

# RL78/L12

R01AN1596EG0100

Rev.1.00

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## Utilising Timer PWM for e2studio

### Introduction

The purpose of this Application Note is to show the user how to add the associated RL78/L12 sample code to a new or existing e2studio workspace; as well as give an explanation of what the sample code does.

The sample code demonstrates usage of the Timer Array Unit 0 (TAU0) to output a 1 KHz square wave whose duty cycle is varied between 10% and 90%.

### Target Device

RL78/L12

### Development environment

IDE: e2studio

Compiler: GNURL78 v12.02 -ELF

Hardware: Renesas Starter Kit for RL78/L12

### Contents

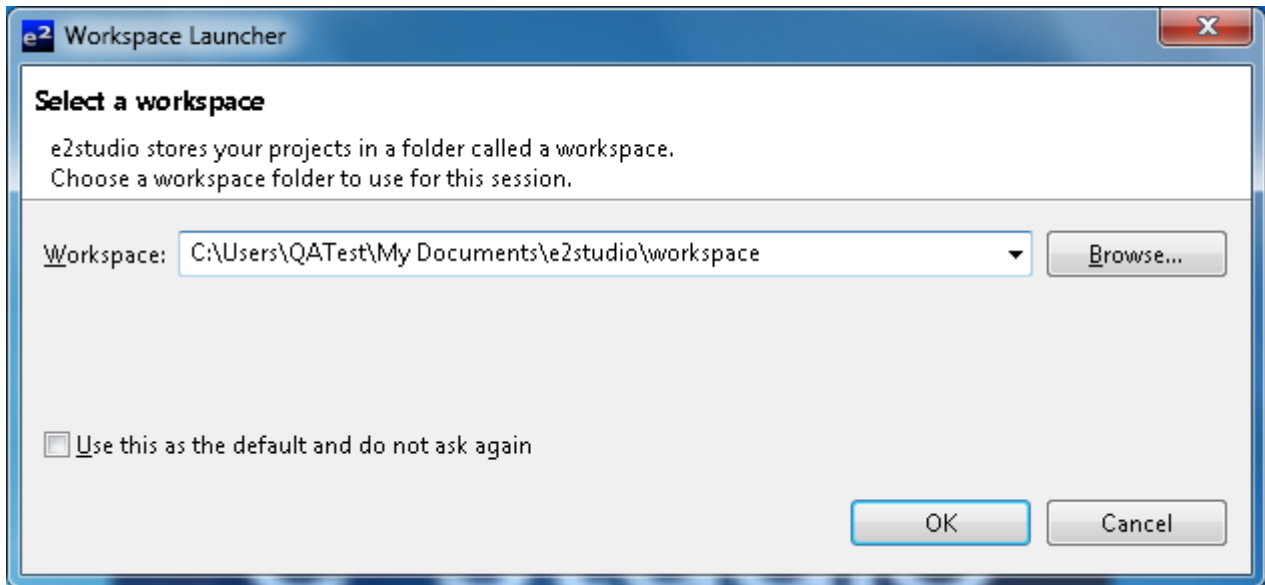
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## 1. Installation

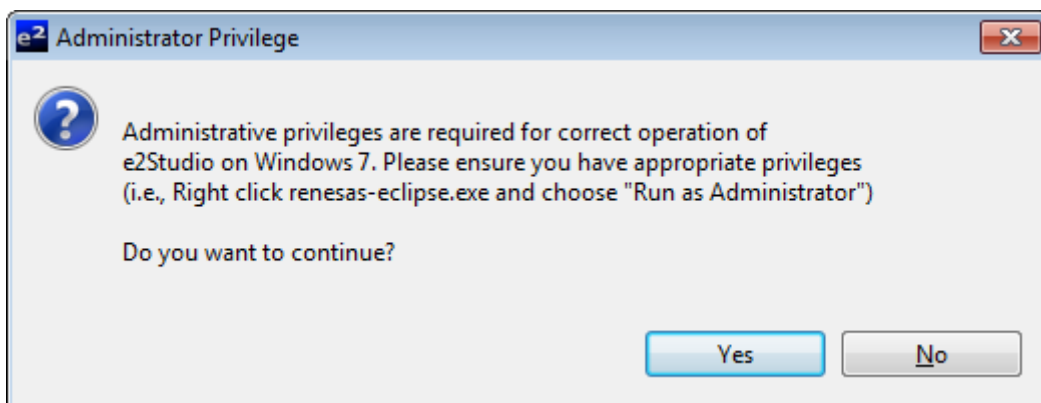
This section assumes e2studio IDE is already installed on the user's personal computer (PC). Create a new folder and name it as 'RSKRL78L12\_Workspace'. Copy the zipped file 'an\_r01an1596eg0100\_rl78l12\_pwm.zip', available in the Application Note package downloaded from the website, to this folder. Extract the 'an\_r01an1596eg0100\_rl78l12\_pwm.zip' file to the RSKRL78L12\_Workspace folder.

