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SH7144/45 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 is used for A/D conversion, with A/D conversion performed consecutively on channels 0 to 3.

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

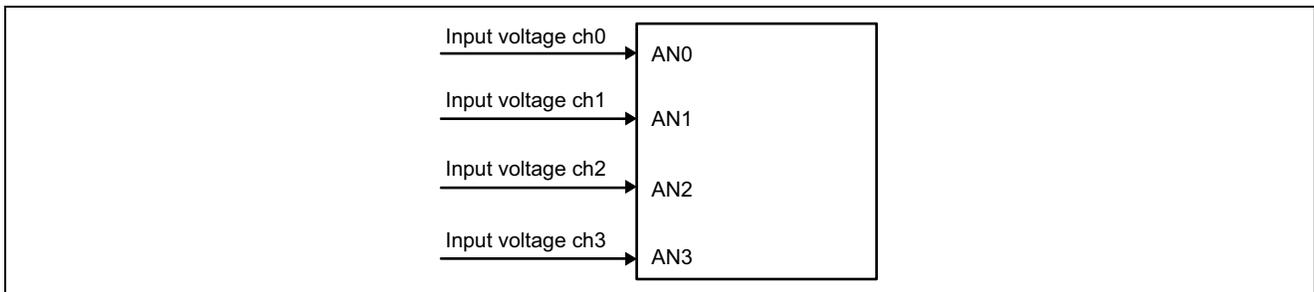


Figure 1 Block Diagram of Voltage Measurement by SH7145

2. Functions Used

In this sample task, the A/D converter is activated by an A/D conversion start request from the MTU.

Figure 2 shows a block diagram of ch0. Ch0 A/D conversion is initiated 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)

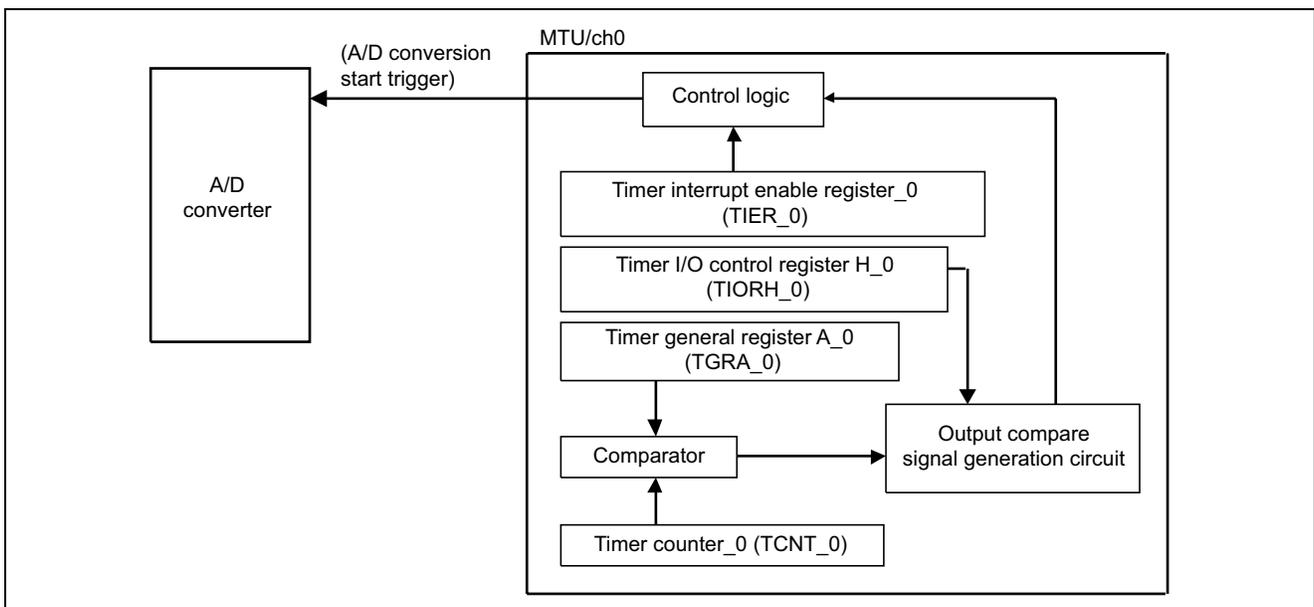


Figure 2 Block Diagram of SH7145 ch0

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 the specified channels (ch0 to ch3) (single-cycle scan mode)

