

Smart Configurator

Guide on Sample Projects for RH850/U2B Devices

Introduction

This document describes how to use the sample project of Smart Configurator for RH850/U2B devices in CS+ integrated development environment.

Target Device

RH850/U2B10 (BGA468, BGA373, BGA292)

RH850/U2B6 (BGA292)

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1. Overview

1.1 Purpose

This document describes how to use the sample project of Smart Configurator for RH850/U2B devices in CS+ integrated development environment.

When applying this application note to a microcontroller, change the contents according to the specifications of the microcontroller you are using and validate the correct operation of the sample projects.

1.2 Operating Environment

Install the Smart Configurator and tools to be used to create or build programs in each integrated development environment based on the source files generated by the Smart Configurator with the use of the sample projects.

For details on how to use your integrated development environment, refer to the user's manual for the integrated development environment that you are using.

Table 1-1 Operating Environment

Type	Name	Abbreviation in This Manual
IDE	CS+ for CC V8.09.00 or later	CS+
Toolchain	C Compiler Package for RH850 Family	CCRH

2. Outline of the Sample Projects

The Smart Configurator for RH850/U2B devices outputs a main function and source files that initialize peripheral modules that are set by components of the Smart Configurator. But it does not output the initialization codes to be performed before the execution of the main function and the startup routine which starts the main function and handles some other processing after the microcontroller has been reset.

This sample project includes boot program and startup code as a reference so that the user application codes and the peripheral modules codes generated according to the configurations in the Smart Configurator can be built and downloaded to the debug tool immediately.

2.1 Introduction of Sample Project

RH850/U2B sample project starts default CPU(PE0) after microcontroller has been reset.

The sample project takes "Interval Timer" as a sample and provides relative user code.

For details on the sample projects, see the descriptions in the relevant sections

2.2 Notes on the Sample Projects

1. When using this sample project, please copy and use it in a directory that does not restrict access.
If you use it in a directory that restricts access, the generated codes and other files will not be saved and some errors may occur.
In general, the following directories require administrator permission:
 - Program files folder (e.g. "C:\Program Files", "C:\Program Files (x86)")
 - System root folder (e.g. "C:\Windows")For your environment, please contact your system administrator(IT department).
2. The Smart Configurator outputs the register descriptors according to iodef.h for the Renesas CCRH compiler. iodef.h for the Renesas CCRH compiler has been included in sample project. This file is used for building files generated by the Smart Configurator.
3. The Smart Configurator uses interrupts with the table lookup method as the method for selecting the interrupt handler addresses. The address where the table starts is set as 0x00040000 in the sample projects.
4. The definition of the interrupt vector table of peripheral modules that was set in the Smart Configurator is reflected in smc/general/r_cg_intvector_PE0.c, which is output by the Smart Configurator. The file r-smc_intprg.c in the "smc/general" folder defines the vector table of EI maskable interrupt sources, which is the default EI vector table, is not set by the Smart Configurator.
5. Settings of files and sections in the sample projects are examples. You should change or create the settings newly to match the specifications of the microcontroller used in your system.

3. Basic Procedures for Operating the Smart Configurator

This section describes the basic operating procedures when building a user application with the files output from the Smart Configurator for RH850/U2B devices.

The basic operating procedure in CS+ environment without using the sample projects is described here. For the operating procedure with using a sample project, see the relevant section 4 “Description of the Sample Project”.

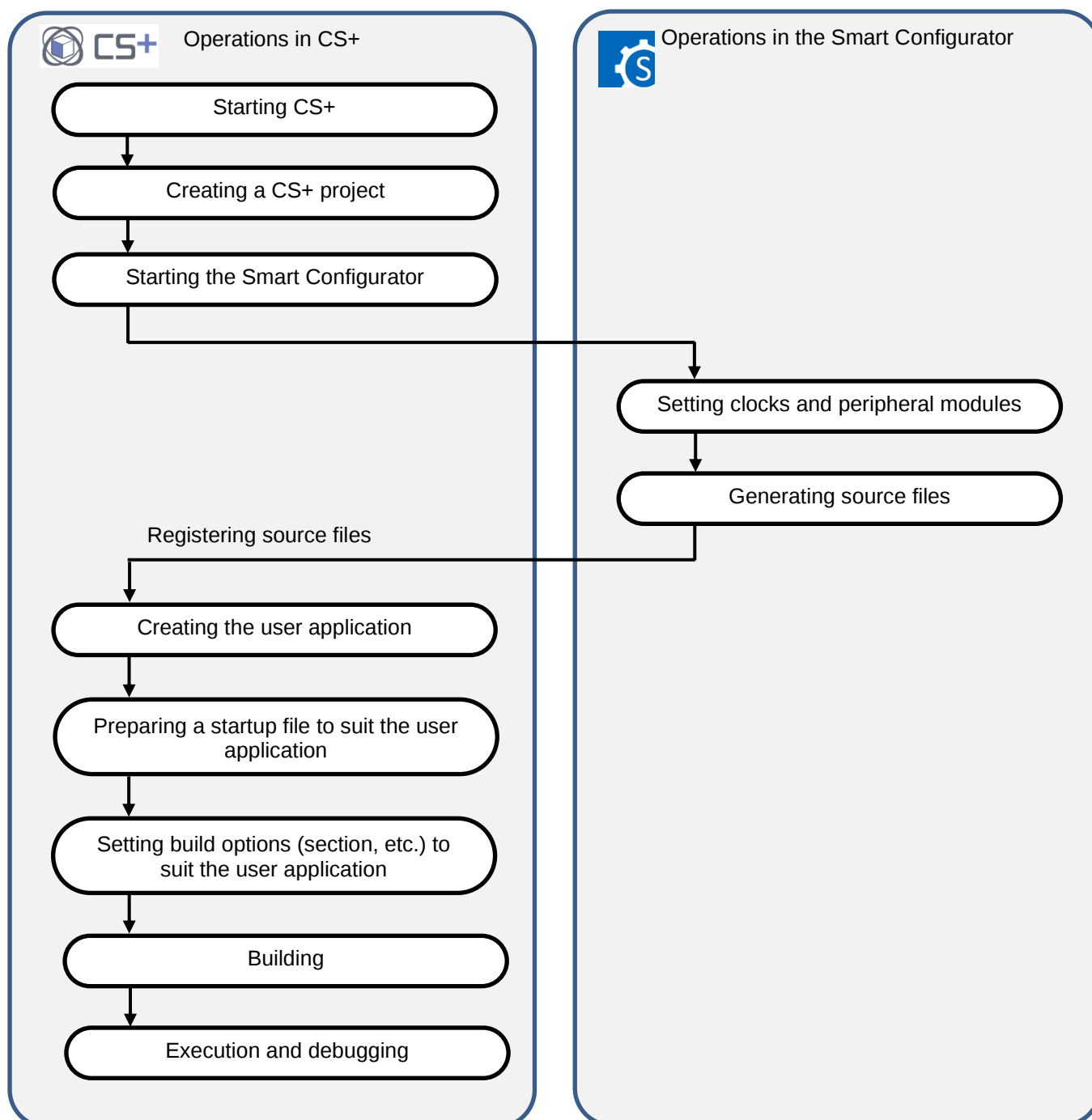


Figure 3-1. Basic Operating Procedure without using Sample Project

4. Description of the Sample Project

4.1 Configuration of the Sample Project

Figure 4-1 and Table 4-1 describes common folders and what files are included in the main project:

