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April 1st, 2010
Renesas Electronics Corporation

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

Timer A Operation in One-Shot Timer Mode

1. Abstract

In one-shot timer mode, the timer operates only once for each trigger. Once a trigger occurs, the output level on TAIOUT pin becomes “H” and the timer starts decrementing. When the value reaches 0000h, the output level on the TAIOUT pin becomes “L” and the timer stops decrementing. 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 at a desired timing (set the TAIOS bit to 1 by a program), using the count source f8.

3.1 Example Description

- (1) Setting the TAIOS bit in the ONSF register to 1 (timer started) while the TAI_S bit in the TABSR register is 1 (count started) causes the counter to decrement the count source. Simultaneously, the output level on the TAIOUT pin 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 TAI_IC register is set to 1 (interrupt requested).
- (3) Setting the TAIOS bit to 1 during count operation causes the counter to reload the content of the reload register at the next count source input and to continue counting.
- (4) Setting the TAI_S bit to 0 (count stopped) causes the counter to stop counting and to reload the content of the reload register. The input 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.

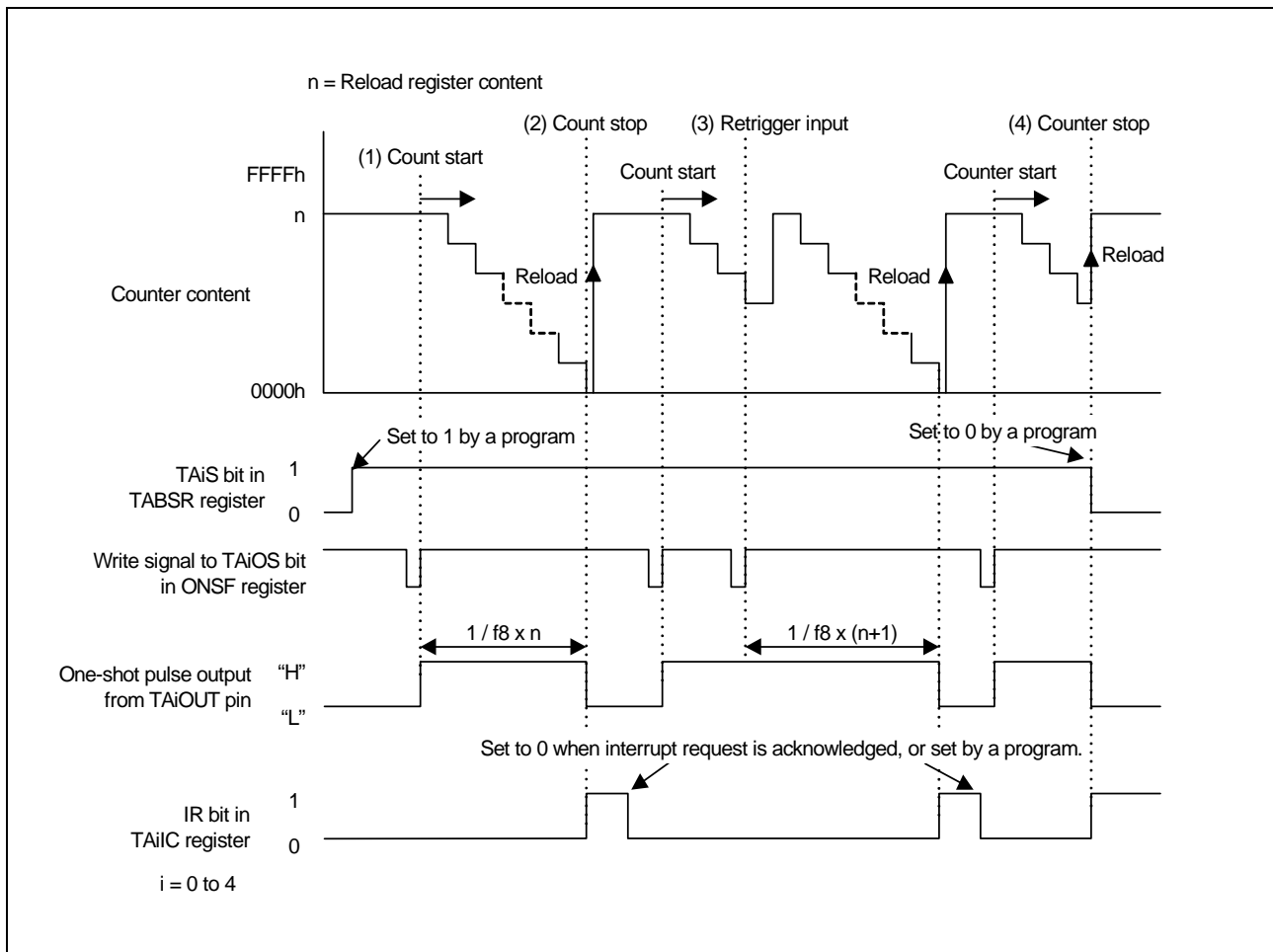


Figure 1 One-Shot Timer Mode Operation

3.2 Setup

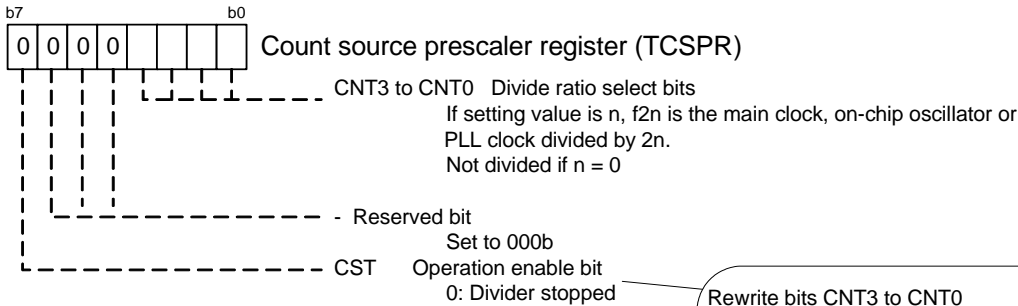
This section shows the setting steps and values to perform the application example described in

3.1 Example Description.

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

(1) Set the count source prescaler register

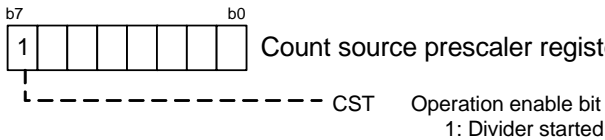
(This is required to use f_{2n} as the count source.)



Rewrite bits CNT3 to CNT0 while the CST bit is set to 0 (divider stopped).

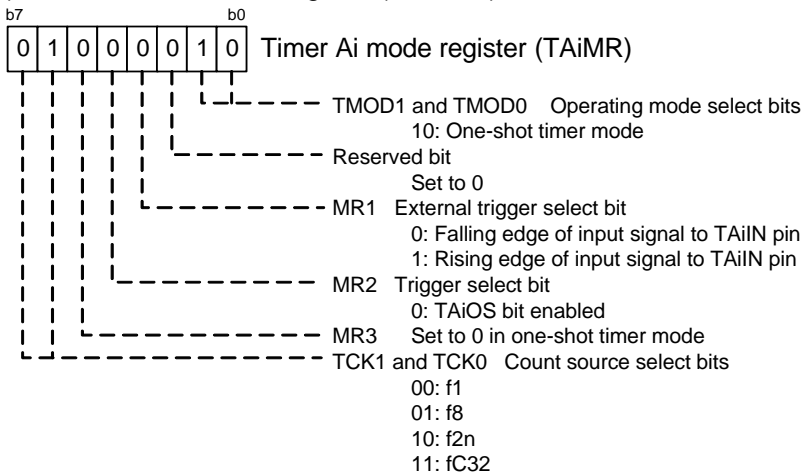
(2) Set the count source prescaler register (divider operation)

(This is required to use f_{2n} as the count source.)

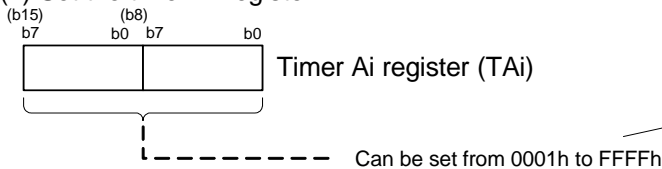


Set the CST bit to 1 (divider started) after setting bits CNT3 to CNT0.

(3) Set the timer Ai mode register (i = 0 to 4)

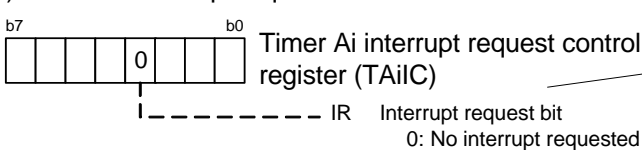


(4) Set the timer Ai register



If 0000h is set, the counter does not run and no timer Ai interrupt request is generated.

