Renesas RA Family

GUIX "Hello World" for EK-RA8E2

Introduction

This application note describes the process of creating a simple two-screen GUI using Azure RTOS GUIX Studio for the EK-RA8E2 kit. This application demonstrates how easily a user can create and configure a new application using the Renesas Flexible Software Package (FSP).
The Renesas Flexible Software Package includes Azure RTOS ThreadX® real-time operating system, the Azure RTOS GUIX library and hardware drivers unified under a single robust software package. This powerful suite of tools provides a comprehensive integrated framework for rapid development of complex embedded applications.

The Hello World application was developed under e² studio using the Renesas Flexible Software Package.

Required Resources

Development tools and software

- e² studio IDE Version: 2025-04.1 (25.4.0).
- Renesas Flexible Software Package (FSP) v6.0.0
- Azure RTOS GUIX Studio V6.4.0.0

Hardware

- Renesas EK- RA8E2 kit (RA8E2 MCU Group)
- With USB-C cable and Capacitive Touch LCD Panel 40 pins connection included.

Reference Manuals

- RA Flexible Software Package Documentation Release v6.0.0.
- Azure RTOS GUIX and GUIX Studio v6.4.0.0.
- Renesas RA8E2 Group User's Manual Rev.1.0.0
- EK-RA8E2-v1.0 Schematics

Provided Software Files

- A `Source.zip` folder that has a `touch_gt911` folder. 4 `*.c` files inside.
- `hal_entry.c`, `system_thread_entry.c`, `touch_thread_entry.c`, `windows_handler.c`.

Purpose

This document will guide you through the setup of an Azure RTOS GUIX touch screen interface Hello World application in e² studio. This document will show how to configure the drivers and library included with the FSP. These will allow you to set up the GLCD Controller, the touch screen driver, and semaphores to communicate with application tasks. It also shows the steps necessary to create a simple GUI interface using the Azure RTOS GUIX Studio editor. In addition, this app note will also cover project setup along with basic debugging operations. When it is running, the application will respond to touchscreen actions, presenting a basic graphical user interface (GUI).

Intended Audience

The intended audience is users who want to design GUI applications.
Note: If the user wants to skip fully design and running the fully functional project see Chapter or Section 6.

Contents

1. Downloading and Installing Tools

1.1 Overview

In this section you will copy materials to your PC and install 2025-04 (25.4.0) /FSP v6.0.0 and Azure RTOS GUIX studio v6.4.0.0.

1.2 Procedural Steps

1.If you already have e² studio 2025-04 (25.4.0) with FSP v6.0.0 or later installed, you can skip this step.

Otherwise, you can download it from https://www.renesas.com/us/en/software-tool/flexible- software-package-fsp

Detailed installation instructions for the e² studio and the FSP are available on the Renesas website https://www.renesas.com/fsp. Review the release notes for e2 studio to ensure that the e² studio version supports the selected FSP version. The starting version of the installer includes all features of the RA MCUs.

2.You can get **Azure RTOS GUIX Studio v6.4.0.0** or greater from this **link.**

You should see the window in the next step on the web browser.
Note: Microsoft Store must be installed and working on your PC to install Azure RTOS GUIX studio.

3.Click **Download** button and a new file download to your system.

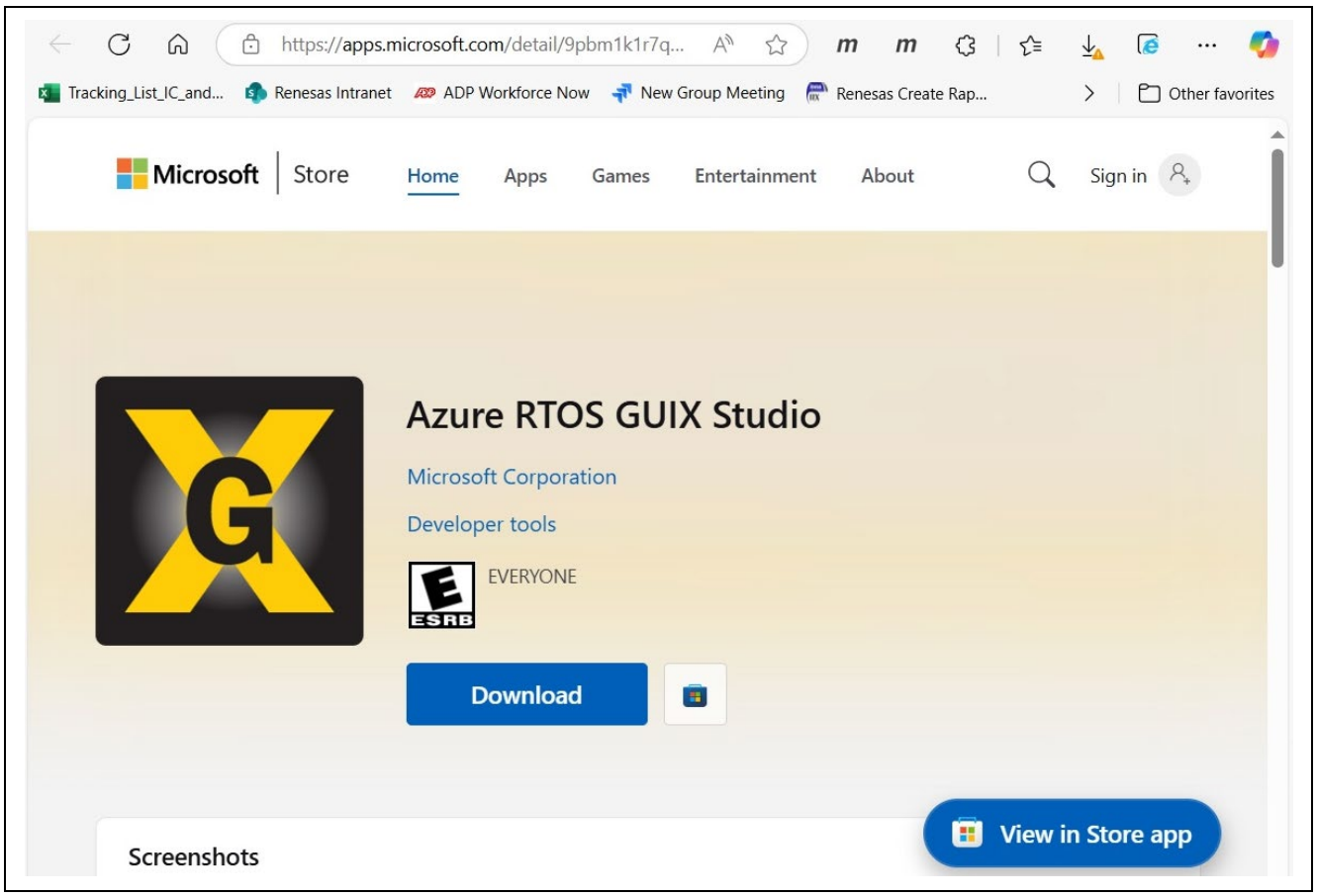


Figure 1. Get Azure RTOS GUIX Studio

4. Click **Azure RTOS GUIX Studio Installer.exe** and continue installing Azure RTOS GUIX studio.

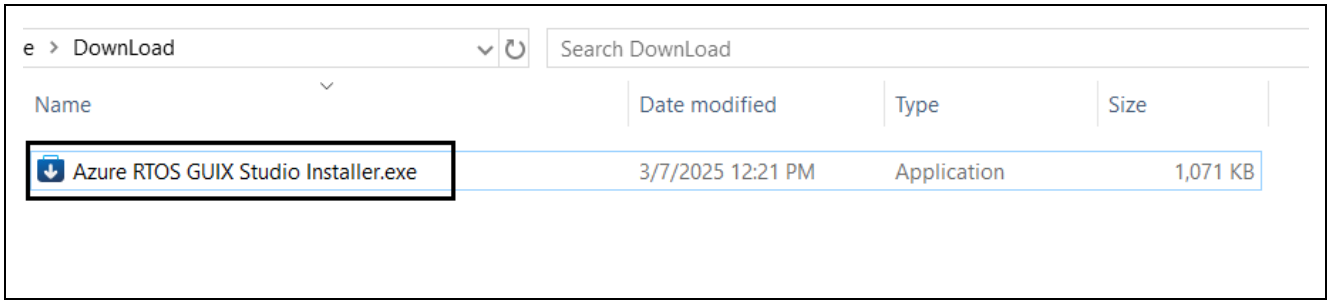


Figure 2. Azure RTOS GUIX Studio installation

5. Click “Open” to open “Azure RTOS GUIX Studio” App.

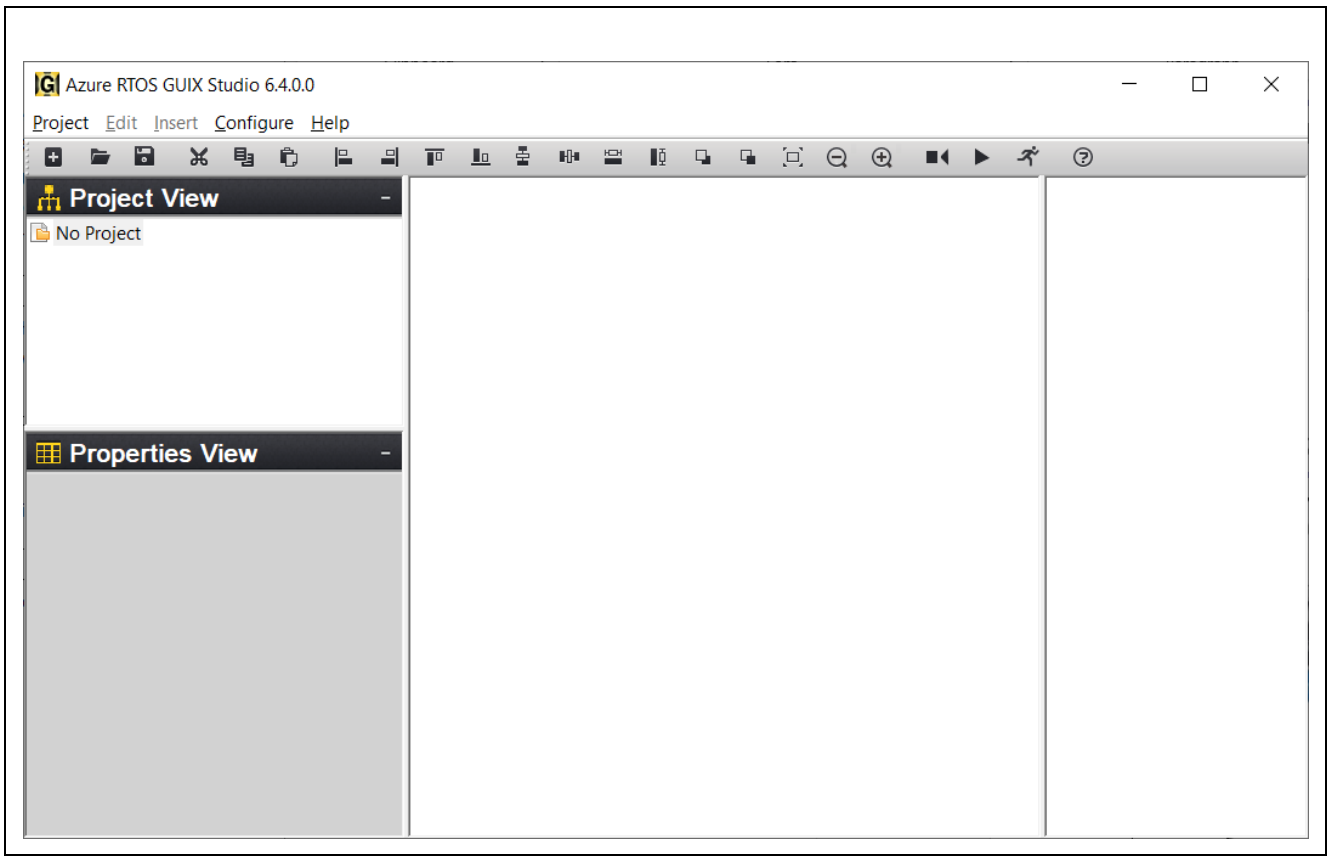


Figure 3. Click Open to start “Azure RTOS GUIX Studio”

2. Creating Application Project and Enabled Backlight

2.1 Overview

In this section, you will create a project to which you will add pre-written source code and integrate it with a pre-created Azure RTOS GUIX studio project.

2.2 Procedural Steps

1. **Create a new Renesas RA C/C++ project. Name it “guix_hello_world_ek_ra8e2”.**

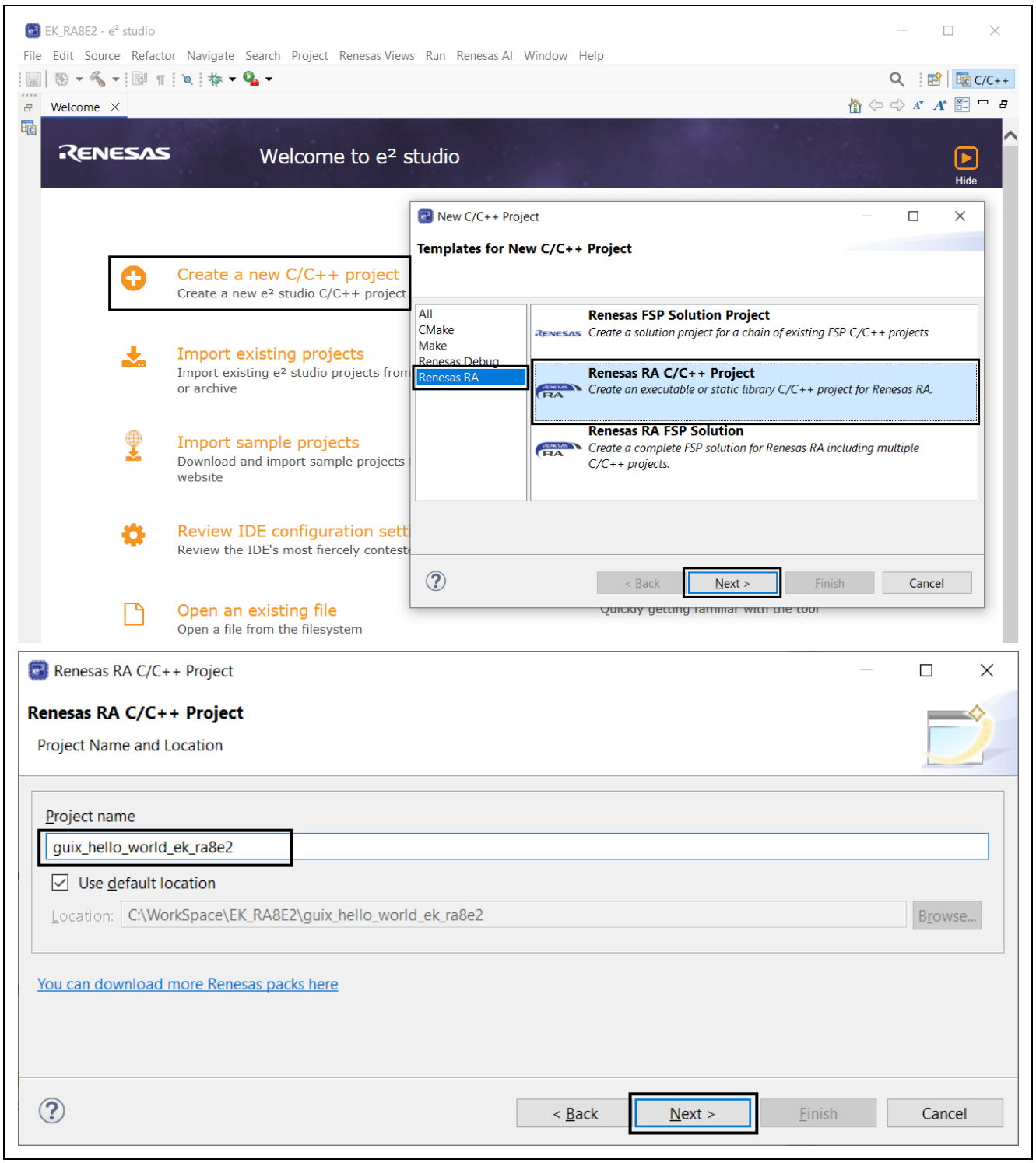


Figure 4. Creating New Project

2. Select and set GNU ARM Embedded for board EK-RA8E2.

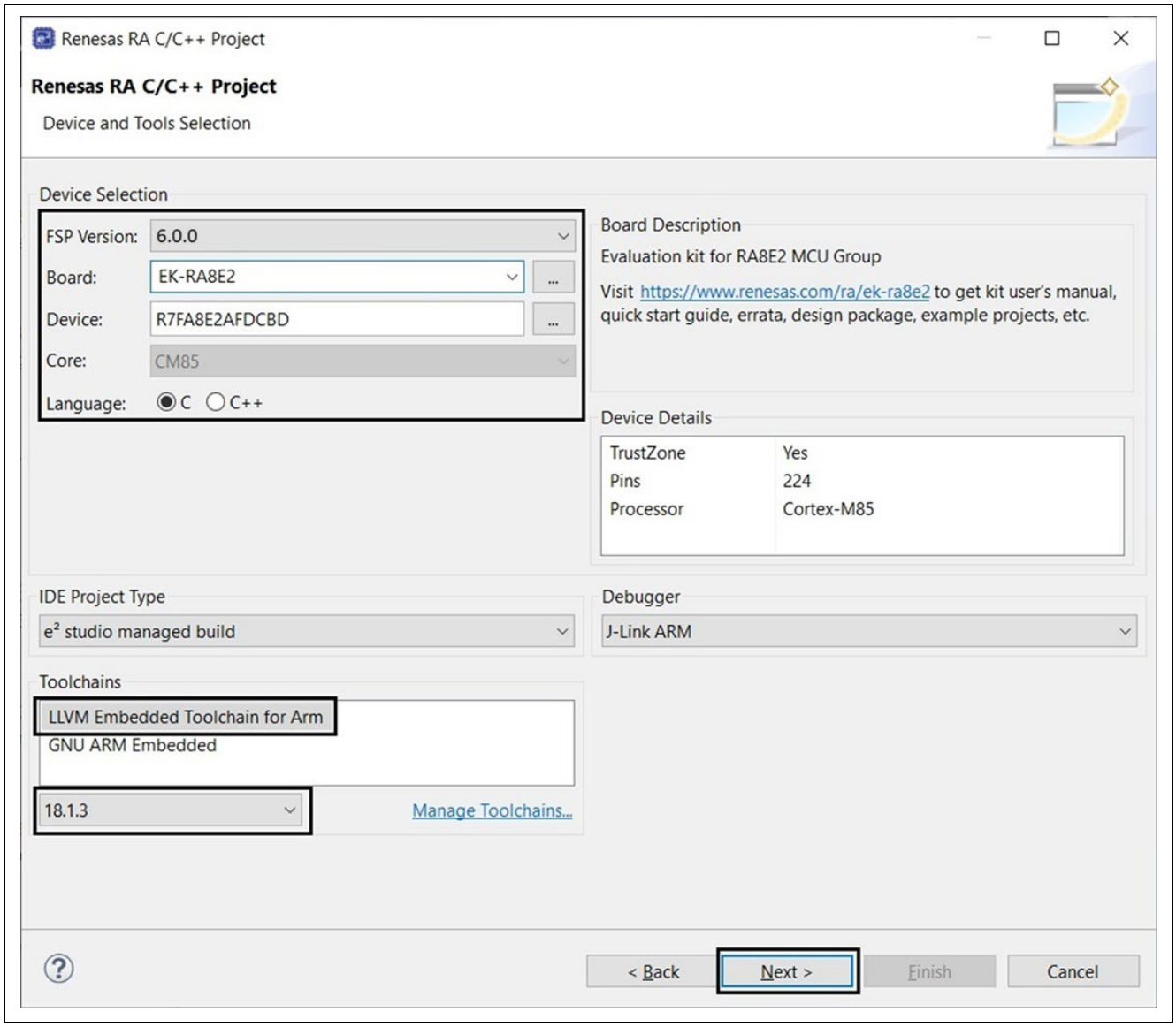


Figure 5. Select LLVM Embedded Toolchain for Arm Board EK-RA8E2

3. Select Executable with Azure RTOS ThreadX (v6.4.0.0+FSP.6.0.0).

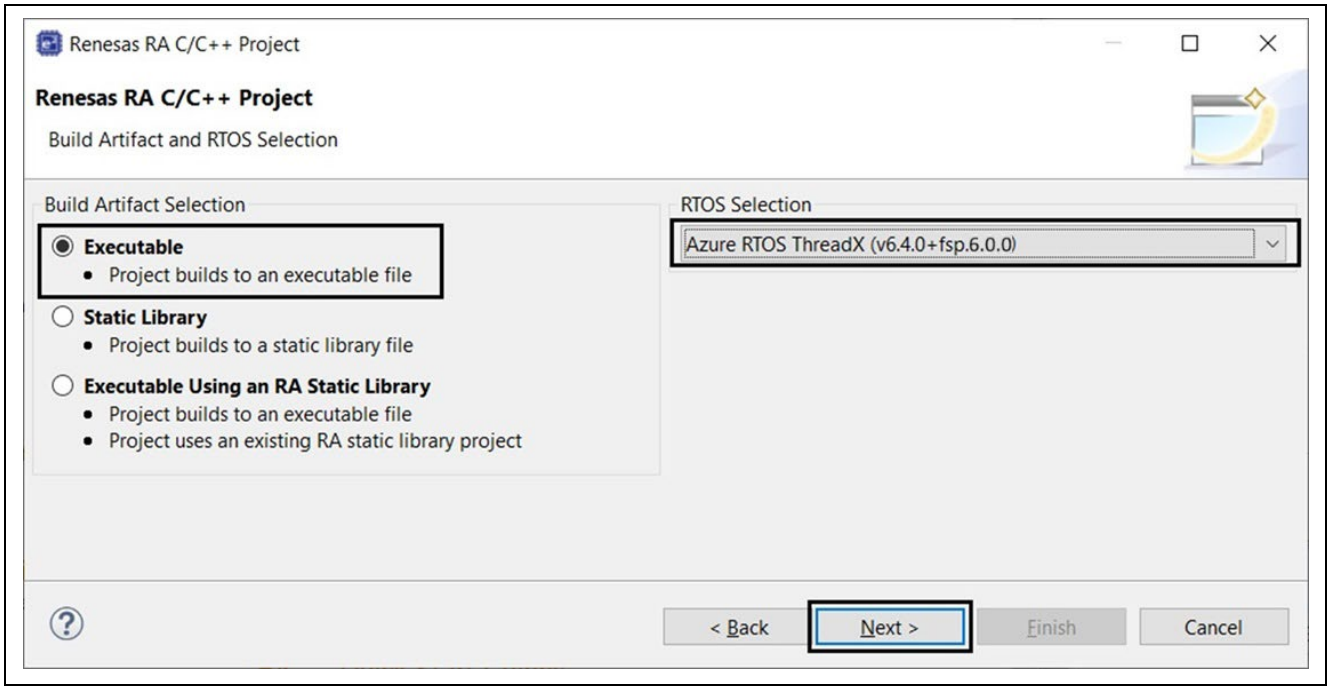


Figure 6. Select Azure RTOS ThreadX

4. Use Azure **RTOS ThreadeX - Minimal** template.

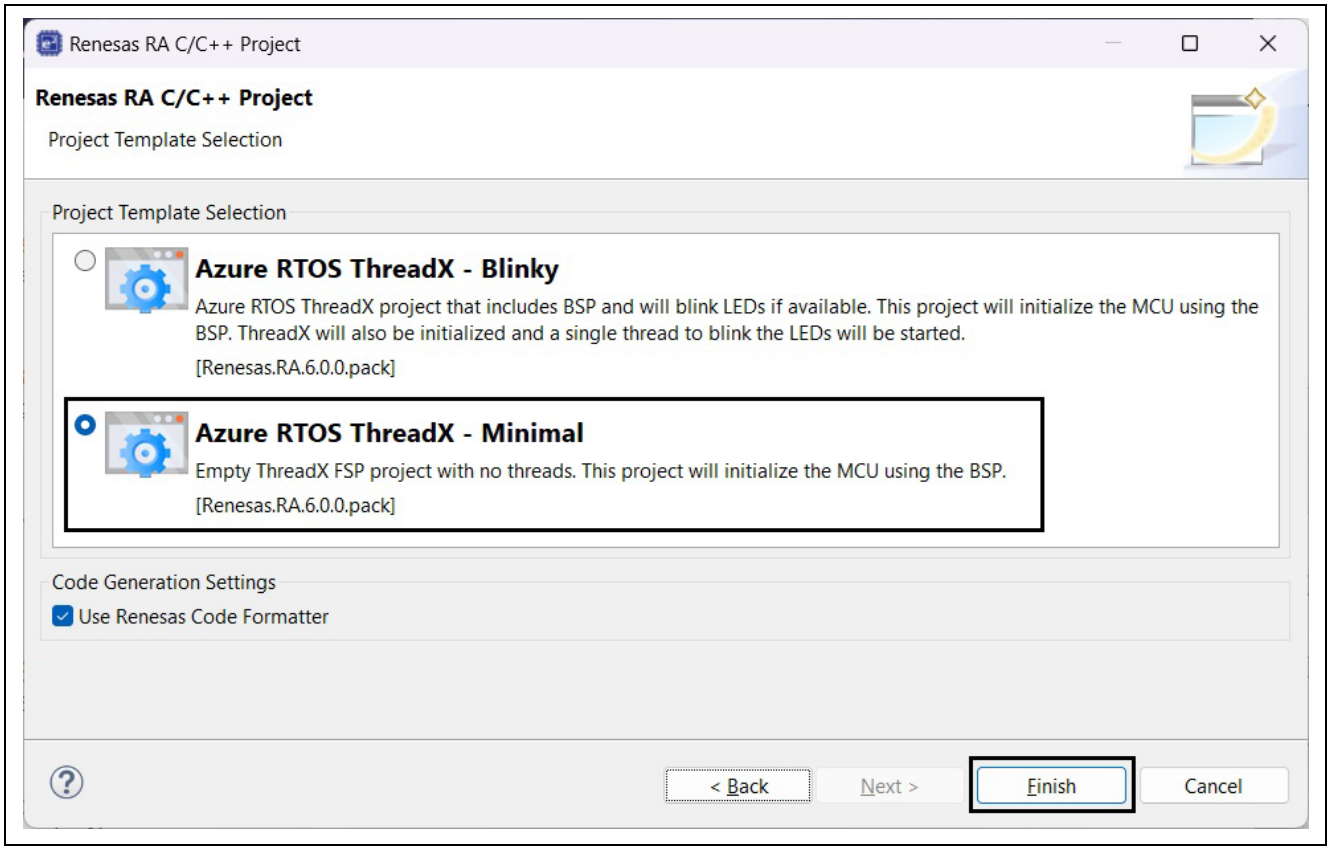


Figure 7. Select Azure RTOS ThreadX Minimal

5. Open the project configuration and go to the **BSP** tab. Change **Heap size (bytes)** to **0x2000 and Enable SDRAM Support**.