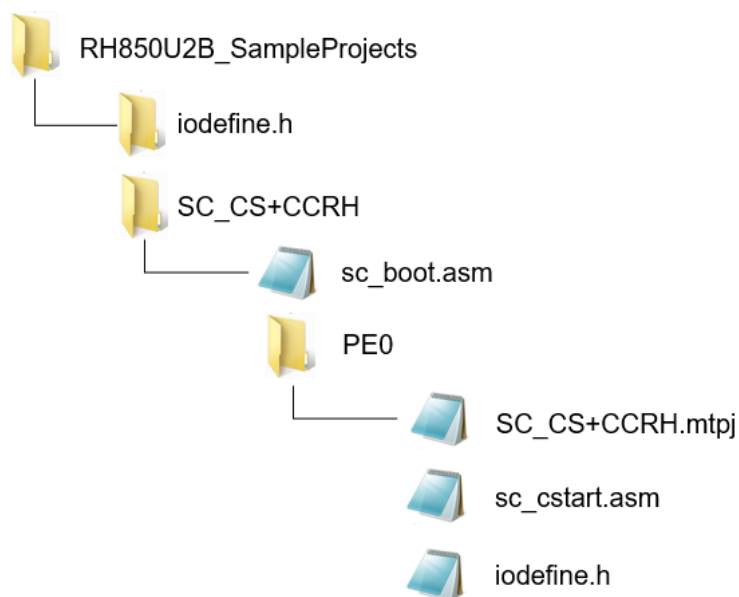


Figure 4-1. Project folder and files

Table 4-1. File Configuration of the main Project (corresponding to Figure 4-1)

File Name	Outline of File
iodefine.h folder	Folder which includes iodefine.h file
SC_CS+CCRH folder	Folder which includes all files belonging to CS+ project
sc_boot.asm	Definition of the procedure from a reset to branching to the startup routine in sc_cstart.asm.
PE0 folder	Folder which includes files belonging to default CPU(PE0)
SC_CS+CCRH.mtpj	Project file for CS+
sc_cstart.asm	Definition of the startup routine which is called by boot0.asm and is executed until branching to the main() function
iodefine.h	Renesas CCRH header file that defines the registers for RH850/U2B devices

4.2 Basic Operating Procedure

Figure 4-2 shows the operating procedure in CS+ environment when using the sample project.

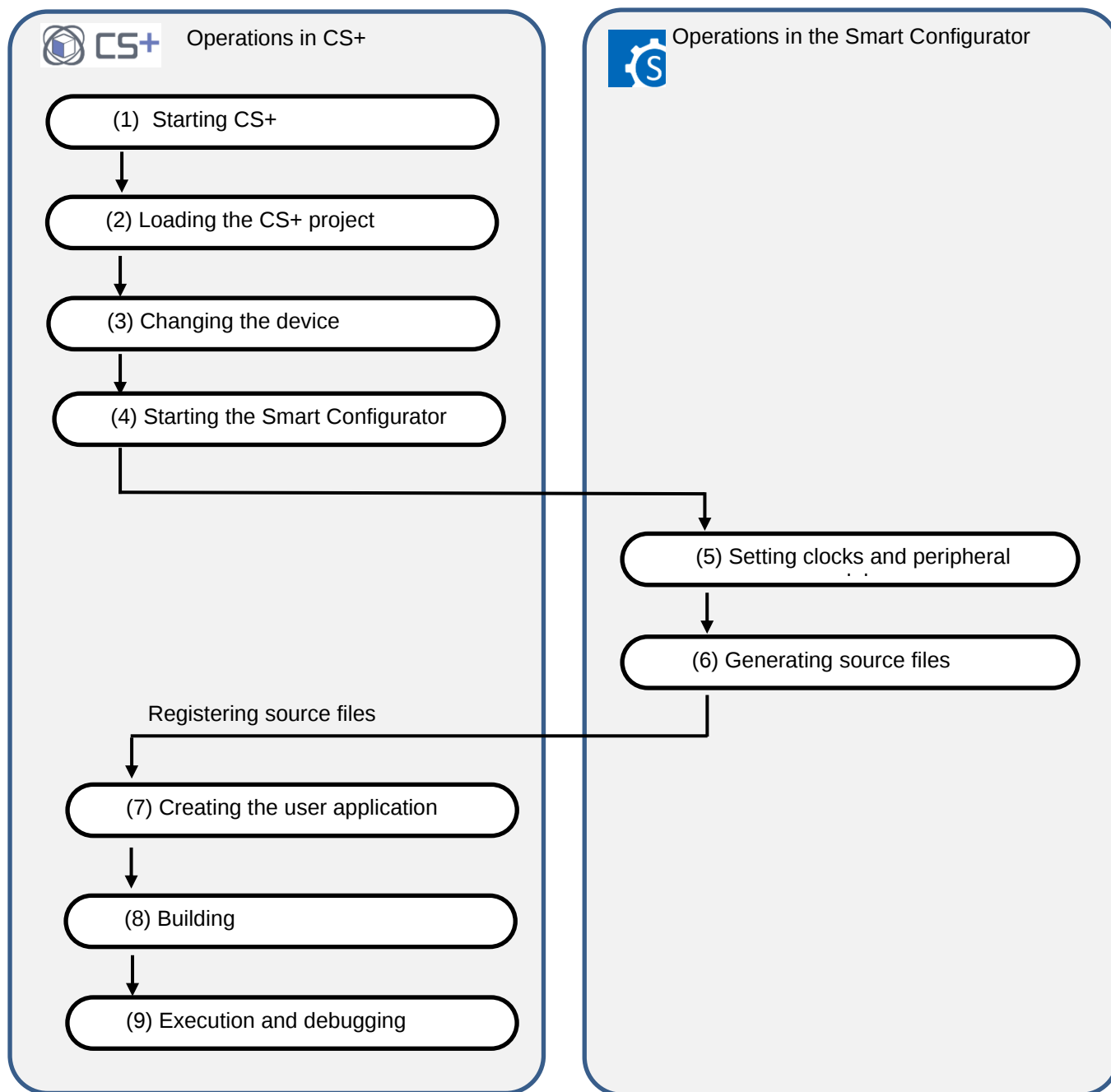


Figure 4-2. Operating Procedure for Sample Project

(1) Starting CS+

In the [Start] menu of Windows, select [Renesas Electronics CS+] → [CS+ for CC (RL78, RX, RH850)].

(2) Loading the CS+ sample project

From the [Open...] item of the [File] menu or [Open Existing Project] of CS+, select "SC_CS+CCRH.mtpj".

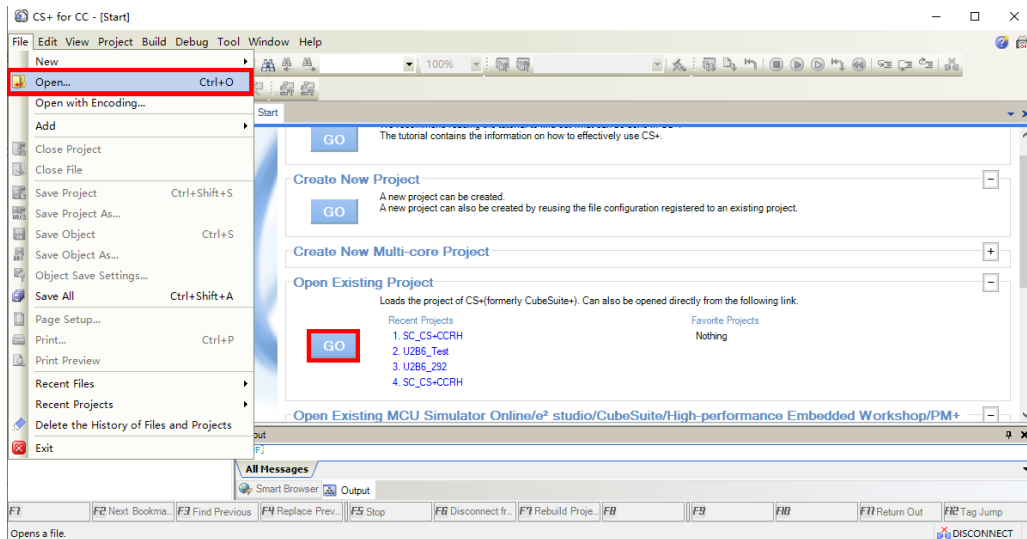


Figure 4-3. Loading the CS+ Sample Project

NOTE: Sample project has to be copied to a directory that does not restrict access before using . Please refer [2.2-1](#) for the detail.

