# RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group

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RX Driver Package Ver.1.03

## Introduction

This document is the RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package User's Manual, version 1.03.

This User's Manual describes basic structures, features and usage of RX Driver Package applications, and about the sample application program using the FIT modules included in this package.

## Target Device

RX110 Group (Renesas Starter Kit for RX110)

RX111 Group (Renesas Starter Kit for RX111)

RX113 Group (Renesas Starter Kit for RX113)

RX130 Group (Renesas Starter Kit for RX130)

RX230 Group (Renesas Starter Kit for RX230)

RX231 Group (Renesas Starter Kit for RX231)

RX23T Group (Renesas Starter Kit for RX23T)

RX24T Group (Renesas Starter Kit for RX24T)

When using this application note with your product, careful evaluation is recommended.

And when using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

## Related Documents

- RX Family Board Support Package Module Using Firmware Integration Technology (R01AN1685EU)
- Firmware Integration Technology User's Manual (R01AN1833EU)
- RX Family Adding Firmware Integration Technology Modules to Projects (R01AN1723EU)
- RX Family Adding Firmware Integration Technology Modules to CS+ Projects (R01AN1826EJ)
- The User's Manual provided with the RX Driver Package Application.

## Contents

# 1. Overview

## 1.1 Applicability

This User's Manual applies to the RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package, version 1.02.

## 1.2 Operating Environment

This package runs under the operating environment described below.

**Table 1-1 Operating Environment (RX110)**

| | |
|---|---|
| Microcontroller | RX110 Group |
| Evaluation board | Renesas Starter Kit for RX110 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-2 Operating Environment (RX111)**

| | |
|---|---|
| Microcontroller | RX111 Group |
| Evaluation board | Renesas Starter Kit for RX111 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-3 Operating Environment (RX113)**

| | |
|---|---|
| Microcontroller | RX113 Group |
| Evaluation board | Renesas Starter Kit for RX113 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-4 Operating Environment (RX130)**

| | |
|---|---|
| Microcontroller | RX130 Group |
| Evaluation board | Renesas Starter Kit for RX130 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-5 Operating Environment (RX230)**

| | |
|---|---|
| Microcontroller | RX230 Group |
| Evaluation board | Renesas Starter Kit for RX230 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-6 Operating Environment (RX231)**

| | |
|---|---|
| Microcontroller | RX231 Group |
| Evaluation board | Renesas Starter Kit for RX231 |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-7 Operating Environment (RX23T)**

| | |
|---|---|
| Microcontroller | RX23T Group |
| Evaluation board | Renesas Starter Kit for RX23T |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

**Table 1-8 Operating Environment (RX24T)**

| | |
|---|---|
| Microcontroller | RX24T Group |
| Evaluation board | Renesas Starter Kit for RX24T |
| Integrated development environment (IDE) | e$^2$ studio, V4.0.2 or later |
| Cross tools | RX Family C/C++ Compiler Package V2.03.00 or later |
| Emulator | E1, E20 |

## 2. About RX Driver Package

The RX Driver Package is a software platform (framework) that combines the following modules to be required for development in a single package. Since the package contains multiple modules, you can start developing immediately without having to obtain each module separately.

- Board Support Package (BSP) module
- FIT peripheral function modules (free version)
- FIT middleware modules (free version)
- FIT interface modules

You can develop the user application layer with ease by using the Sample Application Program (RX Driver Package Application) which utilizes the RX Driver Package.

### 2.1 System Structure

The figure below shows the system structure of the RX Driver Package.

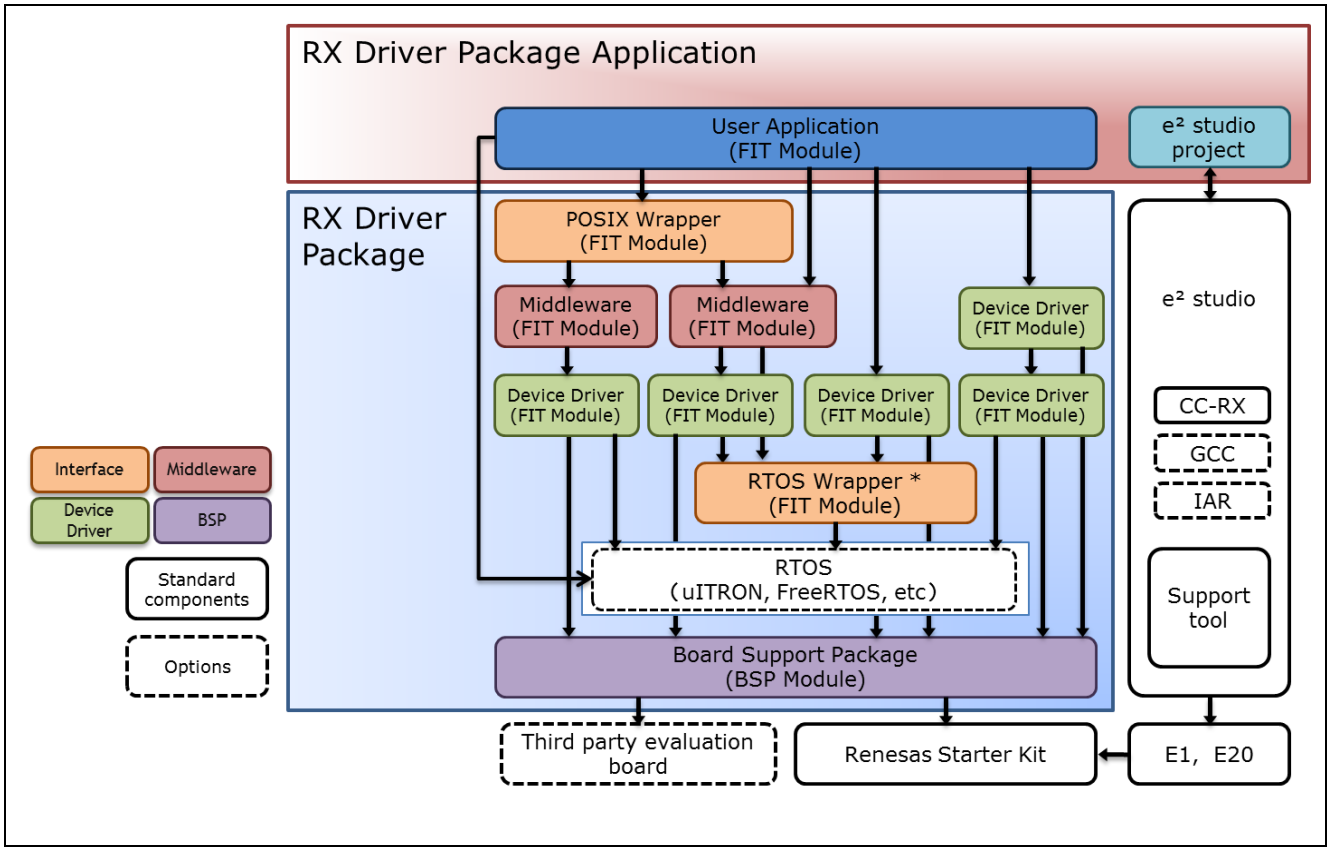



**Figure 2-1 System Structure**

## 2.2 RX Driver Package Features

The RX Driver Package has the following features.

**(a) Select necessary modules and start developing immediately the application program**

You can easily build a system simply by selecting the modules you need from the package. After that, all you have to do is develop the application program.

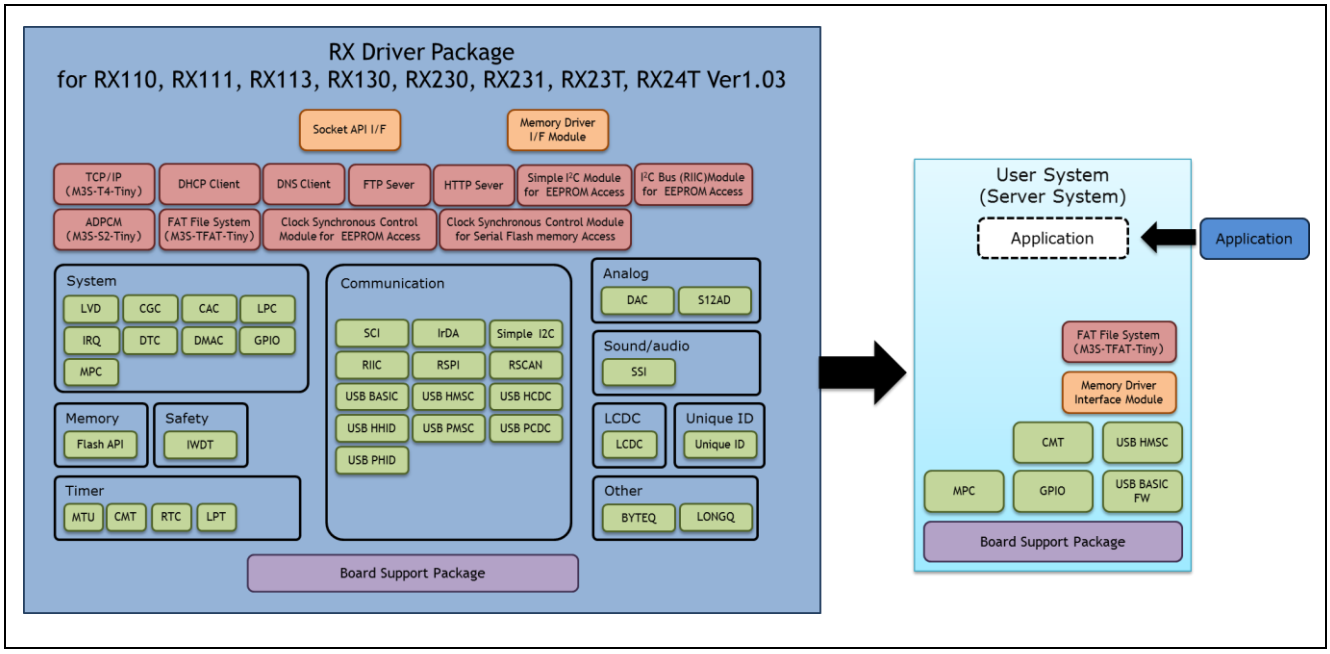



**Figure 2-2 An example of system build**

**(b) Free to use**

All the modules included in the RX Driver Package can be used free of charge. Free versions of middleware modules such as TCP/IP and file system are included.

**(c) Can upgrade to paid versions of modules**

The free versions of modules in the RX Driver Package can be replaced with commercial (paid) versions. By using a commercial (paid) version, all the functionality of the module will be available, as well as support about a commercial version.

**(d) Check operation including user application**

The RX Driver Package Application is provided as a sample user application that uses the RX Driver Package. The RX Driver Package Application consists of programs for operating each module in the RX Driver Package, and the project files for building the programs. It enables you to start checking the operation of your user application immediately.

# 3. Structure of the RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package

## 3.1 Folder Structure

The folder structure used in this package is shown below.

When the ZIP file for this package is downloaded from the Renesas web site and decompressed, a folder of the same name will be present and it will contain a **FITModules** folder, a **reference_documents** folder, and this document.

The **FITModules** folder contains the FIT modules for the modules shown in Table 3-1(as ZIP files and XML files).

