Renesas Synergy™ Platform

GUIX "Hello World" for SK-S7G2 and PK-S5D9

Introduction

This application note guides you through the process of creating a simple two screen GUI using GUIX Studio™ for the SK-S7G2 and PK-S5D9 kits for the Synergy MCU family. This application project demonstrates how you can create and configure a new application using the Renesas Synergy™ Software Package (SSP).

The Synergy Software Package includes Express Logic’s ThreadX® real-time operating system (RTOS), the X-Ware™ suite of stacks (NetX™, USBX™, GUIX™, and FileX®), and a set of hardware drivers unified under a single robust framework. This powerful suite of tools provides a comprehensive integrated framework for rapid development of complex embedded applications.

The Hello World application was developed within e^2 studio using the Renesas Synergy™ Platform.

Target Device

- SK-S7G2 Starter Kit for Synergy MCUs v3.1
- PK-S5D9 Evaluation Kit Synergy MCUs v1.0

Minimum PC

- Microsoft® Windows® 7
- Intel® Core™ family processor running at 2.0 GHz or higher (or equivalent processor)
- 8-GB memory
- 250-GB hard disk or SSD
- USB 2.0
- Internet connection.

Installed Software

- Synergy™ e^2 studio Integrated Solution Development Environment (ISDE) Version 2021 (21.7.0) or later
- Synergy™ Software Package (SSP) v2.2.0 or later
- GUIX Studio v6.1.8 or later

Note: If you do not have one of these software applications, you should install it before continuing. You can download the required software from the Renesas Synergy™ Gallery at: www.renesas.com/synergy/software

Source Files Provided

- `guiapp_event_handlers.c`
- `main_thread_entry.c`
- `lcd_setup.c`
- `lcd.h`

Note: You can use the Source_SK or Source_PK files, depending on your project.

Purpose

This guide takes you through the setup of a GUIX touch screen interface Hello World application in e^2 studio, where you configure hardware functions (LCD, SPI, and I^{2}C interface), threads, as well as message passing, interrupts, the LCD driver, and the touchscreen. It covers initial project setup in e^2 studio, along with basic debugging operations. It also instructs you in creating a simple GUI interface using the GUIX Studio editor. Once the application is running, it responds to touchscreen actions using the Touch Panel V2 Framework on sf_touch_panel_v2 framework, presenting a basic graphical user interface (GUI).

Intended Audience

The intended audience are developers designing GUI applications

Contents

1. Overview

This application note shows how to set up a project and develop a simple GUI-based application using GUIX Studio.

2. Importing the project into e^2 studio

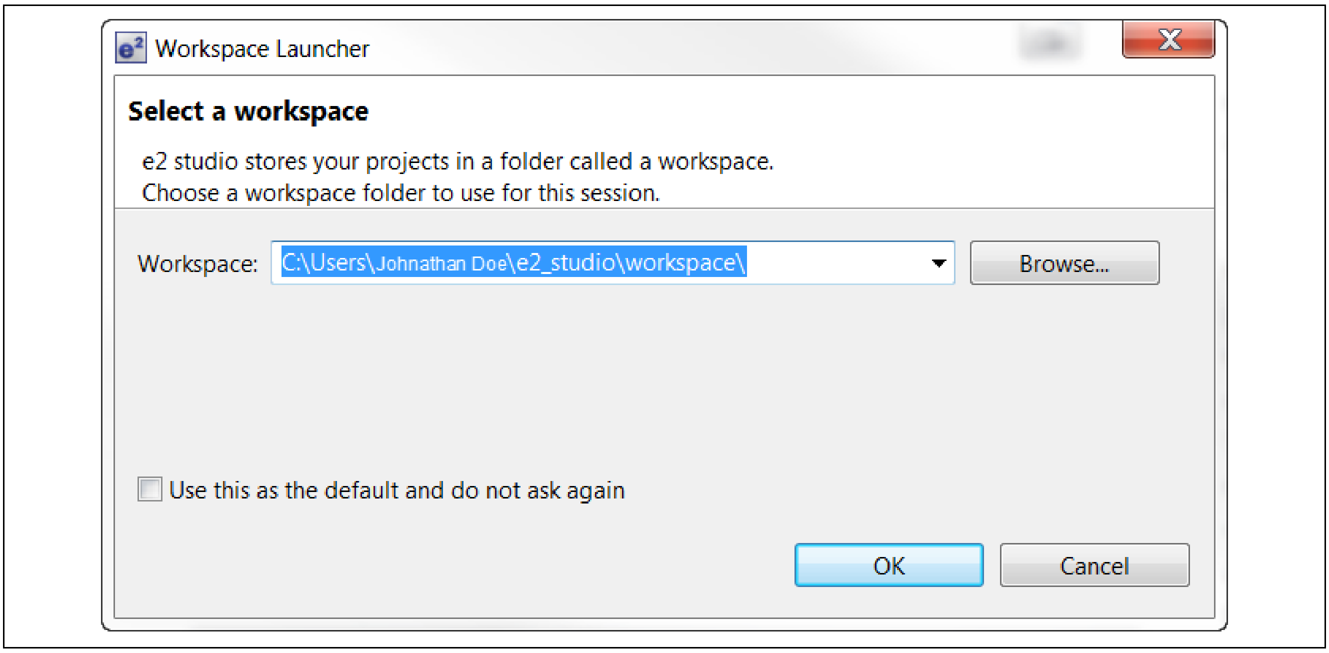
Note: This step is included to give you the ability to skip the development steps and start at the point of verifying a working project on the SK-S7G2 Synergy MCU Group or the PK-S5D9 Synergy MCU Group. You can skip this step and proceed to section 3 to create a project in e^2 studio. If you do import the project, skip to section 7,Running the application.

To skip the development walkthrough in this document and open a completed project in e^2 studio, see *Renesas Synergy™ Project Import Guide* (REN_r11an0023eu0121-synergy-ssp-import-guide_APN_20181022.pdf) in this package. It contains instructions on importing the project into e^2 studio and building the project. The included `GUIX_Hello_World_SK-S7G2.zip` and `GUIX_Hello_World_PK-S5D9.zip` files contain the completed project.

3. Creating the project in e^2 studio

Start by creating a new project in e^2 studio.

1. Open e^2 studio by clicking the e^2 studio icon in the **Windows Start Menu > All Programs > Renesas Electronics e^2 studio** folder.
2. If the **Workspace Launcher** dialog box appears, click **OK** to use the default workspace.



Workspace Launcher

Select a workspace

e2 studio stores your projects in a folder called a workspace.
Choose a workspace folder to use for this session.

Workspace: C:\Users\Johnathan Doe\e2_studio\workspace\

□ Use this as the default and do not ask again

Figure 1. Workspace Launcher Dialog

3. Create a new workspace:
   From the **File** drop-down menu, select **Switch Workspace** > **Other**…
4. Append a workspace name:
   In the **Workspace Launcher** window, add text to the end of the workspace name to make it unique, such as **GUI_APP**. If you installed at the default location, the new workspace name will be **C:\Users\[User name]\e2_studio\workspace\GUI_APP**.
5. Click **OK** to create the new workspace.

6. Proceed past the **Welcome** screen by closing the **Welcome** tab.

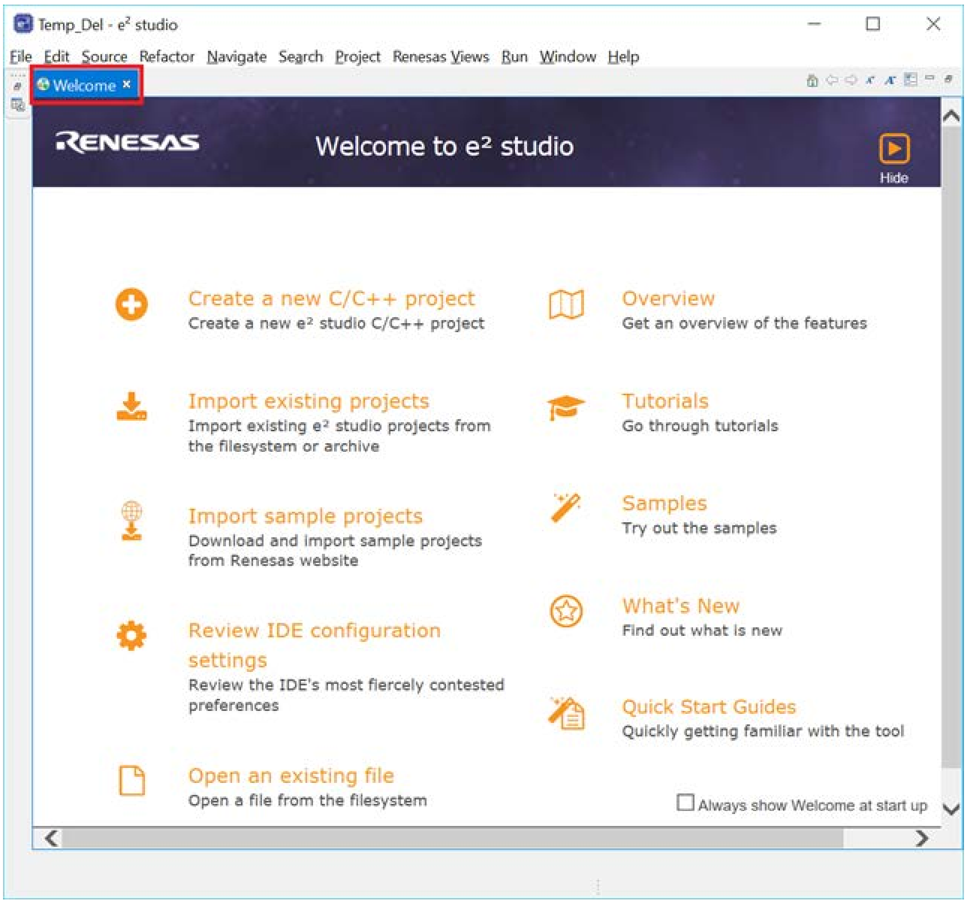

Temp_Del - e² studio
File Edit Source Refactor Navigate Search Project Renesas Views Run Window Help
Welcome ×
RENESAS
Welcome to e² studio
Hide
Create a new C/C++ project
Create a new e² studio C/C++ project
Import existing projects
Import existing e² studio projects from the filesystem or archive
Import sample projects
Download and import sample projects from Renesas website
Review IDE configuration settings
Review the IDE's most fiercely contested preferences
Open an existing file
Open a file from the filesystem
Overview
Get an overview of the features
Tutorials
Go through tutorials
Samples
Try out the samples
What's New
Find out what is new
Quick Start Guides
Quickly getting familiar with the tool
□ Always show Welcome at start up

Figure 2. Close the Welcome Window by clicking in the Workbench Area

7. Start a new project by clicking the drop-down menu ▾ next to the **New** icon in the Tool Bar.

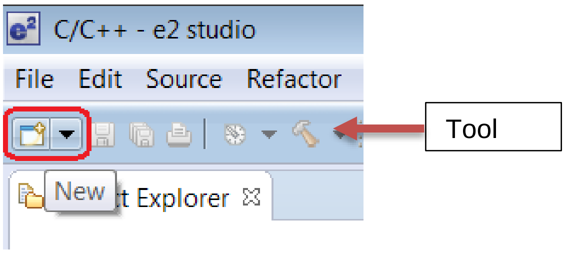


Figure 3. Start a New Project

8. Select **Synergy C/C++ Project** from the menu.

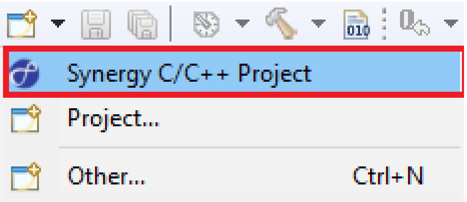
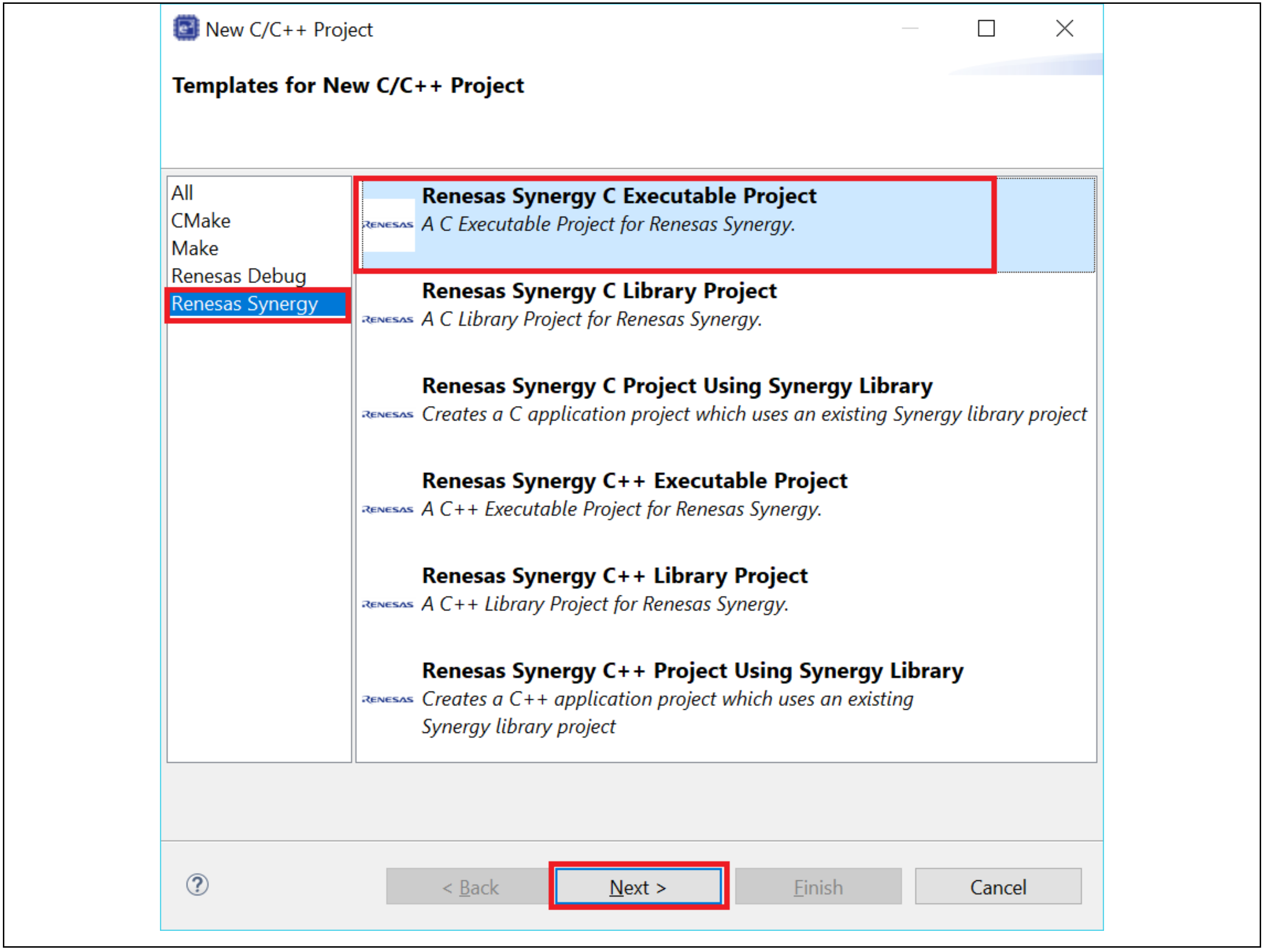


Figure 4. Select Synergy C/C++ Project in the drop-down menu

9. Select **Renesas Synergy C Executable Project**.



New C/C++ Project

Templates for New C/C++ Project

- All
- CMake
- Make
- Renesas Debug
- Renesas Synergy

Renesas Synergy C Executable Project
A C Executable Project for Renesas Synergy.

Renesas Synergy C Library Project
A C Library Project for Renesas Synergy.

Renesas Synergy C Project Using Synergy Library
Creates a C application project which uses an existing Synergy library project

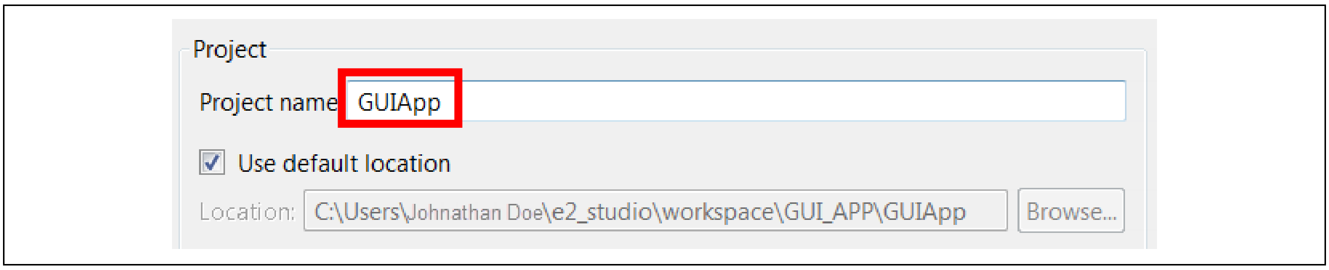
Renesas Synergy C++ Executable Project
A C++ Executable Project for Renesas Synergy.

Renesas Synergy C++ Library Project
A C++ Library Project for Renesas Synergy.

Renesas Synergy C++ Project Using Synergy Library
Creates a C++ application project which uses an existing Synergy library project

Figure 5. Project type selection

10. Enter a name for the project in the **Project name** text field. For example, **GUIApp**.



Project

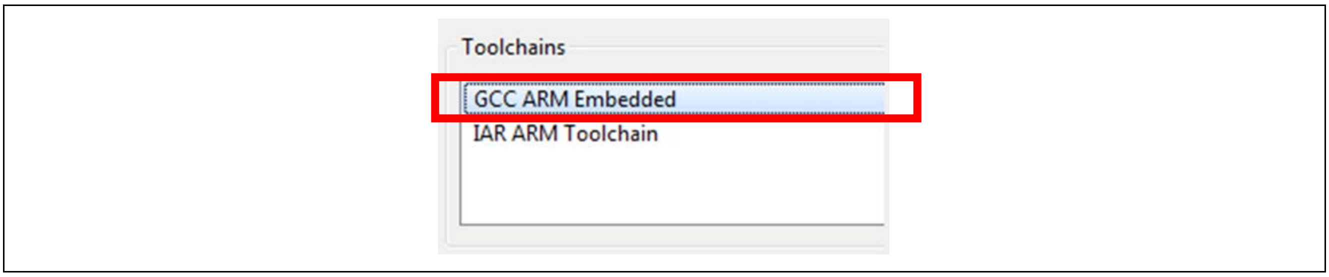
Project name GUIApp

☑ Use default location

Location: C:\Users\Johnathan Doe\e2_studio\workspace\GUI_APP\GUIApp

Figure 6. Enter a project name

11. On the top right of this page, verify that the **Toolchains** option is set to **GCC ARM Embedded**.



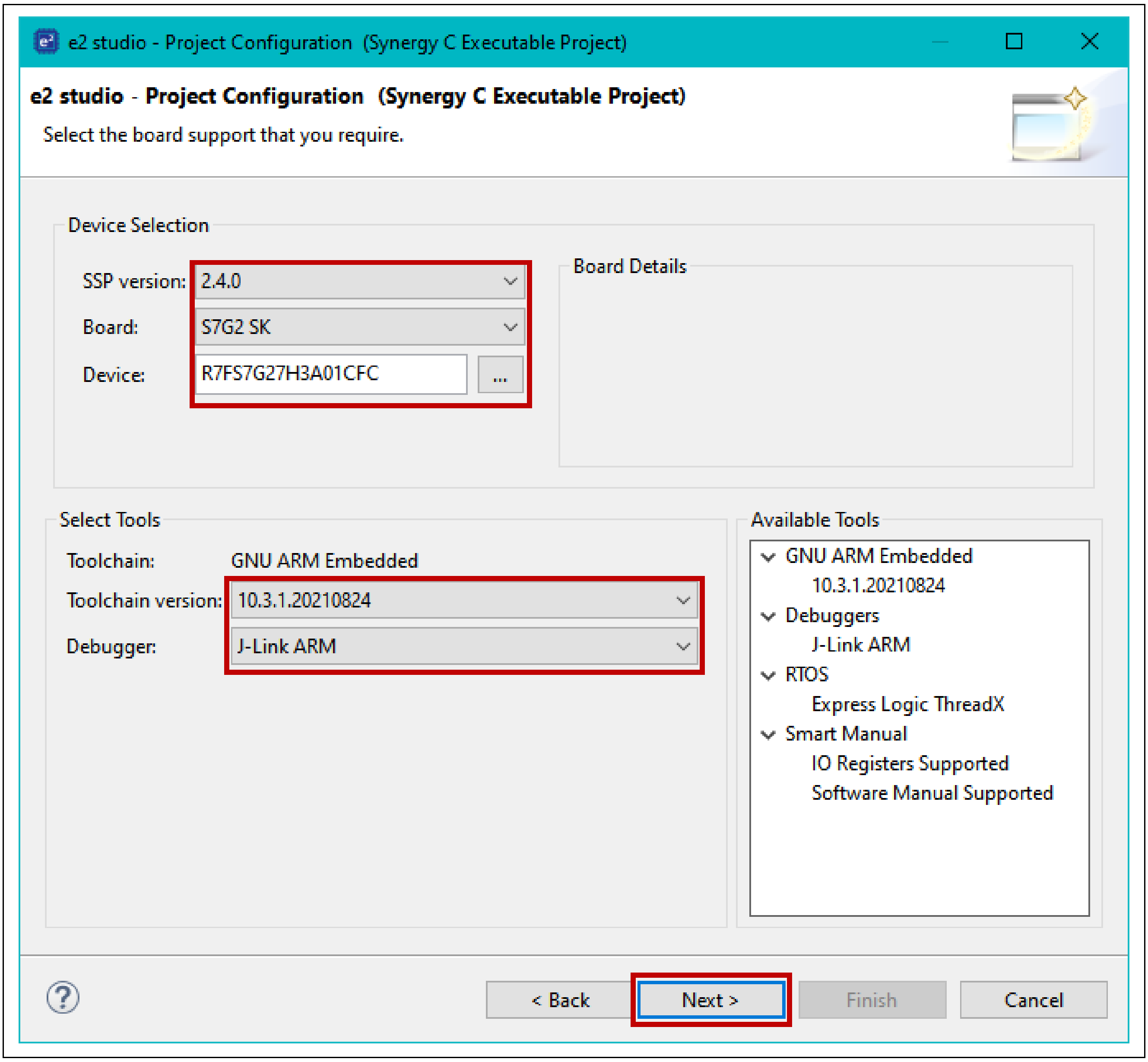
Toolchains

GCC ARM Embedded
IAR ARM Toolchain

Figure 7. Verify GCC ARM Embedded Toolchain

12. Click the **Next** button to continue.
13. Under **Device Selection** (top left), select **SSP version** as v2.1.0 (or later).

14. For **Board** field, select **S7G2 SK**. The **Device** field updates automatically.



e2 studio - Project Configuration (Synergy C Executable Project)

e2 studio - Project Configuration (Synergy C Executable Project)

Select the board support that you require.

Device Selection

SSP version: 2.4.0

Board: S7G2 SK

Device: R7FS7G27H3A01CFC

Board Details

Select Tools

Toolchain: GNU ARM Embedded

Toolchain version: 10.3.1.20210824

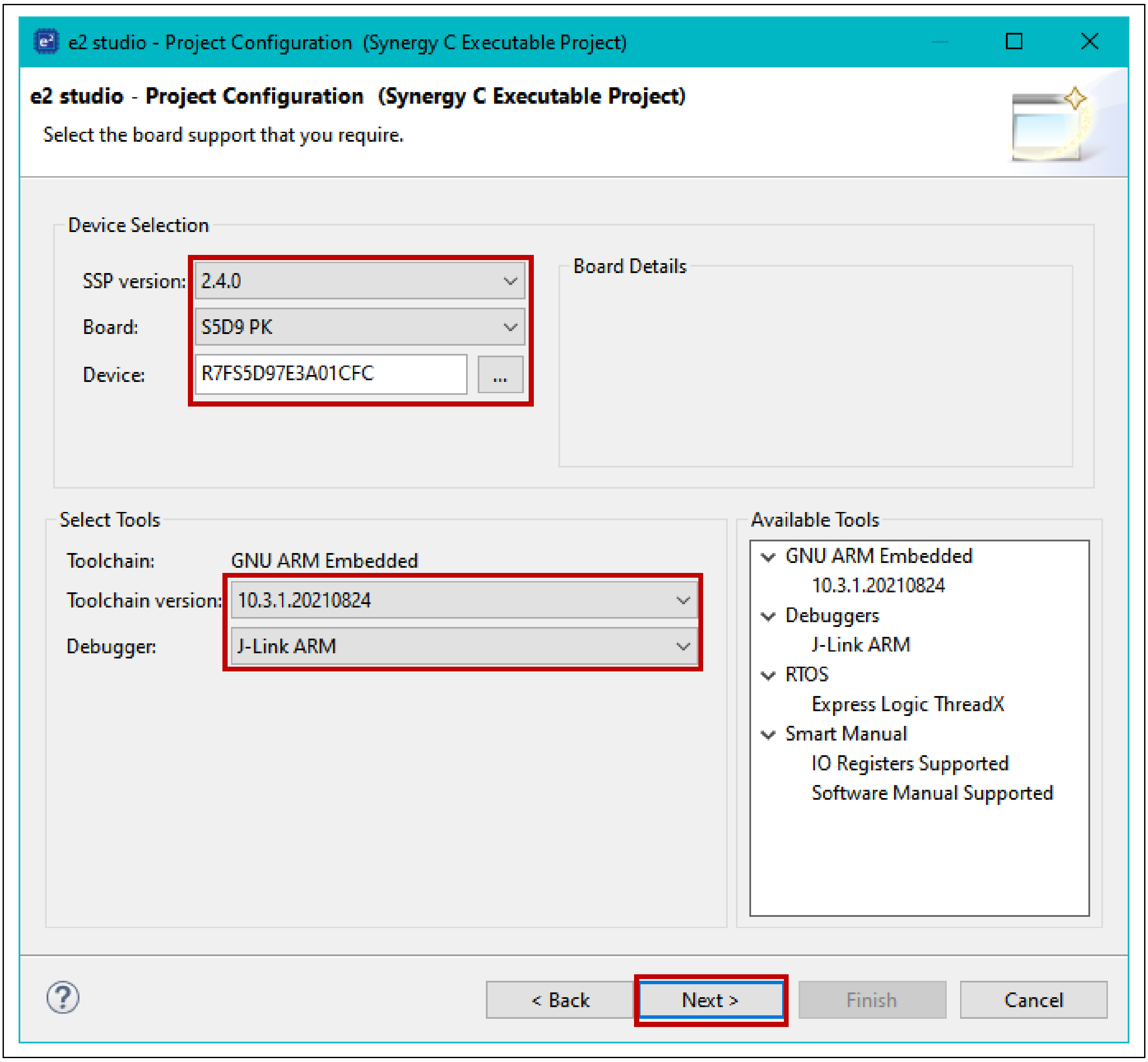
Debugger: J-Link ARM

Available Tools

- GNU ARM Embedded
  - 10.3.1.20210824
- Debuggers
  - J-Link ARM
- RTOS
  - Express Logic ThreadX
- Smart Manual
  - IO Registers Supported
  - Software Manual Supported

Figure 8. SK-S7G2 Device Selection

15. For the **Board** field, select **S5D9 PK** if using PK-S5D9 board. The **Device** field updates automatically.



e2 studio - Project Configuration (Synergy C Executable Project)

e2 studio - Project Configuration (Synergy C Executable Project)

Select the board support that you require.

