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SH7046 Group

Start of A/D Conversion by MTU

1. Specifications

Four channel voltages are input and subjected to A/D conversion as shown in figure 1.

Single-cycle scan mode and 4-channel scan mode are used for A/D conversion, with A/D conversion performed consecutively on channels 8 to 11.

A/D converter activation is performed by an MTU/ch0 TGRA_0 compare match.

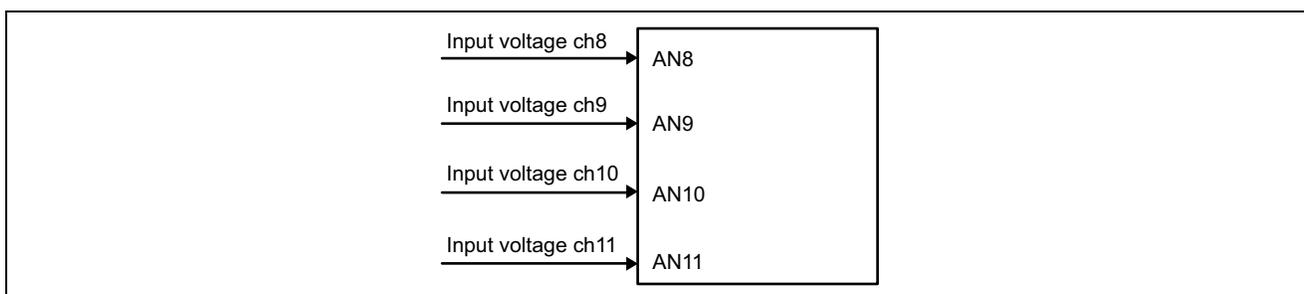


Figure 1 Block Diagram of Voltage Measurement by SH7046

2. Functions Used

In this sample task, A/D conversion is started by an MTU compare match.

Figure 2 shows a block diagram of ch0. In ch0, the A/D converter is activated using the following functions.

- A function that starts A/D conversion by means of an MTU compare match, without software intervention
- A function that outputs pulses automatically by hardware without software intervention (output compare)

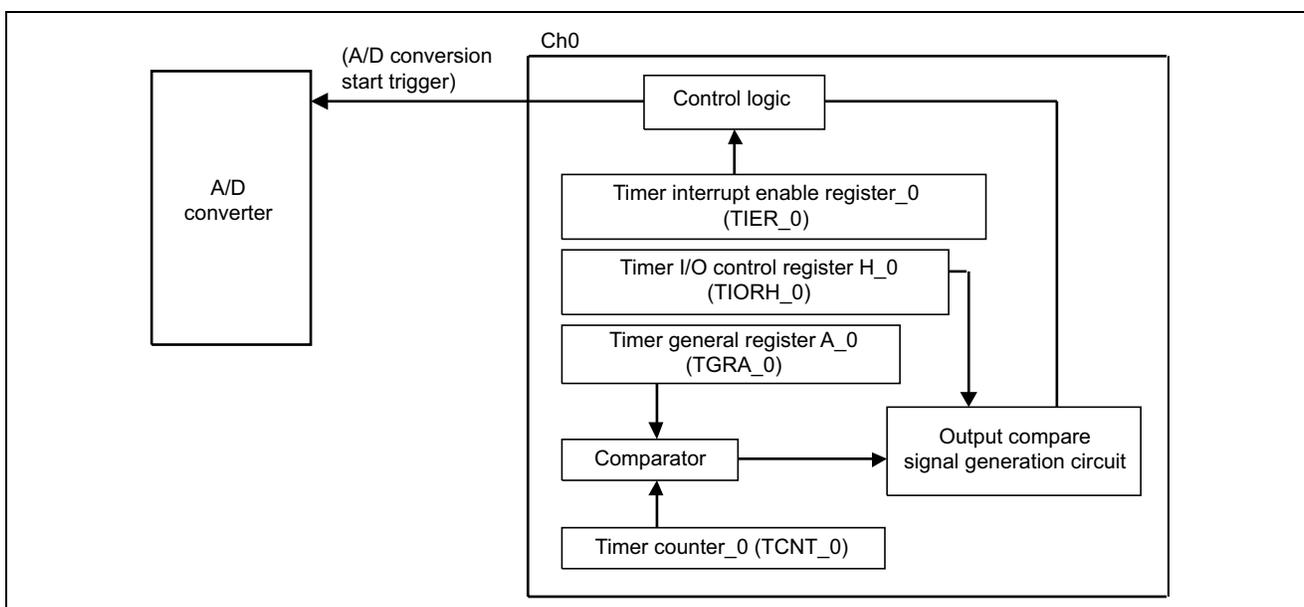


Figure 2 Block Diagram of SH7046 ch0

Figure 3 shows a block diagram of the A/D converter. The A/D converter performs conversion from analog to digital form using the following function.