(3) Changing the device

The R7F70255x (RH850/U2B6) is selected as the target device in the sample project. If you are using another device, change the target device and file to be used with reference to section 4.3, "Procedure for Changing the Device". If the device does not require a change, proceed to step (4).

(4) Starting the Smart Configurator

- (a) Confirm the setting of the path for the Smart Configurator for RH850. In the Project Tree panel, select [Smart Configurator (Design Tool)] and open the [Property] panel. Confirm that the path in which the Smart Configurator for RH850 was installed is set in [Smart Configurator for RH850 executable file path].

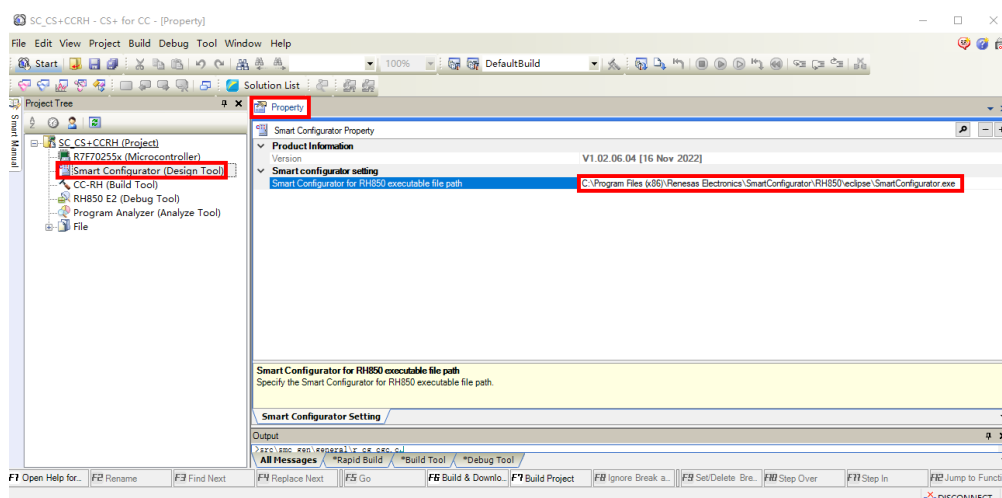


Figure 4-4. Setting the path for Smart Configurator

- (b) Start the Smart Configurator for RH850 by double-clicking on [Smart Configurator (Design Tool)] in the Project Tree panel.
- (c) If [RH850/U2B10 Package Selection] pops up, please choose the chip user wants to use:
Such as choose R7F70254*EABB -C(292pin) as following figure shows:

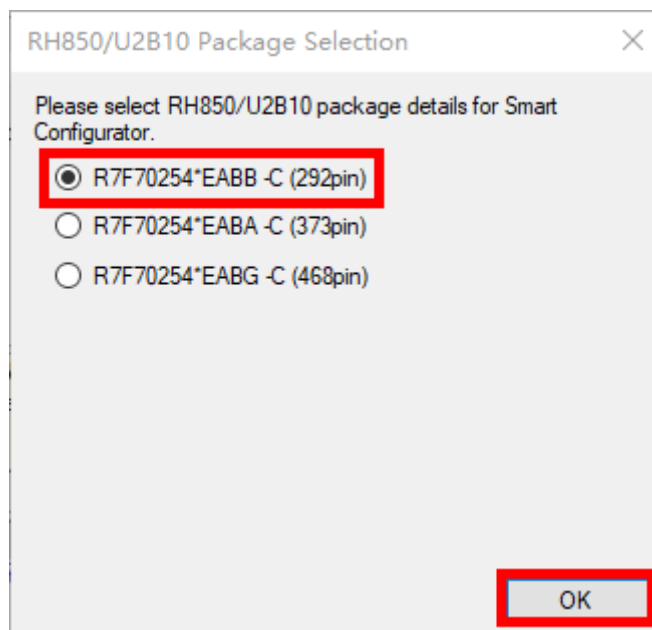


Figure 4-5. RH850/U2B10 Package Selection

- (5) Smart Configurator setting - Clocks
- (6) Smart Configurator setting - Components
- (7) Smart Configurator setting - Generating code

Above (5) ~ (7) are the procedures for setting clocks and components and generating a driver in the Smart Configurator, please see section 5 "Operations in the Smart Configurator".

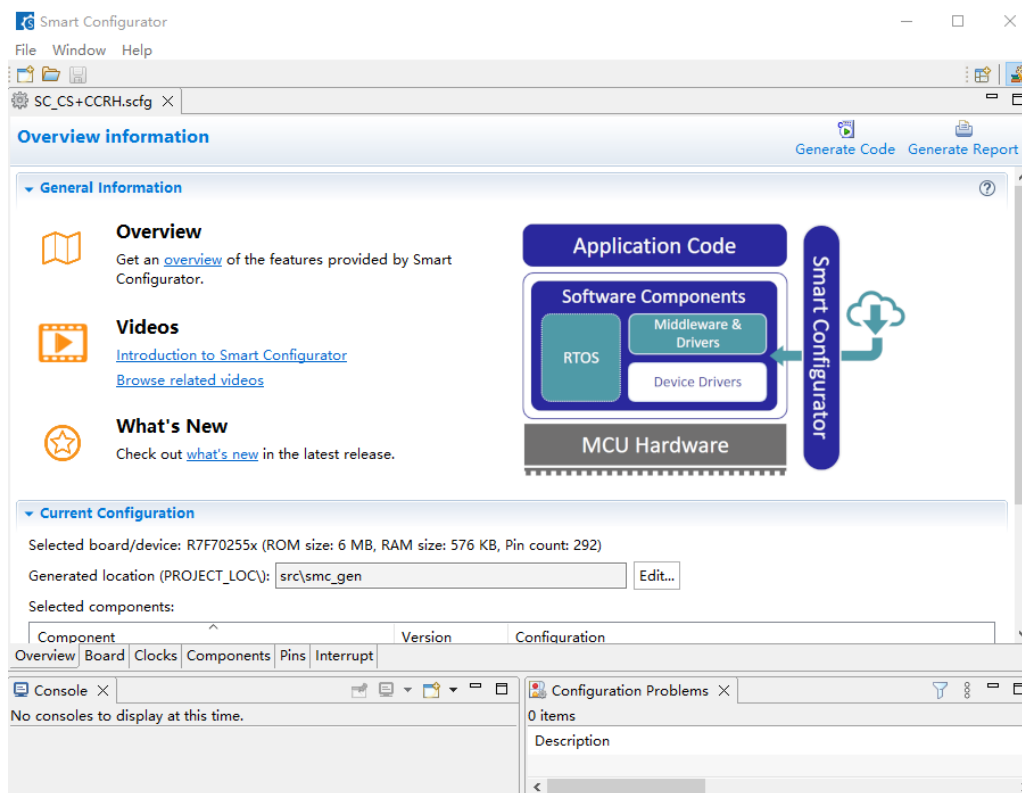


Figure 4-6. Smart Configurator setting

(8) Building

Build the driver and application code. Select [Build Project] from the [Build] menu or click on the [Builds the project. (F7)] button in the toolbar of CS+.

