# RL78/L1C

## Utilising the System Input Capture for e² studio

R01AN2309EG0100
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### Introduction

This sample code logs time, temperature and an ADC reading into non-volatile storage and allows data retrieval via the serial port to a terminal program.

### Target Device

RL78/L1C

### Development environment

IDE: e$^2$ studio
Compiler: GNURL78 v13.02 -ELF
Hardware: Renesas Starter Kit for RL78/L1C

### Contents

## 1. Installation

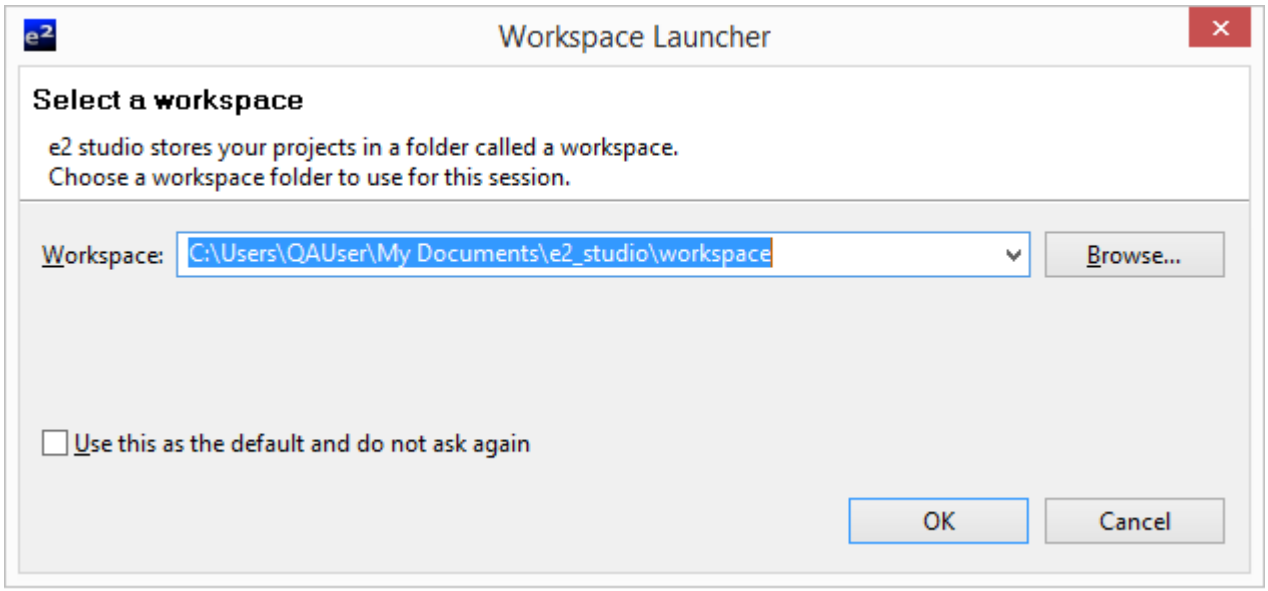
This section assumes e² studio IDE is already installed on the user's personal computer (PC). It is also assumed that the following software and versions are installed:

- Renesas e² studio Version 2.02.00.13 or later
- Application Leading Tool for RL78 Version 1.01.00.02
- GNURL78 Version 13.02-ELF