Device Selection

SSP version: 2.4.0

Board: S5D9 PK

Device: R7FS5D97E3A01CFC

Board Details

Select Tools

Toolchain: GNU ARM Embedded

Toolchain version: 10.3.1.20210824

Debugger: J-Link ARM

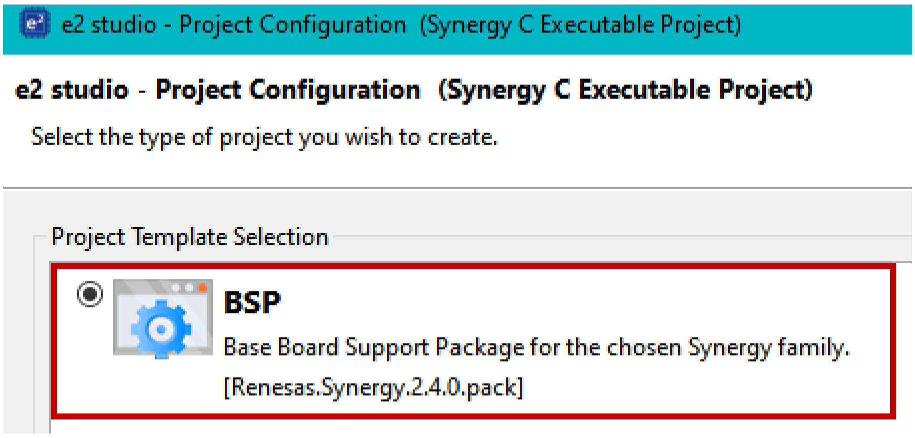
Available Tools

- GNU ARM Embedded
  - 10.3.1.20210824
- Debuggers
  - J-Link ARM
- RTOS
  - Express Logic ThreadX
- Smart Manual
  - IO Registers Supported
  - Software Manual Supported

Figure 9. PK-S5D9 Device selection

16. Click the **Next button** to continue.

17. In the **Project Configuration** dialog, select the option **BSP**.



e2 studio - Project Configuration (Synergy C Executable Project)

e2 studio - Project Configuration (Synergy C Executable Project)

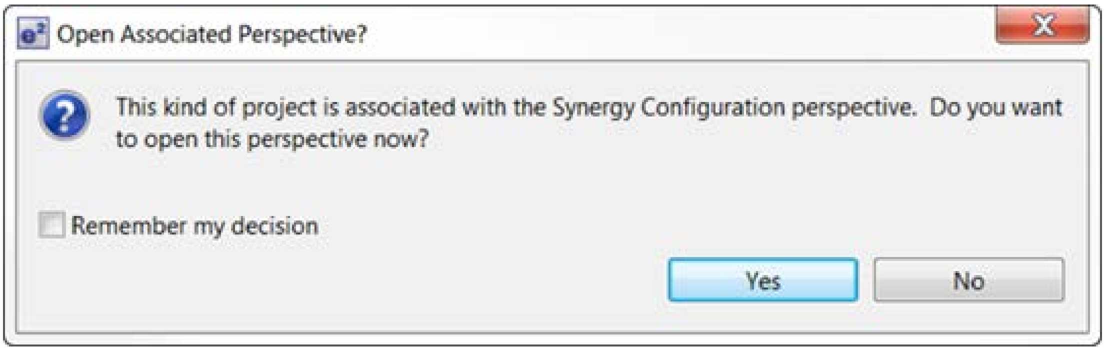
Select the type of project you wish to create.

Project Template Selection

● **BSP**
Base Board Support Package for the chosen Synergy family.
[Renesas.Synergy.2.4.0.pack]

Figure 10. Select BSP

18. Click the **Finish** button.
19. If you have not directed e^2 studio to remember your perspectives, e^2 studio displays the **Open Associated Perspective?** Dialog box. If opened, click **Yes** to acknowledge and close.



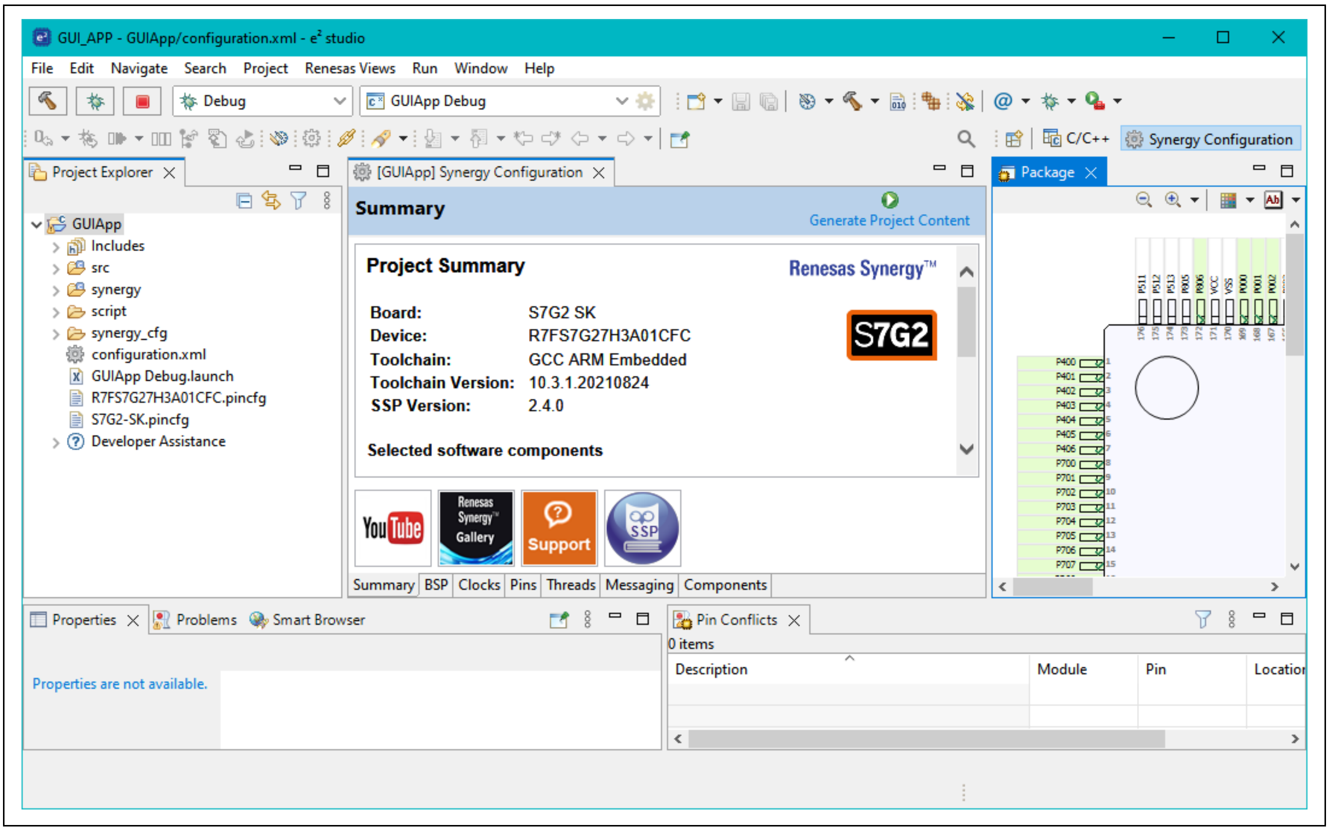
Open Associated Perspective?

This kind of project is associated with the Synergy Configuration perspective. Do you want to open this perspective now?

□ Remember my decision

Figure 11. Open Associated Perspective dialog box

When the project is created, e^2 studio displays the following screen.



Project Summary

Board:	S7G2 SK
Device:	R7FS7G27H3A01CFC
Toolchain:	GCC ARM Embedded
Toolchain Version:	10.3.1.20210824
SSP Version:	2.4.0

Selected software components

Figure 12. GUIApp project

Note: The settings applicable for PK-S5D9 Synergy MCU Group are the same as SK-S7G2 Synergy MCU Group unless explicitly specified.

4. Configuring the project in e^2 studio

Once successfully created in the e^2 studio ISDE, the project can be configured for the GUI application.

1. Open the **Synergy Configuration**, if not already open, by double-clicking the `configuration.xml` file in the **Project Explorer** window.

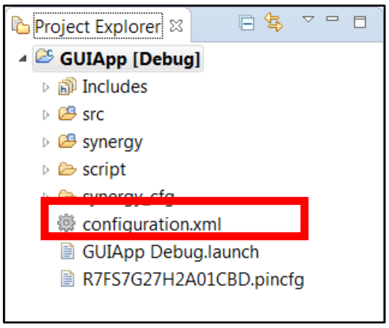


Figure 13. Selecting the configuration.xml file in Project Explorer

2. In the **Synergy Configuration** window, click the **Threads** tab.

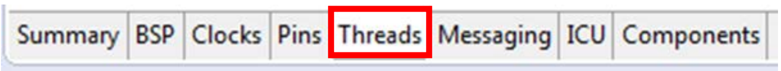


Figure 14. Synergy Configuration Threads tab

3. Create a new thread by clicking **New Thread** in the **Threads** area.

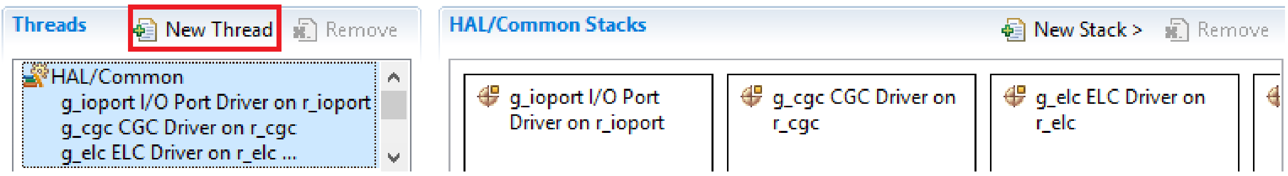
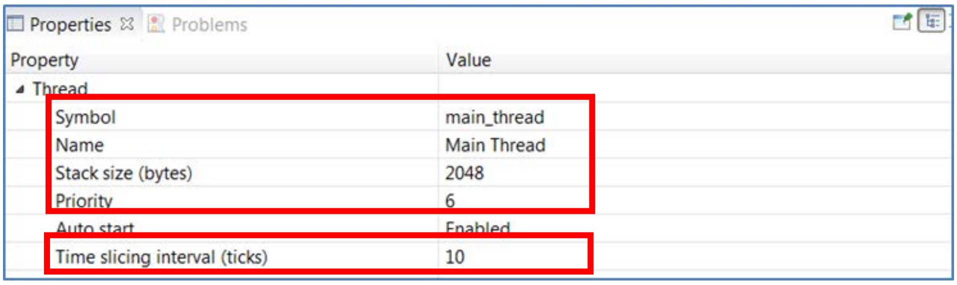

Threads
New Thread
Remove
HAL/Common
g_ioport I/O Port Driver on r_ioport
g_cgc CGC Driver on r_cgc
g_elc ELC Driver on r_elc ...
HAL/Common Stacks
New Stack >
Remove
g_ioport I/O Port Driver on r_ioport
g_cgc CGC Driver on r_cgc
g_elc ELC Driver on r_elc

Figure 15. Create a New Thread

4. Click **New Thread** to display the properties.
5. Edit the **Properties** to match the following.



Property	Value
Thread	
Symbol	main_thread
Name	Main Thread
Stack size (bytes)	2048
Priority	6
Auto start	Enabled
Time slicing interval (ticks)	10

Figure 16. Configure Main Thread Properties

6. Back in the Synergy **Configuration** window, **Threads** tab, **Main Thread Stacks** area, click **New**.
   Note: Be sure that **Main Thread** is selected before adding new modules.

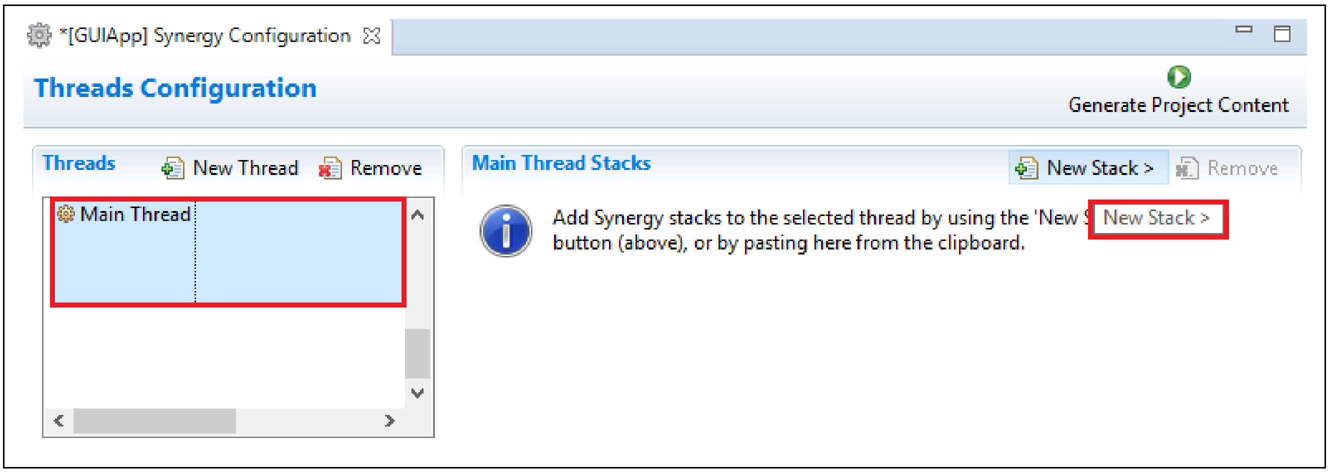

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
Main Thread
Main Thread Stacks
New Stack >
Remove
Add Synergy stacks to the selected thread by using the 'New S New Stack >
button (above), or by pasting here from the clipboard.

Figure 17. Main Thread Stacks

7. Add a framework for the Touch Panel by selecting **New Stack > Framework > Input > Touch Panel V2 Framework on sf_touch_panel_v2**.

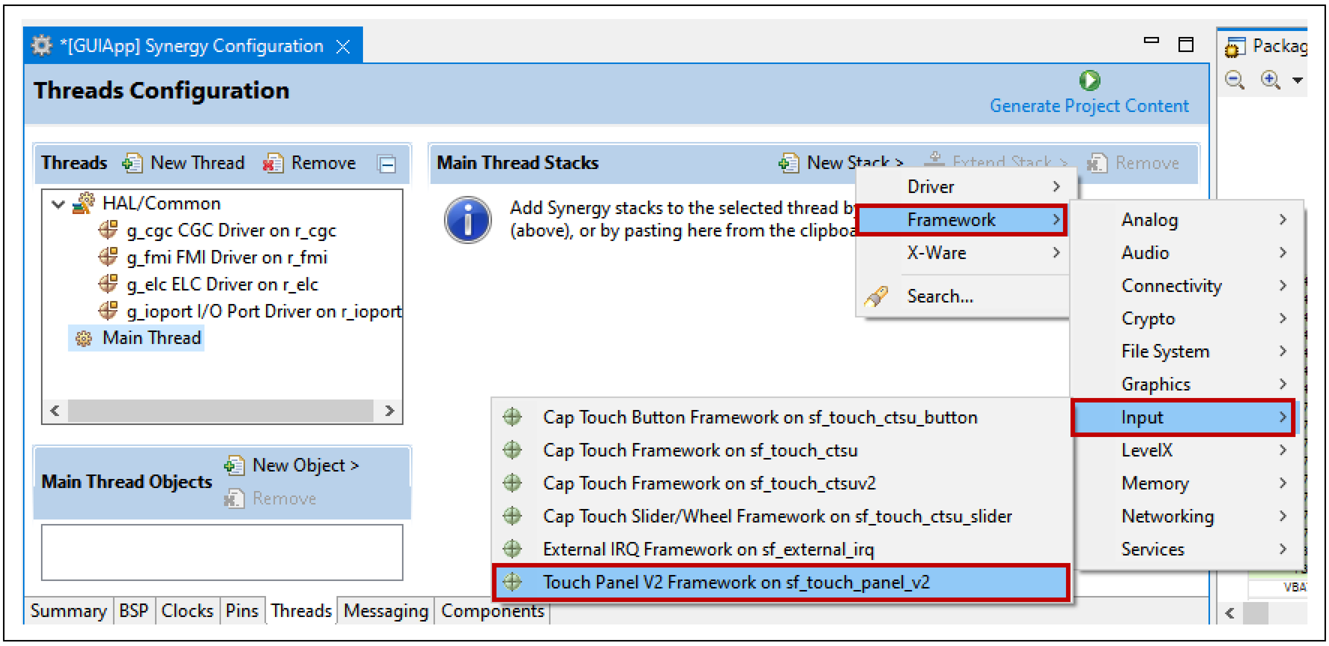
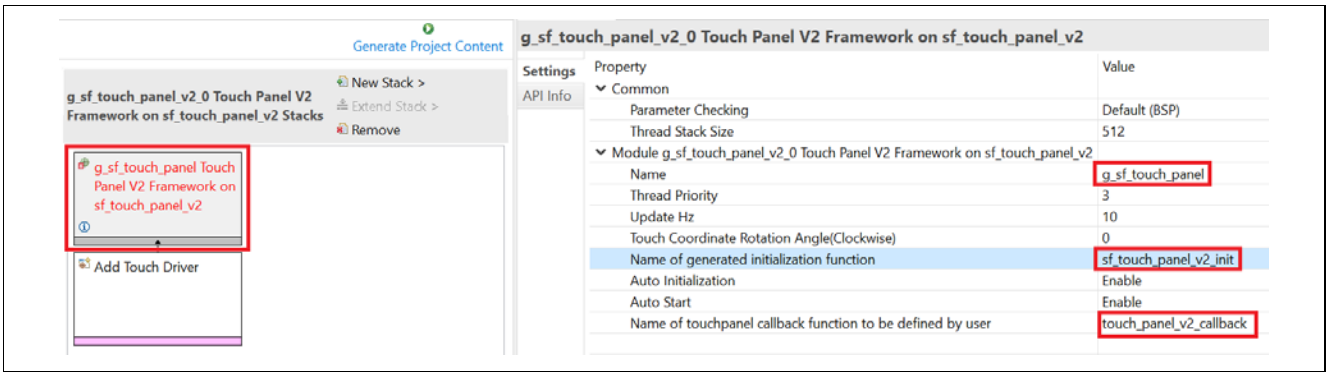

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_elc ELC Driver on r_elc
g_ioport I/O Port Driver on r_ioport
Main Thread
Main Thread Stacks
New Stack >
Extend Stack >
Remove
Add Synergy stacks to the selected thread b
(above), or by pasting here from the clipboa
Driver
Framework
X-Ware
Search...
Analog
Audio
Connectivity
Crypto
File System
Graphics
Input
LevelX
Memory
Networking
Services
Cap Touch Button Framework on sf_touch_ctsu_button
Cap Touch Framework on sf_touch_ctsu
Cap Touch Framework on sf_touch_ctsuv2
Cap Touch Slider/Wheel Framework on sf_touch_ctsu_slider
External IRQ Framework on sf_external_irq
Touch Panel V2 Framework on sf_touch_panel_v2
Main Thread Objects
New Object >
Remove
Summary
BSP
Clocks
Pins
Threads
Messaging
Components
Packag

Figure 18. Adding Touch Panel framework

8. Configure the following properties.


Generate Project Content
g_sf_touch_panel_v2_0 Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
Add Touch Driver
Settings
API Info

g_sf_touch_panel_v2_0 Touch Panel V2 Framework on sf_touch_panel_v2

Property	Value
Common	
Parameter Checking	Default (BSP)
Thread Stack Size	512
Module g_sf_touch_panel_v2_0 Touch Panel V2 Framework on sf_touch_panel_v2	
Name	g_sf_touch_panel
Thread Priority	3
Update Hz	10
Touch Coordinate Rotation Angle(Clockwise)	0
Name of generated initialization function	sf_touch_panel_v2_init
Auto Initialization	Enable
Auto Start	Enable
Name of touchpanel callback function to be defined by user	touch_panel_v2_callback

Figure 19. Configure Touch Panel properties

9. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click on **Add Touch Driver > New > Touch_panel_chip_sx8654**.

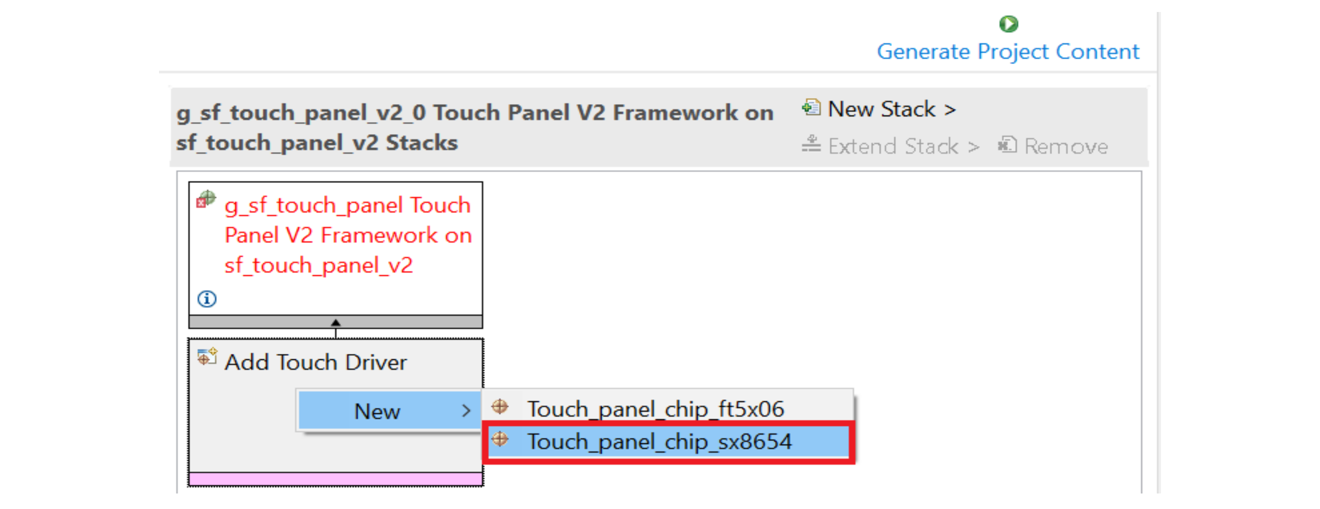
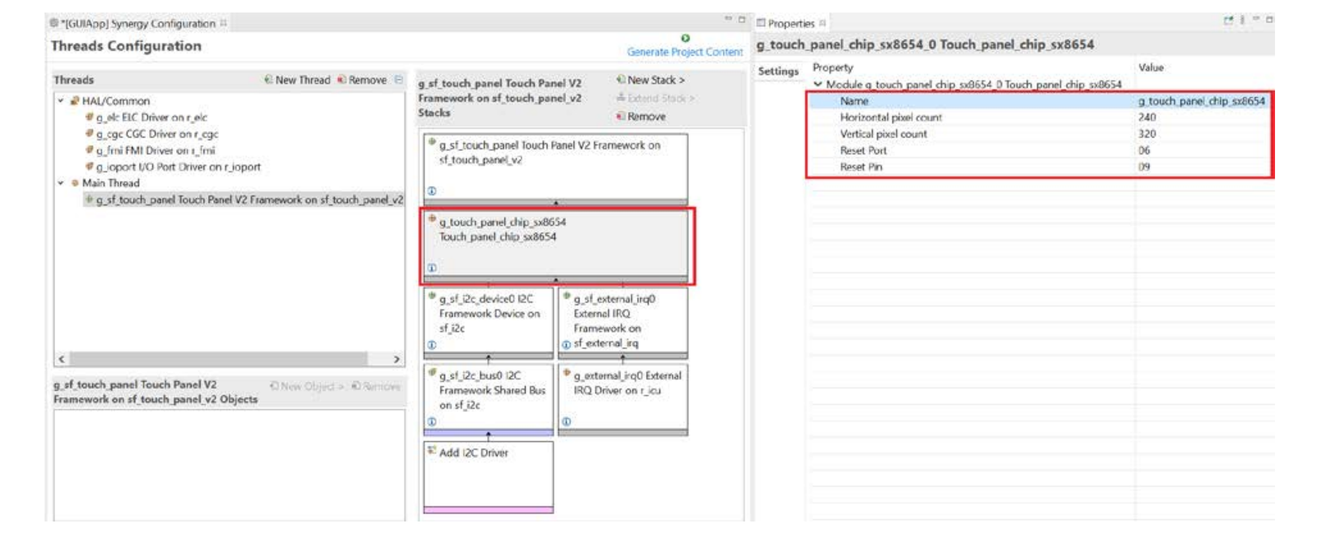

Generate Project Content
g_sf_touch_panel_v2_0 Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
Add Touch Driver
New
Touch_panel_chip_ft5x06
Touch_panel_chip_sx8654

Figure 20. Add the Touch_panel_chip_sx8654 Touch driver

10. Configure the **Touch_panel_chip_sx8654** Properties as shown.

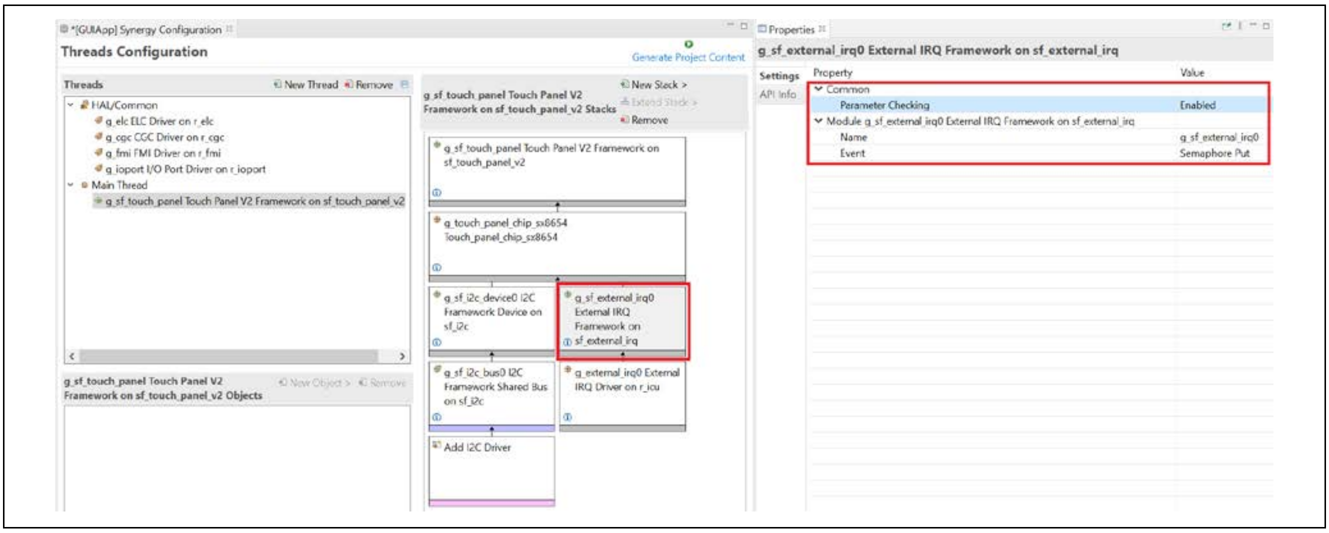

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings

g_touch_panel_chip_sx8654_0 Touch_panel_chip_sx8654

Property	Value
Module g_touch_panel_chip_sx8654_0 Touch_panel_chip_sx8654	
Name	g_touch_panel_chip_sx8654
Horizontal pixel count	240
Vertical pixel count	320
Reset Port	06
Reset Pin	09

Figure 21. Configure Touch_panel_chip_sx8654 Properties

Notice that the Synergy Configurator has already created the external IRQ framework and has a placeholder for the external IRQ and I^2C driver stacks. The Touch Panel V2 Framework module scans data from a touch controller and invokes the user registered touch panel callback when a touch event occurs. (If the user callback is not registered, the `sf_touch_panel_v2_api_t::touchDataGet` API function can be used to retrieve the data). The SF External Interrupt is a framework layer used by the touch controller driver as shown below.

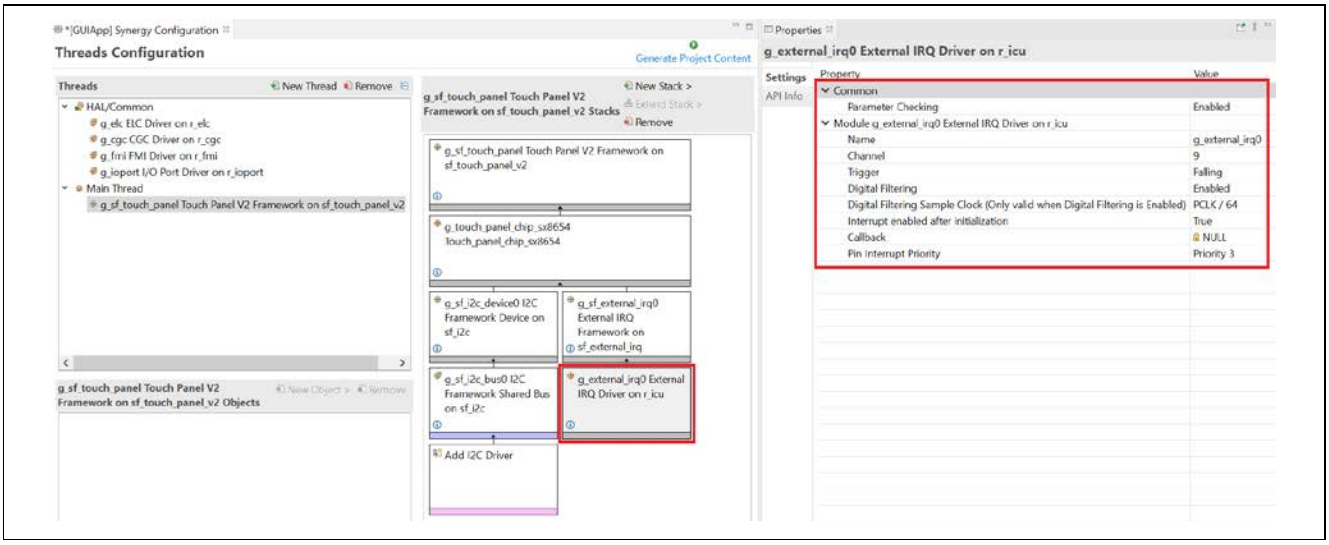

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings
API Info

g_sf_external_irq0 External IRQ Framework on sf_external_irq

Property	Value
Common	
Parameter Checking	Enabled
Module g_sf_external_irq0 External IRQ Framework on sf_external_irq	
Name	g_sf_external_irq0
Event	Semaphore Put

Figure 22. Configure the properties for External IRQ Framework Stack

11. Select **External IRQ Driver on r_icu**. Configure the properties for the new module as shown. Hint: Change the **Channel** first!