The **reference_documents** folder contains the documentation for using this package in various development

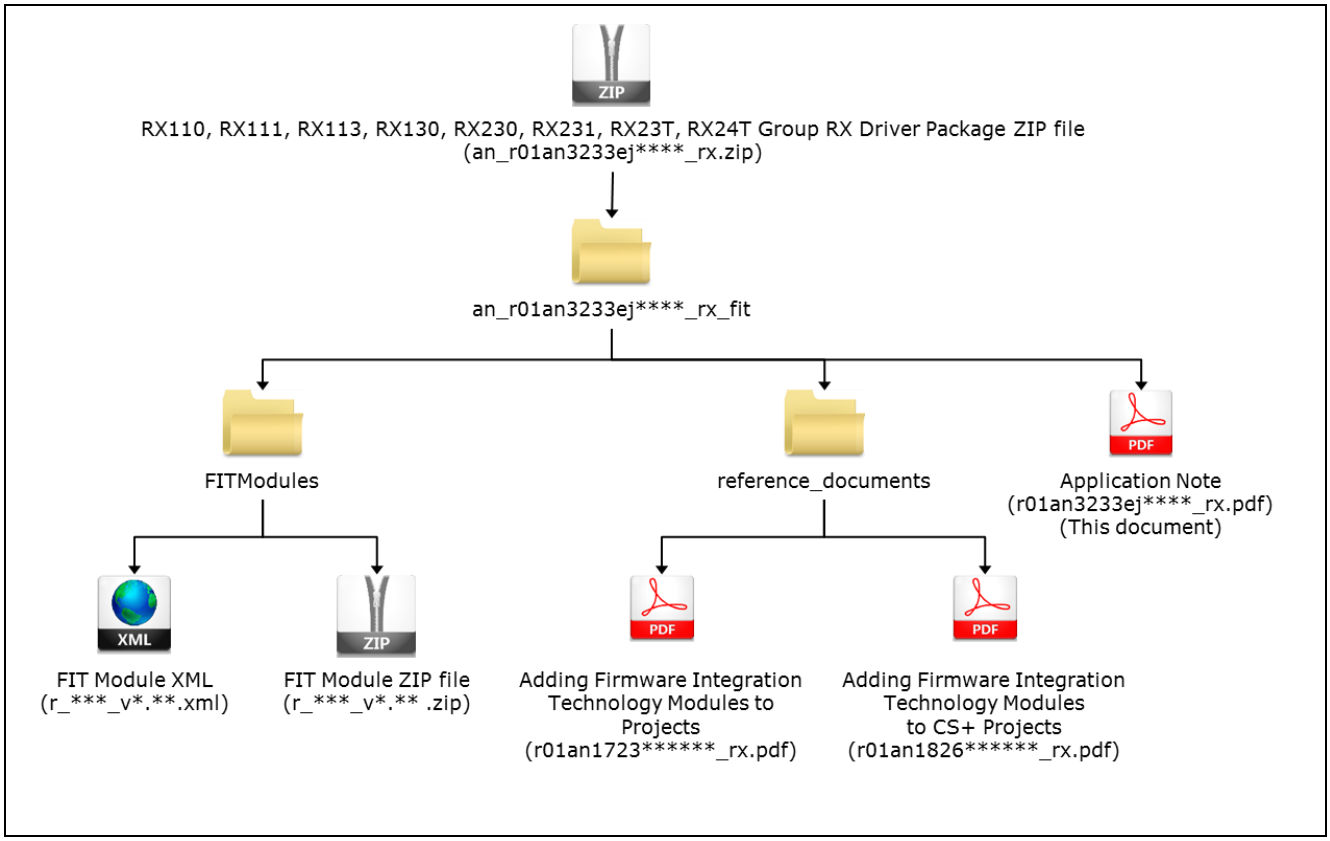



**Figure 3-1 Folder Structure of the RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package**

## 3.2 Module Structure

The figure below shows the types and structure of the FIT modules included in this package.

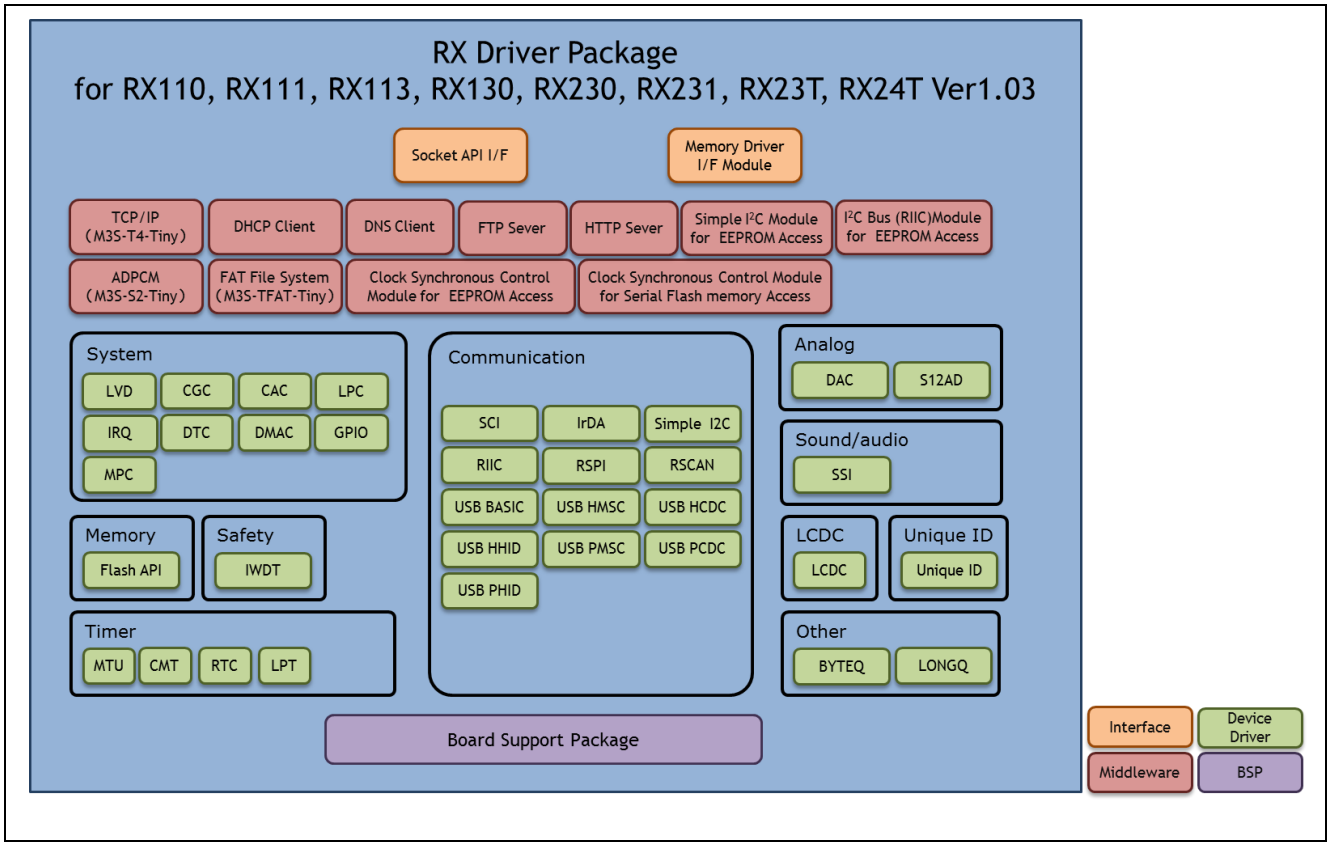



**Figure 3-2 RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package FIT Module Structure**

## 3.3 FIT Modules

The table below lists the FIT modules included in this package.

**Table 3-1 RX110, RX111, RX113, RX130, RX230, RX231, RX23T, RX24T Group RX Driver Package FIT Modules**

| Type | Module | FIT Module Name | RX110 | RX111 | RX113 | RX130 | RX230 | RX231 | RX23T | RX24T | Rev |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Board Support Package | Board Support Package (BSP) | r_bsp | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 3.30 |
| Device Driver | Voltage Detection Circuit (LVD) | r_lvd_rx | ✓ | ✓ | ✓ | - | - | ✓ | - | - | 1.50 |
| Device Driver | Clock Generation Circuit (CGC) | r_cgc_rx100 | ✓ | ✓ | ✓ | - | - | - | - | - | 1.31 |
| Device Driver | Clock Frequency Accuracy Measurement Circuit (CAC) | r_cac_rx | ✓ | ✓ | - | - | - | - | - | - | 1.10 |
| Device Driver | Low Power Consumption (LPC) | r_lpc_rx100 | ✓ | ✓ | ✓ | - | - | - | - | - | 1.30 |
| Device Driver | Battery Backup (VBATT) | r_vbatt_rx | - | - | - | - | ✓ | ✓ | - | - | 1.01 |
| Device Driver | Interrupt Controller (IRQ) | r_irq_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.90 |
| Device Driver | Data Transfer Controller (DTC) | r_dtc_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.04 |
| Device Driver | DMA Controller (DMAC) | r_dmaca_rx | - | - | - | - | ✓ | ✓ | - | - | 1.03 |
| Device Driver | I/O Ports (GPIO) | r_gpio_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.00 |
| Device Driver | Multi-Function Pin Controller (MPC) | r_mpc_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.00 |
| Device Driver | Multi-pulse Timer Unit (MTU2a) | r_mtu_rx | ✓ | ✓ | ✓ | - | - | ✓ | - | - | 1.20 |
| Device Driver | Compare Match Timer (CMT) | r_cmt_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.90 |
| Device Driver | Real-Time Clock (RTC) | r_rtc_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | - | 2.41 |
| Device Driver | Low Power Timer (LPT) | r_lpt_rx | - | - | ✓ | - | - | - | - | - | 1.00 |
| Device Driver | Independent Watchdog Timer (IWDT) | r_iwdt_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 1.51 |
| Device Driver | Serial Communications Interface (SCI: Asynchronous/Clock Synchronous) | r_sci_rx | ✓ | ✓ | ✓ | - | - | ✓ | ✓ | - | 1.70 |
| Device Driver | Serial Communications Interface (SCI: Simple $I^2C$ Bus) | r_sci_iic_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.90 |
| Device Driver | $I^2C$ Bus Interface (RIIC) | r_riic_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.90 |
| Device Driver | Serial Peripheral Interface | r_rspi_rx | ✓ | ✓ | ✓ | - | - | ✓ | - | - | 1.40 |
| Device Driver | Serial Peripheral Interface (RSPI: Device Driver for Serial Memory Control) | r_rspi_smstr_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.10 |
| Device Driver | USB Basic Firmware | r_usb_basic_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Host Mass Storage Class | r_usb_hmsc_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Host Communication Device Class | r_usb_hcdc_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Host Human Interface Device Class | r_usb_hhid_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Peripheral Mass Storage Class | r_usb_pmsc_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Peripheral Communications Device Class | r_usb_pcdc_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | USB Peripheral Human Interface Device Class | r_usb_phid_mini | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Device Driver | IrDA Interface (IrDA) | r_irda_sci_rx | - | - | ✓ | - | - | - | - | - | 1.01 |
| Device Driver | CAN Module (RSCAN) | r_rscan_rx | - | - | - | - | - | ✓ | - | - | 1.00 |

