RX113 Group

RX Driver Package User's Manual

R01AN2466EJ0100
Rev.1.00
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Introduction

This application note documents the RX113 Group RX Driver Package User's Manual, version 1.00.

The RX Driver Package is a software platform that collects middleware and drivers that support the Firmware Integration Technology (FIT). This package provides an environment for conveniently evaluating the rich set of peripheral functions provided by RX microcontrollers.

The RX Driver Package includes device drivers for the peripheral modules included in RX microcontrollers, middleware developed for RX microcontrollers, a variety of interface modules, and the Board Support Package (BSP). Users can freely combine the modules included in the RX Driver Package construct systems simply by creating applications that using those modules, and thus quickly start the evaluation process.

This document describes the RX Driver Package, the basic structures and features of RX Driver Package applications, and the FIT modules included in this application note.

See the related documents for detailed information on using the RX Driver Package and procedures for evaluating applications that use the RX Driver Package.

In the use to the product, to fit your environment, please careful evaluated.

Target Device

RX113 Group (Renesas Starter Kit RX113)

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 CubeSuite+ Projects (R01AN1826EJ)
- The User's Manual provided with the RX Driver Package Application.

Contents

1. Overview

1.1 Applicability

This document applies to the RX113 Group RX Driver Package, version 1.00.

1.2 RX113 Group RX Driver Package

The RX113 Group RX Driver Package (referred to as "this package" below) is a software platform(framework) that was packaged such as device drivers and middleware for the RX113. It is available for free of charge to everybody.

1.3 Operating Environment

This package runs under the operating environment described below.

Table 1.3.1 Operating Environment

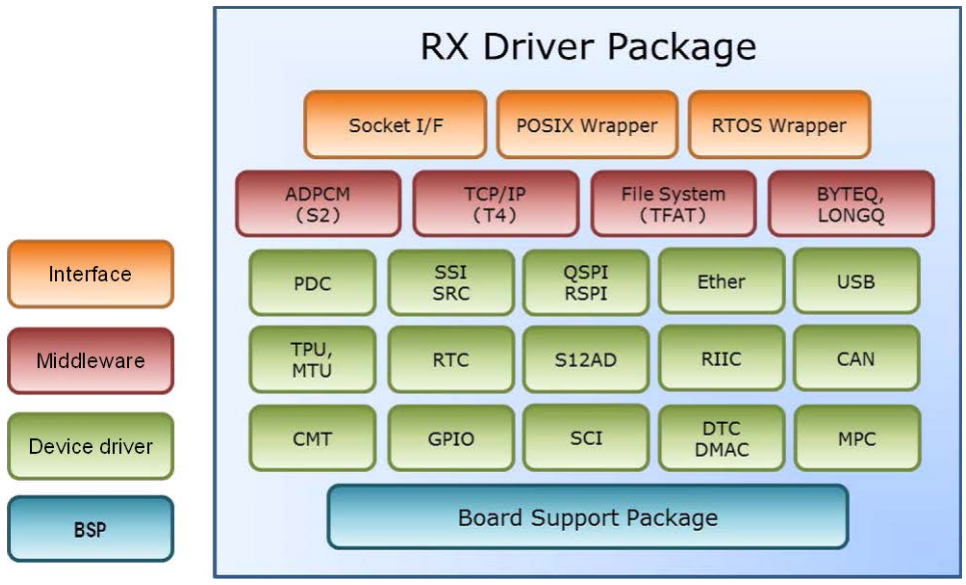
Microcontroller	RX113 Group
Evaluation board	Renesas Starter Kit RX113
Integrated development environment (IDE)	e^2 studio, V3.1.2 or later Or: CS+ V3.00.00 or later
Cross tools	RX Family C/C++ Compiler Package V2.02.00 or later
Emulator	E1, E20

2. RX Driver Package

2.1 RX Driver Package Structure

The RX Driver Package is a software platform that collects the lower level software components required to develop application programs. A wide range of applications can be developed using the RX Driver Package.

The RX Driver Package consists of the BSP module, microcontroller peripheral module device drivers, middleware (TCP/IP, file systems, and other items), and various interfaces.



Note: Items marked with an asterisk are examples.

Figure 2.1.2 RX Driver Package Structure

For example, as shown in the figure below, a system can be constructed by collecting the required components from those in the RX Driver Package and providing an application program.

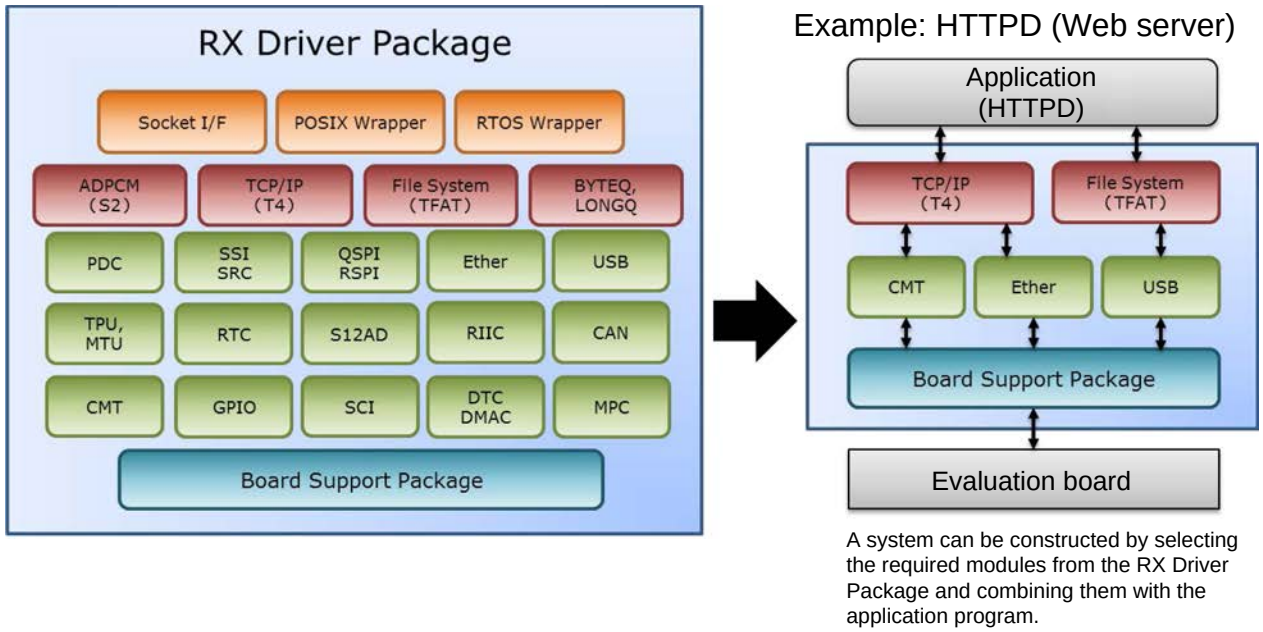


Figure 2.1.3 System Construction with the RX Driver Package

Furthermore, all of these modules meet the FIT specifications and since the folder structure and API are standardized (with a few exceptions), this structure makes it easy to swap modules in and out or to port an application to another microcontroller.

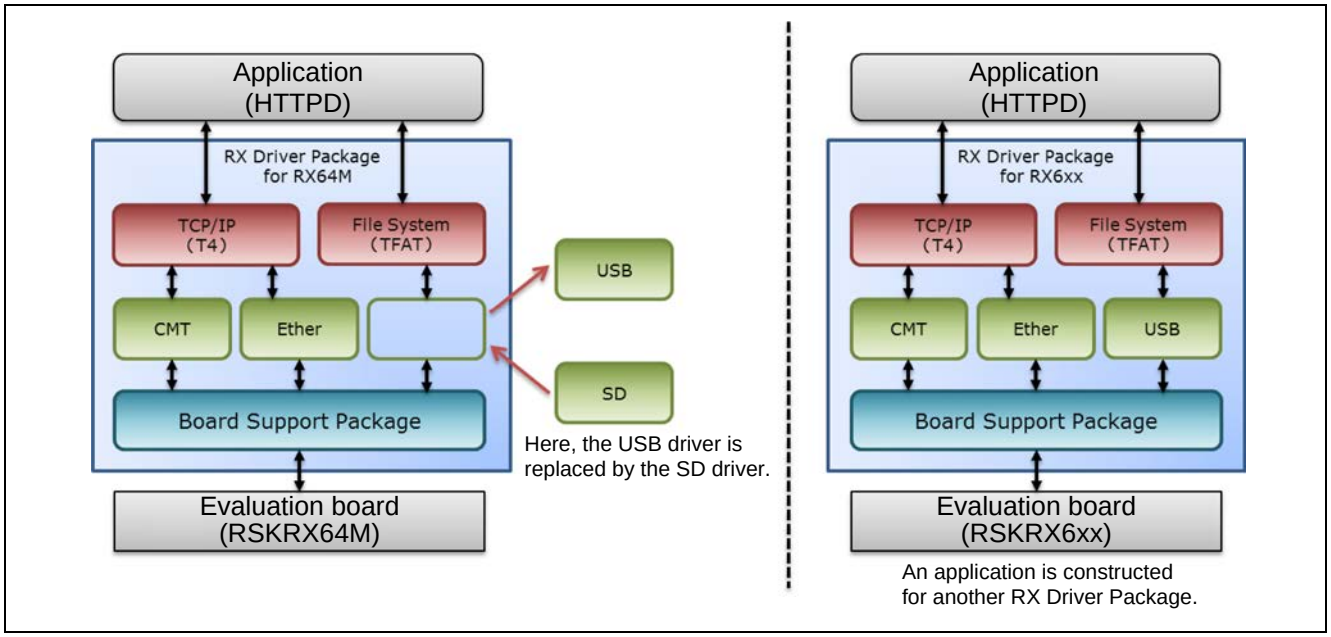


Figure 2.1.4 RX Driver Package Application Examples

2.2 RX Driver Package Features

The RX Driver Package has the following features.

- The RX Driver Package is a software platform that provides, in a single package, the device drivers and middleware required for application program development. Renesas will proved RX Driver Packages in a timely as microcontrollers are released.
- Application programs developed on one RX Driver Package can easily be ported to the RX Driver Package for a different microcontroller.
- All the device drivers and middleware included in the RX Driver Package are either compliant with or compatible with the FIT specifications. Thus applications that take advantage of the FIT features can be developed easily.
- The RX Driver Package provides a common interface to middleware and real-time OSes. This makes it easy to reuse software assets and to port applications between real-time OSes.
- Renesas supplies "RX Driver Package Application" sample applications that, when combined with the corresponding RX Driver Package, allow evaluation to be started immediately.
- The RX Driver Package is provided without charge. All the modules in the RX Driver Package can be used without charge, even in commercial applications.

