FreeRTOS User's Guide

FreeRTOS User's Guide
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Contents

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1 Introduction

1.1 Analog Devices FreeRTOS

The Analog Devices FreeRTOS product is an add-on to the FreeRTOS Real-time operating system that provides additional support for Analog Devices processors. The product is installed on top of the FreeRTOS operating system in order to gain additional platform support.

In order to avoid confusion the FreeRTOS operating system will be referred to as the **FreeRTOS product.** Components from Analog Devices are always referred to as the **Analog Devices FreeRTOS product** or the **FreeRTOS product from Analog Devices**.

The Analog Devices FreeRTOS product contains ports of FreeRTOS specific to Analog Devices processors and FreeRTOS example applications for Analog Devices processors. It is intended to be installed on top of version 10.0.x of the FreeRTOS operating system.

1.2 What's in the user's guide

This User's Guide document provides instructions on getting started with FreeRTOS for these boards using the following development environments:

- CrossCore Embedded Studio
- IAR Embedded Workbench
- Keil MDK5

The following processors are supported with examples being provided for the following EZ-Kits:

Processors Supported	Examples Provided For
ADSP-SC5xx Cortex-A5 Core	ADSP-SC589 EZ-Kit ADSP-SC584 EZ-Kit ADSP-SC573 EZ-Kit
ADSP-SC5xx SHARC+ Core	ADSP-SC589 EZ-Kit ADSP-SC584 EZ-Kit ADSP-SC573 EZ-Kit
ADSP-BF7xx	ADSP-BF707 EZ-Kit
ADuCM302x	ADuCM3029 EZ-Kit

Processors Supported	Examples Provided For
ADuCM405x	ADuCM4050 EZ-Kit
ADSP-2156x	ADSP-21569 EZ-Kit

Detailed description for setting up the hardware and software environment, and how to run the demo exmaples on Analog Devices processor boards are included. An appendix containing RTOS benchmark data for various platforms is also provided.

2 Hardware and software set up

To run the FreeRTOS examples, this section would guide users how to get the hardware and software ready, including get the FreeRTOS source code and set up running environment.

2.1 Get the hardware ready

The Analog Devices FreeRTOS product supports a couple of reference development board from Analog Devices, including ADuCM3029/4050 EZ-Kit board, ADSP-SC589/ADSP-SC584/ADSP-SC573 EZ-Kit board, BF707 EZ-Kit board and ADSP-21569 EZ-Kit board. Depending on which software development tool you are using, different JTAG debug board are required.

Below is a list of the hardware involved.

ADI reference board:

- ADuCM3029 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-aducm3029-ezkit.htmL
- ADuCM4050 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-U4050LF-EZKIT.html
- ADSP-SC589 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/EVAL-ADSP-SC589.html
- ADSP-SC584 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/EVAL-ADSP-SC584.html
- ADSP-SC573 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/SC573EZKIT.html
- ADSP-BF707 EZ-kit: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-bf707.html
- ADSP-21569 EZ-kit: https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-21569-EZKIT.html

Jtag debugger:

- ICE1000/2000: http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/emulators.html
- J-Link: https://www.segger.com/products/debug-probes/j-link/models/j-link-lite/j-link-lite-arm/

PC:

A mainstream configuration of Windows PC is required. Verify that your PC has these minimum requirements:

- 2 GHz single core processor; 3.3GHz dual core or better recommended
- 4 GB RAM; 8GB or more recommended
- 2 GB available disk space
- One open USB port

2.2 Get the source code ready

This page describes how to get the FreeRTOS source code.

2.2.1 Download FreeRTOS source code

Source code for both upstream official FreeRTOS release, and the Analog Devices FreeRTOS add on product release are required. As shown in the list:

Name	Version	Download from
Official FreeRTOS source code	10.0.0	https://sourceforge.net/projects/freertos/files/FreeRTOS/
Analog Devices FreeRTOS	1.4.0	http://www.analog.com/en/design-center/processors-and-dsp/evaluation-and-development-software/freertos.html#dsp-relatedsoftware

2.2.2 Install the FreeRTOS product from Analog Devices

To install the Analog Devices FreeRTOS product you will need to first unzip the FreeRTOS product and then install the Analog Devices FreeRTOS product on top of it:

For example, unzip them into folder "freertos":

1. Unzip the "FreeRTOSv10.0.0.zip" into C:\Analog Devices\freertos.

You will get the path such as "C:\Analog Devices\freertos\FreeRTOSv10.0.0\FreeRTOS".

2. Unzip "adi-freertos-1.4.0.zip" into C:\Analog Devices\freertos.

It will add new files and overwrite some files saved in "C:\Analog Devices\freertos\FreeRTOSv10.0.0\FreeRTOS".

