Quick Start Guide

RA4E2 Group

Evaluation Kit for RA4E2 Microcontroller Group
EK-RA4E2
Quick Start Guide

Renesas RA Family
RA4 Series

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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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Precautions

This Evaluation Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Evaluation Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RA Family

EK-RA4E2

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1. Introduction

This Quick Start Guide (QSG) provides:

- An overview of the Quick Start example project that the EK-RA4E2 board comes pre-programmed with.
- Instructions for running the Quick Start example project.
- Instructions for importing, modifying, and building the Quick Start example project using Flexible Software Package (FSP) and e² studio Integrated Development Environment (IDE).

1.1 Assumptions and Advisory Notes

1. Tool experience: It is assumed that the user has prior experience working with IDEs such as e² studio and terminal emulation programs such as Tera Term.
2. Subject knowledge: It is assumed that the user has basic knowledge about microcontrollers, embedded systems, and FSP to modify the example project described in this document.
3. Prior to running the Quick Start example project or programming the EK-RA4E2 board, default jumper settings must be used. Refer to the EK-RA4E2 user's manual for the default jumper settings.
4. The screen shots provided throughout this document are for reference. The actual screen content may differ depending on the version of software and development tools used.

2. Kit Contents

The following components are included in the kit:

1. EK-RA4E2 board
2. Micro USB device cable (type-A male to micro-B male)

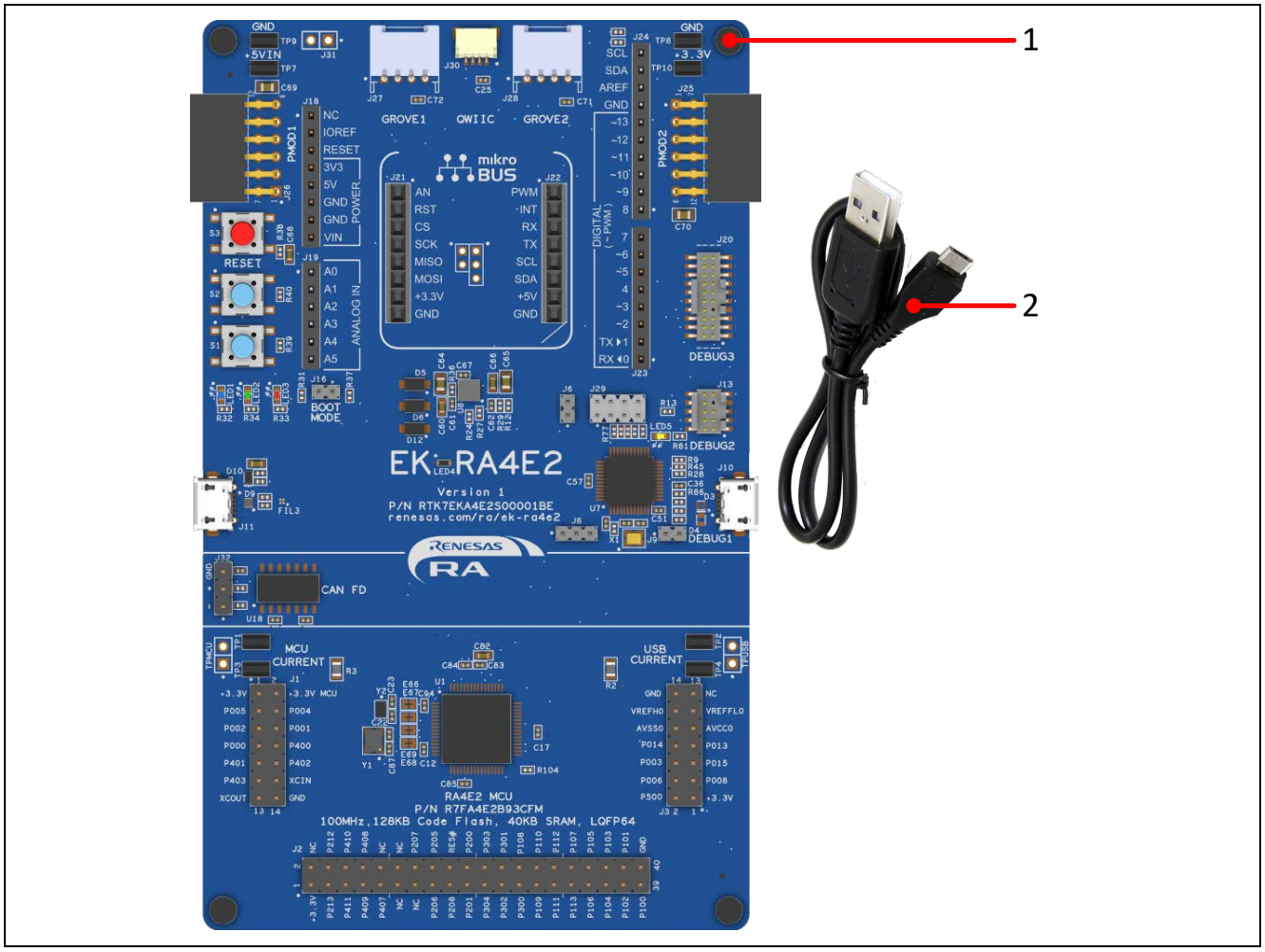


Figure 1. EK-RA4E2 Kit Contents

3. Overview of the Quick Start Example Project

The Quick Start example project allows the user to change the frequency and intensity of the on-board user LED1 (blue) using the user buttons (S1 and S2). The frequency options are 1 Hz, 5 Hz, and 10 Hz and the intensity options are 10%, 50%, and 90%.

When the EK-RA4E2 board running the Quick Start example project is connected to a host PC via USB as a Full Speed CDC Device, the kit information, MCU die temperature, and user LED blinking frequency are displayed on a terminal console.

3.1 Quick Start Example Project Flow

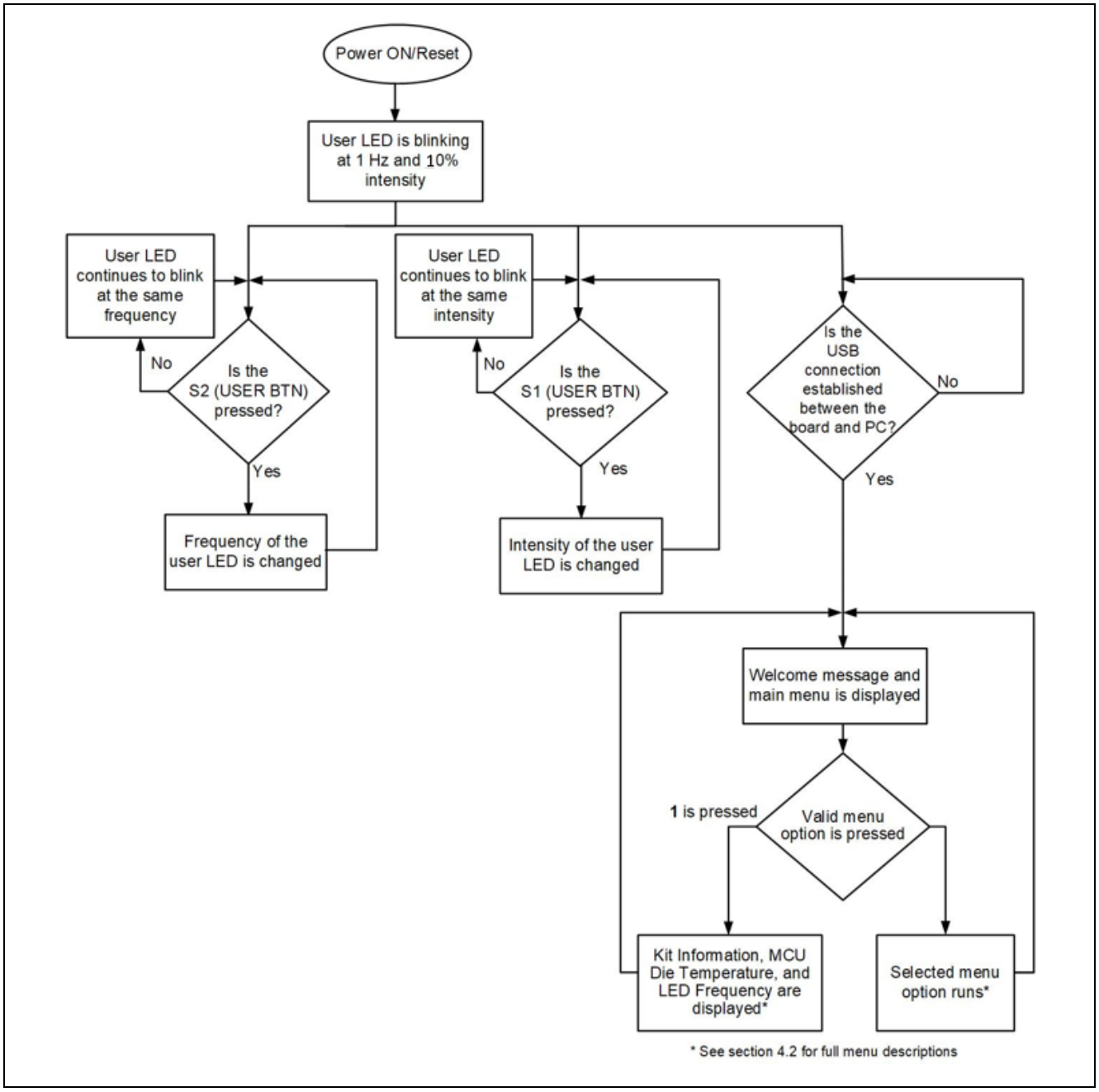


Figure 2. Quick Start Example Project Flow

4. Running the Quick Start Example Project

This section lists the requirements and instructions to power up the EK-RA4E2 board and run the Quick Start example project.

Hardware Requirements

- EK-RA4E2 board
- Micro USB device cable
- A PC with at least one USB port

Software Requirements

- Windows® 10 operating system
- USB Serial Drivers (included in Windows 10)
- Tera Term (or similar) terminal console application

4.1 Connecting and Powering Up the EK-RA4E2 Board

1. Check that J8 is set to link pins 1-2. And that J29 (link pins 1-2, 3-4, 5-6 and 7-8) and J6 links are closed.
2. Connect the micro USB end of the micro USB device cable to micro-AB USB Full Speed port (J11) of the EK-RA4E2 board.
3. Connect the other end of this cable to the USB port of the host PC. Power LED (LED4) on the EK-RA4E2 board lights up white, indicating that the EK-RA4E2 board is powered on.