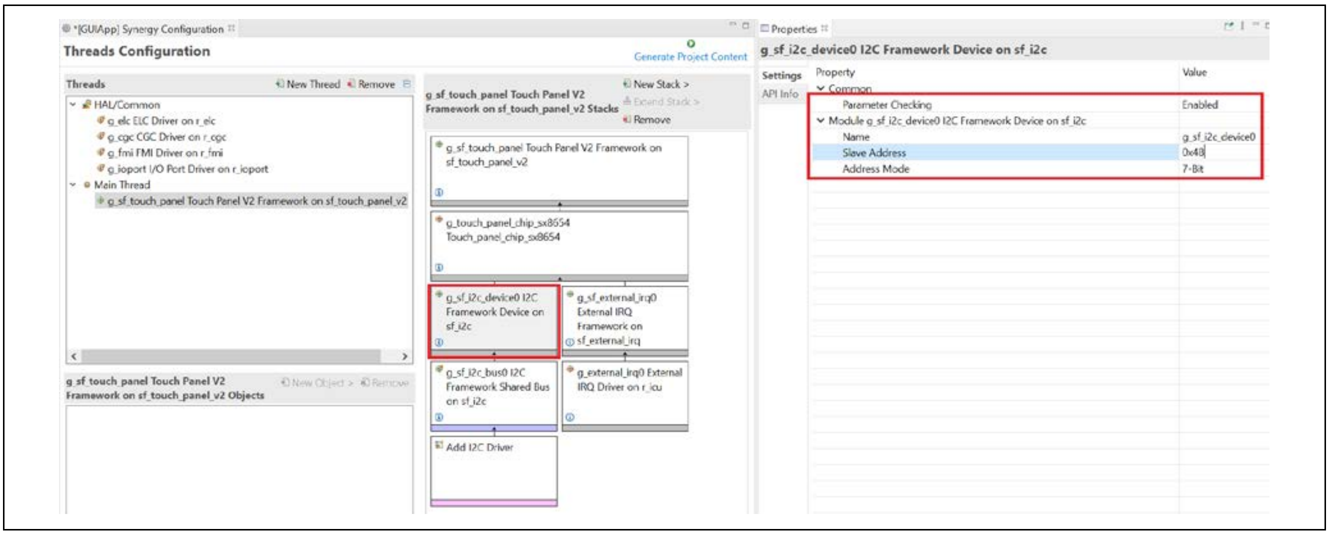

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings
API Info

g_external_irq0 External IRQ Driver on r_icu

Property	Value
Common	
Parameter Checking	Enabled
Module g_external_irq0 External IRQ Driver on r_icu	
Name	g_external_irq0
Channel	9
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is Enabled)	PCLK / 64
Interrupt enabled after initialization	True
Callback	NULL
Pin Interrupt Priority	Priority 3

Figure 23. Configure the properties for IRQ Driver on r_icu

12. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click on **g_sf_i2c_device0 I2C Framework Device on sf_i2c**. Configure the properties for **g_sf_i2c_device0 I2C Framework Device on sf_i2c**.

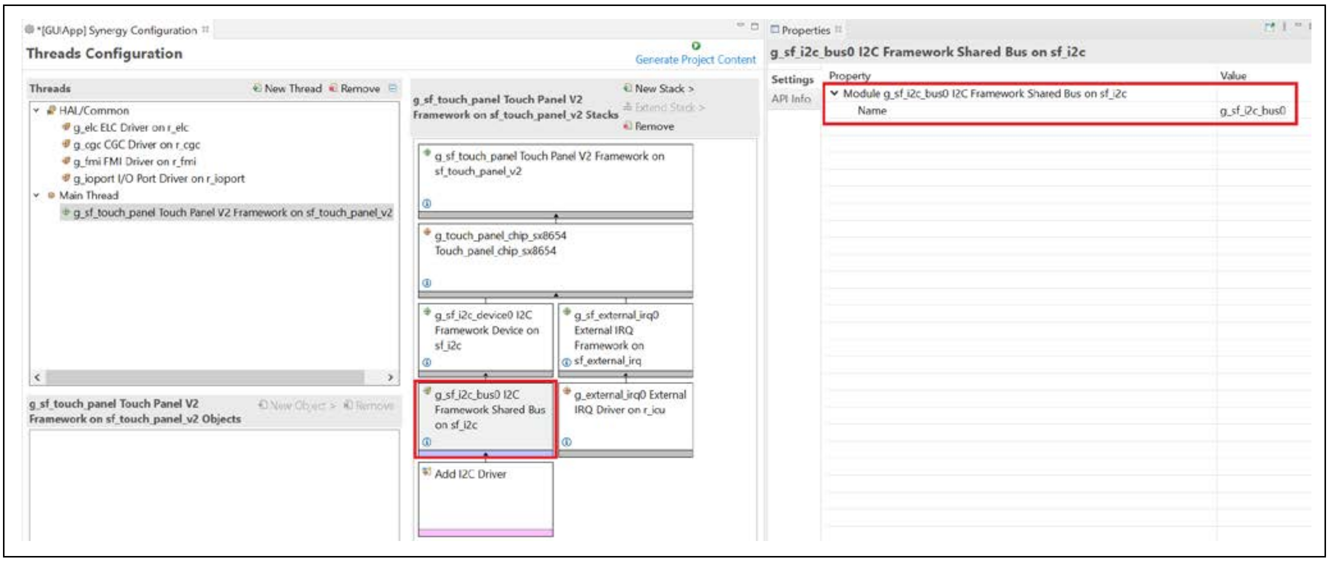

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings
API Info

g_sf_i2c_device0 I2C Framework Device on sf_i2c

Property	Value
Common	
Parameter Checking	Enabled
Module g_sf_i2c_device0 I2C Framework Device on sf_i2c	
Name	g_sf_i2c_device0
Slave Address	0x48
Address Mode	7-Bit

Figure 24. Configure the properties for g_sf_i2c_device0 I2C Framework Device on sf_i2c.

13. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click **g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c.** Configure the properties for **g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c**.


*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings
API Info

g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c

Property	Value
Module g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c	
Name	g_sf_i2c_bus0

Figure 25. Configure g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c

14. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click on **Add I2C Driver > New > I2C Master Driver on r_riic**.

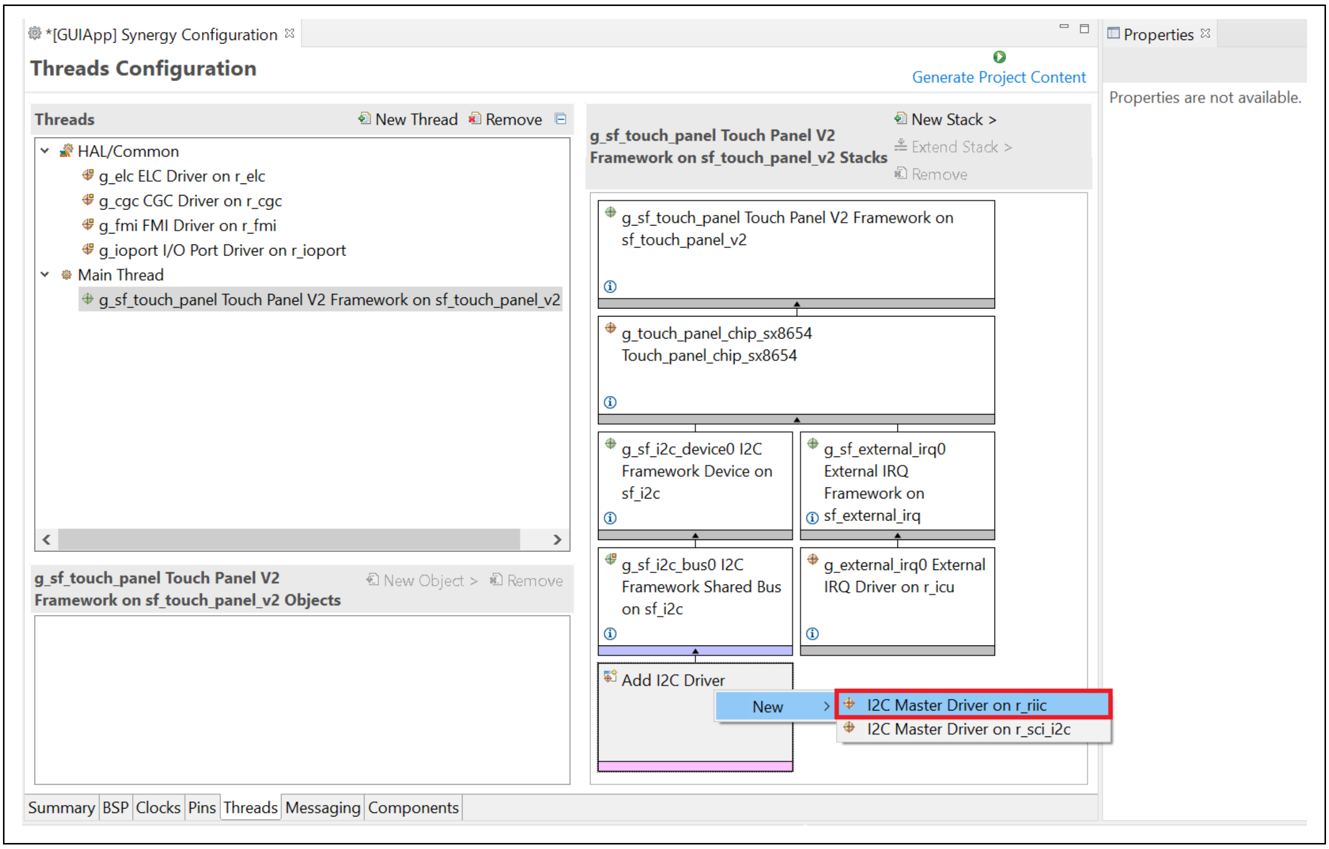
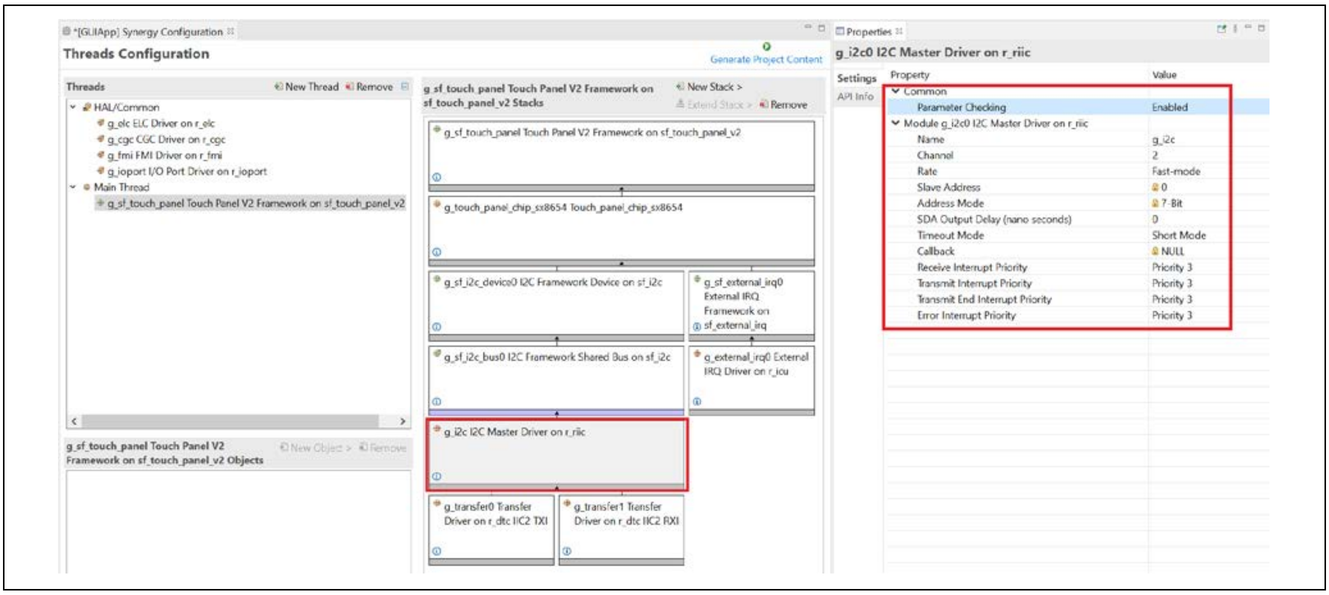

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Properties
Properties are not available.
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
Add I2C Driver
New >
I2C Master Driver on r_riic
I2C Master Driver on r_sci_i2c
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Summary
BSP
Clocks
Pins
Threads
Messaging
Components

Figure 26. Add I2C Master Driver on r_riic

15. In the **Synergy Configuration Window > Threads tab > Main Thread Stacks** area, click on **I2C Master Driver on r_riic** and configure the properties for **I2C Master Driver on r_riic**.

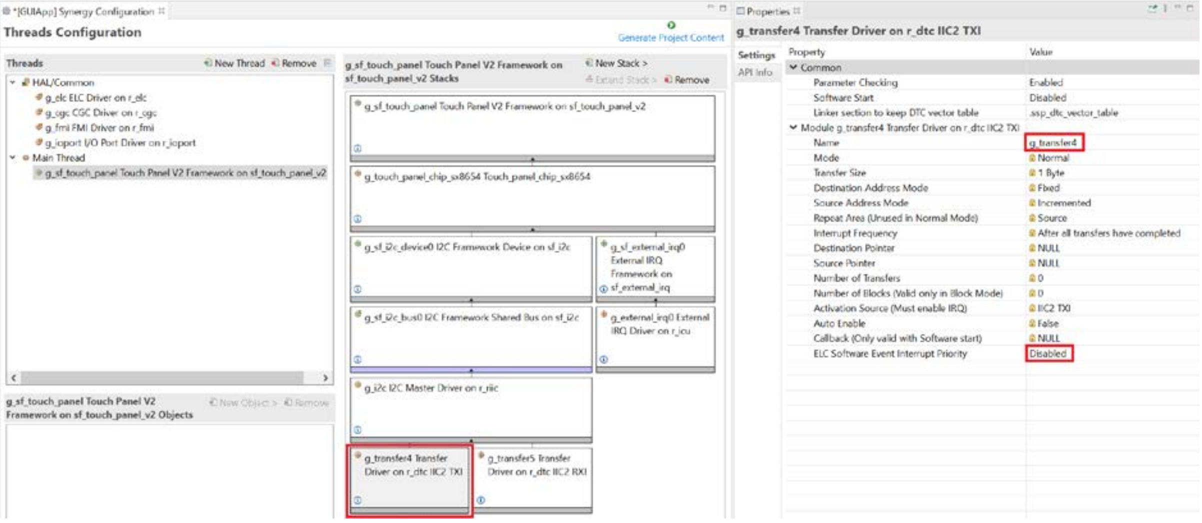

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
g_i2c I2C Master Driver on r_riic
g_transfer0 Transfer Driver on r_dtc IIC2 TXI
g_transfer1 Transfer Driver on r_dtc IIC2 RXI
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
Properties
Settings
API Info

g_i2c0 I2C Master Driver on r_riic

Property	Value
Common	
Parameter Checking	Enabled
Module g_i2c0 I2C Master Driver on r_riic	
Name	g_i2c
Channel	2
Rate	Fast-mode
Slave Address	0
Address Mode	7-Bit
SDA Output Delay (nano seconds)	0
Timeout Mode	Short Mode
Callback	NULL
Receive Interrupt Priority	Priority 3
Transmit Interrupt Priority	Priority 3
Transmit End Interrupt Priority	Priority 3
Error Interrupt Priority	Priority 3

Figure 27. Configuring I^{2}C Driver

16. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click on g_**transfer4 Transfer Driver on r_dtc SCI7 TXI** and configure the properties for **g_transfer4 Transfer Driver on r_dtc SCI7 TXI**.

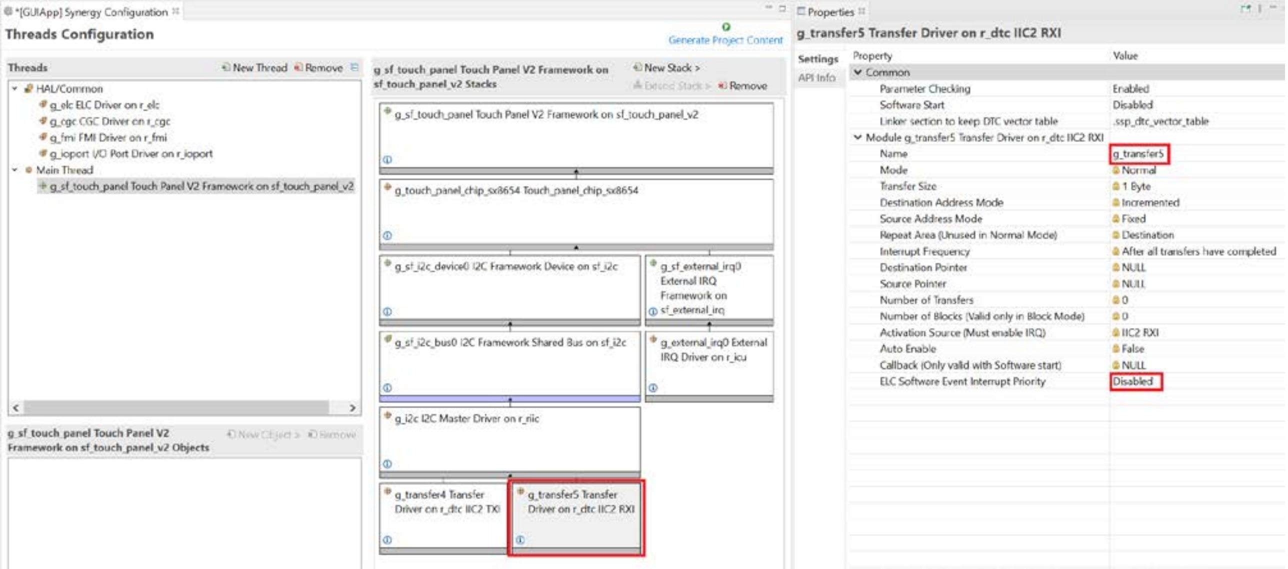

*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
g_i2c I2C Master Driver on r_riic
g_transfer4 Transfer Driver on r_dtc IIC2 TXI
g_transfer5 Transfer Driver on r_dtc IIC2 RXI
Properties
Settings
API Info

g_transfer4 Transfer Driver on r_dtc IIC2 TXI

Property	Value
Common	
Parameter Checking	Enabled
Software Start	Disabled
Linker section to keep DTC vector table	.ssp_dtc_vector_table
Module g_transfer4 Transfer Driver on r_dtc IIC2 TXI	
Name	g_transfer4
Mode	Normal
Transfer Size	1 Byte
Destination Address Mode	Fixed
Source Address Mode	Incremented
Repeat Area (Unused in Normal Mode)	Source
Interrupt Frequency	After all transfers have completed
Destination Pointer	NULL
Source Pointer	NULL
Number of Transfers	0
Number of Blocks (Valid only in Block Mode)	0
Activation Source (Must enable IRQ)	IIC2 TXI
Auto Enable	False
Callback (Only valid with Software start)	NULL
ELC Software Event Interrupt Priority	Disabled

Figure 28. Configure the Properties of g_transfer4 Transfer Driver on r_dtc SCI7 TXI

17. In the **Synergy Configuration** window > **Threads** tab > **Main Thread Stacks** area, click on **g_transfer5 Transfer Driver on r_dtc SCI7 RXI** and configure the properties for **g_transfer4 Transfer Driver on r_dtc SCI7 RXI**.


*[GUIApp] Synergy Configuration
Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_elc ELC Driver on r_elc
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Objects
New Object >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2 Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on r_icu
g_i2c I2C Master Driver on r_riic
g_transfer4 Transfer Driver on r_dtc IIC2 TXI
g_transfer5 Transfer Driver on r_dtc IIC2 RXI
Properties
Settings
API Info

g_transfer5 Transfer Driver on r_dtc IIC2 RXI

Property	Value
Common	
Parameter Checking	Enabled
Software Start	Disabled
Linker section to keep DTC vector table	.ssp_dtc_vector_table
Module g_transfer5 Transfer Driver on r_dtc IIC2 RXI	
Name	g_transfer5
Mode	Normal
Transfer Size	1 Byte
Destination Address Mode	Incremented
Source Address Mode	Fixed
Repeat Area (Unused in Normal Mode)	Destination
Interrupt Frequency	After all transfers have completed
Destination Pointer	NULL
Source Pointer	NULL
Number of Transfers	0
Number of Blocks (Valid only in Block Mode)	0
Activation Source (Must enable IRQ)	IIC2 RXI
Auto Enable	False
Callback (Only valid with Software start)	NULL
ELC Software Event Interrupt Priority	Disabled

Figure 29. Configure the Properties of g_transfer5 Transfer Driver on r_dtc SCI7 RXI

18. Under **Main Thread Stacks**, select **New Stack**, then **X-Ware > GUIX > GUIX on gx**.

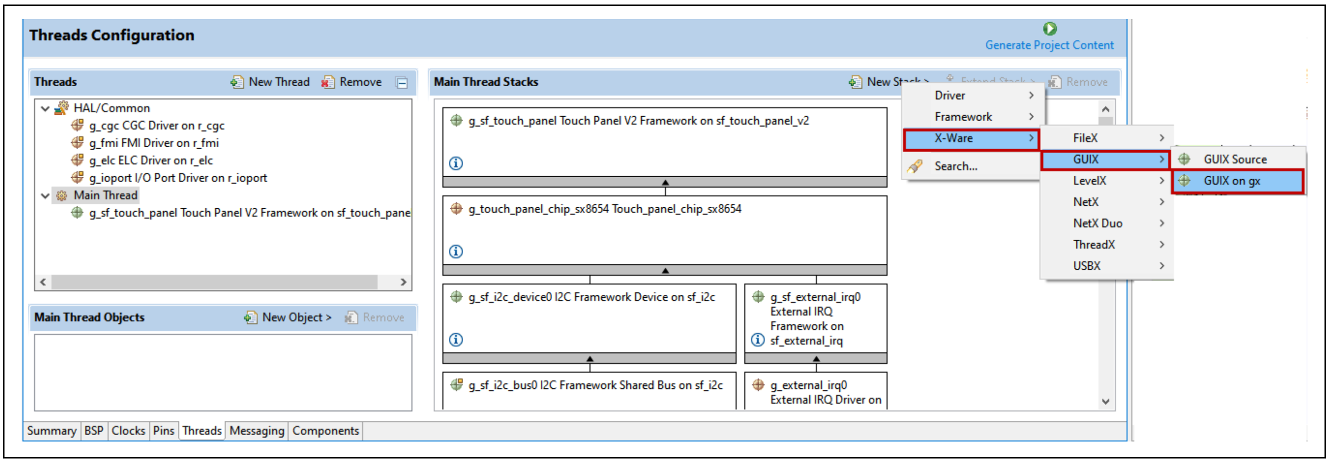

Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_elc ELC Driver on r_elc
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_pane
Main Thread Objects
New Object >
Remove
Main Thread Stacks
New Stack >
Extend Stack >
Remove
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_panel_v2
g_touch_panel_chip_sx8654 Touch_panel_chip_sx8654
g_sf_i2c_device0 I2C Framework Device on sf_i2c
g_sf_external_irq0 External IRQ Framework on sf_external_irq
g_sf_i2c_bus0 I2C Framework Shared Bus on sf_i2c
g_external_irq0 External IRQ Driver on
Driver
Framework
X-Ware
Search...
FileX
GUIX
LevelX
NetX
NetX Duo
ThreadX
USBX
GUIX Source
GUIX on gx
Summary
BSP
Clocks
Pins
Threads
Messaging
Components

Figure 30. Adding Framework for GUIX on gx

Notice that the Synergy Configurator has already created the **GUIX Port on sf_el_gx framework, Display Driver** and has a placeholder for the JPEG decode and D/AVE hardware accelerator stacks.

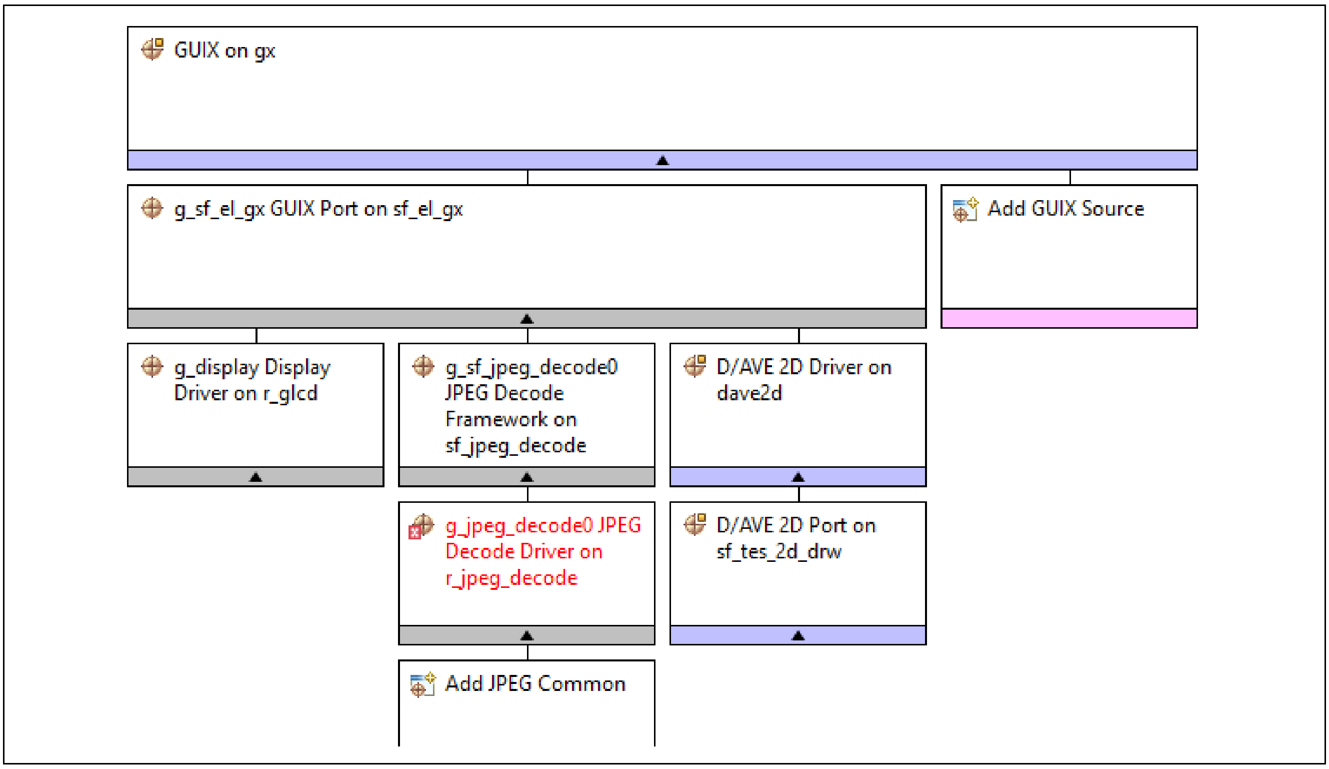
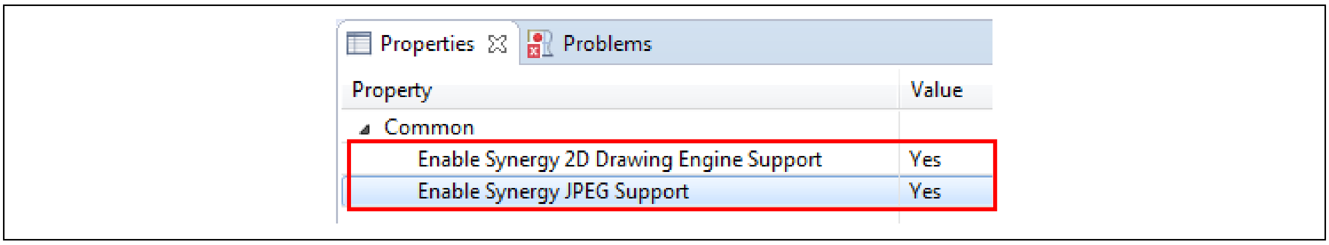

