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April 1st, 2010
Renesas Electronics Corporation

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M16C/80 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 20-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 gose 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 gose to “H”.
(5) As soon as the counter of timer A1 becomes “0000_{16}”, the output level of the $TA1_{OUT}$ pin gose to “L”, the counter reloads the content of the reload register, and stops counting. At this time, timer A1 interrupt request bit gose to “1”.

Note • 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.

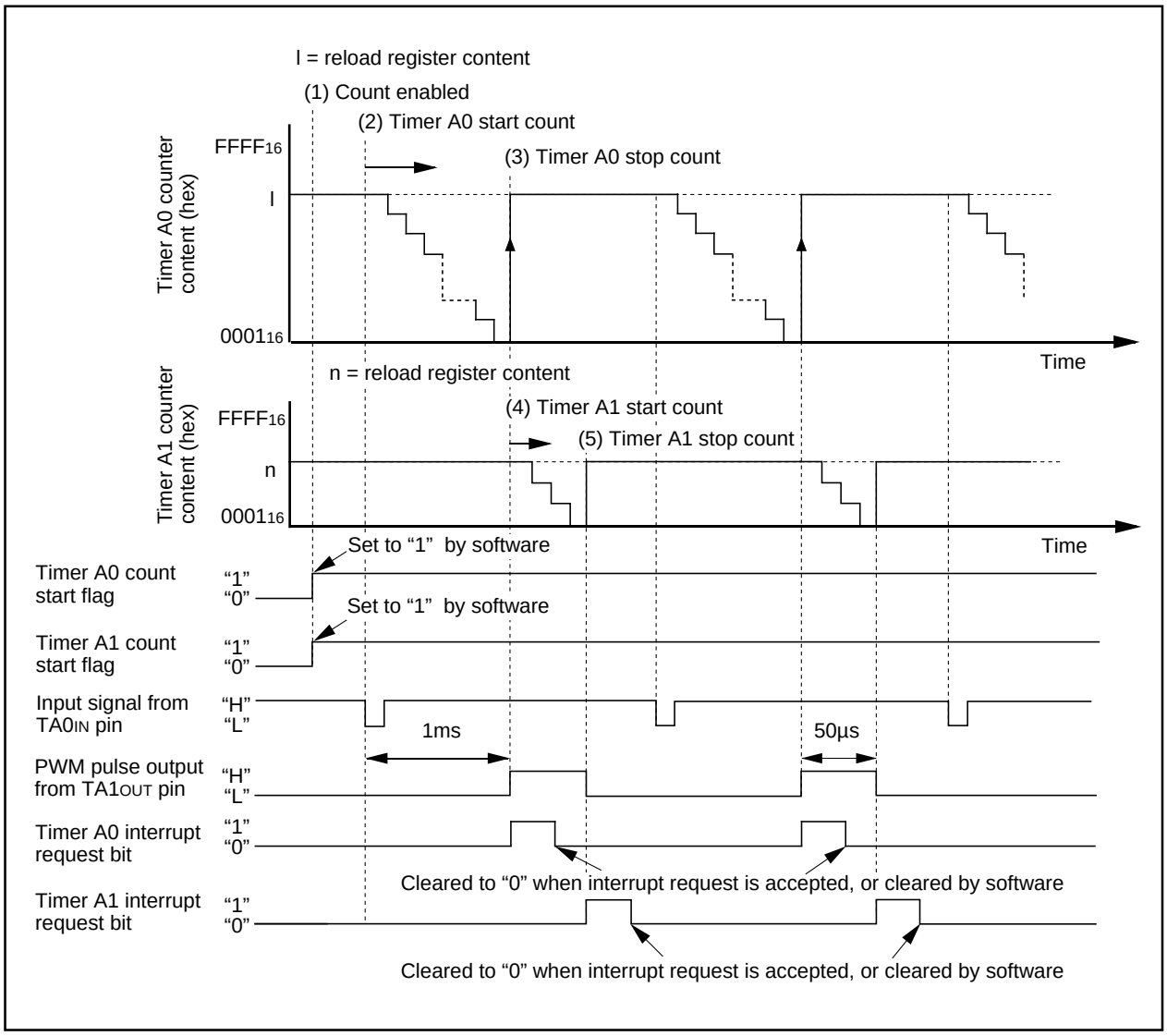


Figure 1. Operation timing of delayed one-shot output

Figure 2 shows the connection diagram.

