RL78/G13

R01AN3156EJ0100
Rev.1.00
Feb 05, 2016

A/D converter One-shot conversion mode (Low power)

Abstract

This document describes using the sample program with the Code Generator for e^2 studio. The CC-RL is used as a compiler in the sample program.

The sample program can operate on the e^2 studio simulator, so the operation of the peripheral functions can be confirmed without having the actual MCU.

Target Device

RL78/G13

Contents

1. Using the Sample Program

1.1 Development Environment

The sample program is operated under the following environment.

- Integrated development environment
  e^2 studio Version. 4.3.0.007
- Compiler
  CCRL v1.02.00

1.2 Importing a Project

Start e^2 studio and import the sample program.

Select File >> Import (Figure 1).

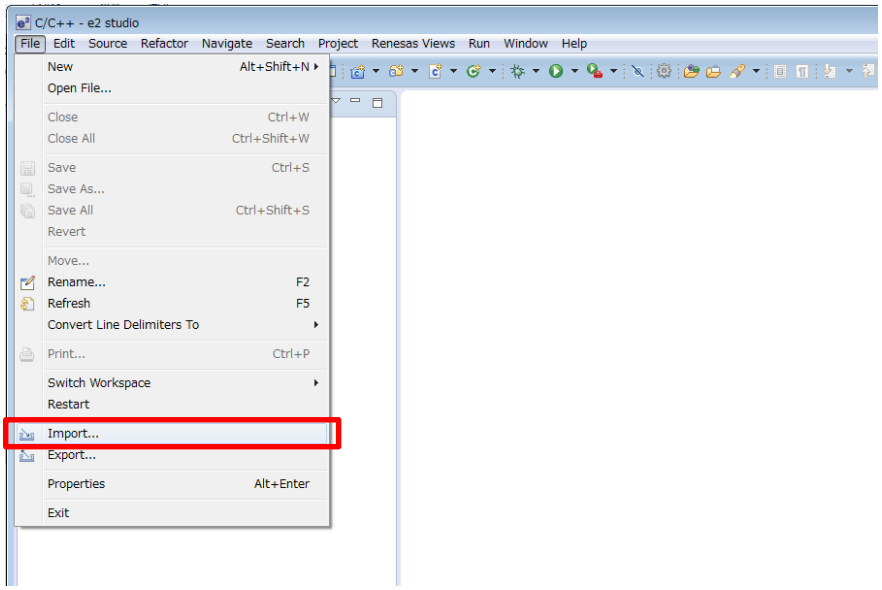

Figure 1 File Menu

The Import dialog box opens. Select 'Existing Projects into Workspace' and click the Next button (Figure 2).

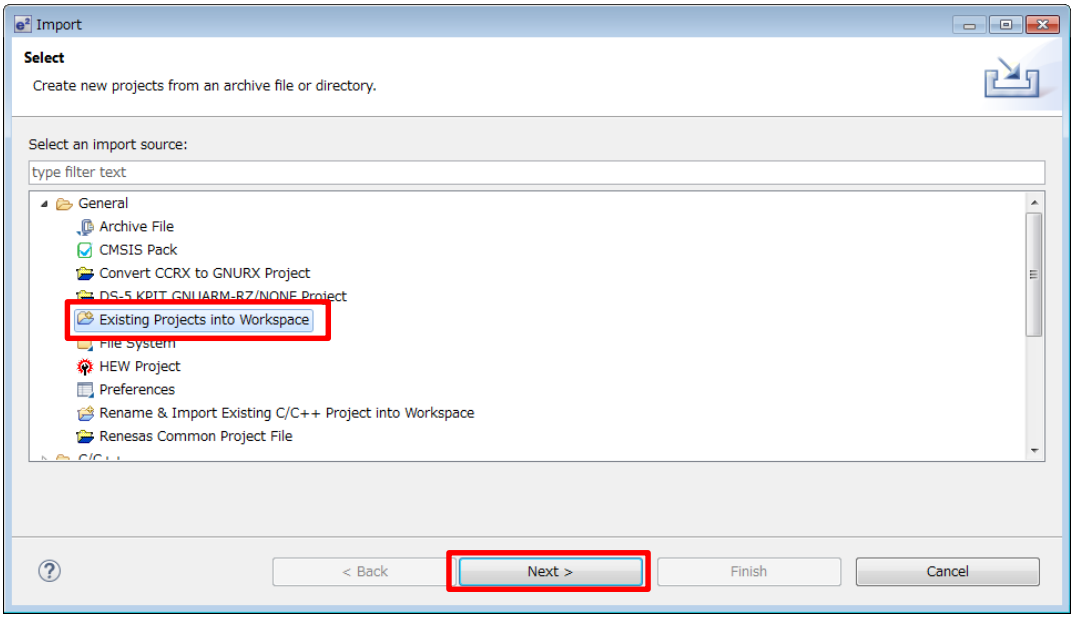

Figure 2 Import Dialog Box 1/2

Click the Browse button and select the folder where the sample program is stored.

The project will be displayed in the Projects section. Confirm that the project is ticked and click the Finish button (Figure 3).