2.3 Software environment set up for CrossCore Embedded Studio

This part shows the software environment setup for CrossCore Embedded Studio on four kinds of boards: ADSP-SC589/ADSP-SC584/ADSP-SC573/ADSP-2156X, ADuCM3029 EZ-Kit, ADuCM4050 EZ-Kit AND ADSP-BF7XX EZ-Kit.

ADSP-SC589/ADSP-SC584/ADSP-SC573

- Analog Devices CrossCore Embedded Studio version 2.8.3 or later
- For Users want to try LwIP, install LwIP for CCES: Lightweight TCP/IP Stack for CrossCore Embedded Studio Rev. 2.6.0 (http://www.analog.com/en/design-center/processors-and-dsp/evaluation-and-development-software/adswp-lwip.html#dsp-relatedsoftware)

ADuCM3029 EZ-Kit

- Analog Devices CrossCore Embedded Studio version 2.8.3 or later
- Device Family Pack (DFP) for CCES: ADuCM302x Software for Keil version 1.0.6 or later (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-aducm3029-ezkit.html#eb-relatedsoftware)

ADuCM4050 EZ-Kit

- Analog Devices CrossCore Embedded Studio version 2.8.3 or later
- Device Family Pack (DFP) for CCES: ADuCM4x50 Device Family Pack version 3.1.0 or later (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-U4050LF-EZKIT.html#eb-relatedsoftware)

ADSP-BF7XX EZ-Kit

- Analog Devices CrossCore Embedded Studio version 2.8.3 or later
  No other software needed to run the examples in CCES on ADSP-BF707 board.

ADSP-2156X EZ-Kit

- Analog Devices CrossCore Embedded Studio version 2.9.1 or later
  No other software needed to run the examples in CCES on ADSP-2156X board.

2.4 Software environment set up for IAR Embedded Workbench

This part shows the software environment setup for IAR Embedded Workbench on two kinds of boards: ADuCM3029 EZ-Kit and ADuCM4050 EZ-Kit. For ADSP-SC589/SC584/SC573 EZ-Kit boards, users do not need to install any other pack files except the software IAR Embedded Workbench version 7.60 or later.

ADuCM3029 EZ-Kit

- IAR Embedded Workbench version 7.60 or later
- Board Support Package (BSP) for IAR: ADuCM302x EZ-Kit Lite BSP for IAR version 1.0.6 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-aducm3029-ezkit.html#eb-relatedsoftware)
- Edit an environment variable for your account (**ADI_CM302x_BSP_PATH**: This should point to the ADuCM302x_EZ_Kit/ directory of your ADuCM302x BSP installation)

ADuCM4050 EZ-Kit

- IAR Embedded Workbench version 7.60 or later
- ADuCM4050 EZ-Kit: ADuCM4x50 BSP for IAR version 1.1.0 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-U4050LF-EZKIT.html#eb-relatedsoftware)
- Edit an environment variable for your account (**ADI_CM4x50_BSP_PATH**: This should point to the ADuCM4x50_EZ_Kit/ directory of your ADuCM4x50 BSP installation)

2.5 Software environment set up for Keil MDK

This part shows the software environment setup for Keil MDK on two kinds of boards: ADuCM3029 EZ-Kit and ADuCM4050 EZ-Kit. For ADSP-SC589/SC584/SC573 EZ-Kit boards, users do not need to install any other pack files except the software Keil MDK for ARM processors version 5.21a or later.

ADuCM3029 EZ-Kit

- Keil MDK for ARM processors version 5.21a or later
- Device Family Pack (DFP) for Keil: ADuCM3029 EZ-Kit: ADuCM302x Software for Keil version 1.0.6 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-aducm3029-ezkit.html#eb-relatedsoftware)
- Board Support Package (BSP) for Keil: ADuCM302x EZ-Kit Lite BSP for IAR version 1.0.6 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/eval-aducm3029-ezkit.html#eb-documentation)
- Edit an environment variable for your account (ADI_CM302x_BSP_PATH: This should point to the ADuCM302x_EZ_Kit/ directory of your ADuCM302x BSP installation)

ADuCM4050 EZ-Kit

- Keil MDK for ARM processors version 5.21a or later
- Device Family Pack (DFP) for Keil: ADuCM4x50 Device Family Pack version 3.1.0 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-U4050LF-EZKIT.html#eb-relatedsoftware)

- Board Support Package (BSP) for Keil: ADuCM4x50 EZ-KIT Board Support Pack version 3.1.0 (http://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/ADZS-U4050LF-EZKIT.html#eb-relatedsoftware)
- Edit an environment variable for your account (ADI_CM4x50_BSP_PATH: This should point to the ADuCM4x50_EZ_Kit/ directory of your ADuCM4x50 BSP installation)

3 Running the Examples on the ADuCM302x EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Toolchain	Example(s)
ADuCM3029	IAR Embedded Workbench	Basic Demo
ADuCM3029	Keil MDK	Basic Demo
ADuCM3029	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System.

