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Renesas Electronics Corporation

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M16C/Tiny Series

Delayed One-Shot Output

1. 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. Introduction

The explanation of this issue is applied to the following condition:
Applicable MCU: M16C/26, M16C/26A, M16C/28, M16C/29 Group

This program can also be used when operating other microcomputers within the M16C family, provided they have the same SFR (Special Function Registers) as the M16C/26, M16C/26A, M16C/28, M16C/29 microcomputers. However, some functions may have been modified.
Refer to the User's Manual for details. Use functions covered in this Application Note only after careful evaluation.

3. Contents

3.1 Specification

(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 f1 for the count source.
(3) Connect a 20MHz oscillator to XIN.

3.2 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 f1.
(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" (Note 1).
(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".

Note 1: The settings of the TAi_{OUT} pin corresponding port direction register are invalid.

Figure 1 shows the operation timing of delayed one-shot output.

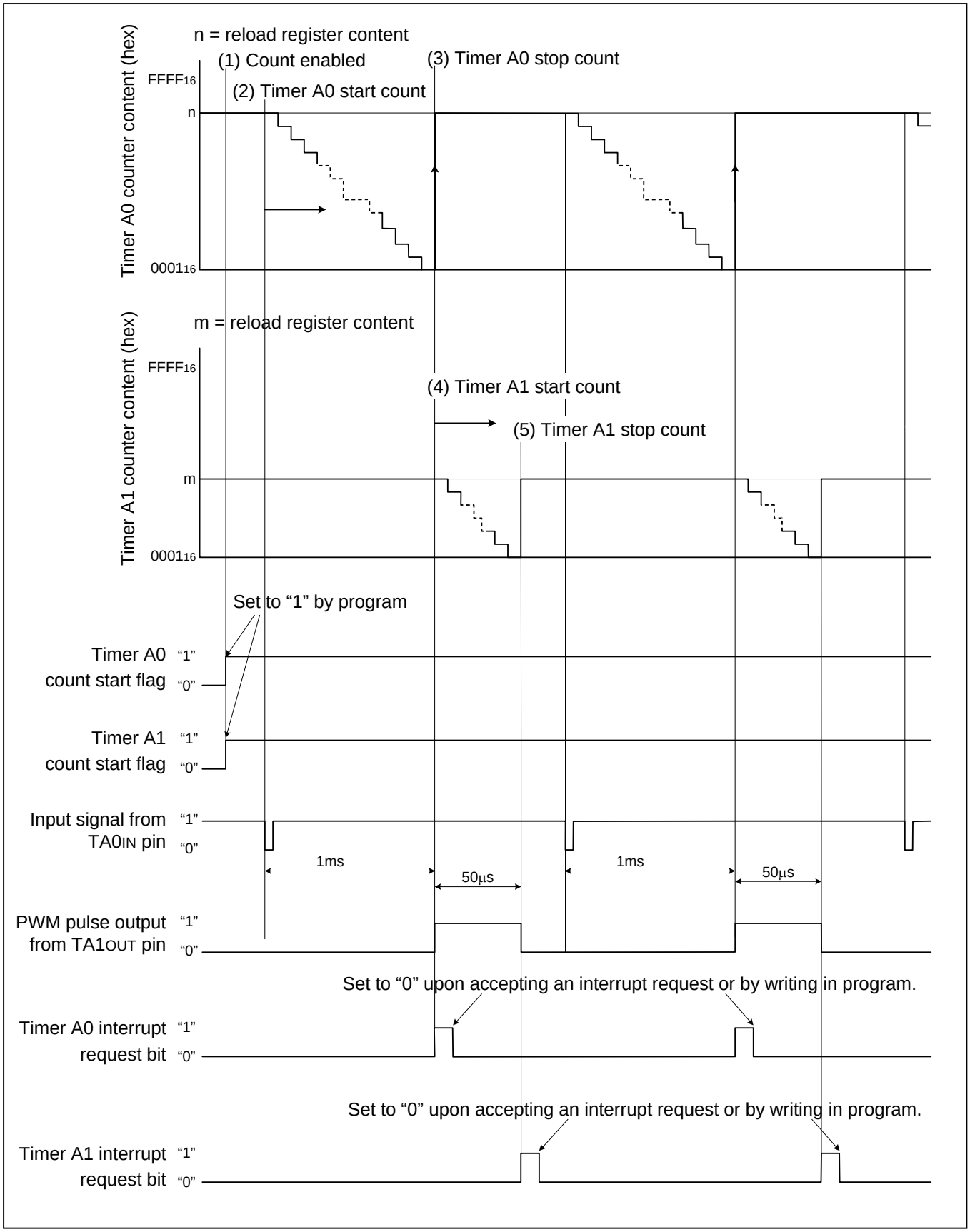


Figure 1. Operation Timing of Delayed One-Shot Output

Figure 2 shows the operation timing of delayed one-shot output.