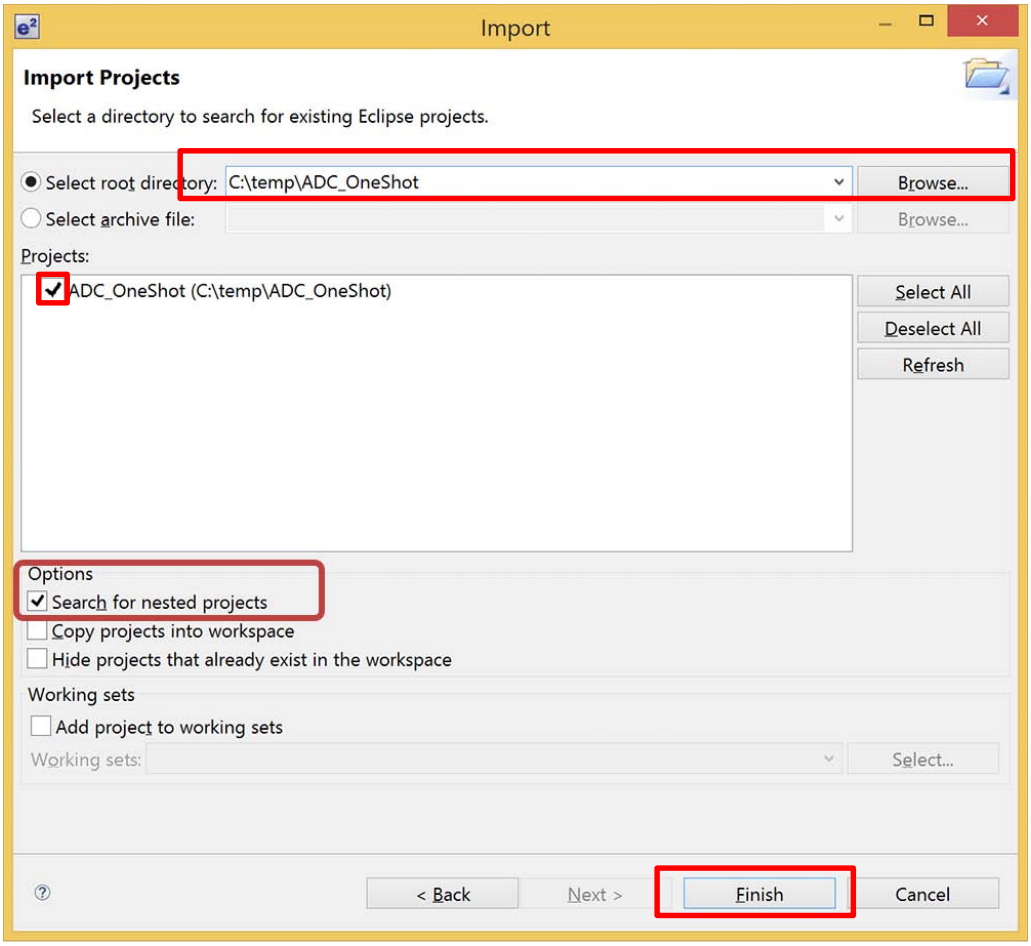

Figure 3 Import Dialog Box 2/2

The imported project is displayed in the Project Explorer (Figure 4).

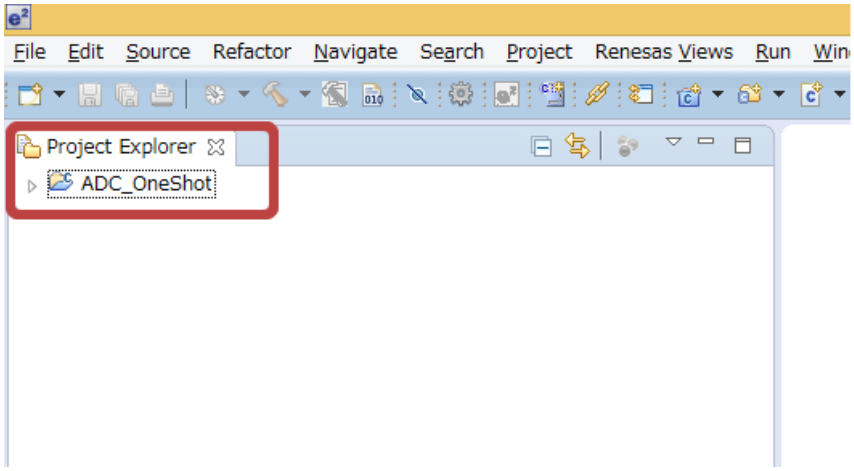

Figure 4 Project Explorer

1.3 Building the Project

Select Project >> Build Project (Figure 5).

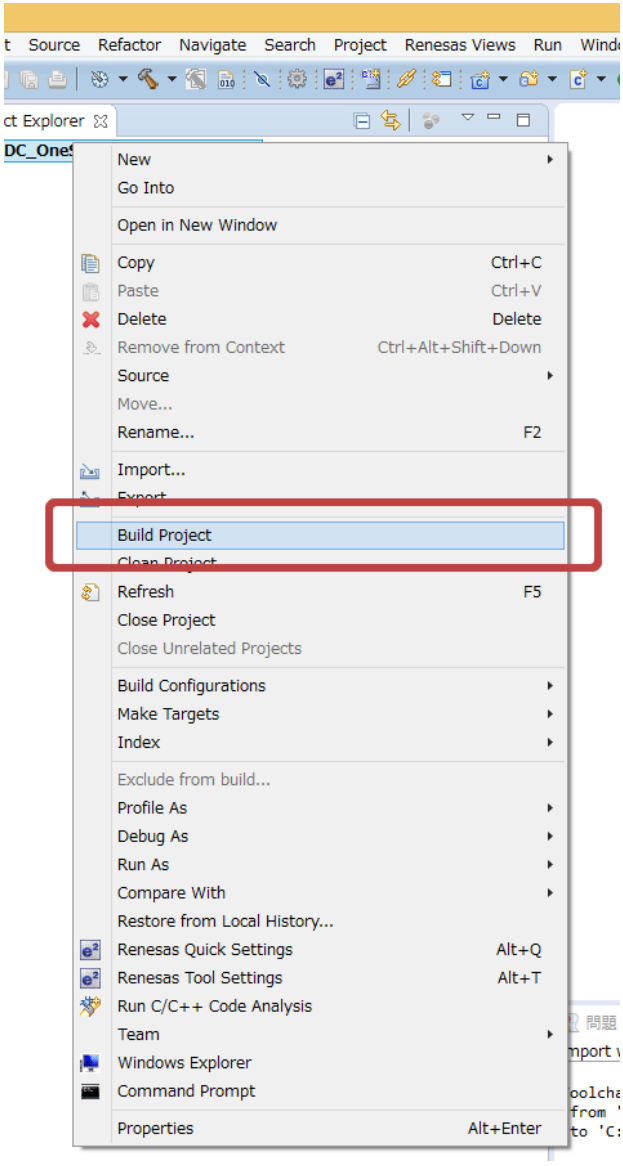

Figure 5 Building the Project

The project will be built and the process is shown in the Build Project dialog box (Figure 6).

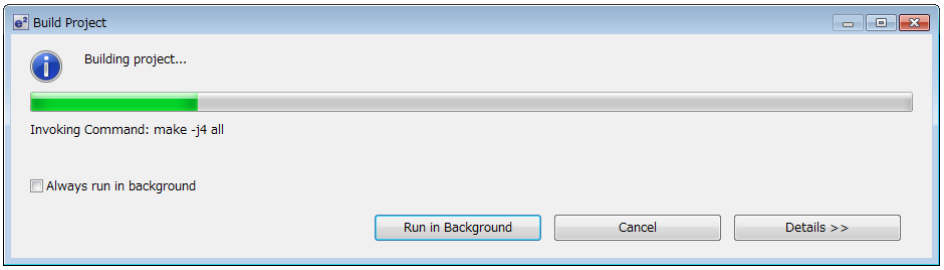

Figure 6 Build Project Dialog Box

When the build has finished, the result is shown in the Console tab.

Consumption current simulator is disabled in default mode and must be enabled. Indicate [Consumption Current] view (Figure 7). If the [Consumption Current] panel is not visible,Select [debug],[Consumption Current] in the [renesas views] menu.

