

# RE01 1500KB, 256KB Group A/D Scan Conversion (Single Scan) (Low Level Code)

## 14-Bit A/D Converter Single Scan Conversion (Software trigger) Sample Code

### Introduction

This application note explains the 14-Bit A/D Converter (\*) sample code which does not use the RE01 1500KB Group, 256KB Group CMSIS driver function.

In this sample code, the registers of Peripheral modules are directly accessed.

This sample code is intended for users who need to:

- Improve performance by eliminating overhead code in the driver.
- Reduce ROM/RAM size.
- Develop simple, easy-to-understand code.
- Implement features not supported by the driver.

Note. The function names differ between the 1500KB group and the 256KB group.

The peripheral function names in each group are shown below.

1500KB Group : S14AD

256KB Group : ADC14

### Target Device

RE01 1500KB Group

RE01 256KB Group

### Contents

|                                  |   |
|----------------------------------|---|
| 1. Specifications .....          | 2 |
| 1.1 Sample Code Information..... | 3 |
| Revision History .....           | 5 |

### Description of Project

The following sample code projects are provided with this application note.

Sample code project for RE01 1500KB group : r01an5148\_re\_adc\_single\_LLCode

Sample code project for RE01 256KB group : r01an5148\_re\_adc\_single\_LLCode\_256kb

The r01an5148\_re\_adc\_single\_LLCode project has been tested using the Evaluation Kit RE01 1500KB. This project is configured to match the settings of R7F0E015D2CFB mounted on the Evaluation Kit RE01 1500KB.

The r01an5148\_re\_adc\_single\_LLCode\_256kb project has been tested using the Evaluation Kit RE01 256KB. This project is configured to match the settings of R7F0E01182CFP mounted on the Evaluation Kit RE01 256KB.

When using another device, change the device settings in the project to those of the target device.

## 1. Specifications

This sample code performs A/D conversion using the 14-Bit A/D Converter single scan mode.

The operation of the sample code is shown below.

- After reset release, perform 14-Bit A/D Converter offset calibration.
- Set the ADC as follows.
  - [RE01 1500KB Group]  
Single scan mode, select AN028, select software trigger
  - [RE01 256KB Group]  
Single scan mode, select AN000, select software trigger
- When the A/D conversion SW (SW2) input is detected, start A/D conversion.
  - [RE01 1500KB Group]
    - If the A/D conversion result is 0 or more and less than  $1/3 VCC$ , only LED0 lights.
    - If the A/D conversion result is more than  $1/3 VCC$  and less than  $2/3 VCC$ , only LED1 lights.
    - If the A/D conversion result is  $2 / 3VCC$  or more, only LED2 lights.
  - [RE01 256KB Group]
    - If the A/D conversion result is 0 or more and less than  $1/2 VCC$ , only LED0 lights.
    - If the A/D conversion result is  $1 / 2 VCC$  or more, only LED1 lights.
- Pressing the ADC stop SW (\*) during ADC operation stops the ADC and turns off all LEDs.
- Pressing the A/D conversion SW (SW2) while the ADC is stopped initializes the ADC and executes A/D conversion.

Note. For RE01 1500KB group, use SW3. For RE01 256KB group, use SW1.

## 1.1 Sample Code Information

Table 1. Sample Code Information For RE01 1500KB Group

| Item                           | Description  | Remarks   |
|--------------------------------|--|---|
| Peripheral Function            | S14AD  | 14-bit resolution<br>Single scan mode<br>Software trigger |
| Interrupt                      | IRQ2<br>IRQ4   | SW3<br>SW2  |
| Pins                           | P506(AN028)<br>P410(IRQ2)<br>P508(IRQ4)<br>P009(LED0)<br>P008(LED1)<br>P007(LED2)  | SW3 input<br>SW2 input                                    |
| Environment<br>(IDE, Compiler) | IDE: IAR Embedded Workbench for ARM Version 8.40.2<br>C compiler : IAR C/C++ Compiler for ARM Version 8.40.2                 | -   |
|                                | IDE: Renesas e <sup>2</sup> studio Version 7.6.0<br>C Compiler : GCC ARM Embedded Version 6.3.1.20170620GNU 6-2017-q2-update | -   |
| Target Board                   | Evaluation Kit RE01 1500KB<br>(RTK70E015DSXXXXXBE)   | -   |
| I/O header Version             | Rev1.01  | -   |
| Sample code Version            | Rev1.00  | -   |

RE01 1500KB, 256KB Group A/D Scan Conversion (Single Scan) (Low Level Code)  
 14-Bit A/D Converter Single Scan Conversion (Software trigger) Sample Code

**Table 2. Sample Code Information For RE01 256KB Group**

| Item                           | Description  | Remarks   |
|--------------------------------|--|---|
| Peripheral Function            | ADC14  | 14-bit resolution<br>Single scan mode<br>Software trigger |
| Interrupt                      | KEY_INTKR<br>IRQ4  | SW1<br>SW2  |
| Pins                           | P000(AN000)<br>P509(KRM01)<br>P508(IRQ4)<br>P210(LED0)<br>P410(LED1)   | SW1 input<br>SW2 input                                    |
| Environment<br>(IDE, Compiler) | IDE: IAR Embedded Workbench for ARM Version 8.40.2<br>C compiler : IAR C/C++ Compiler for ARM Version 8.40.2           | -   |
|                                | IDE: Renesas e <sup>2</sup> studio 2020-07<br>C Compiler : GCC ARM Embedded Version 6.3.1.20170620GNU 6-2017-q2-update | -   |
| Target Board                   | Evaluation Kit RE01 256KB<br>(RTK70E0118CXXXXXBJ)  | -   |
| I/O header Version             | Rev1.00  | -   |
| Sample code Version            | Rev1.03  | -   |

RE01 1500KB, 256KB Group A/D Scan Conversion (Single Scan) (Low Level Code)  
14-Bit A/D Converter Single Scan Conversion (Software trigger) Sample Code

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### Revision History

| Rev. | Date        | Description                  |   |
|------|-------------|------------------------------|---|
|      |             | Page                         | Summary   |
| 1.00 | Dec.26.2019 | -                            | First edition issued  |
| 1.01 | Feb.14.2020 | -                            | Add RE01 256KB group.   |
| 1.02 | Mar.27.2020 | 1,2,4<br>Program<br>(256KB)  | RE01 256KB group target board changed to Evaluation Kit<br>RE01 256KB.<br>Replaced CMSIS Driver Package<br>- RE01 256KB: CMSIS Driver Package Rev.0.80            |
| 1.03 | Jun.01.2020 | 1<br>3<br>Program<br>(256KB) | Change the name of the sample code project<br>Updated " Sample Code Information "<br>Replaced CMSIS Driver Package<br>- RE01 256KB: CMSIS Driver Package Rev.1.00 |

## General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

### 1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

### 2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

### 3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

### 4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

### 5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

### 6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

### 7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

### 8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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