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M16C/28, 29 Group

How to Use Timer S Interrupt

1. Abstract

Timer S (IC/OC) has many interrupt request factors such as the time measurement interrupt and the waveform generation interrupt. Timer S brings several interrupt request factors together and use them as one IC/OC interrupt. This application note introduces how to use the Timer S interrupt.

2. Introduction

This application note is applied to the following microcomputers.

- MCU: M16C/28 Group
- M16C/29 Group

3. Detailed description

The following describes IC/OC interrupt block diagram.

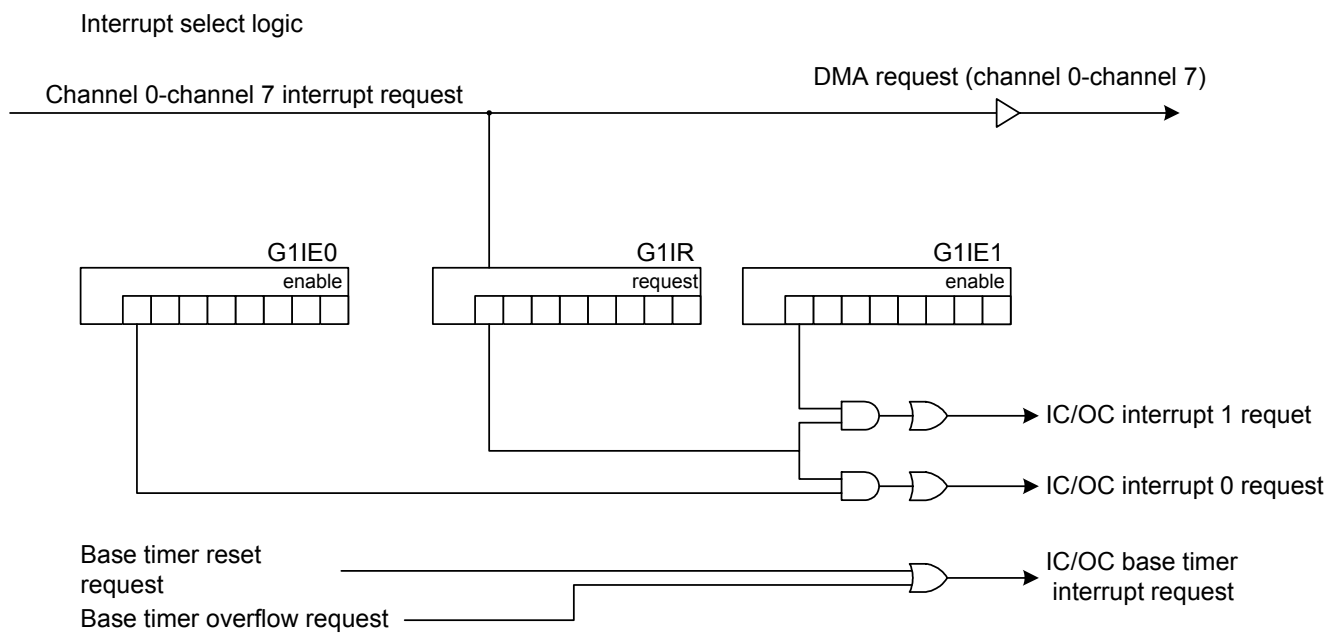


Figure 1 IC/OC Interrupt and DMA Request

When either the base timer reset request or the base timer overflow request is generated, IR bit (bit 3 in the BTIC register) for the IC/OC base timer interrupt becomes “1” (interrupt request). And when the interrupt request of each of eight channel (channel i) is generated, bit i in the G1IR register becomes “1” .

When using IC/OC interrupt 0, set the bit for the G1IE0 register channel to “1” (IC/OC interrupt 0 request enable).

EX) When using the waveform generation interrupt request of channel 3 and the time measurement interrupt request of channel 6, set bit 3 and bit 6 in the G1IE0 register to “1” .

If the waveform generation interrupt request of channel 3 is generated, bit 3 in the G1IR register becomes “1” and IR bit (bit 3 in the IC/OC0IC register) for IC/OC interrupt 0 becomes “1”.

If the time measurement interrupt request of channel 6 is generated, bit 6 in the G1IR register becomes “1” and IR bit (bit 3 in the IC/OC0IC register) for IC/OC interrupt 0 becomes “1”.

By reading the G1IR register within an interrupt process, the microcomputer determines which channel generated the interrupt request.

Each bit in the G1IR register does not become “0” automatically even if the interrupt request is received. Therefore set to “0” by the program. If leaving these bits “1”, all interrupt factors of IC/OC channel which have generated since then are invalid.