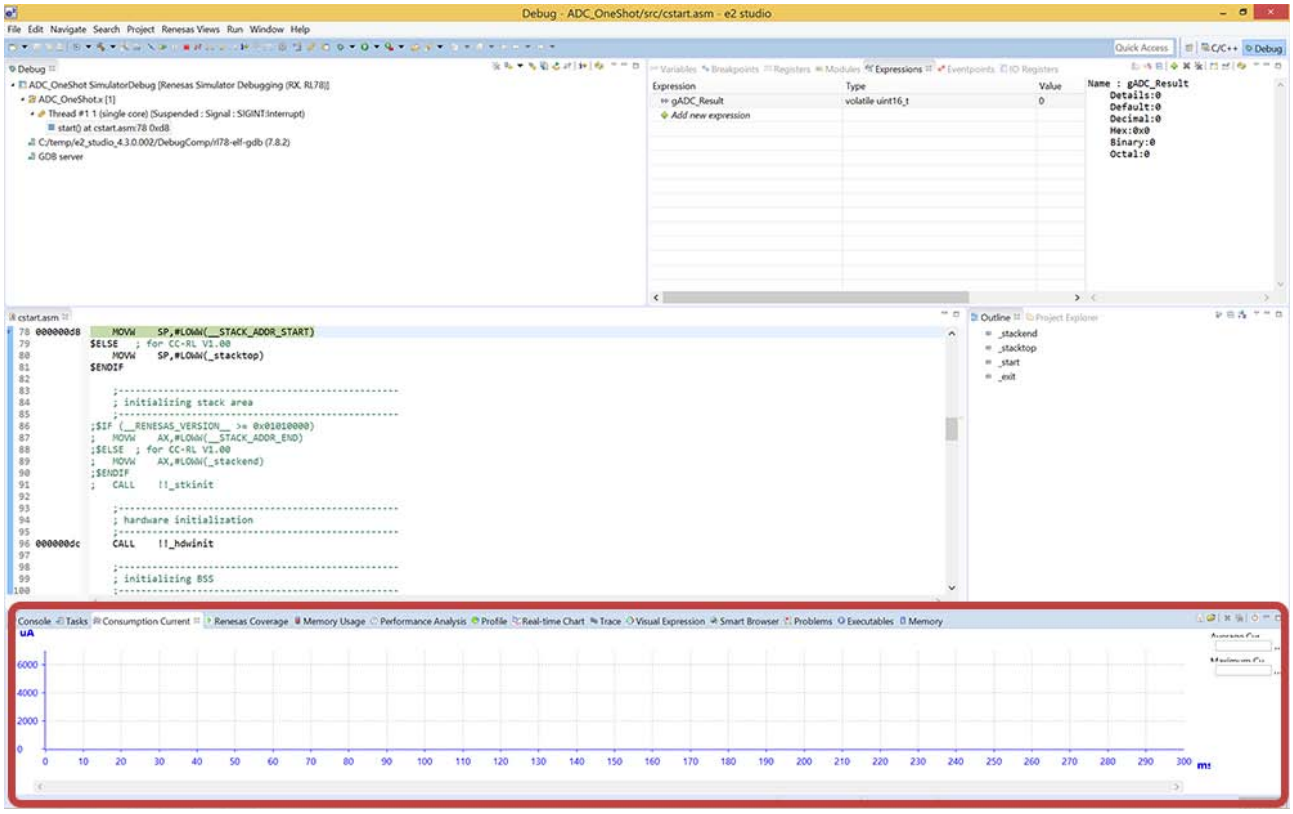

Figure 7 [Consumption Current] view

Enable the simulator by placing a check against the power supply mark icon in the upper right hand corner of the [Consumption Current] tool bar (Figure 8).

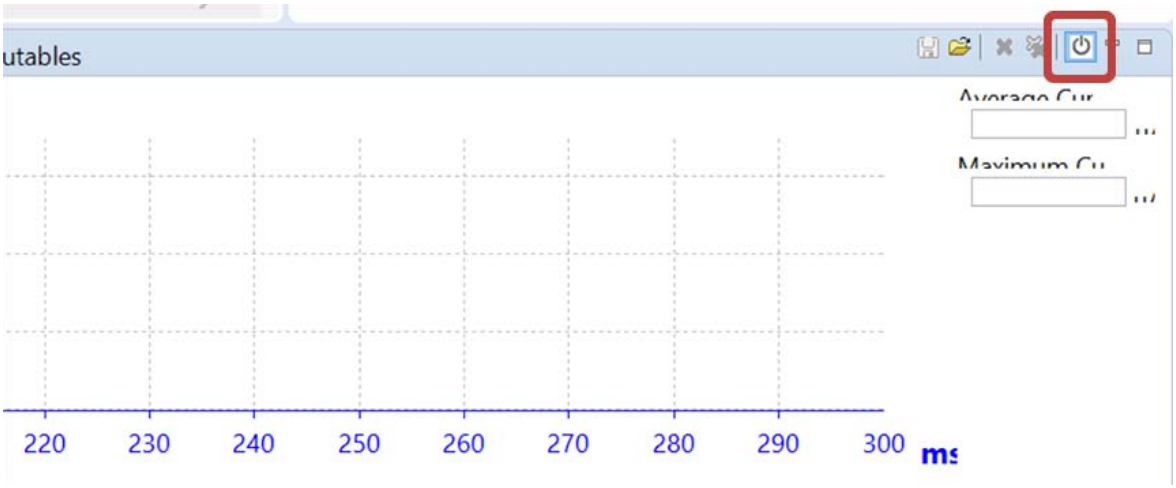

Figure 8 Power supply mark icon of the [Consumption Current] tool bar

1.4 Debugging

Debugging of the sample program can be performed by the simulator.

Select Run >> Debug Configurations (Figure 9).

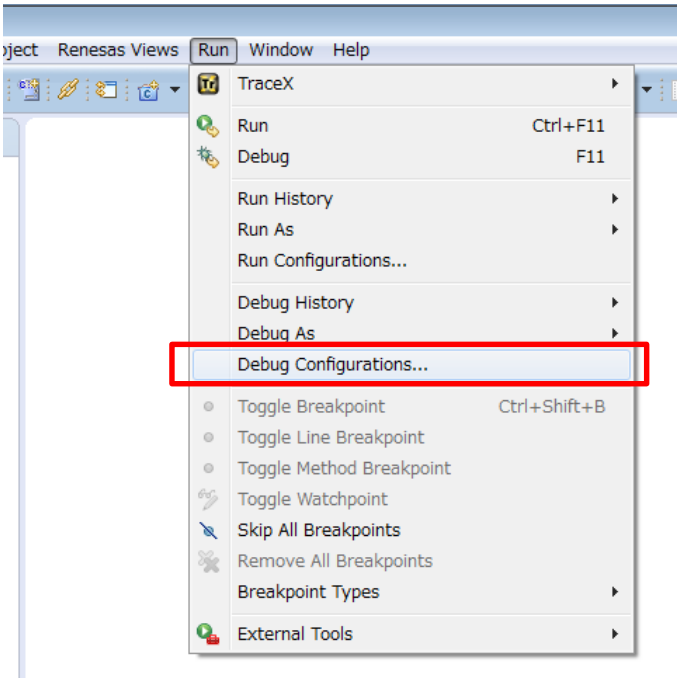

Figure 9 Run Menu

Select 'RL78G13_CG_Sample_e2s SimulatorDebug' and click the Debug button (Figure 10).

