RX Family

QE for Display GUI Display Application Development Guide
using Serial Connection LCD

Summary

QE for Display [RX,RA] is a plug-in for the e^2 studio integrated development environment with support for suitable Renesas RX microcontrollers and provides a graphical interface for display control to assist in the development of embedded systems incorporating display devices.

QE for Display [RX] 2.0.0 and later versions are capable of supporting emWin GUIs, which are based on a high-performance graphics library from SEGGER Microcontroller. QE for Display [RX] 2.1.0 and later versions are also capable of supporting GUIs created with Aeropoint® GUI for RX, which is GUI middleware from CRI Middleware. This enables selecting the GUI drawing tool that best suits your needs.
In addition, QE for Display [RX,RA] 3.1.0 and later versions support serially connected LCDs, making it possible to display LCDs even on RX MCUs not equipped with a graphic LCD controller (GLCDC).

The emWin library is a high-reliability embedded GUI solution which has been adopted in various fields. It supports all kinds of displays, achieves high performance while minimizing the footprint in memory, and allows embedding of the GUIs in a great variety of systems. In addition, the emWin bundle incorporates AppWizard, which makes it easy to configure an excellent GUI through intuitive operations.

For Aeropoint GUI, the GUI design can be implemented by simply using PowerPoint® to configure the screen and set up the layout of GUI components to be seamlessly confirmed on the actual machine. Furthermore, the system employs an excellent subtractive color technology, which allows the drawing of fine images from 256-color (8-bit) image data, thus enabling the creation of GUIs to be run on larger displays even from microcontrollers with relatively little memory. Aeropoint GUI can be used by MCUs incorporating a GLCDC.

QE for Display [RX,RA] covers everything from the initial adjustment of the display to the creation of designs for screens. It can also be interlinked with various GUI development solutions to provide total support for the development of GUIs within short timeframes.

This application note describes procedures for displaying GUIs on a serially connected LCD using various tools interlinked with QE for Display. When using an MCU that incorporates GLCDC, refer to the RX Family QE for Display [RX] Application Note (R20AN0582).

Target Devices

All RX Family devices

Assumed Operating Environments

For the procedures described in this application note, operation in one of the following environments is assumed.

- Renesas Starter Kit for RX130-512KB
- Target Board for RX130
- Renesas Starter Kit for RX140
- Renesas Starter Kit for RX231
- Target Board for RX231
- Renesas Solution Starter Kit for RX23W
- Target Board for RX23W
- Target Board for RX23W module
- Renesas Starter Kit+ for RX64M
- Target Board for RX65N
- Renesas Starter Kit for RX660
- Target Board for RX660
- Renesas Starter Kit+ for RX671
- Target Board for RX671
- Renesas Starter Kit+ for RX71M

When you apply this application note with a different device or board, adjust the settings to be appropriate and thoroughly evaluate the results.

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1. Overview

QE for Display [RX,RA] is a tool that provides a graphical interface for display control.

The AppWizard GUI drawing tool allows you to design a GUI in a short time by combining prepared resources and settings without having to spend a long time for reading manuals or coding programs. These tools also allow the efficient implementation of detailed specifications in response to various demands using the API functions provided by the emWin library.

In addition, as shown in Figure 1.1, LCD Development Environment Structure, QE for Display [RX,RA] can also be used with the Smart Configurator, which simplifies embedding of the Renesas drivers, and Firmware Integration Technology (FIT), which provides drivers and middleware for the RX family. These tools can further simplify display control and the creation and display of GUIs.

This application note mainly concerns the use of the following FIT modules and the Smart Configurator that are provided with QE for Display [RX,RA], which serves as the nucleus.

- emWin Firmware Integration Technology (emWin FIT) module

The flowchart on the following page describes the basic procedure for developing systems with the use of QE for Display [RX,RA].

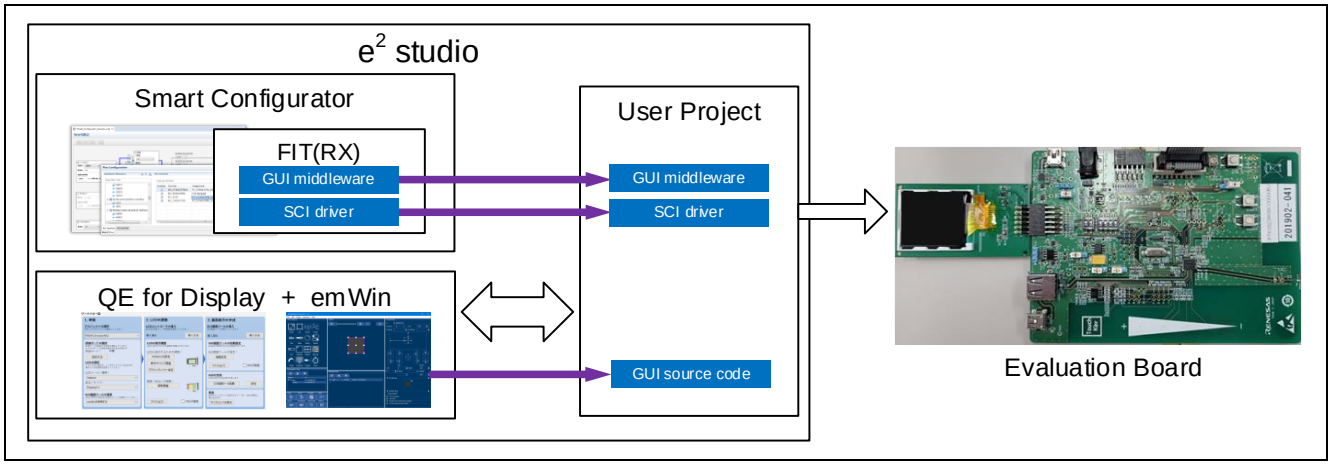


Figure 1.1 LCD Development Environment Structure

1.1 System Development Flow Using QE for Display [RX,RA]

Figure 1.2, System Development Using QE for Display [RX,RA] shows the system development flow using QE for Display [RX,RA].

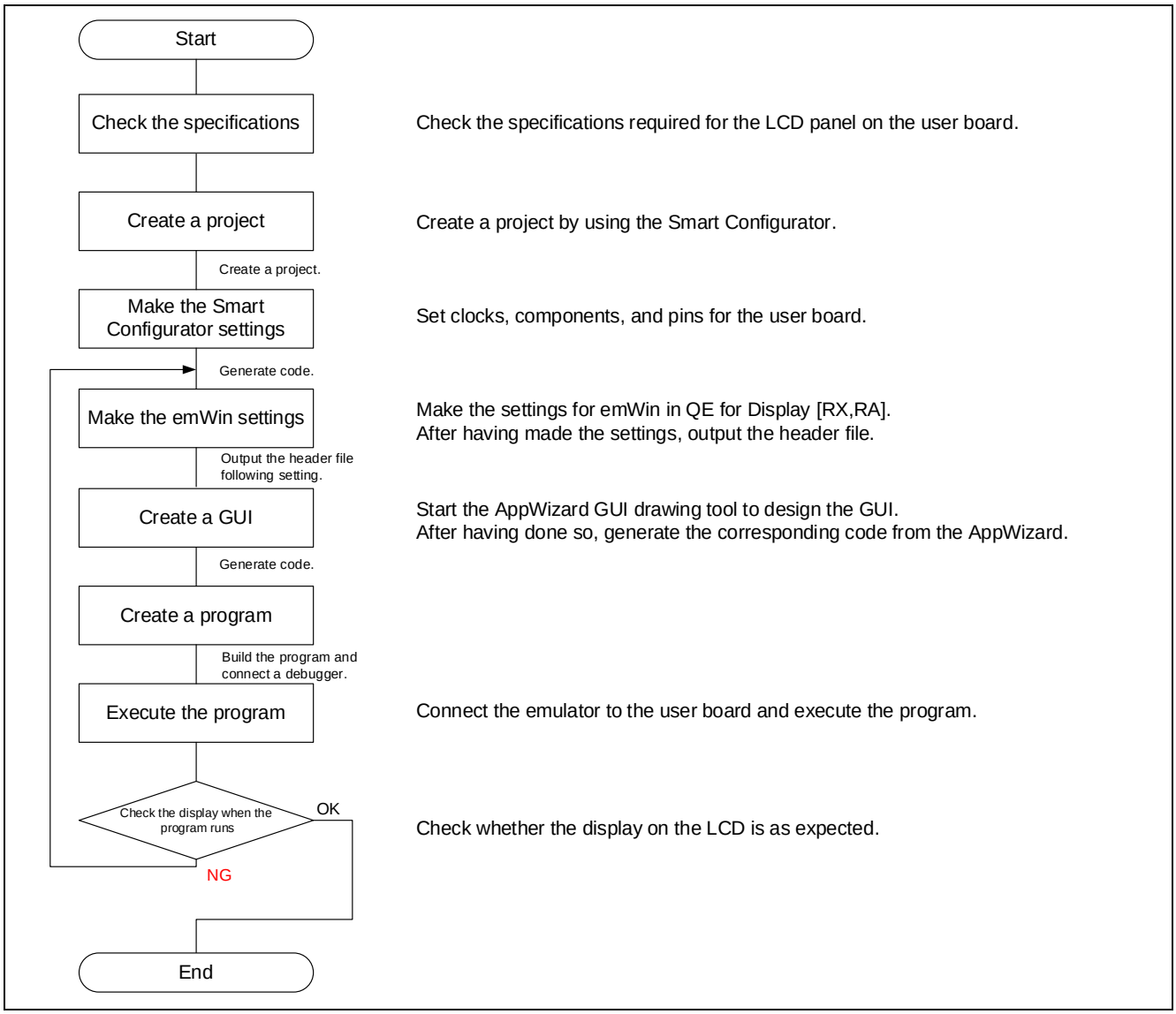


Figure 1.2 System Development Using QE for Display [RX,RA]

2. Operating Environment

The procedures described in this application note assume operations on one of the boards listed under “Assumed Operational Environments”.

Table 2.1 Development Environment

Item	Contents
Integrated development environment	Renesas Electronics e^2 studio 2022-07
C compiler	Renesas Electronics C/C++ Compiler Package for RX Family V.3.04.00
	Compiler option -lang = C99

Conditions used in confirming operations on each of the boards are listed in the following table.

Required changes to the board, such as cutting or shorting patterns, are listed in “Board Settings.” When no changes are indicated, the board can be used in factory default conditions.

Table 2.2 Conditions for Confirming Operation (RSK RX130)

Item	Contents
MCU used	R5F51308ADFP (RX130 Group)
Operating frequency	• Main clock: 8 MHz • PLL: 32 MHz (main clock x 1/2 x 8) • System clock (ICLK): 32 MHz (PLL x 1/1) • Peripheral module clock B (PCLKB): 32 MHz (PLL x 1/1)
Endian	Little endian
Emulator	E2 Lite
Connection type	FINE
Board used	Renesas Starter Kit for RX130-512KB (Product No.: RTK5051308Sxxxxxxx)

Table 2.3 Conditions for Confirming Operation (Target Board RX130)

Item	Contents
MCU used	R5F51308ADFP (RX130 Group)
Operating frequency	• HOCO clock: 32 MHz • System clock (ICLK): 32MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 32 MHz (HOCO x 1/1)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	Target Board for RX130 (Product No.: RTK5RX1300C00000BR)

Table 2.4 Conditions for Confirming Operation (RSK RX140)

Item	Contents
MCU used	R5F51406BDFN (RX140 Group)
Operating frequency	• Main clock: 8 MHz • PLL: 48 MHz (main clock x 1/1 x 6) • System clock (ICLK): 48 MHz (PLL x 1/1) • Peripheral module clock B (PCLKB): 24 MHz (PLL x 1/2)
Endian	Little endian
Emulator	E2 Lite
Connection type	FINE
Board used	Renesas Starter Kit for RX140 (Product No.: RTK551406BS00000BE)

Table 2.5 Conditions for Confirming Operation (RSK RX231)

Item	Contents
MCU used	R5F52318ADFP (RX231 Group)
Operating frequency	• Main clock: 8 MHz • PLL: 54MHz (main clock x 1/2 x 13.5) • System clock (ICLK): 54 MHz (PLL x 1/1) • Peripheral module clock B (PCLKB): 27 MHz (PLL x 1/2)
Endian	Little endian
Emulator	E2 Lite
Connection type	FINE
Board used	Renesas Starter Kit for RX231 (Product No.: R0K505231S900BE)

Table 2.6 Conditions for Confirming Operation (Target Board RX231)

Item	Contents
MCU used	R5F52318ADFP (RX231 Group)
Operating frequency	• HOCO clock: 32 MHz • System clock (ICLK): 32MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 16 MHz (HOCO x 1/2)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	Target Board for RX231 (Product No.: RTK5RX2310C00000BR)

Table 2.7 Conditions for Confirming Operation (RSSK RX23W)

Item	Contents
MCU used	R5F523W8ADBL (RX23W Group)
Operating frequency	• HOCO clock: 54 MHz • System clock (ICLK): 54 MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 27 MHz (HOCO x 1/2)
Endian	Little endian
Emulator	E2 Lite
Connection type	FINE
Board used	Renesas Solution Starter Kit for RX23W (Product No.: RTK5523W8xxxxxxxxx)

Table 2.8 Conditions for Confirming Operation (Target Board RX23W)

Item	Contents
MCU used	R5F523W8ADNG (RX23W Group)
Operating frequency	• HOCO clock: 32 MHz • System clock (ICLK): 32MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 16 MHz (HOCO x 1/2)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	Target Board for RX23W (Product No.: RTK5RX23W0C00000BJ)

Table 2.9 Conditions for Confirming Operation (Target Board RX23W module)

Item	Contents
MCU used	R5F523W8CDLN (RX23W Group)
Operating frequency	• HOCO clock: 32 MHz • System clock (ICLK): 32MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 16 MHz (HOCO x 1/2)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	Target Board for RX23W module (Product No.: RTK5RX23W0C01000B)
Board settings (jumper/switch)	<Pmod: CN2> Cut SS2, short SO3 Cut SS1 and SO2, short SO1 (Use Type 2A) <Others> Default settings

Table 2.10 Conditions for Confirming Operation (RSK RX64M)

Item	Contents
MCU used	R5F564MLCDFC (RX64M Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240MHz (main clock x 1/1 x 10) • System clock (ICLK): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 Lite
Connection type	JTAG / FINE
Board used	Renesas Starter Kit+ for RX64M (Product No.: R0K50564MSxxxxx)

Table 2.11 Conditions for Confirming Operation (Target Board RX65N)

Item	Contents
MCU used	R5F565NEDDFP (RX65N Group)
Operating frequency	• HOCO clock: 16 MHz • System clock (ICLK): 16MHz (HOCO x 1/1) • Peripheral module clock B (PCLKB): 4 MHz (HOCO x 1/4)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	JTAG / FINE
Board used	Target Board for RX65N (Product No.: RTK5RX65N0C00000BR)

Table 2.12 Conditions for Confirming Operation (RSK RX660)

Item	Contents
MCU used	R5F56609HDFB (RX660 Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240MHz (main clock x 1/1 x 10) • System clock (ICLK): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 Lite
Connection type	JTAG / FINE
Board used	Renesas Starter Kit+ for RX64M (Product No.: R0K50564MSxxxxx)

Table 2.13 Conditions for Confirming Operation (Target Board RX660)

Item	Contents
MCU used	R5F56609BDFP (RX660 Group)
Operating frequency	• HOCO clock: 16 MHz • PLL: 240MHz (main clock x 1/1 x 15) • System clock (ICLK): 120MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	FINE
Board used	Target Board for RX660 (Product No.: RTK5RX6600C00000BJ)
Board settings (jumper/switch)	<Operating voltage> Mount header J3 (select 3.3V) Remove resistor R52 <Pmod: CN1> Cut SS13, short SC1 Cut SS14, short SC2 (Use Type 2A) <Others> Default settings

Table 2.14 Conditions for Confirming Operation (RSK RX671)

Item	Contents
MCU used	R5F5671EHDFB (RX671 Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240MHz (main clock x 1/1 x 10) • System clock (ICLK): 120 MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 Lite
Connection type	JTAG / FINE
Board used	Renesas Starter Kit+ for RX671 (Product No.: RTK55671EHS10000BE)

Table 2.15 Conditions for Confirming Operation (Target Board RX671)

Item	Contents
MCU used	R5F5671EHDFP (RX671 Group)
Operating frequency	• HOCO clock: 16 MHz • PLL: 240MHz (main clock x 1/1 x 15) • System clock (ICLK): 120MHz (PLL x 1/2) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 OB (E2 emulator On Board)
Connection type	JTAG / FINE
Board used	Target Board for RX671 (Product No.: RTK5RX6710C00000BJ)
Board settings (jumper/switch)	<Pmod: CN1> Cut SS13, short SC1 Cut SS14, short SC2 (Use Type 2A) <Others> Default settings

Table 2.16 Conditions for Confirming Operation (RSK RX71M)

Item	Contents
MCU used	R5F571MLCDFC (RX71M Group)
Operating frequency	• Main clock: 24 MHz • PLL: 240MHz (main clock x 1/1 x 10) • System clock (ICLK): 240 MHz (PLL x 1/1) • Peripheral module clock B (PCLKB): 60 MHz (PLL x 1/4)
Endian	Little endian
Emulator	E2 Lite
Connection type	JTAG / FINE
Board used	Renesas Starter Kit+ for RX71M (Product No.: R0K50571MSxxxxx)

3. Related Documents

Also refer to the following documents which are related to this application note.

Table 3.1 Documents Related to FIT Modules

Document Title	Document No.
Firmware Integration Technology User's Manual	R01AN1833
RX Family Board Support Package Firmware Integration Technology Module	R01AN1685
RX Family emWin v.6.26g Module Firmware Integration Technology	R01AN6452

Table 3.2 Document Related to Tools

Document Title	Document No.
Renesas e^2 studio Smart Configurator User Guide	R20AN0451

Table 3.3 Documents Related to Boards

Document Title	Document No.
RX130 Group Renesas Starter Kit User's Manual	R20UT3921
RX130 Group Target Board for RX130 User's Manual	R20UT4169
RX140 Group Renesas Starter Kit for RX140 User's Manual	R20UT5026
RX231 Group Renesas Starter Kit User's Manual	R20UT3027
RX231 Group Target Board for RX231 User's Manual	R20UT4168
RX23W Group Renesas Solution Starter Kit for RX23W User's Manual	R20UT4446
RX23W Group Target Board for RX23W User's Manual	R20UT4634
RX23W Group Target Board for RX23W module User's Manual	R20UT4890
RX64M Group Renesas Starter Kit+ User's Manual For CubeSuite+	R20UT2590
RX65N Group Target Board for RX65N User's Manual	R20UT4167
RX660 Group Renesas Starter Kit for RX660 User's Manual	R20UT5017
RX660 Group Target Board for RX660 User's Manual	R20UT5068
RX671 Group Renesas Starter Kit+ for RX671 User's Manual	R20UT4879
RX671 Group Target Board for RX671 User's Manual	R20UT4894
RX71M Group Renesas Starter Kit+ User's Manual	R20UT3217

Table 3.4 Documents Related to Devices

Document Title	Document No.
RX130 Group User's Manual: Hardware	R01UH0560
RX140 Group User's Manual: Hardware	R01UH0905
RX230 Group, RX231 Group User's Manual: Hardware	R01UH0496
RX23W Group User's Manual: Hardware	R01UH0823
RX64M Group User's Manual: Hardware	R01UH0377
RX65N Group, RX651 Group User's Manual: Hardware	R01UH0590
RX660 Group User's Manual: Hardware	R01UH0937
RX671 Group User's Manual: Hardware	R01UH0899
RX71M Group User's Manual: Hardware	R01UH0493

Please use the latest versions that are available. Visit the Renesas Electronics Web site to check and obtain the latest versions.

4. Procedures for Execution

This chapter describes the procedures for creating a new project in the e^2 studio, using QE for Display [RX,RA] to set the LCD and emWin, designing the GUI, and displaying the resulting project.

The results of emWin, which enable the efficient creation of the GUI, are generated as FIT modules for embedding in the project using the Smart Configurator. Since the settings for emWin can be made from the GUI of QE for Display [RX,RA], the user can smoothly proceed with GUI development according to the workflow.

Before starting this project, be sure to make the jumper settings as stated in chapter 2, Operating Environment, as required.

Preparation

1. Installing QE for Display [RX,RA]

Procedure

2. Creating a new project
3. Making the clock settings
4. Making the emWin settings according to the workflow of QE for Display [RX,RA]
5. Building the project
6. Connecting a debugger and executing the program

4.1 Installing QE for Display [RX,RA]

Install QE for Display [RX,RA] in the e² studio integrated development environment. Use the following procedure to install this product.

4.1.1 Installing QE for Display [RX,RA]

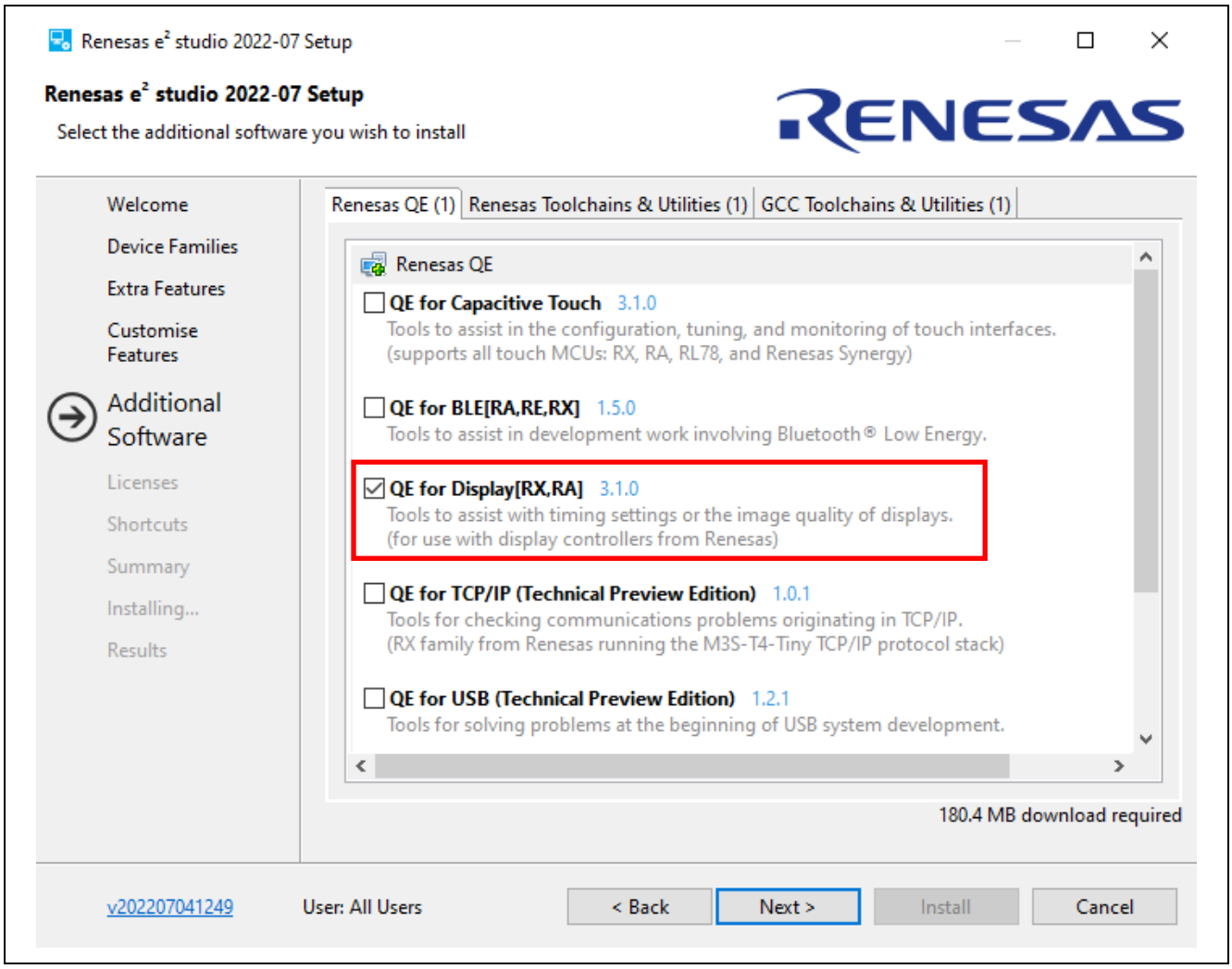
4.1.1.1 Updating the e² studio using its installer

For updating the e² studio, refer to section 3, Updating Your Product, described in "[Upgraded to version] e² studio 2022-07" in Renesas Tool News (document No. R20TS0685EJ0100).

https://www.renesas.com/search/keyword-search.html#genre=document&q=r20ts0685

Select "QE for Display [RX,RA]" for "Additional Software" in the installer of the e² studio.