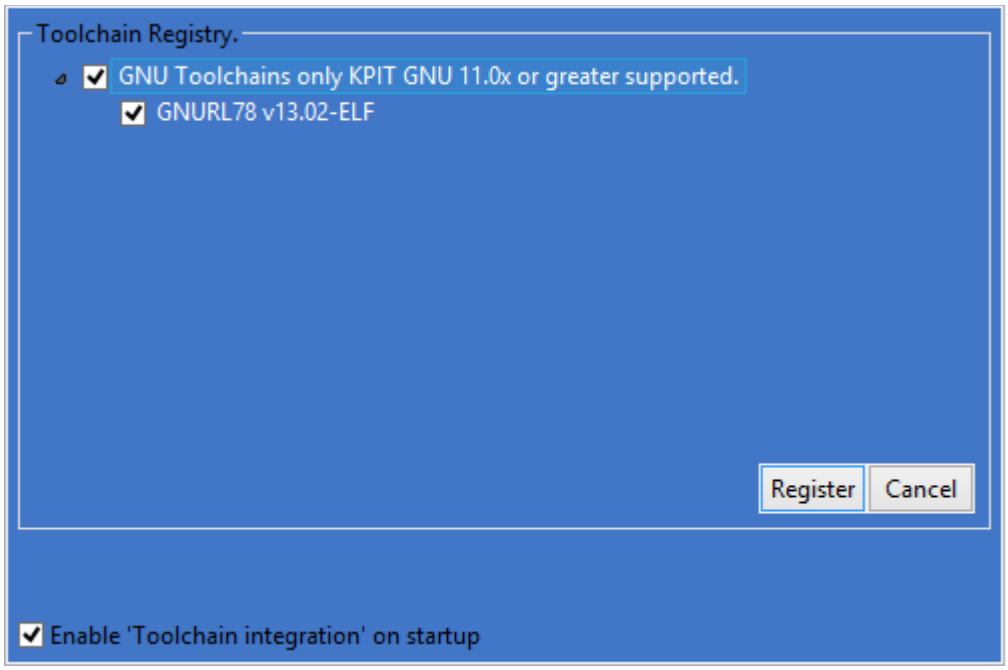
Create a new folder and name it as 'RSKRL78L1C_Workspace'. Copy the zipped file 'an_r01an2125eg0100_rl78l1c_system_input_capture.zip', available in the Application Note package downloaded from the website, to this folder. Extract the 'an_r01an2125eg0100_rl78l1c_system_input_capture.zip' file to the 'RSKRL78L1C_Workspace' folder.

## 2. Creating the Project Workspace

Open e² studio IDE by clicking the Windows Start button, select All Programs > Renesas Electronics e2 studio > Renesas e2 studio.