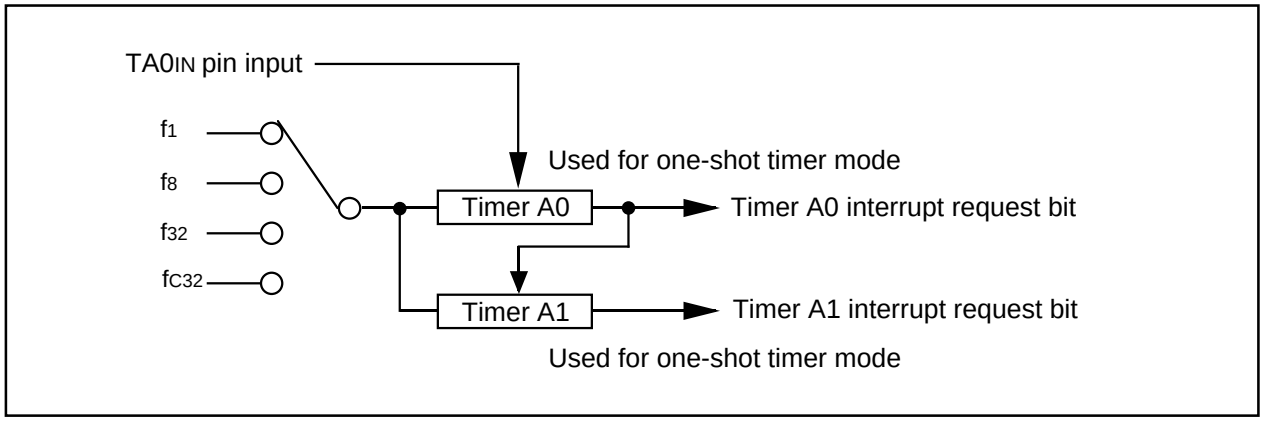
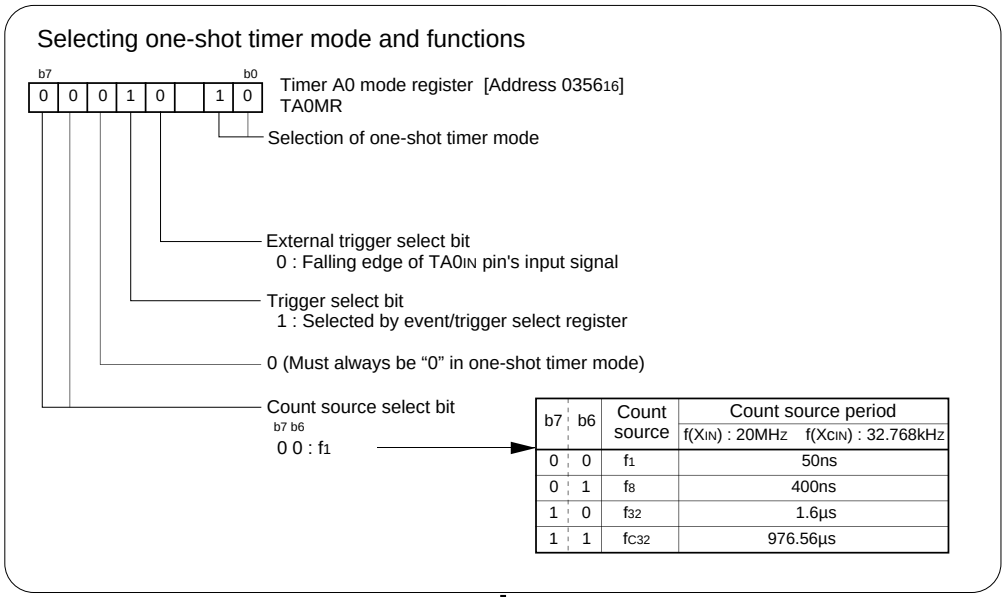
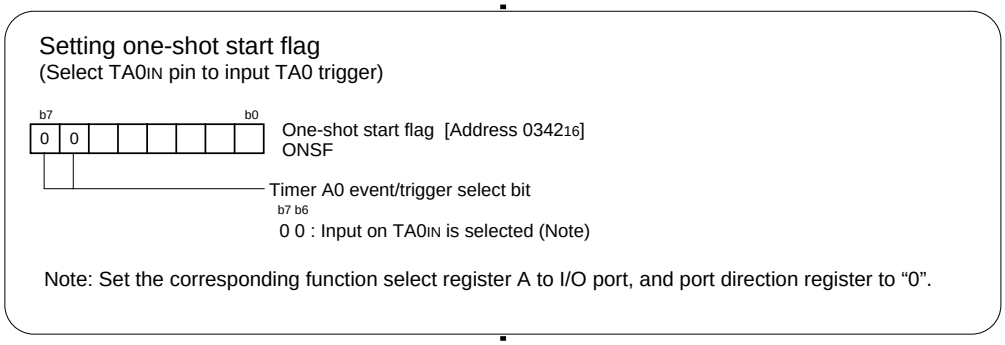