3. Structure of the RX113 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 3.3.1 (as ZIP files and XML files).

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

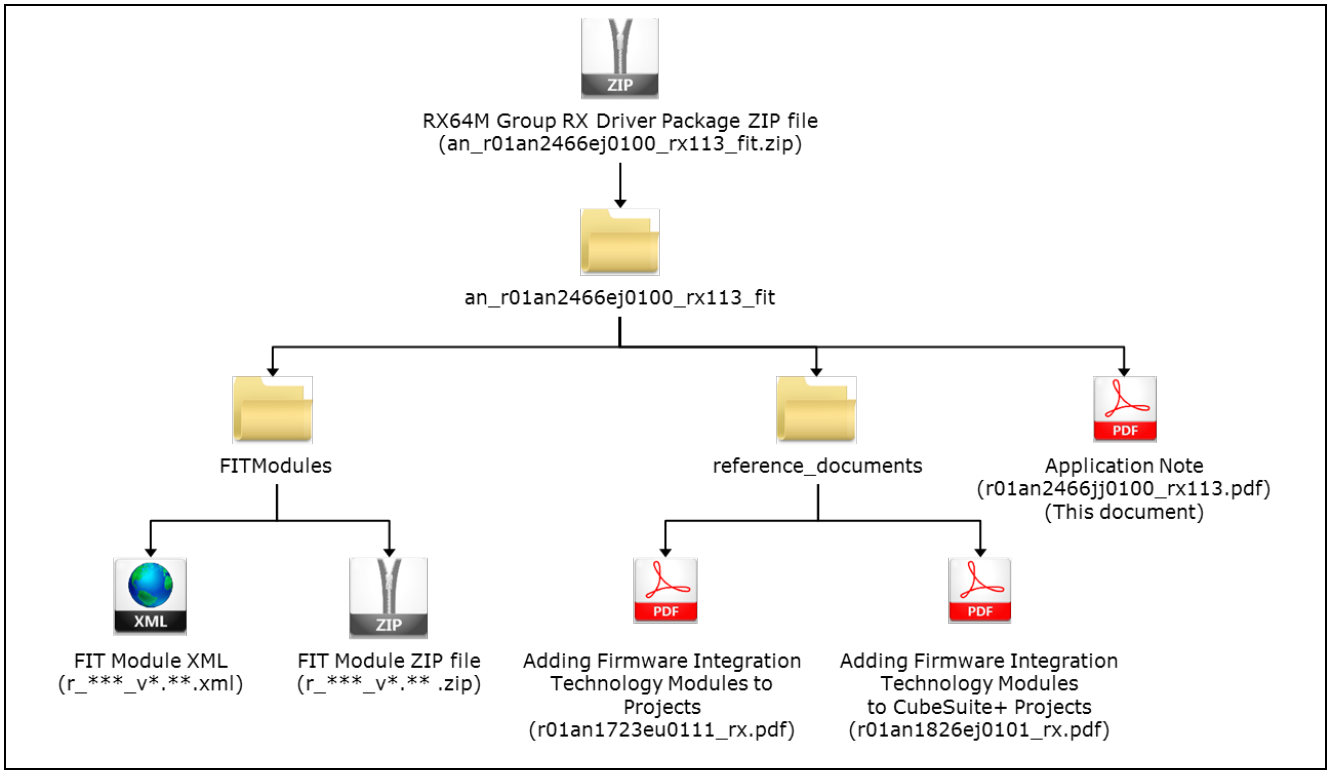


Figure 3.1.1 Folder Structure of the RX113 Group RX Driver Package

3.2 Module Structure

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

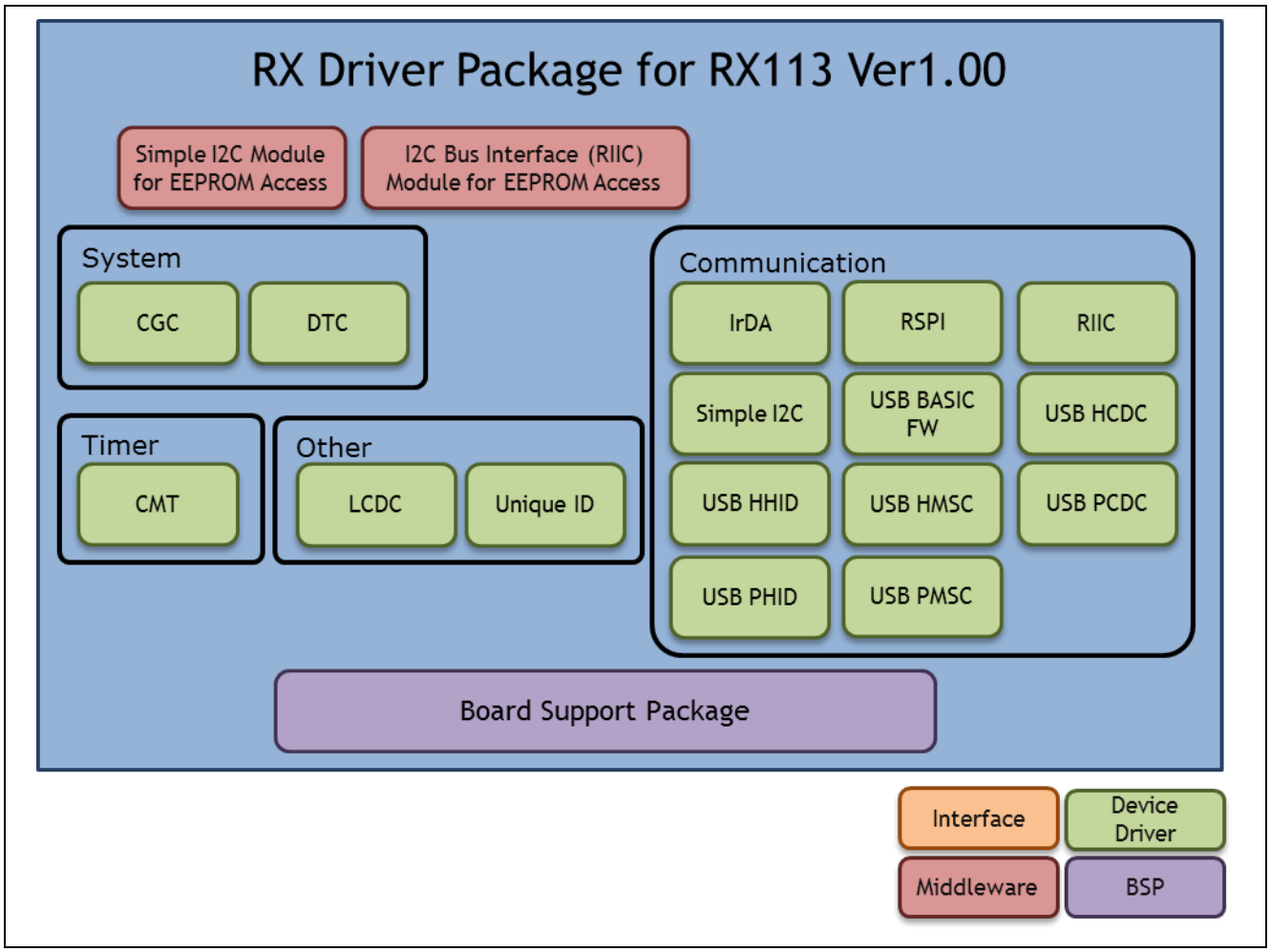


Figure 3.2.1 RX113 Group RX Driver Package FIT Module Structure

3.3 FIT Modules

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

Table 3.3.1 RX113 Group RX Driver Package FIT Modules

Type	Module	FIT Module Name	Version
Board Support Package	Board support package	r_bsp	2.70
Device Driver	Clock Generation Circuit (CGC)	r_cgc_rx100	1.30
Device Driver	Data Transfer Controller (DTC)	r_dtc_rx	2.01
Device Driver	Compare match timer (CMT)	r_cmt_rx	2.40
Device Driver	Serial Communications Interface (SCI: Simple I²C Bus)	r_sci_iic_rx	1.40
Device Driver	I²C Bus Interface (RIIC)	r_riic_rx	1.50
Device Driver	Serial peripheral interface (RSPI)	r_rspi_smstr_rx	1.07
Device Driver	USB Basic Mini Firmware	r_usb_basic_mini	1.00
Device Driver	USB Host Mass Storage Class	r_usb_hmsc_mini	1.00
Device Driver	USB Host Communication Device Class	r_usb_hcdc_mini	1.00
Device Driver	USB Host Human Interface Device Class	r_usb_hhid_mini	1.00
Device Driver	USB Peripheral Mass Storage Class	r_usb_pmsc_mini	1.00
Device Driver	USB Peripheral Communications Device Class	r_usb_pcdc_mini	1.00
Device Driver	USB Peripheral Human Interface Device Class	r_usb_phid_mini	1.00
Device Driver	IrDA Interface (IrDA)	r_irda_sci_rx	1.00
Device Driver	LCD Controller/Driver (LCDC)	r_lcdc_rx	1.00
Device Driver	Unique ID Read	r_uid_rx	1.00
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

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+ (CubeSuite+), see the document "RX Family Adding Firmware Integration Technology Modules to CubeSuite+ Projects (R01AN1826EJ)" included in this package.

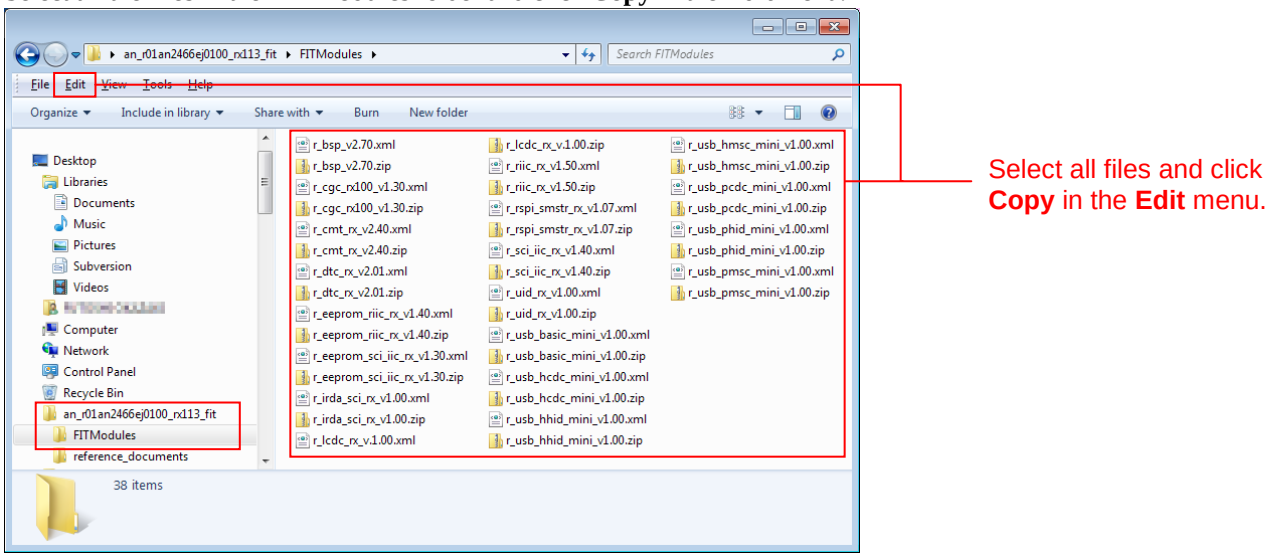
4.1 Environment Used

The RX113 is used as the target microcontroller and the Renesas Starter Kit RX113 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

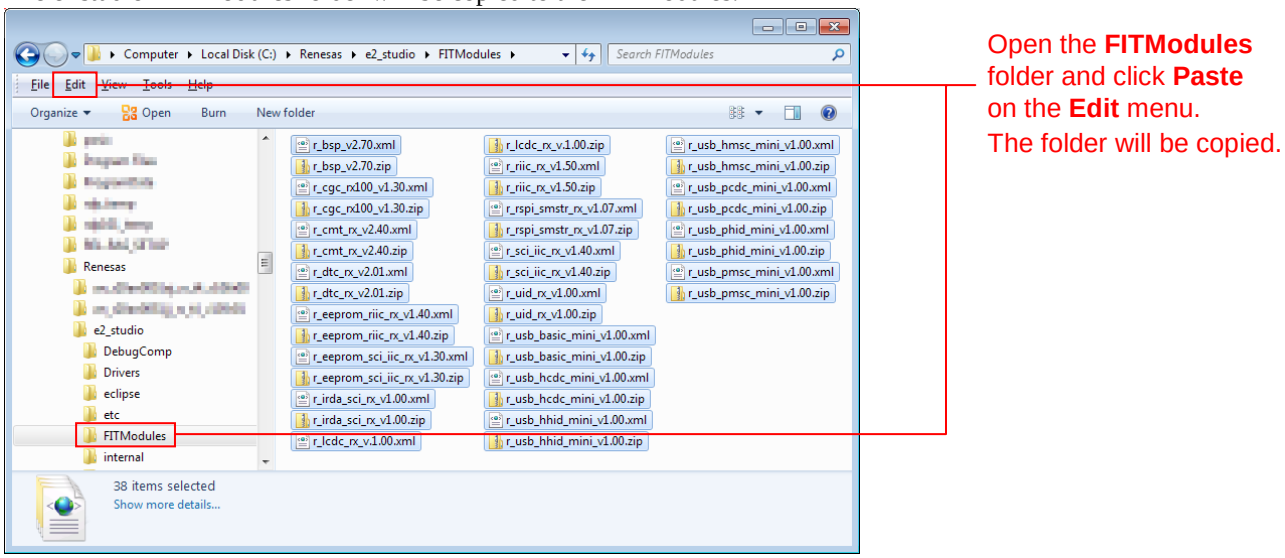
Install the FIT modules in the RX Driver Package into e^2 studio.

