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Renesas Electronics Corporation

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M16C/Tiny Series

Operation of A/D Converter (One-Shot Mode)

1. Abstract

In one-shot mode of A/D converter, choose functions from those listed in Table 1. Operations of the checked items are described below.

Table 1. Choosed Functions

Item	Set-up		Item	Set-up	
Operating Clock ϕ_{AD}	Yes	fAD, divided-by-2 of fAD, divided-by-3 of fAD, divided-by-4 of fAD, divided-by-6 of fAD, divided-by-12 of fAD	A/D Conversion Start Condition	Yes	Software trigger
					ADTRG trigger
Resolution		8-bit	Sample and hold function		Without sample and hold
	Yes	10-bit		Yes	With sample and hold
Analog Input Pins	Yes	Select one pin from AN ₀ to AN ₇ (Note 1)			

Note 1: Conditions for the M16C/26

For the M16C/26A, the 48-pin version permits one of AN₀–AN₇, AN₃₀–AN₃₂, and AN₂₄ to be selected, and the 42-pin version permits one of AN₀–AN₇ and AN₃₀–AN₃₁ to be selected.

For the M16C/28, the 80-pin version permits one of AN₀–AN₇, AN₀₀–AN₀₇, and AN₂₀–AN₂₇ to be selected, and the 64-pin version permits one of AN₀–AN₇, AN₀₀–AN₀₃, and AN₂₄ to be selected.

For the M16C/29, the 80-pin version permits one of AN₀–AN₇, AN₀₀–AN₀₇, AN₂₀–AN₂₇, and AN₃₀–AN₃₂ to be selected, and the 64-pin version permits one of AN₀–AN₇, AN₀₀–AN₀₃, AN₂₄, and AN₃₀–AN₃₂ to be selected.

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 A/D Converter

- (1) Setting the A/D conversion start flag to "1" causes the A/D converter to begin operating.
- (2) After A/D conversion is completed, the content of the successive comparison register (conversion result) is transmitted to A/D register i. At this time, the A/D conversion interrupt request bit goes to "1". Also, the A/D conversion start flag goes to "0", and the A/D converter stops operating.

Figure 1 shows the operation timing.

