupt Request bit (IR) in the Interrupt Control Registers (ICRs) while the Interrupt enable FLAG (I-FLAG) is "1" may result in unintended operations, such as BRK and other interrupts being generated.

3. Considerations for writing new program

It is recommended that the interrupts must be disabled by clearing the I-FLAG, before setting ILVL or clearing the IR bit in the ICRs.
In order to avoid the influence of the CPU pipeline, a certain number of instructions (eg. NOP) should be inserted between writing to the ICRs and setting the I-FLAG.

The number of instructions (NOPs) required is shown in TABLE.

4. Conditions to be checked for program already written

Please confirm that at least one condition is met for both actions listed below. If any one of the conditions is met, the symptom will not occur.

(1) When changing ILVL

- I-FLAG is "0". (Interrupt disabled) (*Note)
- The processor interrupt priority level (IPL) in the flag register is "7".
- The ILVL changes from a lower level than IPL to a higher level.
- The ILVL before and after the change is lower than IPL.
- The ILVL before and after the change is higher than IPL.
- It is obvious that the corresponding interrupt will not occur while changing the ILVL.

(2) When clearing the IR

- I-FLAG is "0". (Interrupt disabled) (*Note)
- The IPL in the flag register is "7".
- The ILVL during the operation is "0".
- The ILVL is lower than IPL.
- It is obvious that the corresponding interrupt will not occur while clearing the IR.

Note: In order to avoid the influence of the CPU pipeline, a certain number of instructions (eg. NOP) should be inserted between writing to ICRs and setting the I-FLAG.

The number of instructions required is showed in the TABLE.

	When not using HOLD function	When using HOLD function
Example 1	Two NOP instructions required	Four NOP instructions required
Example 2	No NOP instruction required (because there is dummy read)	
Example 3	No NOP instruction required	

5. Program examples

The program examples are described as follow:

(1) For assembler

Example 1:

```
INT_SWITCH1:
  FCLR   I           ; Disable interrupts.
  AND.B  #00h, 0055h ; Clear TA0IC int. priority level and int. request bit.
  NOP                ; Four NOP instructions are required when using HOLD function.
  NOP
  FSET   I           ; Enable interrupts.
```

Example 2:

```
INT_SWITCH2:
  FCLR   I           ; Disable interrupts.
  AND.B  #00h, 0055h ; Clear TA0IC int. priority level and int. request bit.
  MOV.W  MEM, R0     ; Dummy read.
  FSET   I           ; Enable interrupts.
```

Example 3:

```
INT_SWITCH3:
  PUSHC  FLG         ; Push Flag register onto stack
  FCLR   I           ; Disable interrupts.
  AND.B  #00h, 0055h ; Clear TA0IC int. priority level and int. request bit.
  POPC   FLG         ; Enable interrupts.
```

The reason why two NOP instructions (four when using the HOLD function) or dummy read are inserted before FSET I in Examples 1 and 2 is to prevent the interrupt enable flag I from being set before the interrupt control register is rewritten due to effects of the instruction queue.

(2) For C language

```
#pragma   ASM
 INT_SWITCH:
  FCLR   I
#pragma   ENDASM
  TA0IC  & =00 ;     /* Clear TA0IC int. priority level and int. request bit. */
#pragma   ASM
  NOP                ; Four NOP instructions are required when using HOLD function.
  NOP
  FSET   I
#pragma   ENDASM
```

GRADE A

MESC TECHNICAL NEWS No.M16C-17-9902

M16C/60 Group, M16C/61 Group, M16C/62 Group
Precautions For Power Control State Transitions

