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April 1st, 2010
Renesas Electronics Corporation

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M16C/62A Group
Long-Period Timers

1.0 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 function:

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

2.0 Introduction

Specifications (1) Set timer A0 to timer mode, and set timer A1 to event counter mode.

(2) Perform a count on count source f_1 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 16-MHz oscillator to X_{IN}.

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 f_1.

(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”.

Figure 1. shows the operation timing

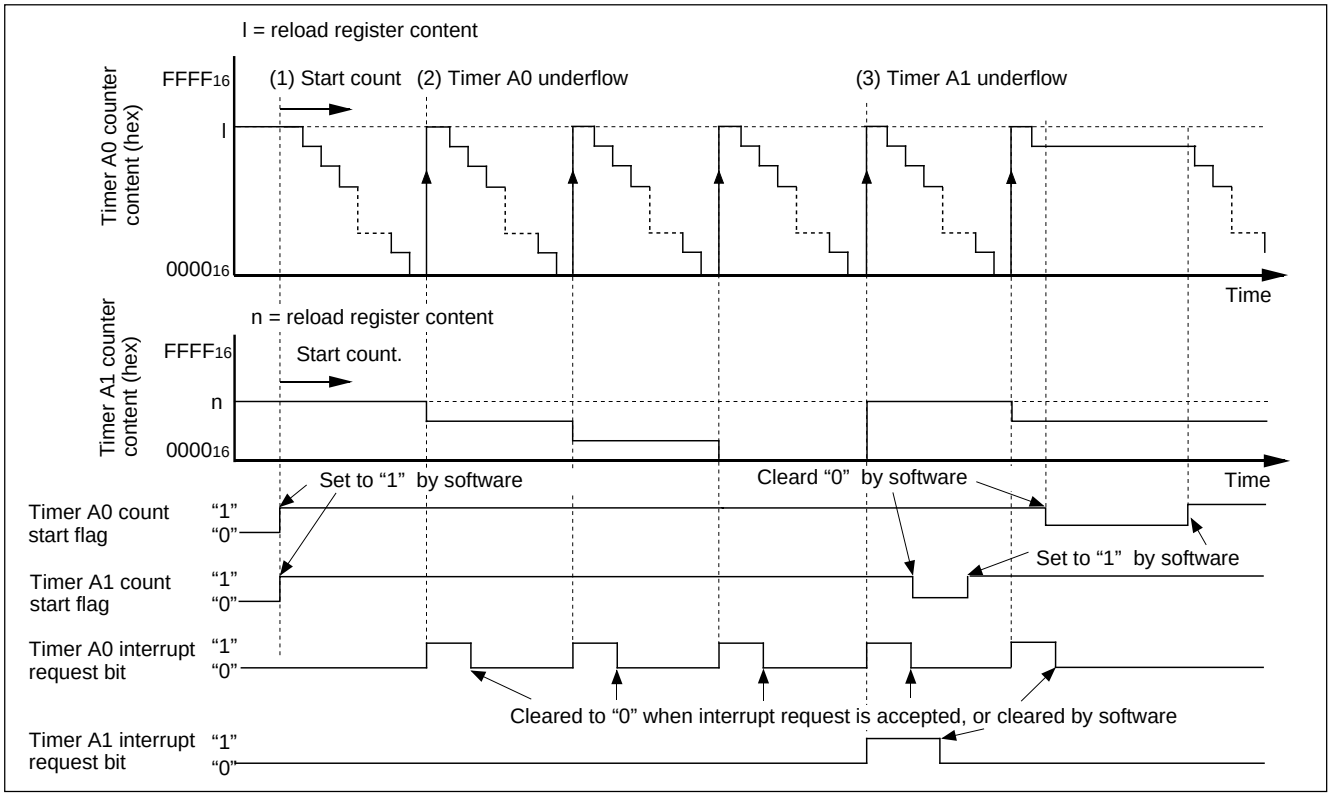

Figure 1. Operation timing of long-period timers

Figure 2 shows the connection diagram

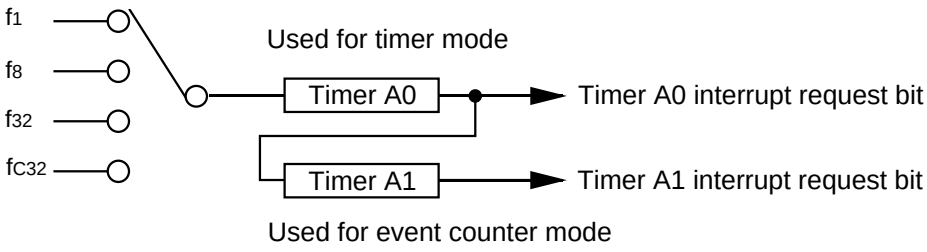

Figure 2. Connection diagram of long-period timers

3.0 Set-up procedure

Setting timer A0

Selecting timer mode and functions

b7 b0

0	0	0	0	0	0	0	0

Timer A0 mode register [Address 039616]
TA0MR

Selection of timer mode

Pulse output function select bit
0 : Pulse is not output (TA0OUT pin is a normal port pin)

