RL78 Family

How to change devices in the sample project for the DSP Library and the Security Library

Introduction

This document describes the procedures for migrating the driver and middleware sample code projects shown in the table below to other RL78 family devices.

Table 1. Target driver and middleware

Category	Driver and Middleware Name	Document Number	Target Device
DSP Library	RL78 Family RL78 Digital Signal Controller Library - Filter Note1	R01AN1665	RL78/G16 RL78/G21 RL78/G22 RL78/G24 RL78/L23
	RL78 Family FFT Library Note1	R20AN0150	RL78/G16 RL78/G21 RL78/G22 RL78/G24 RL78/L23
Security Library	RL78 Family AES Library	R20AN0151	RL78/G16 RL78/G21 RL78/G22 RL78/G24 RL78/L23
	RL78 Family RSA Library	R20AN0326	RL78/G21 RL78/G24 RL78/L23
	RL78 Family SHA Hash Function Library	R20AN0211	RL78/G15 RL78/G16 RL78/G21 RL78/G22 RL78/G24 RL78/L23
	RL78/G23 Unique ID Read Driver	R20AN0615	RL78/G21 RL78/G22 RL78/G24 RL78/L23
	RL78 Family True Random Number Generator (TRNG) Software Driver	R20AN0617	RL78/G22 RL78/G24 RL78/L23

Notes: 1. When changing a sample project to a different device, use a sample project from a device that belongs to the same CPU core category as the target device.
- S2 Core : When changing to RL78/G16, use a sample project for RL78/G15.
- S3 Core : When changing to RL78/G22, RL78/G24, or RL78/L23, use a sample project for RL78/G23.

For more information on CPU core classification, please refer to the following document.
- RL78 Family User's Manual: Software (R01US0015)

The sample code included in the migration source project may not be usable as is because the ROM/RAM capacity of the migration destination device is not sufficient. In such cases, please change the sample code to fit into the ROM/RAM capacity of the migration destination device. See "2.1 Sample Code Size Adjustment" for an example of changing sample codes.

Target Device

RL78/G15, RL78/G16, RL78/G21, RL78/G22, RL78/G24, RL78/L23

When using this application note with other Renesas devices, careful evaluation is recommended after making modifications to comply with the alternate devices.

The versions of the development tools used in reviewing the procedures in this document are as follows.

RL78/G15

- CS+ for CC V8.14.00
- e2 studio 2025-12
- CC-RL V1.15.01
- LLVM for Renesas RL78 17.0.1.202512
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.15.0

RL78/G16

- CS+ for CC V8.14.00
- e2 studio 2025-12
- CC-RL V1.15.01
- LLVM for Renesas RL78 17.0.1.202512
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.15.0

RL78/G21

- CS+ for CC V8.16.00
- e2 studio 2026-07
- CC-RL V1.16.00
- LLVM for Renesas RL78 17.0.1.202606
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.18.0

RL78/G22

- CS+ for CC V8.14.00
- e2 studio 2025-12
- CC-RL V1.15.01
- LLVM for Renesas RL78 17.0.1.202512
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.15.0

RL78/G24(DSP Libraries)

- CS+ for CC V8.14.00
- e² studio 2025-12
- CC-RL V1.15.01
- LLVM for Renesas RL78 17.0.1.202512
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.15.0

RL78/G24(Security Libraries)

- CS+ for CC V8.09.00
- e² studio 2023-04
- CC-RL V1.12.00
- LLVM for Renesas RL78 10.0.0.202306
- IAR Embedded Workbench for Renesas RL78 version 4.21.4
- IAR C/C++ Compiler for Renesas RL78 : 4.21.1.2409
- Smart Configurator for RL78 V1.6.0

RL78/L23

- CS+ for CC V8.14.00
- e2 studio 2025-12
- CC-RL V1.15.01
- LLVM for Renesas RL78 17.0.1.202512
- IAR Embedded Workbench for Renesas RL78 version 5.20.2
- IAR C/C++ Compiler for Renesas RL78 : 5.20.2.2949
- Smart Configurator for RL78 V1.15.0

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1. Project Migration Procedure

Describes how to use each IDE's features to migrate a sample code project created for a specific RL78 family device to other RL78 family devices.

Open a migration source project in each IDE and change the device. Change source code, build settings, and debug settings according to the changed device.

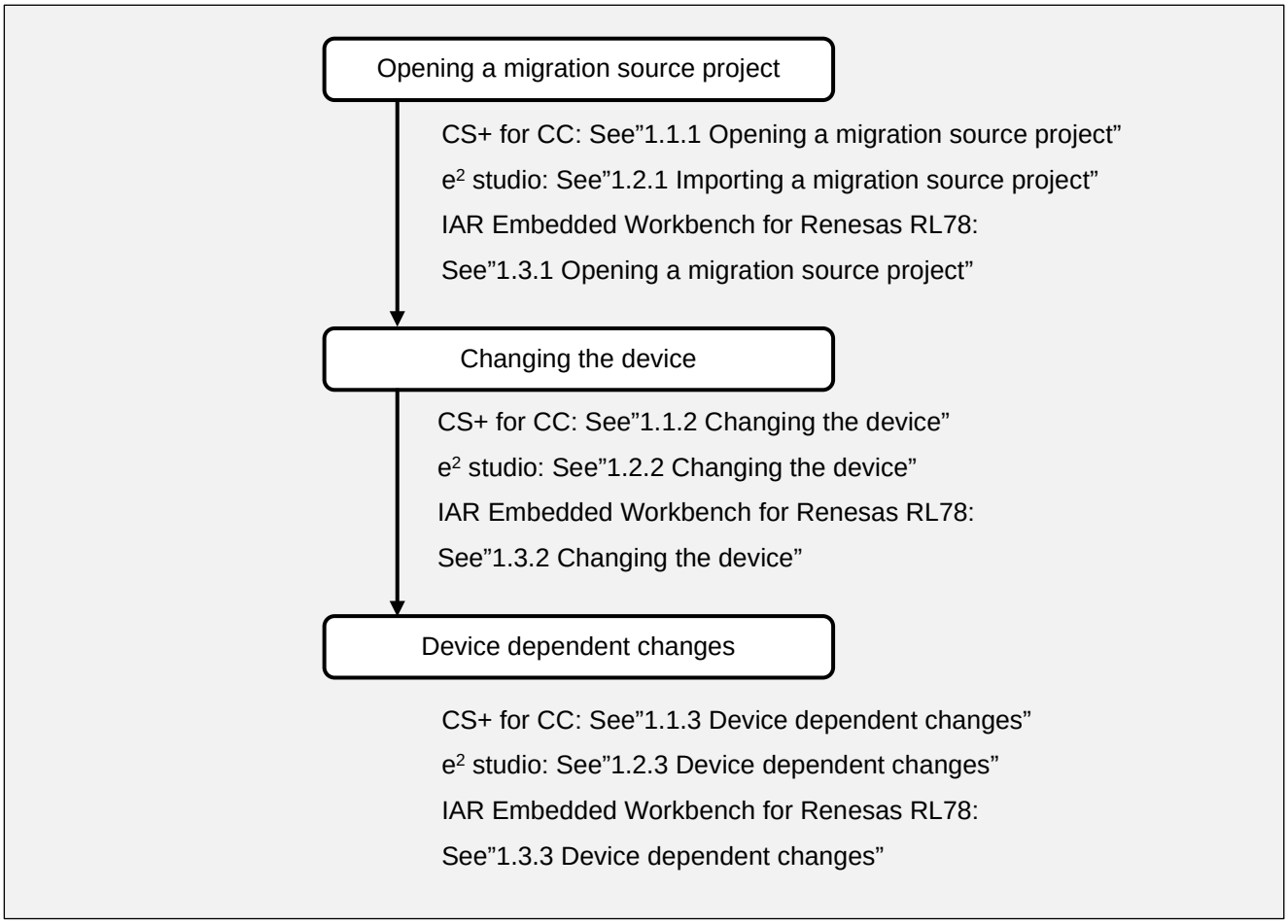


Figure 1-1 Project Migration Procedure

1.1 CS+ for CC

Use the [Change Microcontroller] function to change the device.

If necessary, make a backup by manually copying a folder containing a migration source project file (.mtpj).

1.1.1 Opening a migration source project

(1) Click [Project] −> [Open Project] to display the Explorer for selecting a project file.

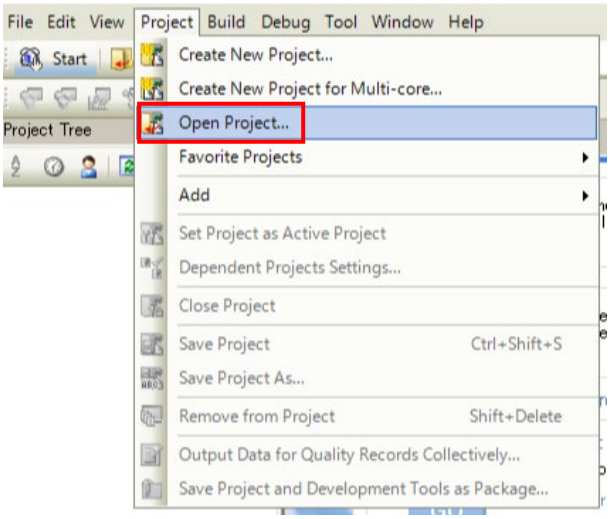


Figure 1-2 Opening a migration source project (1/2)

(2) In the Explorer that appears, select a migration source project file and click [Open] to open the project.

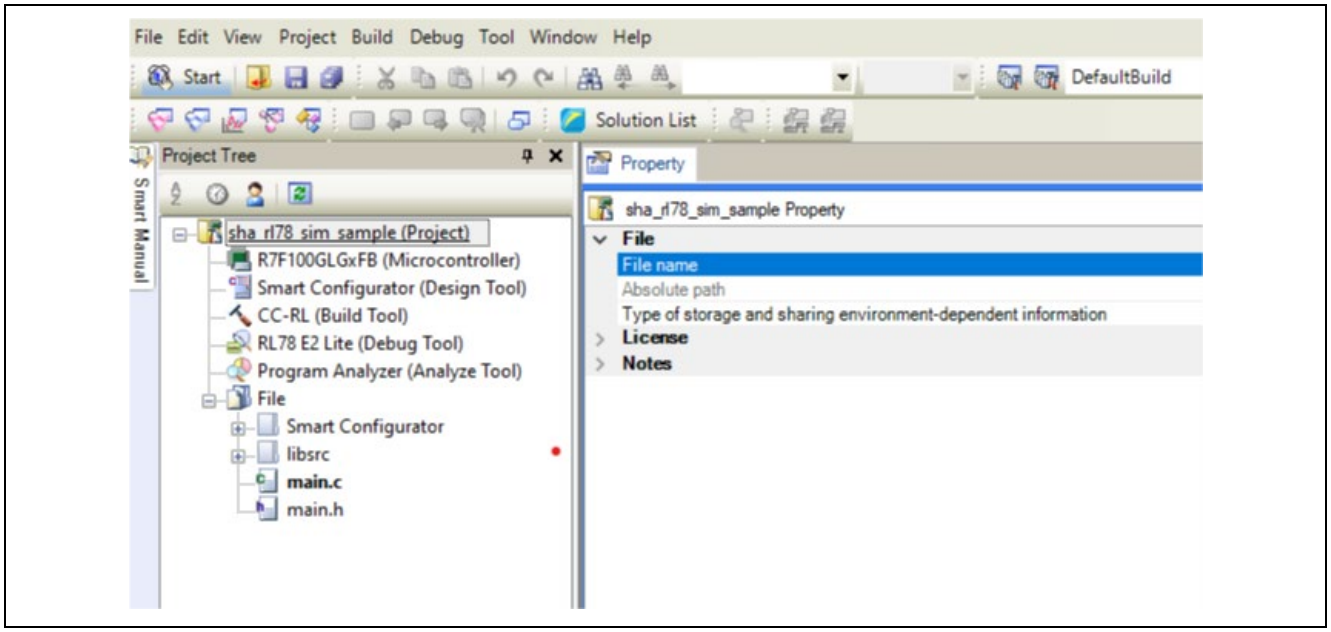


Figure 1-3 Opening a migration source project (2/2)

1.1.2 Changing the device

(1) Right-click on the Microcontroller item in the project tree and click [Change Microcontroller].

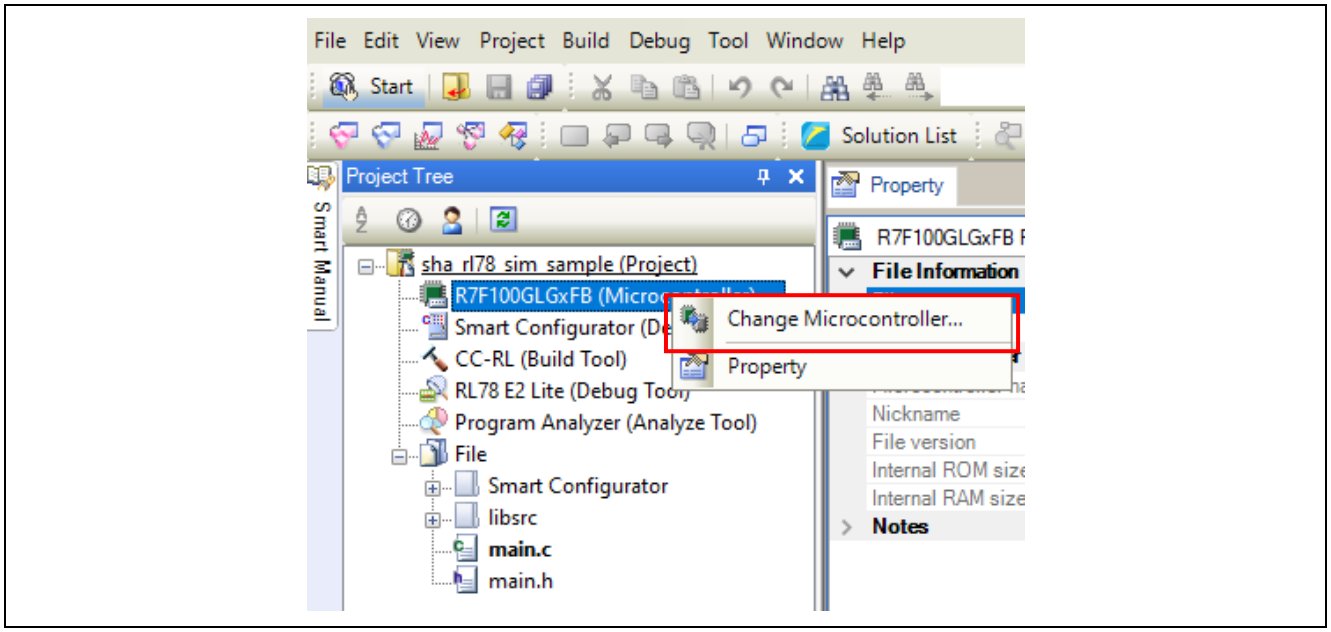


Figure 1-4 Changing the device (1/4)

(2) The message dialog appears confirming the project overwrite. Click [OK] to overwrite the migration source project.

