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Renesas Electronics Corporation

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M16C/Tiny Series

Operation of A/D Converter (Repeat Sweep Mode 0)

1. Abstract

In repeat sweep mode 0 of A/D converter, choose functions from those listed in Table 1. Operations of the checked items are described below.

Table 1. Chosed Functions

Item	Set-up		Item	Set-up	
Operating Clock ϕ_{AD}	Yes	fAD, divided-by-2 of fAD,	A/D Conversion Start Condition	Yes	Software trigger
		divided-by-3 of fAD, divided-by-4 of fAD, divided-by-6 of fAD, divided-by-12 of fAD			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 from AN ₀ to AN ₁ (2 pins), AN ₀ to AN ₃ (4 pins), AN ₀ to AN ₅ (6 pins), AN ₀ to AN ₇ (8 pins) (Note 1)			

Note 1: Conditions for the M16C/26

For the M16C/26A, AN₃₀ to AN₃₂, and AN₂₄ can be used in the same way as AN₀ to AN₇. However, all input pins need to belong to the same group.

For the M16C/28, AN₀₀ to AN₀₇, AN₂₀ to AN₂₇ can be used in the same way as AN₀ to AN₇. However, all input pins need to belong to the same group.

For the M16C/29, AN₀₀ to AN₀₇, AN₂₀ to AN₂₇, and AN₃₀ to AN₃₂ can be used in the same way as AN₀ to AN₇. However, all input pins need to belong to the same group.

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 start the conversion on voltage input to the AN0 pin.
- (2) After the A/D conversion of voltage input to the AN0 pin is completed, the content of the successive comparison register (conversion result) is transmitted to A/D register 0.
- (3) The A/D converter converts all pins selected by the user. The conversion result is transmitted to A/D register i corresponding to each pin every time A/D conversion on the pin is completed. The A/D conversion interrupt request bit does not go to "1".
- (4) The A/D converter continues operating until the A/D conversion start flag is set to "0" by program.

