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April 1st, 2010
Renesas Electronics Corporation

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M16C/Tiny Series

Operation of Protect

1. Abstract

This application note describes the protect operation.

2. Introduction

The explanation of this issue is applied to the following condition:
Applicable MCU: M16C/26, M16C/26A, M16C/28, M16C/29 Group

This program can be used for the other M16C Families which have the same SFR (Special Function Register) as the one in the M16C/26, M16C/26A, M16C/28, M16C/29 However, since some functions may be modified such as added functions, check it in a manual. Execute sufficient evaluation when using this application note.

3. Operation of Protect

In the event that a program runs out of control, this function protects the important registers so that they will not be rewritten easily.
The following lists the registers protected by the PRC bit

Protect Bit	Registers Protected by the PRC Bit	M16C/Tiny Series			
		M16C/26	M16C/26A	M16C/28	M16C/29
Protect Bit 0 (prc0)	System clock control register 0 (CM0)	Yes	Yes	Yes	Yes
	System clock control register 1 (CM1)	Yes	Yes	Yes	Yes
	Oscillation stop detection register (CM2)	Yes	Yes	Yes	Yes
	Peripheral clock select register (PCLKR)	Yes	Yes	Yes	Yes
	On-chip oscillator control register (ROCR)		Yes	Yes	Yes
	PLL control register 0 (PLC0)		Yes	Yes	Yes
	CAN0 clock select register (CCLKR)				Yes
Protect Bit 1 (prc1)	Processor mode register 0 (PM0)	Yes	Yes	Yes	Yes
	Processor mode register 1 (PM1)	Yes	Yes	Yes	Yes
	Processor mode register 2 (PM2)	Yes	Yes	Yes	Yes
	Timer B2 special mode register (TB2SC)	Yes	Yes	Yes	Yes
	Three phase PWM control register 0(INVC0)	Yes	Yes	Yes	Yes
	Three phase PWM control register 1(INVC1)	Yes	Yes	Yes	Yes
Protect Bit 2 (prc2)	Port P9 direction register 0 (PD9)	Yes	Yes	Yes	Yes
	Pin assignment control register (PACR)		Yes	Yes	Yes
	SI/O4 control register (S4C)			Yes	Yes
	NMI digital debounce register (NDDR)		Yes	Yes	Yes
Protect Bit 3 (prc3)	Voltage detection register 2 (VCR2)	Yes	Yes	Yes	Yes
	Voltage down detection interrupt register (D4INT)	Yes	Yes	Yes	Yes

This application note describes the protect operation of each protect bit.

(1) Protect Bit 0
- Setting protect bit 0 to “1” enables a register for write.
- Alter the value of the register protected by protect bit 0.
- Setting protect bit 0 to “0” protects a register against write.

(2) Protect Bit 1
- Setting protect bit 1 to “1” enables a register for write.
- Alter the value of the register protected by protect bit 1.
- Setting protect bit 1 to “0” protects a register against write.

(3) Protect Bit 2
- Setting protect bit 2 to “1” enables a register for write.
- Alter the value of the protected register by the next instruction after enabling it for write.

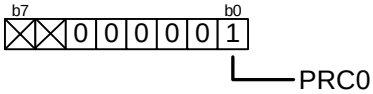
If a write to any address is executed after setting protect bit 2 to “1”, protect bit 2 is set to “0”. The register protected by protect bit 2 should be altered by the next instruction after setting protect bit 2 to “1”. Make sure that no interrupts or DMA transfers occur in the interval between an instruction that sets protect bit 2 to “1” and the next instruction.

(4) Protect Bit 3
- Setting protect bit 3 to “1” enables a register for write.
- Alter the value of the register protected by protect bit 3.
- Setting protect bit 3 to “0” protects a register against write.

3.1 Register Setting

To enable the operation defined in “Section 3. Operation of Protect”, the following register settings must be taken place step by step. For detail configuration of each register, please refer to M16C/26 Group hardware manual, M16C/26A Group hardware manual, M16C/28 Group hardware manual, M16C/29 Group hardware manual.

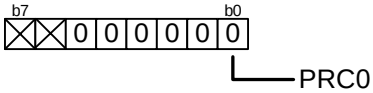
(1) Clearing the protect (set to write enabled state)



Protect Bit 0
1: Write enabled

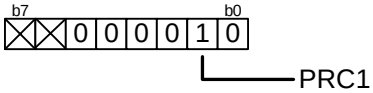
(2) Alter the value of the register protected by protect bit 0.

(3) Setting the protect (set to write protected state)



Protect Bit 0
0: Write protected

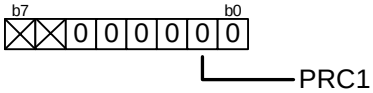
(4) Clearing the protect (set to write enabled state)



Protect Bit 1
1: Write enabled

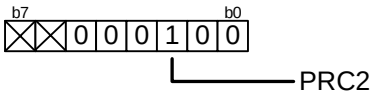
(5) Alter the value of the register protected by protect bit 1.

(6) Setting the protect (set to write protected state)



Protect Bit 1
0: Write protected

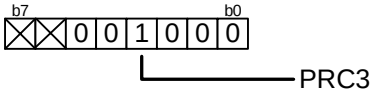
(7) Clearing the protect (set to write enabled state)



Protect Bit 2
1: Write enabled

(8) Alter the value of the register protected by protect bit 2.

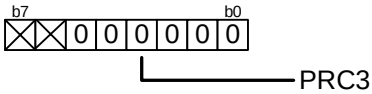
(9) Setting the protect (set to write protected state)



Protect Bit 3
1: Write enabled

(10) Alter the value of the register protected by protect bit 3.

(11) Setting the protect (set to write protected state)



Protect Bit 3
0: Write protected

4. Sample Program

```
/************************************************************
 *                                                          *
 *   FILE NAME :                                            *
 *   CPU       : M16C/Tiny series                           *
 *   Function    : Protect opration                         *
 *   Version     : 1.00                                     *
 *                                                          *
 *   Copyright (C)2004, Renesas Technology Corp.            *
 *   Copyright (C)2004, Renesas Solutions Corp.             *
 *                                                          *
 ************************************************************/
/***************************
 *   include file          *
 ***************************/
#include "sfr28.h"

/***************************
 *   main                  *
 ***************************/
void main(void) {

    prc0 = 1;        /* Protect bit 0 Write enable */

    cm0 = 0x08;      /* System Clock Control register 0 setting */
    cm1 = 0x20;      /* System Clock Control register 1 setting */

    prc0 = 0;        /* Protect bit 0 Write protected */

    prc1 = 1;        /* Protect bit 1 Write enable */

    pm2 = 0x10;      /* Processeor Mode register 2 setting */

    prc1 = 0;        /* Protect bit 1 Write protected */

    prc2 = 1;        /* Protect bit 2 Write enable */

    pd9 = 0x0f;      /* Port P9 direction register setting */

    prc3 = 1;        /* Protect bit 3 Write enable */

    vcr2 = 0x80;     /* Voltage Detection register 2 setting */

    prc3 = 0;        /* Protect bit 3 Write protected */

    while (1) {
    }
}
```

5. Reference

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Hardware Manual

M16C/26, M16C/26A, M16C/28, M16C/29 Group Hardware Manual
(Use the latest version on the home page: http://www.renesas.com)

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REVISION HISTORY

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