Renesas e² studio

Smart Configurator FreeRTOS™ Configuration

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Introduction

This application note describes the Renesas FreeRTOS™ configuration which is integrated within Smart Configurator.

FreeRTOS™ configuration feature helps the user save valuable time to create a project by importing FreeRTOS™ package to Smart Configurator.

The Smart Configurator provides a function to change the setting of the FreeRTOS™ kernel through graphical user interface (GUI) and code generation tool easily.

Target Devices

RX600 and RX700 Group

References

FreeRTOS™ customization:

https://www.freertos.org/a00110.html

FreeRTOS™ Memory Management:

https://www.freertos.org/a00111.html

Smart Configurator:

https://www.renesas.com/smart-configurator

Contents

1. Creating an FreeRTOS(TM) project

FreeRTOS™ project creation is supported in e² studio v7.3 and above.

At the start of project creation, the user would be able to choose the version of Renesas FreeRTOS™ package, and the selected version will be imported automatically into the project. This makes it easier for the user so that the user can focus only on FreeRTOS™ configuration and writing application code.

The steps below show how to select RTOS during project creation:

1) Create a new C project in the e² studio.

   The Renesas Starter Kit for RX65N is used in this application notes.

   Go to [File] → [New] → [C/C++ Project] to start new project generation.

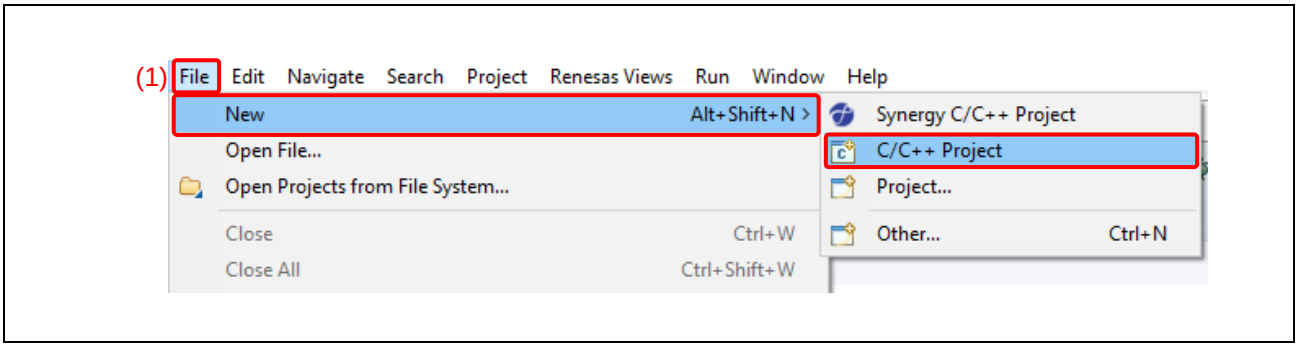

Figure 1-1 Creating project from File menu

2) Select [Renesas RX] → [Renesas CC-RX C/C++ Executable Project]. Click [Next].

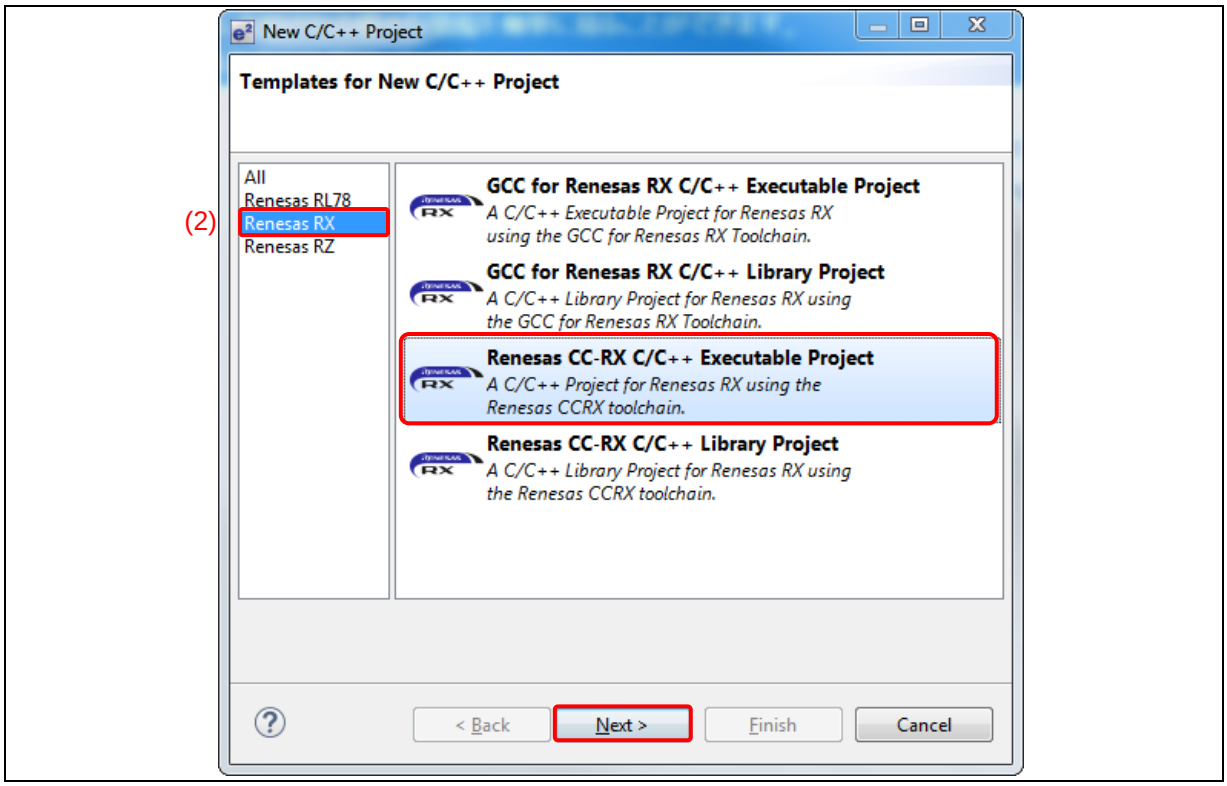

Figure 1-2 Creating project

3) Give an appropriate name to the project, for example, “RTOS”. Click [Next].