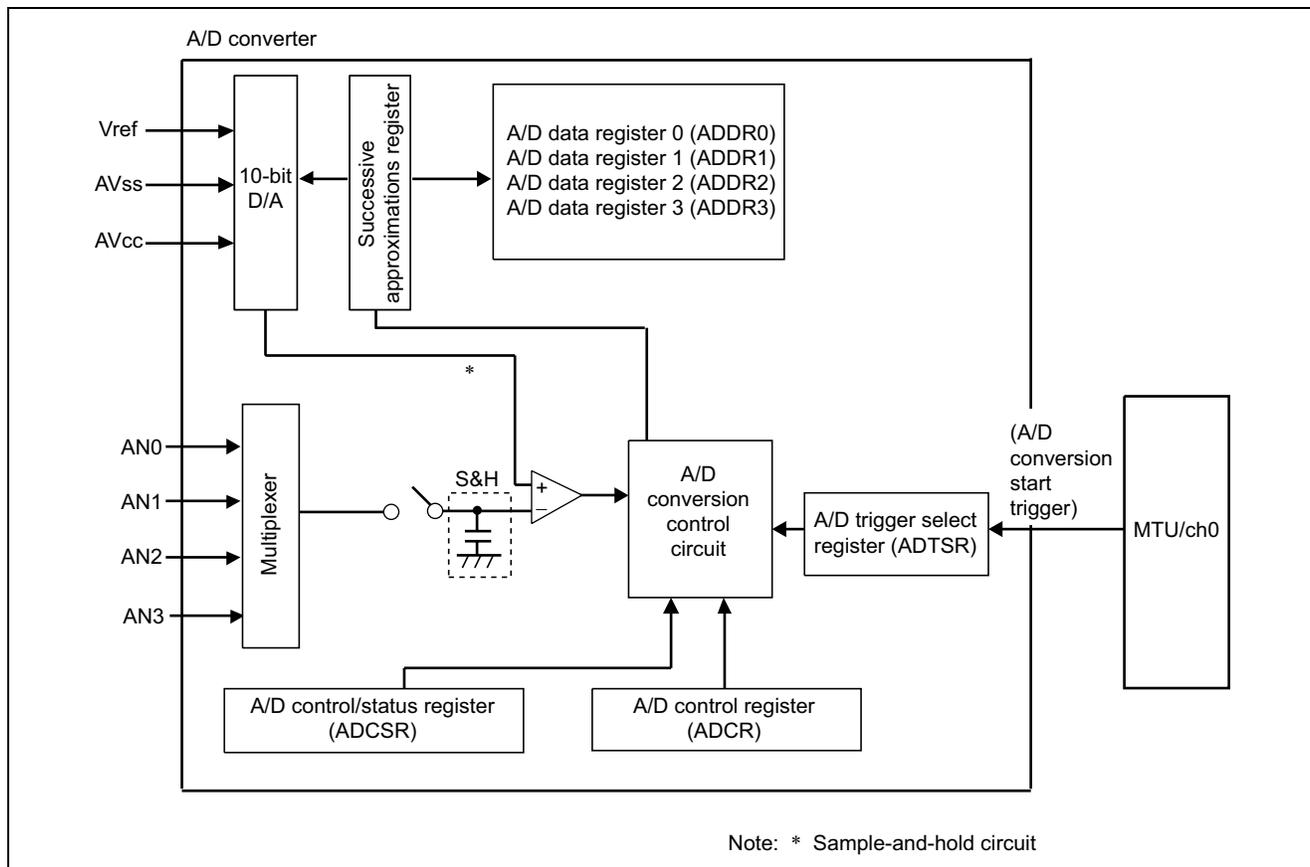


Figure 3 Block Diagram of Voltage Measurement by SH7145

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

Table 1 Function Assignments

Pin or Register Name	Function Assignment
AN0 to AN3	Analog input pins
TCR_0	Selection of counter clearing source
TIER_0	Enables A/D conversion start request generation
TGRA_0	A/D conversion sampling period setting
ADCR	A/D conversion mode and measurement pin setting
ADCSR	Selection of conversion time and activation source
ADDR0 to ADDR3	Storage of A/D conversion results