## 2. Creating the Project Workspace

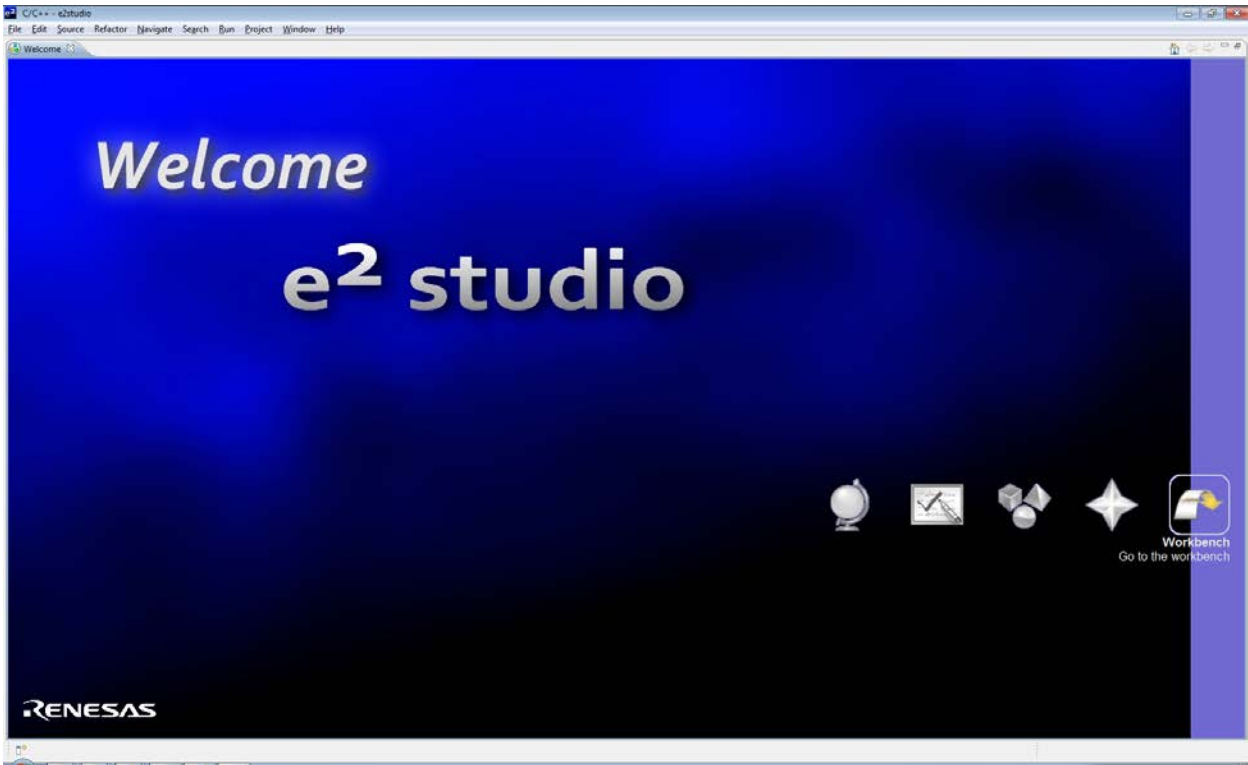
Open e2studio IDE by clicking the Windows Start button, select All Programs > Renesas Electronics e2studio > Renesas e2studio.