| Type | Module | FIT Module Name | RX110 | RX111 | RX113 | RX130 | RX230 | RX231 | RX23T | RX24T | Rev |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Device Driver | 12-Bit A/D Converter (S12AD) | r_s12ad_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | - | 2.11 |
| Device Driver | D/A Converter (DAC) | r_dac_rx | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.80 |
| Device Driver | Flash Memory (Flash API) | r_flash_rx | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ | 1.60 |
| Device Driver | Serial Sound Interface (SSI) | r_ssi_api_rx | - | - | ✓ | - | ✓ | ✓ | - | - | 1.20 |
| Device Driver | LCD Controller/Driver (LCDC) | r_lcdc_rx | - | - | ✓ | - | - | - | - | - | 1.00 |
| Device Driver | Unique ID Read | r_uid_rx | ✓ | ✓ | ✓ | - | - | - | - | - | 1.00 |
| Device Driver | Byte Queue Buffer (Data Management) | r_byteq | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.60 |
| Device Driver | Long Queue Buffer (Data Management) | r_longq | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.60 |
| Middleware | TCP/IP M3S-T4-Tiny for Embedding | r_t4_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.05 |
| Interface | Embedded TCP/IP M3S-T4-Tiny Socket API Module | r_socket_rx | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 1.30 |
| Middleware | DHCP client using the embedded TCP/IP M3S-T4-Tiny Module | r_t4_dhcp_client_rx | - | - | - | - | - | - | - | - | 1.03 |
| Middleware | DNS client using the embedded TCP/IP M3S-T4-Tiny Module | r_t4_dns_client_rx | - | - | - | - | - | - | - | - | 1.02 |
| Middleware | FTP server using the embedded TCP/IP M3S-T4-Tiny Module | r_t4_ftp_server_rx | - | - | - | - | - | - | - | - | 1.03 |
| Middleware | Web server using the embedded TCP/IP M3S-T4-Tiny Module | r_t4_http_server_rx | - | - | - | - | - | - | - | - | 1.04 |
| Middleware | Sound playback system and compression system (original ADPCM codec) | r_s2_rx | - | ✓ | ✓ | - | - | ✓ | - | - | 3.03 |
| Middleware | M3S-TFAT-Tiny (FAT file system) | r_tfat_rx | - | ✓ | ✓ | - | - | ✓ | - | - | 3.02 |
| Interface | M3S-TFAT-Tiny Memory Driver Interface Module | r_tfat_driver_rx | - | ✓ | ✓ | - | - | ✓ | - | - | 1.02 |
| Middleware | Simple I2C Module for EEPROM Access | r_eeprom_sci_iic_rx | ✓ | ✓ | ✓ | - | - | - | - | - | 1.30 |
| Middleware | I2C Bus Interface (RIIC) Module for EEPROM Access | r_eeprom_riic_rx | ✓ | ✓ | ✓ | - | - | - | - | - | 1.40 |
| Middleware | SPI Serial EEPROM Module | r_eeprom_spi | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.33 |
| Middleware | SPI Serial Flash memory Module | r_flash_spi | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2.33 |

Note: This package includes the M3S-T4-Tiny (TCP/IP protocol stack library) of evaluation version. For the commercial version, please go to the below URL.
http://www.renesas.com/mw/t4

# 4. Usage Procedures

The RX Driver Package allows programs to be easily constructed by using the FIT plugin included in e$^2$ studio. The remainder of this section presents a simple usage example using e$^2$ studio. To use CS+, see the document "RX Family Adding Firmware Integration Technology Modules to CS+ Projects (R01AN1826EJ)" included in this package.

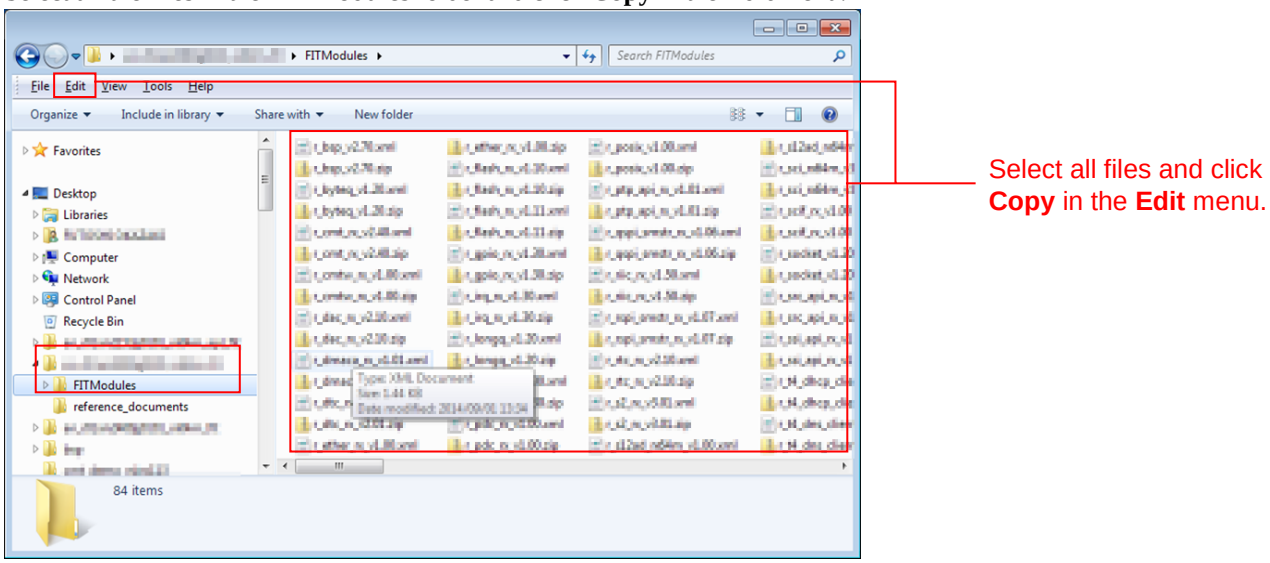
## 4.1 Environment Used

The RX231 is used as the target microcontroller and the Renesas Starter Kit RX231 is used as the target board. If a different environment is used, replace the specifics used in the example with the ones for that environment as you read.

## 4.2 Install RX Driver Package in e$^2$ studio

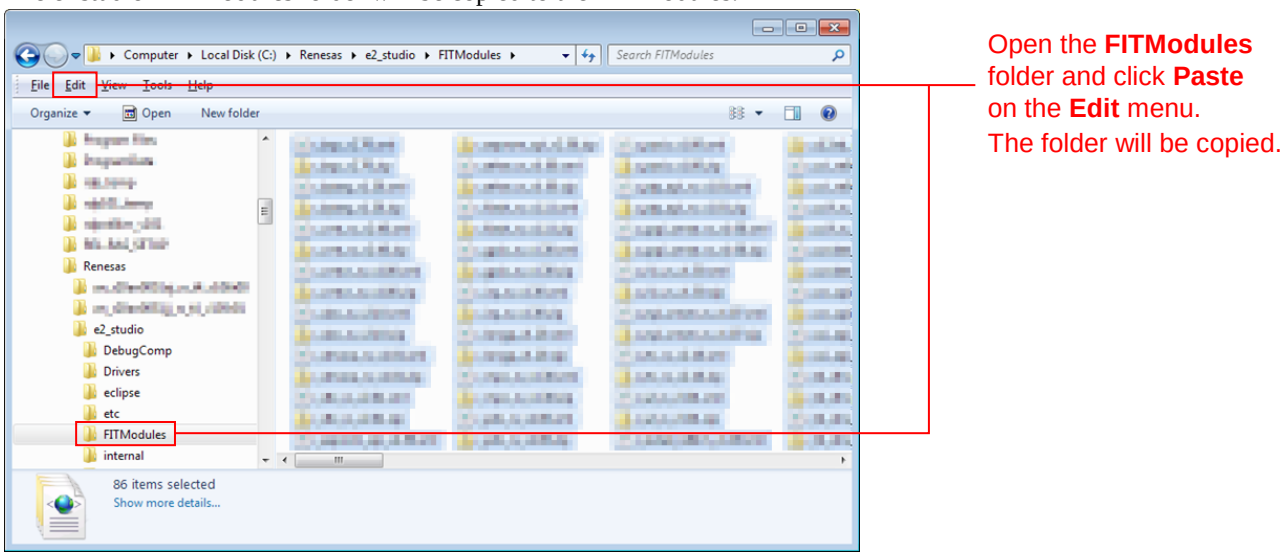
Install the FIT modules in the RX Driver Package into e$^2$ studio.

1. Decompress the downloaded file **an_r01an3233ej0101_rx.zip** into an arbitrary directory.
2. Open the folder that was decompressed and open the **FITModules** folder in that folder.
3. Select all the files in the **FITModules** folder and click **Copy** in the **Edit** menu.



4. Open the e$^2$ studio install folder (Usually, this will be c:/Renesas/e2_studio.) and open the **FITModules** folder in that folder.

5. Click **Paste** on the **Edit** menu.
   The e$^2$ studio **FITModules** folder will be copied to the FIT modules.




## 4.3 Application Creation

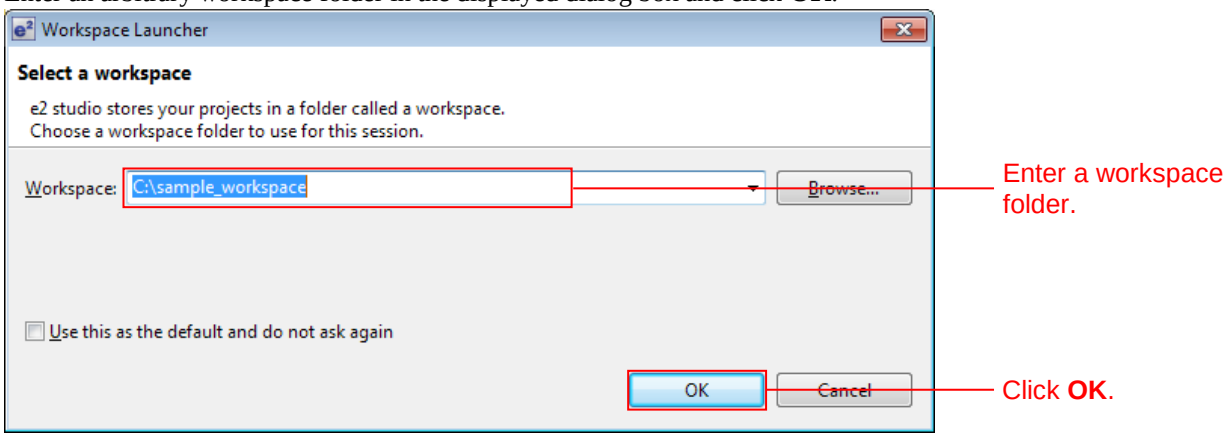
In this section, create a simple application that drives an LED.