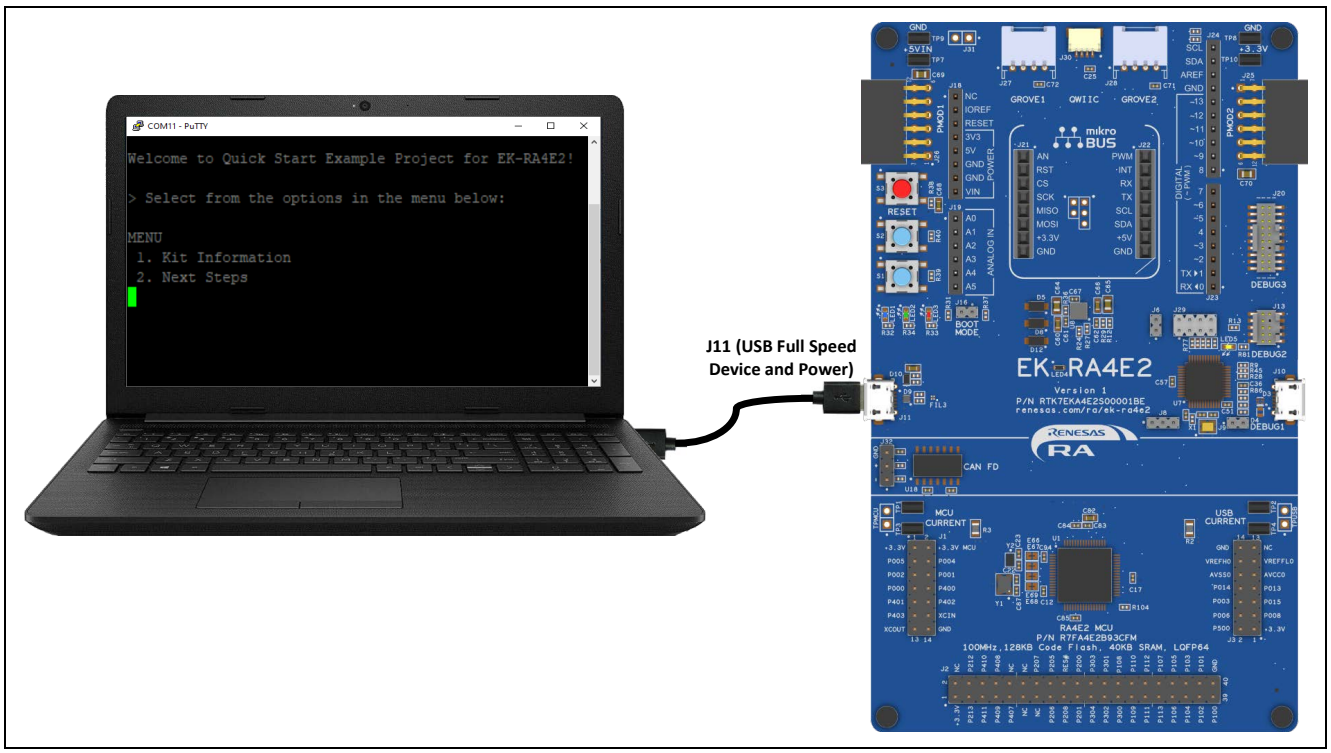


Figure 3. Connecting the EK-RA4E2 Board to the Host PC via USB Full Speed Port

4.2 Running the Quick Start Example Project

To run the Quick Start example project, use the following instructions:

1. On power up or RESET, the three user LEDs will take on the following states:
   - LED1 Blue - Blinking at 1 Hz frequency and at 10% intensity
   - LED2 Green – Steady, full intensity
   - LED3 Red – Off

   Note: The debug LED (LED5) will blink or light up orange; this can be ignored for now.

2. Press the user button (S1) on the EK-RA4E2 board to change the intensity of the user LED1. With every press of the user button (S1), the intensity will switch from 10% to 50% to 90% and cycle back.
3. Press the user button (S2) on the EK-RA4E2 board to change the blinking frequency of the user LED1 (blue). With every press of the first user button (S2), the frequency will switch from 1 Hz to 5 Hz to 10 Hz and cycle back.
4. On the host PC, open Windows Device Manager. Expand **Ports (COM & LPT)**, locate **USB Serial Device (COMxx)** and note down the COM port number for reference in the next step.

   Note: USB Serial Device drivers are required to communicate between the EK-RA4E2 board and the terminal application on the host PC. These are already included in Windows 10.

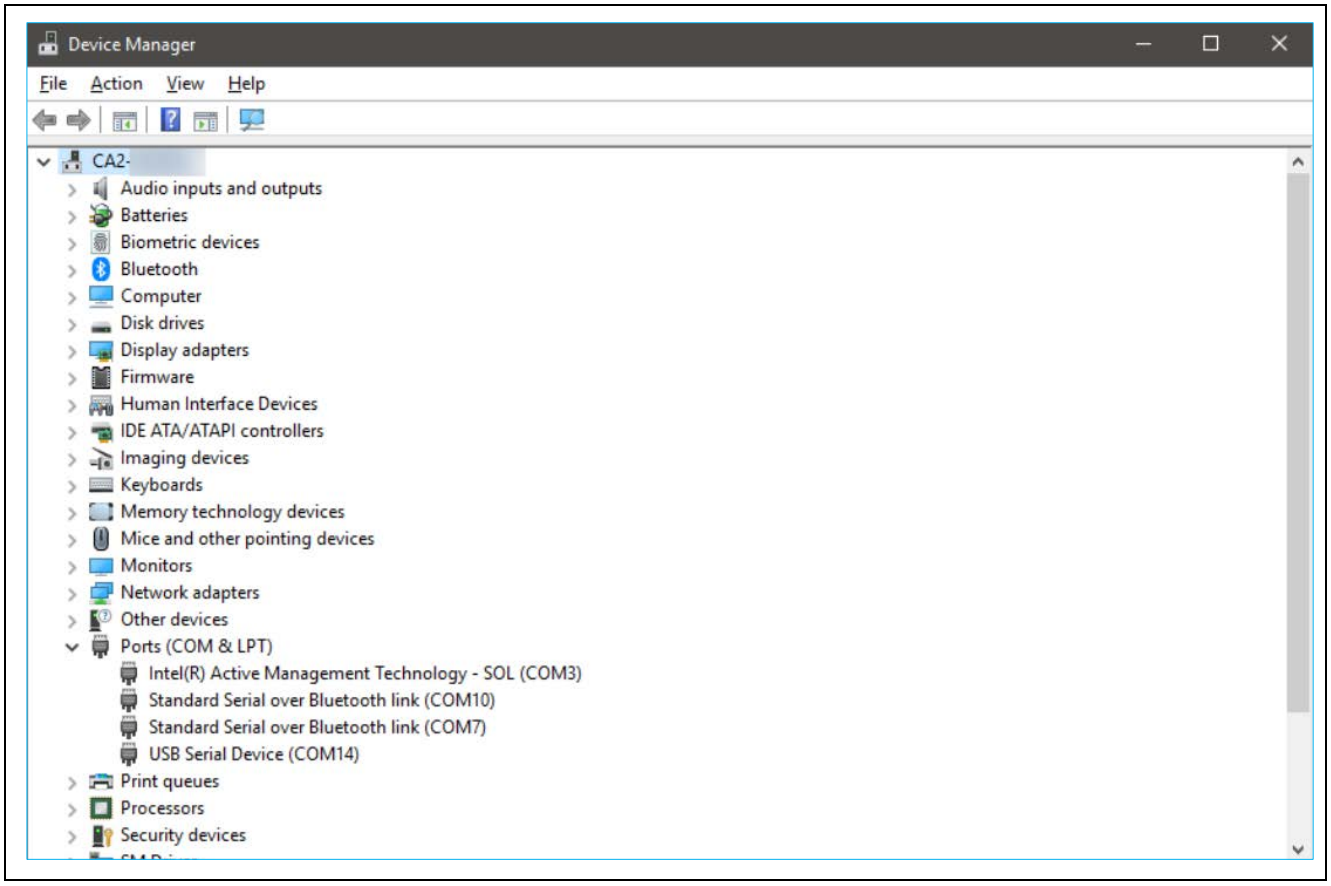


Figure 4. USB Serial Device in Windows Device Manager

5. Open Tera Term, select **Serial** and **COMxx: USB Serial Device (COMxx)** and click **OK**.

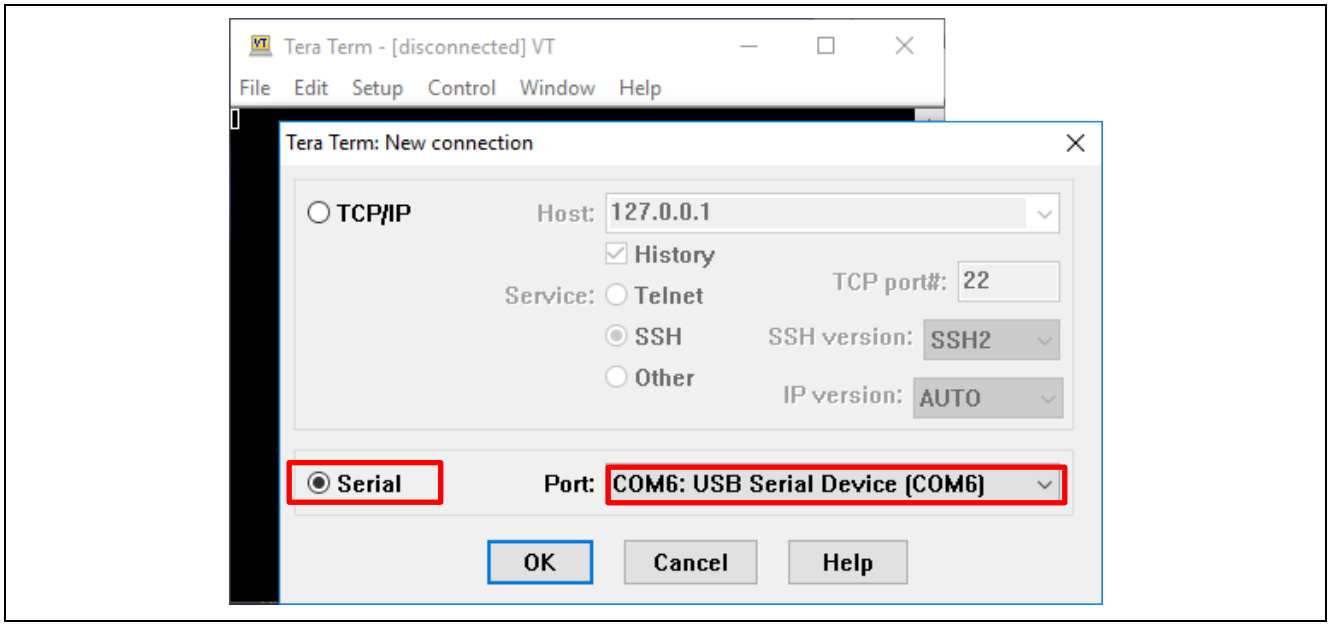


Figure 5. Selecting the Serial Port on Tera Term

6. Using the **Setup** menu pull-down, select **Serial port…** and ensure that the speed is set to 115200, as shown below.

