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Renesas Electronics Corporation

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

## Delayed One-Shot Output

## 1. Abstract

Two timer A's are connected to perform the pulse output only once after an external trigger is input and a predetermined time elapsed.

Use the peripheral functions listed below.

- Timer A0 in one-shot timer mode
- Timer A1 in one-shot timer mode

## 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 Description

## 3.1 Specifications

(1) Set timer A0 to one-shot timer mode with an external input (falling edge) as the trigger, and set timer A1 to one-shot timer mode with timer A0 underflows as the trigger.
Also, select the TA1OUT output for the P7_2 function.
(2) Set timer A0 to 1 ms as the PWM period, and set timer A1 to 50 µs as the PWM “H” width.
(3) Connect a 32 MHz oscillator to Xin.

## 3.2 Operation

(1) Setting bits TA0S and TA1S in the TABSR register to 1 (count started) sets timer A0 and timer A1 to enable counting.
(2) If a falling edge is input to the TA0IN pin, the timer A0 counter decrements the count source f1.
(3) When the timer A0 count value reaches 0000h, the counter reloads the content of the reload register and stops counting. At this time, the IR bit in the TA0IC register is set to 1 (interrupt requested).
(4) When the timer A0 count value reaches 0000h, the timer A1 counter starts counting.
At the same time, the output level on the TA1OUT pin becomes “H”.
(5) When the timer A1 counter value races 0000h, the output level on the TA1OUT pin becomes “L”, and the counter reloads the content of the reload register and stops counting.
At the same time, the IR bit in the TA1IC register is set to 1 (interrupt requested).

Figure 1 shows the Operation Timing and Figure 2 shows the Timer Connection Diagram.