- A function that performs A/D conversion once on a number of channels (ch8 to ch11) (4-channel, single-cycle scan mode)

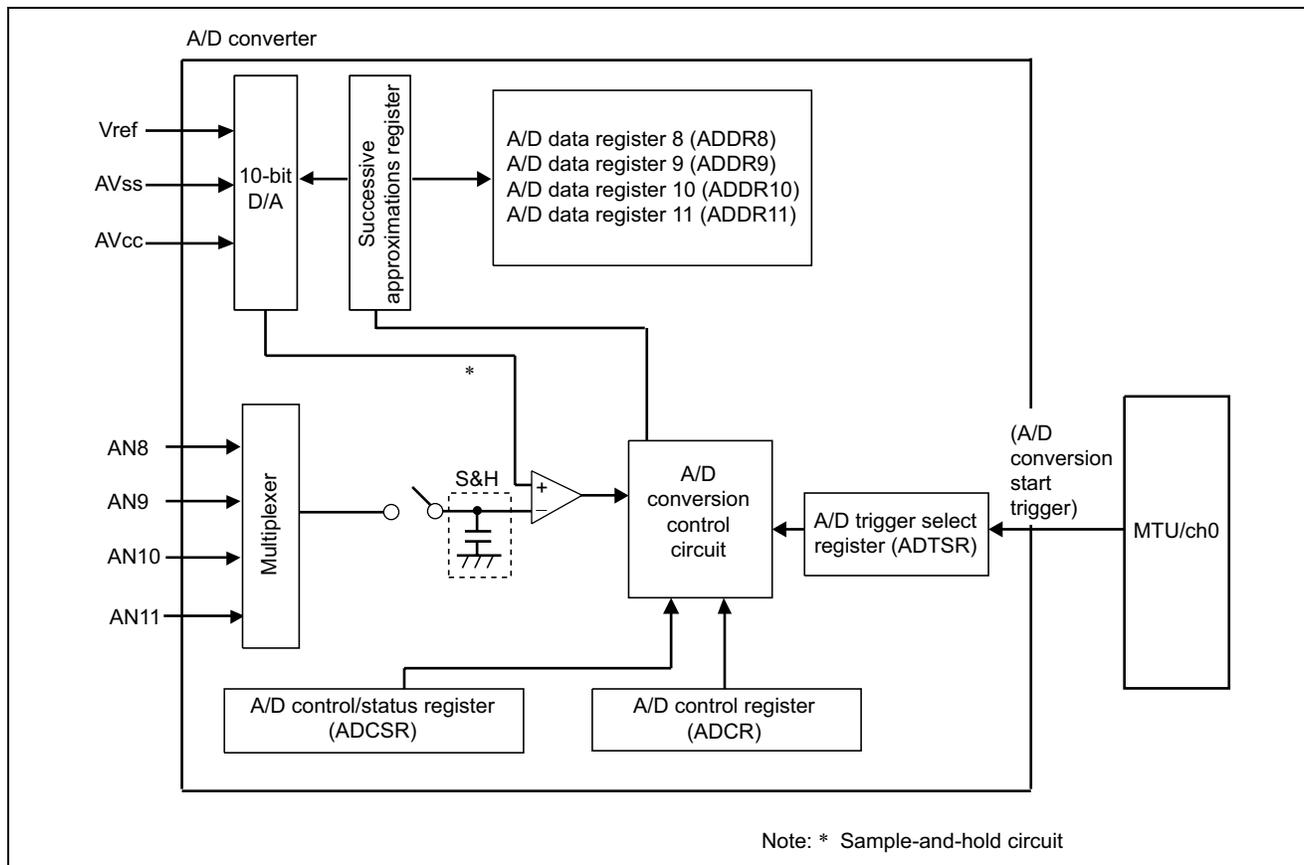


Figure 3 Block Diagram of Voltage Measurement by SH7046

Table 1 shows the function assignments used in this sample task.

Table 1 Function Assignments

Pin or Register Name	Function	Function Assignment
AN8 to AN11	Pins	Analog measurement pins
TCR_0	Register	Selection of counter clearing source
TIER_0	Register	Enables A/D conversion start request generation
TIORH_0	Register	Timer pin function setting
TGRA_0	Register	Sampling period setting
ADCR	Register	A/D conversion mode and measurement pin setting
ADCSR	Register	Selection of conversion time and activation source
ADTSR	Register	Enables start of A/D0 module conversion by MTU trigger signal
ADDR8 to ADDR11	Registers	Storage of A/D conversion results

3. Operation

Figure 4 illustrates the principles of operation of this sample task. As shown in the figure, the A/D converter is activated by a TGRA_0 compare match and sequentially measures voltages input to AN8 through AN11.