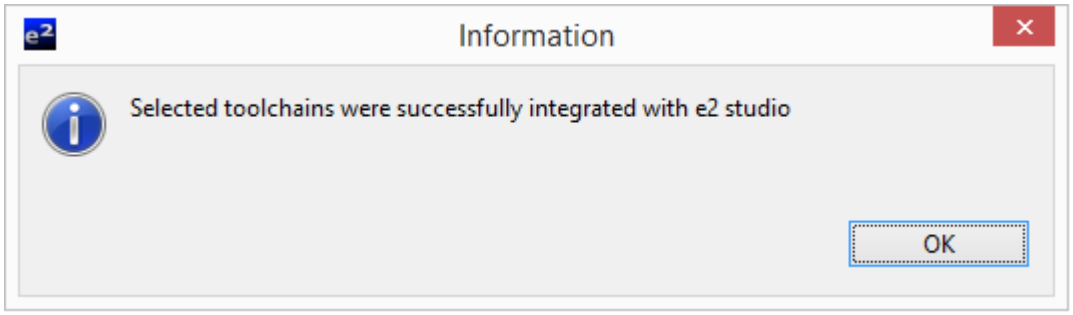


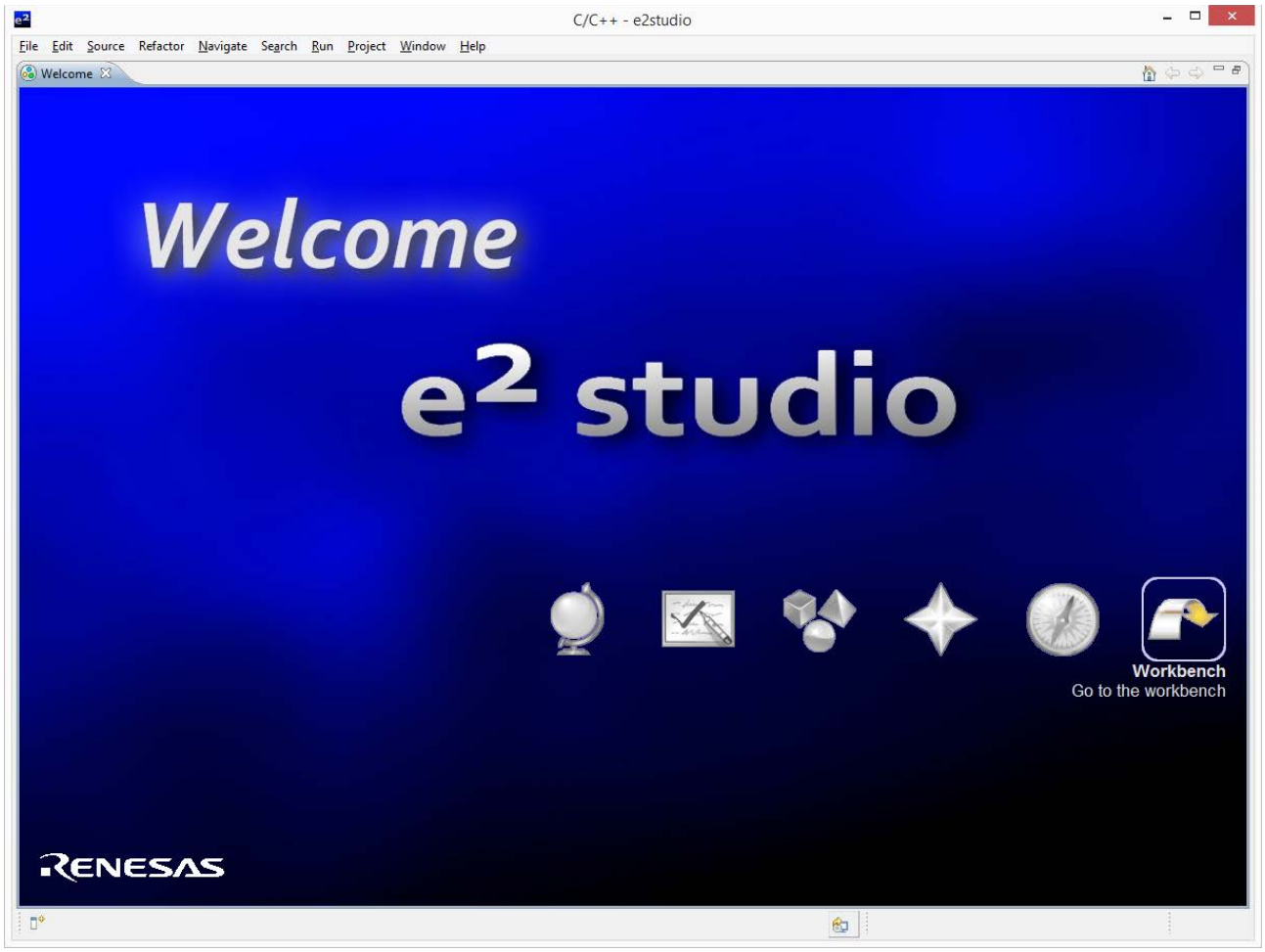

Select <OK>




Select ‘GNU Toolchains only…’ and ‘GNURL78 v13.02-ELF’ checkboxes. Click ‘Register’. A dialog will appear Click <OK>.

