RL78/G13

Utilising the Timer Array Unit (TAU) Sample Code

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Introduction

The purpose of this Application Note is to show the user how to add the associated RL78/G13 sample code to a new or existing CubeSuite+ workspace; as well as give an explanation of what the sample code does.

The sample code provided with this Application Note runs on the RL78/G13 RSK and demonstrates usage of the Timer Array Unit (TAU) in various application modes; PWM mode, square wave output, interval timer and event counter.

Target Device

RL78/G13

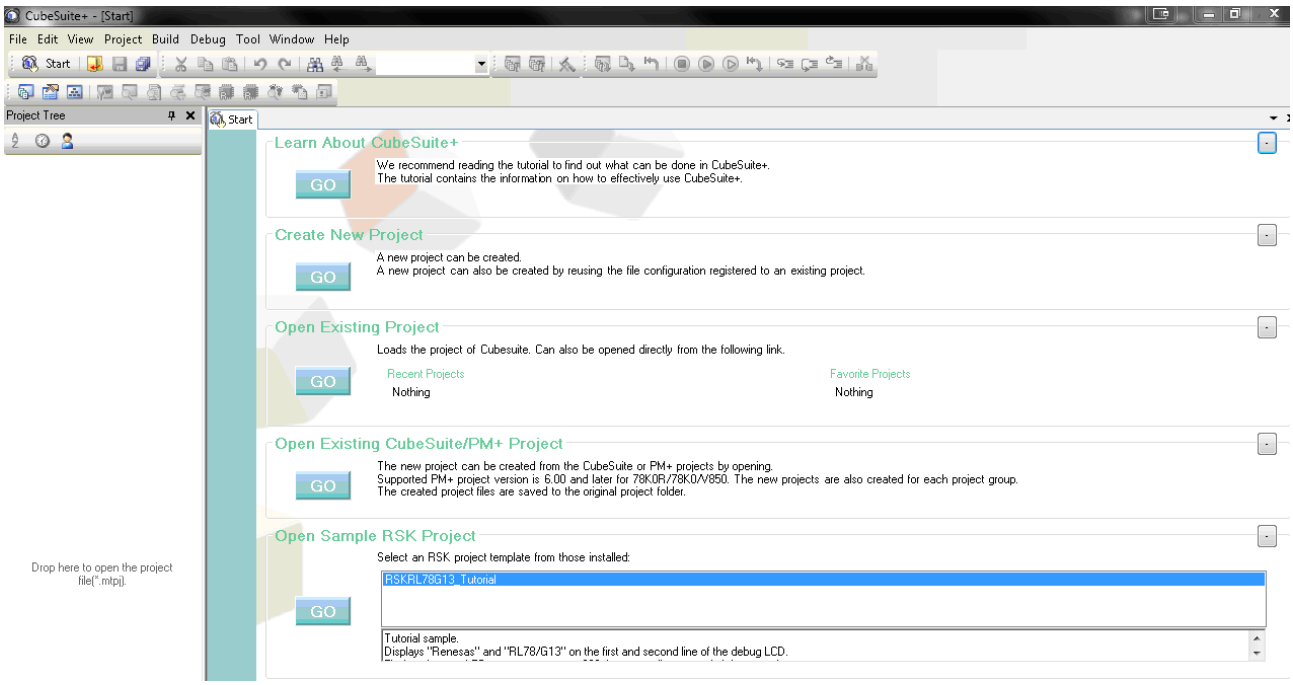
Contents

1. Installation

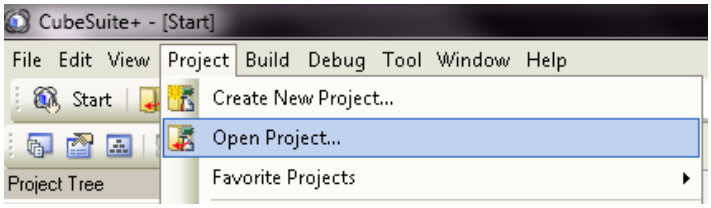
This section assumes CubeSuite+ IDE is already installed on the user's personal computer (PC). Create a new folder and name it as 'RSKRL78G13_Workspace'. Copy the zipped file Timer.zip, available in the Application Note package downloaded from the website, to this folder. Extract the Timer.zip file to the RSKRL78G13_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…