1. Decompress the downloaded file **an_r01an2466ej0100_rx113_fit.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

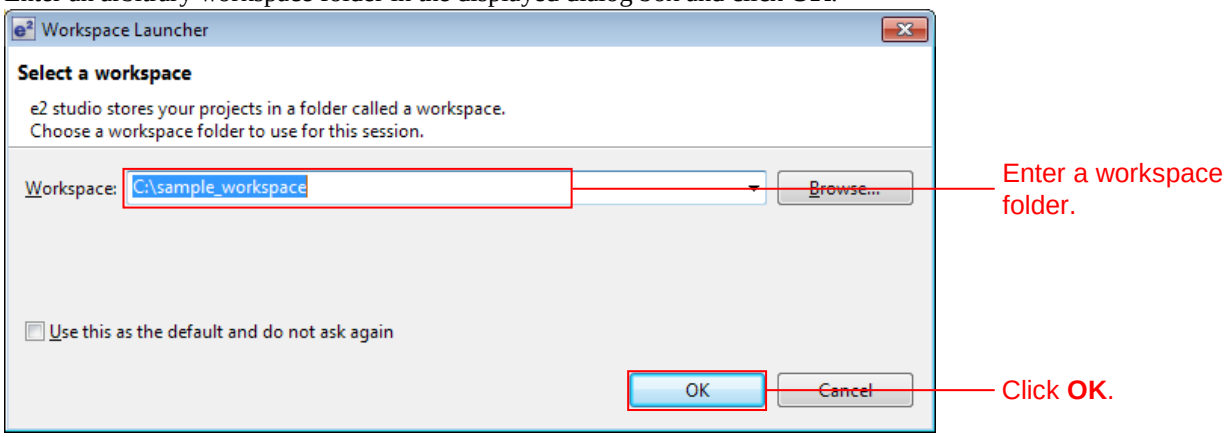
In this section, create a simple application that drives an LED.

4.3.1 Create a Workspace and a Project

First, create a new workspace and a new project.

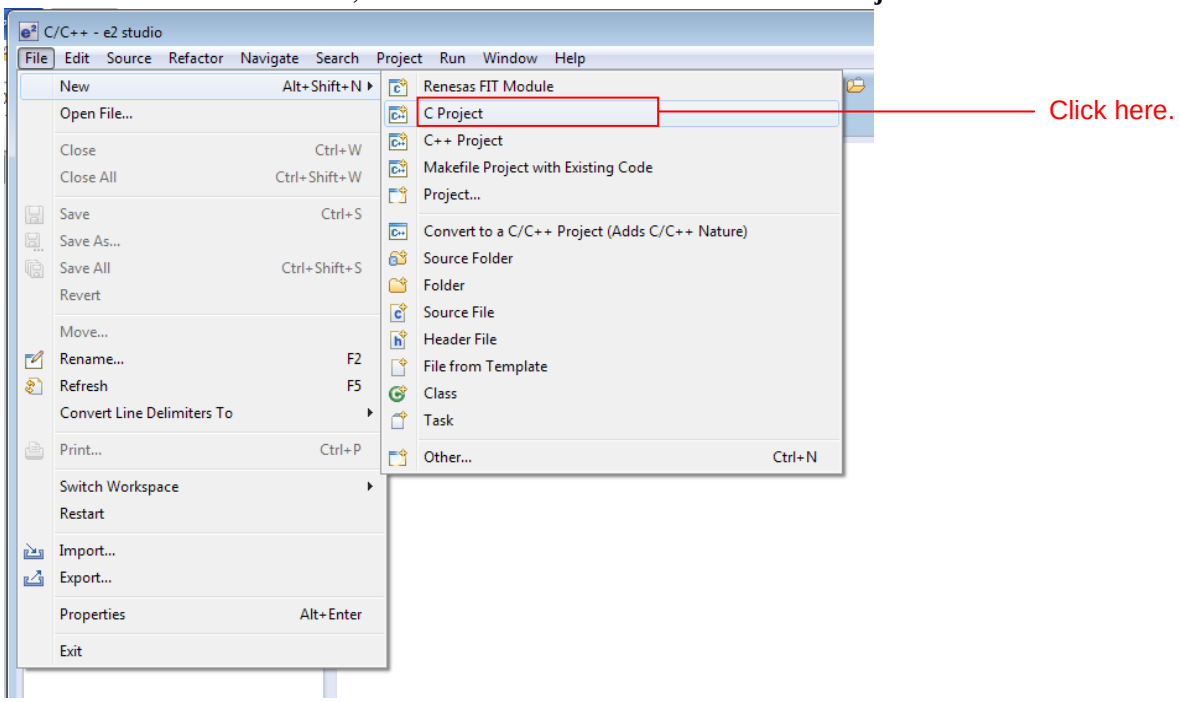
1. Start e^2 studio.

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

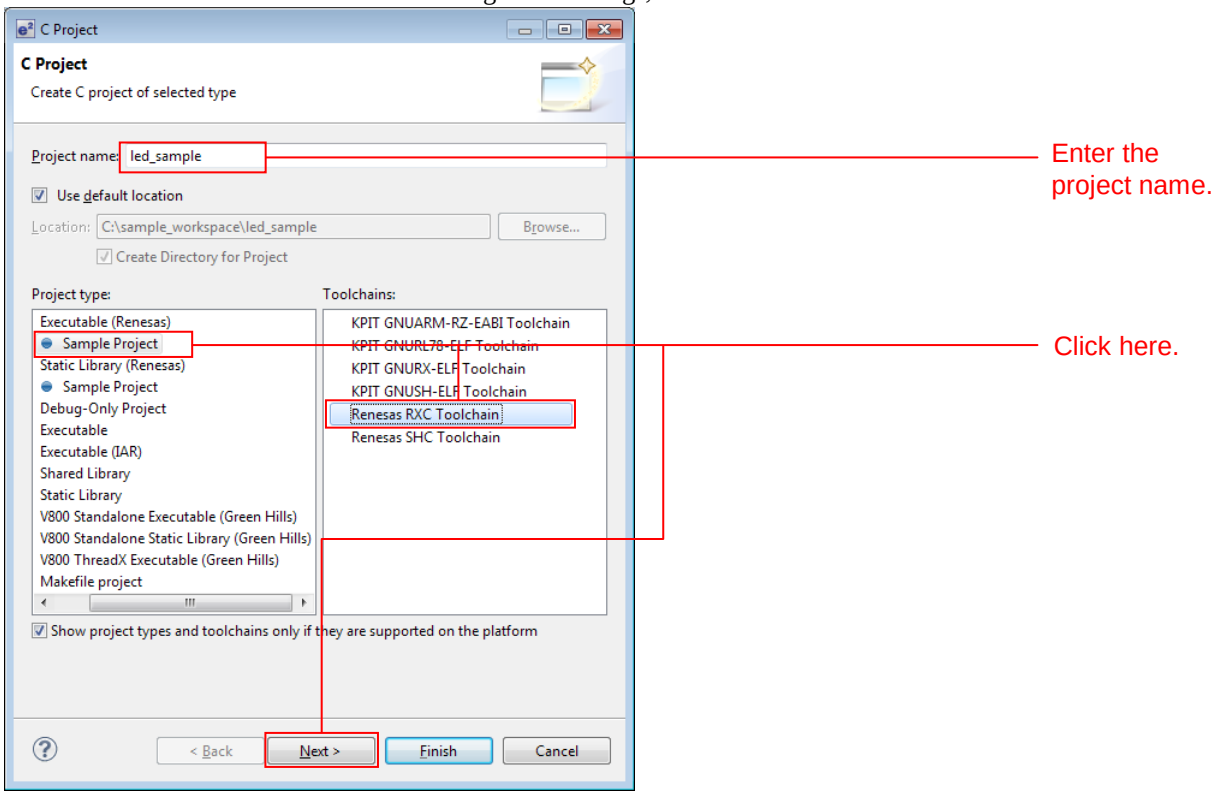


3. When the following window is displayed, click **Workbench**.

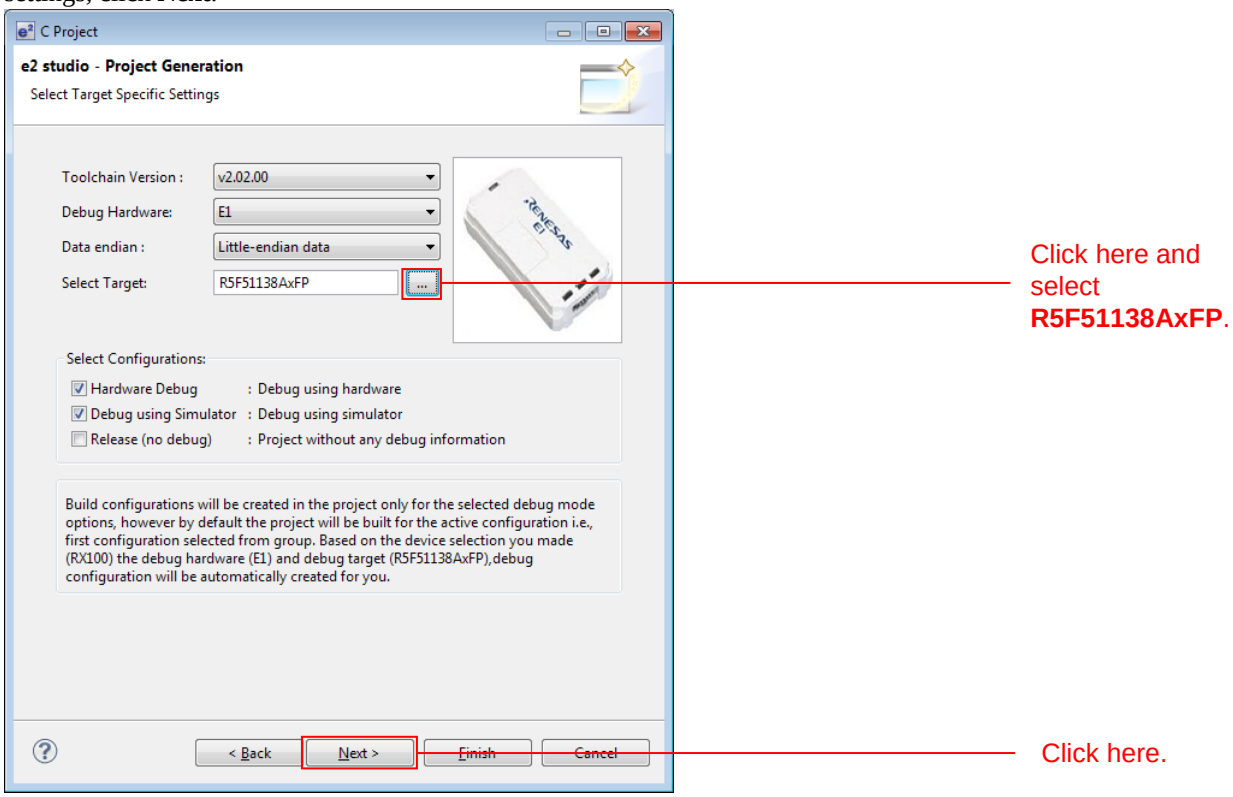
4. When the workbench has started, select **New** from the **File** menu and click **C Project**.



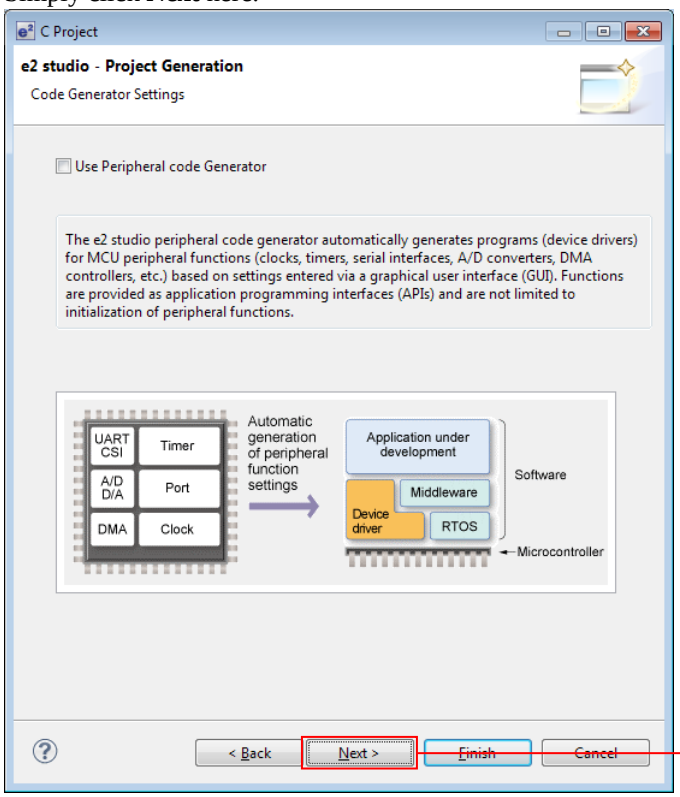
5. Enter the project name. For the project type, click **Sample Project** under **Executable (Renesas)**. For the tool chain, click **Renesas RXC Toolchain**. After making these settings, click **Next**.



6. Select the target. Click the "..." button under **Target Selection** and select **R5F51138AxFP**. After making these settings, click **Next**.