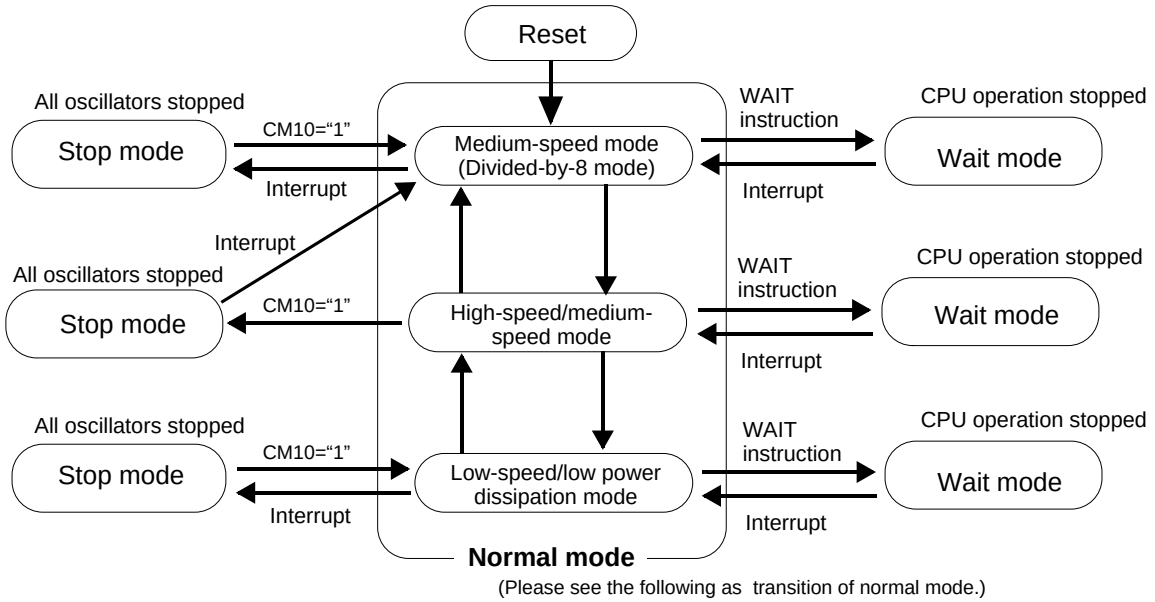
1. Related devices

M16C/60 group, M16C/61 group, M16C/62 group

2. Precautions

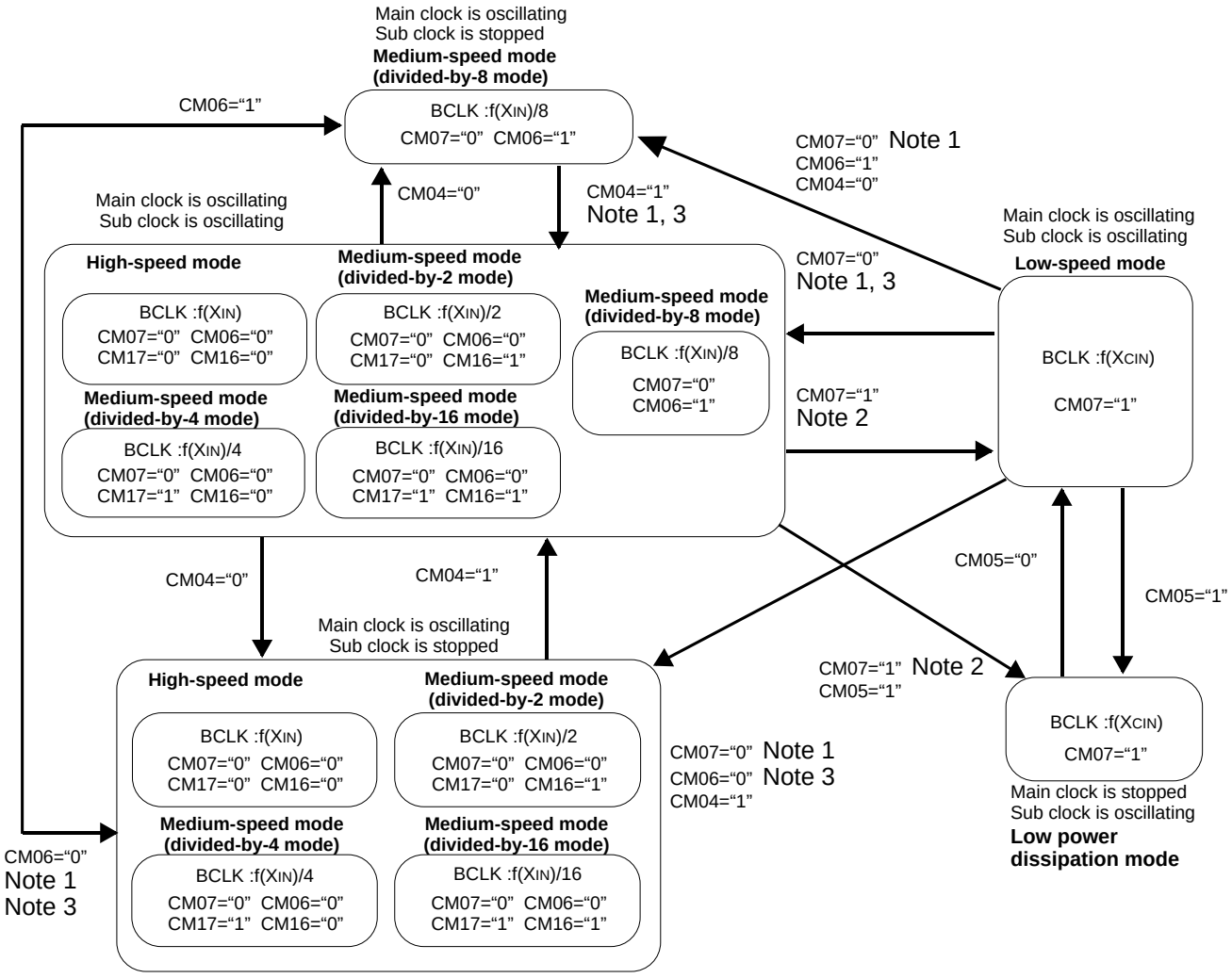
Power control state transition is shown on the next page.
Please change modes according to a directions of arrows.
When count source of BCLK is changed from clock A to clock B (X_{IN} to X_{CIN} or X_{CIN} to X_{IN}), clock B needs to be stable before changing.
Please wait to change modes until after oscillation has stabilized.
The delay time is depends on the oscillator. Please refer to the oscillator manufacture's specifications.

Transition of stop mode, wait mode



(Please see the following as transition of normal mode.)

Transition of normal mode



Note 1: Switch clocks after oscillation of main clock is fully stable.
Note 2: Switch clocks after oscillation of sub clock is fully stable.
Note 3: Change CM17 and CM16 before CM06.
Note 4: Please change according to a direction of an arrow.

GRADE A

MESC TECHNICAL NEWS No.M16C-19-9903

MESC TECHNICAL NEWS
'No.M16C-16-9902' replace

MESC TECHNICAL NEWS 'No.M16C-16-9902' has an error, so we will correct.
Please replace old Technical News 'No.M16C-16-9902' to corrected Technical News 'M16C/60, M16C/61, M16C/62 Group Precautions for Setting Pull-up Resistors'.

[Attached]

Corrected Technical News 'No.M16C-19-9903'
'M16C/60, M16C/61, M16C/62 Group Precautions for Setting Pull-up Resistors' ..... 1 page

GRADE A

MESC TECHNICAL NEWS No.M16C-19-9903

M16C/60, M16C/61, M16C/62 Group
Precautions for Setting Pull-up Resistors

1. Related devices

M16C/60 group, M16C/61 group, M16C/62 group

2. Precautions

Ports P0 to P10 can be set to apply a pull-up resistor by using the pull-up control registers.

(1) M16C/60 Group, M16C/61 Group

In Memory expansion mode or Microprocessor mode, the settings of pull-up control registers for ports P0 to P5 are invalid.
In Memory expansion mode or Microprocessor mode, ports P0, P1, $P3_1$ to $P3_7$ and P4 can be used as input ports, but internal pull-up resistors can not be connected.

(2) M16C/62 Group

In Memory expansion mode or Microprocessor mode, the settings of pull-up control registers for P0 to P3, $P4_0$ to $P4_3$ and P5 are invalid.
In Memory expansion mode or Microprocessor mode, ports P0, P1, $P3_1$ to $P3_7$ and $P4_0$ to $P4_3$ can be used as input ports, but internal pull-up resistors can not be connected.
(In Memory expansion mode or Microprocessor mode, $P4_4$ to $P4_7$ can be used as general input ports, and pull-up control register can be used to connect the internal pull-up resistors.)

GRADE A

MESC TECHNICAL NEWS No.M16C-25-9905

M16C/60 , M16C/20 Series

Precautions for Wait and Stop modes

1. Related devices

M16C/60 Series , M16C/20 Series

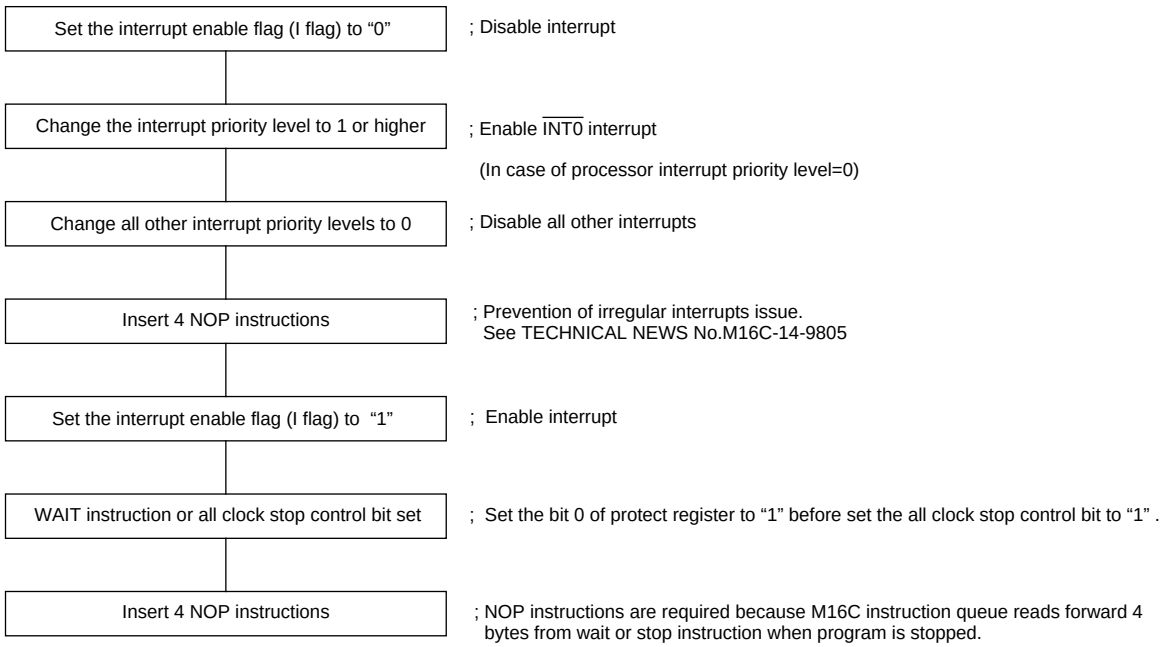
2. Precautions

The M16C has both WAIT and STOP modes. These modes can be used to reduce power consumption when the CPU is not required to perform any work. To return to normal operating mode after issuing a WAIT instruction or setting the all clock stop control bit, perform a hardware reset or use an interrupt. The interrupts for canceling the WAIT and STOP modes must be enabled before entering either mode. The priority level of the interrupts not used for these modes should be set to 0 before switching into the WAIT or STOP modes. Also, if only hardware reset or $\overline{\text{NMI}}$ interrupts are used for canceling the WAIT or STOP modes, all interrupt priority level should be set to 0 before switching into the WAIT or STOP mode.