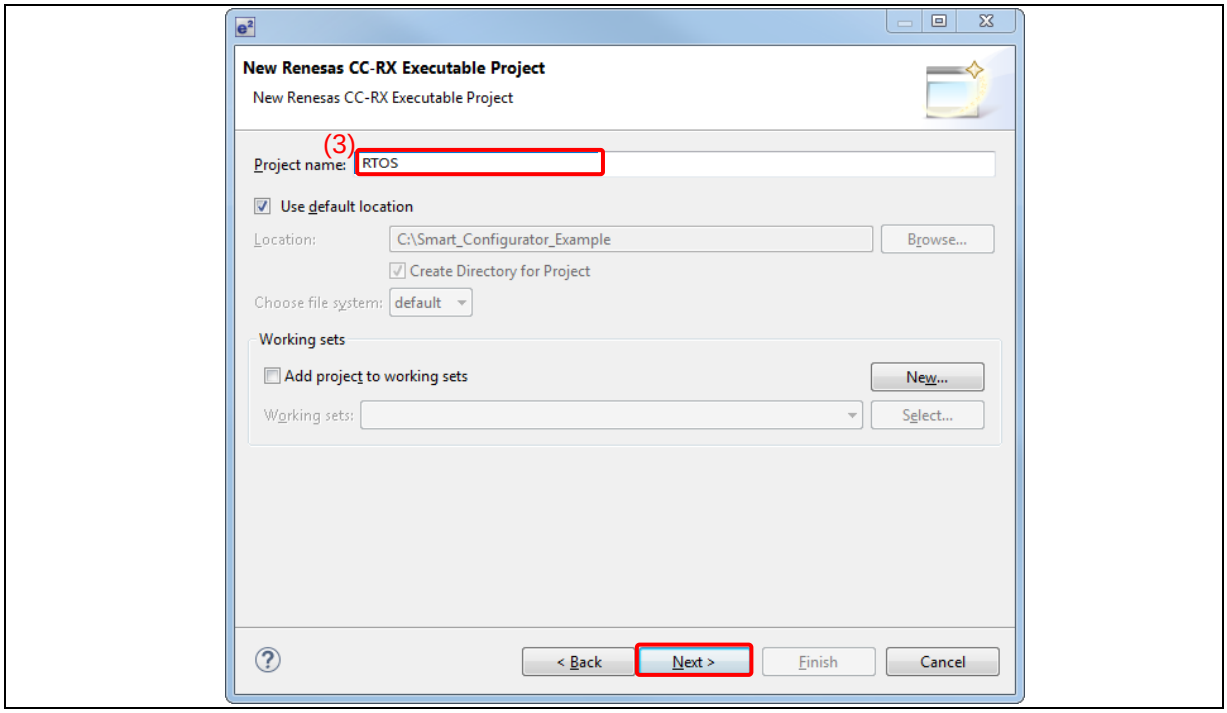

Figure 1-3 Creating project

4) Select “C” as Language.

5) Select “Renesas CCRX” as Toolchain.

6) Select the Toolchain Version. e.g. “v3.01.00”

7) In the RTOS pull down menu, choose ‘**FreeRTOS**’.

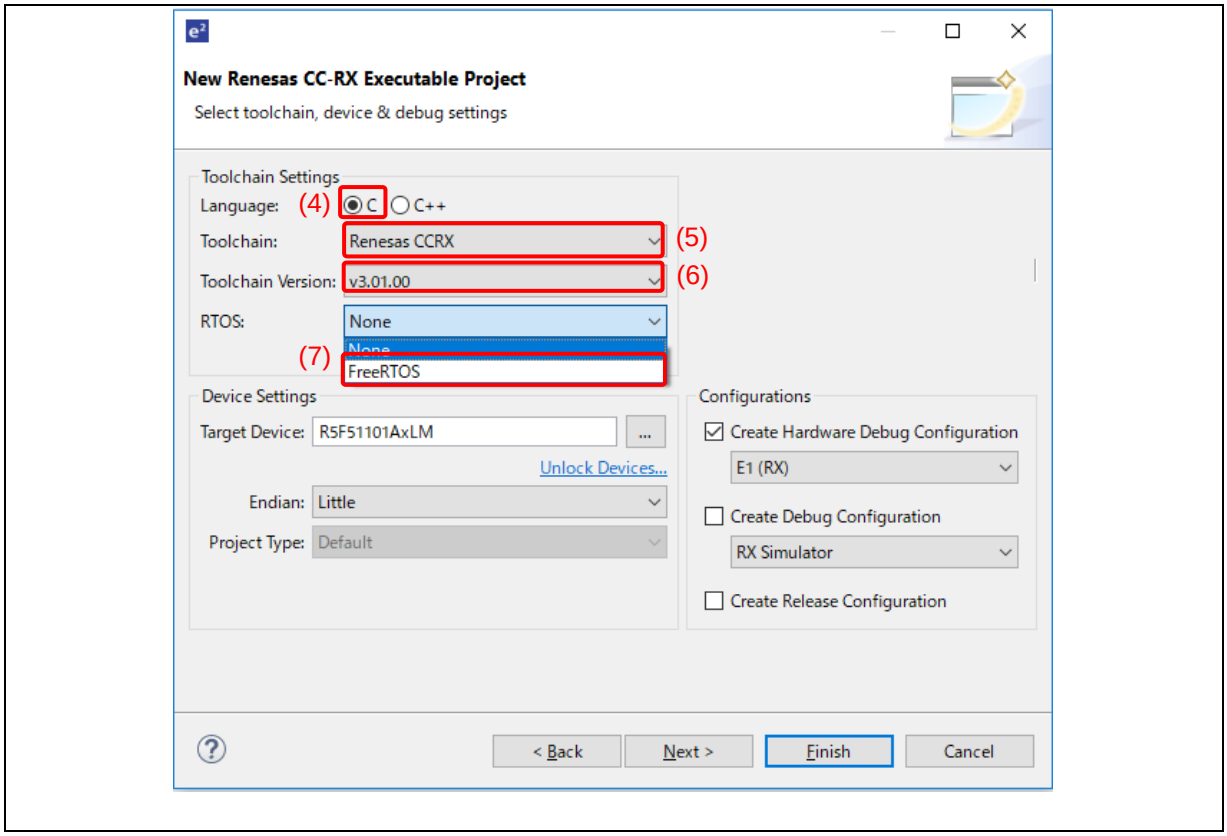

Figure 1-4 Creating project

8) Select your region if the region selection window pops-up.