(Note) Use the following instructions when writing “0” (no interrupt request) to each bit in the G1IR register.
AND, BCLR

3.1 Interrupt Process Flow

Figure 2 shows the IC/OC interrupt process flow.

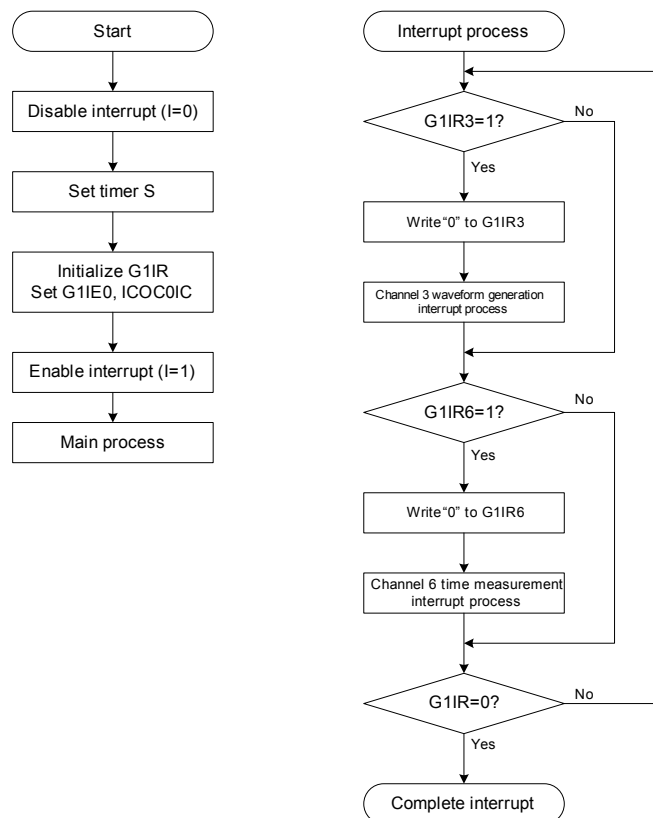
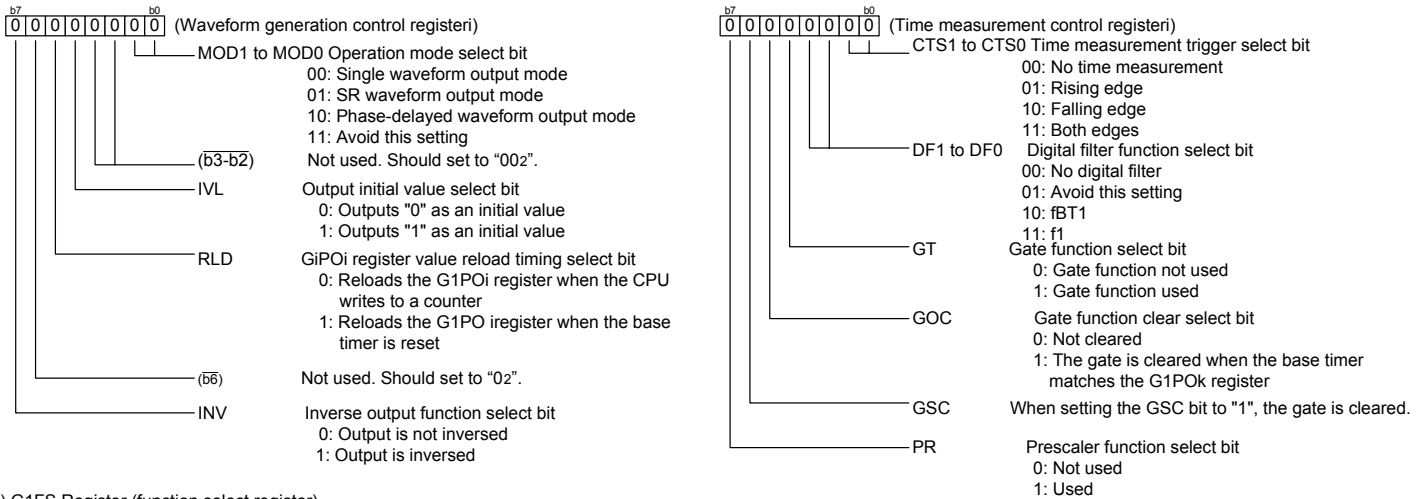


Figure 2 Interrupt Process Flow

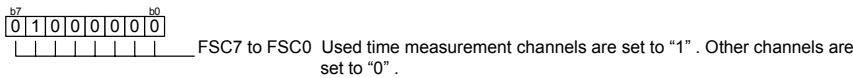
3.2 How to Set Up

The setting procedure and value for the register of G1IR, G1IE0 and ICOC0IC are shown in order to execute “3. Detailed Description”. Refer to the application notes regarding the setting of the time measurement function and the waveform generation function in each channel. Also refer to the user’s hardware manuals of related microcomputers for details of each register.