GUIX on gx
g_sf_el_gx GUIX Port on sf_el_gx
Add GUIX Source
g_display Display Driver on r_glcd
g_sf_jpeg_decode0 JPEG Decode Framework on sf_jpeg_decode
D/AVE 2D Driver on dave2d
g_jpeg_decode0 JPEG Decode Driver on r_jpeg_decode
D/AVE 2D Port on sf_tes_2d_drw
Add JPEG Common

Figure 31. GUIX on gx stack

19. Select **GUIX on gx** and configure the following **Properties**.



Property	Value
Common	
Enable Synergy 2D Drawing Engine Support	Yes
Enable Synergy JPEG Support	Yes

Figure 32. GUIX on gx Properties

20. Add **JPEG Common** to the Decode Driver on **r_jpeg_decode**.

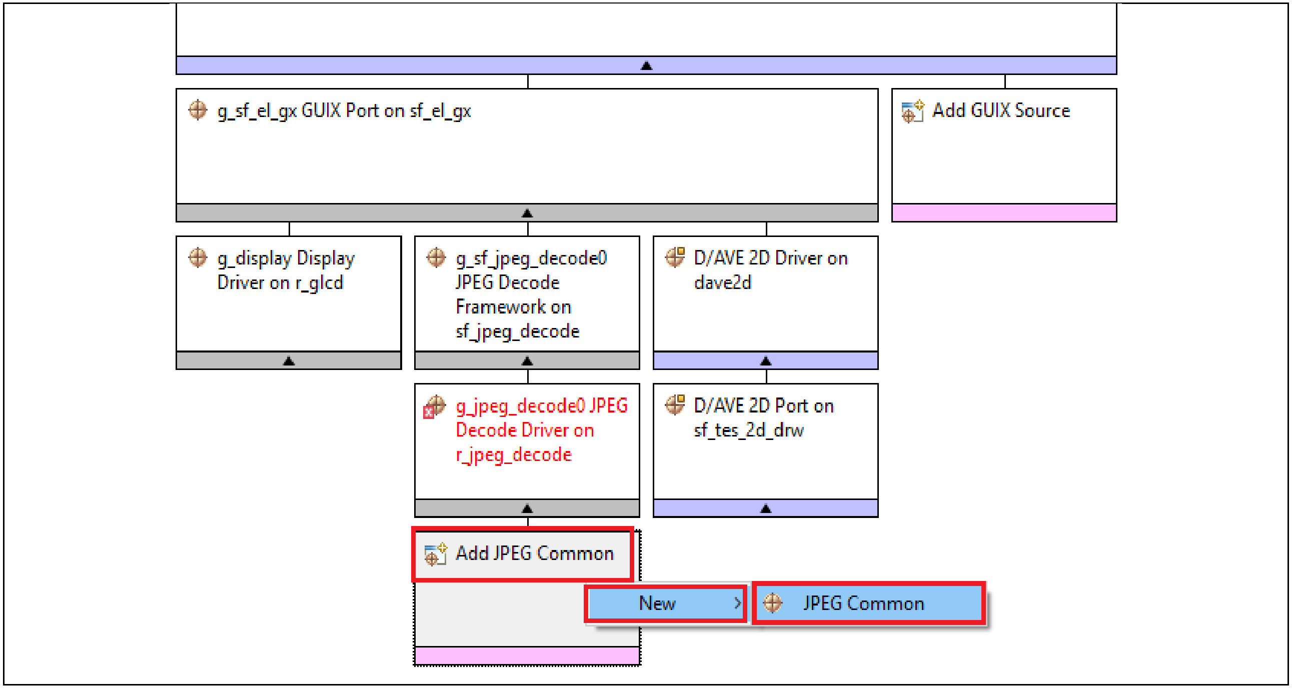
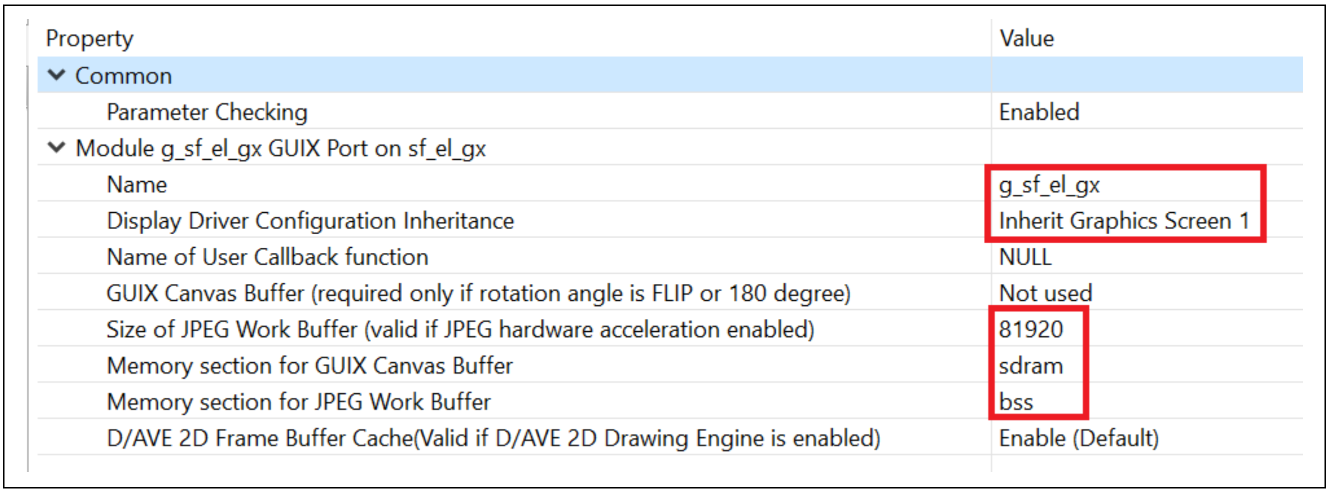

g_sf_el_gx GUIX Port on sf_el_gx
Add GUIX Source
g_display Display Driver on r_glcd
g_sf_jpeg_decode0 JPEG Decode Framework on sf_jpeg_decode
D/AVE 2D Driver on dave2d
g_jpeg_decode0 JPEG Decode Driver on r_jpeg_decode
D/AVE 2D Port on sf_tes_2d_drw
Add JPEG Common
New
JPEG Common

Figure 33. JPEG Common module

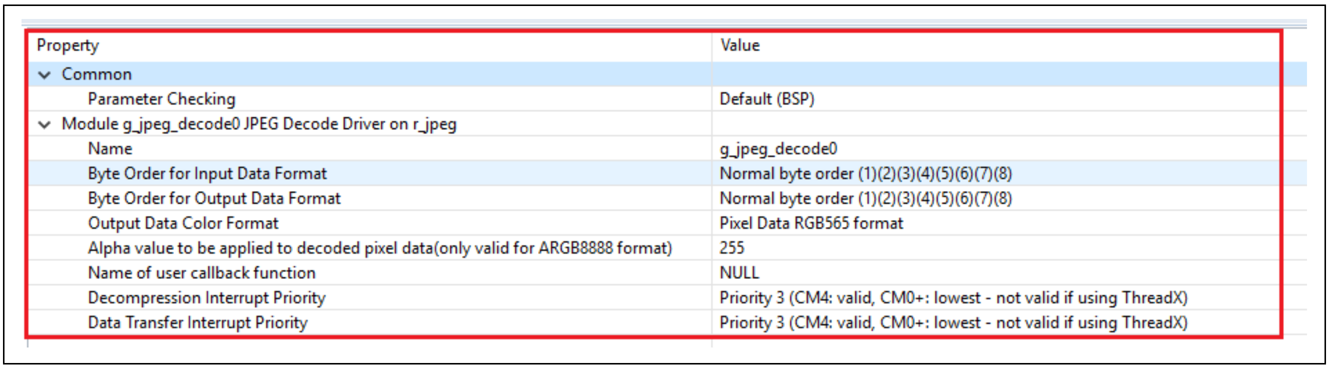
21. Select **GUIX Port** on **sf_el_gx** and configure the following properties.



Property	Value
⌄ Common	
Parameter Checking	Enabled
⌄ Module g_sf_el_gx GUIX Port on sf_el_gx	
Name	g_sf_el_gx
Display Driver Configuration Inheritance	Inherit Graphics Screen 1
Name of User Callback function	NULL
GUIX Canvas Buffer (required only if rotation angle is FLIP or 180 degree)	Not used
Size of JPEG Work Buffer (valid if JPEG hardware acceleration enabled)	81920
Memory section for GUIX Canvas Buffer	sdram
Memory section for JPEG Work Buffer	bss
D/AVE 2D Frame Buffer Cache(Valid if D/AVE 2D Drawing Engine is enabled)	Enable (Default)

Figure 34. Configure GUIX Port property

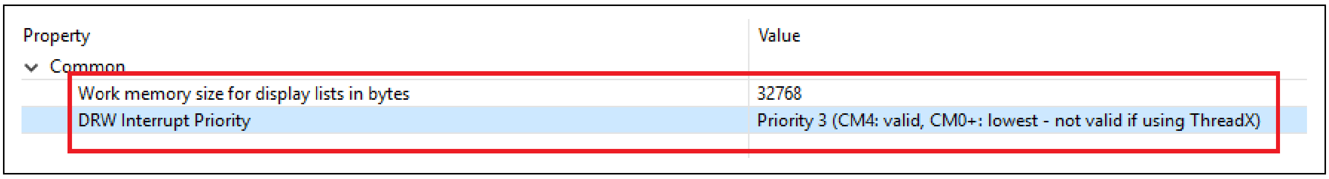
22. Select the **JPEG Decode Driver on r_jpeg** and configure the following interrupt properties. Note that Priority 3 is just an arbitrary number.



Property	Value
⌄ Common	
Parameter Checking	Default (BSP)
⌄ Module g_jpeg_decode0 JPEG Decode Driver on r_jpeg	
Name	g_jpeg_decode0
Byte Order for Input Data Format	Normal byte order (1)(2)(3)(4)(5)(6)(7)(8)
Byte Order for Output Data Format	Normal byte order (1)(2)(3)(4)(5)(6)(7)(8)
Output Data Color Format	Pixel Data RGB565 format
Alpha value to be applied to decoded pixel data(only valid for ARGB8888 format)	255
Name of user callback function	NULL
Decompression Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Data Transfer Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)

Figure 35. JPEG Decode Driver on r_jpeg properties

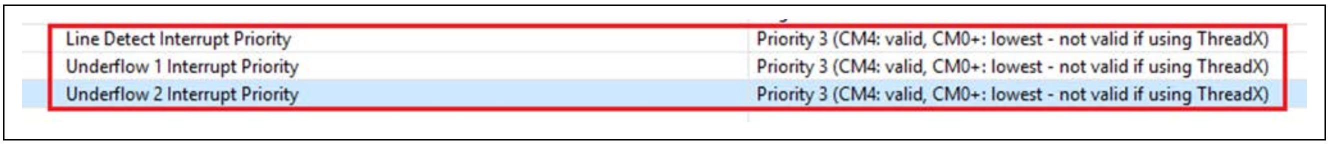
23. Under **Main Thread Stacks**, select **D/AVE 2D Port on sf_tes_2d_drw** and configure the following properties.



Property	Value
Common	
Work memory size for display lists in bytes	32768
DRW Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)

Figure 36. D/AVE 2D Port Properties

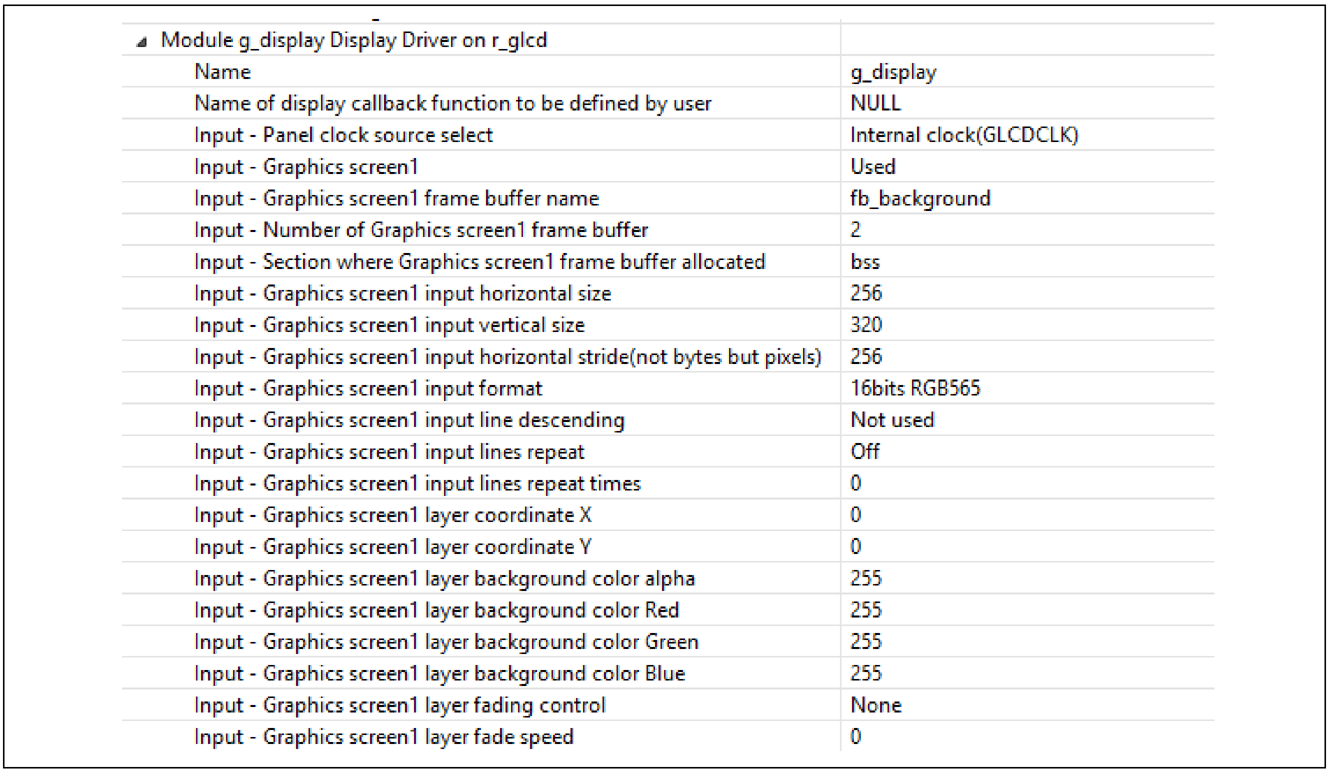
24. Under M**ain Thread Stacks**, select **Display Driver on r_glcd** and configure the following interrupt properties.



Line Detect Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Underflow 1 Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Underflow 2 Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)

Figure 37. Interrupt Properties

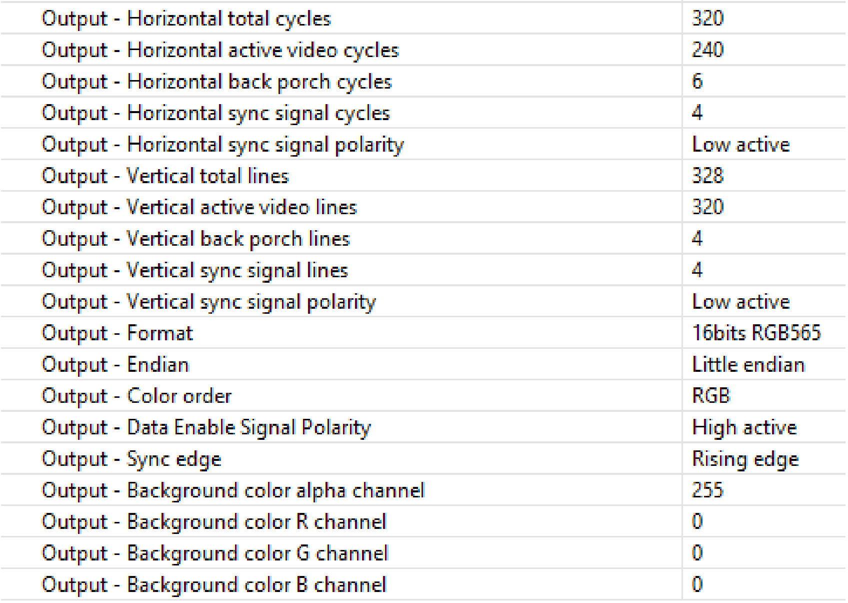
25. Configure the following properties for **Graphics Screen 1**.



Module g_display Display Driver on r_glcd	
Name	g_display
Name of display callback function to be defined by user	NULL
Input - Panel clock source select	Internal clock(GLCDCLK)
Input - Graphics screen1	Used
Input - Graphics screen1 frame buffer name	fb_background
Input - Number of Graphics screen1 frame buffer	2
Input - Section where Graphics screen1 frame buffer allocated	bss
Input - Graphics screen1 input horizontal size	256
Input - Graphics screen1 input vertical size	320
Input - Graphics screen1 input horizontal stride(not bytes but pixels)	256
Input - Graphics screen1 input format	16bits RGB565
Input - Graphics screen1 input line descending	Not used
Input - Graphics screen1 input lines repeat	Off
Input - Graphics screen1 input lines repeat times	0
Input - Graphics screen1 layer coordinate X	0
Input - Graphics screen1 layer coordinate Y	0
Input - Graphics screen1 layer background color alpha	255
Input - Graphics screen1 layer background color Red	255
Input - Graphics screen1 layer background color Green	255
Input - Graphics screen1 layer background color Blue	255
Input - Graphics screen1 layer fading control	None
Input - Graphics screen1 layer fade speed	0

Figure 38. Graphics Screen 1 properties

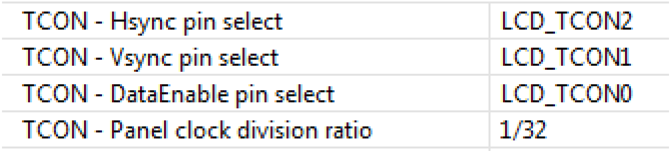
26. Configure the following output properties.



Output - Horizontal total cycles	320
Output - Horizontal active video cycles	240
Output - Horizontal back porch cycles	6
Output - Horizontal sync signal cycles	4
Output - Horizontal sync signal polarity	Low active
Output - Vertical total lines	328
Output - Vertical active video lines	320
Output - Vertical back porch lines	4
Output - Vertical sync signal lines	4
Output - Vertical sync signal polarity	Low active
Output - Format	16bits RGB565
Output - Endian	Little endian
Output - Color order	RGB
Output - Data Enable Signal Polarity	High active
Output - Sync edge	Rising edge
Output - Background color alpha channel	255
Output - Background color R channel	0
Output - Background color G channel	0
Output - Background color B channel	0

Figure 39 Output Screen 2 properties

27. Configure the following TCON pins and clock.



TCON - Hsync pin select	LCD_TCON2
TCON - Vsync pin select	LCD_TCON1
TCON - DataEnable pin select	LCD_TCON0
TCON - Panel clock division ratio	1/32

Figure 40. TCON settings

28. Under **Main Thread Stacks**, select **New Stack > Driver > Connectivity > SPI Driver on r_sci_spi**.

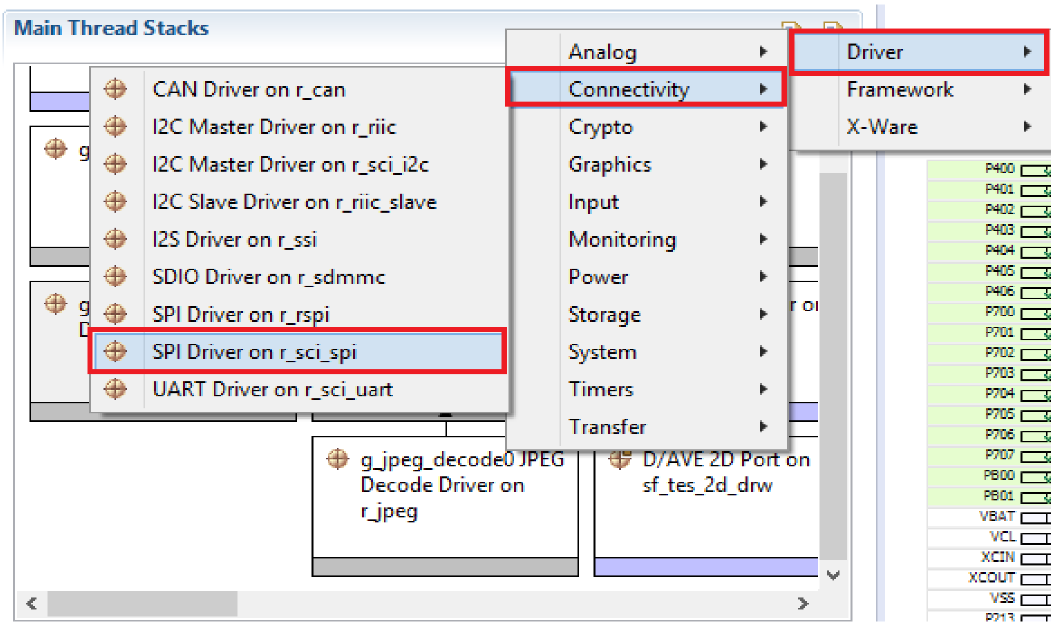
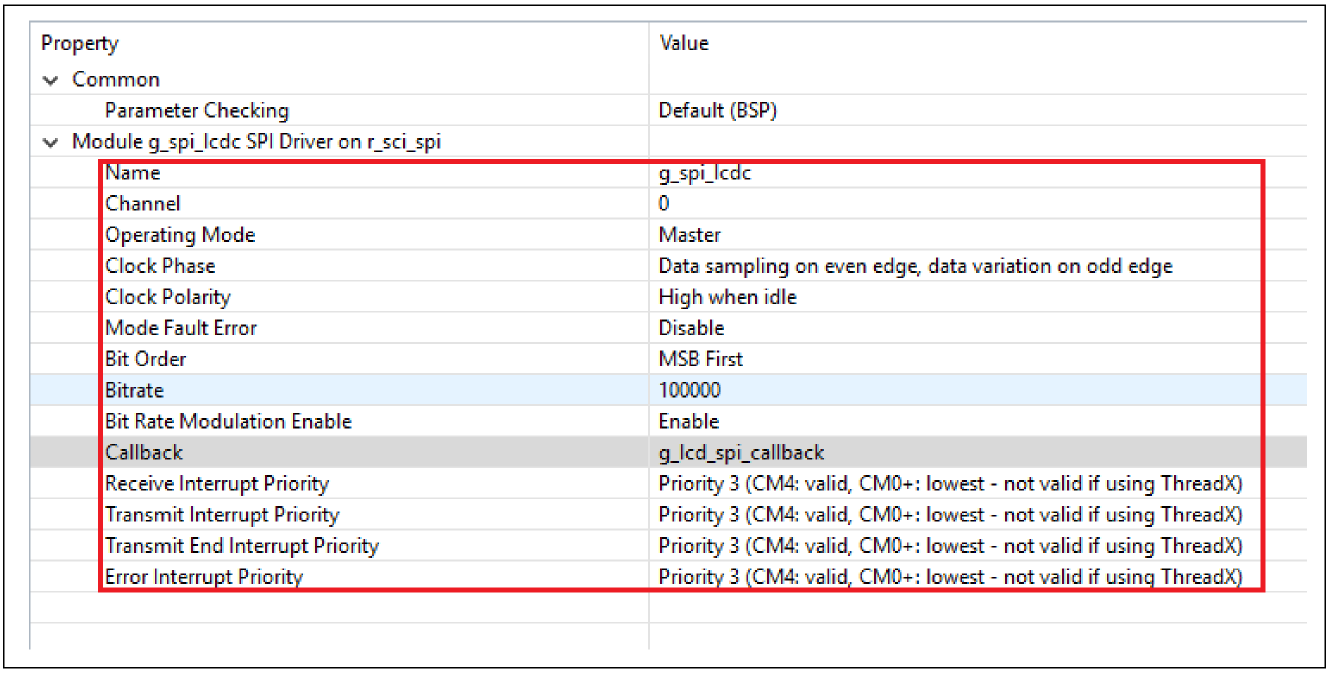


Figure 41. Adding Simple SPI (on SCI) Driver

29. Configure the following properties.



Property	Value
Common	
Parameter Checking	Default (BSP)
Module g_spi_lcdc SPI Driver on r_sci_spi	
Name	g_spi_lcdc
Channel	0
Operating Mode	Master
Clock Phase	Data sampling on even edge, data variation on odd edge
Clock Polarity	High when idle
Mode Fault Error	Disable
Bit Order	MSB First
Bitrate	100000
Bit Rate Modulation Enable	Enable
Callback	g_lcd_spi_callback
Receive Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Transmit Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Transmit End Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)
Error Interrupt Priority	Priority 3 (CM4: valid, CM0+: lowest - not valid if using ThreadX)

Figure 42. Configure Simple SPI (on SCI) properties

30. Click each **g_transfer** drive and remove it by clicking **Remove** since it is not needed for the LCD.

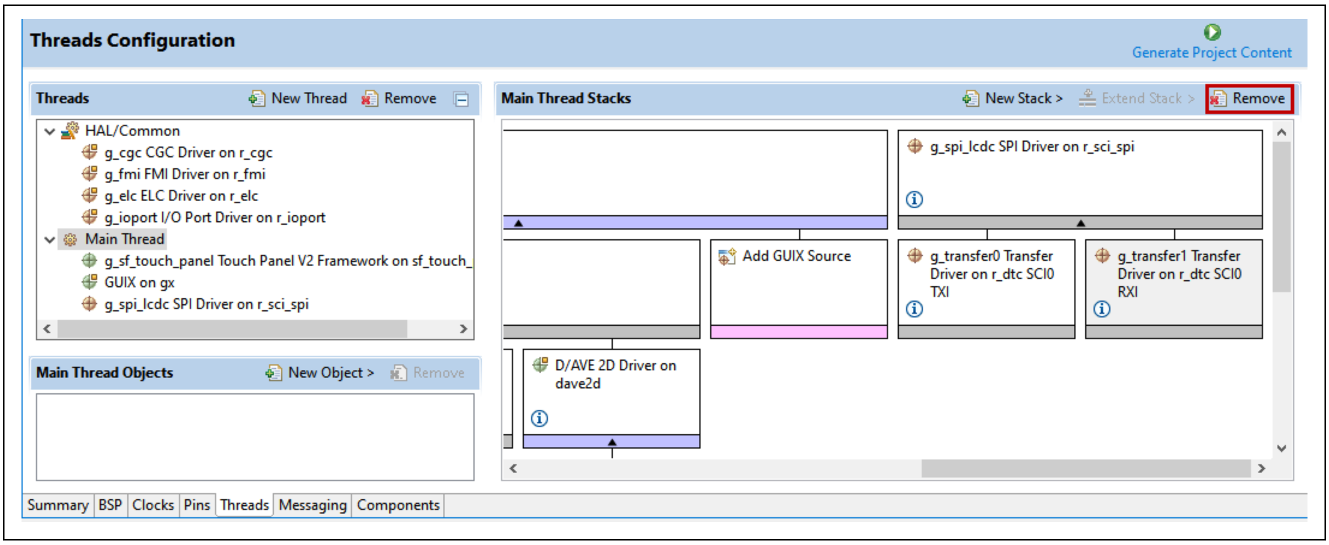

Threads Configuration
Generate Project Content
Threads
New Thread
Remove
HAL/Common
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_elc ELC Driver on r_elc
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch_
GUIX on gx
g_spi_lcdc SPI Driver on r_sci_spi
Main Thread Objects
New Object >
Remove
Main Thread Stacks
New Stack >
Extend Stack >
Remove
g_spi_lcdc SPI Driver on r_sci_spi
Add GUIX Source
g_transfer0 Transfer Driver on r_dtc SCI0 TXI
g_transfer1 Transfer Driver on r_dtc SCI0 RXI
D/AVE 2D Driver on dave2d
Summary
BSP
Clocks
Pins
Threads
Messaging
Components

Figure 43. Remove Transfer Drivers

31. After removing the drivers, the placeholders for adding drivers remain as shown in the following figure.

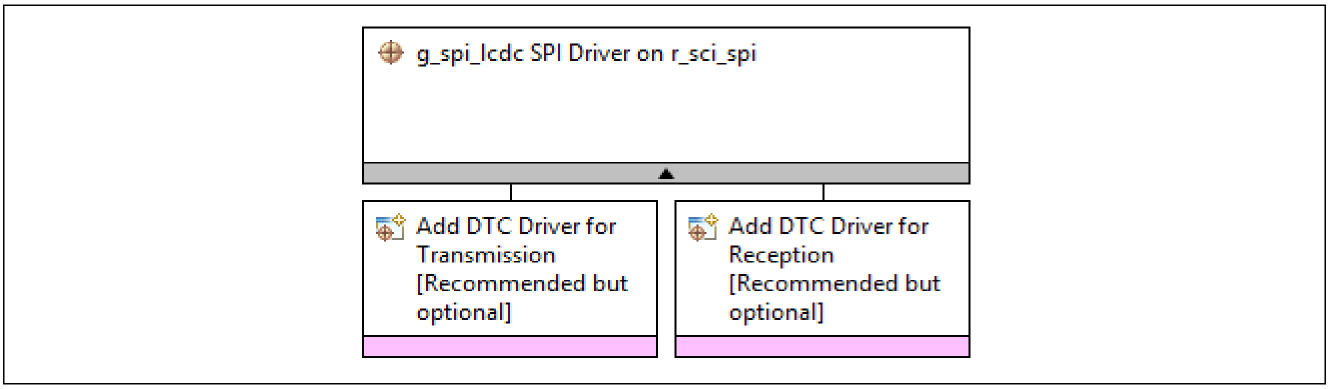

g_spi_lcdc SPI Driver on r_sci_spi
Add DTC Driver for Transmission [Recommended but optional]
Add DTC Driver for Reception [Recommended but optional]