Figure 1 shows the operation timing

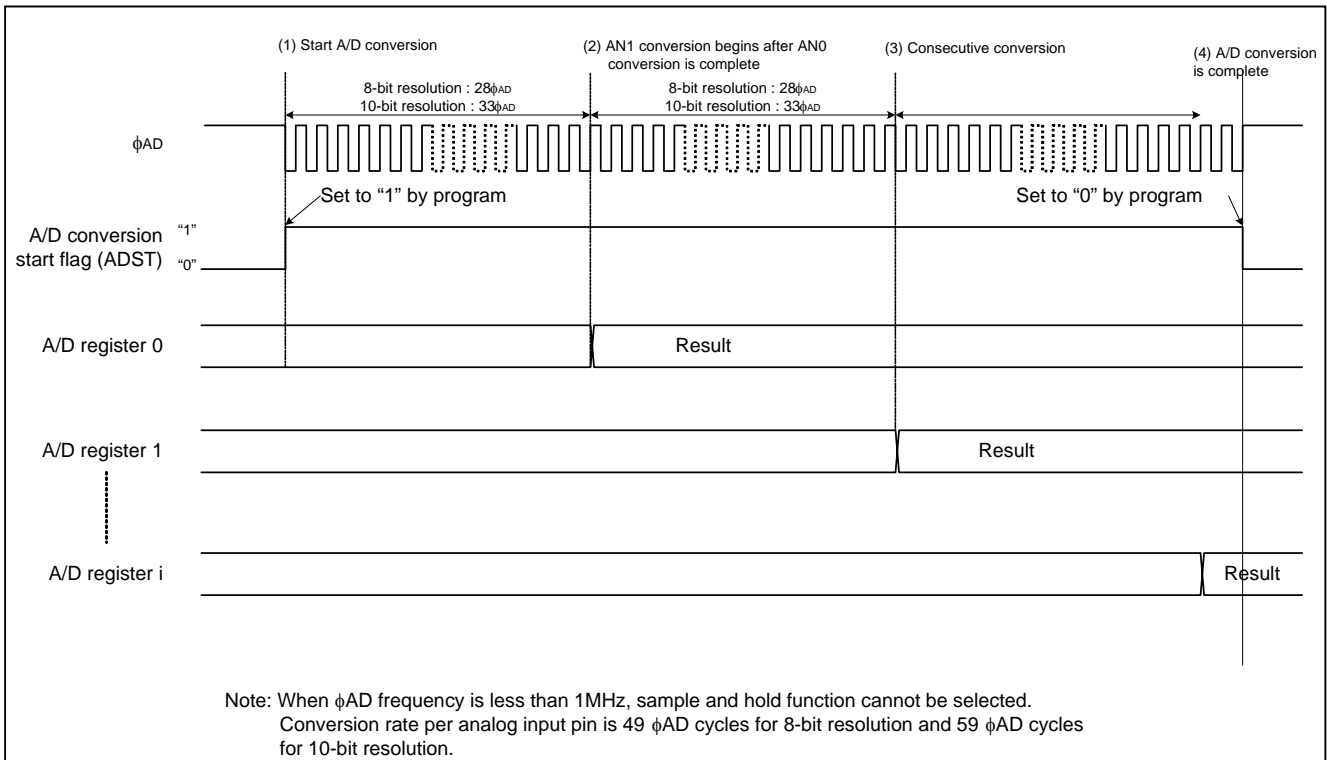


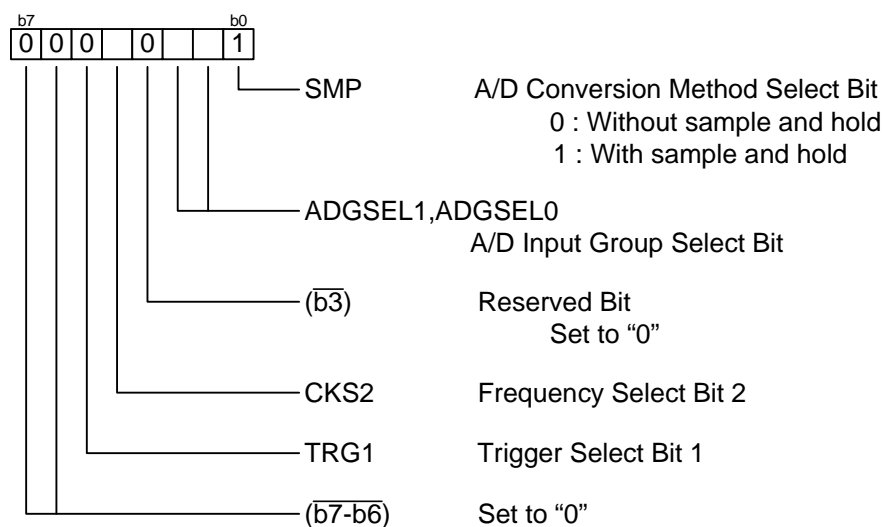
Figure 1. Operation Timing of Repeat Sweep Mode 0

3.1 Register Setting

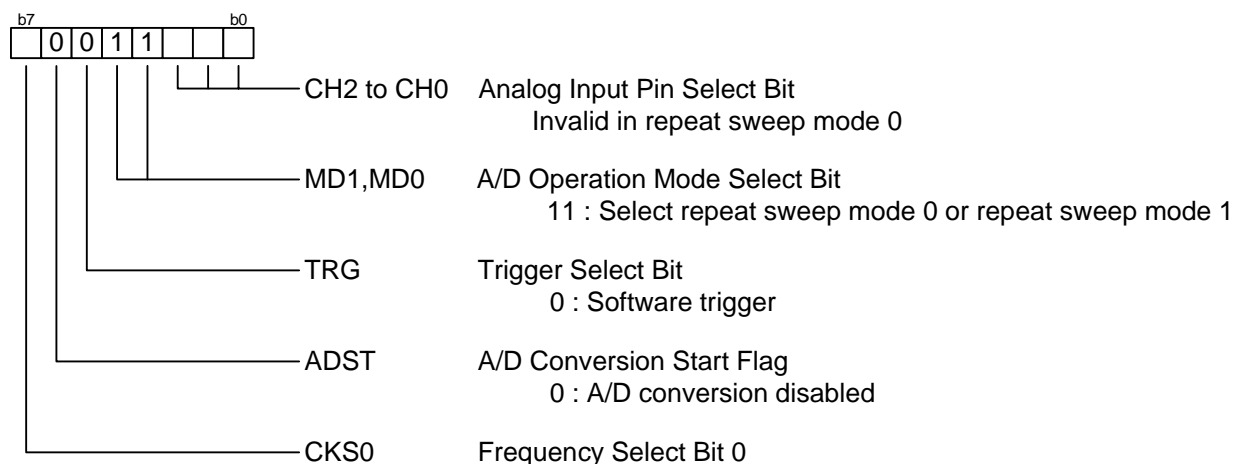
To enable the operation defined in “Section 3. Operation of A/D Converter”, the following register settings must be taken place step by step. For detail configuration of each register, please refer to M16C/26 Group hardware manual, M16C/26A Group hardware manual, M16C/28 Group hardware manual, M16C/29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