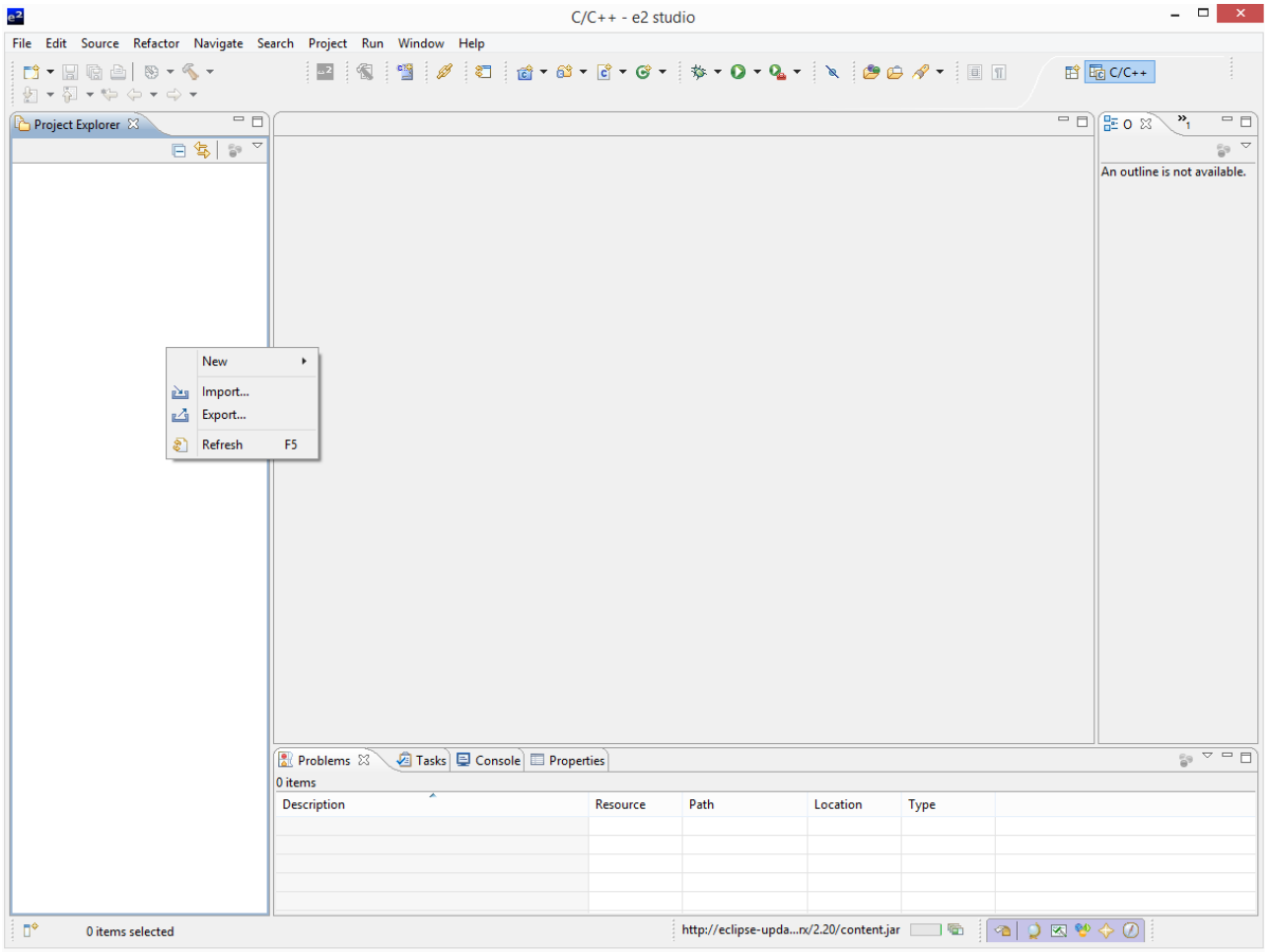
“Selected Toolchains were successfully integrated with e2studio”. Click <OK>.