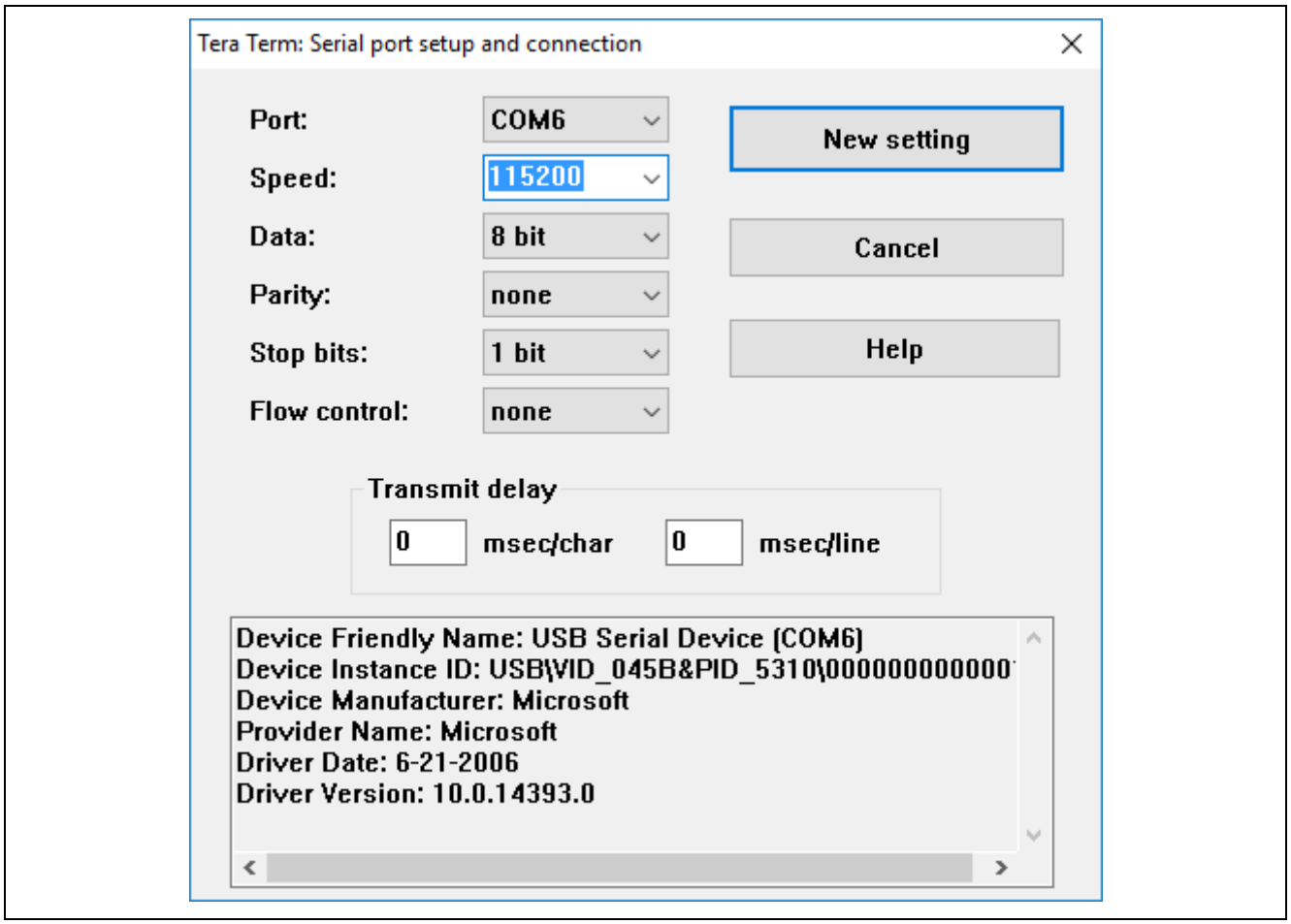


Figure 6. Select 115200 on the Speed Pulldown

7. Complete the connection. The ‘welcome and main menu’ screen will be displayed.



Figure 7. Welcome and Main Menu

8. Press **1** to display the **Kit Information** including the kit name, part number, MCU ID, MCU die temperature, user LED’s current blinking frequency and the user LED blinking intensity.

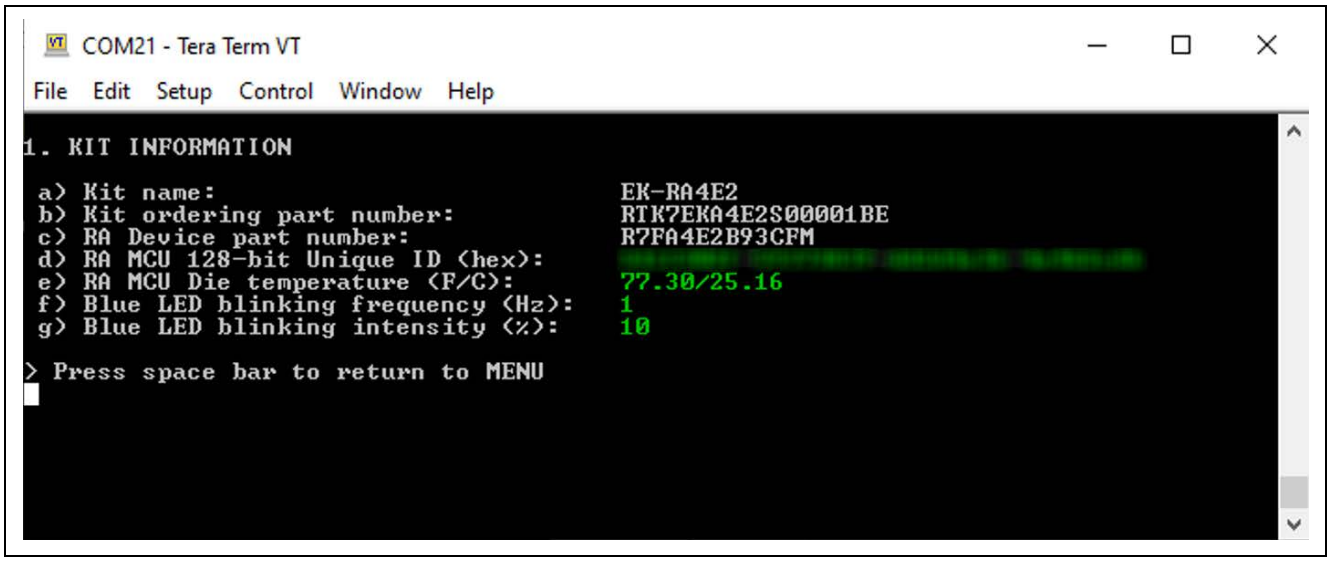


Figure 8. Kit Information

9. Press **space** to return to the ‘welcome and main menu’ screen.
10. Press **2** to display **Next Steps**.

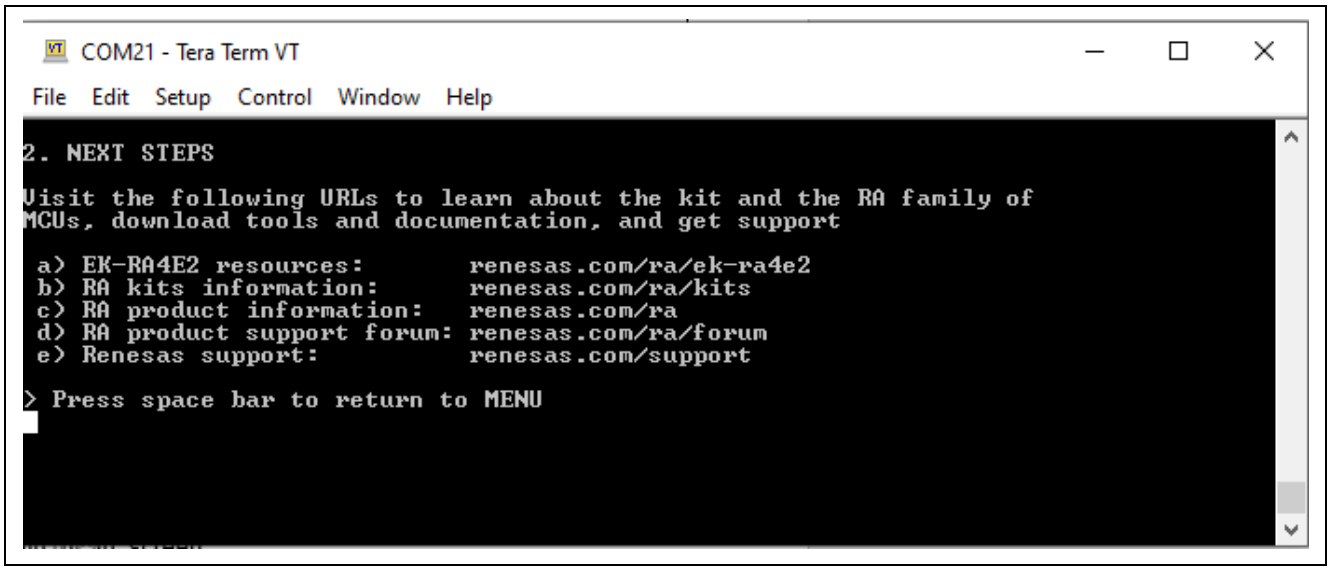


Figure 9. Next Steps

11. Press **space** to return to the 'welcome and main menu' screen.

5. Customizing the Quick Start Example Project

This section lists the requirements and instructions for customizing the Quick Start example project.

