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April 1st, 2010
Renesas Electronics Corporation

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M16C/80 Group

Operation of Timer A (one-shot timer mode)

1.0 Abstract

In one-shot timer mode, choose functions from those listed in Table 1. Operations of the circled items are described below.

Table 1. Choosed functions

Item	Set-up	
Count source	**O**	Internal count source (f_1 / f_8 / f_{32} / fc_{32})
Pulse output function		No pulses output
	O	Pulses output
Count start condition		External trigger input (falling edge of input signal to the TAi_{IN} pin)
		External trigger input (rising edge of input signal to the TAi_{IN} pin)
		Timer overflow (TB2/TAj/TAk overflow)
	O	Writing “1” to the one-shot start flag

Note: j = i – 1, but j = 4 when i = 0; k = i + 1, but k = 0 when i = 4.

2.0 Introduction

Operation (1) Setting the one-shot start flag to “1” with the count start flag set to “1” causes the counter to perform a down count on the count source. At this time, the TAi_{OUT} pin outputs an “H” level.

(2) The instant the value of the counter becomes “0000_{16}”, the TAi_{OUT} pin outputs an “L” level, and the counter reloads the content of the reload register and stops counting. At this time, the timer Ai interrupt request bit goes to “1”.

(3) If a trigger occurs while a count is in progress, the counter reloads the value in the reload register again and continues counting. The reload timing is in step with the next count source input after the trigger.

(4) Setting the count start flag to “0” causes the counter to stop and to reload the content of the reload register. Also, the TAi_{OUT} pin outputs an “L” level. At this time, the timer Ai interrupt request bit goes to “1”.

Note
- When using pulse output, select TAi_{OUT} output function with the function select register A and B.
- When setting the function select registers A, B, and C, sets the function select registers B and/or C first, and then sets the function select register A.

Figure 1 shows the operation timing

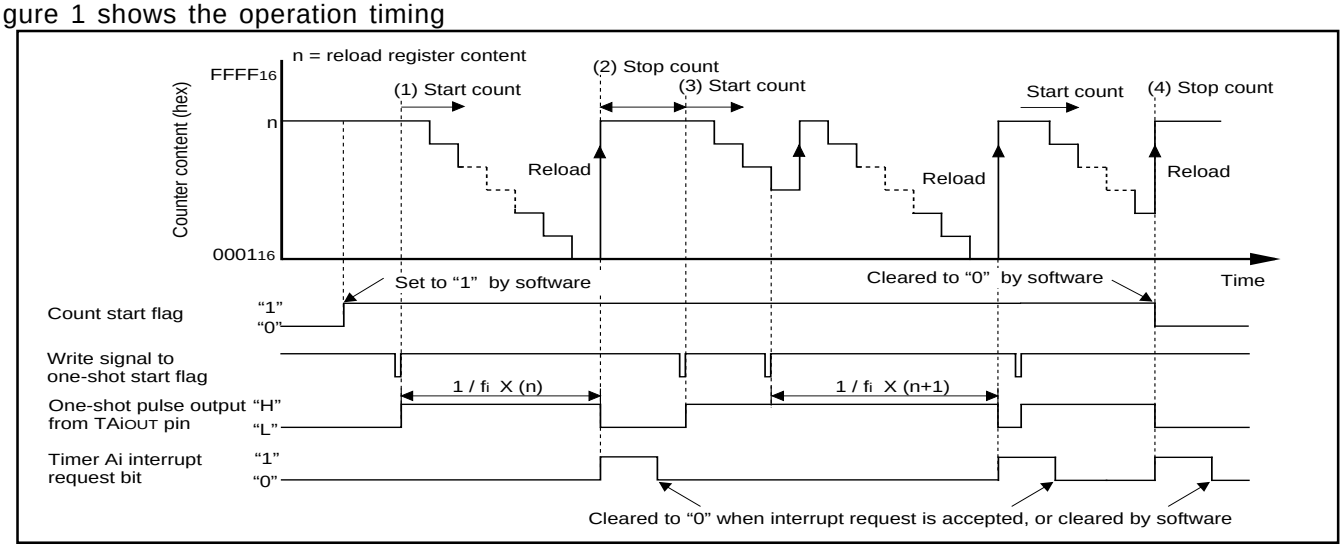

Figure 1. Operation timing of one-shot mode

3.0 Set-up procedure

Selecting one-shot timer mode and functions

b7 b0: 0 0 _ _ 1 0

Timer Ai mode register (i=0 to 4) [Address 0356$_{16}$ to 035A$_{16}$]
TAiMR (i=0 to 4)