3. Principles of 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 AN0 through AN3.

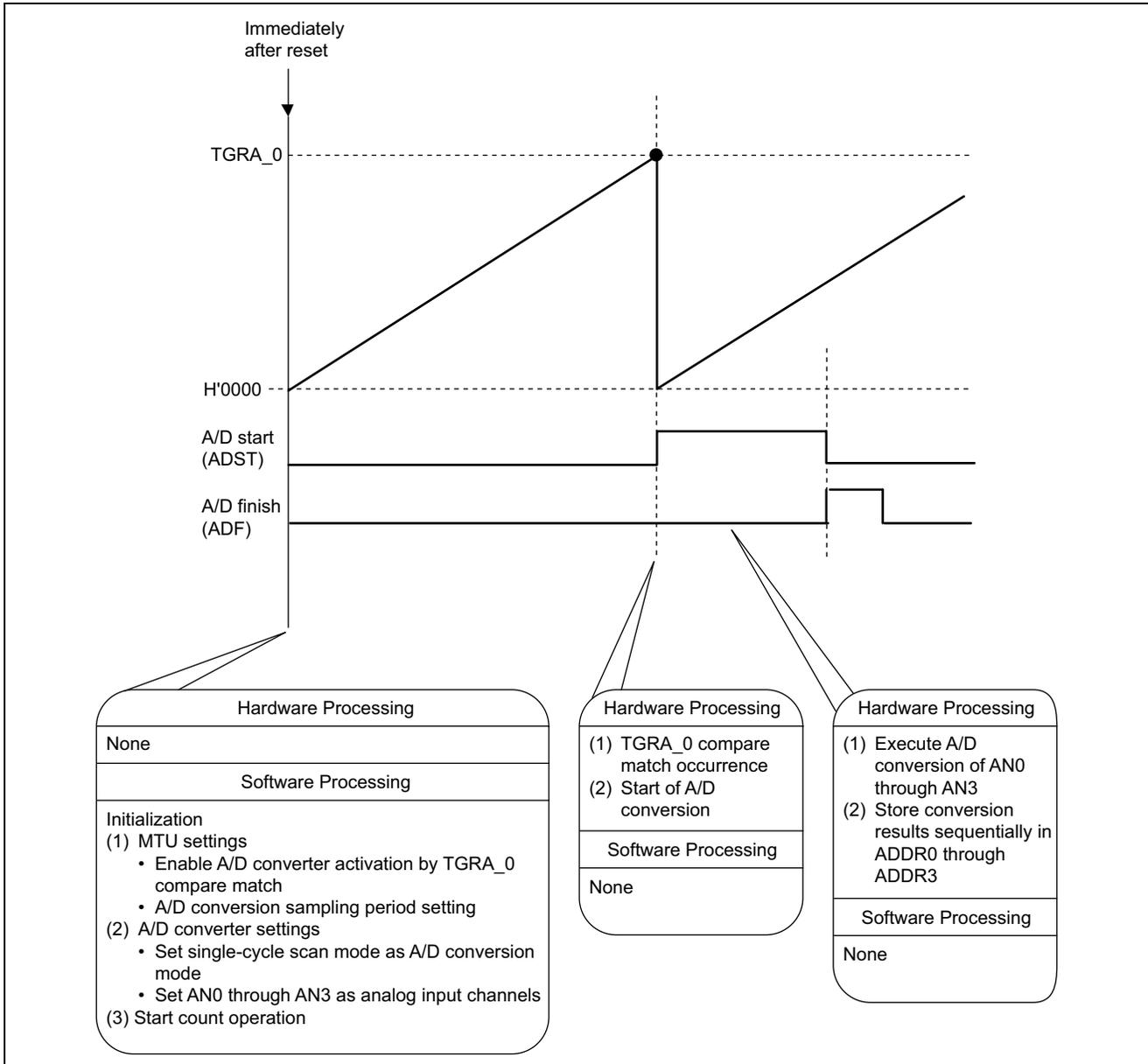


Figure 4 Principles of Operation of A/D Conversion Initiation by MTU

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 converter)	H'FFFF861E	H'd0ed
P_MTU0.TCR_0	Selection of TCNT_0 counter clock, and setting of output compare A as TCNT_0 counter clearing source	H'FFFF8260	H'20
P_MTU0.TIORH_0	Sets TGRA_0 for output compare	H'FFFF8262	H'00
P_MTU0.TIER_0	Enables generation of A/D conversion start requests from MTU	H'FFFF8264	H'c1
P_MTU0.TGRA_0	Sets 1 ms as A/D conversion sampling period	H'FFFF8268	H'9c40
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 channels (AN0 to AN3) and conversion time	H'FFFF8480	H'1b
P_AD.ADTSR	Sets enabling of start of A/D0 module conversion by MTU A/D conversion start trigger signal	H'FFFF87F4	H'02

