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M16C/80 Group

DMA (DMA0, DMA1 only) setup procedures using C language (later version than NC308WA Ver.5)

1.0 Abstract

The following article introduces DMA (DMA0, DMA1) setup procedures using C language and its application example.

2.0 Introduction

The explanation of this issue is applied of the following condition.

Applicable MCU: M16C/80 Group

C compiler version for M32C/80, M16C/80 series : M3T-NC308WA V.5.00 Release 1

Please refer to M16C / 80 group application note DMA setup procedures (when using ASM function) in less than M3T-NC308WA V.5.00 Release 1.

This program can be also operated under the condition of M16C family products with the same SFR (Special Function Register) as M16C/80 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.

3.0 Description of the application example

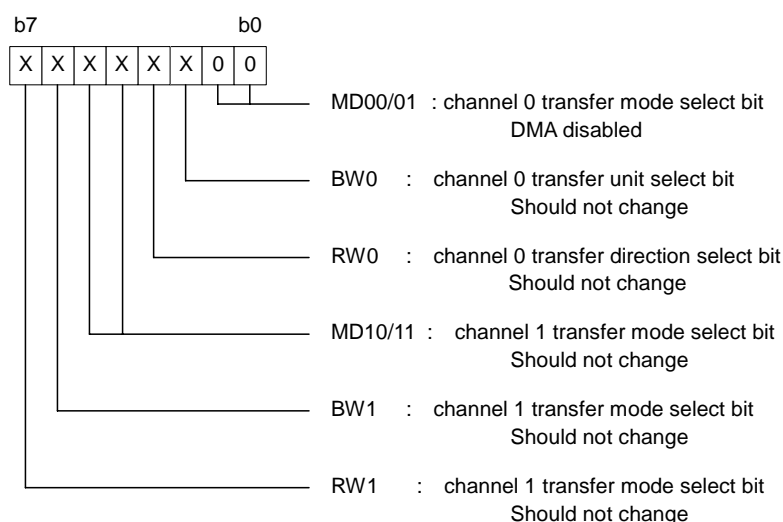
By writing “#pragma DMAC” with C compiler for M32C/80, M16C/80 series (M3T-NC308WA V.5.00 Release 1), the external variable are mapped to register exclusively for DMAC. As a result, the users can access to DMAC register.

3.1 Setup procedures

The setup procedures and the setting value will be shown to use DMA0. Refer to M16C/80 Group datasheet for the details of each register.

(1) Set DMA mode register 0 (DMD0)

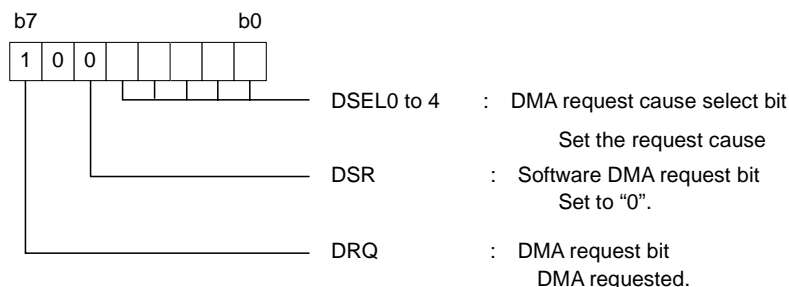
Set DMA0 transfer mode select bit “0” (DMA disabled)



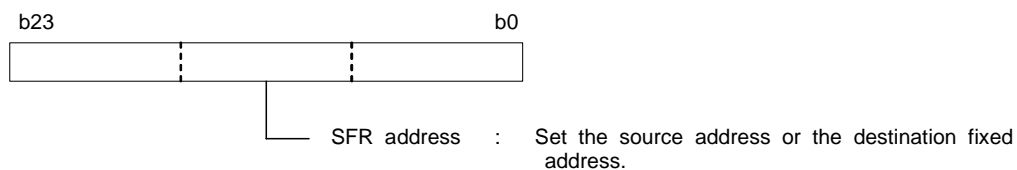
(2) Set DMA0 request cause select register (DM0SL)

Set the request factors that trigger DMA transfer using DMA request cause select bit.

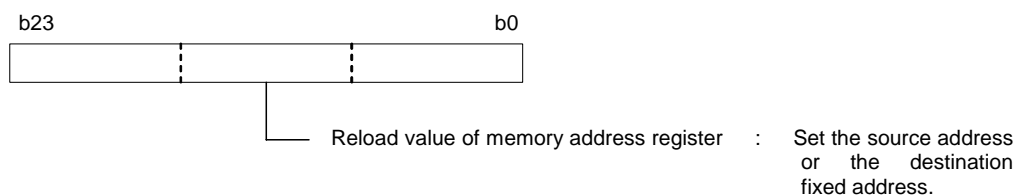
Set DMA request bit to “1” (DMA requested).