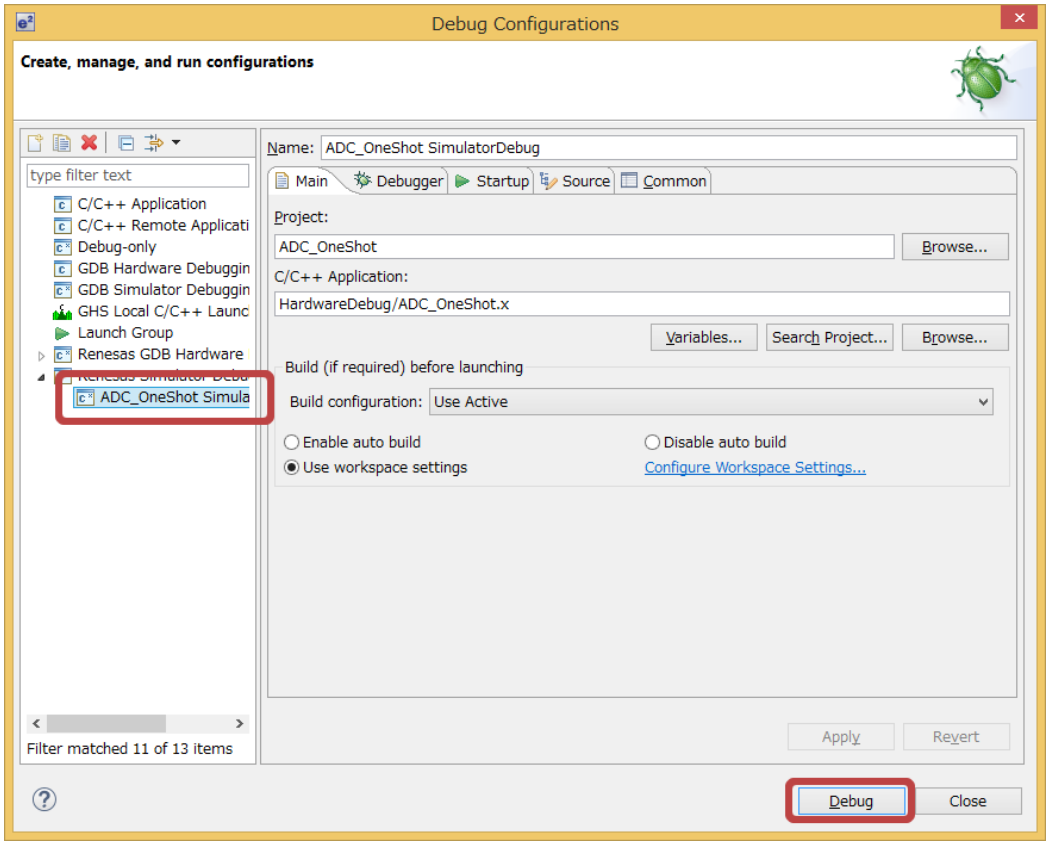

Figure 10 Debug Configuration

If the following dialog box appears (Figure 11), click Yes. The Debug perspective will appear.

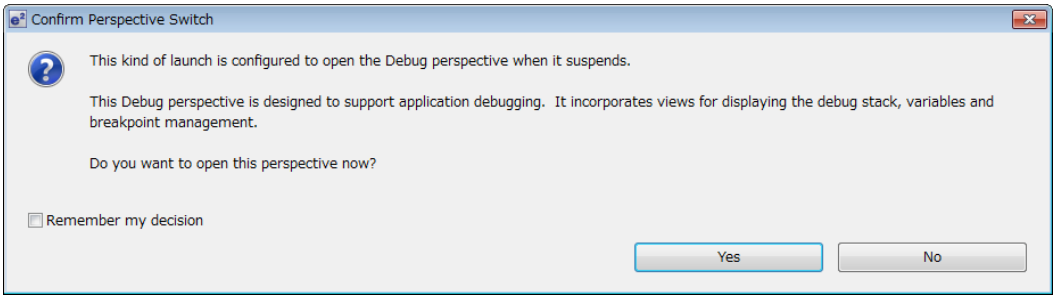

Figure 11 Perspective Switch Confirmation

Also the Simulator GUI starts up separately (Figure 12). The MCU peripheral functions can be debugged in this window.

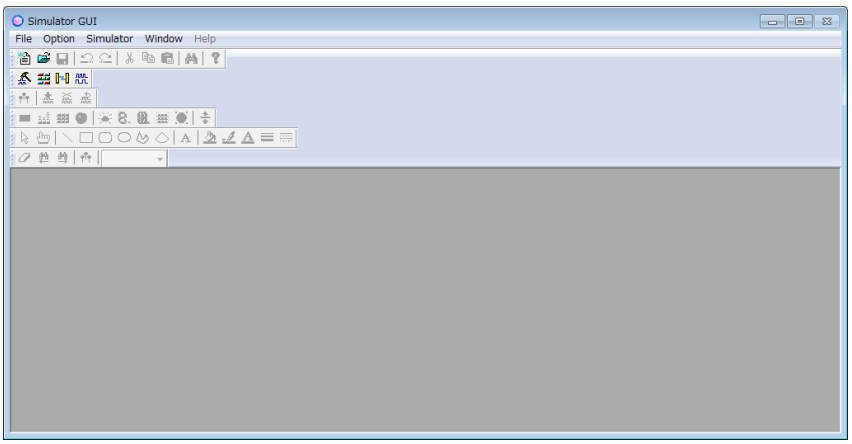

Figure 12 Simulator GUI

Select File >> Open in the Simulator GUI (Figure 13).

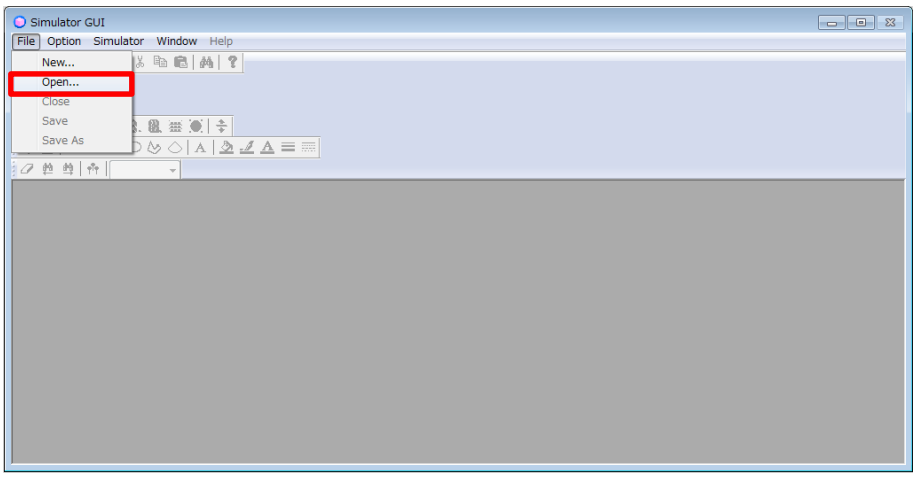

Figure 13 File Menu in the Simulator GUI

Select 'G13_RSK_Board.pnl' in your project folder and click the Open button.