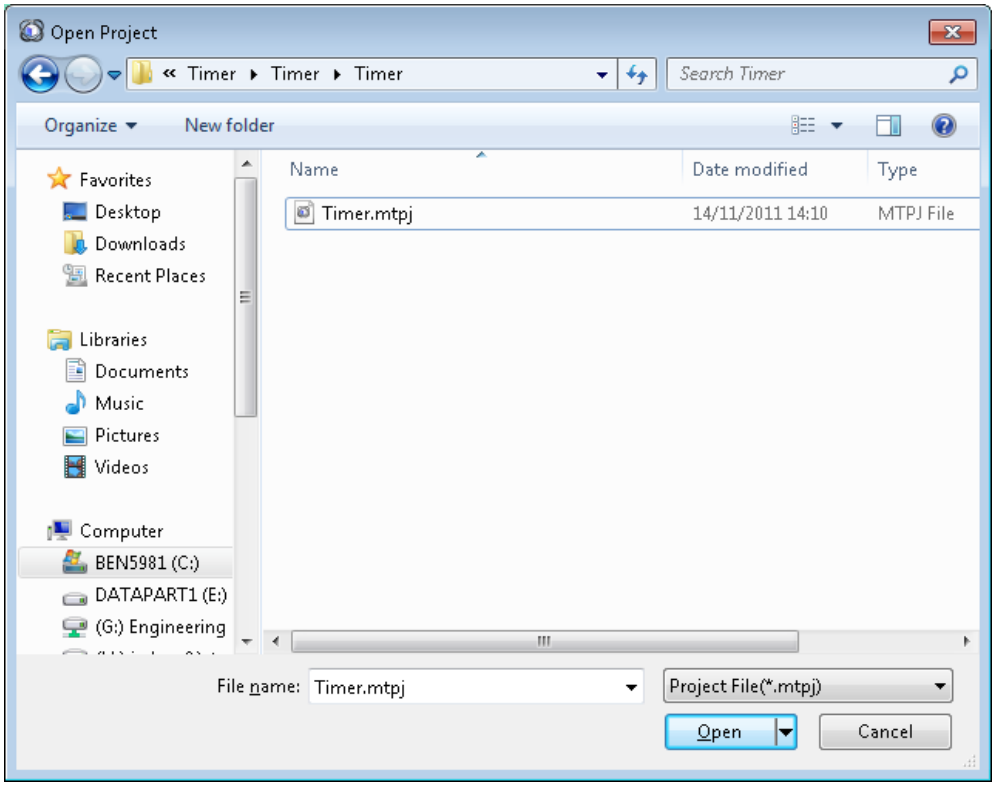


CubeSuite+ will open a dialog.

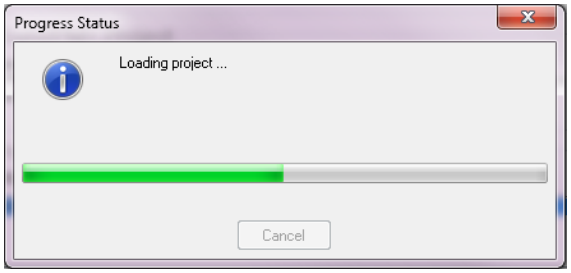
Navigate to the unzipped Timer folder located in RSKRL78G13_Workspace.

Select the Timer.mtpj file.

Click <Open>.