Select <OK>.

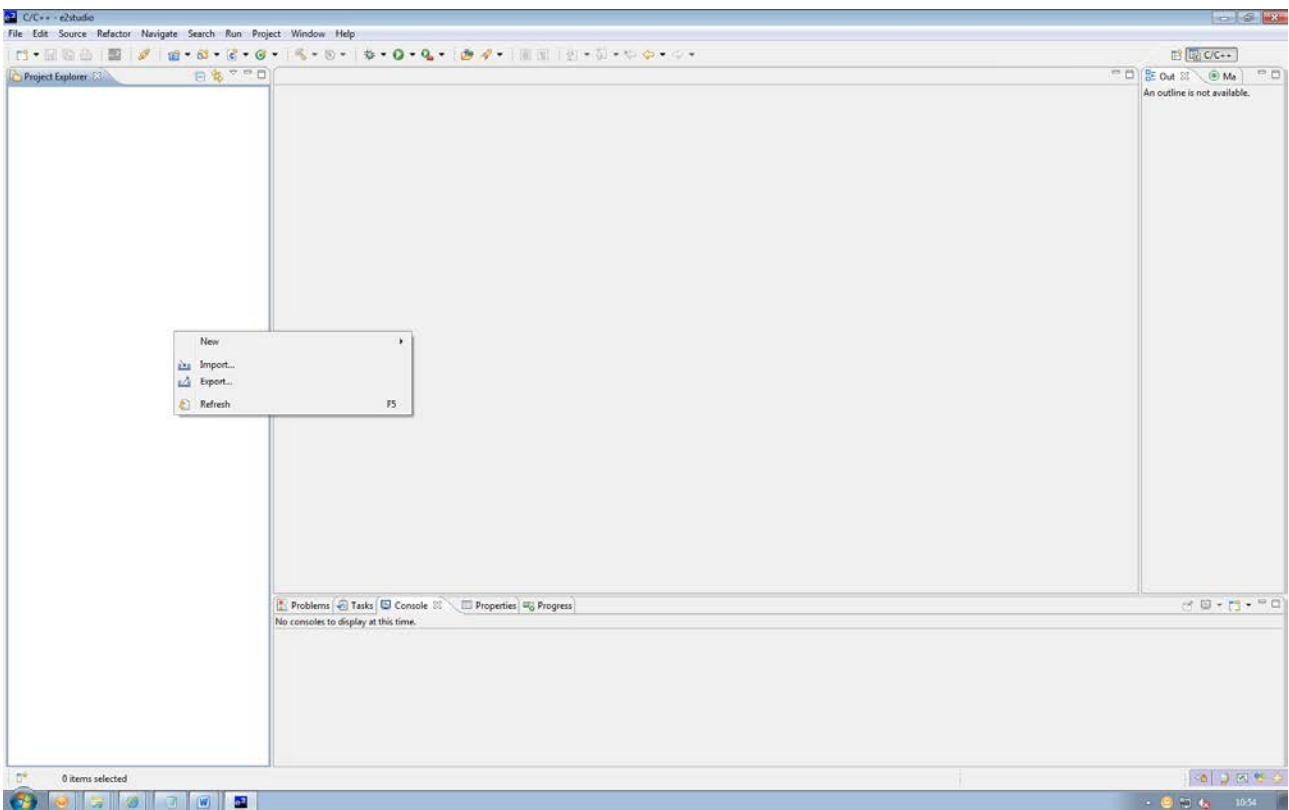


Select <Yes> to Administrator Privilege dialog.