### 4.3.1 Create a Workspace and a Project

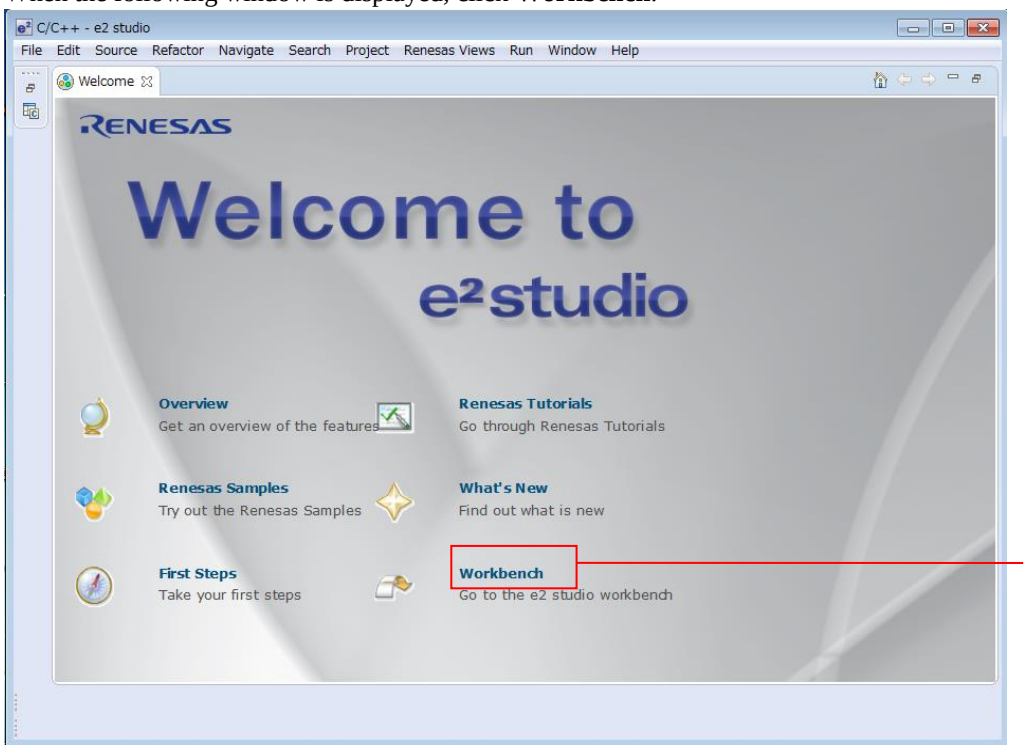
First, create a new workspace and a new project.

1. Start e$^2$ studio.

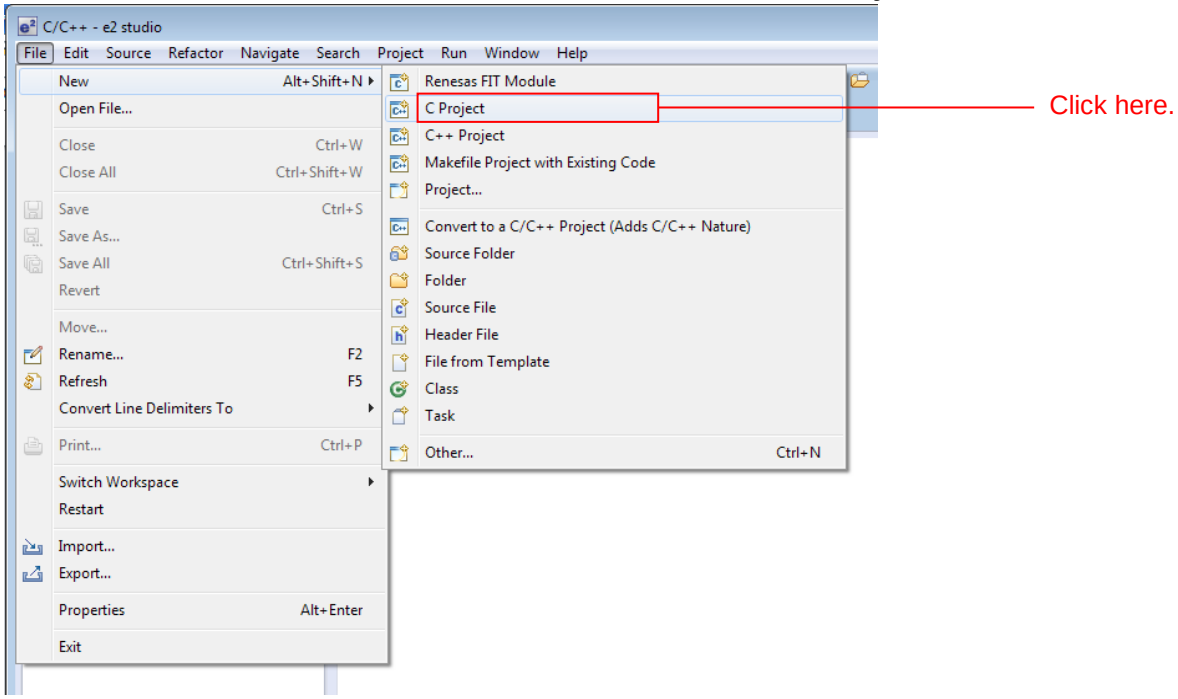
2. Enter an arbitrary workspace folder in the displayed dialog box and click **OK**.



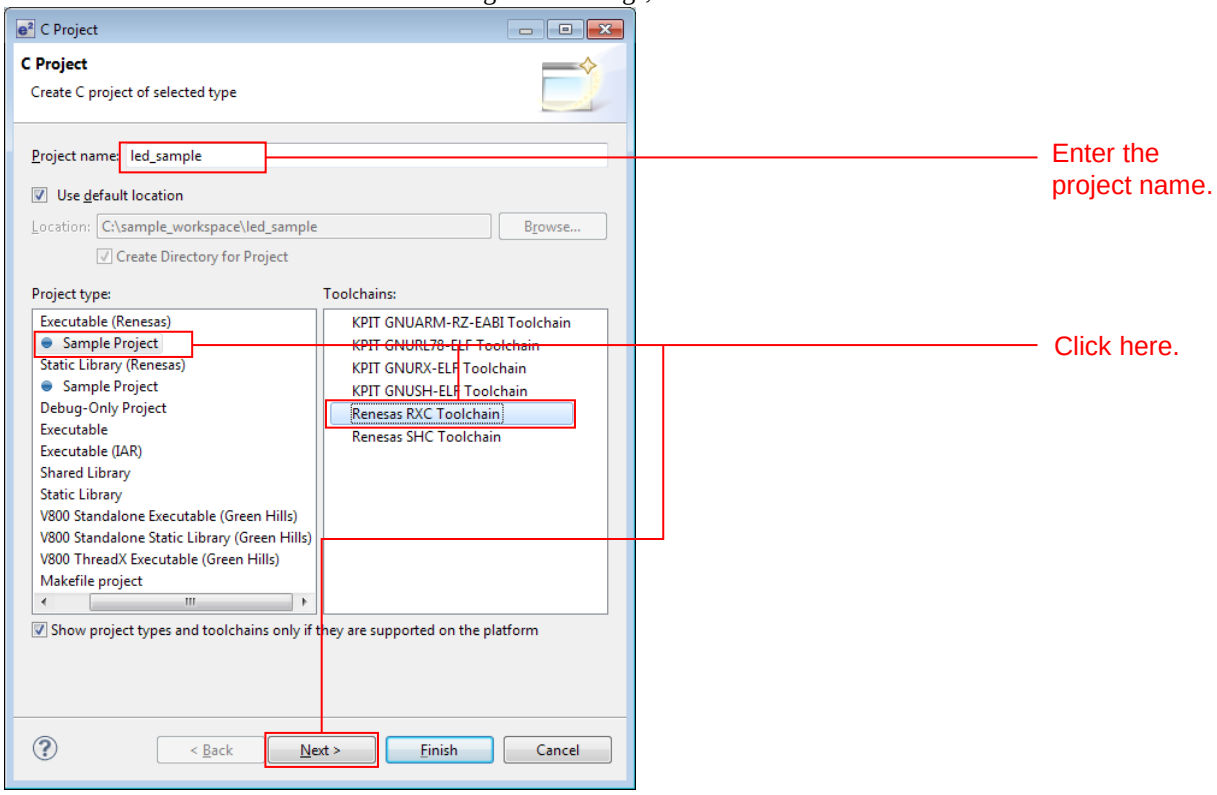
3. When the following window is displayed, click **Workbench**.