Note: Since this step is not possible in situations where an Internet connection is not available, update QE for Display [RX,RA] with the method described in section 4.1.1.3, Installing QE for Display [RX,RA] by downloading the installer from the Web site.



4.1.1.2 Installing QE for Display [RX,RA] using Renesas Software Installer of the e² studio

Refer to the following for how to install QE for Display [RX,RA].

1. Start the e² studio.
2. Select the “Renesas Software Installer” menu item from “Renesas Views” to open the “Renesas Software Installer” dialog box.
3. Select “Renesas QE” and click on the “Next” button.
4. Select the “QE for Display [RX,RA] (v3.1.0)” checkbox and click on the “Finish” button.
5. Confirm that the “Renesas QE for Display [RX,RA]” checkbox has been selected in the “Install” dialog box and click on the “Next” button.
6. Confirm that “Renesas QE for Display [RX,RA]” is selected as the target of installation and click on the “Next” button.
7. After confirming the license agreement, select the “I accept the terms of the license agreements” radio button if you agree with the license agreement, and click on the “Finish” button.
8. If the dialog box for the trust certificate is displayed, confirm the certificate and click on the “OK” button to continue installation.
9. Restart the e² studio by following the instructions on the screen.
10. Start this product from the “Renesas QE” menu under “Renesas Views” of the e² studio.

Note: Since this step is not possible in situations where an Internet connection is not available, download the installer of QE in a different environment and update QE for Display [RX,RA] with the method described in section 4.1.1.3, Installing QE for Display [RX,RA] by downloading the installer from the Web site.

4.1.1.3 Installing QE for Display [RX,RA] by downloading the installer from the Web site

Download QE from the following URL for installation.

- QE for Display V3.1.0: Development Assistance Tool for Display
  https://www.renesas.com/qe-display#downloads

Refer to the following for how to install QE for Display [RX,RA].

1. Start the e² studio.
2. Select the “Install New Software...” menu item from the “Help” menu to open the “Install” dialog box.
3. Click on the “Add...” button to open the “Add Repository” dialog box.
4. Click on the “Archive” button, select the zip file for installation in the dialog box for selecting a file that has opened, and click on the “Open” button.
5. Click on the “OK” button in the “Add Repository” dialog box.
6. Expand the “Renesas QE” item shown in the “Install” dialog box, select the “Renesas QE for Display [RX,RA]” checkbox, and then click on the “Next” button.
   *You can deselect the “Contact all update sites during install to find required software” checkbox to shorten the installation time.
7. Confirm that the target of installation is correctly selected and click on the “Next” button.
8. After confirming the license agreement, select the “I accept the terms of the license agreements” radio button if you agree with the license agreement, and click on the “Finish” button.
9. If the dialog box for the trust certificate is displayed, confirm the certificate and click on the “Accept selected” button to continue installation.
10. Restart the e² studio by following the instructions on the screen.
11. Start this product from the “Renesas QE” menu under “Renesas Views” of the e² studio.

4.1.2 Uninstalling QE for Display [RX,RA]

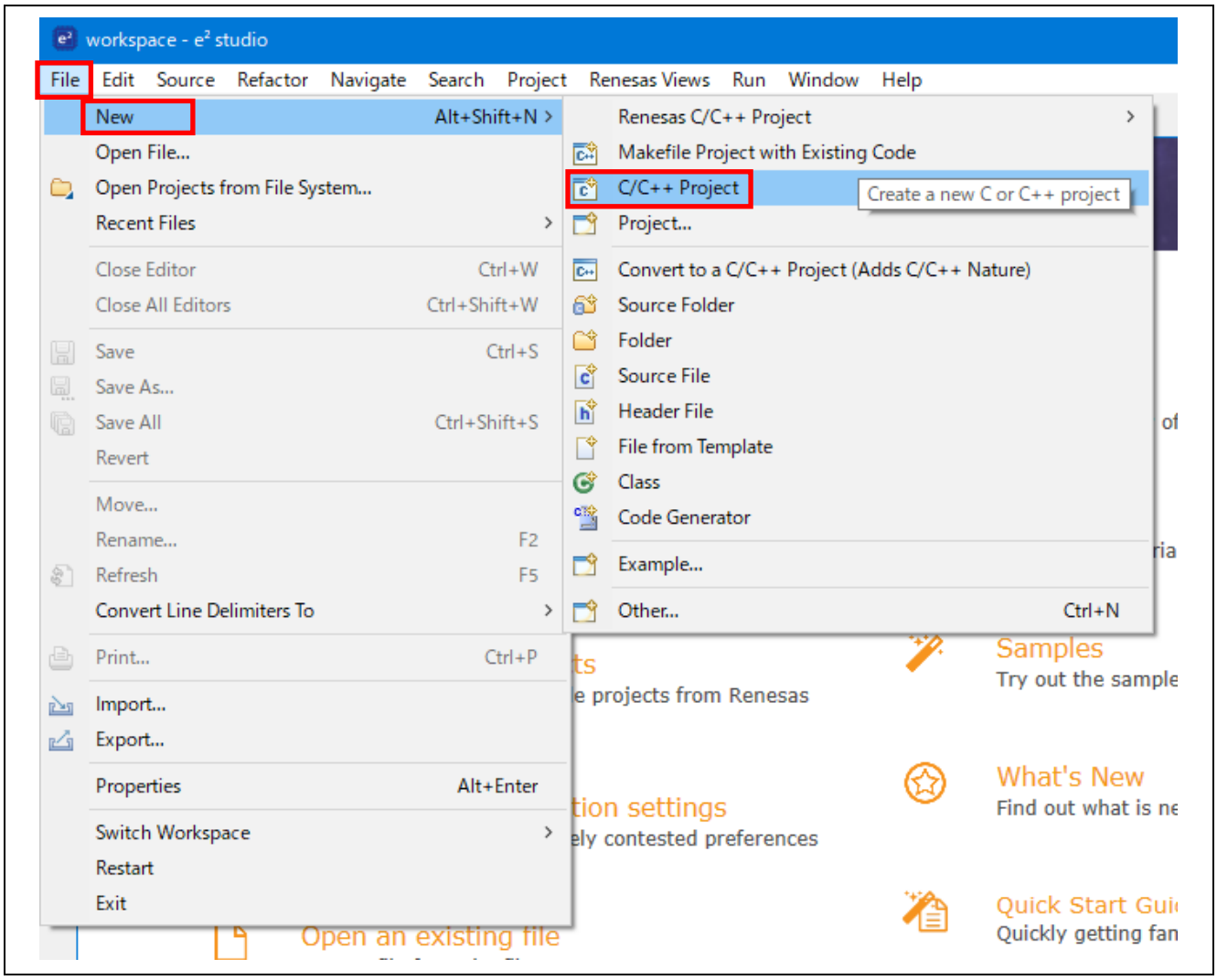
To uninstall QE for Display [RX,RA], follow the procedure below.

1. Start the e^2 studio.
2. From the “Help” menu, select the “About e^2 studio” menu item, click on the “Installation Details” button to open the “e^2 studio Installation Details” dialog box.
3. Select “Renesas QE for Display [RX,RA]” displayed on the “Installed Software” tabbed page and click on the “Uninstall...” button to open the “Uninstall” dialog box.
4. Confirm the displayed information and click on the “Finish” button.
5. Restart the e^2 studio by following the instructions on the screen.

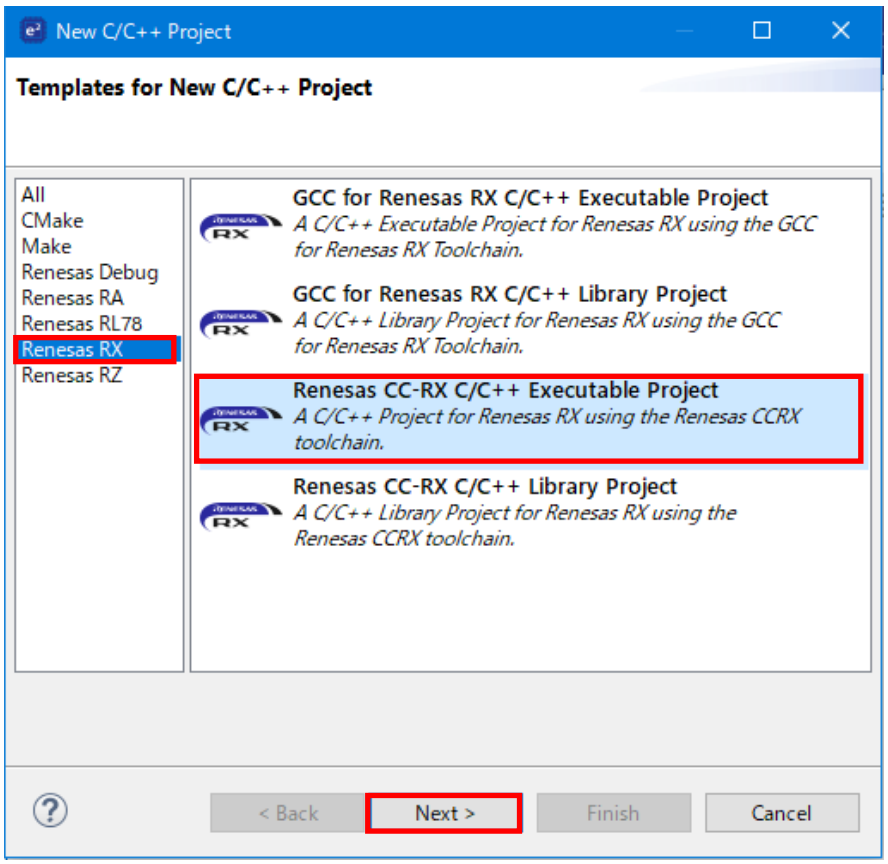
4.2 Creating a New Project

Create a project with the e² studio.

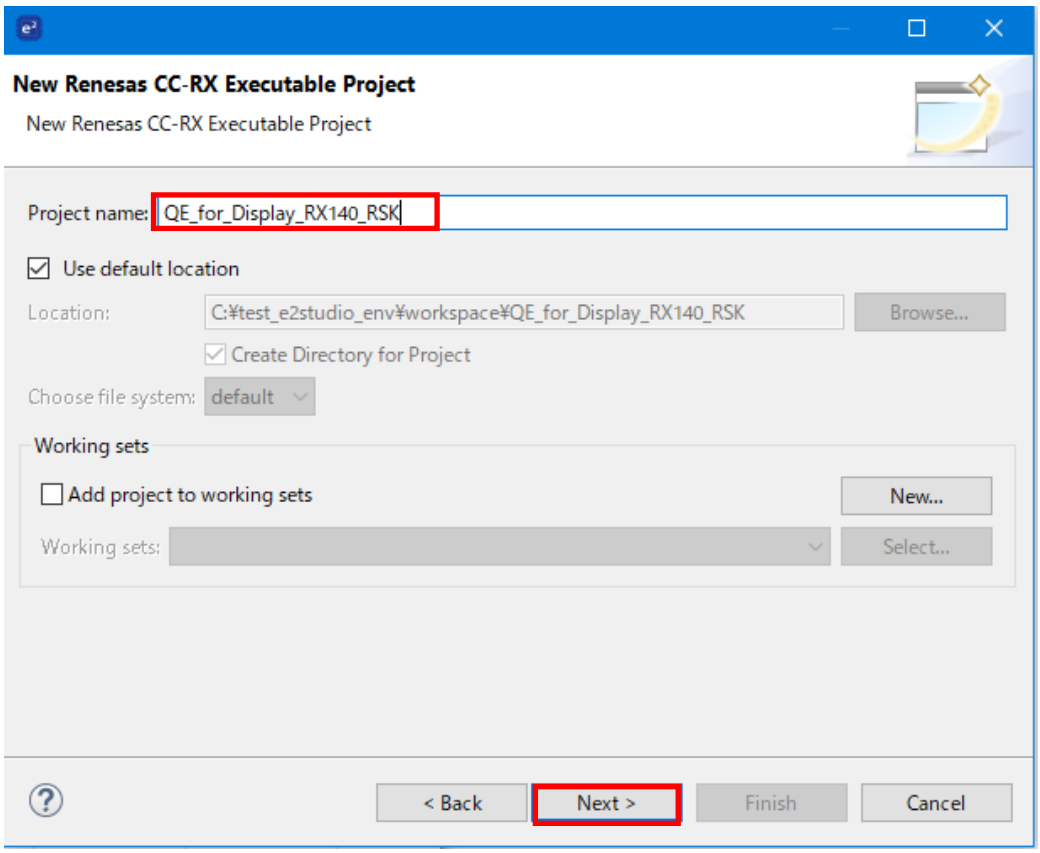
1. Click on “File” -> “New”, and then “C/C++ Project”.



2. Select “Renesas RX” -> “Renesas CC-RX C/C++ Executable Project” and click on “Next”.



3. Enter the name of the project in the “Project name:” text box and click on “Next”.



4. Select the board to be used from the “Target Board:” combo box. After selecting the target board, the selection from the “Target Device:” combo box is automatically made.
   If the name of the board to be used is not included in the selection list, download the Board Description File (BDF). Click on [Download additional boards…] and download the Board Description File for the target board.
5. Confirm that the checkbox for “Create Hardware Debug Configuration” is selected and select the emulator to be used from the combo box below it. Click on “Next”.

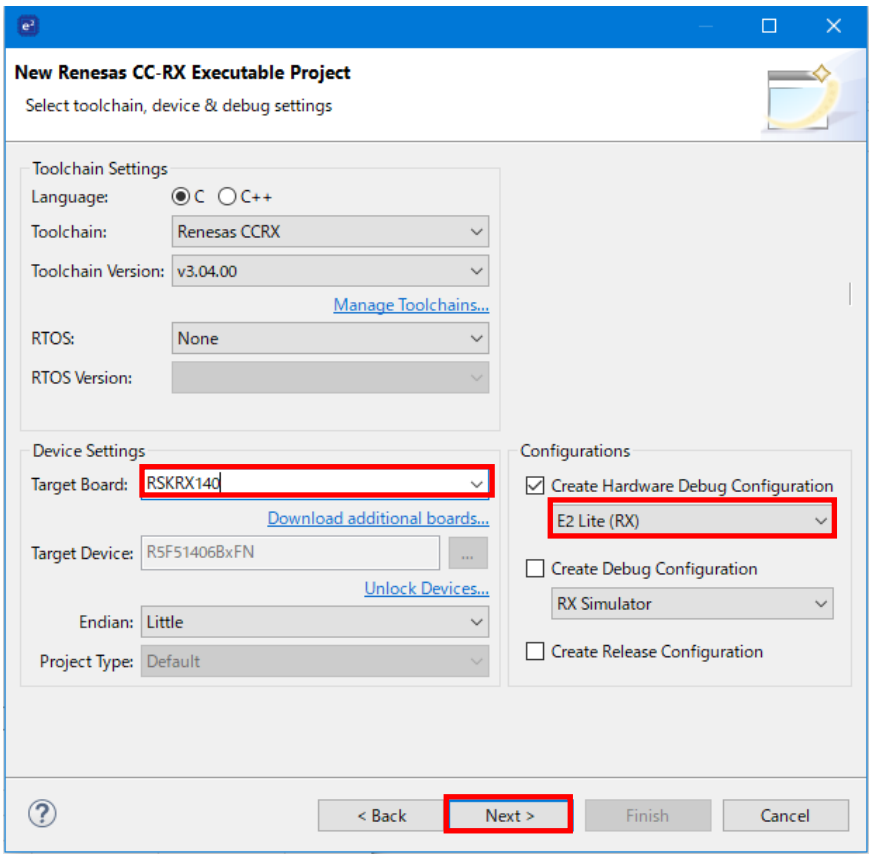
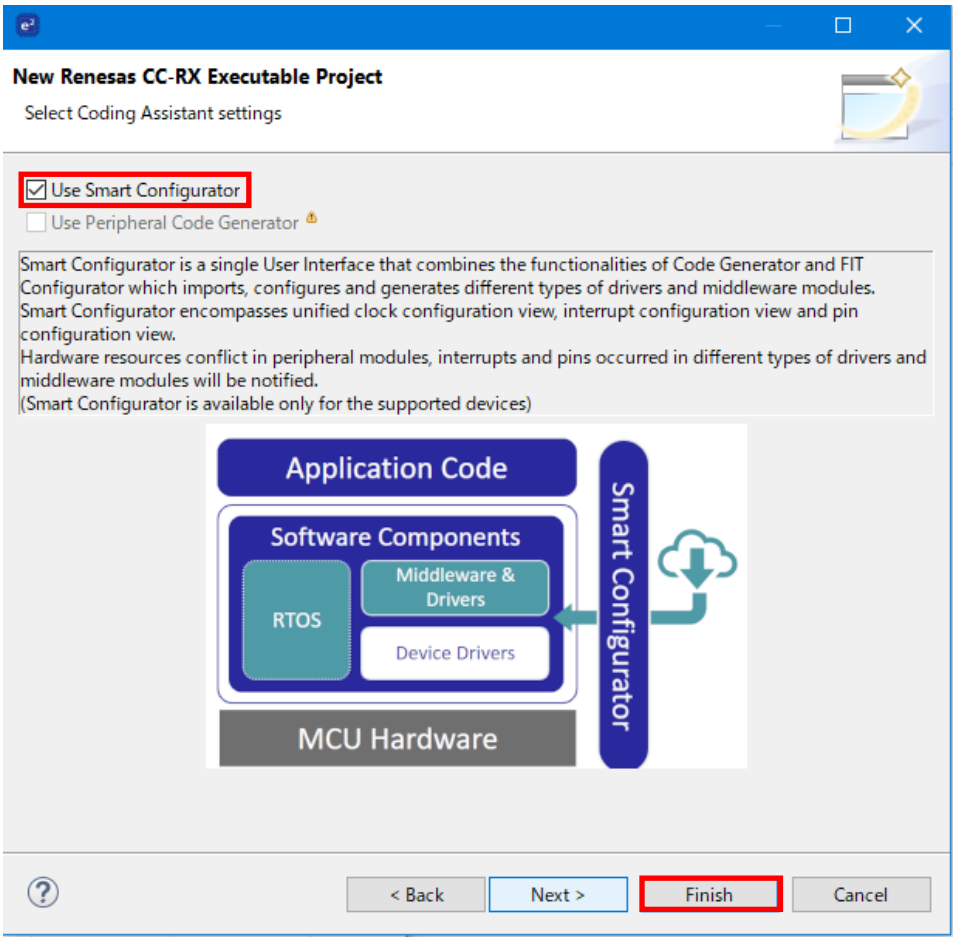


Table 4.1, Correspondence between Target Board, Target Device, and Emulator shows the Board Description File name, target device, and emulator selection corresponding to each target board.

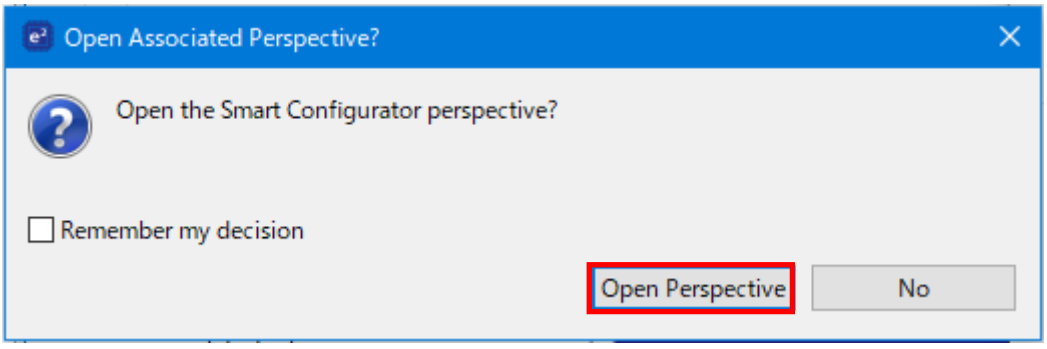
Table 4.1 Correspondence between Target Board, Target Device, and Emulator

Target Board	Target Device	Emulator
RSKRX130-512KB	R5F51308AxFN	E2 Lite (RX)
TargetBoardRX130	R5F51308AxFP	E2 Lite (RX)
RSKRX140	R5F51406BxFN	E2 Lite (RX)
RSKRX231	R5F52318AxFP	E2 Lite (RX)
TargetBoardRX231	R5F52318AxFP	E2 Lite (RX)
RSSKRX23W	R5F523W8AxBL	E2 Lite (RX)
TargetBoardRX23W	R5F523W8AxNG	E2 Lite (RX)
TargetBoardRX23Wmodule	R5F523W8CxLN	E2 Lite (RX)
RSKRX64M	R5F564MLCxFC	E2 Lite (RX)
TargetBoardRX65N	R5F565NEDxFP	E2 Lite (RX)
RSKRX660	R5F56609HxFB	E2 Lite (RX)
TargetBoardRX660	R5F56609BxFP	E2 Lite (RX)
RSKRX671	R5F5671EHxFB	E2 Lite (RX)
TargetBoardRX671	R5F5671EHxFP	E2 Lite (RX)
RSKRX71M	R5F571MLCxFC	E2 Lite (RX)

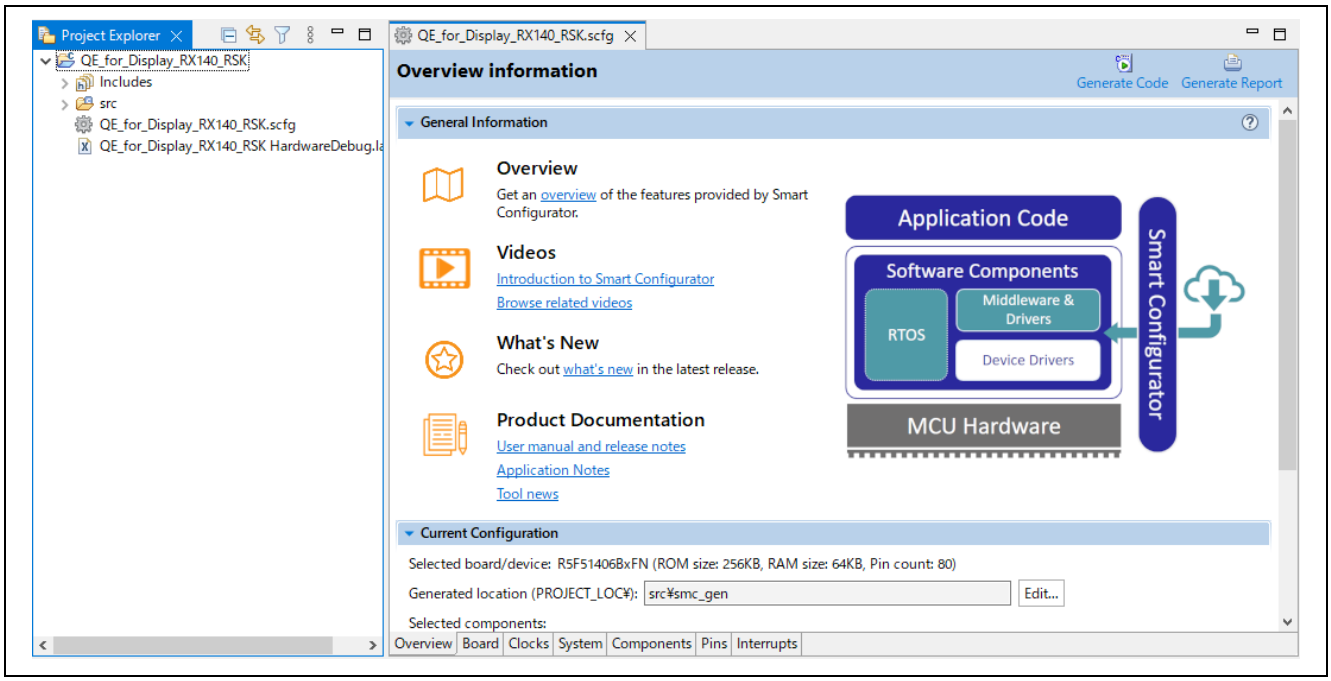
6. Select the “Use Smart Configurator” checkbox.
7. Click on “Finish”.