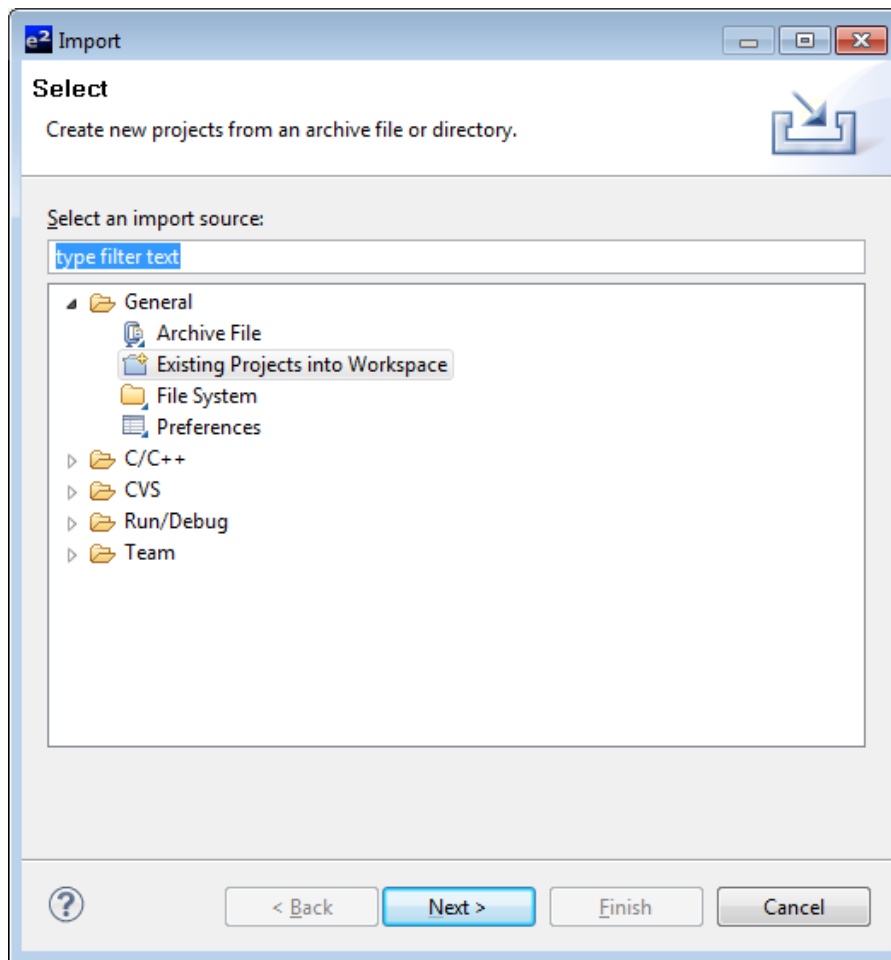


On the welcome screen select 'Go to the Workbench' icon as shown above.

