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April 1st, 2010
Renesas Electronics Corporation

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M16C/80 Group

Solution for External Interrupt Pins Shortage

1.0 Abstract

The following are solution for external interrupt pins shortage using event counter mode of timer A.
Use the following peripheral function:
• Event counter mode of timer A

2.0 Introduction

Specifications

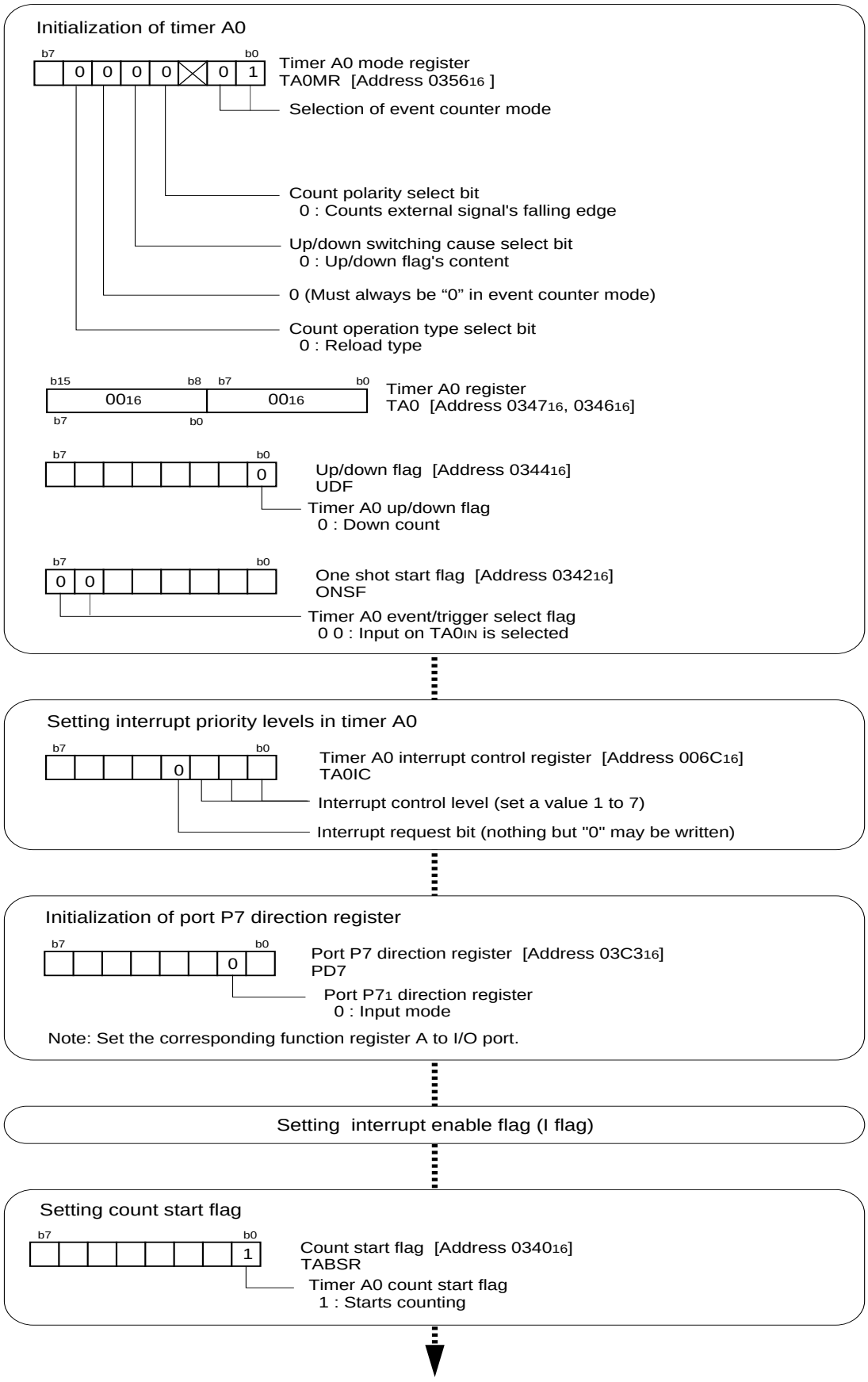
(1) Inputting a falling edge to the $TA0_{IN}$ pin generates a timer A0 interrupt.

Operation

(1) Set timer A0 to event counter mode, set timer to “0”, and set interrupt priority levels in timer A0.

(2) Inputting a falling edge to the $TA0_{IN}$ pin generates a timer A0 interrupt.