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

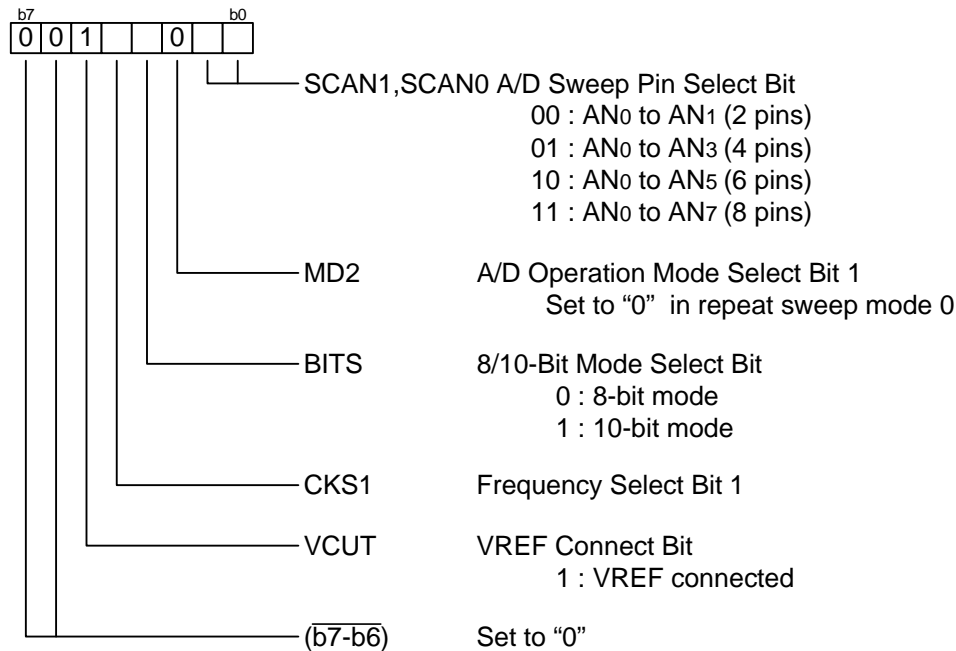
(1) Setting A/D control register 2



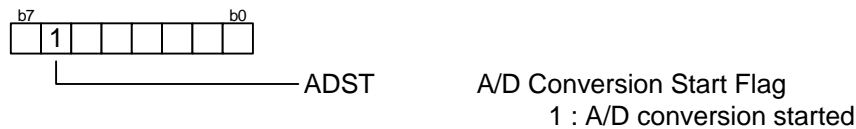
(2) Setting A/D control register 0



(3) Setting A/D control register 1

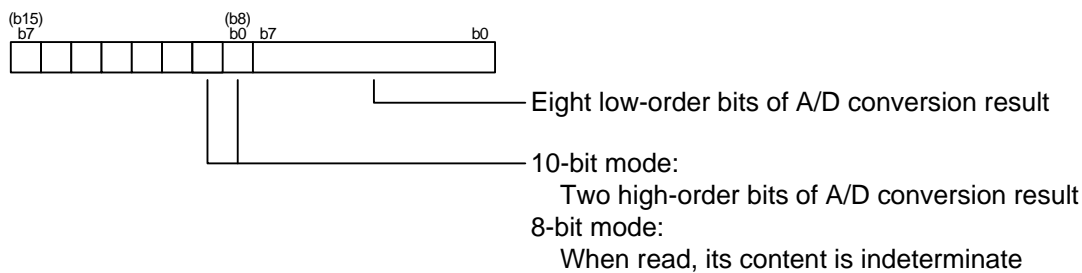


(4) A/D conversion start (setting A/D control register 0)



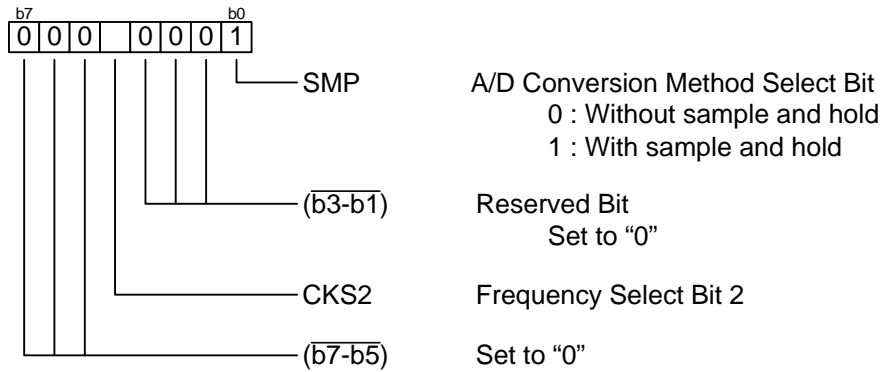
(5) Repeatedly carries out A/D conversion on pins selected through the A/D sweep pin select bit.

