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M32C/84 Group

Operation of Timer B (pulse width measurement mode)

1. Abstract

In pulse period/pulse width measurement mode, choose functions from those listed in Table 1. Operations of the circled items are described below. Figure 1 shows the operation timing, and Figure 2 shows the set-up procedure. A reference program is an example when using the Timer B0 interrupt based on the setting procedure of Figure 2.

2. Introduction

This application note is applied to the M32C/84 group Microcomputers.

This program can be operated under the condition of M16C family products with the same SFR(Special Function Register) as M32C/84 Group products. Because some functions may be modified of the M16C family products, see the user's manual. When using the functions shown in this application note, evaluate them carefully for an operation

3. Chooosed functions

Table 1. Chooosed functions

Item	Set-up
Count source	0 Internal count source (f1 / f8 / f2n / fc32)
Measurement mode	Pulse period measurement (interval between measurement pulse falling edge to falling edge)
	Pulse period measurement (interval between measurement pulse rising edge to rising edge)
	0 Pulse width measurement (interval between measurement pulse falling edge to rising edge, and between rising edge to falling edge)

4. Operation

- (1) Setting the count start flag to "1" causes the counter to start counting the count source.
- (2) If an effective edge of a pulse to be measured is input, the value of the counter goes to "0000h", and measurement is started. In this instance, an indeterminate value is transferred to the reload register. The timer Bi interrupt request does not generate.
- (3) If an effective edge of a pulse to be measured is input again, the value of the counter is transferred to the reload register, and the timer Bi interrupt request bit goes to "1". Then the value of the counter becomes "0000h", and measurement is started again.

Note

- The timer Bi interrupt request bit goes to "1" when an effective edge of a pulse to be measured is input or timer Bi is overflows. The factor of interrupt request can be determined by use of the timer Bi overflow flag within the interrupt routine.
- The value of the counter at the beginning of a count is indeterminate. 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.
- The timer Bi overflow flag is indeterminate after reset. The timer Bi overflow flag goes to "0" if timer Bi mode register is written to when the count start flag is "1". This flag cannot be set to "1" by software.
- Set TBIIN pin's function select register A to I/O port and port direction register to "0".