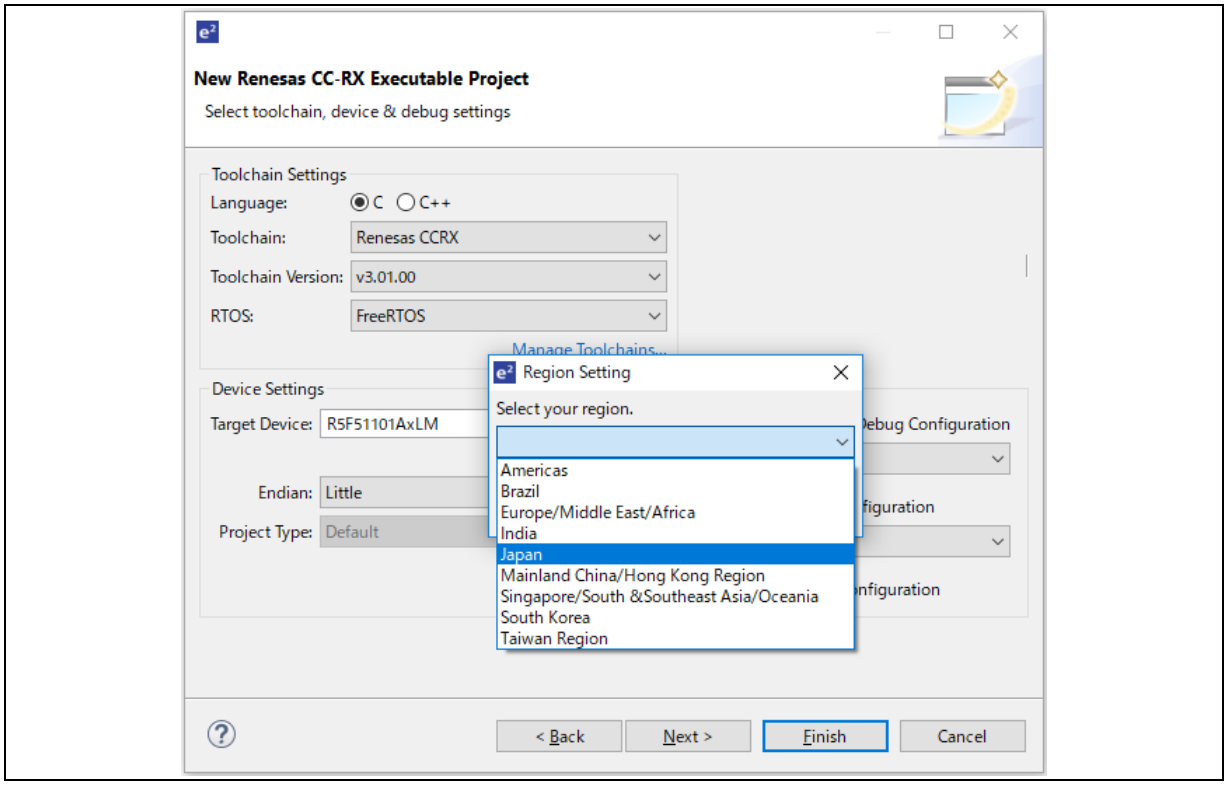

Figure 1-5 Region Setting

9) If FreeRTOS™ package has not been downloaded before, a login window will pop up to start the download of the FreeRTOS™ package. Fill in user's My Renesas username and password and click [OK] to proceed.

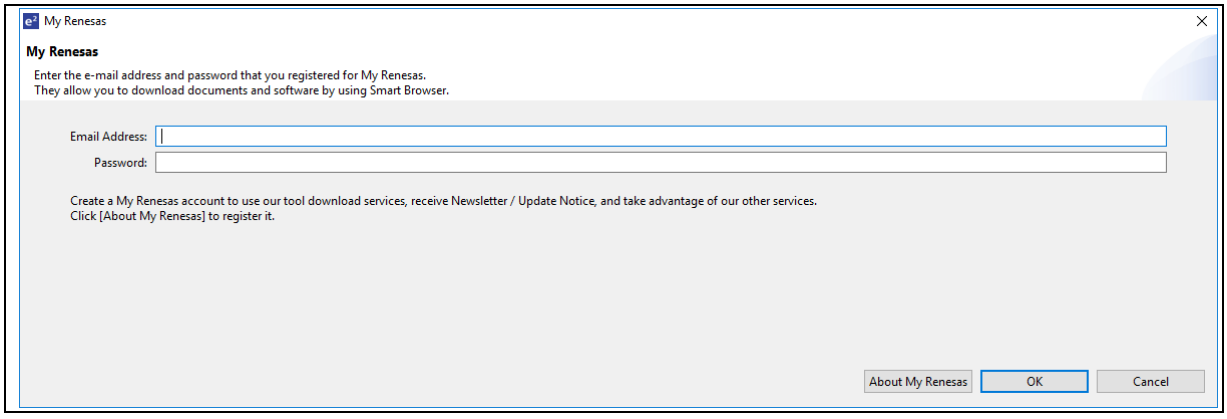

Figure 1-6 Login MyRenesas

10) Check the box corresponding to the package to download and click [Download] button to start downloading.

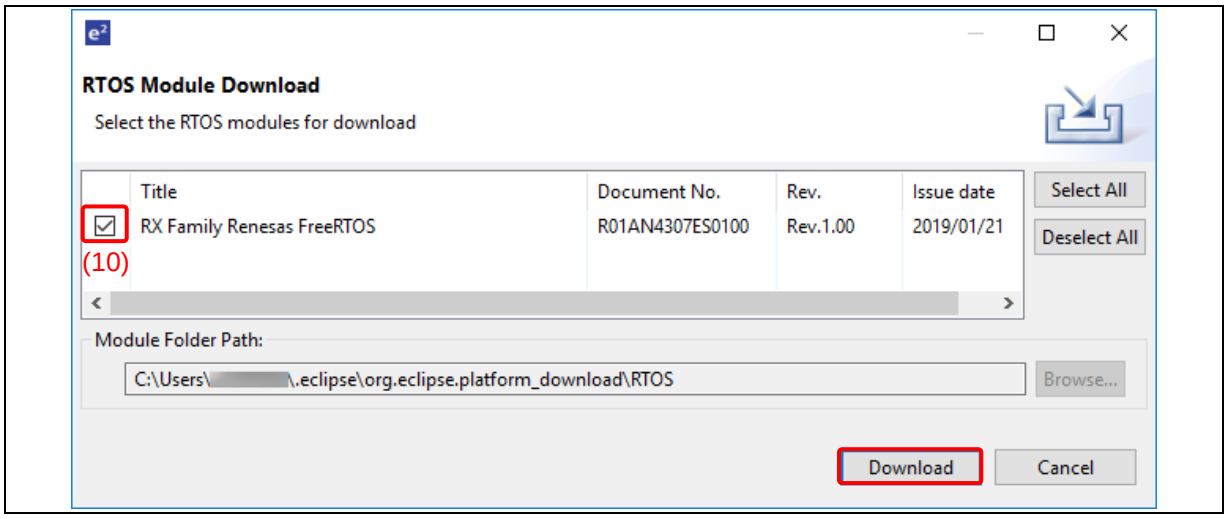

Figure 1-7 RTOS Module Download

11) After downloading, [FreeRTOS] option is enabled.