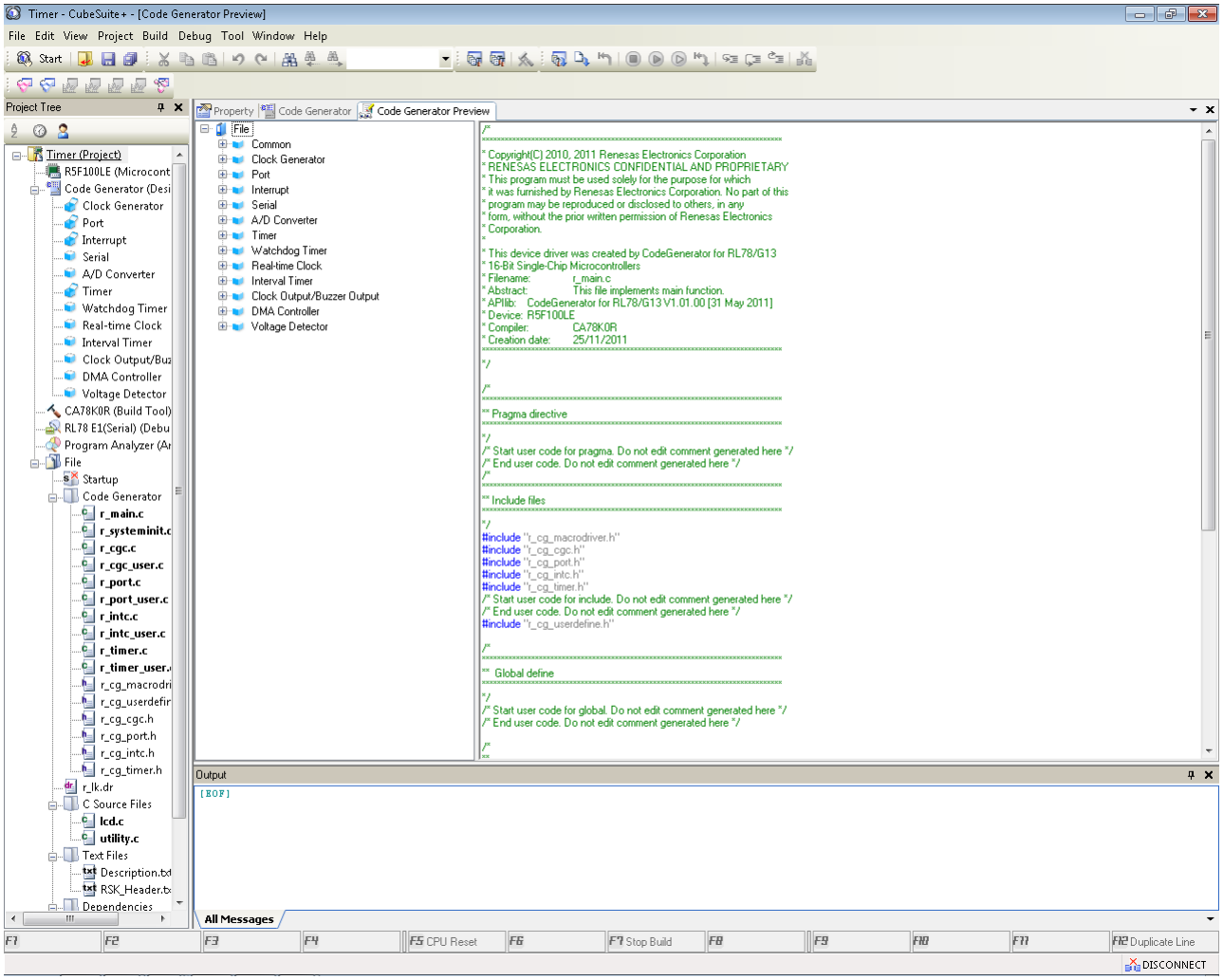


A Progress Status dialog will appear briefly whilst CubeSuite+ loads the project.



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

Only one application can be executed at a time after each code build and download. A list of application modes can be found in the r_cg_userdefine.h header file. An application can be selected by specifying a value for the macro "#define __Current_TMR_APP" that matches the value defined next to each macro definition in the applications list. The list of applications include:

```
/* List of timer applications */
#define __TMR_PWM            1
#define __TMR_SqOut          2
#define __TMR_Interval       3
#define __TMR_EventCount     4
/* Change definition value to that of the desired timer application */
#define __Current_TMR_APP    1
```

The PWM application is configured as the default project.

1. Select the desired application to be executed.

2. Compile the sample code, and download to the RSK by clicking on the 'Build and Download' button on the debug toolbar. Click the 'Go' button to start the program execution.

- The PWM application outputs a 1KHz squarewave whose duty cycle is varied from 0% to 90%. The duty cycle variation can be stopped by pressing switch SW2. Pressing SW2 results in the display of the duty cycle being shown on the debug LCD as a percentage. The duty cycle variation can be restarted by pressing SW1; which also clears the displayed duty cycle percentage. Connect an oscilloscope to JA5-9 to observe the PWM waveform.

- The Squarewave Output application outputs a 1 KHz squarewave with 50% duty cycle. Connect an oscilloscope to JA2-20 to observe the waveform.

- The Interval Measurement application measures the interval between pressing and releasing switch SW1. The interval is displayed on the debug LCD as long as it is less than 10 seconds. If the interval exceeds 10 secs, the debug LCD displays " > 10s". Further measurements can be made, simply by pressing and releasing SW1.

- The Event Count application configures a timer channel to be clocked from an external falling edge signal. The falling edge signal of switch SW3 is used as the clock signal which is also the event.

6. Website, Inquiries and Support

Renesas Electronics Website
http://www.renesas.com/
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http://www.renesas.com/inquiry
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7. Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Nov 23, 2011	—	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.
   — The characteristics of MPU/MCU in the same group but having different type numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different type numbers, implement a system-evaluation test for each of the products.

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