Figure 44 Transfer Drivers Placeholders

32. In the **Synergy Configuration** window, **Threads** tab, make sure the **Main thread** is still selected.

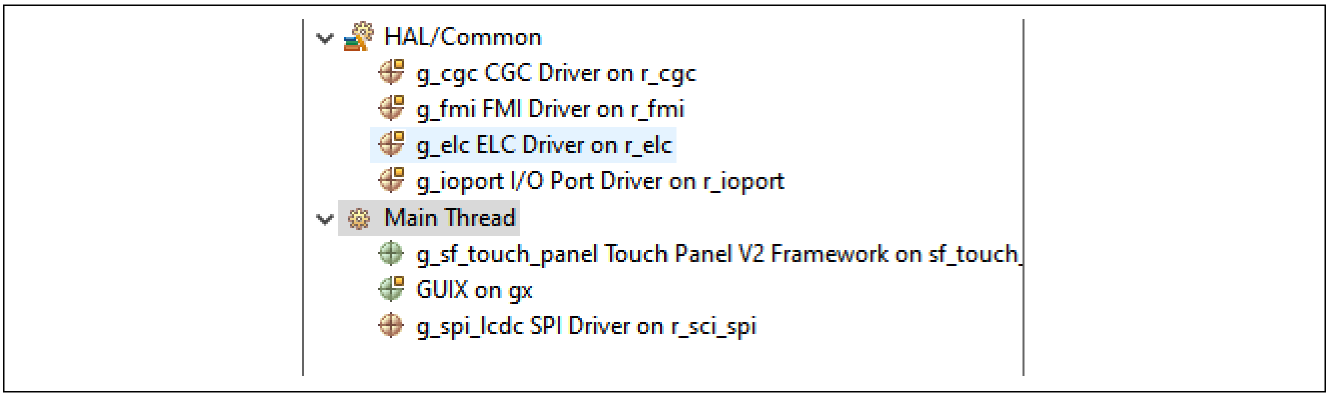

HAL/Common
g_cgc CGC Driver on r_cgc
g_fmi FMI Driver on r_fmi
g_elc ELC Driver on r_elc
g_ioport I/O Port Driver on r_ioport
Main Thread
g_sf_touch_panel Touch Panel V2 Framework on sf_touch
GUIX on gx
g_spi_lcdc SPI Driver on r_sci_spi

Figure 45. Click on Main thread

33. Under the **Main Thread Objects**, click **New Object > Semaphore**.

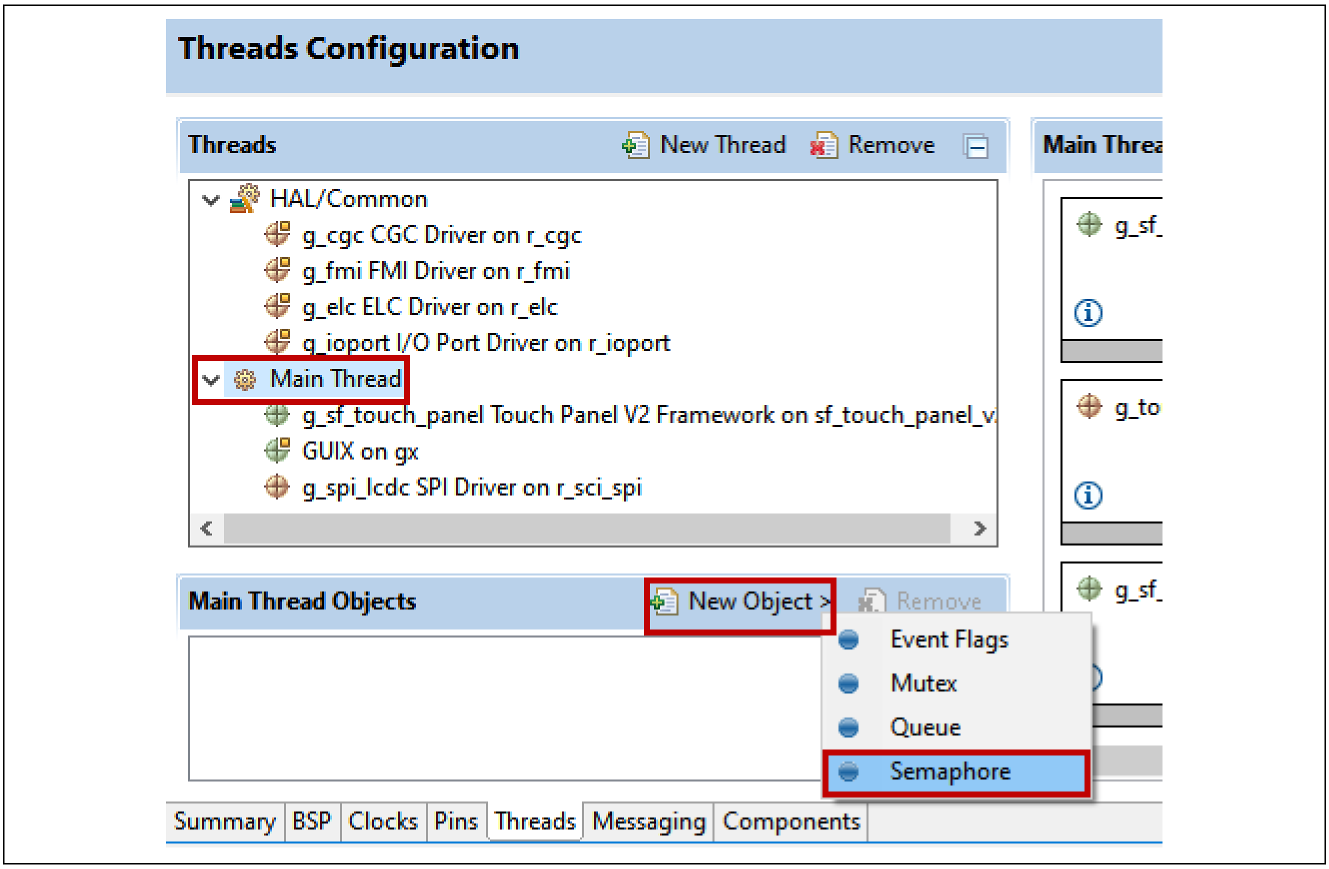
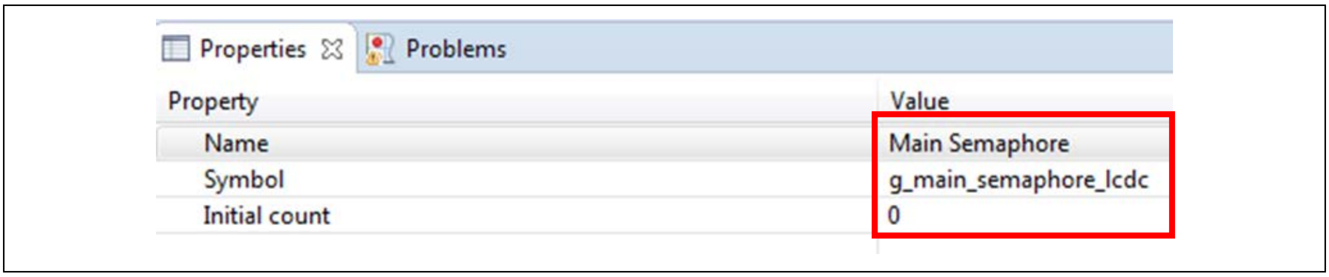


Figure 46. Add a Semaphore

34. Configure the following properties.



Property	Value
Name	Main Semaphore
Symbol	g_main_semaphore_lcdc
Initial count	0

Figure 47. Configure Semaphore

35. In the **Synergy Configuration** window, select the **Pins** tab

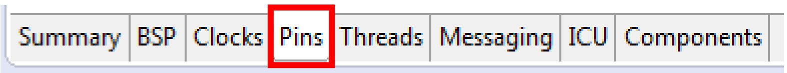
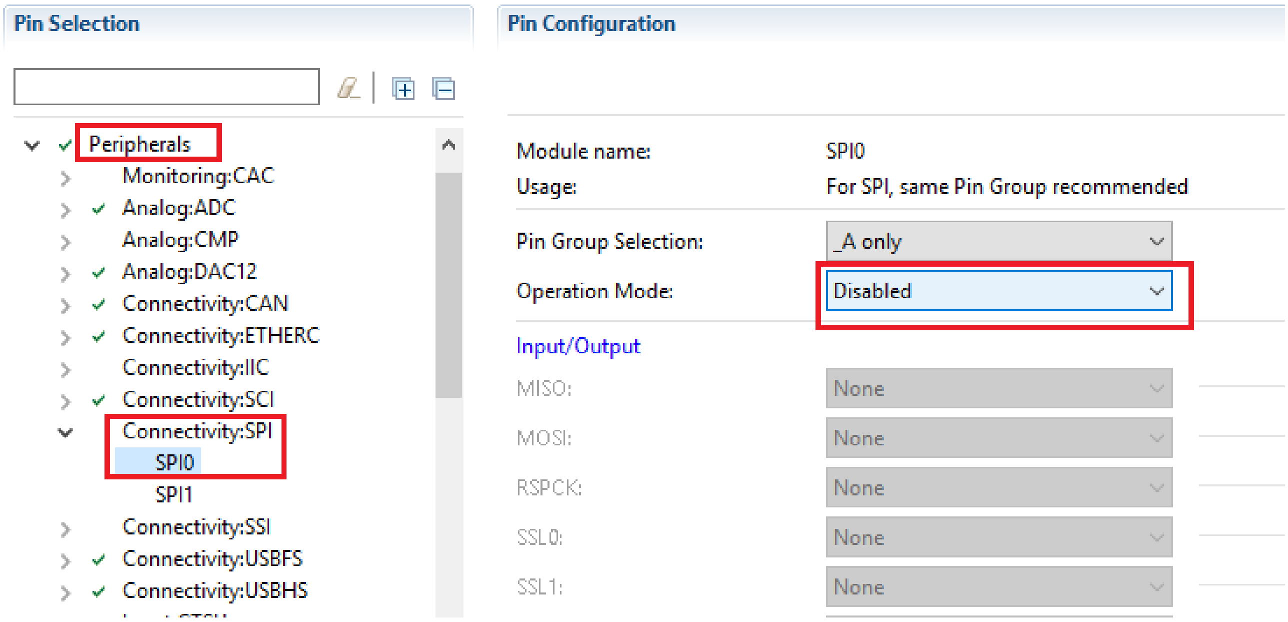


Figure 48. Configuration Pins

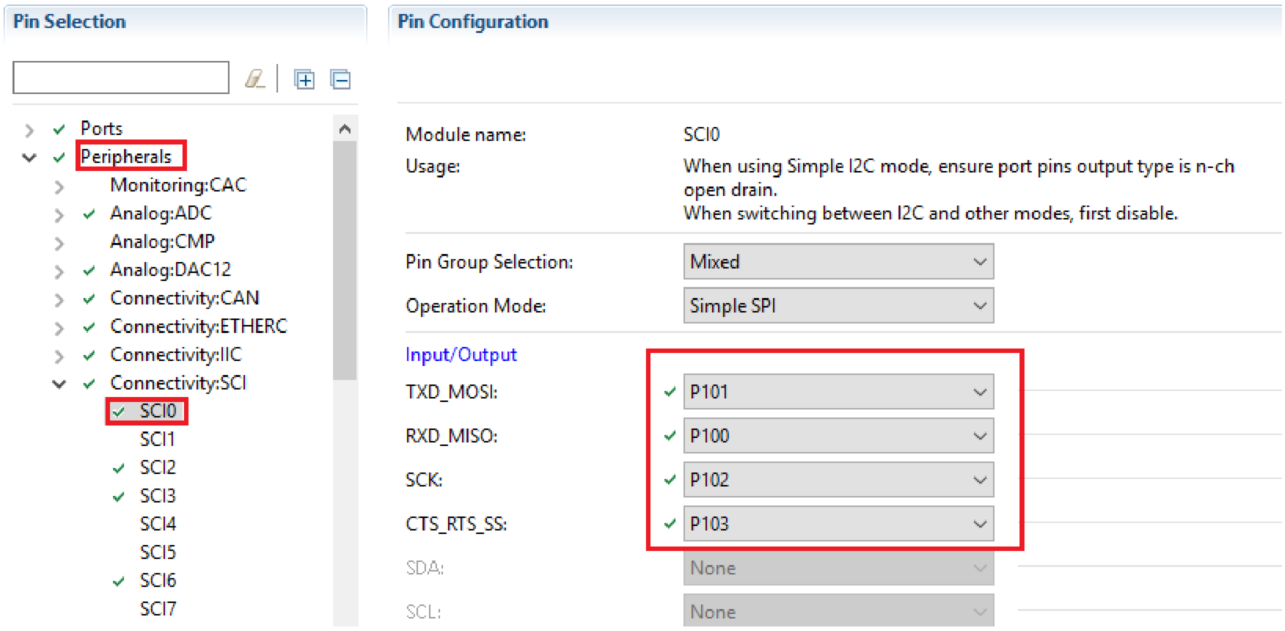
36. Select **Peripherals** > **Connectivity:SPI** > **SPI0** in **Pin Selection** and change **Operation Mode** to **Disabled** in **Pin Configuration** of **SPI0**. This must be disabled to free the pins it shares with the SCI module.



Module name: SPI0
Usage: For SPI, same Pin Group recommended
Pin Group Selection: _A only
Operation Mode: Disabled
MISO: None
MOSI: None
RSPCK: None
SSL0: None
SSL1: None

Figure 49. Disable SPI0_Pin_Option_A in Pin Configuration

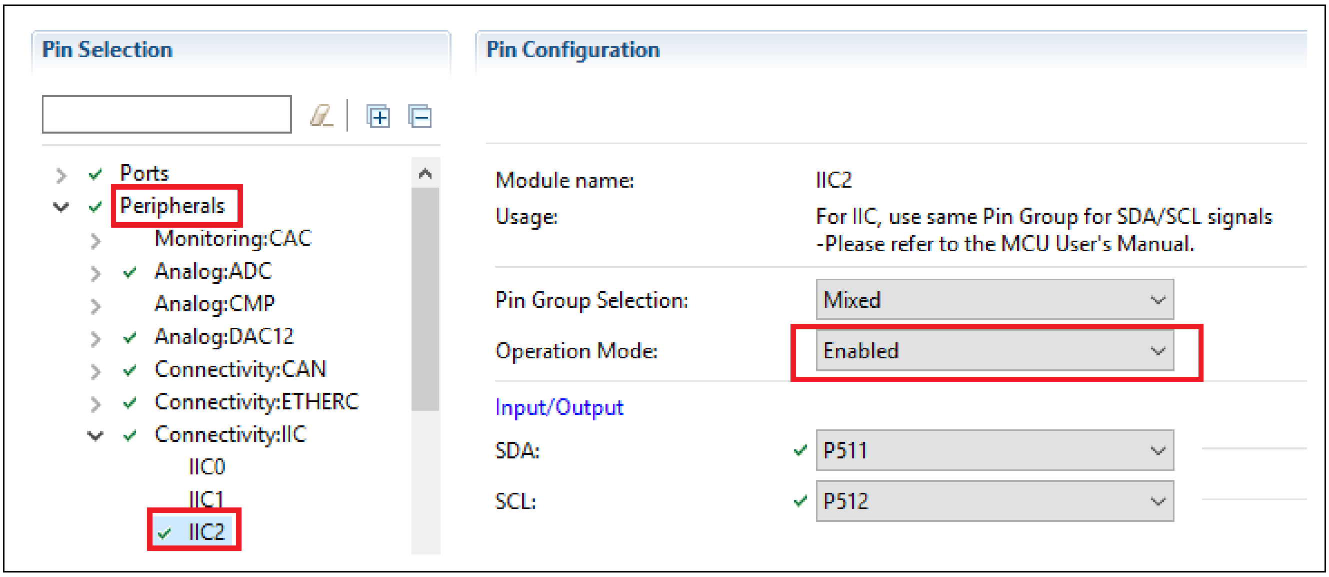
37. Select **Peripherals** > **Connectivity:SCI**> **SCI0** in **Pin Selection** and make the following configuration in **Pin Configuration** of the **SCI0** module.



Module name: SCI0
Usage: When using Simple I2C mode, ensure port pins output type is n-ch open drain.
When switching between I2C and other modes, first disable.
Pin Group Selection: Mixed
Operation Mode: Simple SPI
TXD_MOSI: P101
RXD_MISO: P100
SCK: P102
CTS_RTS_SS: P103
SDA: None
SCL: None

Figure 50. Configure SCI0 Pin Configuration

38. Select **Peripherals** > **Connectivity: IIC** > **IIC2** as the **Pin Selection** and enable the **IIC2** module in the **Pin Configuration**.



Module name: IIC2

Usage: For IIC, use same Pin Group for SDA/SCL signals -Please refer to the MCU User's Manual.

Pin Group Selection: Mixed

Operation Mode: Enabled

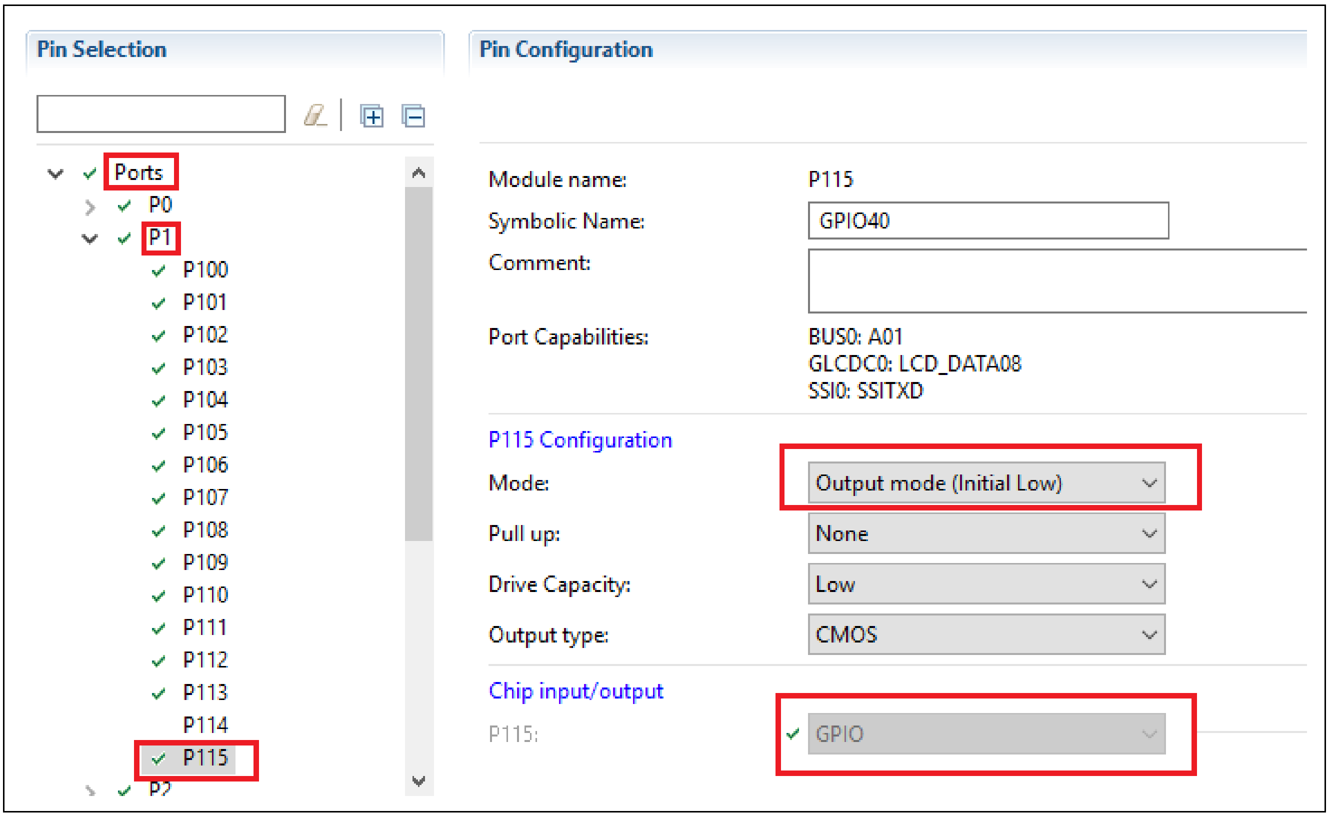
Input/Output

SDA: P511

SCL: P512

Figure 51. Configure IIC2 Pin Configuration

39. Select **Ports** > **P1** > **P115** in **Pin Selection** and configure **GPIO** in **Pin Configuration**. This pin is connected with the LCD panel on the SK-S7G2 board to control data access timing from LCD_WR signal.



Module name: P115

Symbolic Name: GPIO40

Comment:

Port Capabilities: BUS0: A01
GLCDC0: LCD_DATA08
SSI0: SSITXD

P115 Configuration

Mode: Output mode (Initial Low)

Pull up: None

Drive Capacity: Low

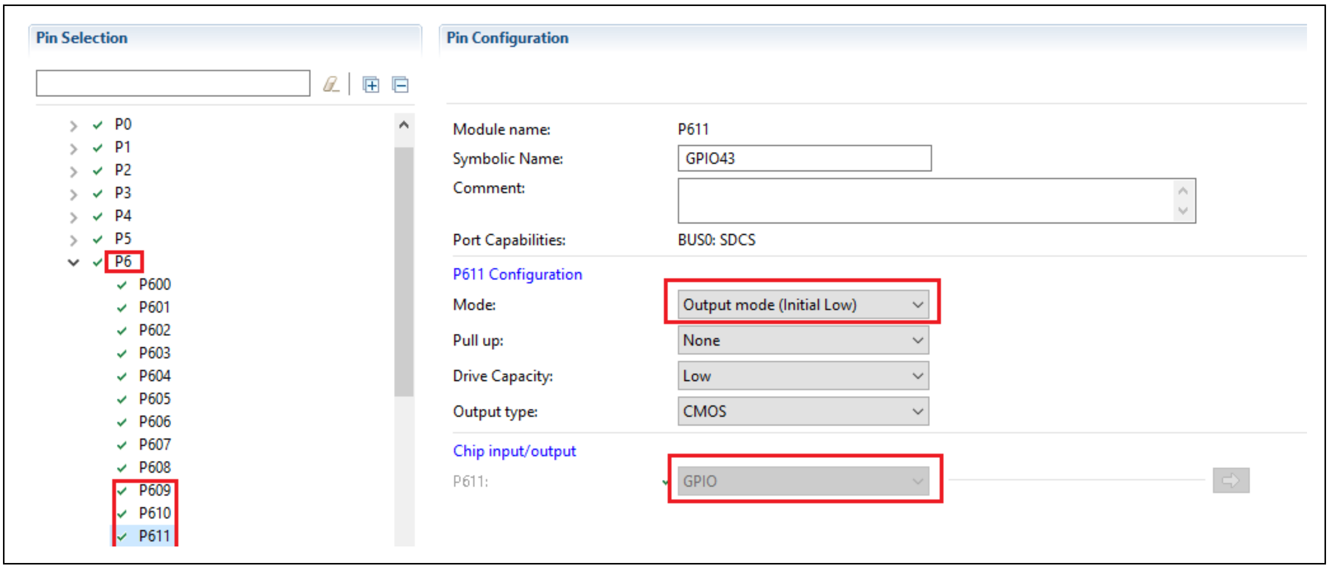
Output type: CMOS

Chip input/output

P115: GPIO

Figure 52. P115 configuration

40. Select **Ports** > **P6** in **Pin Selection** and configure **P609** (RESET# for Touch Panel), **P610** (LCD_RESET), and **P611** (LCD_CS) with output mode of **GPIO**.



Pin Selection

P0
P1
P2
P3
P4
P5
P6
P600
P601
P602
P603
P604
P605
P606
P607
P608
P609
P610
P611

Pin Configuration

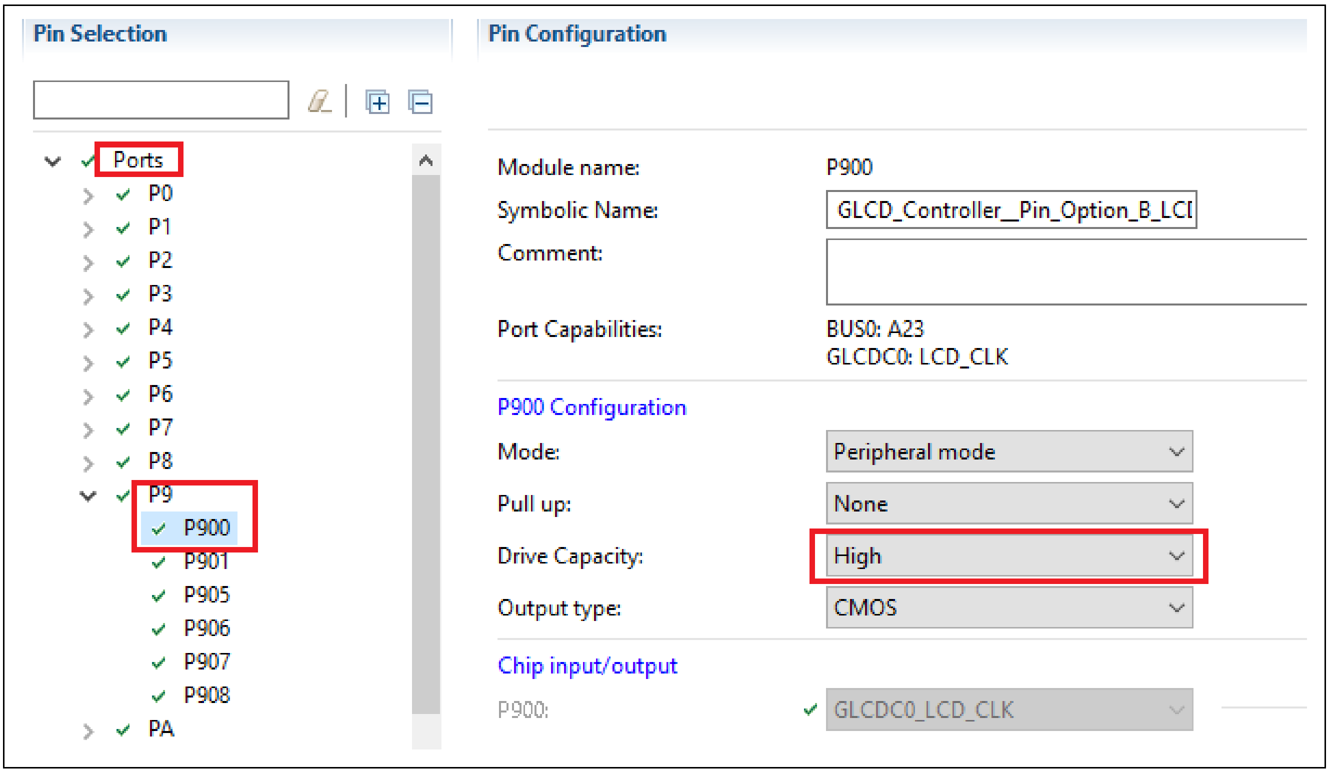
Module name: P611
Symbolic Name: GPIO43
Comment:
Port Capabilities: BUS0: SDCS

P611 Configuration
Mode: Output mode (Initial Low)
Pull up: None
Drive Capacity: Low
Output type: CMOS

Chip input/output
P611: GPIO

Figure 53. P609, P610 and P611 configurations

41. Configure **Drive Capacity** to **High** for all pins related to **GLCD_Controller_Pin_Option_B** as shown in Figure 54.
There are two methods for setting the **Drive Capacity to High**. You may pick either one (A or B).
A. You can confirm which pins would be used for **GLCD_Controller_Pin_Option_B** by referring to Figure 54. through Figure 56.



