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## M32C/84, 85, 86, 87, 88 Group

### Timer A Operation in One-Shot Timer Mode (External Trigger)

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#### 1. Abstract

The timer starts counting with an external signal (input from the TAIIN pin) or other timer's underflow/overflow as a trigger. Once a trigger occurs, the output level on the TAIOUT pin becomes "H" and the timer starts decrementing its value. When the value reaches 0000h, the output level on the TAIOUT pin becomes "L" and the timer stops decrementing its value. An interrupt request is simultaneously generated.

#### 2. Introduction

The application example described in this document is applied to the following MCUs and parameter(s):

MCUs: M32C/84 Group  
M32C/85 Group  
M32C/86 Group  
M32C/87 Group  
M32C/88 Group

This program can be used with other M16C Family MCUs which have the same special function registers (SFRs) as the above MCUs. Check the manual for any additions and modifications to functions. Careful evaluation is recommended before using this application note.

### 3. Application Example

This section describes how to perform the 1 ms “H” output from the TAIOUT pin when a rising edge of the TAIIN pin is detected, using the count source f8.

#### 3.1 Example Description

- (1) If the input signal to the TAIIN pin changes from “L” to “H” while the TAI<sub>S</sub> bit in the TABSR register is 1 (count started), the counter decrements the count source. At the same time, the TAIOUT pin output level becomes “H”.
- (2) When the count value reaches 0000h, the output level on the TAIOUT pin becomes “L”, and the counter reloads the content of the reload register and continues counting. At the same time, the IR bit in the TAIIC register is set to 1 (interrupt requested).
- (3) If a trigger occurs during a count operation, the counter reloads the content of the reload register again and continues counting. The reload timing is at the next count source input after a trigger is input.
- (4) Setting the TAI<sub>S</sub> bit to 0 (count stopped) causes the counter to stop counting and to reload the content of the reload register. Also, the output level on the TAIOUT pin becomes “L”. At the same time, the IR bit is set to 1 (interrupt requested).

Figure 1 shows the One-Shot Timer Mode Operation.