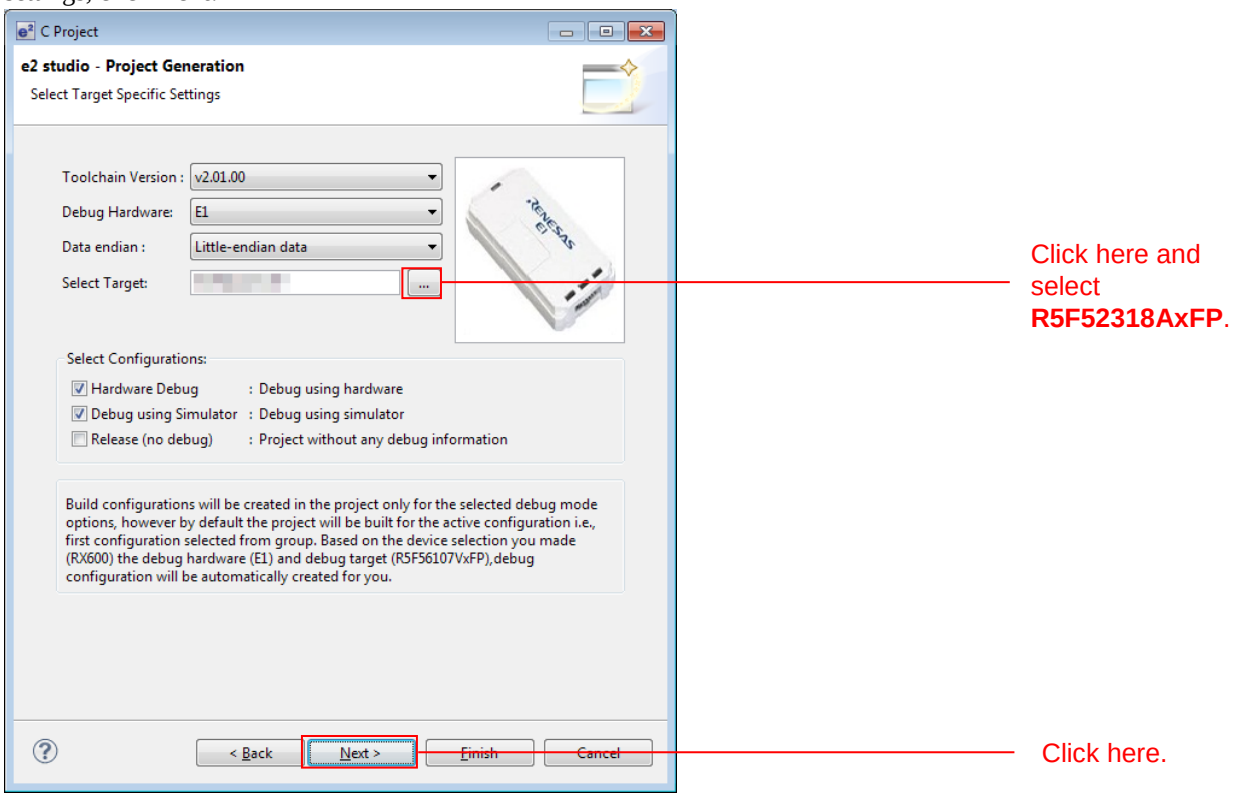

4. When the workbench has started, select **New** from the **File** menu and click **C Project**.



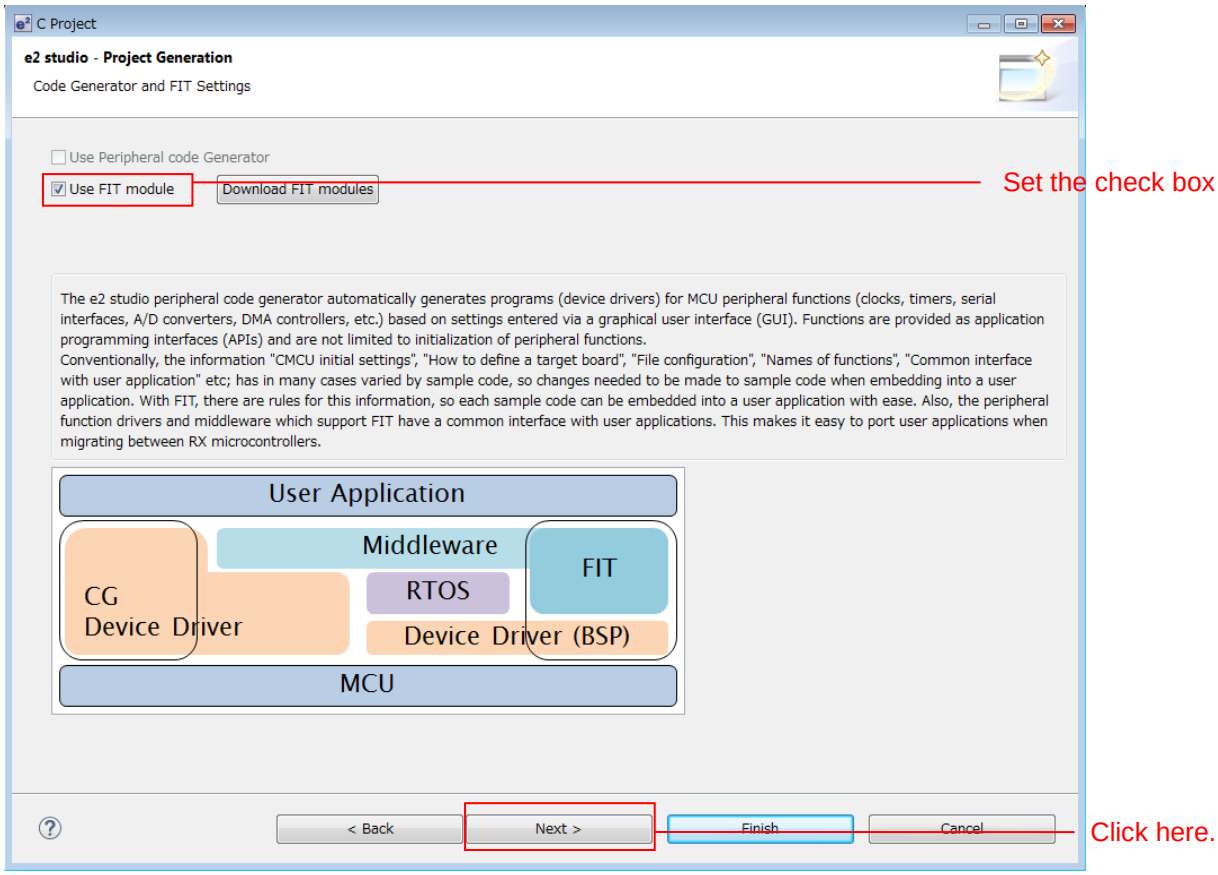
5. Enter the project name. For the project type, click **Sample Project** under **Executable (Renesas)**. For the tool chain, click **Renesas RXC Toolchain**. After making these settings, click **Next**.



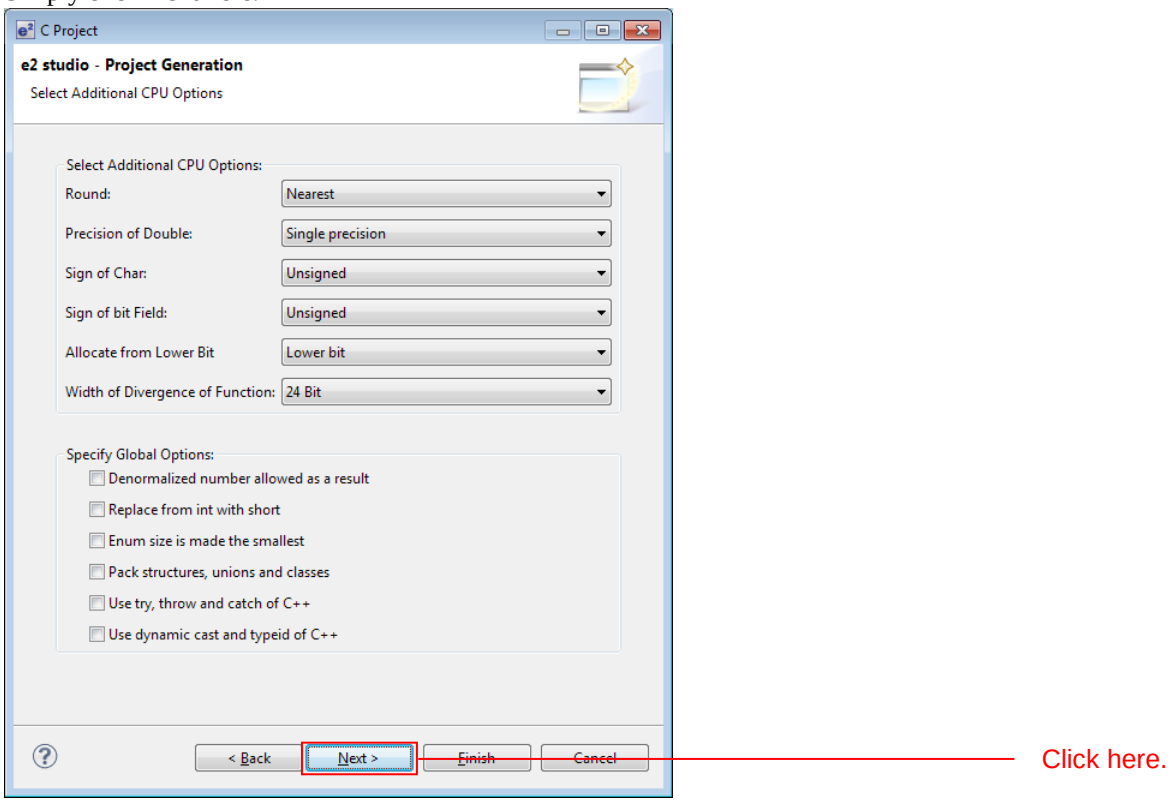

6. Select the target. Click the "..." button under **Target Selection** and select **R5F52318AxFP**. After making these settings, click **Next**.



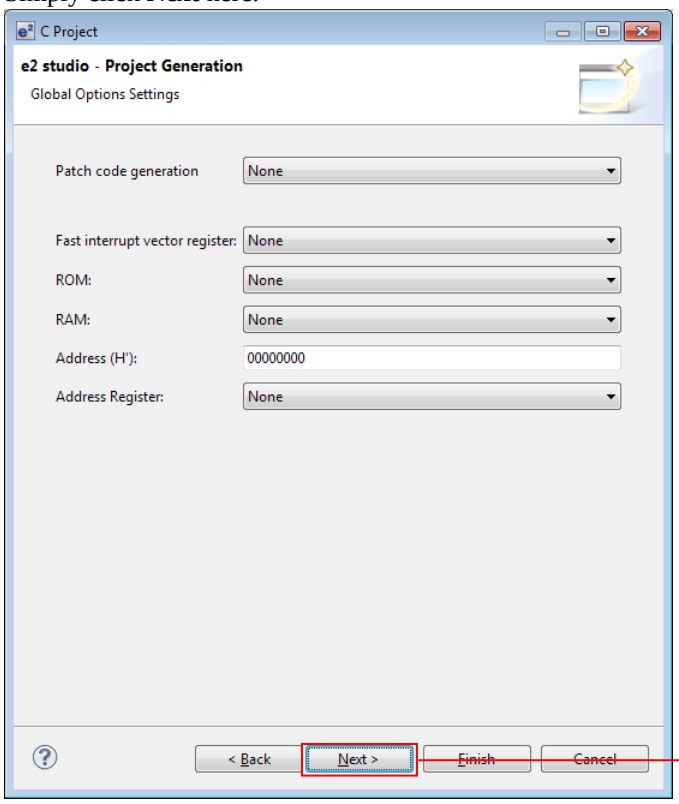
7. Set the check box of “Use FIT module” and click **Next** here.



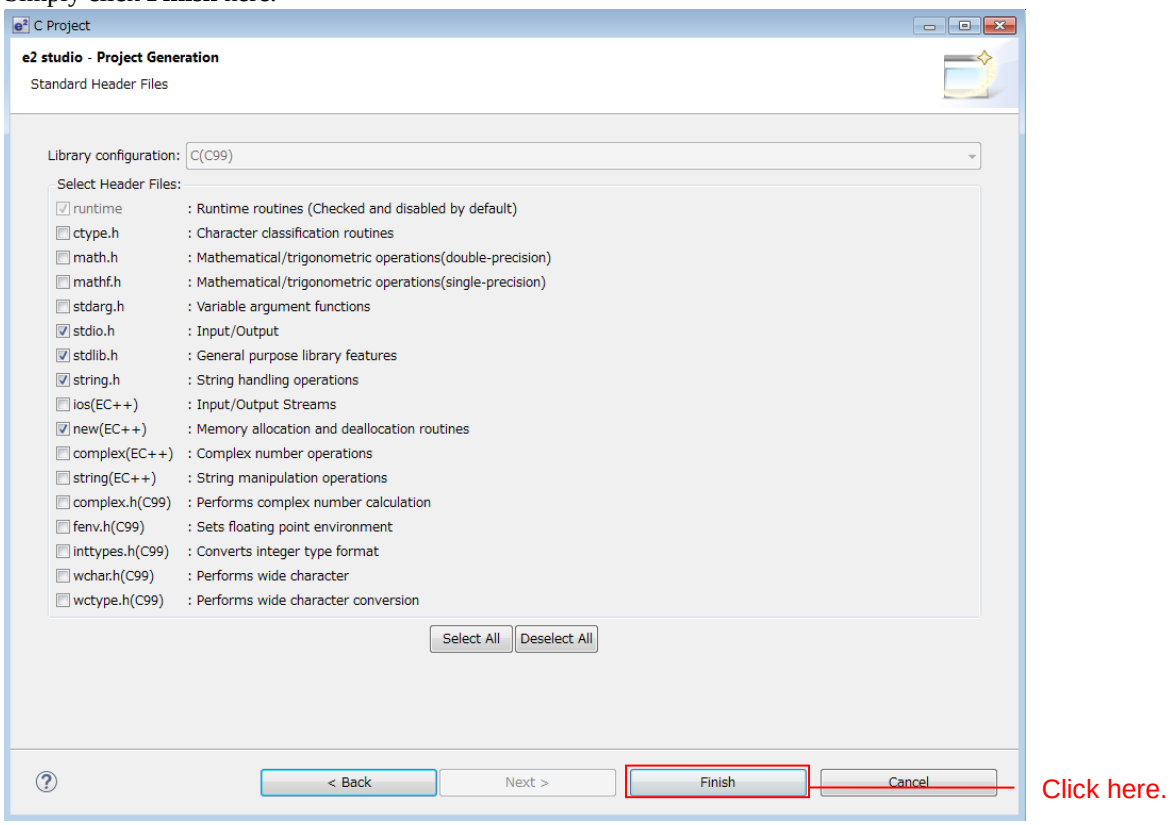

8. Simply click **Next** here.



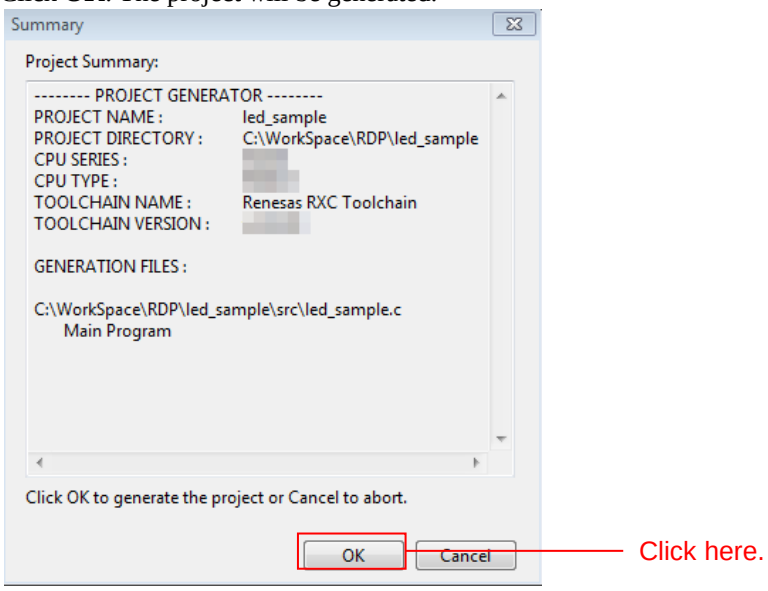
9. Simply click **Next** here.