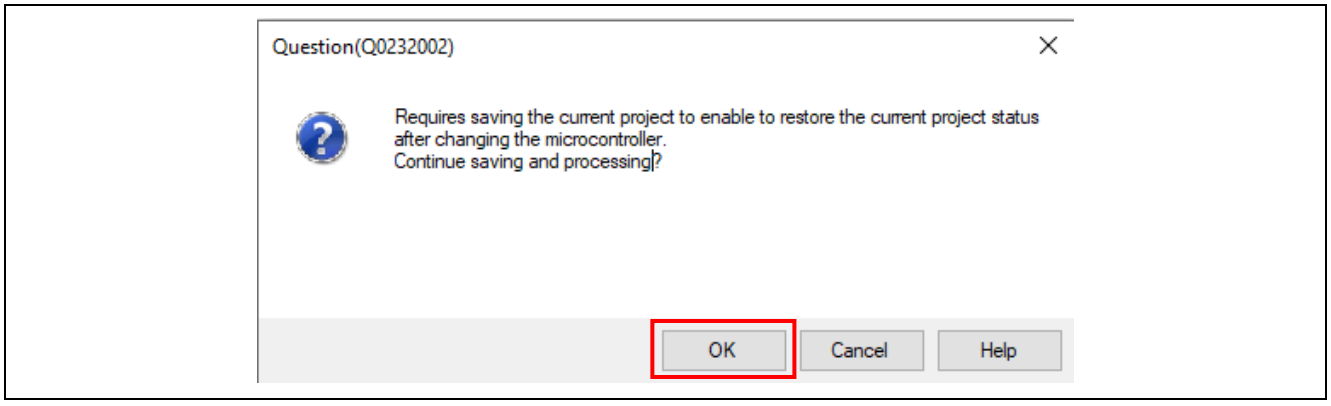


Figure 1-5 Changing the device (2/4)

(3) After the migration source project is overwritten and saved, the Change Microcontroller dialog appears. Select the migration destination device (in this example, explained in R5F12068xSP) and click [OK].

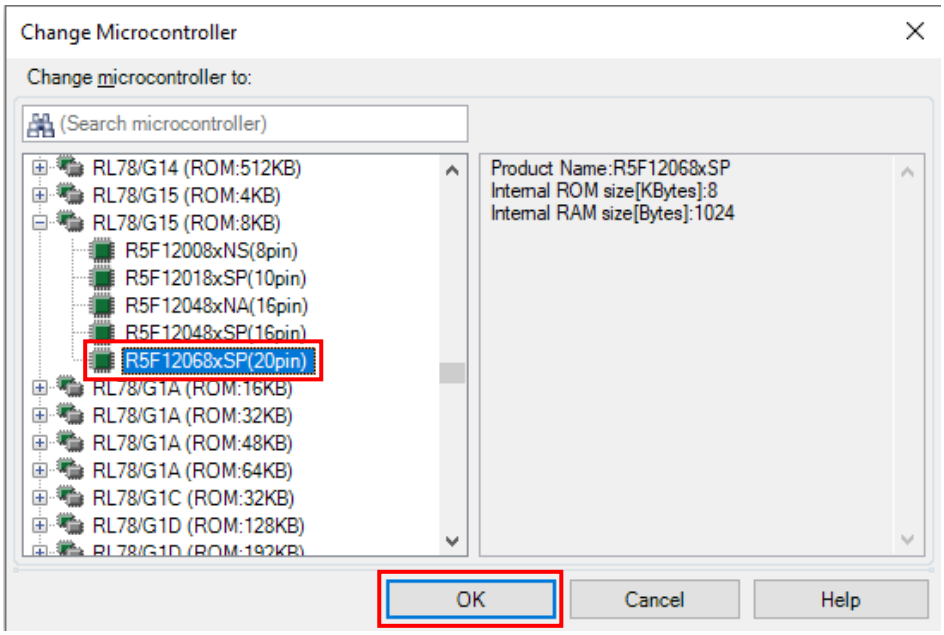


Figure 1-6 Changing the device (3/4)

(4) Confirm that the Microcontroller item in the project tree has been changed to the migration destination device.

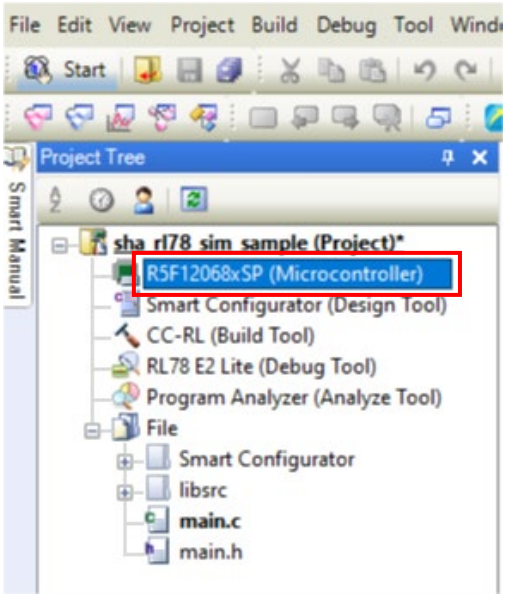


Figure 1-7 Changing the device (4/4)

1.1.3 Device dependent changes

Change the source code and debug settings depending on the device.

Change the debug settings according to the operating environment.

For information on how to configure debug settings, please refer to the following document.

— CS+ Integrated Development Environment User's Manual: RL78 Debug Tool (R20UT5136)

When using the Smart Configurator, refer to section 2.2, "Smart Configurator Change Procedure," to generate source code.

1.2 e² studio

Use the MCU migration feature to change the device.

If necessary, make a backup by manually copying a folder containing a migration source project file.

1.2.1 Importing a migration source project

Import a migration source project into the migration destination workspace. If necessary, specify a new workspace directory or switch a workspace.

(1) Click [File] -> [Import] to open the project import window.

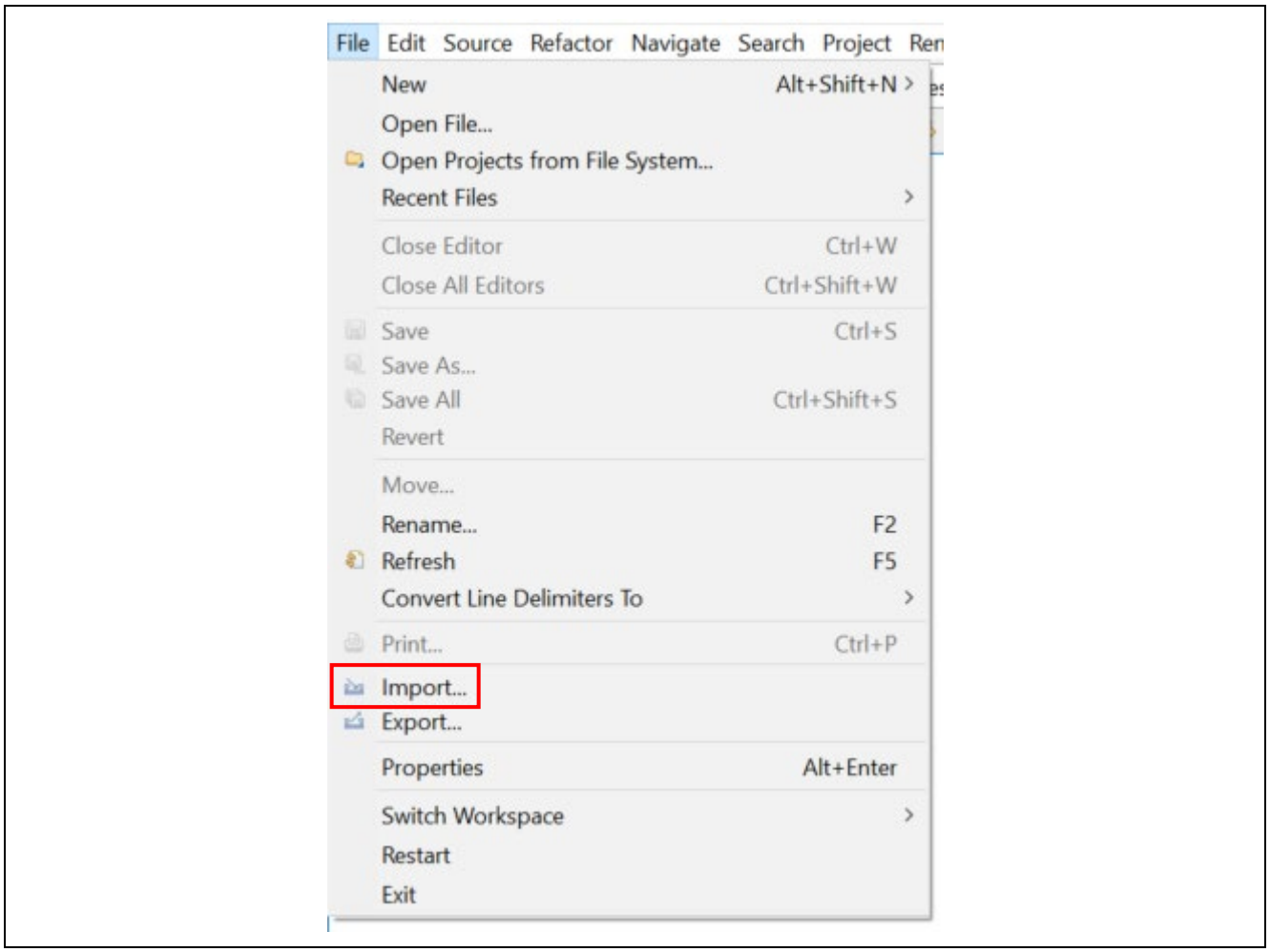


Figure 1-8 Importing a migration source project (1/4)

(2) Select [General] -> [Existing Project to Workspace] and click [Next] to proceed to the next screen.

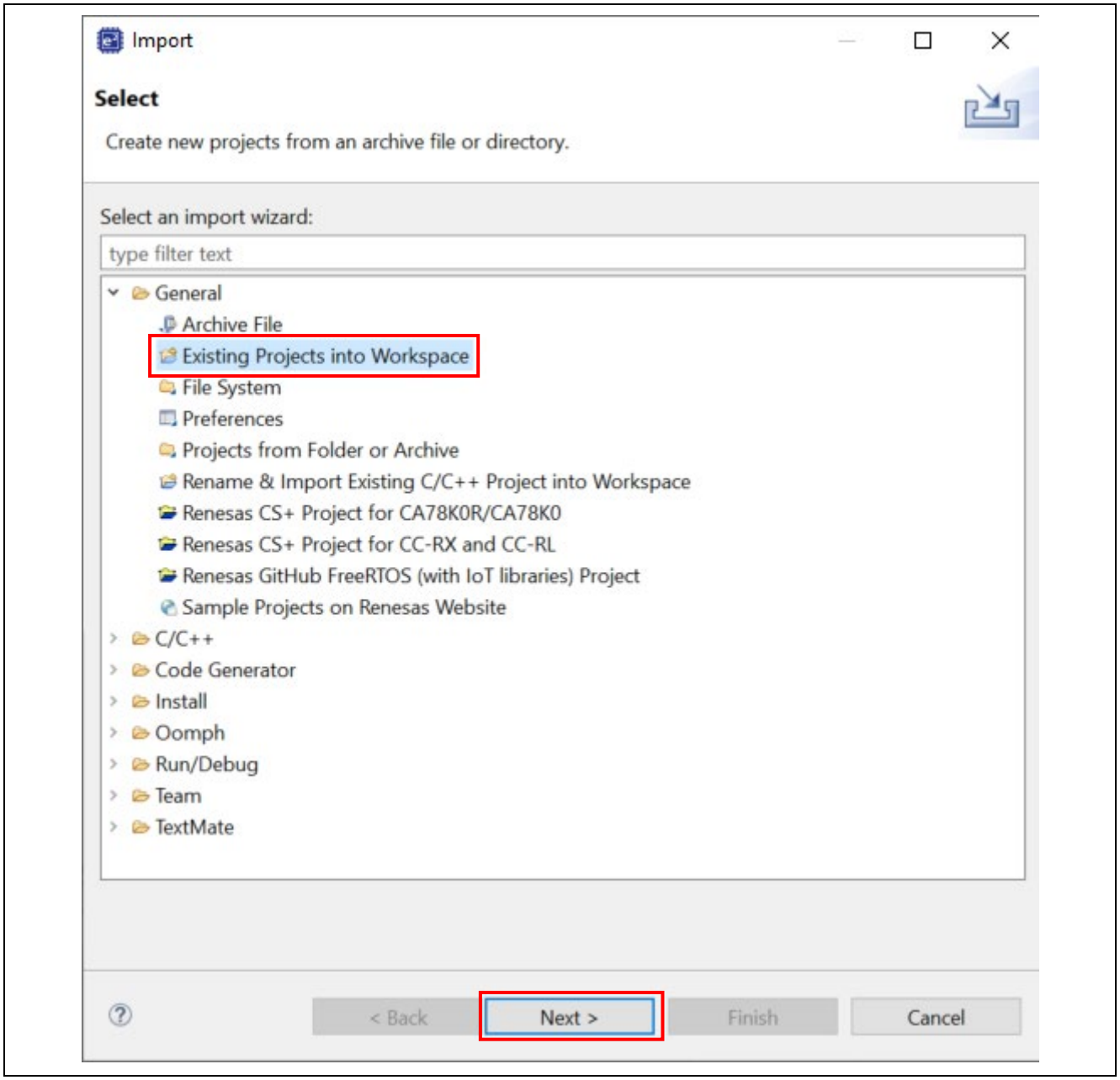


Figure 1-9 Importing a migration source project (2/4)

(3) Select a migration source project and import it into the workspace.
Click [Browse] and select a migration source project folder.
Confirm that the migration source project is selected and click [Finish].

