RL78/G13

R01AN1527EG0100
Rev.1.00
Jun 7, 2013

Utilising the Low Power Snooze Mode (Using GNURL78 v13.01 Toolchain)

Introduction

The purpose of this Application Note is to show the user how to add the associated RL78G13 sample code to a new or existing e^{2}studio workspace; as well as give an explanation of what the sample code does.

The sample code demonstrates low power operating mode. The CPU and all peripherals are configured to run off the internal high speed oscillator. The CPU is placed in low power (snooze) mode by executing the STOP instruction which stops the internal high speed oscillator's oscillations. The CPU is woken up from snooze mode by an interrupt request from the interval timer; which in turn triggers an A/D conversion.

Target Device

RL78G13

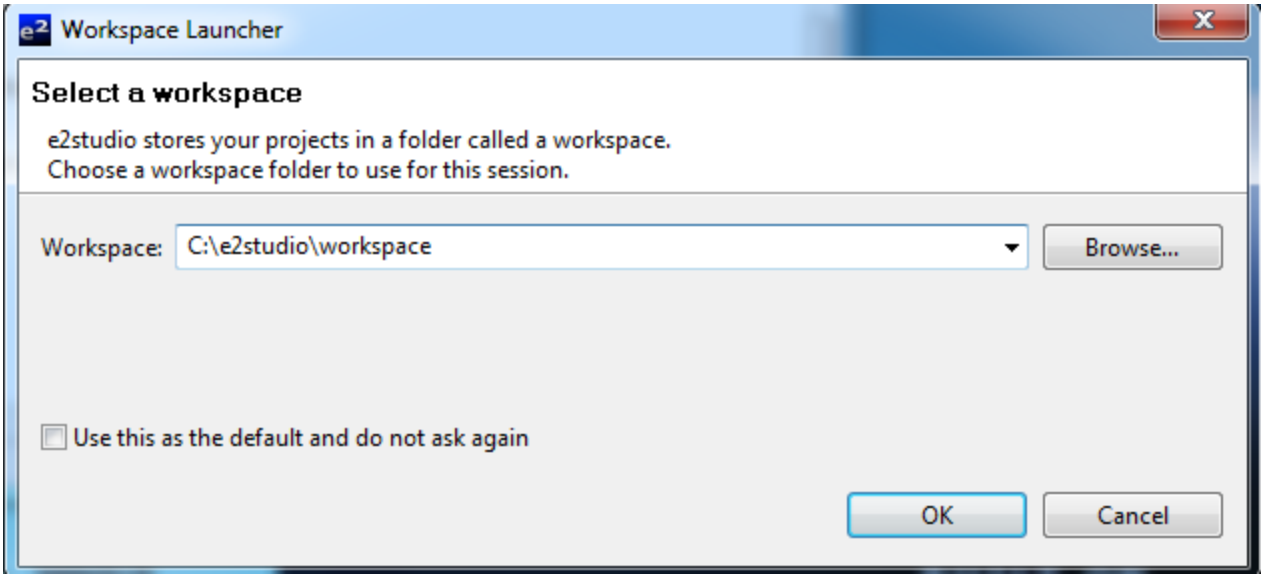
Contents

1. Installation

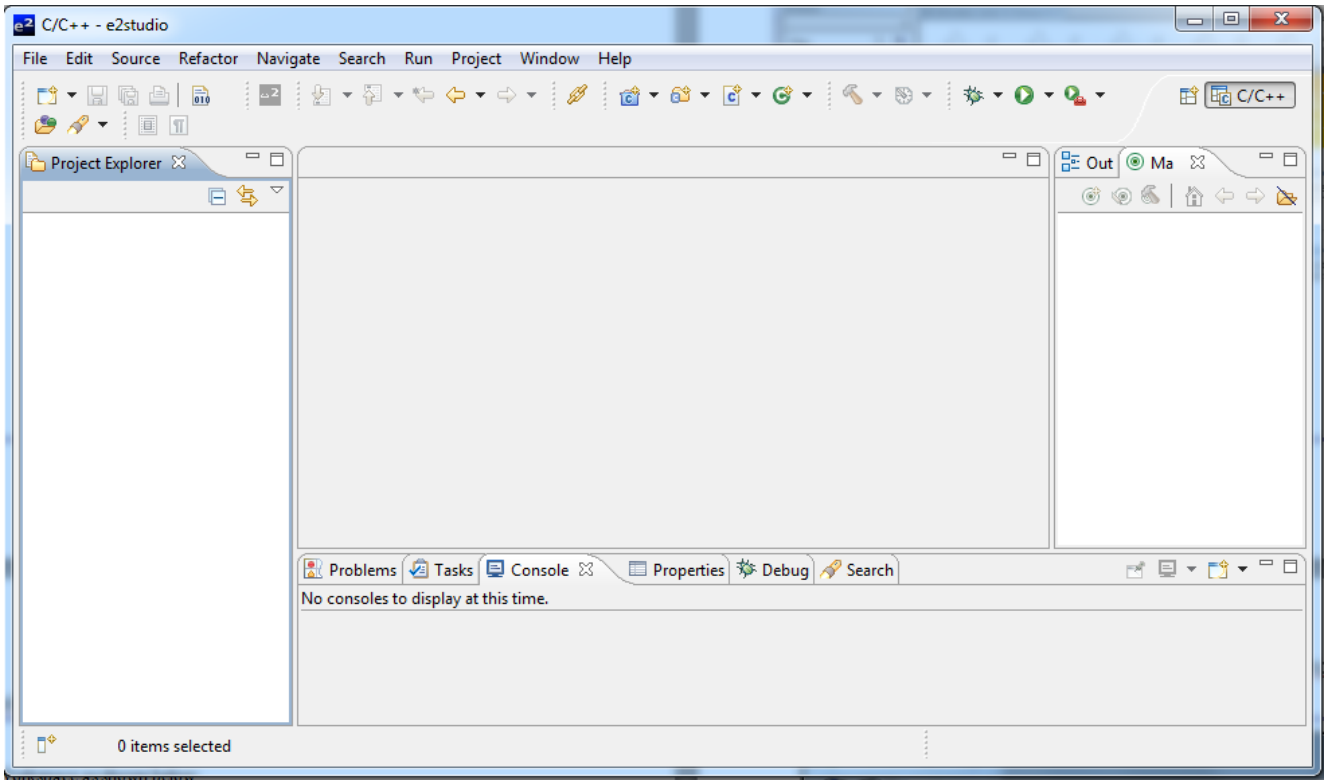
This section assumes e^{2}studio is already installed on the user's personal computer (PC). Create a new folder and name it as 'RSKRL78G13_Workspace'. Copy the zipped file ADC_Repeat.zip, available in the Application Note package downloaded from the website, to this folder. Extract the ADC_Repeat.zip file to the RSKRL78G13_Workspace folder.