The I/O Panel window opens in the Simulator GUI window (Figure 14). This is the data generated specific to the RSKRL78G13 board. The following functions are available.

- SW1 to SW3 (input)
- Potentiometer (input)
- Reset button (input)
- LED0 to LED3 (output)

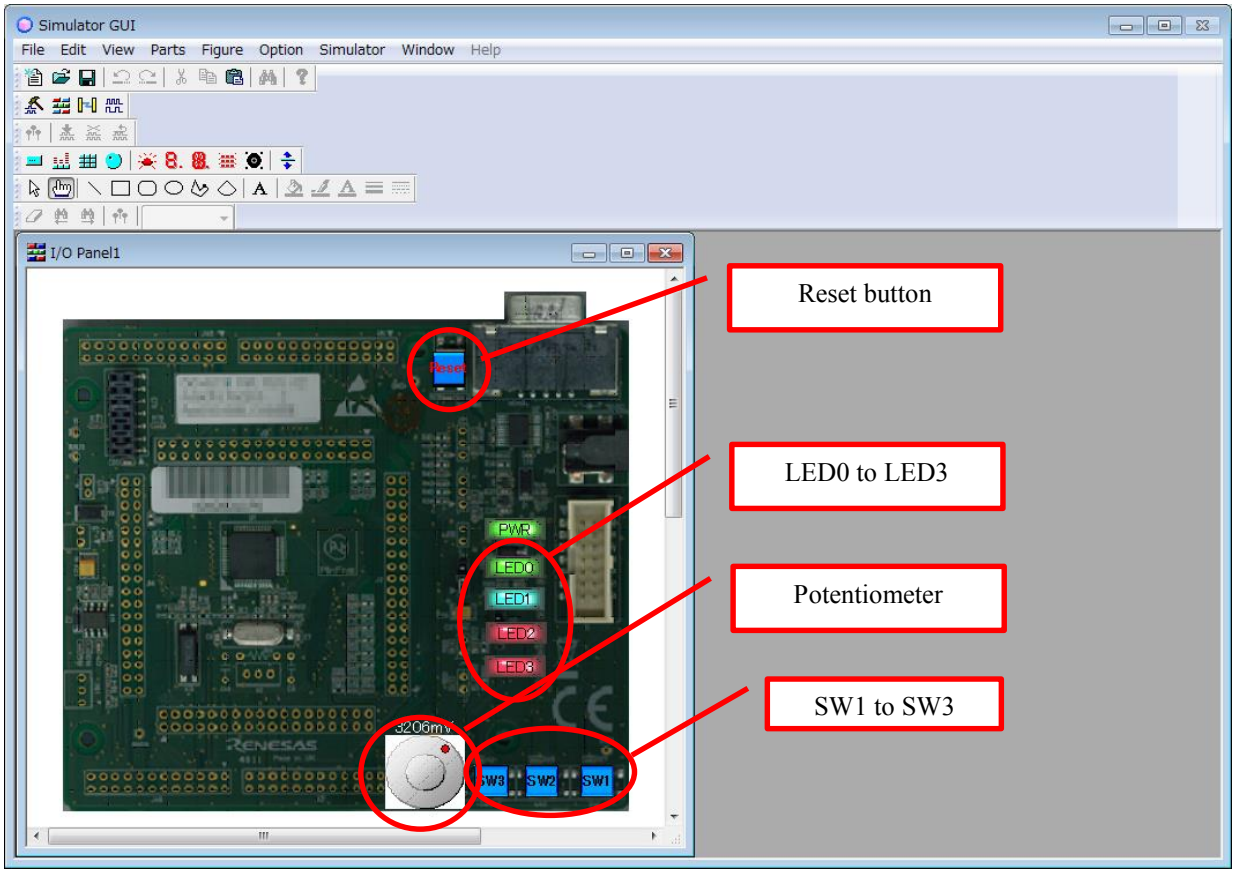

Figure 14 I/O Panel

Add a variable to indicate the value after A/D conversion to the numerical expression view (Figure 15).

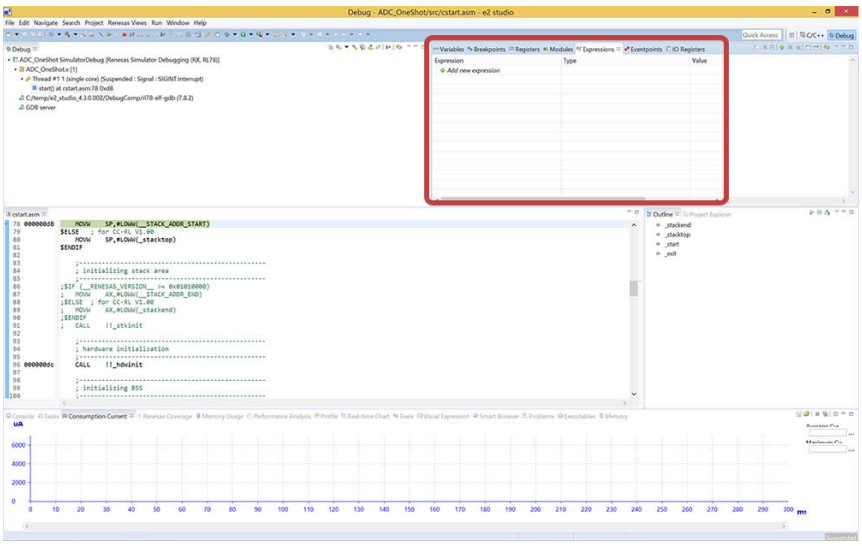

Figure 15 Resume Button

Add a variable to indicate the value after A/D conversion to the numerical expression view.

gADC_Result

Configuration will be changed to renew the added “gADC_Result” even during operation. Right click on “gADC_Result” and select [Real-time Refresh] from the menu (Figure 16).