3. Examples

3.1 Use the following algorithm to enter the WAIT or STOP modes when an interrupt is used to cancel either mode.

• Hardware reset, $\overline{\text{NMI}}$ interrupt, and $\overline{\text{INT0}}$ interrupt is used to cancel either mode



3.2 When using only hardware reset or $\overline{\text{NMI}}$ interrupt to cancel the STOP or WAIT modes, use the following algorithm to enter the STOP or WAIT modes.

Set the interrupt enable flag (I flag) to “0”	; Disable interrupt
Change all interrupt priority levels to 0	; Disable maskable interrupt
WAIT instruction or all clock stop control bit set	; Set the bit 0 of protect register to “1” before set the all clock stop control bit to “1” .
Insert 4 NOP instructions	; NOP instructions are required because M16C instruction queue reads forward 4 bytes from wait or stop instruction when program is stopped.

GRADE A

MESC TECHNICAL NEWS No.M16C-26-9905

M16C/61 , M16C/62 Group

Precautions for UART2

1. Related devices

M16C/61 Group, M16C/62 Group

2. Precautions

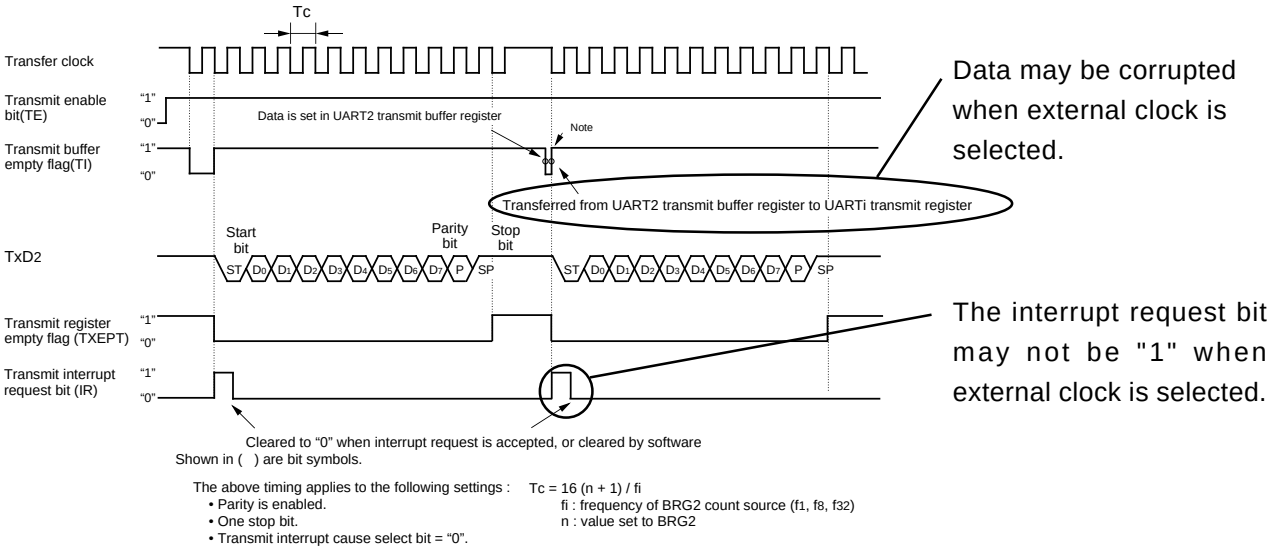
When using UART2 in clock asynchronous serial I/O (UART) mode choose internal clock. If UART2 in clock asynchronous mode is used with external clock, then one of the following may occur;

2.1 The interrupt may not be issued at the end of data transmission when the hardware transfers the data from the transmit buffer register to the transmit register.

2.2 Data may be corrupted when the hardware transfers the data from the transmit buffer register to the transmit register.

This precaution only applies to the UART2 asynchronous serial I/O mode and does not apply to UART0 or UART1. It does not apply to any UART when used in the synchronous clocked serial I/O mode.

Example of transmit with UART mode, Transfer data 8 bits long.



Note: The transmit is started with overflow timing of BRG after having written in a value at the transmit buffer in the above timing.

GRADE A

MESC TECHNICAL NEWS No.M16C-32-9908

M16C/60 Series

Precautions for Address Match Interrupt

1. Related devices

M16C/60 Series

2. Precautions

When using the address match interrupt, please observe the following usage conditions.

(1) Address match interrupt for internal address.
(2) Address match interrupt for external address and 16-bit bus.

When external address and 8-bit bus, you can not use the address match interrupt for external address.

GRADE A

MESC TECHNICAL NEWS No.M16C-39-9911

M16C Family

Cautions for “Event counter mode” with Timer A

1. Affected devices

- M16C/80 Group, M16C/60 Group, M16C/61 Group, M16C/62 Group (Included 3V version)
- M16C/62A Group (Included 3V version), M16C/6N Group, M16C/6K Group, M16C/6V Group
- M16C/6H Group, M16C/21 Group, M16C/24 Group

2. Cautions

In the case of using “Event counter mode” as “Free-Run type” for timer A, the timer register contents may be unknown when counting begins. If the timer register is set before counting has started, then the starting value will be unknown.
This issue will occur only for the “Event counter mode” operating as “Free-Run type”. The value of the timer register will not be unknown during counting.

3. Countermeasure

(1) In the case where the up/down count will not be changed.

Enable the “Reload” function and write to the timer register before counting begins. Rewrite the value to the timer register immediately after counting has started.
If counting up, rewrite “0000_{16}” to the timer register.
If counting down, rewrite “$FFFF_{16}$” to the timer register.
This will cause the same operation as “Free-Run type” mode.

(2) In the case where the up/down count has changed.

First set to “Reload type” operation. Once the first counting pulse has occurred, the timer may be changed to “Free-Run type”.