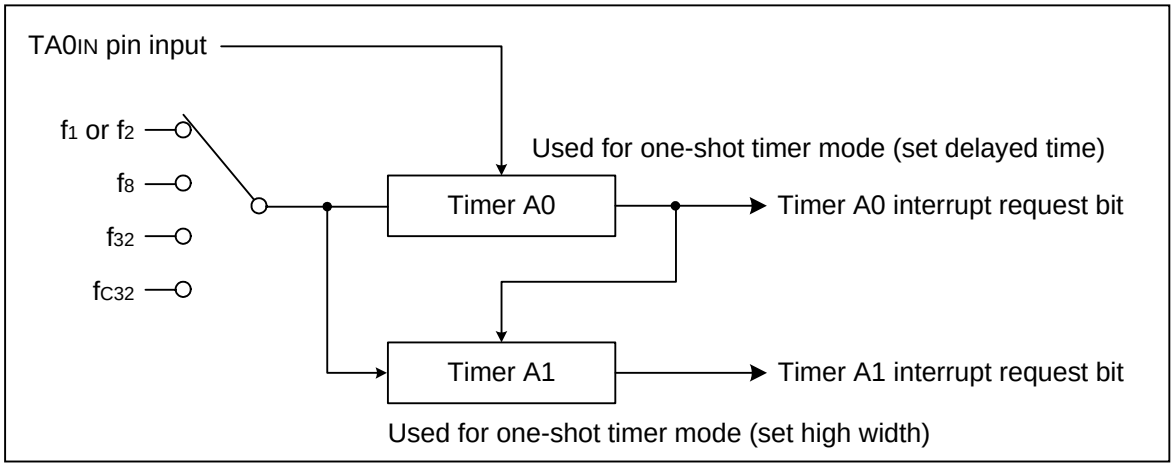
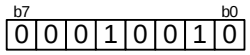


Figure 2. Connection Diagram of Delayed One-Shot Output

3.3 Register Setting

To enable the operation defined in “Section 3. Operation of timer A”, the following register settings must be taken place step by step. For detail configuration of each register, please refer to M16C/26 Group hardware manual, M16C/26A Group hardware manual, M16C/28 Group hardware manual, M16C/29 Group hardware manual.

(1) Setting timer A0 mode register



TMOD1,TMOT0 Operation Mode Select Bit
10: Selection of one-shot timer mode

MR0 Pulse Output Function Select Bit
0: Pulse is not output (TA0OUT pin is a normal port pin)

MR1 External trigger select bit
1: Rising edge of input signal to the TA0IN pin

MR2 Trigger select bit
1: Selected by TA0TGH to TA0TGL bits

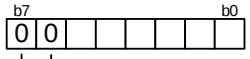
MR3 Set to “0” in one-shot timer mode

TCK1,TCK0 Count Source Select Bit
00 : f_1 or f_2
01 : f_8
10 : f_{32}
11 : f_{C32}

b7	b6	Count source	Count source period f(XIN): 20MHz f(XCIN): 32.768kHz
0	0	f_1 (Note 1)	50ns
0	0	f_2 (Note 1)	100ns
0	1	f_8	400ns
1	0	f_{32}	1600ns
1	1	f_{C32}	976.56ms

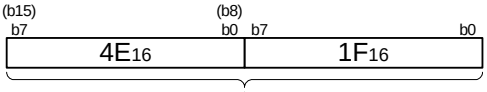
Note 1: Count source is f2 if PCLK0 bit in the PCLKR register is “0”, f1 if PCLK0 bit in the PCLKR register is “1”.

(2) Setting one-shot start flag



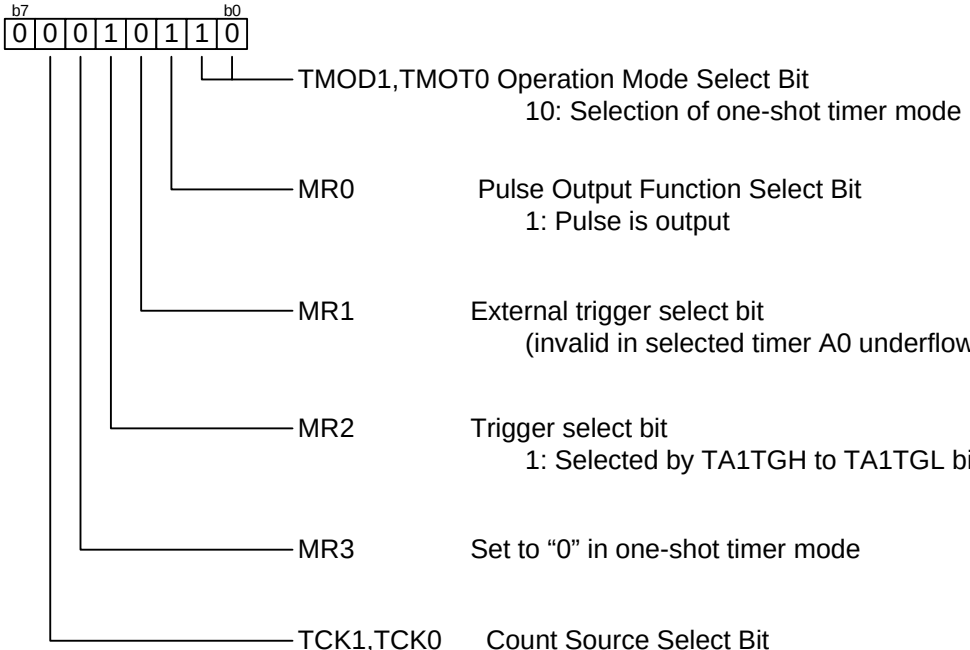
TA0TGH,TA0TGL Timer A0 Event/Trigger Select Bit
0: Input on TA0IN is selected