(9) Execution and debugging

For program execution and debugging in the emulator, refer to CS+ Integrated Development Environment User's Manual: RH850 Debug Tool (Obtained the latest information from the website of Renesas Electronics).

4.3 Procedure for Changing the Device

When the target device of the sample project differs from the device that is to be used, the target device or file to be used must be changed according to the following procedure.

- (1) Select "R7F70255x (Microcontroller)" of main project "SC_CS+CCRH.mtpj" and then select [Change Microcontroller...] from the context menu.
Click on the [OK] button in the [Question] dialog box that appears.

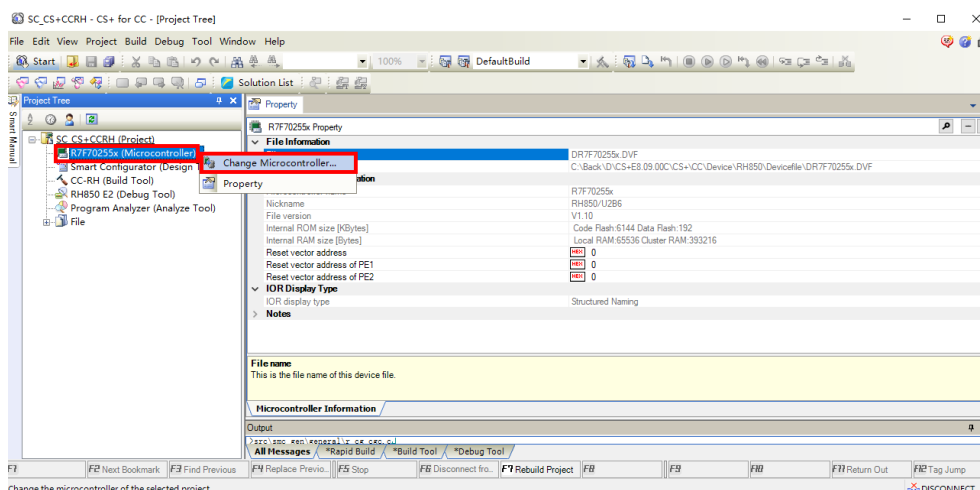


Figure 4-7. Change Microcontroller

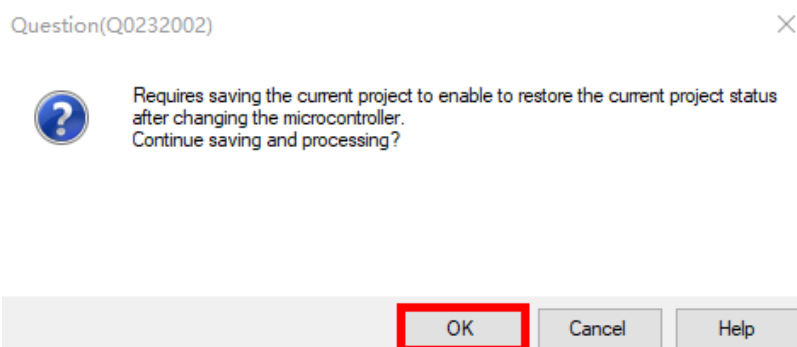


Figure 4-8. Save and continue

- (2) In the [Change Microcontroller] dialog box, select the RH850/U2B device to be used.
Example: Changing from R7F70255x to R7F70254x

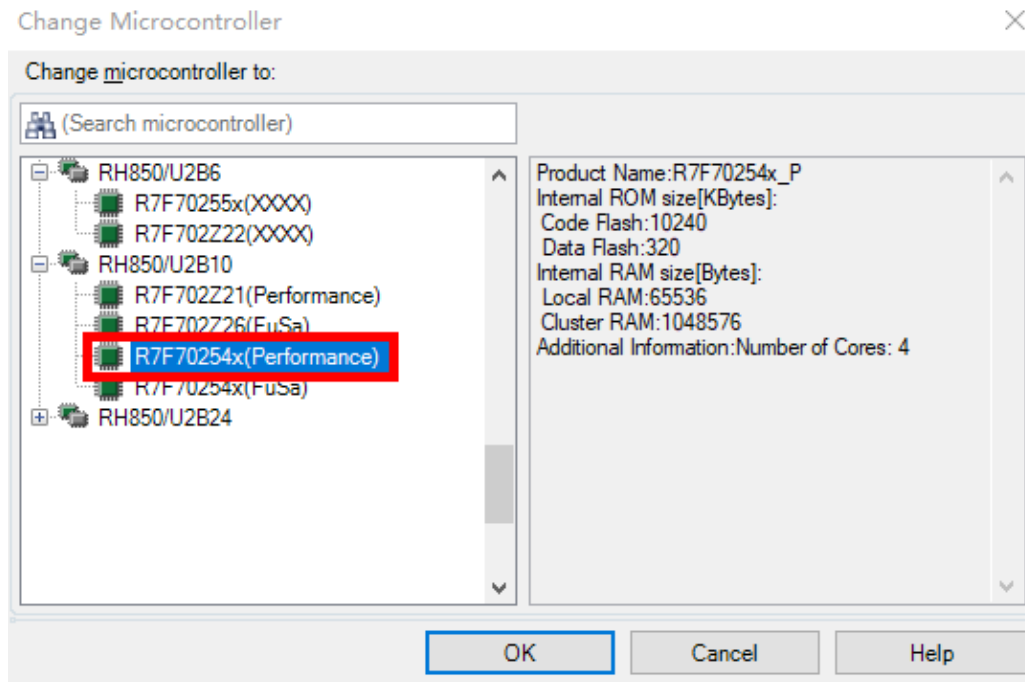


Figure 4-9. Select device to be changed

- (3) Confirm that the microcontroller displayed in the Project Tree panel has become the device to be used after the change.

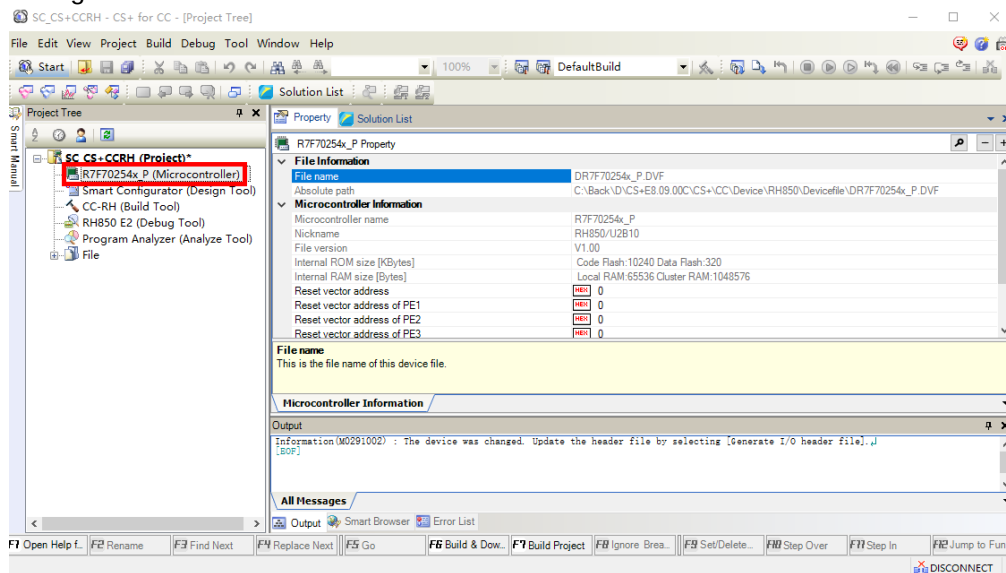


Figure 4-10. Confirm microcontrollers are changed

- (4) Save the project by selecting [Save Project] from the [File] menu.