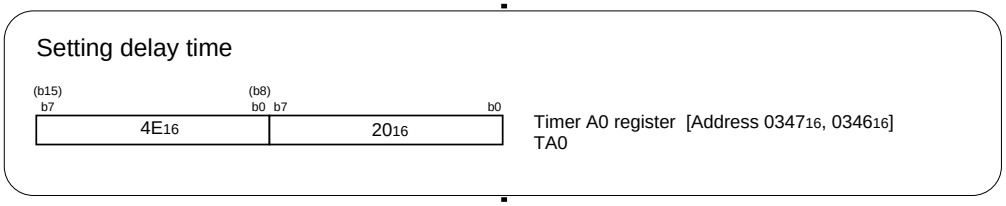
Figure 2. Connection diagram of delayed one-shot output

3.0 Set-up procedure

Setting timer A0







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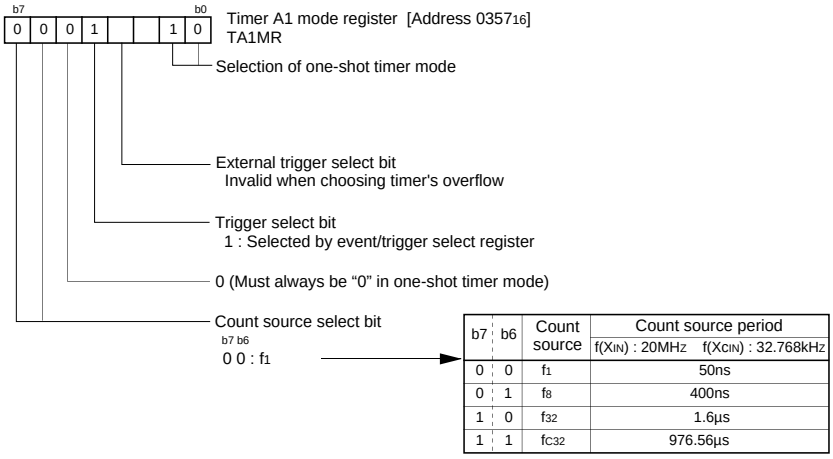
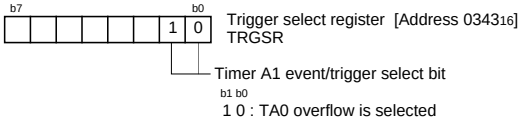
Setting timer A1

Selecting one-shot timer mode and functions

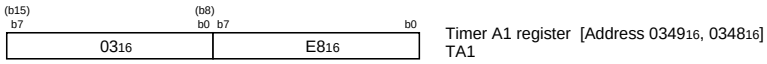


b7	b6	Count source	Count source period f(XIN) : 20MHz f(XCIN) : 32.768kHz
0	0	f1	50ns
0	1	f8	400ns
1	0	f32	1.6µs
1	1	fC32	976.56µs

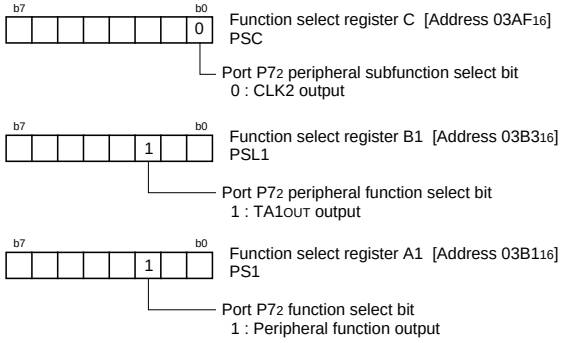
Setting trigger select register
(Set timer A0 to trigger timer A1)