10. Simply click **Finish** here.



11.Click **OK**. The project will be generated.

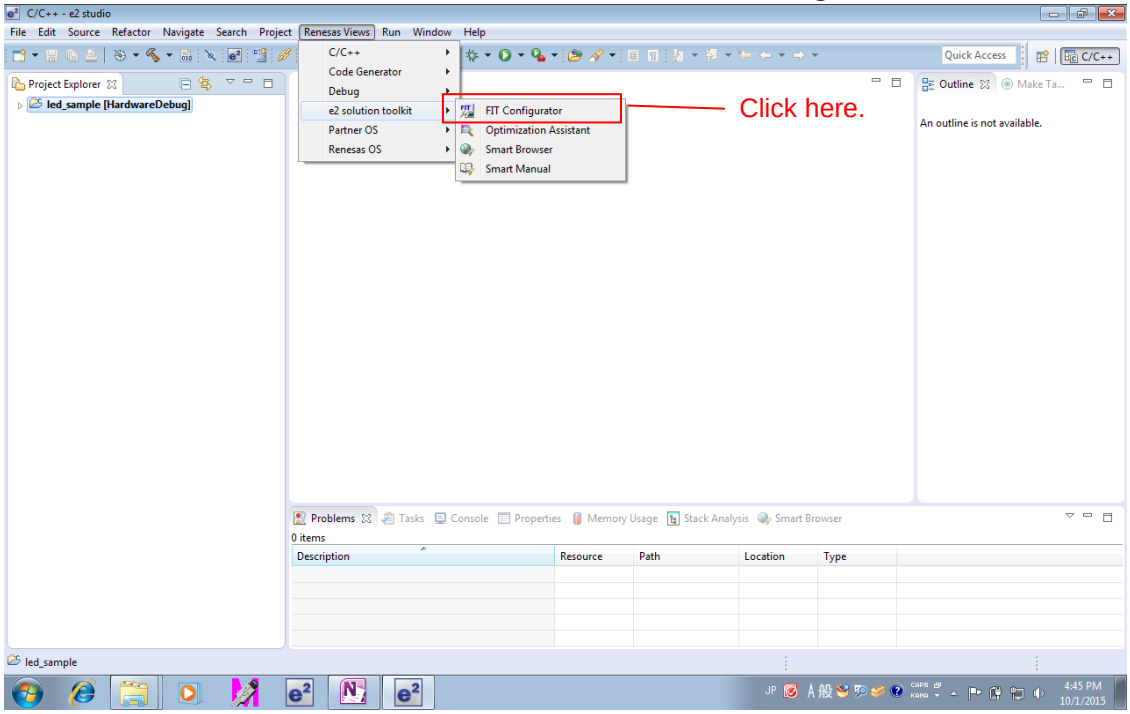


### 4.3.2 Install the FIT Modules with the FIT Plugin.

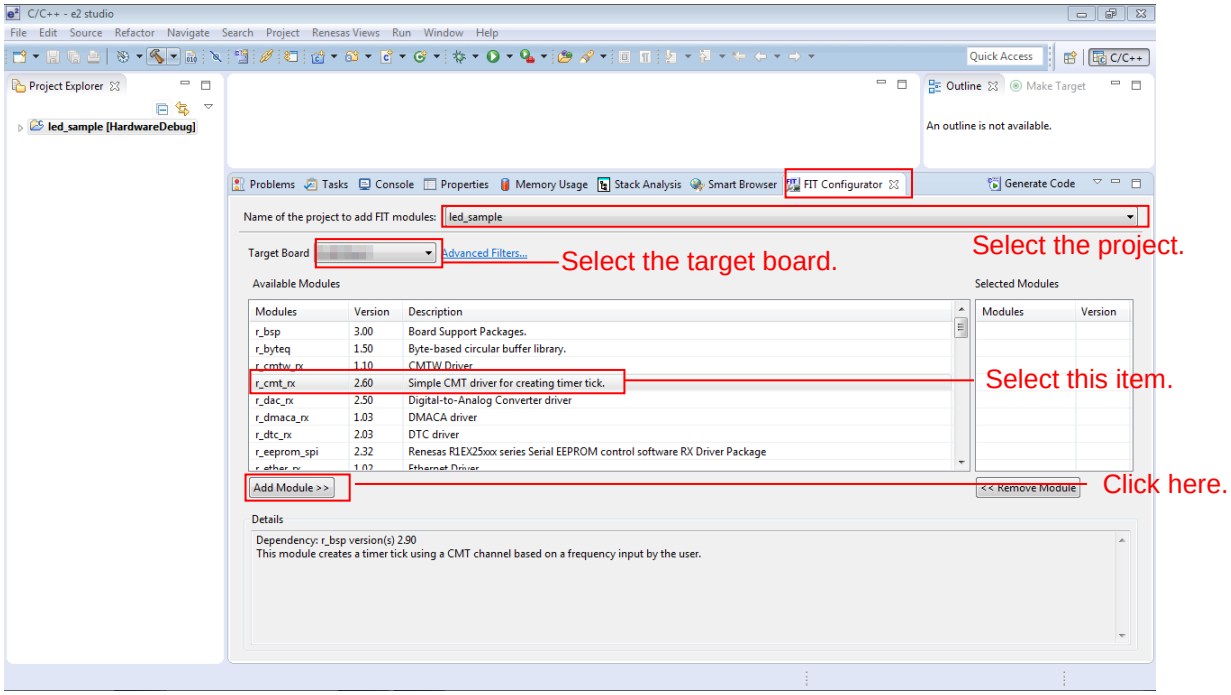
Install the required modules with the FIT plugin into the created project.

Here, install the BSP module (r_bsp) and the compare match timer driver (r_cmt_rx).

1. In the **Renesas Views** menu, select **e2 solution toolkit** and click **FIT Configurator**.

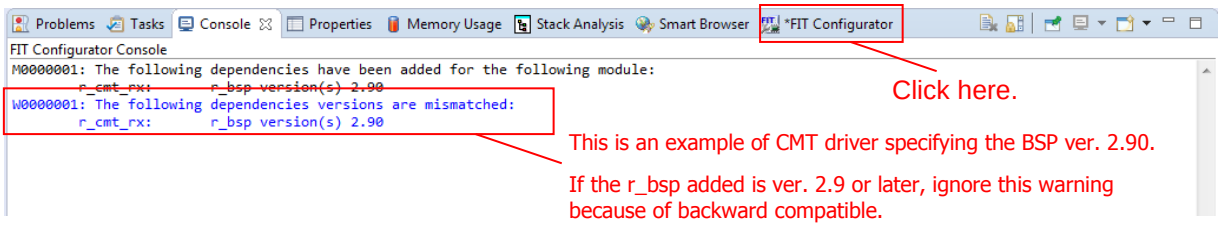



2. In the **FIT Configurator** tab,
   Select the created project with **Project to Add FIT Module** to.
   Next, select **RX231** under **Group** and select **RSKRX231** from **Target Board**.
   Next, click **r_cmt_rx** in the module list and click **Add Module** >>.

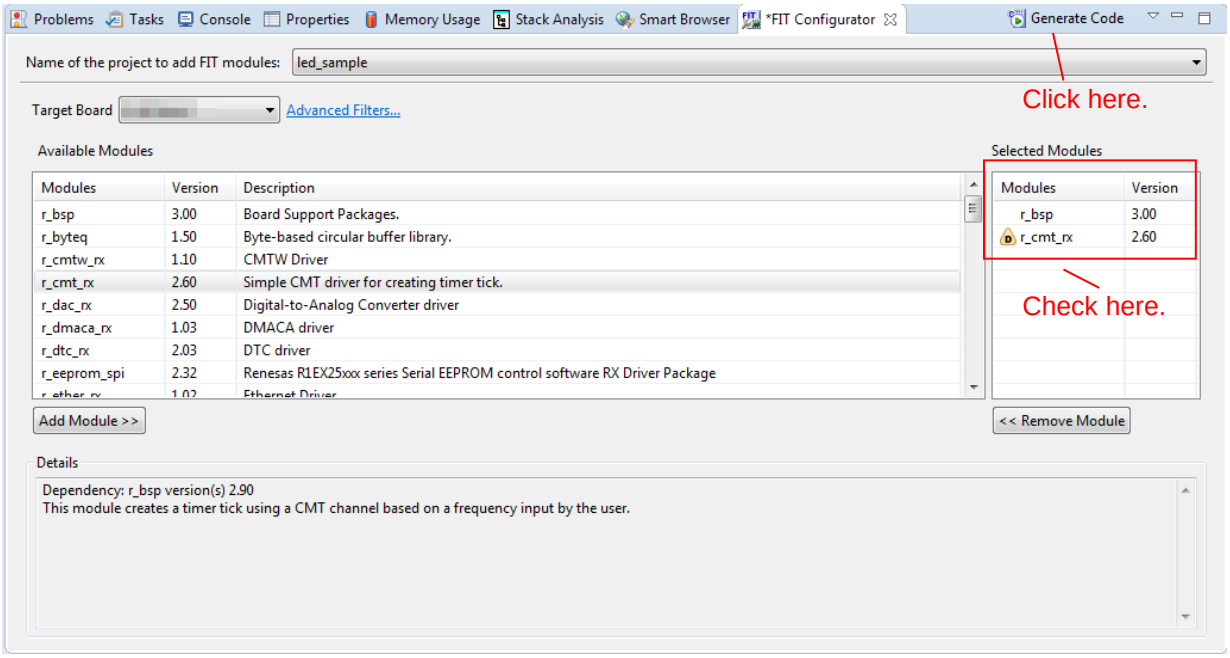


3. In the **Console** tab,
   The **r_bsp** having a dependency with **r_cmt_rx** is also added at a time. Note
   Click **FIT Configurator** again.