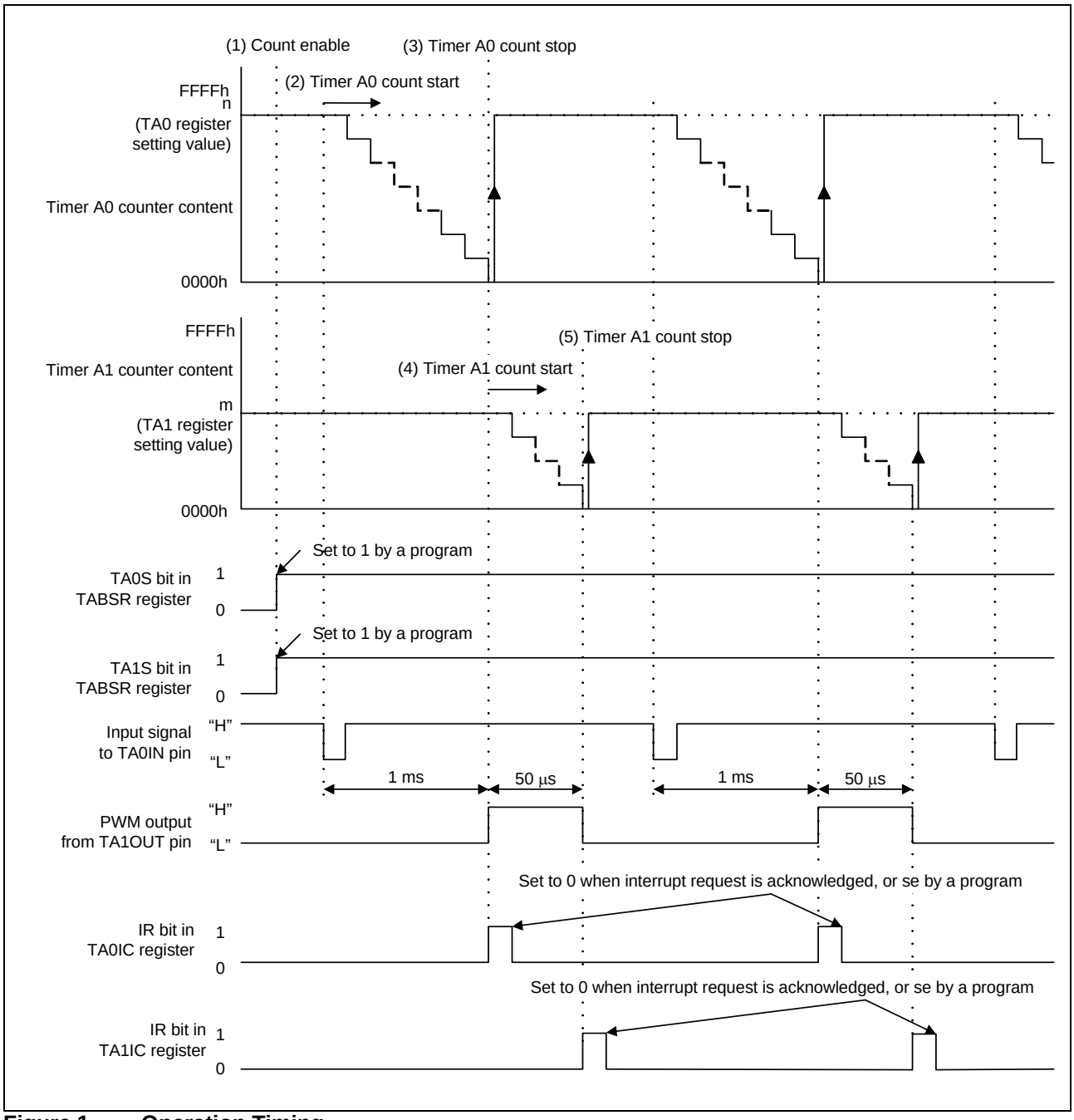



**Figure 1 Operation Timing**

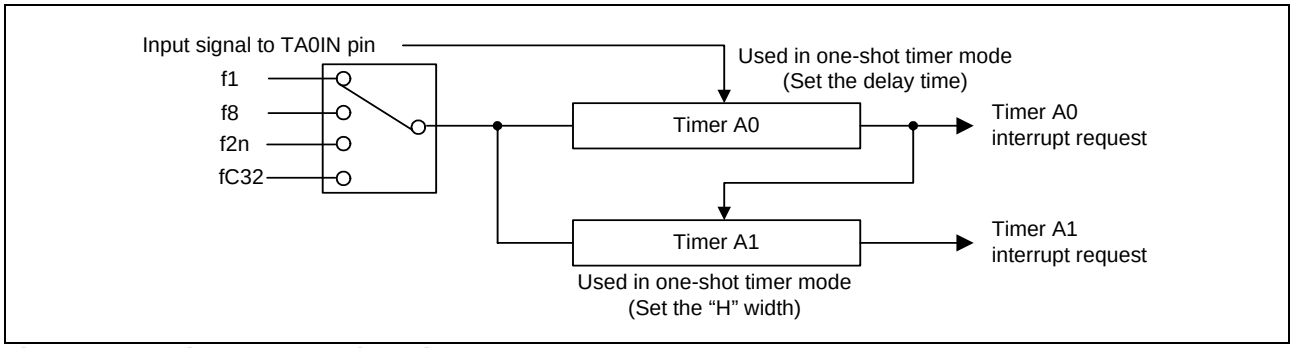
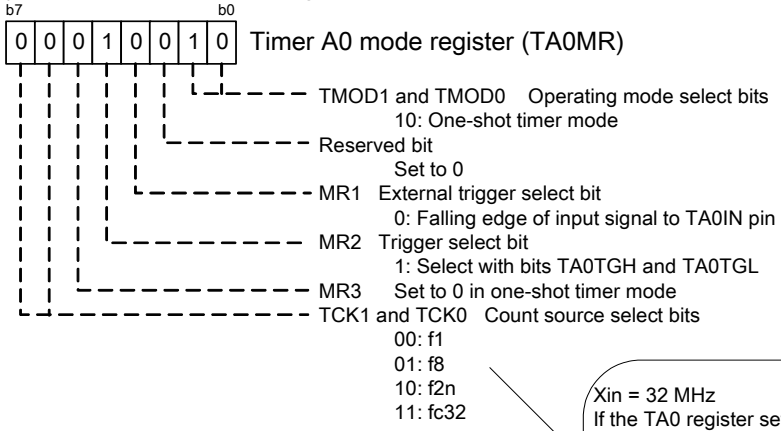



**Figure 2 Timer Connection Diagram**

## 3.3 Setup

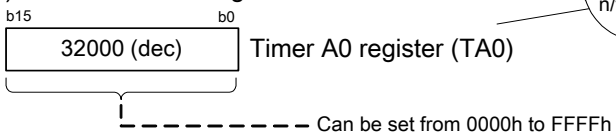
This section shows the setting steps and values to perform the application example described in **3. Application Description**.
Refer to the MCUs Hardware Manual for details of individual registers.

(1) Set the timer A0 mode register

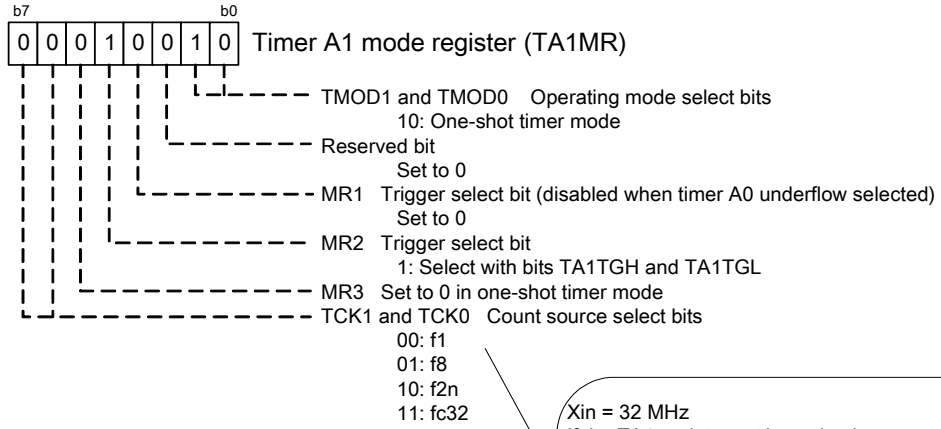



Xin = 32 MHz
If the TA0 register setting value is n,
the timer A0 period is;
n/f1 = 32000/(32 x $10^6$) = $10^{-3}$ = 1 ms