12) Select Target Device, e.g. "RX600 > RX65N > RX65N - 176pin > R5F565NEDxFC".

13) Ensure [Create Hardware Debug Configuration] is checked. Select emulator, e.g. “E1 RX”.

14) Click [Next].

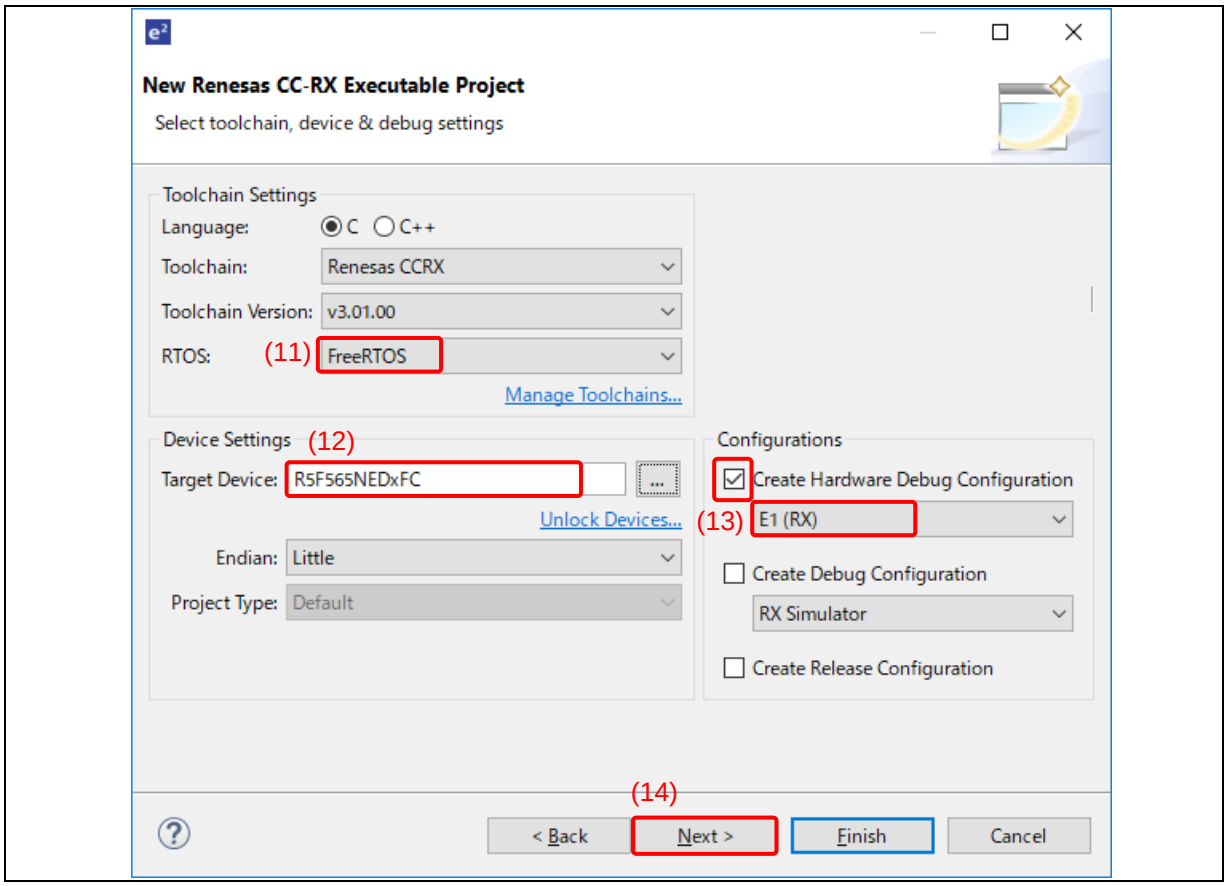

Figure 1-8 Creating project

15) Choose supported FreeRTOS™ version or check for more supported FreeRTOS™ version. Click [Next].

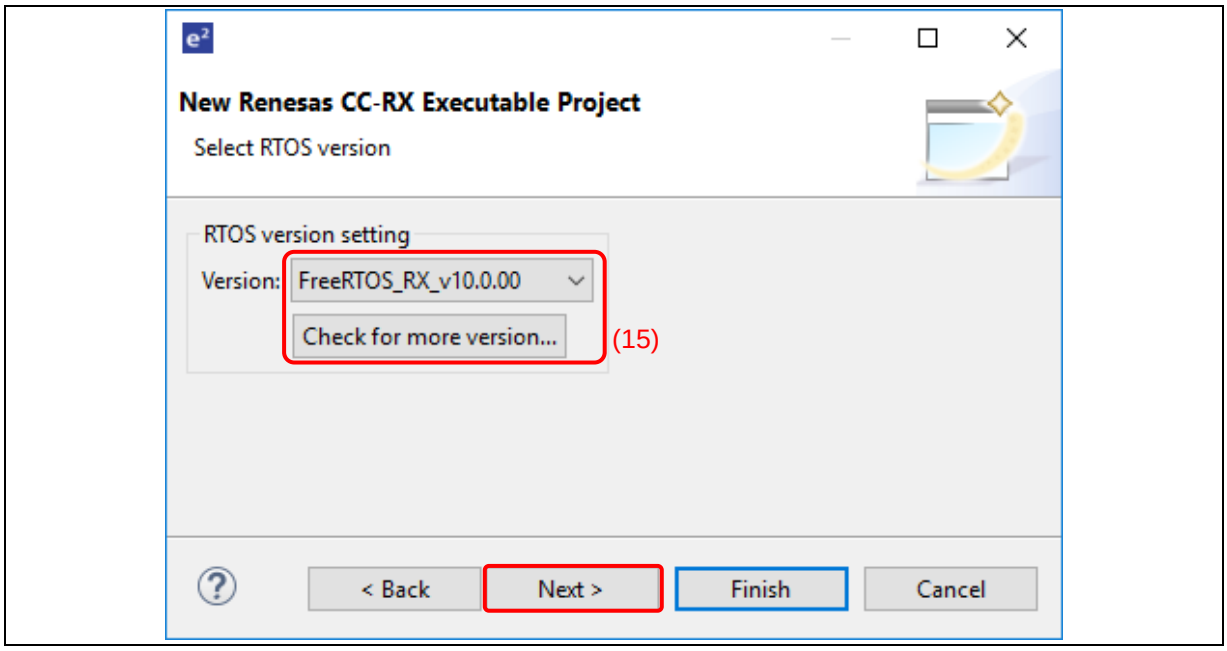

Figure 1-9 Creating project

16) [Smart Configurator] is selected by default.