Setting one-shot timer's time



Setting timer TA1 pulse output



Start counting

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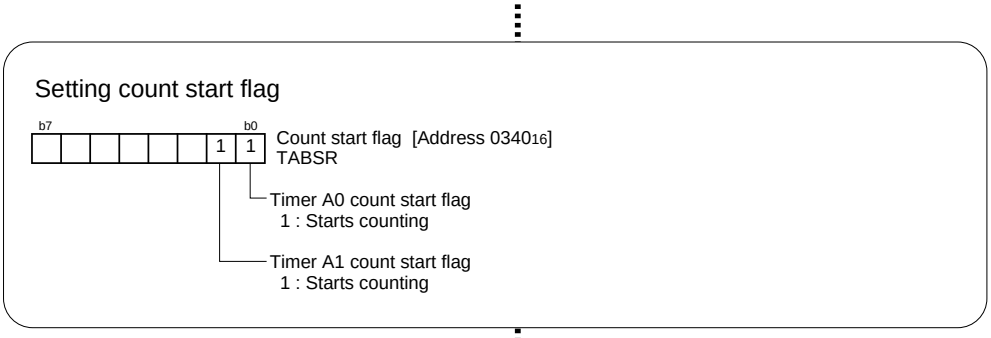

Start counting

4.0 Programming Code

```
;***************************************************************************************
;
;   M16C/80 Program Collection
;
;   FILE NAME : rjj05b0507_src.a30
;   CPU       : M16C/80 Group
;   FUNCTION  : Timer A Applications
;               (Delayed One-Shot Output)
;   HISTORY   : 2004.03.15  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
;***************************************************************************************
RAM_TOP          .EQU    000400H    ;Start address of RAM
RAM_END          .EQU    002BFFH    ;End address of RAM
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:
        LDC      #RAM_END+1, ISP   ;Sets initial value in stack pointer
        ; 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 (delayed one-shot output)
;=============================================================================
;-----------------------------------------------------------------------------
;       Setting Timer A0 (One-shot timer mode, make 1msec delay time)
;-----------------------------------------------------------------------------
        ; Selecting one-shot timer mode and functions
        MOV.B    #00010010B, ta0mr
;                 ||||||++---------;Selection of one-shot timer mode
;                 |||||+-----------;This bit is invalid in M16C/80 series
;                 ||||+------------;External trigger select bit
;                 ||||              (0:Falling edge of TA0in pin's input signal)
;                 |||+-------------;Trigger select bit
;                 |||               (1:Selected by event/trigger select register)
;                 ||+--------------;Must always be "0" in one-shot timer mode
;                 ++---------------;Count source (00:f1)
        ; Clearing timer A0 interrupt request bit
        MOV.B    #00000000B, ta0ic
;                     +------------;Interrupt request bit
        ; Setting one-shot start flag (Select TA0in pin to input TA0 trigger)
        MOV.B    #00000000B, onsf
;                 ++---------------;Timer A0 event/trigger select bit
;                                   (00:Input on TA0IN is selected) (Note)
        ; (Note) Set the corresponding function select register A to I/O port,
        ;        and port direction register to "0".
        BCLR     pd7_1             ;Port P71(TA0in) direction register (0:Input mode)
        BCLR     ps1_0             ;Port P71 is I/O port
        ; Setting delay time (1msec @20MHz, f1)
        MOV.W    #4E20H, ta0
;
;-----------------------------------------------------------------------------
;       Setting Timer A1 (One-shot timer mode, make 50usec one-shot)
;-----------------------------------------------------------------------------
        ; Selecting one-shot timer mode and functions
        MOV.B    #00010010B, ta1mr
;                 ||||||++---------;Selection of one-shot timer mode
;                 |||||+-----------;This bit is invalid in M16C/80 series
;                 ||||+------------;External trigger select bit
;                 ||||              (Invalid when choosing timer's overflow as trigger)
;                 |||+-------------;Trigger select bit
;                 |||               (1:Selected by event/trigger select register)
;                 ||+--------------;Must always be "0" in one-shot timer mode
;                 ++---------------;Count source (00:f1)
        ; Clearing timer A1 interrupt request bit
        MOV.B    #00000000B, ta1ic
;                     +------------;Interrupt request bit
        ; Setting trigger select register (Set timer A0 to trigger timer A1)
        MOV.B    #00000010B, trgsr
;                       ++---------;Timer A1 event/trigger select bit
;                                   (10:TA0 overflow is selected)
        ; Setting one-shot timer's time
        MOV.W    #03E8H, ta1       ;(50usec @20MHz, f1)
        ; Setting timer TA1 pulse output
        BCLR     psc_0             ;Port P72 peripheral subfunction select bit
                                   ;(Set this bit to "0" when PSL1_2 = "1")
        BSET     psl1_2            ;Port P72 peripheral function select bit
                                   ;(1:TA1out output)
        BSET     ps1_2             ;Port P72 function select bit
                                   ;(1:Peripheral function output)
        ; Setting count start flag
        MOV.B    #00000011B, tabsr
;                       |+---------;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
        .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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M16C/80 group Rev. E3
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