# RL78/G14

## Utilising Low Power Modes Sample Code for Cubesuite+

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## Introduction

The purpose of this Application Note is to show the user how to add the associated RL78/G14 sample code to a new or existing CubeSuite+ workspace; as well as give an explanation of what the sample code does.

The sample code runs on the RL78/G14 Renesas Starter Kit (RSK) and 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

RL78/G14

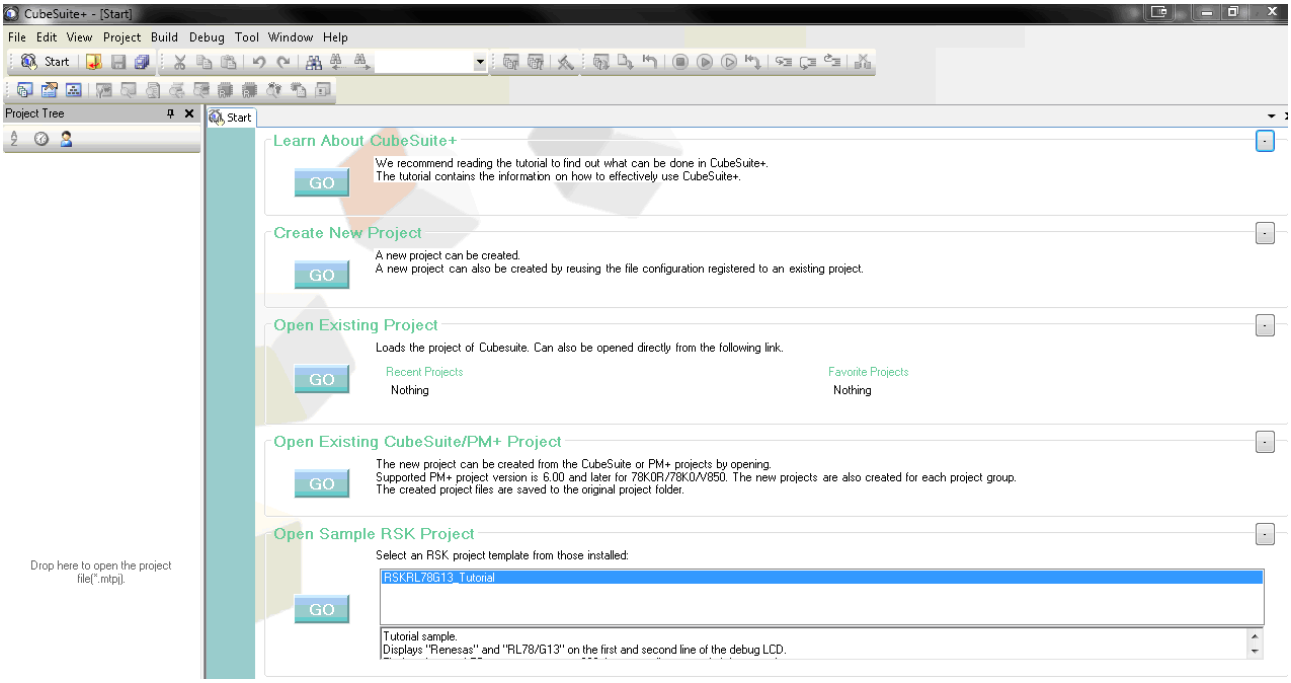
## Contents

## 1. Installation

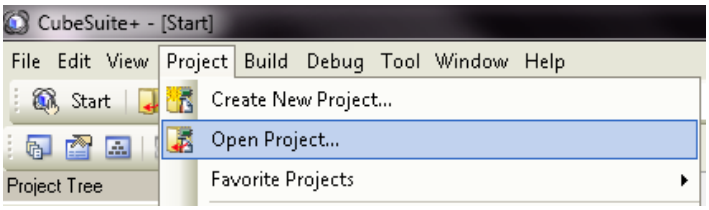
This section assumes CubeSuite+ IDE is already installed on the user's personal computer (PC). Create a new folder and name it as 'RSKRL78G14_Workspace'. Copy the zipped file Low_Power_Mode.zip, available in the Application Note package downloaded from the website, to this folder. Extract the Low_Power_Mode.zip file to the RSKRL78G14_Workspace folder.