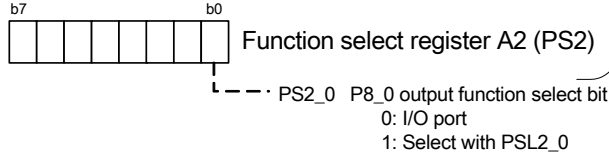
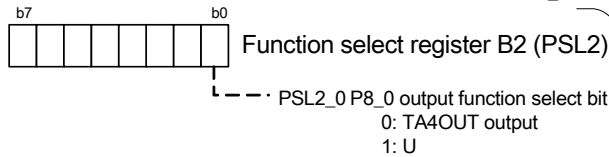
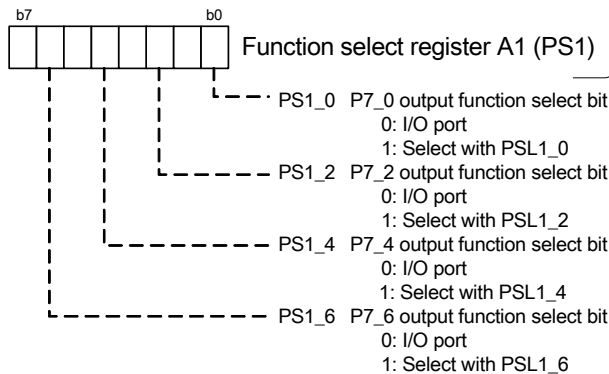
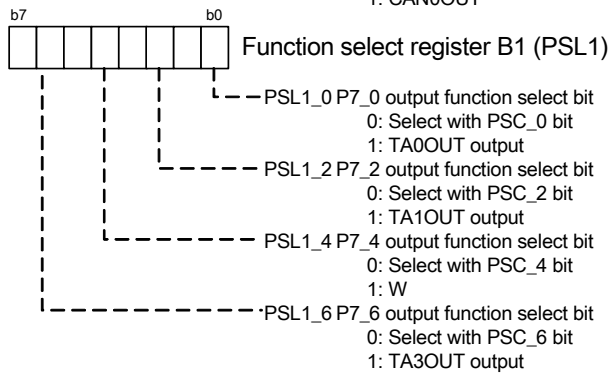
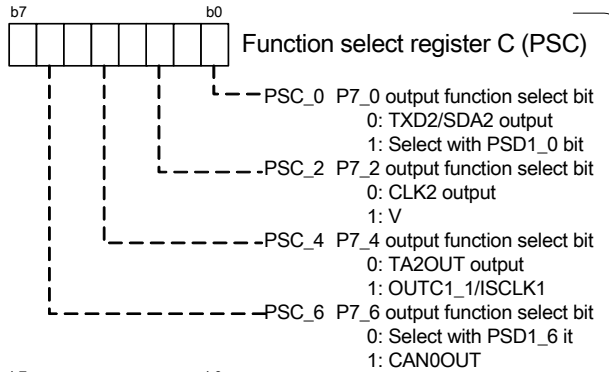
(5) Clear the interrupt request bit



Setting bits TMOD1 to TMOD0 in the TAiMR register to 10b (one-shot timer mode) may cause the IR bit to become 1 (interrupt requested). Set the IR bit to 0 after setting bits TMOD1 to TMOD0.

(6) 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 ⁽²⁾	PSL1 register	PSC register
P7_0 (TA0OUT) ⁽¹⁾	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 last for the bit setting order.

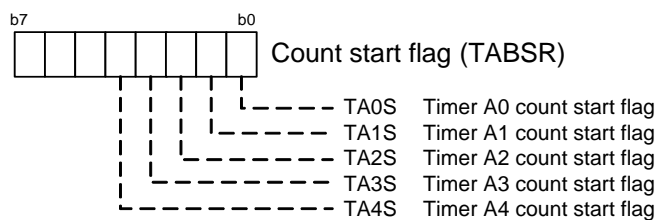
The P8 function can be selected with registers PS2 and PSL2. When the TA4OUT pin is used for the output function, the settings are follows:

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

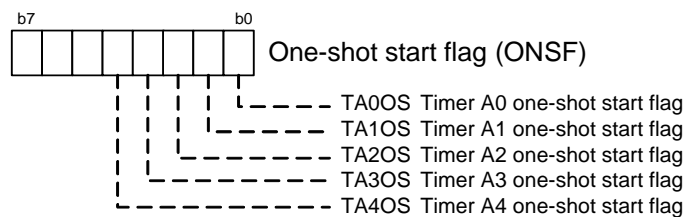
NOTE:

- Set the PS2 register last for the bit setting order.

(7) Set the count start flag



(8) Set the one-shot 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
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Rev.	Date	Description	
		Page	Summary
1.00	Sep.10, 2006	-	First Edition issued

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