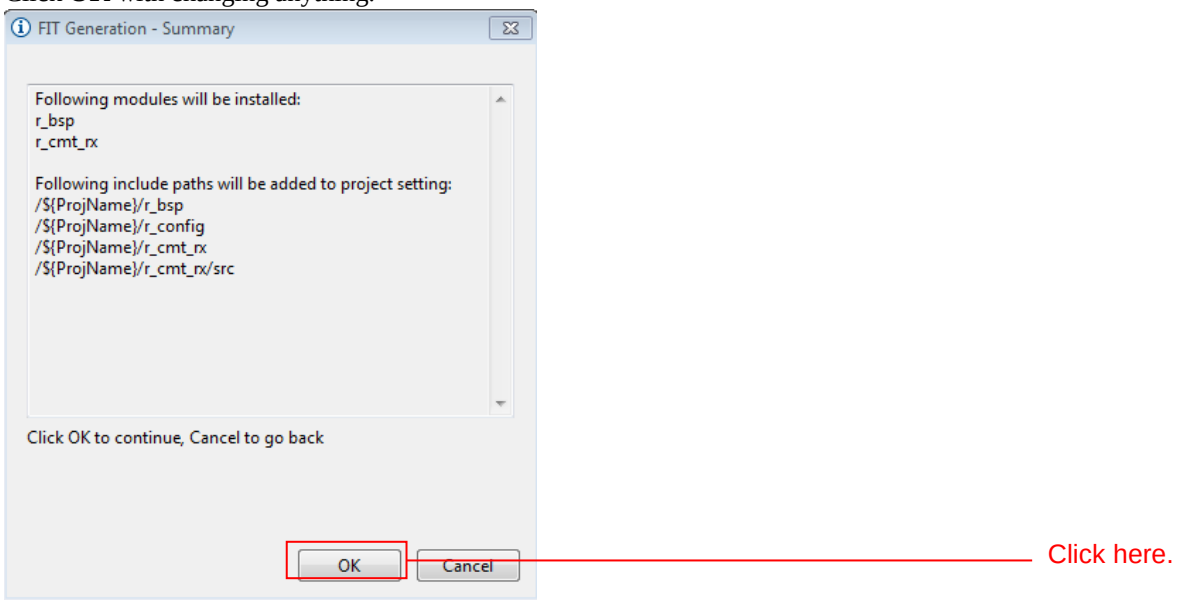
   Note: Additional FIT driver specifies the adaptable "r_bsp" version.
   If the "r_bsp" versions specified and added mismatch according to the time of FIT driver release, Warning (W0000001) is output on the console screen.
   If the "r_bsp" version added is the one specified or later, Warning can be ignored, as the new "r_bsp" version is backward compatible.




4. Check **r_bsp** and **r_cmt_rx** are added in **Selected Modules**. The mark  on **r_cmt_rx** indicates occurrence of the Warning explained in the above 3.
   Then, click **Generate Code**.



5. Click **OK** with changing anything.



### 4.3.3 Create an LED Driving Program

Create a program that toggles the LED0 on/off state every 0.5 seconds using the compare match timer.

Open the file src/(the project name).c and modify it as shown below.

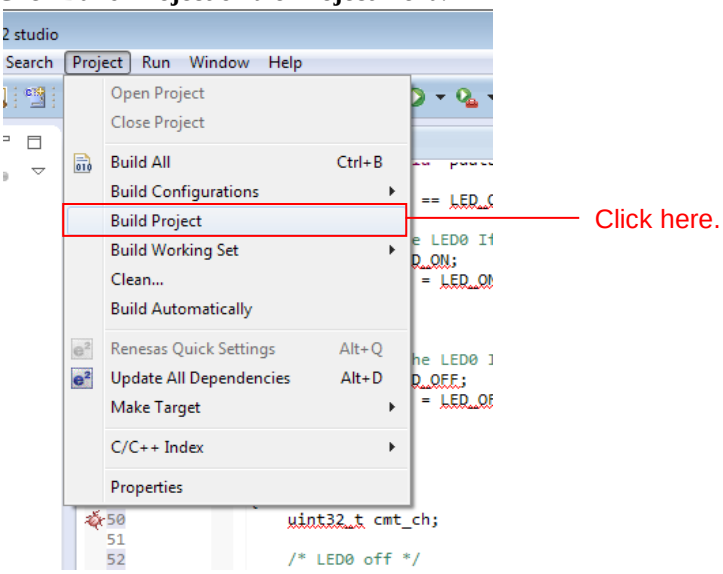
**src/(the project name).c**

```
#include "platform.h"
#include "r_cmt_rx_if.h"

/* LED Currently status */
uint32_t ledstatus = LED_OFF;

void call_back(void *pdata)
{
 if (ledstatus == LED_OFF)
 {
    /* Turn ON the LED0 If the status is LED_OFF */
  LED0 = LED_ON;
  ledstatus = LED_ON;
 }
 else
 {
    /* Turn OFF the LED0 If the status is LED_ON */
  LED0 = LED_OFF;
  ledstatus = LED_OFF;
 }
}

void main(void)
{
 uint32_t cmt_ch;

 /* LED0 off */
 LED0 =LED_OFF;
 /* Create of 0.5 second(2Hz) cyclic timer. */
 R_CMT_CreatePeriodic(2, &call_back, &cmt_ch);

 while(1);
}
```

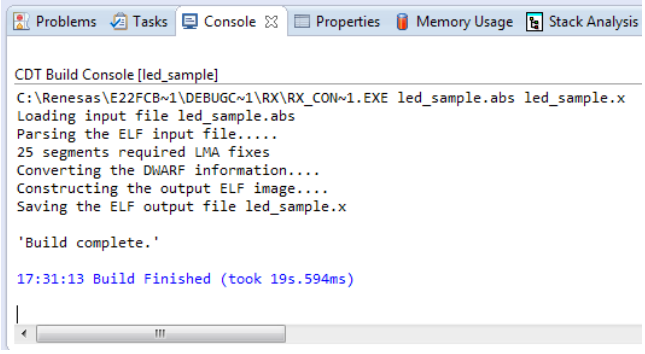
### 4.3.4 Build and Try Running the Program

Build the program just created and verify that it runs.

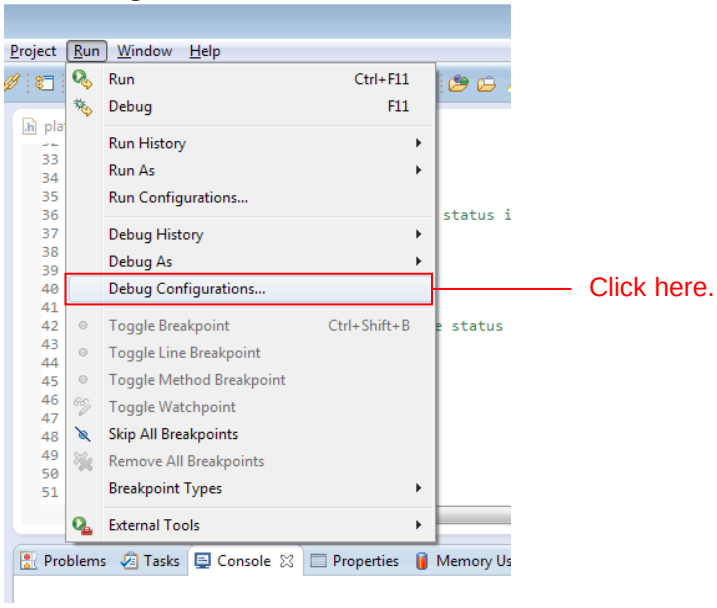
1. Click **Build Project** on the **Project** menu.




2. When the build completes, the following will be displayed in **Console** view.

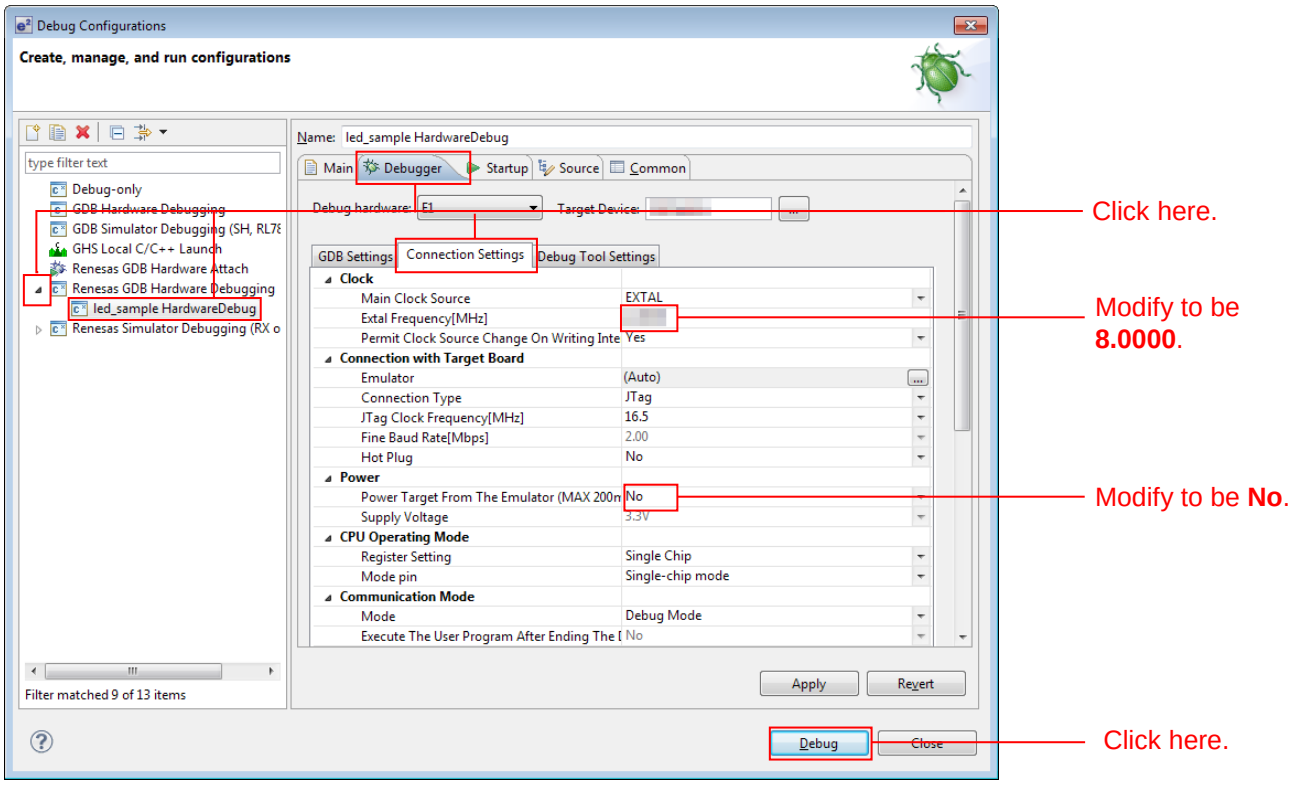



3. Click **Debug Build** on the **Run** menu.

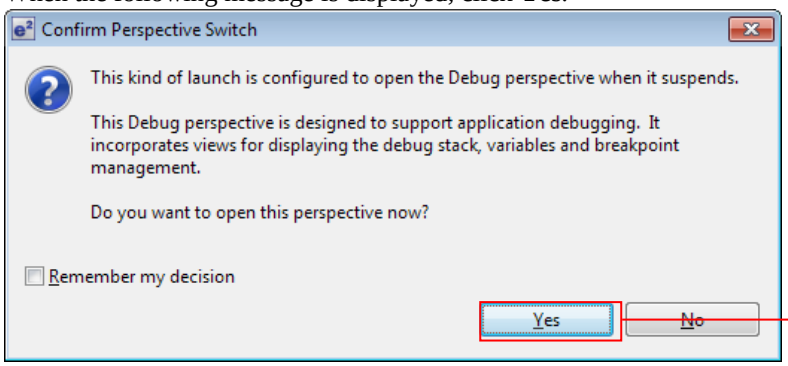


4. Click under the **Renesas GDB Hardware Debugging and c**lick **led_sample HardwareDebug**. Click the **Debugger** tab and click **Connection Setting**.
   Modify **EXTAL Frequency** to be **8.0000** and change **Provide Power from Emulator** to **No ***.
   When these changes have been made, click **Debug**.