Note: If FIT module has not been downloaded, choose “Download FIT Modules” to download FIT package.

17) Click [Finish].

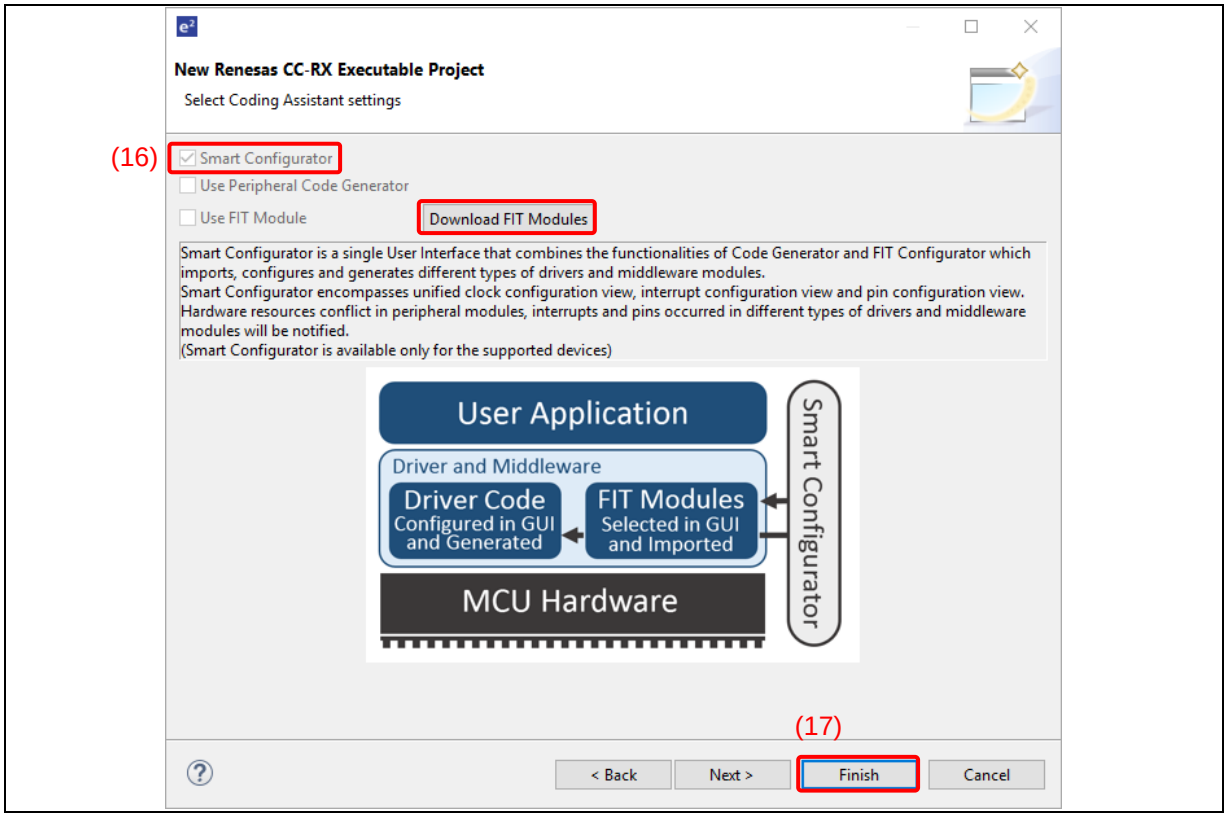

Figure 1-10 Creating project

2. Configure the FreeRTOS(TM) kernel

1) Smart Configurator perspective will be launched as shown below.

2) In RTOS.scfg panel, FreeRTOS™ package is ready and displayed in Current Configuration in [Overview] tab.

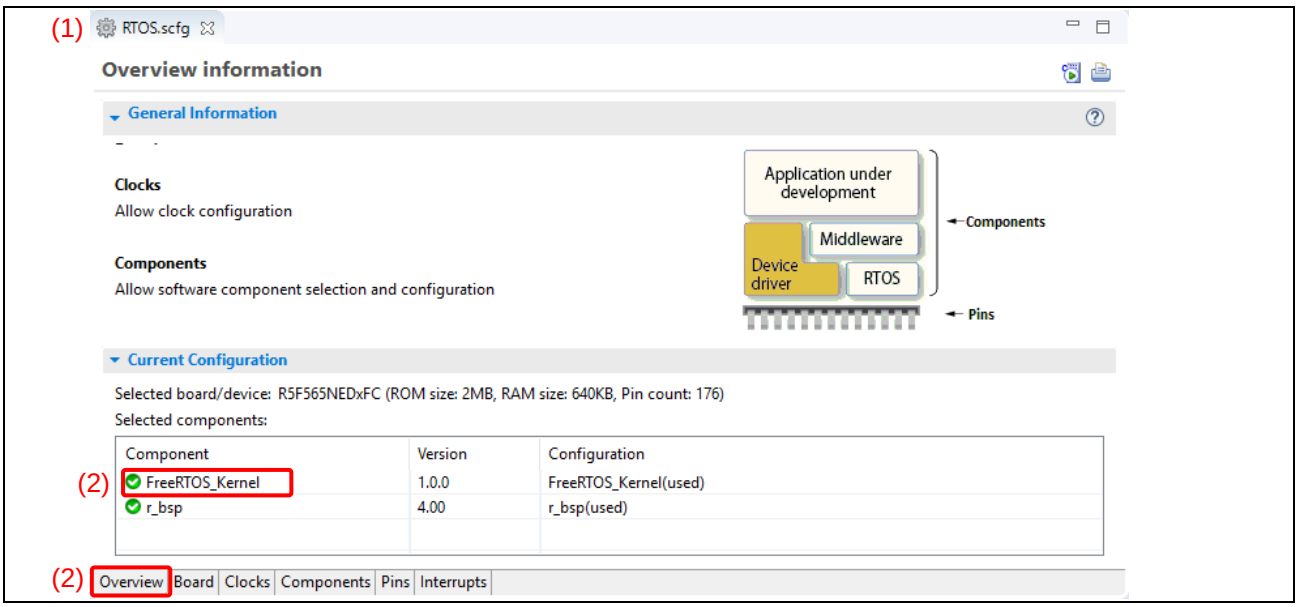

Figure 2-1 Smart Configurator perspective with FreeRTOS™

3) In [Components] tab, select [FreeRTOS_kernel] layer in the Components tree at the left panel.