4.4 Settings in the Sample Project

The sample project is created in CS+ as an [Application for Multi-core (CC-RH)] project. The include path is added and the settings of the following options are changed.

- (1) [Property] panel from [CC-RH (Build Tool)] → [Link Options] tab → [Section] → [Section start address]
Settings in the sample project:

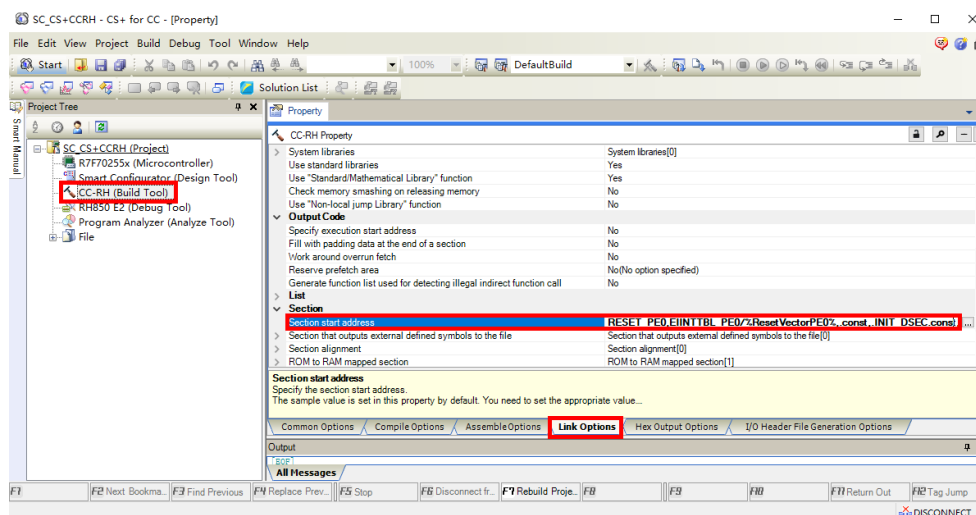


Figure 4-11. Link options setting

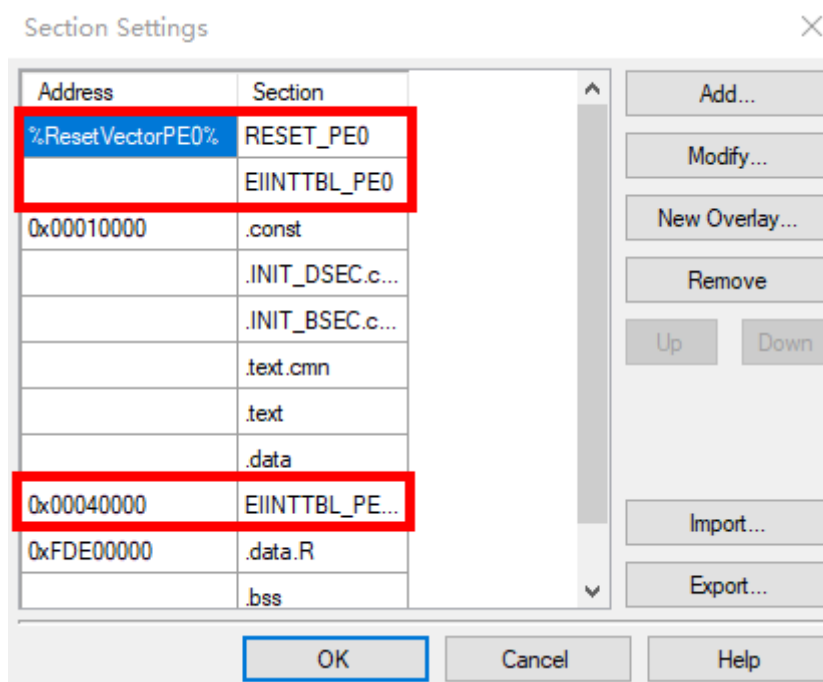


Figure 4-12. Setting in the sample project

- (5) [Property] panel from [CC-RH (Build Tool)] → [I/O Header File Generation Options] tab → [I/O Header File] → [Update I/O header file on build]

Settings in the sample project:

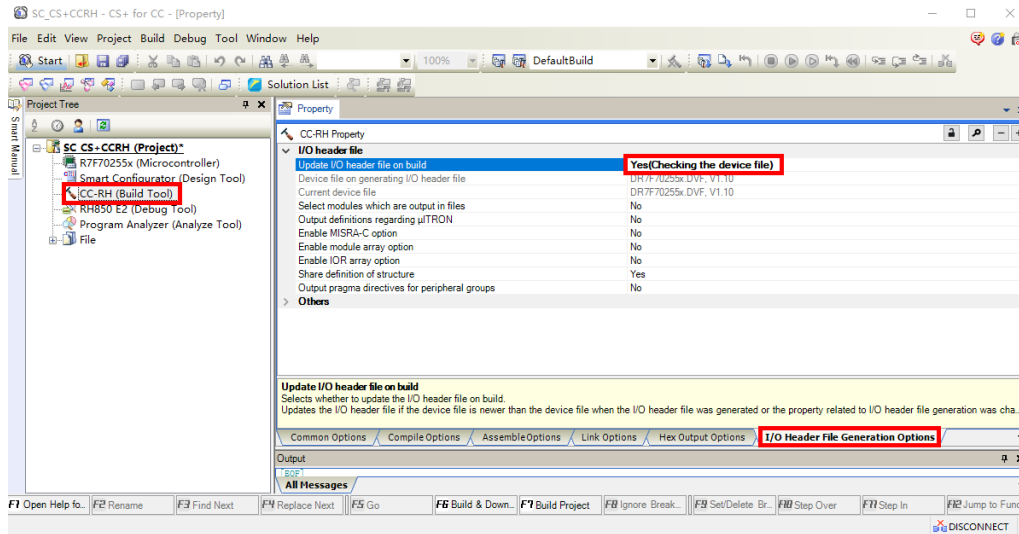


Figure 4-13. Setting in the sample project

- (6) [Property] panel from [RH850 E2 (Debug Tool)] → [Connection settings] tab.

Settings in the sample project:

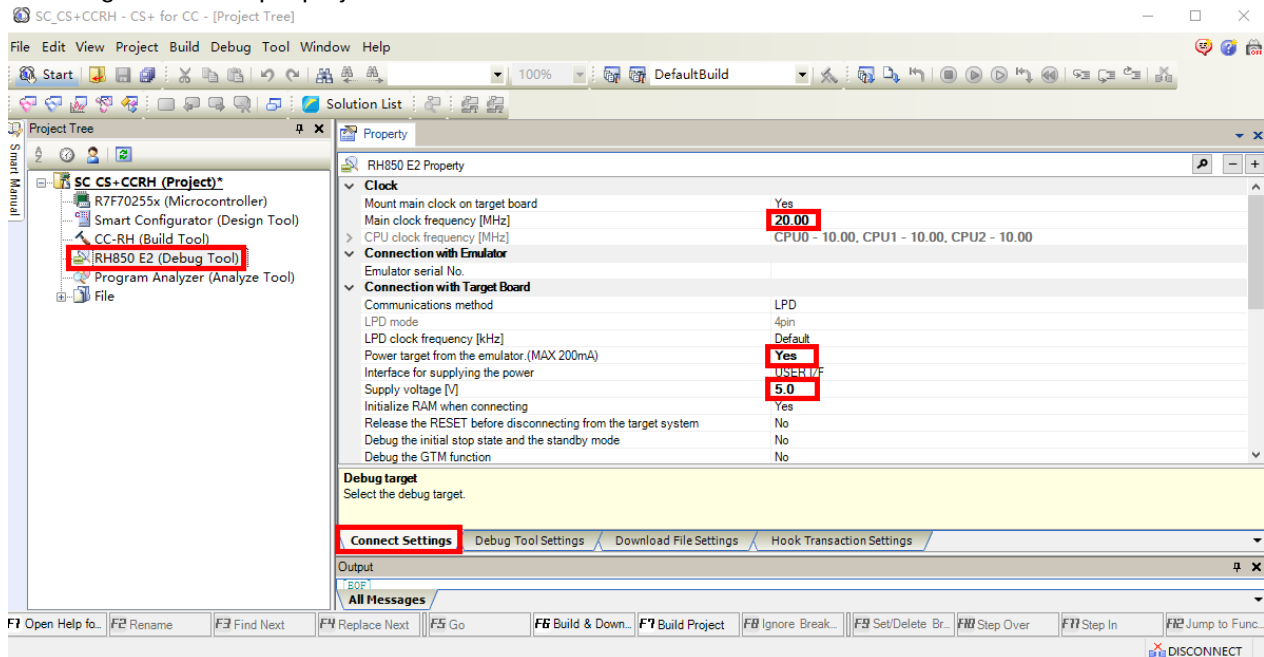


Figure 4-14. Connect Settings in the sample project (1)