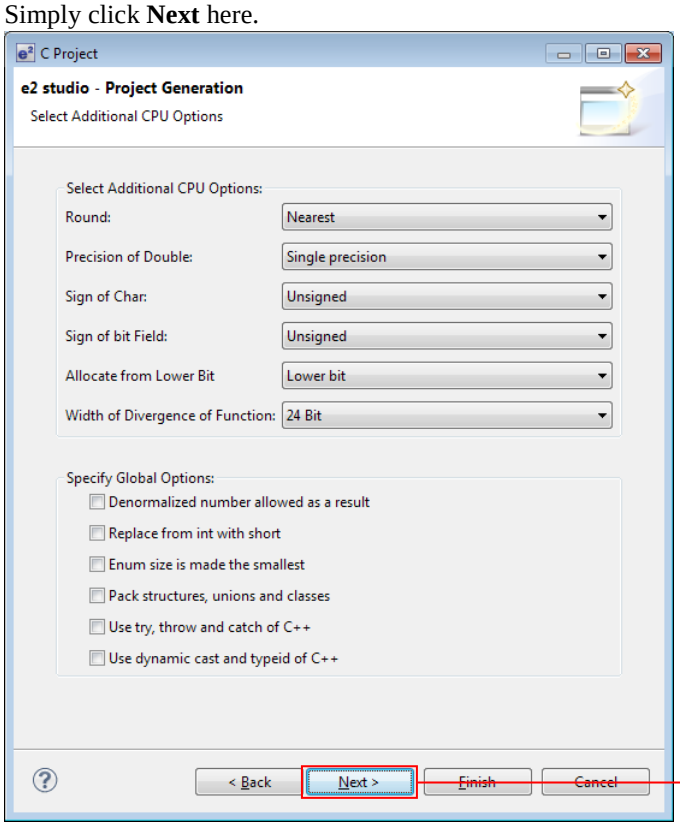


7. Simply click **Next** here.



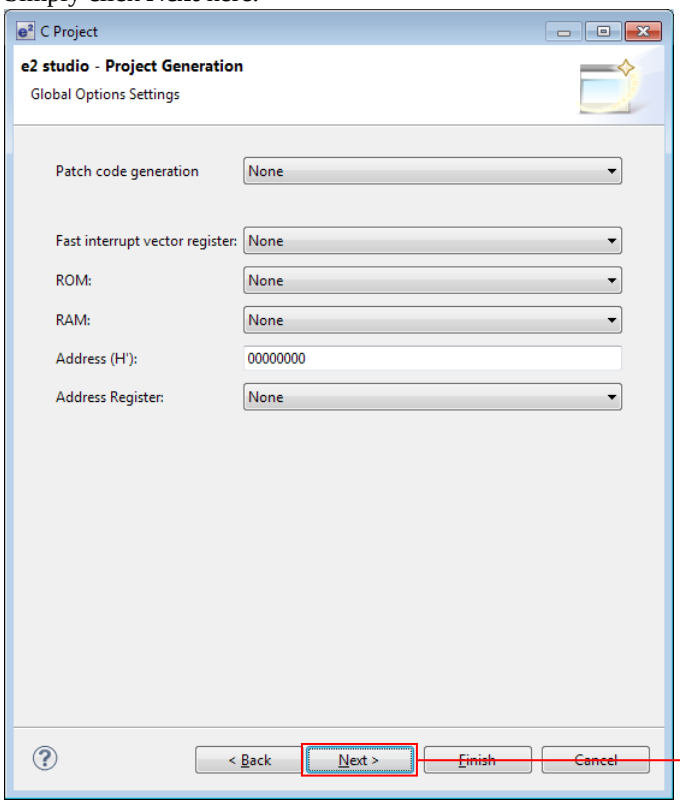
Click here.

8. Simply click **Next** here.

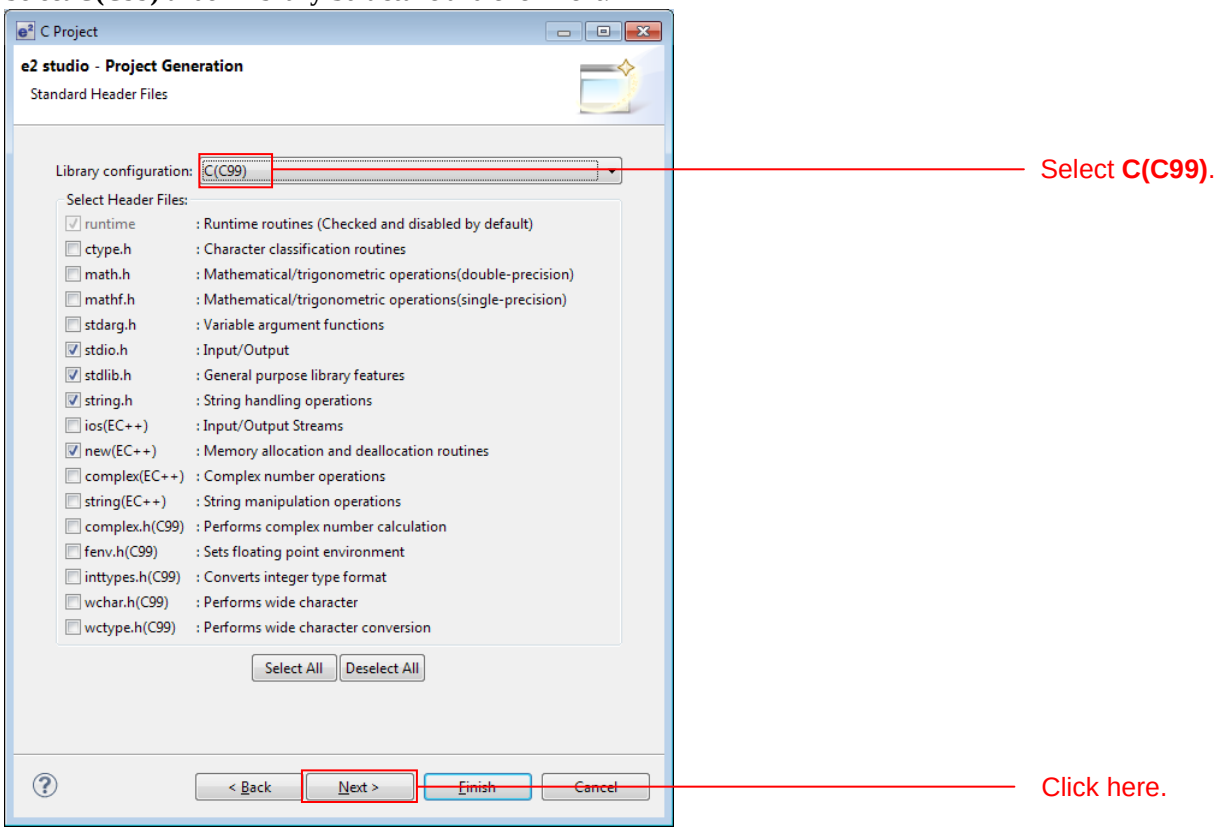


Click here.

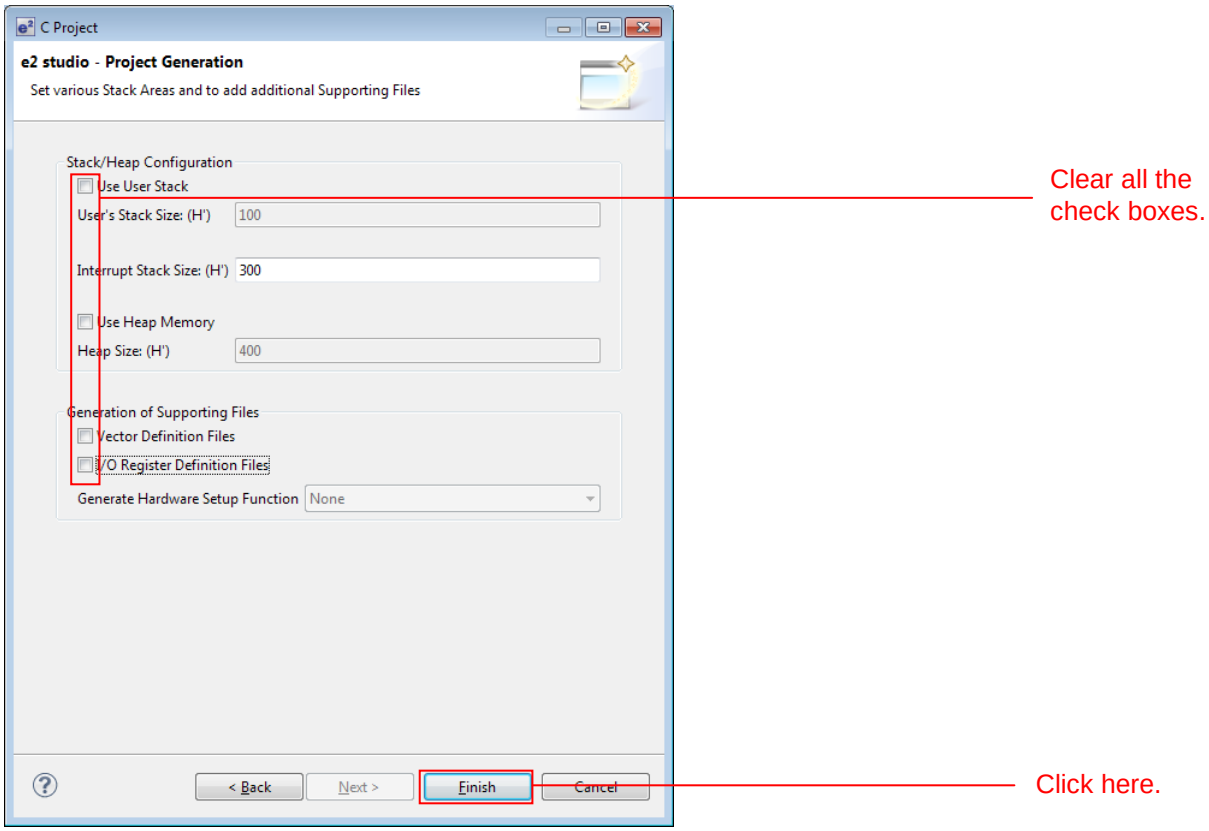
9. Simply click **Next** here.



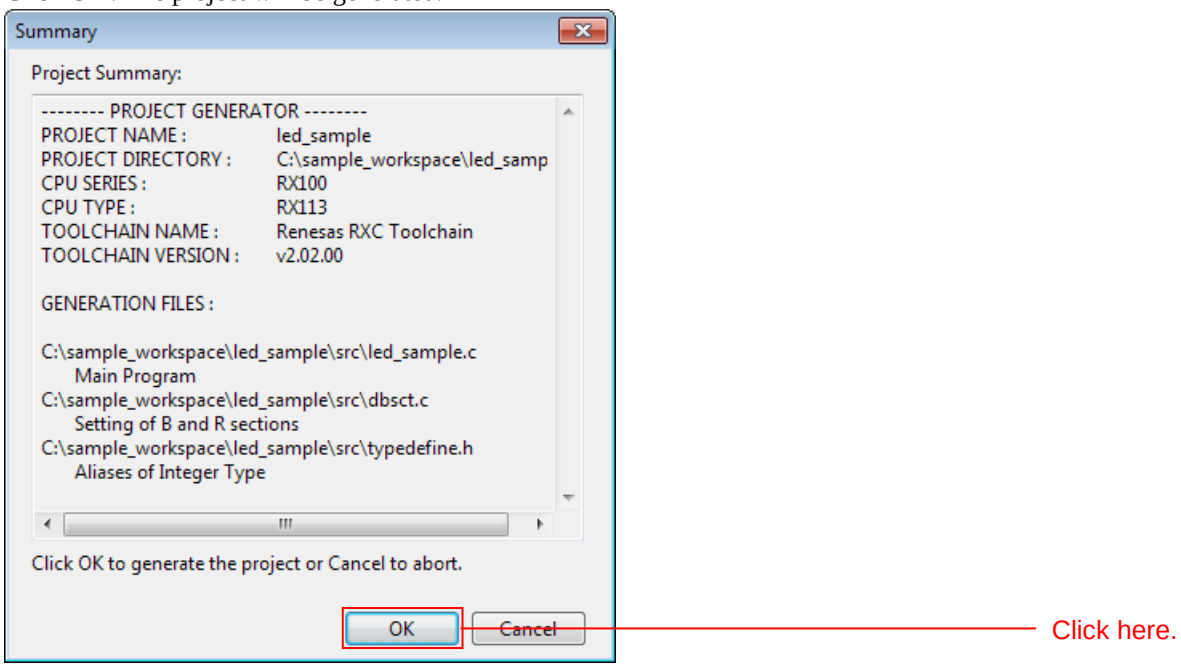
10. Select **C(C99)** under **Library Structure** and click **Next**.