For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

3.1 Running the Basic Example for ADuCM302x EZ-Kit with CrossCore Embedded Studio

3.1.1 Overview

This page describes the steps required to build and run basic example on ADuCM3029 EZ-KIT board using CrossCore Embedded Studio.

3.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

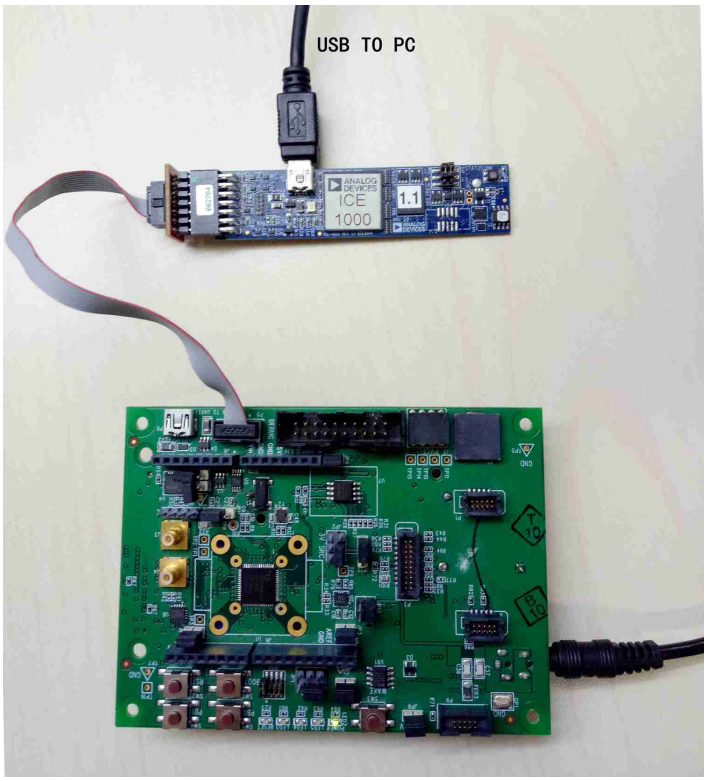
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM302x EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P5** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 5 volts as in the diagram below



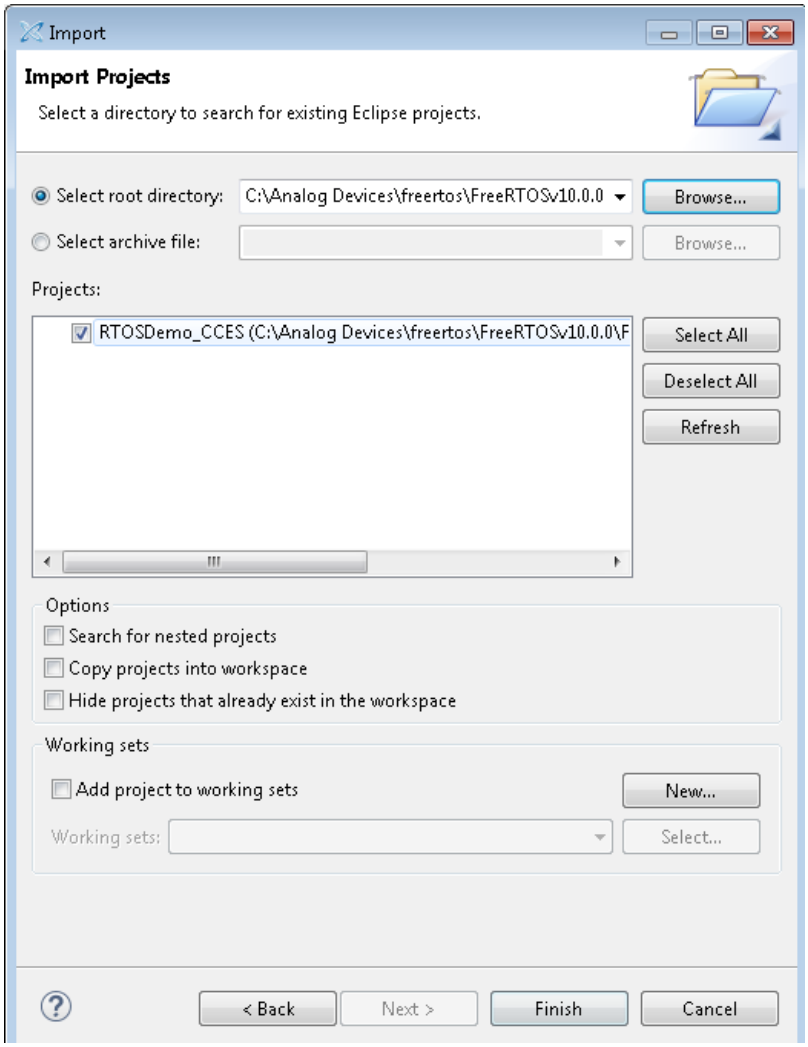
3.1.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

