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April 1st, 2010
Renesas Electronics Corporation

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M16C/Tiny Series

Long-Period Timers

1. Abstract

In this process, Timer A0 and Timer A1 are connected to make a 16-bit timer with a 16-bit prescaler. Use the following peripheral functions:

- Timer mode of timer A
- Event counter mode of timer A

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. Contents

3.1 Specifications

- (1) Set timer A0 to timer mode, and set timer A1 to event counter mode.
- (2) Perform a count on count source f1 using timer A0 to count for 1 ms, and perform a count on timer A0 using timer A1 to count for 1 second.
- (3) Connect a 20-MHz oscillator to XIN.

3.2 Operation

- (1) Setting the count start flag to "1" causes the counter to begin counting. The counter of timer A0 performs a down count on count source f1.
- (2) If the counter of timer A0 underflows, the counter reloads the content of the reload register and continues counting. At this time, the timer A0 interrupt request bit goes to "1". The counter of timer A1 performs a down count on underflows in timer A0.
- (3) If the counter of timer A1 underflows, the counter reloads the content of the reload register and continues counting. At this time, the timer A1 interrupt request bit goes to "1".
- (4) Setting the count start flag to "0" causes the counter to hold its value and to stop.

Figure 1 shows the operation timing of long-period timers.

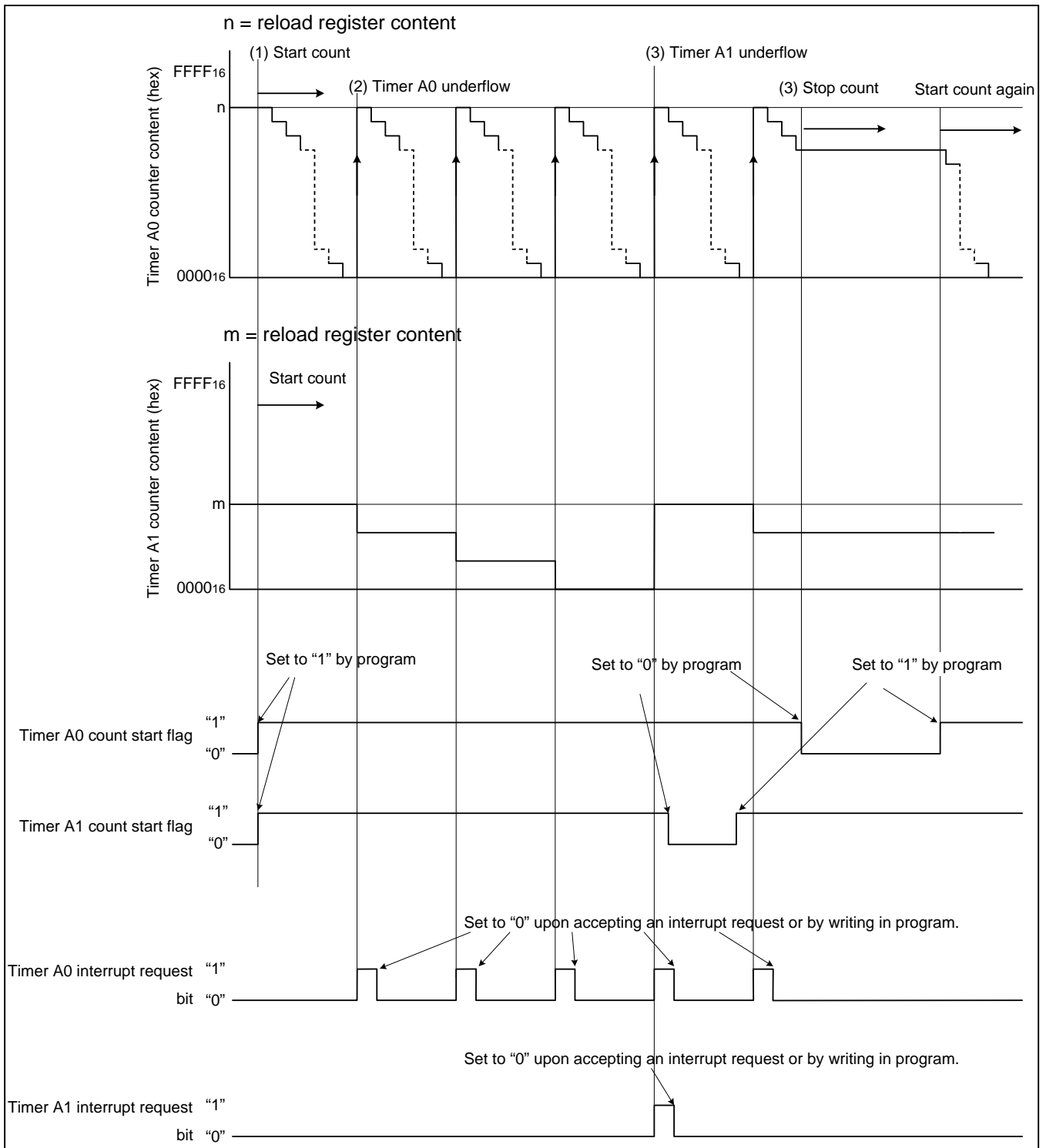


Figure 1. Operation Timing of Long-Period Timers

Figure 2 shows the Connection diagram of long-period timers.

