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April 1st, 2010
Renesas Electronics Corporation

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M16C/62A Group
Delayed One-Shot Output

1.0 Abstract
The following are steps of outputting a pulse only once after a specified elapse since an external trigger is input.
Use the following peripheral function:
- One-shot timer mode of timer A

2.0 Introduction
Specifications
(1) Set timer A0 in one-shot timer mode, and set timer A1 in one-shot timer mode with pulse-output function.
(2) Set 1 ms, an interval before a pulse is output, in timer A0; and set 50 µs, a pulse width, in timer A1. Both timer A0 and timer A1 use f_1 for the count source.
(3) Connect a 16-MHz oscillator to X_{IN}.

Operation
(1) Setting the trigger select bit to “1” and setting the count start flag to “1” enables the counter of timer A0 to count.
(2) If an effective edge, selected by use of the external trigger select bit, is input to the $TA0_{IN}$ pin, the counter begins a down count. The counter of timer A0 performs a down count on count source f_1.
(3) As soon as the counter of timer A0 becomes “0000_{16}”, the counter reloads the content of the reload register and stops counting. At this time, the timer A0 interrupt request bit goes to “1”.
(4) An underflow in timer A0 triggers the counter of timer A1 and causes it to begin counting. When timer A1 begins counting, the output level of the $TA1_{OUT}$ pin goes to “H”.
(5) As soon as the counter of timer A1 becomes “0000_{16}”, the output level of the $TA1_{OUT}$ pin goes to “L”, the counter reloads the content of the reload register, and stops counting. At this time, timer A1 interrupt request bit goes to “1”.