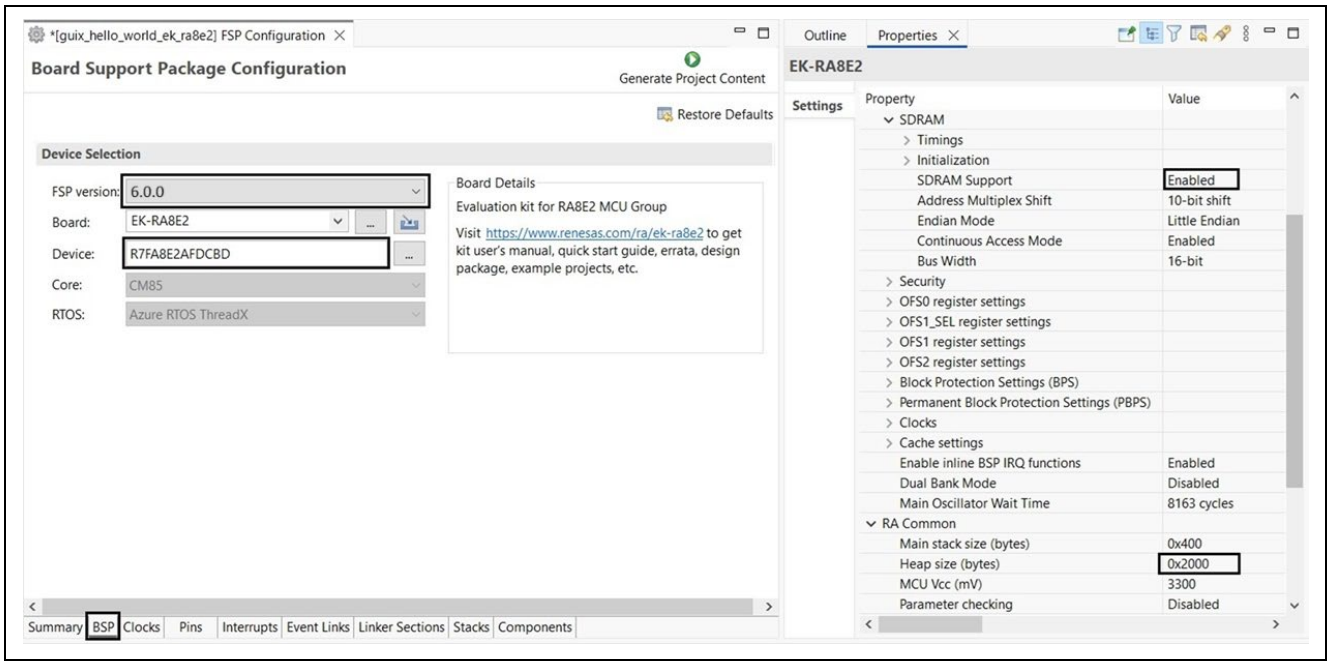


Figure 8. Change Heap Size and Enable SDRAM Support

6. Click tab “**Clocks**” and set “Clocks” for the LCD.

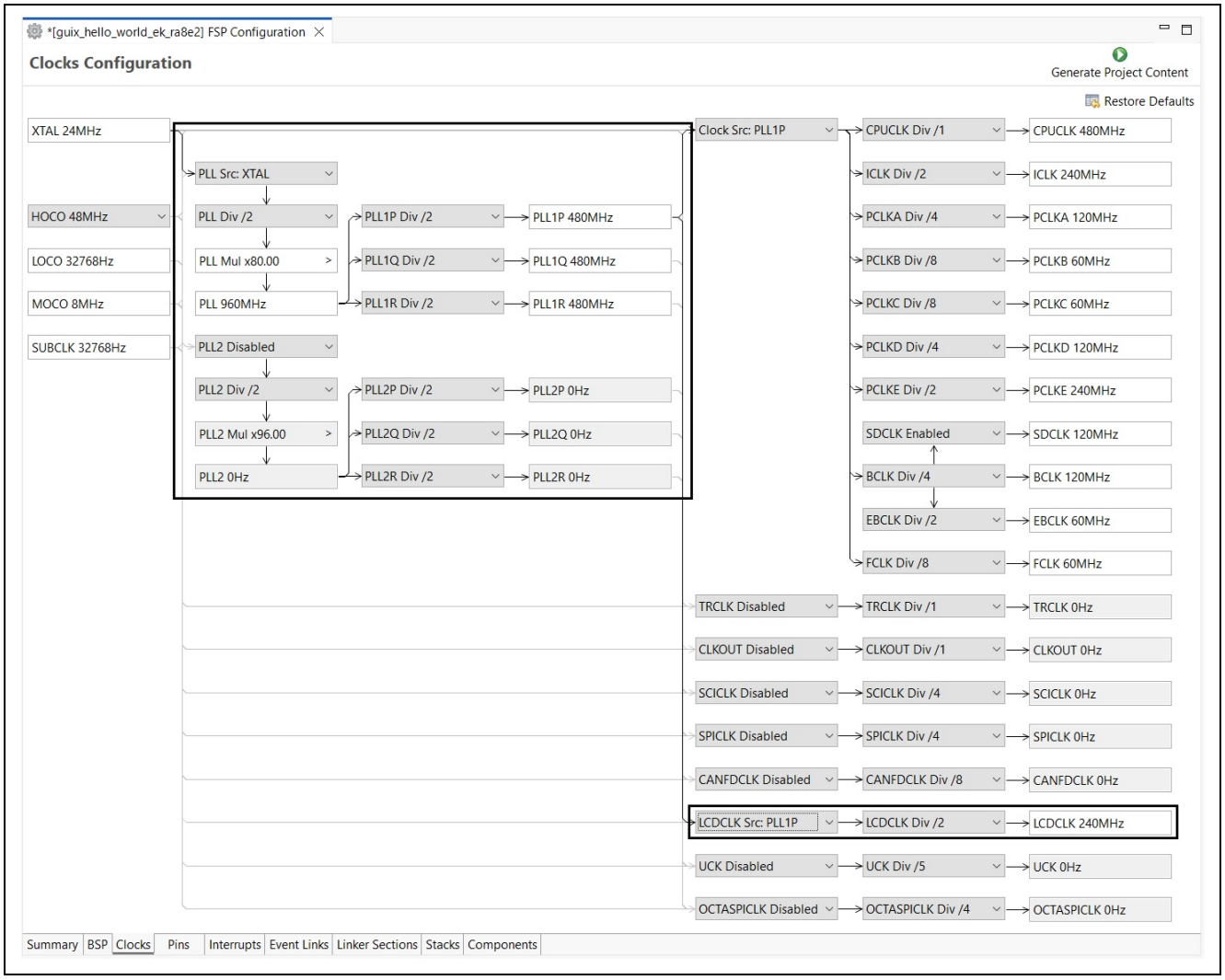


Figure 9. Setting All Clocks

7. Add a **new thread** and name it as **System Thread** with the settings below.

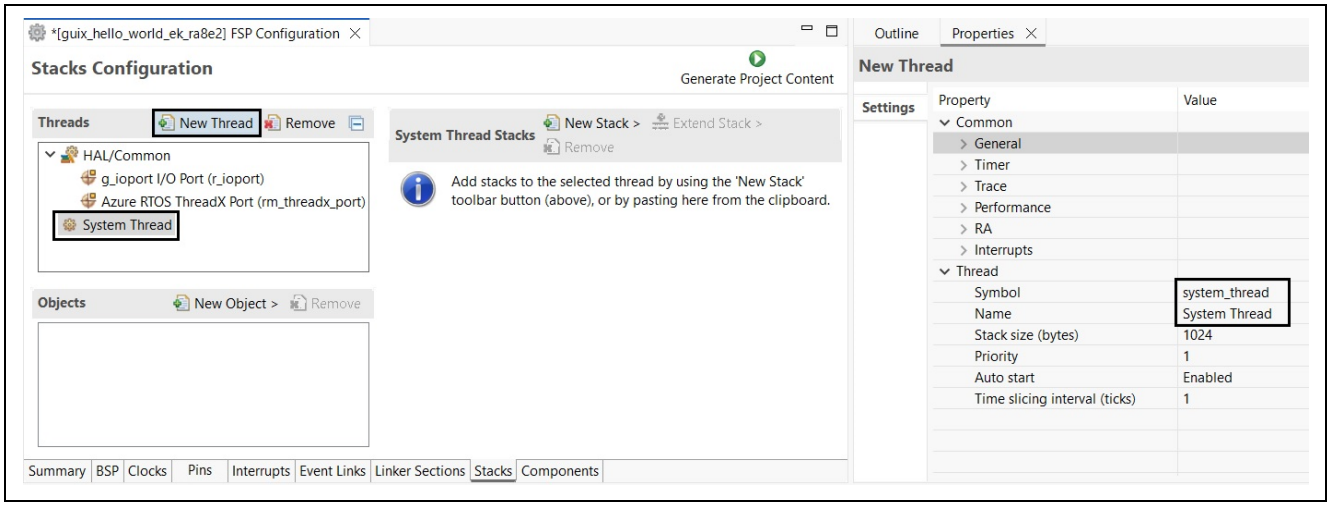


Figure 10. Add System Thread

8. Click “**New Stack**” and add **Azure RTOS GUIX** to System thread.

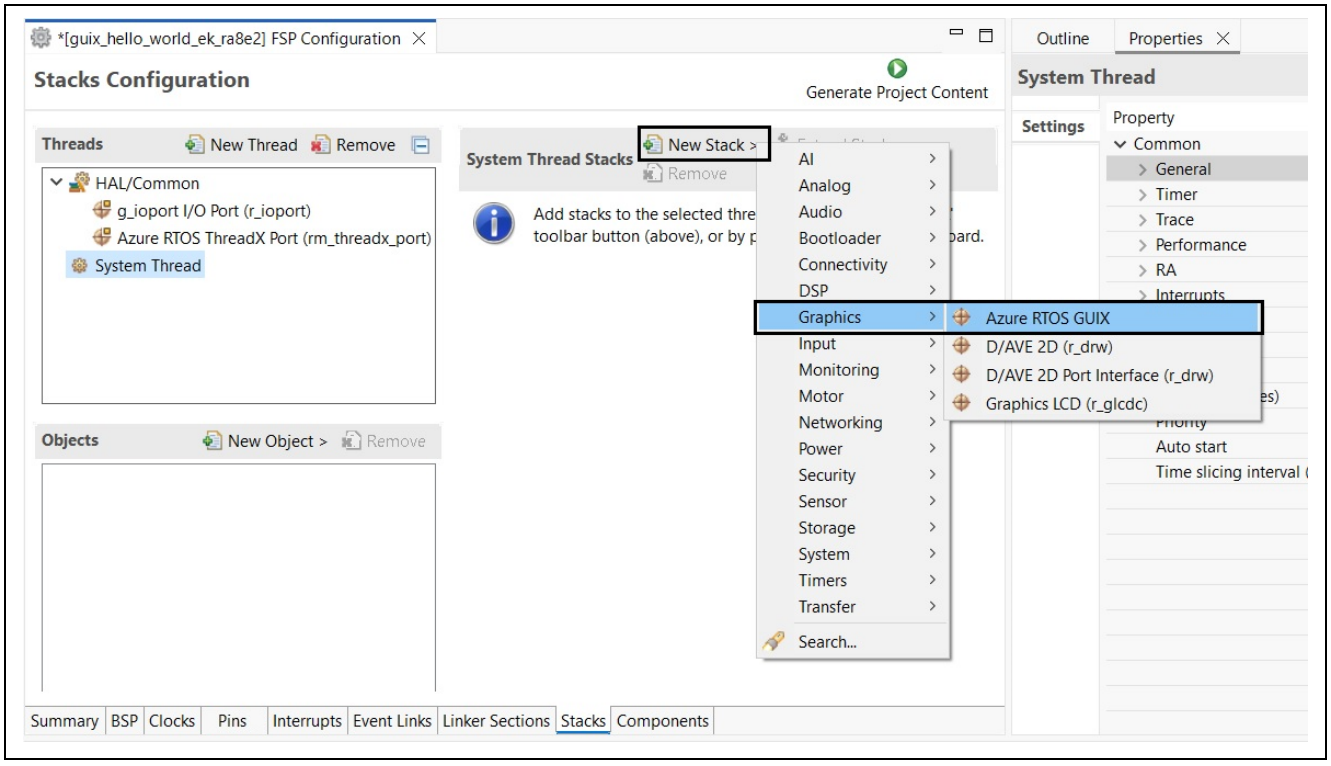


Figure 11. Add Graphics Azure RTOS GUIX

9. Settings properties for Graphic LCD **Azure RTOS GUIX**

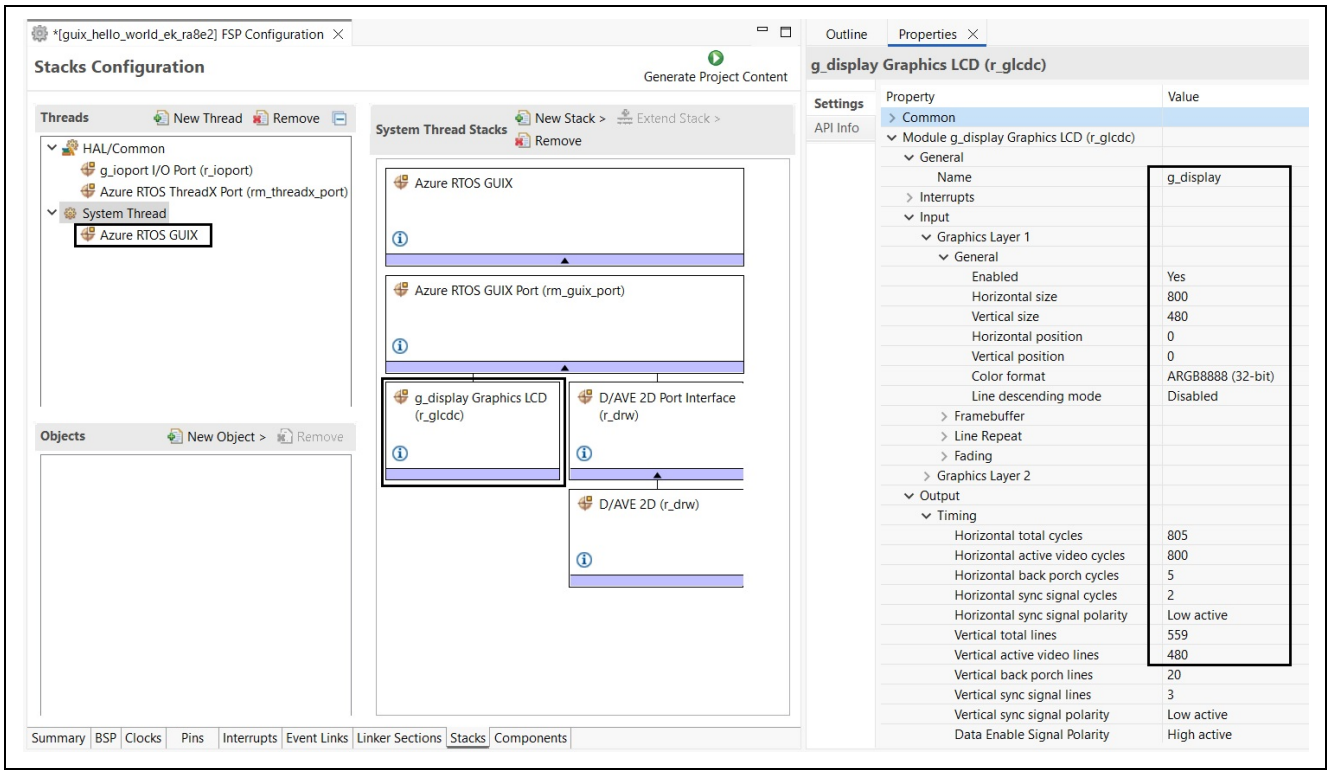


Figure 12. Setting and Checking Properties for Hardware

10. Click “**New Stack**” and add **PWM Timer**. PWM controls the brightness of back light.

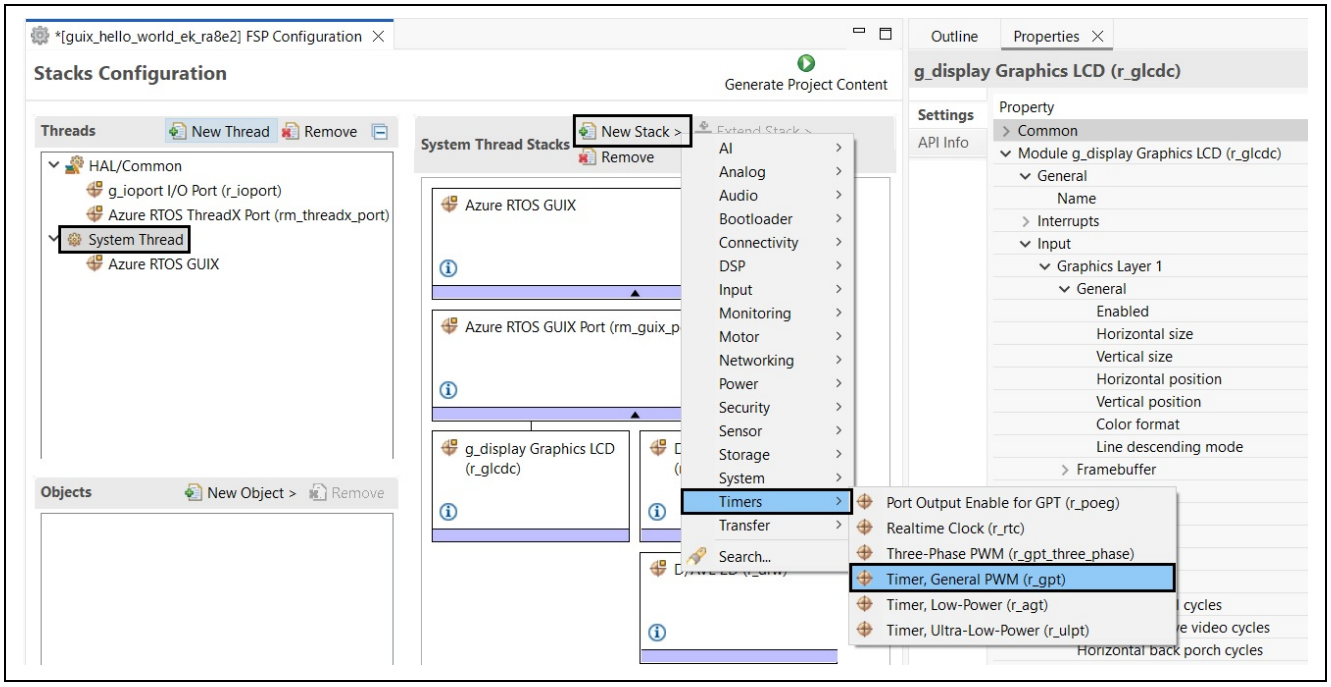


Figure 13. Add the Timer

11. Setting “**Timer**” module properties. Click “arrow”  to set pin P404 for “BLEN”.

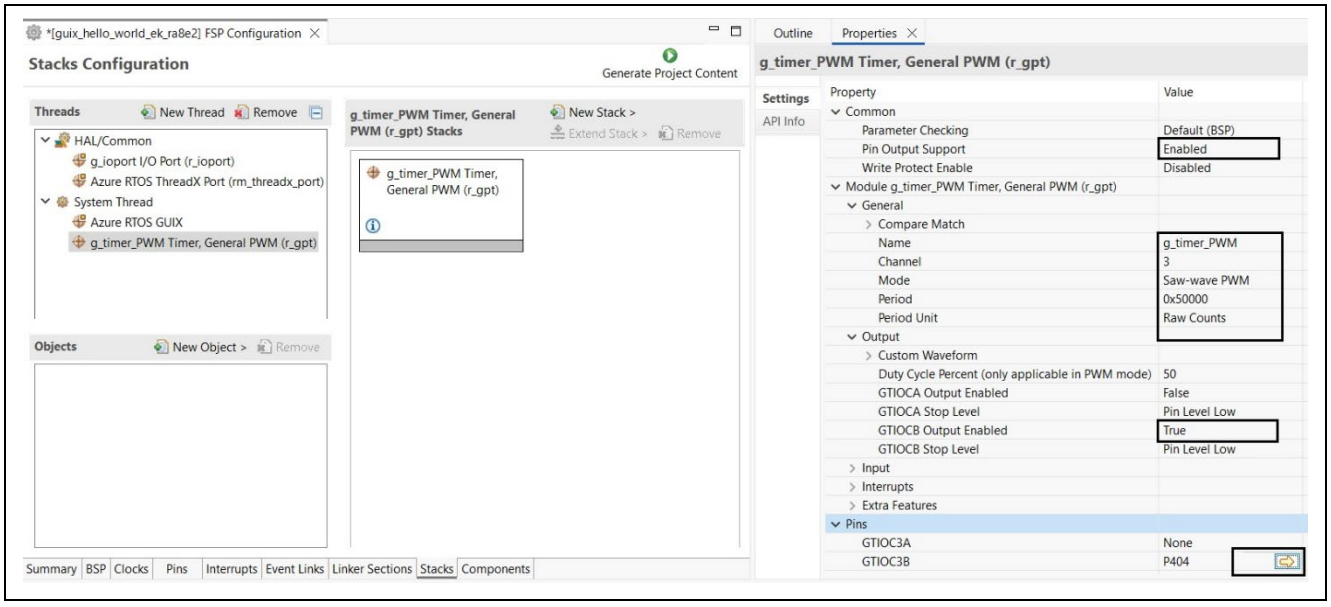


Figure 14. Settings Timer Property and BLEN pin P404

12. Configuration pin **P404** for the **BLEN** signal of the LCD panel.
    Note: If the **GTIOC3B** Pin showed as <unavailable> then user needs to perform step 12 first then step 11.

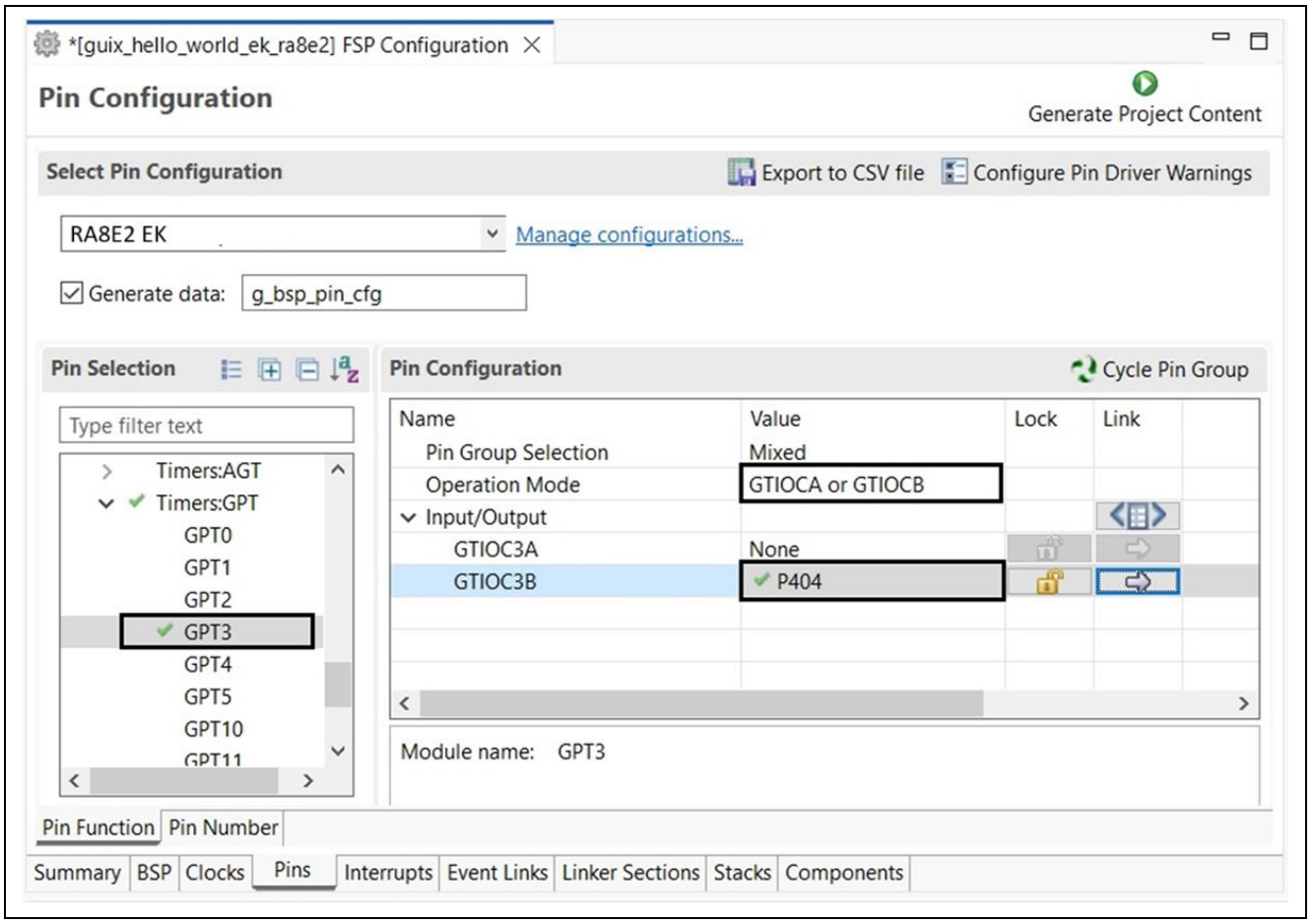


Figure 15. Settings for Pin P404 BLEN

13. BLEN pin from the LCD panel will connect to BLEN pin P404 of the board RA8E2 **Figure 16**.

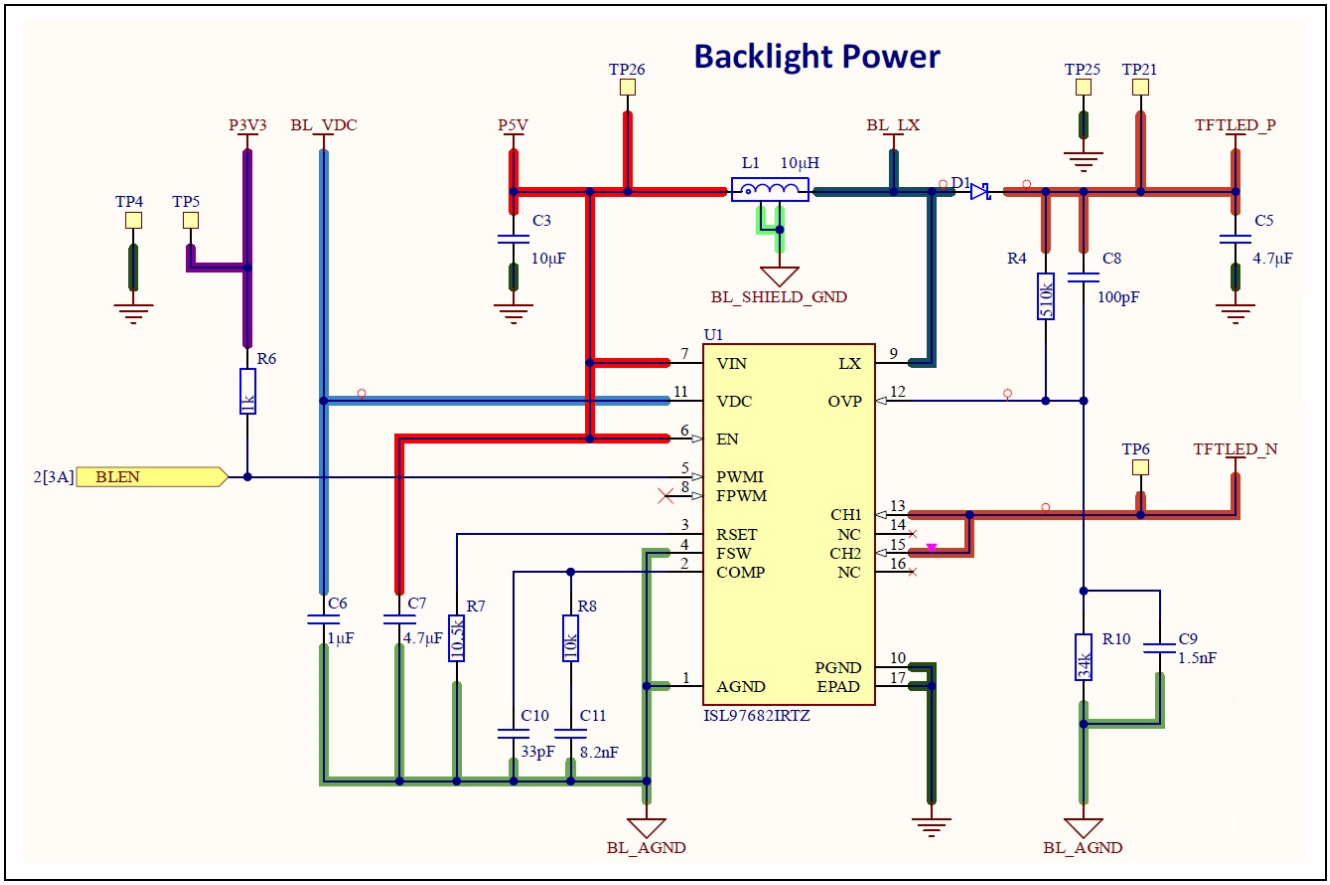


Figure 16. BLEN will connect to BLEN pin P404

14. Refer to “system_thread_entry.c” file in “**Source.zip**” for more information. This function below controls the PWM output.

```
 * @brief This function is setting up GPT/PWM timer
static fsp_err_t gpt_timer_PWM_setup(void)
{
    fsp_err_t err = FSP_SUCCESS;
    /* Open GPT */
    err = R_GPT_Open(&g_timer_PWM_ctrl, &g_timer_PWM_cfg);
    if(FSP_SUCCESS != err)
    {
        return err;
    }
    /* Enable GPT Timer */
    err = R_GPT_Enable(&g_timer_PWM_ctrl);
    /* Handle error */
    if (FSP_SUCCESS != err)
    {
        return err;
    }
    /* Start GPT timer */
    err = R_GPT_Start(&g_timer_PWM_ctrl);;
    if(FSP_SUCCESS != err)
    {
        return err;
    }

    return err;
}
```