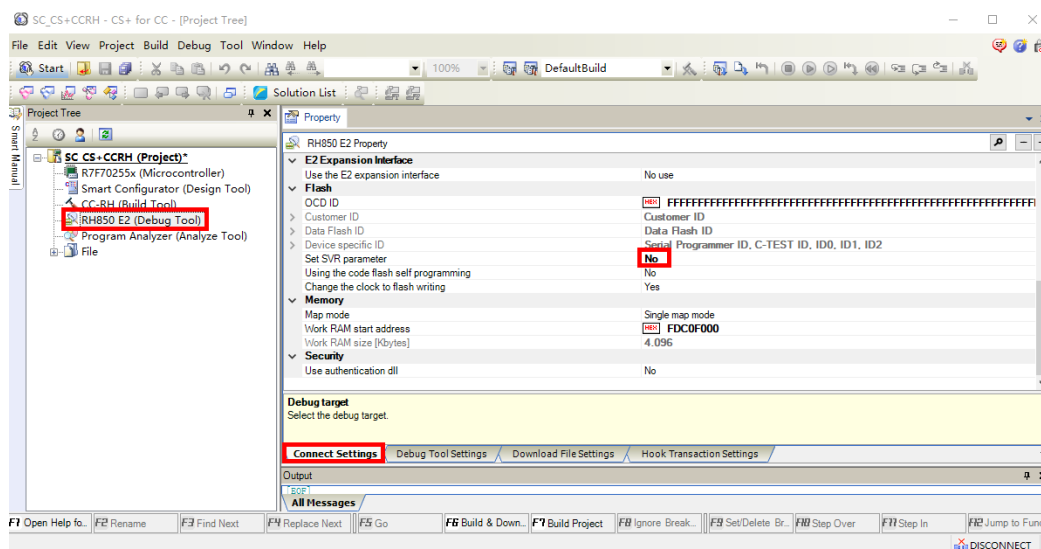


Figure 4-15. Connect Settings in the sample project (2)

5. Operations in the Smart Configurator

This section gives an overview of setting the drivers of peripheral modules of the device and handling of the Smart Configurator for the generation of code.

For details, refer to Smart Configurator User's Guide: CS+ (R20AN0516).

5.1 Setting the Peripheral Modules (Software Components)

(1) Configure the clocks of the device on the [Clocks] tab page.

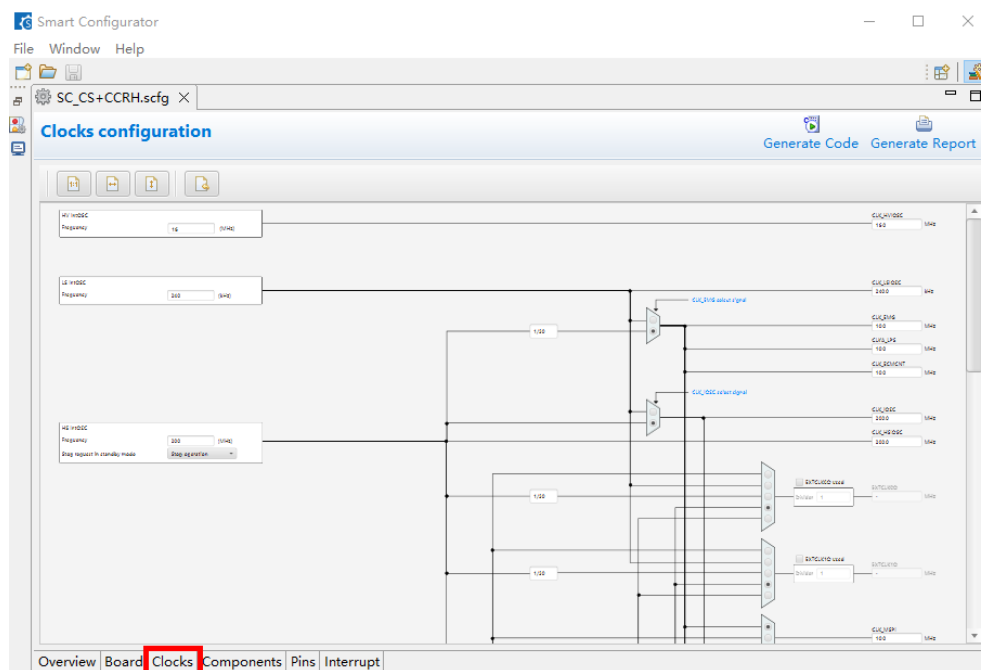


Figure 5-1. Configure clock

- (2) Add or set the peripheral modules of the device on the [Components] tab page. The peripheral modules are set as software components. Click on the [Add component] icon.

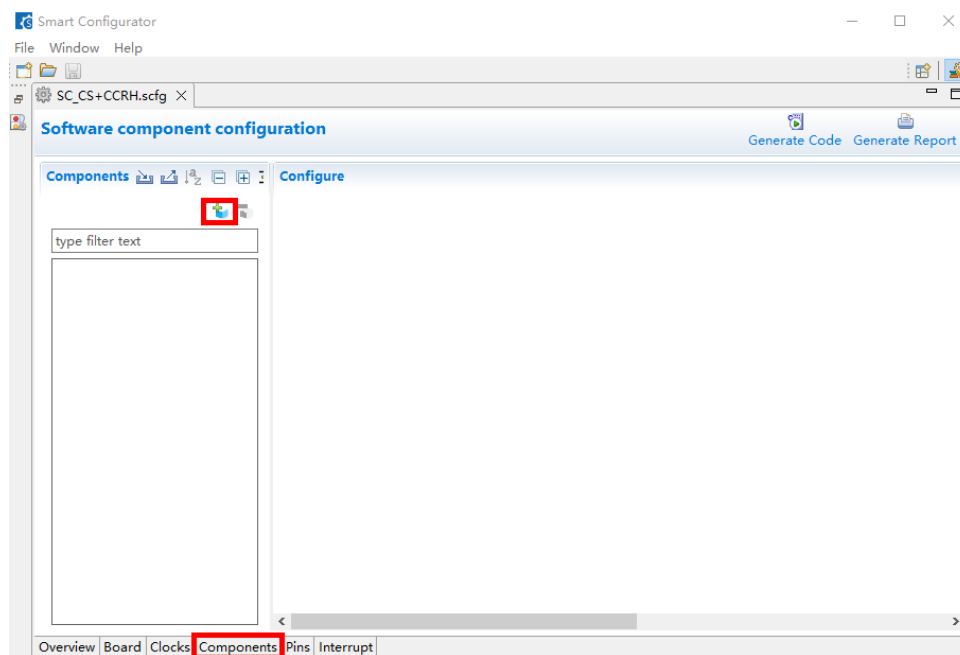


Figure 5-2. Add modules

- (3) Select components on the [Software Component Selection] page of the [New Component] dialog box.
Select each component to be used from the list and click on the [Next] button.