Gate function select bit
b4 b3
0 0 : Gate function not available (TA0IN pin is a normal port pin)

0 (Must always be "0" in timer mode)

Count source select bit
b7 b6
0 0 : f1

b7	b6	Count source	Count source period f(XIN) : 16MHz	Count source period f(XCIN) : 32.768kHz
0	0	f1	62.5ns	
0	1	f8	500ns	
1	0	f32	2µs	
1	1	fC32	976.56µs	

Setting counter value

(b15) (b8)
b7 b0 b7 b0

3E16	7F16

Timer A0 register [Address 038716, 038616]
TA0

Setting timer A1

Selecting event counter mode and each function

b7 b0

	0	0	0	0	0	0	1

Timer A1 mode register [Address 039716]
TA1MR

Selection of event counter mode

Pulse output function select bit]
0 : Pulse is not output (TA1OUT pin is a normal port pin)

Count polarity select bit

Up/down switching cause select bit
0 : Up/down flag content

0 (Must always be "0" in event counter mode)

Count operation type select bit
0 : Reload type

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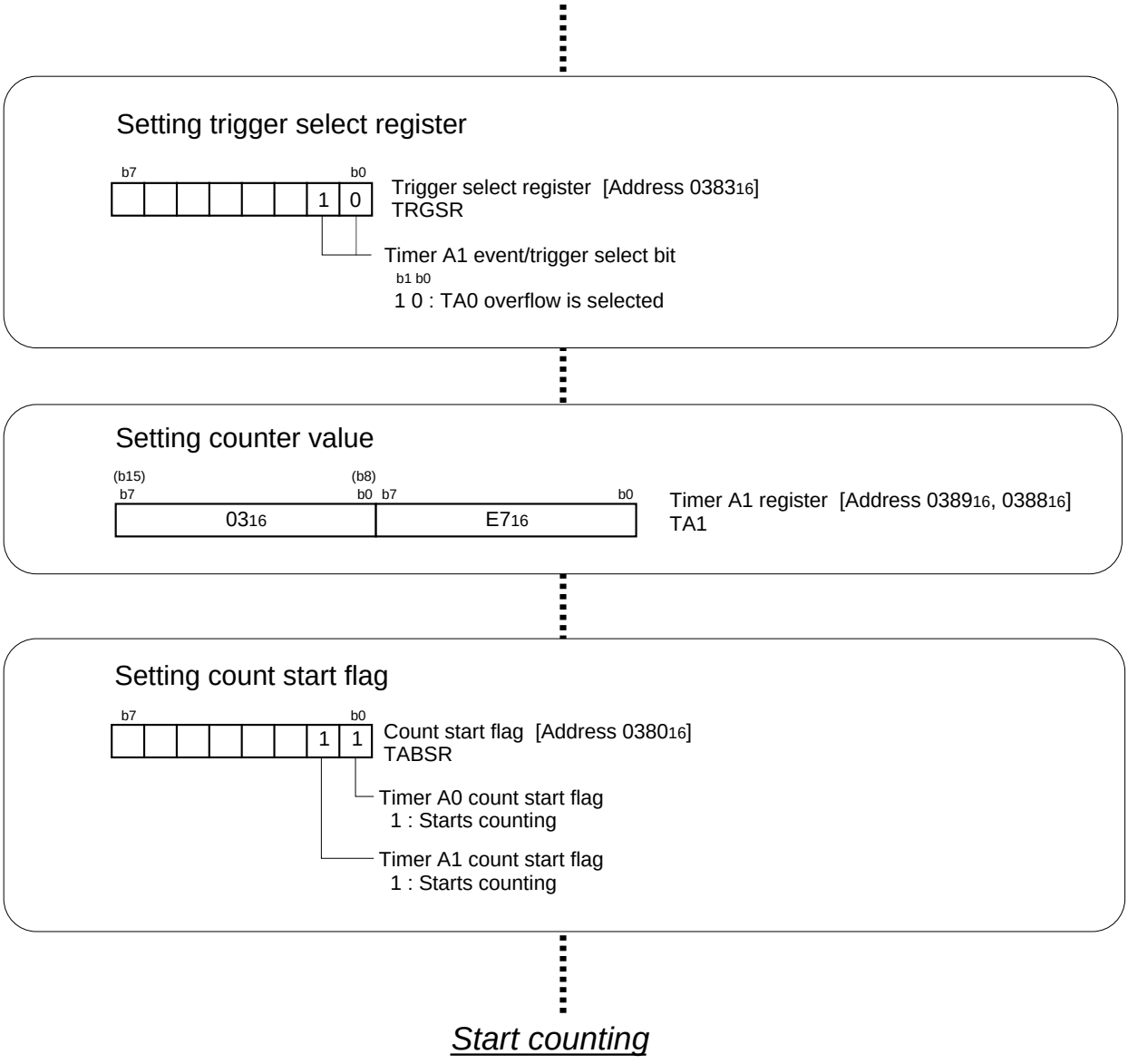