Figure 1 shows the operation timing

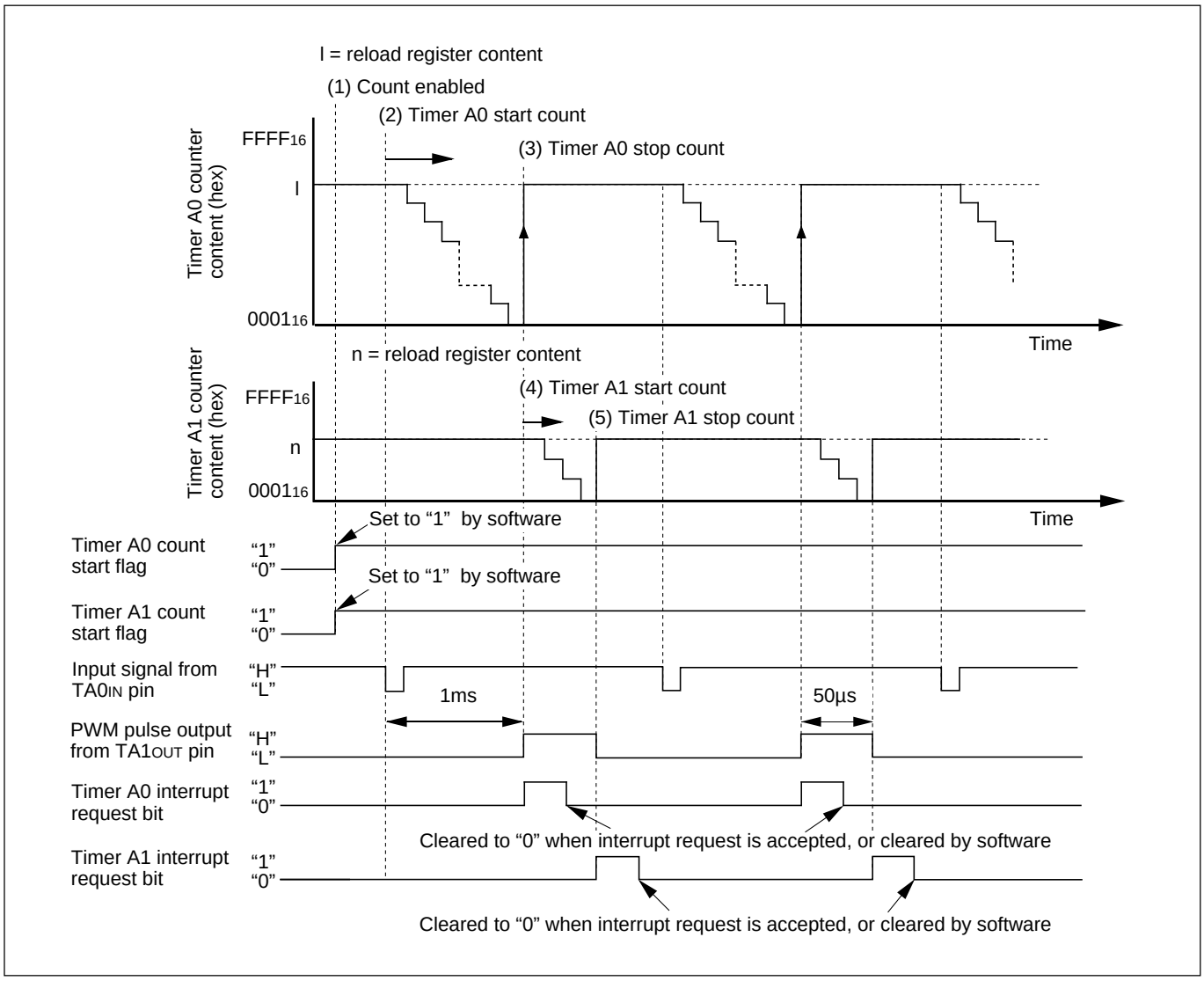


Figure 1. Operation timing of delayed one-shot output

Figure 2 shows the connection diagram

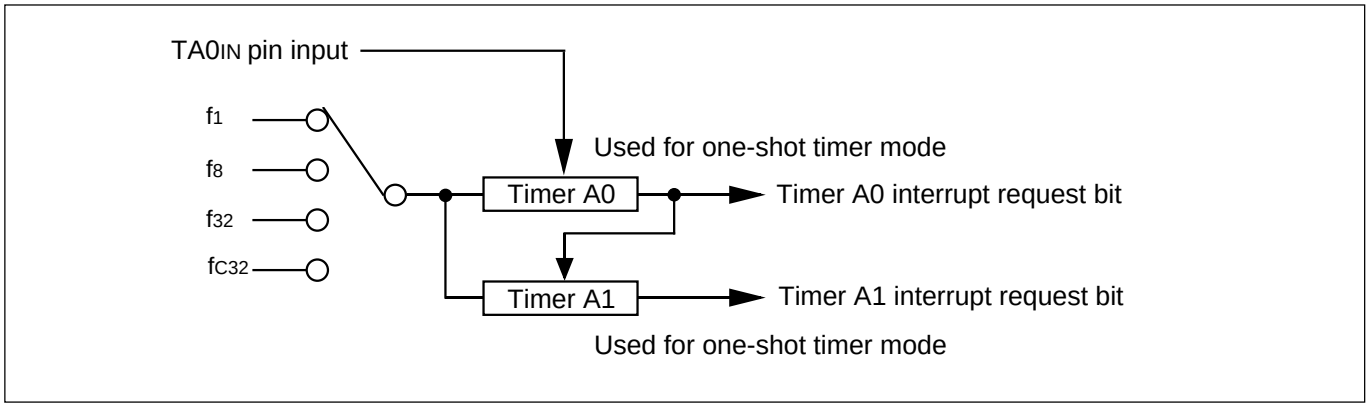
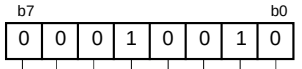


Figure 2. Connection diagram of delayed one-shot output

3.0 Set-up procedure

Setting timer A0

Selecting one-shot timer mode and functions



Timer A0 mode register [Address 039616]
TA0MR

Selection of one-shot timer mode

Pulse output function select bit
0 : Pulse is not output (TA0OUT pin is normal port pin)

External trigger select bit
0 : Falling edge of TA0IN pin's input signal

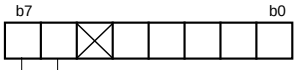
Trigger select bit
1 : Selected by event/trigger select register

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

Count source select bit
b7 b6
0 0 : f1

b7	b6	Count source	Count source period f(XIN) : 16MHz f(XCIN) : 32.768kHz
0	0	f1	62.5ns
0	1	f8	500ns
1	0	f32	2µs
1	1	fC32	976.56µs

Setting one-shot start flag
(Select TA0IN pin to input TA0 trigger)

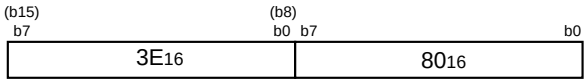


One-shot start flag [Address 038216]
ONSF

Timer A0 event/trigger select bit
b7 b6
0 0 : Input on TA0IN is selected (Note)

Note: Set the corresponding port direction register to “0”.

Setting delay time



Timer A0 register [Address 038716, 038616]
TA0

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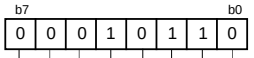
Setting timer A1

Selecting one-shot timer mode and functions



Timer A1 mode register [Address 0397_{16}]
TA1MR

Selection of one-shot timer mode

Pulse output function select bit
1 : Pulse is output (TA1OUT pin is pulse output pin)

External trigger select bit
Invalid when choosing timer's overflow

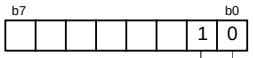
Trigger select bit
1 : Selected by event/trigger select register

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

Count source select bit
b7 b6
0 0 : f_1

b7	b6	Count source	Count source period f(XIN) : 16MHz f(XCIN) : 32.768kHz
0	0	f_1	62.5ns
0	1	f_8	500ns
1	0	f_{32}	2µs
1	1	f_{C32}	976.56µs

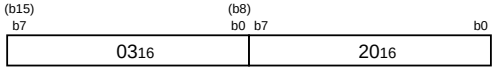
Setting trigger select register
(Set timer A0 to trigger timer A1)