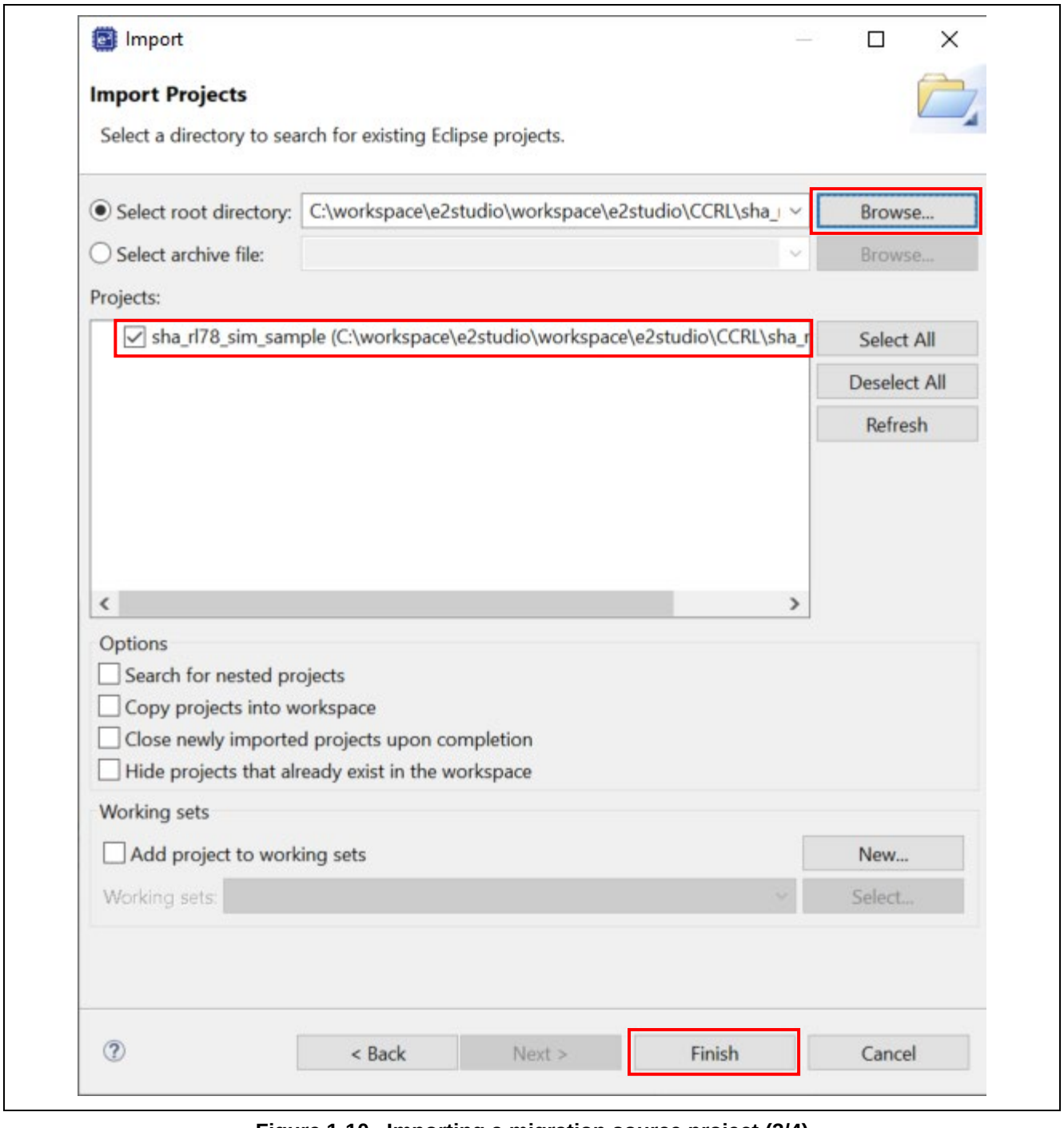


Figure 1-10 Importing a migration source project (3/4)

(4) Confirm that the migration source project has been imported into the workspace.

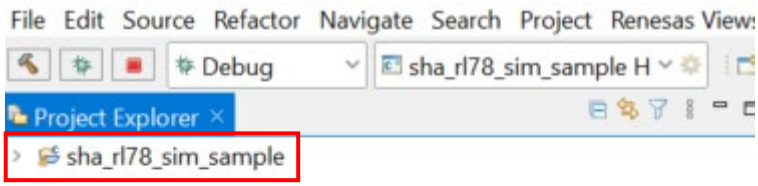


Figure 1-11 Importing a migration source project (4/4)

1.2.2 Changing the device

(1) Select the project and click [Project] -> [Change Device] to display the device change screen.

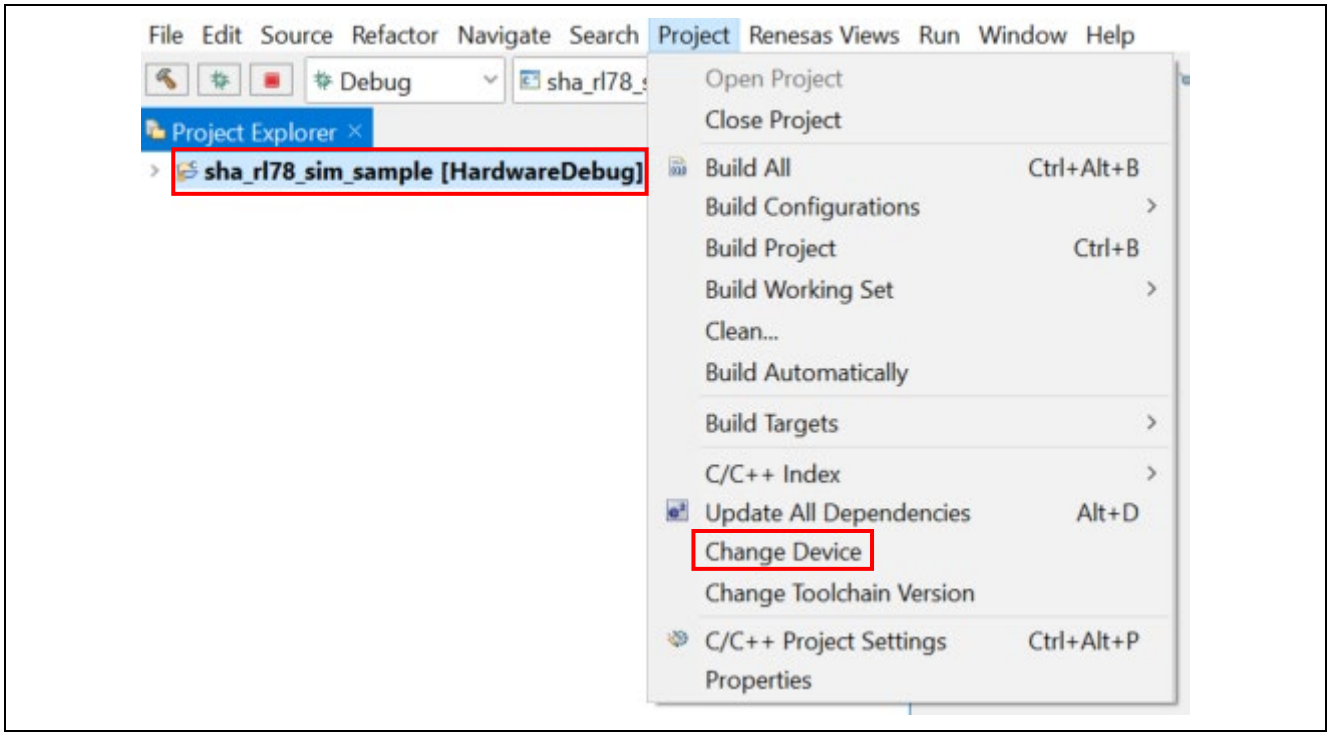


Figure 1-12 Changing the device (1/5)

(2) Click the button to the right of [Target Device] and select the migration destination device (in this example, explained in R5F12068xSP).
Click [Next] to proceed to the next screen.

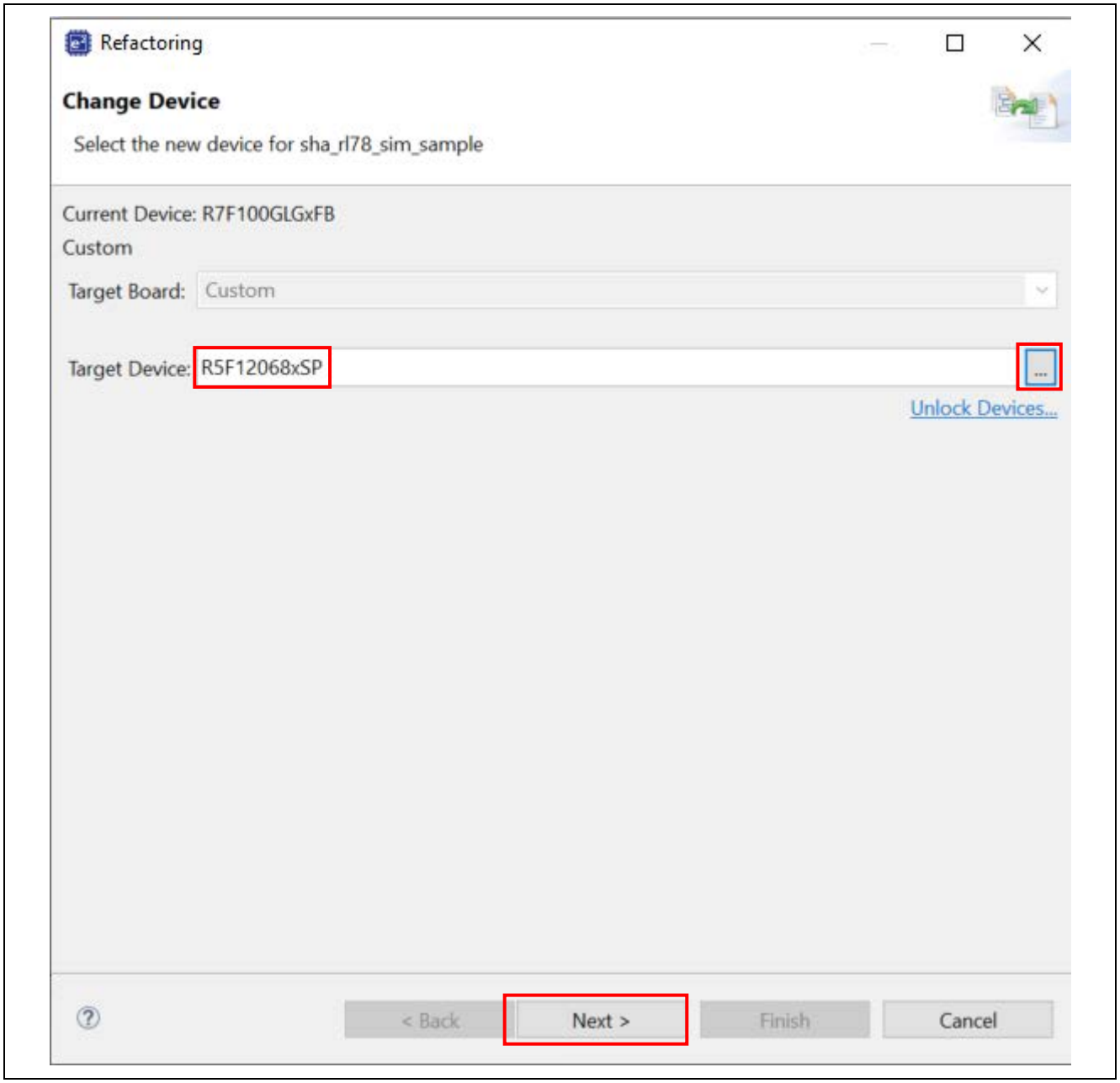


Figure 1-13 Changing the device (2/5)

(3) You may be warned to back up your project, as changes to the device cannot be undone. If necessary, make a backup by manually copying a folder containing a migration source project file.
Click [Next] to proceed to the next screen.