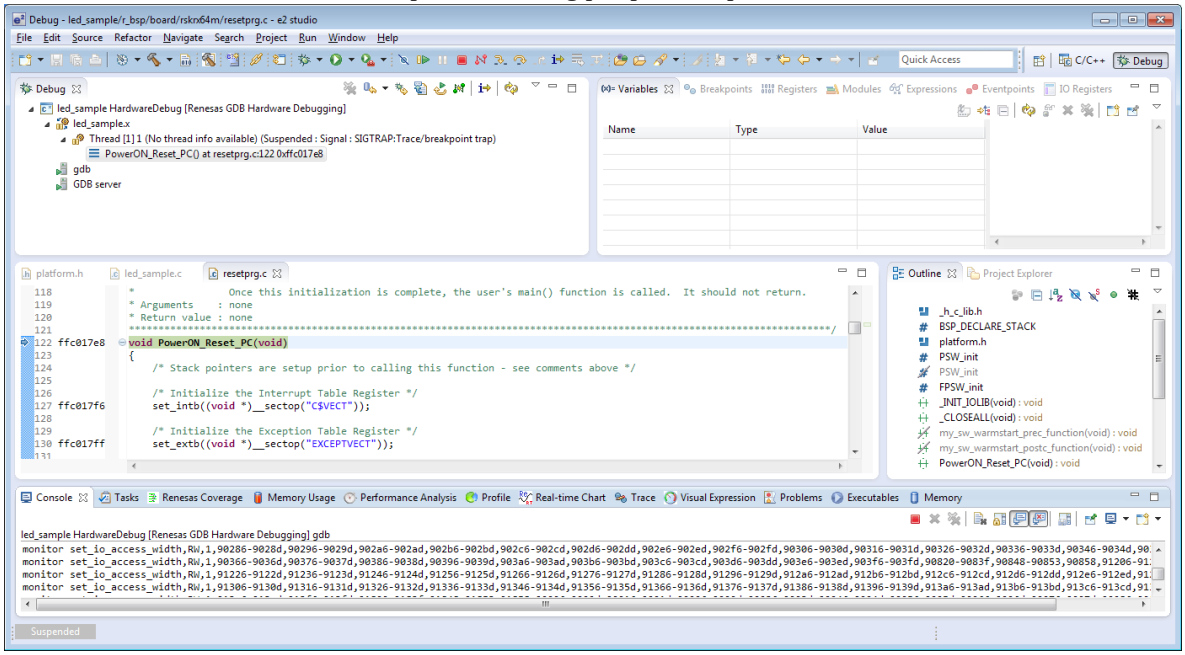
   Note : This is setting when using an external power supply. When supplying power from the emulator, select **Yes.**



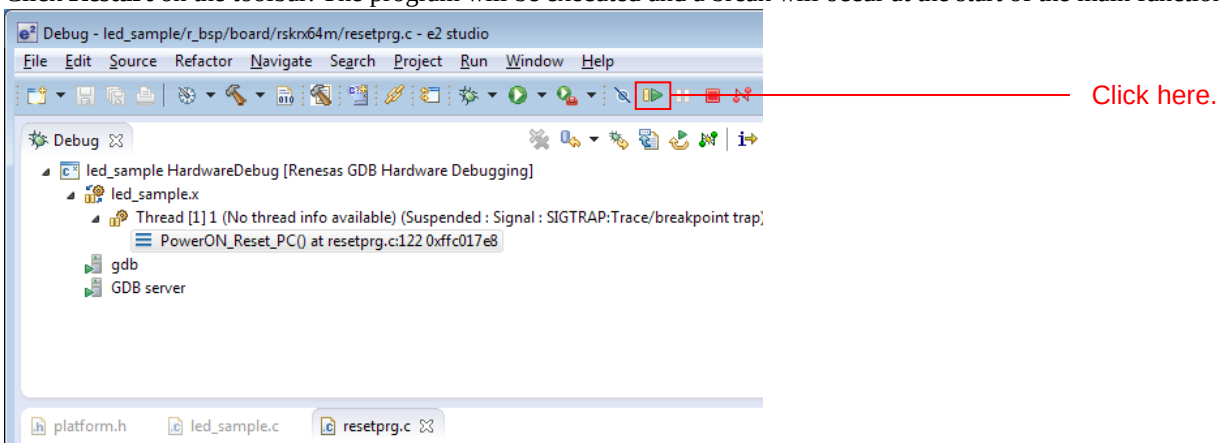
5. When the following message is displayed, click **Yes**.




6. When the load module download completes, a **Debug** perspective opens.



7. Click **Restart** on the toolbar. The program will be executed and a break will occur at the start of the main function.




8. After the break at the start of the main function, click **Restart** on the tool bar again.
The project will be run and the program will iterate toggling LED0 with a period of 0.5 seconds.

### 4.3.5 For location of the API information of each FIT module

For the API information of FIT module embedded in the project, refer to the **doc** folder of each FIT module folder.

# 5. RX Driver Package Application

## 5.1 RX Driver Package Application Structure

The RX Driver Package Application is a sample application program provided so that users can use the RX Driver Package easily. The RX Driver Package Application consists of an application program that operates using device drivers and middleware included in the RX Driver Package and a project file for building that application. This allows users to start evaluation quickly.

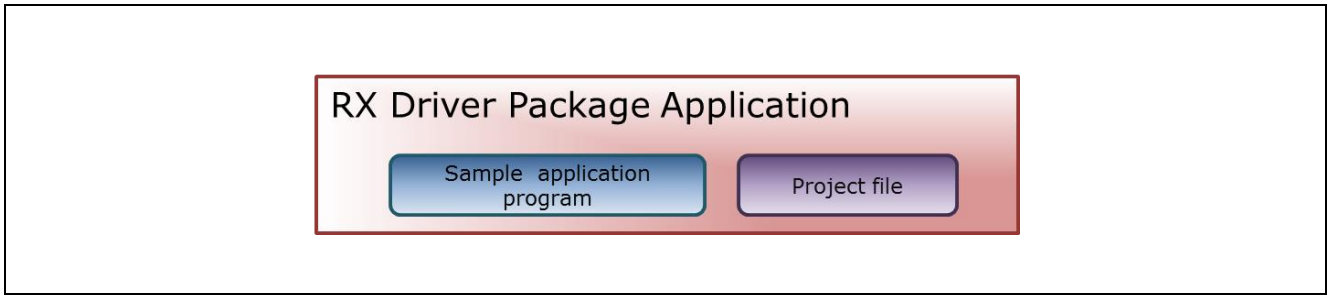



**Figure 5-1 RX Driver Package Application Structure**

Renesas plans to release a variety of types of this RX Driver Package Application in the future, such as system programs that operate using a combination of multiple drivers and middleware and evaluation programs for independent modules from the RX Driver Package.

For information of the latest RX Driver Package Application, refer to the “Products Supporting RX Driver Package Application” shown in the following URL.

http://www.renesas.com/products/mpumcu/rx/child/fit.jsp

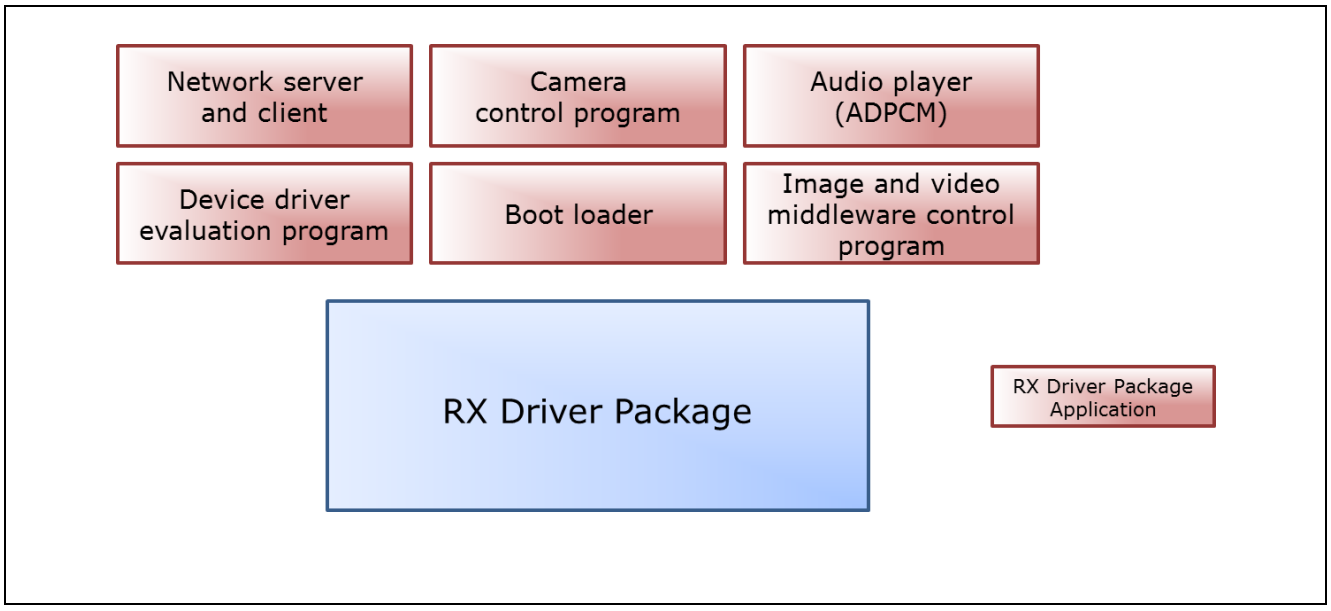



**Figure 5-2 Types of RX Driver Package Application**

# 6. Supplement

## 6.1 Commercial Version of Middleware and Drivers Supporting FIT

A list of the commercial version (paid) Middleware and Drivers for RX family is shown below.

For the information of the latest commercial version (paid) Middleware and Drivers, refer to the page of the Middleware and Drivers shown in the following URL.

Page of Middleware and Drivers: http://www.renesas.com/mw/

**Table 6-1 list of the commercial version (paid) Middleware and Drivers for RX family**

| Commercial Version | URL | FIT Compliant |
|---|---|---|
| TCP/IP for Embedding<br>M3S-T4-Tiny | http://www.renesas.com/mw/t4 | Available |

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## Revision History

| | | Description | |
|---|---|---|---|
| **Rev.** | **Date** | **Page** | **Summary** |
| 1.00 | Sep 1, 2014 | - | First edition issued |
| 1.01 | Oct 31, 2015 | - | Updated existing modules to latest modules.<br>Added RX110, RX111 and RX231.<br>Updated e2studio version and changed set-up procedure.<br>Changed document number from R01AN2466EJ0100 to R01AN2670EJ0101. |
| 1.02 | Feb 29, 2016 | | Updated existing modules to latest modules.<br>Added RX130 and RX23T.<br>Changed document number from R01AN2670EJ0101 to R01AN3159EJ0102. |
| 1.03 | Apr 15, 2016 | | Updated existing modules to latest modules.<br>Added RX230 and RX24T.<br>Changed document number from R01AN3159EJ0102 to R01AN3233EJ0103. |

## 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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