8. When the following message is displayed, click on “Open Perspective”.



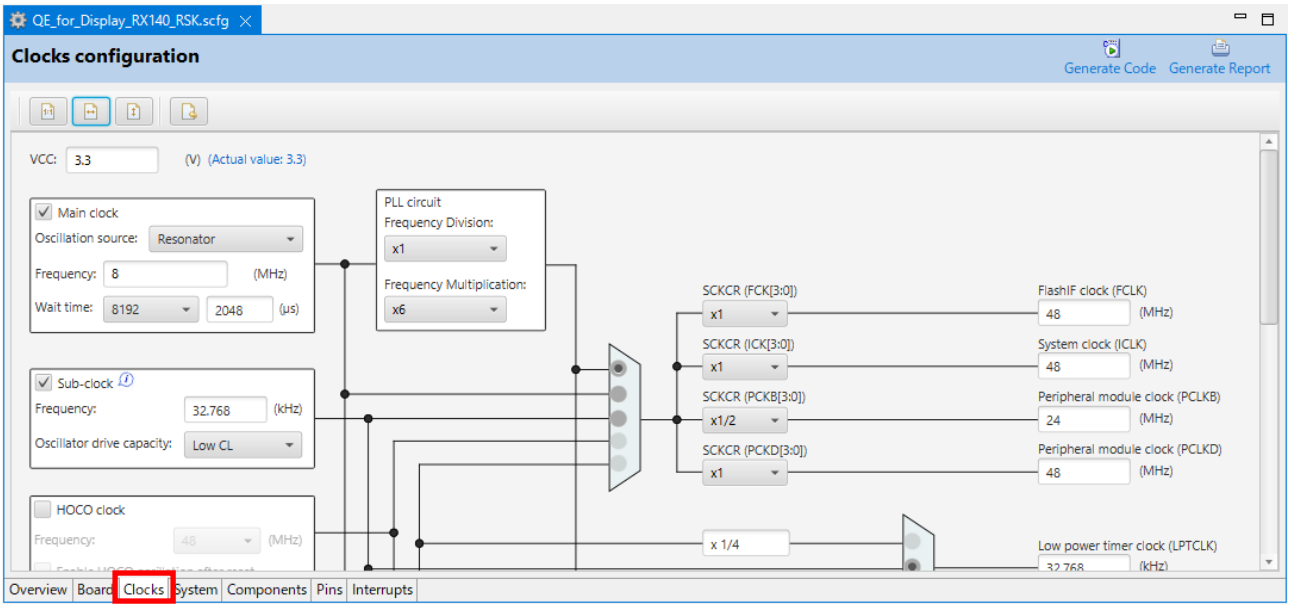
9. The project is created and the Smart Configurator is opened.



4.3 Making the Clock Settings

Make clock settings to suit the board to be used.

1. Select the “Clocks” tab of the Smart Configurator.
2. Set the clock according to the board to be used.
   When using a Board Description File, the default settings are adjusted according to the board; no changes are required.
   When not using a Board Description File, set to values that meet the target usage environment.
3. When the clocks have been set, click on the “Generate Code” button in the upper-right corner of the window.

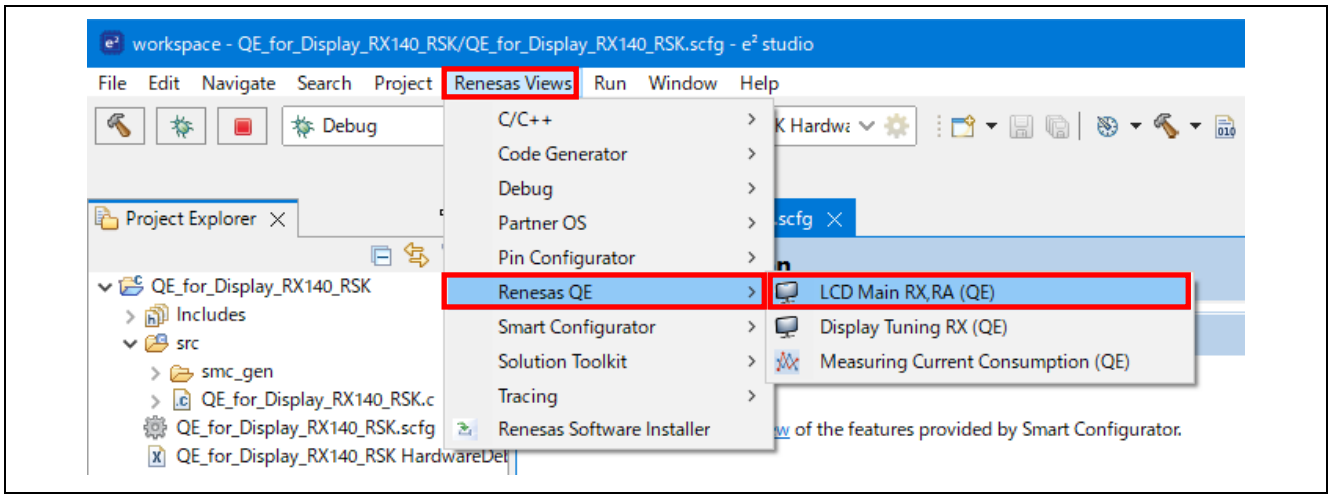


4.4 Setting the LCD According to the Workflow of QE for Display [RX,RA]

Start QE for Display [RX,RA] and set the LCD in the order of “1. Preparation” and “3. GUI Creation on LCD” in the workflow view.

Start QE for Display [RX,RA].

1. Select “Renesas Views” -> “Renesas QE” -> “LCD Main RX,RA (QE)”.



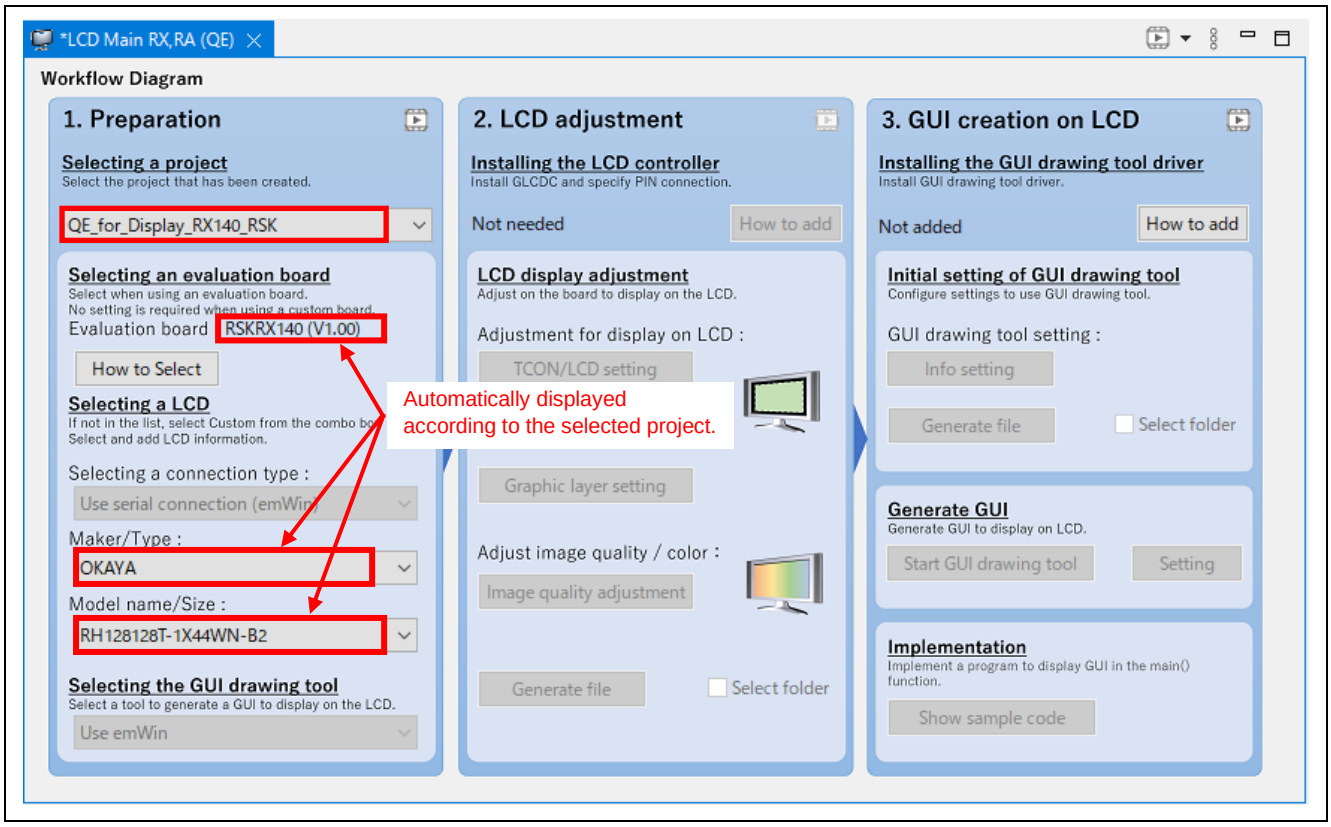
4.4.1 Preparation

Make the settings for “1. Preparation” in the workflow view of QE for Display [RX,RA].

1. In “Selecting a project”, select the target project. Once the project is selected, the entries for “Evaluation board”, “LCD maker/Type”, and “Model name/Size” are automatically displayed.
   If you are using a board other than one of those listed in Table 4.2, Correspondences between “Evaluation Board”, “LCD maker/Type”, and “Model name/Size”, select “Custom” in the “LCD maker/Type” combo box and add the information on the LCD to be used in the “Edit Custom Display Data” dialog box. For details on how to add LCD information, refer to the explanation produced by clicking on the “Help” button.

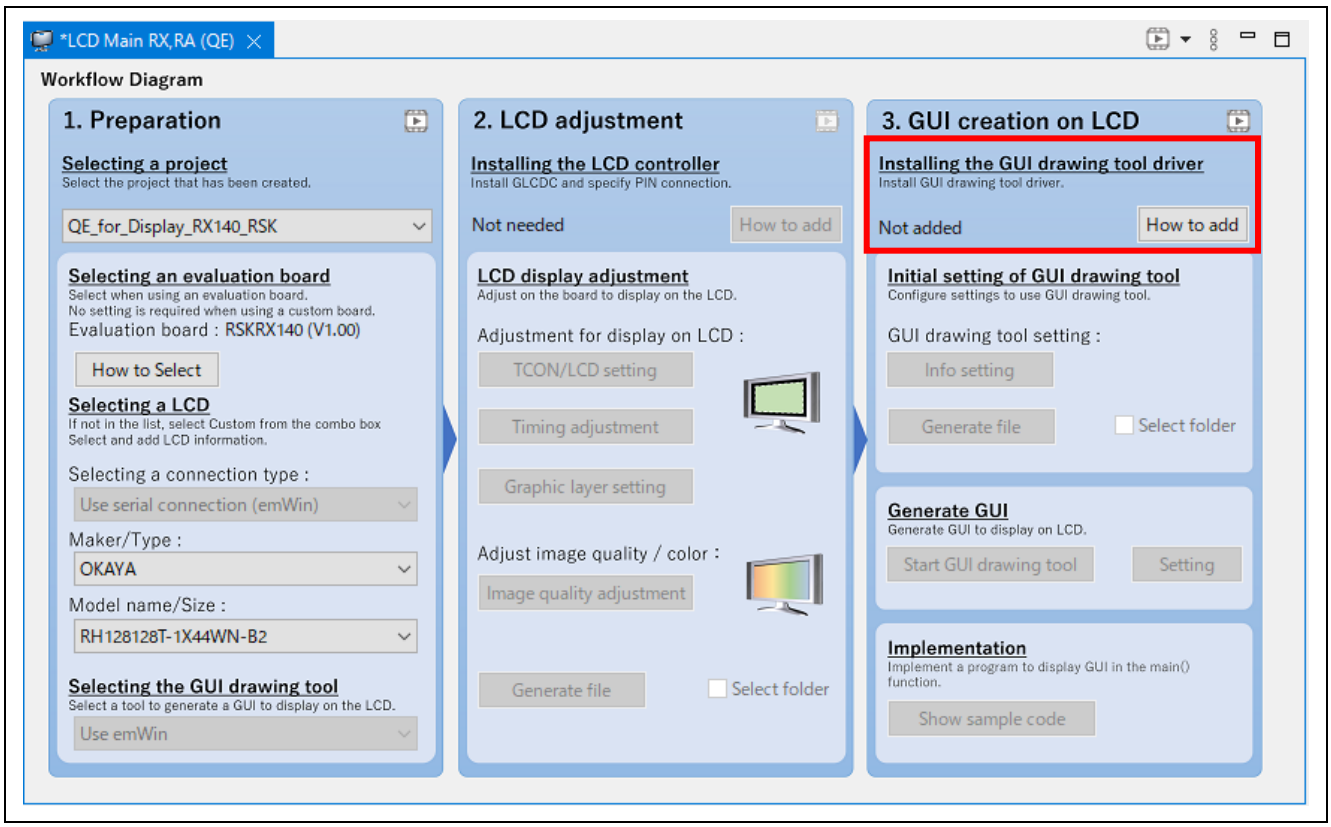
Table 4.2 Correspondences between “Evaluation Board”, “LCD maker/Type”, and “Model name/Size”

LCD maker/Type	Model name/Size
OKAYA	RH128128T-1X44WN-B2 / 128x128
Kuongshun Electronic	MSP2807 / 320x240

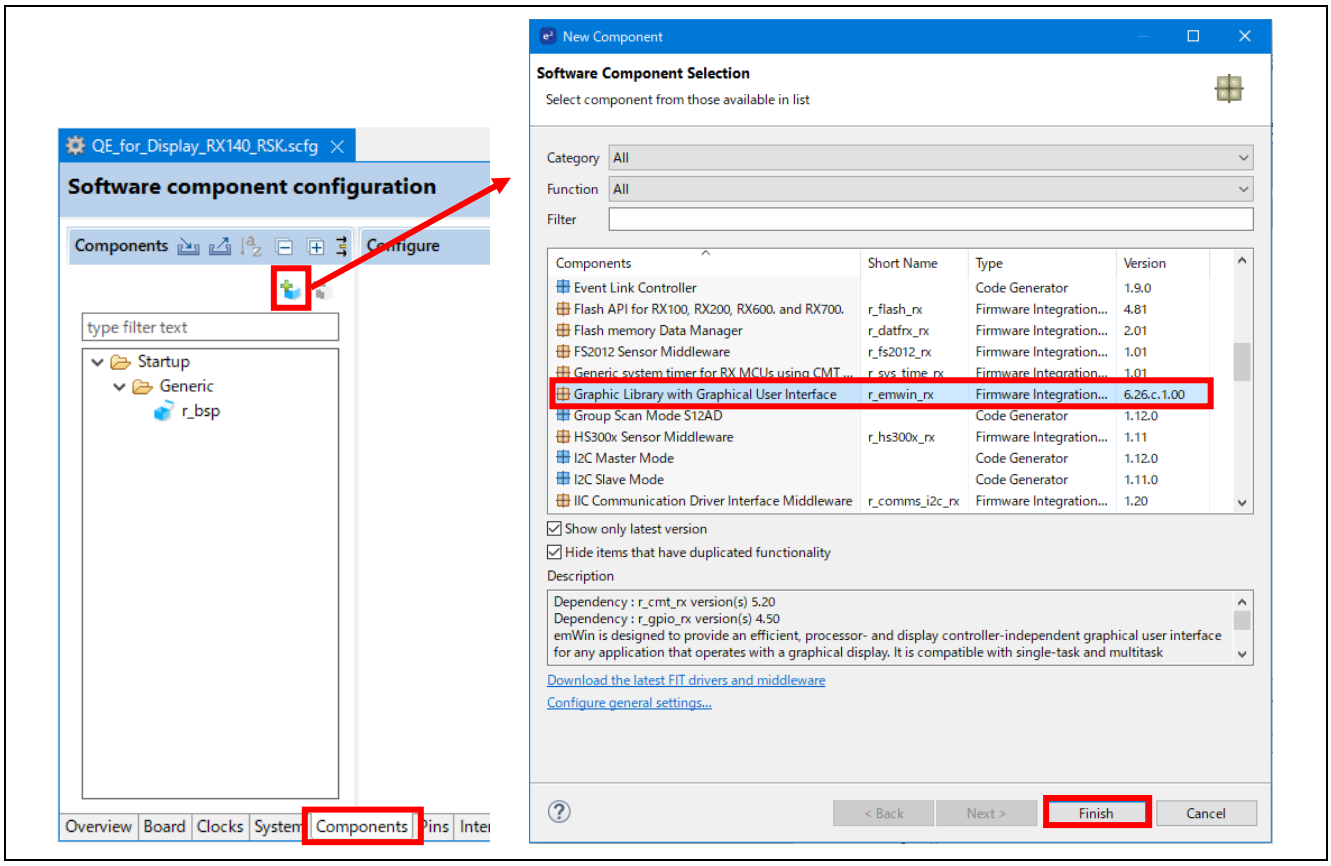


4.4.2 Create a GUI for an LCD

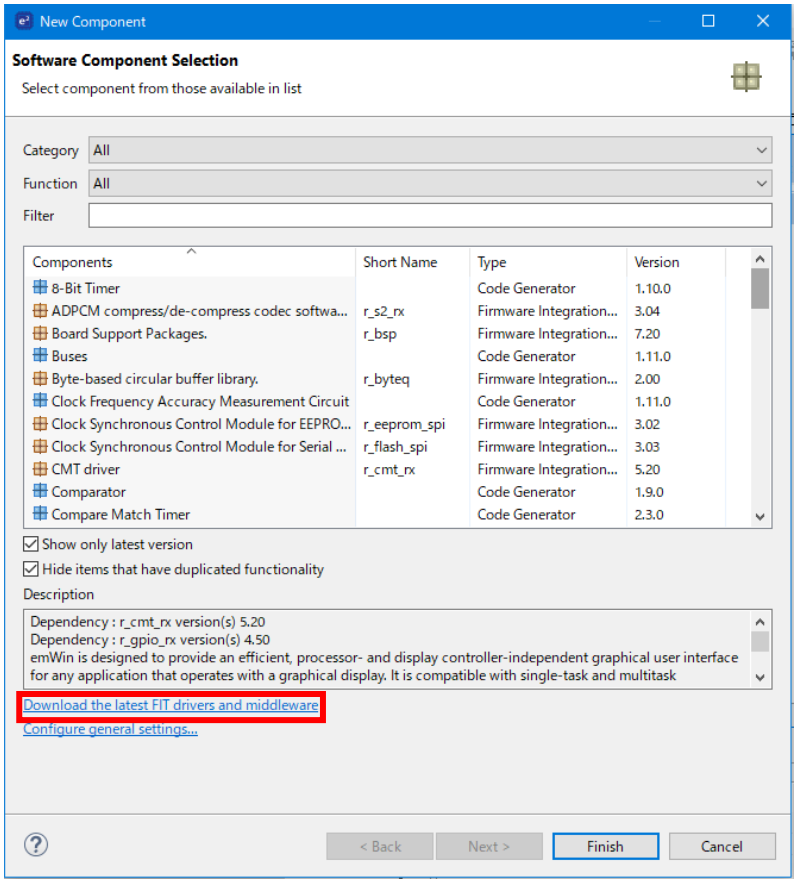
The following shows the procedure for installing a GUI drawing tool using emWin.



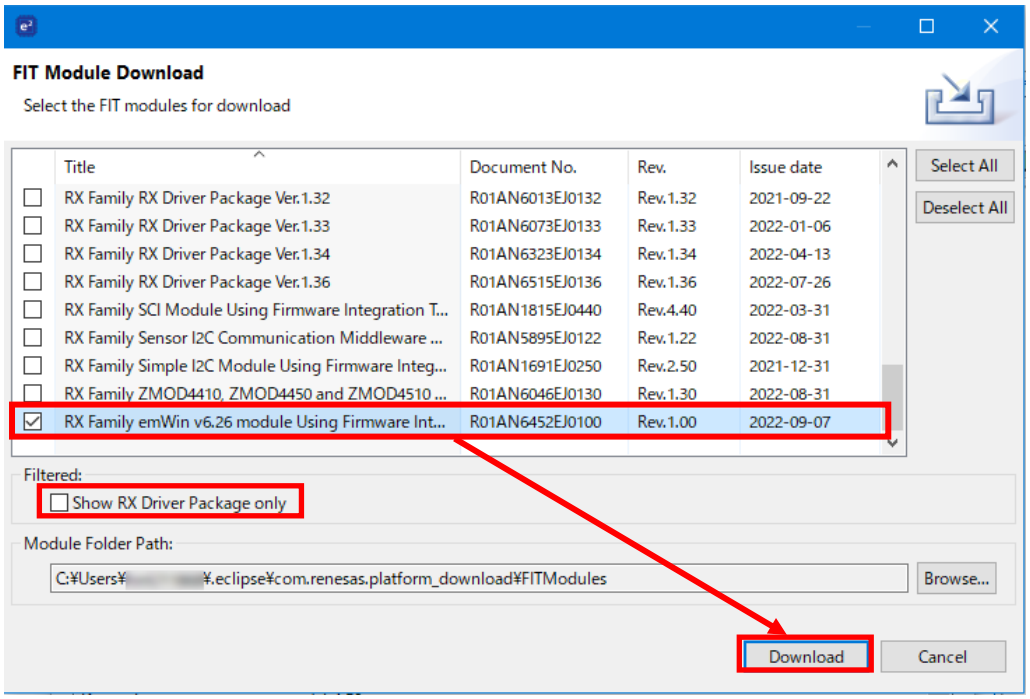
1. Select the “Components” tab of the Smart Configurator and click on the “Add component” icon.
2. In the “New Component” dialog box, select “Graphic Library with Graphical User Interface (r_emwin_rx)” (version 6.26.c.1.00 or a later version) and click on the “Finish” button.



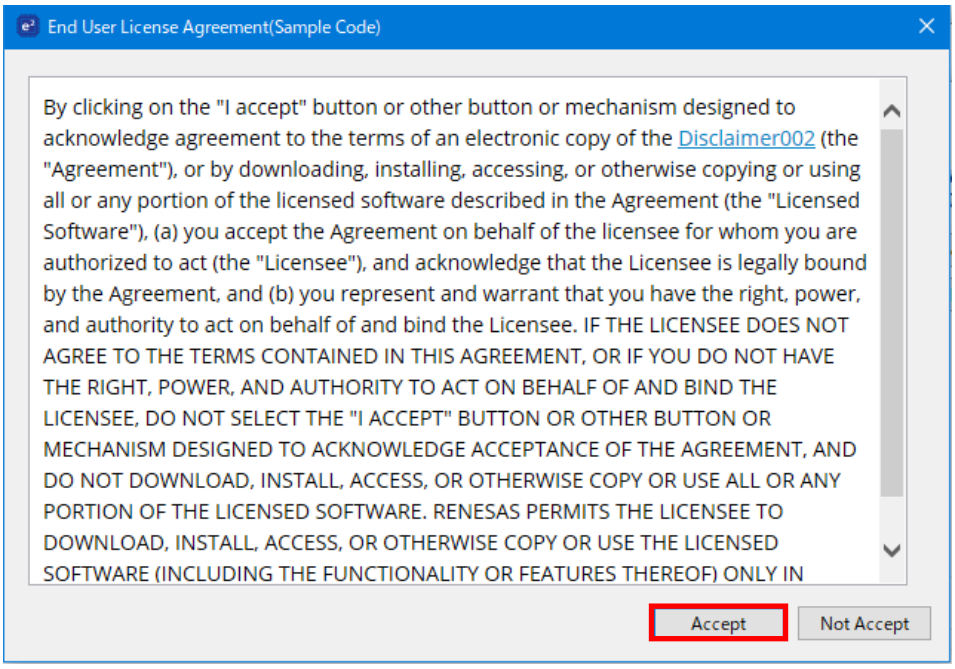
3. If the graphic library is not displayed in the list of components in the “New Component” dialog box, click on “Download the latest FIT drivers and middleware”.