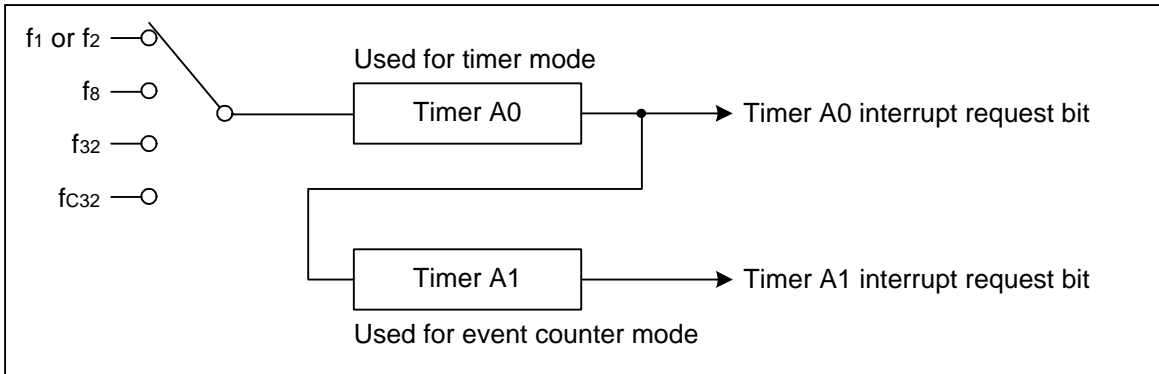
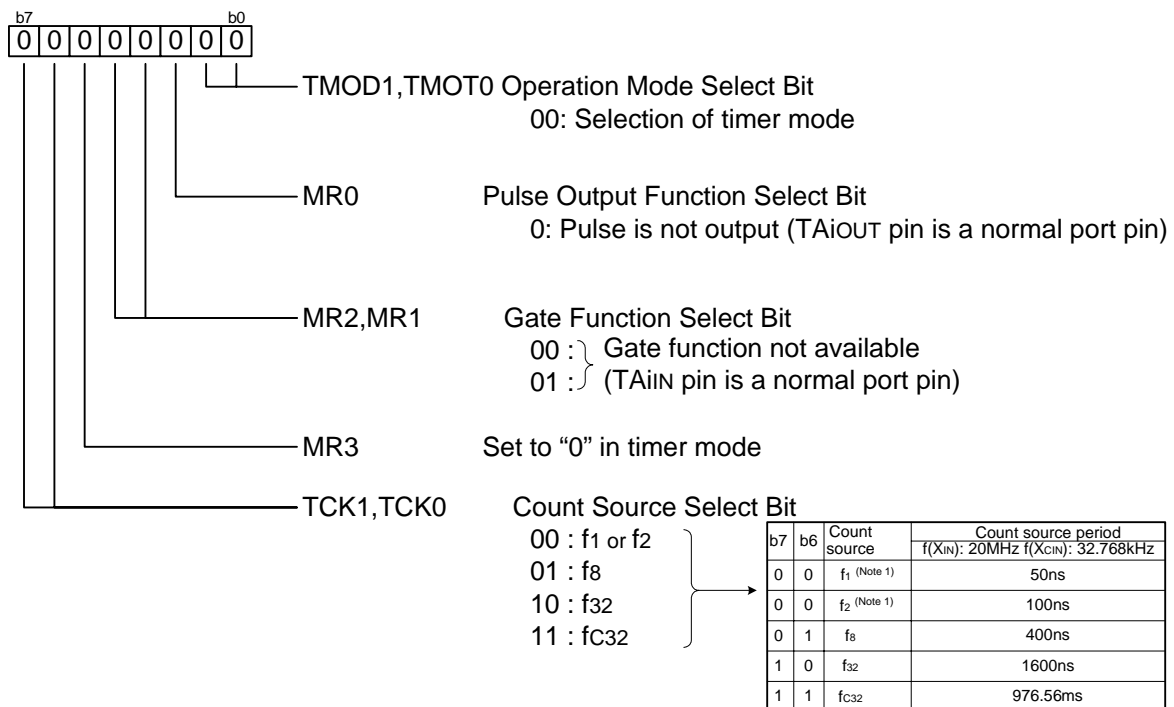


Figure 2. Connection Diagram of Long-Period Timers

3.3 Register Setting

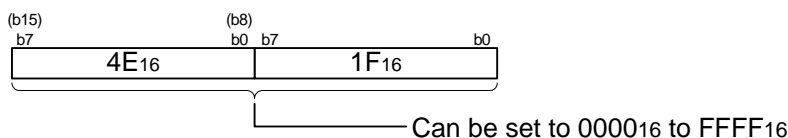
To enable the operation defined in “Section 3. Operation of timer A”, the following register settings must be taken place step by step. For detail configuration of each register, please refer to M16C/26 Group hardware manual, M16C/26A Group hardware manual, M16C/28 Group hardware manual, M16C/29 Group hardware manual.