GRADE A

MESC TECHNICAL NEWS No.M16C-49-0004

M16C/80 Series, M16C/60 Series

Cautions for Using Memory Expansion Mode or Microprocessor Mode

1. Affected devices

- M16C/80 Series
- M16C/60 Series

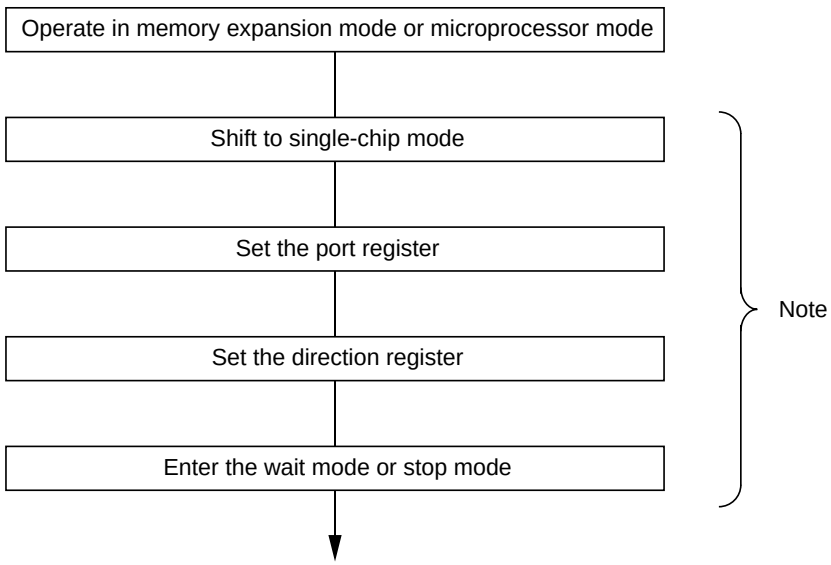
2. Cautions

When the MCU enters wait mode while operating in memory expansion mode or microprocessor mode, a pin functioning as part of the address or data bus retains it's state on the bus before wait mode is entered. Shift to single-chip mode and output an arbitrary value in order to reduce current consumption. By shifting to single-chip mode, a pin which was functioning as part of the bus becomes a general-purpose port and can output an arbitrary value. Set the port registers and direction registers after shifting to single-chip mode (this implies that any control pins ($\overline{CS}$,$\overline{WR}$,$\overline{RD}$,etc..) being used for access of an external device be changed as well).

If the port registers and direction registers are set while in memory expansion mode or microprocessor mode, the operation will be ignored.

This is similar when entering stop mode.

Setting procedure is following.



Note: This program does not work in external area. Transfer a program to internal RAM and work on internal RAM.

GRADE A

MESC TECHNICAL NEWS No.M16C-54-0004

Difference between M16C/62 and M16C/62A

(include low voltage version)

1. Affected devices

• M16C/62 group
{M16C/62, M16C/62L (low voltage version), M16C/62A, M16C/62M (low voltage version)}

Table 1 shows the product list of M16C/62 and M16C/62A.
Table 2 shows the product list of M16C/62L (low voltage version) and M16C/62M (low voltage version).

Table 1. Product list of M16C/62 and M16C/62A

Memory type	M16C/62 group		Package	ROM/RAM size
	M16C/62	M16C/62A		
Mask ROM version	M30622M4-XXXFP/GP	M30622M4A-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	32K byte / 3K byte
	M30623M4-XXXGP	M30623M4A-XXXGP	80P6S-A	
	M30622M8-XXXFP/GP	M30622M8A-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	64K byte /4K byte
	M30623M8-XXXGP	M30623M8A-XXXGP	80P6S-A	
	M30620M8-XXXFP/GP	M30620M8A-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	64K byte /10K byte
	M30621M8-XXXGP	M30621M8A-XXXGP	80P6S-A	
	M30622MA-XXXFP/GP	M30622MAA-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	96K byte /5K byte
	M30623MA-XXXGP	M30623MAA-XXXGP	80P6S-A	
	M30620MA-XXXFP/GP	M30620MAA-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	96K byte /10K byte
	M30621MA-XXXGP	M30621MAA-XXXGP	80P6S-A	
	M30622MC-XXXFP/GP	M30622MCA-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	128K byte /5K byte
	M30623MC-XXXGP	M30623MCA-XXXGP	80P6S-A	
	M30620MC-XXXFP/GP	M30620MCA-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	128K byte /10K byte
	M30621MC-XXXGP	M30621MCA-XXXGP	80P6S-A	
	M30624MG-XXXFP/GP	M30624MGA-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	256K byte /20K byte
	M30625MG-XXXGP	M30625MGA-XXXGP	80P6S-A	
External ROM version	M30620SFP/GP	M30620SAFP/GP	FP:100P6S-A GP:100P6Q-A	- /10K byte
	M30622SFP/GP	M30622SAFP/GP	FP:100P6S-A GP:100P6Q-A	- /3K byte
Flash memory version	M30624FGFP/GP	M30624FGAFP/GP	FP:100P6S-A GP:100P6Q-A	256K byte /20K byte
	M30625FGGP	M30625FGAGP	80P6S-A	
	None	M30620FGAFP/GP	FP:100P6S-A GP:100P6Q-A	128K byte /10K byte
		M30621FGAGP	80P6S-A	

Table 2. Product list of M16C/62L (low voltage version) and M16C/62M (low voltage version)

Memory type	M16C/62 group		Package	ROM/RAM size
	M16C/62L	M16C/62M		
Mask ROM version	None	M30620MCM-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	128K byte /10K byte
		M30621MCM-XXXGP	80P6S-A	
		M30624MGM-XXXFP/GP	FP:100P6S-A GP:100P6Q-A	256K byte /20K byte
		M30625MGM-XXXGP	80P6S-A	
Flash memory version	M30624FGLFP/GP	M30624FGMFP/GP	FP:100P6S-A GP:100P6Q-A	256K byte /20K byte
	M30625FGLGP	M30625FGMGP	80P6S-A	
	None	M30620FGMFP/GP	FP:100P6S-A GP:100P6Q-A	128K byte /10K byte
		M30621FGMGP	80P6S-A	

2. Contents

Table 3 shows the differences between M16C/62 and M16C/62A.

Table 4 shows the differences between M16C/62L (low voltage version) and M16C/62M (low voltage version).

Note: In M16C/62A and M16C/62M (low voltage version), built in non-volitile memory is of type Flash only. One-time PROM and EPROM versions are not availible.

Table 3. Differences between M16C/62 and M16C/62A

Item		M16C/62 group		Remarks
		M16C/62	M16C/62A	
Mask ROM, Flash memory versions common	SDA output delay function in I^2C mode (UART2)	Analog delay	Can be selected analog delay or digital delay	For details, refer to M16C/62A data sheet.
	Memory space	1M byte Expansion mode 1(1.2Mbyte) Expansion mode 2(4Mbyte)	1M byte	Single-chip mode is supported in 80-pin version. Memory expansion and microprocessor modes are not supported in 80-pin version.
	Separate $\overline{CTS}$/$\overline{RTS}$ pins function of serial I/O	Can be selected	None	
Flash memory version	Standard serial I/O mode of flash memory version (flash memory rewrite)	Synchronous mode	Synchronous mode UART mode	
	Restrictions improvement (flash memory version)	Precautions for external bus timing (technical news NO. M16C-24-9905) Precautions for boot mode (technical news NO. M16C-27-9906, M16C-29-9906) Precautions for hysteresis (technical news NO. M16C-33-9908)	Being done to improve the left description	
	Reduction of power supply electric current (flash memory version)	Standard value at f(X_{IN})=16MHz; 35mA Standard value at f(X_{CIN})=32kHz; 8mA	Standard value at f(X_{IN})=16MHz; 32.5mA Standard value at f(X_{CIN})=32kHz; 2.2mA	
	Flash memory program time (256K byte)	Standard value; Approximately 8 second	Standard value; Approximately 6 second	

Table 4. Differences between M16C/62L (low voltage version) and M16C/62M (low voltage version)