1. Once the e2studio environment has initialised, right click in the project explorer window and click <Import...>



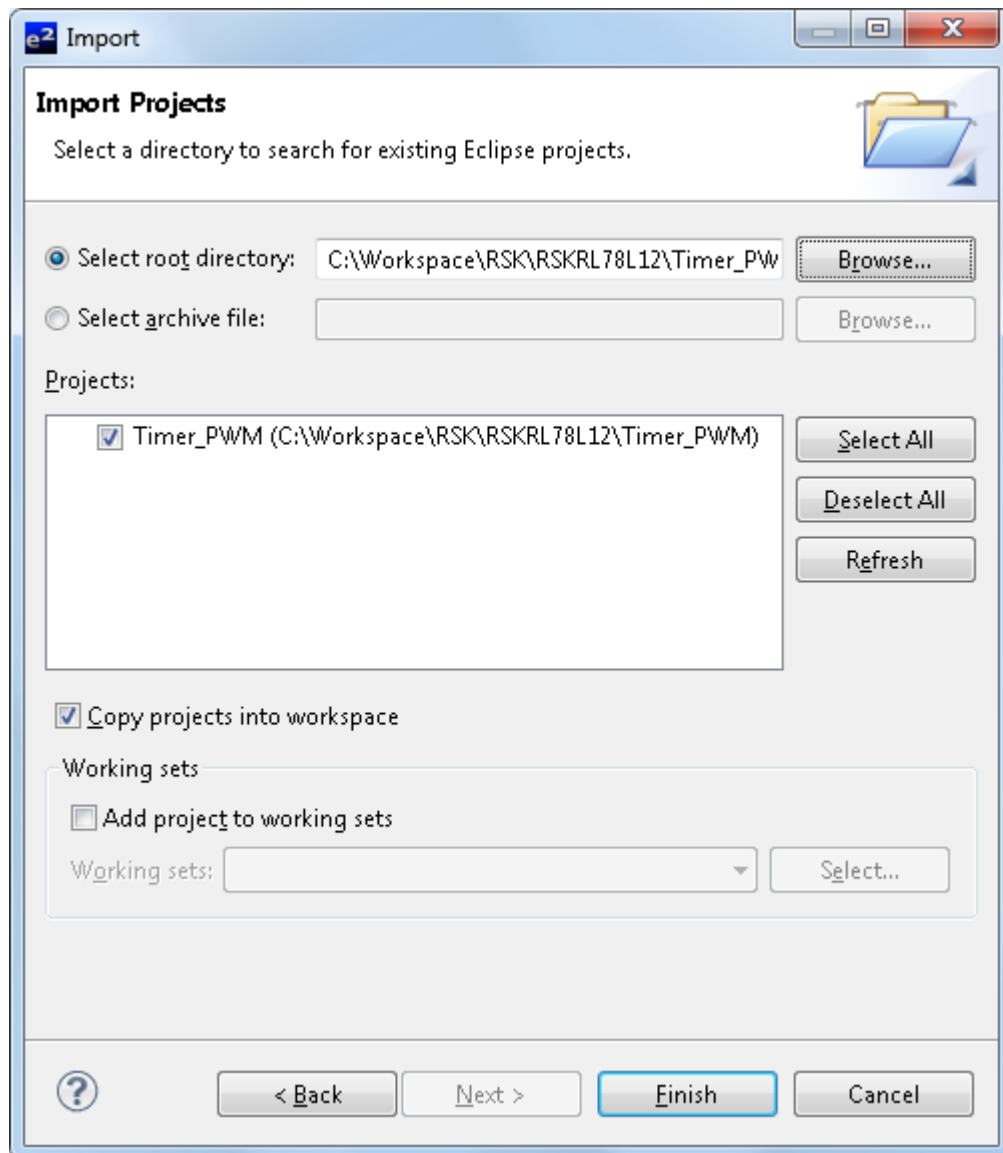
2. The Import dialog will now appear. Expand the “General” folder icon, and select “Existing Projects into Workspace”, then click ‘Next’.



3. The Import Dialog will now appear and specify the project to import. Click the “Browse” button and locate the directory: C:\Workspace\RSK\RSKRL78L12.