11. Clear all four check boxes and click **Finish**.



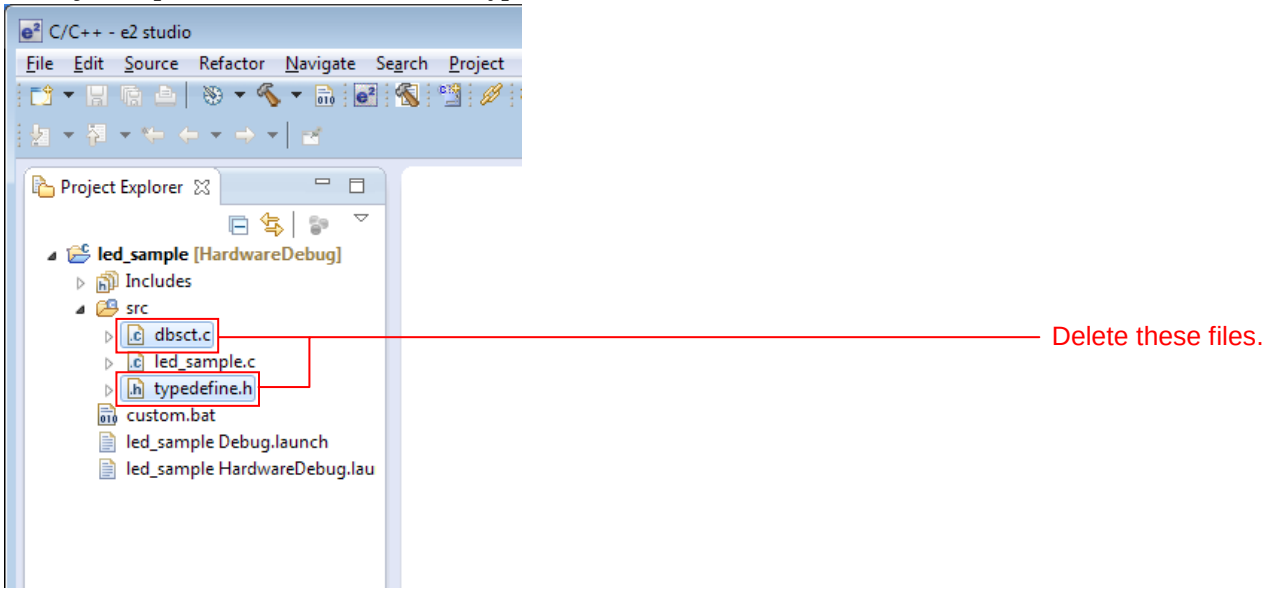
12. Click **OK**. The project will be generated.



4.3.2 Prepare to Embed the FIT Modules

Since the FIT modules are independently initialized in BSP, it is necessary to modify certain aspects of the project generated by e^2 studio.

1. In **Project Explorer**, delete the **dbsct.c** and **typedefine.h** files in the **src** folder.

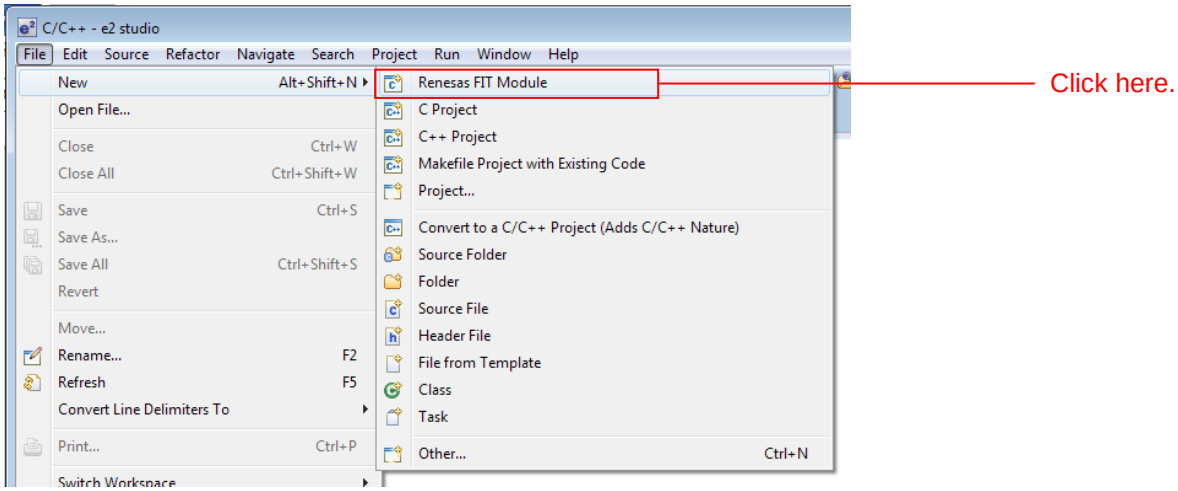


4.3.3 Install the FIT Modules with the FIT Plugin.

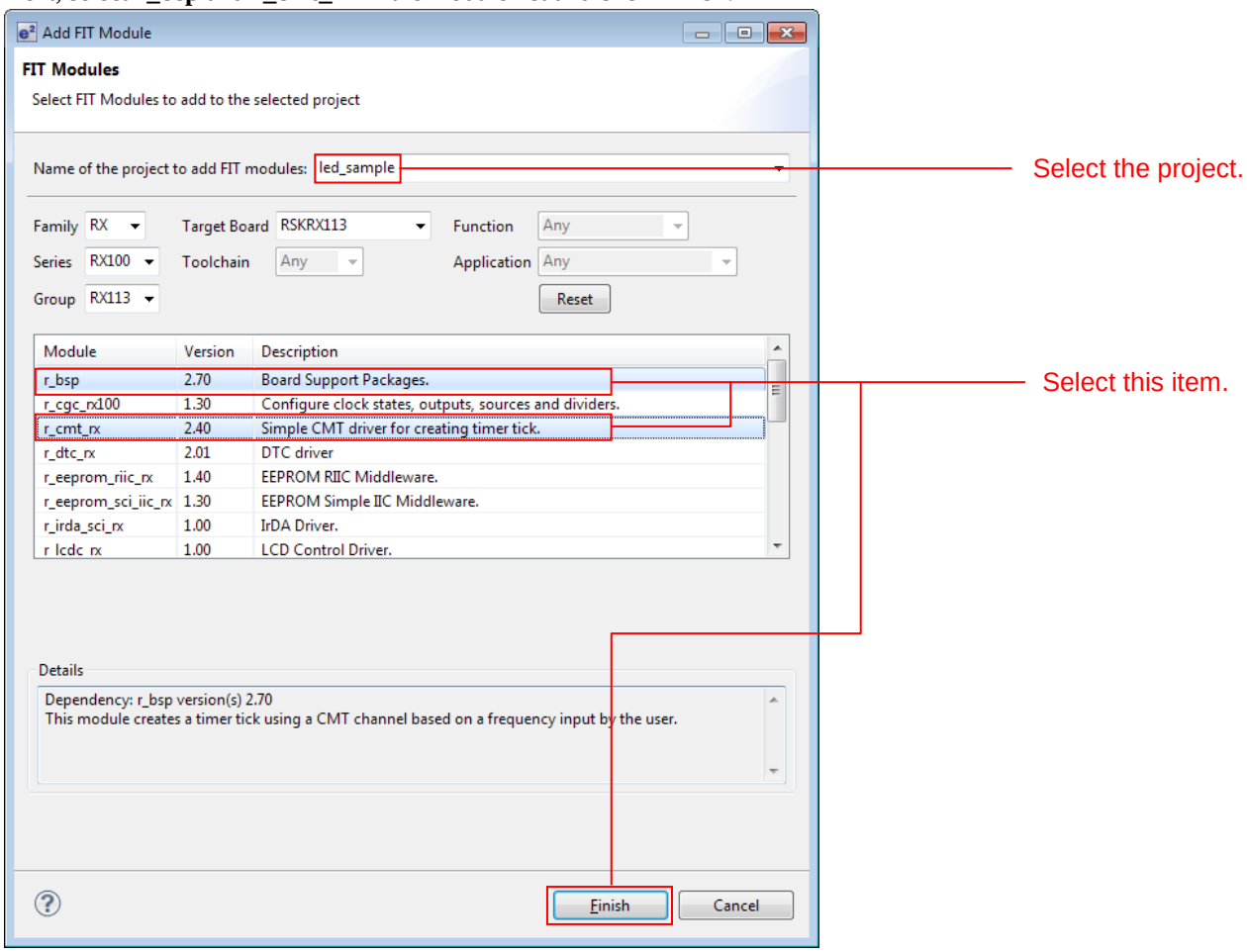
Install the required modules with the FIT plugin into the created project.

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

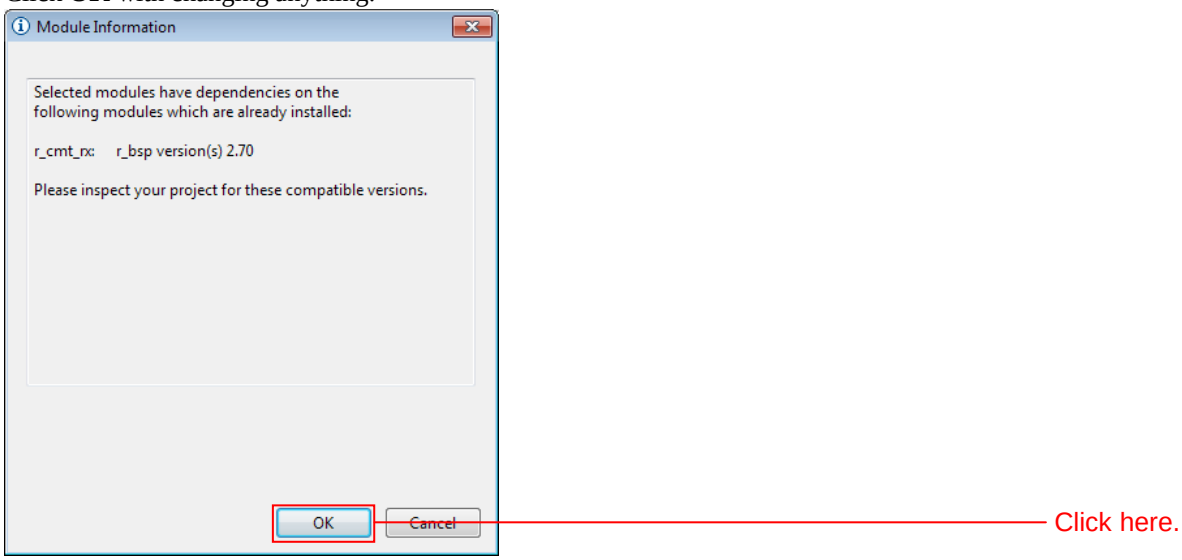
1. In the **File** menu, select **New** and click **Renesas FIT Module**.



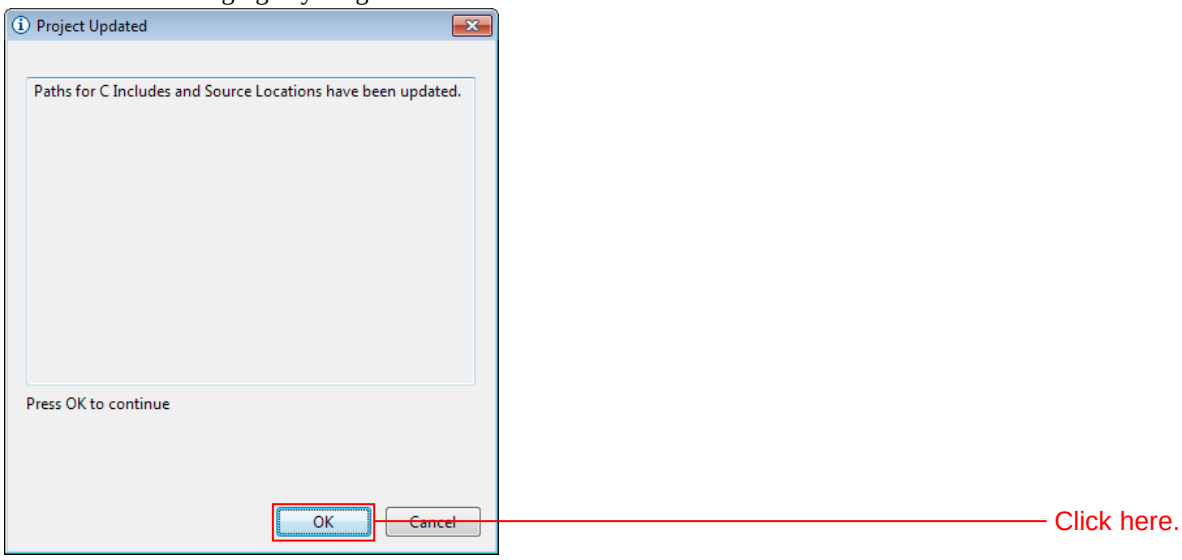
2. Select the created project with **Project to Add FIT Module** to.
   Next, select **r_bsp** and **r_cmt_rx** in the module list and click **Finish**.