Selection of one-shot timer mode

External trigger select bit
When internal trigger is selected, this bit can be “1” or “0”

Trigger select bit
0 : When the one-shot start flag is set “1”

0 (Must always be “0” in one-shot timer mode)

Count source select bit
b7 b6
0 0 : f_1
0 1 : f_8
1 0 : f_{32}
1 1 : f_{C32}

b7	b6	Count source	Count source period f(X_{IN}):20MHz	Count source period f(X_{CIN}):32.768kHz
0	0	f_1	50ns	
0	1	f_8	400ns	
1	0	f_{32}	1.6µs	
1	1	f_{C32}	976.56µs	

Setting function select register A and B

Function select register A1
[Address 03B1$_{16}$]
PS1

Port 7_0 output function select bit
0 : I/O port
1 : Peripheral function output (PSL1_0 enabled)

Port $P7_2$ output function select bit
0 : I/O port
1 : Peripheral function output (PSL1_2, PSC_0 enabled)

Port $P7_4$ output function select bit
0 : I/O port
1 : Peripheral function output (PSL1_4 enabled)

Port $P7_6$ output function select bit
0 : I/O port
1 : $TA3_{OUT}$ output

Function select register A2
[Address 03B4$_{16}$]
PS2

Port 8_0 function select bit
0 : I/O port
1 : Peripheral function output (PSL2_0 enabled)

Function select register B1
[Address 03B3$_{16}$]
PSL1

Port $P7_0$ output peripheral function select bit
0 : TxD_2(SDA$_2$) output
1 : $TA0_{OUT}$ output

Port $P7_2$ output peripheral function select bit
0 : Port $P7_2$ peripheral subfunction select bit
1 : $TA1_{OUT}$ output

Port $P7_4$ output peripheral function select bit
0 : $TA2_{OUT}$ output
1 : W phase output

Function select register B2
[Address 03B6$_{16}$]
PSL2

Port 8_0 output peripheral function select bit
0 : $TA4_{OUT}$ output
1 : U phase output

Function select register C [Address 03AF$_{16}$]
PSC

Port $P7_2$ output peripheral subfunction select bit
0 : Must set "0" in selecting $TA1_{OUT}$ output

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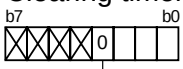
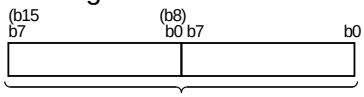
Clearing timer Ai interrupt request bit

(Please refer to the notes on the one-shot timer mode of Timer A in the User's manual.)



Timer Ai interrupt control register
[Addresses 006C16, 008C16, 006E16, 008E16, 007016]
TAiIC (i=0 to 4)
Interrupt request bit

Setting one-shot timer's time

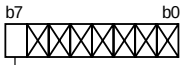


Timer A0 register [Address 034716, 034616] TA0
Timer A1 register [Address 034916, 034816] TA1
Timer A2 register [Address 034B16, 034A16] TA2
Timer A3 register [Address 034D16, 034C16] TA3
Timer A4 register [Address 034F16, 034E16] TA4

Can be set to 000116 to FFFF16

Setting clock prescaler reset flag

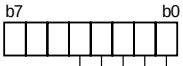
(This function is effective when fC32 is selected as the count source. Reset the prescaler for generating fC32 by dividing the XCIN by 32.)



Clock prescaler reset flag [Address 034116]
CPSRF

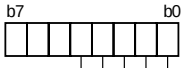
Clock prescaler reset flag
0 : No effect
1 : Prescaler is reset (When read, the value is "0")

Setting count start flag



Count start flag [Address 034016]
TABSR
Timer A0 count start flag
Timer A1 count start flag
Timer A2 count start flag
Timer A3 count start flag
Timer A4 count start flag

Setting one-shot start flag



One-shot start flag [Address 034216]
ONSF
Timer A0 one-shot start flag
Timer A1 one-shot start flag
Timer A2 one-shot start flag
Timer A3 one-shot start flag
Timer A4 one-shot start flag