Hardware Requirements

- EK-RA4E2 board
- Micro USB device cable
- A PC with at least one USB port

Software Requirements

- Windows® 10 operating system
- e² studio IDE
- SEGGER J-Link® USB drivers
- FSP
- Quick Start example project

5.1 Downloading and Installing Software and Development Tools

Before the Quick Start example project can be modified, it is necessary to download and install software and development tools on the host PC.

The FSP, J-Link USB drivers, and e² studio are bundled in a downloadable platform installer available on the FSP webpage at renesas.com/ra/fsp. New users are recommended to use the **Quick Install** option provided in the installation wizard, to minimize the amount of manual configuration needed.

There is no need to download and install software, development tools, and drivers separately.

5.2 Downloading and Importing the Quick Start Example Project

1. Download and extract the Quick Start example project to a local directory on the host PC.
   - The Quick Start example project (source code and project files) is available in the EK-RA4E2 Example Projects Bundle that is available in the Downloads tab of EK-RA4E2 webpage at renesas.com/ra/ek-ra4e2
   - Download and extract the example projects bundle (`xxxxxxxxxxxxxx-ek-ra4e2-exampleprojects.zip`) to a local directory on the host PC.
   - Browse to the Quick Start example project at `xxxxxxxxxxxxxx-ek-ra4e2-exampleprojects\ek_ra4e2\_quickstart\quickstart_ek_ra4e2_ep`
2. Launch e² studio.
3. Browse to the Workspace where the project file is to be imported. Enter the name in the Workspace dialog box to create a new workspace.