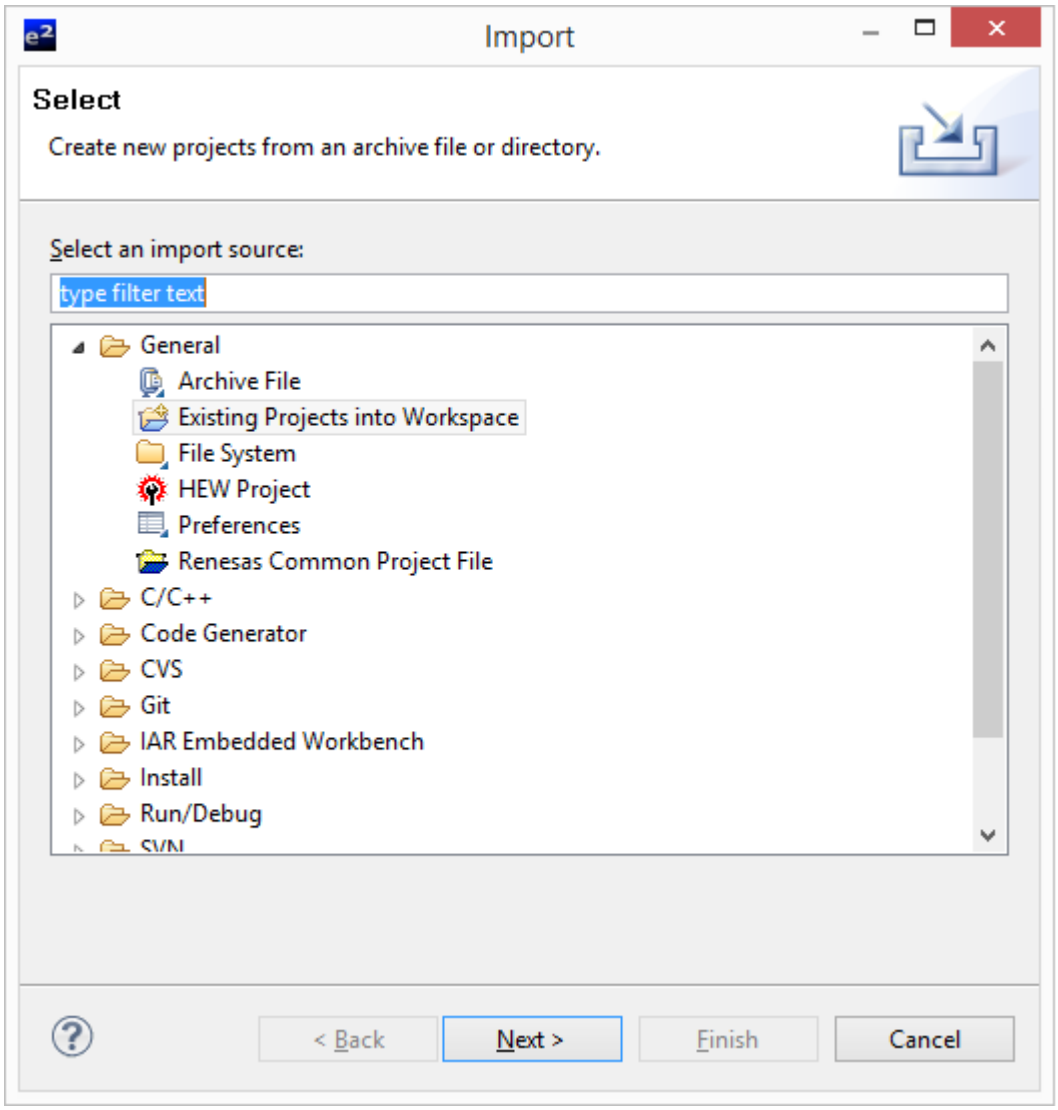

C/C++ - e2studio
File Edit Source Refactor Navigate Search Run Project Window Help
Welcome
Welcome
e² studio
Workbench
Go to the workbench
RENESAS

On the welcome screen, select ‘Go to the Workbench’ icon as shown above.