Item		M16C/62 group		Remarks
		M16C/62L	M16C/62M	
Mask ROM, Flash memory versions common	Operation voltage/ frequency characteristics	Vcc=2.7V to 3.6V (f(XIN)=10MHz, No wait) Vcc=2.4V to 3.6V (f(XIN)=7MHz, No wait)	Vcc=2.7V to 3.6V (f(XIN)=10MHz, No wait) Vcc=2.4V to 3.6V (f(XIN)=7MHz, No wait) Vcc=2.2V to 3.6V (f(XIN)=7MHz, 1 wait)	
	SDA output delay function in I^2C mode (UART2)	Analog delay	Can be selected analog delay or digital delay	For details refer to M16C/62A data sheet.
	Memory space	1M byte Expansion mode 1(1.2Mbyte) Expansion mode 2(4Mbyte)	1M byte	Single-chip mode is supported in 80-pin version. Memory expansion and microprocessor modes are not supported in 80-pin version.
	Separate $\overline{CTS}$/$\overline{RTS}$ pins function of serial I/O	Can be selected	None	
Flash memory version	Program/erase voltage (flash memory version)	Operation voltage ; Vcc=2.4V to 3.6V Program/erase voltage ; Vcc=2.7V to 3.6V	Operation voltage ; Vcc=2.4V to 3.6V Program/erase voltage ; Vcc=2.7V to 3.6V Operation voltage ; Vcc=2.2V to 2.4V Program/erase voltage ; Vcc=2.7V to 3.4V	
	Standard serial I/O mode of flash memory version (flash memory rewrite)	Synchronous mode	Synchronous mode UART mode	
	Restrictions improvement (flash memory version)	Precautions for external bus timing (technical news NO. M16C-24-9905) Precautions for boot mode (technical news NO. M16C-27-9906, M16C-29-9906) Precautions for hysteresis (technical news NO. M16C-33-9908)	Being done to improve the left description	
	Reduction of power supply electric current (flash memory version)	Standard value at f(XCIN)=32kHz; 700µA	Standard value at f(XCIN)=32kHz; 45µA	
	Flash memory program time (256K byte)	Standard value; Approximately 8 second	Standard value; Approximately 6 second	

GRADE **A**

MESC TECHNICAL NEWS No.M16C-55-0006

M16C Family

Cautions Using Data Registers that Include Write Only Bits

1. Affected devices

• M16C Family

2. Cautions

The registers shown in the table on the following page contain bits that will result in unknown data when read.
If performing a read-modify-write sequence of instructions to a register with write only bits, please reset the write only bits to their previous values before writing back to the register.
If your software accesses these registers frequently, please use a temporary RAM area to change the value, and then transfer it to the register.

Figure 1 shows an example of a register structure. If you execute a 'Read Modify Write' instruction like BSET, BCLR, AND or OR, the values of bits 5-7 may change. (Please see Figure 2)

'Table 10' show instruction table for Read Modify Write.

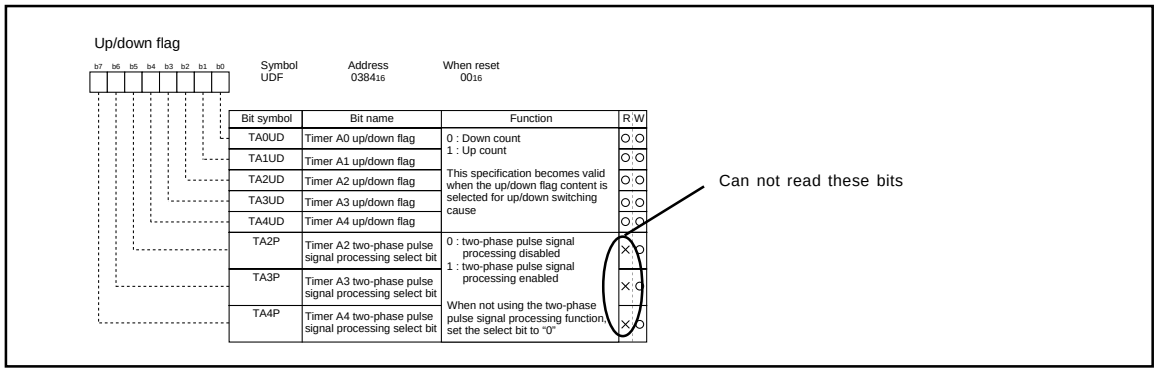


Figure 1. Example of a register structure

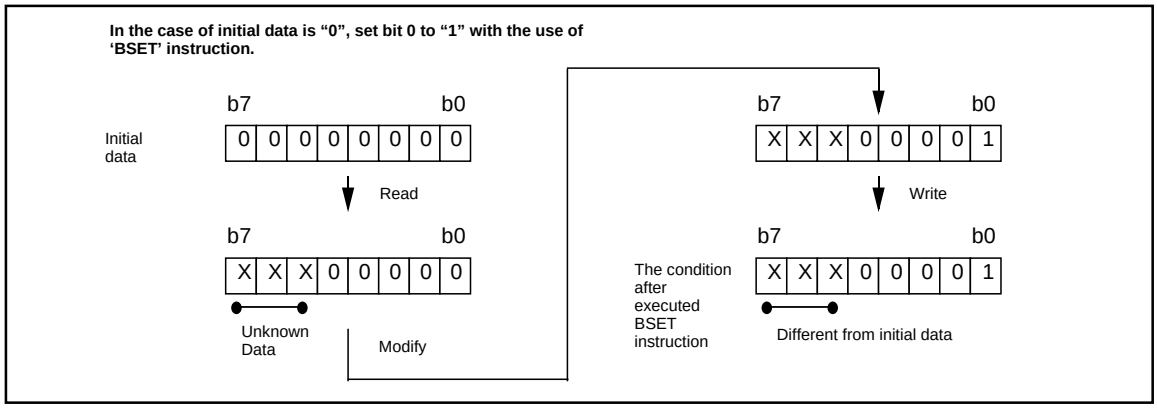


Figure 2. Example of a register change

Table 1. Affected register (M16C/80 group)

Register name	Symbol	Address
UART4 bit rate generator	U4BRG	$02F9_{16}$
UART4 transmit buffer register	U4TB	$02FB_{16}$, $02FA_{16}$
Dead time timer	DTT	$030C_{16}$
Timer B2 interrupt occurrences frequency set counter	ICTB2	$030D_{16}$
UART3 bit rate generator	U3BRG	0329_{16}
UART3 transmit buffer register	U3TB	$032B_{16}$, $032A_{16}$
UART2 bit rate generator	U2BRG	0339_{16}
UART2 transmit buffer register	U2TB	$033B_{16}$, $033A_{16}$
Up/down flag	UDF	0344_{16}
Timer A0 register (Note)	TA0	0347_{16} , 0346_{16}
Timer A1 register (Note)	TA1	0349_{16} , 0348_{16}
Timer A2 register (Note)	TA2	$034B_{16}$, $034A_{16}$
Timer A3 register (Note)	TA3	$034D_{16}$, $034C_{16}$
Timer A4 register (Note)	TA4	$034F_{16}$, $034E_{16}$
UART0 bit rate generator	U0BRG	0361_{16}
UART0 transmit buffer register	U0TB	0363_{16} , 0362_{16}
UART1 bit rate generator	U1BRG	0369_{16}
UART1 transmit buffer register	U1TB	$036B_{16}$, $036A_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 2. Affected register (M16C/61 group)

Register name	Symbol	Address
UART2 bit rate generator	U2BRG	0379_{16}
UART2 transmit buffer register	U2TB	$037B_{16}$, $037A_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 3. Affected register (M16C/62 group)

Register name	Symbol	Address
Dead time timer	DTT	$034C_{16}$
Timer B2 interrupt occurrences frequency set counter	ICTB2	$034D_{16}$
SI/O3 bit rate generator	S3BRG	0363_{16}
SI/O4 bit rate generator	S4BRG	0367_{16}
UART2 bit rate generator	U2BRG	0379_{16}
UART2 transmit buffer register	U2TB	$037B_{16}$, $037A_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 4. Affected register (M16C/6H group)