Pin Selection

Ports
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P900
P901
P905
P906
P907
P908
PA

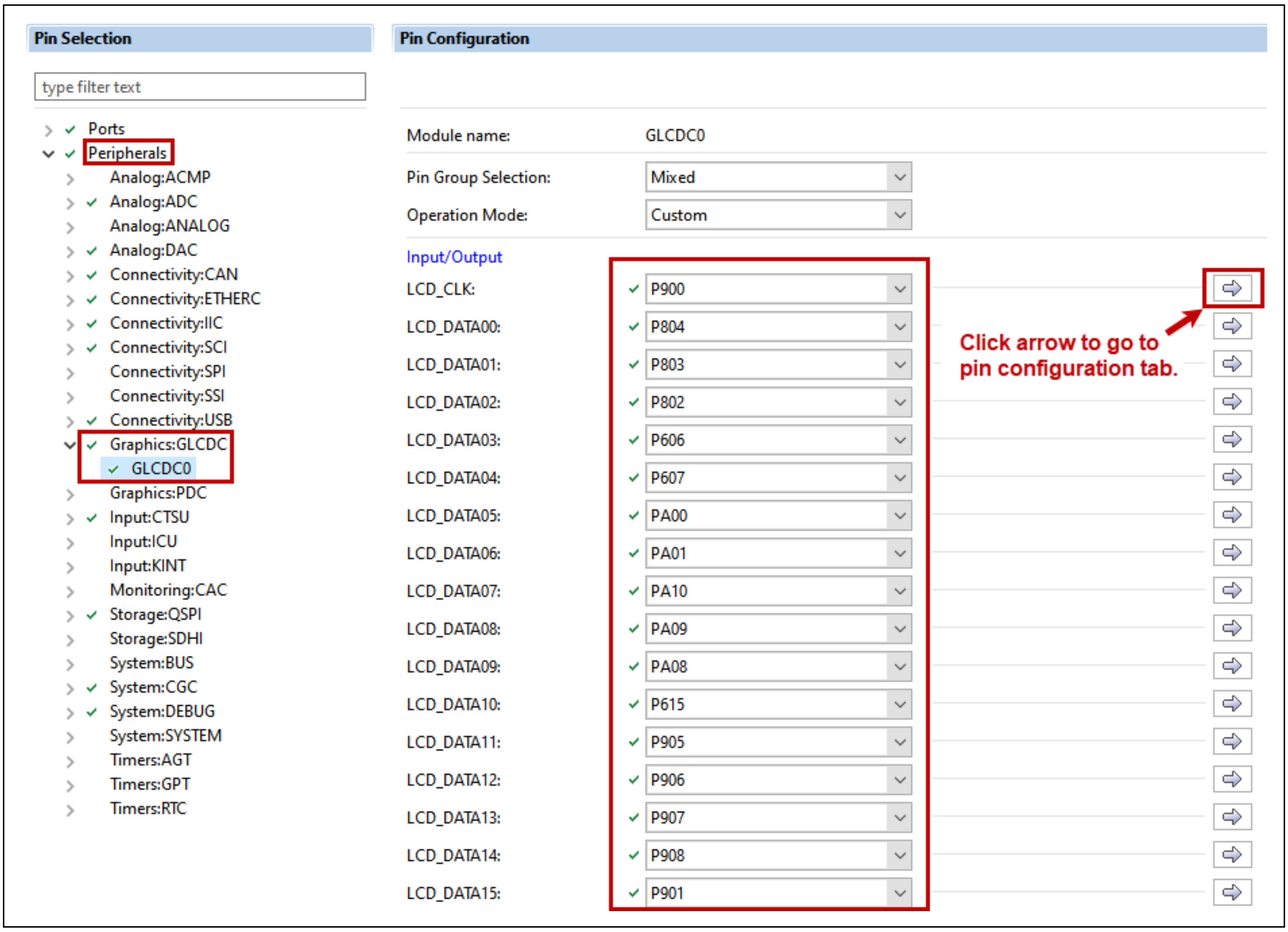
Pin Configuration

Module name: P900
Symbolic Name: GLCD_Controller_Pin_Option_B_LCI
Comment:
Port Capabilities: BUS0: A23
GLCDC0: LCD_CLK

P900 Configuration
Mode: Peripheral mode
Pull up: None
Drive Capacity: High
Output type: CMOS

Chip input/output
P900: GLCDC0_LCD_CLK

Figure 54. Example of Drive Capability configuration for GLCDC



Module name: GLCDC0

Pin Group Selection: Mixed

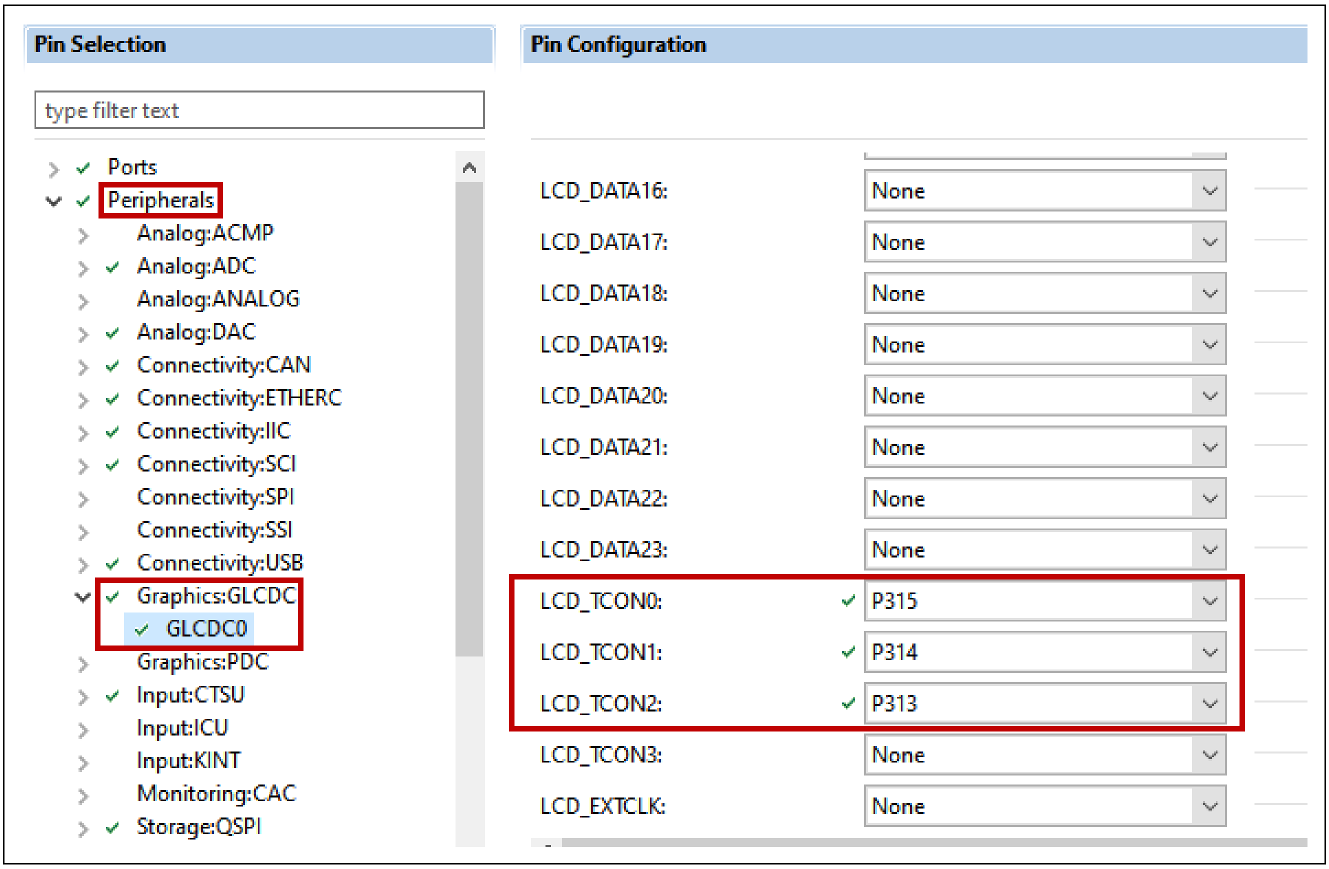
Operation Mode: Custom

Input/Output

LCD_CLK:	P900
LCD_DATA00:	P804
LCD_DATA01:	P803
LCD_DATA02:	P802
LCD_DATA03:	P606
LCD_DATA04:	P607
LCD_DATA05:	PA00
LCD_DATA06:	PA01
LCD_DATA07:	PA10
LCD_DATA08:	PA09
LCD_DATA09:	PA08
LCD_DATA10:	P615
LCD_DATA11:	P905
LCD_DATA12:	P906
LCD_DATA13:	P907
LCD_DATA14:	P908
LCD_DATA15:	P901

Click arrow to go to pin configuration tab.

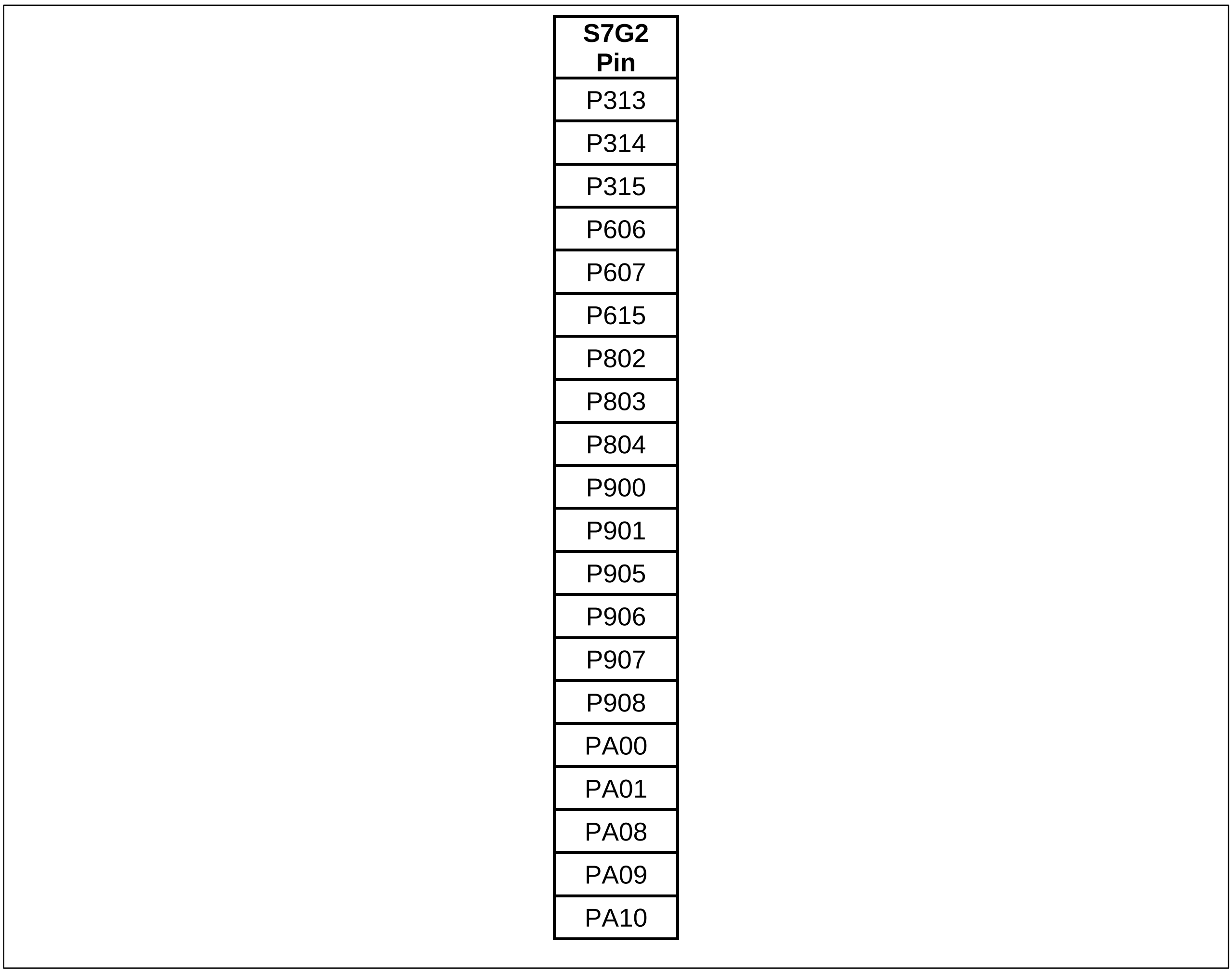
Figure 55. Pin assignment for GLCD_Controller_Pin_Option_B



LCD_DATA16: None
LCD_DATA17: None
LCD_DATA18: None
LCD_DATA19: None
LCD_DATA20: None
LCD_DATA21: None
LCD_DATA22: None
LCD_DATA23: None
LCD_TCON0: ✓ P315
LCD_TCON1: ✓ P314
LCD_TCON2: ✓ P313
LCD_TCON3: None
LCD_EXTCLK: None

Figure 56. Pin assignment for GLCD_Controller_Pin_Option_B (continued)

B. You can also set the pins by port. Below is an ordered list of the pins that must have the **Drive Capacity** set to **High**. You can access these ports by going to **Ports** > **PX** > **PXYZ**, where X is the second digit of the port from the list, and PXYZ is the entire port. Once the port is selected, set the **Drive Capacity** to **High** as shown in Figure 57.



S7G2 Pin
P313
P314
P315
P606
P607
P615
P802
P803
P804
P900
P901
P905
P906
P907
P908
PA00
PA01
PA08
PA09
PA10

Figure 57. Ordered list of ports to configure as high drive capacity

42. Save the project by pressing **Ctrl + s** on the keyboard.
43. Click the **Generate Project Content** button to update the project files.

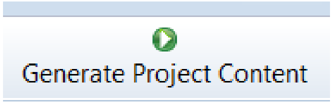


Figure 58. Generate Project Content

44. In the **Project Explorer** window, right-click **src** and select **New** > **Folder** to bring up the **New Folder** dialog box.

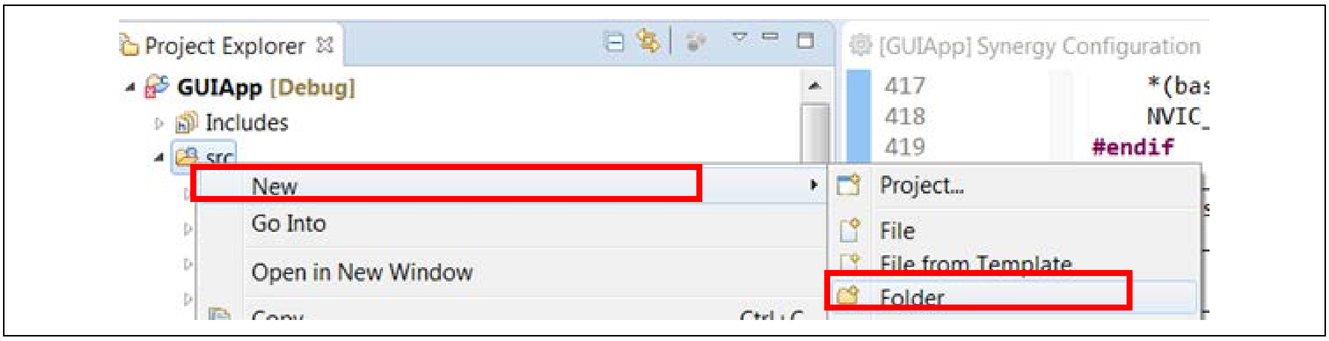
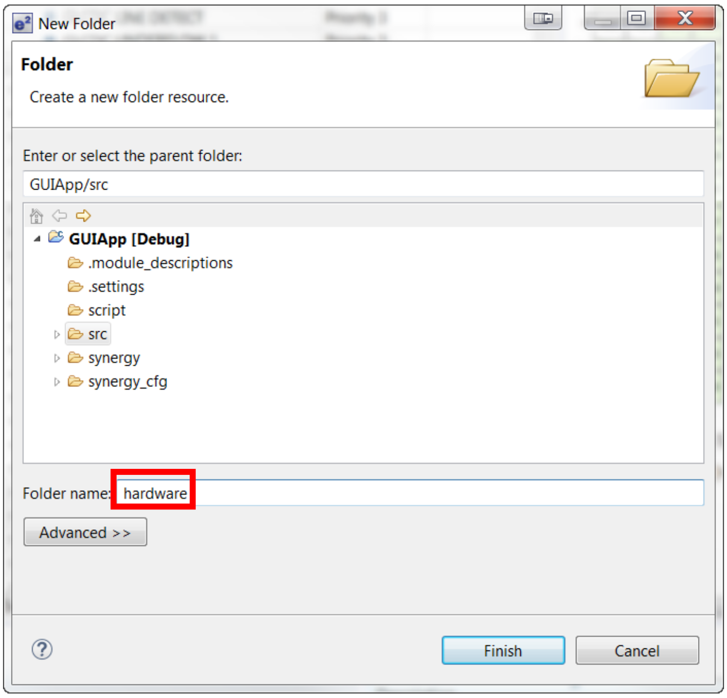


Figure 59. Creating a New Folder

45. Enter the name of the new folder, **hardware**, in the **Folder name:** text box.


New Folder

Folder

Create a new folder resource.

Enter or select the parent folder:

GUIApp/src

Folder name: hardware

Figure 60. New Folder Dialog

46. Click the **Finish** button.

47. The folder appears in **Project Explorer** shown below.

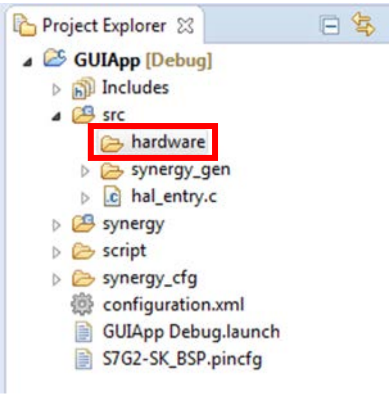
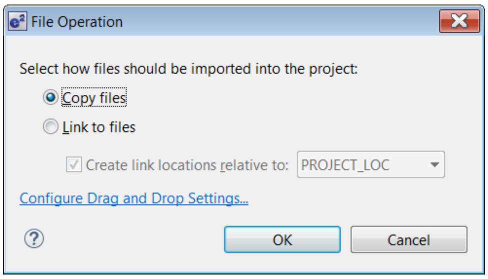


Figure 61. Hardware folder

48. Open **Windows Explorer** and navigate to where you put the files included with this application note. Locate the file `Source_PK or Source_SK Files\lcd.h`. Now drag the file from the **Windows Explorer** window into the new **hardware** folder inside the e^2 studio **Project Explorer** window.
49. When prompted to import the selected files, click **OK** to copy the files.



File Operation

Select how files should be imported into the project:

● Copy files

○ Link to files

☑ Create link locations relative to: PROJECT_LOC

Configure Drag and Drop Settings...

Figure 62. File Operation dialog

Note: This file contains the command definitions to control LCD panel.

50. Open **Windows Explorer** and navigate to where you put the files included with this application note. Locate the file `Source_PK or Source_SK Files\lcd_setup.c`. Now drag the file from the **Windows Explorer** window into the **hardware** folder inside the e^2 studio **Project Explorer** window.
51. When prompted to import the selected files, click **OK** to copy the files.

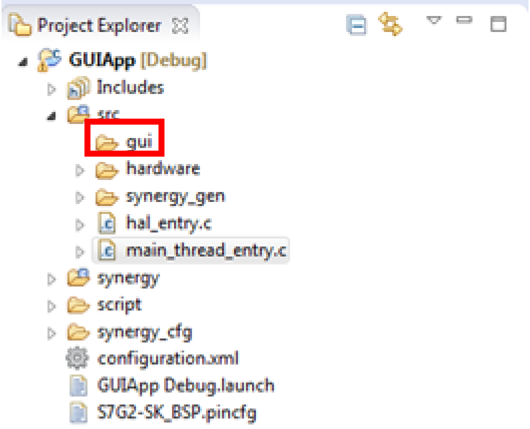
    Note: This file contains command protocol through SPI to LCD panel and the initialization sequence.
52. Open **Windows Explorer** and navigate where you put the files included in this application note. Locate the file `Source Files\main_thread_entry.c`. Now drag the file from the **Windows Explorer** window into the **src** folder inside the e^2 studio **Project Explorer** window.
53. When prompted to import the selected files, click **OK** to copy the files.
54. When prompted to overwrite, click **Yes**.

    Note: This file contains the Main Thread event handling code. It reads low level touchscreen events from the queue and transforms them to graphical user interface actions.

5. Creating the GUIX Interface using GUIX Studio

Now that the base project is set up, you can start adding the GUIX components.

1. Create a new folder named **gui** inside the **src** by right clicking on the **src** folder and selecting **New** > **Folder**.

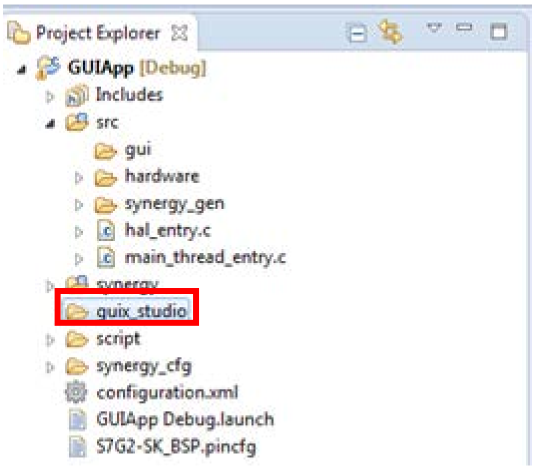


Project Explorer

- GUIApp [Debug]
  - Includes
  - src
    - gui
    - hardware
    - synergy_gen
    - hal_entry.c
    - main_thread_entry.c
  - synergy
  - script
  - synergy_cfg
  - configuration.xml
  - GUIApp Debug.launch
  - S7G2-SK_BSP.pincfg

Figure 63. Creating a gui folder under the src folder

2. Create another new folder named **guix_studio** in the root folder of the project by right-clicking **GUIApp** and selecting **New** > **Folder**. The final folder layout should look like the figure below.



```
GUIApp [Debug]
  Includes
  src
    gui
    hardware
    synergy_gen
    hal_entry.c
    main_thread_entry.c
  synergy
  guix_studio
  script
  synergy_cfg
  configuration.xml
  GUIApp Debug.launch
  S7G2-SK_BSP.pincfg
```

Figure 64. Final Folder list

3. Open GUIX Studio by clicking the desktop icon or by clicking the **GUIX Studio** icon in the **Windows Start** menu, **All Programs** > **Express Logic** > **GUIX Studio 6.1.8.0** folder.

Figure 65. Start GUIX Studio

4. In the **Recent Projects** dialog, click **Create New Project…**

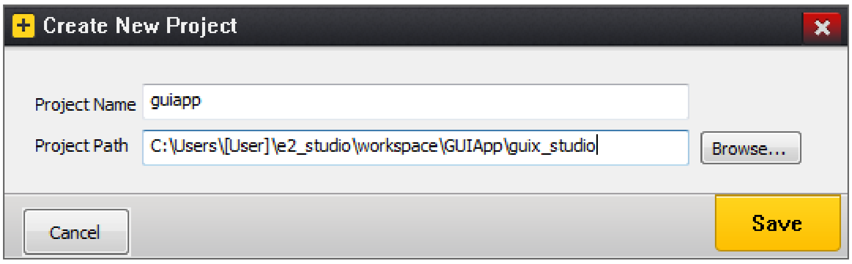
Figure 66. Create New Project

5. Name the project **guiapp**.

Important: Filenames are generated by appending names to the project name. Be aware that the project name is case-sensitive. Later, files will be added to the project that you have named **guiapp**.

6. For the project path, browse to the location of the folder we created earlier called **guix_studio**.

   Note: If you installed the tools into the default directories, the folder will be located at `C:\Users\[User]\e2_studio\workspace\GUIAPP\GUIApp\guix_studio`.



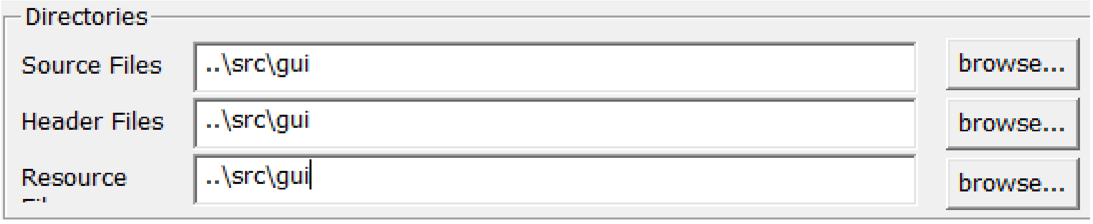
Project Name: guiapp

Project Path: C:\Users\[User]\e2_studio\workspace\GUIApp\guix_studio

Figure 67. Create a New GUIX project

7. Click **Save**.

8. Change the **Directories** for all three options to `..\src\gui`.



Directories

Source Files: ..\src\gui

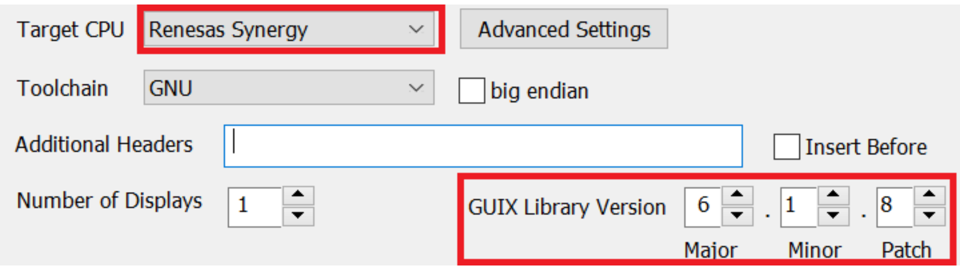
Header Files: ..\src\gui

Resource Files: ..\src\gui

Figure 68. Correct the file Locations

Important: Make sure you put in two periods **..** in the directories above.

9. Change the **Target CPU** setting to **Renesas Synergy**.
10. Change the **Toolchain** setting to **GNU** and select the latest **GUIX Library Version**.



Target CPU: Renesas Synergy

Toolchain: GNU

□ big endian

Additional Headers:

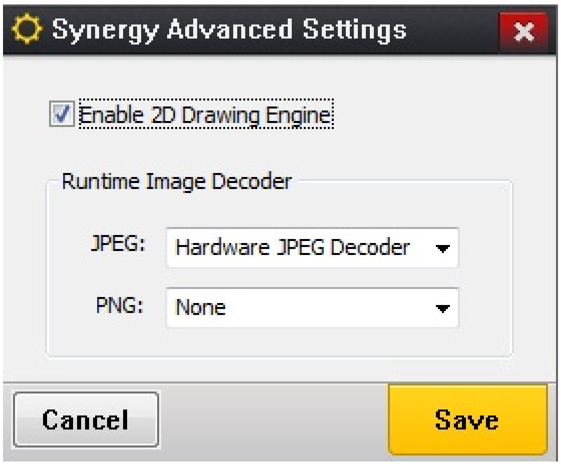
□ Insert Before

Number of Displays: 1

GUIX Library Version: 6 . 1 . 8 (Major, Minor, Patch)

Figure 69. Target and GUIX version settings

11. Click **Advanced Settings**. A dialog will appear.
12. Enable the **2D Drawing Engine** and **Hardware JPEG Decoder** as shown in the following screen.



Synergy Advanced Settings

☑ Enable 2D Drawing Engine

Runtime Image Decoder

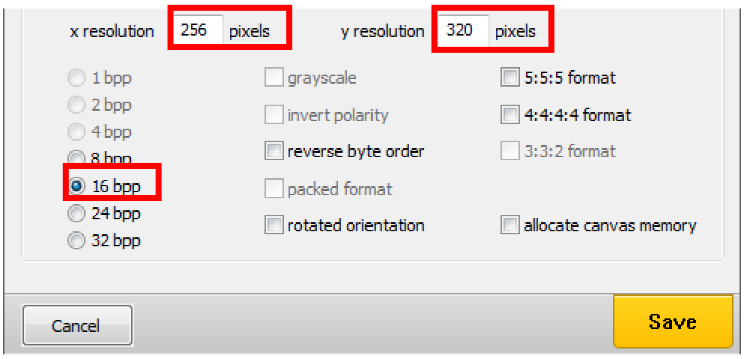
JPEG: Hardware JPEG Decoder

PNG: None

Figure 70. Synergy Advanced Settings

13. Click **Save**.

14. Setup the **Display Configuration** as shown below.



x resolution 256 pixels y resolution 320 pixels

○ 1 bpp □ grayscale □ 5:5:5 format
○ 2 bpp □ invert polarity □ 4:4:4 format
○ 4 bpp □ reverse byte order □ 3:3:2 format
○ 8 bpp □ packed format
● 16 bpp
○ 24 bpp □ rotated orientation □ allocate canvas memory
○ 32 bpp

Figure 71. Configure Project

15. Click **Save** to generate the project.
16. Right-click **display_1** in the **Project View**.
17. Select **Insert** > **Window** > **Window**.