Trigger select register [Address 0383_{16}]
TRGSR

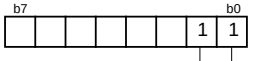
Timer A1 event/trigger select bit
b1 b0
1 0 : TA0 overflow is selected

Setting one-shot timer's time



Timer A1 register [Address 0389_{16}, 0388_{16}]
TA1

Setting count start flag



Count start flag [Address 0380_{16}]
TABSR

Timer A0 count start flag
1 : Starts counting

Timer A1 count start flag
1 : Starts counting

Start counting

4.0 Programming Code

```
;*****************************************************************************
;
;   M16C/62A Program Collection
;
;   FILE NAME : rjj05b0071_src.a30
;   CPU       : M16C/62A Group
;   FUNCTION  : Timer A Applications
;               (Delayed One-Shot Output)
;   HISTORY   : 2003.05.16  Ver 1.00
;
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;
;*****************************************************************************
;*****************************************************************************
;       Include
;*****************************************************************************
        .LIST       OFF             ;Stops outputting lines to the assembler list file
        .INCLUDE    sfr62a.inc      ;Reads the file that defined SFR
        .LIST       ON              ;Starts outputting lines to the assembler list file
;
;*****************************************************************************
;       Symbol definition
;*****************************************************************************
ROM_TOP         .EQU    0F8000H     ;Start address of ROM
FIXED_VECT_TOP  .EQU    0FFFDCH     ;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:
        MOV.B    #03H, prcr         ;Removes protect
                                    ;Set processor mode registers 0 and 1
        MOV.B    #00000000B, pm0    ; Single-chip mode
        MOV.B    #00000000B, pm1    ; No expansion, No wait
                                    ;Set system clock control registers 0 and 1
        MOV.B    #00001000B, cm0    ; Xcin-Xcout High
        MOV.B    #00100000B, cm1    ; Xin-Xout High, Main clock is No divison
        MOV.B    #00H, prcr         ;Protects all registers
;
```

```
;===============================================================================
;       TimerA (delayed one-shot output)
;===============================================================================
;------------TimerA0------------
        MOV.B    #00010010B, ta0mr ;TimerA0 mode register
;                 ||||||++---------;Selection of one-shot timer mode
;                 |||||+-----------;Pulse output function select bit
;                 |||||             (0:Pulse is not output (TA0OUT pin is normal port pin))
;                 ||||+------------;External trigger select bit
;                 ||||              (0:Falling edge of TA0IN pin's input pin)
;                 |||+-------------;Trigger select bit
;                 |||               (1:Selected by event/trigger select register)
;                 ||+--------------;Must always be "0" in one-shot timer mode
;                 ++---------------;Count source select bit (00:Count source f1)
        MOV.B    #00000000B, onsf  ;Setting one-shot start flag
;                 ++---------------;Timer A0 event/trigger select bit
;                                   (00:Input on TA0IN is selected) (Note)
        BCLR     pd7_1             ;(Note)Set the corresponding port direction register to "0"
        MOV.W    #3E80H, ta0       ;Setting delay time (1msec @16MHz, f1)
;
;------------TimerA1------------
        MOV.B    #00010110B, ta1mr ;TimerA1 mode register
;                 ||||||++---------;Selection of one-shot timer mode
;                 |||||+-----------;Pulse output function select bit
;                 |||||             (1:Pulse is output(TA1OUT pin is pulse output pin))
;                 ||||+------------;External trigger select bit
;                 ||||              (Invalid when choosing timer's overflow)
;                 |||+-------------;Trigger select bit
;                 |||               (1:Selected by event/trigger select register)
;                 ||+--------------;Must always be "0" in one-shot timer mode
;                 ++---------------;Count source select bit (00:Count source f1)
        MOV.B    #00000010B, trgsr ;Setting trigger select register
;                       ++---------;Timer A1 event/trigger select bit
;                                   (10:TA0 overflow is selected)
        MOV.W    #0320H, ta1       ;Setting one-shot time's time (50u @16MHz, f1)
        MOV.B    #00000011B, tabsr ;Setting count start flag
;                       |+---------;TimerA0 count start flag(1:Starts counting)
;                       +----------;TimerA1 count start flag(1:Starts counting)
;
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 interrupt vector
        .LWORD    dummy    ;Overflow (INT0 instruction) interrupt vector
        .LWORD    dummy    ;BRK instruction interrupt vector
        .LWORD    dummy    ;Address match interrupt vector
        .LWORD    dummy    ;Single-step interrupt vector
        .LWORD    dummy    ;Watchdog timer interrupt vector
        .LWORD    dummy    ;DBC interrupt vector
        .LWORD    dummy    ;NMI interrupt vector
        .LWORD    RESET    ;Sets reset vector
;
        .END
```

5.0 Reference

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Data Sheet

M16C/62A group Rev. C.1
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