3.0 Set-up procedure



4.0 Programming Code

```
;******************************************************************************
;
;   M16C/80 Program Collection
;
;   FILE NAME : rjj05b0509_src.a30
;   CPU       : M16C/80 Group
;   FUNCTION  : Timer A Applications
;               (Solution for External Interrupt Pins Shortage)
;   HISTORY   : 2004.03.15  Ver 1.00
;
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;
;******************************************************************************
;******************************************************************************
;       Include
;******************************************************************************
        .LIST       OFF             ;Stops outputting lines to the assembler list file
        .INCLUDE    sfr80100.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    002BFFH    ;End address of RAM
ROM_TOP          .EQU    0FFC000H   ;Start address of ROM
VECT_TOP         .EQU    0FFF5BAH   ;Start address of variable vector
FIXED_VECT_TOP   .EQU    0FFFFDCH   ;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:
        LDC      #RAM_END+1, ISP   ;Sets initial value in stack pointer
        ; Sets Processor mode, System clock and Main clock division
        MOV.B    #03H, prcr        ;Removes protect
        MOV.B    #10000000B, pm0   ; Single-chip mode
        MOV.B    #11000000B, pm1   ; Flash memory version
        MOV.B    #00001000B, cm0   ; Xcin-Xcout High
        MOV.B    #00100000B, cm1   ; Xin-Xout High
        MOV.B    #00010010B, mcd   ; No division mode
        MOV.B    #00H, prcr        ;Protects all registers
;
        LDC      #VECT_TOP, INTB   ;Sets initial value in interrupt table register
;
```

```
;===============================================================================
;       TimerA (solution for external interrupt pins shortage)
;===============================================================================
;-------------------------------------------------------------------------------
;       Initialization of Timer A0
;-------------------------------------------------------------------------------
        ; Selecting timer mode and functions
        MOV.B    #00000001B, ta0mr
;                 ||||||++---------;Selection of event counter mode
;                 |||||+-----------;This bit is invalid in M16C/80 series
;                 ||||+------------;Count polarity select bit
;                 ||||              (0:Counts external signal's falling edge)
;                 |||+-------------;Up/down switching cause select bit (0:Up/down flag's content)
;                 ||+--------------;Must always be "0" in event counter mode
;                 |+---------------;Count operation  type select bit (0:Reload type)
;                 +----------------;When not using the 2-phase pulse signal processing function,
;                                   set the select bit to "0"
        ; Setting Timer A0 register
        MOV.W    #0000H, ta0
        ; Up/down flag
        MOV.B    #00000000B, udf
;                       +---------;Timer A0 up/down flag (0:Down count)
        ; One shot start flag
        MOV.B    #00000000B, onsf
;                 ++---------------;Timer A0 event/trigger select flag
;                                   (00:Input on TA0in is selected)
        ; Setting interrupt priority levels in timer A0
        MOV.B    #00000001B, ta0ic
;                    |+++---------;Interrupt control level (Set a value 1 to 7)
;                    +------------;Interrupt request bit (This bit can only be accessed for reset(=0) )
        ; Initialization of port P7 direction register
        BCLR     pd7_1             ;Port P71(TA0in) direction register (0:Input mode) (Note)
        ; (Note) Set the corresponding function register A to I/O port
        BCLR     ps1_1             ;Port P71 is I/O port
;
        ; Setting interrupt enable flag (I flag)
        FSET     I
;
        ; Setting count start flag
        MOV.B    #00000001B, tabsr
;                       +---------;TimerA0 count start flag (1:Starts counting)

MAIN:
        ; Inputting a falling edge to the TA0in pin
        ; generates a timer A0 interrupt
        JMP      MAIN
;
;===============================================================================
;       Interrupt program
;===============================================================================
INT_TA0:
        REIT
;
```

```
;=============================================================================
;       Dummy interrupt processing program
;=============================================================================
dummy:
        REIT
;
;*******************************************************************************
;       Setting of variable vector table
;*******************************************************************************
        .SECTION    VECT, ROMDATA
        .ORG        VECT_TOP+(12*4)
;
        .LWORD    INT_TA0      ;TA0 interrupt vector
        .LWORD    dummy        ;TA1 interrupt vector
;
;*******************************************************************************
;       Setting of fixed vector
;*******************************************************************************
        .SECTION    F_VECT, ROMDATA
        .ORG        FIXED_VECT_TOP
;
        .LWORD    dummy    ;Undefined instruction
        .LWORD    dummy    ;Overflow
        .LWORD    dummy    ;BRK instruction execution
        .LWORD    dummy    ;Address match
        .LWORD    dummy    ;
        .LWORD    dummy    ;Watchdog timer
        .LWORD    dummy    ;
        .LWORD    dummy    ;NMI
        .LWORD    RESET    ;Reset
;
        .END
```

5.0 Reference

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E-mail: support_apl@renesas.com

Data Sheet

M16C/80 group Rev. E3
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