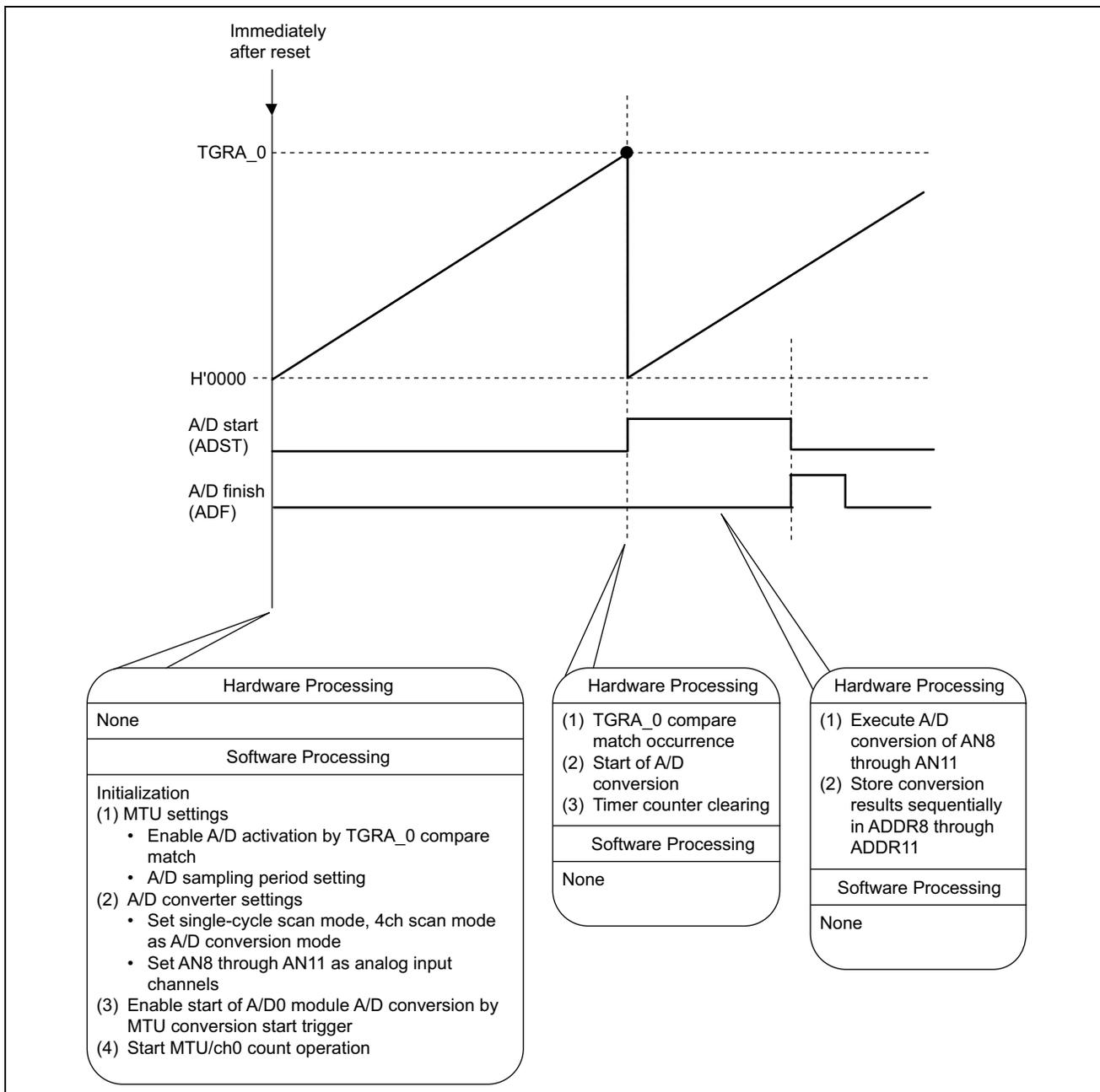


Figure 4 Principles of Operation of A/D Converter Activation by MTU

4. Software

(1) Modules

Module Name	Label	Function Assignment
Main routine	main	A/D converter activation by MTU