(6) Reading conversion result (read AD_i register)

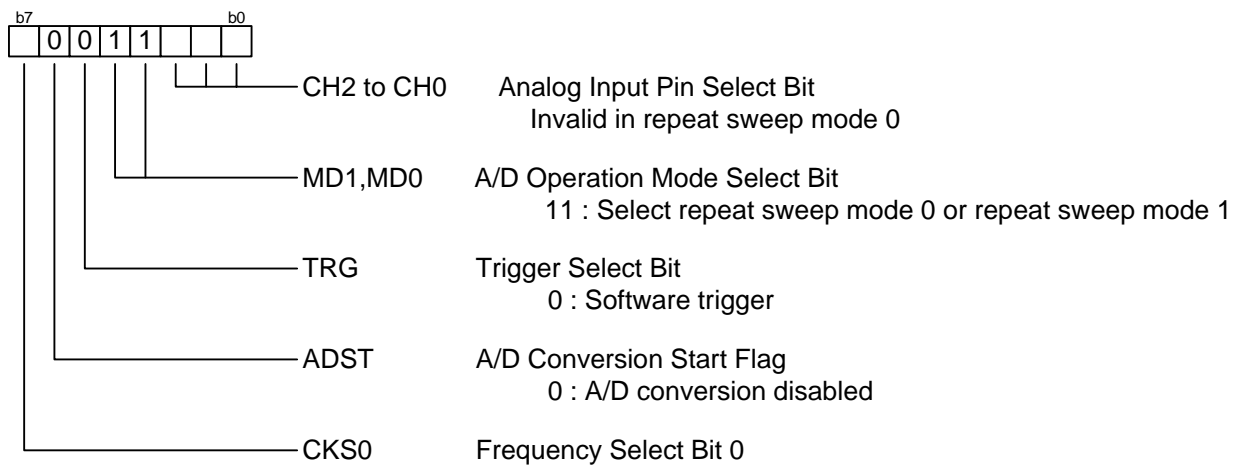


3.1.2 M16C/26

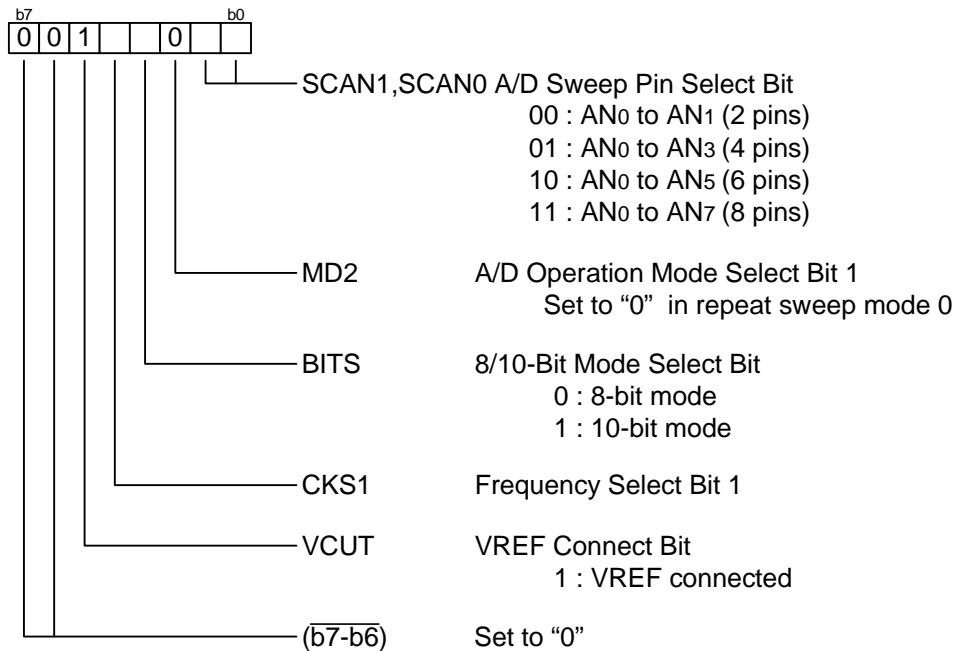
(1) Setting A/D control register 2



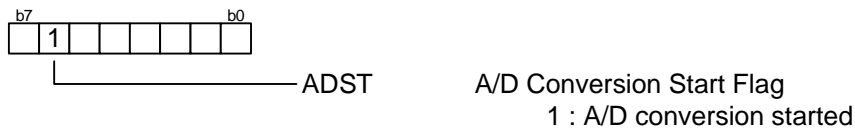
(2) Setting A/D control register 0



(3) Setting A/D control register 1

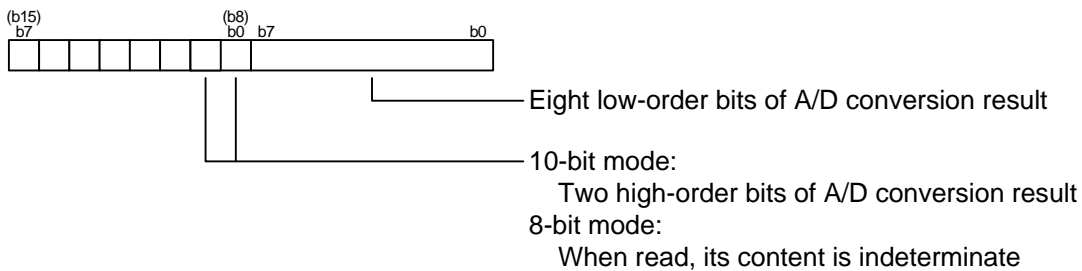


(4) A/D conversion start (setting A/D control register 0)



(5) Repeatedly carries out A/D conversion on pins selected through the A/D sweep pin select bit.

(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
 *           (repeat sweep mode 0 )
 * 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_data0;
unsigned short ad_data1;
unsigned short ad_data2;
unsigned short ad_data3;
unsigned short ad_data4;
unsigned short ad_data5;
unsigned short ad_data6;
unsigned short ad_data7;

void main(void) {

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

    adcon0 = 0x18; /* Setting A/D control register 0
                  Repeat sweep mode 0 is selected
                  Software trigger is selected
                  */

    adcon1 = 0x2b; /* Setting A/D control register 1
                  A/D sweep pin is selected 11(AN0,AN7 (8 pins))
                  10-bit mode is selected
                  Vref is connected
                  */

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

    while (1) {

        ad_data0 = 0x03ff & ad0; /* Read conversion result AN0 */
        ad_data1 = 0x03ff & ad1; /* Read conversion result AN1 */
        ad_data2 = 0x03ff & ad2; /* Read conversion result AN2 */
        ad_data3 = 0x03ff & ad3; /* Read conversion result AN3 */
        ad_data4 = 0x03ff & ad4; /* Read conversion result AN4 */
        ad_data5 = 0x03ff & ad5; /* Read conversion result AN5 */
        ad_data6 = 0x03ff & ad6; /* Read conversion result AN6 */
        ad_data7 = 0x03ff & ad7; /* Read conversion result AN7 */

    }
}

```

4.2 M16C/26

```

/*****
*
*   FILE NAME :