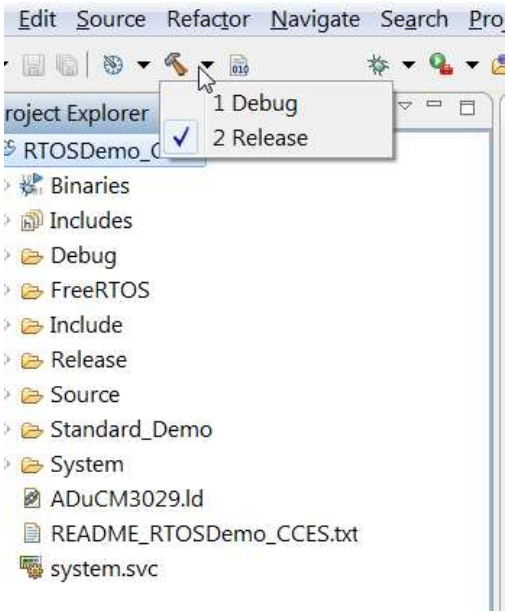
1. Select the **File** menu and then select the **Import** option from the menu and when the **Import** project window appears

- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**

- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\CORTEX_M3_ADuCM302x_CCES** folder
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Finish** to close the file browser dialog



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio

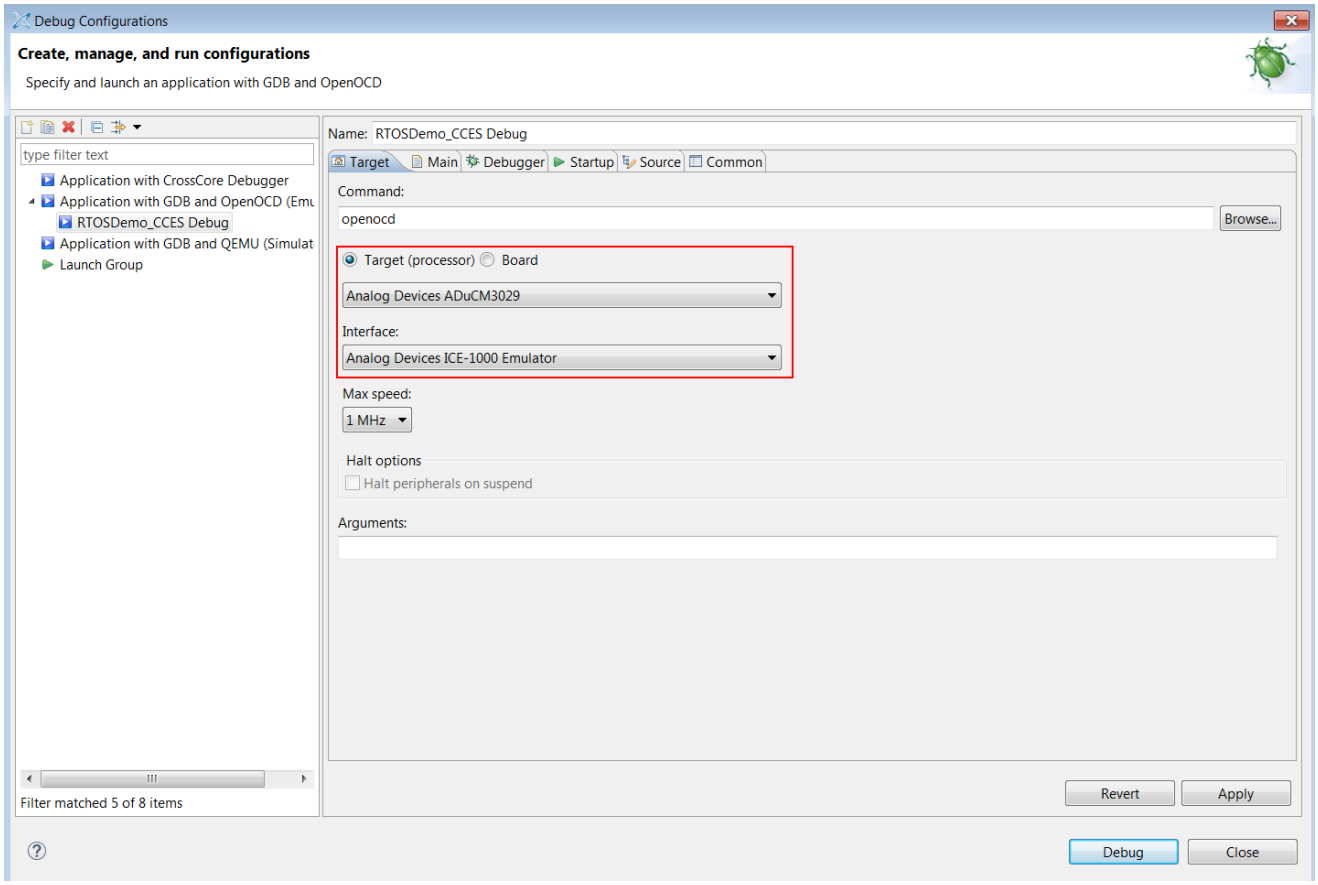
- In the **Project Explorer** right click on the **RTOSDemo_CCES** project and select the **Build Project** option from the menu