4) The corresponding parameter is displayed in the right panel for users to quickly manage the FreeRTOS™ kernel setting.

   This provides all possible configuration setting options for the FreeRTOS™ kernel.

5) Click on any configurations option setting in the right panel to display its definition as shown in the picture below.

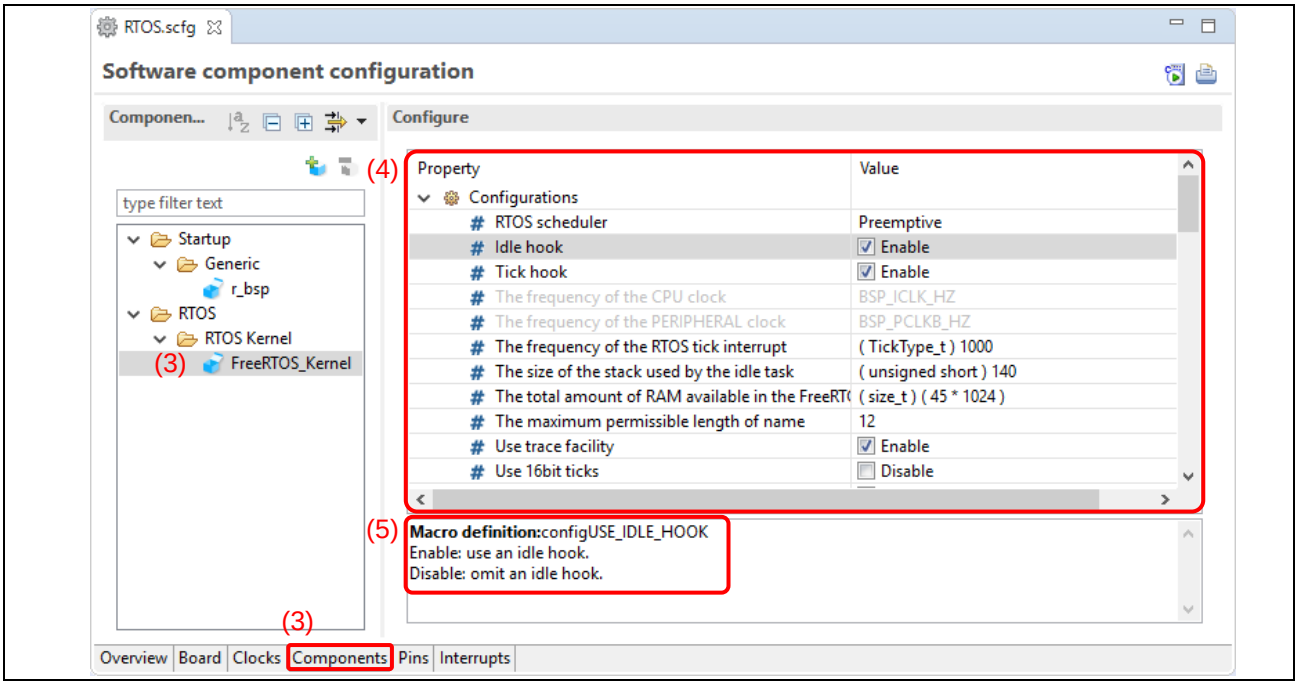

Figure 2-2 FreeRTOS_Kernel configuration panel

6) After configuring the FreeRTOS™ kernel, FreeRTOS™ kernel code or middleware modules can be generated and imported to the project source folder by clicking the “Code Generation” button

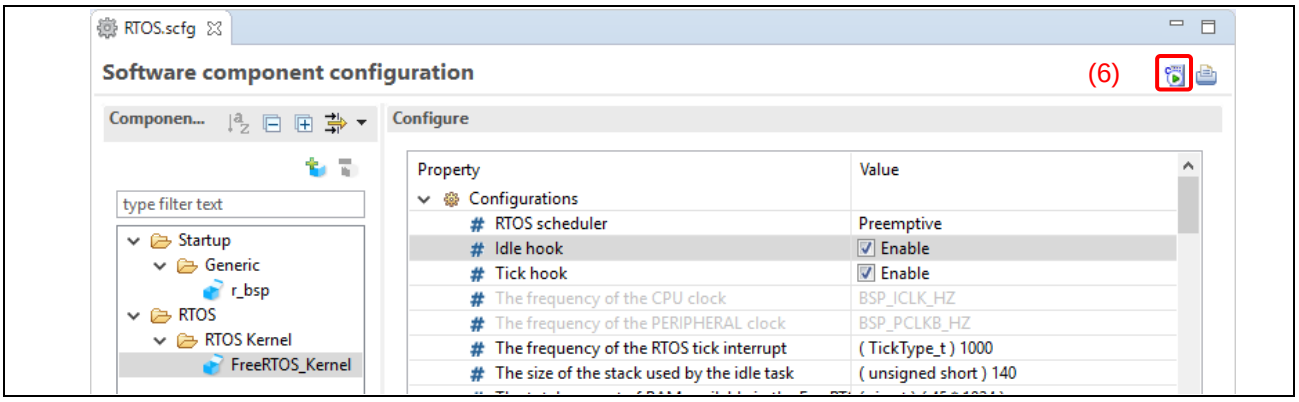

Figure 2-3 “Code Generation” button

7) Three folders are generated under <ProjectDir>\src folder:

- **[FreeRTOS]**: Contains the FreeRTOS™ real time kernel source files.

- [**frtos_config]**: Consists of ‘FreeRTOSConfig.h’. Every FreeRTOS™ application must have a FreeRTOSConfig.h header file. FreeRTOSConfig.h configures the RTOS kernel to the application being built (e.g. Semaphores, Timers and Heap Size). It is therefore specific to the application, not the RTOS.