2. Creating the Project Workspace

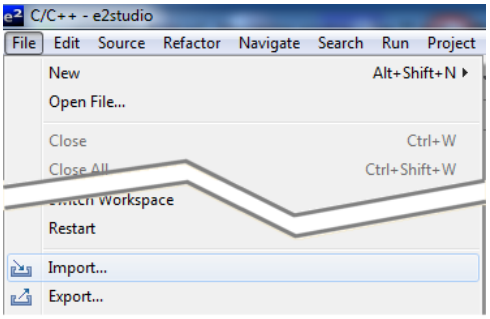
Run e^{2}studio by clicking the Windows Start button, select All Programs > Renesas Electronics e2studio > Renesas e2studio. Choose a workspace folder.



This will automatically open e^{2}studio IDE with an empty workspace.



To add the sample code select from the menu bar File > Import as shown:



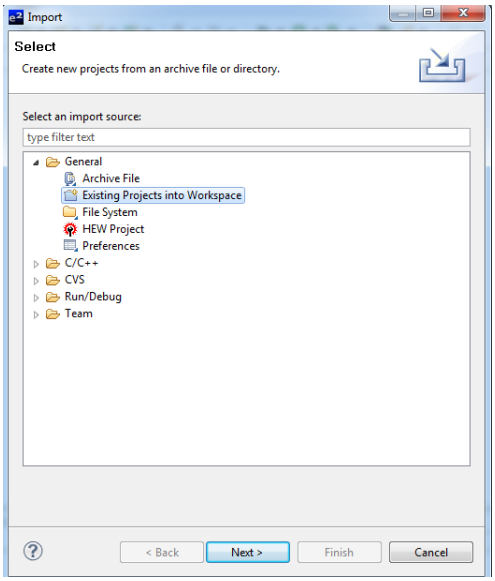
Choose ‘Existing Projects into Workspace’as shown:

Click Next >, a new window will appear. Navigate to the RSKRL78G13_Workspace folder and select the Snooze folder.

Make sure that ‘Copy projects into workspace’ is checked.

Single-click the project file to select it.

Click < Finish > to add the project to the workspace.



3. Opening Sample Code and Source Files

Once the project has been added, the source code and all dependant files can be opened in the editor by expanding the folders in the Project Explorer window and double clicking the files in the folders. Each source file listed in Workspace window in e^{2}studio can be expanded to reveal its dependant files ; as well as the output files.