3.1.4 Run the Example

Follow below four steps to do debug configuration, download and run the built binary on the target board.

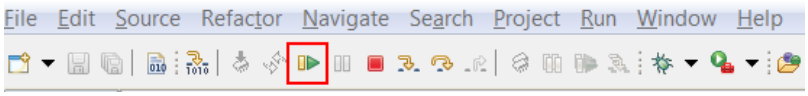
1. In the **Project Explorer** right click on the **RTOSDemo_CCES** project and select the **Debug As** option from the menu

2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



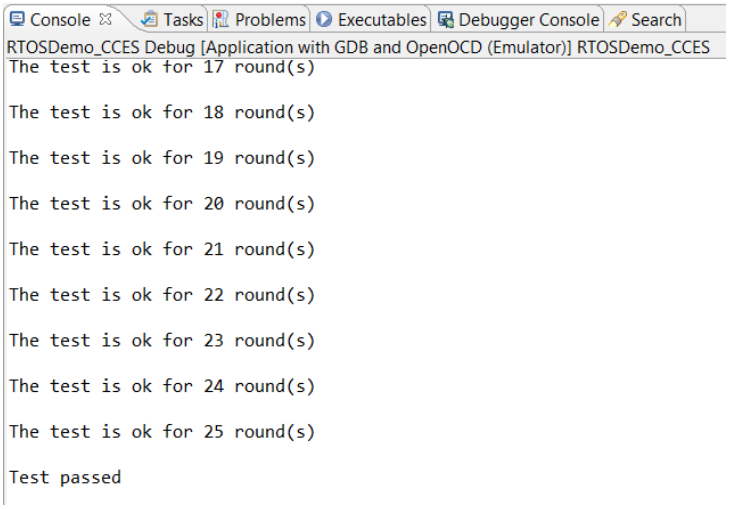
3. Click the **Debug** button to close the **Debug Configuration** window

4. Click the **Run/Resume** button to start running your application



3.1.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit are blinking. **The test is ok for <num> round (s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds in the console.



3.2 Running the Basic Example for ADuCM302x EZ-Kit with IAR Embedded Workbench

3.2.1 Overview

This page describes the steps required to build and run basic example on ADuCM3029 EZ-KIT board using IAR Embedded Workbench.

3.2.2 Environment Setup

Before running the basic example with IAR Embedded Workbench, you should make some preparation for environment setup including software and hardware.

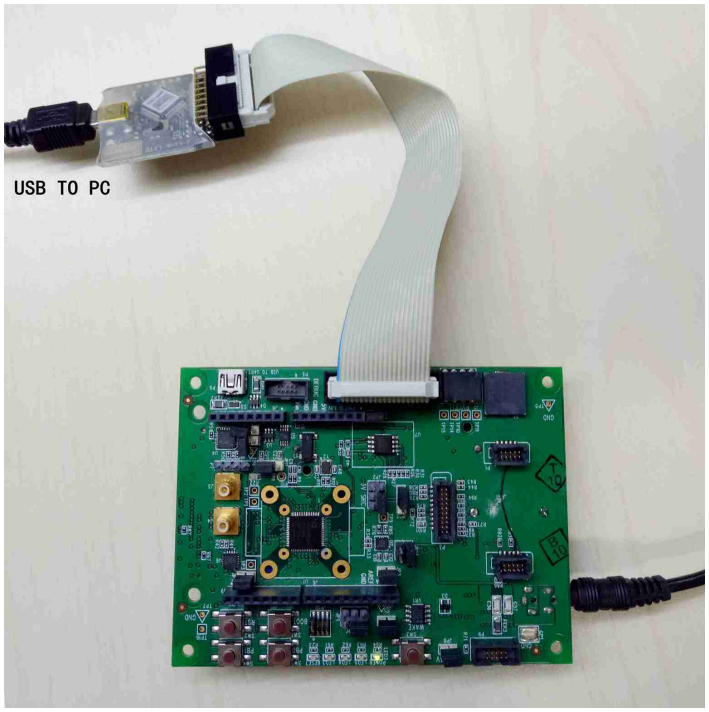
Software Requirement

- Analog Devices IAR Embedded Workbench. For more information please refer to Software environment set up for IAR Embedded Workbench
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM302x EZ-Kit board
- A J-Link Lite