- **[frtos_startup]**:
  The freertos_start.c file performs the following:
  - The “Processing_Before_Start_Kernel()” function which is called by the “PowerOn_Reset_PC()” function initialises Kernel objects and creates the main task.
  - Set up Hook functions.
  - Configure CMT0 as the RTOS system timer.

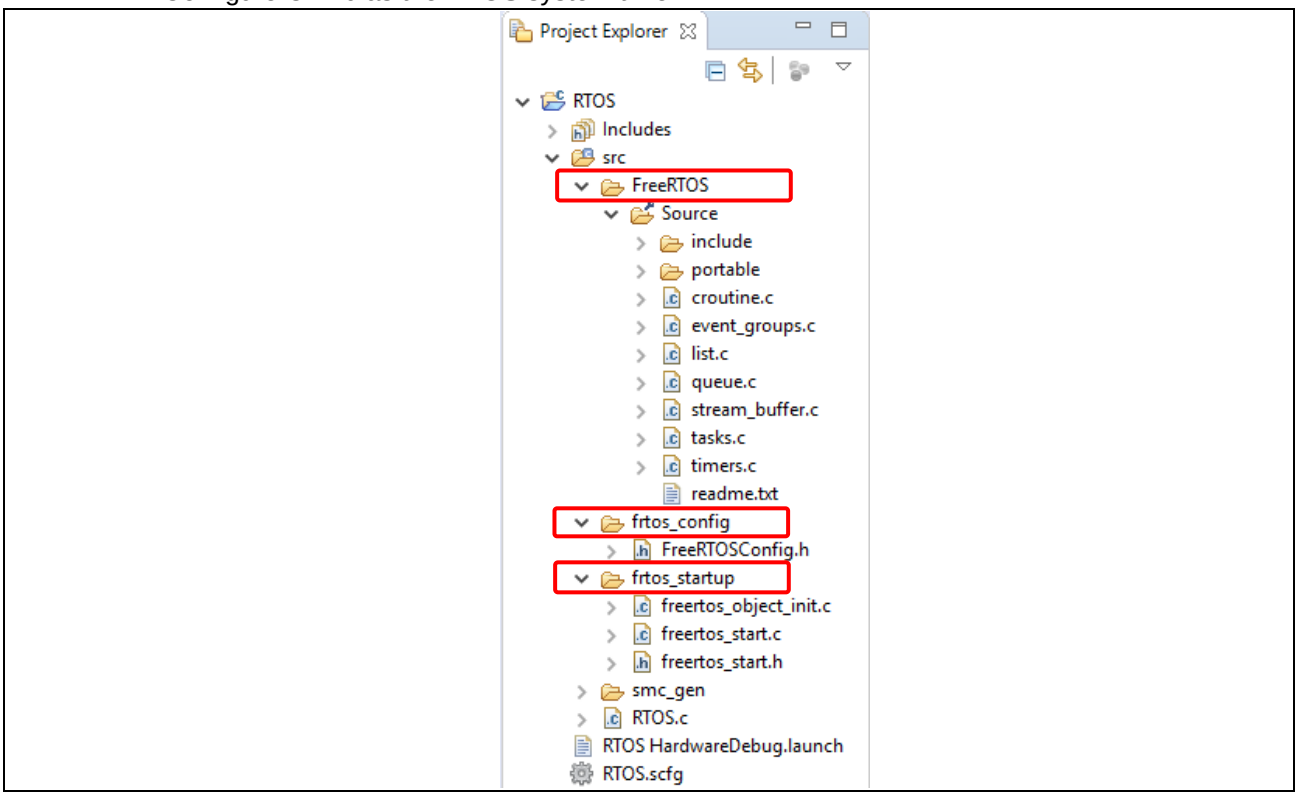

Figure 2-4 Project Explorer

8) Once FreeRTOS™ kernel is configured, the configurator automatically generates the code reflecting the configuration choices in “<Project folder>/src/frtos_config/ FreeRTOSConfig.h”

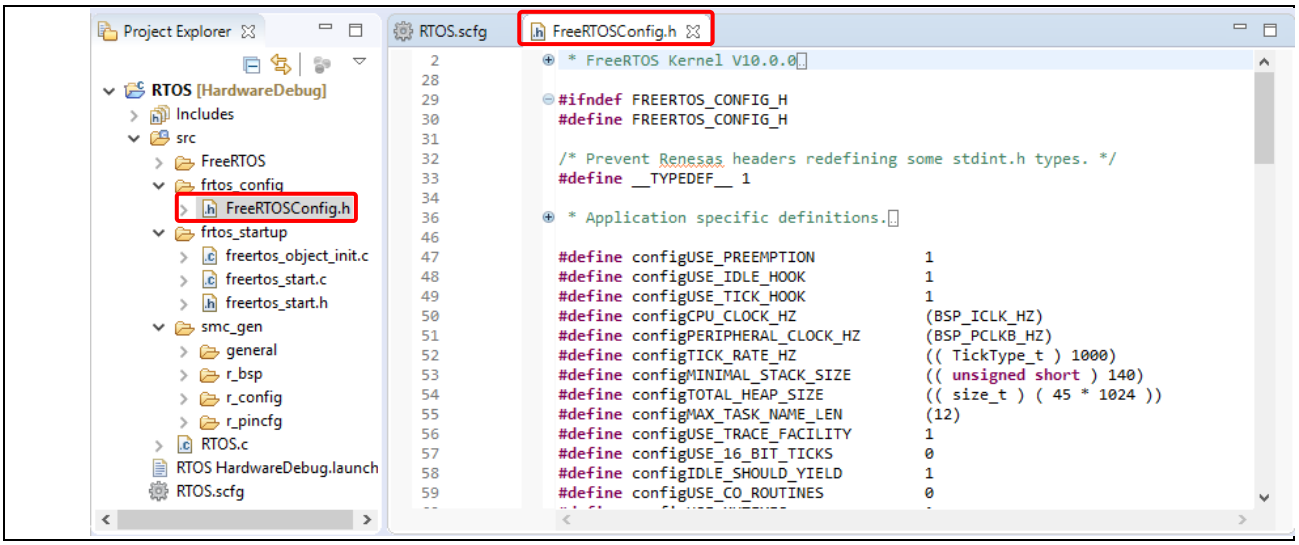

Figure 2-5 FreeRTOSConfig.h

9) The ‘main_task()’ is in <ProjectDir>\src\{ProjName}.c.