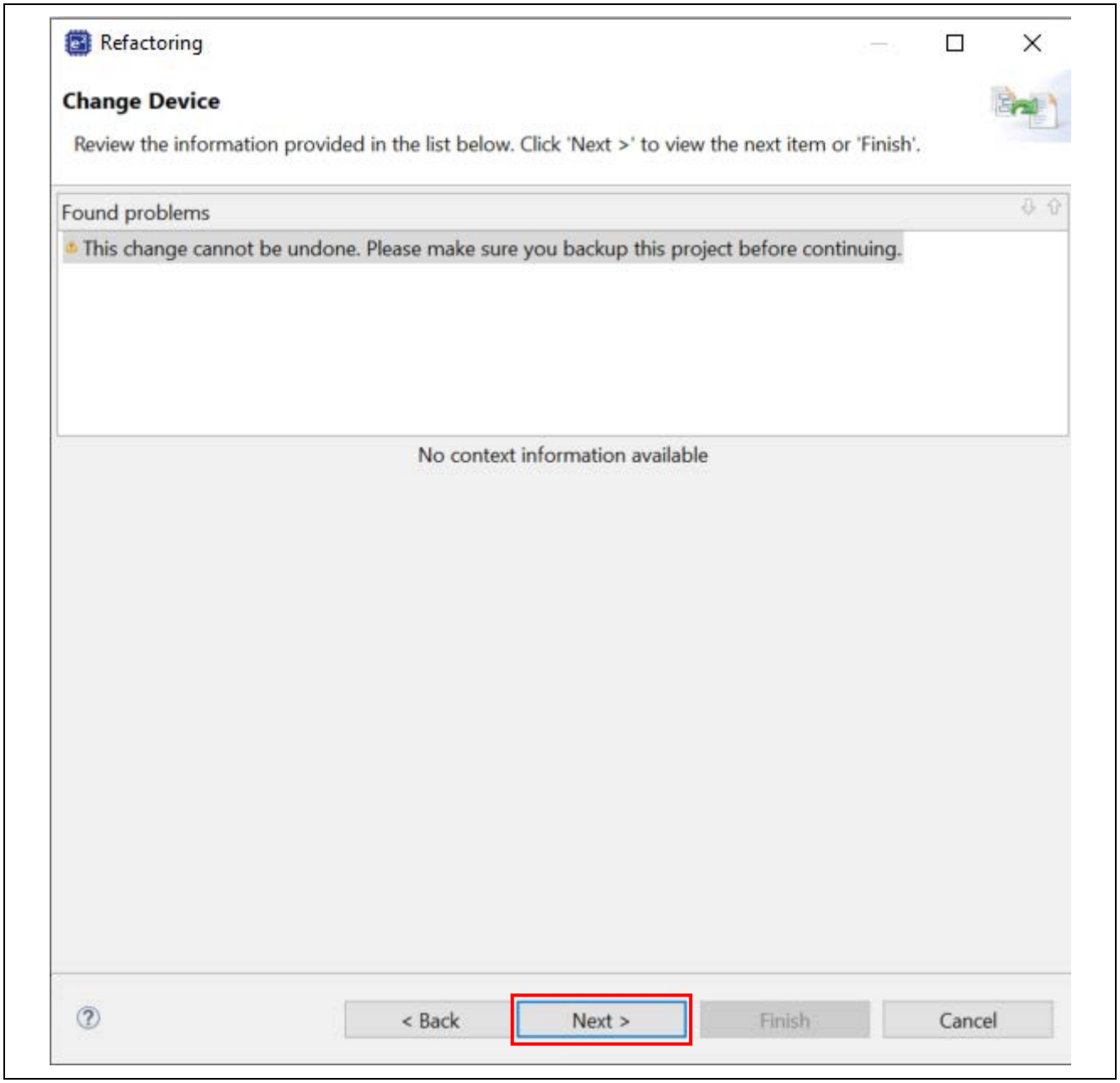


Figure 1-14 Changing the device (3/5)

(3-1) If the toolchain used in the migration source project is not registered, an error will occur.
To resolve the error, you need to either register the version of that toolchain or change the toolchain used in the migration source project.
This section explains how to change the toolchain used in the migration source project.
Click [Cancel].
If no error occurs, proceed to step (4).

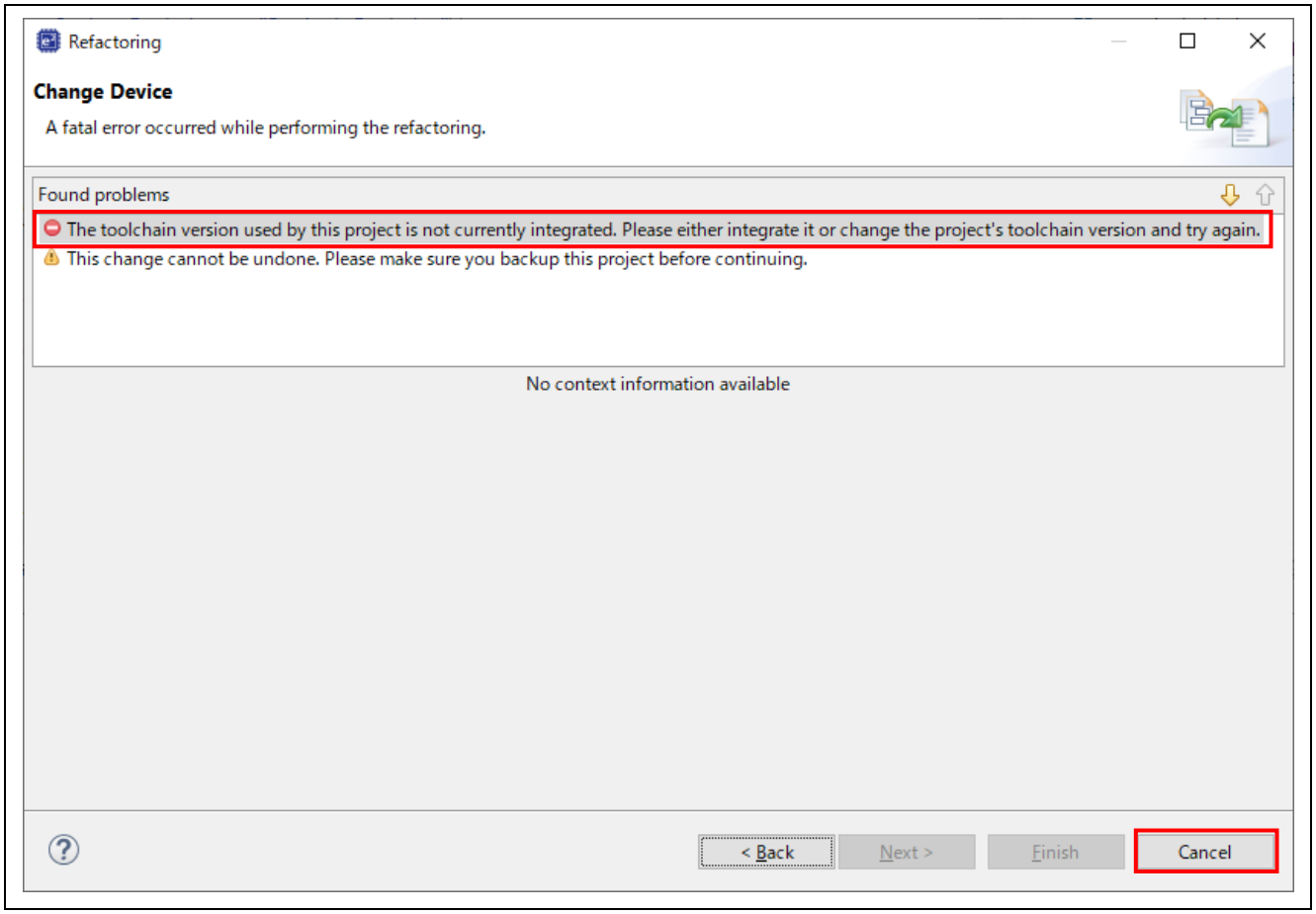


Figure 1-15 Changing the Toolchain (1/5)

(3-2) Click [Project] → [Change Toolchain Version] to open the Change Toolchain Version screen.

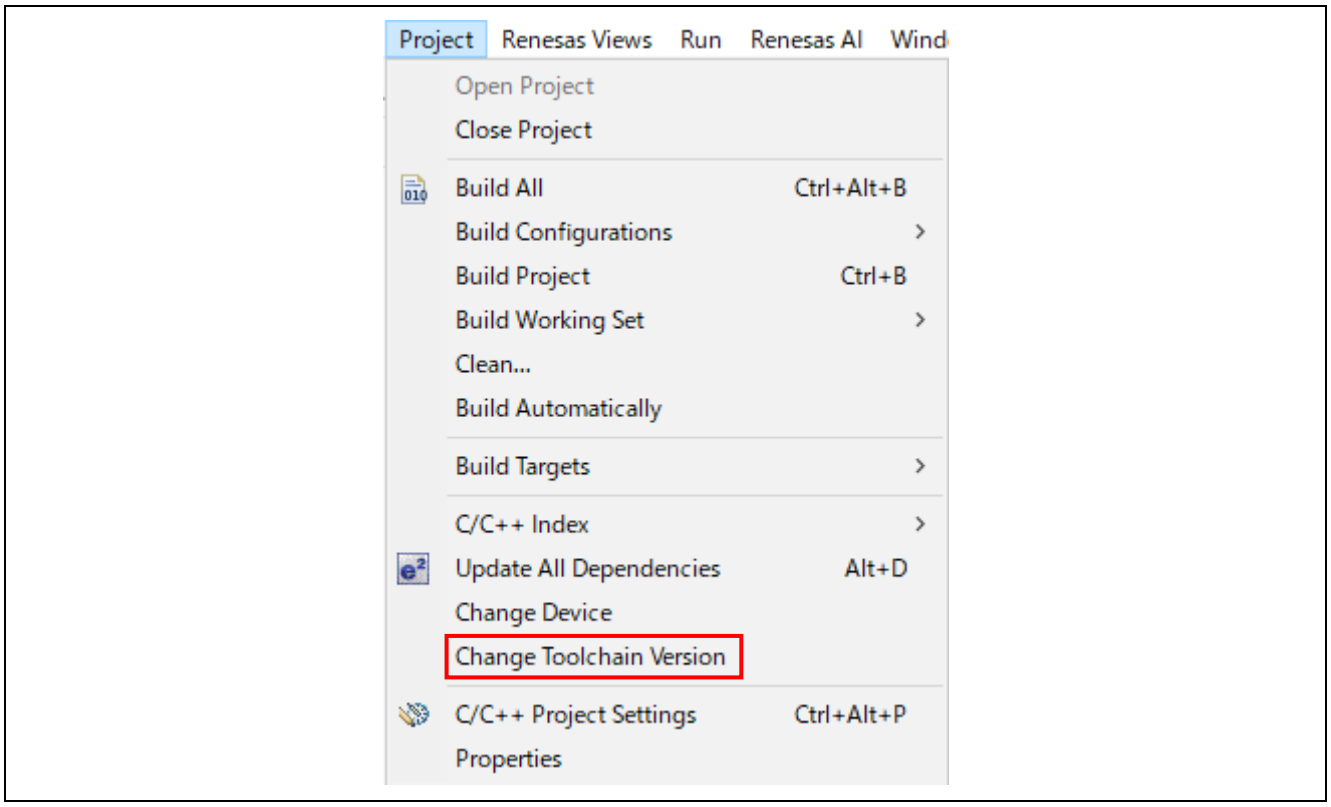


Figure 1-16 Changing the Toolchain (2/5)

(3-3) Select the registered toolchain in [Toolchain Version].
Click [Next] to proceed to the next screen.

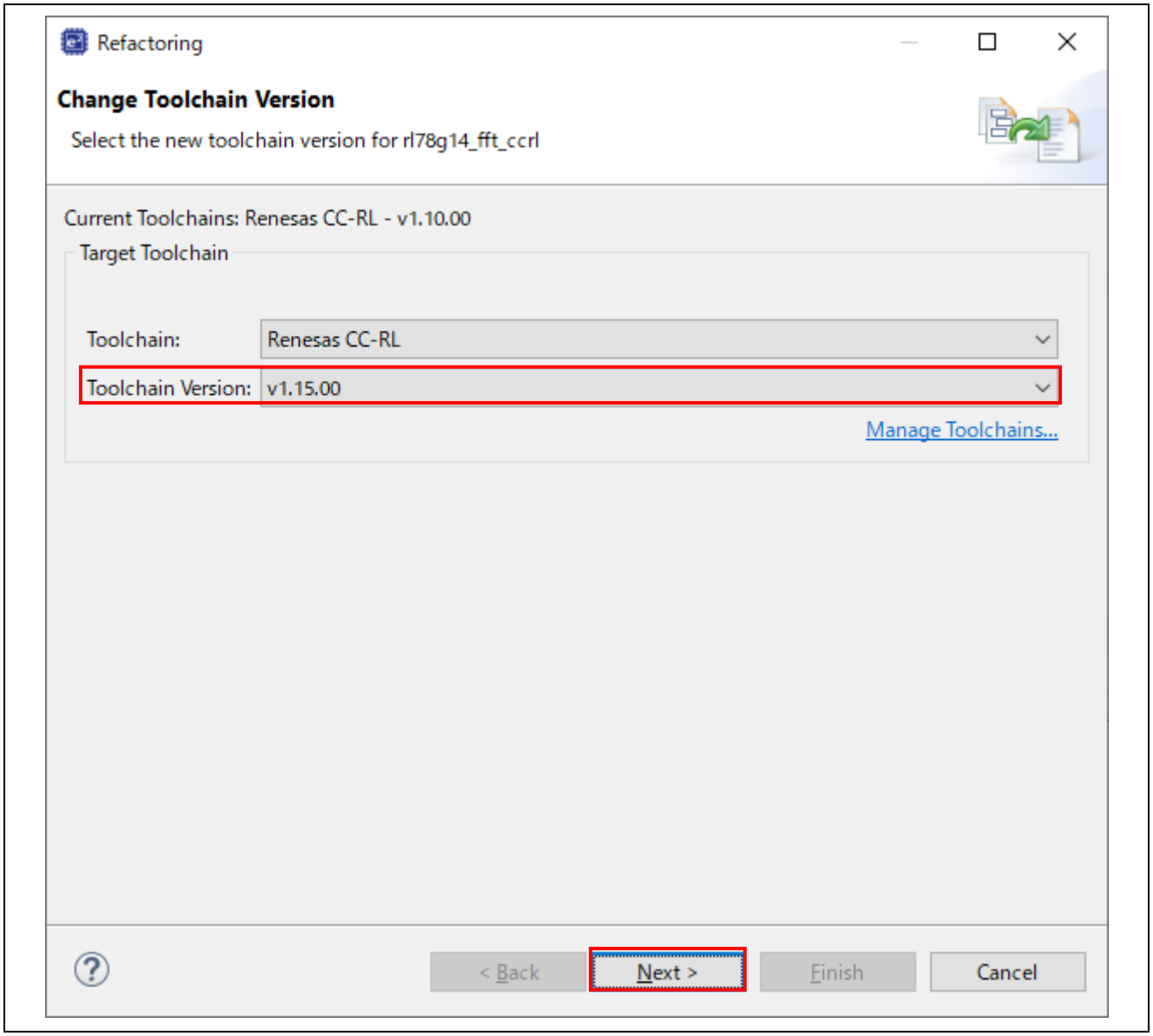


Figure 1-17 Changing the Toolchain (3/5)

(3-4) Since the change of toolchain version cannot be undone, a warning will appear prompting you to back up the project.
If necessary, manually copy the folder containing the migration source project file to create a backup.
Click [Next] to proceed to the next screen.

