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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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M32C/84 Group

Operation of timer A (2-phase pulse single process in event counter mode, multiply-by-4 mode selected)

1. Abstract

In processing 2-phase pulse signals in event counter mode, choose functions from those listed in Table 1. Operations of the circled items are described below. Figure 1 shows the operation timing, and Figure 2 shows the set-up procedure. A reference program is an example when using the Timer A4 interrupt based on the setting procedure of Figure 2.

2. Introduction

This application note is applied to the M32C/84 group Microcomputers.

This program can be operated under the condition of M16C family products with the same SFR(Special Function Register) as M32C/84 Group products. Because some functions may be modified of the M16C family products, see the user's manual. When using the functions shown in this application note, evaluate them carefully for an operation

3. Chooosed functions

Table 1. Chooosed functions

Item	Set-up		Item	Set-up	
Count operation type		Reload type	Processing 2 phase pulses (Note)		Normal processing
	0	Free run type		0	4-multiplication processing

Note: Timer A3 alone can be selected. Timer A2 is solely used for normal processes, and timer A4 is solely used for 4-multiplication processes.

4. Operation

- (1) Setting the count start flag to "1" causes the counter to count effective edges of the count source.
- (2) Even if an underflow occurs, the content of the reload register is not reloaded, but the count continues. At this time, the interrupt request bit goes to "1".
- (3) Even if an overflow occurs, the content of the reload register is not reloaded, but the count continues. At this time, the interrupt request bit goes to "1".

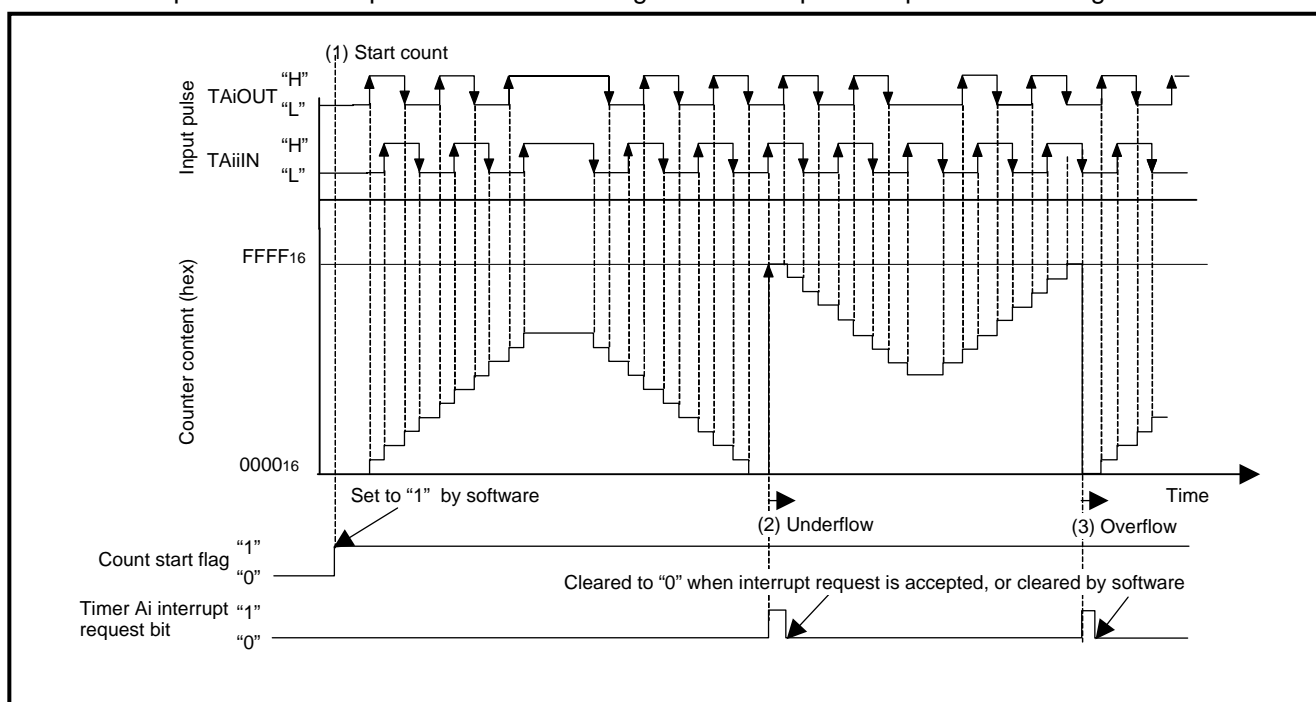
Note

- The conditions and effective edges of up count or down count are as follows:

Table 2. The conditions and effective edges of up count or down count

	Input signal to the TAIOUT pin	Input signal to the TAIIN pin		Input signal to the TAIOUT pin	Input signal to the TAIIN pin
Up count	"H" level	Rising	Down count	"H" level	Falling
	"L" level	Falling		"L" level	Rising
	Rising	"L" level		Rising	"H" level
	Falling	"H" level		Falling	"L" level

- Set TAIIN pin and TAIOUT pin's function select register A to I/O port and port direction register to "0".


Figure 1. Operation timing of 2-phase pulse single process in event counter mode, multiply-by-4 mode selected

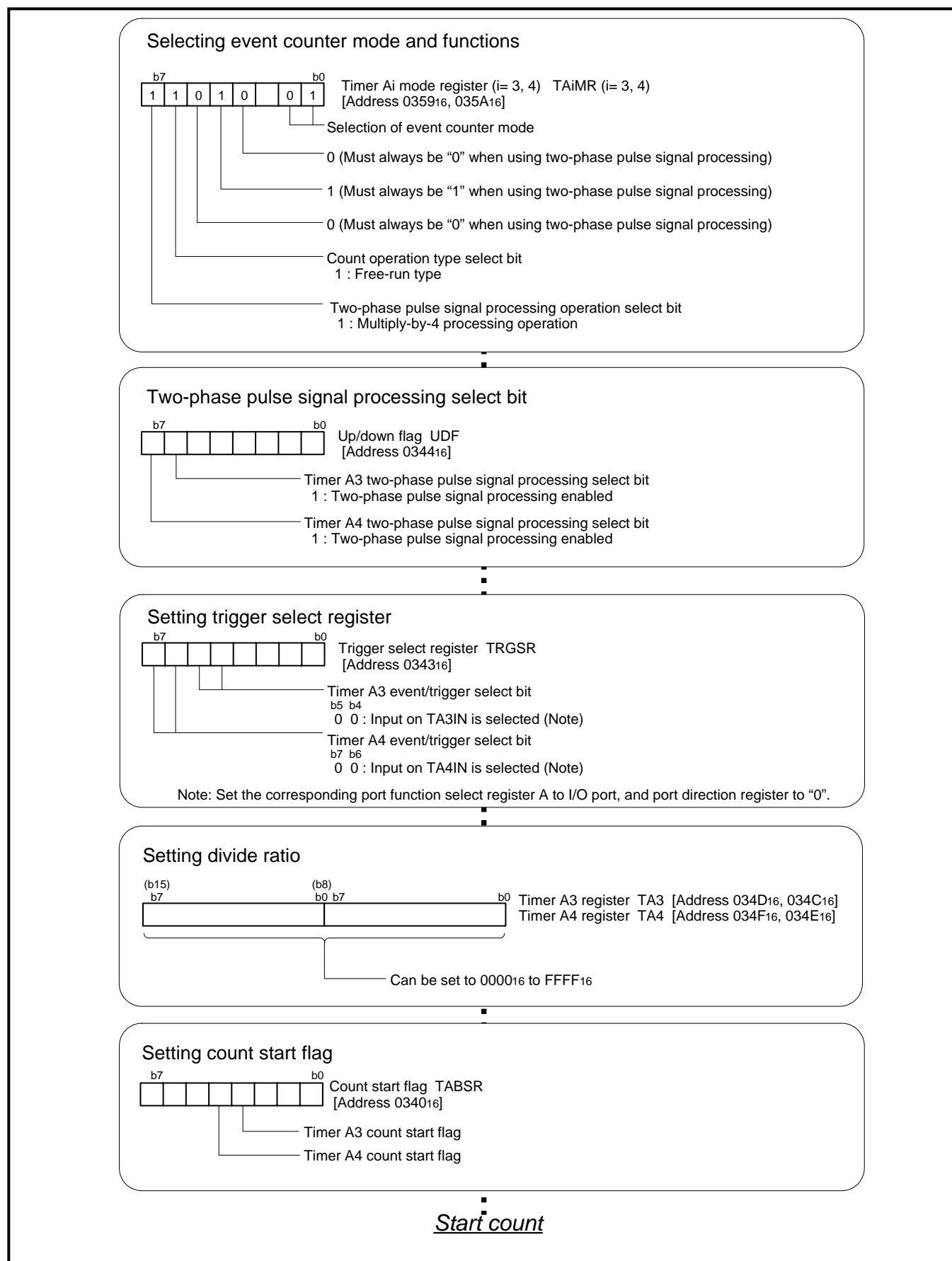


Figure 2. Set-up procedure of 2-phase pulse single process in event counter mode,multiply-by-4 mode selected