Figure 17. gpt_timer_PWM

15. Selected and set up pin P515 LCD_DISP_EN configuration for LCD display.

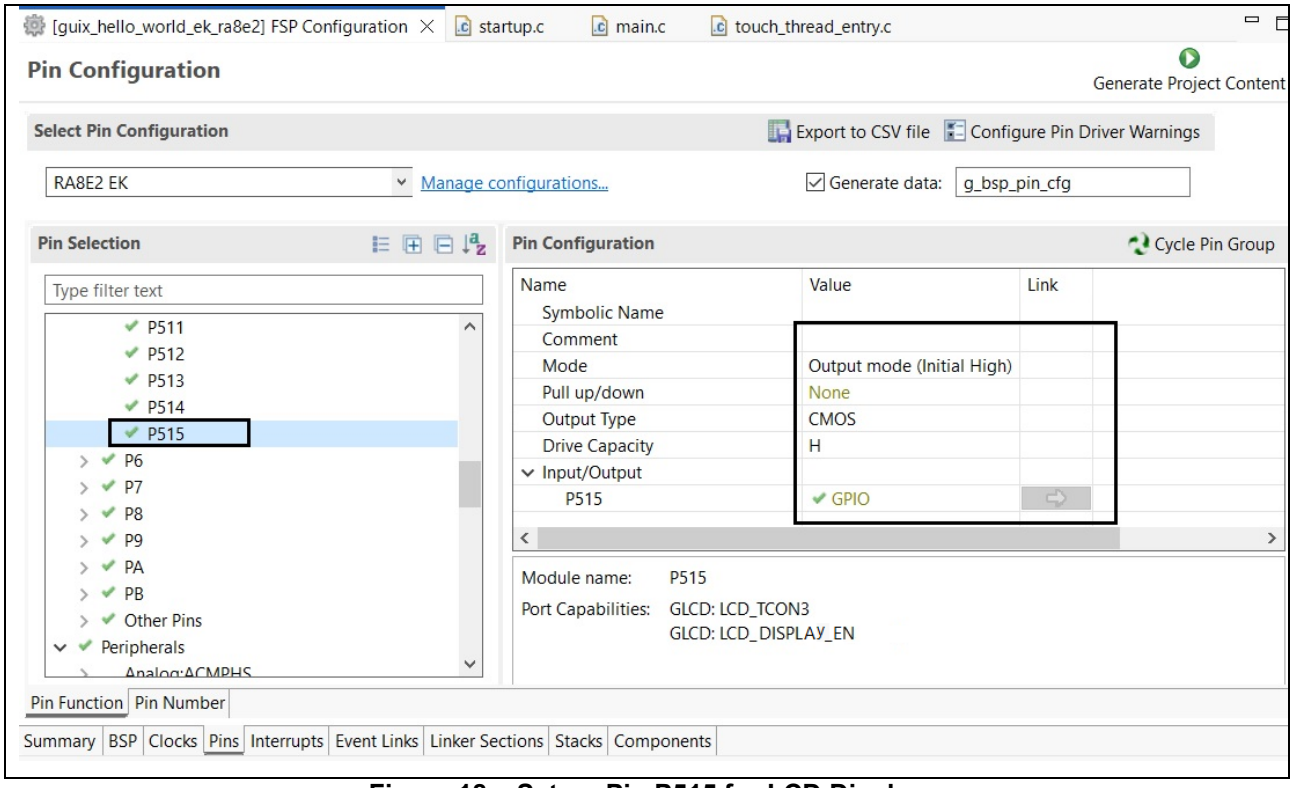


Figure 18. Set up Pin P515 for LCD Display

3. Adding and Configuring “Touch Function Driver”

1. Click **“New Thread”** and name **“Touch Thread”** with the setting below**.**

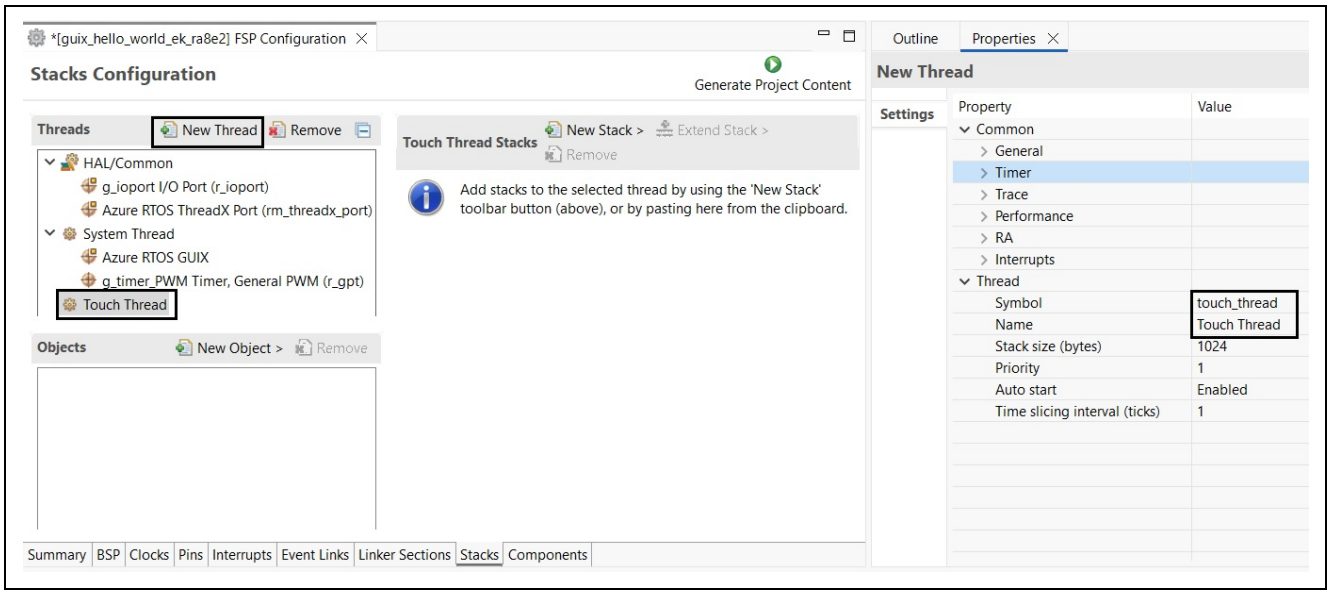


Figure 19. Add and Set TOUCH THREAD Properties

2. Click “**New Stack**” and add “**External IRQ**” module.

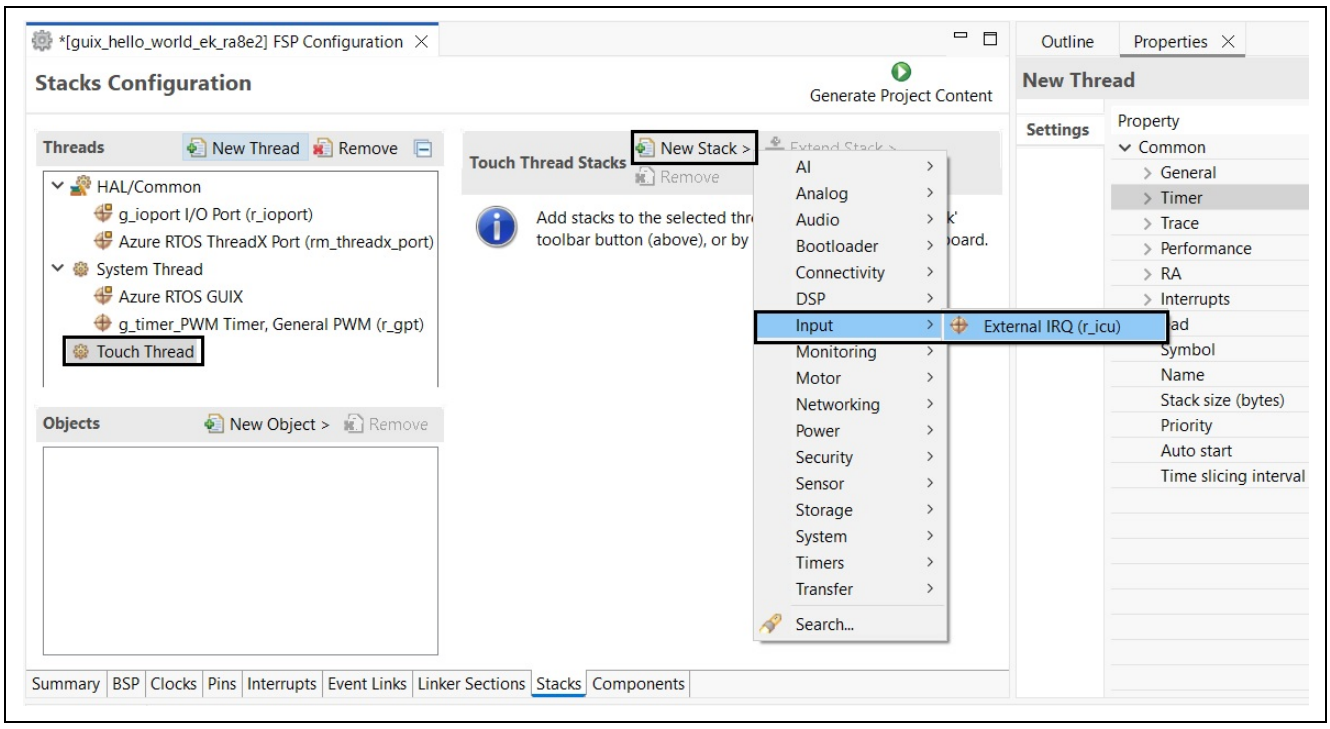


Figure 20. Add External IRQ

3. Name “**g_int_gt911**” and setting **External IRQ** property.

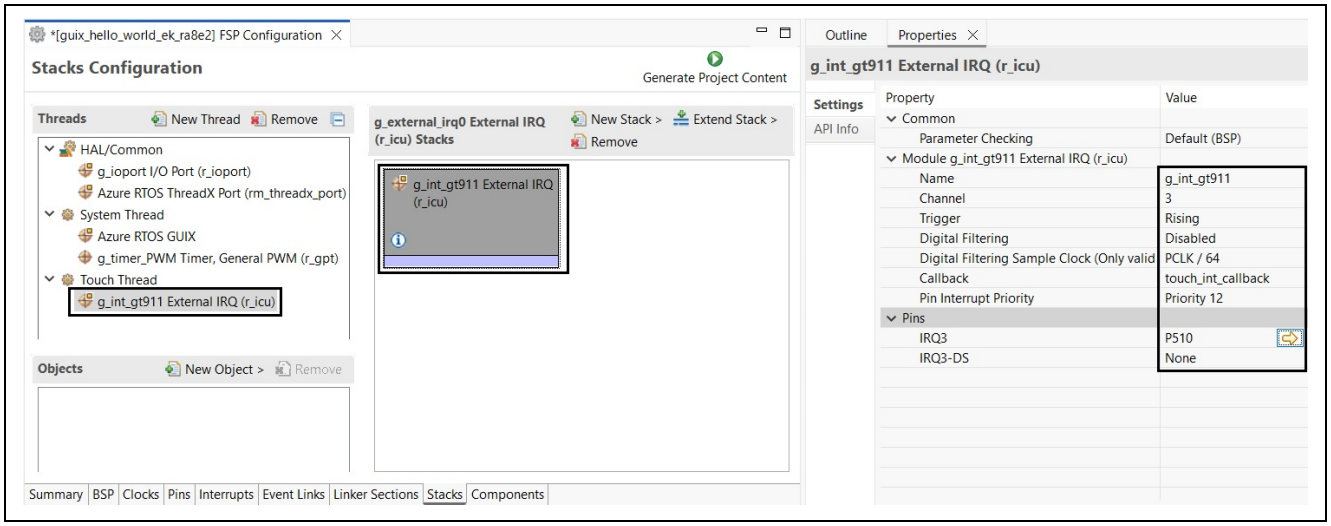


Figure 21. Setting External IRQ Properties

4. Configuration pin **P510** for **INT_L** signal pin.

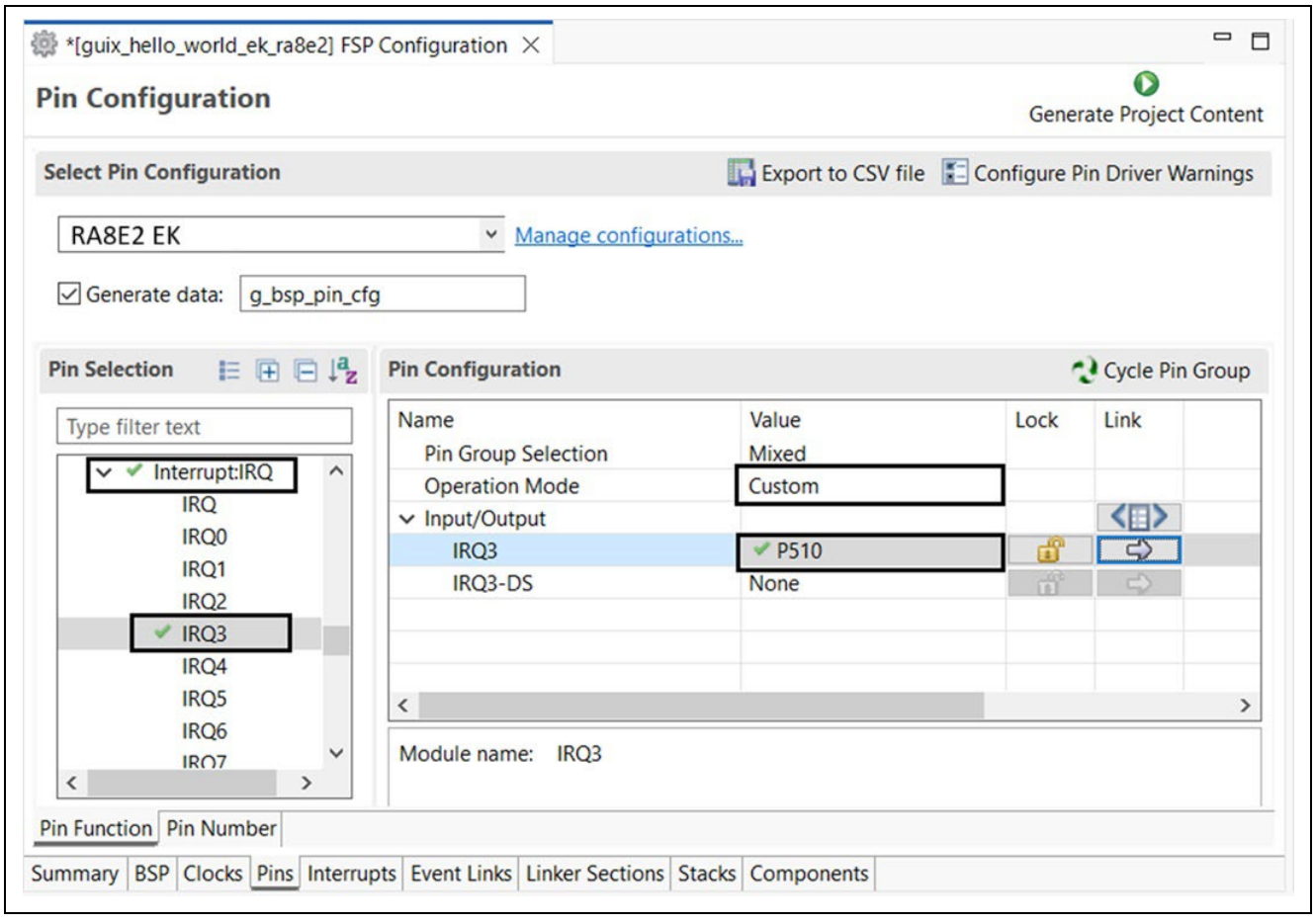


Figure 22. Configuration Pin P510 “IRQ3”

5. Click “**New Stack**” and add “**I2C Master**”.

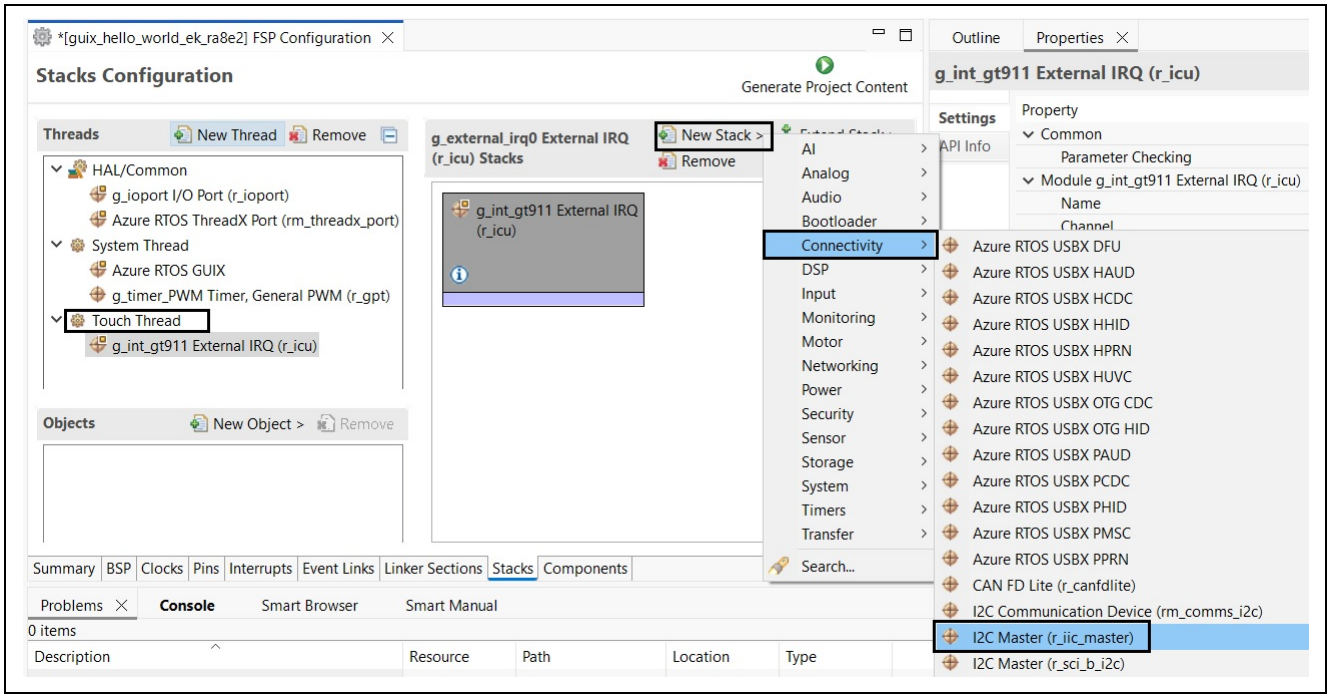
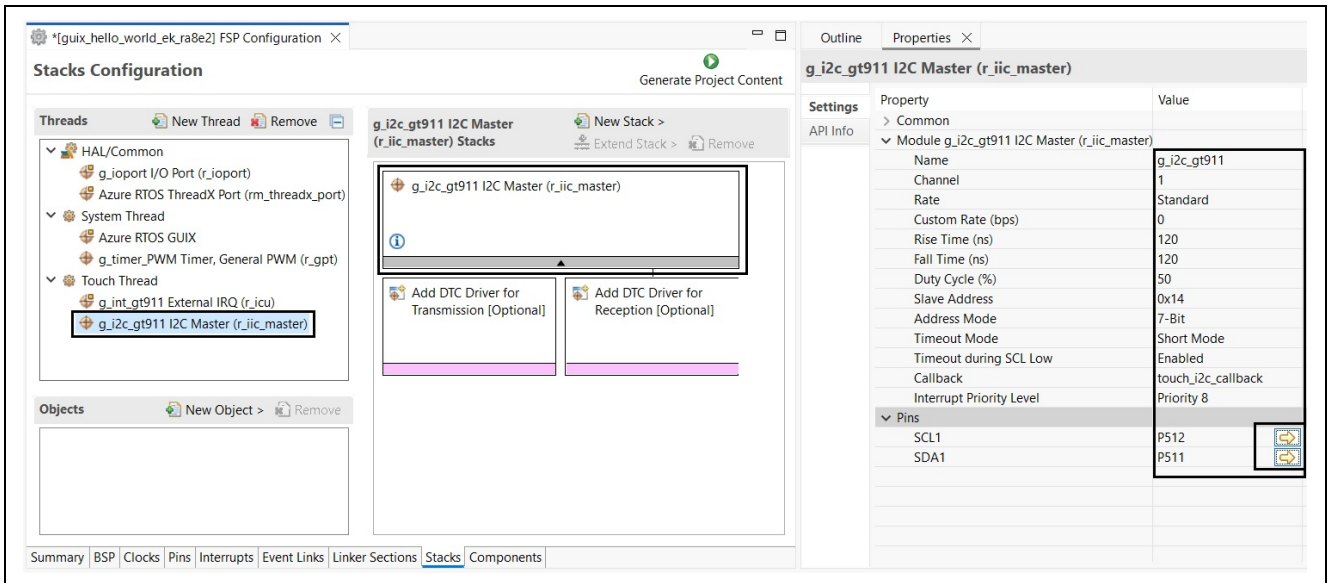