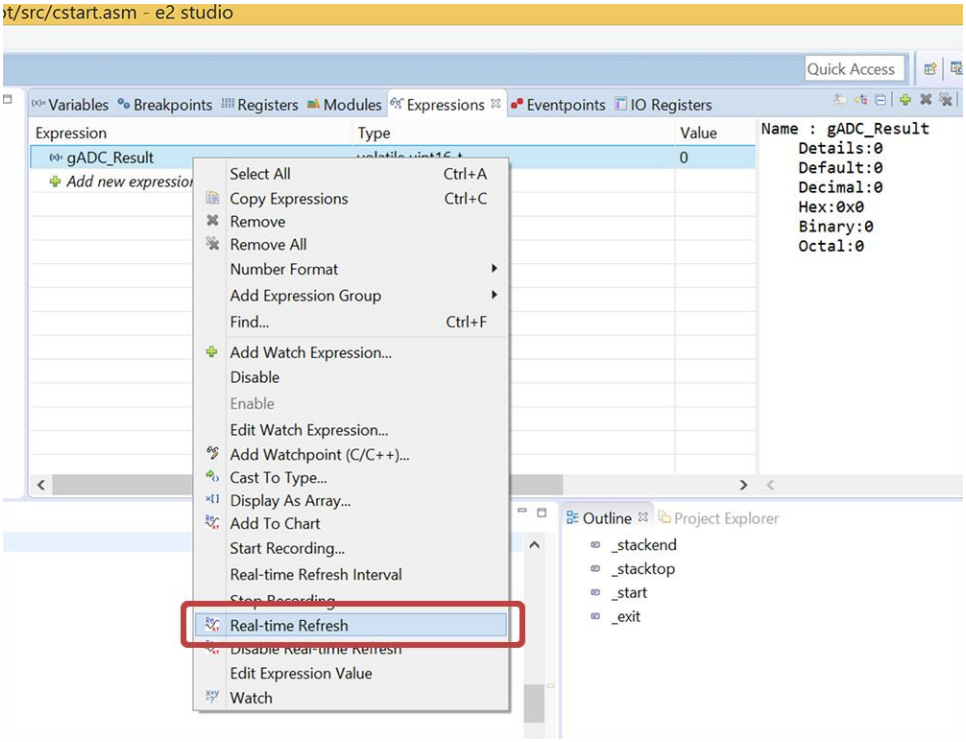

Figure 16 Expression Menu

Select [Resume] from the execution menu to run the program (Figure 17).

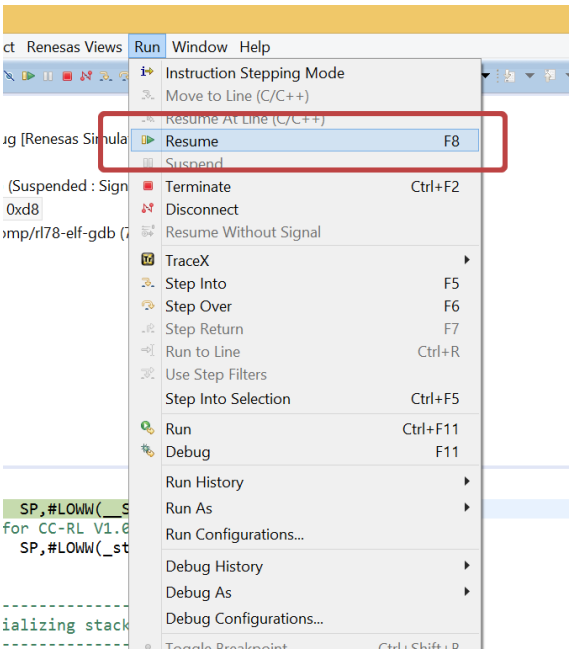

Figure 17 Resume of Execution Menu

It is set to stop at the head of the main ( ) function. Run the program by clicking on [Resume] from the [Run] menu.

Pressing down the Resume icon on the tool bar will result in the same action (Figure 18).

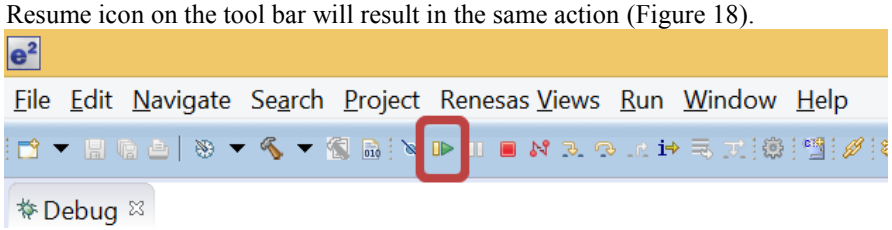

Figure 18 Resume icon on the tool bar

Set the input voltage level by operating the potentiometer with the mouse, in the I/O panel indicated by the simulator GUI. A/D conversion will occur when SW1 is clicked and the value will be indicated in “gADC_Result” registered in the formula panel (Figure 19).
Furthermore, it will be indicated in 8 bit resolution when SW2 is pressed and in 10 bit resolution when SW3 is pressed.

When A/D conversion is made using the SW1 button while SW3 is selected, “gADC_Result” registered in the formula panel will be indicated in 10 bit resolution.

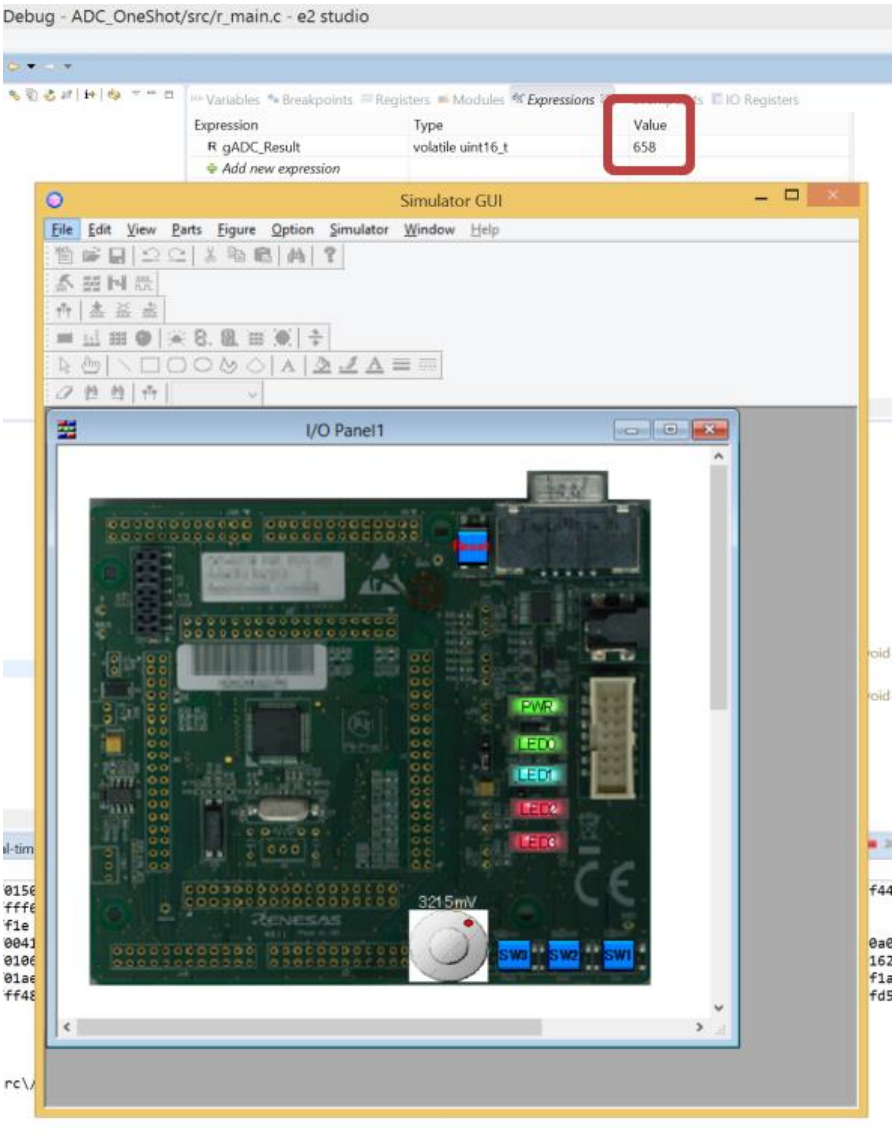

Figure 19 “gADC_Result” in the formula panel 1/2

By changing the input potential using the potentiometer and followed by A/D conversion with the SW1 button, the value of "gADC_Result" registered in the formula panel will change (Figure 20).