(3) Setting timer A0 register



Can be set to 0001_{16} to $FFFF_{16}$

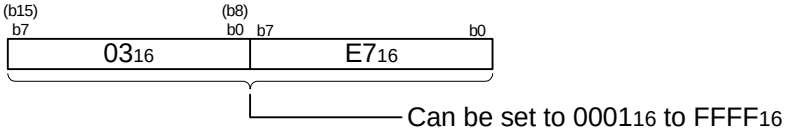
(4) Setting timer A1 mode register



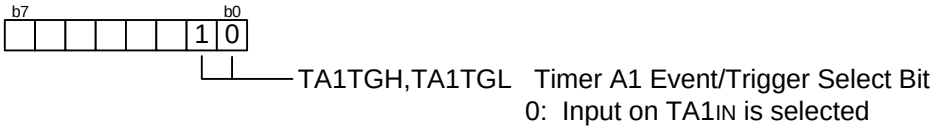
b7	b6	Count source	Count source period f(XIN): 20MHz f(XCIN): 32.768kHz
0	0	f1 (Note 1)	50ns
0	0	f2 (Note 1)	100ns
0	1	f8	400ns
1	0	f32	1600ns
1	1	fC32	976.56ms

Note 1: Count source is f2 if PCLK0 bit in the PCLKR register is “0”, f1 if PCLK0 bit in the PCLKR register is “1”.

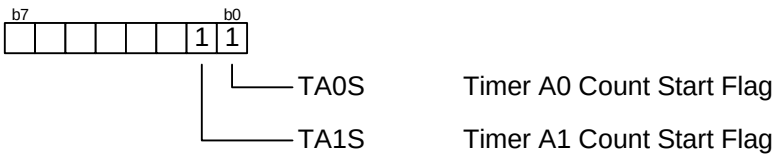
(4) Setting timer A1 register



(5) Setting trigger select register



(6) Setting count start flag



4. Sample Program

```
/************************************************************
 *                                                          *
 *   FILE NAME :                                            *
 *   CPU       : M16C/Tiny series                           *
 *   Function  : Operation of Timer A                       *
 *                  (Delayed One-Shot Output)               *
 *                                                          *
 *   Version   : 1.10 (05-05-30)                            *
 *                     Add ta0ic=0x00, ta1ic=0x00           *
 *             : 1.00 (04-12-01)                            *
 *   Copyright (C)2004 (2005), Renesas Technology Corp.     *
 *   Copyright (C)2004 (2005), Renesas Solutions Corp.      *
 *                                                          *
 ************************************************************/
/*************************
 *   include file          *
 *************************/
#include "sfr28.h"

/*************************
 *   main                  *
 *************************/
void main(void) {

    ta0mr = 0x12;    /*  Selection of one-shot timer mode
                         Pulse output function select bit (0:Pulse is not output)
                         Trigger select bit (1:Selected by event/trigger select register)
                         Count source (01:f1 or f2)
                     */
    ta0ic=0x00;      /* Clears timer A0 interrupt request bit */

    onsf = 0;        /*  Setting one-shot start flag
                         Timer A0 event/trigger select bit
                         (00:Input on TA0IN is selected)
                     */

    pd7_1 = 0;       /* Port P7_1 is set to in-put mode */

    ta0 = 20000-1;   /*  Setting counter value (1ms @20MHz, f1) */

    ta1mr = 0x16;    /*  Selection of one-shot timer mode
                         Pulse output function select bit (1:Pulse is output)
                         Trigger select bit (1:Selected by event/trigger select register)
                         Count source is selected to f1 or f2
                     */
    ta1ic=0x00;      /* Clears timer A1 interrupt request bit */

    ta1 = 1000-1;    /*  Setting counter value (50us @ 20MHz, f1)  */

    trgsr = 0x02;    /*  Setting Trigger select register
                         Trigger of Timer A1 is selected timer A0 0verflow
                     */

    tabsr = 0x03;    /*  Setting Cout start flag
                         Timer A0 and Timer A1 start
                     */

    while (1) {
    }
}
```

5. Reference

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Hardware Manual

M16C/26, M16C/26A, M16C/28, M16C/29 Group Hardware Manual
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REVISION HISTORY

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		Page	Summary
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