Figure 23. Add Touch I2C Master

6. Name “**g_i2c_gt911**” and setting “**I2C Master**” property.



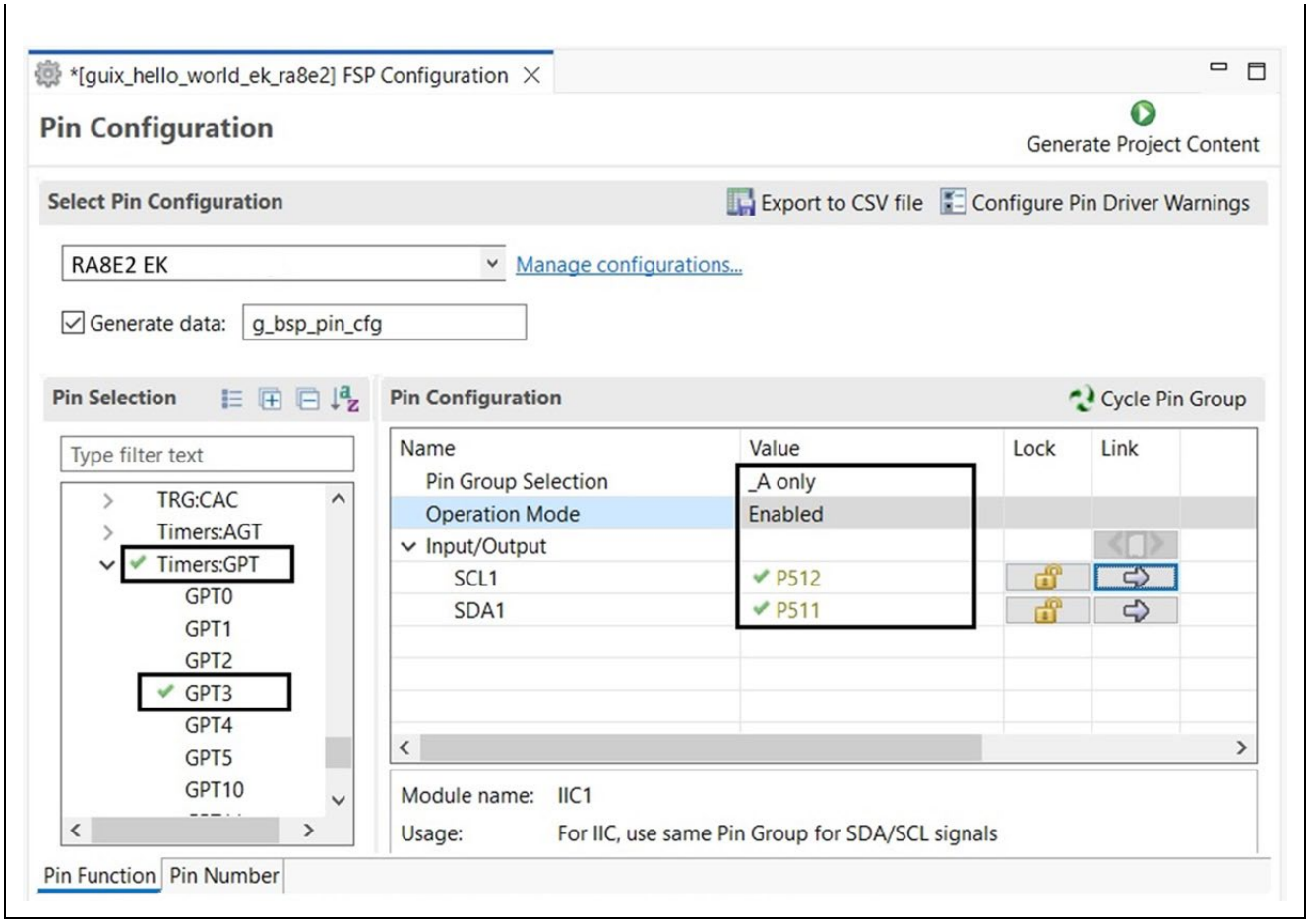


Figure 24. Name and Settings Property

7. Click “New Object” and add Semaphore.

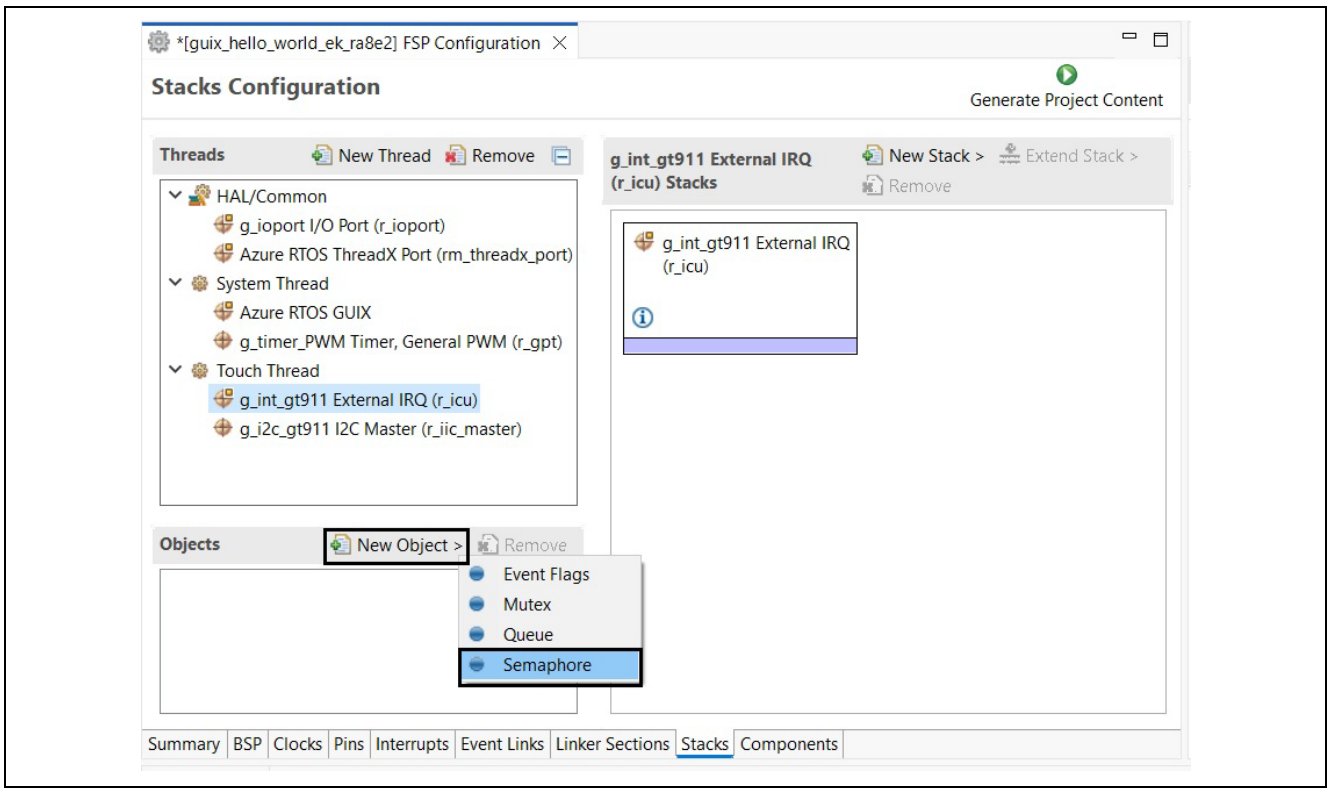


Figure 25. Add New Semaphore

8. Name “Touch Semaphore” and setting Property.

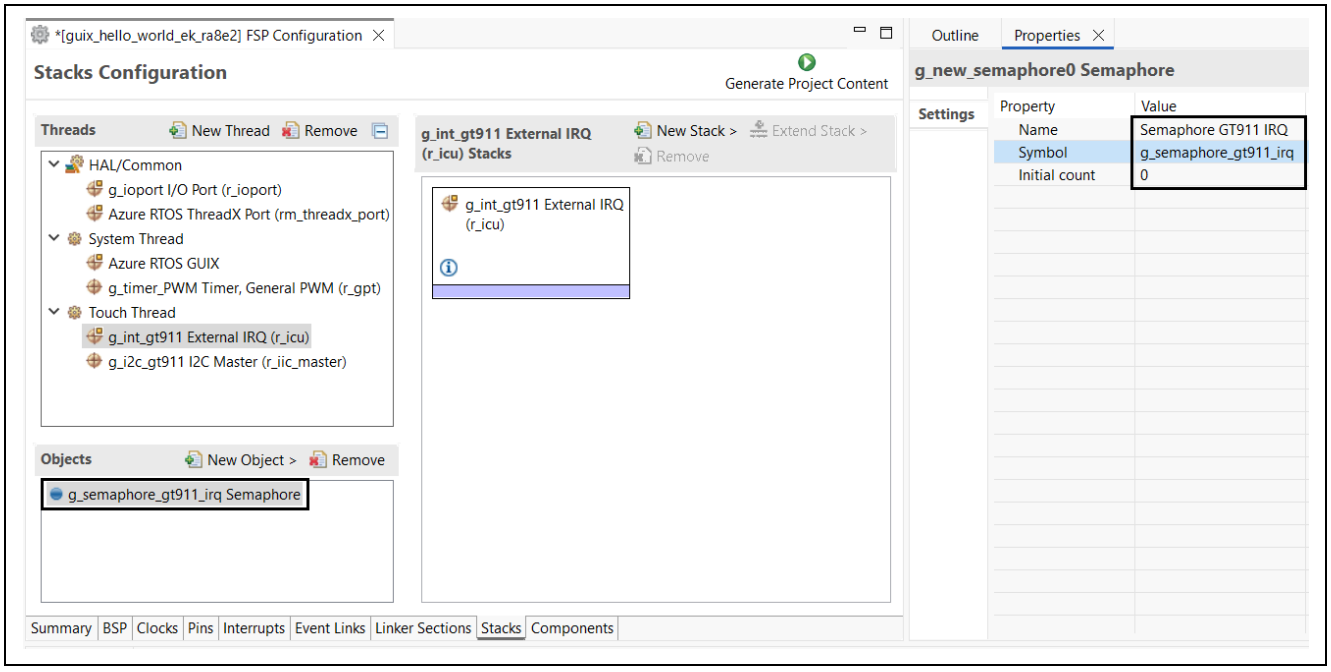


Figure 26. Name Touch Semaphore

9. Click “New Object” and add another Semaphore

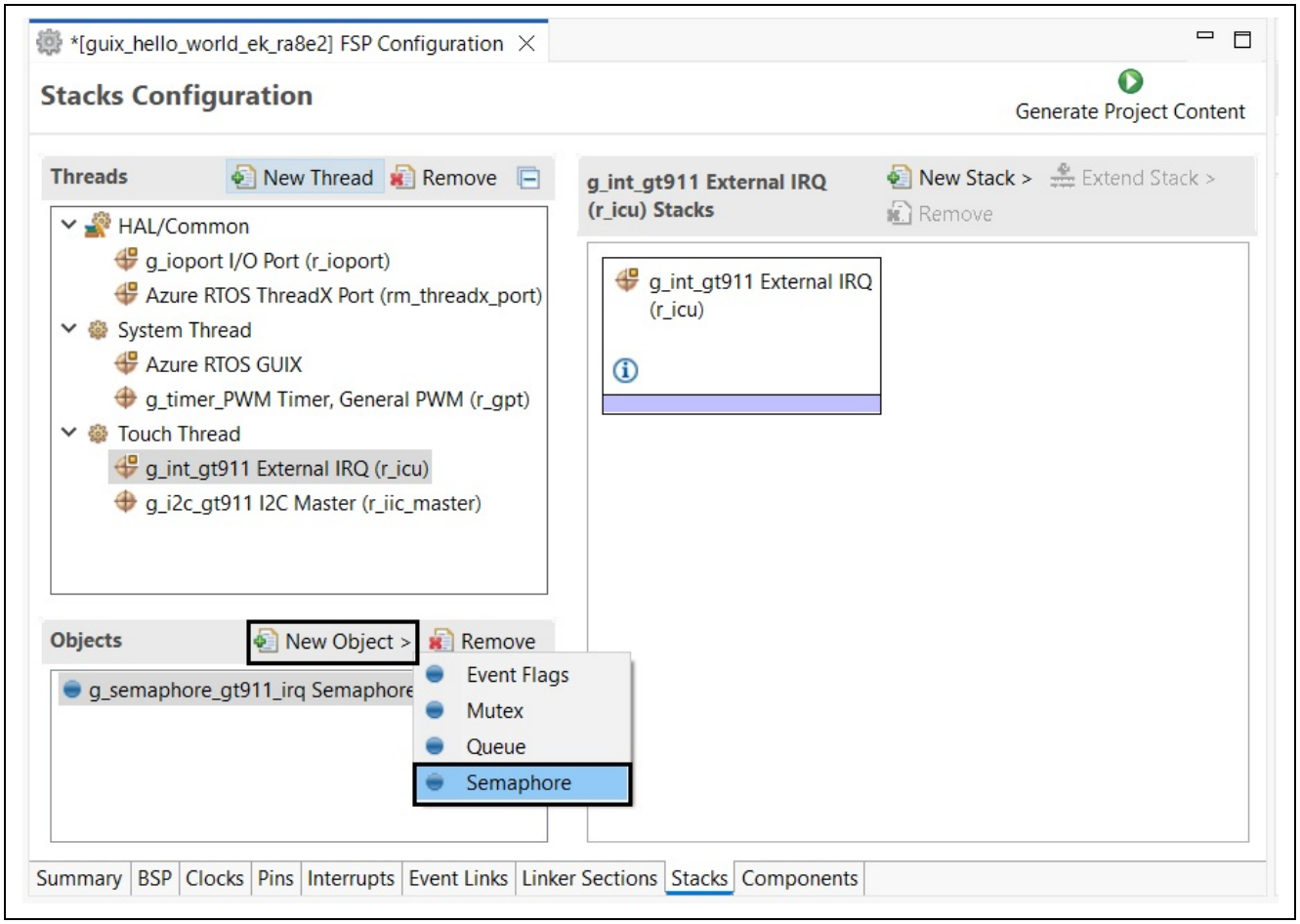


Figure 27. Add Another New Semaphore

10. Name "**I2C Semaphore**" and setting Property.

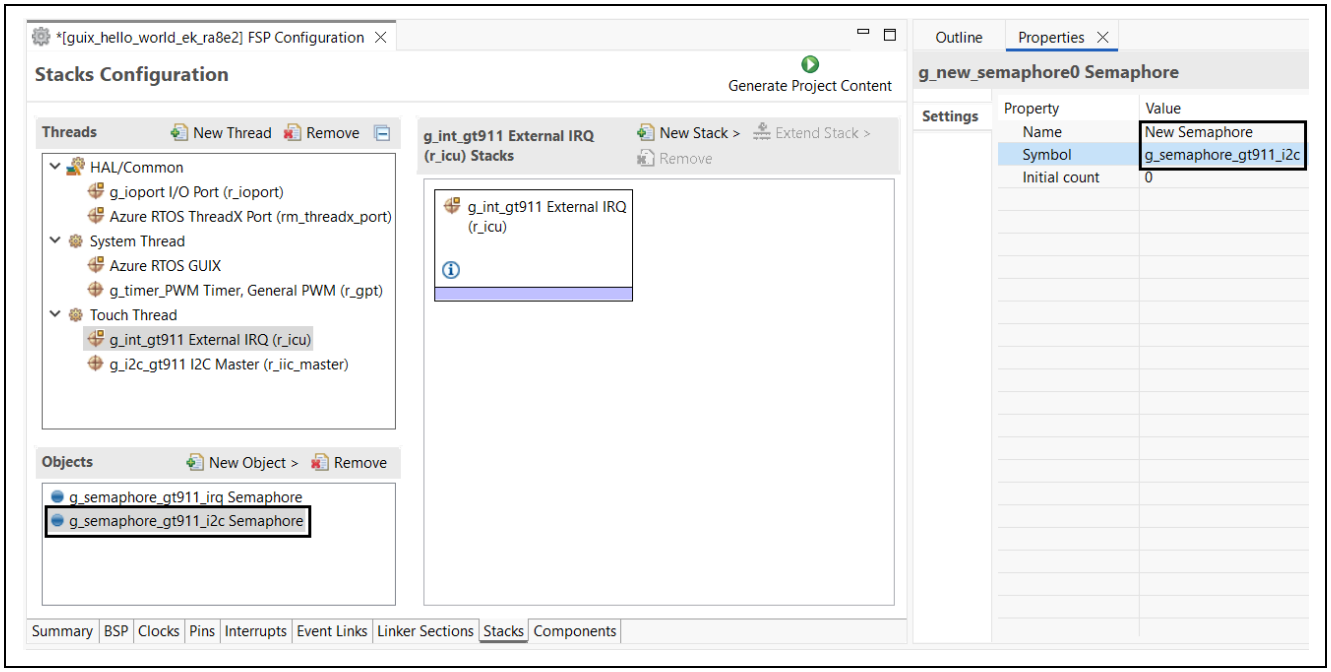


Figure 28. Add and Name I2C Semaphore

11. LCD panel connects to J1 40 pins on EK_RA8E2 board. It should look like **figure 29**.

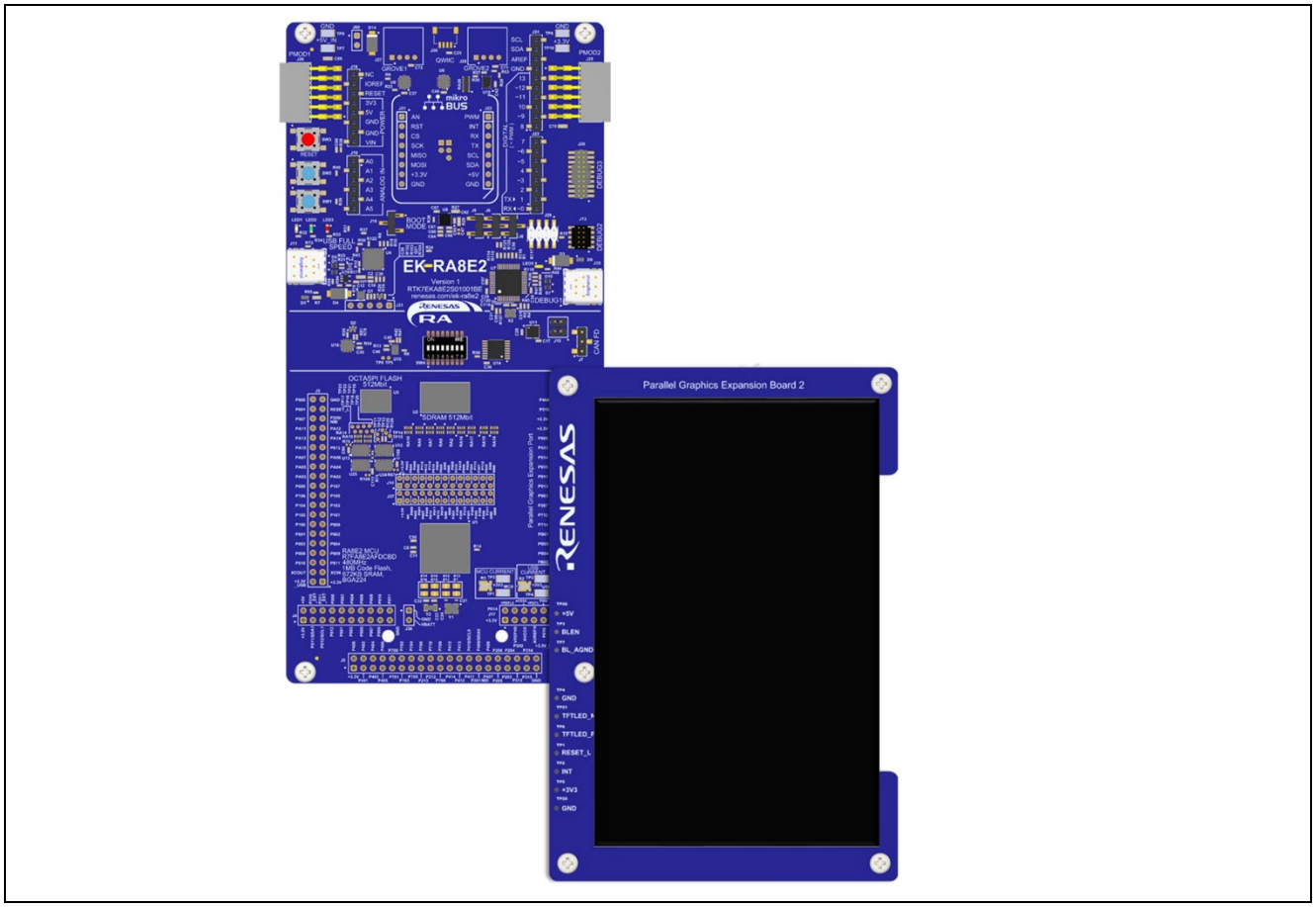


Figure 29. Schematic and Board Connection between LCD to J1 Connector on EK- RA8E2 **Board**

12. LCD Module pins connection

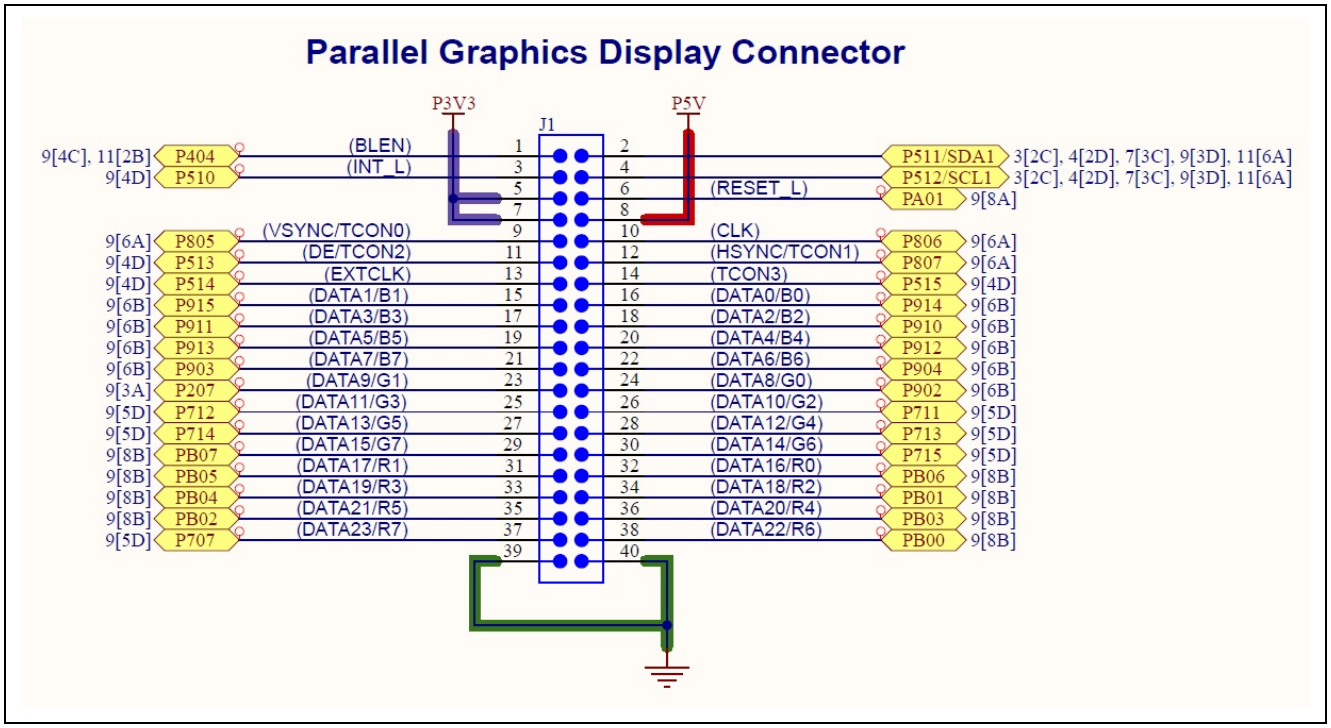


Figure 30. Parallel Graphics Display Connector

The pins marked in a black square above are used for the touch panel controller on the LCD board:

- INT_L interrupt (P510) is used to trigger touch events.
- I2C channel 1 (P512, P511) is used to read and write data to the touch controller.
- Touch driver folder `touch_gt911` for touch function is inside the provided `Source` folder.
- RESET_L (PA01) is used to reset the LCD's touch controller.

13. Note: Refer to the `touch_thread_entry.c` file in `Source.zip` for more information. The following code initializes the touch controller and process touch events.

```
/* New Thread entry function */
void touch_thread_entry(void)
{
    GX_EVENT gxe = {0};
    gxe.gx_event_type = GX_EVENT_PEN_UP;
    uint8_t status = 0;
    /* TODO: add your own code here */


    touch_gt911_ctrl_t gt911_ctrl;

    fsp_err_t err = FSP_SUCCESS;

    uint32_t gt911_err = 0;

    uint16_t gt911_fw_version = 0;

    UINT tx_err = TX_SUCCESS;

    err = R_TOUCH_GT911_Validate(&gt911_cfg, &gt911_err);

    if(FSP_SUCCESS != err)
    {
        __BKPT(0);
    }

    memset(&gt911_ctrl, 0, sizeof(touch_gt911_ctrl_t));

    err = R_TOUCH_GT911_Open(&gt911_ctrl, &gt911_cfg);

    if(FSP_SUCCESS != err)
    {
        __BKPT(0);
    }


    err = R_TOUCH_GT911_Reset(&gt911_ctrl);

    if(FSP_SUCCESS != err)
    {
        __BKPT(0);
    }
#if 1
    err = R_TOUCH_GT911_VersionGet(&gt911_ctrl, &gt911_fw_version);

    if(FSP_SUCCESS != err)
    {
        __BKPT(0);
    }
#endif
    while (FSP_SUCCESS == err)
    {
```

Figure 31. Initializes the Touch Controller and Process Touch Events

14. From Stacks Configuration, click "**Generate Project Content**" to generate project content.

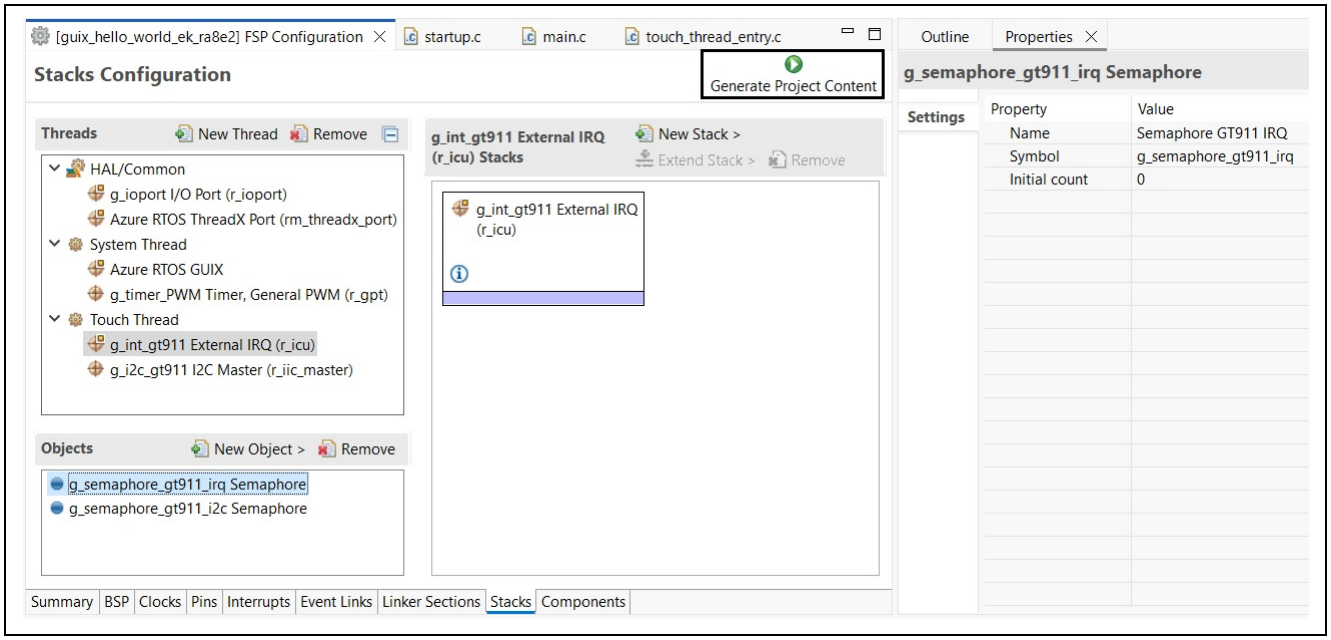


Figure 32. "Generate Project Content"

15. Unzip and open the provided folder `Source.zip`. Copy the four `*.c`, a folder `touch_gt911` and paste into the folder "`src`" of your project "**guix_hello_world_ek_ra8e2"**.
    - Touch_gt911 folder
    - hal_entry.c
    - system_thread_entry.c
    - touch_thread_entry.c
    - windows_handler.c

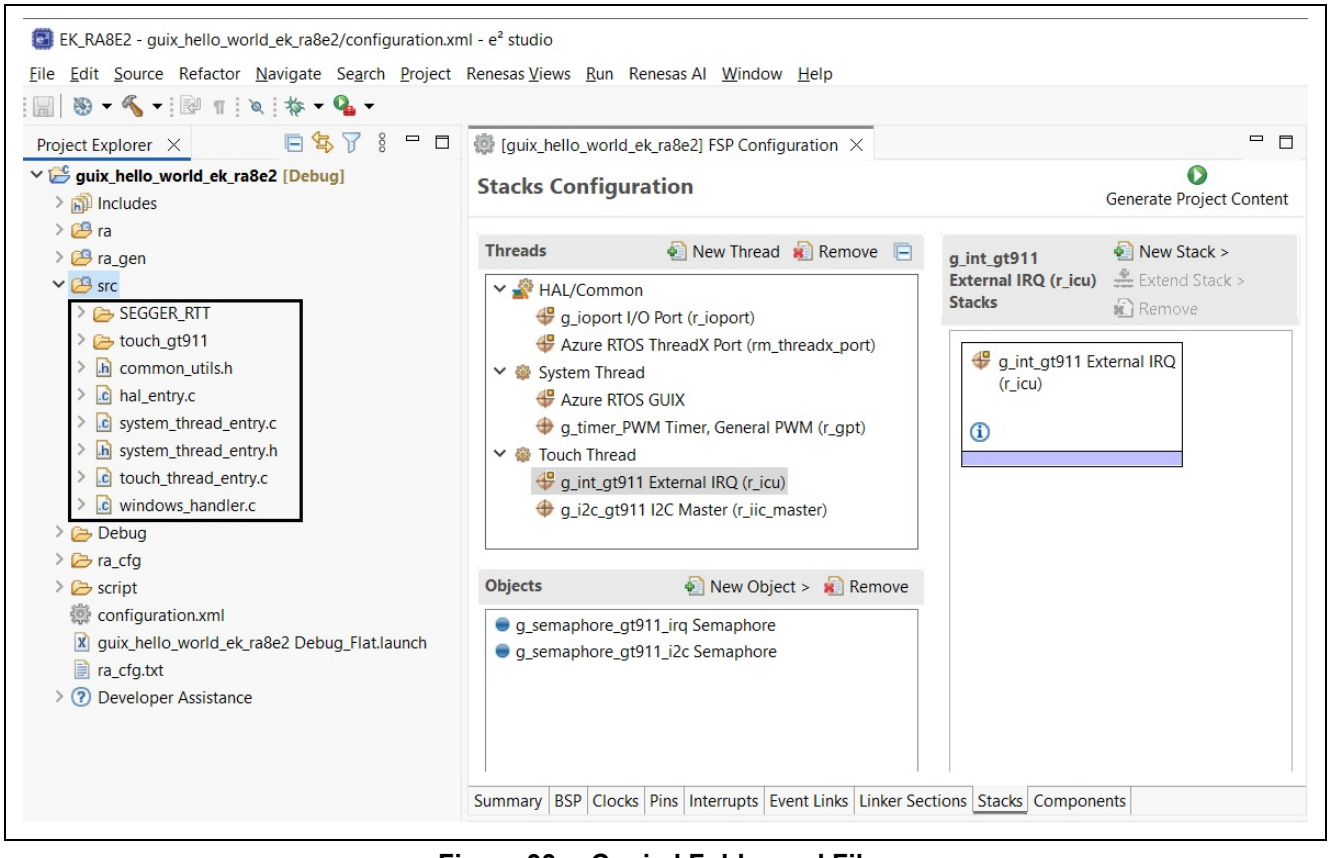


Figure 33. Copied Folder and Files

4. Creating Folders in the guix_gello_world_ek_ra8e2 Project for Azure RTOS GUIX Studio Project

1. Under folder **`src`** create a new folder and name it **`guix_gen`.** Follow the image below, then click Finish.

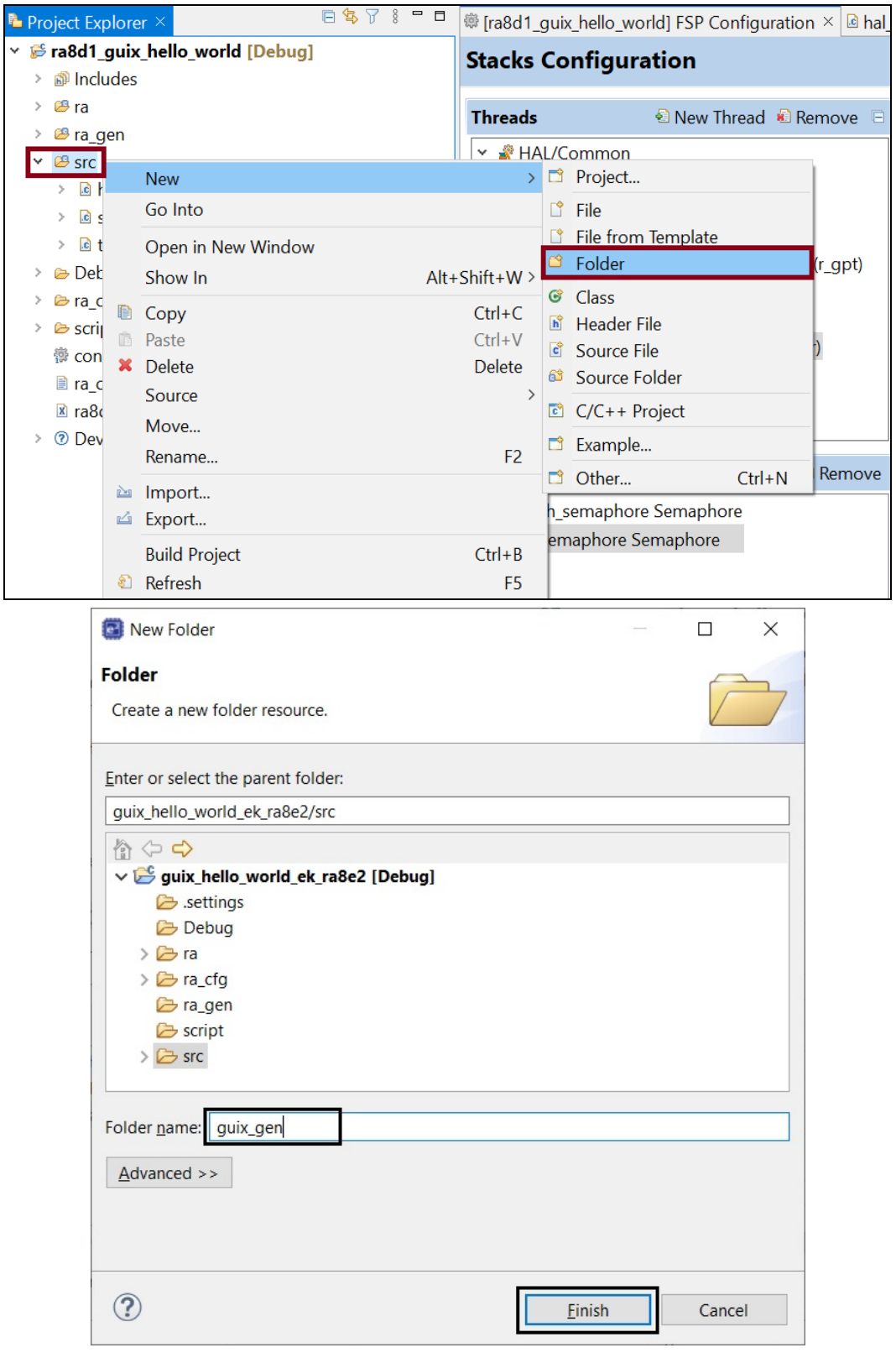


Figure 34. Create and Name “guix_gen” Folder

2. Under folder `src` create a new folder and name it `guix_studio`. Then follow the image below and click **Finish**.

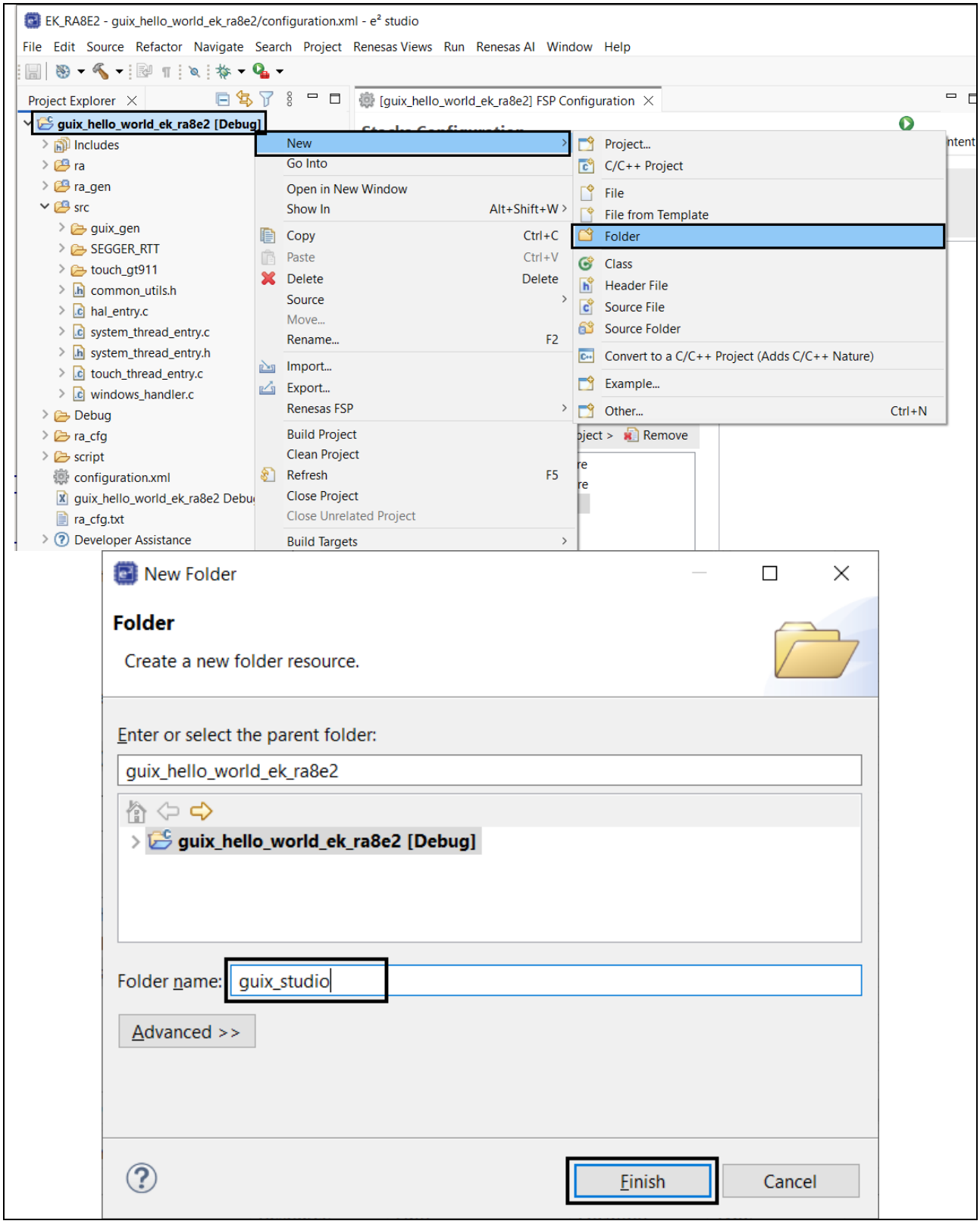


Figure 35. Create New Folder and Name "guix_studio"