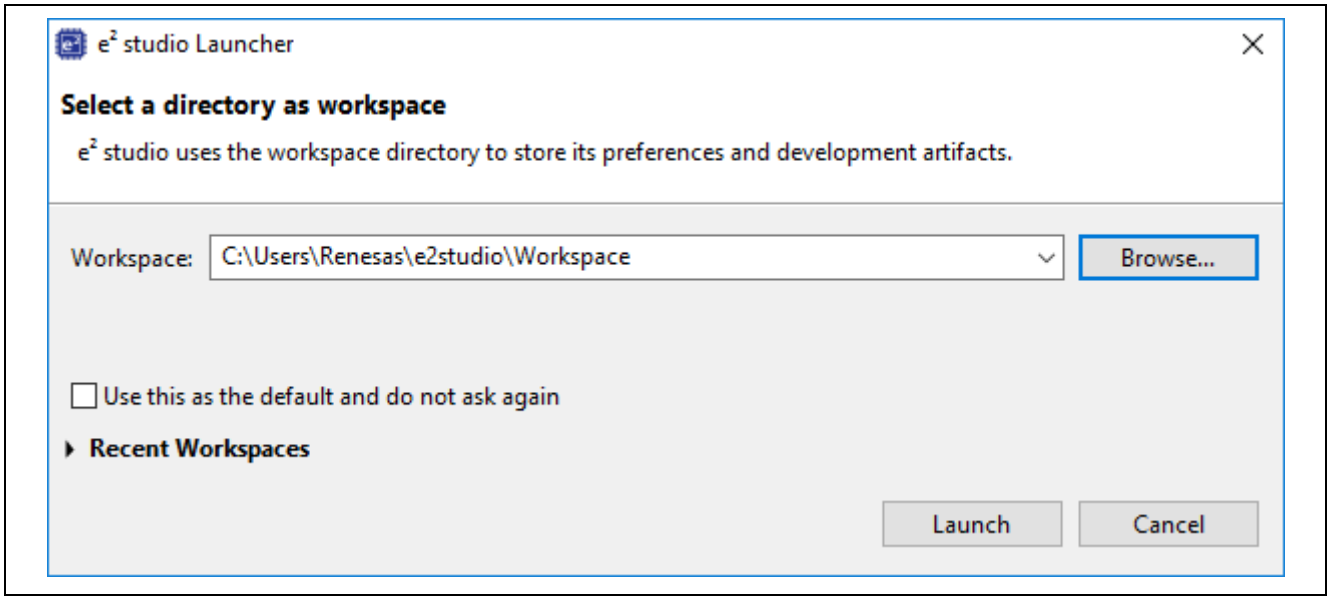


Figure 10. Creating a New Workspace

4. Click **Launch.**

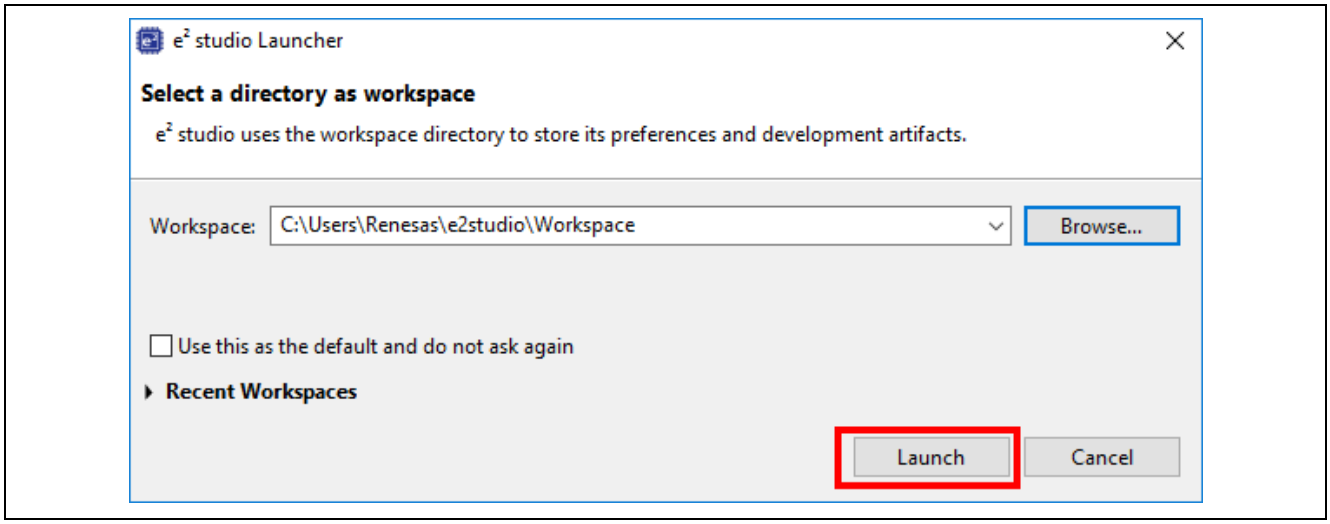


Figure 11. Launching the Workspace

5. Click **Import** from the **File** drop-down menu.

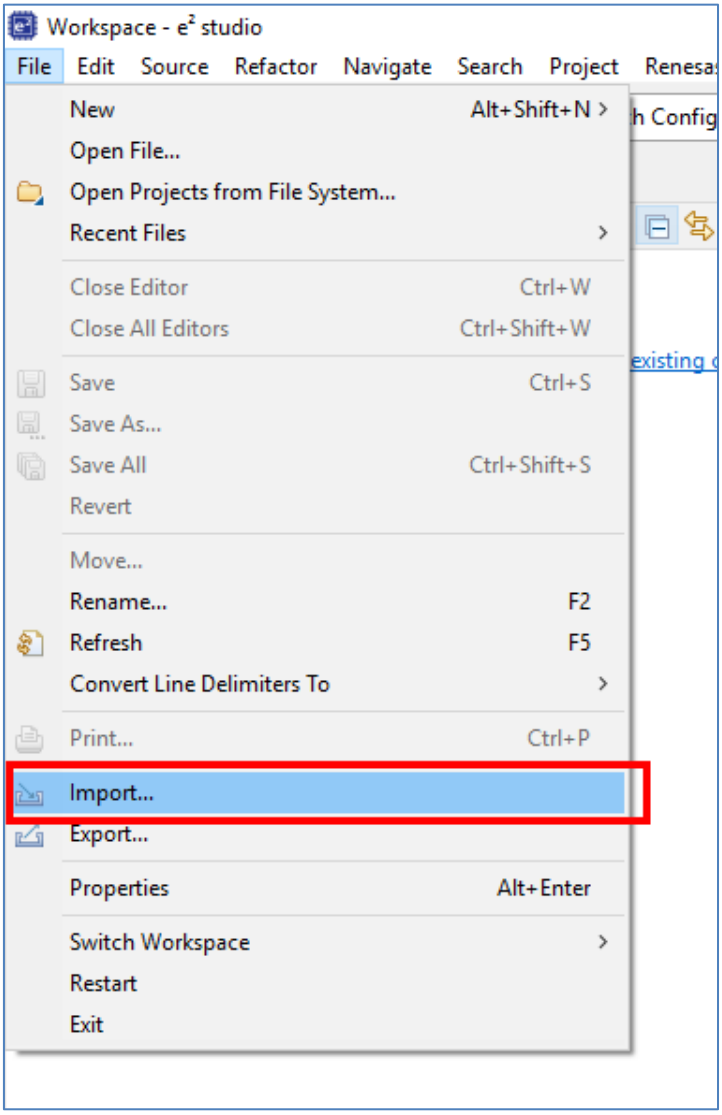


Figure 12. Importing the Project

6. In the **Import** dialog box, select **General**, and then select **Existing Projects into Workspace.**

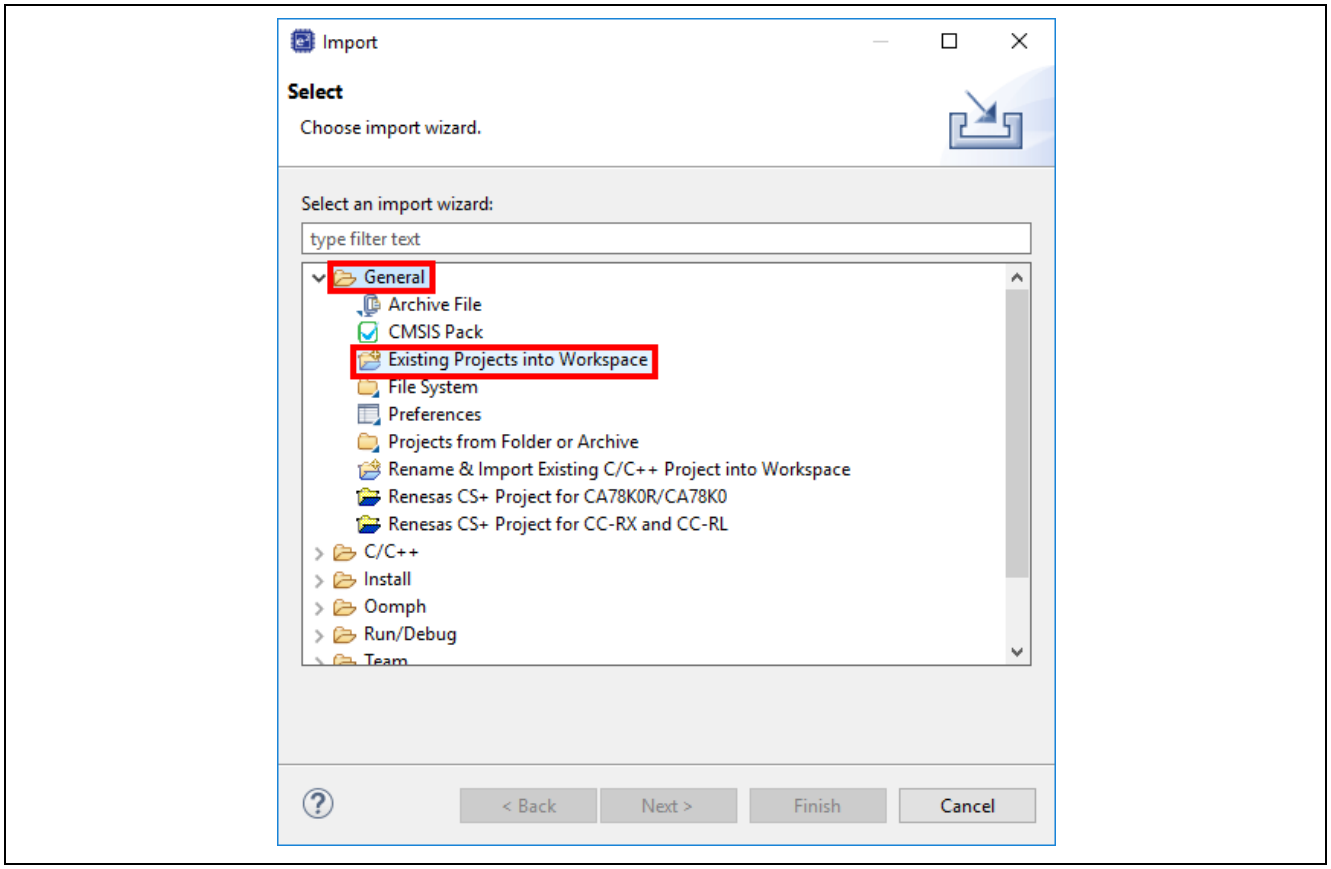


Figure 13. Importing Existing Projects into the Workspace

7. Click **Next**.

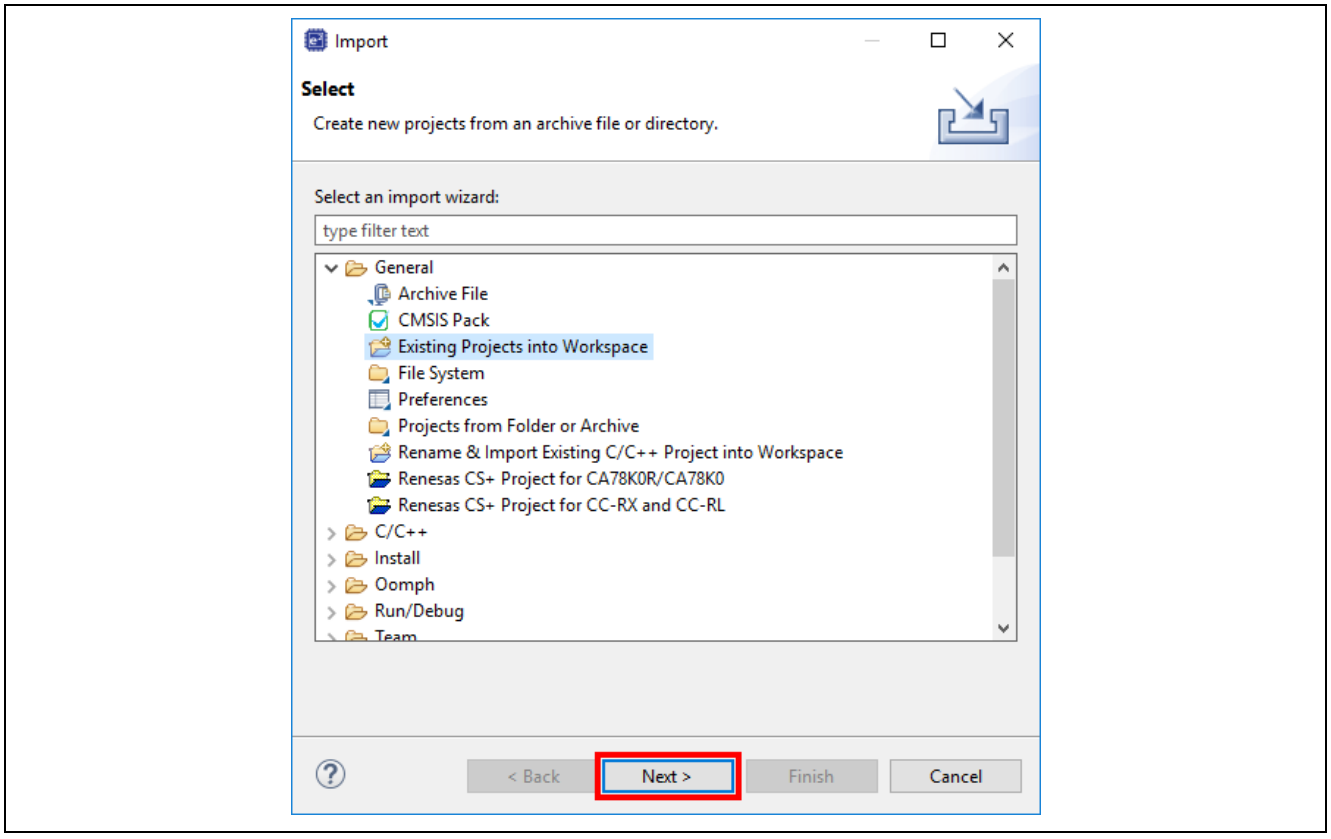


Figure 14. Clicking Next to Import Existing Projects into the Workspace

8. Click **Select root directory** and click **Browse** to go to the location of the Quick Start example project folder.

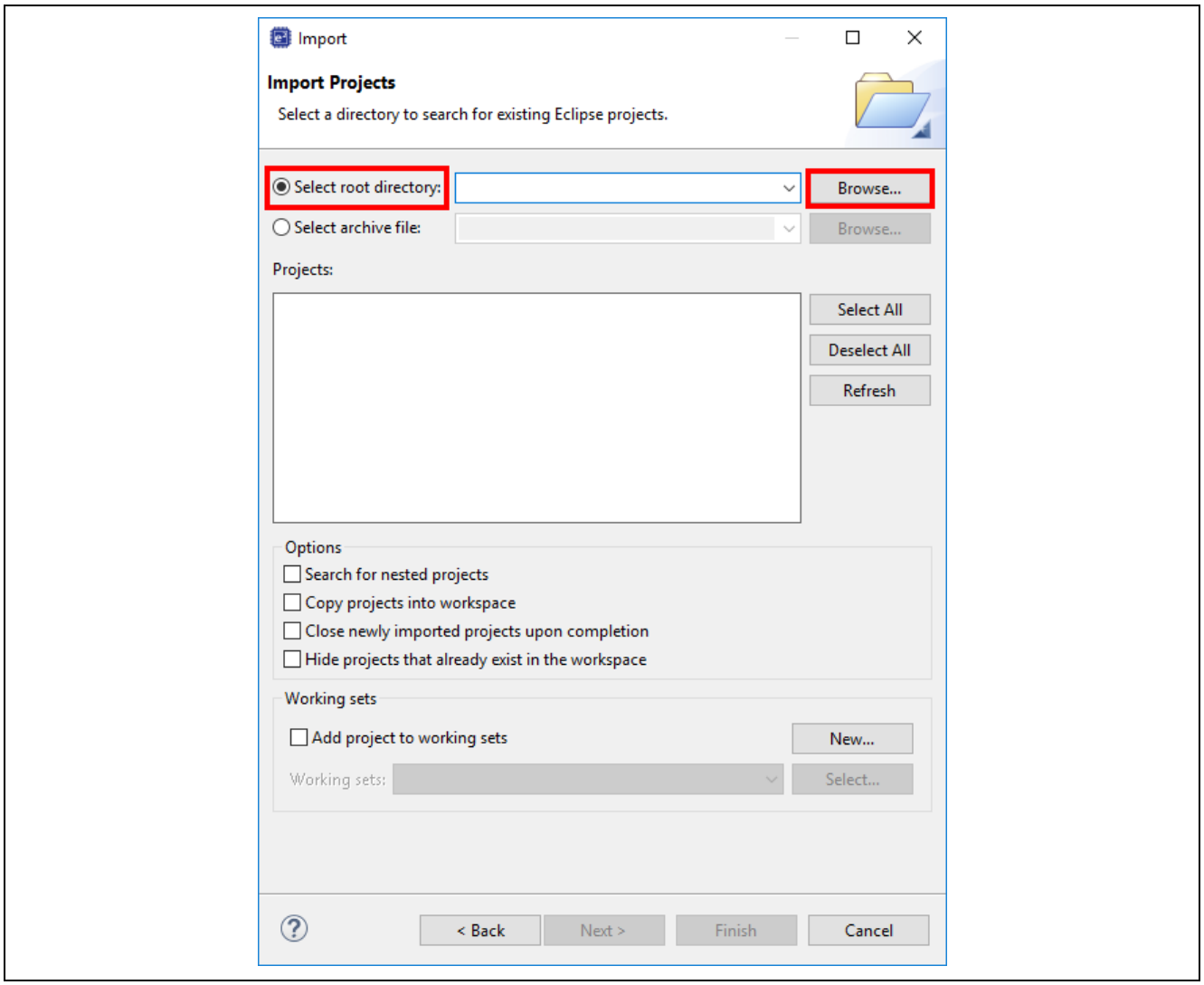


Figure 15. Selecting the Root Directory

9. Select the Quick Start example project and click **Finish.**

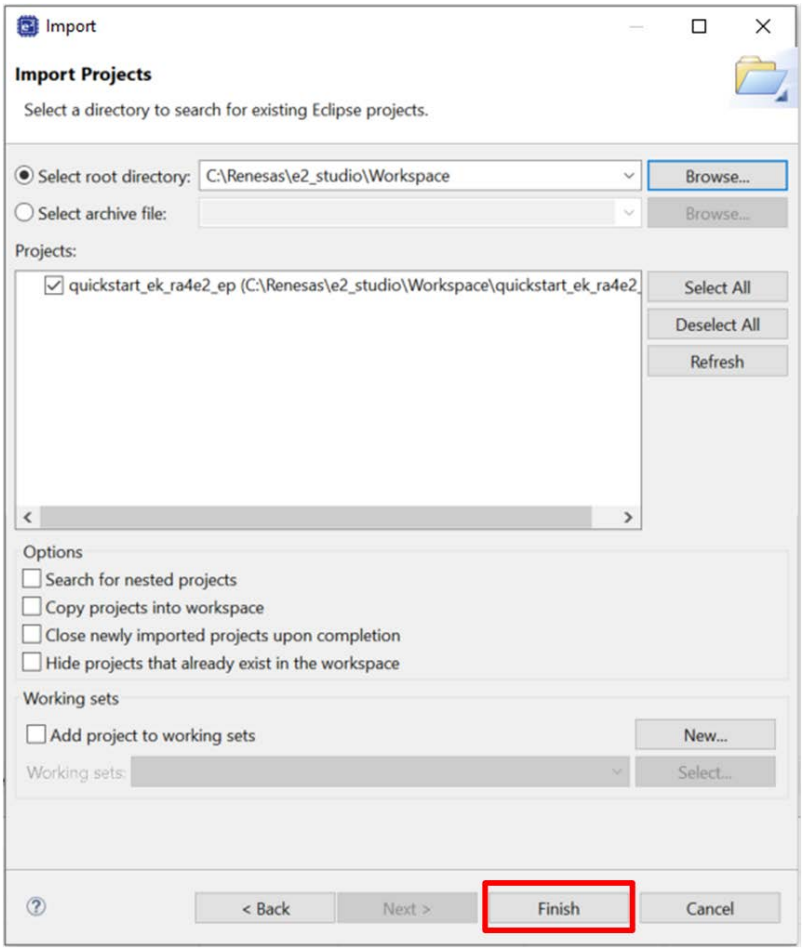


Figure 16. Finishing Importing the Quick Start Example Project

5.3 Modifying, Generating, and Building the Quick Start Example Project

This section provides instructions to modify the Quick Start example project. The Quick Start example project can be modified by editing the source code and reconfiguring the properties of the MCU peripherals, pins, clocks, interrupts, and so forth.