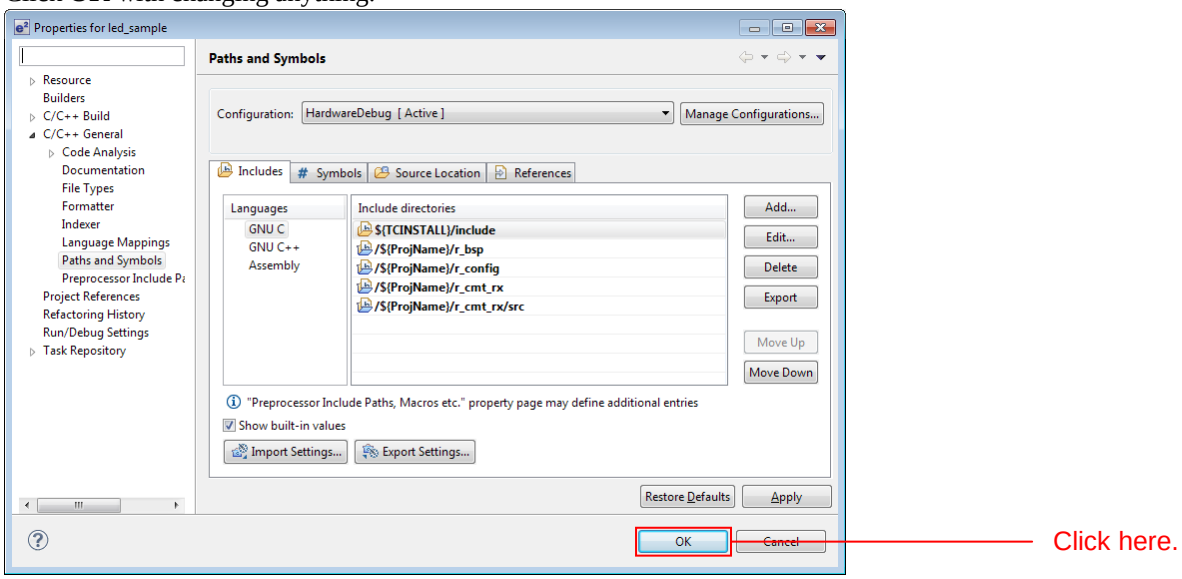
3. Click **OK** with changing anything.



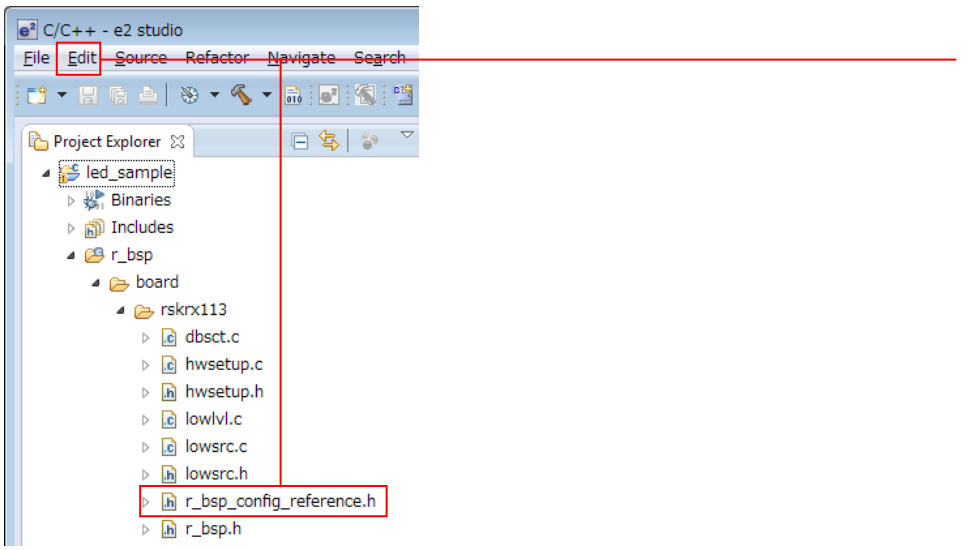
4. Click **OK** with changing anything.



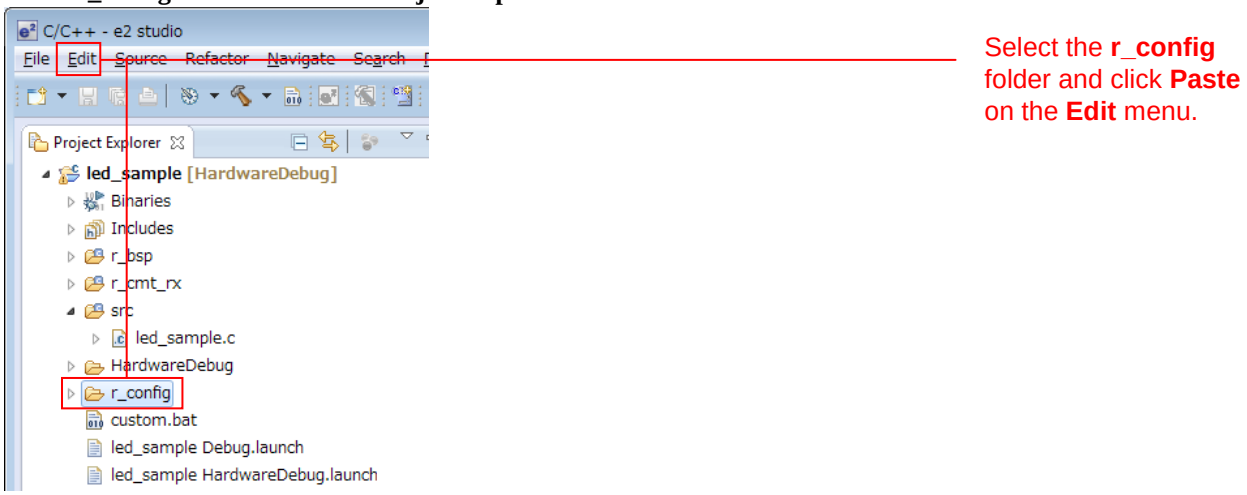
5. Click **OK** with changing anything.



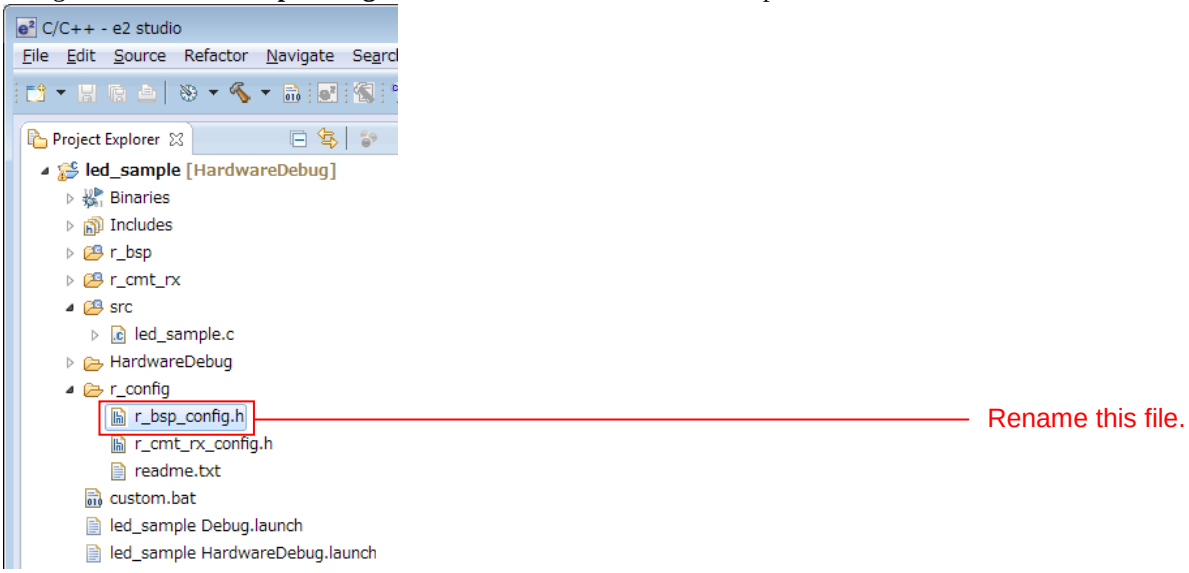
6. Open **r_bsp/board/rskrx113** from the e^2 studio Project Explorer, select **r_bsp_config_reference.h**, and click **Copy** on the **Edit** menu.



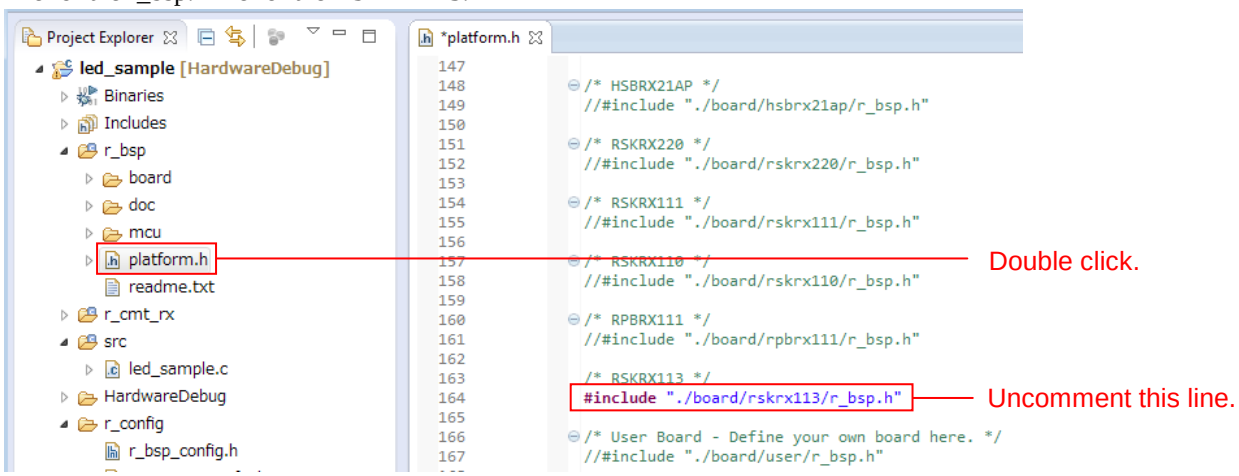
7. Select **r_config** from the e^2 studio **Project Explorer** and click **Paste** on the **Edit** menu.



8. Change the names of **r_bsp_config.h**. That is, delete the "_reference_" part of the file names.



9. Modify platform.h to correspond to the target board used.
   Double click **r_bsp/platform.h** from the e^2 studio **Project Explorer** and, in the editor, uncomment from the include line for the r_bsp.h file for the RSKRX113.



4.3.4 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/led_sample.c and modify it as shown below.

