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April 1st, 2010
Renesas Electronics Corporation

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M32C/84, 85, 86, 87, 88 Group

A/D Converter Operation in Repeat Sweep Mode 0

1. Abstract

In the A/D converter repeat sweep mode 0, the input voltage of pins selected from pins AN0 to AN7, AN15_0 to AN15_7, AN0_0 to AN0_7, and AN2_0 to AN2_7 is A/D converted repeatedly.

2. Introduction

The application example described in this document is applied to the following MCUs and parameter(s):

MCUs: M32C/84 Group
M32C/85 Group
M32C/86 Group
M32C/87 Group
M32C/88 Group

This program can be used with other M16C Family MCUs which have the same special function registers (SFRs) as the above MCUs. Check the manual for any additions and modifications to functions. Careful evaluation is recommended before using this application note.

3. Application Example

This section describes how to repeatedly A/D convert the input voltage of pins AN0 to AN7 in repeat sweep mode 0.

Other configurations are as follows:

- Operating clock (ϕ_{AD}) : f_{AD} divided by 2
- Resolution : 10 bits
- A/D conversion start parameters : Software trigger
- Sample & hold function : Enabled
- DMAC operation mode : Disabled

3.1 Example Description

- (1) Setting the ADST bit in the AD0CON0 register to 1 (A/D conversion started) causes the A/D converter to start operating and the input voltage of the AN0 pin is A/D converted.
- (2) After the A/D conversion is completed on the AN0 pin, the content of the successive approximation register (conversion result) is transferred to the AD00 register.
A/D conversion continuously takes place on the selected analog input pin in order. The conversion result is transferred to the corresponding AD0i register each time the A/D conversion is completed on the selected pin.
- (3) After the A/D conversion is completed on all the selected analog input pins, A/D conversion restarts from the AN0 pin. The IR bit in the AD0IC register is not set to 1 (interrupt requested).
- (4) The A/D converter does not stop operating until the ADST bit is set to 0 (A/D conversion stopped) by a program.

Figure 1 shows the Repeat Sweep Mode 0 Operation.