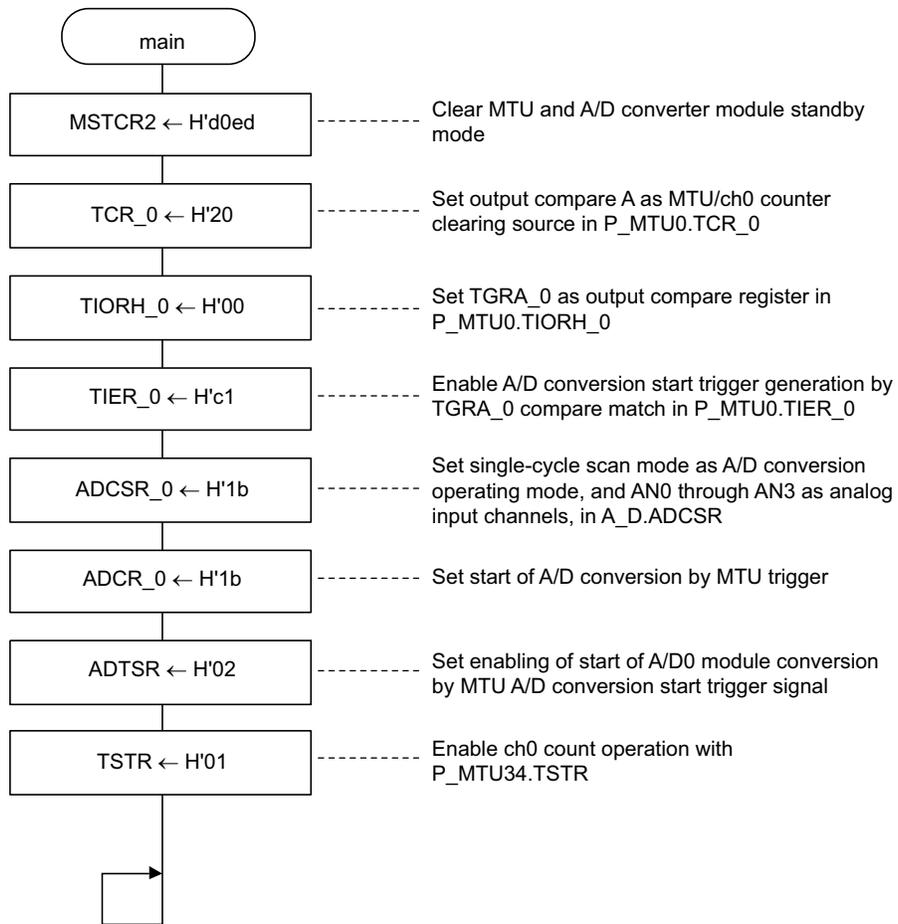
(4) RAM Used

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

Note: SH7145 header file names are used for register label names.

5. Flowcharts

(1) Main routine



6. Program Listing

```

/*****
/*
/*          INCLUDE FILE
/*
/*****
#include <machine.h>
#include "iodefine_7145F.h"
/*****
/*
/*          PROTOTYPE
/*
/*****
void main(void);
/*****
/*
/*          MAIN PROGRAM
/*
/*****
void main(void)
{
    P_STBY.MSTCR2.WORD = 0xd0ed;    /* Clear Module standby mode */

    P_MTU0.TCR_0.BYTE = 0x20;      /* clock=Pφ/1,counter clear TGRA_0 */
    P_MTU0.TIORH_0.BYTE = 0x00;
    P_MTU0.TIER_0.BYTE = 0xc1;     /* enable TGIA */
    P_MTU0.TCNT_0 = 0x0000;
    P_MTU0.TGRA_0 = 0x9c40;        /* A/D sampling period = 1.0ms */

    P_AD.ADCR_0.BYTE = 0x87;       /* 1cycle scan mode */
    P_AD.ADCSR_0.BYTE = 0x1b;      /* 4channel scan mode */
    P_AD.ADTSR.BYTE = 0x02;
    P_MTU34.TSTR.BYTE = 0x01;      /* Start timer counter */

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

```

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