Note: The specific modifications that can be performed to the Quick Start example project are not prescribed in this QSG.

1. Once the Quick Start example project is imported, click the **configuration.xml** file to open the configurator. The configurator provides an easy-to-use interface to configure the properties of the MCU peripherals.

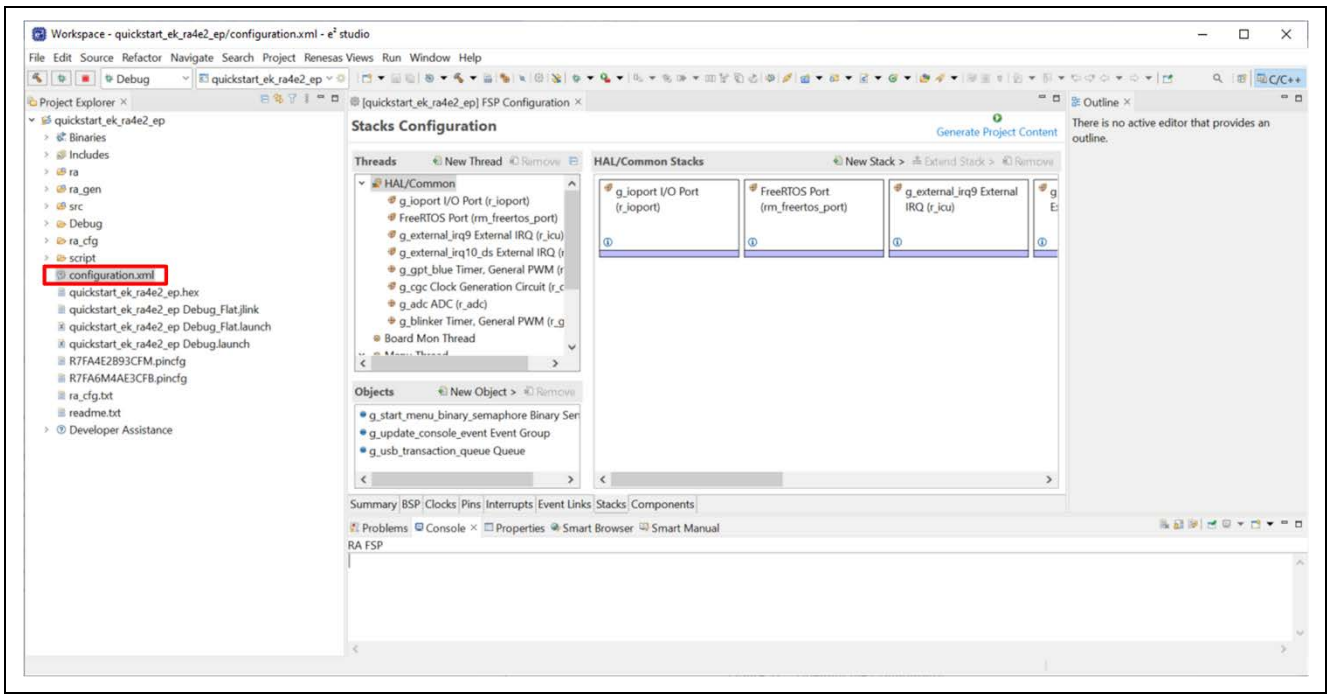


Figure 17. Opening the Configurator

2. For example, in the **Stacks** tab of the configurator, the user can click to select modules to modify the configuration settings, as required, in the **Properties** tab. The following screen shot illustrates modifying the **ADC** driver configuration.

   Note: To access the stack component properties, the view must be set to **FSP Configuration** using the Open Perspective button, if necessary.

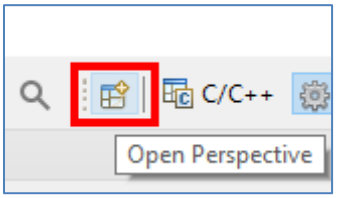


Figure 18. Open Perspective

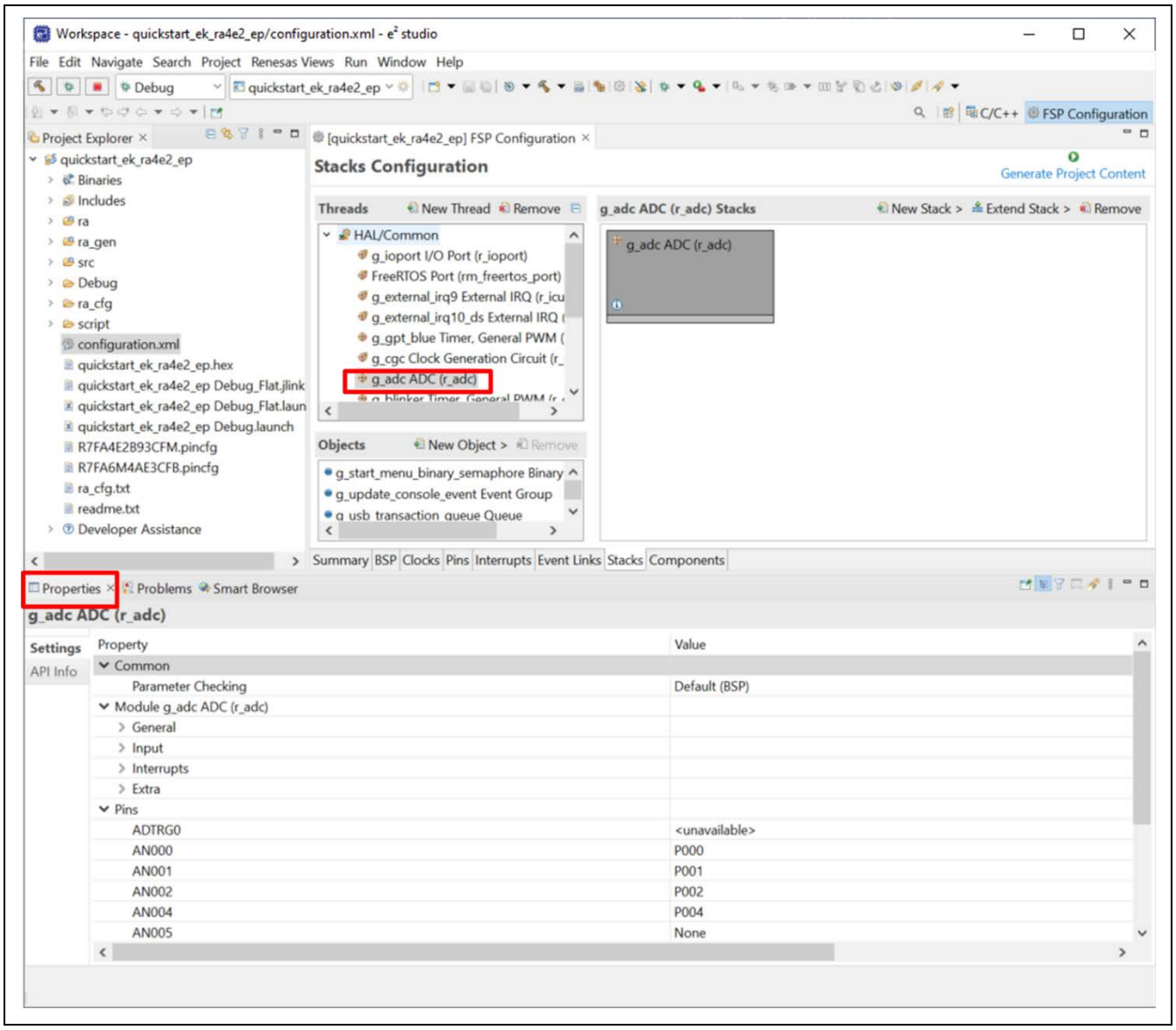


Figure 19. Modifying the Configuration Settings

3. After the desired modifications are made, click **Generate Project**. A dialog box may appear with an option of saving the configuration changes. Click **Proceed**.