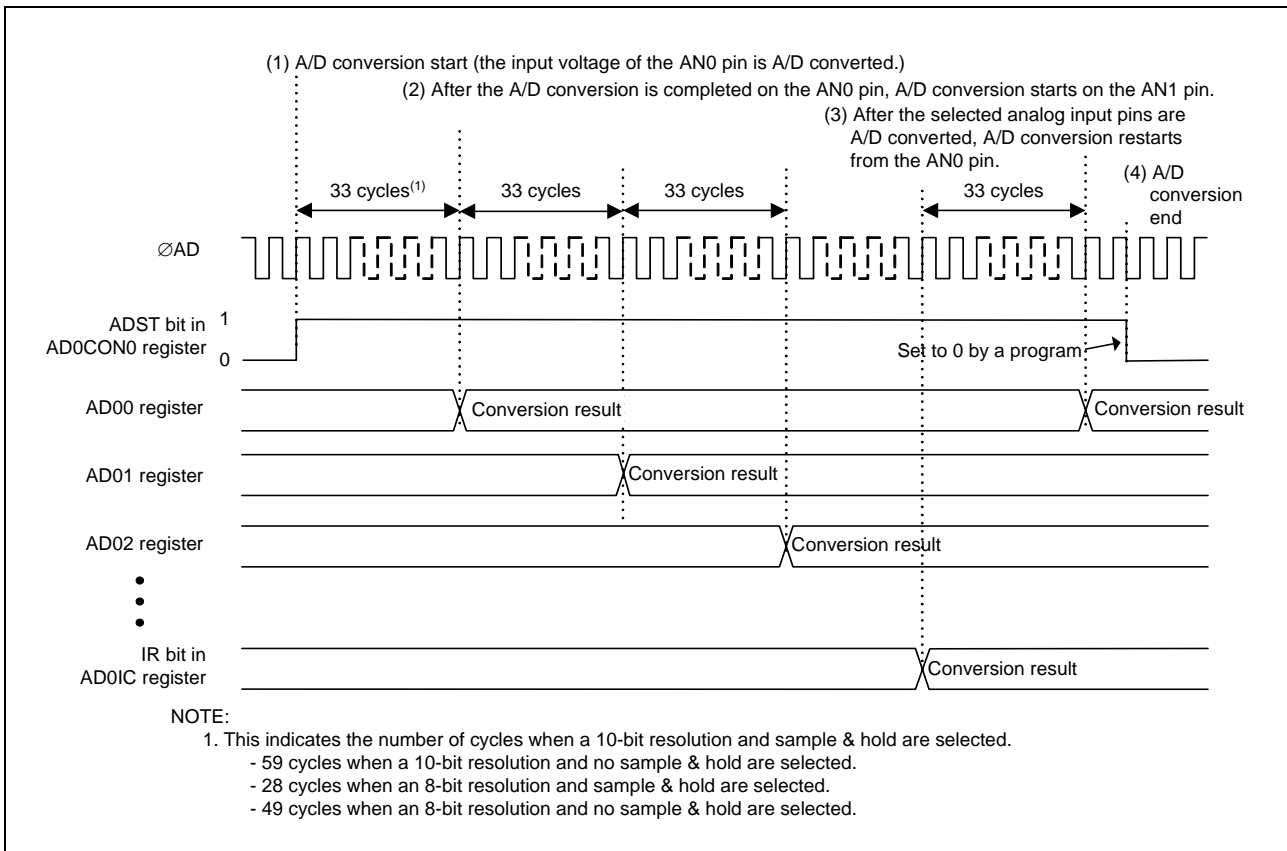


Figure 1 Repeat Sweep Mode 0 Operation

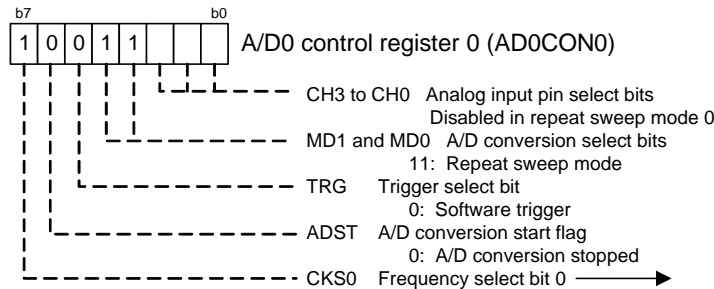
3.2 Setup

This section shows the setup sequence and values to perform the application example described in

3.1 Example Description.

Refer to the MCUs Hardware Manual for details of individual registers.

(1) Set A/D0 control register 0

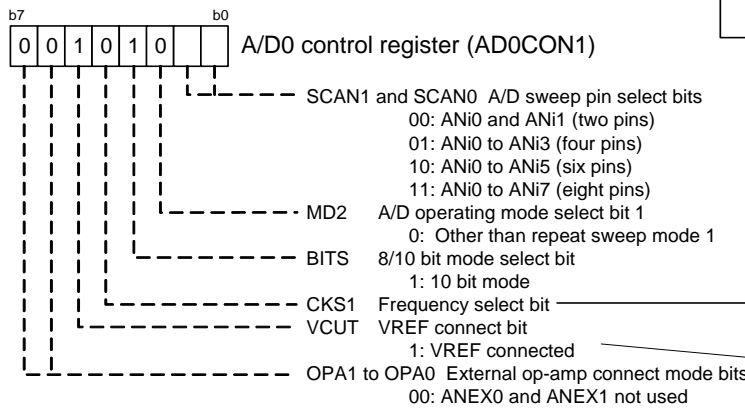


The A/D converter operating clock (ϕ AD) can be selected by:
the CKS0 bit in the AD0CON0 register,
the CKS1 bit in the AD0CON1 register,
or the CKS2 bit in the AD0CON3 register.

CKS2	CKS1	CKS0	
0	0	0	: fAD divided by 4
0	0	1	: fAD divided by 2
0	1	0	: fAD divided by 3
0	1	1	: fAD
1	0	0	: fAD divided by 8
1	1	0	: fAD divided by 6

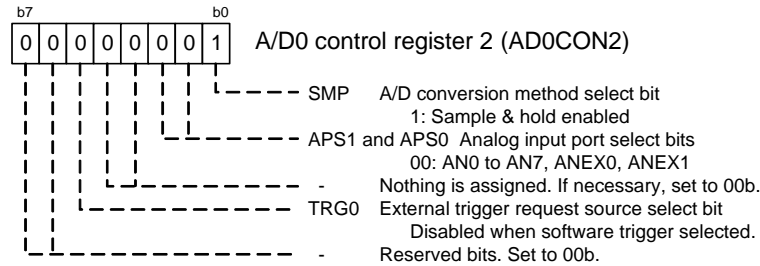
Make sure the settings are set as shown above.
When VCC1 = 4.2 V to 5.5 V,
set ϕ AD frequency to 16 MHz or below.
When VCC1 = 3.0 V to 5.5 V,
set ϕ AD frequency to 10 MHz or below.