1. Once the e$^2$ studio environment has initialised, right click in the project explorer window and click <Import…>



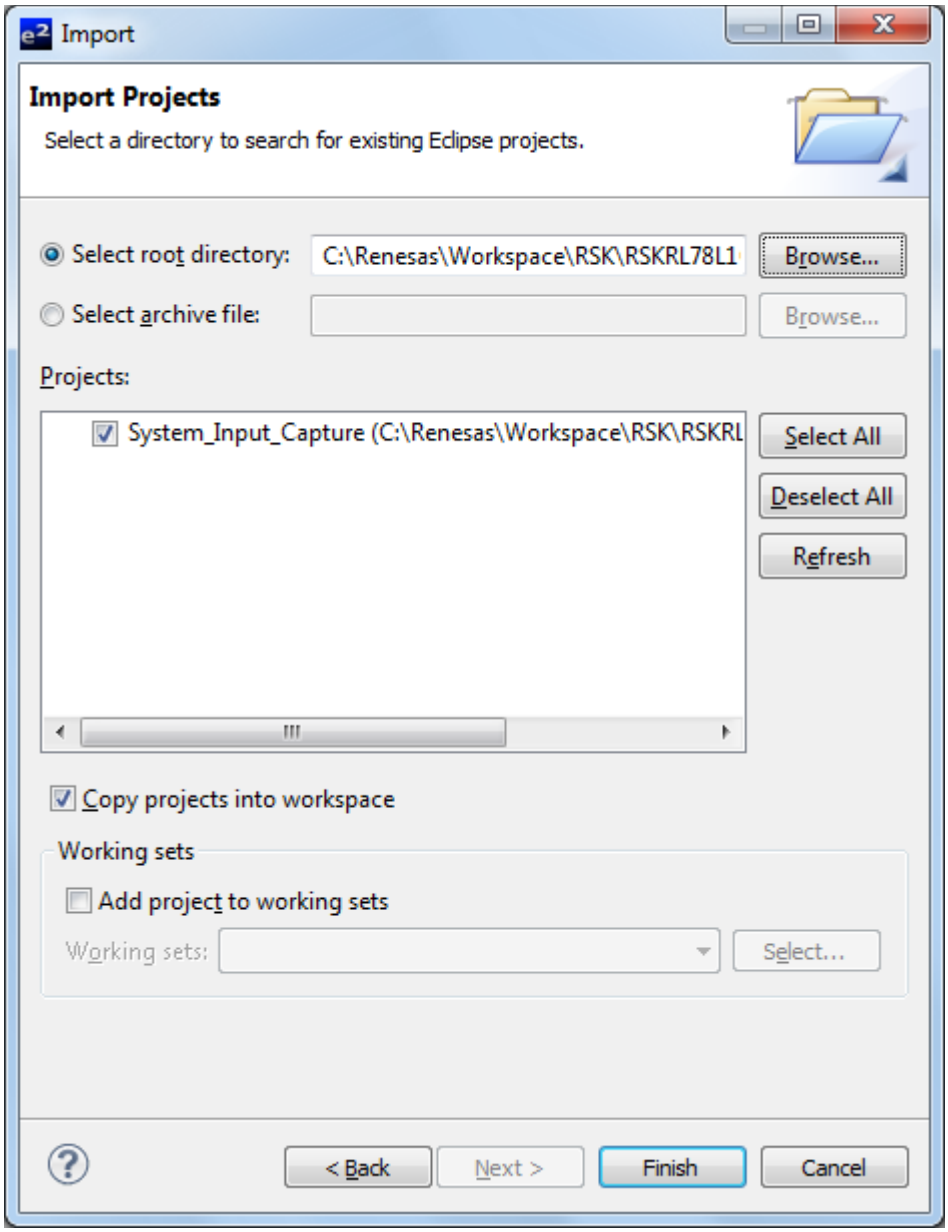
2. The Import dialog will now appear. Expand the “General” folder icon, and select “Existing Projects into Workspace”, then click ‘Next’.




3. The Import Dialog will now appear and specify the project to import. Click the “Browse” button and locate the directory created in section 1: ‘RSKRL78L1C_Workspace’.