Start count

4.0 Programming Code

```
;***************************************************************************************
;
;   M16C/80 Program Collection
;
;   FILE NAME : rjj05b0130_src.a30
;   CPU       : M16C/80 Group
;   FUNCTION  : Operation of Timer A
;               (one-shot timer mode)
;   HISTORY   : 2003.06.16  Ver 1.00
;
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;
;***************************************************************************************
;***************************************************************************************
;       Include
;***************************************************************************************
        .LIST       OFF             ;Stops outputting lines to the assembler list file
        .INCLUDE    sfr80100.inc    ;Reads the file that defined SFR
        .LIST       ON              ;Starts outputting lines to the assembler list file
;***************************************************************************************
;       Symbol definition
;***************************************************************************************
ROM_TOP         .EQU    0FFC000H    ;Start address of ROM
FIXED_VECT_TOP  .EQU    0FFFFDCH    ;Start address of fixed vector
;***************************************************************************************
;       Program area
;***************************************************************************************
;=======================================================================
;       Start up
;=======================================================================
        .SECTION    PROGRAM, CODE  ;Declares section name and section type
        .ORG        ROM_TOP        ;Declares start address
RESET:
        ; Sets Processor mode, System clock and Main clock division
        MOV.B    #03H, prcr        ;Removes protect
        MOV.B    #10000000B, pm0   ; Single-chip mode
        MOV.B    #11000000B, pm1   ; Flash memory version
        MOV.B    #00001000B, cm0   ; Xcin-Xcout High
        MOV.B    #00100000B, cm1   ; Xin-Xout High
        MOV.B    #00010010B, mcd   ; No division mode
        MOV.B    #00H, prcr        ;Protects all registers
;
```

```
;===============================================================================
;       TimerA (one-shot timer mode)
;===============================================================================
        ; Selecting one-shot timer mode and functions
        MOV.B    #01000010B, ta1mr
;                 ||||||++---------;Selection of one-shot timer mode
;                 |||||+-----------;This bit is invalid in M16C/80 series
;                 ||||+------------;External trigger select bit
;                 ||||              (When internal trigger is selected,this bit can be "1" or "0")
;                 |||+-------------;Trigger select bit
;                 |||               (0:When the one-shot start flag is set "1")
;                 ||+--------------;Must always be "0" in one-shot timer mode
;                 ++---------------;Count source (01:f8)
        ; Clearing timer A1 interrupt request bit
        MOV.B    #00000000B, ta1ic
;                     +------------;Interrupt request bit
        ; Setting function select register A and B (Setting pulse output function)
        BSET     psl1_2             ;Port P72 peripheral function select bit (TA1OUT output)
        BCLR     psc_0              ;Must set "0" in selecting TA1OUT output
        BSET     ps1_2              ;Port P72 function select bit (peripheral function output)
        ; Setting one-shot timer's time
        MOV.W    #2500, ta1         ;(1msec @20MHz, f8)
        ; Setting clock prescaler reset flag
        ; (This function is effective when fC32 is selected as the count source)
        MOV.B    #00000000B, cpsrf
;                 +----------------;Clock prescaler reset flag (0:No effect)
        ; Setting count start flag
        MOV.B    #00000010B, tabsr
;                       +----------;Timer A1 count start flag
        ; Setting one-shot start flag
        MOV.B    #00000010B, onsf
;                       +----------;Timer A1 one-shot start flag
;
MAIN:
        JMP      MAIN
;
;===============================================================================
;       Dummy interrupt processing program
;===============================================================================
dummy:
        REIT
;
;*******************************************************************************
;       Setting of fixed vector
;*******************************************************************************
        .SECTION    F_VECT, ROMDATA
        .ORG        FIXED_VECT_TOP
;
        .LWORD    dummy    ;Undefined instruction
        .LWORD    dummy    ;Overflow
        .LWORD    dummy    ;BRK instruction execution
        .LWORD    dummy    ;Address match
        .LWORD    dummy    ;
        .LWORD    dummy    ;Watchdog timer
        .LWORD    dummy    ;
        .LWORD    dummy    ;NMI
        .LWORD    RESET    ;Reset
;
        .END
```

5.0 Reference

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Data Sheet

M16C/80 group Rev. E3
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M16C/80 group Rev. B
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