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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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

## Timer A Operation in Timer Mode

### 1. Abstract

In timer mode, the timer decrements the counter value using an internally-generated count source. When the count value underflows, an interrupt request is generated.

Timer period = (timer register value + 1) × timer count source period

f1 = 32 MHz, fC = 32.768 kHz

Count Source	Count Source Period	Maximum Period (Timer Value = 0xFFFF)
f1	31.25 ns	2.048 ms
f8	250 ns	16.384 ms
f2n (n = 15)	937.5 ns	61.44 ms
fC32	Approx. 0.977 ms	64s

### 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 generate the timer interrupt request every 1 ms period using the count source f8.

#### 3.1 Example Description

- (1) Setting the TAI<sub>i</sub>S bit in the TABSR register to 1 (count started) causes the counter to decrement the count source.
- (2) If an underflow occurs, the counter reloads the content of the reload register and continues counting.  
At the same time, the IR bit in the TAI<sub>i</sub>C register is set to 1 (interrupt requested).
- (3) Setting the TAI<sub>i</sub>S bit to 0 (count stopped) causes the counter to hold its count value and to stop.

Figure 1 shows the Timer Mode Operation.

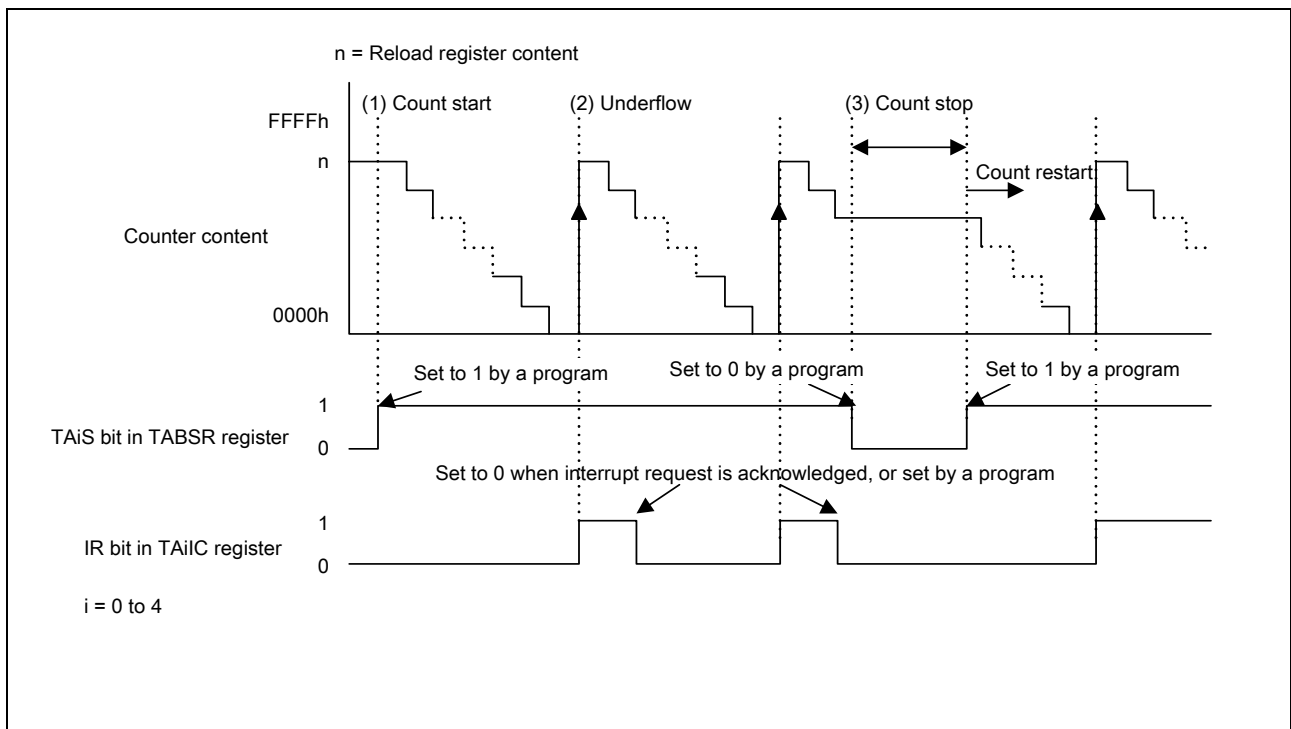


Figure 1 Timer Mode Operation

### 3.2 Setup

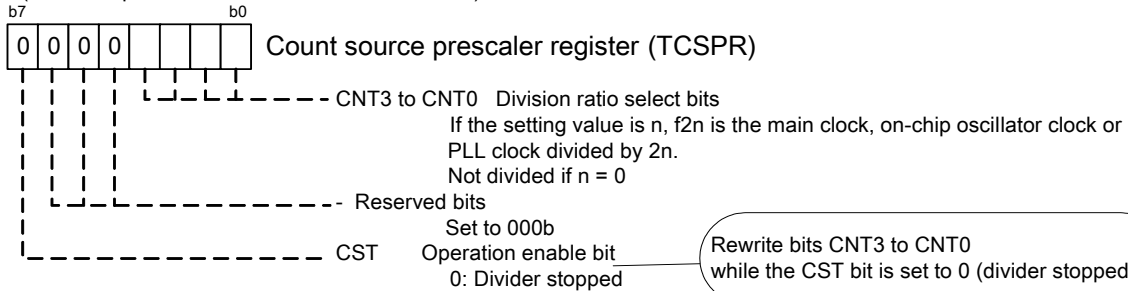
This section shows the setting steps and values to perform the application example described in

#### 3.1 Example Description.

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

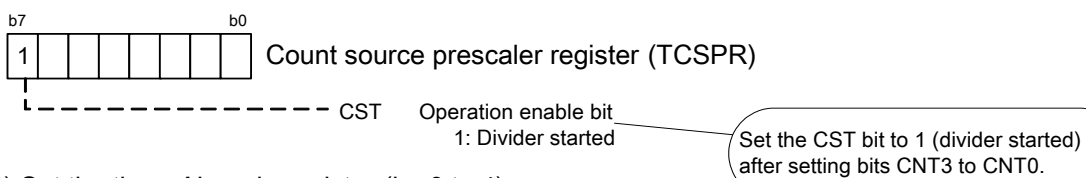
(1) Set the count source prescaler register

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

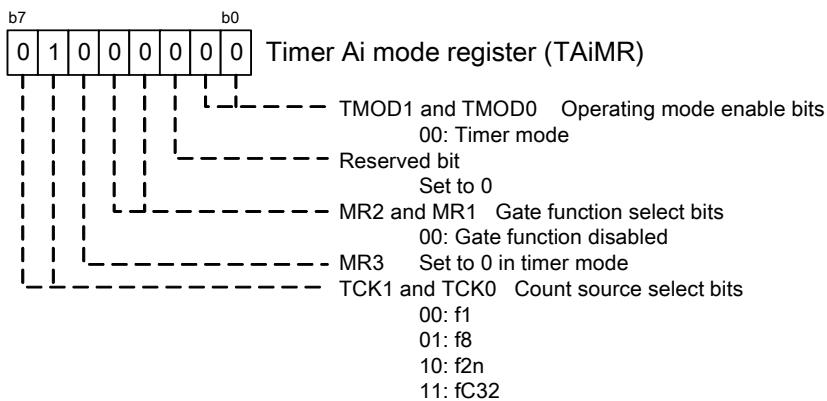


(2) Set the count source prescaler register (divider operation)

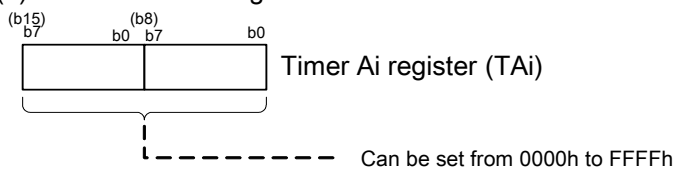
(This is required to use  $f_{2n}$  as the count source.)



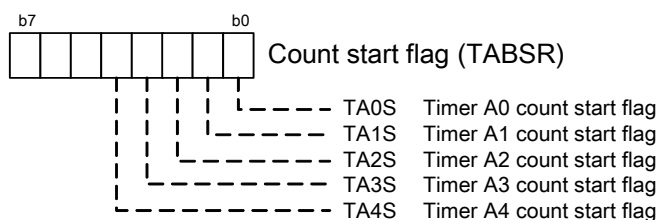
(3) Set the timer Ai mode register ( $i = 0$  to 4)



(4) Set the timer Ai register



(5) 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 Timer A Operation in Timer Mode
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Rev.	Date	Description	
		Page	Summary
1.00	Sep.10, 2006	-	First Edition issued

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