e.g. RTOS.c

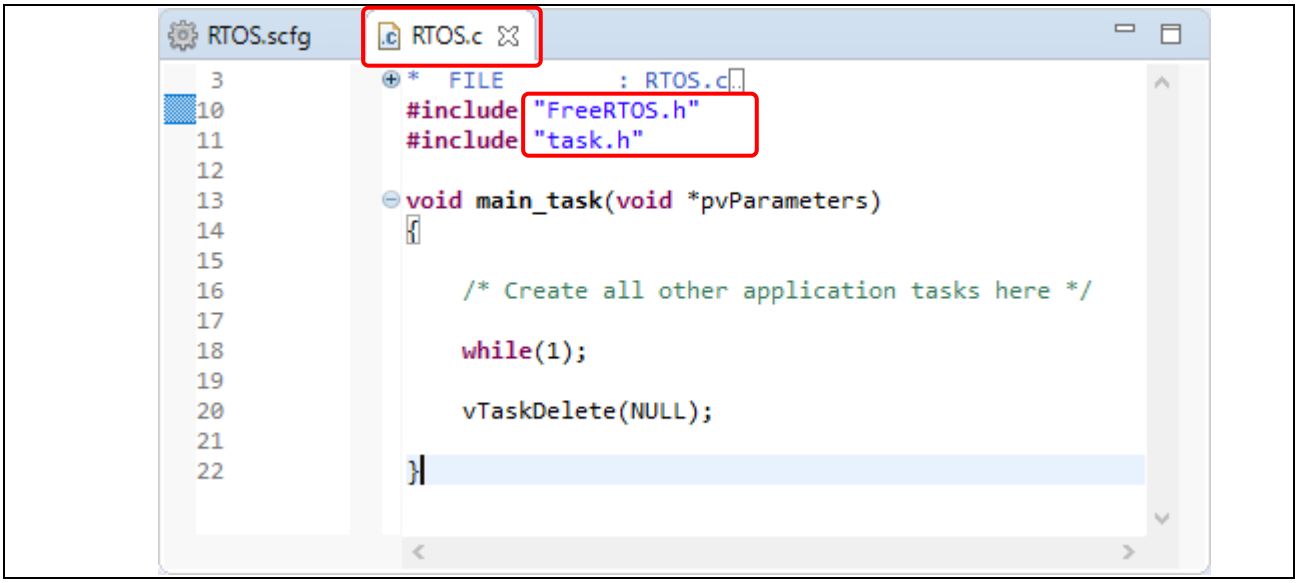

Figure 2-6 {ProjName}.c

10) Check your board and select the clock setting in the [Clocks] tab.

For example, if 'Renesas Starter Kit (RSK)' is used, the clock source should be set to 'Main clock' and if the 'Target Board for RX family' is used, the clock source should be changed to 'HOCO clock' as shown in the picture below.

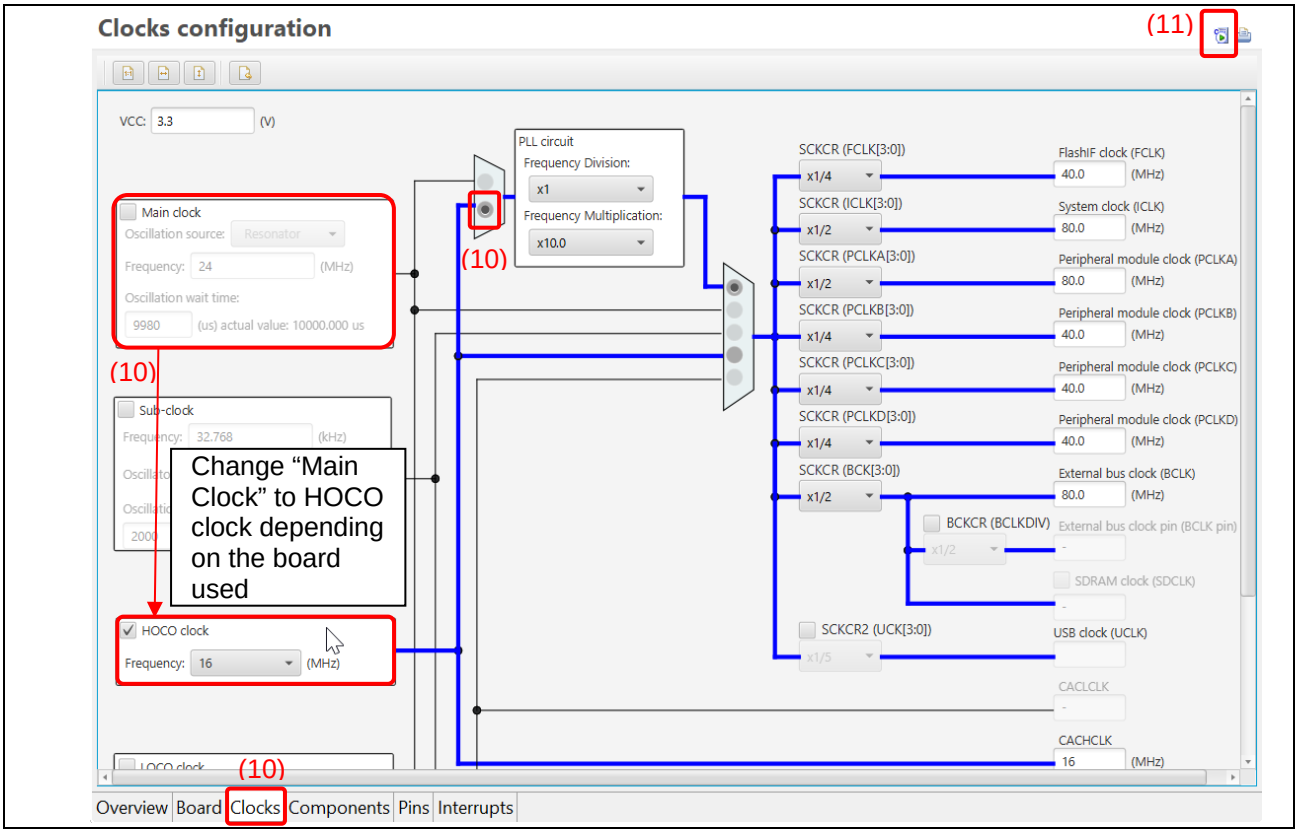

Figure 2-7 Change Clock Setting

11) Click [Generate Code] button on the top right to save the changes.

12) To build and debug the project, refer to e² studio Getting Started Guide in this link:

https://www.renesas.com/search/keyword-search.html#q=r20ut4374

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	25 Feb 2019	-	1st edition

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit 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. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance 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 the 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.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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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