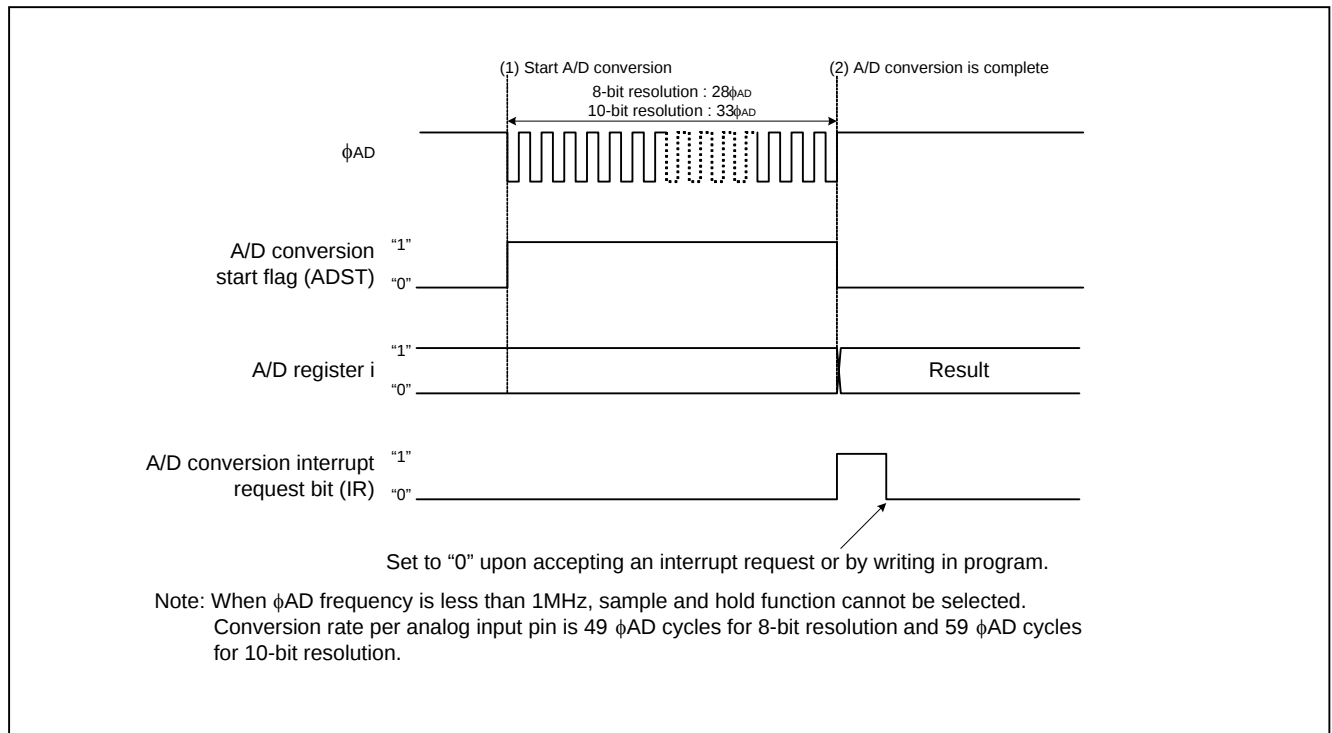


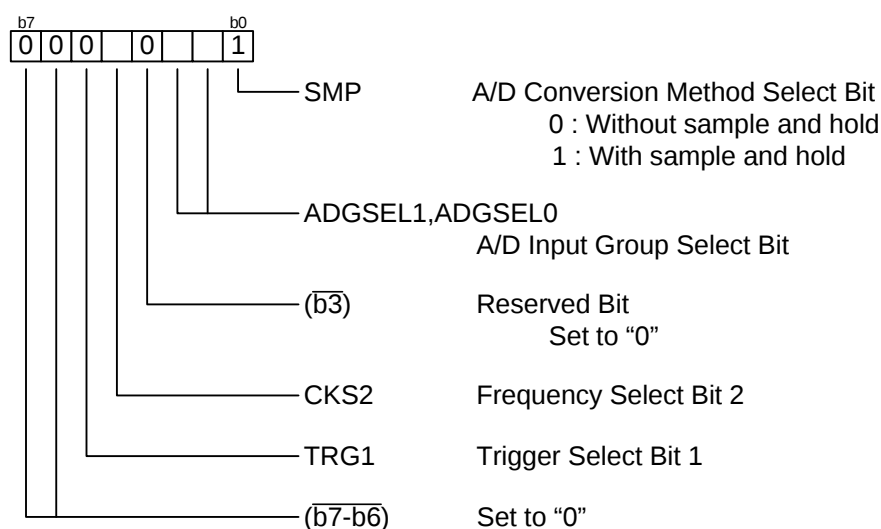
Figure 1. Operation Timing of One-Shot Mode

3.1 Register Setting

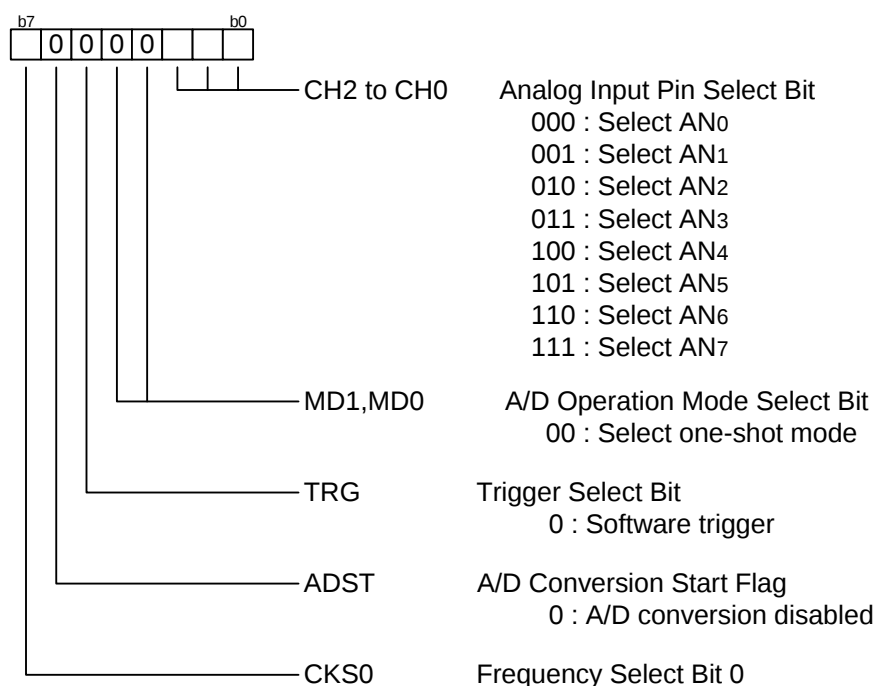
To enable the operation defined in “Section 3. Operation of A/D Converter”, the following register settings must be taken place step by step. For detail configuration of each register, please refer to M16C/26 Group hardware manual, M16C/26A Group hardware manual, M16C/28 Group hardware manual, M16C/29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