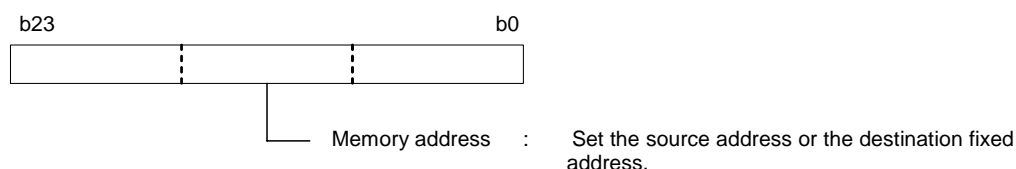
(3) Set DMA0SFR address register (DSA0)



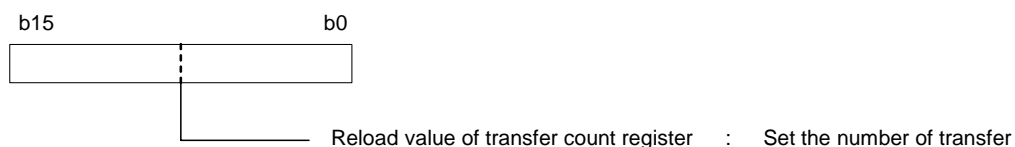
(4) Set DMA0 memory address reload register (DRA0)



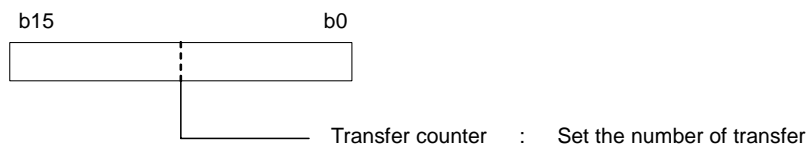
(5) Set DMA0 memory address register (DMA0)



(6) Set DMA0 transfer count reload register (DRC0)



(7) Set DMA0 transfer count register (DCT0)

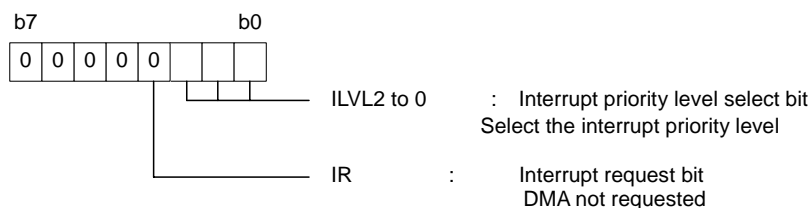


(8) Insert dummy cycle

Insert the same number of “NOP instruction” obtained by the following formula as the number of used DMA channel.

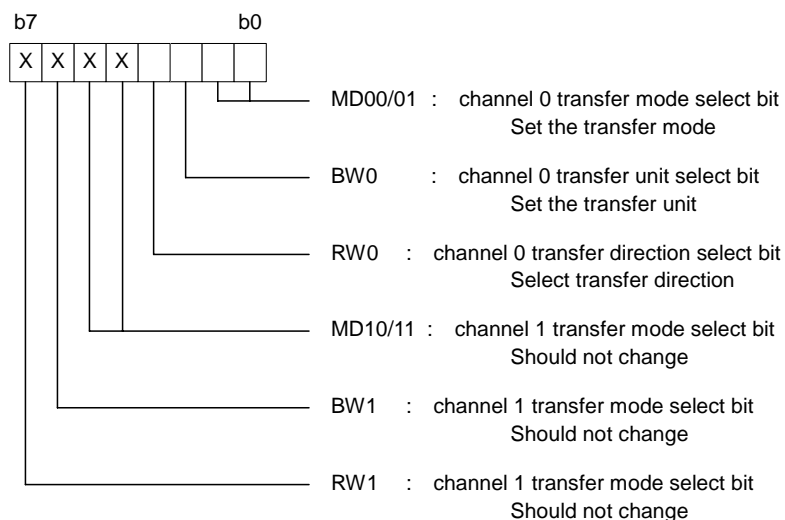
The number of dummy cycle = $8+6n$ (n =the number of every potential channel that DMA request factors generate except for corresponding channels)

(9) Set DMA0 interrupt control register (DM0IC)



(10) Reset DMA mode register 0 (DMD0)

Set transfer mode select bit, transfer unit select bit, and transfer direction set bit.



(11) Set the interrupt to Enabled (I flag = "1")

(12) Peripheral functions are initiated as DMA0 request factors.