Start counting

4.0 Programming Code

```
;***************************************************************************************
;
;   M16C/62A Program Collection
;
;   FILE NAME : rjj05b0069_src.a30
;   CPU       : M16C/62A Group
;   FUNCTION  : Timer A Applications
;               (Long-Period Timers)
;   HISTORY   : 2003.05.16  Ver 1.00
;
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;
;***************************************************************************************
;***************************************************************************************
;       Include
;***************************************************************************************
        .LIST       OFF             ;Stops outputting lines to the assembler list file
        .INCLUDE    sfr62a.inc      ;Reads the file that defined SFR
        .LIST       ON              ;Starts outputting lines to the assembler list file
;
;***************************************************************************************
;       Symbol definition
;***************************************************************************************
ROM_TOP         .EQU    0F8000H     ;Start address of ROM
FIXED_VECT_TOP  .EQU    0FFFDCH     ;Start address of fixed vector
;
;***************************************************************************************
;       Program area
;***************************************************************************************
;=======================================================================
;       Start up
;=======================================================================
        .SECTION    PROGRAM, CODE   ;Declares section name and section type
        .ORG        ROM_TOP         ;Declares start address
RESET:
        MOV.B    #03H, prcr         ;Removes protect
                                    ;Set processor mode registers 0 and 1
        MOV.B    #00000000B, pm0    ; Single-chip mode
        MOV.B    #00000000B, pm1    ; No expansion, No wait
                                    ;Set system clock control registers 0 and 1
        MOV.B    #00001000B, cm0    ; Xcin-Xcout High
        MOV.B    #00100000B, cm1    ; Xin-Xout High, Main clock is No divison
        MOV.B    #00H, prcr         ;Protects all registers
;
```

```
;=============================================================================
;       TimerA (Long-Period Timers)
;=============================================================================
;------------TimerA0-------------
        MOV.B    #00000000B, ta0mr ;TimerA0 mode register
;                 ||||||++---------;Selection of timer mode
;                 |||||+-----------;Pulse output function select bit
;                 |||||             (0:Pulse is not output (TA0OUT pin is a normal port pin))
;                 |||++------------;Gate function select bit
;                 |||               (00:Gate function not available (TA0OUT pin is a normal port pin))
;                 ||+--------------;Must always be "0" in timer mode
;                 ++---------------;Count source select bit (00:Count source f1)
        MOV.W    #3E7FH, ta0       ;Setting counter value (1msec @16MHz, f1)
;
;------------TimerA1-------------
        MOV.B    #00000001B, ta1mr ;TimerA1 mode register
;                   |||||++---------;Selection of event counter mode
;                   ||||+-----------;Pulse output function select bit
;                   ||||             (0:Pulse is not output (TA1OUT pin is a normal port pin))
;                   |||+------------;Count polarity select bit
;                   ||+-------------;Up/down switching cause select bit (0:Up/down flag content)
;                   |+--------------;Must always be "0" in event counter mode
;                   +---------------;Count operation type select bit (0:Reload type)
        MOV.B    #00000010B, trgsr ;Setting trigger select register
;                          ++---------;Timer A1 event/trigger select bit
;                                      (10:TA0 overflow is selected)
        MOV.W    #03E7H, ta1       ;Setting counter value (1msec * 1000 = 1sec)
;
        MOV.B    #00000011B, tabsr ;Setting count start flag
;                          |+---------;TimerA0 count start flag (1:Starts counting)
;                          +----------;TimerA1 count start flag (1:Starts counting)
;
MAIN:
        JMP      MAIN
;
;=============================================================================
;       Dummy interrupt processing program
;=============================================================================
dummy:
        REIT
;
;*****************************************************************************
;       Setting of fixed vector
;*****************************************************************************
        .SECTION    F_VECT, ROMDATA
        .ORG        FIXED_VECT_TOP
;
        .LWORD    dummy    ;Undefined instruction interrupt vector
        .LWORD    dummy    ;Overflow (INT0 instruction) interrupt vector
        .LWORD    dummy    ;BRK instruction interrupt vector
        .LWORD    dummy    ;Address match interrupt vector
        .LWORD    dummy    ;Single-step interrupt vector
        .LWORD    dummy    ;Watchdog timer interrupt vector
        .LWORD    dummy    ;DBC interrupt vector
        .LWORD    dummy    ;NMI interrupt vector
        .LWORD    RESET    ;Sets reset vector
;
        .END
```

5.0 Reference

Renesas Technology Corporation Semiconductor Home page

http://www.renesas.com/

Technical Support

E-mail: support_apl@renesas.com

Data Sheet

M16C/62A group Rev. C.1
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User's Manual

M16C/62A group Rev. 1.0
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