*   CPU       : M16C/Tiny series
*   Function  : Operation of A/D Converter
*               (repeat sweep mode 0 )
*   Version   : 1.00
*
*   Copyright (C)2004, Renesas Technology Corp.
*   Copyright (C)2004, Renesas Solutions Corp.
*
*****/
/*****
*   include file
*****/
#include "sfr262.h"

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

/*****
*   main
*****/
unsigned short ad_data0;
unsigned short ad_data1;
unsigned short ad_data2;
unsigned short ad_data3;
unsigned short ad_data4;
unsigned short ad_data5;
unsigned short ad_data6;
unsigned short ad_data7;

void main(void) {

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

    adcon0 = 0x18; /* Setting A/D control register 0
                   Repeat sweep mode 0 is selected
                   Software trigger is selected
                   */

    adcon1 = 0x2b; /* Setting A/D control register 1
                   A/D sweep pin is selected 11(AN0,AN7 (8 pins))
                   10-bit mode is selected
                   Vref is connected
                   */

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

    while (1) {

        ad_data0 = 0x03ff & ad0; /* Read conversion result AN0 */
        ad_data1 = 0x03ff & ad1; /* Read conversion result AN1 */
        ad_data2 = 0x03ff & ad2; /* Read conversion result AN2 */
        ad_data3 = 0x03ff & ad3; /* Read conversion result AN3 */
        ad_data4 = 0x03ff & ad4; /* Read conversion result AN4 */
        ad_data5 = 0x03ff & ad5; /* Read conversion result AN5 */
        ad_data6 = 0x03ff & ad6; /* Read conversion result AN6 */
        ad_data7 = 0x03ff & ad7; /* Read conversion result AN7 */
    }
}

```

5. Reference

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Hardware Manual

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

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REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
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