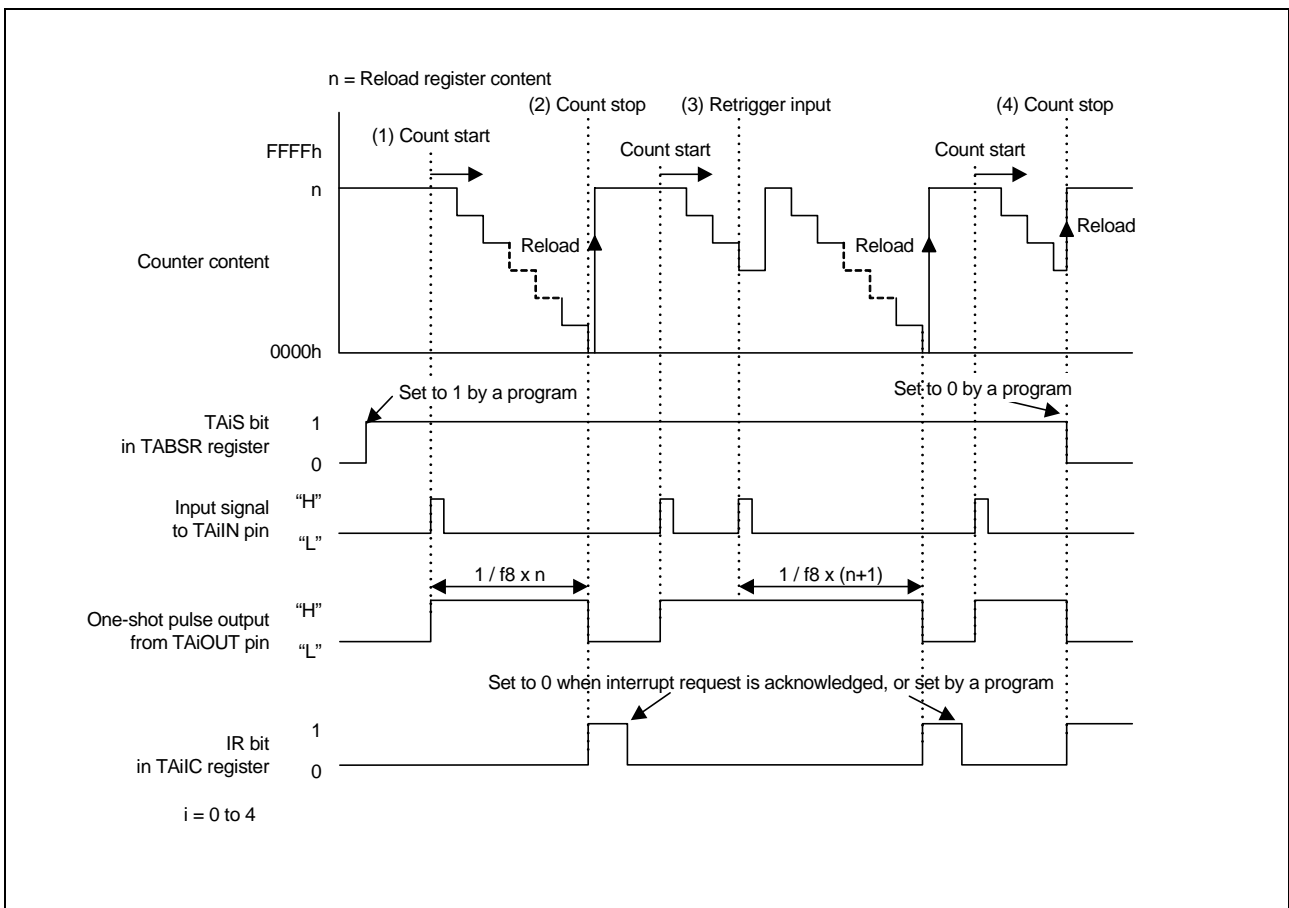


Figure 1 One-Shot Timer Mode Operation

### 3.2 Setup

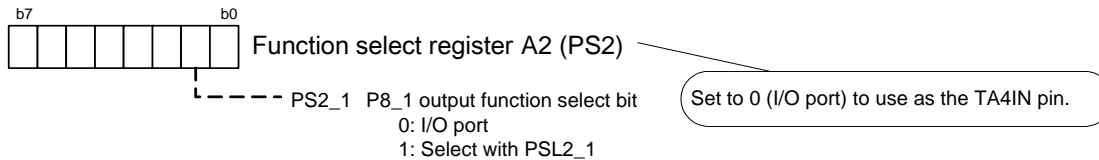
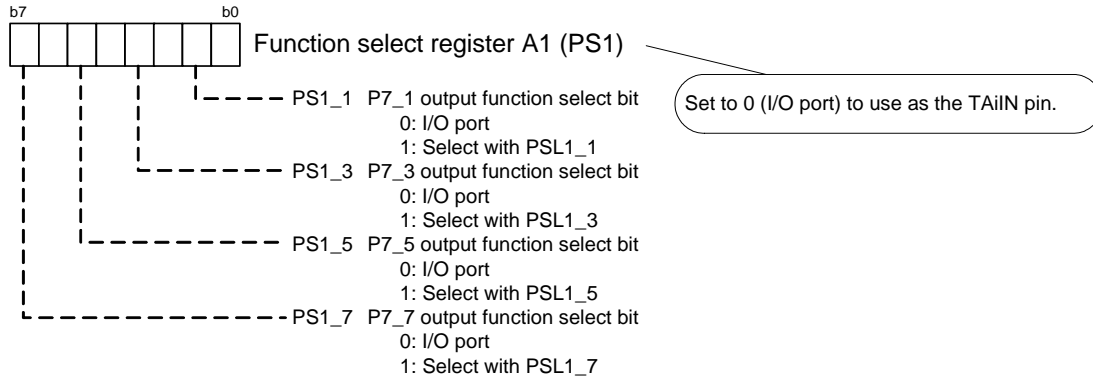
This section shows the setting steps and values to perform the application example described in

#### 3.1 Example Description.

Refer to the each MCUs Hardware Manual for details of individual registers.

