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April 1st, 2010
Renesas Electronics Corporation

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M16C/80 Group

Operation of Timer A (timer mode, gate function)

1.0 Abstract

In 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	**O**	No pulses output
		Pulses output
Gate function		No gate function
		Performs count only for the period in which the TAiIN pin is at "L" level
	O	Performs count only for the period in which the TAiIN pin is at "H" level

2.0 Introduction

Operation (1) When the count start flag is set to "1" and the TAi_{IN} pin inputs at "H" level, the counter performs a down count on the count source.

(2) When the TAiIN pin inputs at "L" level, the counter holds its value and stops.

(3) If an underflow occurs, the content of the reload register is reloaded and the count continues. At this time, the timer Ai interrupt request bit goes to "1".

(4) Setting the count start flag to "0" causes the counter to hold its value and to stop.

Note
- Make the pulse width of the signal input to the TAiIN pin not less than two cycles of the count source.
- Set the corresponding function select register A to I/O port and port direction register to "0".
- When not using pulse output, do not select TAiOUT output function with the function select register A and B.

Figure 1 shows the operation timing

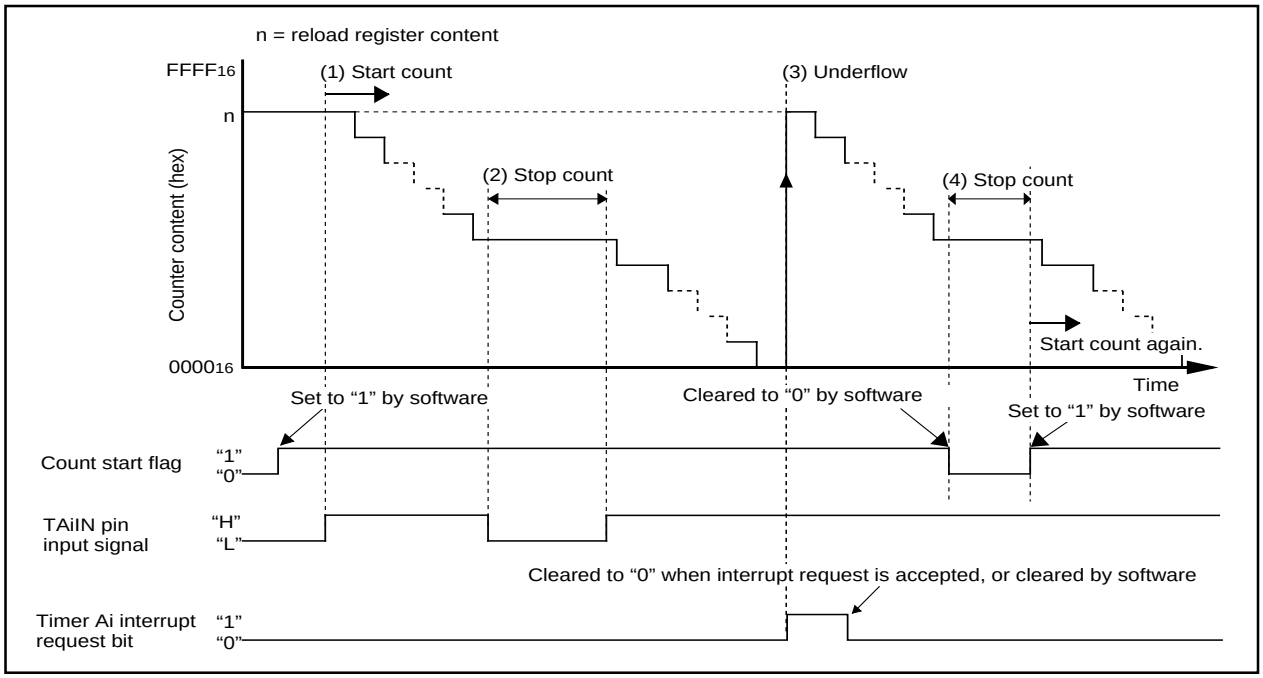
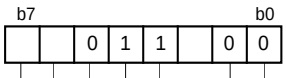


Figure 1. Operation timing of timer mode, gate function selected

3.0 Set-up procedure

Selecting timer mode and functions



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

Selection of timer mode

Gate function select bit
b4 b3
1 1 : Timer counts only when TA_{iIN} pin is held "H" (Note)

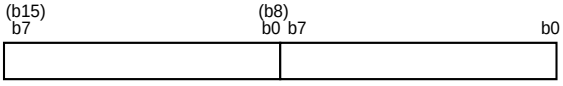
0 (Must always be "0" in timer mode)

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 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

Note: Set the corresponding function select register A to I/O port and port direction register to "0".

Setting divide ratio

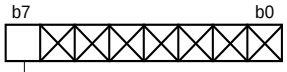


Timer A0 register [Address 0347_{16}, 0346_{16}] TA0
Timer A1 register [Address 0349_{16}, 0348_{16}] TA1
Timer A2 register [Address $034B_{16}$, $034A_{16}$] TA2
Timer A3 register [Address $034D_{16}$, $034C_{16}$] TA3
Timer A4 register [Address $034F_{16}$, $034E_{16}$] TA4

Can be set to 0000_{16} to $FFFF_{16}$

Setting clock prescaler reset flag

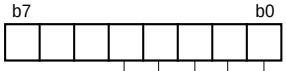
(This function is effective when f_{C32} is selected as the count source. Reset the prescaler for generating f_{C32} by dividing the X_{CIN} by 32.)



Clock prescaler reset flag [Address 0341_{16}]
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 0340_{16}]
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

Start count

4.0 Programming Code

```
;***********************************************************************************
;
;   M16C/80 Program Collection
;
;   FILE NAME : rjj05b0123_src.a30
;   CPU       : M16C/80 Group
;   FUNCTION  : Operation of Timer A
;               (timer mode, gate function)
;   HISTORY   : 2003.06.16  Ver 1.00
;
;   Copyright(C)2003, Renesas Technology Corp.
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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 (timer mode,gate function selected)
;======================================================================
        ; Selecting timer mode and functions
        MOV.B    #01011000B, ta1mr
;                 ||||||++---------;Selection of timer mode
;                 |||||+-----------;This bit is invalid in M16C/80 series
;                 |||++------------;Gate function select bit
;                 |||               (11:Timer counts only when TAiIN pin is held "H") (Note)
;                 ||+--------------;Must always be "0" in timer mode
;                 ++---------------;Count source (01:f8)
        ; (Note) Sets the corresponding function select register A to I/O port and
        ; port direction register to "0"
        BCLR     pd7_3             ;Port P73 direction register
        BCLR     ps1_3             ;Port P73 is I/O port
        ; Setting divide ratio
        MOV.W    #2500-1, 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
;
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

Renesas Technology Corporation Semiconductor Home page

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Technical Support

E-mail: support_apl@renesas.com

Data Sheet

M16C/80 group Rev. E3
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