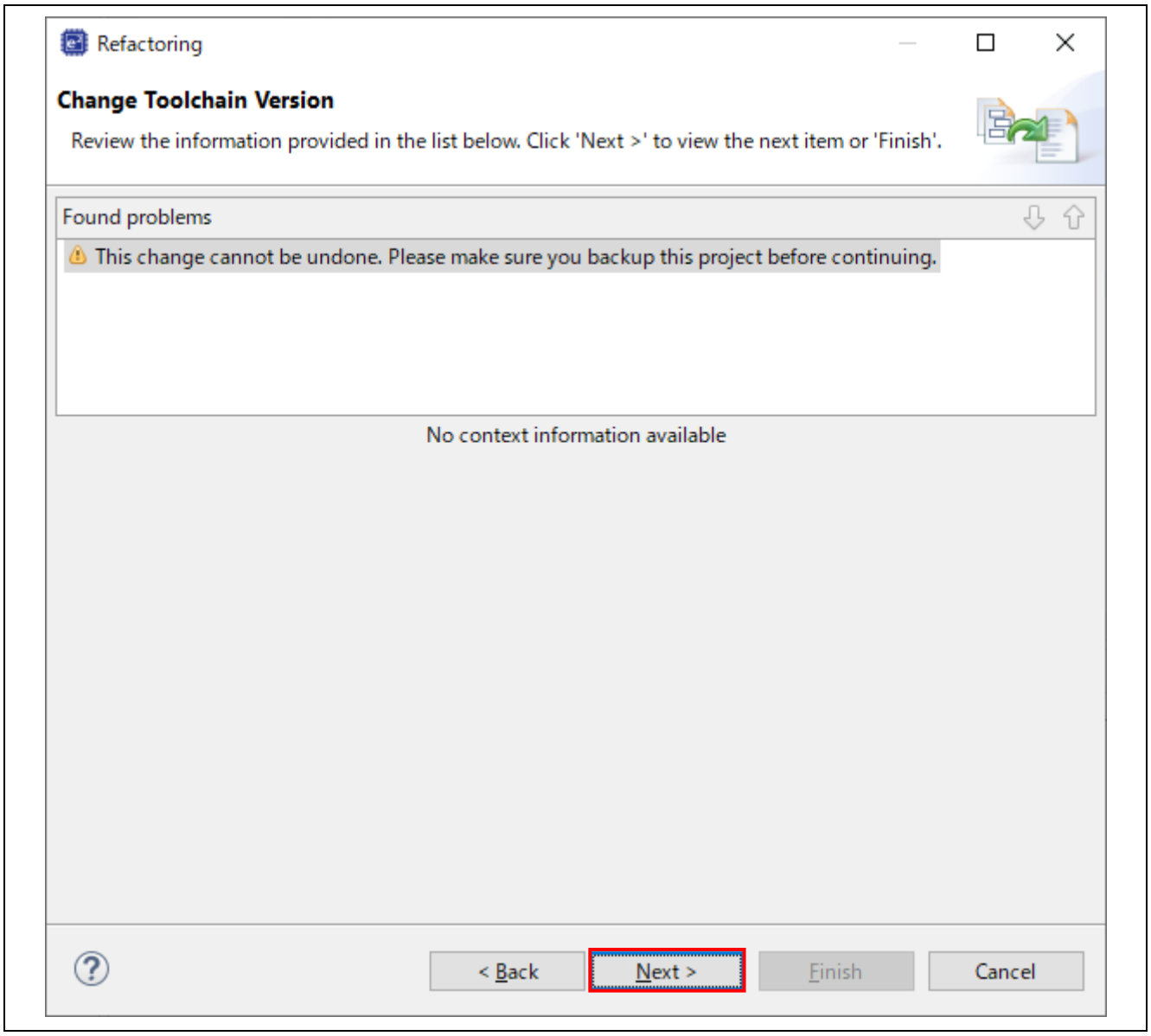


Figure 1-18 Changing the Toolchain (4/5)

(3-5) The changes made to the project will be displayed.
Click [Finish].
Please perform the device change again from “1.2.2 Changing the device”

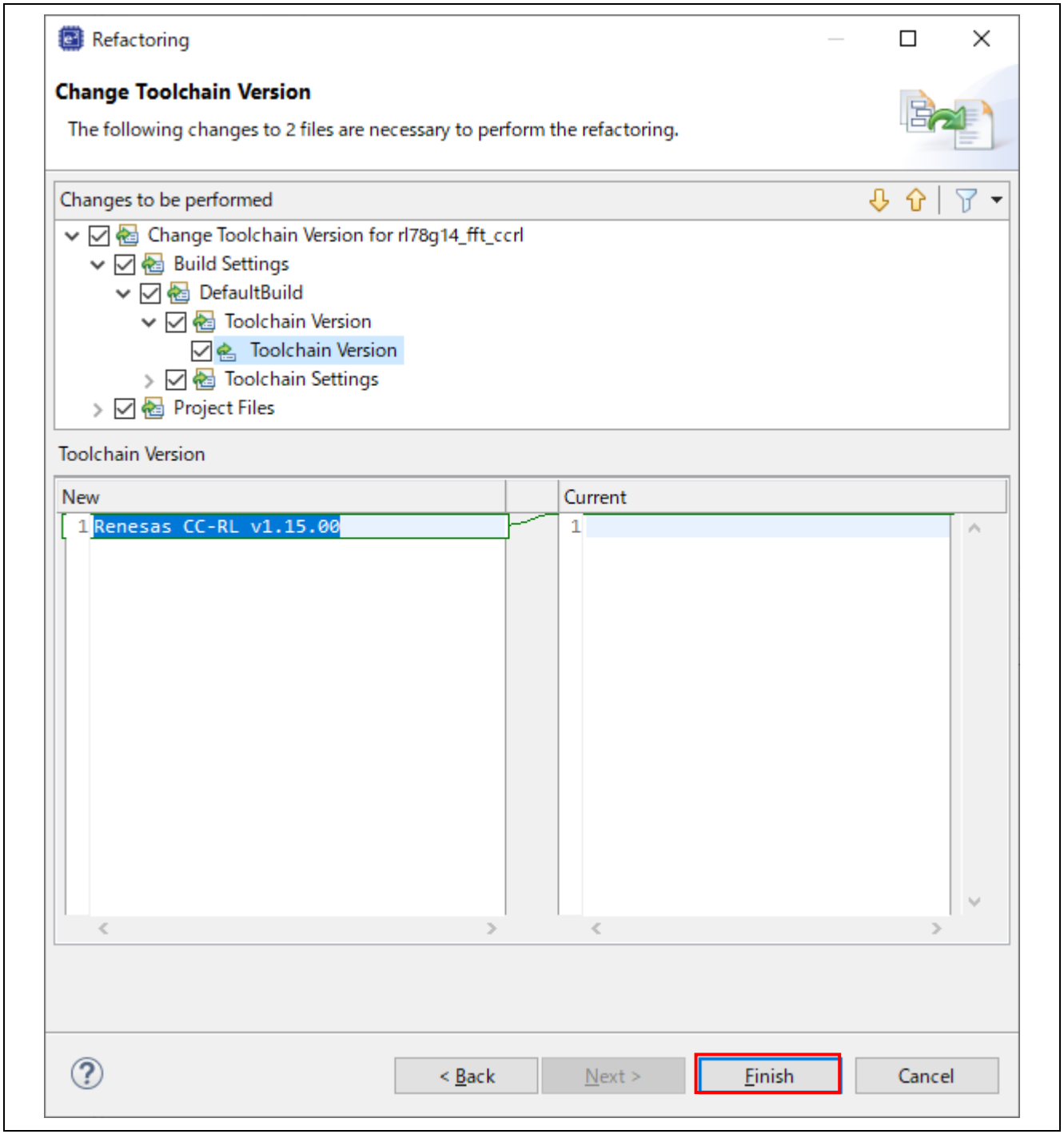


Figure 1-19 Changing the Toolchain (5/5)

(4)The project changes are displayed. Click [Finish].

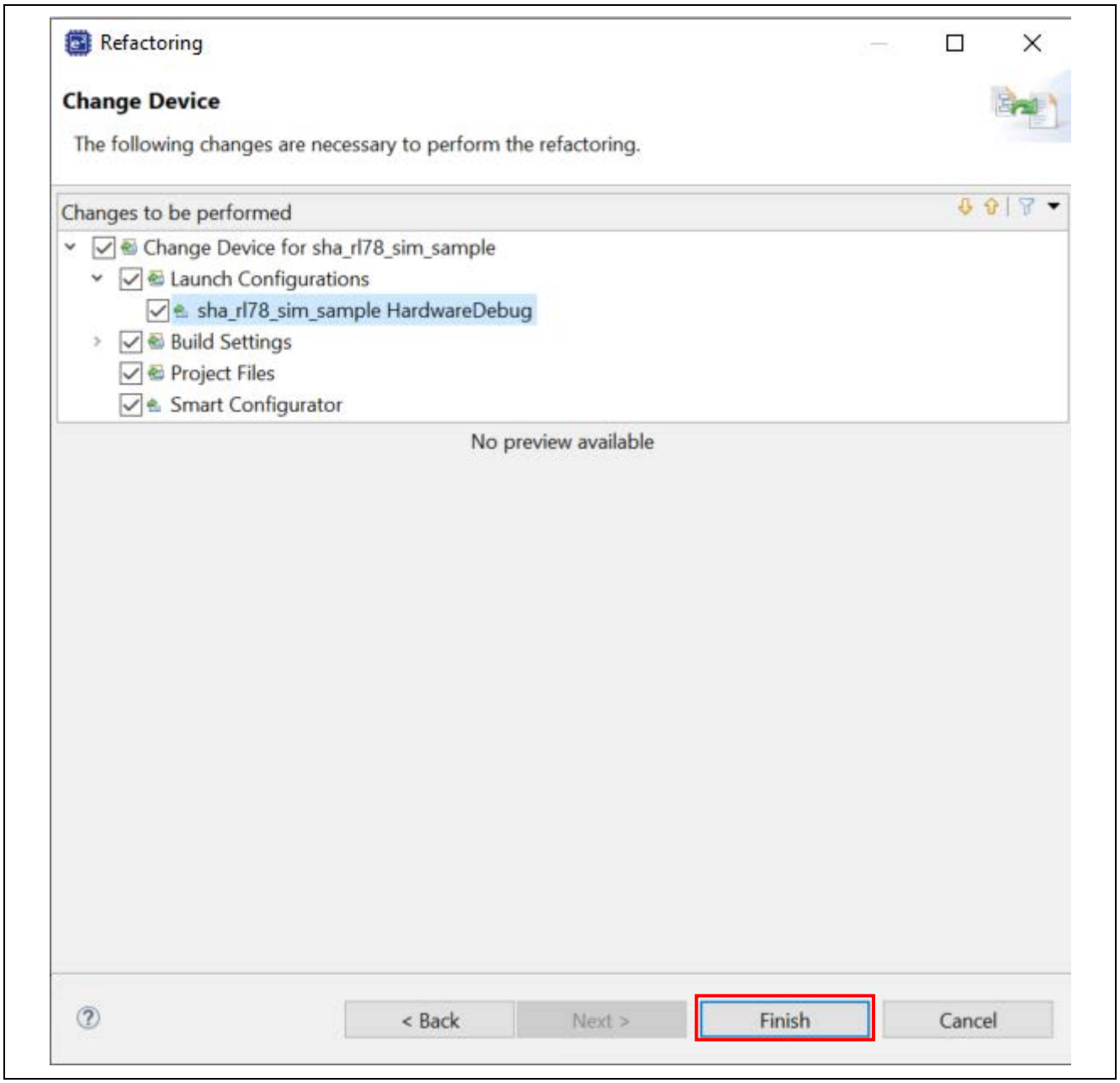


Figure 1-20 Changing the device (4/5)

(5) Open the project properties (right click on the project -> [Properties]) and confirm that [Current Device] under [C/C++ Build] -> [Settings] -> [Device] has been changed to the migration destination device.

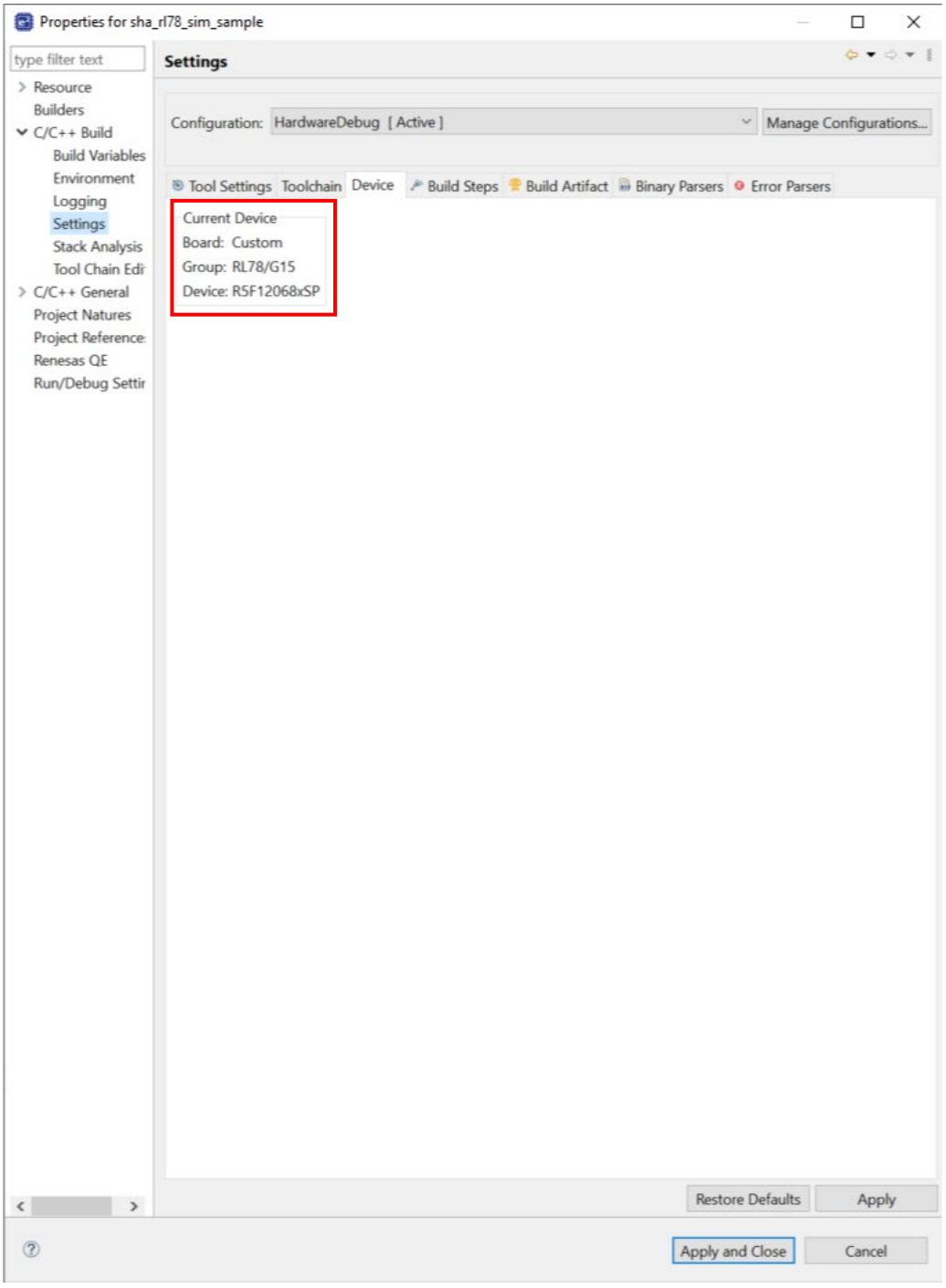


Figure 1-21 Changing the device (5/5)

1.2.3 Device dependent changes

Change the source code and debug settings depending on the device.