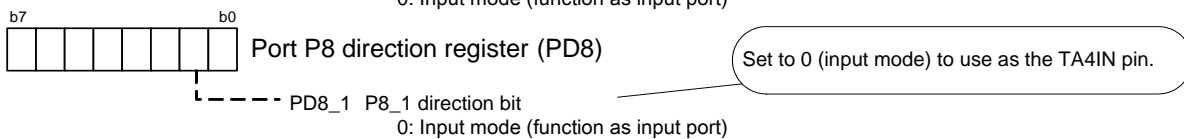
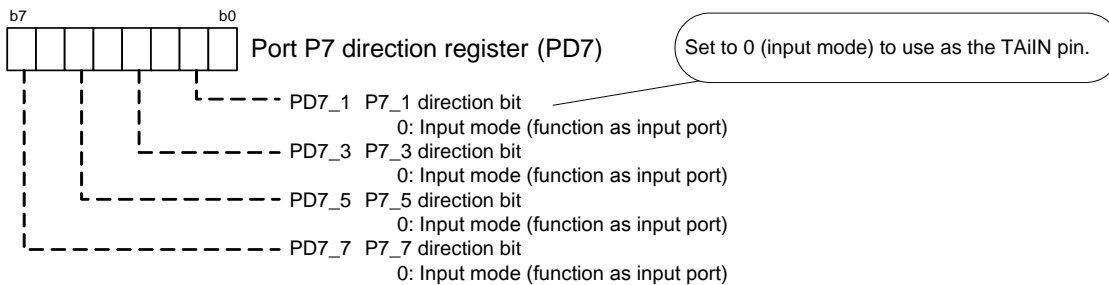
#### (1) Set the function select registers

The TAiIN pins are assigned to P7\_1 (TA0IN), P7\_3 (TA1IN), P7\_5 (TA2IN), P7\_7 (TA3IN), and P8\_1 (TA4IN).  
 Select I/O ports using the function select registers.



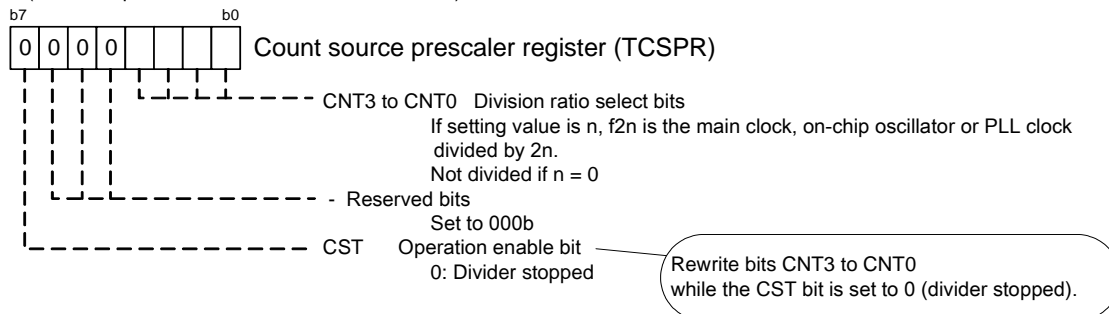
#### (2) Set the port P7 register and the port P8 direction register

Set the pin to use as the TAiIN pin to an input port.

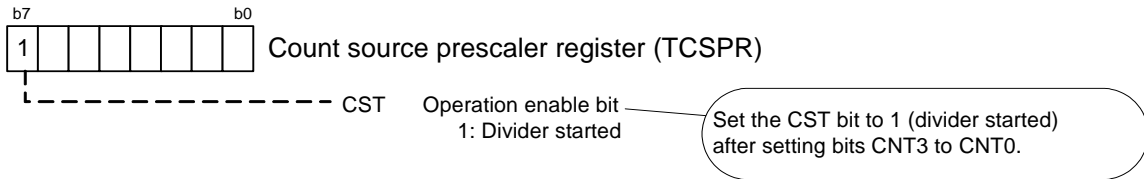


#### (3) Set the count source prescaler register

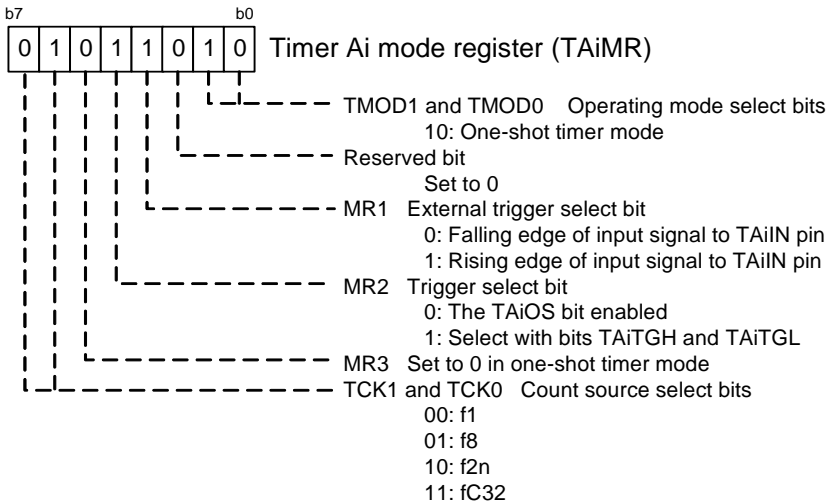
(This is required to use f2n as the count source.)