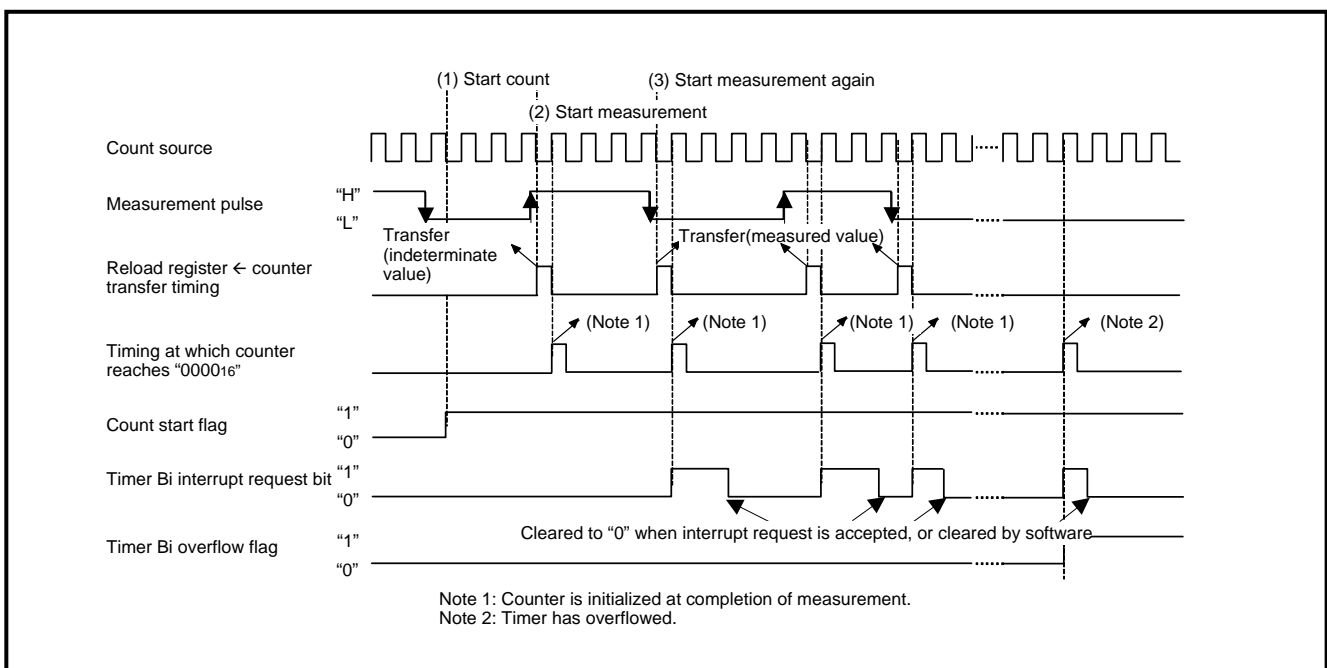


Figure 1. Operation timing of pulse width measurement mode

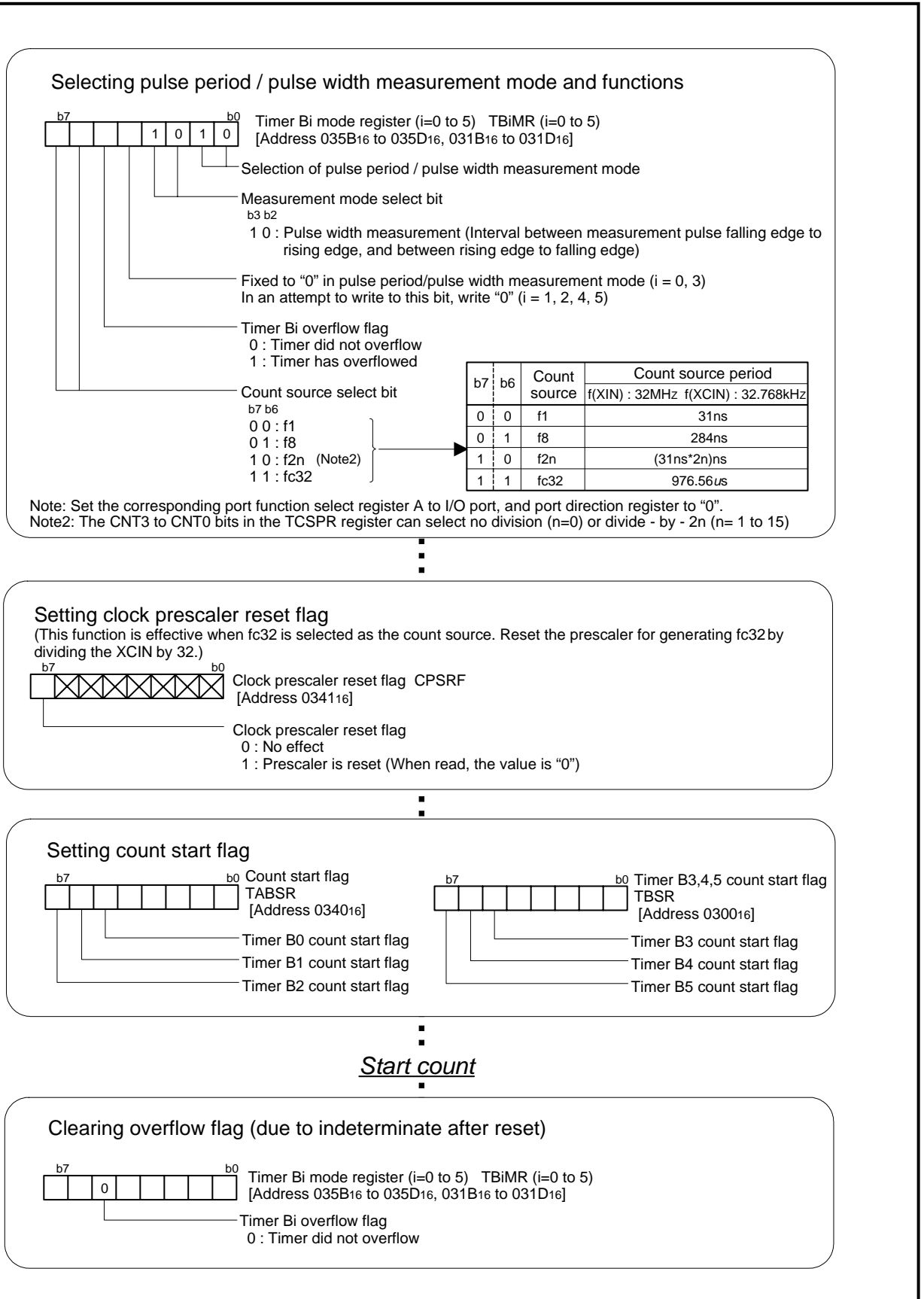


Figure 2. Set-up procedure of pulse width measurement mode

5. The example of reference program

```

*****
;
;
; M32C/84 Program Collection
;
; FILE NAME : rjj05b0716_src.a30
; CPU       : M32C/84 Group
; FUNCTION  : Operation of Timer B (pulse width measurement)
; HISTORY   : 2005.1.31 Ver 1.00
;
; Copyright(C)2005, Renesas Technology Corp.
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; All rights reserved.
;
*****
;
; Include
*****
;
; .LIST      off           ;Stops outputting lines to the assembler list file
; .INCLUDE   sfr32c84.inc  ;Reads the file that defined SFR
; .LIST      on           ;Starts outputting lines to the assembler list file
;
;
*****
;
; Symbol definition
*****
;
;
RAM_TOP      .equ    000400h    ;Start address of RAM
RAM_END      .equ    002affh    ;End address of RAM
ROM_TOP      .equ    0fe0000h   ;Start address of ROM
VECT_TOP     .equ    0ffe00h    ;Start address of vect_top
FIXED_VECT_TOP .equ    0fffdch   ;Start address of fixed_vect_top
;
;
*****
;
; Program area
*****
;
;=====
;
; Start up
;=====
;
; .SECTION   PROGRAM, CODE    ;Declares section name and section type
; .ORG      ROM_TOP          ;Declares start address
START:
;
; ldc       #RAM_END+1,isp    ;Sets interrupt stack pointer
; mov.b    #03h, prcr        ;Removes protect
; mov.b    #00000000b, pm0    ;Single-chip mode
; mov.b    #00000000b, pm1    ;
;

```

```

mov.b      #00001000b, cm0      ;Xcin-Xcout High
mov.b      #00100000b, cm1      ;
mov.b      #00010010b, mcd      ;No division mode
mov.b      #00h, prcr           ;Protects all registers