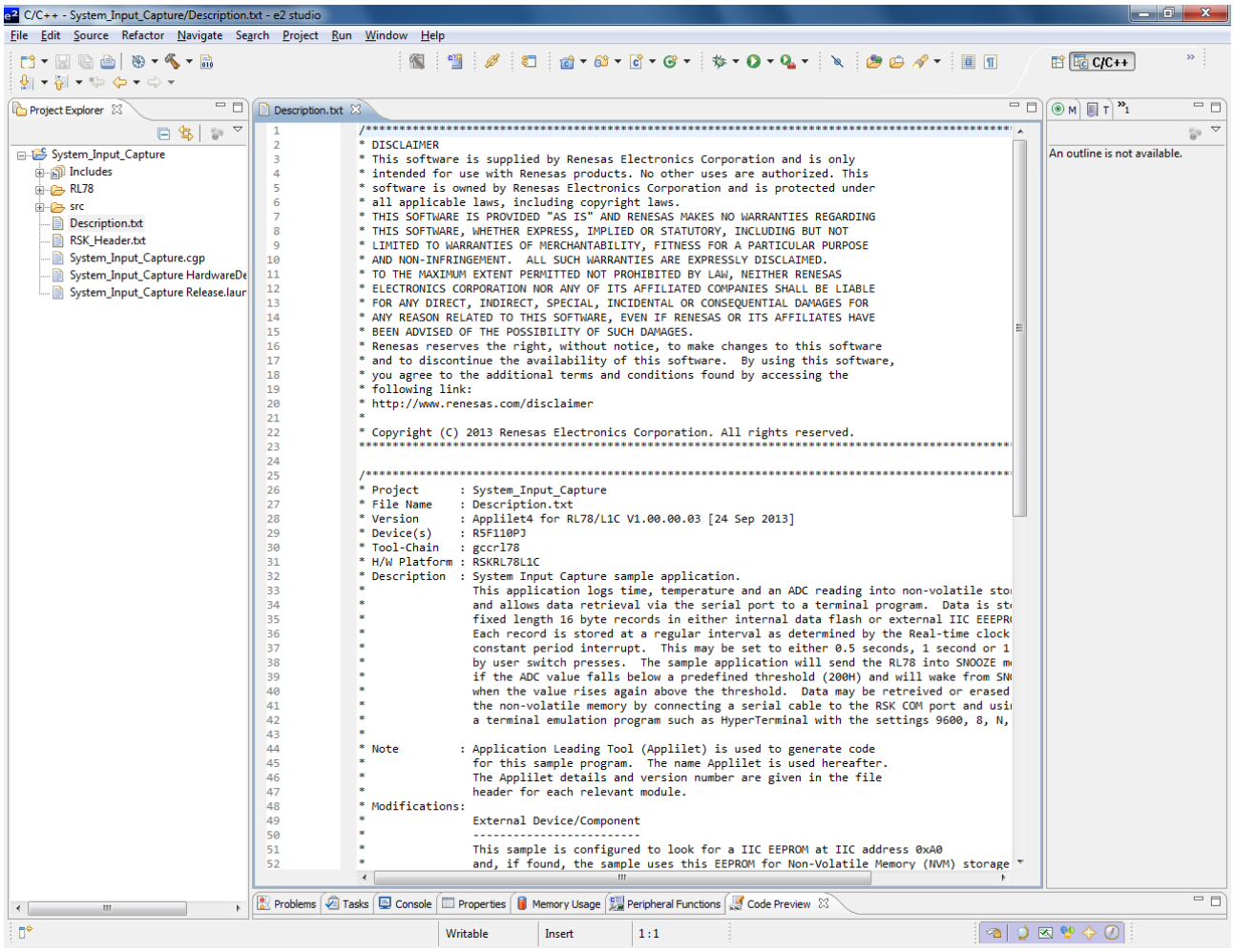
   Also ensure that the ‘Copy projects into workspace’ option is ticked, and then click <Finish>

   The IDE e$^2$ studio will load the project.


Import
Import Projects
Select a directory to search for existing Eclipse projects.
Select root directory:
C:\Renesas\Workspace\RSK\RSKRL78L1
Browse...
Select archive file:
Browse...
Projects:
System_Input_Capture (C:\Renesas\Workspace\RSK\RSKRL
Select All
Deselect All
Refresh
Copy projects into workspace
Working sets
Add project to working sets
Working sets:
Select...
< Back
Next >
Finish
Cancel

## 3. Opening Sample Code and Source

Once the project has been opened, the source code and all dependent files can be opened in the editor by expanding the folders in the Project Tree window and double clicking the files listed. All files have been grouped according to their file type.




## 4. Source Code Functionality

The source code project is specifically written to run on the appropriate RSK. However, this source code can be useful as an example even without the RSK.

The project was written using source files containing API functions generated using Code Generator. The project will contain a C source file ‘r_cg_main.c’. This source file includes the C function main(). All source files and dependent files whose filenames are prefixed with ‘r_cg_’ were generated using Applilet4 (Application Leading Tool). For more information, refer to Description.txt.

## 5. Flash Data Libraries

The sample code for the “System Input Capture” includes the RL78 Flash Data Library T04. This library is **NOT** to be used for production purposes. For more information and the latest updates, please refer to the following website:

Europe:
http://www.renesas.eu/products/tools/flash_prom_programming/flash_libraries/self_prg_lib/index.jsp

America:
http://am.renesas.com/products/tools/flash_prom_programming/flash_libraries/index.jsp

Japan:
http://www.renesas.com/products/tools/flash_prom_programming/flash_libraries/self_prg_lib/index.jsp