5. The example of reference program

```

*****
;
;
; M32C/84 Program Collection
;
; FILE NAME : rjj05b0713_src.a30
; CPU       : M32C/84 Group
; FUNCTION  : Operation of timer A (2-phase pulse single process in event
;            : counter mode, multiply-by-4 mode selected)
; HISTORY   : 2005.1.31 Ver 1.00
;
; Copyright(C)2005, Renesas Technology Corp.
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; All rights reserved.
;
*****
;
*****
;
; Include
;
*****
;
; .LIST      off                ;Stops outputting lines to the assembler list file
; .INCLUDE   sfr32c84.inc       ;Reads the file that defined SFR
; .LIST      on                 ;Starts outputting lines to the assembler list file
;
;
*****
;
; Symbol definition
;
*****
;
RAM_TOP      .equ    000400h      ;Start address of RAM
RAM_END      .equ    002affh      ;End address of RAM
ROM_TOP      .equ    0fe0000h     ;Start address of ROM
VECT_TOP     .equ    0fffe00h     ;Start address of vect_top
FIXED_VECT_TOP .equ    0fffdch    ;Start address of fixed_vect_top
;
;
*****
;
; Program area
;
*****
;
=====
;
; Start up
;
=====
;
; .SECTION   PROGRAM, CODE       ;Declares section name and section type
; .ORG      ROM_TOP              ;Declares start address
;
START:
;
ldc          #RAM_END+1,isp      ;Sets interrupt stack pointer
mov.b        #03h, prcr          ;Removes protect
mov.b        #00000000b, pm0     ;Single-chip mode

```

```

mov.b      #00000000b, pm1      ;
mov.b      #00001000b, cm0      ;Xcin-Xcout High
mov.b      #00100000b, cm1      ;
mov.b      #00010010b, mcd      ;No division mode
mov.b      #00h, prcr           ;Protects all registers
ldc        #VECT_TOP,intb       ;Sets interrupt table register
;
;=====
;      Main program
;=====
mov.b      #11010001b,ta4mr      ;Timer A4 mode register
;      ||||| ++-----;Event counter mode
;      ||||| +-----;To use two-phase pulse signal processing,
;      |||||           ;set this bit to "0"
;      ||||| +-----;To use two-phase pulse signal processing,
;      |||||           ;set this bit to "0"
;      ||| +-----;To use two-phase pulse signal processing,
;      |||            ;set this bit to "1"
;      || +-----;To use two-phase pulse signal processing,
;      ||             ;set this bit to "0"
;      | +-----;Free-run type
;      +-----;Multiply-by-4 processing operation
mov.b      #10000000b,udf        ;Up/down flag
;      +-----;Two-phase pulse signal processing enabled
bclr       pd8_0                 ;(Note)Set the corresponding port direction register to "0"
;                                     ;(TA4OUT)
bclr       pd8_1                 ;(Note)Set the corresponding port direction register to "0"
;                                     ;(TA4IN)
bclr       ps2_0                 ;Port P8_0 is I/O port
bclr       ps2_1                 ;Port P8_1 is I/O port
mov.b      #00000000b,trgsr      ;Trigger select register
;      ++-----;Input on ta4in is selected
mov.w      #0,ta4                ;Timer A4 register
mov.b      #00000011b,ta4ic      ;Interrupt control register
;      |+++-----;Interrupt priority level select bit
;      |           ;(011:Level 3, interrupt disabled)
;      +-----;Interrupt request bit (0:interrupt not requested)
mov.b      #00010000b,tabsr      ;Count start flag
;      +-----;Starts counting
fset       i                     ;Set interrupt enable flag
;
MAIN:
;
jmp        MAIN
;=====
;      Interrupt program
;=====

```

TA4_INT:

```

;
;
;           ;/ TA4_INT interrupt routine /
;
;           reit
;
;
;=====
;           Dummy interrupt processing program
;=====