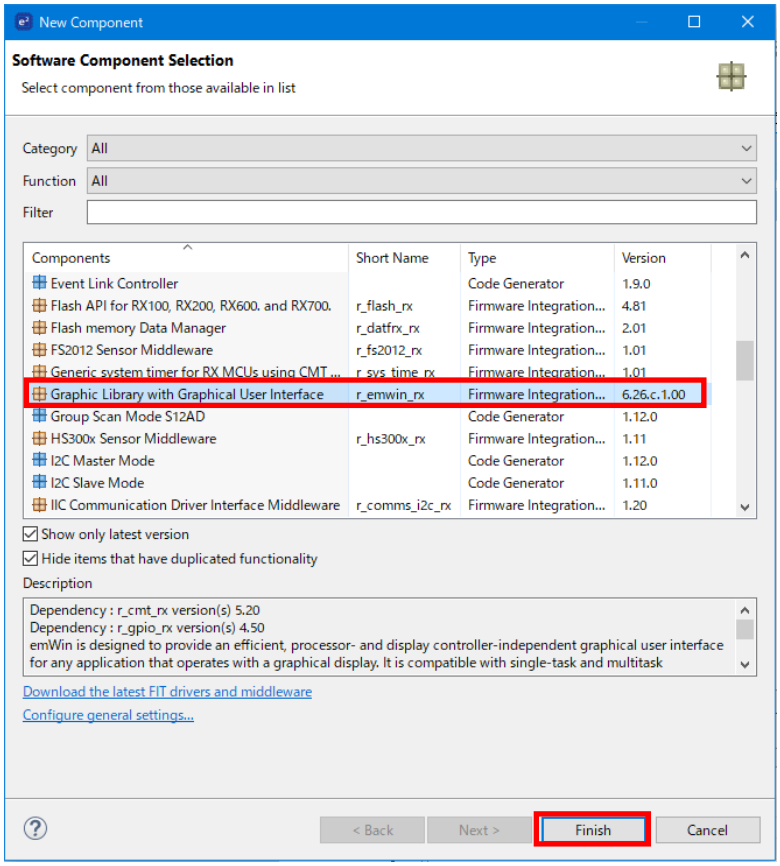
4. In the “FIT Module Download” dialog box, remove the check against “Show RX Driver Package only” and select “RX Family emWin v6.26 module”.
5. Click on “Download”.



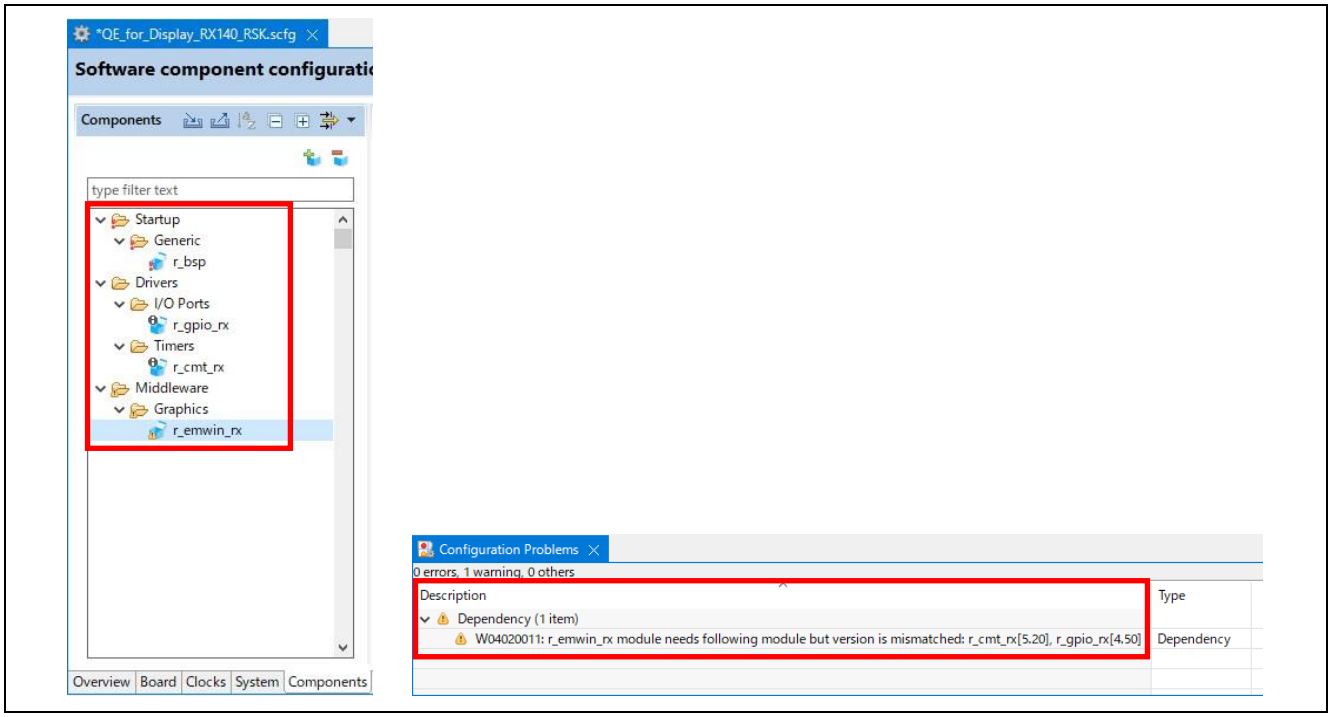
6. Read the description in the “End User License Agreement (Sample Code)” dialog box. If you agree, click on “Accept”.



7. When “Graphic Library with Graphical User Interface (r_emwin_rx)” is displayed in the list of components, select it and click on the “Finish” button.

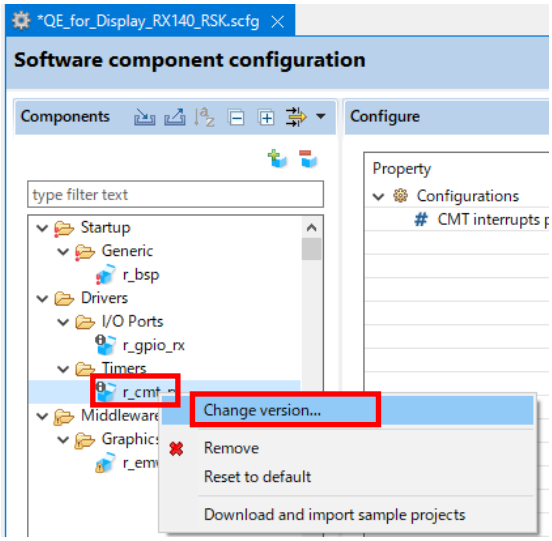


8. Components that have a dependency on the added component will be automatically added. However, a component that has not been added or a component with a version that differs from the required one will lead to an error message or a warning.
   In such cases, add the required component or update the version.
   The following example shows a warning issued regarding the component version of [r_cmt_rx] and [r_gpio_rx].

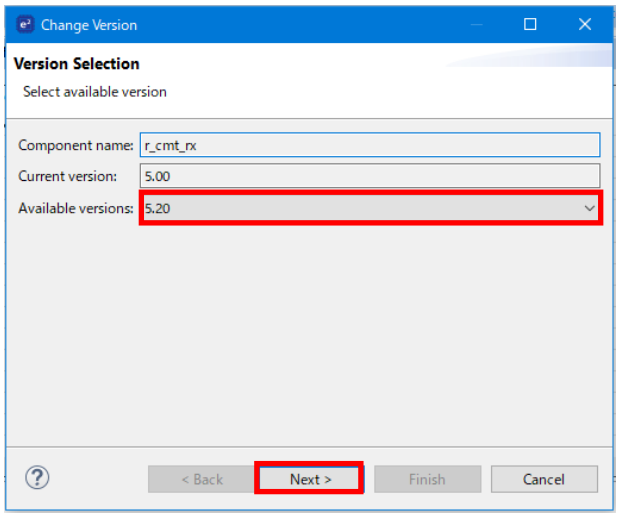


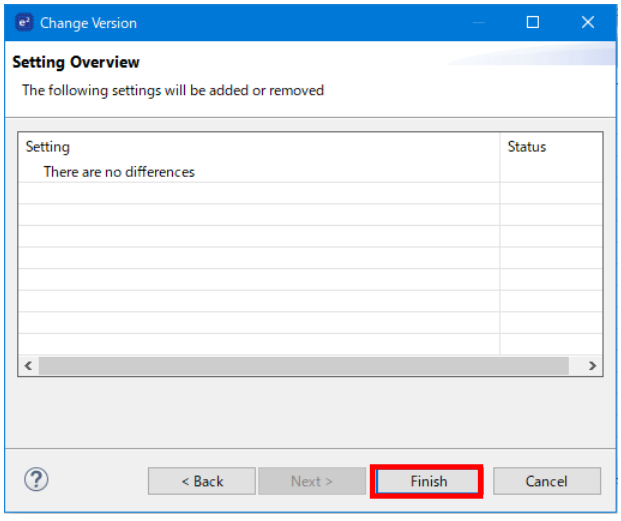
Update the component to the required version (r_cmt_rx).

9. Right-click on the component for r_cmt_rx and select “Change version”.

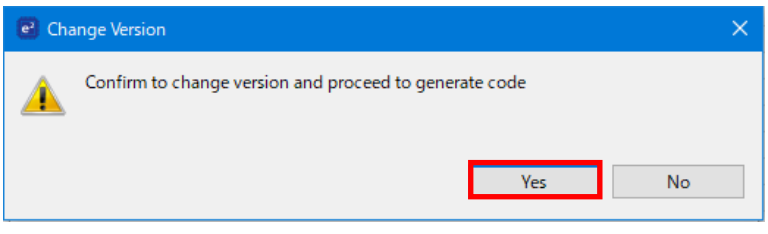


10. Confirm “Available versions” in the “Change Version” dialog box and click on “Next”.
11. Confirm “Setting Overview” and click on “Finish”.

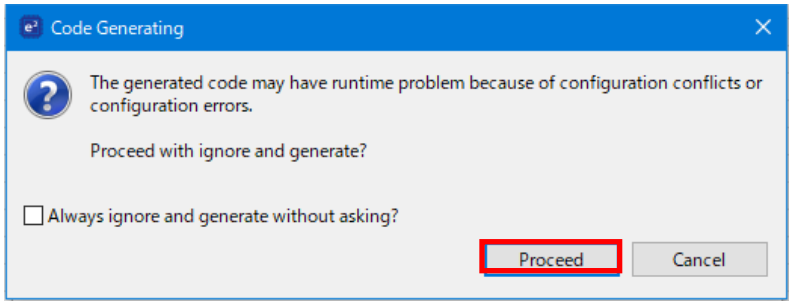




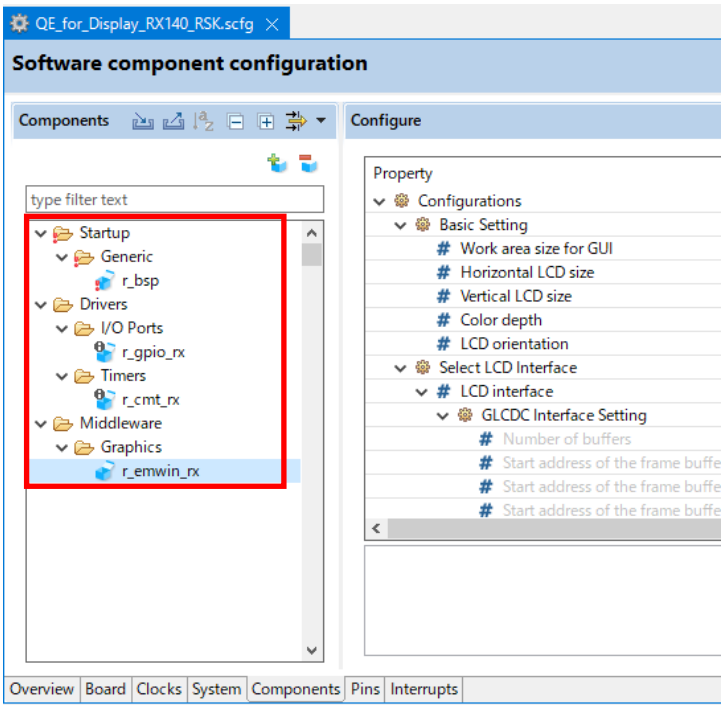
12. When the confirmation message is displayed in the “Change Version” dialog box, click on “Yes”.



13. When the confirmation message is displayed in the “Code Generation” dialog box, click on “Proceed”. Any other errors or warnings should also be dealt with in the same manner.



14. The error and warnings regarding the dependencies of components have now been resolved.



Set the LCD connection method to be used in emWin.

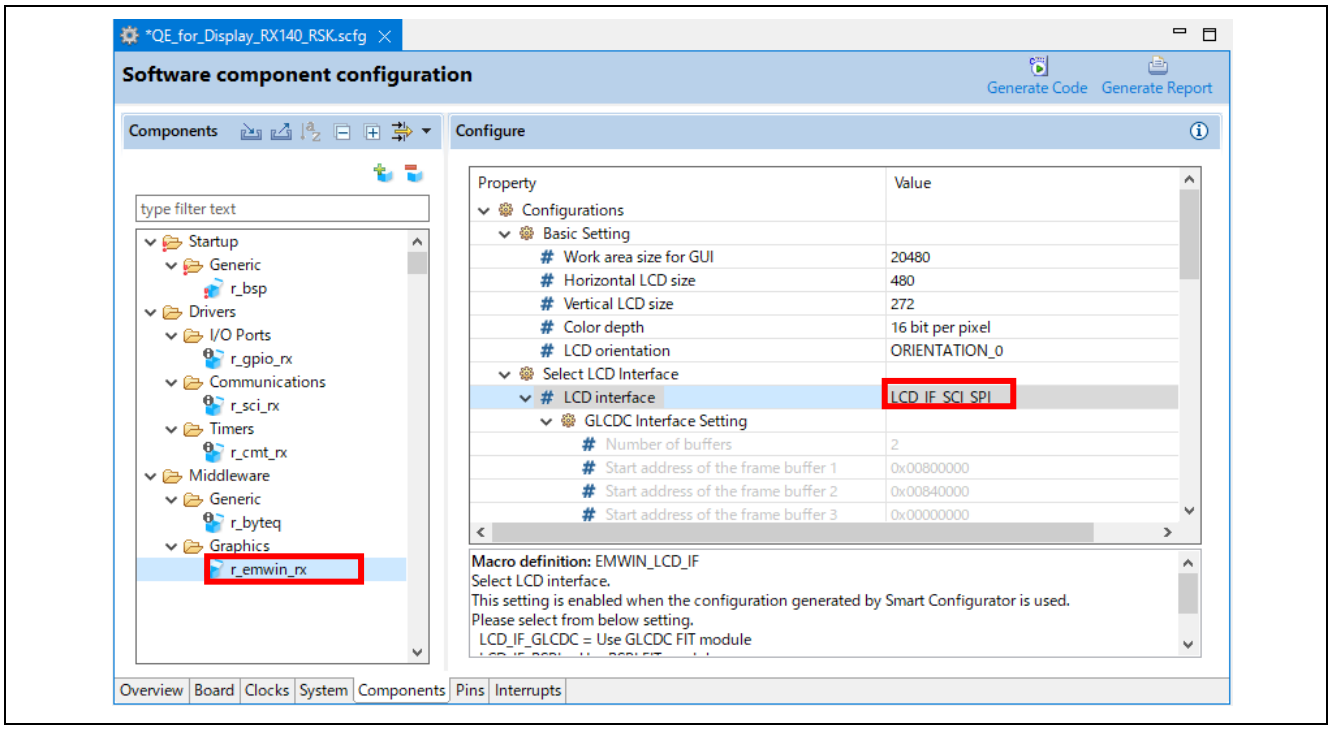
When using an RSK board (RSK RX130, RSK RX140, RSK RX231, RSSK RX23W, RSK RX64M, RSK RX660, RSK RX671, or RSK RX71M), the LCD display manufactured by OKAYA & Co., Ltd. is selected by the default. If you are using an OKAYA display, configure the emWin settings according to steps 15, 16, and 17 below.

When using a Target Board (Target Board RX130, Target Board RX231, Target Board RX23W, Target Board RX23W module, Target Board RX65N, Target Board RX660, or Target Board RX671), the LCD display manufactured by Kuongshun Electronic Ltd. is selected as by default. If you are using the Kuongshun Electronic display, configure the emWin settings according to steps 15, 18, and 19 below.

Steps 20 and beyond apply to both displays.

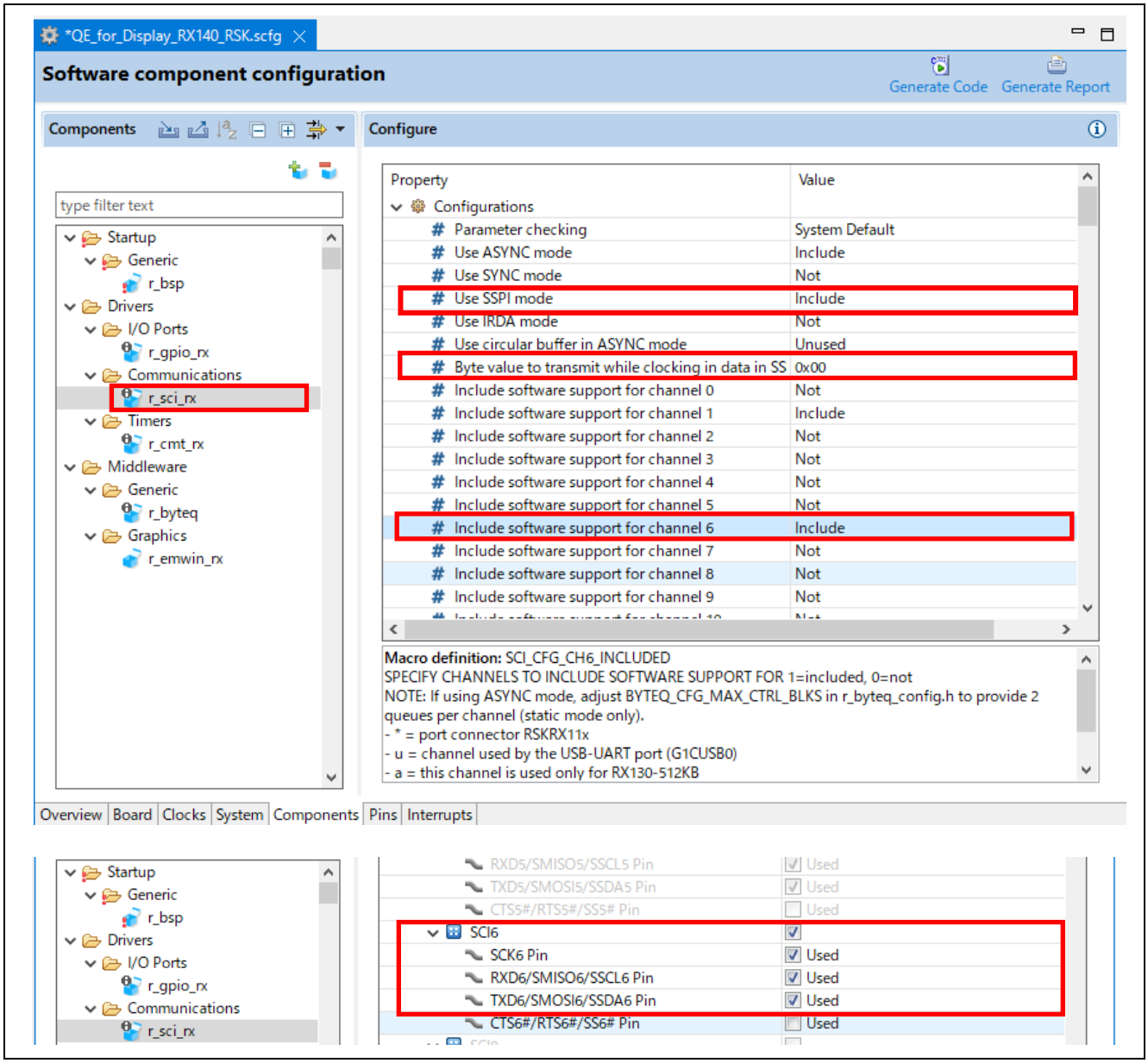
15. Select “r_emwin_rx” from the components.

16. Set the [LCD interface] value to [LCD_IF_SCI_SPI].



17. When selecting a board in the creation of a project, setting [LCD interface] to [LCD_IF_SCI_SPI] also adds the related FITs (r_sci_rx and r_byteq).
Select [r_sci_rx] from Components and set the following.

(1) Use SSPI mode : Include
(2) Byte value to transmit while clocking in data in SSPI mode : 0x00
(3) Include software support for channel6 (SCI channel number to be used) : Include
(4) SCI6 (SCI channel number to be used) : Check “include” for all pins excluding CTS



For (3) and (4), select the SCI channel that corresponds to the board specifications.

Table 4.3 Channel Numbers to be Used

Evaluation Board	SCI Channel Number
RSKRX130-512KB	6
RSKRX140	6
RSKRX231	8
RSSKRX23W	12
RSKRX64M	6
RSKRX660	6
RSKRX671	6
RSKRX71M	6

For Kuongshun Electronic manufactured display:

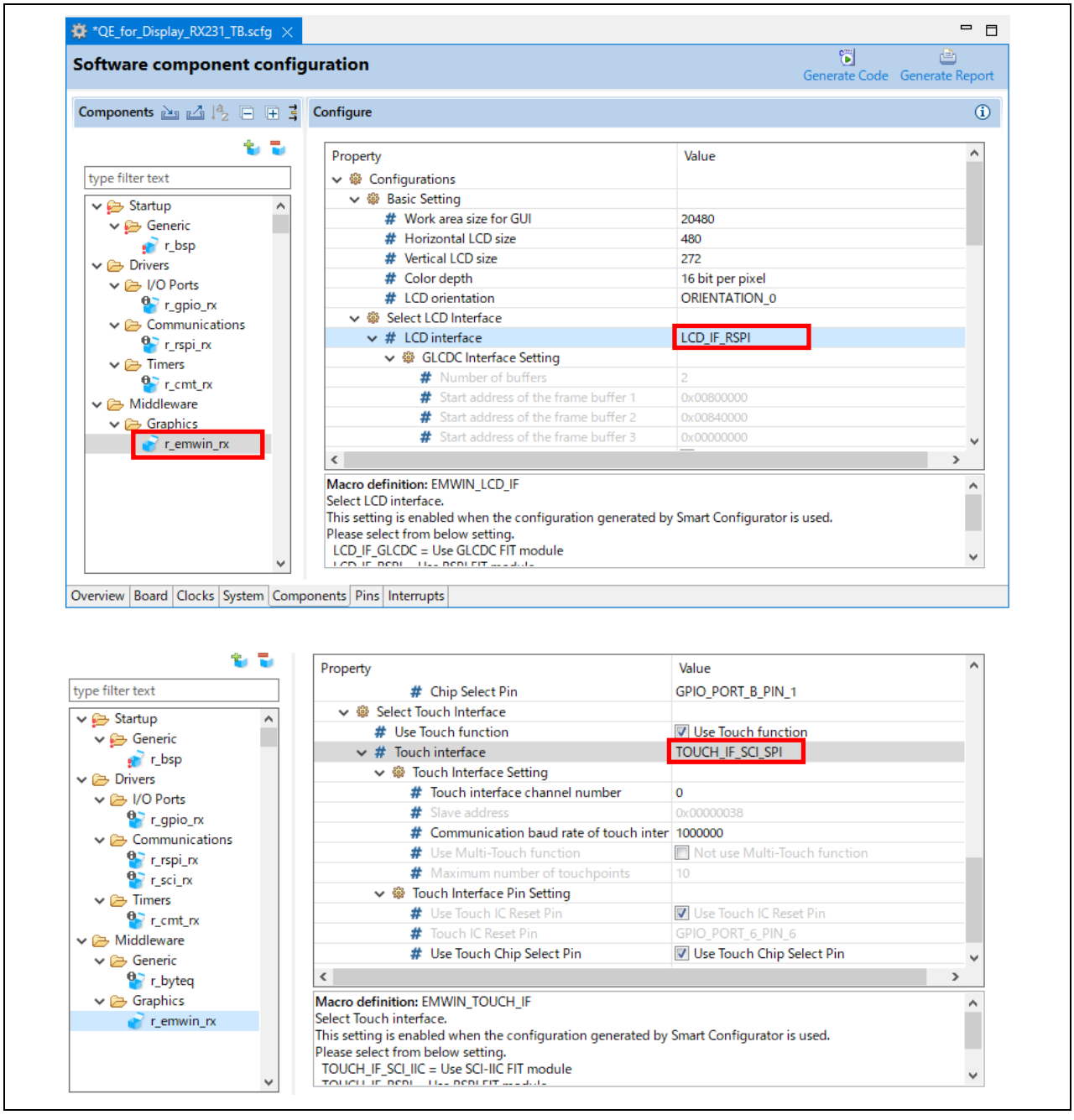
The display manufactured by Kuongshun is equipped with an LCD as well as a touch function.
The channels used for the LCD connection and touch function are as follows.