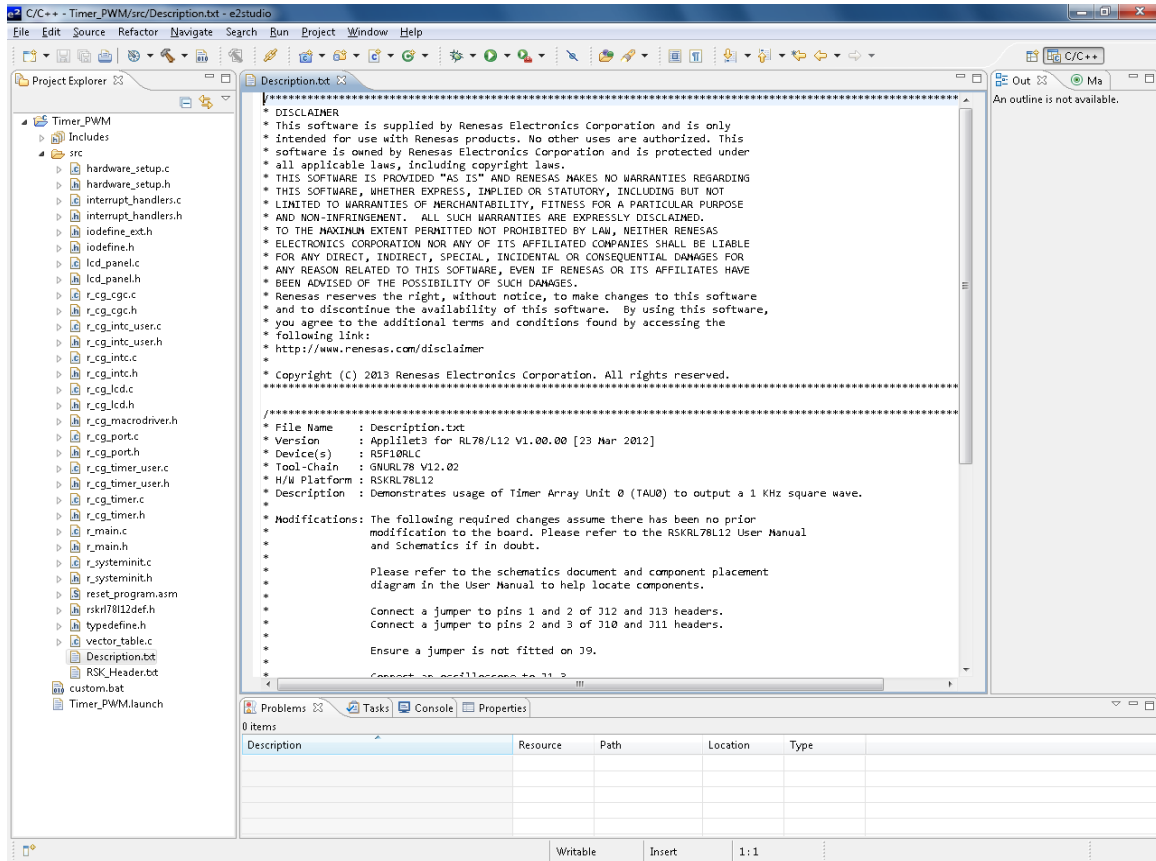
Navigate to the unzipped Timer\_PWM folder located in RSKRL78L12 Workspace folder.  
Select the Timer\_PWM folder.

And also ensure that the ‘Copy projects into workspace’ option is ticked, and then click <Finish>  
The IDE e2studio will load 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 dependent files whose filenames are prefixed with 'r\_' were generated using Application Leading Tool. For more information, refer to Description.txt.

## 5. Code Execution

The sample code demonstrates usage of the Timer Array Unit 0 (TAU0) to output a 1 KHz square wave whose duty cycle is varied between 10% and 90%.

### Modifications:

The following required changes assume there has been no prior modification to the board. Please refer to the RSKRL78L12 User Manual and Schematics if in doubt.

Please refer to the schematics document and component placement diagram in the User Manual to help locate components.

Connect a jumper to pins 1 and 2 of J12 and J13 headers.

Connect a jumper to pins 2 and 3 of J10 and J11 headers.

Ensure a jumper is not Fitted on J9.

Connect an oscilloscope to J1-3.

Note: It is recommended to connect one end of a wire to J1-3 and connect the other end to the oscilloscope probe.

Fit the LCD panel.

### Instructions:

1. Compile the sample code, and download to the RSK. Click the 'Resume' button to start program execution. Click again if the program stops at main().

2. Click the 'Restart' button to start program execution.

3 This application outputs a 1 KHz square wave signal whose duty cycle is varied between 10% to 90%. The duty cycle variation can be stopped and restarted by pressing switch SW1.

Note: Due to the Timer output (TI05) (MCU port pin P42) being directly connected to the LCD, the RTC digit to the right of the colon is turned on, when the LCD is fitted. These segments have been masked by turning on all 7-segments of the RTC digits.

## 6. Website, Inquiries and Support

Renesas Electronics Website

<http://www.renesas.com/>

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**Revision Record**

<b>Rev.</b>	<b>Date</b>	<b>Description</b>	
		<b>Page</b>	<b>Summary</b>
1.00	November 01, 2013	—	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 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 a product with a different type 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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