Register name	Symbol	Address
Display RAM address control register	CA	0203_{16} , 0202_{16}
Font RAM address control register	FA	0207_{16} , 0206_{16}
SYRAM address control register	YA	$020B_{16}$, $020A_{16}$
Slice RAM address control register	SA	$020F_{16}$, $020E_{16}$
VBIRAM address control register	EA	0213_{16} , 0212_{16}
Address control register for expansion register	DA	0217_{16} , 0216_{16}
SI/O3 bit rate generator	S3BRG	0363_{16}
SI/O4 bit rate generator	S4BRG	0367_{16}
UART2 bit rate generator	U2BRG	0379_{16}
UART2 transmit buffer register	U2TB	$037B_{16}$, $037A_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 5. Affected register (M16C/6K group)

Register name	Symbol	Address
SI/O3 bit rate generator	S3BRG	0363_{16}
SI/O4 bit rate generator	S4BRG	0367_{16}
UART2 bit rate generator	U2BRG	0379_{16}
UART2 transmit buffer register	U2TB	$037B_{16}$, $037A_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$
Comparator control register	CMPCON	$03DE_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 6. Affected register (M16C/6N group)

Register name	Symbol	Address
Dead time timer	DTT	$01CC_{16}$
Timer B2 interrupt occurrences frequency set counter	ICTB2	$01CD_{16}$
SI/O3 bit rate generator	S3BRG	$01E3_{16}$
UART2 bit rate generator	U2BRG	$01F9_{16}$
UART2 transmit buffer register	U2TB	$01FB_{16}$, $01FA_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 7. Affected register (M16C/6V group)

Register name	Symbol	Address
Processor mode register 1	PM1	0005_{16}
OSD reserved register 3	OR3	$027B_{16}$
UART2 bit rate generator	U2BRG	0379_{16}
UART2 transmit buffer register	U2TB	$037B_{16}$, $037A_{16}$
Up/down flag	UDF	0384_{16}
Timer A0 register (Note 1)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note 1)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note 2)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note 2)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note 1)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
Port P6 register	P6	$03EC_{16}$
Port P8 register	P8	$03F0_{16}$
Port P9 register	P9	$03F1_{16}$

Note 1: It is affected only in one-shot timer mode.
Note 2: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 8. Affected register (M30201 group)

Register name	Symbol	Address
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer X0 register (Note)	TX0	0389_{16} , 0388_{16}
Timer X1 register (Note)	TX1	$038B_{16}$, $038A_{16}$
Timer X2 register (Note)	TX2	$038D_{16}$, $038C_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 9. Affected register (M30218 group)

Register name	Symbol	Address
Up/down flag	UDF	0384_{16}
Timer A0 register (Note)	TA0	0387_{16} , 0386_{16}
Timer A1 register (Note)	TA1	0389_{16} , 0388_{16}
Timer A2 register (Note)	TA2	$038B_{16}$, $038A_{16}$
Timer A3 register (Note)	TA3	$038D_{16}$, $038C_{16}$
Timer A4 register (Note)	TA4	$038F_{16}$, $038E_{16}$
UART0 bit rate generator	U0BRG	$03A1_{16}$
UART0 transmit buffer register	U0TB	$03A3_{16}$, $03A2_{16}$
UART1 bit rate generator	U1BRG	$03A9_{16}$
UART1 transmit buffer register	U1TB	$03AB_{16}$, $03AA_{16}$

Note: It is affected only in one-shot timer mode and pulse width modulation mode.

Table 10. Instruction table for Read Modify Write

Function	Mnemonic
Bit manipulation	BCLR, BNOT, BSET, BTSTC, BTSTS
Shift	ROLC, RORC, ROT, SHA, SHL
Arithmetic	ABS, ADC, ADCF, ADD, DEC, EXTS, INC, MUL, MULU, NEG,
	SBB, SUB
Logical	AND, NOT, OR, XOR
Jump	ADJNZ, SBJNZ

3. C language programming

Figure 3 shows an example using C programming

(1)

```
#pragma     ADDRESS   UDF   0384h
char   near   UDF;

void   func(void)
{
            ⋮
       UDF  =      0x01   ;
            ⋮
}
```

‘Image of extract’

```
    ⋮
MOV.B       #01h, UDF
    ⋮
```

(2)

```
struct bit_def {
                    char   b0:1;
                    char   b1:1;
                    char   b2:1;
                    char   b3:1;
                    char   b4:1;
                    char   b5:1;
                    char   b6:1;
                    char   b7:1;
                };

union byte_def{
                    struct bit_def bit;
                    char    byte;
                };
#pragma  ADDRESS  UDF  0384h
char  near  UDF;

#pragma  BIT  UDF_RAM
union  byte_def UDF_RAM=0 ;  /*Initial data*/

#define  TA0UD_RAM  UDF_RAM.bit.b0
#define  TA1UD_RAM  UDF_RAM.bit.b1
#define  TA2UD_RAM  UDF_RAM.bit.b2
#define  TA3UD_RAM  UDF_RAM.bit.b3
#define  TA4UD_RAM  UDF_RAM.bit.b4
#define  TA2P_RAM  UDF_RAM.bit.b5
#define  TA3P_RAM  UDF_RAM.bit.b6
#define  TA4P_RAM  UDF_RAM.bit.b7

void func(void);

void   func(void)
{
            ⋮
       TA0UD_RAM = 1 ;
       UDF = UDF_RAM.byte ;
            ⋮
}
```

‘Image of extract’

```
    ⋮
BSET        TA0UD_RAM
MOV.B       UDF_RAM, UDF
    ⋮
```

Figure 3. Example for C programming

GRADE A

MAEC TECHNICAL NEWS No.M16C-69-0104

Supplemental Description for WAIT Peripheral Function Clock Stop Bit

Classification

Corrections and supplementary explanation of document
Notes
Knowhow
✔ Others

Products Effected

M16C/60 Series
M16C/20 Series

1. Supplemental Description

The WAIT peripheral function clock stop bit (CM02) is used to halt peripheral operations during WAIT mode. When the WAIT peripheral function clock stop bit is set to “1”, all the peripheral clocks generated from main clock will stop. When the MCU running in low-speed or low power dissipation mode, do not enter WAIT mode with this bit(CM02) set to “1”.

We plan to add this information to the following data sheets in future.

M16C/60 Series
- M16C/62 group (M16C/62, M16C/62A)
- M16C/6H group
- M16C/6K group
- M16C/6N group
- M16C/6V group

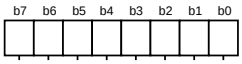
M16C/20 Series
- M30201 group
- M30218 group
- M30220 group
- M30221 group

Attached are the corresponding pages from the M16C/62A Group data sheet to be used as reference. The underlined text represents the additional comments.

Attached: M16C/62A Group data sheet (3 pages)

Figure 1.10.4 shows the system clock control registers 0 and 1.