Table 4.4 Display Interface and Channel Number

Evaluation Board	LCD Connection		Touch Function	
	Interface	Channel Number	Interface	Channel Number
TargetBoardRX130	RSPI	0	SCI_SPI	1
TargetBoardRX231	RSPI	0	SCI_SPI	0
TargetBoardRX23W	SCI_SPI	1	SCI_SPI	5
TargetBoardRX23Wmodule	SCI_SPI	1	SCI_SPI	12
TargetBoardRX65N	RSPI	0	RSPI	1
TargetBoardRX660	SCI_SPI	5	SCI_SPI	0
TargetBoardRX671	SCI_SPI	5	SCI_SPI	0

The RX231 Target Board is used in the following example to describe the setting procedures. For boards that use SCI_SPI for LCD connection, use the same settings as described in steps 19 (4) to (7). For boards that use RSPI for the touch function, use the same settings as described in steps 19 (1) to (3).

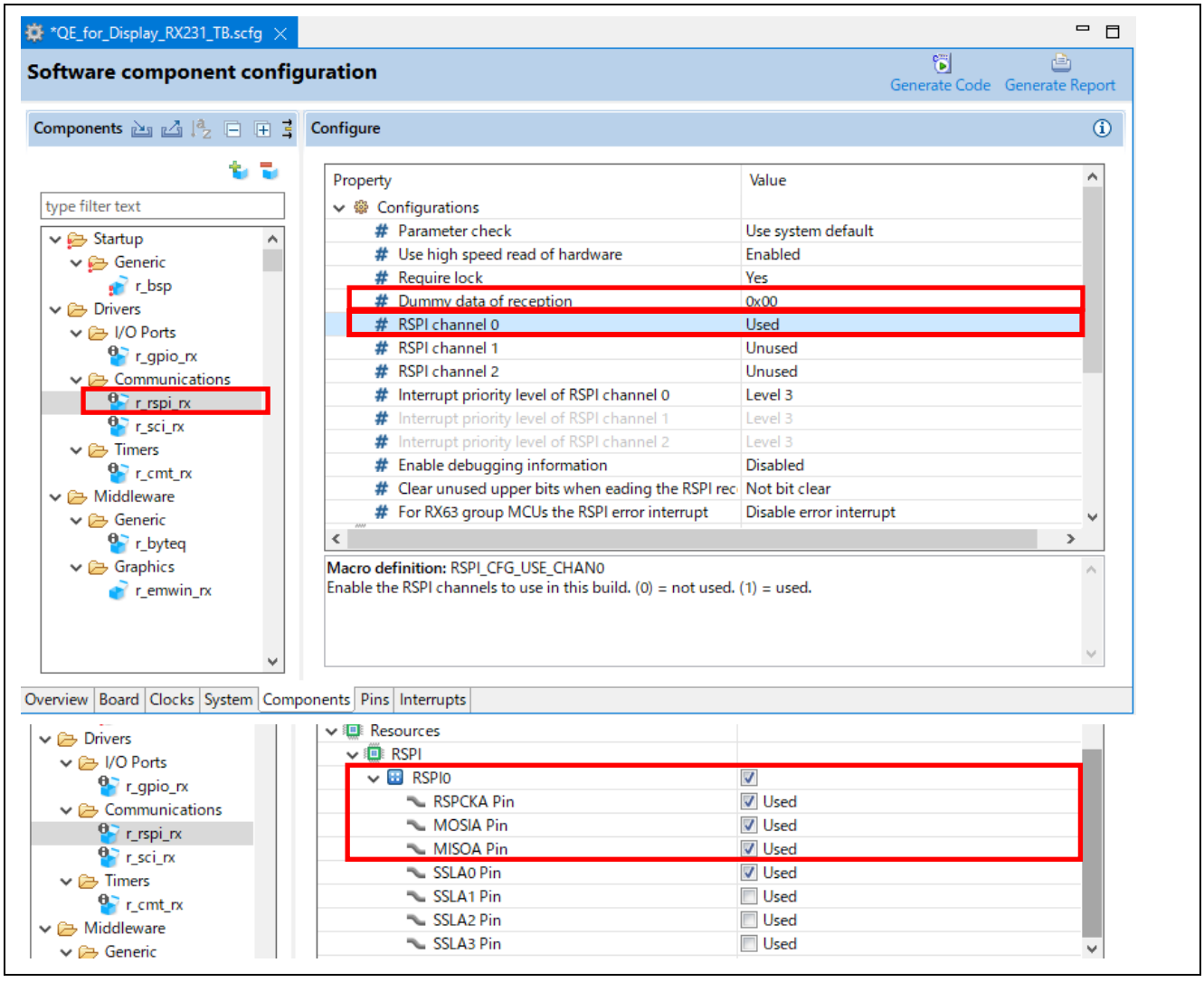
18. Set the [LCD interface] value to [LCD_IF_RSPI] and the [Touch interface] value to [TOUCH_IF_SCI_SPI].
    As setting values and channel numbers vary according to each board, refer to Table 4.4, Display Interface and Channel Number for details.



19. When a board is selected in the creation of a project, setting [LCD_IF_RSPI] and [TOUCH_IF_SCI_SPI] also adds the related FITs (r_rspi_rx and r_sci_rx).

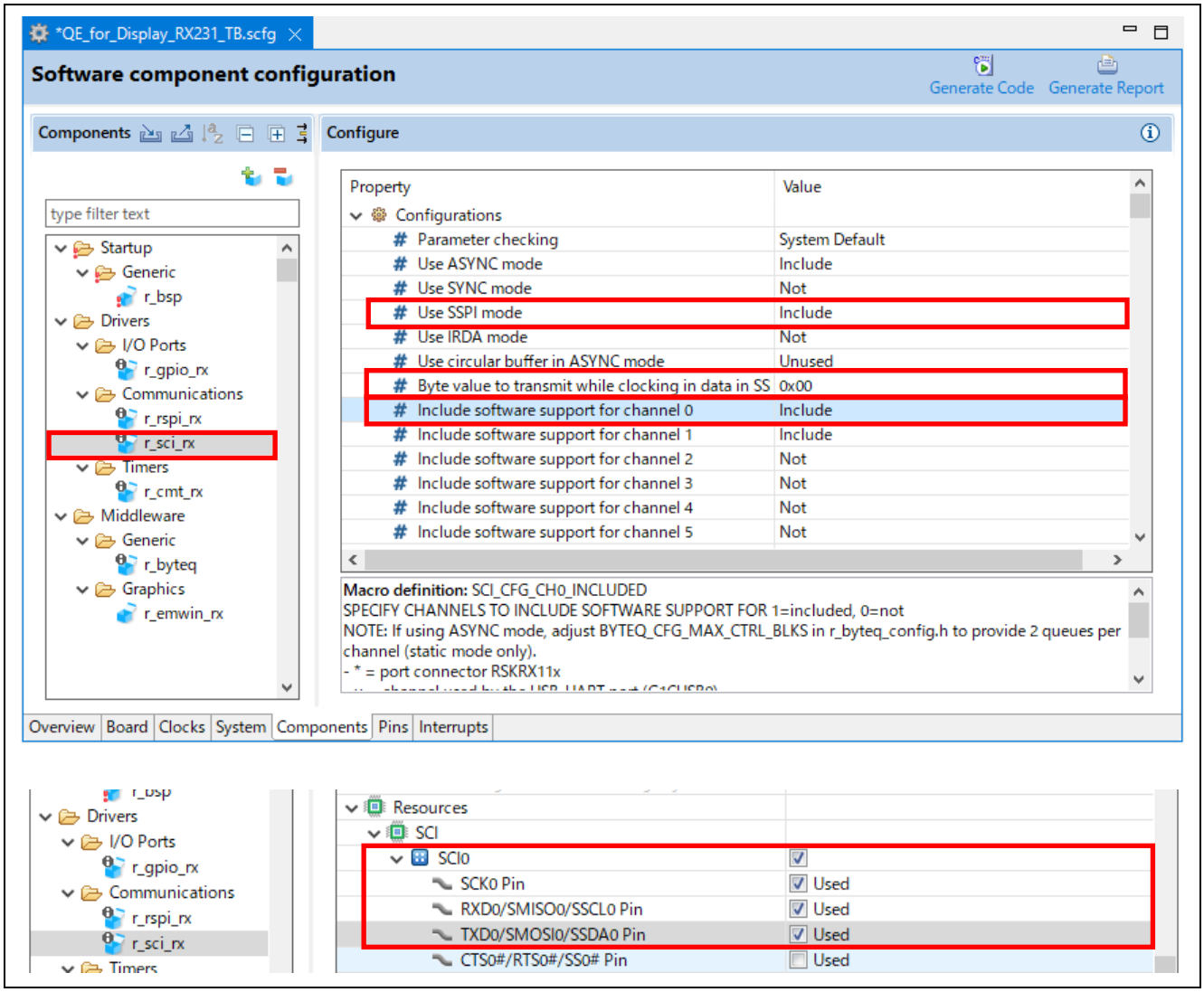
    RSPI setting:
    Select [r_rspi_rx] from Components and set the following.

    (1) Dummy data of reception : 0x00
    (2) RSPI channel 0 (RSPI channel for LCD connection) : Used
    (3) RSPI0 (RSPI channels for LCD connection) : Used



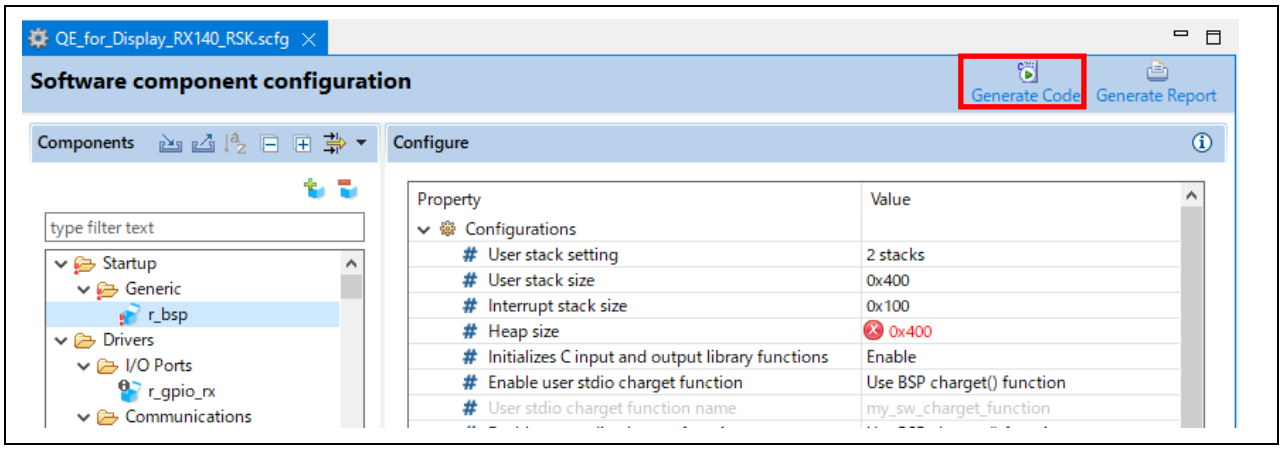
SCI_SPI setting:
Select [r_sci_rx] from Components and set the following.

(4) Use SSPI mode : Include
(5) Byte value to transmit while clocking in data in SSPI mode : 0x00
(6) Include software support for channel0 (SCI channel for touch function) : Include
(7) SCI0 (SCI channels for touch function) : Check “Used” for all pins excluding CTS

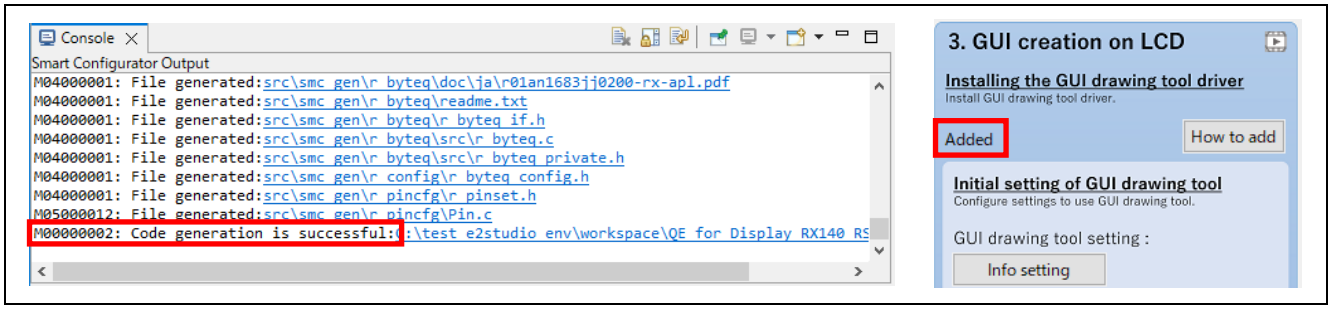


20. When the pins have been set, click on the “Generate Code” button in the upper-right corner of the window. The code is generated according to the settings.

    The [r_bsp] Heap size shows an error, but this can be ignored for serial connections.

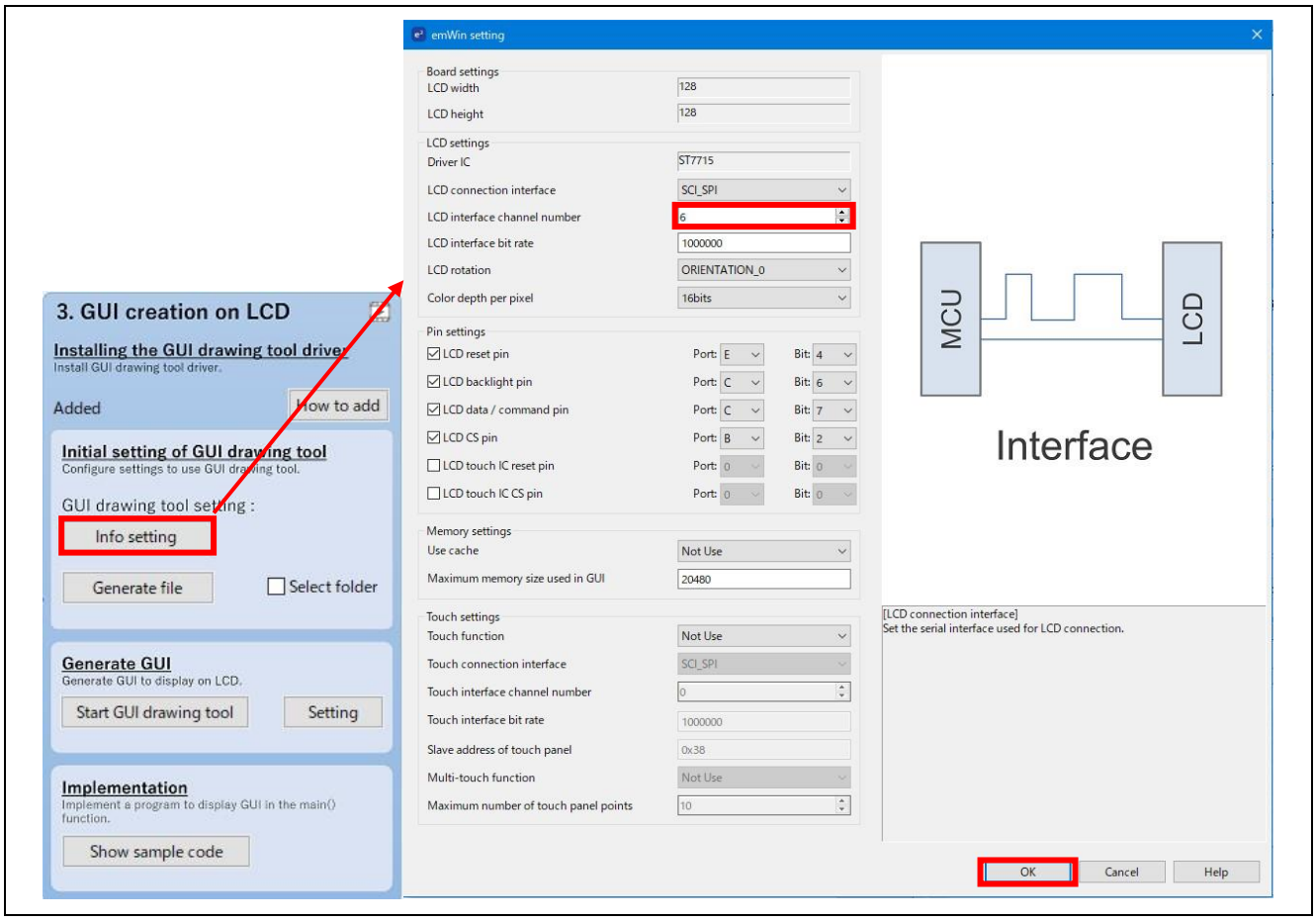


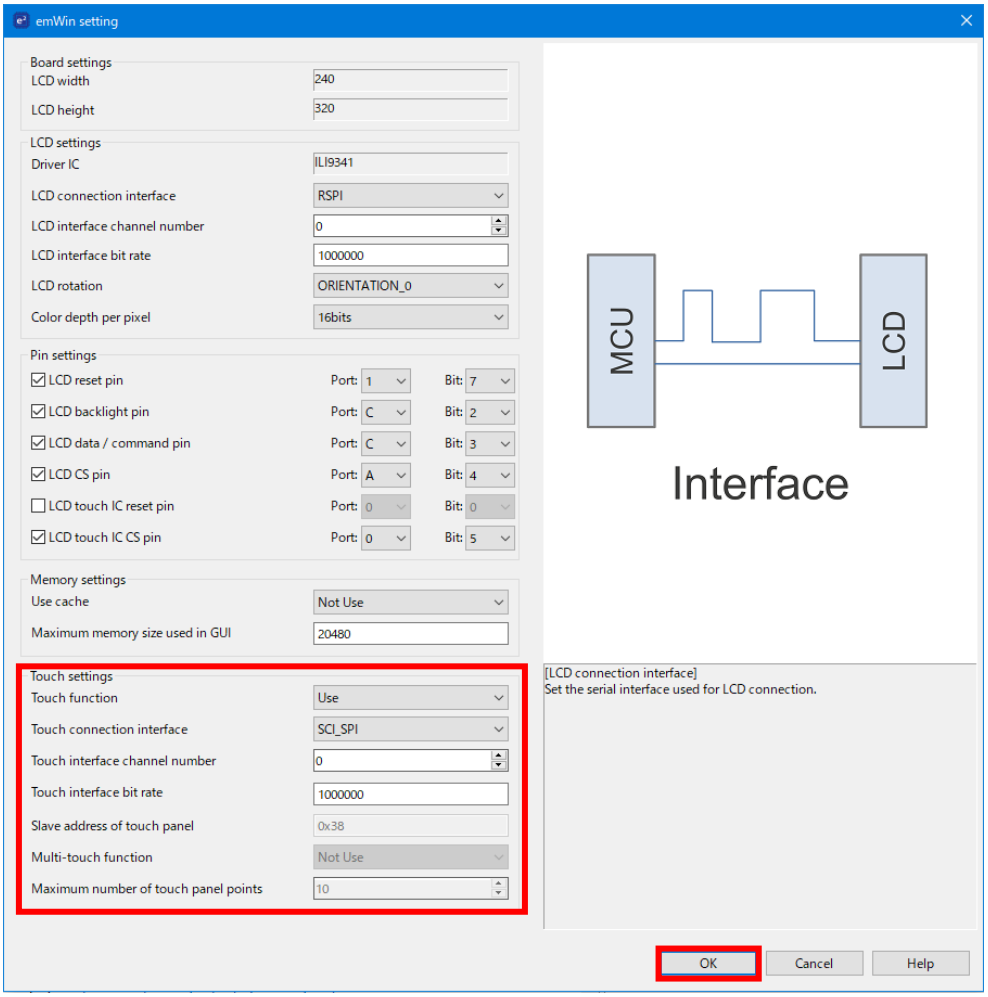
21. After code generation is finished, “Added” is displayed immediately below “Installing the GUI drawing tool driver”.



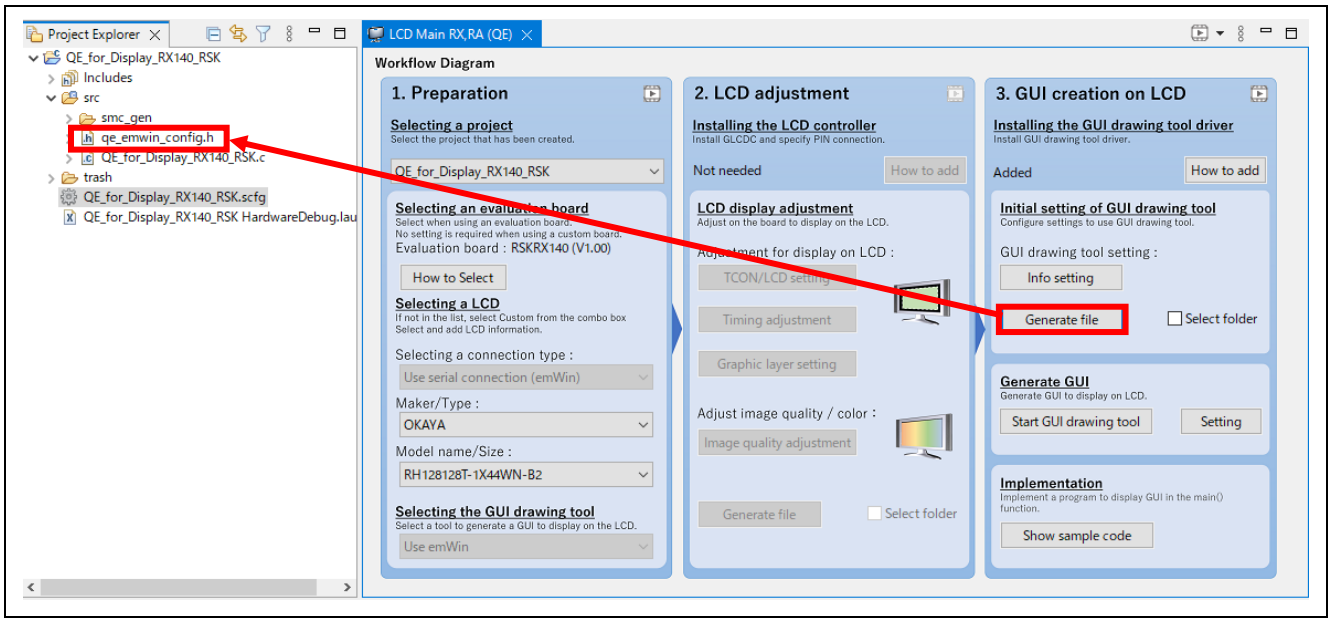
Make the initial settings for the GUI drawing tool.

22. Clicking on the “Info setting” button displays the “emWin setting” dialog box.
23. Values are set according to the information on the board selected in the project.
    [LCD interface channel number] must match the channel specified as [Include] by the [r_sci_rx] component and the channel specified as [Used] by the [r_rspi_rx] component in the Smart Configurator.
    When using the Kuongshun Electronic LCD display, the values are already set in the [Touch settings] section.
    For details, refer to the explanation produced by clicking on the “Help” button.
    Confirm the settings and click on the “OK” button to close the dialog box.