3.1.1 M16C/26A, M16C/28, M16C/29

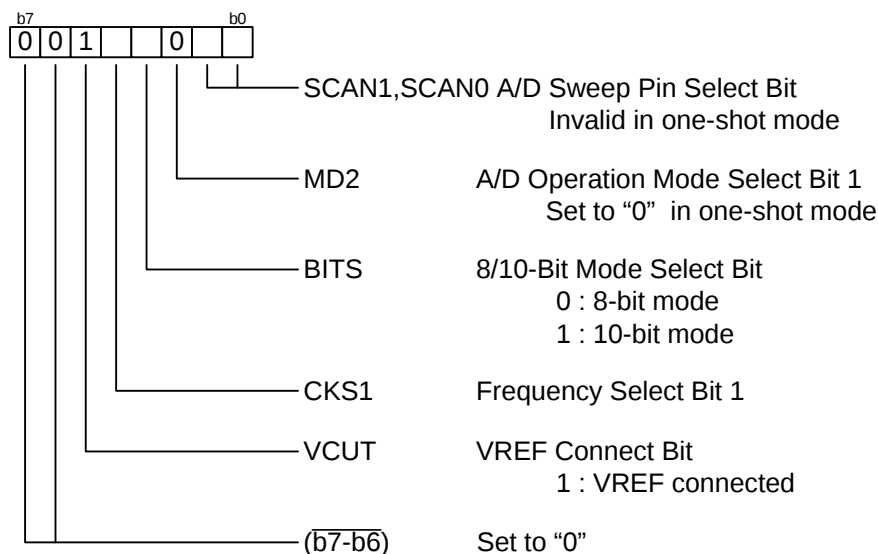
(1) Setting A/D control register 2



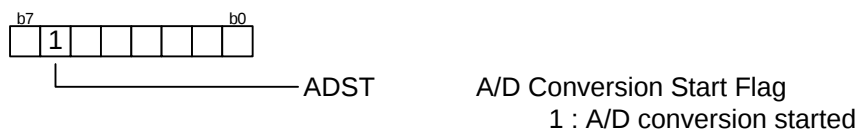
(2) Setting A/D control register 0



(3) Setting A/D control register 1

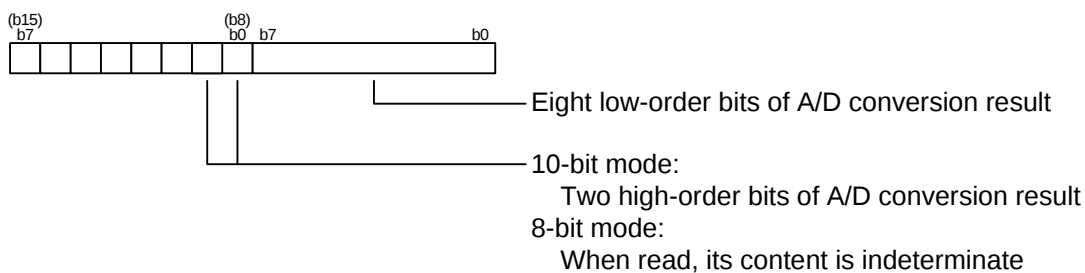


(4) A/D conversion start (setting A/D control register 0)