System clock control register 0 (Note 1)

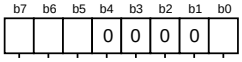


Symbol: CM0 | Address: 000616 | When reset: 4816

Bit symbol	Bit name	Function	R	W
CM00	Clock output function select bit (Valid only in single-chip mode)	b1 b0 0 0 : I/O port P57 0 1 : fC output 1 0 : f8 output 1 1 : f32 output	○	○
CM01			○	○
CM02	WAIT peripheral function clock stop bit	0 : Do not stop peripheral function clock in wait mode 1 : Stop peripheral function clock in wait mode (Note 8)	○	○
CM03	XCIN-XCOUT drive capacity select bit (Note 2)	0 : LOW 1 : HIGH	○	○
CM04	Port XC select bit	0 : I/O port 1 : XCIN-XCOUT generation	○	○
CM05	Main clock (XIN-XOUT) stop bit (Note 3, 4, 5)	0 : On 1 : Off	○	○
CM06	Main clock division select bit 0 (Note 7)	0 : CM16 and CM17 valid 1 : Division by 8 mode	○	○
CM07	System clock select bit (Note 6)	0 : XIN, XOUT 1 : XCIN, XCOUT	○	○

Note 1: Set bit 0 of the protect register (address 000A16) to “1” before writing to this register.
Note 2: Changes to “1” when shiffing to stop mode and at a reset.
Note 3: When entering power saving mode, main clock stops using this bit. When returning from stop mode and operating with XIN, set this bit to “0”. When main clock oscillation is operating by itself, set system clock select bit (CM07) to “1” before setting this bit to “1”.
Note 4: When inputting external clock, only clock oscillation buffer is stopped and clock input is acceptable.
Note 5: If this bit is set to “1”, XOUT turns “H”. The built-in feedback resistor remains being connected, so XIN turns pulled up to XOUT (“H”) via the feedback resistor.
Note 6: Set port Xc select bit (CM04) to “1” and stabilize the sub-clock oscillating before setting to this bit from “0” to “1”. Do not write to both bits at the same time. And also, set the main clock stop bit (CM05) to “0” and stabilize the main clock oscillating before setting this bit from “1” to “0”.
Note 7: This bit changes to “1” when shifting from high-speed/medium-speed mode to stop mode and at a reset. When shifting from low-speed/low power dissipation mode to stop mode, the value before stop mode is retained.
Note 8: fC32 is not included. Do not set to “1” when using low-speed or low power dissipation mode.

System clock control register 1 (Note 1)



Symbol: CM1 | Address: 000716 | When reset: 2016

Bit symbol	Bit name	Function	R	W
CM10	All clock stop control bit (Note4)	0 : Clock on 1 : All clocks off (stop mode)	○	○
Reserved bit		Always set to “0”	○	○
Reserved bit		Always set to “0”	○	○
Reserved bit		Always set to “0”	○	○
Reserved bit		Always set to “0”	○	○
CM15	XIN-XOUT drive capacity select bit (Note 2)	0 : LOW 1 : HIGH	○	○
CM16	Main clock division select bit 1 (Note 3)	b7 b6 0 0 : No division mode 0 1 : Division by 2 mode 1 0 : Division by 4 mode 1 1 : Division by 16 mode	○	○
CM17				

Note 1: Set bit 0 of the protect register (address 000A16) to “1” before writing to this register.
Note 2: This bit changes to “1” when shifting from high-speed/medium-speed mode to stop mode and at a reset. When shifting from low-speed/low power dissipation mode to stop mode, the value before stop mode is retained.
Note 3: Can be selected when bit 6 of the system clock control register 0 (address 000616) is “0”. If “1”, division mode is fixed at 8.
Note 4: If this bit is set to “1”, XOUT turns “H”, and the built-in feedback resistor is cut off. XCIN and XCOUT turn high-impedance state.

Figure 1.10.4. Clock control registers 0 and 1

Wait Mode

When a WAIT instruction is executed, the BCLK stops and the microcomputer enters the wait mode. In this mode, oscillation continues but the BCLK and watchdog timer stop. Writing "1" to the WAIT peripheral function clock stop bit and executing a WAIT instruction stops the clock being supplied to the internal peripheral functions, allowing power dissipation to be reduced. However, peripheral function clock fc32 does not stop so that the peripherals using fc32 do not contribute to the power saving. When the MCU running in low-speed or low power dissipation mode, do not enter WAIT mode with this bit set to "1". Table 1.10.3 shows the status of the ports in wait mode.

Wait mode is cancelled by a hardware reset or an interrupt. If an interrupt is used to cancel wait mode, the microcomputer restarts from the interrupt routine using as BCLK, the clock that had been selected when the WAIT instruction was executed.

Table 1.10.3. Port status during wait mode

Pin		Memory expansion mode Microprocessor mode	Single-chip mode
Address bus, data bus, $\overline{CS0}$ to $\overline{CS3}$		Retains status before wait mode	
$\overline{RD}$, $\overline{WR}$, $\overline{BHE}$, $\overline{WRL}$, $\overline{WRH}$		"H"	
$\overline{HLDA}$,BCLK		"H"	
ALE		"H"	
Port		Retains status before wait mode	Retains status before wait mode
CLK_{OUT}	When f_C selected	Valid only in single-chip mode	Does not stop
	When f_8, f_{32} selected	Valid only in single-chip mode	Does not stop when the WAIT peripheral function clock stop bit is "0". When the WAIT peripheral function clock stop bit is "1", the status immediately prior to entering wait mode is maintained.

Timer B (pulse period/pulse width measurement mode)

(1) If changing the measurement mode select bit is set after a count is started, the timer Bi interrupt request bit goes to “1”.

(2) When the first effective edge is input after a count is started, an indeterminate value is transferred to the reload register. At this time, timer Bi interrupt request is not generated.

A-D Converter

(1) Write to each bit (except bit 6) of A-D control register 0, to each bit of A-D control register 1, and to bit 0 of A-D control register 2 when A-D conversion is stopped (before a trigger occurs).
In particular, when the Vref connection bit is changed from “0” to “1”, start A-D conversion after an elapse of 1 μs or longer.

(2) When changing A-D operation mode, select analog input pin again.

(3) Using one-shot mode or single sweep mode
Read the correspondence A-D register after confirming A-D conversion is finished. (It is known by A-D conversion interrupt request bit.)

(4) Using repeat mode, repeat sweep mode 0 or repeat sweep mode 1
Use the undivided main clock as the internal CPU clock.

Stop Mode and Wait Mode

(1) When returning from stop mode by hardware reset, $\overline{\text{RESET}}$ pin must be set to “L” level until main clock oscillation is stabilized.

(2) When switching to either wait mode or stop mode, instructions occupying four bytes either from the WAIT instruction or from the instruction that sets the every-clock stop bit to “1” within the instruction queue are prefetched and then the program stops. So put at least four NOPs in succession either to the WAIT instruction or to the instruction that sets the every-clock stop bit to “1”.

(3) When the MCU running in low-speed or low power dissipation mode, do not enter WAIT mode with WAIT peripheral function clock stop bit set to “1”.

Interrupts

(1) Reading address 00000_{16}

- When maskable interrupt is occurred, CPU read the interrupt information (the interrupt number and interrupt request level) in the interrupt sequence.
  The interrupt request bit of the certain interrupt written in address 00000_{16} will then be set to “0”.
  Reading address 00000_{16} by software sets enabled highest priority interrupt source request bit to “0”.
  Though the interrupt is generated, the interrupt routine may not be executed.
  Do not read address 00000_{16} by software.

(2) Setting the stack pointer

- The value of the stack pointer immediately after reset is initialized to 0000_{16}. Accepting an interrupt before setting a value in the stack pointer may become a factor of runaway. Be sure to set a value in the stack pointer before accepting an interrupt.
  When using the $\overline{\text{NMI}}$ interrupt, initialize the stack point at the beginning of a program. Concerning the first instruction immediately after reset, generating any interrupts including the $\overline{\text{NMI}}$ interrupt is prohibited.

(3) The $\overline{\text{NMI}}$ interrupt

- The $\overline{\text{NMI}}$ interrupt can not be disabled. Be sure to connect $\overline{\text{NMI}}$ pin to Vcc via a pull-up resistor if unused.
- Do not get into stop mode with the $\overline{\text{NMI}}$ pin set to “L”.