(2) Internal Registers Used

Register Name	Function	Address	Set Value
P_STBY.MSTCR2	Module standby mode clearing (MTU, A/D)	H'FFFF861E	H'd2ed
P_MTU0.TCR_0	Selection of TCNT counter clock, and setting of output compare A as TCNT_0 counter clearing source	H'FFFF8260	H'00
P_MTU0.TIORH_0	Sets TGRA_0 for output compare	H'FFFF8262	H'00
P_MTU0.TIER_0	Enables A/D conversion start request generation	H'FFFF8264	H'c1
P_MTU0.TGRA_0	Sets A/D conversion sampling period	H'FFFF8268	H'1000
P_AD.ADCR_0	Sets MTU conversion start trigger as A/D conversion mode (single-cycle scan mode) activation source	H'FFFF8488	H'87
P_AD.ADCSR_0	Setting of A/D conversion mode (4ch scan mode), conversion channels (AN8 to AN11), and conversion time, and enabling of A/D conversion end interrupt	H'FFFF8480	H'5f
P_AD.ADTSR	Enables start of A/D0 module conversion by MTU conversion start trigger signal	H'FFFF87F4	H'02

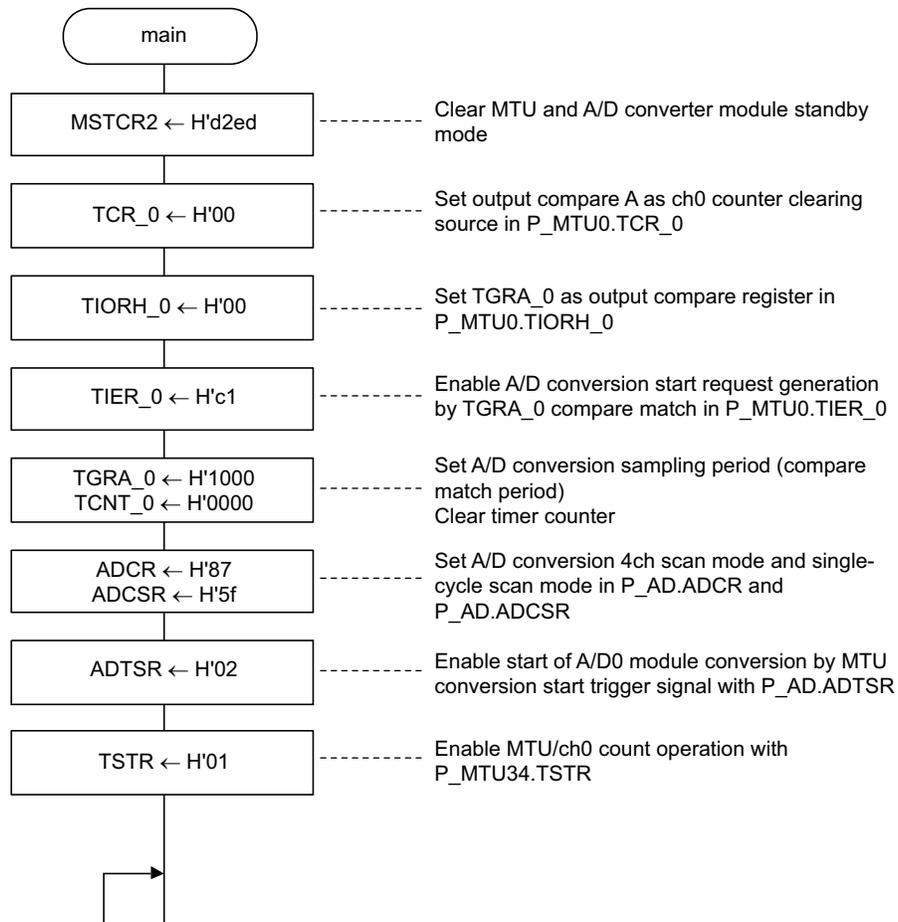
(3) RAM Used

This sample task does not use any RAM apart from the arguments.

Note: SH7046 header file names are used for register label names.

5. Flowcharts

(1) Main routine



6. Program Listing

```

/*****
/*
/*****
#include <machine.h>
#include "iodefine_7046.h"
/*****
/*
/*****
void main(void);
/*****
/*
/*****
void main(void)
{
    P_STBY.MSTCR2.WORD = 0xd2ed;      /* Clear Module standby mode */

    P_MTU0.TCR_0.BYTE = 0x00;        /* clock=Pφ/1 */
    P_MTU0.TIORH_0.BYTE = 0x00;
    P_MTU0.TIER_0.BYTE = 0xc1;       /* enable TGIA interrupt */
    P_MTU0.TGRA_0 = 0x1000;
    P_MTU0.TCNT_0 = 0x0000;

    P_AD.ADCR_0.BYTE = 0x87;         /* 1-cycle scan mode */
    P_AD.ADCSR_0.BYTE = 0x5f;        /* 4-channel scan mode */
    P_AD.ADTSR.BYTE = 0x02;          /* A/D start by MTU */
    P_MTU34.TSTR.BYTE = 0x01;        /* Start timer counter */

    set_imask(0x0);
    while(1);
}

```

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