

To our customers,

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## Old Company Name in Catalogs and Other Documents

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# M16C/Tiny Series

## Operation of Timer A (One-shot Timer Mode, External Trigger)

### 1. Abstract

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

**Table 1. Chosed Functions**

Item	Set-up	
Count source		f1 or f2
	Yes	f8
		f32
		fC32
Pulse output function		No pulses output
	Yes	Pulses output
Count start condition		External trigger input (falling edge of input signal to the $TA_{iN}$ pin)
	Yes	External trigger input (rising edge of input signal to the $TA_{iN}$ pin)
		Timer overflow (TB2 overflow /TAj overflow /TAk overflow)
		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. 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. Operation of Timer A

- (1) If the TAIIN pin input level changes from “L” to “H” with the count start flag set to “1”, the counter performs a down count on the count source. At this time, the TAIOUT pin outputs an “H” level.
- (2) The instant the value of the counter becomes “0000<sub>16</sub>”, the TAIOUT 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 TAIOUT pin outputs an “L” level. At this time, the timer Ai interrupt request bit goes to “1”.

Complement: The settings of the TAIOUT pin corresponding port direction register are invalid.

Figure 1 shows the operation timing of one-shot timer mode, external trigger selected.

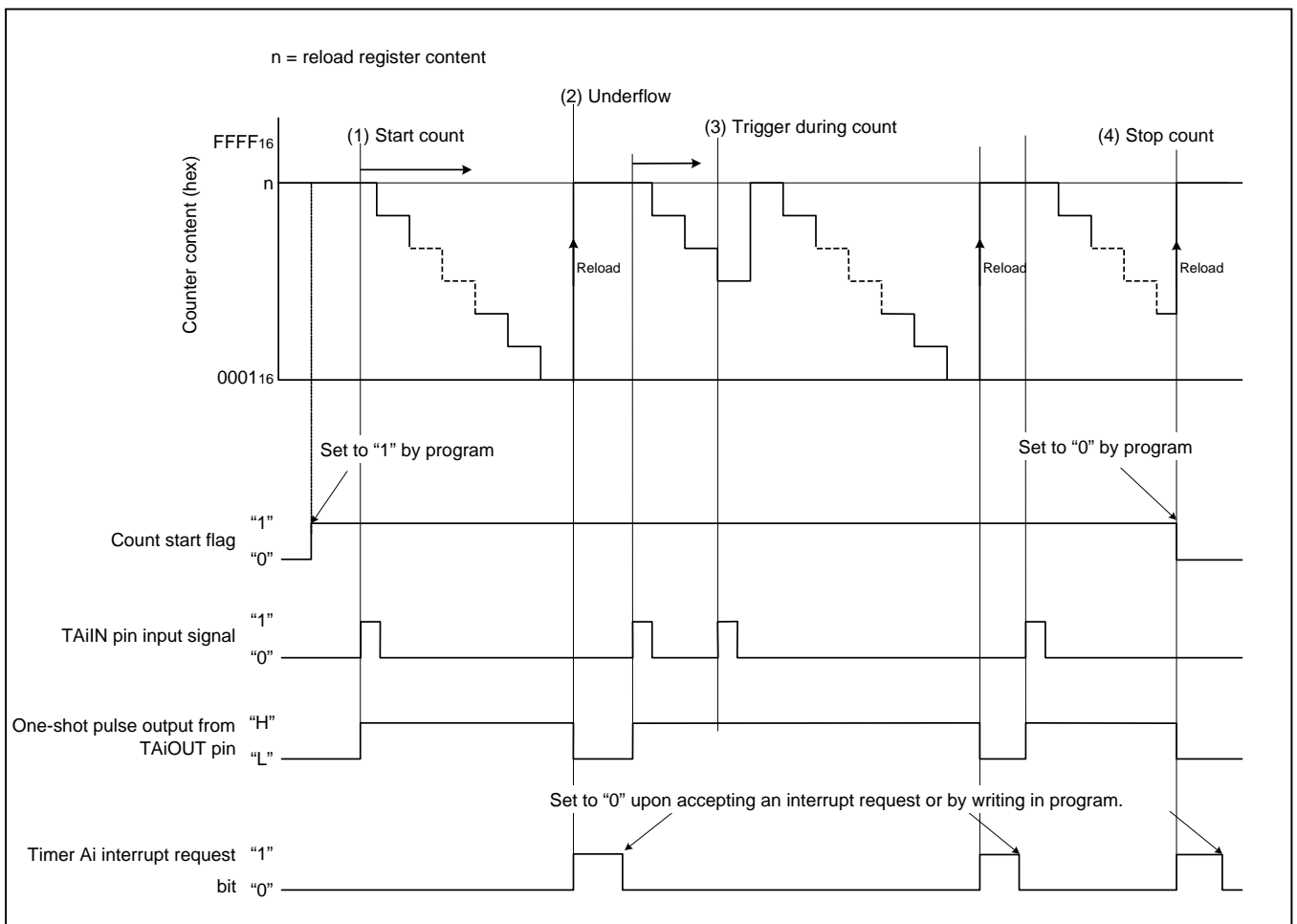
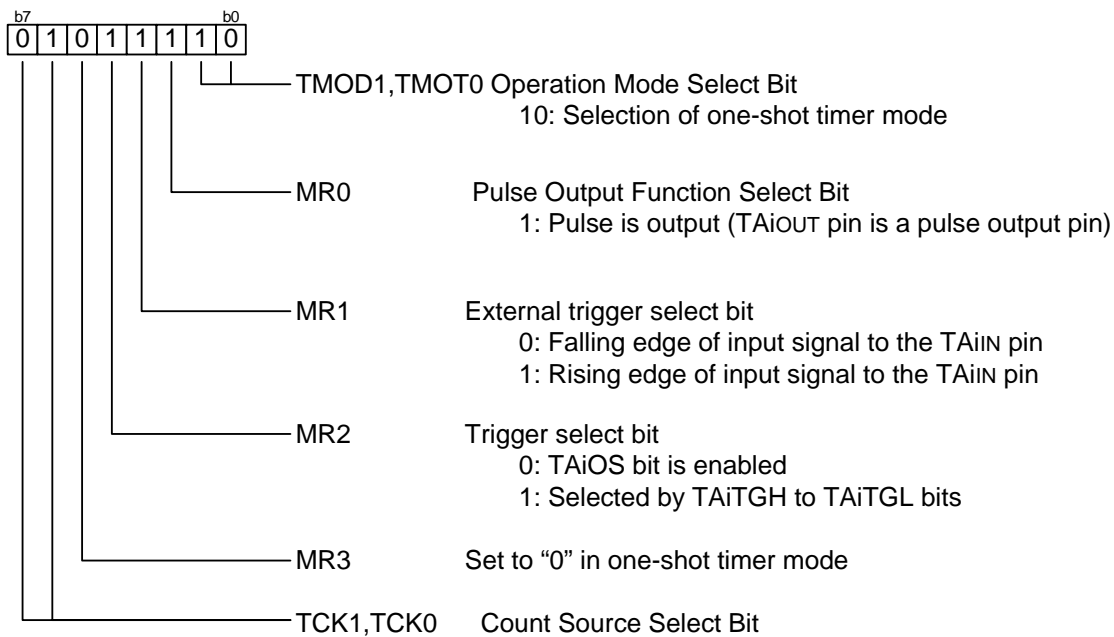