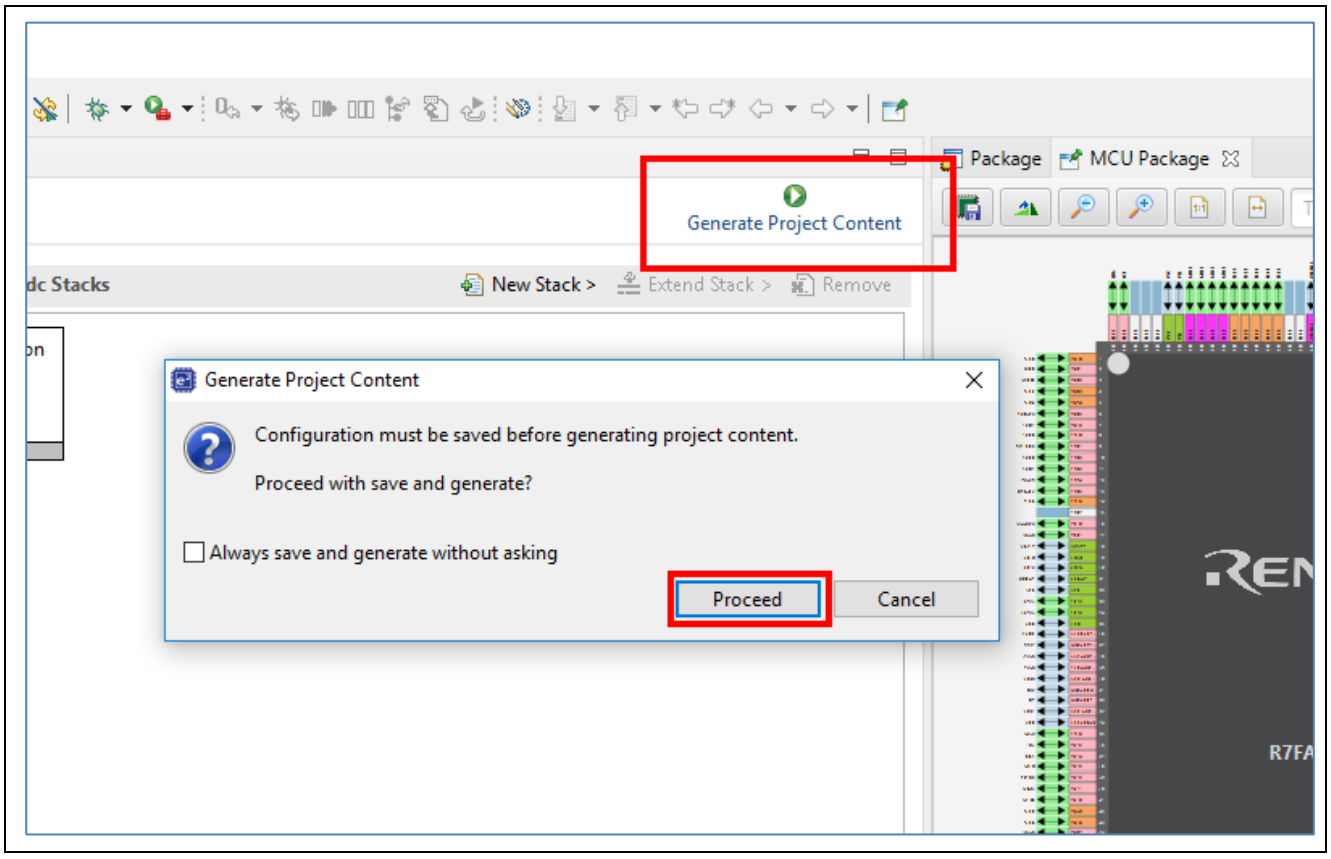


Figure 20. Saving the Configuration Changes

4. Modify the source files in the ***/src*** folder as needed and save the changes.
5. Build the project by clicking the build icon.

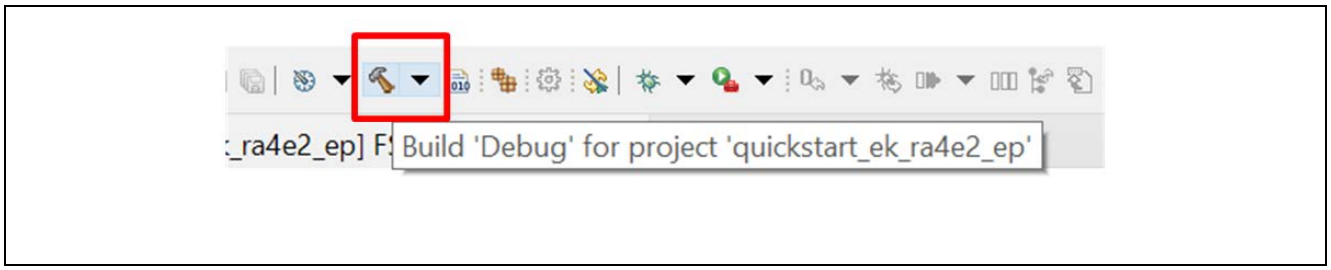


Figure 21. Building the Project

6. A successful build produces an output as follows.

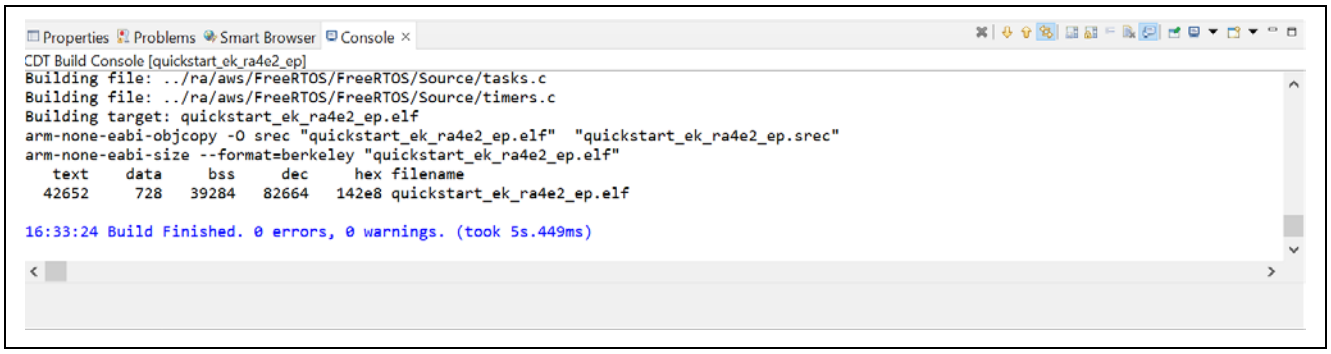


Figure 22. Successful Build Output

5.4 Setting Up Debug Connection between the EK-RA4E2 Board and Host PC

To program the modified Quick Start example project on to the EK-RA4E2 board, a debug connection is necessary between the EK-RA4E2 board and host PC.

1. Disconnect the USB cable from micro-AB USB Full Speed port (J11) and connect it to micro-B USB debug port (J10) of the EK-RA4E2 board.

Note: The EK-RA4E2 board supports 3 debugging modes. In this section and the following sections, default debugging mode, Debug On-Board, is used. More information on debugging modes is available in EK-RA4E2 user's manual.

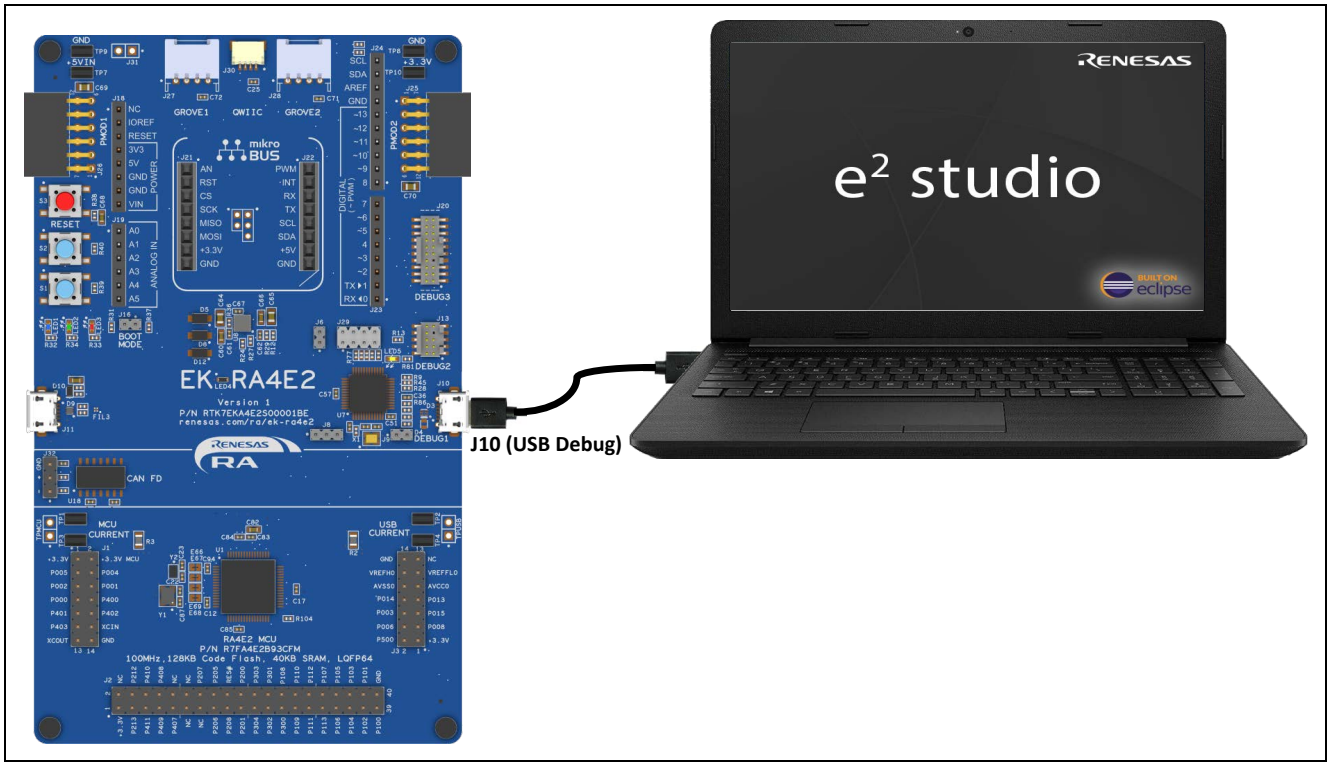


Figure 23. Connecting the EK-RA4E2 Board to the Host PC via USB Debug Port

2. Verify that the debug LED (LED5) stops blinking and lights up orange indicating that the J-Link drivers are detected by the EK-RA4E2 board.