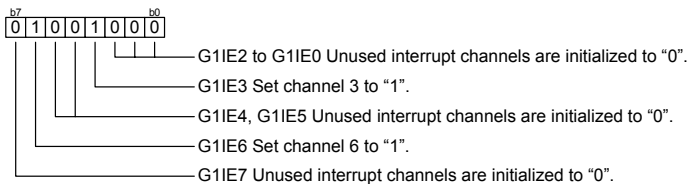
(1) Setting waveform generation control register or time measurement control register



(2) G1FS Register (function select register)



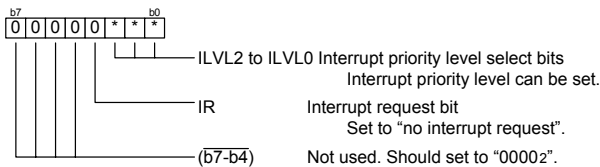
(3) G1IE0 Register



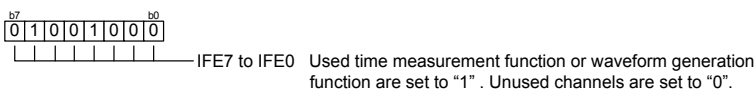
(4) G1IR Register



(5) ICOC0IC Register (Setting interrupt priority level)



(6) G1FE register (function enable register)



4. Sample Program

```

/*****
 *
 * FILE NAME :
 * Version : 1.20
 * Function : How to use timer S interrupt
 *
 * Copyright (C)2004, Renesas Technology Corp.
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 *
 *****/
/*****
 * include file
 *****/
#include "sfr28.h"

/*****
 * Function Definition
 *****/
void icoc0_int(void);
#pragma INTERRUPT icoc0_int

void port_init(void);
void icoc_init(void);
/*****
 * main
 *****/
void main(void) {

    port_init();
    icoc_init();

    bts_glbcr1 = 1;          /* Base Timer Start */
    asm (" fset I");
    while (1) {
    }

void port_init() {
    p0 = 0;
    p1 = 0;
    p2 = 0;
    p3 = 0;

    p7 = 0;
    p8 = 0;
    p9 = 0;
    p10 = 0;

    pd0 = 0xff;
    pd1 = 0xff;
    pd2 = 0x00;
    pd3 = 0xff;

    pd7 = 0xff;
    pd8 = 0xff;
    prcr = 4;
    pd9 = 0xff;
    pd10 = 0xff;

    ifsr2a = 1;
}

void icoc_init() {

    glbv = 20-1;          /* fBT is 1MHz */
    glbcr0 = 0x03;

```

```

glbcr1 = 0x00;

glpocr3 = 0x20;          /* ch-3 Single waveform output mode */
glpo3 = 0x4000;

gltmcr6 = 0x0d;

glfs = 0x40;           /* ch-6 Time measurement function select */

glie0 = 0;             /* Interrupt enable register 0 set to 0 */

glie0 = 0x48;         /* Interrupt enable register 0 set */

glir = 0;              /* Interrupt request register initialize */

icoc0ic = 0x04;       /* IC/OC 0 Interrupt control register set */
/* IC/OC 0 Interrupt request bit clear */

glfe = 0x48;          /* ch-6,ch-3 function enable */
}

void icoc0_int() {

while ( glir & 0x48 ) {          /* repeat until no request */
    if (glir3 == 1 ) {          /* ch-3 interrupt process */
        glir3 = 0;             /* ch-3 interrupt request bit clear */

        p1++;
        if ( p9_3==1 ) {
            glpo3 = glpo3 + 0x10;
            if ( glpo3 == 0x6000 ) {
                p9_3 = 0;
            }
        } else {
            glpo3 = glpo3 - 0x10;
            if ( glpo3 == 0x2000 ) {
                p9_3 = 1;
            }
        }
    }
}

if (glir6 == 1 ) {             /* ch-6 interrupt process */
    glir6 = 0;                 /* ch-6 interrupt request bit clear */

    p7++;
    p3 = gltm6l;
    p10 = gltm6h;
    p9_0 = ~p9_0;
}
}
}

```

5. Reference

Hardware Manual

M16C/28 Group Hardware Manual

M16C/29 Group Hardware Manual

6. Website and Contact for Support

Renesas Website

<http://www.renesas.com/>

For technical information related to M16C family

E-mail: support_apl@renesas.com

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.10	2004.09.23	-	First edition issued
1.20	2004.11.30	3, 4, 5	How to set up revised

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