## 6. Appendix

Example of comment block with code functionality.

```
/***********************************************************************************************
* Project      : System_Input_Capture
* File Name    : Description.txt
* Version      : Applilet4 for RL78/L1C V1.00.00.03 [24 Sep 2013]
* Device(s)    : R5F110PJ
* Tool-Chain   : gccrl78
* H/W Platform : RSKRL78L1C
* Description  : System Input Capture sample application.
*              This application logs time, temperature and an ADC reading into non-volatile storage
*              and allows data retrieval via the serial port to a terminal program.  Data is stored in
*              fixed length 16 byte records in either internal data flash or external IIC EEEPROM.
*              Each record is stored at a regular interval as determined by the Real-time clock (RTC)
*              constant period interrupt.  This may be set to either 0.5 seconds, 1 second or 1 minute
*              by user switch presses.  The sample application will send the RL78 into SNOOZE mode
*              if the ADC value falls below a predefined threshold (200H) and will wake from SNOOZE
*              when the value rises again above the threshold.  Data may be retreived or erased from
*              the non-volatile memory by connecting a serial cable to the RSK COM port and using
*              a terminal emulation program such as HyperTerminal with the settings 9600, 8, N, 1.
*
* Note         : Application Leading Tool (Applilet) is used to generate code
*              for this sample program.  The name Applilet is used hereafter.
*              The Applilet details and version number are given in the file
*              header for each relevant module.
* Modifications:
*              External Device/Component
*              ------------------------
*              This sample is configured to look for a IIC EEPROM at IIC address 0xA0
*              and, if found, the sample uses this EEPROM for Non-Volatile Memory (NVM) storage.
*              If no EEPROM is found, the RL78 internal data flash is used for NVM.
*              This sample works with the Renesas R1EX24xxx series, 16Kbit EEPROM and
*              compatible devices. The EEPROM device should be in a circuit
*              recommended by the manufacturer to ensure it is operational.
*              The size of the EEPROM is defined in the file iic_eeprom.h and may be changed by editing
*              line 44:
*              #define IIC_EEPROM_SIZE_BYTES 2048
*
* Instructions :
```

```
*           1. Compile the sample code and download to the RSK. Ensure the potentiometer RV1 is turned fully
clockwise.
*             Click the 'Resume' button to start program execution. Click again if the program stops at main().
*
*           2. A real time clock will be displayed in the format:
*             HH:MM
*             The : will flash every second, the seconds will be displayed in the main display.
*             The clock is updated when the device is in normal operating mode.
*
*           3. The measured temperature and ADC value will be continually scrolled in the lower part
*             of the LCD panel.
*
*           4. A data log record is being stored in NVM every second.  Press SW1 to change this interval to 0.5
*             seconds, SW3 to change it to 1 minute and SW2 to change back to 1 second.
*
*           5. Turn the potentiometer gradually anti-clockwise.  When the ADC value falls below 200H the RL78 will
*             enter SNOOZE mode and data logging will be suspended.  In SNOOZE mode the MCU will take ADC
readings
*             at the current RTC constant period interrupt interval (0.5s, 1s or 1 min).  If the ADC reading rises
*             above 200H then the system will wake from SNOOZE and data logging will resume.
*             (It is also possible to wake the MCU from SNOOZE via a UART interrupt, however this may only be
achieved
*             in the RL78/L1C with UART0 and UART2.  Since this RSK is designed to use UART1 as the COM port,
wake from
*             UART interrupt is not supported with this RSK.)
*
*           6. Connect the terminal program via the SERIAL connector on the RSK using 9600, 8, N, 1.  Pressing 'R'
*             or 'r' in the terminal window results in all the data stored in NVM to be sent to the terminal in
*             a readable .csv format.  This data may copied from the terminal and saved to a .csv file for later
*             importing into Microsoft Excel or a similar spreadsheet application.
*
*           7. At some point, depending on the data logger interval and NVM medium used, the NVM storage will be
*             exhausted and 'FULL' will be displayed at the bottom of the LCD panel.  Pressing 'E' or 'e' in the terminal
*             window will perform a full erase of the NVM and data logging will immediately be resumed.
*
*
******************************************************************************************************/
```

## Website and Support

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

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

Support
http://www.renesas.com/rskrl78l1c

## Revision History

| | | Description | |
|---|---|---|---|
| **Rev.** | **Date** | **Page** | **Summary** |
| 1.0 | Sep 11, 2014 | - | First edition issued |

## General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU 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 an MPU or MCU 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.

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