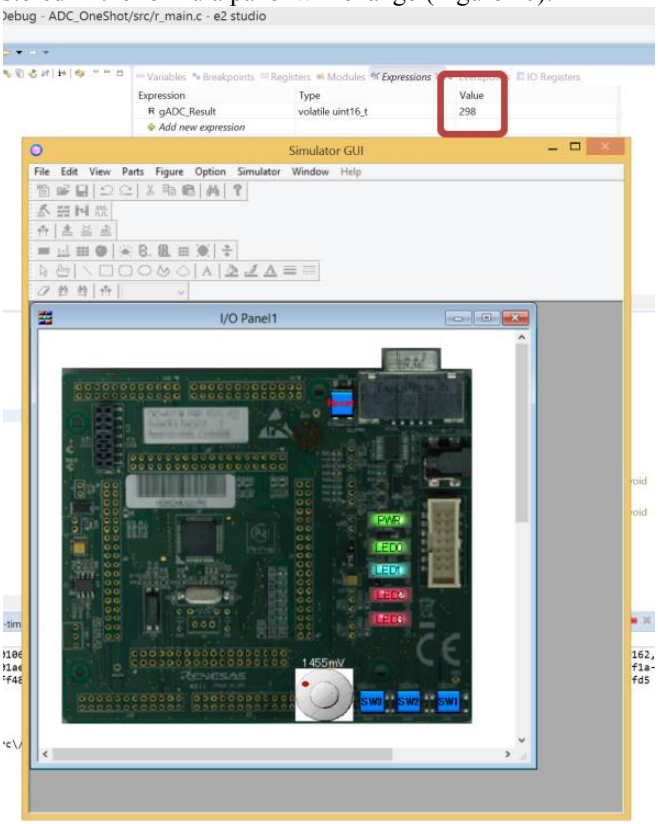

Figure 20 "gADC_Result" in the formula panel 2/2

When A/D conversion is made using the SW1 button while SW2 is selected, "gADC_Result" registered in the formula panel will be indicated in 8 bit resolution (Figure 21).

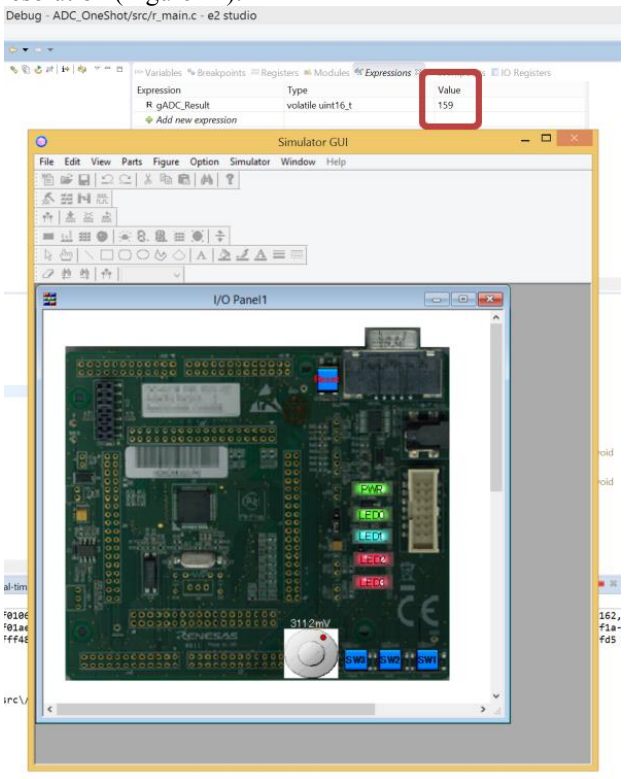

Figure 21 "gADC_Result" in the formula panel (8 bit resolution)

Select [Suspend] from [Run] menu to terminate the program (Figure 22).

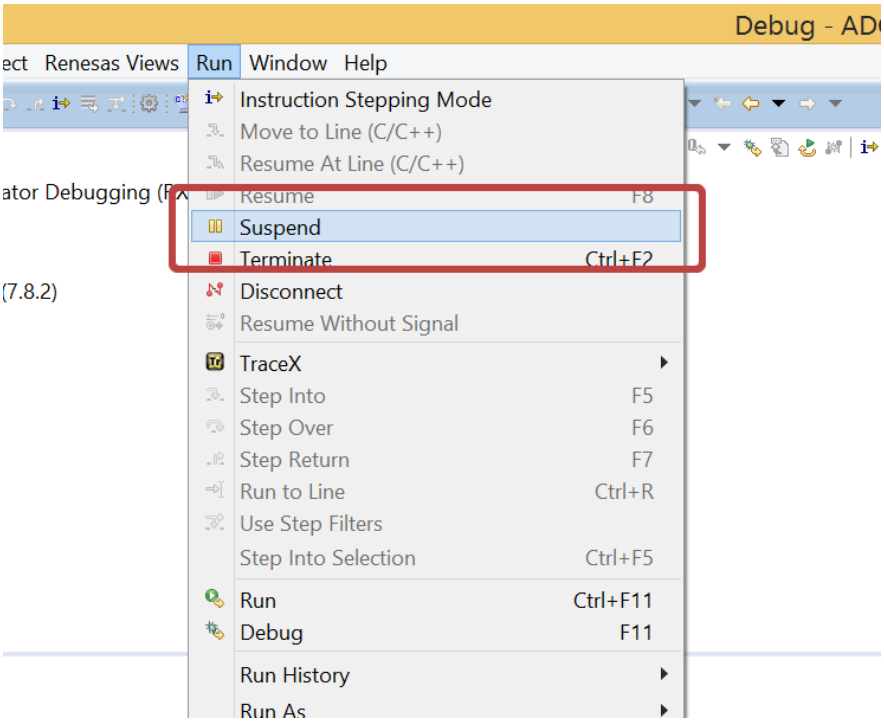

Figure 22 Suspend of Run menu

Indicate the results of consumption current simulation in the [Consumption Current] view and confirm that consumption current has increased during the period of A/D conversion (Figure 23).