## 2. Creating the Project Workspace

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



From the menu bar select File > Project > Open Project…

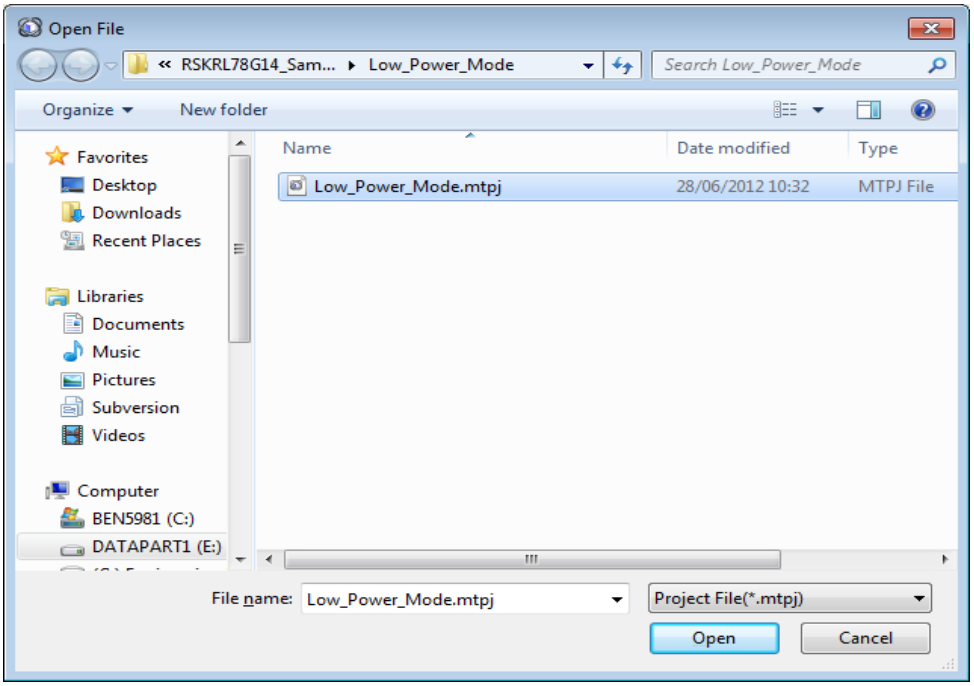



CubeSuite+ will open a dialog.

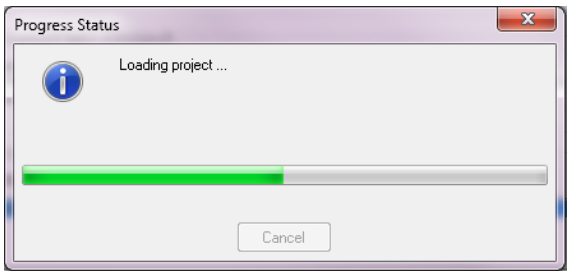
Navigate to the unzipped Low_Power_Mode folder located in RSKRL78G14_Workspace.

Select the Low_Power_Mode.mtpj file.

Click <Open>.