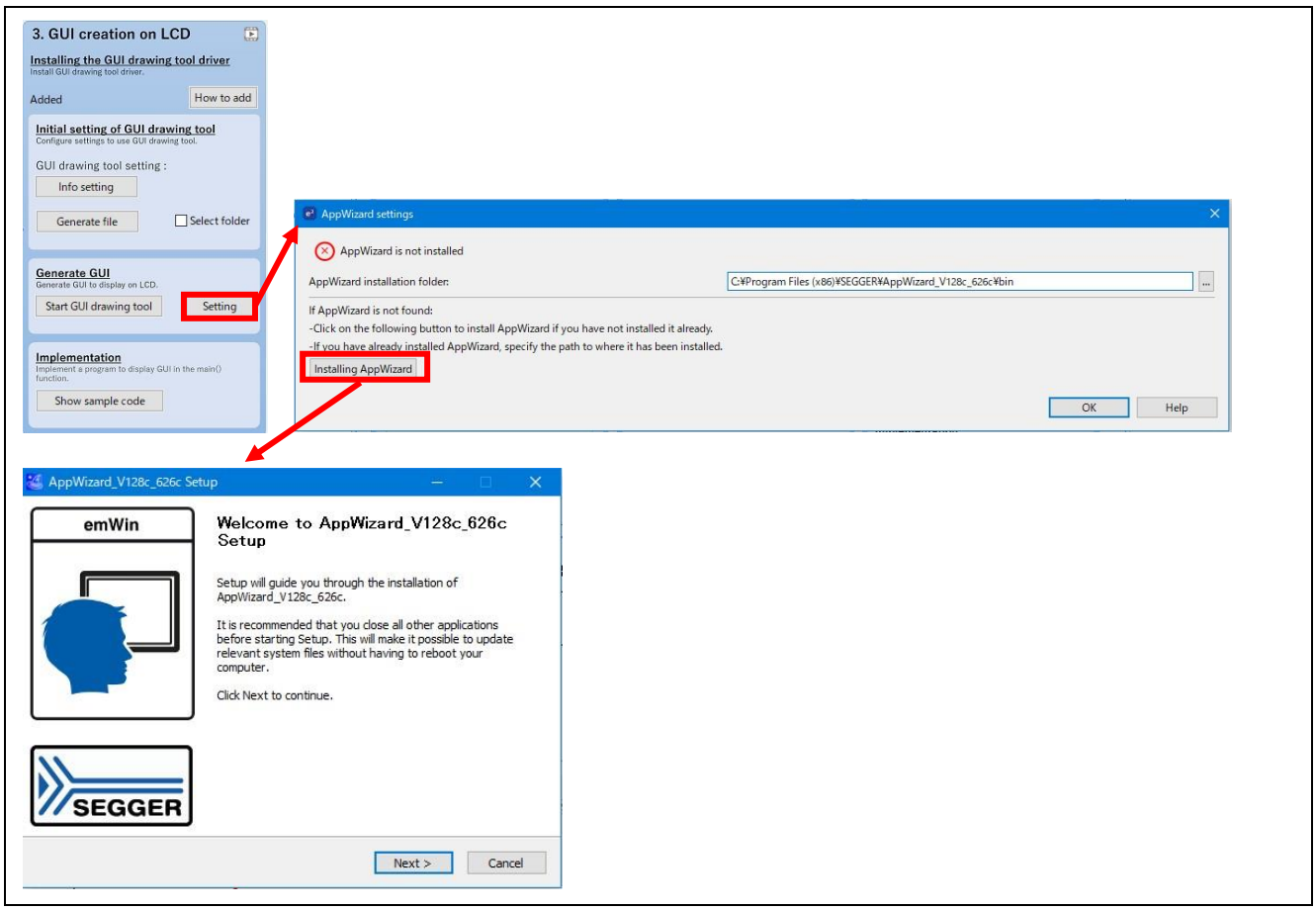

emWin setting
Board settings
LCD width
240
LCD height
320
LCD settings
Driver IC
ILI9341
LCD connection interface
RSPI
LCD interface channel number
0
LCD interface bit rate
1000000
LCD rotation
ORIENTATION_0
Color depth per pixel
16bits
Pin settings
LCD reset pin
Port: 1
Bit: 7
LCD backlight pin
Port: C
Bit: 2
LCD data / command pin
Port: C
Bit: 3
LCD CS pin
Port: A
Bit: 4
LCD touch IC reset pin
Port: 0
Bit: 0
LCD touch IC CS pin
Port: 0
Bit: 5
Memory settings
Use cache
Not Use
Maximum memory size used in GUI
20480
Touch settings
Touch function
Use
Touch connection interface
SCI_SPI
Touch interface channel number
0
Touch interface bit rate
1000000
Slave address of touch panel
0x38
Multi-touch function
Not Use
Maximum number of touch panel points
10
MCU
LCD
Interface
[LCD connection interface]
Set the serial interface used for LCD connection.
OK
Cancel
Help

24. A header file reflecting the initial settings for the GUI drawing tool is output.
    Click on the “Generate file” button to output qe_emwin_config.h. It is output to src immediately under the project folder by default. The output destination folder can be changed by selecting the “Select folder” checkbox.
    The path for including the output header files is also automatically added.

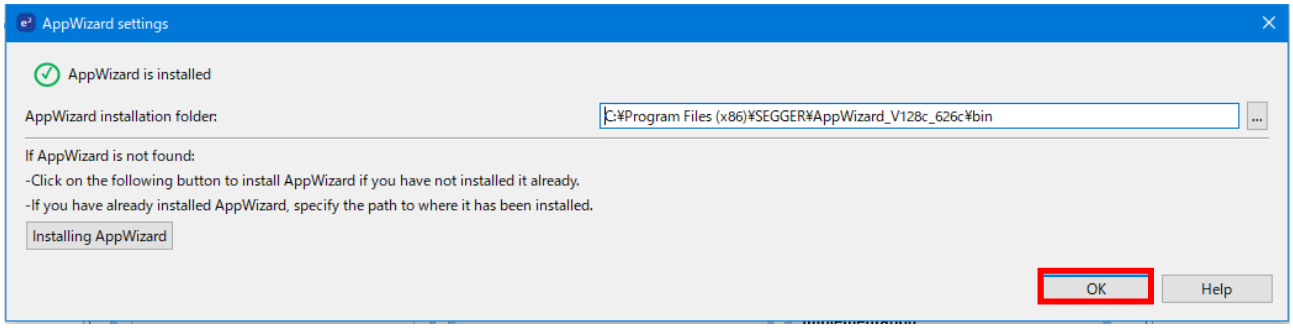


Install AppWizard, which is to be used to create the GUI.

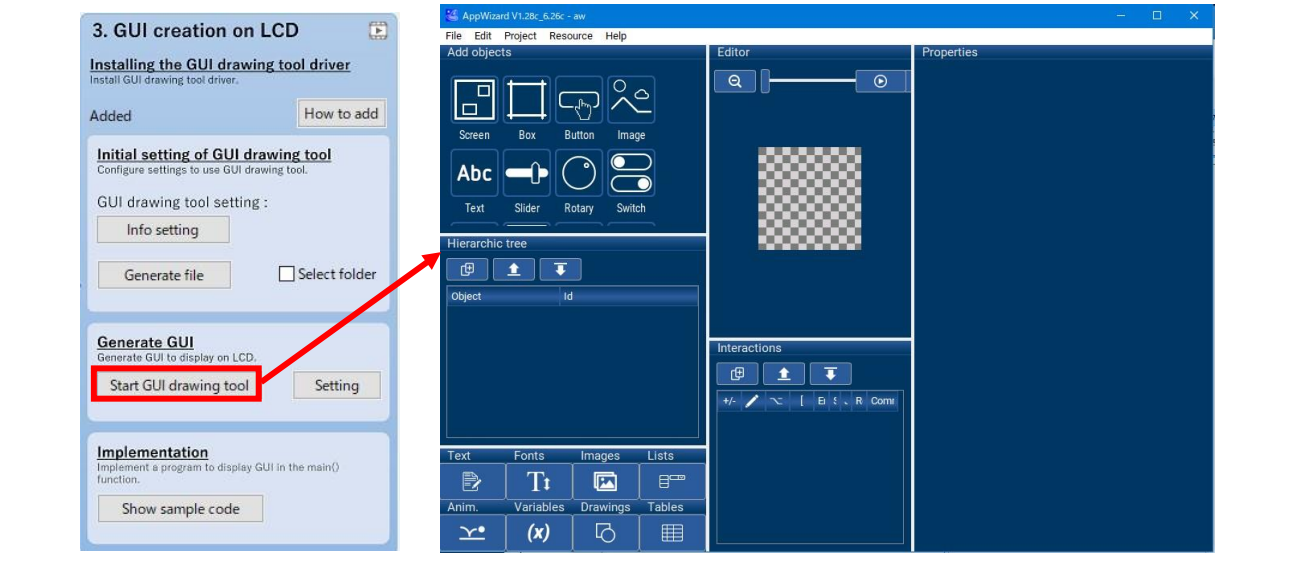
25. Click on the “Setting” button under “Generate GUI” to open the “AppWizard settings” dialog box.
26. Click on the “Installing AppWizard” button to install AppWizard by following the instructions of the AppWizard setup wizard that is displayed.



27. After having installed AppWizard, the state indicator of the “AppWizard settings” dialog box is changed to “AppWizard is installed”. Click on the “OK” button to close the “AppWizard settings” dialog box.

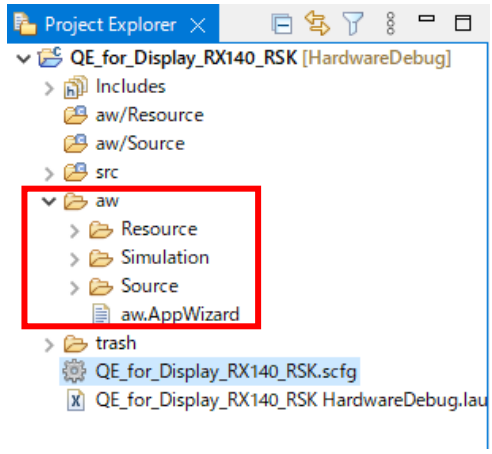


28. The “Start GUI drawing tool” button is now active.
Click on this button to start AppWizard.

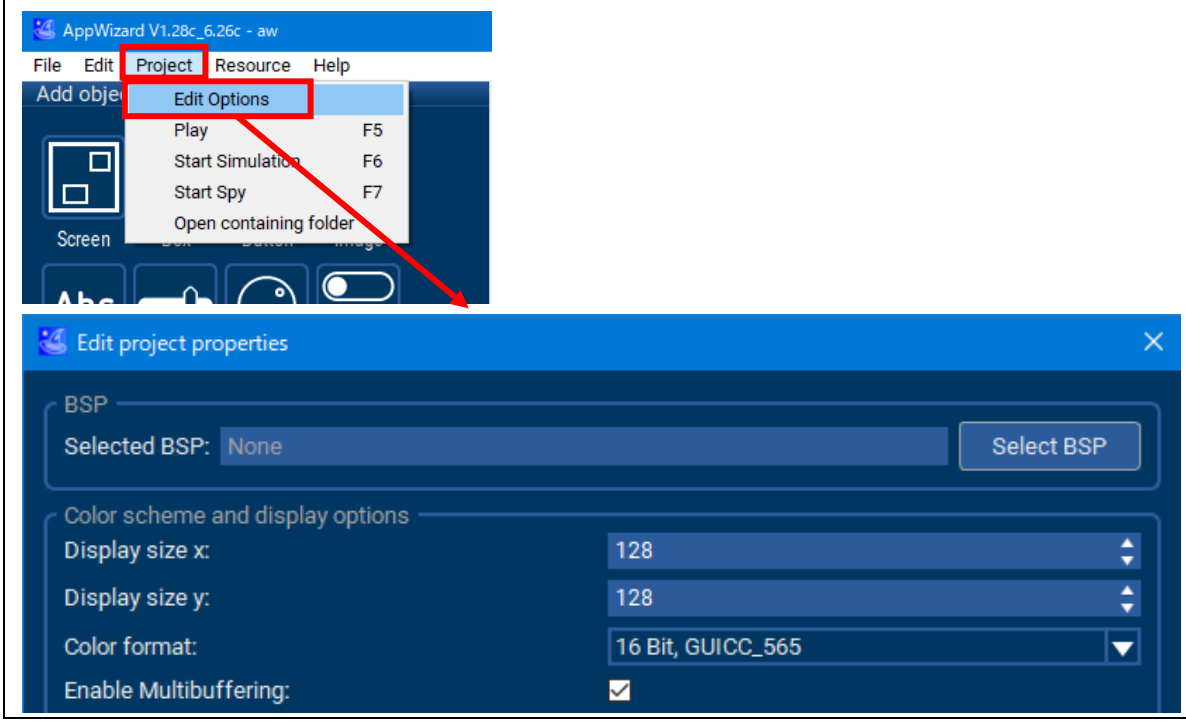


Note: The usage of AppWizard may differ from the way which is described in this application note due to changes to the specifications. For the usage of AppWizard, refer to its help system.

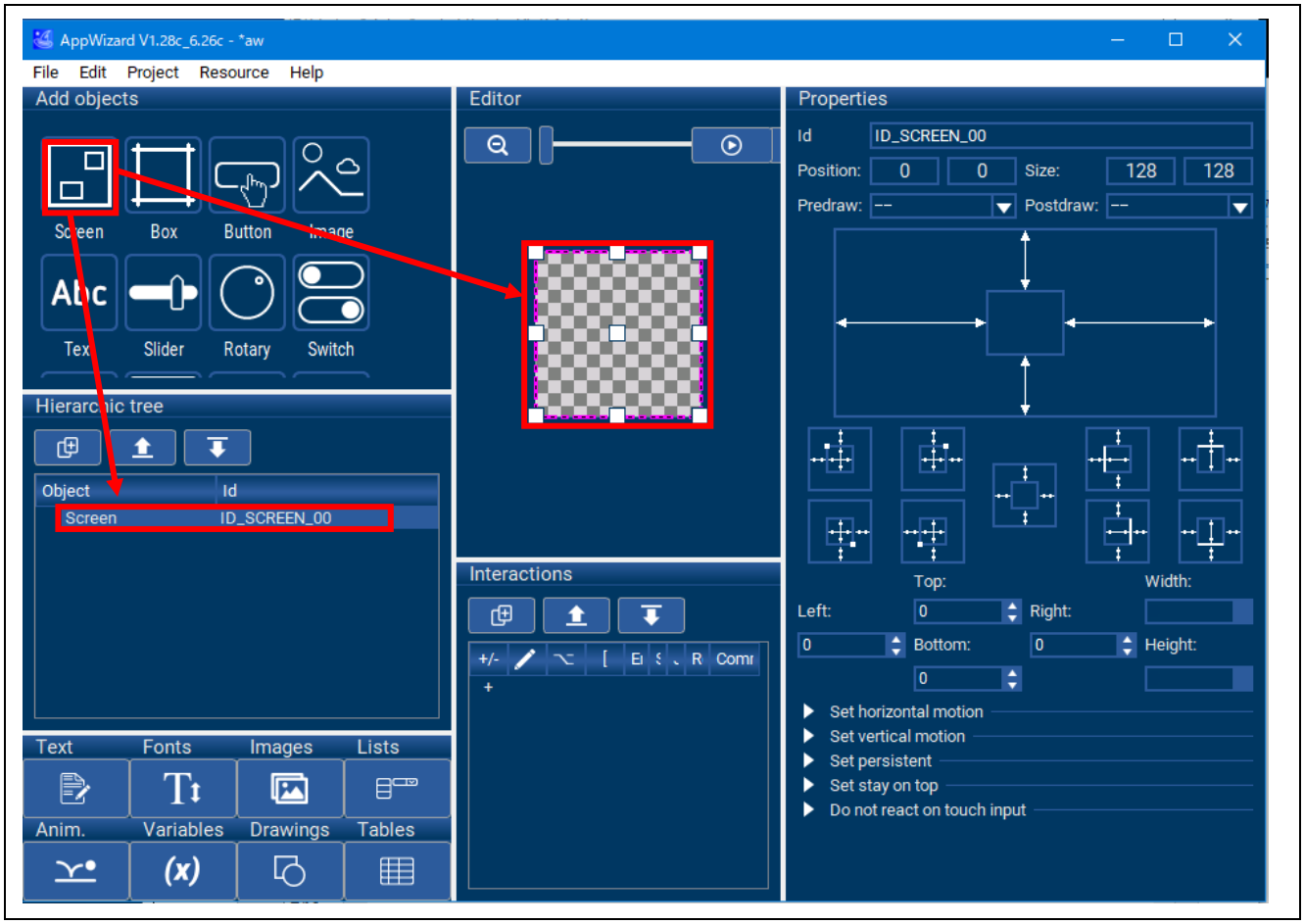
29. When AppWizard is started, the “aw” project folder of AppWizard is automatically created immediately under the project. This folder contains Resource, Simulation, and Source folders and the project file for AppWizard (aw.AppWizard).



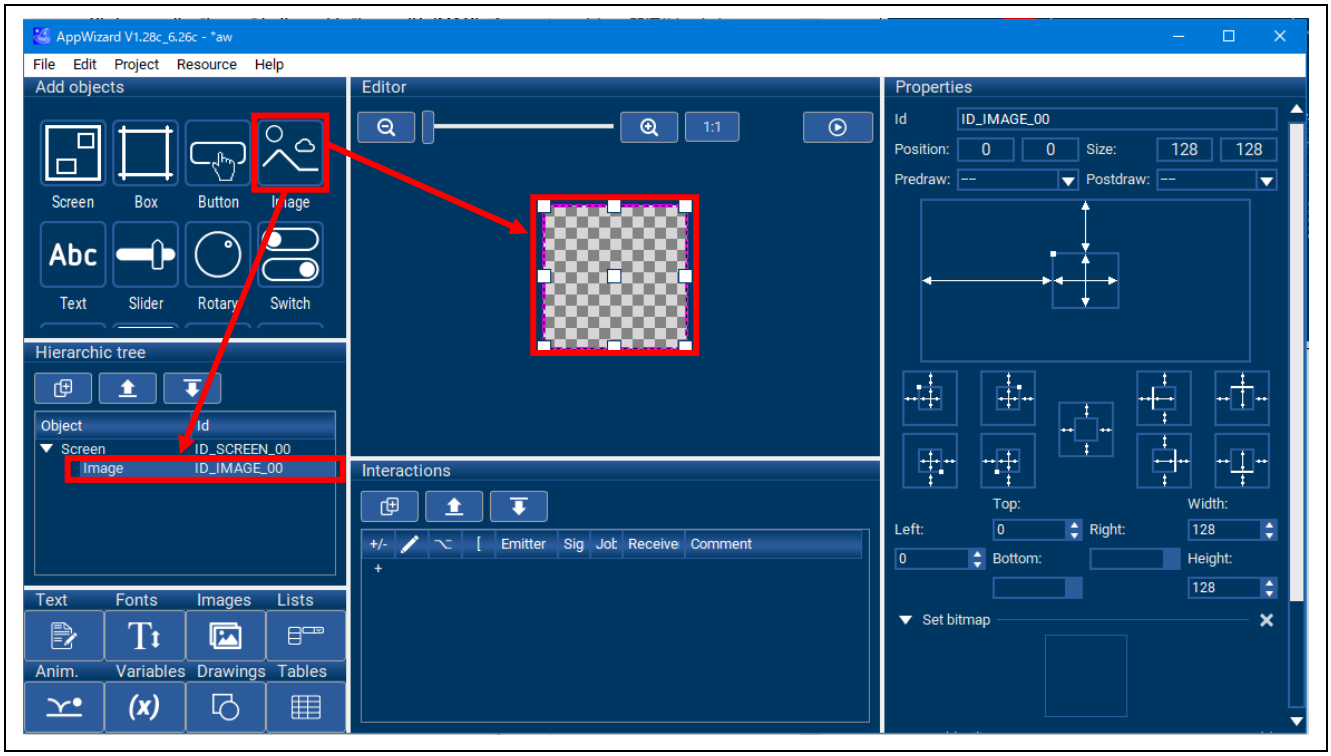
30. Screen size and other properties are automatically set in the AppWizard project.
The setting values can be confirmed in the “Edit project properties” dialog box which is opened from the “Edit Options” item of the “Project” menu.



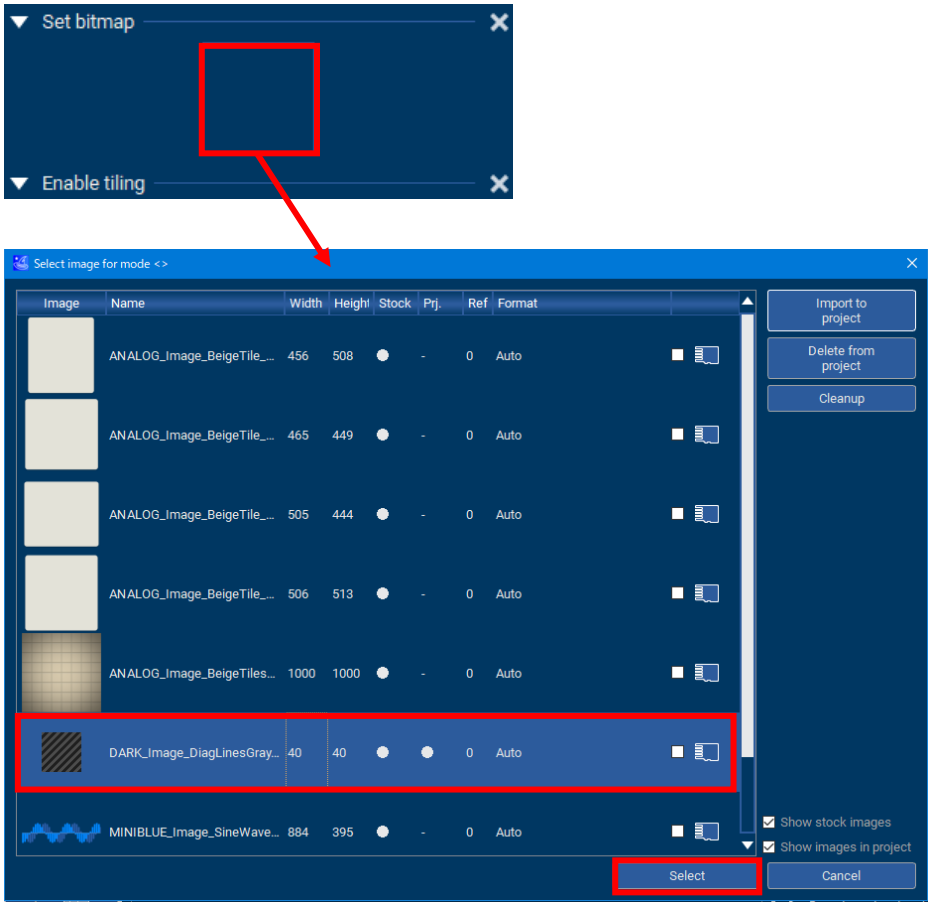
31. Create a GUI with AppWizard.
    Start by adding a screen. Clicking on the “Screen” button adds “Screen ID_SCREEN_00”. Multiple screens can be set and this allows switching between their displays.



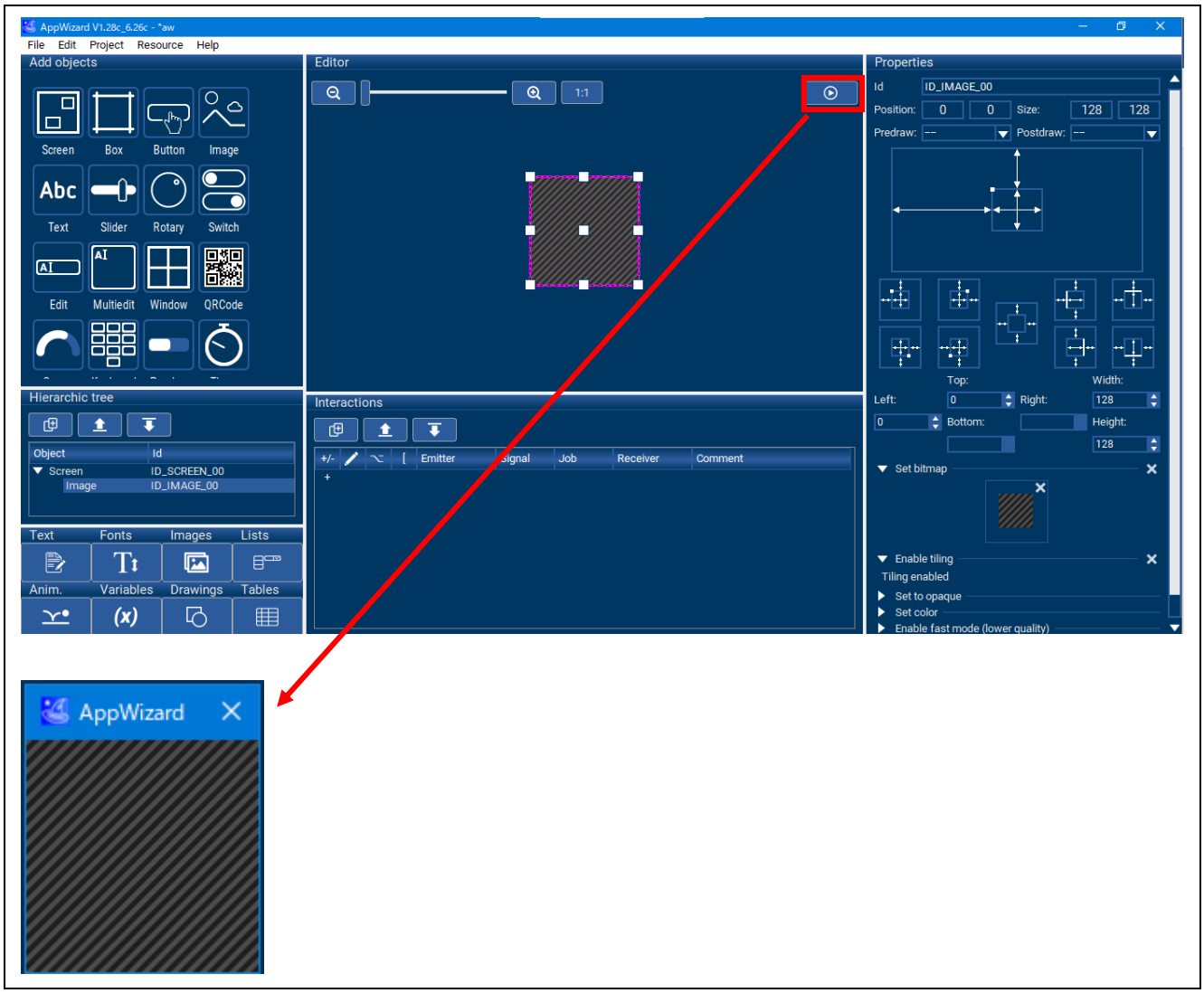
32. After that, add an image. Clicking on the “Image” button adds “Image ID_IMAGE_00”. The position and size are adjusted in “Editor” or “Properties”. In this case, use “Editor” to expand the image to fill the LCD screen.