Figure 1. Operation Timing of One-shot Timer Mode, External Trigger Selected

## 3.1 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 Ai mode register (i=0 to 4)

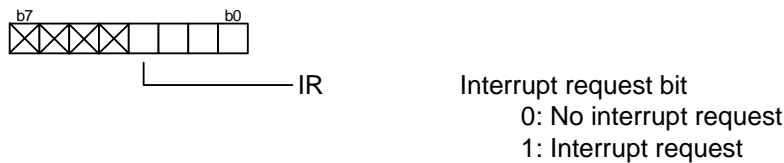


b7	b6	Count source	Count source period	
			f(X <sub>IN</sub> ): 20MHz	f(X <sub>CIN</sub> ): 32.768kHz
0	0	f <sub>1</sub> (Note 1)	50ns	
0	0	f <sub>2</sub> (Note 1)	100ns	
0	1	f <sub>8</sub>	400ns	
1	0	f <sub>32</sub>	1600ns	
1	1	f <sub>C32</sub>	976.56ms	

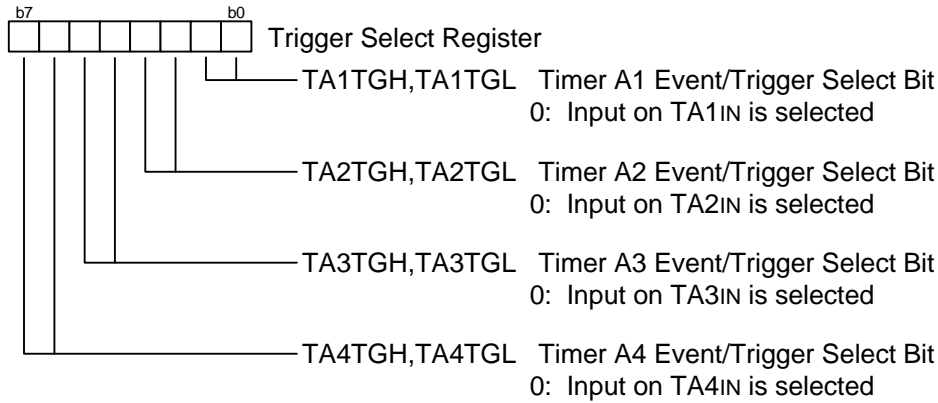
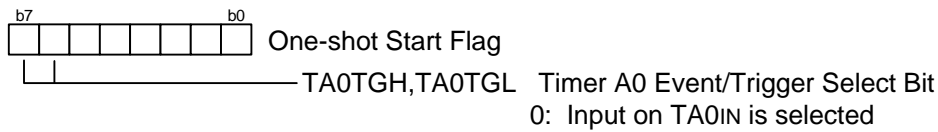
Note 1: Count source is f<sub>2</sub> if PCLK0 bit in the PCLKR register is “0”, f<sub>1</sub> if PCLK0 bit in the PCLKR register is “1”.

### (2) Clearing timer Ai interrupt request bit

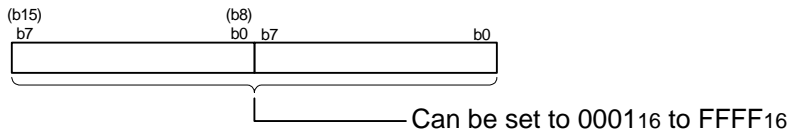
Refer to Precaution for Timer A (one shot timer mode)



(3) Setting one-shot start flag and trigger select register

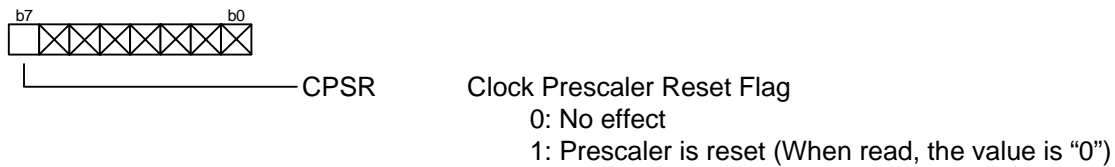


(4) Setting timer Ai register (i=0 to 4)

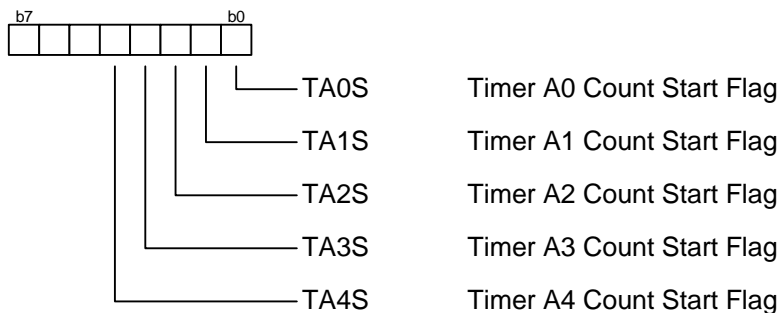


(5) Setting clock prescaler reset flag

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



(6) Setting count start flag



## 4. Sample Program

```

/*****
 *
 * FILE NAME :
 * CPU : M16C/Tiny series
 * Function : Operation of Timer A
 * (One_shot Timer Mode, external trigger)
 * Version : 1.00
 *
 * Copyright (C)2004, Renesas Technology Corp.
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 *
 *****/
/*****
 * include file
 *****/
#include "sfr28.h"

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

    talmr = 0x5e; /* Selection of timer mode
                  Pulse output function select bit (1:Pulse is output)
                  External trigger (Rising edge of TAIIN pin's input signal)
                  Count source (01:f8) */

    talic = 0; /* Clear TimerA1 interrupt request */

    trgsr = 0; /* Setting event/trigger select bit
                00: Input on TAIIN is selected

    tal = 2500-1; /* Setting counter value (1msec @20MHz, f8) */

    cpsrf = 0; /* Setting clock prescaler reset flag (0:No effect) */

    tals = 1; /* TimerA1 count start */

    talos = 1;

    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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