4.0 Sample program

A sample program will be shown below when DMA request cause = "Timer A1", transfer memory space = from any address in the 16M bytes space to a fixed address, transfer unit = 8 bit, transfer mode= repeat transfer.

```

/*****/
/*  FILE NAME : rjj05b0288_src.c          */
/*  Ver      : 1.00                      */
/*  CPU      : M16C/80                  */
/*  FUNCTION  : The DMA setting procedure in the C language.      */
/*-----*/
/*  Copyright(C)2003, Renesas Technology Corp.          */
/*  Copyright(C)2003, Renesas Solutions Corp.          */
/*  All rights reserved.                          */
/*                                                    */
/*****/
/*****/
/*  include file          */
/*****/

#include "sfr80144.h"      // Special Function Register Header File

/*****/
/*  #pragma declaration    */
/*****/

                                // CPU internal register
unsigned short  dmd0;
#pragmaDMAC    dmd0    DMD0      // DMD0(DMA mode register0)
unsigned short  dct0;
#pragmaDMAC    dct0    DCT0      // DCT0(DMA0 transfer count register)
unsigned short  drc0;
#pragmaDMAC    drc0    DRC0      // DRC0(DMA0 transfer count reload register)
void _far *dma0;
#pragmaDMAC    dma0    DMA0      // DMA0(DMA0 memory address register)
void _far *dsa0;
#pragmaDMAC    dsa0    DSA0      // DSA0(DMA0 SFR address register)
void _far *dra0;
#pragmaDMAC    dra0    DRA0      // DRA0(DMA0 memory address reload register)
void _far *dma1;
#pragmaDMAC    dma1    DMA1      // DMA1(DMA1 memory address register)

```

```

void _far *dsa1;
#pragmaDMAC dsa1    DSA1           // DSA1(DMA1 SFR address register)
unsigned short  dct1;
#pragmaDMAC dct1    DCT1           // DCT1(DMA1 transfer count register)
unsigned short  drc1;
#pragmaDMAC drc1    DRC1           // DRC1(DMA1 transfer count reload register)
void _far *dra1;
#pragmaDMAC dra1    DRA1           // DRA1(DMA1 memory address reload register)

unsigned short  dmd1;
#pragmaDMAC dmd1    DMD1           // DMD1(DMA mode register1)

/*****
/*   Function declaration           */
*****/

void ta1_init(void);
void dma0_int(void);

/*****
/*   Global variable declaration    */
*****/

static char      data0[] = {0x1,0x3,0x7,0xf,0x1f,0x3f,0x7f,0xff};

/*****
/*   main function                  */
*****/

void main(void)
{
    short          dmd0_tmp;

    pd0  = 0xff;           // P0 is an output port.
    pd6  = 0xff;           // P6 is an output port.
    pd8  = 0x1f;           // P8_0-P8_4 are an output port.
    p0   = 0;              //
    p6   = 0;              //
    p8   = 0;              //

```



```

// A setup of DMA0
dmd0_tmp = dmd0; // (1)DMA0 inhibit(DMD0)
dmd0_tmp &= 0x00fc; //
dmd0 = dmd0_tmp; //

ta1_init(); //
dm0sl = 0x84; // (2)A setup of DM0SL(DRQ=1, TA1)
dsa0 = &p0; // (3)A setup of DSA0(DMA0 SFR address register)
dra0 = &data0; // (4)A setup of DRA0(DMA0 memory address reload register)
dma0 = &data0; // (5)A setup of DMA0(DMA0 memory address register)
drc0 = 8; // (6)A setup of DRC0(DMA0 transfer count reload register)
dct0 = 8; // (7)A setup of DCT0(DMA0 transfer count register)
// (8)Dummy cycle insertion

asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");
asm("NOP ");

dm0ic = 0x5; // (9)A set of DM0IC(DMA0 interrupt control register)

dmd0_tmp |= 0x0B; // (10)DMA0 permission(DMD0) Repeat transfer(memory -> fixed
address)
dmd0 = dmd0_tmp; //

asm("fset I "); // (11)Interruption permission.

ta1s = 1; // (12)Operation of the circumference function of a DMA demand factor is

```

permitted.

```

        while(1)
        {
            p8_1 = 1;           // test end...
        }

```

```

}

```

```

/*****/
/*   Timer-A1 initialization   */
/*****/

```

```

void ta1_init(void)
{
    ta1mr = 0x80;           // Timer-mode(f32)
    ta1   = 0x8fff;         // Timer value setup
}

```

```

/*****/
/*   DMA0 interrupt routine   */
/*****/

```

```

#pragma INTERRUPT/B dma0_int
void dma0_int(void)
{
    p6_0 = !p6_0;
}

```

5.0 Reference

Datasheet

Refer to M16C/80 Group datasheet

(Acquire the most current version from Renesas web-site)

6.0 Web-site and contact for support

Renesas Web-site

<http://www.renesas.com>

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Mail to : support_apl@renesas.com

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
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