Change the debug settings according to the operating environment.

For information on how to configure debug settings, please refer to the following document.

— e² studio Integrated Development Environment User's Manual: Getting Started Guide (R20UT4819)

When using the Smart Configurator, refer to section 2.2, "Smart Configurator Change Procedure," to generate source code.

1.2.4 Migration of CC-RL Projects

When migrating a project that uses CC-RL V1.16 or later, warning W0561194, such as the following, may occur during the build process.

```
W0561194:Section ".bss" in relocation ".\src\smc_gen\r_bsp\mcu\all\cstart.obj"-".text"-"00000010"
is changed
W0561194:Section ".dataR" in relocation ".\src\smc_gen\r_bsp\mcu\all\cstart.obj"-".text"-
"0000003a" is changed
W0561194:Section ".data" in relocation ".\src\smc_gen\r_bsp\mcu\all\cstart.obj"-".text"-"00000037"
is changed
```

For information on how to resolve this warning, refer to the following FAQ:

- W0561194 (Linker Section Splitting) (CC-RL)

1.2.5 Migration of LLVM Projects

When migrating an LLVM project, you may encounter link errors after building. In such cases, please modify the linker_script.ld file.

1.2.5.1 Handling Link Errors (rodata Section)

After migrating to a new device, the following link errors may occur during the linking process:

ld.lld: error: Error: rodata section start address is too large.
Move the text section after the rodata section to ensure that correct data is added to the MIRROR area.

ld.lld: error: Error: rodata section size exceeds length of the MIRROR area.
These errors are caused by the .rodata section exceeding the size or placement constraints of the MIRROR area. You can avoid this by placing the .text section after the .rodata section. This ensures that the contents of .rodata fit correctly within the MIRROR area, preventing link errors.

Below is an example of how to modify the .text section—move it to follow the .rodata section.

```
.rodata MAX(., (CONSTANT(MIRRORAREASTART)+0x3000)):
{
  // content omitted
} >ROM

.text (. + __romdatacopysize):
{
  // content omitted
} >ROM AT>ROM
```

Figure 1-22 Example of .text Section Placement After .rodata

1.2.5.2 Handling Memory Overlap Errors Between .data and .ocd_traceram Sections

After migrating to a new device, the following link error may occur during the linking process.
(Note: The addresses shown in the error are examples.)

ld.lld: error: section .data virtual address range overlaps with .ocd_traceram

>>> .data range is [0xF7F00, 0xF88B5]

>>> .ocd_traceram range is [0xF8300, 0xF86FF]

This error occurs because the .data section and the .ocd_traceram section are placed in the same RAM area. To resolve this error, change the starting address of the .ocd_traceram section so that it does not overlap with the .data section.
Below is an example of changing the starting address of the .ocd_traceram section from 0xF8300 to 0xFBF00.

```
.ocd_traceram 0xFBF00 (NOLOAD) :
{
        KEEP(*(.ocd_traceram))
} >RAM
```

Figure 1-23 Example of Changing the Starting Address of the .ocd_traceram Section

1.3 IAR Embedded Workbench for Renesas RL78

Change the device in the project options settings.

If necessary, make a backup by manually copying a folder containing a migration source project file (.ewp).

1.3.1 Opening a migration source project

(1) Click [Project] -> [Add Existing Project] to display the Explorer for selecting a project file.

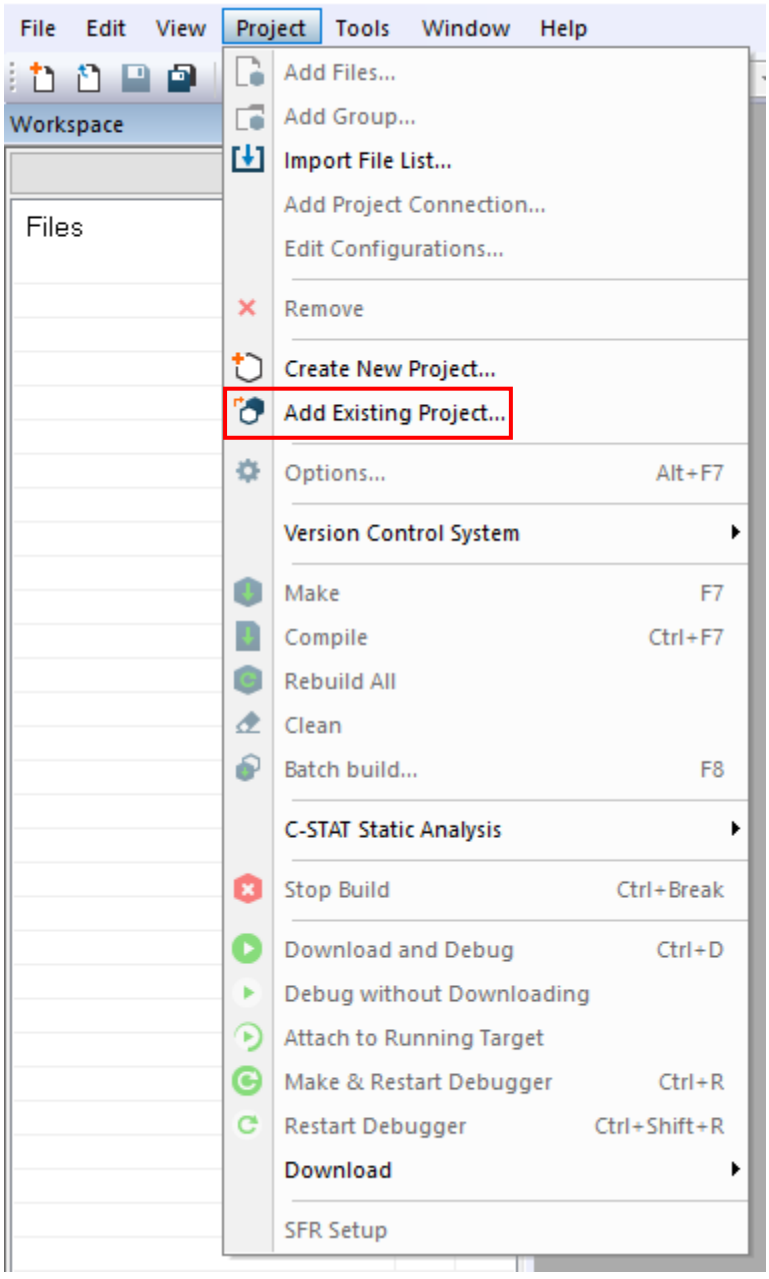


Figure 1-24 Opening a migration source project (1/2)

(2) In the Explorer that appears, select a migration source project file, and click [Open] to open the project.

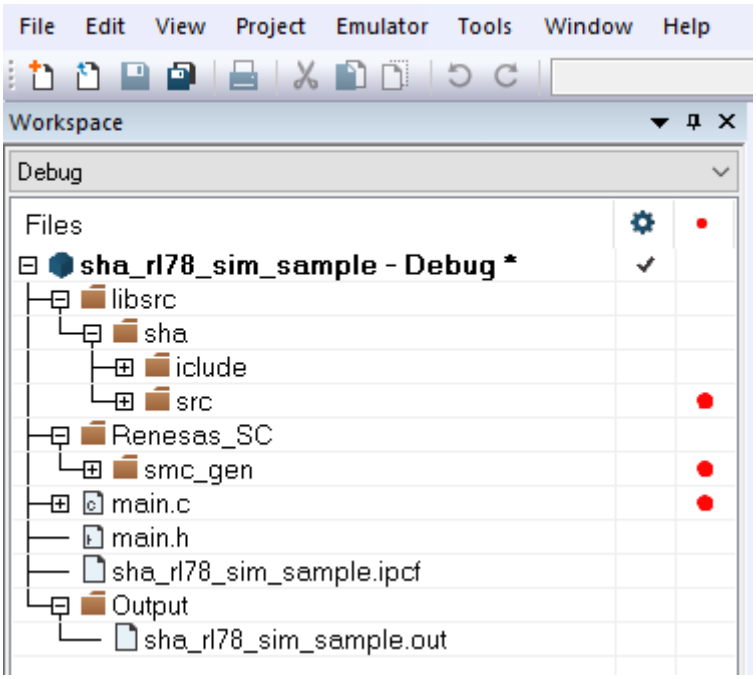


Figure 1-25 Opening a migration source project (2/2)

If the following screen appears when opening a project, click [Yes].

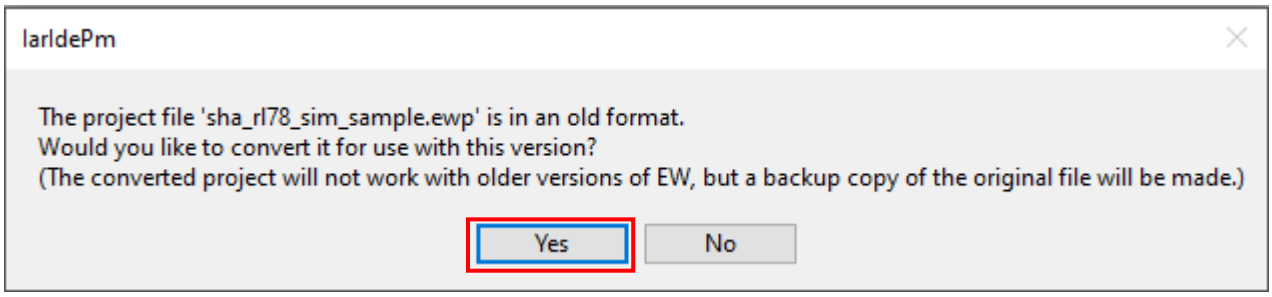


Figure 1-26 Confirmation of project file conversion

1.3.2 Changing the device

(1) Right-click on the project and click [Options] to open the options screen.

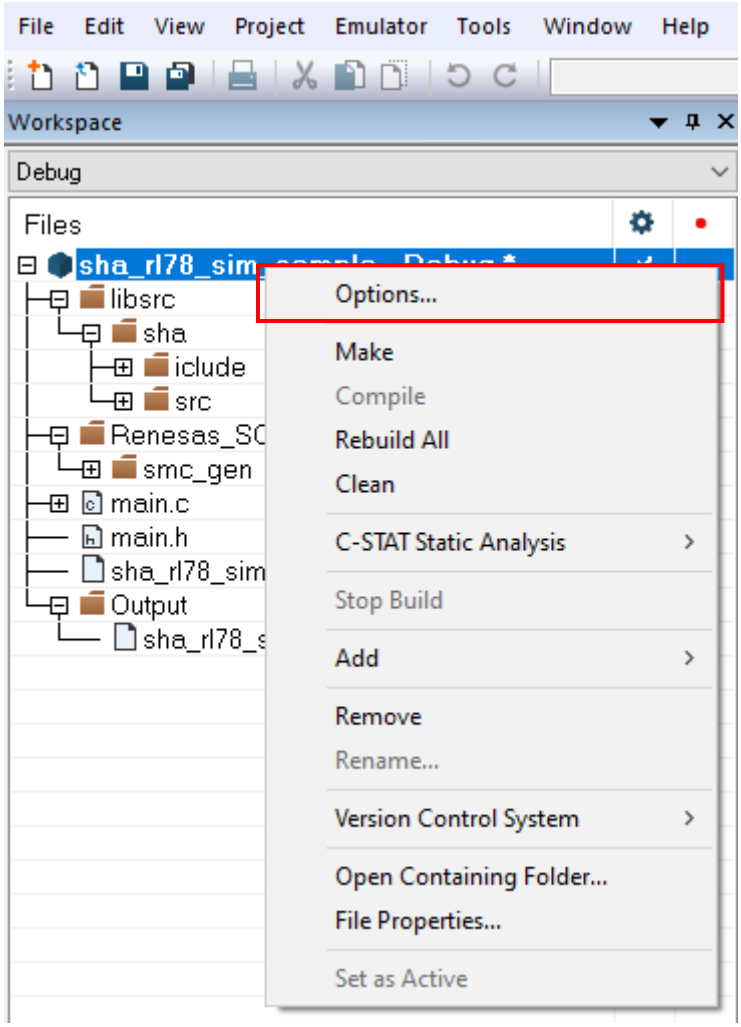


Figure 1-27 Changing the device (1/2)

(2) Open [General Options] -> [Target] and click the button to the right of [Device] to select the migration destination device (in this example, explained in [RL78 - R5F12068]).
Confirm that the migration destination device is selected and click [OK].