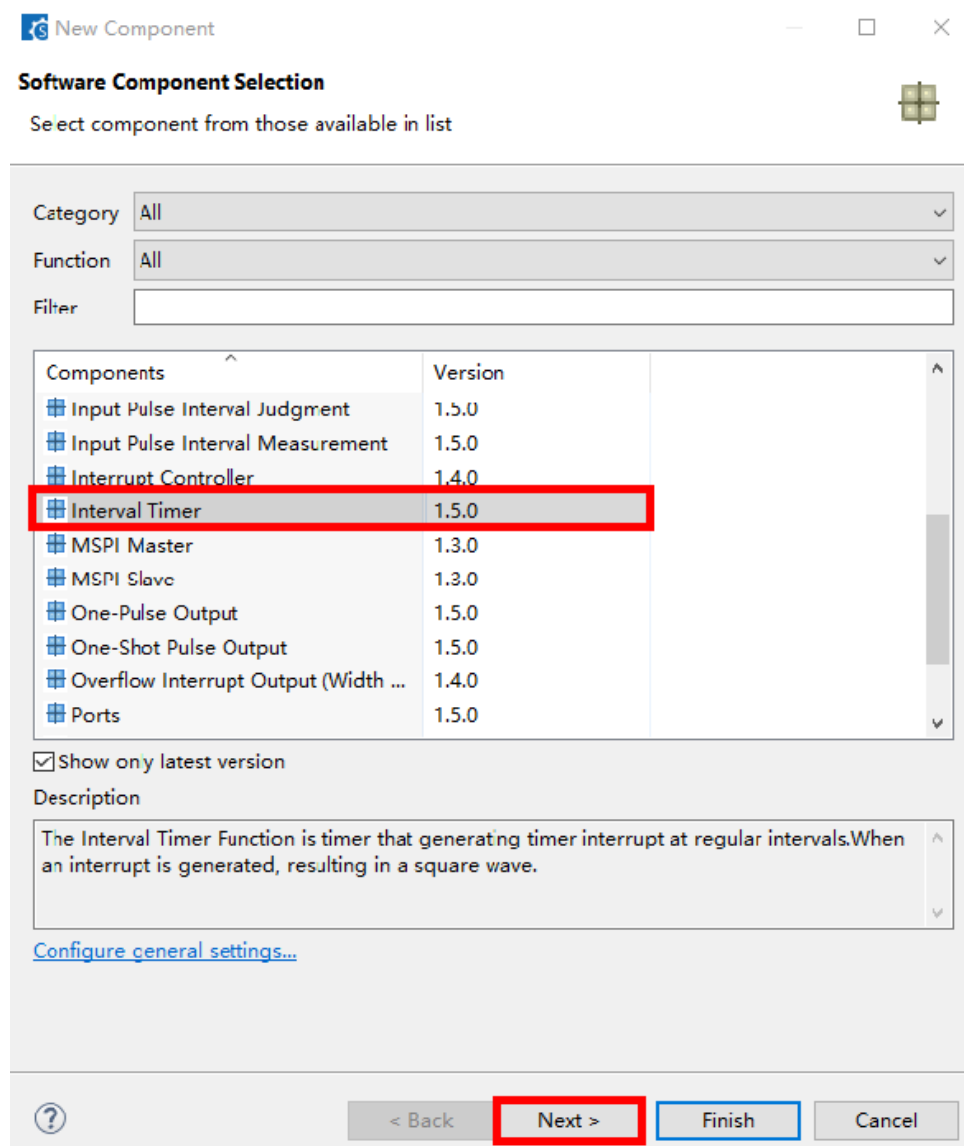


Figure 5-3. Select components

- (4) Select the configuration name and resource of the selected component. On the [Add new configuration for selected component] page of the [New Component] dialog box, enter an appropriate configuration name or use the default name. Select the resource or use the default resource. After you have made the selections, click on the [Finish] button.

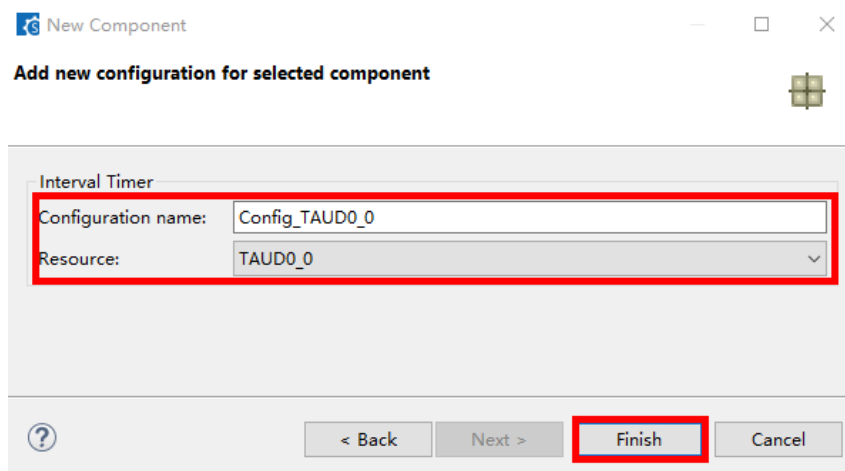


Figure 5-4. Input Configuration name and select Resource

- (5) Set the configuration of the component. Click on the configuration icon in the Component Tree panel and make detailed settings in the right-hand panel.

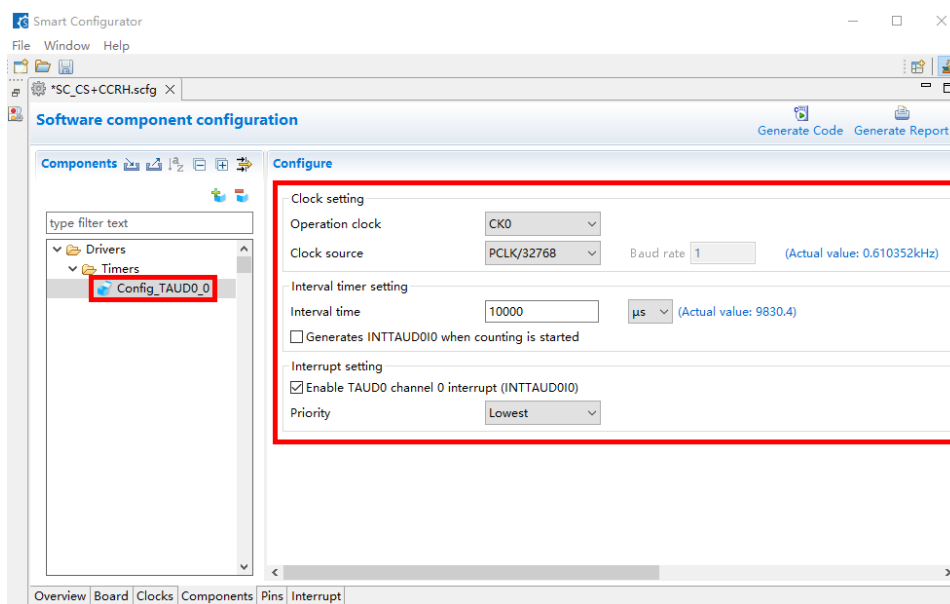


Figure 5-5. Set component configuration

- (6) Repeat steps (2) to (5) for each component that you intend to use.

5.2 Generating Drivers

Click on the [Code Generator] button  to generate code. The source files generated by the Smart Configurator are stored in the <ProjectDir>\src\smc_gen folder.