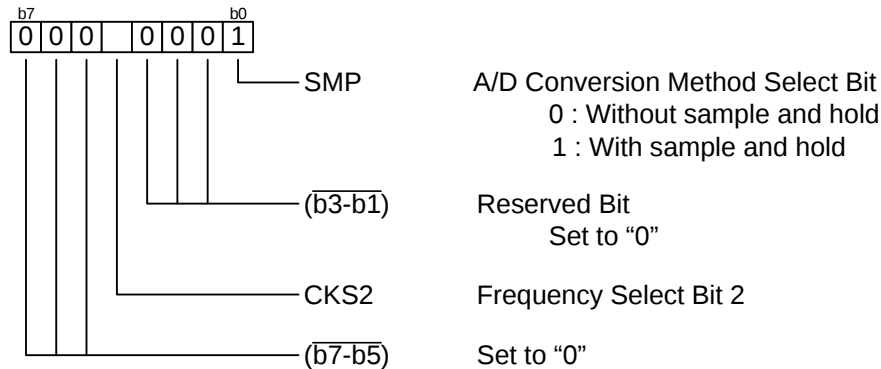
(5) Wait until the A/D converter stops.

(6) Reading conversion result (read ADi register)

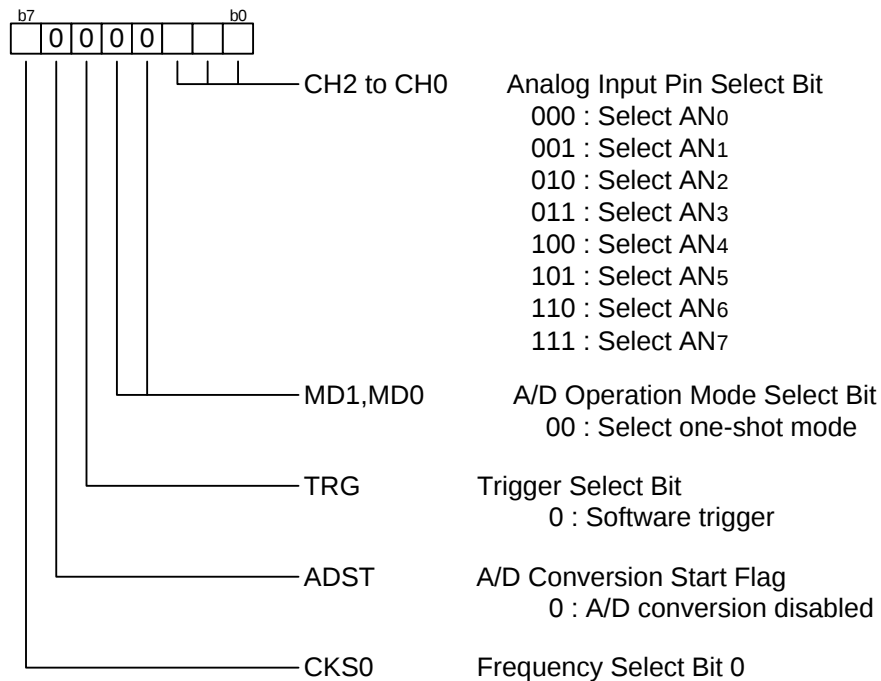


3.1.2 M16C/26

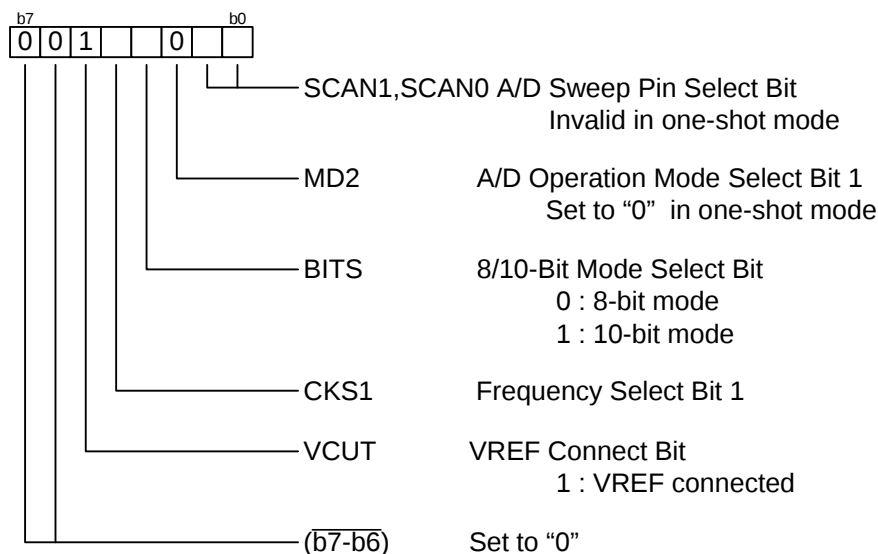
(1) Setting A/D control register 2



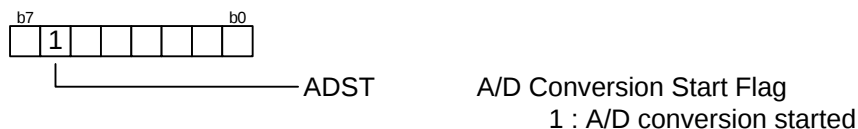
(2) Setting A/D control register 0



(3) Setting A/D control register 1

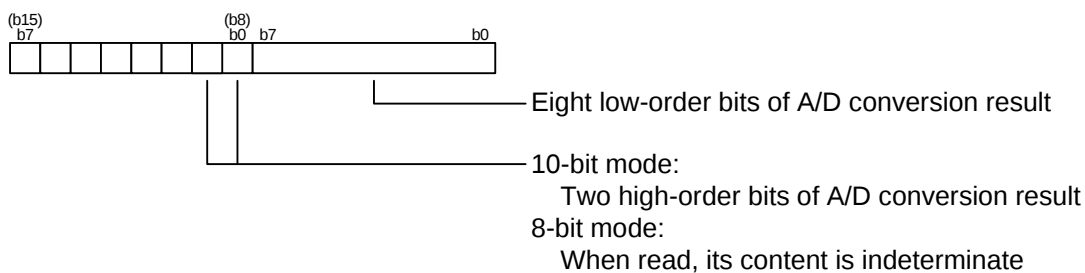


(4) A/D conversion start (setting A/D control register 0)



(5) Wait until the A/D converter stops.

(6) Reading conversion result (read ADi register)



4. Sample Program

4.1 M16C/26A, M16C/28, M16C/29

```

/*****
 *
 * FILE NAME :
 * CPU      : M16C/Tiny series
 * Function  : Operation of A/D Converter
 *             (one-shot mode)
 * Version   : 1.00
 *
 * Copyright (C)2004, Renesas Technology Corp.
 * Copyright (C)2004, Renesas Solutions Corp.
 *
 *****/
/*****
 * include file
 *****/
#include "sfr28.h"

/*****
 * Function Definition
 *****/

/*****
 * main
 *****/
    unsigned short  ad_data;

void main(void) {

    adic = 0;

    adcon2 = 0x01; /* Setting A/D control register 2
                   Enabled sample and hold
                   Port 10 group selected
                   Frequency is selected to fAD/4
                   */

    adcon0 = 0x00; /* Setting A/D control register 0
                   AN0 is selected
                   One-shot mode is selected
                   Software trigger is selected
                   */

    adcon1 = 0x28; /* Setting A/D control register 1
                   10-bit mode is selected
                   Vref is connected
                   */

    while (1) {

        adst = 1; /* A/D convert start */