```

DUMMY:

```

;           reit
;
;*****
;
;           Setting of variable vector table
;*****
;
;
;           .SECTION      VECT,ROMDATA
;           .ORG          VECT_TOP + (8*4)
;
;           .lword        DUMMY          ;DMA0 interrupt vector
;           .lword        DUMMY          ;DMA1 interrupt vector
;           .lword        DUMMY          ;DMA2 interrupt vector
;           .lword        DUMMY          ;DMA3 interrupt vector
;           .lword        DUMMY          ;TA0 interrupt vector
;           .lword        DUMMY          ;TA1 interrupt vector
;           .lword        DUMMY          ;TA2 interrupt vector
;           .lword        DUMMY          ;TA3 interrupt vector
;           .lword        TA4_INT        ;TA4 interrupt vector
;           .lword        DUMMY          ;UART0 transmit/NACK interrupt vector
;           .lword        DUMMY          ;UART0 receive/ACK interrupt vector
;           .lword        DUMMY          ;UART1 transmit/NACK interrupt vector
;           .lword        DUMMY          ;UART1 receive/ACK interrupt vector
;           .lword        DUMMY          ;TB0 interrupt vector
;           .lword        DUMMY          ;TB1 interrupt vector
;           .lword        DUMMY          ;TB2 interrupt vector
;           .lword        DUMMY          ;TB3 interrupt vector
;           .lword        DUMMY          ;TB4 interrupt vector
;           .lword        DUMMY          ;INT5 interrupt vector
;           .lword        DUMMY          ;INT4 interrupt vector
;           .lword        DUMMY          ;INT3 interrupt vector
;           .lword        DUMMY          ;INT2 interrupt vector
;           .lword        DUMMY          ;INT1 interrupt vector
;           .lword        DUMMY          ;INT0 interrupt vector
;           .lword        DUMMY          ;TB5 interrupt vector
;           .lword        DUMMY          ;UART2 transmit/NACK interrupt vector
;           .lword        DUMMY          ;UART2 receive/ACK interrupt vector
;           .lword        DUMMY          ;UART3 transmit/NACK interrupt vector

```



```

.lword          DUMMY          ;UART3 receive/ACK interrupt vector
.lword          DUMMY          ;UART4 transmit/NACK interrupt vector
.lword          DUMMY          ;UART4 receive/ACK interrupt vector
.lword          DUMMY          ;Bus collision detection,start/stop
                                ;condition detection (UART2) interrupt vector
.lword          DUMMY          ;Bus collision detection,start/stop
                                ;condition detection (UART3) interrupt vector
.lword          DUMMY          ;Bus collision detection,start/stop
                                ;condition detection (UART4) interrupt vector
.lword          DUMMY          ;A-D interrupt vector
.lword          DUMMY          ;KEY interrupt vector
.lword          DUMMY          ;IntelligentI/O interrupt vector0
.lword          DUMMY          ;IntelligentI/O interrupt vector1
.lword          DUMMY          ;IntelligentI/O interrupt vector2
.lword          DUMMY          ;IntelligentI/O interrupt vector3
.lword          DUMMY          ;IntelligentI/O interrupt vector4
.lword          DUMMY          ;IntelligentI/O interrupt vector8
.lword          DUMMY          ;IntelligentI/O interrupt vector9,CAN0
.lword          DUMMY          ;IntelligentI/O interrupt vector10,CAN1
.lword          DUMMY          ;CAN2
;
;
;*****
;
;      Setting of fixed vector
;*****
;
;
SECTION          F_VECT,ROMDATA
.ORG             FIXED_VECT_TOP
;
.lword          DUMMY          ;Undefined instruction interrupt vector
.lword          DUMMY          ;Overflow interrupt vector
.lword          DUMMY          ;BRK instruction interrupt vector
.lword          DUMMY          ;Address match interrupt vector
.lword          DUMMY          ;
.lword          DUMMY          ;Watchdog timer interrupt vector
.lword          DUMMY          ;
.lword          DUMMY          ;NMI interrupt vector
.lword          START          ;Sets start vector
;
.end

```

6. Reference

Hardware manual

M32C/84 group (Tentative version) Hardware Manual Rev.0.50

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7. Web-site and contact for support

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Revision

Rev.	Issue data	Revised	
		Page	Point
1.00	2005.1.31	-	First edition issued

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