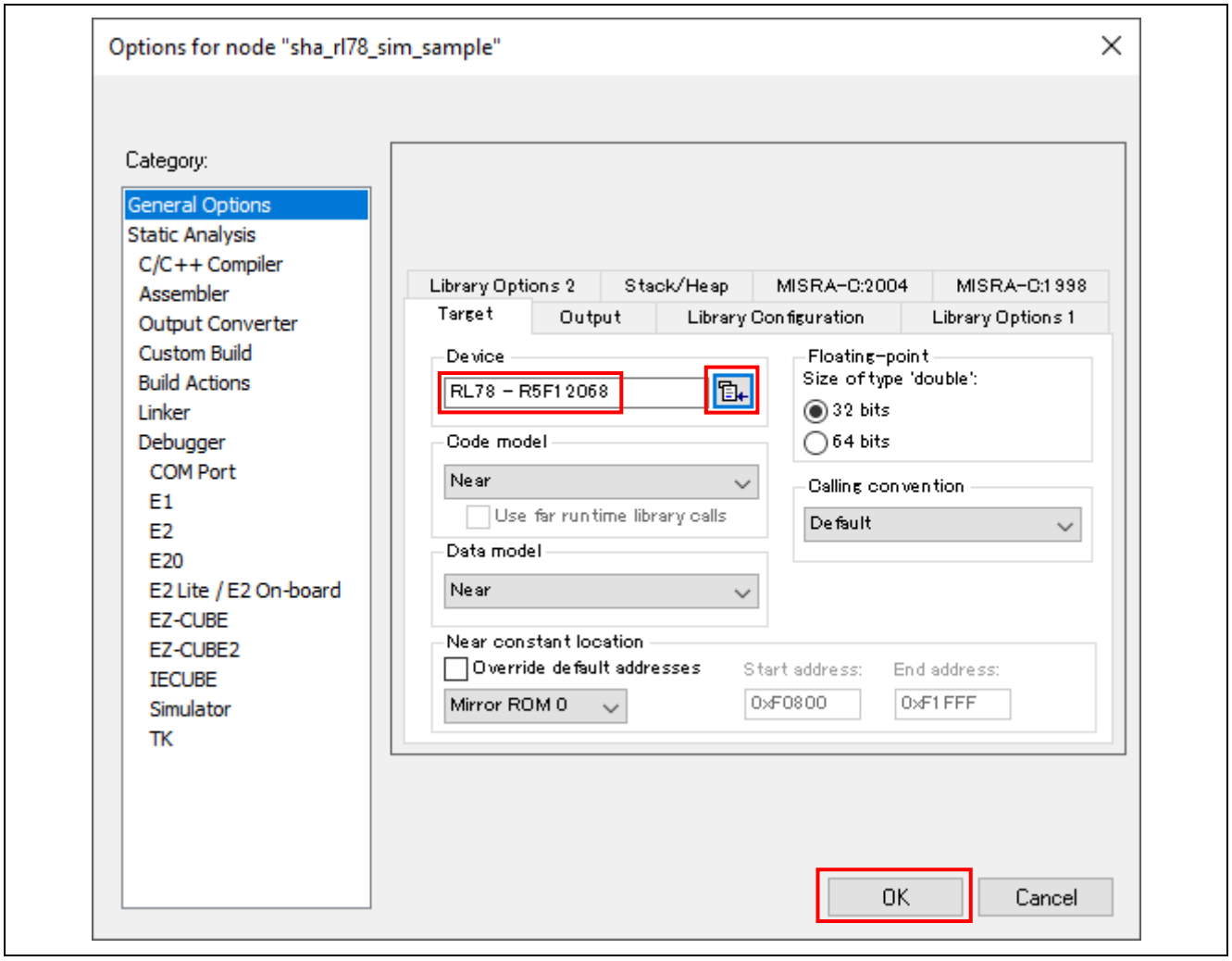


Figure 1-28 Changing the device (2/2)

1.3.3 Device dependent changes

Change source code, build settings, and debug settings depending on the device.

If the sample project does not use the Smart Configurator, step (1) is not necessary.

(1) Changing source code

Refer to "1.3.4 Smart Configurator Settings" to generate source code.

(2) Changing build settings

Change the stack size according to the migration destination device.

On the options screen, open [General Options] -> [Stack/Heap] and change the [Stack size (bytes)].

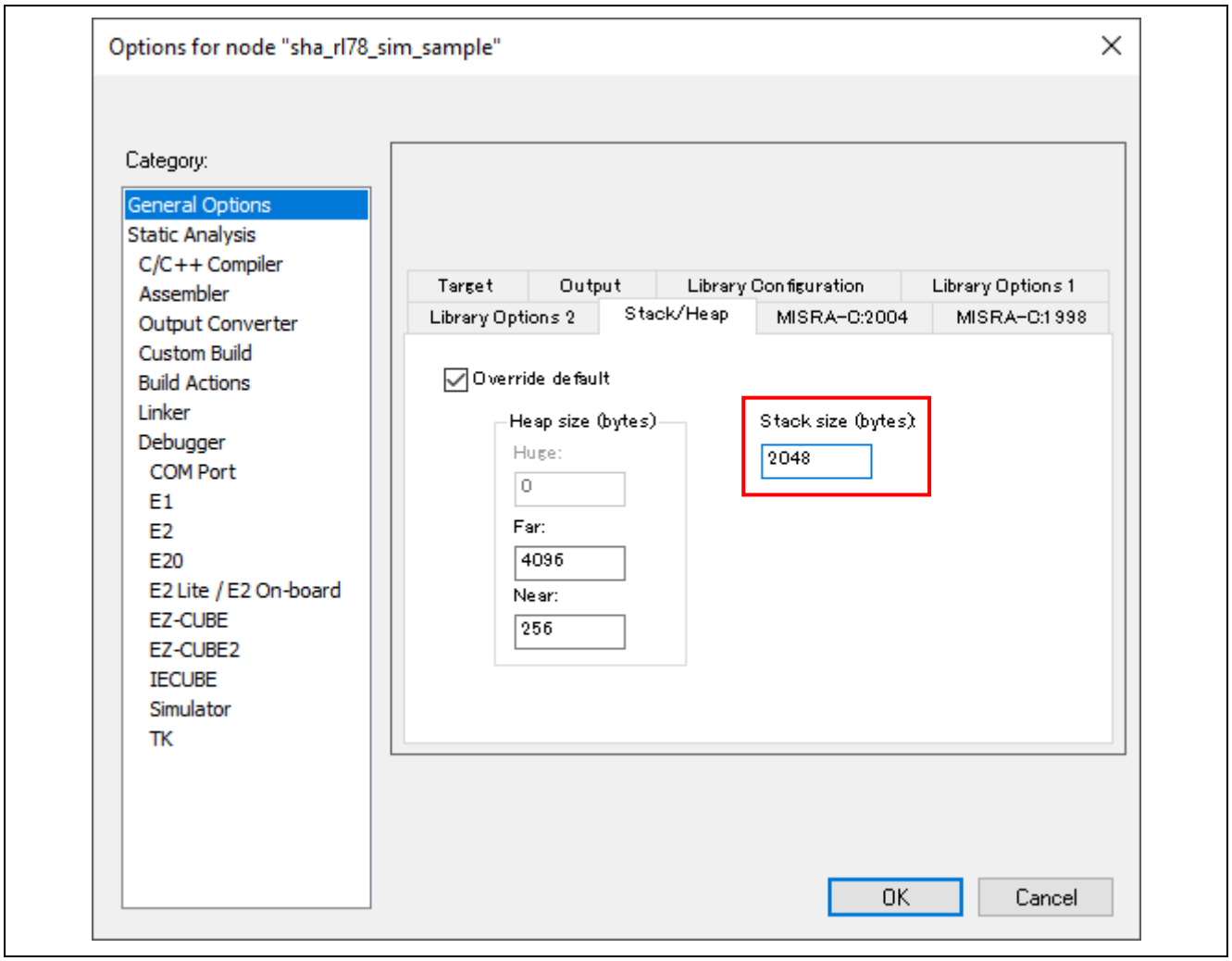


Figure 1-29 Change stack size

(3) Changing debug settings

Change the debug settings according to the operating environment.

For more information on how to configure debug settings, please refer to the relevant documentation from IAR.

1.3.4 Smart Configurator Settings

This procedure is only necessary when migrating a project that uses the Smart Configurator.

When the Smart Configurator opens the configuration file (.scfg) of a migration source project and generates the source code, the project is overwritten to the newly created state. Therefore, a new configuration file for the migration destination device must be created and manually linked to the project.

(1) Create a configuration file for the migration destination device in the Smart Configurator.
See "2.2 Smart Configurator Change Procedure" for details on Smart Configurator settings.

(2) Delete the Renesas_SC folder and the IAR project connection file (.ipcf) from the project.

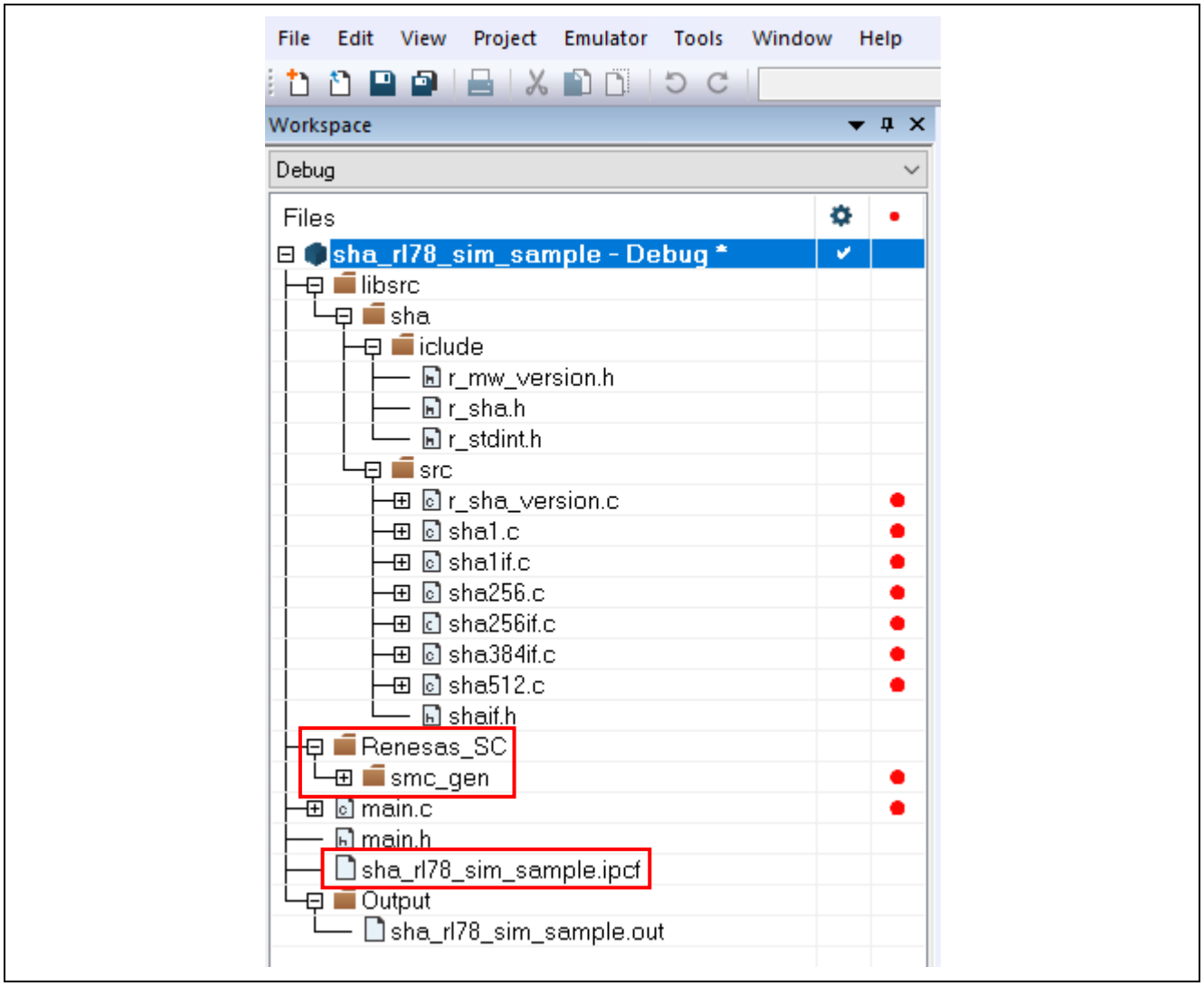


Figure 1-30 Smart Configurator Settings (1/5)

(3) Open the project folder in Explorer and replace the src\smc_gen folder with the one generated in step (1).

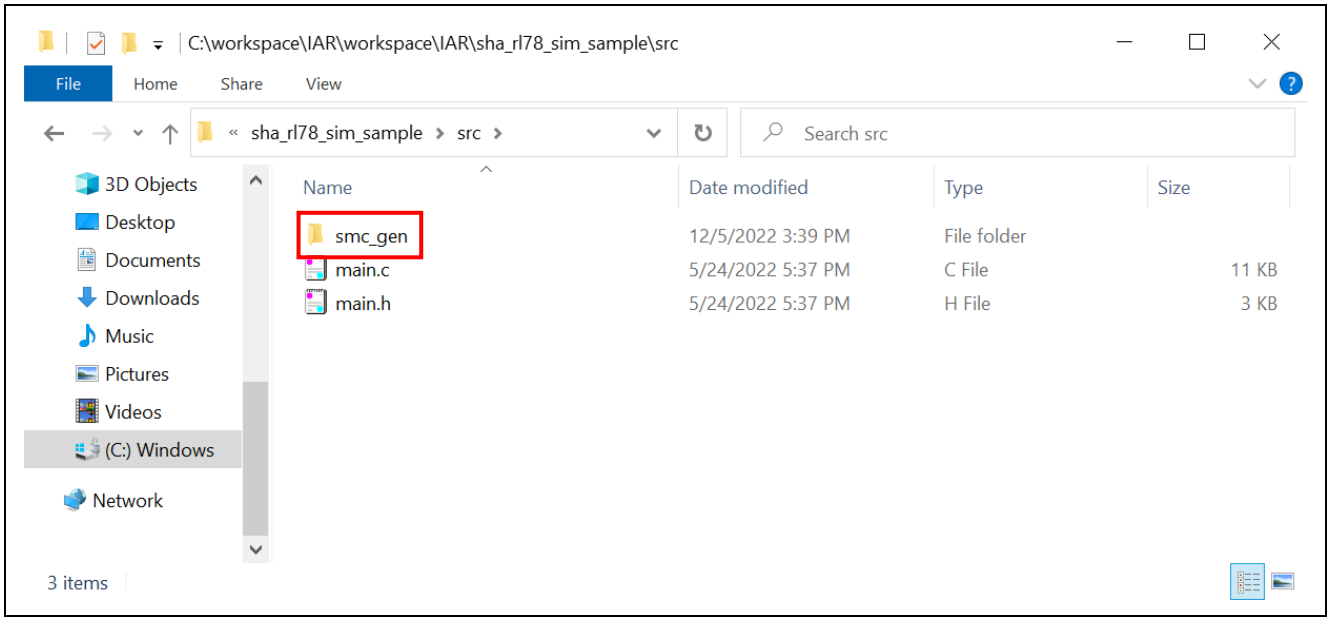


Figure 1-31 Smart Configurator Settings (2/5)

(4) Link the project to the configuration file created in step (1).