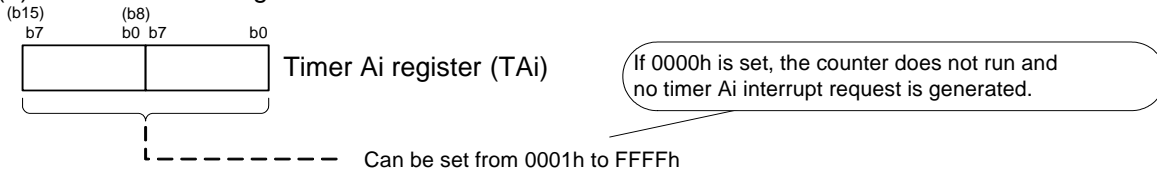
- (4) Set the count source prescaler register (divider operation)  
 (This is required to use f<sub>2n</sub> as the count source.)



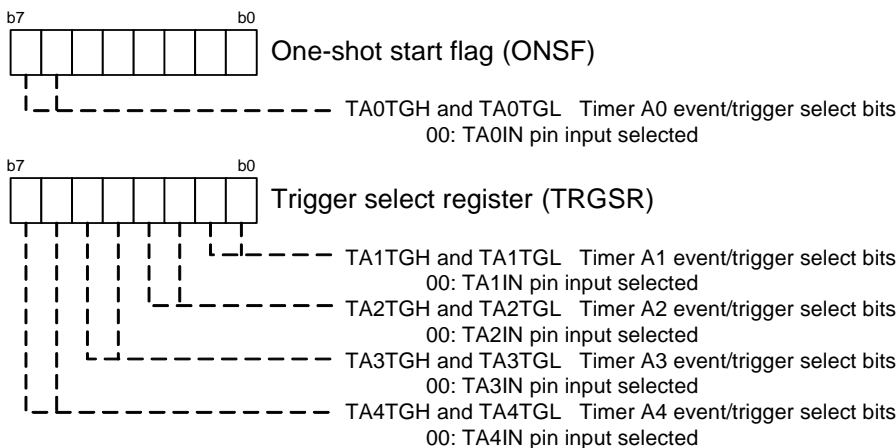
- (5) Set the timer A<sub>i</sub> mode register (i = 0 to 4)



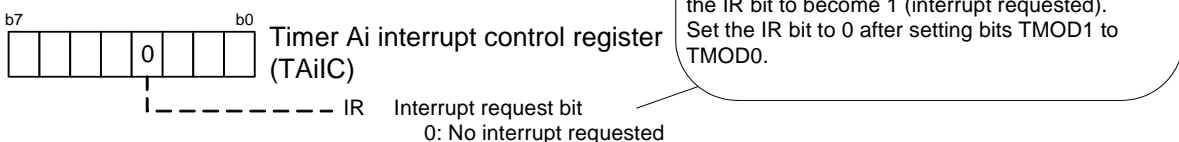
- (6) Set the timer A<sub>i</sub> register