(1) Setting timer A0 mode register

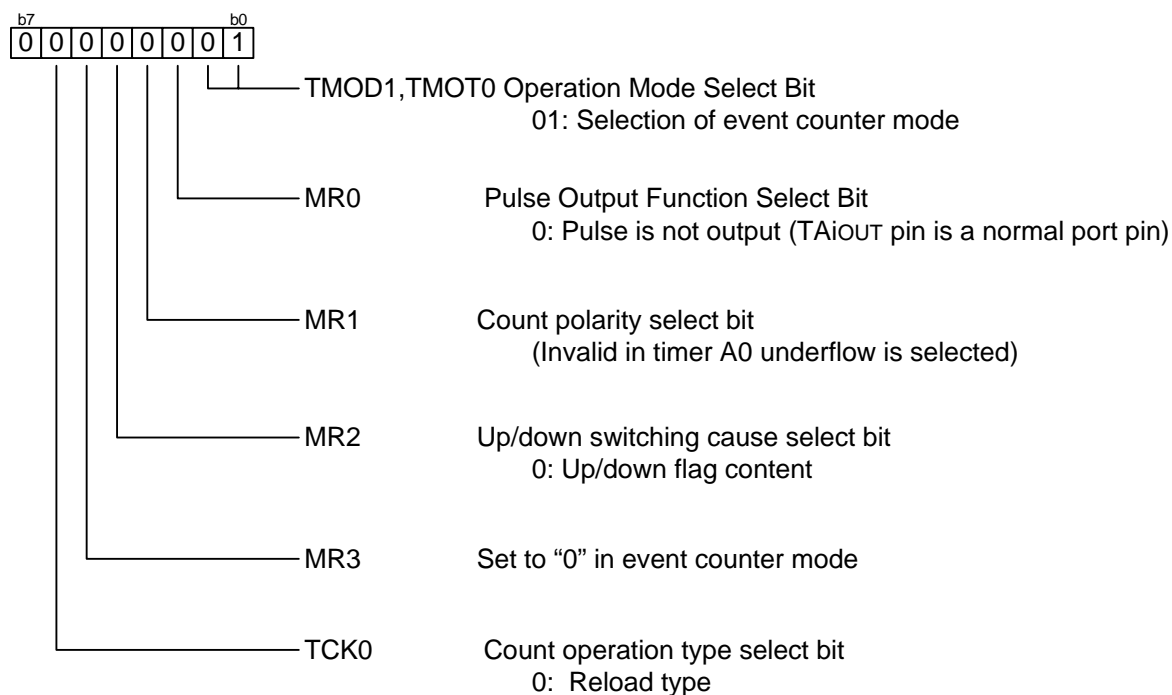


Note 1: Count source is f₂ if PCLK0 bit in the PCLKR register is “0”, f₁ if PCLK0 bit in the PCLKR register is “1”.

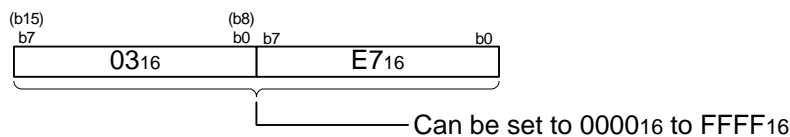
(2) Setting timer A0 register



(3) Setting timer A1 mode register



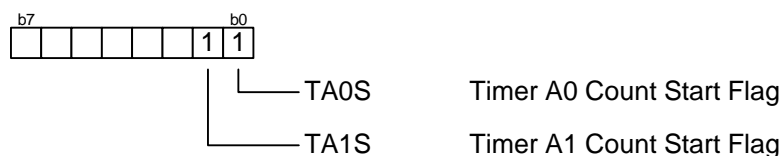
(4) Setting timer A1 register



(5) Setting trigger select register



(6) Setting count start flag



4. Sample Program

```

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

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

    ta0mr = 0x00; /* Selection of timer mode
                  Pulse output function select bit (0:Pulse is not output)
                  Gate function select bit (00:Gate function not available)
                  Count source (01:f1 or f2)
                  */

    ta0 = 20000-1; /* Setting counter value (1ms @20MHz, f1) */

    ta1mr = 0x01; /* Selection of event counter mode
                  Pulse output function select bit (0:Pulse is not output)
                  Counts external signal's falling edge
                  Up/down flag's content
                  Count operation type select bit (0:Reload type)
                  */

    trgsr = 0x02; /* Setting Trigger select register
                  Trigger of Timer A1 is selected timer A0 Overflow
                  */

    ta1 = 1000-1; /* Setting counter value (1sec) */

    tabsr = 0x03; /* Setting Count start flag
                  Timer A0 and Timer A1 start
                  */

    while (1) {
    }
}

```

5. Reference

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Hardware Manual

M16C/26, M16C/26A, M16C/28, M16C/29 Group Hardware Manual

(Use the latest version on the home page: <http://www.renesas.com>)

TECHNICAL UPDATE/TECHNICAL NEWS

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REVISION HISTORY

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		Page	Summary
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