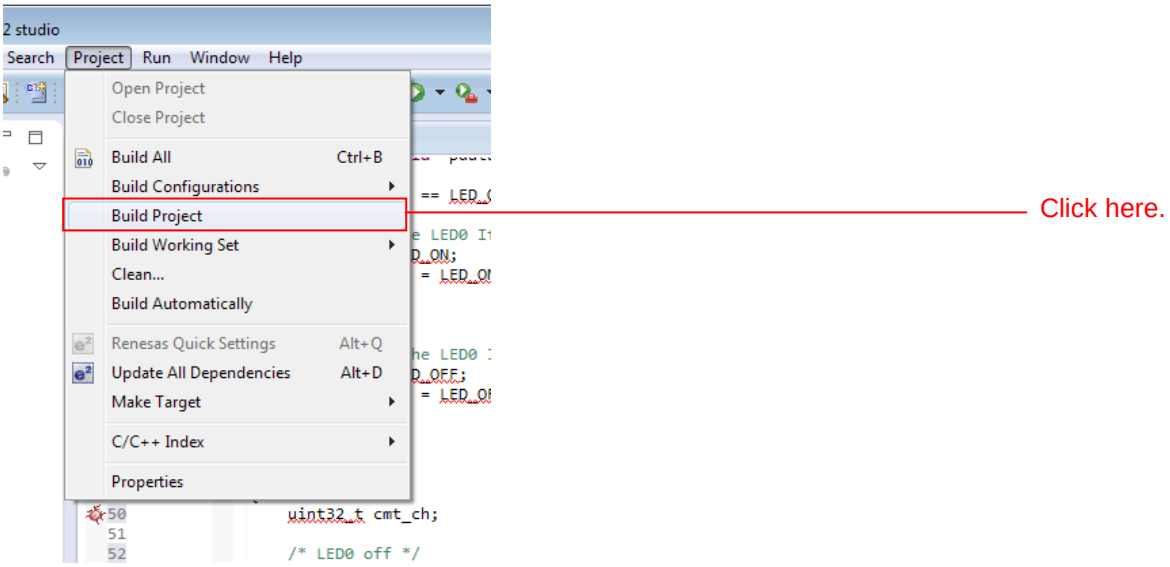
src/led_sample.c

```
/***********************************************************************/
/*                                                                     */
/*  FILE        :Main.c or Main.cpp                                    */
/*  DATE        :Tue, Oct 31, 2006                                     */
/*  DESCRIPTION :Main Program                                          */
/*  CPU TYPE    :                                                      */
/*                                                                     */
/*  NOTE:THIS IS A TYPICAL EXAMPLE.                                    */
/*                                                                     */
/***********************************************************************/
#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);
}
```

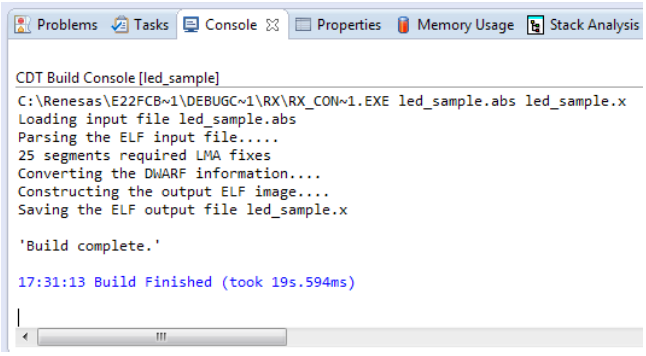
4.3.5 Build and Try Running the Program

Build the program just created and verify that it runs.

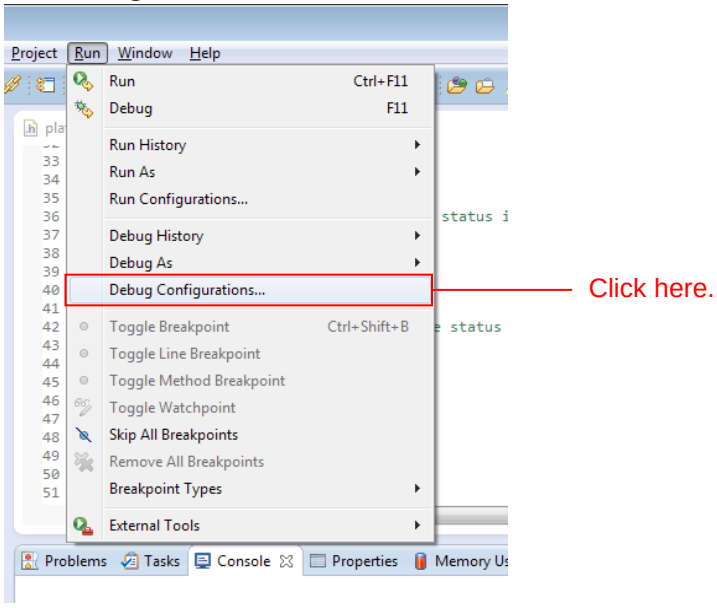
1. Click **Build Project** on the **Project** menu.



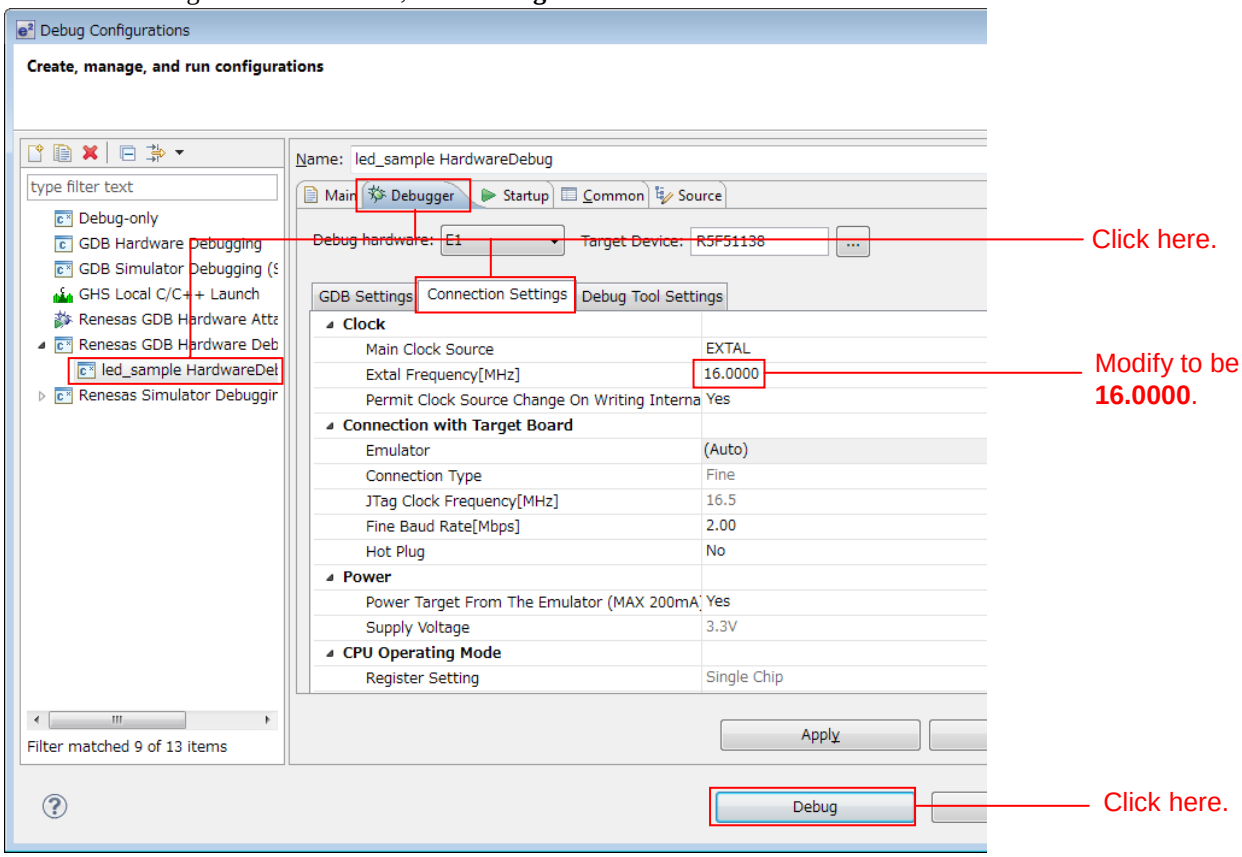
2. When the build completes, the following will be displayed in **Console** view.



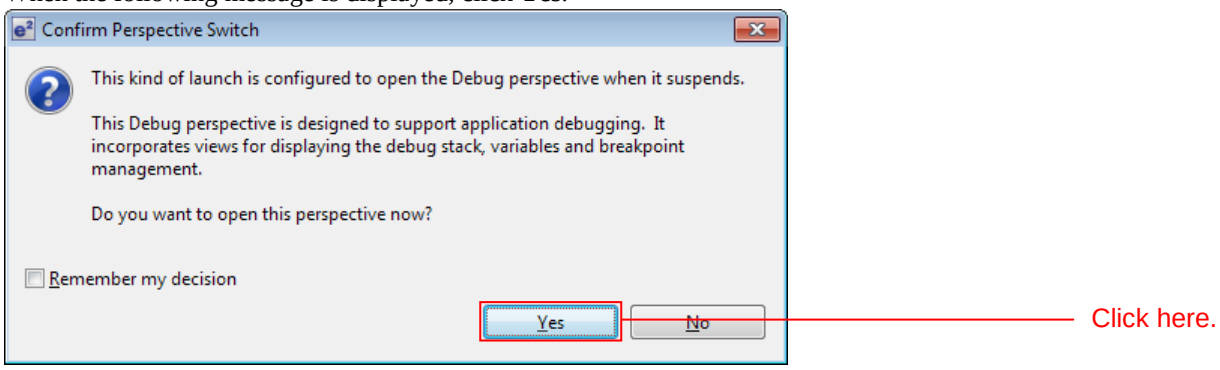
3. Click **Debug Build** on the **Run** menu.



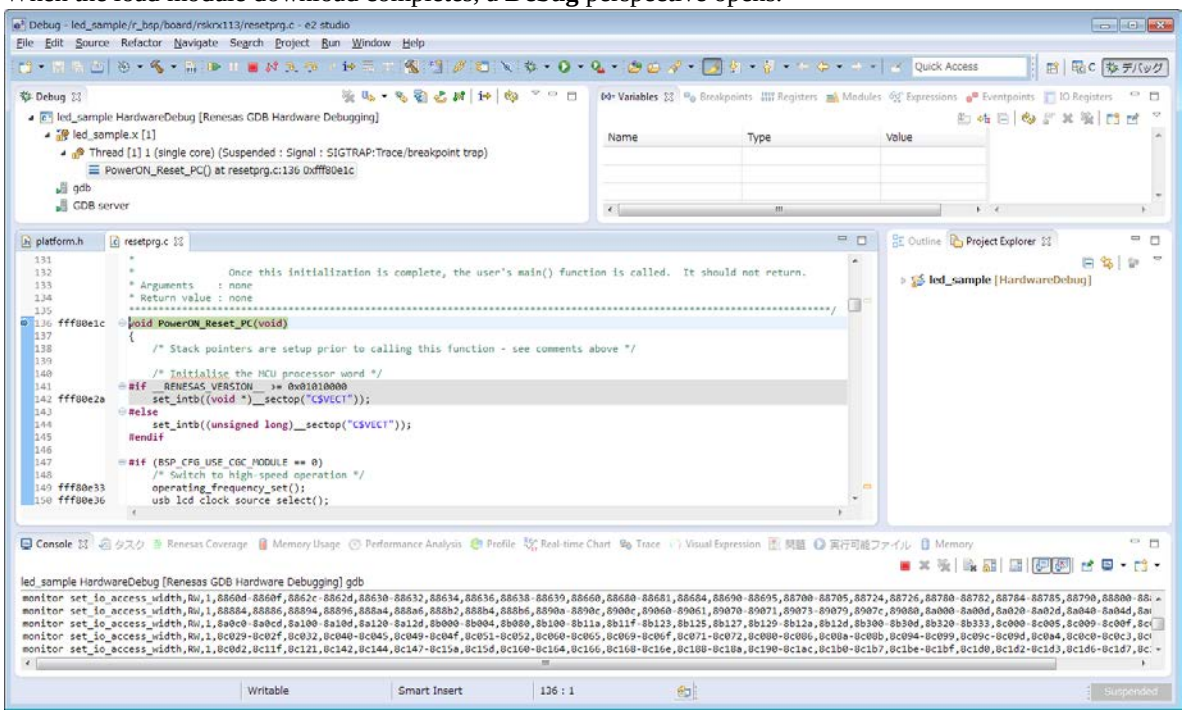
4. Click **led_sample HardwareDebug** under the **Renesas GDB Hardware Debugging**. Click the **Debugger** tab and click **Connection Setting**.
   Modify **EXTAL Frequency** to be **16.0000**.
   When these changes have been made, click **Debug**.



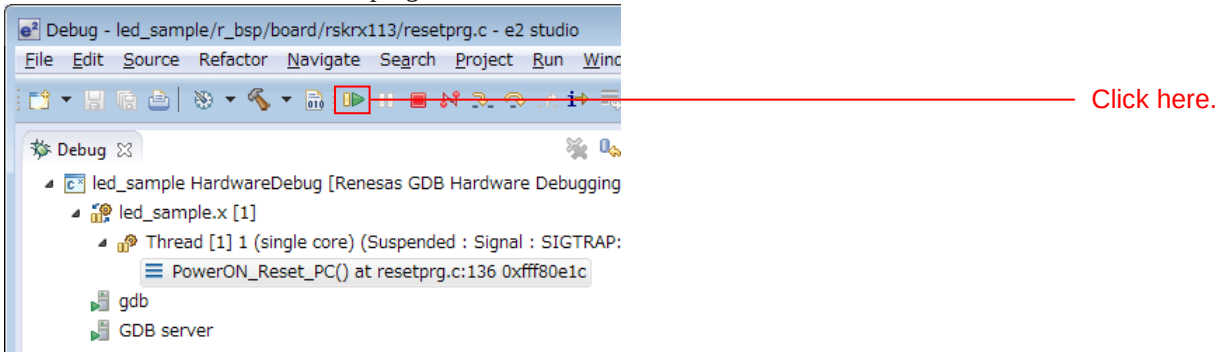
5. When the following message is displayed, click **Yes**.