Connect **DEBUG P4** port of the EZ-KIT board to a PC running IAR Embedded Workbench using the J-Link and simultaneously connect the power supply with 5 volts as in the diagram below

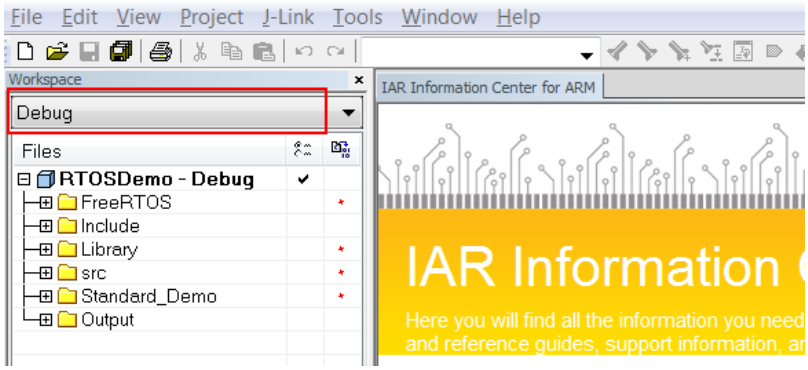


3.2.3 Build the Example

Before you run the FreeRTOS example in IAR Embedded Workbench, follow below three steps to import and build it.

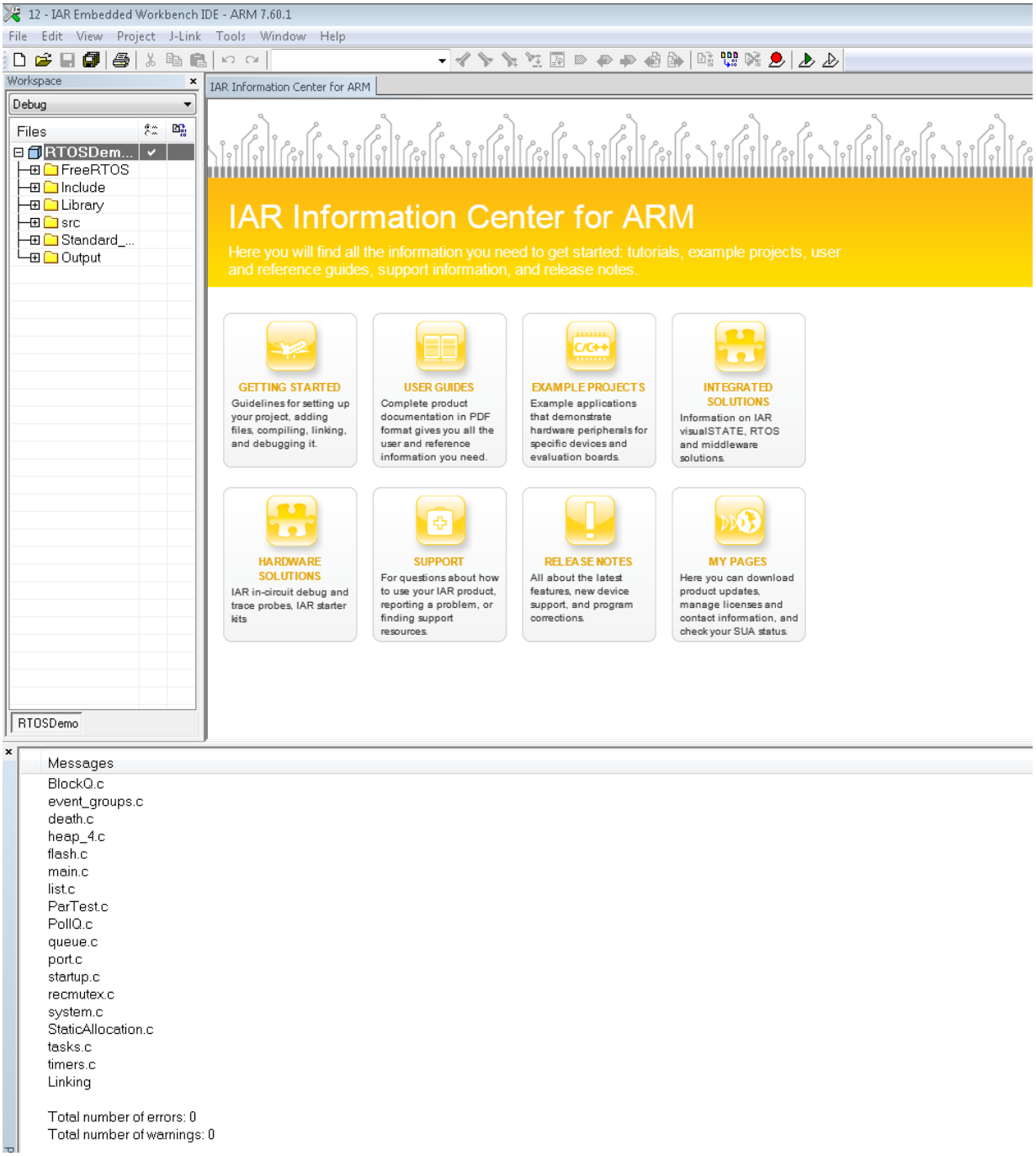
1. Select the **Add Existing Project** from the **Project Menu** and browse to the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_M3_ADuCM302x_IAR\iar** folder within the FreeRTOS product directory and import the project