GRADE A

MAEC TECHNICAL NEWS No.M16C-71-0105

Setting procedure of processor mode bits

Classification

Corrections and supplementary explanation of document

✔ Notes

Knowhow

Others

Products Effected

M16C/80 Series

M16C/60 Series

1. Precautions

Processor mode bits are allocated to bits 1 and 0 of the processor mode register 0. Regardless of the level of the CNVSS pin, changing the processor mode bits selects the mode. Therefore, never change the processor mode bits when changing the contents of other bits. Do not change the processor mode bits simultaneously with other bits when changing the processor mode bits "01_2" or "11_2". Change the processor mode bits after changing the other bits.

Figure 1 shows the processor mode register 0 of M16C/62A group, and figure 2 shows the setting procedure of processor mode bits.

Processor mode register 0 (Note 1)

b7	b6	b5	b4	b3	b2	b1	b0

Symbol: PM0 | Address: 0004_{16} | When reset: 00_{16} (Note 2)

Bit symbol	Bit name	Function	R	W
PM00	Processor mode bit	b1 b0 0 0: Single-chip mode 0 1: Memory expansion mode 1 0: Do not set 1 1: Microprocessor mode	○	○
PM01			○	○
PM02	R/W mode select bit	0 : RD,BHE,WR 1 : RD,WRH,WRL	○	○
PM03	Software reset bit	The device is reset when this bit is set to "1". The value of this bit is "0" when read.	○	○
PM04	Multiplexed bus space select bit	b5 b4 0 0 : Multiplexed bus is not used 0 1 : Allocated to CS2 space 1 0 : Allocated to CS1 space 1 1 : Allocated to entire space (Note4)	○	○
PM05			○	○
PM06	Port $P4_0$ to $P4_3$ function select bit (Note 3)	0 : Address output 1 : Port function (Address is not output)	○	○
PM07	BCLK output disable bit	0 : BCLK is output 1 : BCLK is not output (Pin is left floating)	○	○

Note 1: Set bit 1 of the protect register (address $000A_{16}$) to "1" when writing new values to this register.
Note 2: If the V_{CC} voltage is applied to the CNVSS, the value of this register when reset is 03_{16}. (PM00 and PM01 both are set to "1".)
Note 3: Valid in microprocessor and memory expansion modes.
Note 4: If the entire space is of multiplexed bus in memory expansion mode, choose an 8-bit width.The processor operates using the separate bus after reset is revoked, so the entire space multiplexed bus cannot be chosen in microprocessor mode.
$P3_1$ to $P3_7$ become a port if the entire space multiplexed bus is chosen, so only 256 bytes can be used in each chip select.

Figure 1. Processor mode register 0

When changing into the following state after reset
- Memory expansion mode
- Entire space multiplexed bus

MOV.B #00110001B, PM0

N.G.

MOV.B #00110000B, PM0 ; Setting other bits except the
; processor mode bits
MOV.B #00110001B, PM0

O.K.

Figure 2. Setting procedure

GRADE A

MAEC TECHNICAL NEWS No.M16C-75-0110

Corrections and Supplementary Explanation for M16C/20 Series, M16C/60 Series, M16C/80 Series Data Sheet and User's Manual

Classification

✔Corrections and supplementary explanation of document

Notes

Knowhow

Others

Products Effected

M16C/20 Series (Except for M16C/24 Group)

M16C/60 Series

M16C/80 Series

This is to inform you of the errors that have been found in the data sheets and user's manuals of the M16C/20, M16C/60 and M16C/80 Series. The error statements found in each data sheet and user's manual of the said series may not be exactly the same as the ones shown below. So please rectify the equivalent errors as shown below.

Data Sheet

Location: Timer B, pulse period/pulse width measurement mode

Error: The timer Bi overflow flag changes to "0" when the count start flag is "1" and a value is written to the timer Bi mode register.

Correction: Assume that the count start flag condition is "1" and then the Timer Bi overflow flag becomes "1". If the Timer Bi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Bi overflow flag becomes "0".

Location: Timer X (exist in M30201 Group), pulse period/pulse width measurement mode

Error: The timer Xi overflow flag changes to "0" when the count start flag is "1" and a value is written to the timer Xi mode register.

Correction: Assume that the count start flag condition is "1" and then the Timer Xi overflow flag becomes "1". If the Timer Xi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Xi overflow flag becomes "0".

User's Manual

Location: Hardware, timer B, pulse period/pulse width measurement mode

Error: The timer Bi overflow flag changes to "0" when the count start flag is "1" and a value is written to the timer Bi mode register.

Correction: Assume that the count start flag condition is "1" and then the Timer Bi overflow flag becomes "1". If the Timer Bi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Bi overflow flag becomes "0".

Location: Hardware, timer X (exist in M30201 Group), pulse period/pulse width measurement mode
Error: The timer Xi overflow flag changes to "0" when the count start flag is "1" and a value is written to the timer Xi mode register.
Correction: Assume that the count start flag condition is "1" and then the Timer Xi overflow flag becomes "1". If the Timer Xi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Xi overflow flag becomes "0".

Location: Peripheral functions usage, timer B, pulse period measurement mode
Error: The timer Bi overflow flag goes to "0" if timer Bi mode register is written to when the count start flag is "1".
Correction: Assume that the count start flag condition is "1" and then the Timer Bi overflow flag becomes "1". If the Timer Bi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Bi overflow flag becomes "0".

Location: Peripheral functions usage, timer B, pulse width measurement mode
Error: The timer Bi overflow flag goes to "0" if timer Bi mode register is written to when the count start flag is "1".
Correction: Assume that the count start flag condition is "1" and then the Timer Bi overflow flag becomes "1". If the Timer Bi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Bi overflow flag becomes "0".

Location: Peripheral functions usage, precautions for timer B, pulse period/pulse width measurement mode
Error: When reset, the timer Bi overflow flag goes to "1". This flag can be set to "0" by writing to the timer Bi mode register when the count start flag is "1".
Correction: After reset, the Timer Bi overflow flag is undefined. Under this condition, assume that the count start flag is set to "1" and then the Timer Bi mode register has a write-access after the timer starts counting. Therefore, the Timer Bi overflow flag becomes "0".

Location: Peripheral functions usage, timer X (exist in M30201 Group), pulse period measurement mode
Error: The timer Xi overflow flag goes to "0" if timer Xi mode register is written to when the count start flag is "1".
Correction: Assume that the count start flag condition is "1" and then the Timer Xi overflow flag becomes "1". If the Timer Xi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Xi overflow flag becomes "0".

Location: Peripheral functions usage, timer X (exist in M30201 Group), pulse width measurement mode
Error: The timer Xi overflow flag goes to "0" if timer Xi mode register is written to when the count start flag is "1".
Correction: Assume that the count start flag condition is "1" and then the Timer Xi overflow flag becomes "1". If the Timer Xi mode register has a write-access after next count cycle of the timer from the above condition, the Timer Xi overflow flag becomes "0".

Location: Peripheral functions usage, precautions for timer X (exist in M30201 Group), pulse period/pulse width measurement mode
Error: When reset, the timer Xi overflow flag goes to "1". This flag can be set to "0" by writing to the timer Xi mode register when the count start flag is "1".
Correction: After reset, the Timer Xi overflow flag is undefined. Under this condition, assume that the count start flag is set to "1" and then the Timer Xi mode register has a write-access after the timer starts counting. Therefore, the Timer Xi overflow flag becomes "0".

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Renesas Electronics Corporation
1753, Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8668 Japan