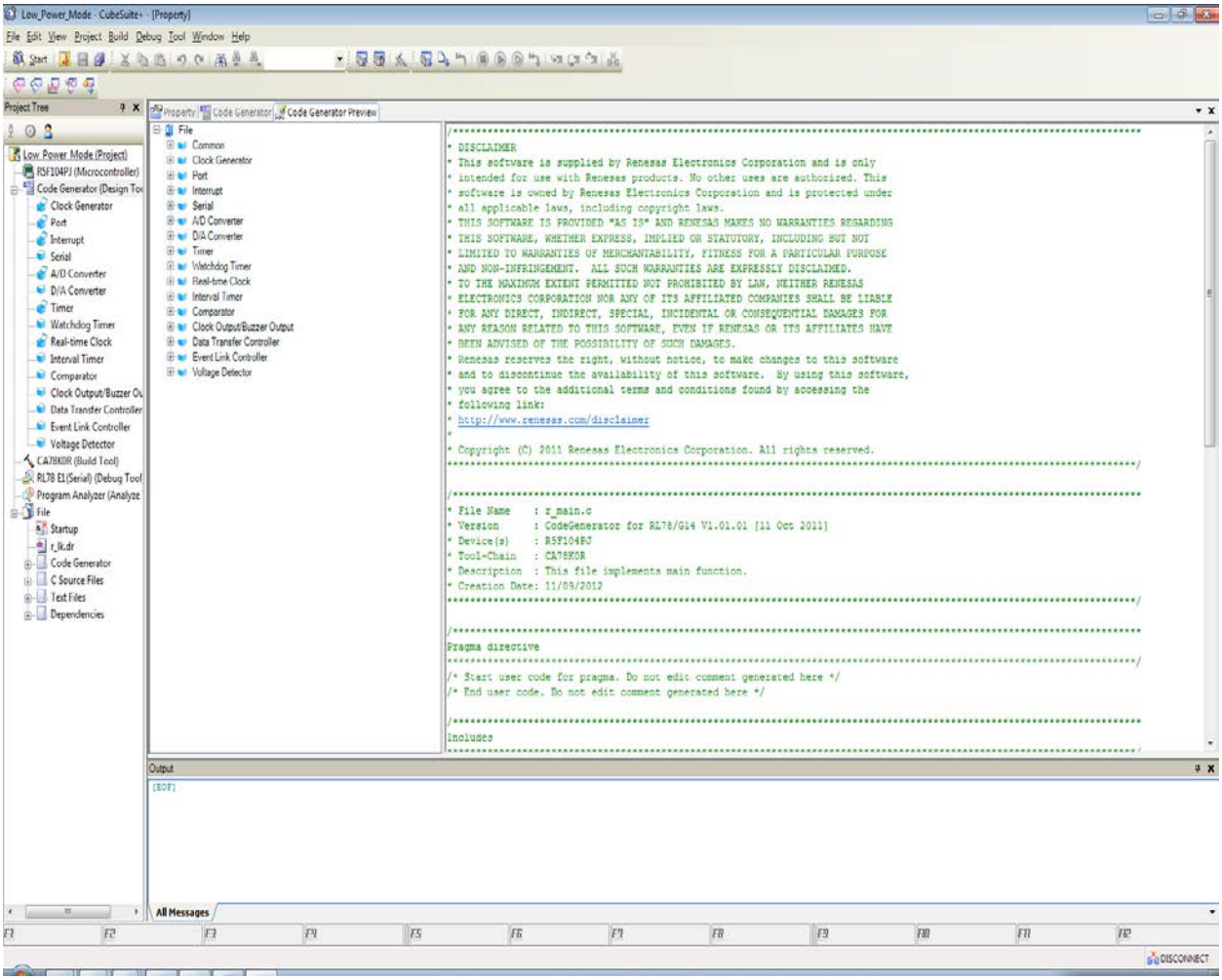



A Progress Status dialog will appear briefly whilst CubeSuite+ loads the project.



## 3. Opening Sample Code and Source Files

Once the project has been opened, the source code and all dependant 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_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

1. Remove R26 and connect an ammeter at J7. Make sure the

ammeter is turned on and set for current sensing mode.

2. Connect a 5.0V regulated power supply to the DC power jack.

3. Connect an E1, compile the sample code, and download to the RSK.

4. Disconnect from the debug tool by pressing 'Shift' and 'F6' keys together.

5. Switch off the power supply then disconnect the E1 from the RSKRL78G14 board.

6. Switch on the power supply.

7. The user LEDs will flash at regular intervals.

8. Press SW1 to send the device into Halt mode, reducing the power consumption without stopping clock supply to all peripherals. The user LEDs will be turned off. Press SW1 to

exit Halt mode and return to normal operation mode. The user LEDs will resume flashing.

9. Press SW2 to send the device into Stop mode. User LEDs will be turned off. Whilst in Stop mode, clock supply to the CPU and peripherals are turned off, reducing the current consumption considerably. Press SW2 to wake the device and return to normal operation mode. The user LEDs will resume flashing.

10. Ensure the potentiometer shaft is turned fully anti-clockwise.

Press SW3 to send the device into Stop mode. The user LEDs will stop flashing. Slowly turn the shaft clockwise until the user LEDs resume flashing, indicating the device has exited the Snooze mode.

11. Go to Step 8 to repeat the demonstration.

Note: This sample project does not use the main crystal oscillator.

In order to obtain the lowest current measurements in the STOP

standby mode, it is highly recommended to connect the crystal's

pins 1 and 2, then pulling them down to ground using a 10K Ohms

resistor.

## 6. Website, Inquiries and Support

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## Revision Record

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Oct 12, 2012 | — | 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 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.
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 the change will not lead to problems.
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