2. Choose Debug/Release mode to build the project.



3. Build the project in the IAR workbench

- From the **Project** menu select the **Make** option and enter the file name



3.2.4 Run the Example

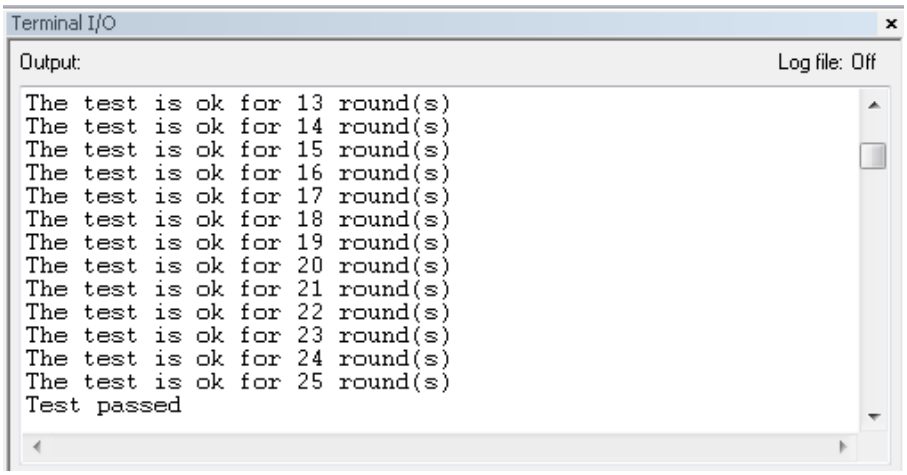
Follow below two steps to do debug configuration, download and run the built binary on the target board

1. From the **Project menu** select the **Download and Debug** option

2. The application should load and halt at main. Continue the application to see it run.

3.2.5 Test Results

Output from the application should be visible within the **Terminal I/O** window which can be found in View menu in the IAR Embedded Workbench IDE. You should see three LEDs on the EZ-Kit are blinking. **The test is ok for <num> round(s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds in the console.



3.3 Running the Basic Example for ADuCM302x EZ-Kit with Keil MDK

3.3.1 Overview

This page describes the steps required to build and run basic example on ADuCM3029 EZ-KIT board using Keil MDK.

3.3.2 Environment Setup

Before running the basic example with Keil MDK, you should make some preparation for environment setup including software and hardware.

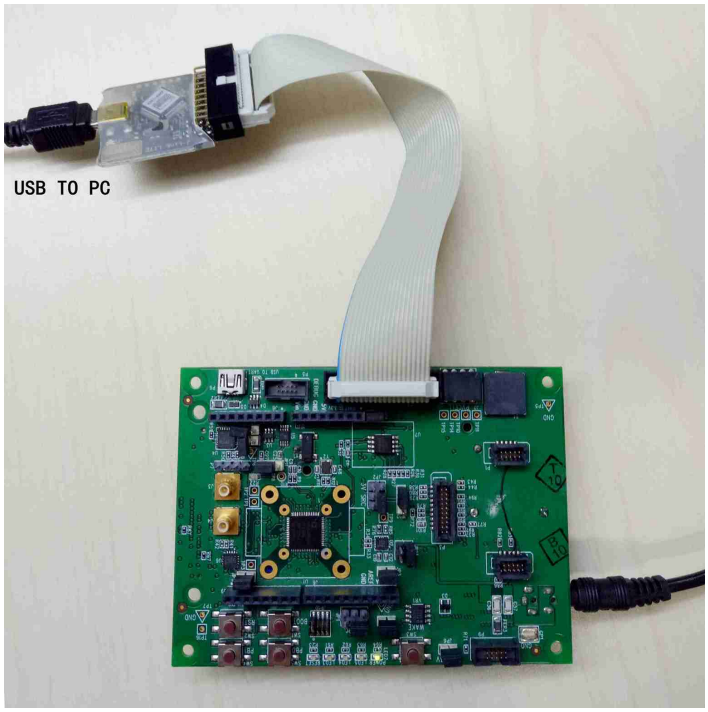
Software Requirement

- Analog Devices Keil MDK. For more information please refer to Software environment set up for Keil MDK
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM302x EZ-Kit board
- A J-Link Lite