3. Under folder `guix_studio` that was created earlier, create a new folder and name `GNU`. Follow the image below, then click **Finish.**

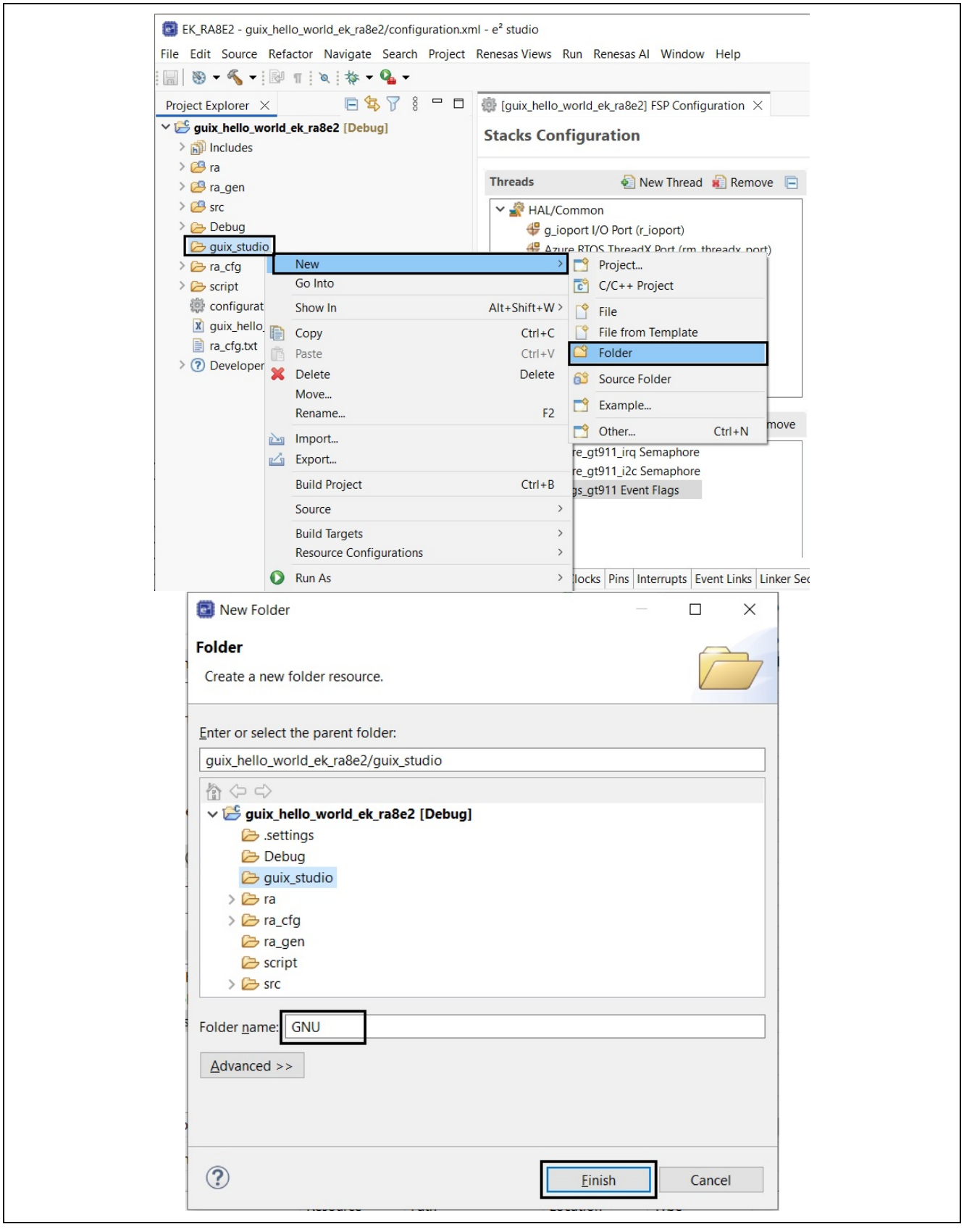


Figure 36. Create New Folder and Name “GNU”

4. After the sub-folder `GNU` is created, the folder structure should look like the image below.

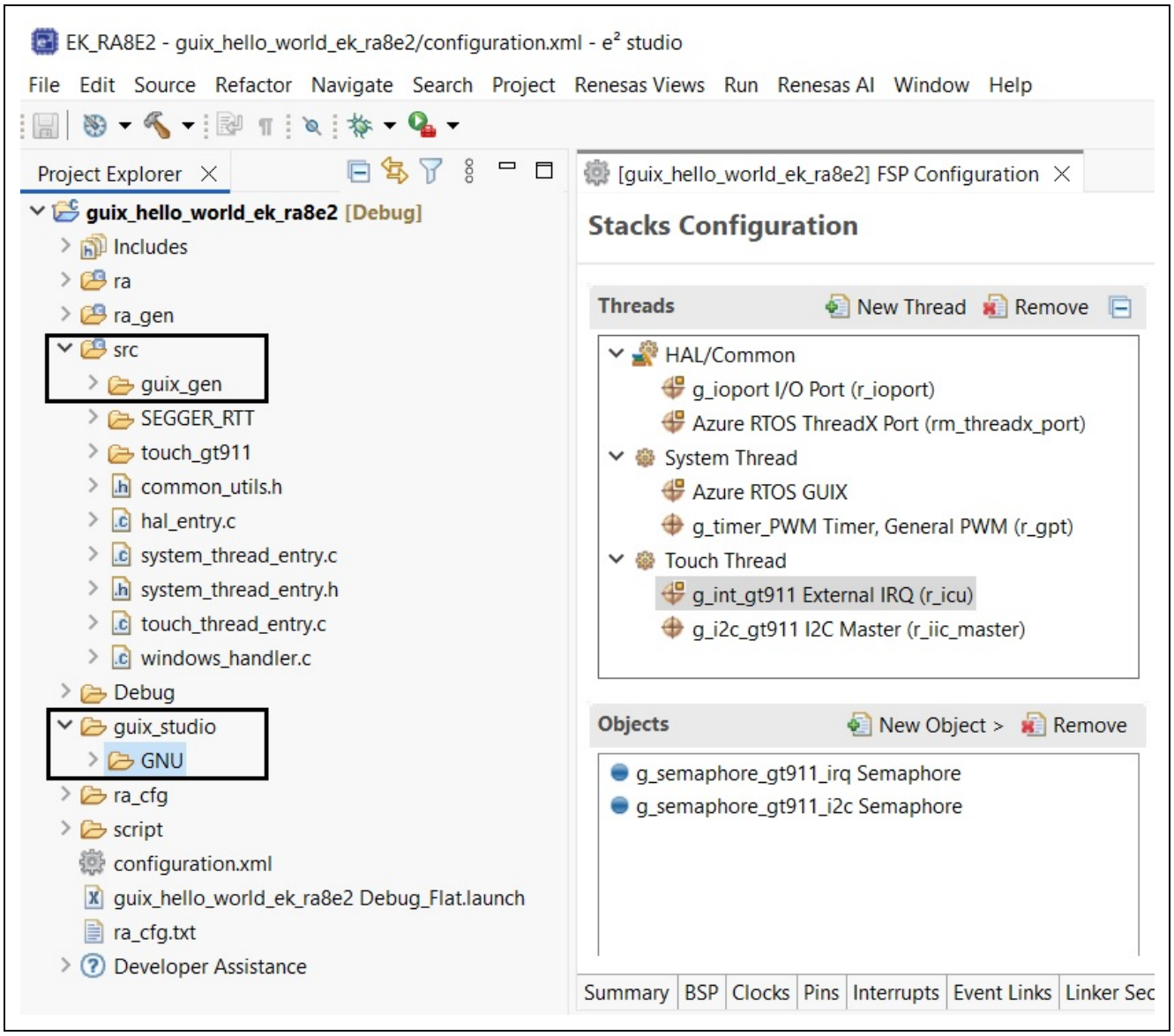


Figure 37. Project with New Folder

5. Using Azure RTOS GUIX Studio create GUI Windows

1. Open **Azure RTOS GUIX Studio v6.4.0.0** or greater**.**

Figure 38. GUIX Studio Icon

2. Create a **New Project** and name it **Hello World**.
   A. Select **Project**. From the drop-down list, select **New Project**.
   B. Project Name: **Hello_World**.
   C. Project Path: Browse to the location of the folder you created in the **<guix_hello_world_ek_ra8e2>**
   D. **guix_studio\GNU** as shown in the image below.
   E. Hit **OK** button and then the **Save** button to confirm your selections.

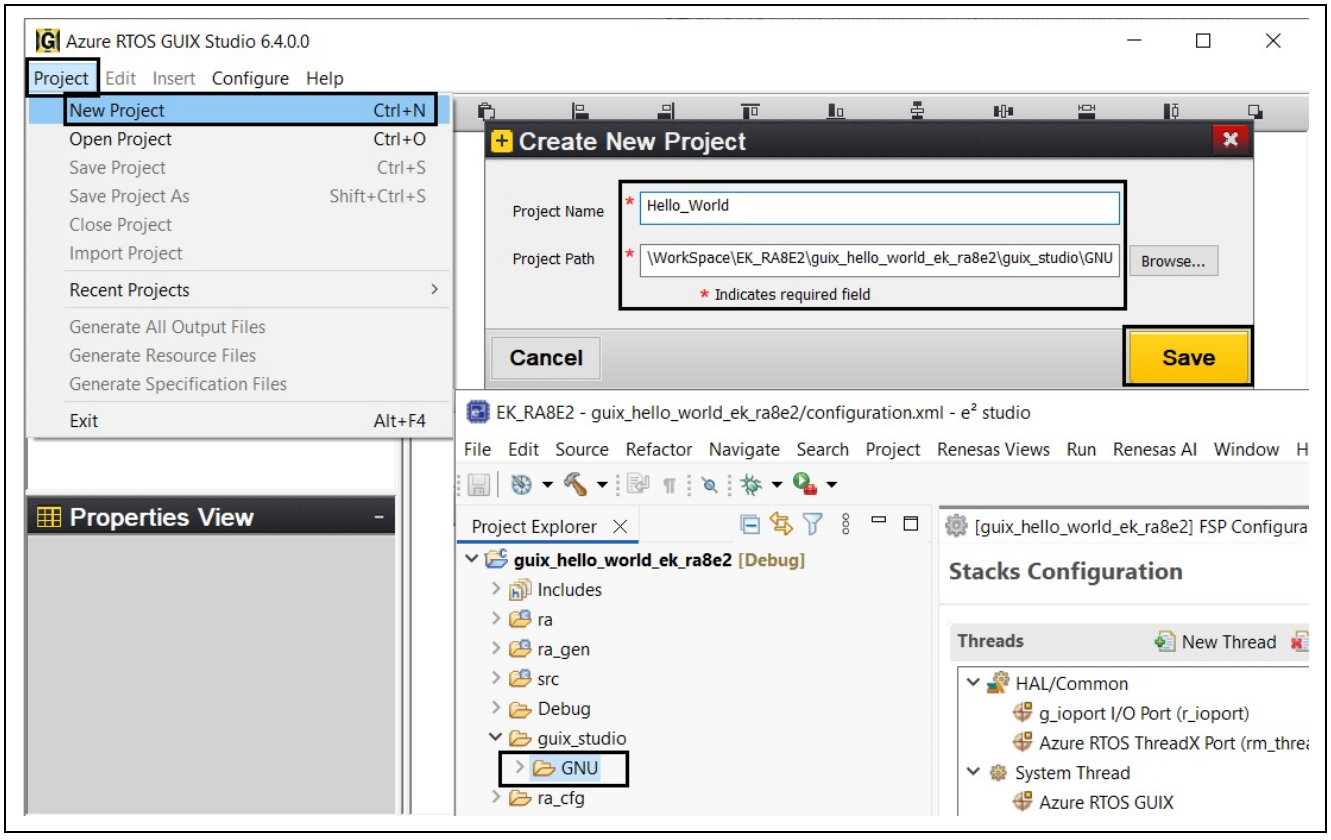


Figure 39. GUIX Studio Creates Hello World Project

3. A new **Configure Project** window will pop up and user needs to set all the options as shown in **Figure 40**. included Advanced Settings. Finally, click **Save**.

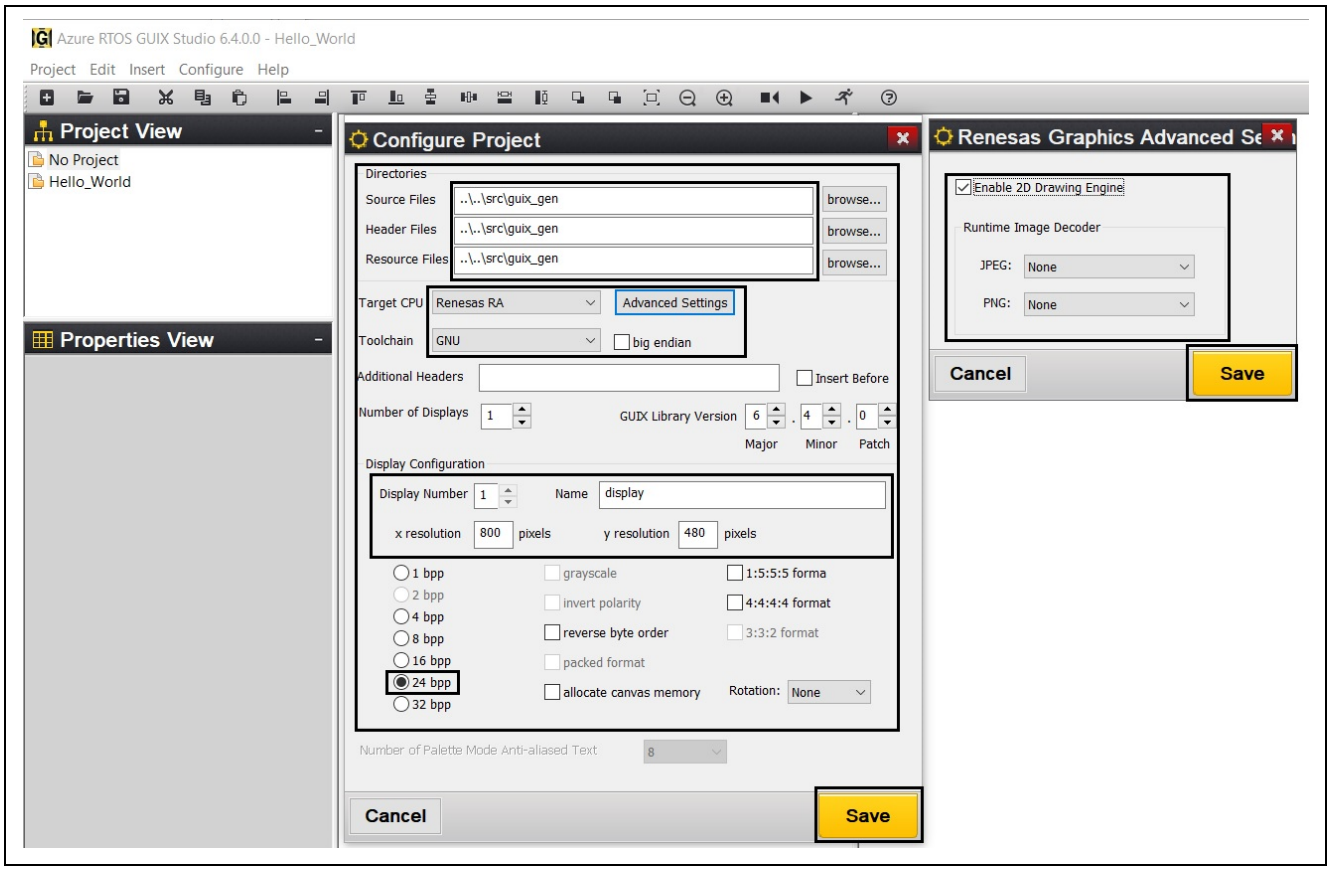


Figure 40. Configuration New Project "Hello World" with Advanced Settings

4. Star New Project "Hello World" should look similar **Figure 41**.

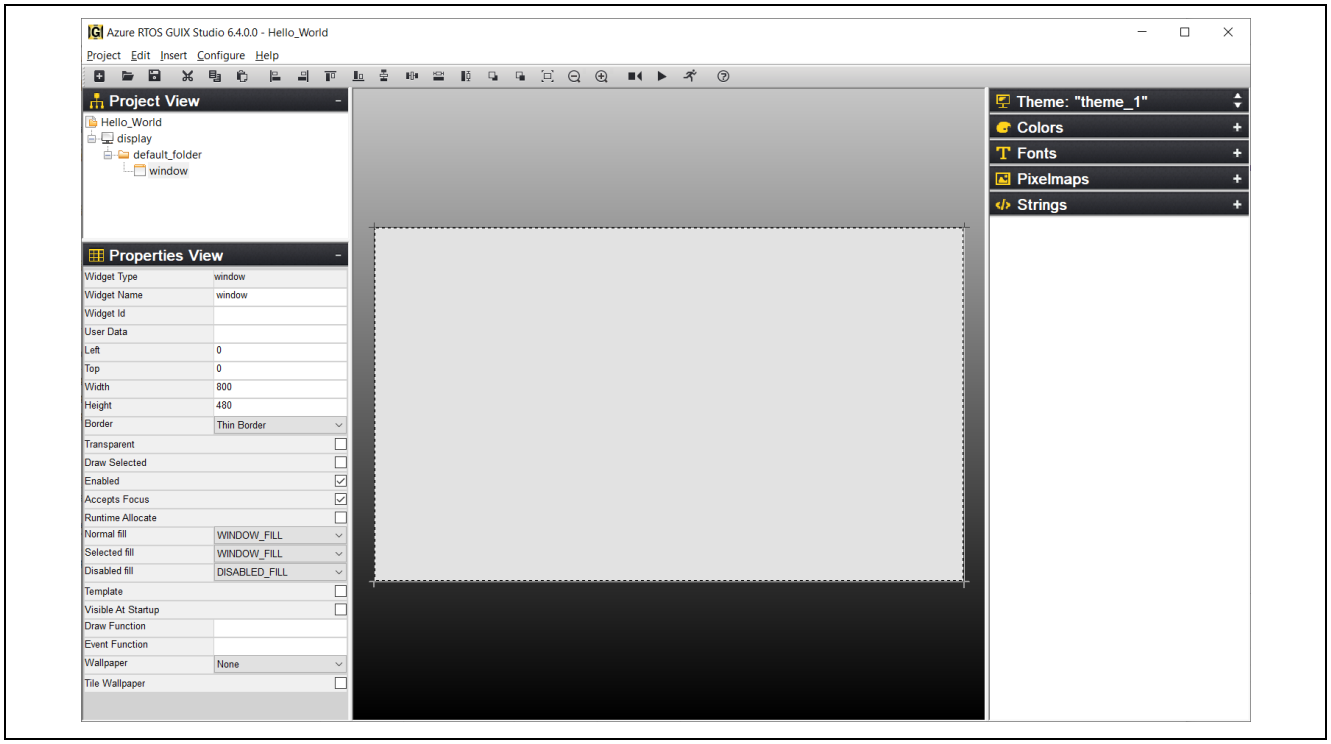


Figure 41. After Settings New Project "Hello World"

5. Setting Properties View of Window1.

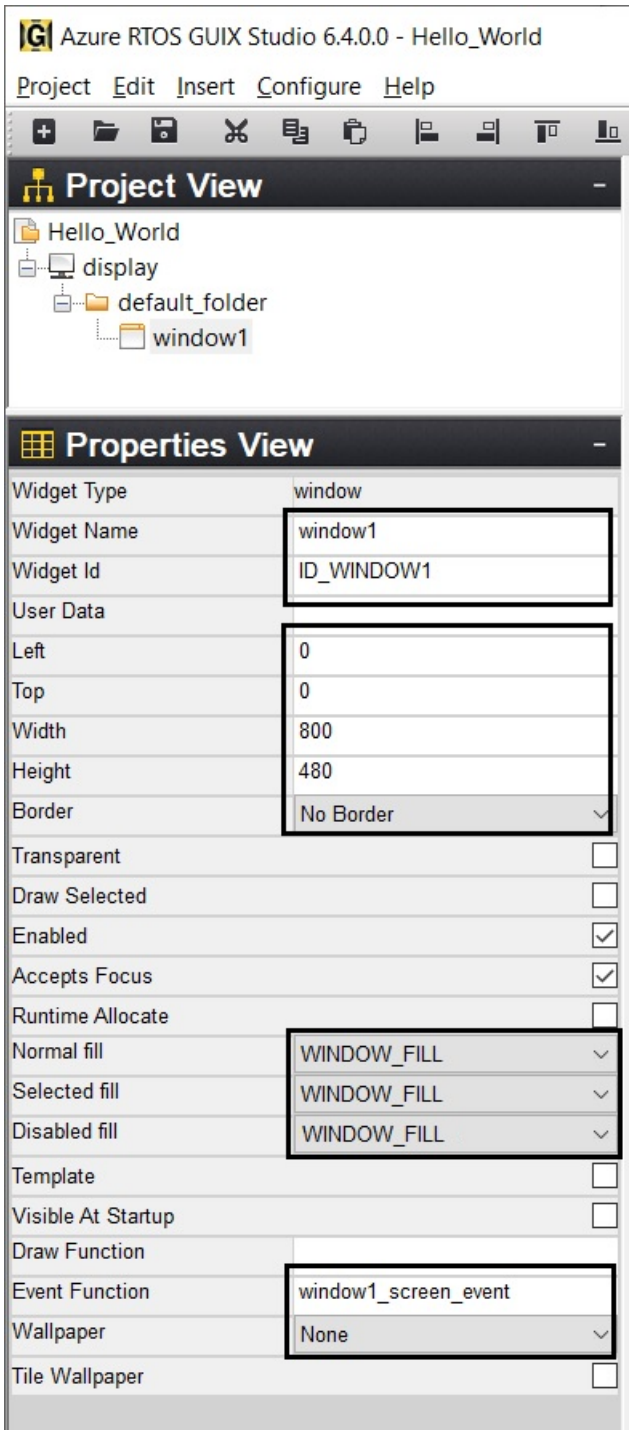


Figure 42. Property View of Window1

6. To add String ID, click on **Strings**. Follow the images below.

Figure 43. Strings

7. From the **Strings** dropdown, click **+ Add New String**.

Figure 44. Add New String

8. New **String Table Editor** window will pop up. Click the **Add String** button.

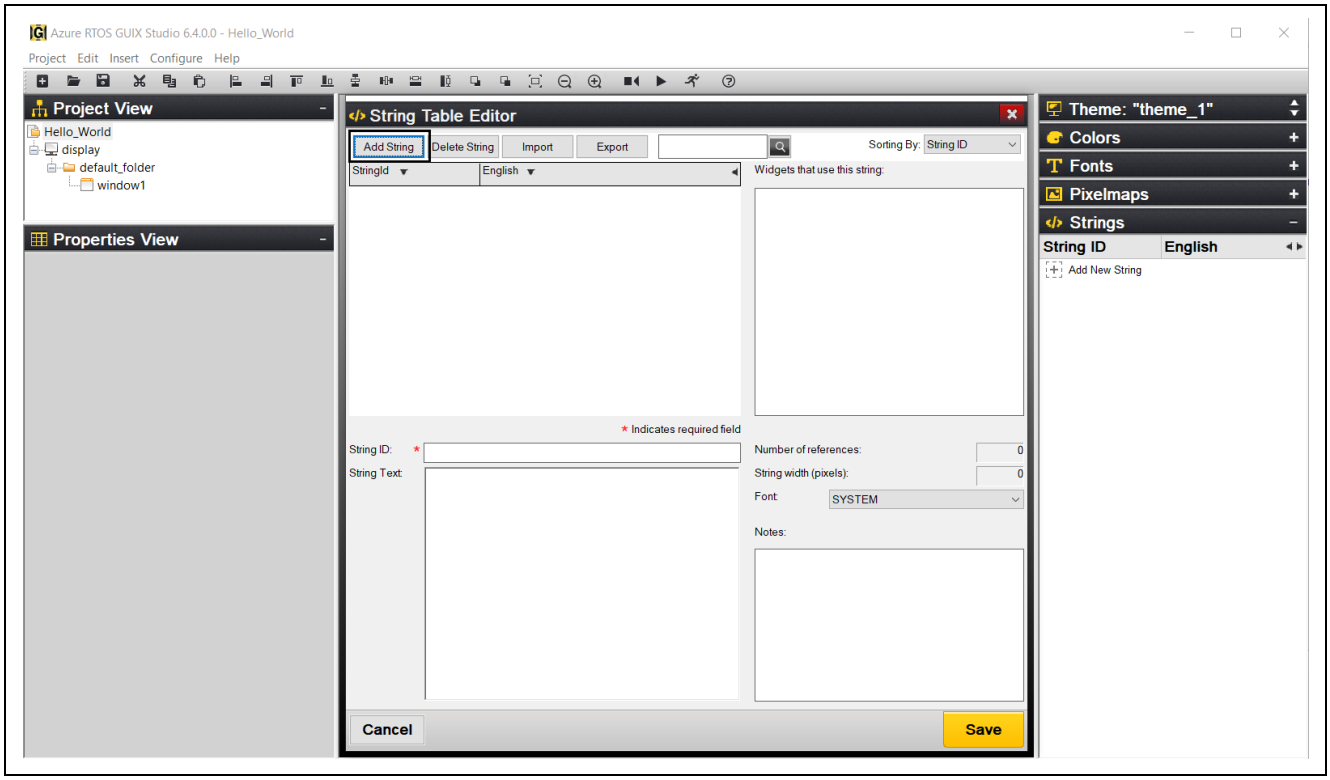


Figure 45. String Table Editor

9. Edit String ID and String Text.

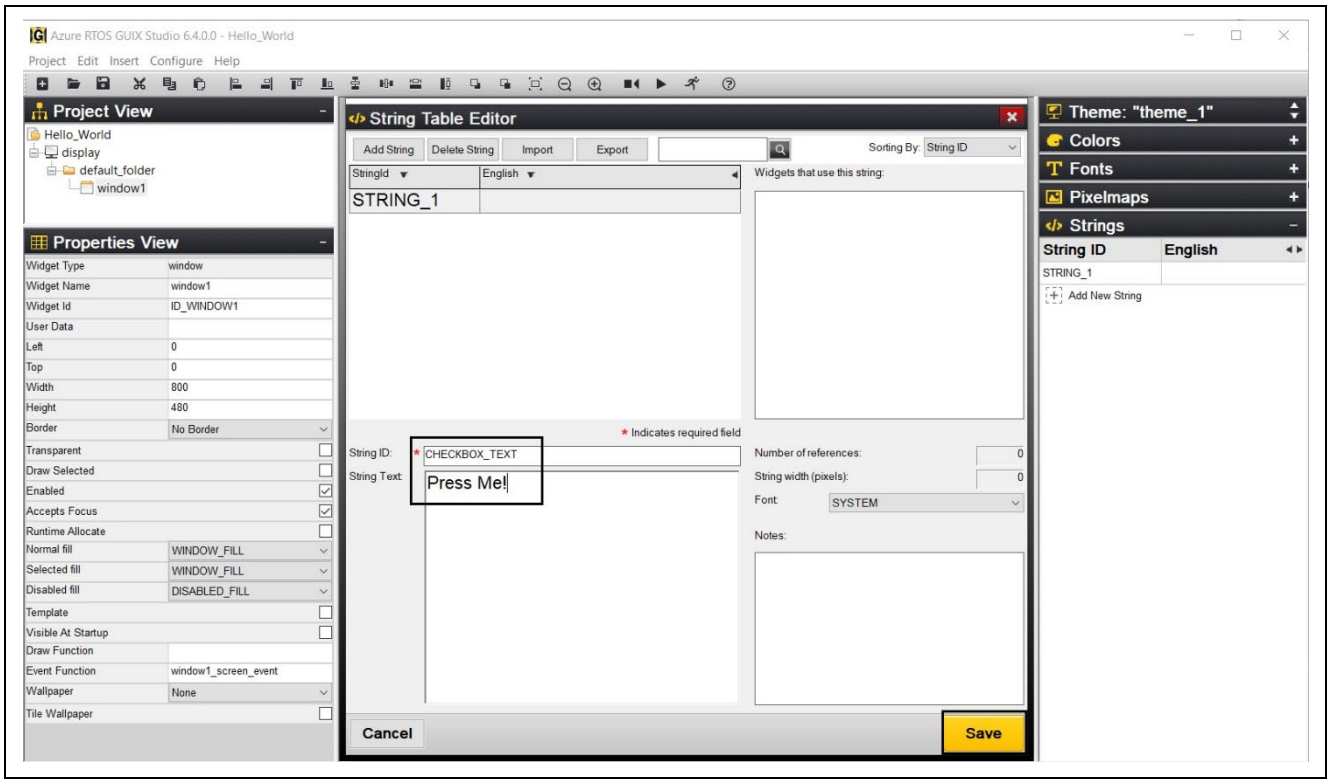


Figure 46. Edit String ID and String Text

10. Continue to click **Adding String**, then edit **String ID** and **String Text** until the table appears like **Figure 47** Then click the **Save** button.