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.

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.

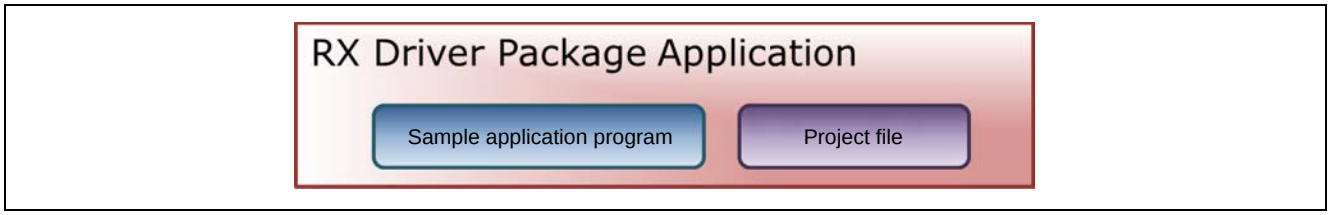


Figure 5.1.1 RX Driver Package Application Structure

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.

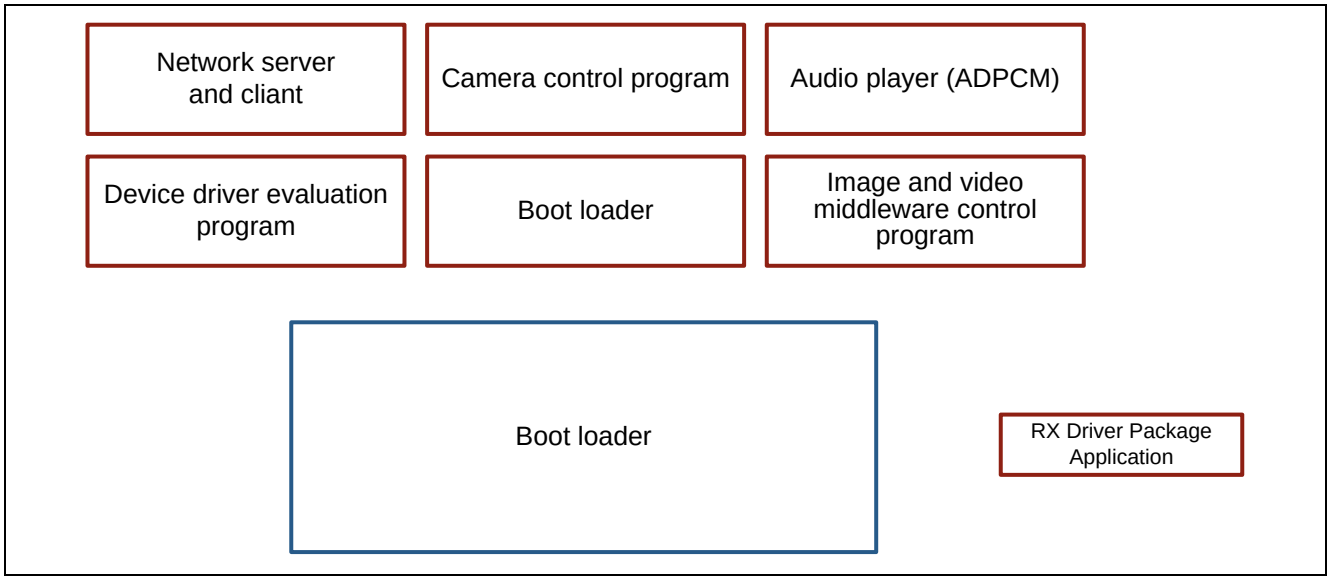


Figure 5.1.2 Types of RX Driver Package Application

5.2 RX Driver Package Application Features

The RX Driver Package Application has the following features.

- The RX Driver Package Application is evaluated in combination with the RX Driver Package.
- Project files are included in the RX Driver Package Application. Since both build and debug configurations for the application project are already set up in the provided project file, the user can quickly begin building and evaluating simply by importing the project into a workspace.
- If e^2 studio is used as the integrated development environment (IDE), the device drivers and middleware used in the application project can be automatically added to the project by using the FIT plugin provided with e^2 studio.
- Renesas provides the RX Driver Package Application without charge.

5.3 RX Driver Package Application Usage Example (when e^2 studio is used)

The device drivers and middleware required by the RX Driver Package Application are automatically added to the project by the FIT plugin, which comes with the e^2 studio.

After the project provided with the RX Driver Package Application has been installed in an e^2 studio workspace, the required device drivers and middleware from the RX Driver Package are also installed simply by installing in the project by selecting the RX Driver Package Application with the FIT plugin. Therefore all that remains is to build the project and start evaluation.

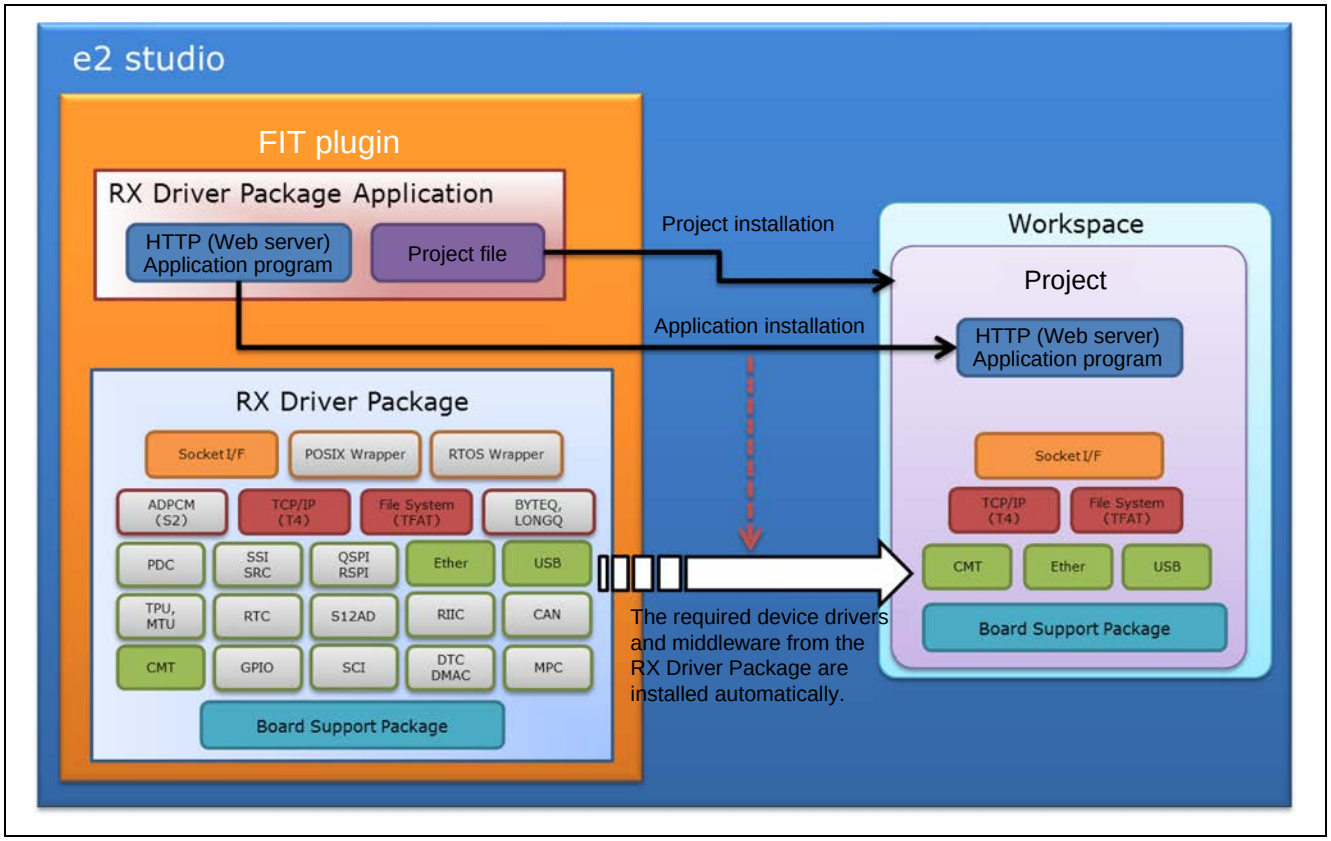


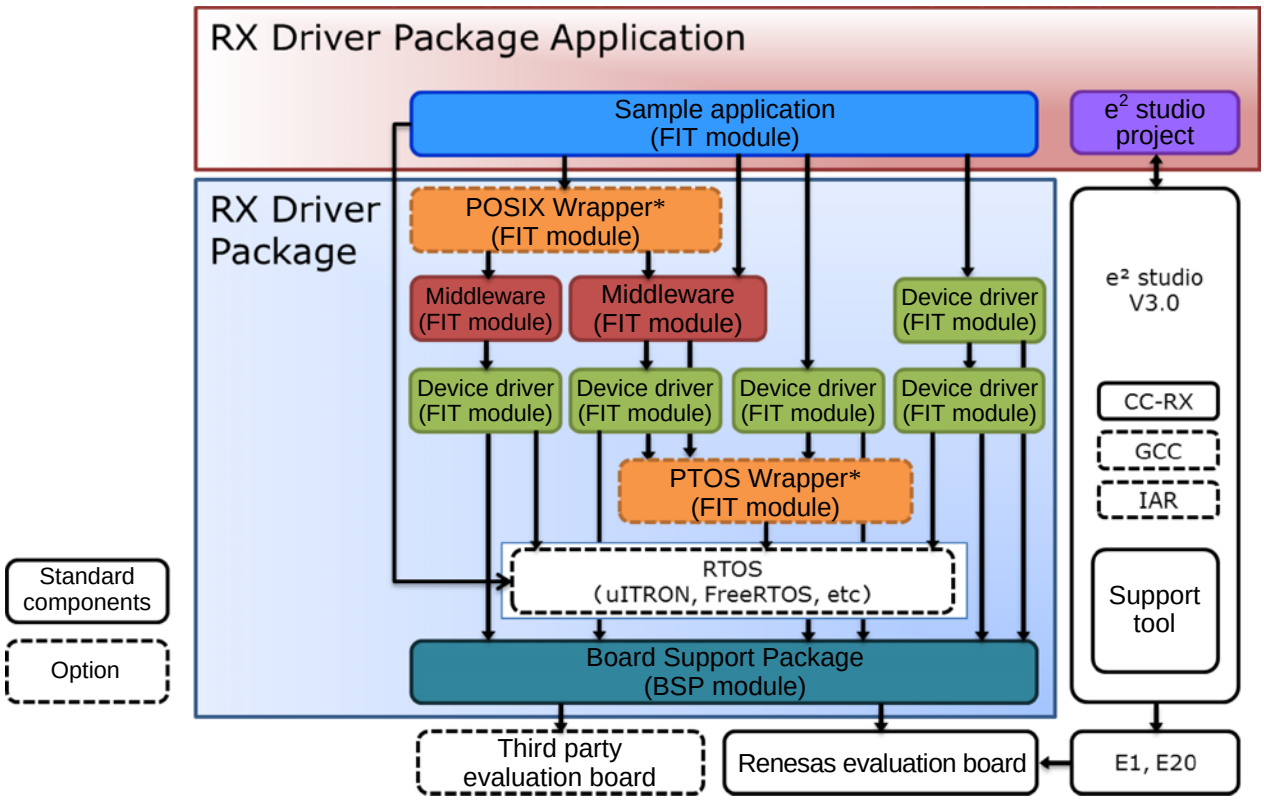
Figure 5.3.1 FIT Plugin Automatic Installation

5.4 When Using in Combination with an RX Driver Package Application

See the document provided with each RX Driver Package Application for detailed usage methods for that RX Driver Package Application.

6. System Structure

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



Note: * Items marked with an asterisk are under development.

Figure 6.1 System Structure

Website and Support

Renesas Electronics Website
http://www.renesas.com/

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Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Nov 28, 2014	—	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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