In the Project Explorer sidebar, right-click on the project's name and select Build Configurations > Set Active > HardwareDebug. This ensures that the best debug experience will be made available when trying this sample.

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_main.c’. This source file includes the C function main(). All source files and dependant files whose filenames are prefixed with ‘r_’ were generated using Code Generator.

5. Code Execution

By default, the debug LCD is not used and should not be connected to the LCD header as it increases the current consumption. If the user wishes to use the LCD, open the r_cg_userdefine.h header file and uncomment the following line:

```
//#define USE_LCD
```

1. Remove R22 and connect an ammeter at J6. Make sure the ammeter is turned on and set for current sensing mode.

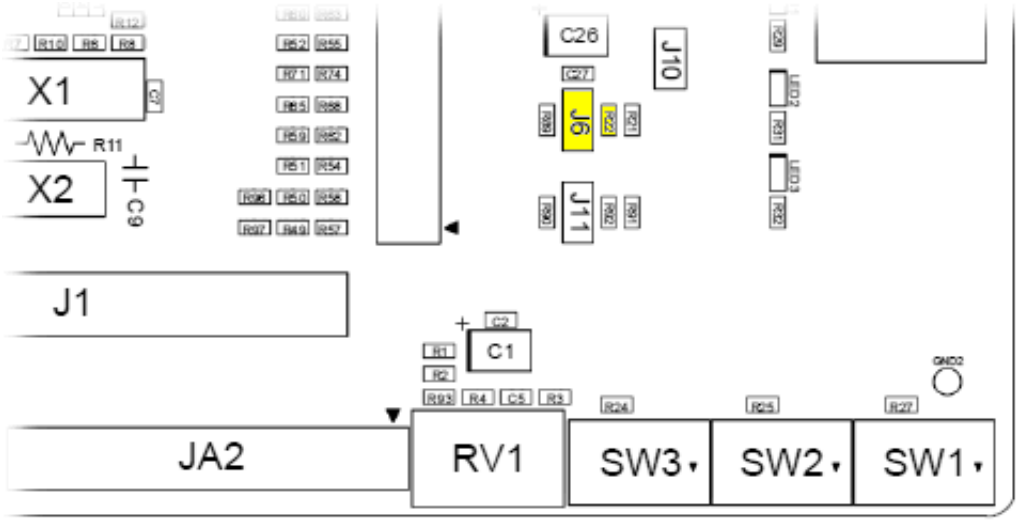


Figure 1 Location of J6 and R22

2. Compile the sample code by clicking on the 'Build Project' button on the debug toolbar. Click the 'Debug' button to switch to the debug perspective. Click 'Resume' button to start program execution. Click again if the program stops at main(). Instructions will be displayed on the LCD.
3. Press switch SW1 to do an A/D conversion based on the potentiometer's current position. LED0 will turn on indicating the normal mode of operation. Observe the result on the debug LCD. Adjust the potentiometer shaft, press SW1 and observe the new result. Make note of the current consumption.
4. Press SW2 to execute a STOP instruction and send the CPU into snooze mode. LED0 will turn off and LED1 will turn on to indicate snooze mode. The current consumption will decrease whilst in snooze mode.
5. Adjust the potentiometer shaft. Press SW3 to start the interval timer. The timer's interrupt signal wakes the CPU from snooze mode and triggers an A/D conversion. The result is displayed on the LCD. LED1 will turn off. The CPU returns to normal operating mode. The current consumption should be the same as the one noted in Step 3.
6. Go to Step 3 to repeat the demonstration.

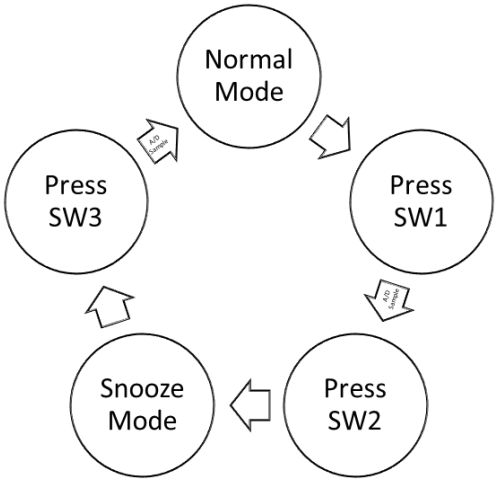


Figure 2 Mode transition diagram

6. Website, Inquiries and Support

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7. Revision Record

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Jun 7, 2013	—	Original document updated for e²studio IDE and GNURL78 v13.01 toolchain

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 manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

- Handle unused pins in accord 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. The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

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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 one with a different type number, confirm that

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