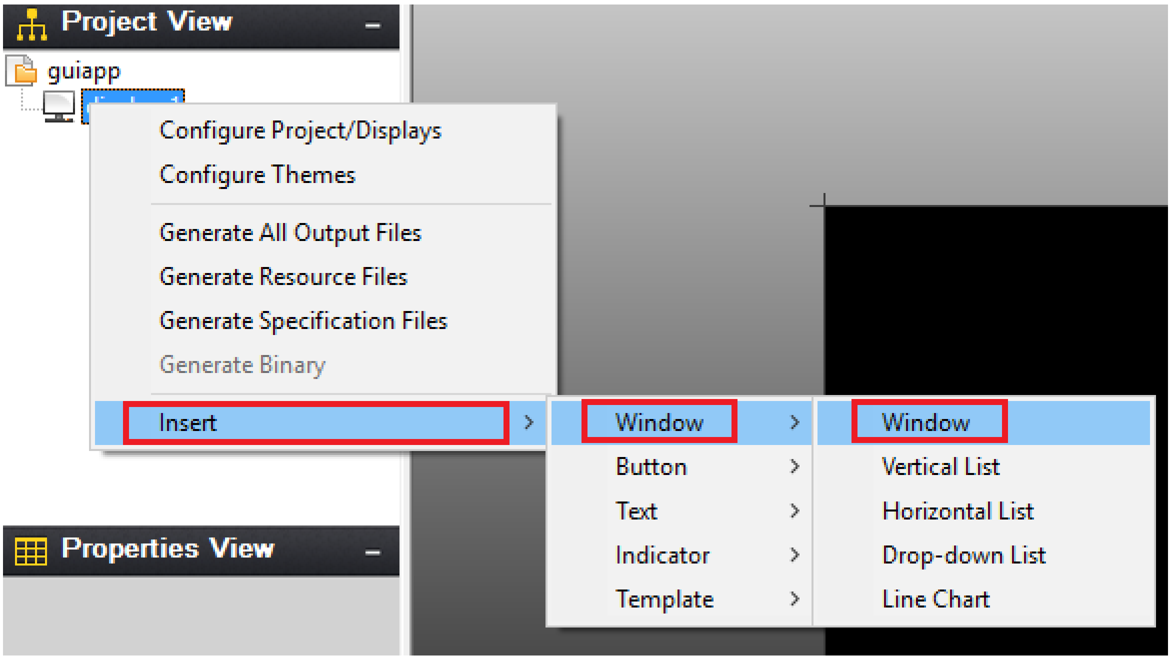
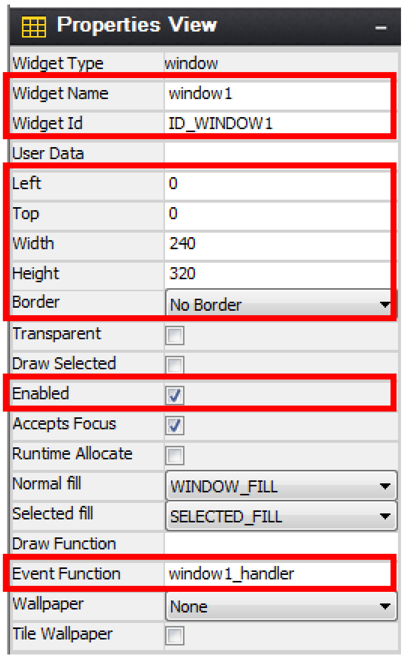


Figure 72. New Window

18. Modify the properties by selecting the new window and editing the **Properties View**. Update the current settings to match the following. Notice the **Event Function** field. This is the event that will be initiated when the touch screen is pressed in window1.

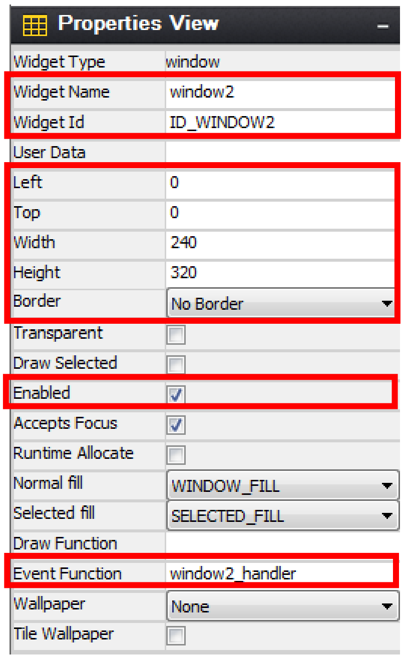


Properties View

Widget Type	window
Widget Name	window1
Widget Id	ID_WINDOW1
User Data	
Left	0
Top	0
Width	240
Height	320
Border	No Border
Transparent	☐
Draw Selected	☐
Enabled	☑
Accepts Focus	☑
Runtime Allocate	☐
Normal fill	WINDOW_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	window1_handler
Wallpaper	None
Tile Wallpaper	☐

Figure 73. Configure window1 properties

19. Notice the window does not occupy the entire display. This is expected when working with GUIX with small screens and does affect the display once the application is running.
20. In the **Project View** window, right-click **display_1** and create another window by selecting **Insert > Window > Window**.
21. Modify the properties to match the following. Notice the **Event Function** field. This is the event that will be initiated when the touch screen is pressed in window2.



Properties View

Widget Type	window
Widget Name	window2
Widget Id	ID_WINDOW2
User Data	
Left	0
Top	0
Width	240
Height	320
Border	No Border
Transparent	☐
Draw Selected	☐
Enabled	☑
Accepts Focus	☑
Runtime Allocate	☐
Normal fill	WINDOW_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	window2_handler
Wallpaper	None
Tile Wallpaper	☐

Figure 74. Configure window2 properties

22. In the **Project View**, right-click **window1** and insert a Text Button by selecting **Insert > Button >Text Button**.

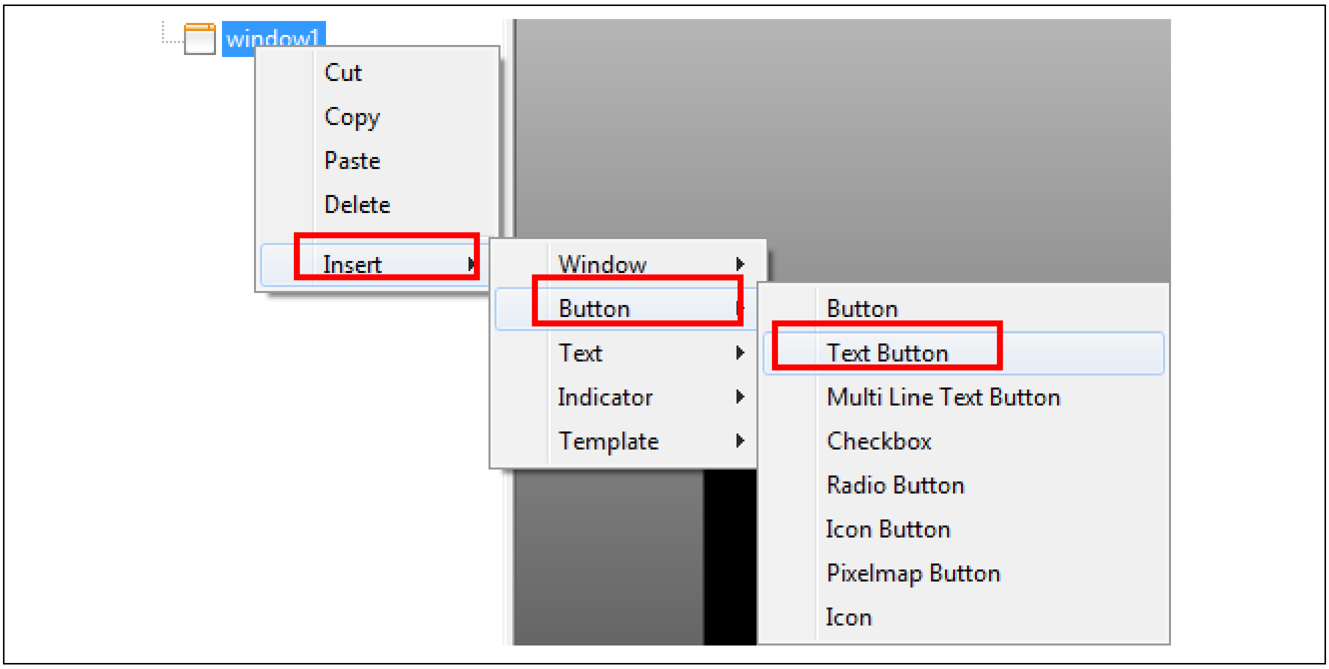


Figure 75. Add a New Text Button

23. In the **Project View**, right-click **window1** and insert a Button Checkbox by selecting **Insert** > **Button** > **Checkbox**.

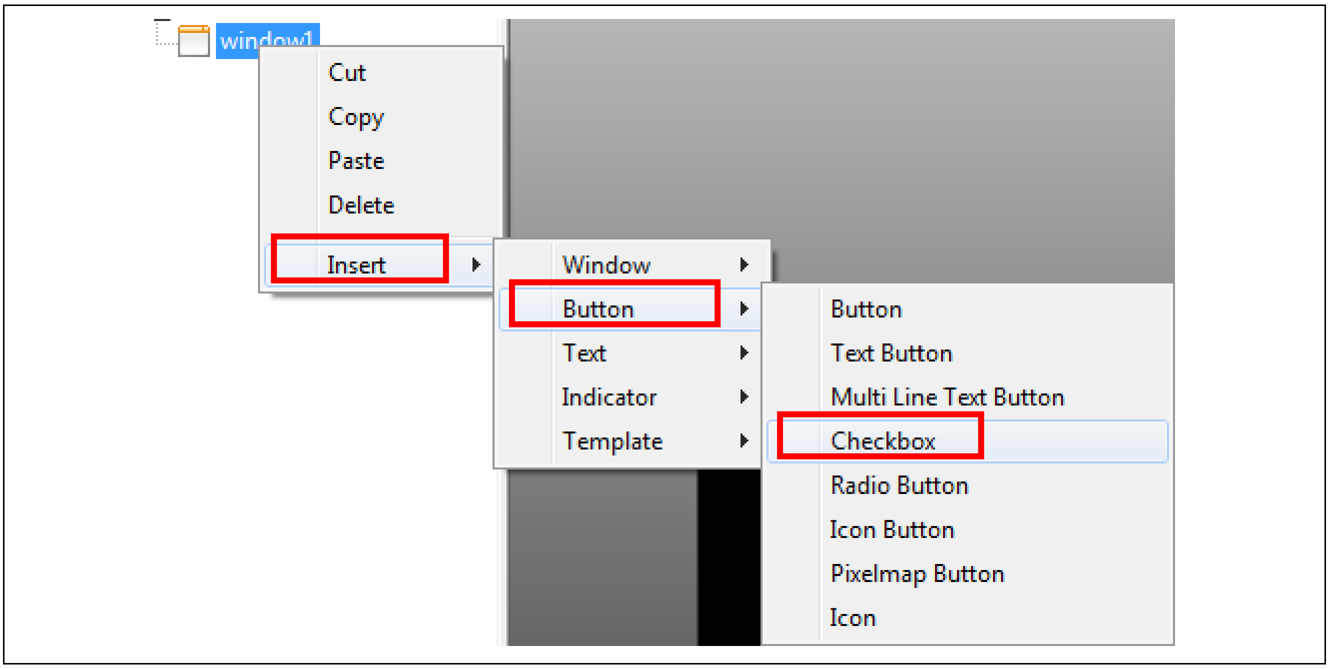


Figure 76. Add a New Checkbox

24. In the **Project View**, right-click **window1** and Insert a Text Prompt by selecting **Insert > Text > Prompt**.

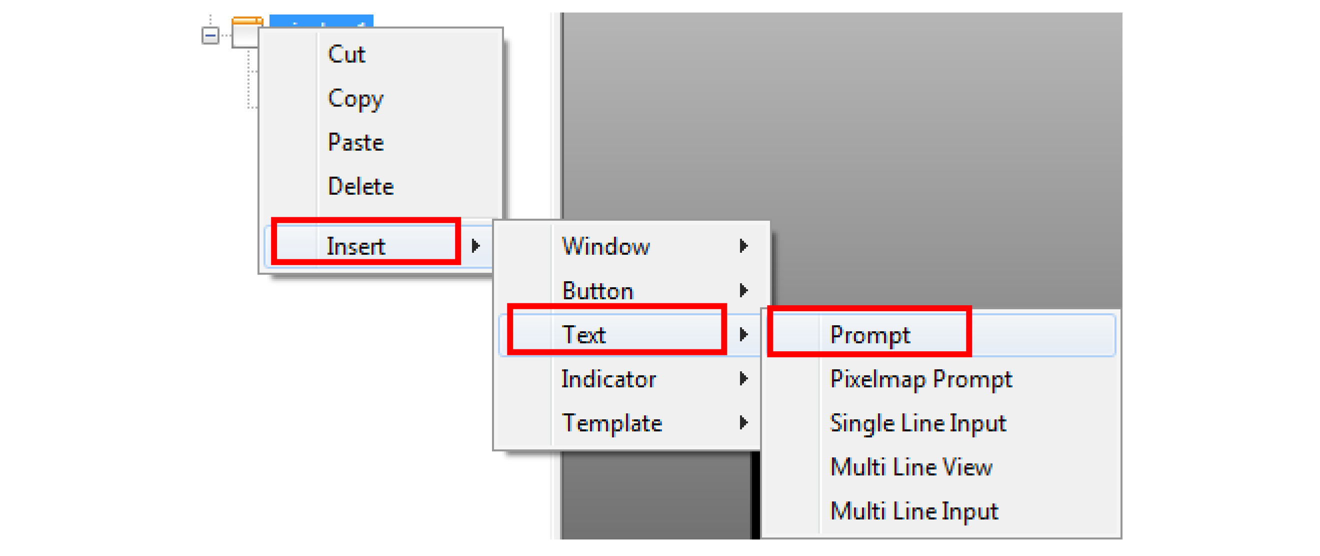


Figure 77. Adding New Prompt

25. In the **Project View**, right-click **window1** and **Insert** another **Text Prompt**.
26. In the **Project View**, right-click **window2** and **Insert** a **Text Prompt**.
27. In the **Project View**, right-click **window2** and **Insert** another **Text Prompt**.
28. If you have followed these directions correctly, your **Project View** should look like the following screen.

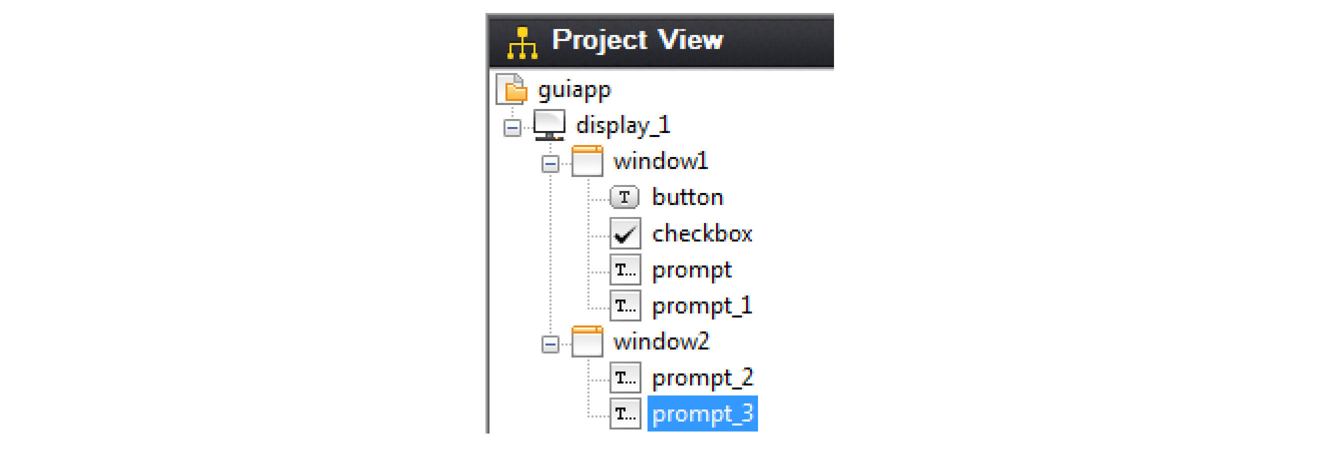


Figure 78. GUIX Project View

29. Expand the **Strings** menu by clicking **+**.

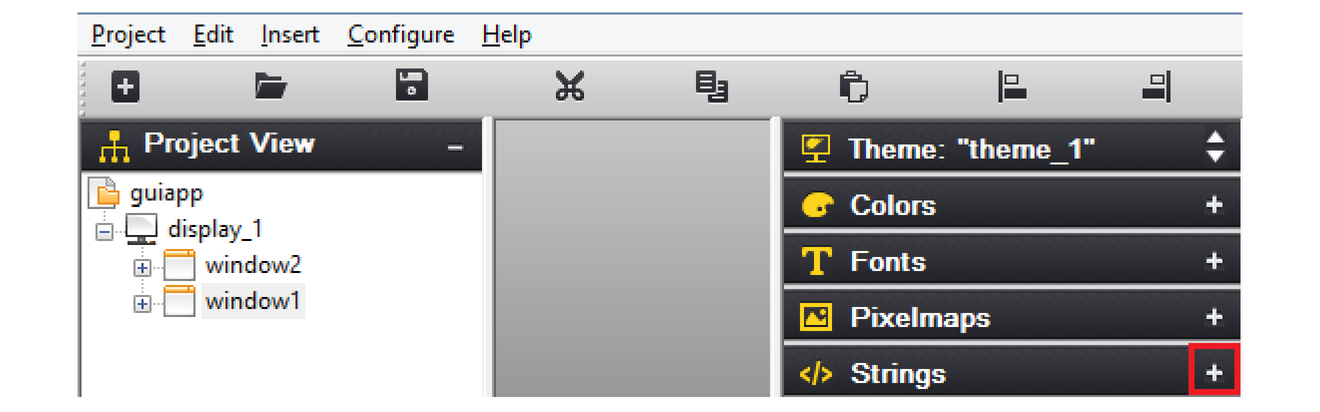
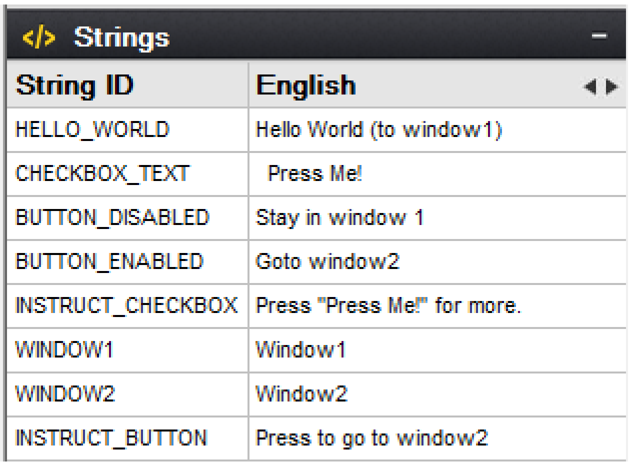


Figure 79. Strings Button

30. Double-click any of the strings to open the **String Table Editor**.
31. Delete the existing strings by selecting them, then click the **Delete String** button in the **String Table Editor**.
32. Add the following **Strings** using the **Add String** button:

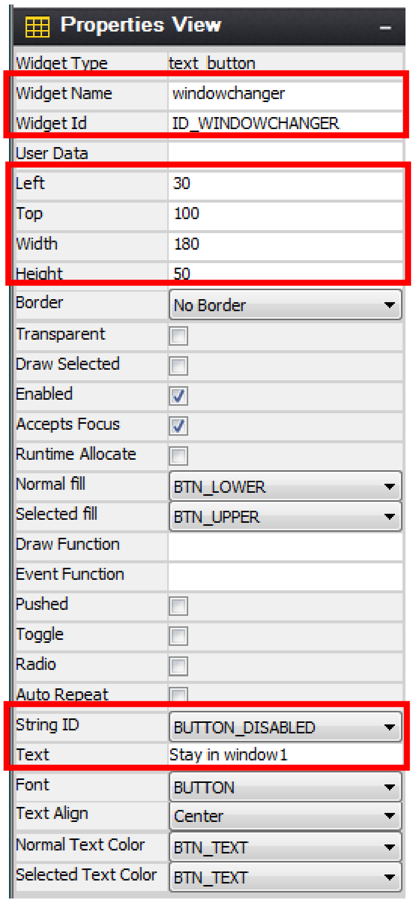


Strings

String ID	English
HELLO_WORLD	Hello World (to window1)
CHECKBOX_TEXT	Press Me!
BUTTON_DISABLED	Stay in window 1
BUTTON_ENABLED	Goto window2
INSTRUCT_CHECKBOX	Press "Press Me!" for more.
WINDOW1	Window1
WINDOW2	Window2
INSTRUCT_BUTTON	Press to go to window2

Figure 80. New Strings

33. When completed, click **Save**.
34. In the **Project View** under **window1**, click the button and then modify the properties in the **Properties View** to match the following.

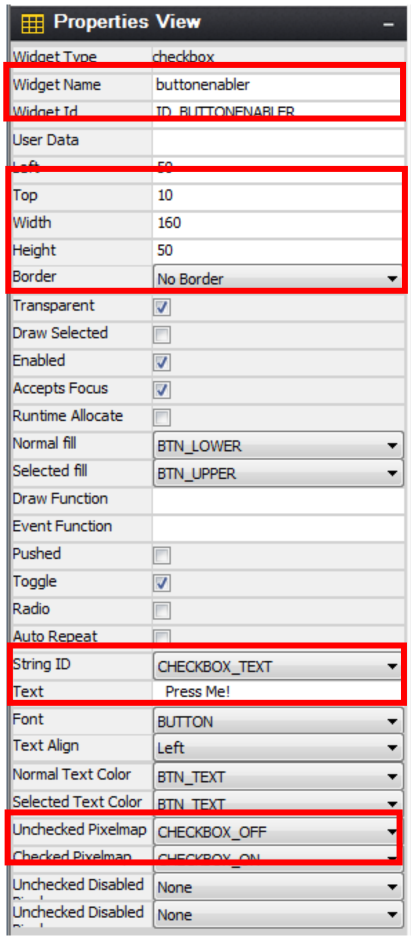


Properties View

Widget Type	text_button
Widget Name	windowchanger
Widget Id	ID_WINDOWCHANGER
User Data	
Left	30
Top	100
Width	180
Height	50
Border	No Border
Transparent	□
Draw Selected	□
Enabled	☑
Accepts Focus	☑
Runtime Allocate	□
Normal fill	BTN_LOWER
Selected fill	BTN_UPPER
Draw Function	
Event Function	
Pushed	□
Toggle	□
Radio	□
Auto Repeat	□
String ID	BUTTON_DISABLED
Text	Stay in window1
Font	BUTTON
Text Align	Center
Normal Text Color	BTN_TEXT
Selected Text Color	BTN_TEXT

Figure 81. Configure windowchanger Button properties

35. In the **Project View** under **window1**, click the checkbox, then modify the properties in the **Properties View** to match the following screen.

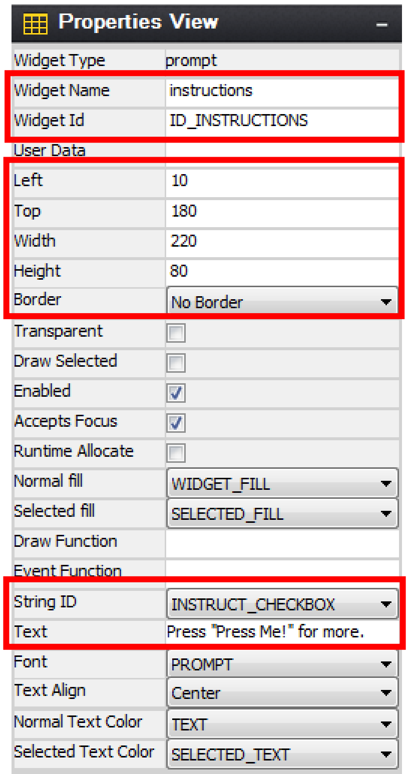


Properties View

Widget Type	checkbox
Widget Name	buttonenabler
Widget Id	ID_BUTTONENABLER
User Data	
Left	50
Top	10
Width	160
Height	50
Border	No Border
Transparent	☑
Draw Selected	□
Enabled	☑
Accepts Focus	☑
Runtime Allocate	□
Normal fill	BTN_LOWER
Selected fill	BTN_UPPER
Draw Function	
Event Function	
Pushed	□
Toggle	☑
Radio	□
Auto Repeat	□
String ID	CHECKBOX_TEXT
Text	Press Me!
Font	BUTTON
Text Align	Left
Normal Text Color	BTN_TEXT
Selected Text Color	BTN_TEXT
Unchecked Pixelmap	CHECKBOX_OFF
Checked Pixelmap	CHECKBOX_ON
Unchecked Disabled	None
Unchecked Disabled	None

Figure 82. Configure Buttonenabler Checkbox properties

36. In the **Project View** under **window1**, click **Prompt**, then modify the properties to match the following.

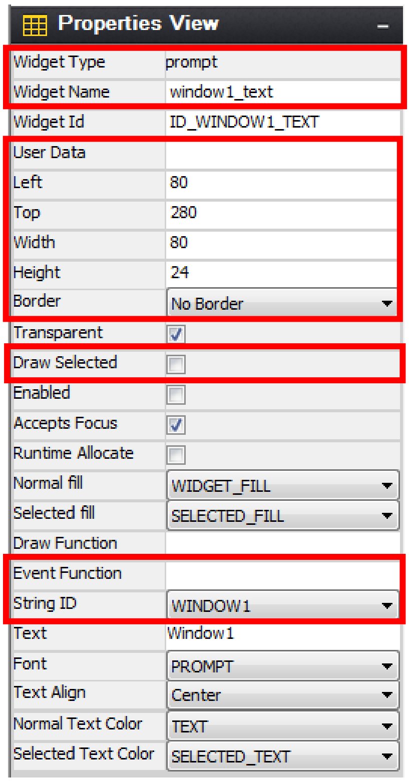


Properties View

Widget Type	prompt
Widget Name	instructions
Widget Id	ID_INSTRUCTIONS
User Data	
Left	10
Top	180
Width	220
Height	80
Border	No Border
Transparent	□
Draw Selected	□
Enabled	☑
Accepts Focus	☑
Runtime Allocate	□
Normal fill	WIDGET_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	
String ID	INSTRUCT_CHECKBOX
Text	Press "Press Me!" for more.
Font	PROMPT
Text Align	Center
Normal Text Color	TEXT
Selected Text Color	SELECTED_TEXT

Figure 83. Configure Prompt properties

37. In the **Project View** under **window1**, click **prompt_1**, then modify the properties to match the following screen.

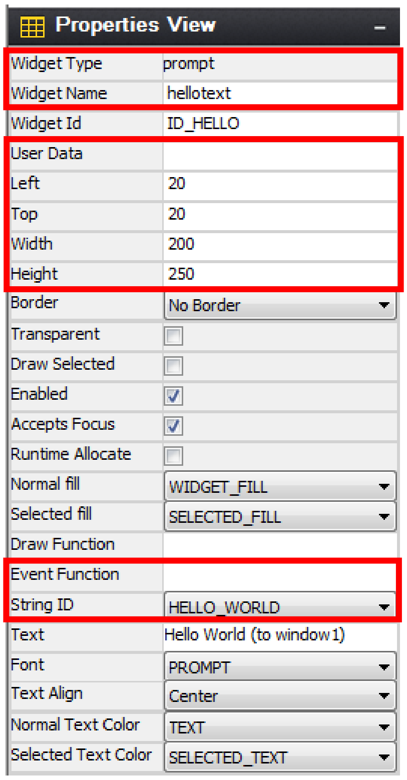


Properties View

Widget Type	prompt
Widget Name	window1_text
Widget Id	ID_WINDOW1_TEXT
User Data	
Left	80
Top	280
Width	80
Height	24
Border	No Border
Transparent	☑
Draw Selected	□
Enabled	□
Accepts Focus	☑
Runtime Allocate	□
Normal fill	WIDGET_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	
String ID	WINDOW1
Text	Window1
Font	PROMPT
Text Align	Center
Normal Text Color	TEXT
Selected Text Color	SELECTED_TEXT

Figure 84. Configure Window Text properties

38. In the **Project View** under **window2**, click **prompt_2**, then modify the properties to match the following.

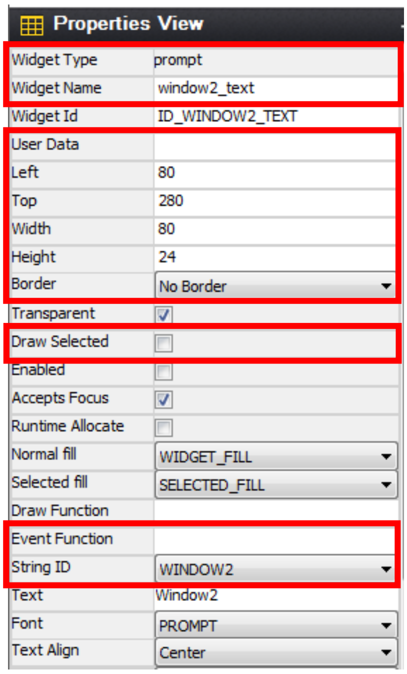


Properties View

Widget Type	prompt
Widget Name	hellotext
Widget Id	ID_HELLO
User Data	
Left	20
Top	20
Width	200
Height	250
Border	No Border
Transparent	□
Draw Selected	□
Enabled	☑
Accepts Focus	☑
Runtime Allocate	□
Normal fill	WIDGET_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	
String ID	HELLO_WORLD
Text	Hello World (to window1)
Font	PROMPT
Text Align	Center
Normal Text Color	TEXT
Selected Text Color	SELECTED_TEXT

Figure 85. Configure Hello Text Prompt properties

39. In the **Project View** under **window2**, click **prompt_3**, then modify the properties to match the following.



Properties View

Widget Type	prompt
Widget Name	window2_text
Widget Id	ID_WINDOW2_TEXT
User Data	
Left	80
Top	280
Width	80
Height	24
Border	No Border
Transparent	☑
Draw Selected	□
Enabled	□
Accepts Focus	☑
Runtime Allocate	□
Normal fill	WIDGET_FILL
Selected fill	SELECTED_FILL
Draw Function	
Event Function	
String ID	WINDOW2
Text	Window2
Font	PROMPT
Text Align	Center

Figure 86. Configure Window Text properties

After these configuration steps, the two windows should look similar to the following images.