ldc        #VECT_TOP,intb      ;Sets interrupt table register
;
;=====
;   Main program
;=====
mov.b      #00000000b,tcspr      ;Count source prescaler register
;          +++++-----;No division
mov.b      #10000000b,tcspr      ;
;          +-----;Divider start
mov.b      #01001010b,tb0mr      ;Timer B0 mode register
;          ||||| ++-----;Pulse period/pulsewidth measurement mode
;          ||| | ++-----;Pulse width measurement(measurement between
;          ||| |              ;a falling edge and the next rising edge of measured
;          ||| |              ;pulse and between a rising edge and the next
;          ||| |              ;falling edge)
;          ||| +-----;Set to"0" in pulse period and pulse widge
;          |||              ;measurement mode
;          || +-----;Timer has not overflowed
;          ++-----;Count source(f8)
mov.b      #04H, prcr           ;Removes protect
bclr       pd9_0                ;(Note)Set the corresponding port direction register to "0"
;                                ;(TB0IN)
bclr       ps3_0                ;Port P9_0 is I/O port
mov.b      #00h,prcr           ;Protects all registers
mov.b      #00000011b,tb0ic      ;Interrupt control register
;          |+++-----;Interrupt priority level select bit
;          |              ;(011:Level 3, interrupt disabled)
;          +-----;Interrupt request bit (0:interrupt not requested)
mov.b      #00100000b,tabsr      ;Count start flag
;          +-----;Starts counting
fset       i                    ;Set interrupt enable flag
mov.b      #01001010b,tb0mr      ;Timer B0 mode register
;          +-----;Timer did not overflowed
MAIN:
;
jmp        MAIN
;=====
;   Interrupt program
;=====
TB0_INT:
;
;          ;/ TB0_INT interrupt routine /
;