(4)-1 Click [Project] -> [Add Project Connection] to display the Add Project Connection screen.

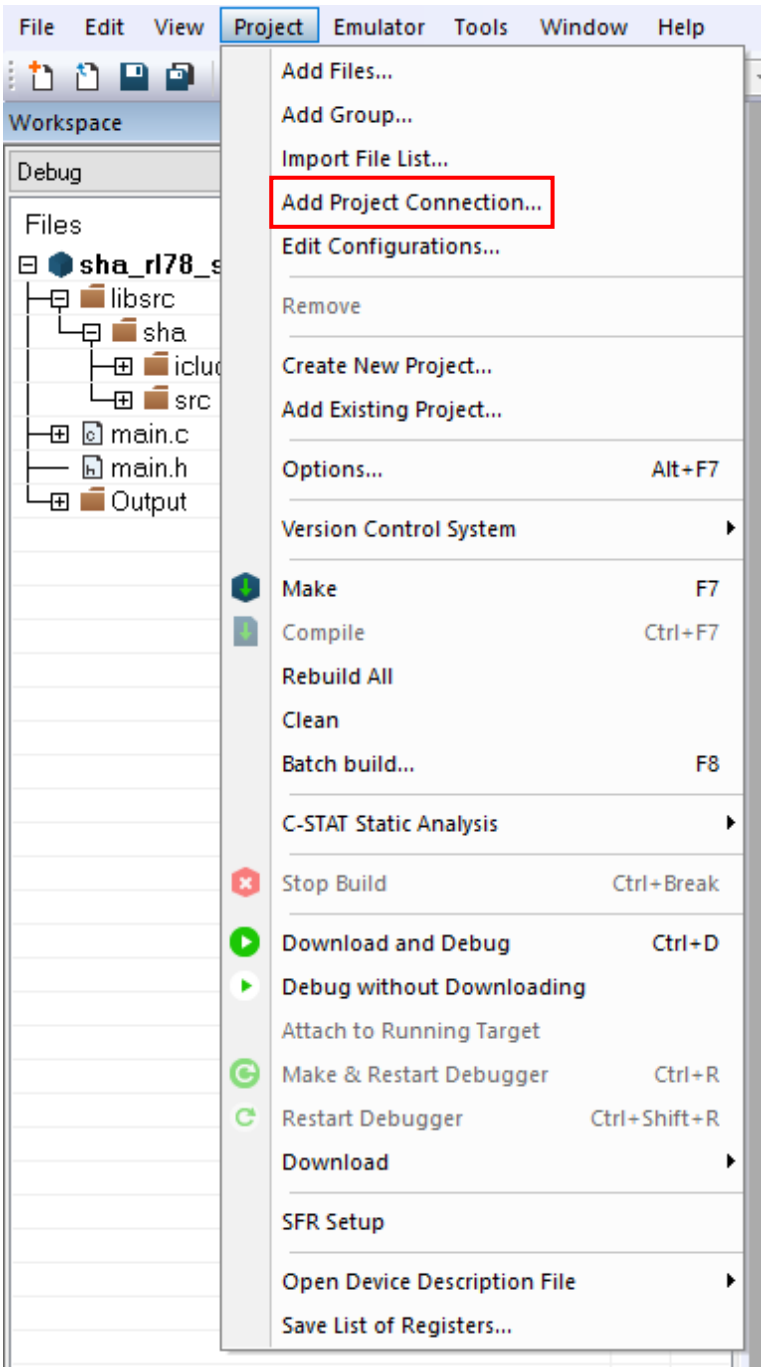


Figure 1-32 Smart Configurator Settings (3/5)

(4)-2 Select [IAR Project Connection]. Click [OK] to open the Explorer for IAR project connection file selection.

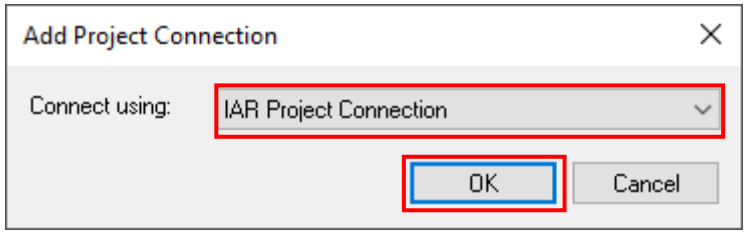


Figure 1-33 Smart Configurator Settings (4/5)

(4)-3 In the Explorer that appears, select the IAR project connection file(.ipcf) generated in step (1) and click [Open].
Make sure that the Renesas_SC folder and the IAR project connection file(.ipcf) are added to the project.

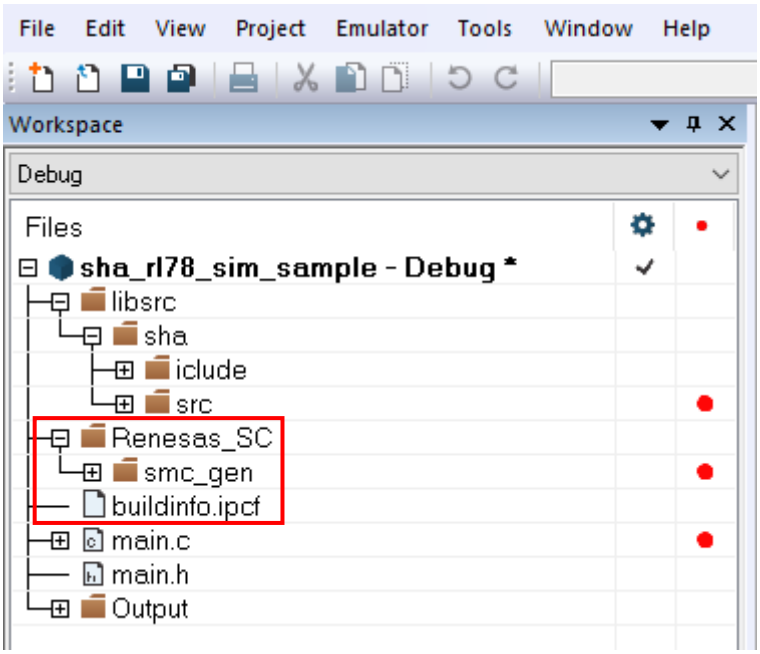


Figure 1-34 Smart Configurator Settings (5/5)

(5) To configure the settings for "RL78 Family True Random Number Generator (TRNG) Software Driver", make the following changes.

Refer to Config_UART0.c and Config_UART0.h in the src\smc_gen\Config_UART0 folder of the migration source project and add the declaration and definition of the putchar and send functions to any source files.

2. Appendix

2.1 Sample Code Size Adjustment

The sample code included in the migration source project may not be usable as is because the ROM/RAM capacity of the migration destination device is not sufficient. In such cases, please change the sample code to fit into the ROM/RAM capacity of the migration destination device.

Examples can be adjusted in the following ways.

- Leave only the functions you want to check in the sample code.
- Increase the level of compiler optimization.

2.2 Smart Configurator Change Procedure

If your project uses the Smart Configurator, make the following changes in the Smart Configurator.

Please refer to the following document for detailed Smart Configurator operation procedures.

- RL78 Smart Configurator User's Guide: CS+ (R20AN0580)
- RL78 Smart Configurator User's Guide: e² studio (R20AN0579)
- RL78 Smart Configurator User's Guide: IAREW (R20AN0581)

(1) Change the device selected on the [Board] page to the migration destination device.

(2) Change the settings on the [Clocks] and [System] pages according to the debugging environment.

Note: When configuring RL78/G15 or RL78/G16 group devices, select a value lower than or equal to the supply voltage of the operating environment for the [Reset generation level(VSDR)] on the [System] page.

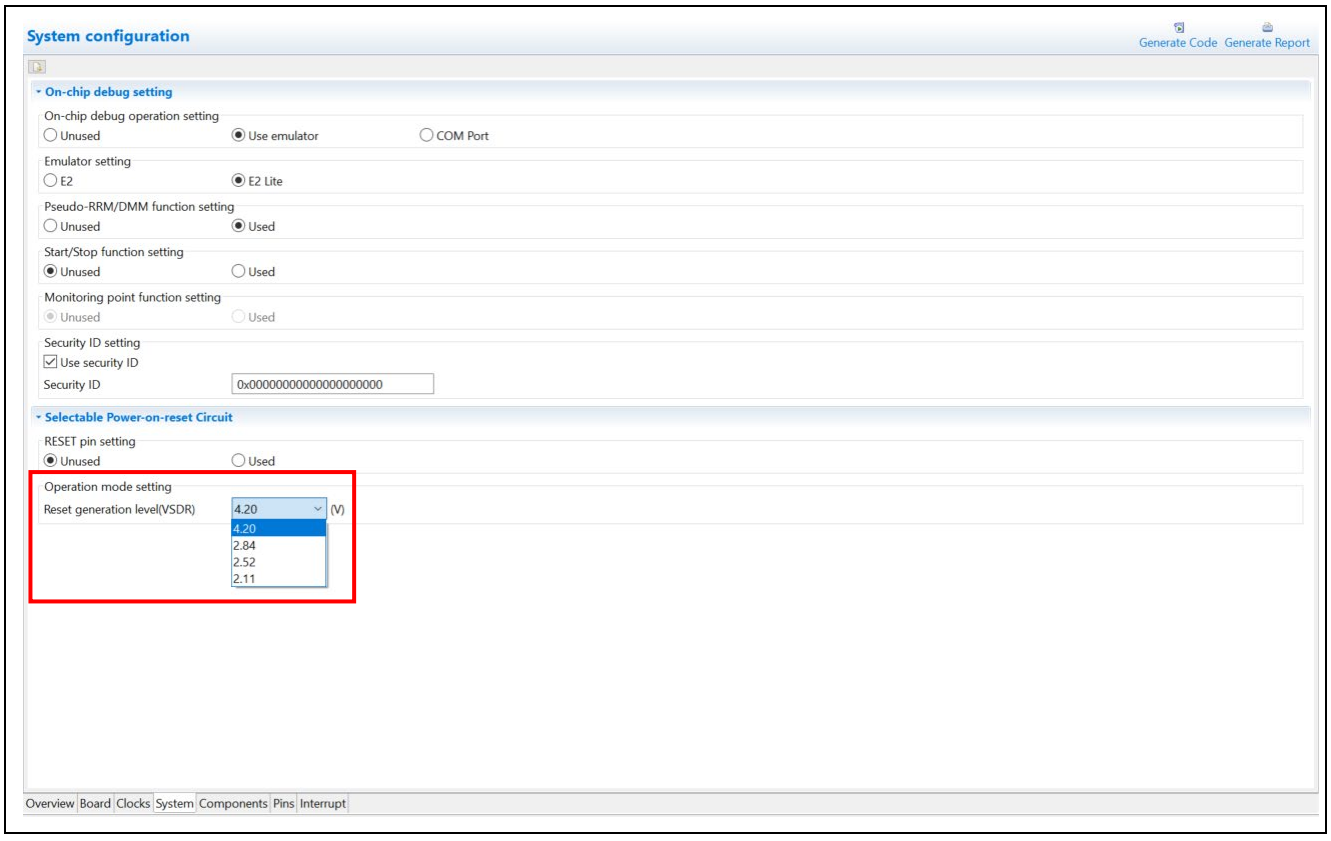


Figure 2-1 Reset generation level(VSDR) setting

(3) To configure settings for "RL78/G23 Unique ID Read Driver" and "RL78 Family True Random Number Generator (TRNG) Software Driver" for IAR Embedded Workbench for Renesas RL78, please add UART communication components on the [Components] page. For details on UART communication component settings, please refer to the application notes for the respective middleware.

(4) On the [Components] page, change the version of the BSP SIS module (r_bsp component) to the version corresponding to the migration destination device.

(5) Generate source code.

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec 15, 2022	-	First edition issued.
1.01	Feb 10, 2023	1	• Title changed. • Added middleware category to Table 1. • Added RL78/G22 to the Target Device.
		28	1.3.4 Smart Configurator Settings Added procedures for configuring settings for the "RL78 Family True Random Number Generator (TRNG) Software Driver".
		30	2.2 Smart Configurator Change Procedure Added procedures for configuring settings for "RL78/G23 Unique ID Read Driver" and "RL78 Family True Random Number Generator (TRNG) Software Driver" for IAR Embedded Workbench for Renesas RL78.
1.02	Jun 05, 2023	-	Added RL78/G16 to the Target Device.
1.03	Aug 01, 2023	-	Added RL78/G24 to the Target Device.
1.04	Jun 02, 2025	-	Added RL78/L23 to the Target Device.
		10	1.1.3.2 When Smart Configurator Is Not Used Added procedures for projects that do not use Smart Configurator.
		12	1.2 Change backup method.
		14	1.2.1 Correct step (3).
		19	Added Handling When Toolchain Is Not Registered in Source Project
		26	1.2.3.2 When Smart Configurator Is Not Used Added procedures for projects that do not use Smart Configurator.
		27	1.2.4 When Migrating LLVM Projects Added handling methods for the following two cases in LLVM sample projects: 1.2.4.1 Handling Link Errors (rodata section) 1.2.4.2 Handling Memory Overlap Errors Between .data Section and .ocd_traceram
1.05	Dec. 22, 2025	-	Added RL78/G24 to the target devices for the DSP Libraries.
		1	Remove Note 2 from Table 1. Updated Note 1.
		2, 3	Updated development tools for the target devices (RL78/G15, RL78/G16, RL78/G22, RL78/L23). Updated the target devices to list RL78/G24 separately for the DSP Libraries and the Security Libraries.
		10	1.1.3.2 When Smart Configurator Is Not Used Deleted procedures for projects that do not use Smart Configurator.
		25	1.2.3.2 When Smart Configurator Is Not Used Deleted procedures for projects that do not use Smart Configurator.

1.06	Aug. 26, 2026	-	Added RL78/G21 to the Target Device.
		23	Corrected the inaccuracies in the document.
		26	Added instructions to Section 1.2.4 for handling warning W0561194 that may occur when migrating a CC-RL project.

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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