<ProjectDir> is the folder containing the project files (.scfg) for the Smart Configurator.

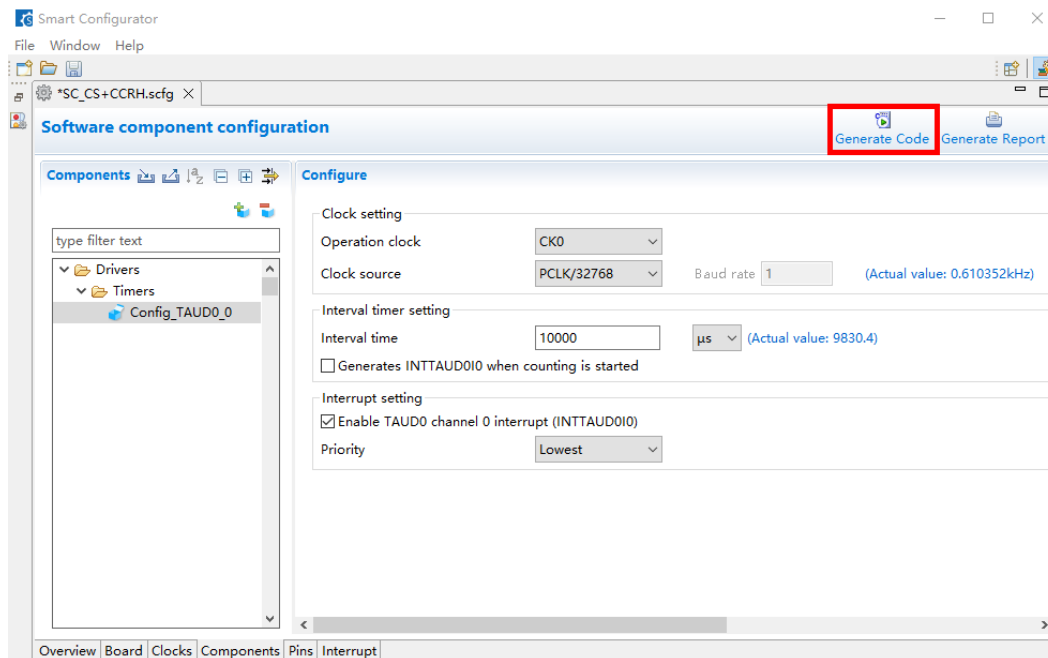


Figure 5-6. Generating code

5.3 Adding the Application Code to the User Code Area

Some generated source files have a user code area for the writing of user code. Open such files in an editor from CS+ environment that you are using and add the application code (e.g. code for interrupt processing) to the user code areas as necessary.

Example: File generated for the interval timer component

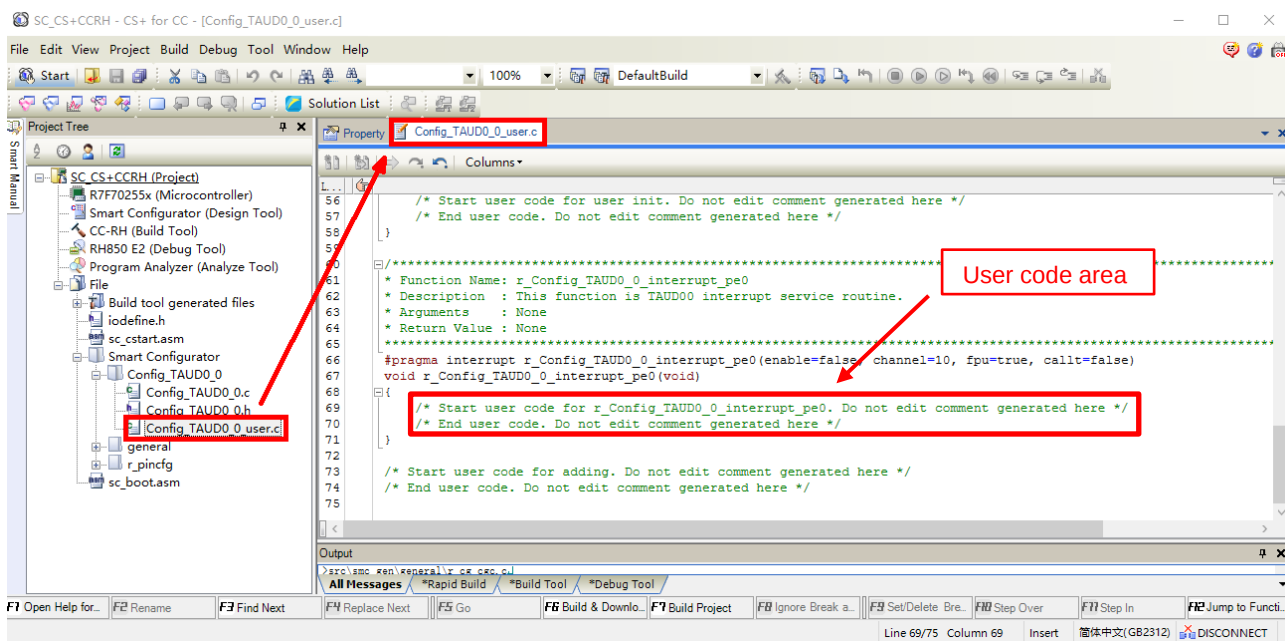


Figure 5-7. Add user code to the user code area of interrupt routine

The main function is in "`<ProjectDir>\src\smc_gen\general\r_cg_main.c`". Open the file in an editor from CS+ environment that you are using and add the application code to the user code area.

The screenshot shows the IAR Embedded Workbench IDE interface. The top menu bar includes File, Edit, View, Project, Build, Debug, Tool, Window, and Help. The top toolbar contains icons for Start, Stop, Run, and other development actions. The Project Tree on the left shows the project structure for 'SC_CS+CCRH (Project)', including files like 'R7F70255x (Microcontroller)', 'Smart Configurator (Design Tool)', 'CC-RH (Build Tool)', 'RH850 E2 (Debug Tool)', 'Program Analyzer (Analyze Tool)', 'File', 'Build tool generated files', 'iodefine.h', 'sc_cstart.asm', 'Smart Configurator', 'Config_TAUD0_0', 'general', 'r_cg_cgc.c', 'r_cg_cgc.h', 'r_cg_cgc_user.c', 'r_cg_interrupt_PEO.c', 'r_cg_macrodriver.h', 'r_cg_main.c' (highlighted with a red box), 'r_cg_systeminit.c', 'r_cg_taud.h', 'r_cg_userdefine.h', 'r_smc_clock_info.h', 'r_smc_interrupt.c', 'r_smc_interrupt.h', 'r_smc_intrpg.c', 'r_pincfg', and 'sc_boot.asm'. The main editor window displays the source code for 'r_cg_main.c'. The code includes comments for function names, descriptions, arguments, and return values. Key sections are highlighted with red boxes and arrows:

- Project Tree:** The 'r_cg_main.c' file is highlighted with a red box.
- Function Name:** The 'main' function is highlighted with a red box.
- User Code Area (Main):** The code block for 'main' is highlighted with a red box, with an arrow pointing to it from a text box stating 'User code area, call TAUD start function here.'
- User Code Area (r_main_userinit):** The code block for 'r_main_userinit' is highlighted with a red box, with an arrow pointing to it from a text box stating 'User code area, cancel TAUD0 module standby mode in advance.'
- Initialization Code:** The code block for 'SYSCTRL' initialization is highlighted with a red box.

The bottom status bar shows the current line and column (Line 1/82, Column 1) and the active tool (Insert).

Figure 5-8. Add user code to main function

Revision History

Rev.	Section	Description
1.00	All	New version

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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