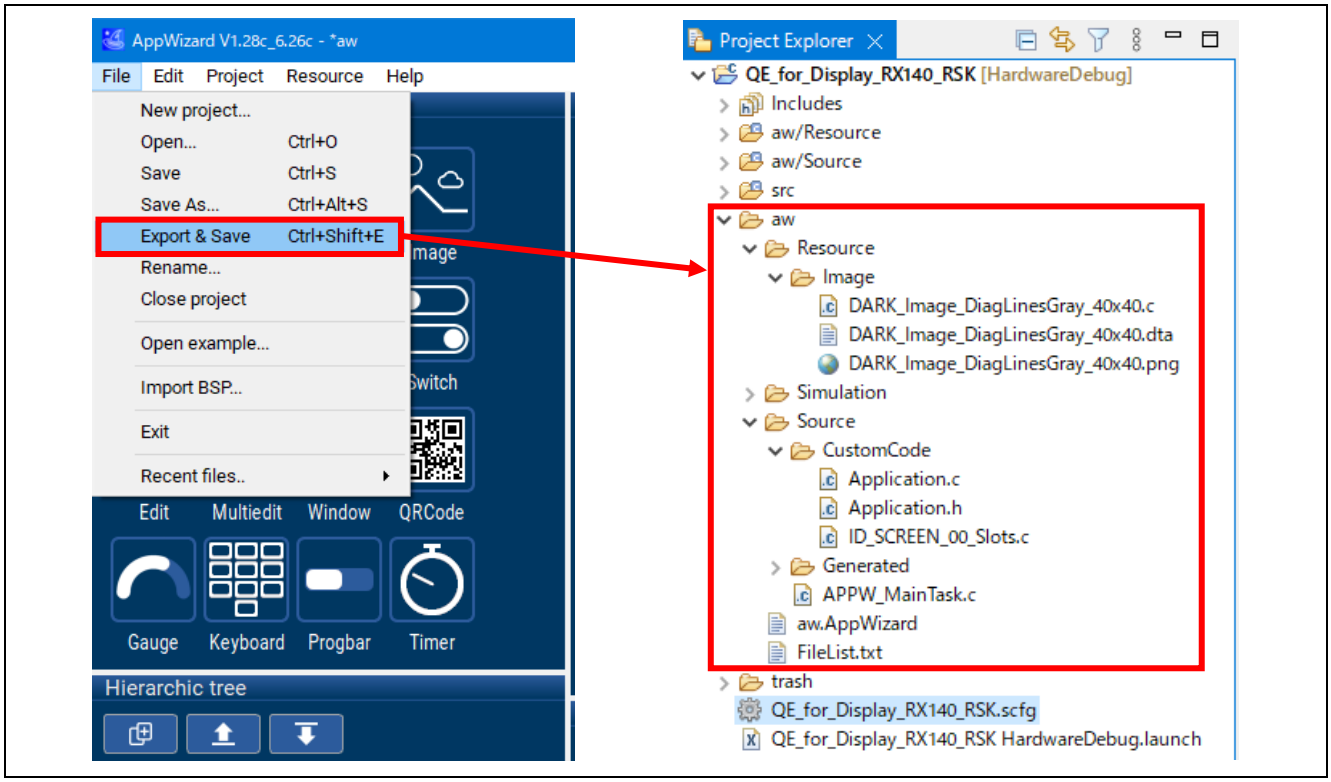
33. Set an image. Open “Set bitmap” in “Properties” and click on the rectangle below the label. Select a desired image from “Select image for mode <>” and click on “Select”. For the image format to be specified, also refer to section 6.2, Usage Note Regarding Image Drawing Speed.



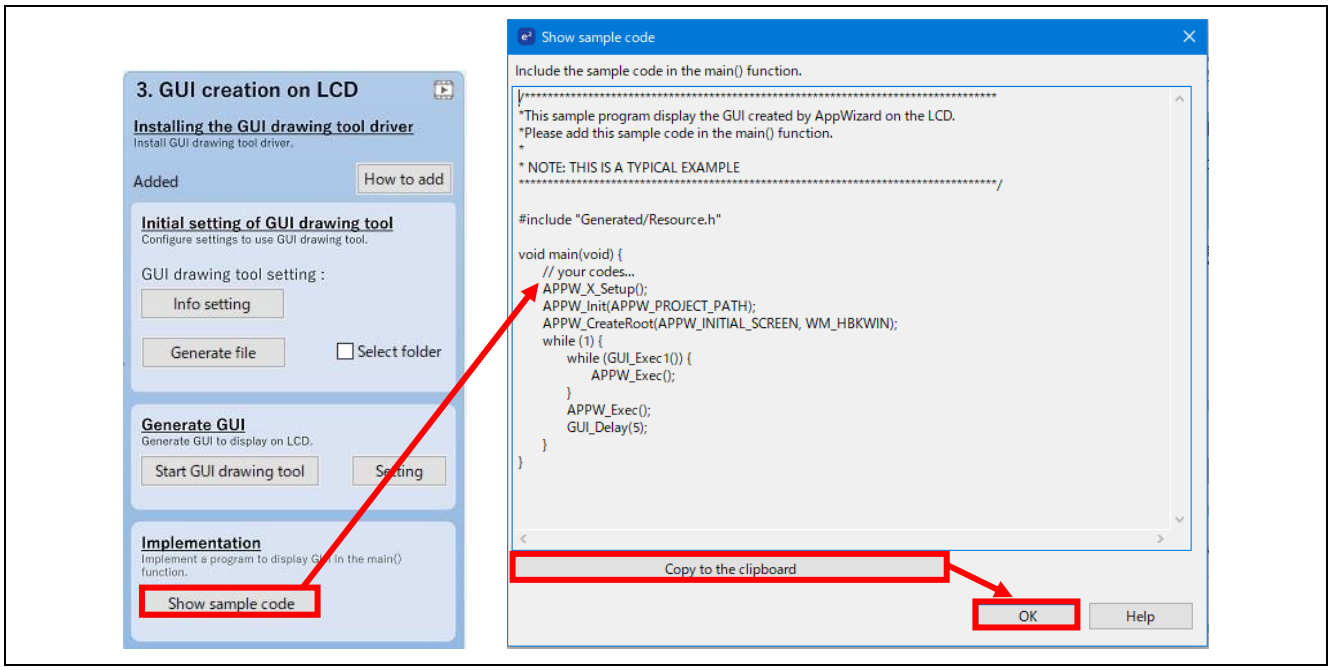
34. Clicking on the “Start play mode” button located at the upper right confirms the operation of the created GUI in the preview. Clicking on the “Esc” button closes the preview.



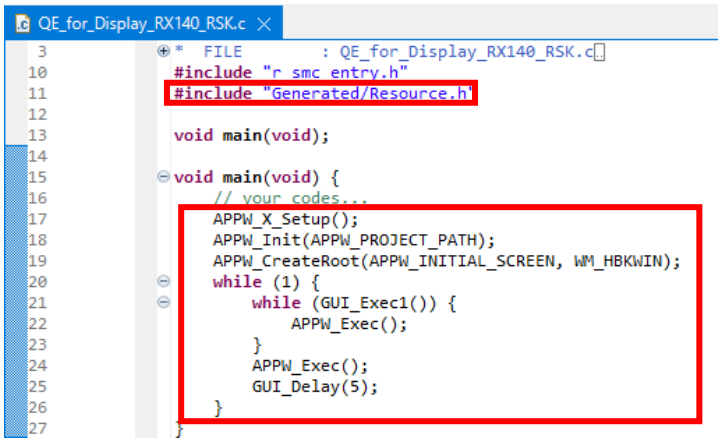
35. Output code from AppWizard.
    Select the “Export & Save” item from the “File” menu of AppWizard.
    Code is output in the “Source” and “Resource” folders under the “aw” project folder of AppWizard. The “Source” and “Resource” folders are automatically specified as the target folders for building.



36. Include code for displaying the created GUI in the main() function.
Click on the “Show sample code” button in the lower part of “3. GUI Creation on LCD” of QE for Display [RX,RA].
After clicking on the “Copy to the clipboard” button in the “Show sample code” dialog box, click on the “OK” button to close it.



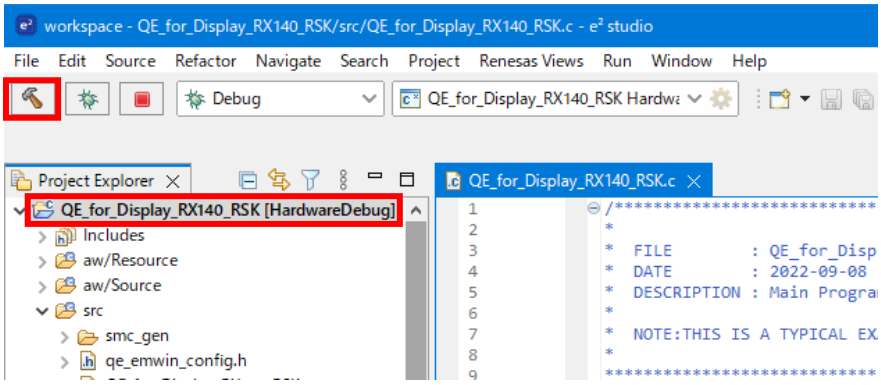
37. Paste the copied code under the user code within the main() function.



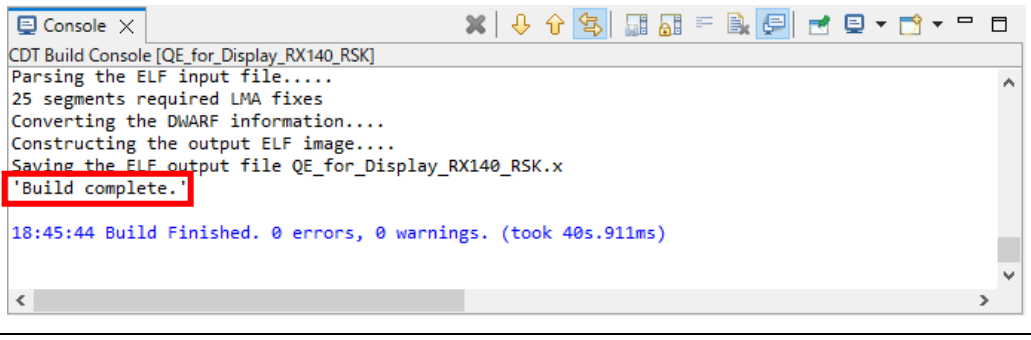
4.5 Building the Project

Build the project and make the load module according to the following procedure.

1. Click on the project you want to build (e.g. QE_for_Display_RX140_RSK HardwareDebug).
2. Click on “Build”.

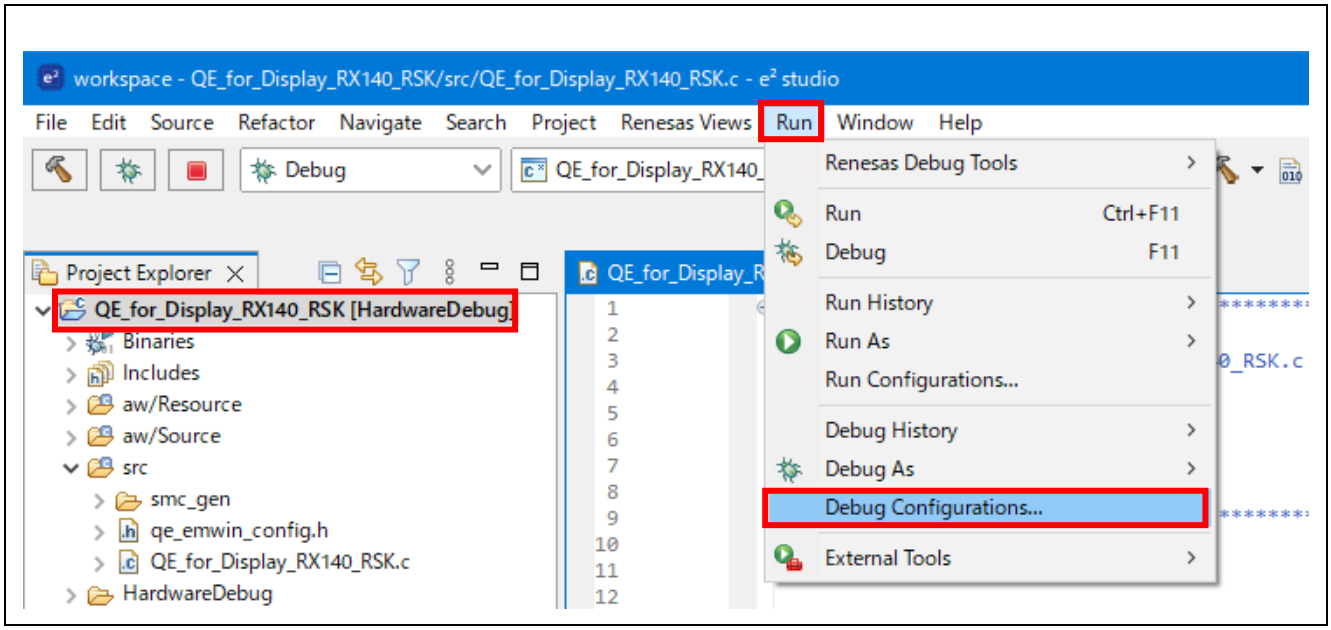


3. When the “Console” panel displays 'Build complete.', the build operation is complete.

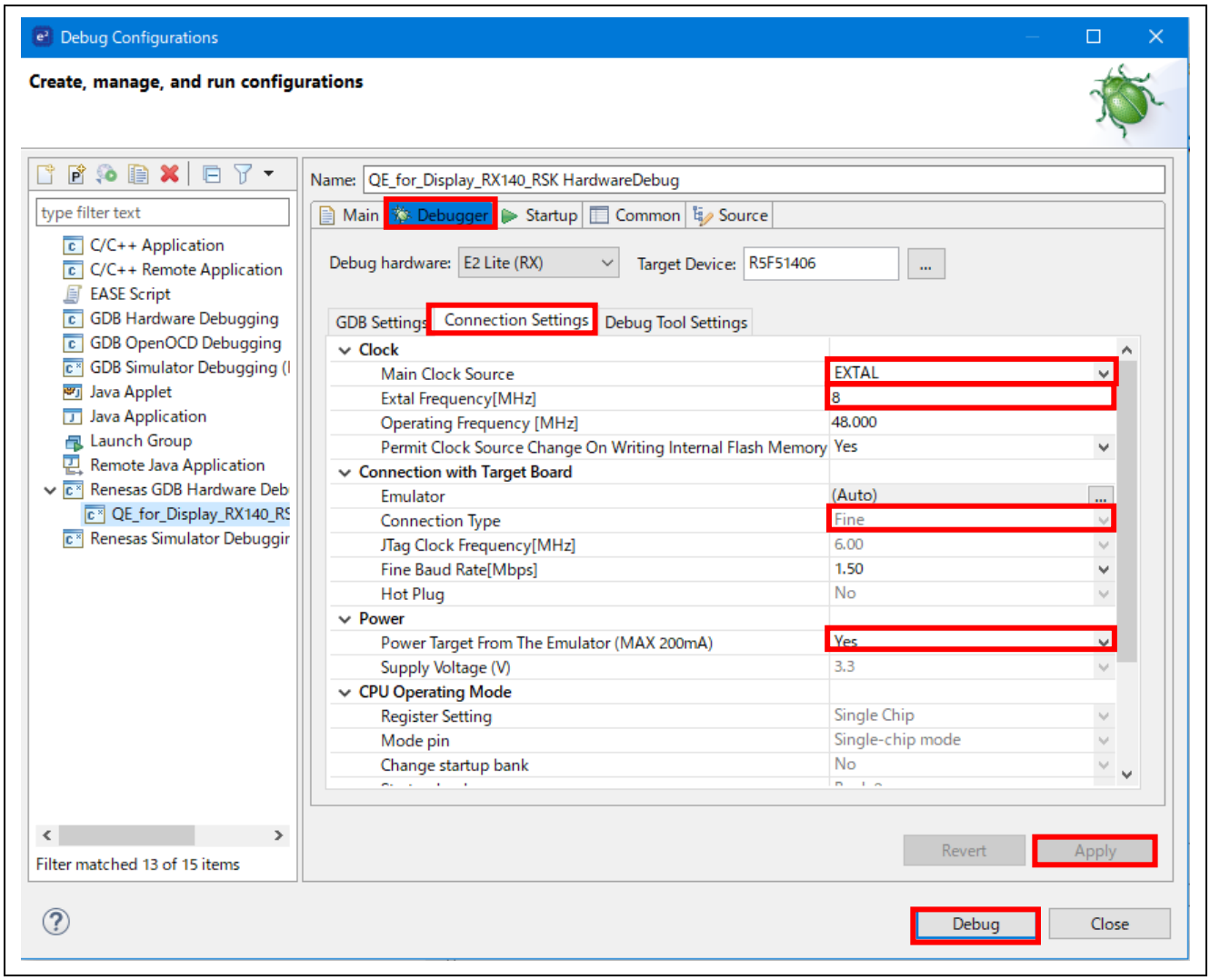


4.6 Connecting a Debugger and Executing the Program

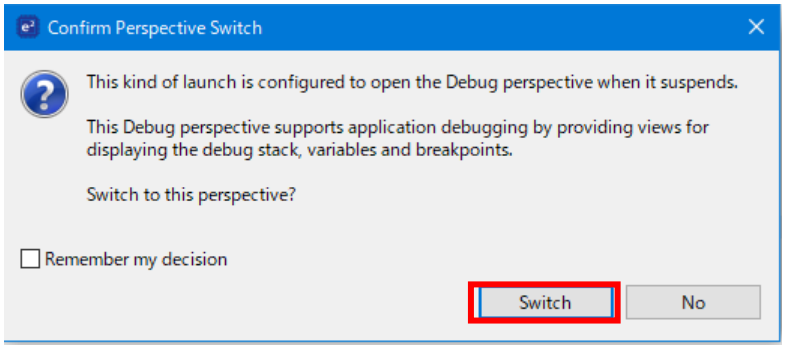
1. Click on the project you want to debug (e.g. QE_for_Display_RX140_RSK HardwareDebug).
2. Click on “Debug Configurations” from the “Run” menu item.



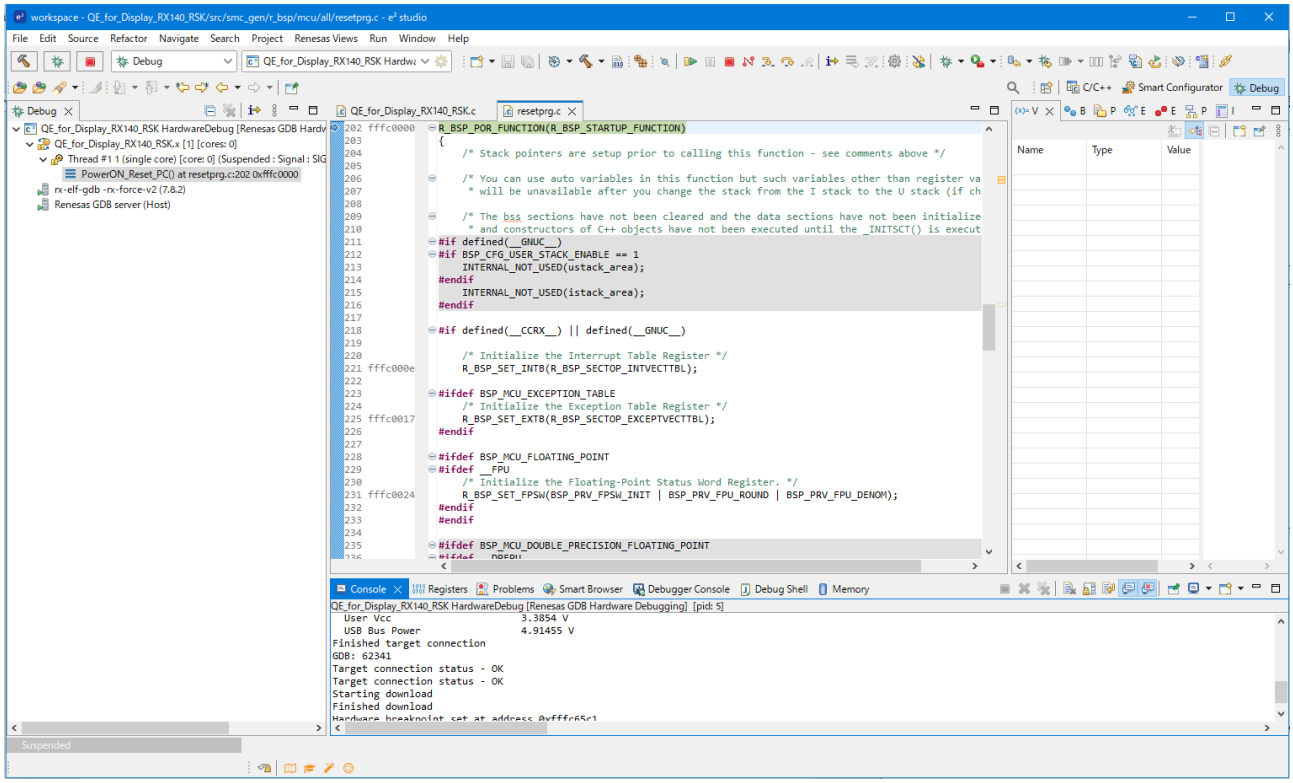
3. Select the “Connection Settings” tab on the “Debugger” tabbed page of the “Debug Configurations” dialog box.
4. Configure the following values according to the target usage environment.
   [Main Clock Source]
   [EXTAL Frequency[MHz]]
   [Connection Type]
   [Power Target From The Emulator (MAX 200mA)]



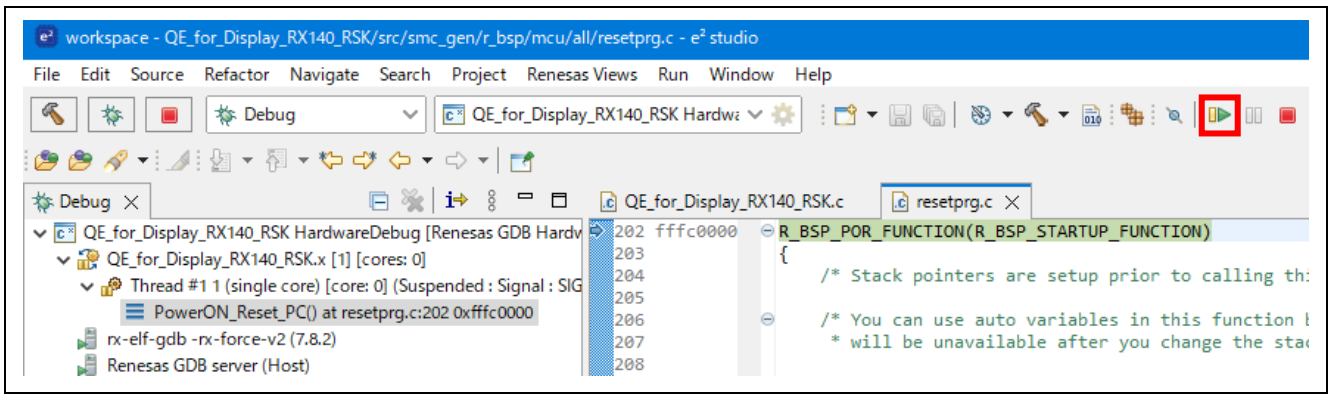
5. When the following message is displayed, click on “Switch”.