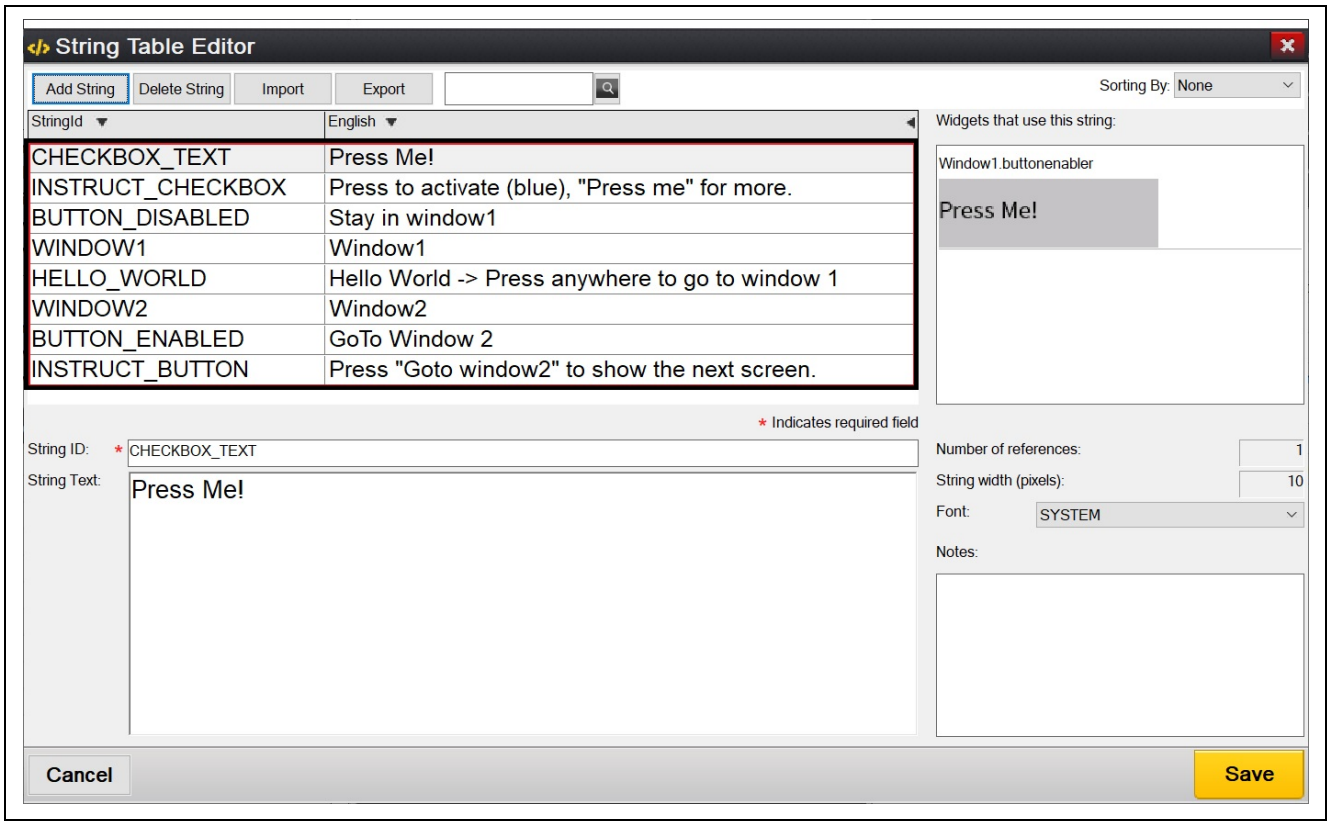


Figure 47. All Strings

11. Right-click on **Window1** to insert a **Text Button** and follow **Figure 48.**

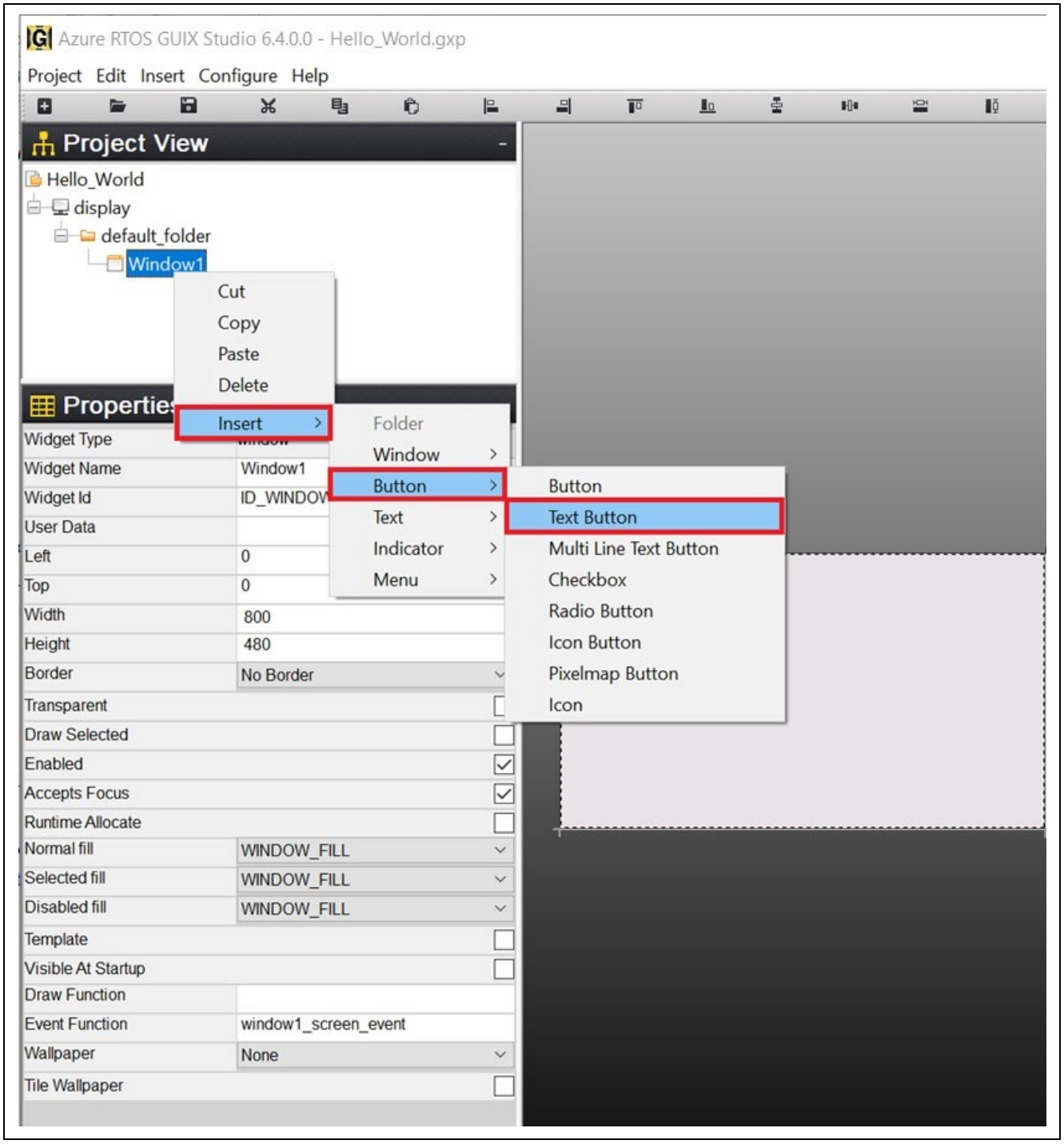


Figure 48. Insert Text Button

12. Set Properties View of “text_button”.

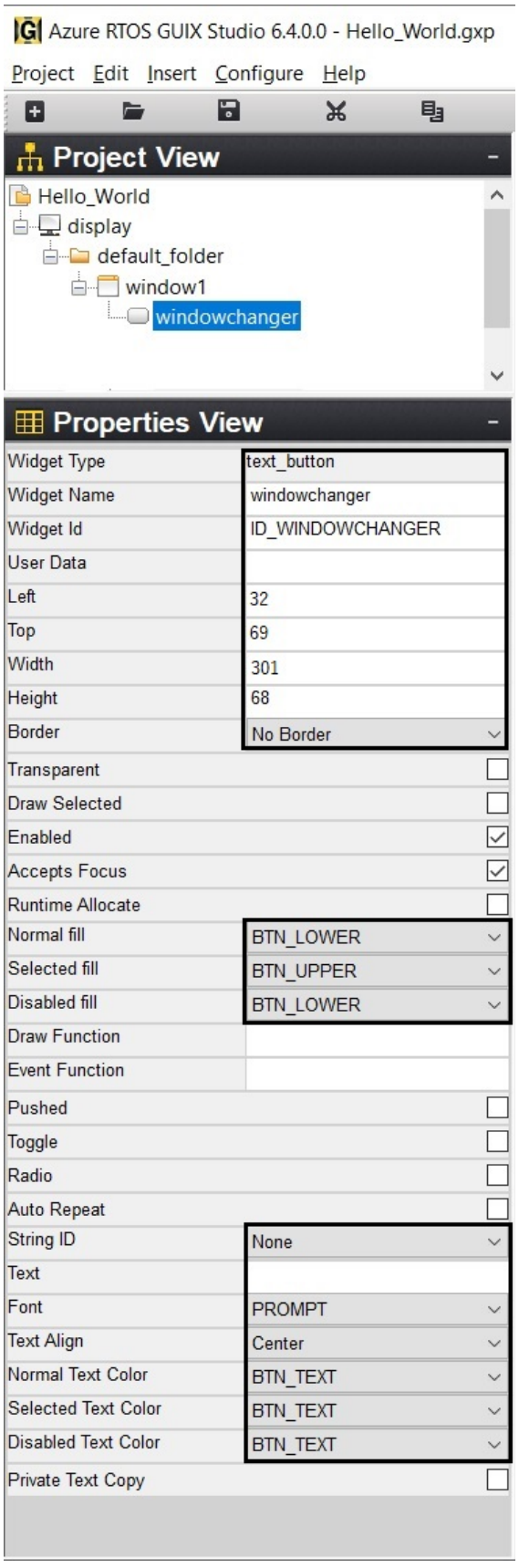


Figure 49. Properties View of text_button

13. Right-click **windowchanger** to insert a **Prompt** and follow **Figure 50**.

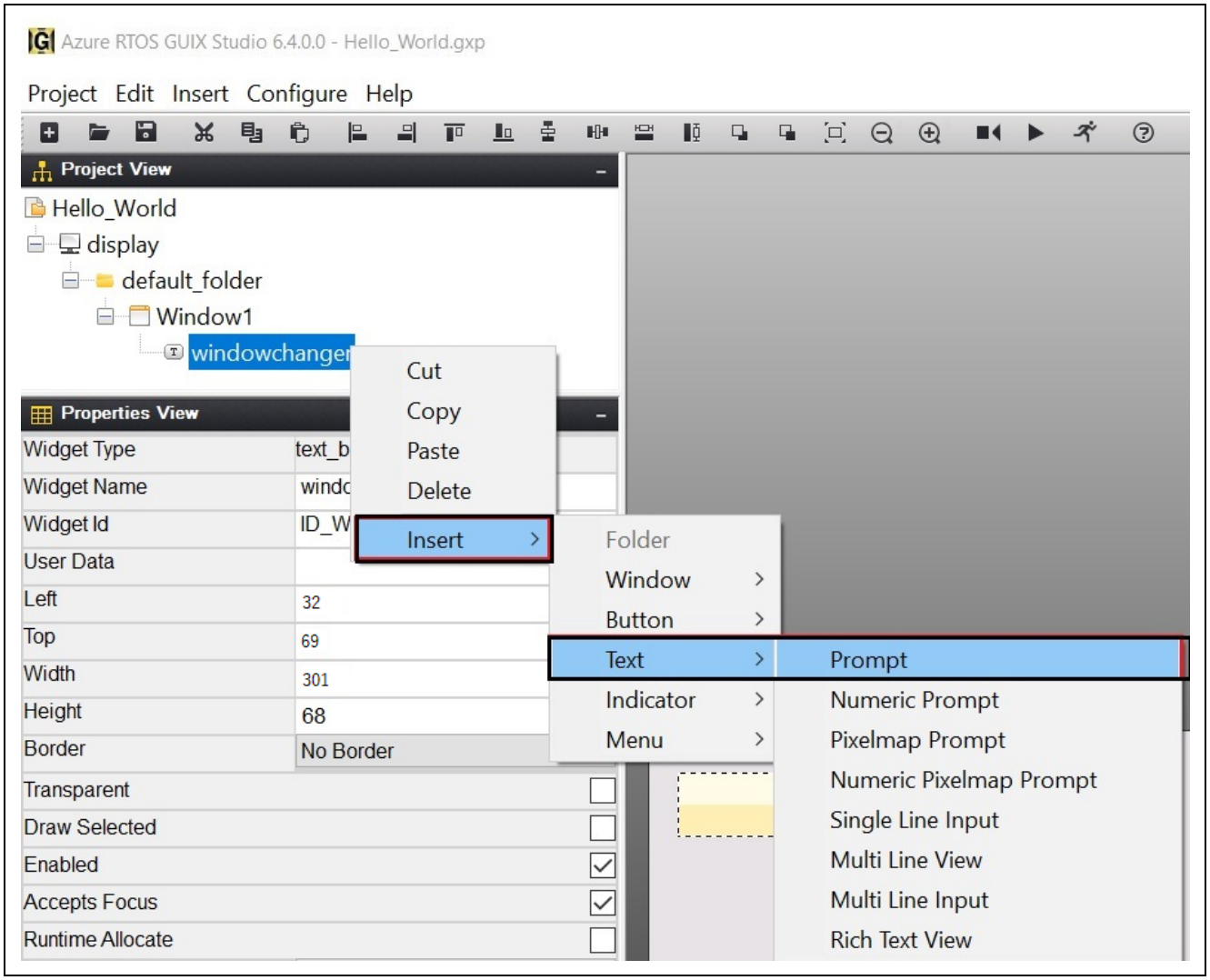


Figure 50. Insert Prompt

14. Set Properties View of prompt.

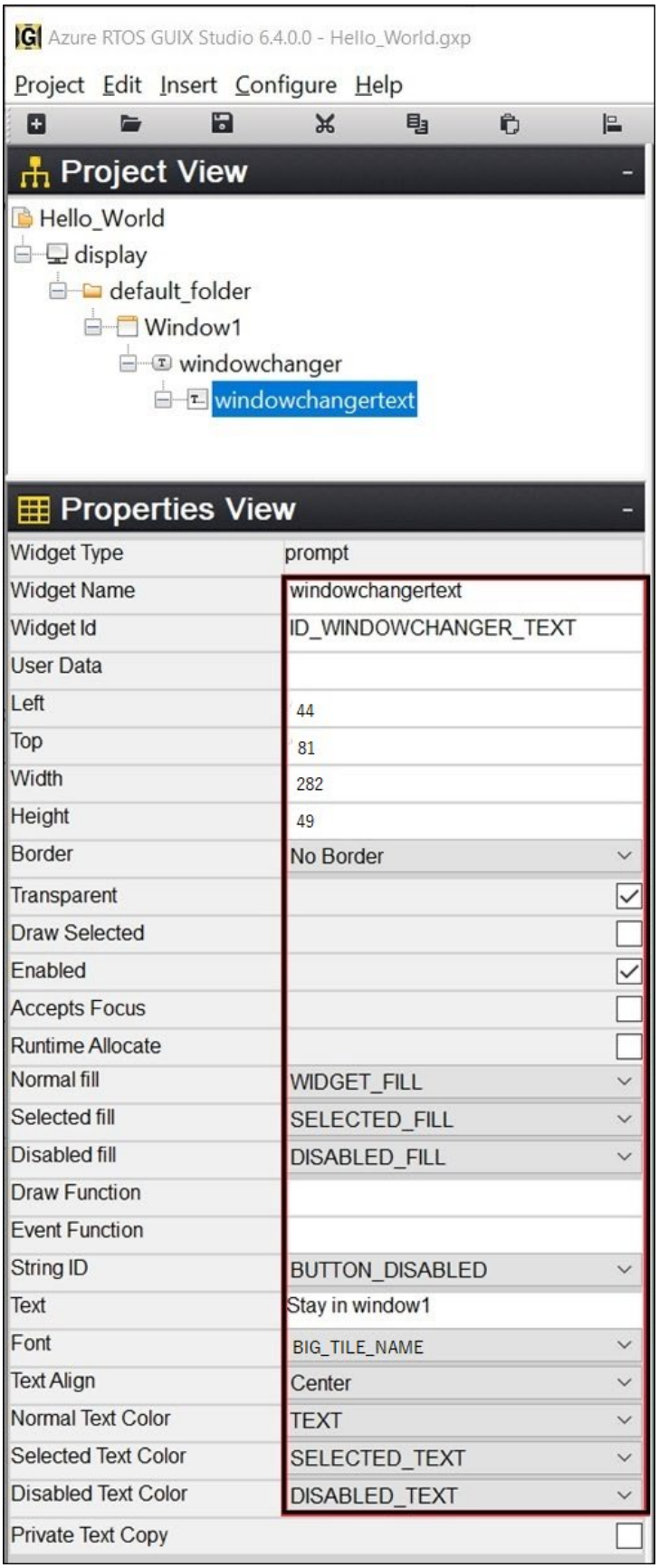


Figure 51. Properties View of Prompt

15. Insert new **Button**. Right-click on **windowchangertext** and follow **figure 52**.

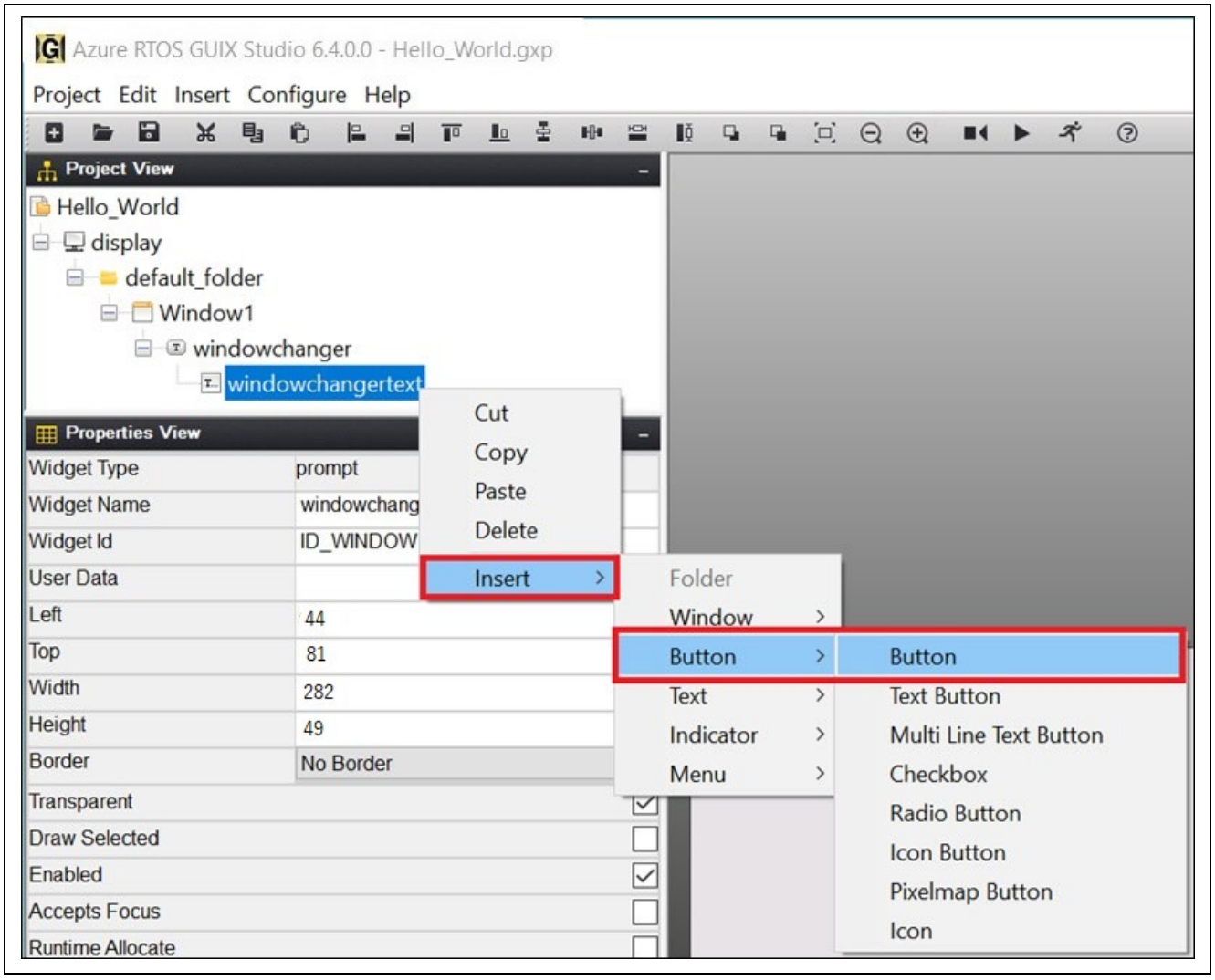


Figure 52. Insert Button

16. Set the Properties view of button.

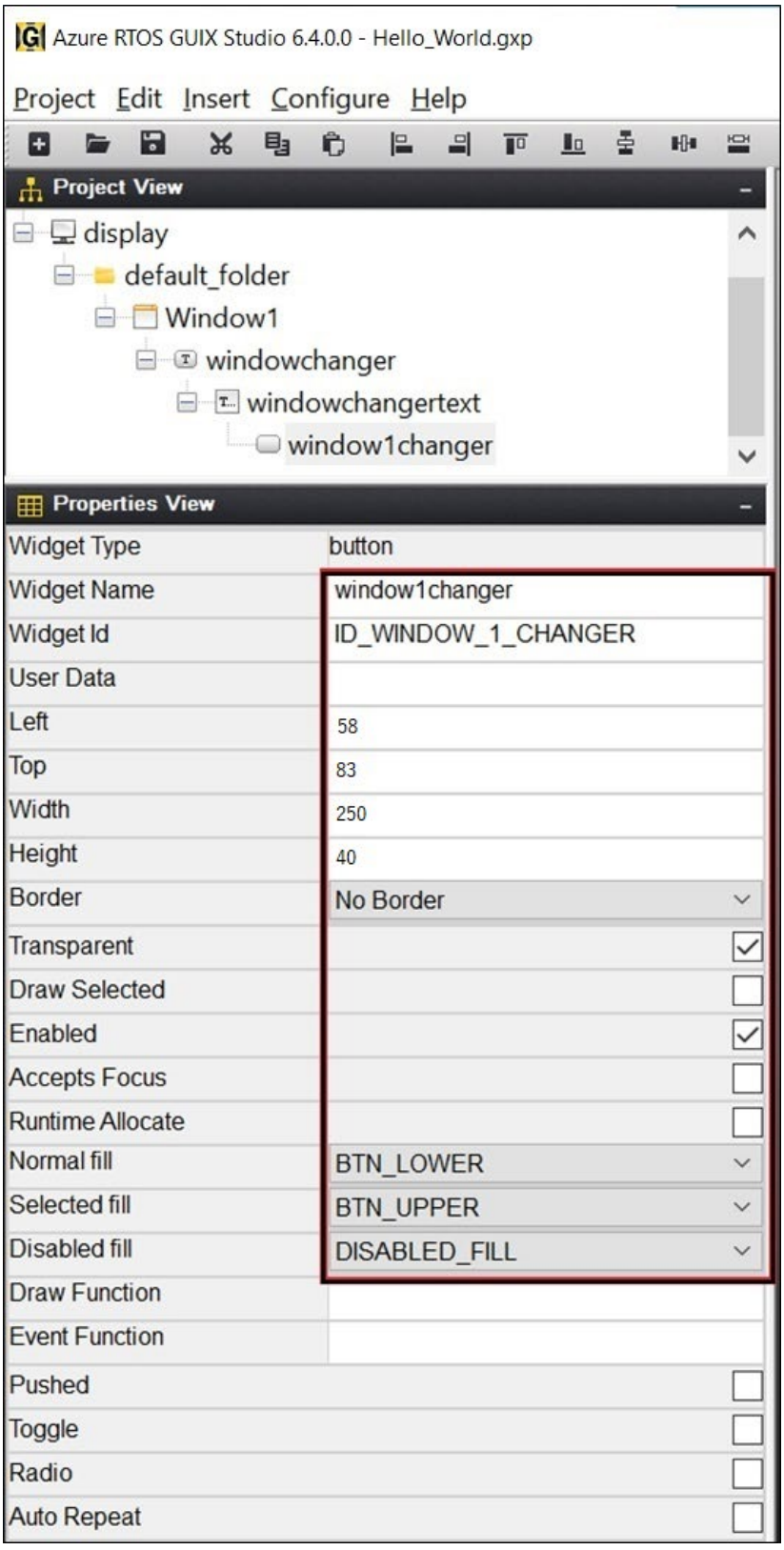


Figure 53. Properties View of Button

17. Insert **Prompt**. Right click on **Window1** and follow **figure 54**.

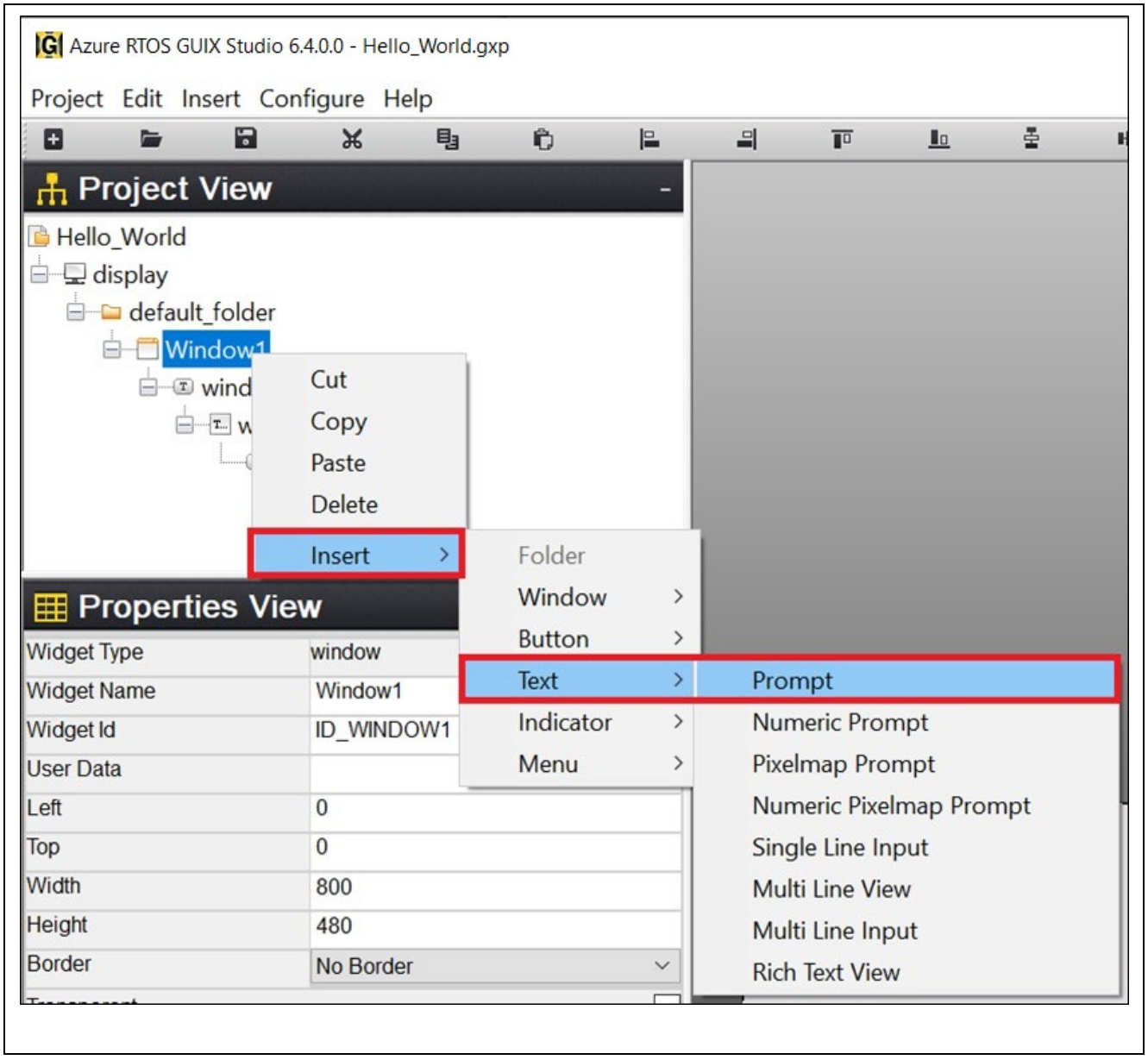


Figure 54. Insert Prompts

18. Insert two times to get two prompts. **Prompt** and **Prompt1** as **figure 55.**

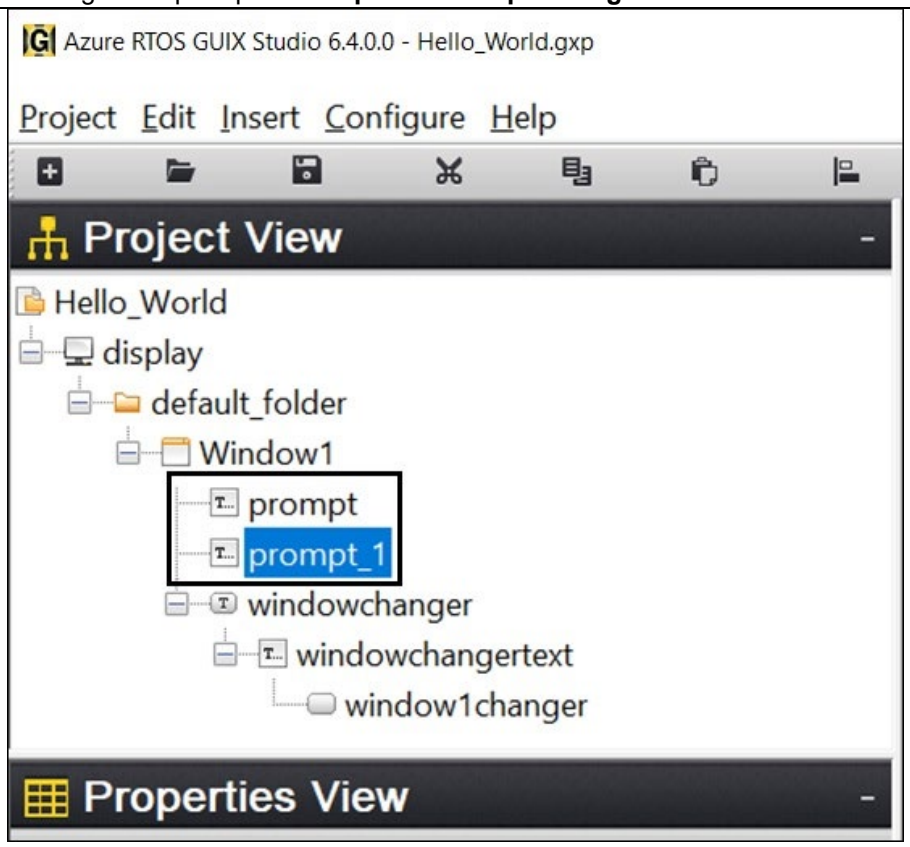


Figure 55. Insert Prompts

19. Set the Properties View of Prompt.

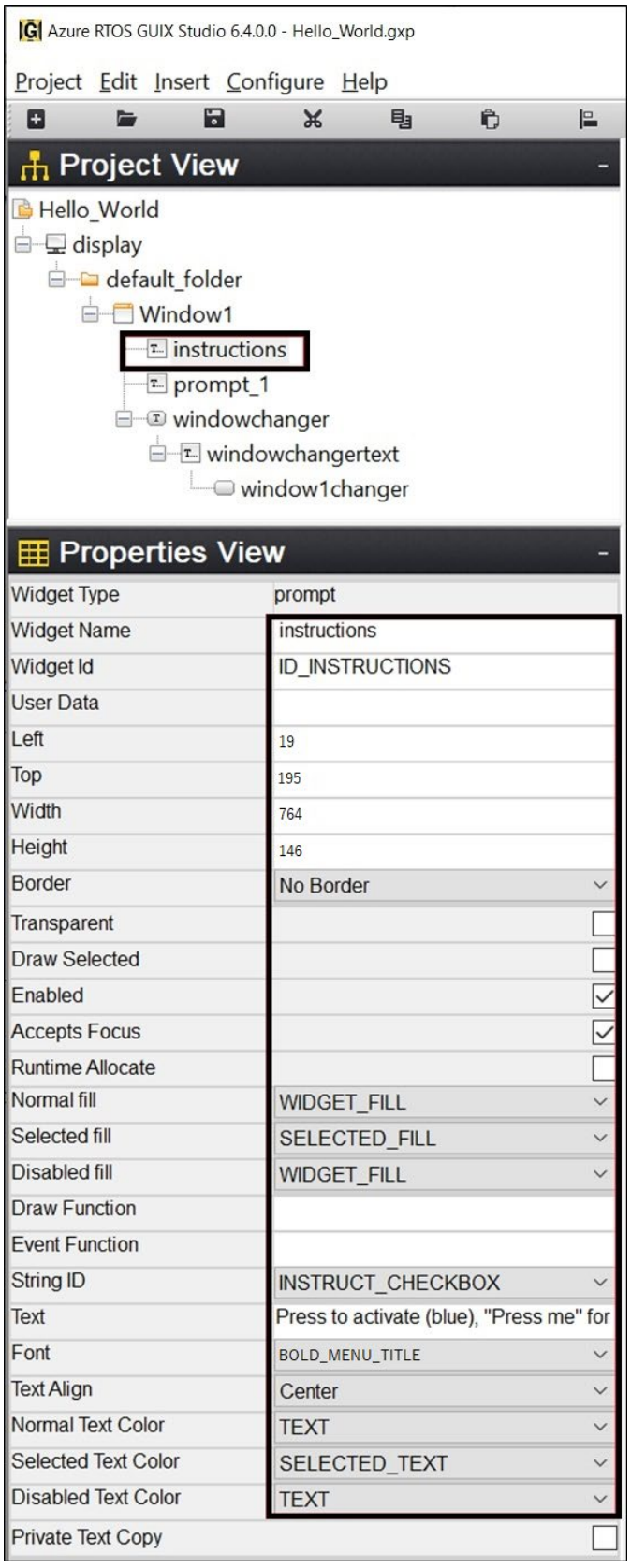


Figure 56. Properties View of Prompt