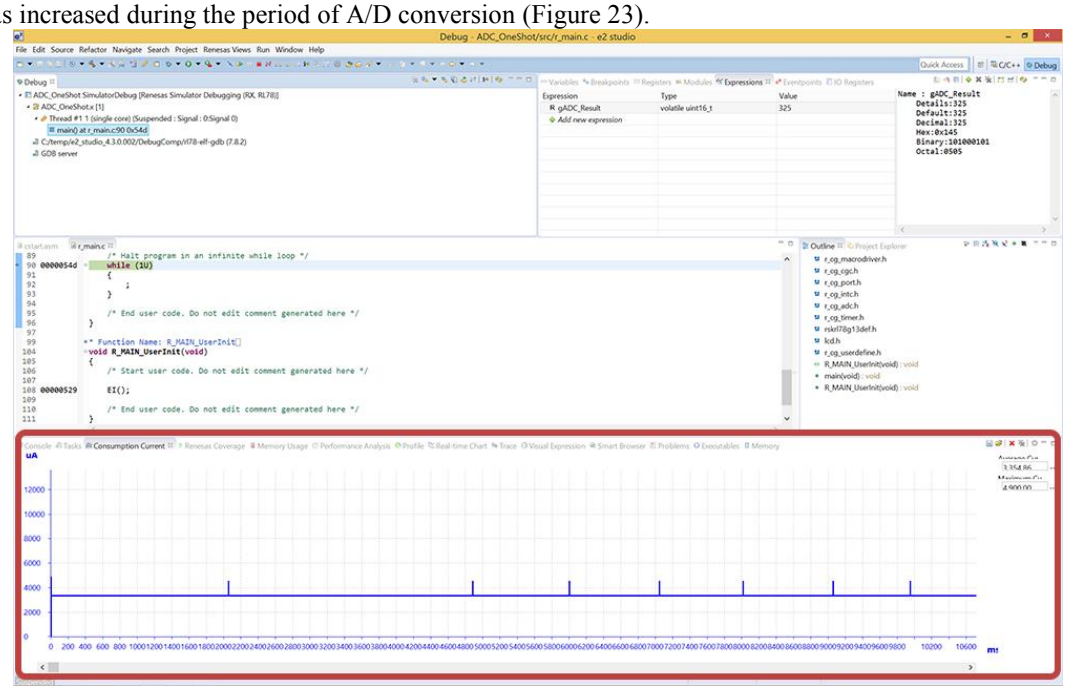

Figure 23 Result of [Consumption Current] view

(1) Enlarge or reduce graphs
Graphs can be enlarged or reduced by a right click in the [Consumption Current] view to indicate the menu (Figure 24).

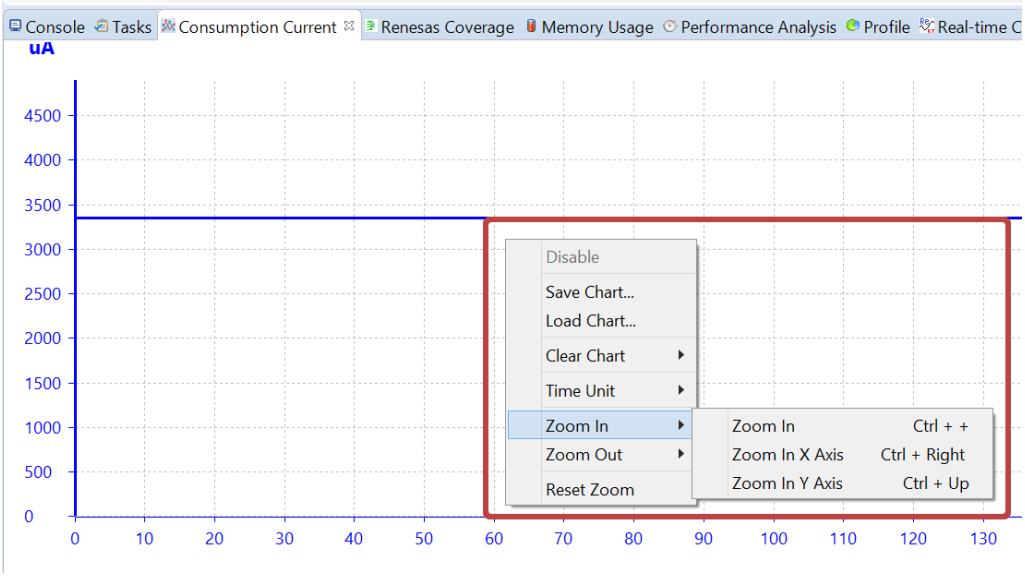

Figure 24 Enlarge or reduce of [Consumption Current] view

(2) To display detailed information
Drag mouse over the graph to indicate detailed information (Figure 25).

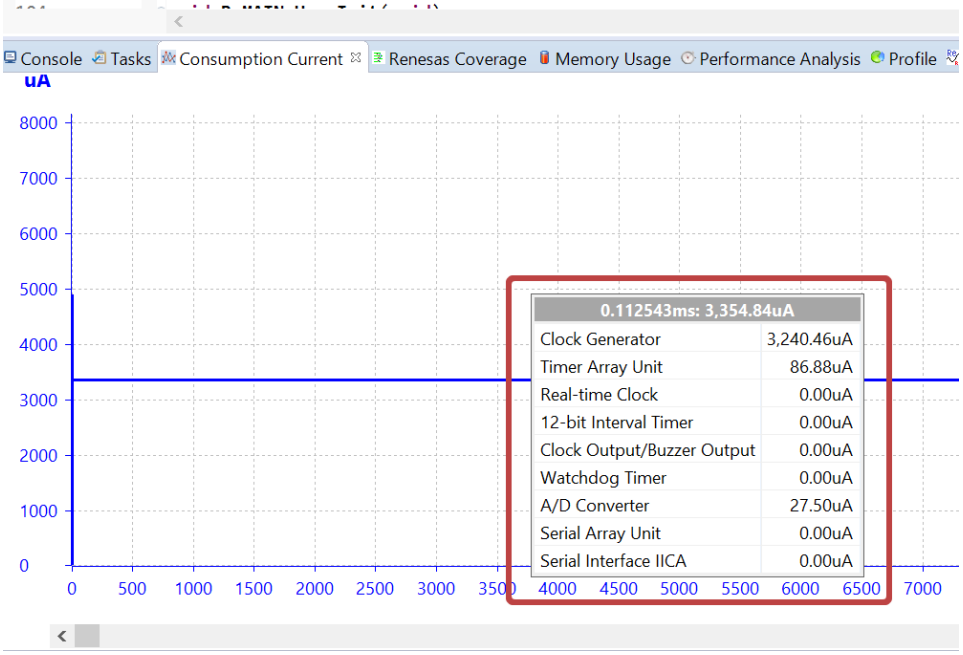

Figure 25 Detailed information of [Consumption Current] view

Website and Support

Renesas Electronics Website
http://www.renesas.com/

Inquiries
http://www.renesas.com/contact/

Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Feb 05, 2016	--	First edition issued.

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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HALII Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 5.0