```

```

        reit
;
;=====
;      Dummy interrupt processing program
;=====
DUMMY:
        reit
;
;*****
;      Setting of variable vector table
;*****
;
;      .SECTION      VECT,ROMDATA
;      .ORG          VECT_TOP + (8*4)
;
;      .lword        DUMMY      ;DMA0 interrupt vector
;      .lword        DUMMY      ;DMA1 interrupt vector
;      .lword        DUMMY      ;DMA2 interrupt vector
;      .lword        DUMMY      ;DMA3 interrupt vector
;      .lword        DUMMY      ;TA0 interrupt vector
;      .lword        DUMMY      ;TA1 interrupt vector
;      .lword        DUMMY      ;TA2 interrupt vector
;      .lword        DUMMY      ;TA3 interrupt vector
;      .lword        DUMMY      ;TA4 interrupt vector
;      .lword        DUMMY      ;UART0 transmit/NACK interrupt vector
;      .lword        DUMMY      ;UART0 receive/ACK interrupt vector
;      .lword        DUMMY      ;UART1 transmit/NACK interrupt vector
;      .lword        DUMMY      ;UART1 receive/ACK interrupt vector
;      .lword        TB0_INT     ;TB0 interrupt vector
;      .lword        DUMMY      ;TB1 interrupt vector
;      .lword        DUMMY      ;TB2 interrupt vector
;      .lword        DUMMY      ;TB3 interrupt vector
;      .lword        DUMMY      ;TB4 interrupt vector
;      .lword        DUMMY      ;INT5 interrupt vector
;      .lword        DUMMY      ;INT4 interrupt vector
;      .lword        DUMMY      ;INT3 interrupt vector
;      .lword        DUMMY      ;INT2 interrupt vector
;      .lword        DUMMY      ;INT1 interrupt vector
;      .lword        DUMMY      ;INT0 interrupt vector
;      .lword        DUMMY      ;TB5 interrupt vector
;      .lword        DUMMY      ;UART2 transmit/NACK interrupt vector
;      .lword        DUMMY      ;UART2 receive/ACK interrupt vector
;      .lword        DUMMY      ;UART3 transmit/NACK interrupt vector
;      .lword        DUMMY      ;UART3 receive/ACK interrupt vector
;      .lword        DUMMY      ;UART4 transmit/NACK interrupt vector
;      .lword        DUMMY      ;UART4 receive/ACK interrupt vector
;      .lword        DUMMY      ;Bus collision detection,start/stop

```



```

;condition detection (UART2) interrupt vector
.word          DUMMY          ;Bus collision detection,start/stop
;condition detection (UART3) interrupt vector
.word          DUMMY          ;Bus collision detection,start/stop
;condition detection (UART4) interrupt vector
.word          DUMMY          ;A-D interrupt vector
.word          DUMMY          ;KEY interrupt vector
.word          DUMMY          ;IntelligentI/O interrupt vector0
.word          DUMMY          ;IntelligentI/O interrupt vector1
.word          DUMMY          ;IntelligentI/O interrupt vector2
.word          DUMMY          ;IntelligentI/O interrupt vector3
.word          DUMMY          ;IntelligentI/O interrupt vector4
.word          DUMMY          ;IntelligentI/O interrupt vector8
.word          DUMMY          ;IntelligentI/O interrupt vector9,CAN0
.word          DUMMY          ;IntelligentI/O interrupt vector10,CAN1
.word          DUMMY          ;CAN2
;
;*****
;
;   Setting of fixed vector
;*****
;
;
;SECTION      F_VECT,ROMDATA
;ORG         FIXED_VECT_TOP
;
.word          DUMMY          ;Undefined instruction interrupt vector
.word          DUMMY          ;Overflow interrupt vector
.word          DUMMY          ;BRK instruction interrupt vector
.word          DUMMY          ;Address match interrupt vector
.word          DUMMY          ;
.word          DUMMY          ;Watchdog timer interrupt vector
.word          DUMMY          ;
.word          DUMMY          ;NMI interrupt vector
.word          START         ;Sets start vector
;
.end

```

6. Referense

Hardware manual

M32C/84 group (Tentative version) Hardware Manual Rev.0.50

(Use the latest version on the web-site: <http://www.renesas.com>)

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Revision

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		Page	Point
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