(2) Set A/D0 control register 1

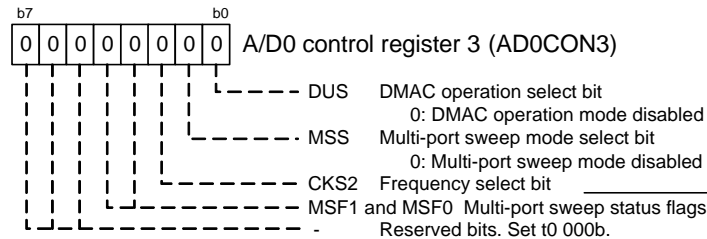


When changing the VCUT bit from 0 to 1, wait for 1 μ s or more before starting A/D conversion.

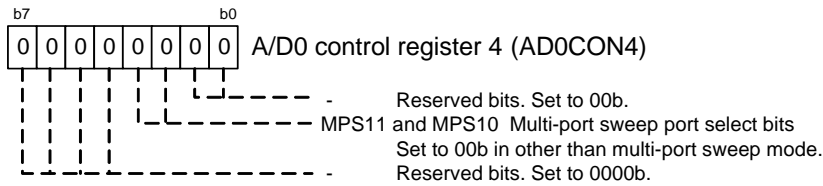
(3) Set A/D0 control register 2



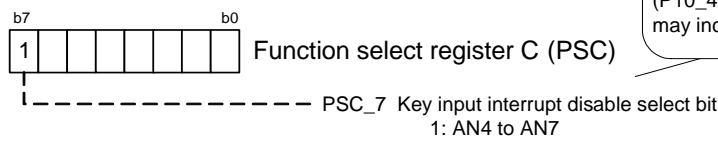
(4) Set A/D0 control register 3



(5) Set A/D0 control register 4

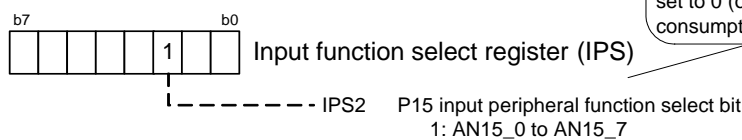


(6) Set the function select register
(When pins P10_4 to P10_7 are used as analog input pins.)



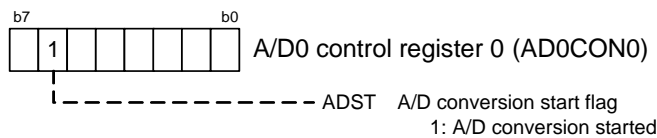
AN4 to AN7 can be used when the PSC_7 bit is set to 0 (P10_4 to P10_7, or KI0 to KI3), but power consumption may increase.

(7) Set the input function select register
(When pins P15_0 to P15_7 are used as analog input pins.)

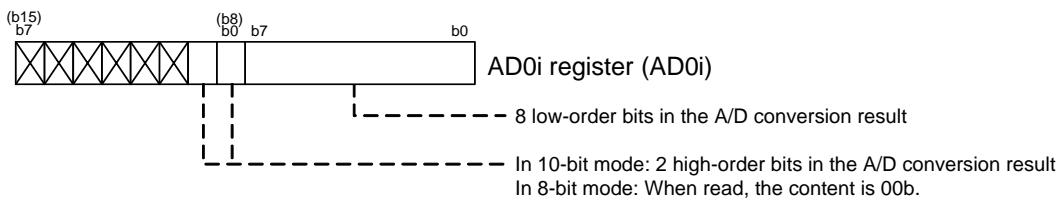


AN15_0 to AN15_7 can be used when the IPS2 bit is set to 0 (other than AN15_0 to AN15_7), but power consumption may increase.

(8) Start A/D Conversion (set A/D0 control register 0)



(9) Read the A/D conversion result (read the AD0i register)



4. Sample Programming Code

A sample program can be downloaded from the Renesas Technology website.
For download, click “Application Notes” in the left-hand side menu of the M16C Family page.

5. Reference Documents

Hardware Manuals

M32C/84 Group Hardware Manual

M32C/85 Group Hardware Manual

M32C/86 Group Hardware Manual

M32C/87 Group Hardware Manual

M32C/88 Group Hardware Manual

The latest version can be downloaded from the Renesas Technology website.

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REVISION HISTORY	M32C/84, 85, 86, 87, 88 Group A/D Converter Operation in Repeat Sweep Mode 0
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