Note: The debug LED (LED5) continues to blink when J-Link drivers are not detected by the EK-RA4E2 board. In that case, make sure that the EK-RA4E2 board is connected to the host PC through the micro-B USB debug port (J10) and that J-Link drivers are installed on the host PC by checking in the Windows Device Manager (expand **Universal Serial Bus controller**, and locate **J-Link driver**).

5.5 Downloading and Running the Modified Quick Start Example Project

1. In e² studio, click the drop-down menu for the debug icon, select **Debug Configurations** option.

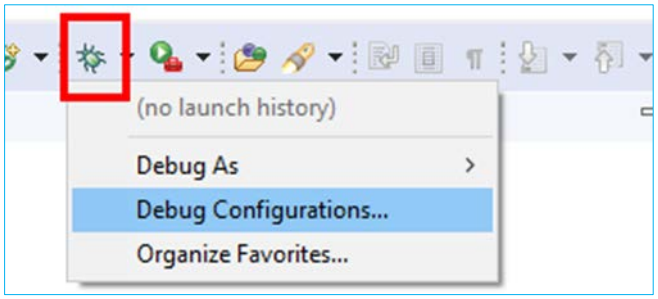


Figure 24. Selecting the Debug Option

2. In the dialogue, on the left-hand pane, expand the **Renesas GDB Hardware Debugger** and select the built image to debug. In this case, the **quickstart_ek_ra4e2_ep Debug_Flat**.

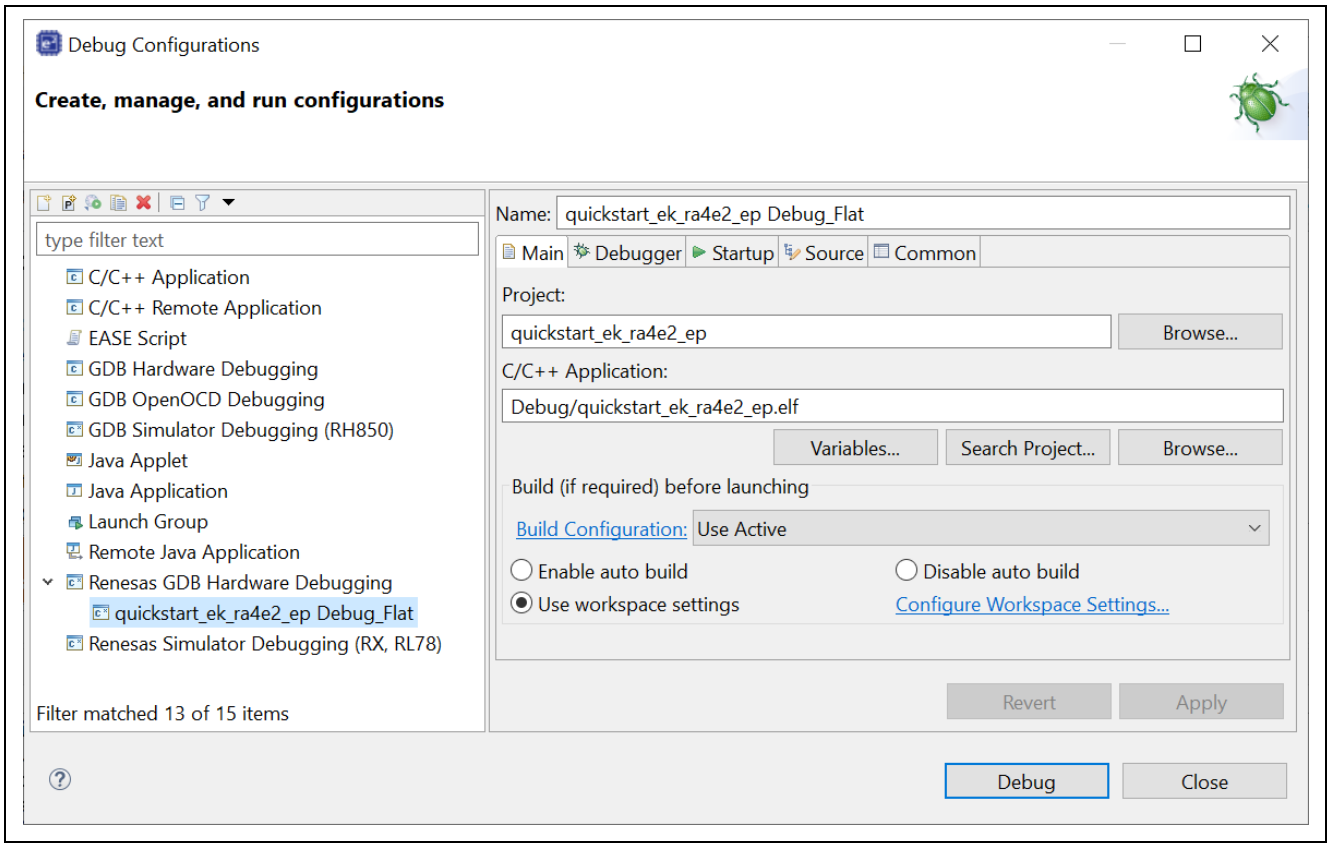


Figure 25. Selecting the Debug Image

5.6 Firewall Dialogue

1. A firewall warning may be displayed for **'e2- server-gdb.exe**'. Check the '**Private networks, such as my home or work network**' box and click '**Allow access**'.
2. A user account control dialog may be displayed. Enter the administrator password and click **Yes**.
3. A dialog box may appear. Click **Yes**.

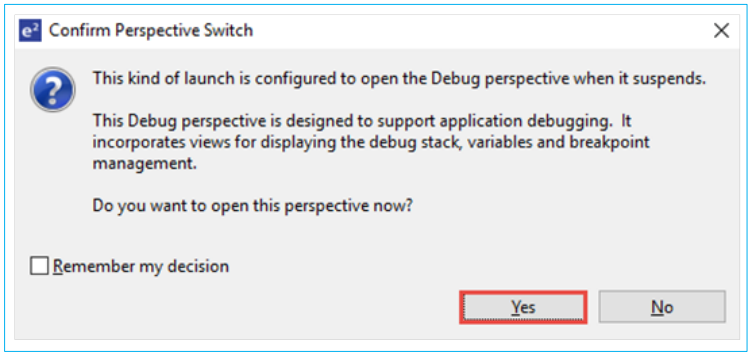


Figure 26. Opening the Debug Perspective

4. Press **F8** or click **Resume** icon to begin executing the project.

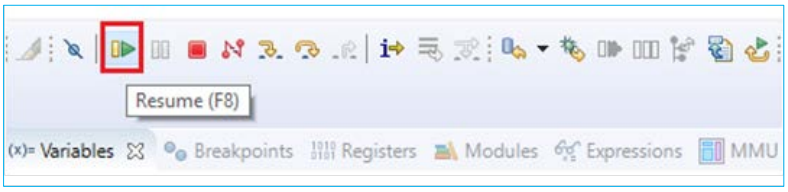


Figure 27. Executing the Project

5. The modified Quick Start example project is programmed into the EK-RA4E2 board and is running. The project can be paused, stopped, or resumed using the debug controls.

6. Next Steps

1. To learn more about the EK-RA4E2 kit, refer to the EK-RA4E2 user's manual and design package available in the Documents and Download tabs respectively of the EK-RA4E2 webpage at renesas.com/ra/ek-ra4e2
2. Renesas provides several example projects that demonstrate different capabilities of the RA MCUs. These example projects can serve as a good starting point for users to develop custom applications. Example projects (source code and project files) for EK-RA4E2 kit are available in the EK-RA4E2 Example Projects Bundle. The example projects bundle is available in the Downloads tab of EK-RA4E2 webpage.
   - Download and extract the example projects bundle (`xxxxxxxxxxxxxxx-ek-ra4e2-exampleprojects.zip`) to a local directory on the host PC.
   - Refer to the list of all example projects (`xxxxxxxxxxxxxxx-ek-ra4e2-exampleprojects.pdf`) available inside the example projects bundle.
   - Browse to the desired example project (for example: adc_ek_ra4e2_ep) in the example projects bundle (`xxxxxxxxxxxxxxx-ek-ra4e2-exampleprojects\ek_ra4e2\adc\adc_ek_ra4e2_ep`)
   - For help on using example projects, refer to `Example Project Usage Guide.pdf` in the RA Example Repository on GitHub at : github.com/renesas/ra-fsp-examples/tree/master/example_projects
   - The archived versions of the source code of the example projects are available in the example project repository.

7. Website and Support

Visit the following URLs to learn about the kit and the RA family of microcontrollers, download tools and documentation, and get support.

EK-RA4E2 Resources	renesas.com/ra/ek-ra4e2
RA Kit Information	renesas.com/ra/kits
RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Videos	renesas.com/ra/videos
RA Kit Feedback and Feature Request	renesas.com/ra/kitfeedback
Renesas Support	renesas.com/support

Revision History

Rev.	Date	Description	
		Page	Summary
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2.00	Feb.21.23	All	Updated for MP boards

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