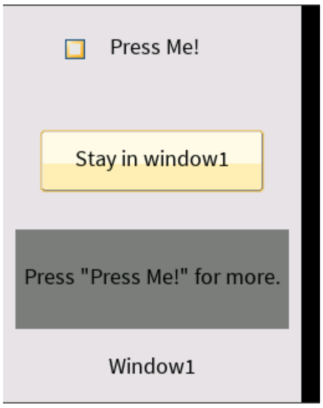


Figure 87. Configured window1

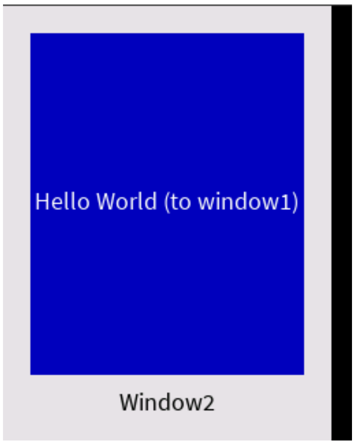


Figure 88. Configured window2

40. **Save** the project.

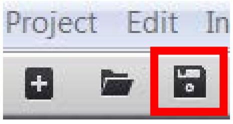


Figure 89. Save project

41. From the **Project** tab select **Generate All Output Files**.

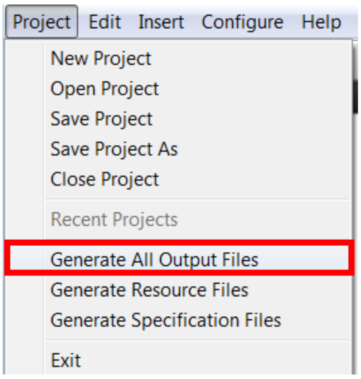
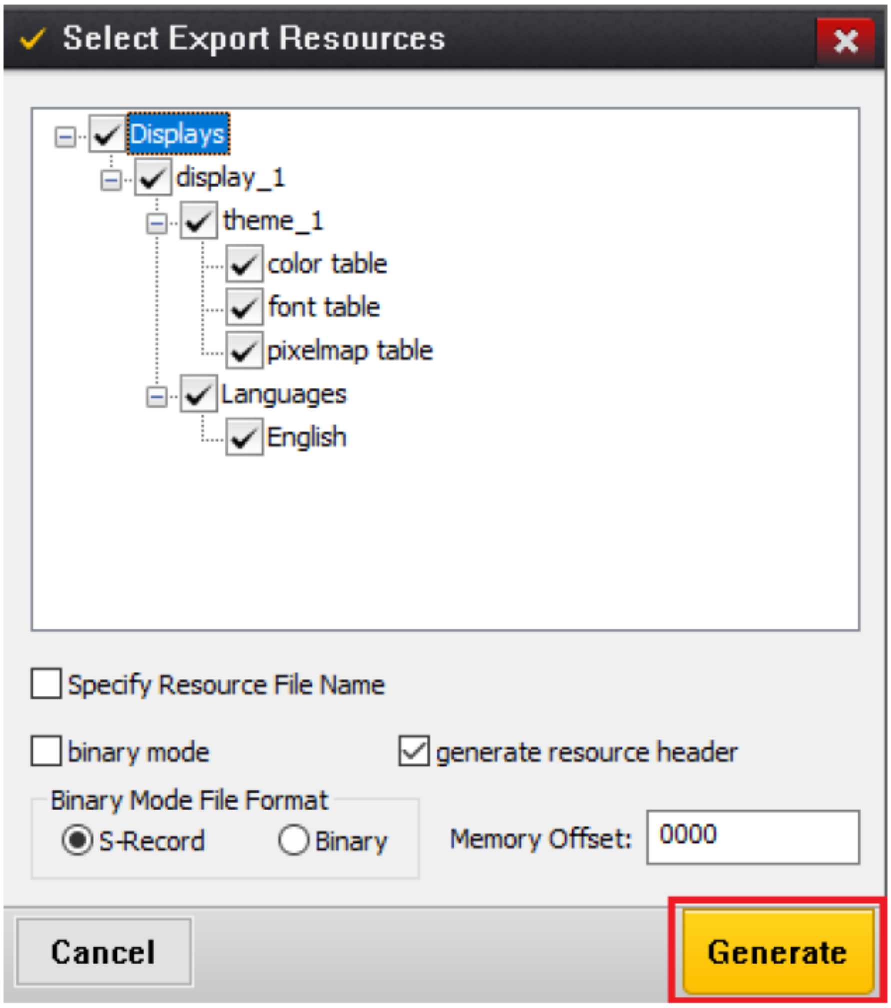


Figure 90. Generate All Output Files

42. Click **Generate**.



Select Export Resources

- ☑ Displays
  - ☑ display_1
    - ☑ theme_1
      - ☑ color table
      - ☑ font table
      - ☑ pixelmap table
    - ☑ Languages
      - ☑ English

☐ Specify Resource File Name

☐ binary mode ☑ generate resource header

Binary Mode File Format: ● S-Record ○ Binary

Memory Offset: 0000

Figure 91. Select Export Resources

43. Return to e^2 studio.

6. Adding code for custom interface controls and building the project

1. Open **Windows Explorer** and navigate to where you put the files included with this application note. Locate the file `Source_PK or Source_SK Files\guiapp_event_handlers.c`. Drag the file from the **Windows Explorer** window into the **src** folder inside the e^2 studio **Project Explorer** window.
2. When prompted to import the selected files, click **OK** to copy the files.

   Note: This file contains the event management functions for the different graphical elements created in GUIX Studio (window1, window2).

   GUIX handles the events that are required at a system level, but to handle custom commands like screen transitions and button actions, the event handler needs to be defined. Shown below is the event handler for window1.

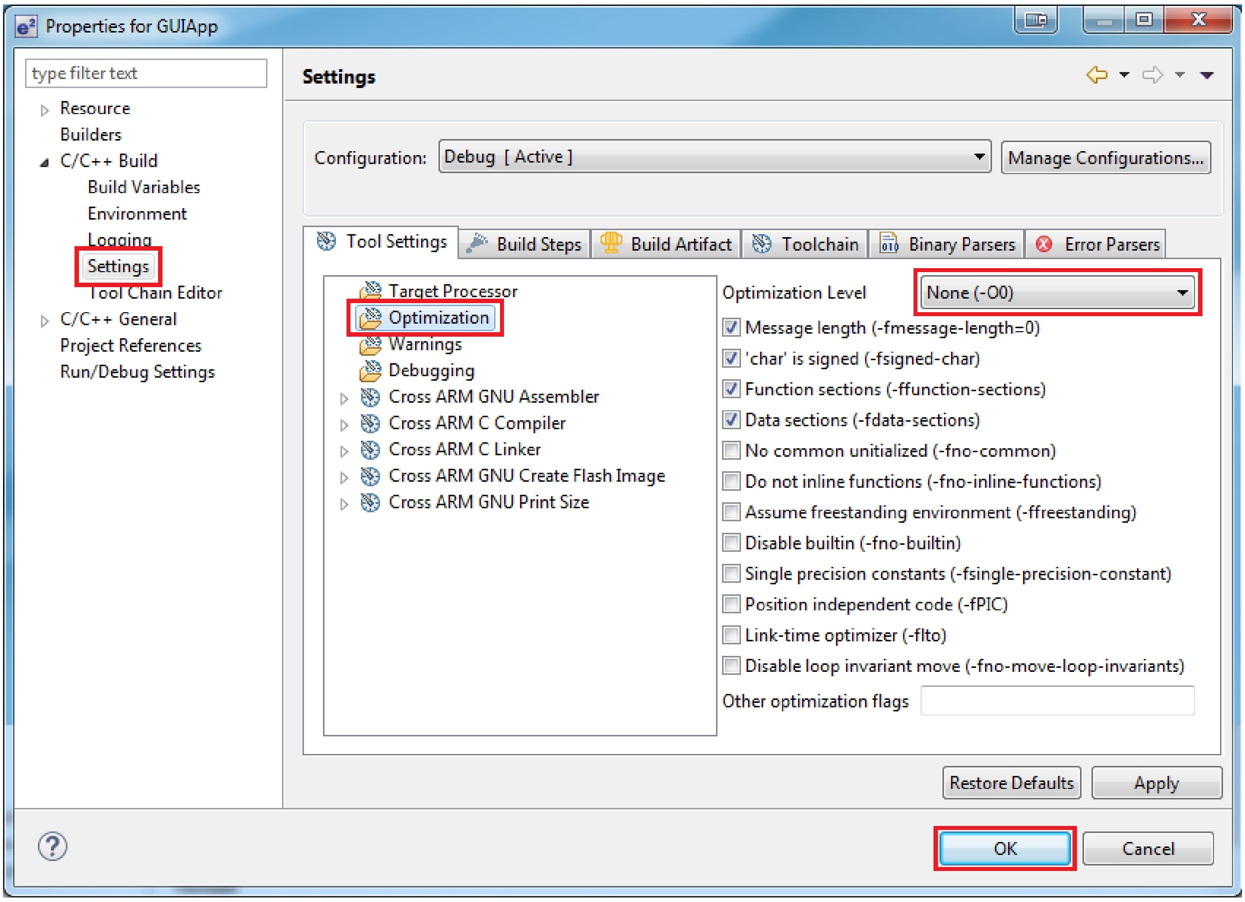
```
UINT window1_handler(GX_WINDOW *widget, GX_EVENT *event_ptr)
{
.    UINT result = gx_window_event_process(widget, event_ptr);

.    switch (event_ptr->gx_event_type)
.    {
.    case GX_SIGNAL(ID_BUTTONENABLER, GX_EVENT_TOGGLE_ON):
.   .     button_enabled = true;
.   .     update_text_id(widget->gx_widget_parent, ID_WINDOWCHANGER,
GX_STRING_ID_BUTTON_ENABLED);
.   .     update_text_id(widget->gx_widget_parent, ID_INSTRUCTIONS,
GX_STRING_ID_INSTRUCT_BUTTON);
.   .     break;
.    case GX_SIGNAL(ID_BUTTONENABLER, GX_EVENT_TOGGLE_OFF):
.   .     button_enabled = false;
.   .     update_text_id(widget->gx_widget_parent, ID_WINDOWCHANGER,
GX_STRING_ID_BUTTON_DISABLED);
.   .     update_text_id(widget->gx_widget_parent, ID_INSTRUCTIONS,
GX_STRING_ID_INSTRUCT_CHECKBOX);
.   .     break;
.    case GX_SIGNAL(ID_WINDOWCHANGER, GX_EVENT_CLICKED):
.   .     if(button_enabled){
.   .   .   .   show_window((GX_WINDOW*)&window2, (GX_WIDGET*)widget, true);
.   .     }
.   .     break;
.    default:
.   .     gx_window_event_process(widget, event_ptr);
.   .     break;
.    }

.    return result;
}
```

Events can be routed based on the ID of the widget and the signal from GUIX. For example, the checkbox ID_BUTTONENABLER can have two states: GX_EVENT_TOGGLE_ON and GX_EVENTS_TOGGLE_OFF. When the box is unchecked and then pressed, the event GX_EVENT_TOGGLE_ON is sent to the handler after the box is checked.

3. Turn optimization off:
   A. Right-click **GUIApp** in the **Project Explorer** window and select **Properties** from the context menu.
   B. Within the properties window, expand the **C/C++ Build** tree element.
   C. Select **Settings**.
   D. In the **Tool Settings** tab, click **Optimization**.
   E. Change the **Optimization Level** to **None (-O0)**.
   F. Click **OK** to save these changes.



Properties for GUIApp

type filter text

- Resource
- Builders
- C/C++ Build
  - Build Variables
  - Environment
  - Logging
  - Settings
  - Tool Chain Editor
- C/C++ General
- Project References
- Run/Debug Settings

Settings

Configuration: Debug [Active] Manage Configurations...

Tool Settings | Build Steps | Build Artifact | Toolchain | Binary Parsers | Error Parsers

- Target Processor
- Optimization
- Warnings
- Debugging
- Cross ARM GNU Assembler
- Cross ARM C Compiler
- Cross ARM C Linker
- Cross ARM GNU Create Flash Image
- Cross ARM GNU Print Size

Optimization Level: None (-O0)

☑ Message length (-fmessage-length=0)
☑ 'char' is signed (-fsigned-char)
☑ Function sections (-ffunction-sections)
☑ Data sections (-fdata-sections)
☐ No common unitialized (-fno-common)
☐ Do not inline functions (-fno-inline-functions)
☐ Assume freestanding environment (-ffreestanding)
☐ Disable builtin (-fno-builtin)
☐ Single precision constants (-fsingle-precision-constant)
☐ Position independent code (-fPIC)
☐ Link-time optimizer (-flto)
☐ Disable loop invariant move (-fno-move-loop-invariants)

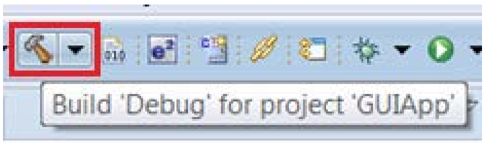
Other optimization flags

Restore Defaults | Apply

OK | Cancel

Figure 92. Disabling Compiler Optimizations

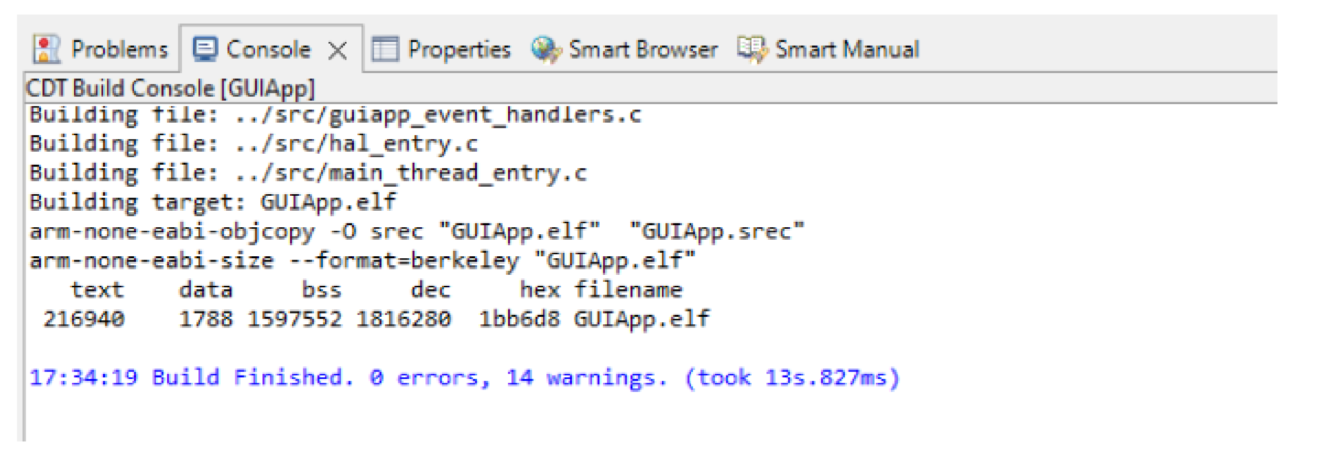
4. Build the project by clicking the **Hammer** icon below the menu bar.



Build 'Debug' for project 'GUIApp'

Figure 93. Build the project

If you followed these steps, there will be no errors reported in the build output, as the following figure shows.



```
Building file: ../src/guiapp_event_handlers.c
Building file: ../src/hal_entry.c
Building file: ../src/main_thread_entry.c
Building target: GUIApp.elf
arm-none-eabi-objcopy -O srec "GUIApp.elf"  "GUIApp.srec"
arm-none-eabi-size --format=berkeley "GUIApp.elf"
   text    data     bss     dec     hex filename
 216940    1788 1597552 1816280  1bb6d8 GUIApp.elf

17:34:19 Build Finished. 0 errors, 14 warnings. (took 13s.827ms)
```

Figure 94. Build finished with 0 errors

7. Running the application

1. Connect the **SK-S7G2** or **PK-S5D9** Synergy MCU Groups (J19) to the PC with the micro USB cable.

   Note: The application is not yet ready to be run on the target hardware. The following steps are necessary to run it.
2. Click the **drop-down menu** for the **debug** icon.
3. Select the **Debug Configurations…** option.

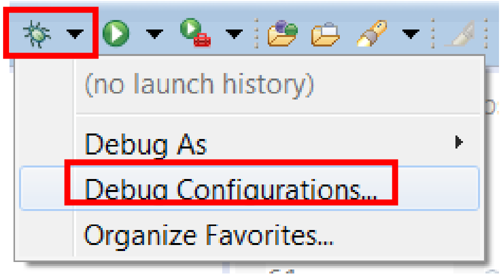
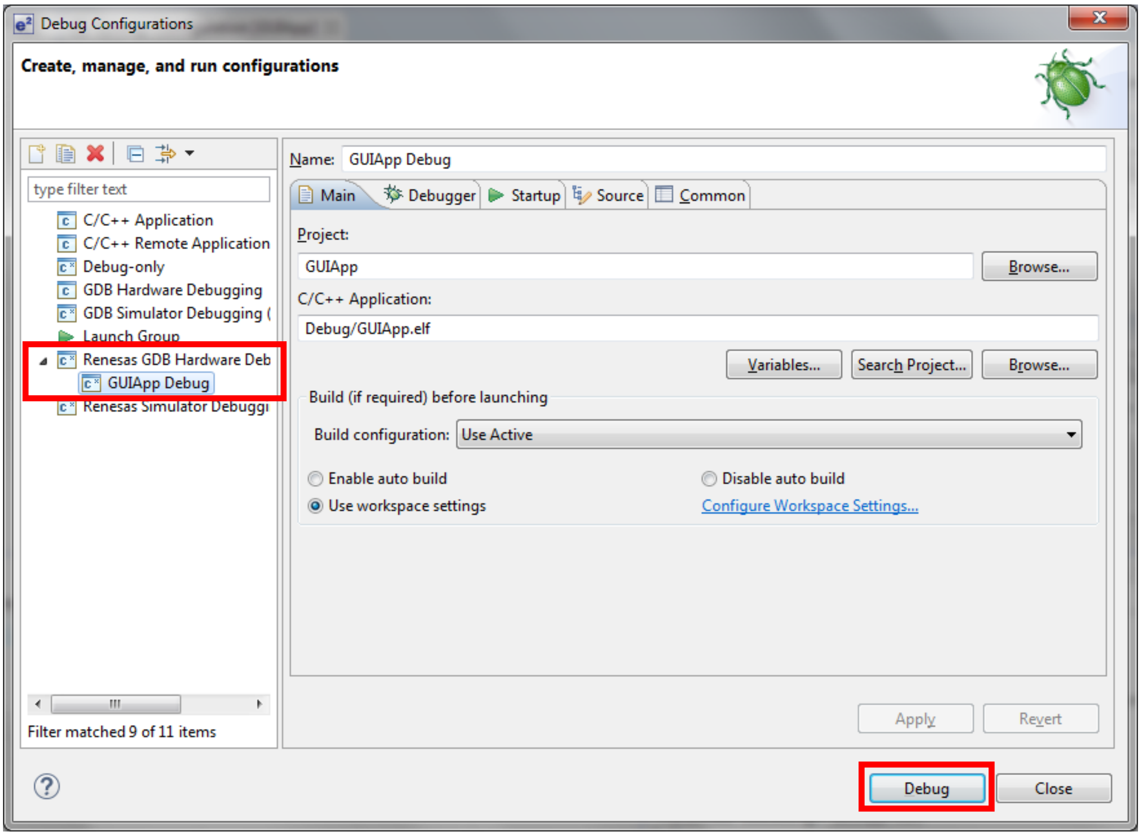


Figure 95. Debug options

4. Under the **Renesas GDB Hardware Debugging** section, select **GUIApp Debug**.
5. Click the Debug button to start debugging.

   Note: If the **Debug** button is greyed out, then it is likely that there is an issue with the build. Check all steps for mismatched options.



Debug Configurations

Create, manage, and run configurations

- C/C++ Application
- C/C++ Remote Application
- Debug-only
- GDB Hardware Debugging
- GDB Simulator Debugging (
- Launch Group
- Renesas GDB Hardware Deb
  - GUIApp Debug
- Renesas Simulator Debuggi

Filter matched 9 of 11 items

Name: GUIApp Debug

Project: GUIApp

C/C++ Application: Debug/GUIApp.elf

Build (if required) before launching

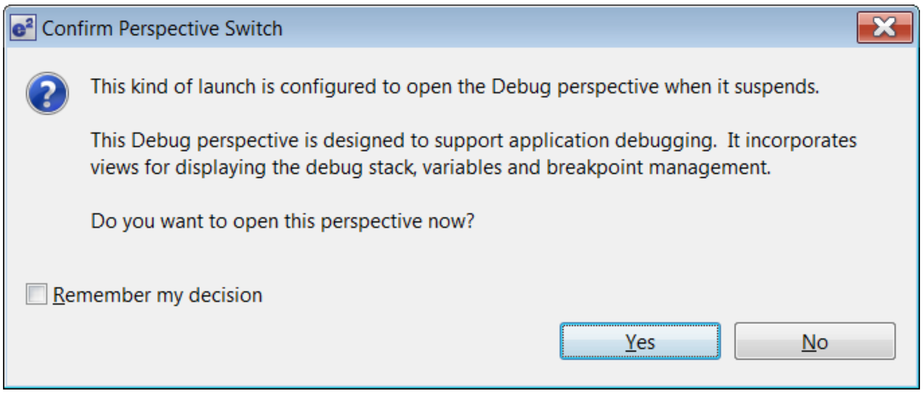
Build configuration: Use Active

○ Enable auto build ○ Disable auto build

● Use workspace settings Configure Workspace Settings...

Figure 96. Debug Configurations

6. If asked to confirm a **Perspective Switch**, click **Yes**. (If you have previously instructed e^2 studio to remember your decision, this dialog box will not be displayed.).



Confirm Perspective Switch

This kind of launch is configured to open the Debug perspective when it suspends.

This Debug perspective is designed to support application debugging. It incorporates views for displaying the debug stack, variables and breakpoint management.

Do you want to open this perspective now?

□ Remember my decision

Figure 97. Perspective Switch Dialog

7. Press **F8** or the **Resume** button to start the application. It will stop at `main`.

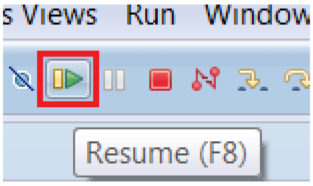


Figure 98. Resume Button

8. Press **F8** or the **Resume** button to run the code.
   Note: The GUI created earlier should display on the screen.
9. Overview of the Demo.

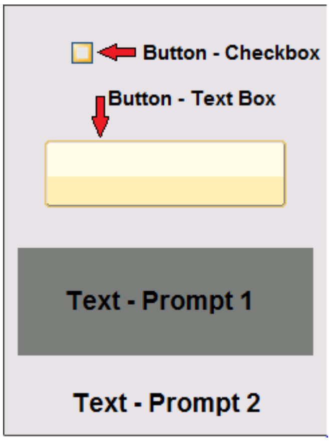


Figure 99. Window1

A. The preceding figure shows **Window1**. In this window are four elements:
   - **Button – Checkbox**: Use this button to enable navigating to **Window2**. Text is set to **Press Me!** and it is unchecked. When you click within the **Checkbox** active area, the event **window1_handler** is activated. This event is picked up inside `guiapp_event_handlers.c`, where the code toggles the checkbox then sets the text in **Text –Prompt 1** and **Button – Text Box** to the appropriate message.
   - **Button – Text Box**: This box shows which window you will go to if you press outside the **Text – Prompt 1** area. (See **Button – Checkbox** for how it is changed.) Click this area to activate the **window1 _handler** event that is picked up by `guiapp_event_handlers.c`, where the code changes the window to **window2**.
   - **Text – Prompt 1**: This area instructs you how to control the demo. (See **Button – Checkbox** for how it is changed.)
   - **Text – Prompt 2**: This Prompt is used to show you what window you are in. It never changes (always shows **window1**).

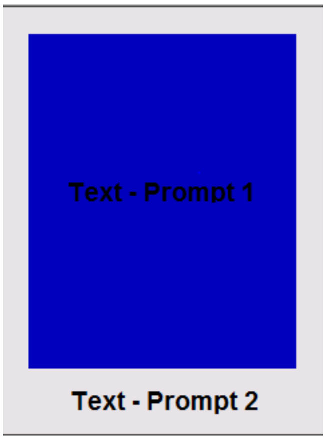


Figure 100. Window2

B. The preceding figure shows **Window2**. In this window are two elements:

- **Text – Prompt 1**: This area presents **Hello World**. Clicking in this area initiates the **window2_handler** event which is picked up by `guiapp_event_handlers.c` and changes the active window to **window1**.
- **Text – Prompt 2**: This prompt shows you which window you are in. It never changes (always shows **window2**).

10. Press **Ctrl + F2** or the **Stop** button to end the debug session.

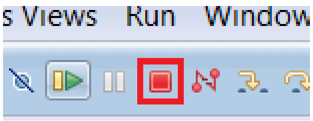


Figure 101. Stop Button

This concludes the GUIX “Hello World” demo for SK-S7G2 and PK-S5D9 Synergy MCU Groups.

8. Appendix

The GUIX image resources files are by default stored in the internal code flash. The resource files can also be stored in the external flash such as QSPI. Refer the Knowledgebase link (https://en-support.renesas.com/knowledgeBase/18054800) to know more about using QSPI for storing the image resource files.

Note: Users are required to set the QSPI pins drive capacity to High instead of Low when QSPI is used for external storage (on the DK-S7G2 board).

Website and Support

Visit the following URLs to learn about key elements of the Synergy Platform, download components and related documentation, and get support.

Synergy Platform MCUs	www.renesas.com/renesas-synergy-platform-mcus
Synergy Software Package	www.renesas.com/synergy/ssp
Software add-ons	www.renesas.com/synergy/addons
SSP Components	www.renesas.com/synergy/sspcomponents
MCU Components	www.renesas.com/synergy/components-synergy-mcus
Kits	www.renesas.com/synergy/kits
Synergy Solutions Gallery	www.renesas.com/synergy/solutionsgallery
Partner projects	www.renesas.com/synergy/partnerprojects
Application projects	www.renesas.com/synergy/applicationprojects
Self-service support resources:	
Knowledgebase	www.renesas.com/synergy/knowledgebase
Forums	www.renesas.com/synergy/forum
Training	www.renesas.com/synergy/training
Videos	www.renesas.com/synergy/videos
Chat and web ticket	www.renesas.com/synergy/resourcelibrary

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jan.22.16	—	Initial version
1.01	Apr.12.16	—	Updated lcd_setup.c to correct semaphore naming issue
1.10	Aug.30.16	—	Update to SSP v1.1.0
1.11	Nov.18.16	—	Minor Format Changes
1.12	Jan.06.17	—	Updated to SSP v1.2.0.b.1
1.13	Feb.28.17	—	Updated to SSP v1.2.0
1.14	Sep.20.17	—	Updated to SSP v1.3.0
1.15	Feb.28.18	—	Updated to SSP v1.4.0
1.16	Jun.18.18	—	Sample codes updated
1.17	Sep.07.18	—	Updated to SSP v1.5.0
1.18	Mar.22.19	—	Updated to SSP v1.6.0
1.19	Aug.11.21	—	Updated for SSP v1.6.0 “Touch Panel V2 Framework”
1.20	Oct.14.21	—	Updated for latest SSP, e^2 studio, and SSC
1.21	Nov.11.21	—	Updated to SSP v2.1.0
1.22	Apr.21.23	—	Removed licensing and messaging framework content

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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(Rev.5.0-1 October 2020)

Corporate Headquarters

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

Contact information

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