(2) Set the timer A0 register

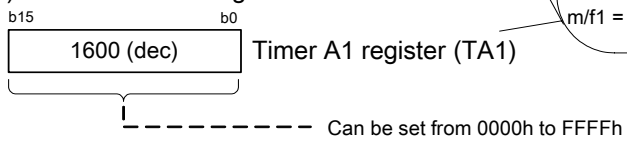



(3) Set the timer A1 mode register

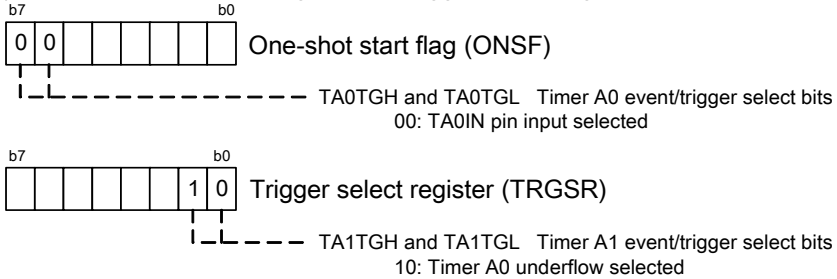



Xin = 32 MHz
If the TA1 register setting value is m,
the timer A1 period is;
m/f1 = 1600/(32 x $10^6$) = 50 x $10^{-6}$ = 50 μs

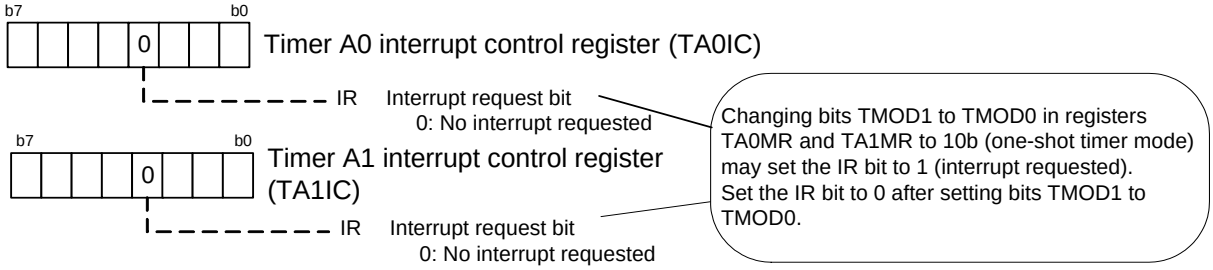
(4) Set the timer A1 register



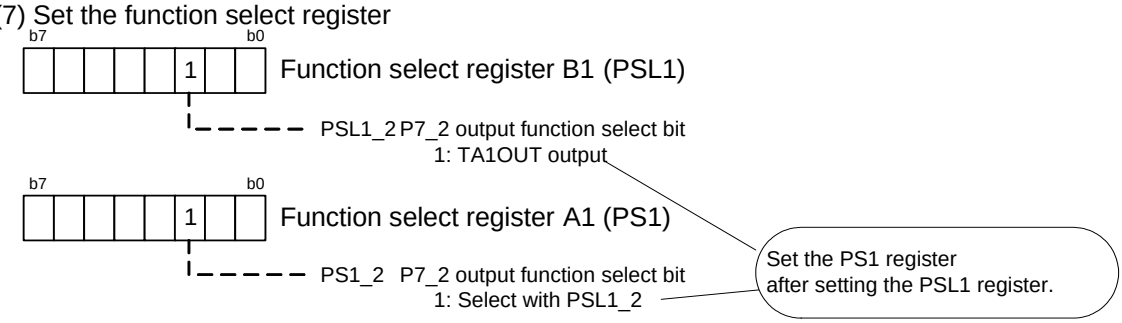

(5) Set the one-shot start flag and the trigger select register



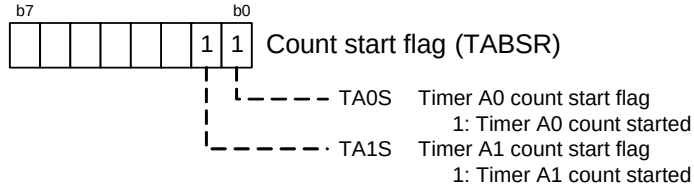
(6) Clear the interrupt request bit




(7) Set the function select register




(8) 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
The latest version can be downloaded from the Renesas Technology website.

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| REVISION HISTORY | M32C/84, 85, 86, 87, 88 Group<br>Delayed One-Shot Output |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Sep.10, 2006 | – | First Edition issued |
| | | | |

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