- (7) Set the one-shot start flag and the trigger select register

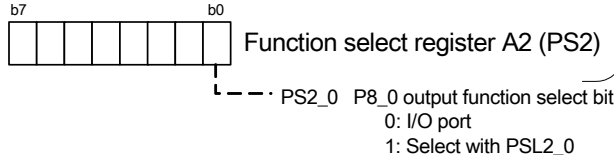
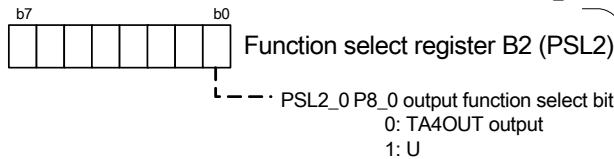
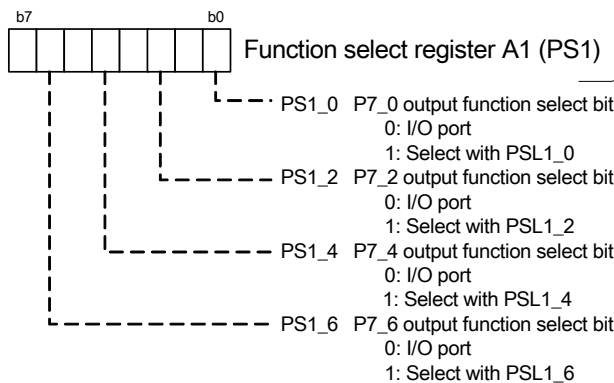
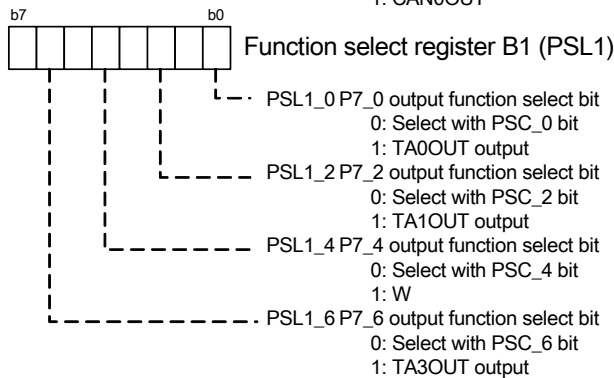
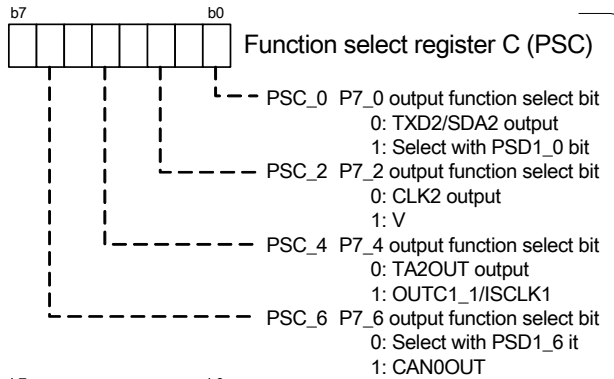


- (8) Clear the interrupt request bit



(9) Set the function select registers

The timer output pins are assigned to P7\_0 (TA0OUT), P7\_2 (TA1OUT), P7\_4 (TA2OUT), P7\_6 (TA3\_OUT), and P8\_0 (TA4OUT). To perform the pulse output using the timer function, select timer output for the pin function by setting the function registers.



The P7 function can be selected with registers PS1, PSL1, and PSC. When the TAiOUT pin (i = 0 to 3) is used for the output function, the settings are follows:

Pin	Bit and Setting Value		
	PS1 register <sup>(2)</sup>	PSL1 register	PSC register
P7_0 (TA0OUT) <sup>(1)</sup>	PS1_0 = 1	PSL1_0 = 1	PSC_0 = 0
P7_2 (TA1OUT)	PS1_2 = 1	PSL1_2 = 1	PSC_2 = 0
P7_4 (TA2OUT)	PS1_4 = 1	PSL1_4 = 0	PSC_4 = 0
P7_6 (TA3OUT)	PS1_6 = 1	PSL1_6 = 1	PSC_6 = 0

NOTES:

- The P7\_0 (TA0OUT) pin is for N-channel open drain output.
- Set the PS1 register for the bit setting order.

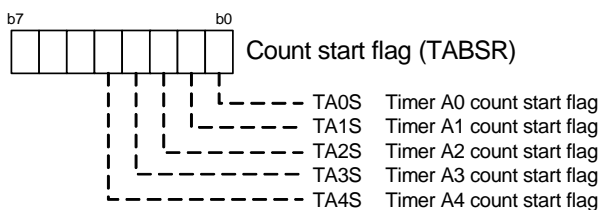
The P8 function can be selected with registers PS2 and PSL2. When the TA4OUT pin is used for the output function, the settings are follows:

Pin	Bit and Setting Value	
	PS2 register <sup>(3)</sup>	PSL2 register
P8_0 (TA4OUT)	PS2_0 = 1	PSL2_0 = 0

NOTE:

- Set the PS2 register for the bit setting order.

(10) Set the count start flag



#### 4. Sample Programming Code

A sample program can be downloaded from the Renesas Technology website.

For download, click “Application Notes” in the left-hand side menu of the M16C Family page.

#### 5. Reference Documents

Hardware Manuals

M32C/84 Group Hardware Manual

M32C/85 Group Hardware Manual

M32C/86 Group Hardware Manual

M32C/87 Group Hardware Manual

M32C/88 Group Hardware Manual

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REVISION HISTORY	M32C/84, 85, 86, 87, 88 Group Timer A Operation in One-Shot Timer Mode (External Trigger)
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Rev.	Date	Description	
		Page	Summary
1.00	Sep.10, 2006	-	First Edition issued

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