20. Set the Properties View of Prompt1.

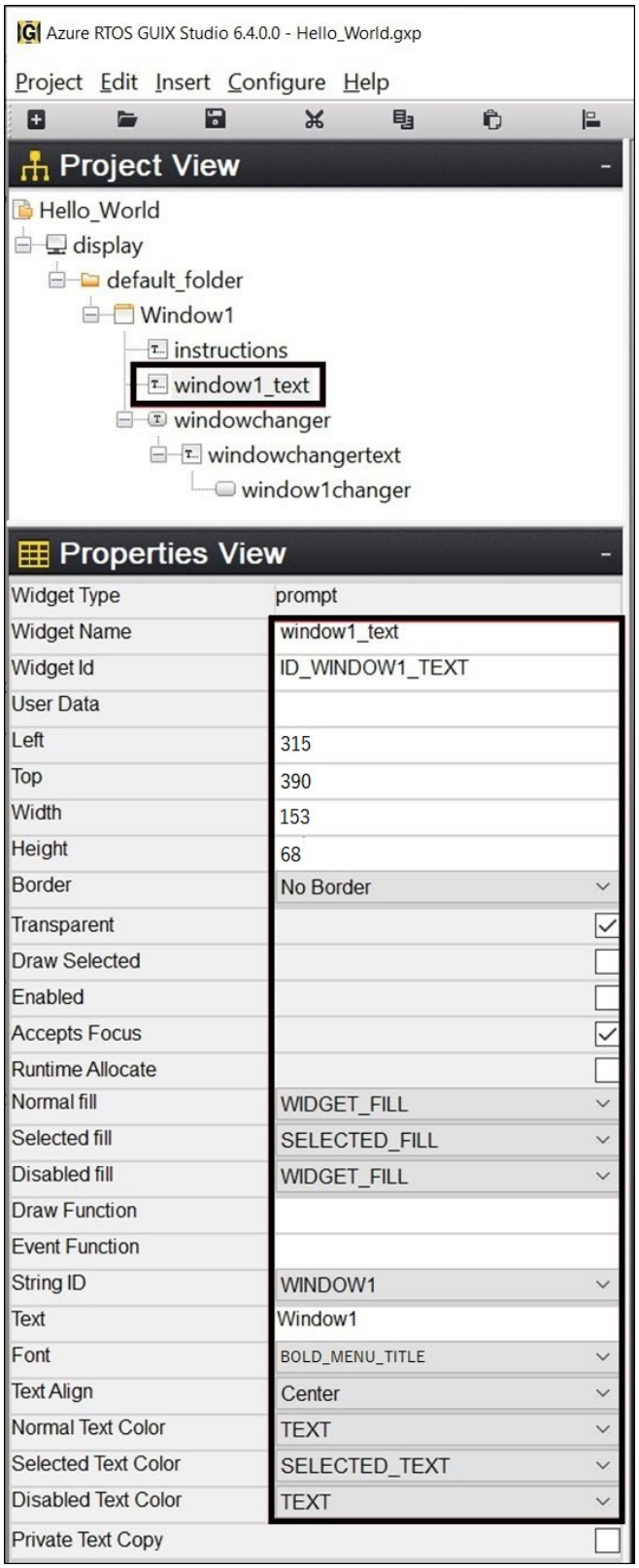


Figure 57. Properties View for Prompt1

21. Insert **button Checkbox**. Right click on **Window1** and follow Figure 58.

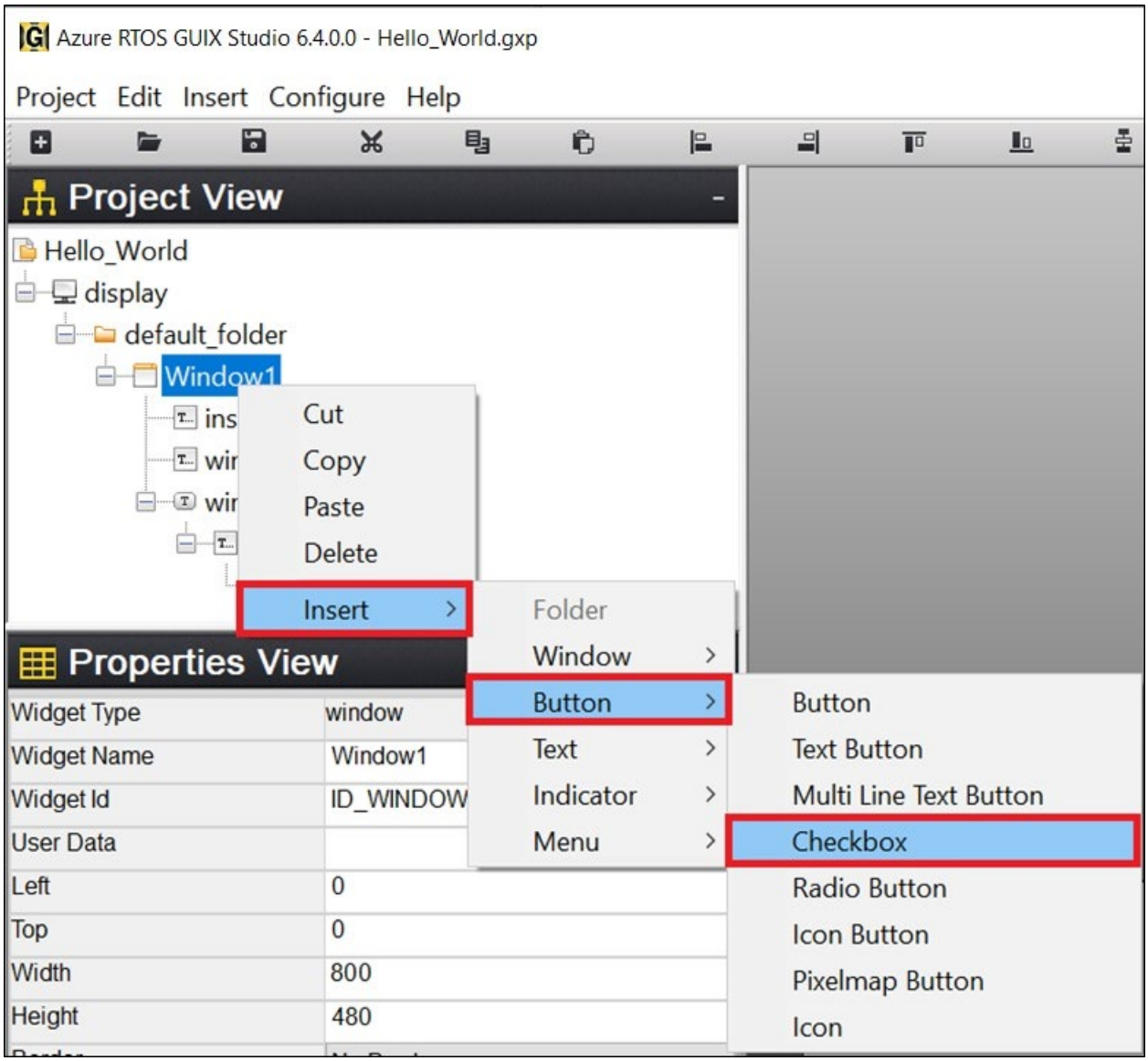


Figure 58. Insert Button Checkbox

22. Setting Properties View of Button Checkbox.

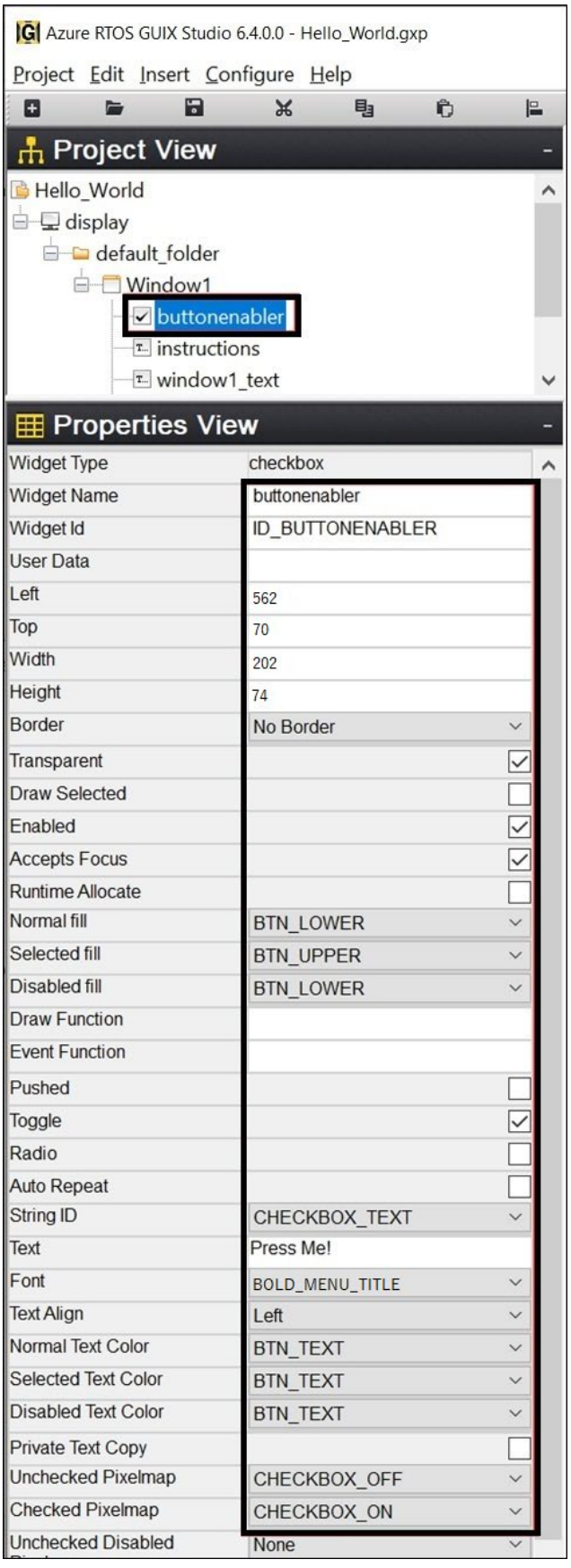


Figure 59. Setting Button Checkbox Properties

23. After you have finished creating **Window1**, it should be like the image below.

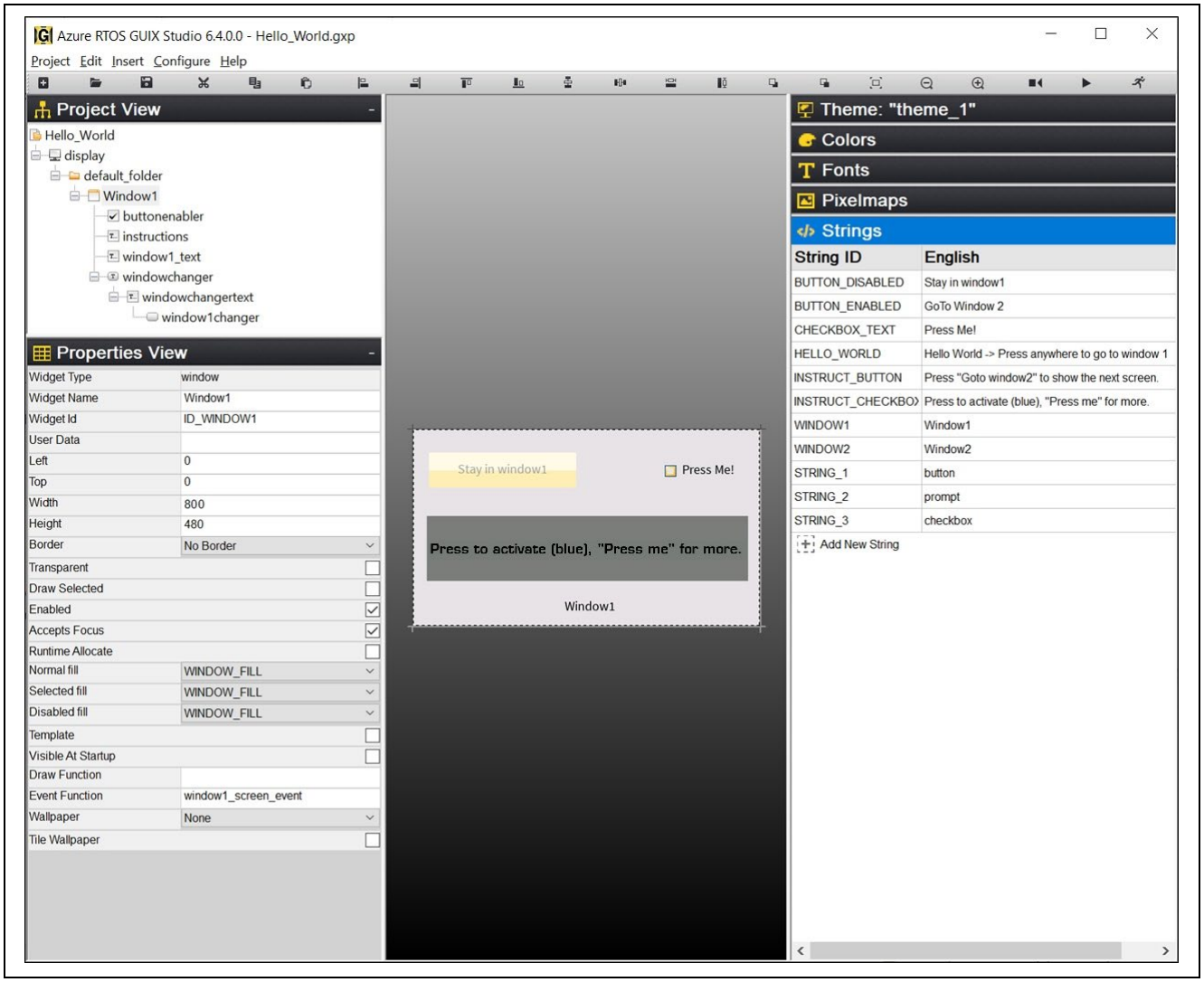


Figure 60. Window1 Created

24. **Insert Window2.** Right click on **default_folder** and **Insert** > **window** > **window** follow Figure 61.

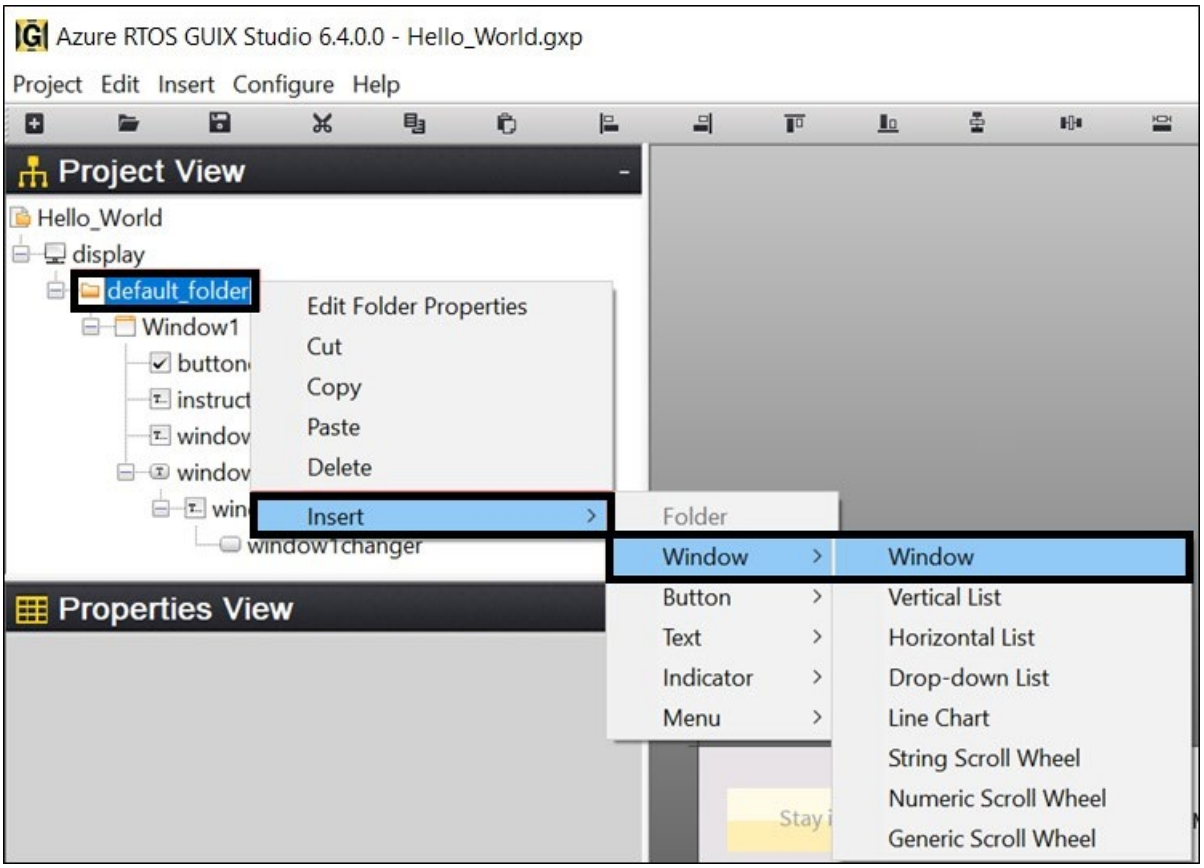


Figure 61. Insert Window2

25. Setting Properties View of Window2.

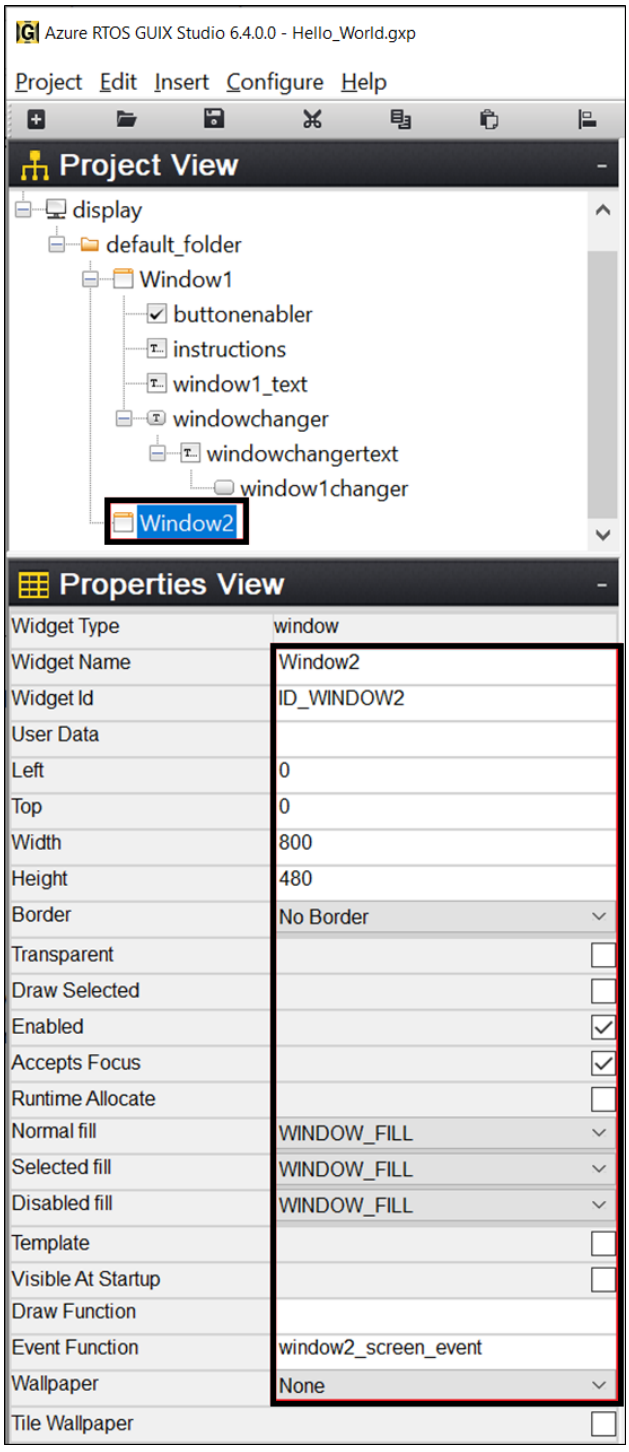


Figure 62. Setting Properties of Window2

26. Insert **Prompt** for Window2. Right click from **Window2**. **Insert** > **Text** > **Prompt** follow **Figure 63**.

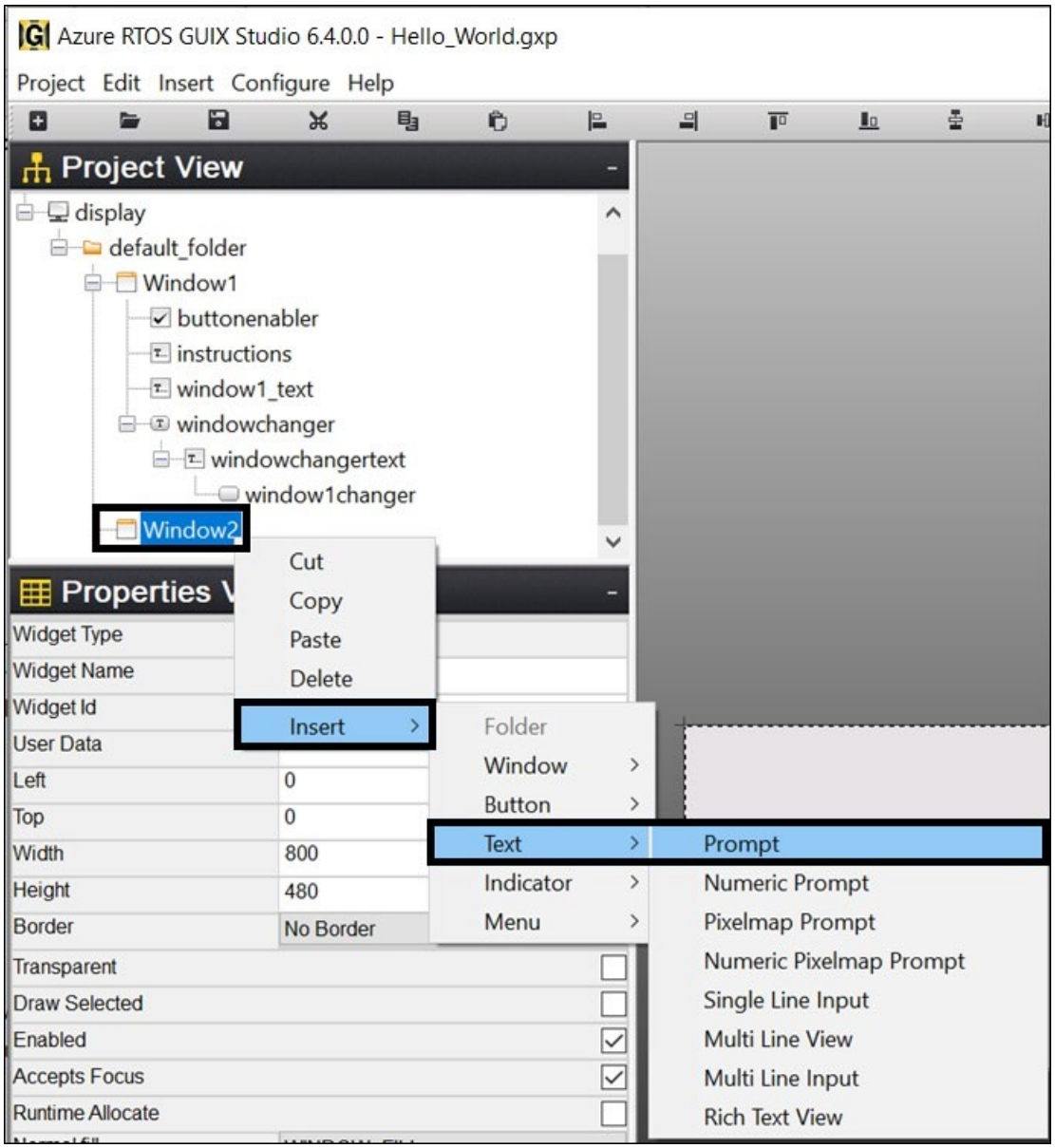


Figure 63. Insert Prompt for Window2

27. Setting Properties View of Prompt.

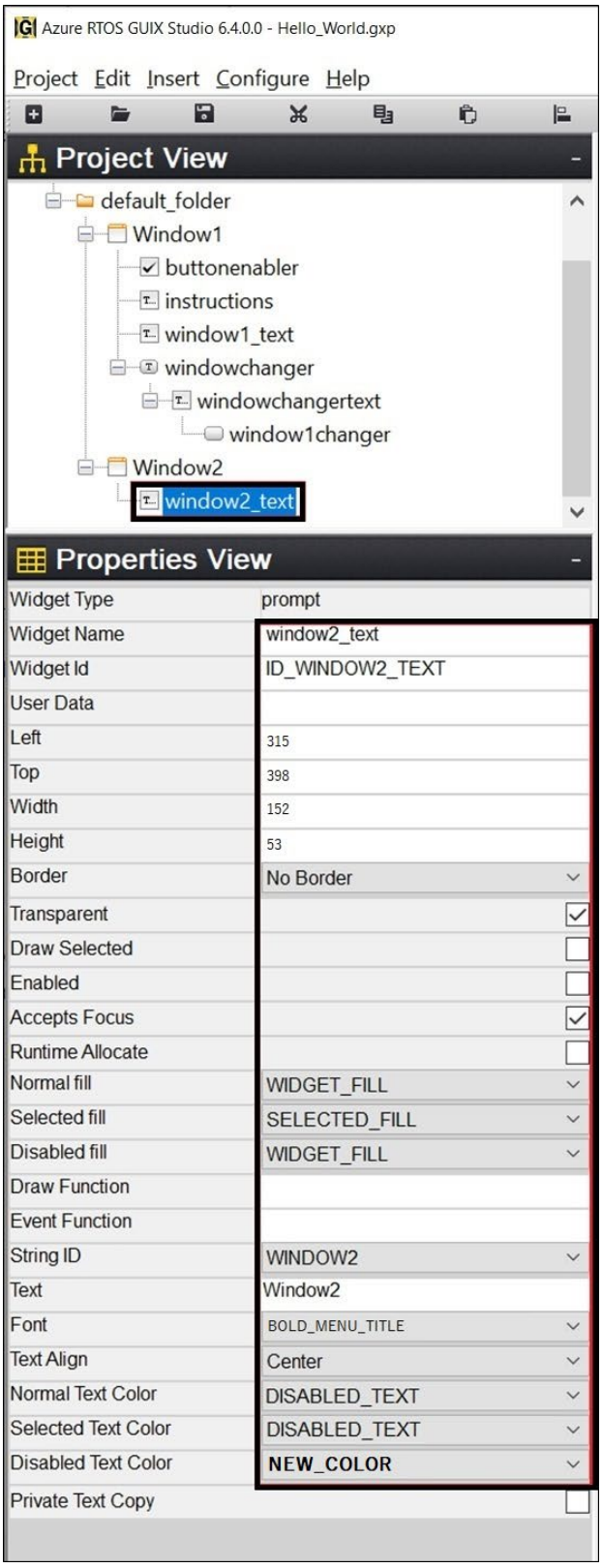


Figure 64. Setting Properties of window2_text

28. Insert **text_button** for window2. Right click from **Window2** > **Insert** > **Button** > **Text_Button** follow Figure 65.