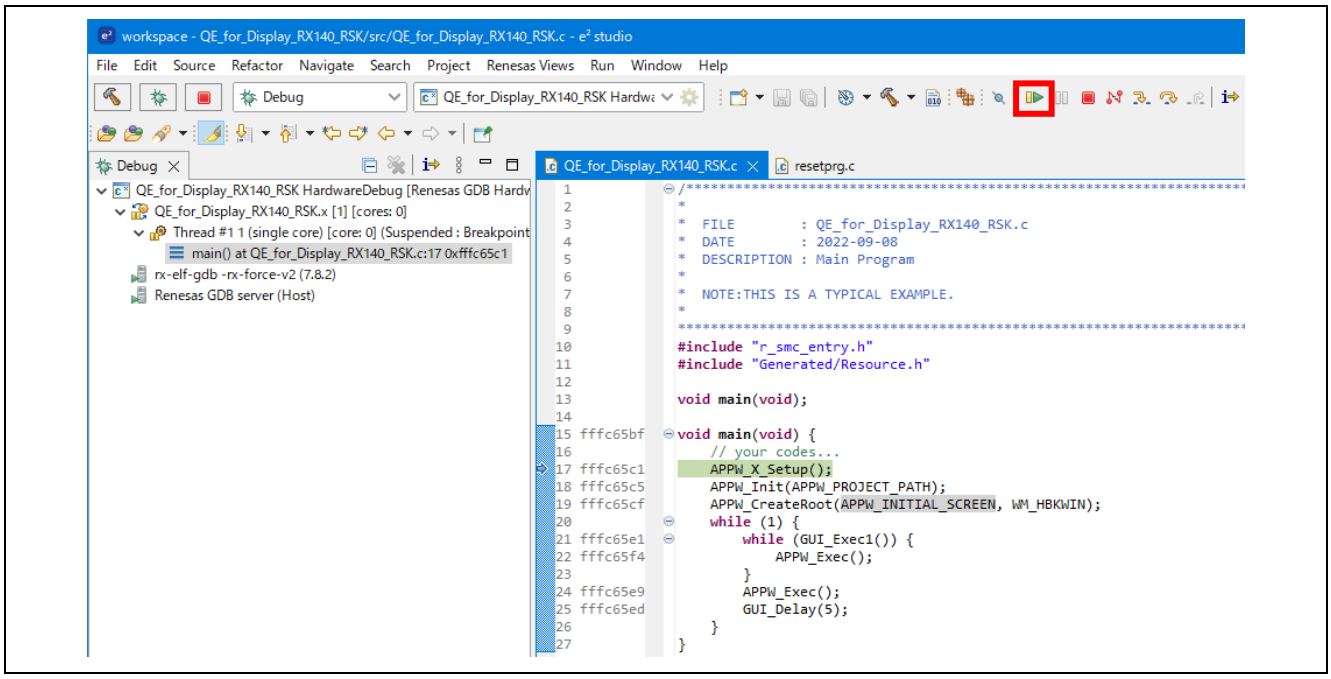
6. When downloading of the load module is completed, the “Debug” perspective opens.



7. Click on “Resume” on the tool bar. The program is executed and breaks at the beginning of the main function.



8. After a break occurs at the beginning of the main function, click on “Resume” again on the toolbar.



9. When the setting of the display device is done correctly, the following screen will be displayed on the LCD panel.

5. Hardware

5.1 Configuration of Hardware

Table 5.1, LCD Panel Used in the Sample shows the LCD panel used in this application note.

Table 5.1 LCD Panel Used in the Sample

Information on the LCD Panel Product
Manufacturer: OKAYA Co. Part number: RH128128T-1X44WN-B2 Display size:128 x 128
Manufacturer: Kuongshun Electronic Co. Part number: MSP2807 Display size:320 x 240 Built-in touch controller

5.2 Pin Functions

Set the pin functions according to the product you are using. Pin functions are automatically set using the Smart Configurator and QE for Display [RX,RA].

Table 5.2 Pins and Functions to be Used (RSK RX130)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PB2	Output	LCD CS pin
	PB1/ SMOSI6	Input/output	LCD data output pin
	PB0/ SMISO6	Input/output	LCD data input pin
	PB3/ SCK6	Input/output	LCD clock pin
	PD0	-	-
	P17	Output	LCD reset pin
	PC2	Output	LCD data / command pin
	PC3	Output	LCD backlight pin

Table 5.3 Pins and Functions to be Used (Target Board RX130)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PA4 / SSLA0	Output	LCD CS pin
	PA6 / MOSIA	Input/output	LCD data output pin
	PA7/ MISOA	Input/output	LCD data input pin
	PA5/ RSPCKA	Input/output	LCD clock pin
	P15	-	-
	P17	Output	LCD reset pin
	PC3	Output	LCD data / command pin
	PC2	Output	LCD backlight pin
	P27 / SCK1	Input/output	LCD touch function clock pin
	PJ3	Output	LCD touch IC CS pin
	P26 / TXD1	Output	LCD touch function data input pin
	P30 / RXD1	Input	LCD touch function data output pin

Table 5.4 Pins and Functions to be Used (RSK RX140)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PB2	Output	LCD CS pin
	PB1/ SMOSI6	Input/output	LCD data output pin
	PB0/ SMISO6	Input/output	LCD data input pin
	PB3/ SCK6	Input/output	LCD clock pin
	P31	-	-
	PE4	Output	LCD reset pin
	PC7	Output	LCD data / command pin
	PC6	Output	LCD backlight pin

Table 5.5 Pins and Functions to be Used (RSK RX231)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	P33	Output	LCD CS pin
	PC7/ SMOSI8	Input/output	LCD data output pin
	PC6/ SMISO8	Input/output	LCD data input pin
	PC5/ SCK8	Input/output	LCD clock pin
	PE6	-	-
	PE7	Output	LCD reset pin
	PE3	Output	LCD data / command pin
	PE4	Output	LCD backlight pin

Table 5.6 Pins and Functions to be Used (Target Board RX231)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PA4 / SSLA0	Output	LCD CS pin
	PA6 / MOSIA	Input/output	LCD data output pin
	PA7/ MISOA	Input/output	LCD data input pin
	PA5/ RSPCKA	Input/output	LCD clock pin
	P15	-	-
	P17	Output	LCD reset pin
	PC3	Output	LCD data / command pin
	PC2	Output	LCD backlight pin
	P22 / SCK0	Input/output	LCD touch function clock pin
	P05	Output	LCD touch IC CS pin
	P20 / TXD0	Output	LCD touch function data input pin
	P21 / RXD0	Input	LCD touch function data output pin

Table 5.7 Pins and Functions to be Used (RSSK RX23W)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PE3	Output	LCD CS pin
	PE1/ SMOSI12	Input/output	LCD data output pin
	PE2/ SMISO12	Input/output	LCD data input pin
	PE0/ SCK12	Input/output	LCD clock pin
	PB1	-	-
	PB3	Output	LCD reset pin
	P03	Output	LCD data / command pin
	PJ3	Output	LCD backlight pin

Table 5.8 Pins and Functions to be Used (Target Board RX23W)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	P31	Output	LCD CS pin
	P26 / SMOSI1	Input/output	LCD data output pin
	P30/ SMISO1	Input/output	LCD data input pin
	P27/ SCK1	Input/output	LCD clock pin
	PB1	-	-
	PD3	Output	LCD reset pin
	P05	Output	LCD data / command pin
	PB7	Output	LCD backlight pin
	PC4 / SCK5	Input/output	LCD touch function clock pin
	P41	Output	LCD touch IC CS pin
	PC3 / TXD5	Output	LCD touch function data input pin
	PC2 / RXD5	Input	LCD touch function data output pin

Table 5.9 Pins and Functions to be Used (Target Board RX23W module)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	P31	Output	LCD CS pin
	P26 / SMOSI1	Input/output	LCD data output pin
	P30/ SMISO1	Input/output	LCD data input pin
	P27/ SCK1	Input/output	LCD clock pin
	PB1	-	-
	PD3	Output	LCD reset pin
	PC3	Output	LCD data / command pin
	PC2	Output	LCD backlight pin
	PE0 / SCK12	Input/output	LCD touch function clock pin
	P05	Output	LCD touch IC CS pin
	PE1 / TXD12	Output	LCD touch function data input pin
	PE2 / RXD12	Input	LCD touch function data output pin

Table 5.10 Pins and Functions to be Used (RSK RX64M)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	P45	Output	LCD CS pin
	P00/ SMOSI6	Input/output	LCD data output pin
	P01/ SMISO6	Input/output	LCD data input pin
	P02/ SCK6	Input/output	LCD clock pin
	P20	-	-
	P21	Output	LCD reset pin
	P46	Output	LCD data / command pin
	P47	Output	LCD backlight pin

Table 5.11 Pins and Functions to be Used (Target Board RX65N)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PA4 / SSLA0-B	Output	LCD CS pin
	PA6 / MOSIA-B	Input/output	LCD data output pin
	PA7/ MISOA-B	Input/output	LCD data input pin
	PA5/ RSPCKA-B	Input/output	LCD clock pin
	P15	-	-
	P17	Output	LCD reset pin
	PC3	Output	LCD data / command pin
	PC2	Output	LCD backlight pin
	PE5 / RSPCKB-B	Input/output	LCD touch function clock pin
	P05	Output	LCD touch IC CS pin
	PE6 / MOSIB-B	Input/output	LCD touch function data input pin
	PE7 / MISOB-B	Input/output	LCD touch function data output pin

Table 5.12 Pins and Functions to be Used (RSK RX660)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PJ3	Output	LCD CS pin
	P00/ SMOSI6	Input/output	LCD data output pin
	P01/ SMISO6	Input/output	LCD data input pin
	P02/ SCK6	Input/output	LCD clock pin
	P56	-	-
	PL0	Output	LCD reset pin
	P71	Output	LCD data / command pin
	P72	Output	LCD backlight pin

Table 5.13 Pins and Functions to be Used (Target Board RX660)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PC0	Output	LCD CS pin
	PC3 / SMOSI5	Input/output	LCD data output pin
	PC2 / SMISO5	Input/output	LCD data input pin
	PC1 / SCK5	Input/output	LCD clock pin
	PB0	-	-
	PB1	Output	LCD reset pin
	PB7	Output	LCD data / command pin
	PB6	Output	LCD backlight pin
	P34 / SCK0	Input/output	LCD touch function clock pin
	P06	Output	LCD touch IC CS pin
	P32 / TXD0	Output	LCD touch function data input pin
	P33 / RXD0	Input	LCD touch function data output pin

Table 5.14 Pins and Functions to be Used (RSK RX671)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PJ3	Output	LCD CS pin
	P00/ SMOSI6	Input/output	LCD data output pin
	P01/ SMISO6	Input/output	LCD data input pin
	P02/ SCK6	Input/output	LCD clock pin
	P56	-	-
	P74	Output	LCD reset pin
	P71	Output	LCD data / command pin
	P72	Output	LCD backlight pin

Table 5.15 Pins and Functions to be Used (Target Board RX671)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	PC0	Output	LCD CS pin
	PC3 / SMOSI5	Input/output	LCD data output pin
	PC2 / SMISO5	Input/output	LCD data input pin
	PC1 / SCK5	Input/output	LCD clock pin
	PB0	-	-
	PB1	Output	LCD reset pin
	PB7	Output	LCD data / command pin
	PB6	Output	LCD backlight pin
	P22 / SCK0	Input/output	LCD touch function clock pin
	P05	Output	LCD touch IC CS pin
	P20 / TXD0	Output	LCD touch function data input pin
	P21 / RXD0	Input	LCD touch function data output pin

Table 5.16 Pins and Functions to be Used (RSK RX71M)

Connected Device	Pin Name	Input/Output	Description
RH128128T-1X44WN-B2	P45	Output	LCD CS pin
	P00/ SMOSI6	Input/output	LCD data output pin
	P01/ SMISO6	Input/output	LCD data input pin
	P02/ SCK6	Input/output	LCD clock pin
	P20	-	-
	P21	Output	LCD reset pin
	P46	Output	LCD data / command pin
	P47	Output	LCD backlight pin

5.3 LCD Connections

Board and LCD connections are listed below.

・RH128128T-1X44WN-B2 (manufactured by OKAYA)
The default setting when using an RSK board is the RH128128T-1X44WN-B2 LCD.
This LCD is equipped with a Pmod connector and should be connected to the board's Pmod1 pin (Pmod2 for RSSK RX23W).

・MSP2807 (manufactured by Kuongshun Electronic)
The default setting when using a Target Board is the MSP2807 LCD.
Connect the LCD using the pins as indicated below.

Table 5.17 LCD Connection Pins

MSP2807	Board Pin
VCC	Pmod1-6
GND	Pmod1-11
CS	Pmod1-1
RESET	Pmod1-8
DC/RS	Pmod1-9
SDI(MOSI)	Pmod1-2
SCK	Pmod1-4
LED	Pmod1-10
SDO(MISO)	Pmod1-3

Table 5.18 Touch Function Connection Pins (Target Board RX130)

MSP2807	MCU Pin (Port)
T_CLK	21 (P27)
T_CS	4 (PJ3)
T_DIN	22 (P26)
T_DO	20 (P30)
T_IRQ	-

Table 5.19 Touch Function Connection Pins (Target Board RX231)

MSP2807	MCU Pin (Port)
T_CLK	26 (P22)
T_CS	100 (P05)
T_DIN	28 (P20)
T_DO	27 (P21)
T_IRQ	-

Table 5.20 Touch Function Connection Pins (Target Board RX23W)

MSP2807	MCU Pin (Port)
T_CLK	26 (PC4)
T_CS	51 (P41)
T_DIN	27 (PC3)
T_DO	29 (PC2)
T_IRQ	-

Table 5.21 Touch Function Connection Pins (Target Board RX23W module)

MSP2807	MCU Pin (Port)
T_CLK	22 (PE0)
T_CS	64 (P05)
T_DIN	21 (PE1)
T_DO	56 (PE2)
T_IRQ	-

Table 5.22 Touch Function Connection Pins (Target Board RX65N)

MSP2807	MCU Pin (Port)
T_CLK	73 (PE5)
T_CS	100 (P05)
T_DIN	72 (PE6)
T_DO	71 (PE7)
T_IRQ	-

Table 5.23 Touch Function Connection Pin (Target Board RX660)

MSP2807	MCU Pin (Port)
T_CLK	16 (P34)
T_CS	1 (P06)
T_DIN	18 (P32)
T_DO	17 (P33)
T_IRQ	-

Table 5.24 Touch Function Connection Pins (Target Board RX671)

MSP2807	MCU Pin (Port)
T_CLK	26 (P22)
T_CS	100 (P05)
T_DIN	28 (P20)
T_DO	27 (P21)
T_IRQ	-

6. Details of Settings

This chapter gives supplementary explanations and notes for each of the procedures described in section 1.1, System Development Flow Using QE for Display [RX,RA], System Development Flow Using QE for Display [RX,RA].

6.1 From Execution to the End of Adjustment

After the program has been created, start the debugger and execute the program. If the initial screen is not correctly displayed, the settings are not correct. Check the values adjusted by QE for Display [RX,RA] and the settings of parameters of the r_sci_rx FIT module.

6.2 Usage Note Regarding Image Drawing Speed

This chapter describes points for caution on the image drawing speed.

6.2.1 Usage Notes for Using JPEG Images with AppWizard

Since there is no JPEG decoder in the hardware for the RX family, the drawing speed will be slow when JPEG images are used. Therefore, the use of JPEG images is not recommended. However, JPEG images can be converted to the bitmap format and used without slowing down the drawing speed. This can also be a way of saving memory.

To convert the JPEG format to the bitmap format, expand “Set bitmap” in “Properties” and select any image in a JPEG format. AppWizard will automatically convert the image from JPEG to the bitmap format.

If the JPEG image is not displayed on the LCD, this can be resolved by adjusting the stack size or heap size.

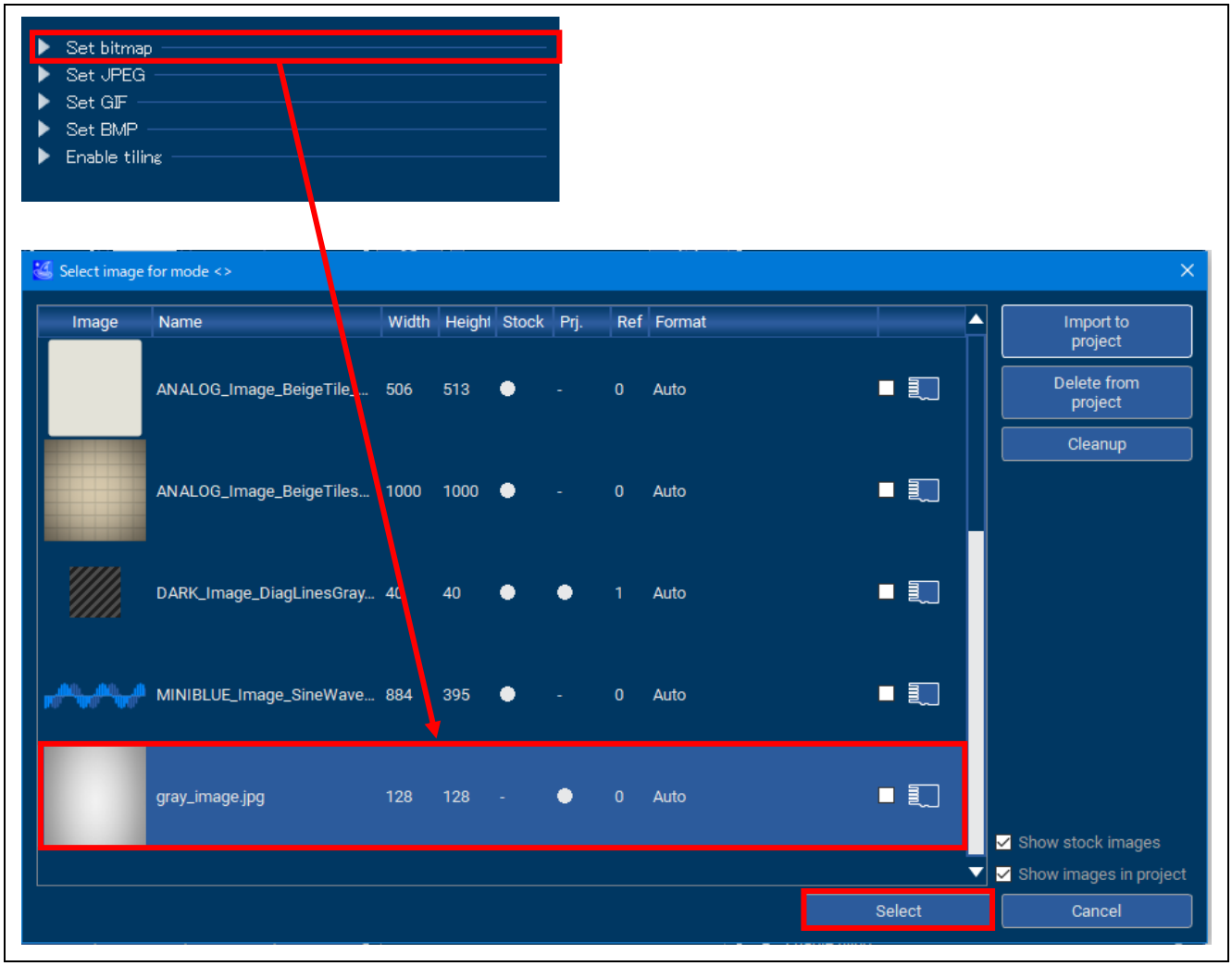


Figure 6.1 Expanding “Set bitmap” and Selecting a JPEG Image

6.3 Usage Note regarding the use of QE for Display[RX,RA] V3.1.0

This chapter describes points for caution on the use of QE for Display[RX,RA] V3.1.0.

6.3.1 Usage Notes for Using the "Kuongshun Electronic - MSP2807" LCD with Specific Evaluation Boards

When selecting the specific board in the [Target Board:] field during project creation and selecting the "Kuongshun Electronic -MSP2807" LCD in the [LCD Main RX,RA (QE)] view, the incorrect display size is set in the [emWin setting] dialog.

Correct: 240 (Width) × 320 (Height)

Incorrect: 280 (Width) × 320 (Height)

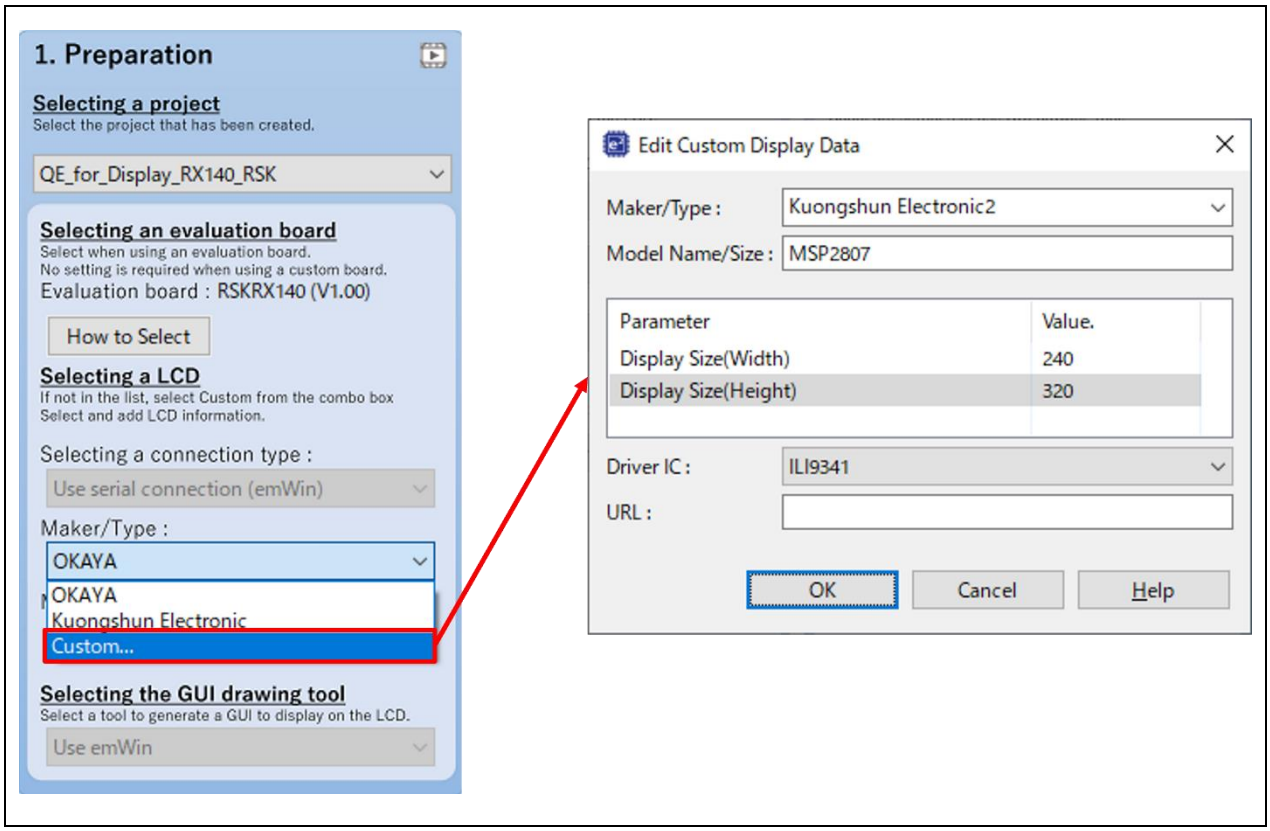
The specific boards are as follows

1. Renesas Starter Kit / Renesas Solution Starter Kit listed in the “Chapter 2 Operating Environment”
2. Evaluation Boards not listed in the “Chapter 2 Operating Environment”
3. No evaluation board

Select “Custom...” in the [Maker / Type:] combo box and create a "Kuongshun Electronic -MSP2807" LCD as a custom display.

Set the following values for LCD information.

1. Display Size (Width): 240
2. Display Size (Height): 320
3. Driver IC: ILI9341



Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Oct.3.22	-	First edition issued.
1.10	Oct.31.22	Page 69	Added usage note.

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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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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