        while (!ir_adic) { /* Check & wait until complete of A/D convert */
        }
        ir_adic = 0;

        ad_data = 0x03ff & ad0; /* Read conversion result */

    }
}

```

4.2 M16C/26

```

/*****
 *
 *   FILE NAME :
 *   CPU       : M16C/Tiny series
 *   Function  : Operation of A/D Converter
 *               (one-shot mode)
 *   Version   : 1.00
 *
 *   Copyright (C)2004, Renesas Technology Corp.
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 *
 *****/
/*****
 *
 *   include file
 *****/
#include "sfr262.h"

/*****
 *   Function Definition
 *****/

/*****
 *   main
 *****/
    unsigned short  ad_data;

void main(void) {
    adic = 0;

    adcon2 = 0x01; /* Setting A/D control register 2
                    Enabled sample and hold
                    Frequency is selected to fAD/4
                    */

    adcon0 = 0x00; /* Setting A/D control register 0
                    AN0 is selected
                    One-shot mode is selected
                    Software trigger is selected
                    */

    adcon1 = 0x28; /* Setting A/D control register 1
                    10-bit mode is selected
                    Vref is connected
                    */

    while (1) {
        adst = 1; /* A/D convert start */

        while (!ir_adic) { /* Check & wait until complete of A/D convert */
        }
        ir_adic = 0;

        ad_data = 0x03ff & ad0; /* Read conversion result */
    }
}

```

5. Reference

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M16C/26, M16C/26A, M16C/28, M16C/29 Group Hardware Manual

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REVISION HISTORY

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