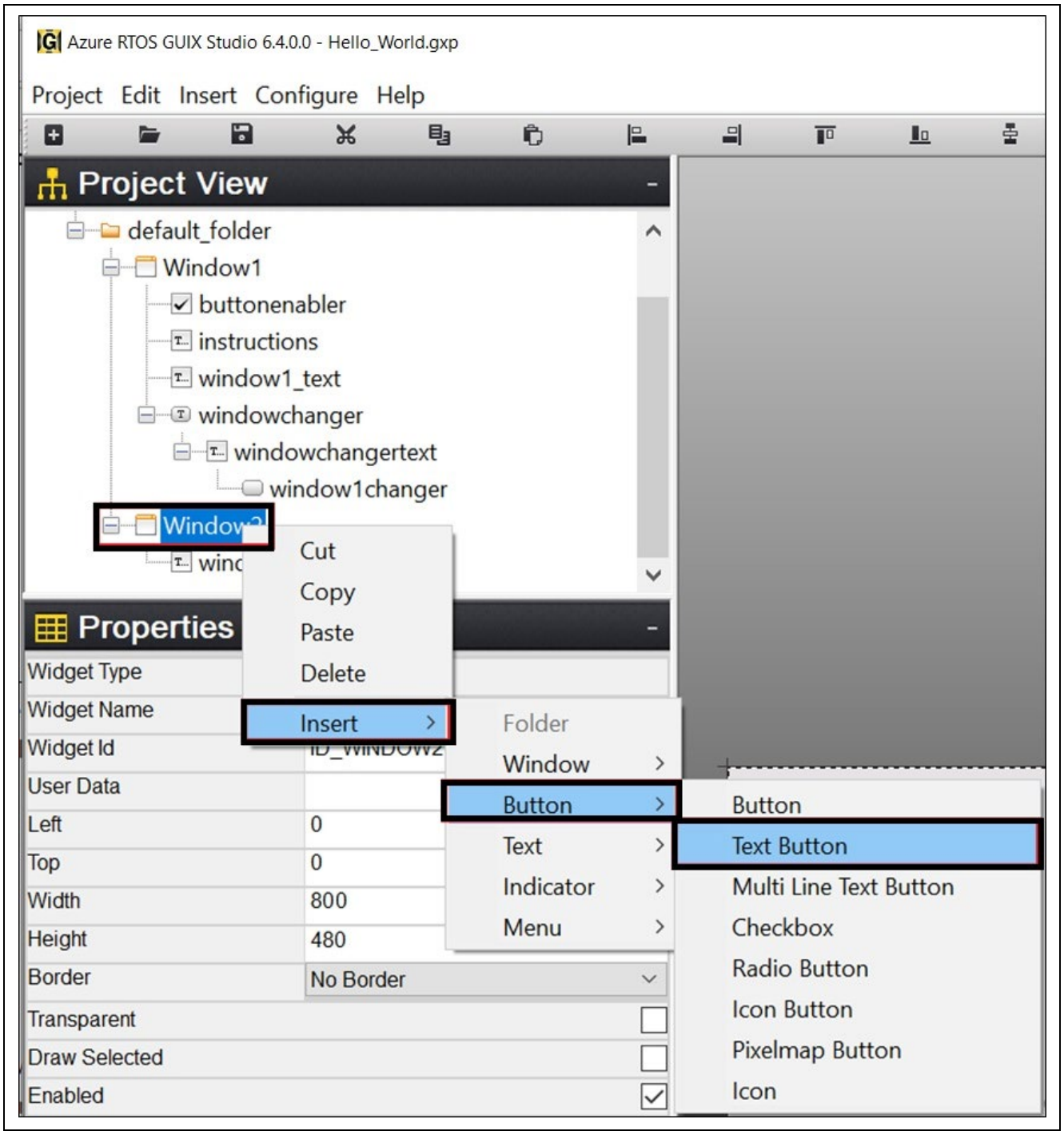


Figure 65. Insert text_button for Window2

29. Setting Properties View of text button.

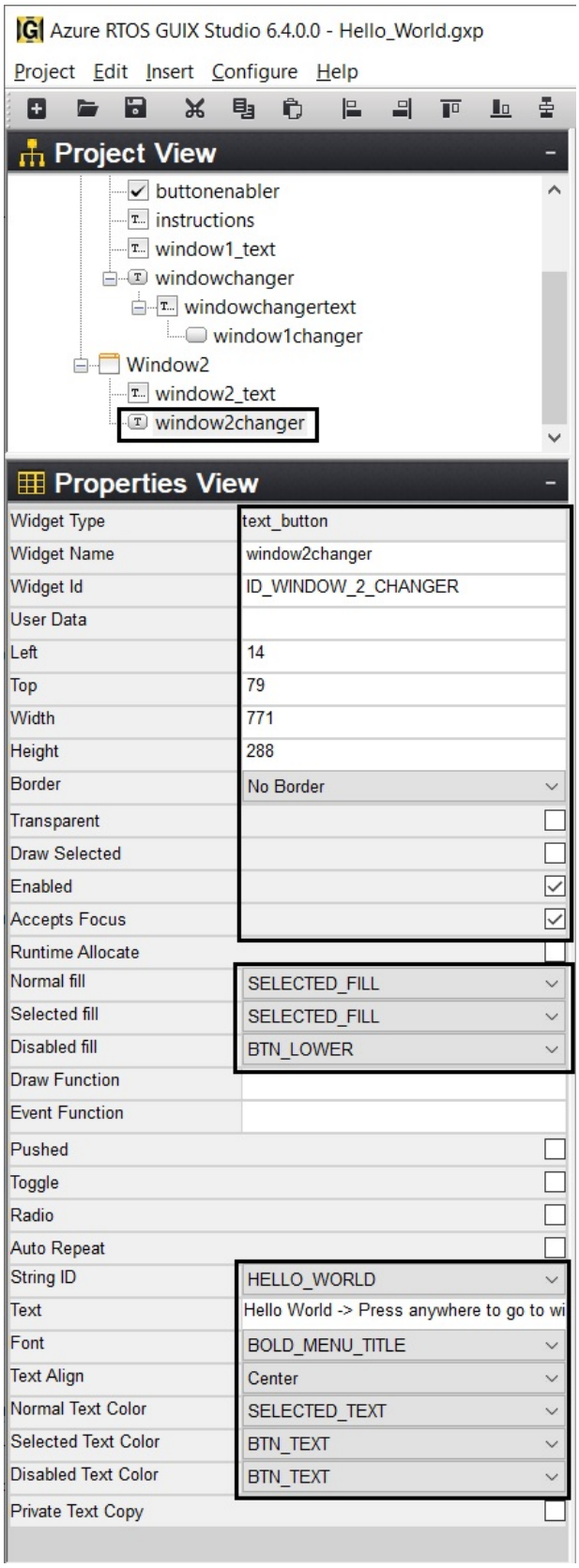


Figure 66. Setting Properties of text_button

30. After Insert and configuration. Window2 looks like **Figure 67**.

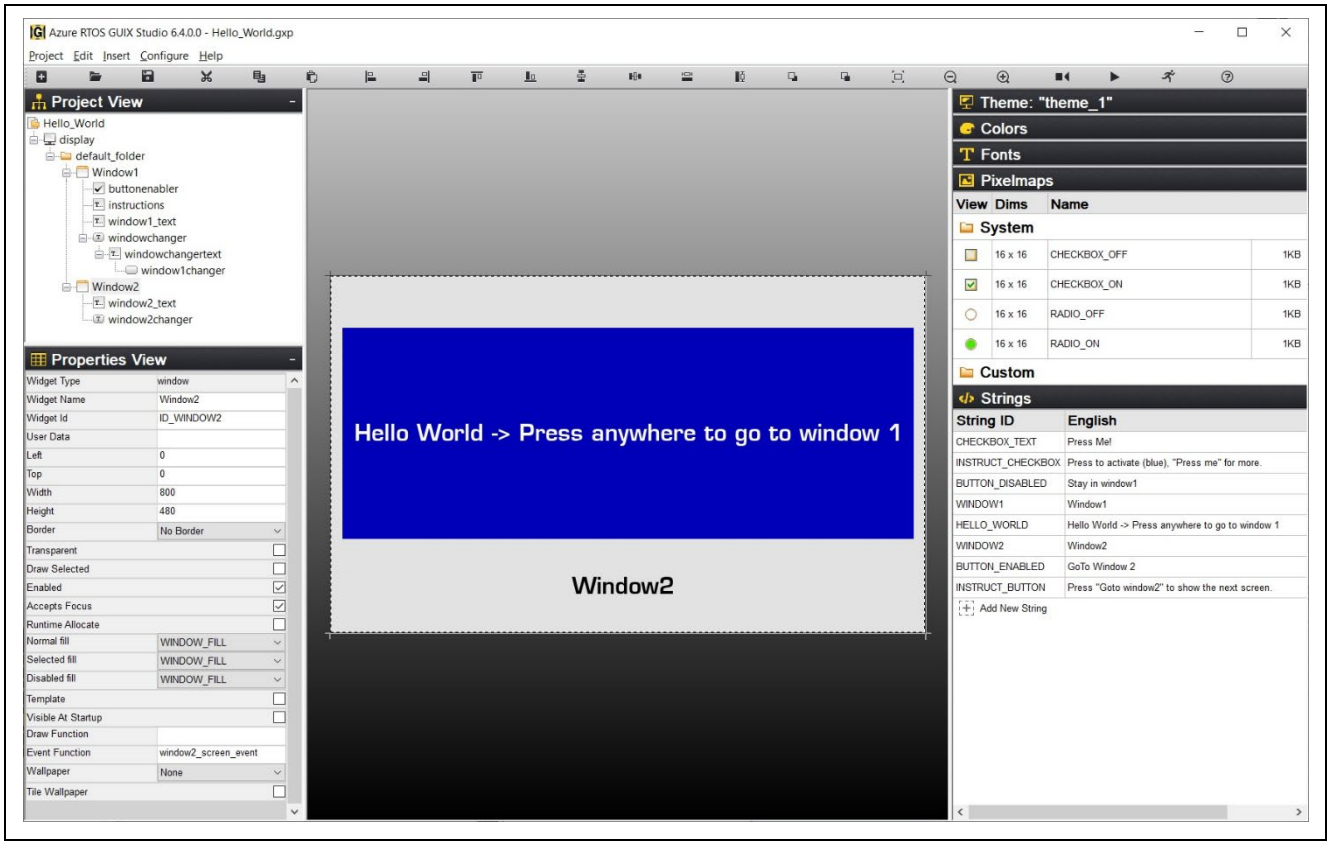


Figure 67. Window2

31. Click on drop-down list **Pixelmaps**, double-click on **CHECKBOX_OF**" and a new window will pop up. Uncheck **Compress Output** then click **Save**. Do the same for **CHECKBOX_ON**.

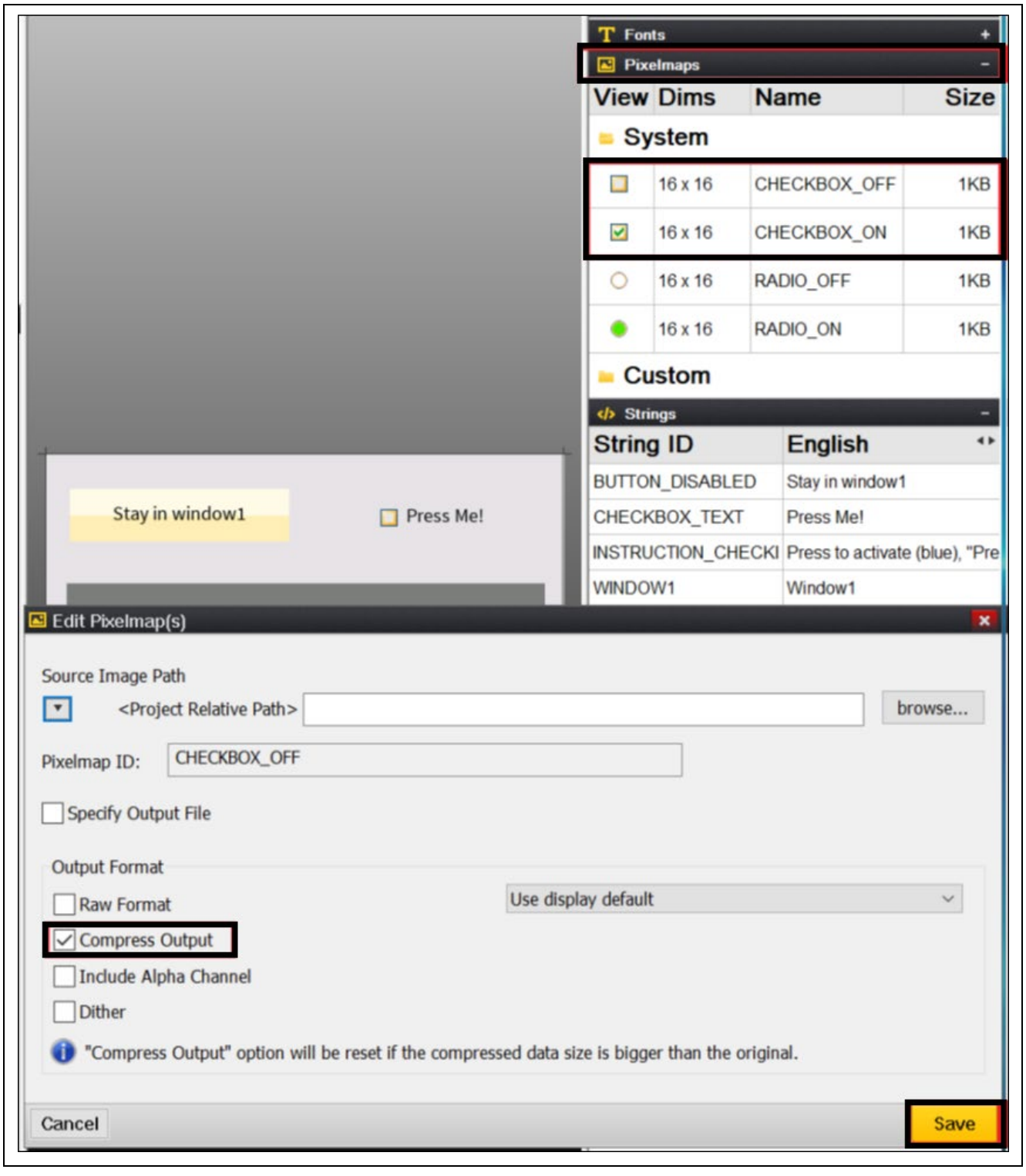


Figure 68. Set Up Pixelmap

32. Now you can click on the **Project** drop down list, **Save Project**, and **Generate All Output Files**. You completed the process of creating and exporting GUIX Hello World into the project.

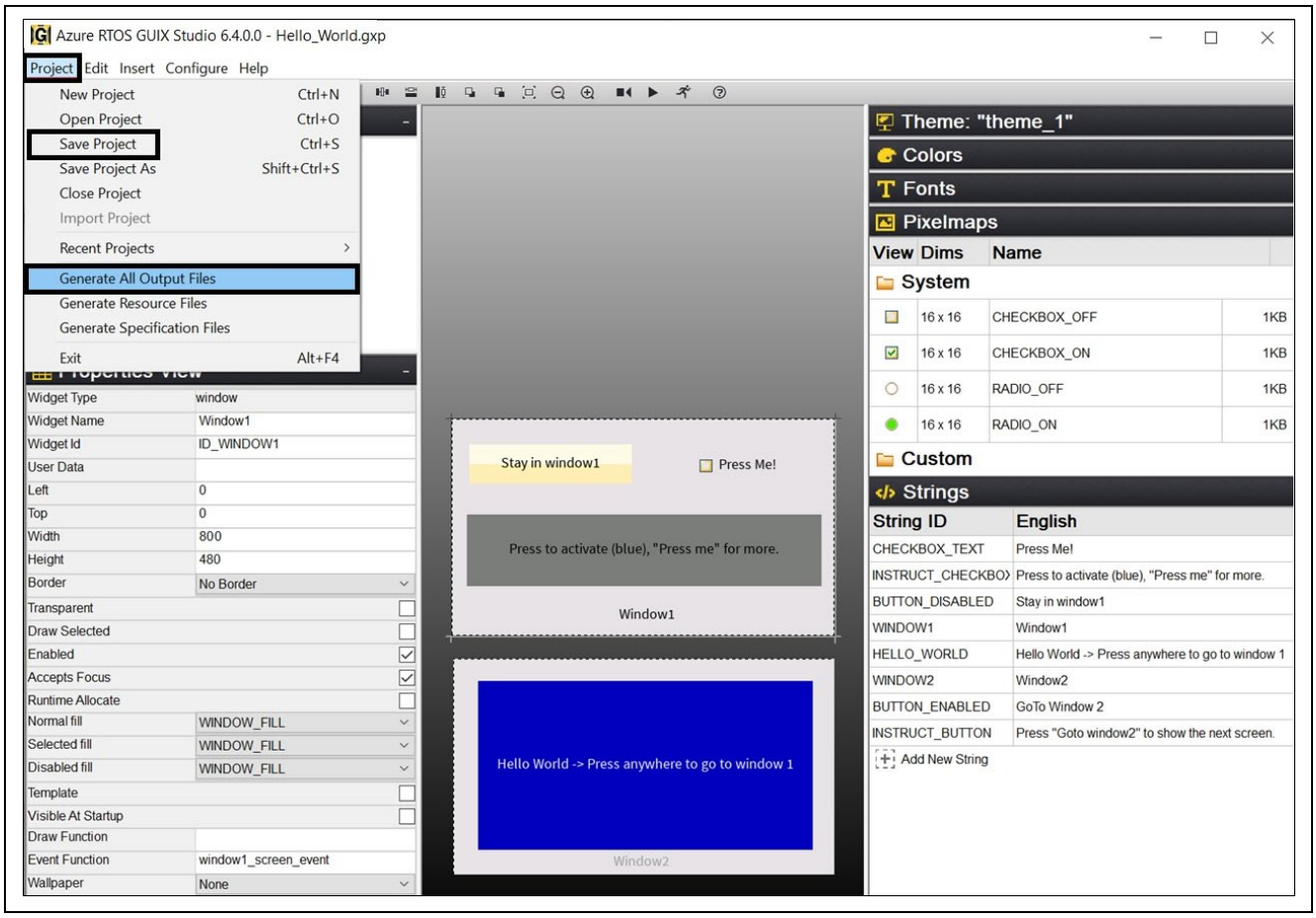


Figure 69. Save and Generate Project

33. Make sure the project is active and click to build the project. It may take a long time to finish building an Azure RTOS/GUIX project on your PC. Project **guix_hello_world_ek_ra8e2** should be built with no errors or warnings.

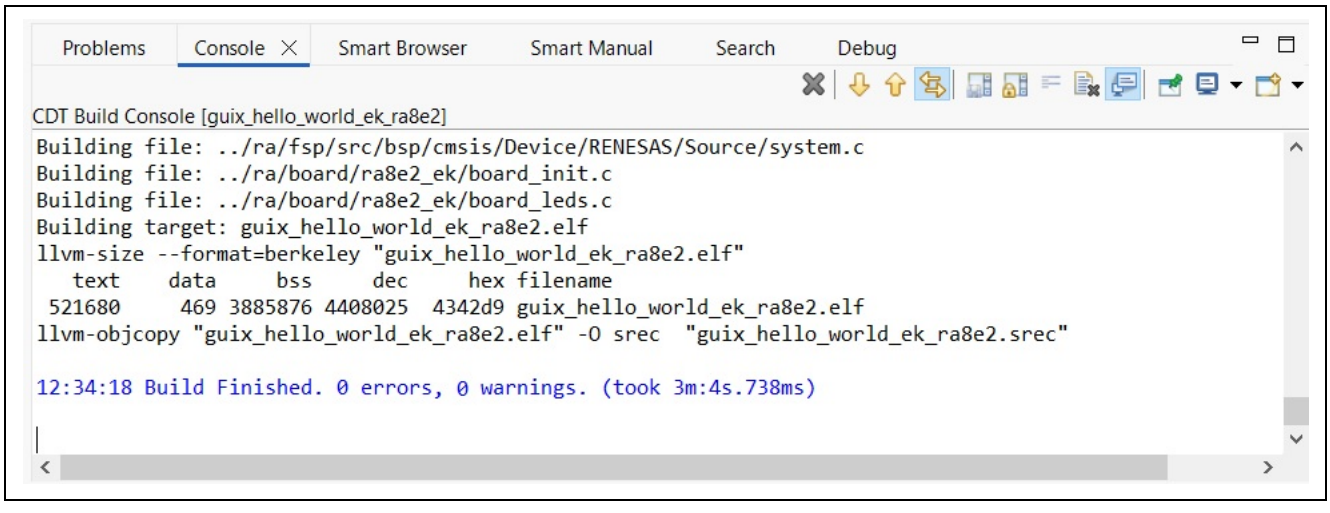


Figure 70. Built the Code

34. Using the Micro USB cable, connect to J10 on EK- RA8E2 board and the other end to your PC. Download and run the “**guix_hello_world_ra8e2**” project.

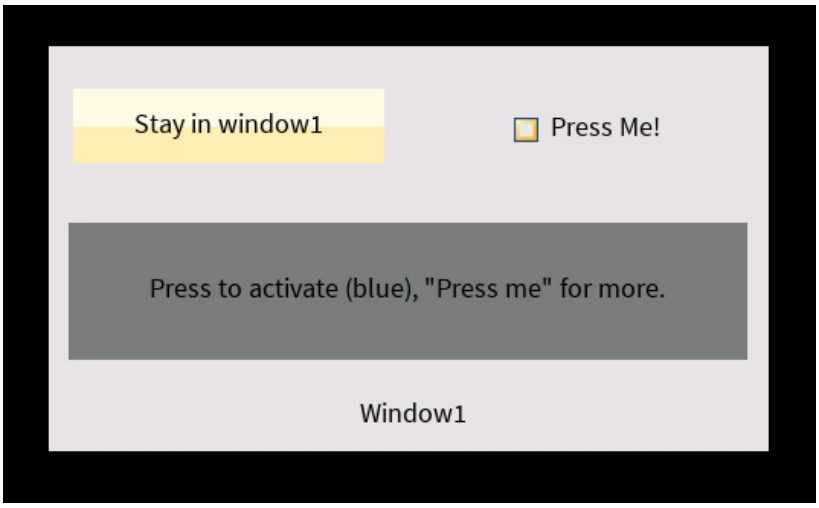


Figure 71. Window1 Display

6. Overview of Fully Functional Project

6.1 Overview

In this section, you will import and run the complete “**guix_hello_world_ek_ra8e2**” project. You can enable or disable the check box function. The text on the button, which is “Stay in window1” or “Go to Window 2”, will be updated. Once you press the button, the screen will change from window1 to window2. Follow the text message on the screen, you can change from window2 back to window1. Referred to Figure 71.

6.2 Procedural Steps

1. You can try the provided project "**guix_hello_world_ek_ra8e2**" for the full function application. Use the **Rename & Import Existing C/C++ Project into Workspace** feature of the **Import** menu to do so since you already had a project with the same in the workspace.

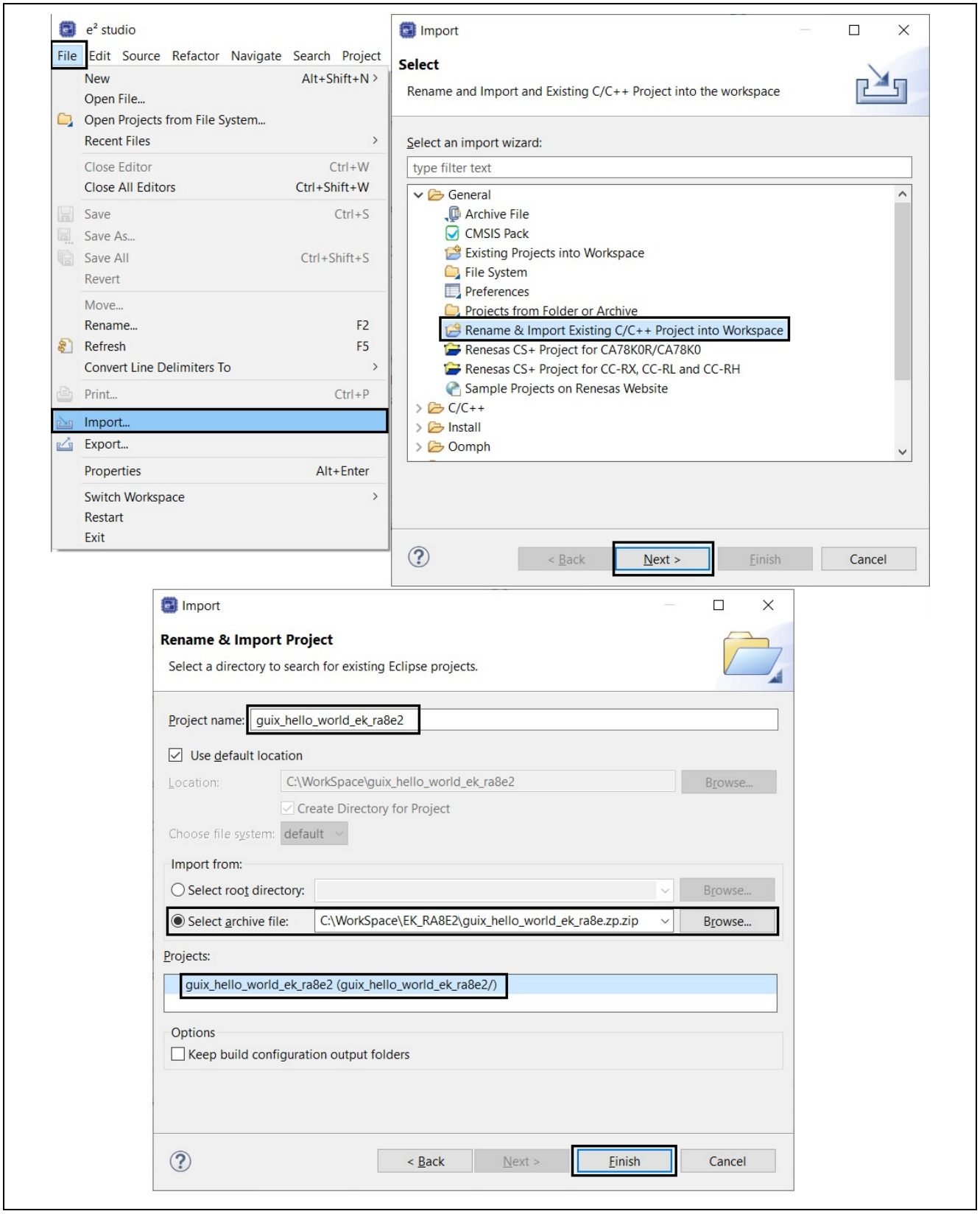


Figure 72. Import Existing Project

7. Website and Support

Visit the following URLs to learn about key elements of the RA family, download components and related documentation, and get support:

RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Flexible Software Package	renesas.com/FSP
Renesas Support	renesas.com/support

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Oct.08.25	—	Initial release

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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