Connect **DEBUG P4** port of the EZ-Kit to the host PC using the J-Link connector, connect the **USB to UART** port on the EZ-Kit to the host PC using the USB cable provided and simultaneously connect the power supply with 5 volts as in the diagram below



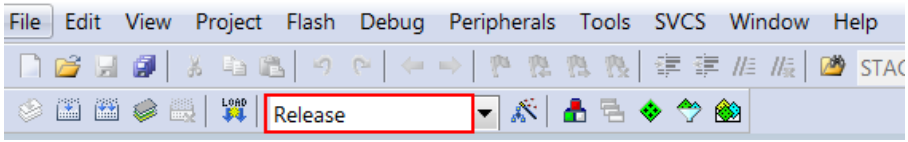
3.3.3 Build the Example

Before you run the FreeRTOS example in Keil MDK, follow below four steps to import and build it.

1. Import the FreeRTOS example into Keil MDK

- Select the **Open Project** option from the **Project** menu
- In the file tree window browse to the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_M3_ADuCM302x_KEIL** folder in the **FreeRTOS product installation** and select the **RTOSDemo.uvprojx** file.
- Click the **Open** button to import the project

2. Choose Debug/Release mode to build the project.

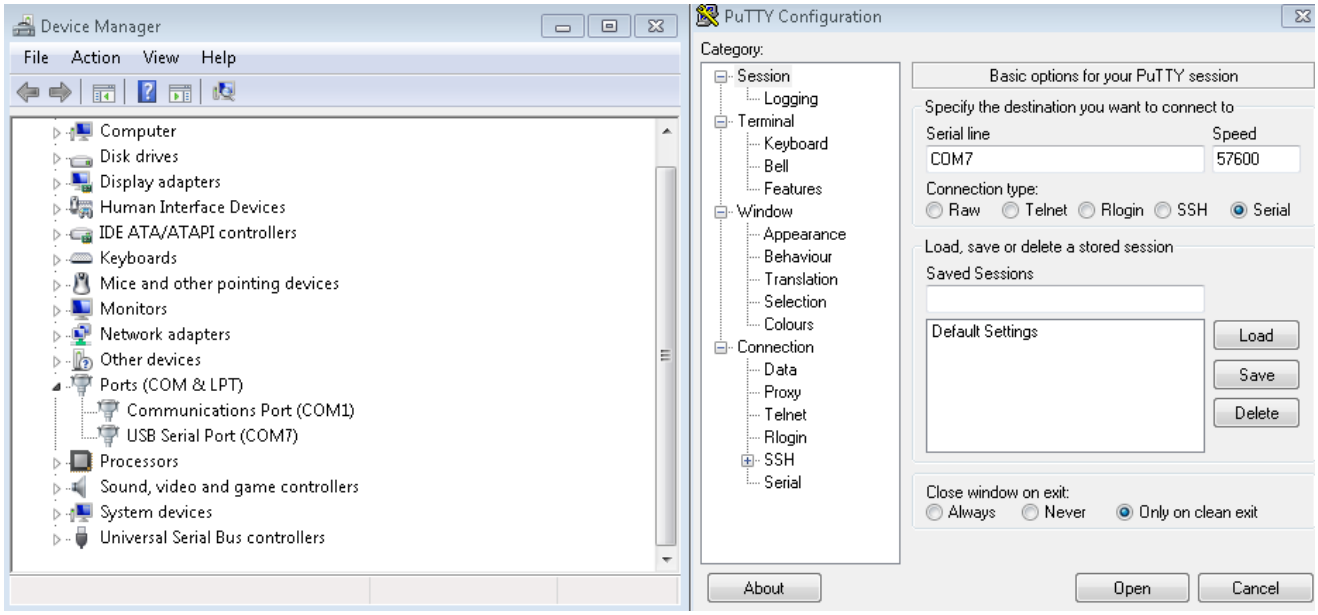


3. Build the project in Keil MDK

- Select the **Build Target/Rebuild All Target Files** option from the **Project** menu

4. Configure a serial console application of your choice to view the output from the **UART to USB connection** on the HOST PC

- The Keil MDK is unable to output and text to the console within the MDK IDE.The output of the application is transmitted via UART to the serial console. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager.From here identify the COM port.Configure your serial console application to connect to the port with a baud rate of 57600

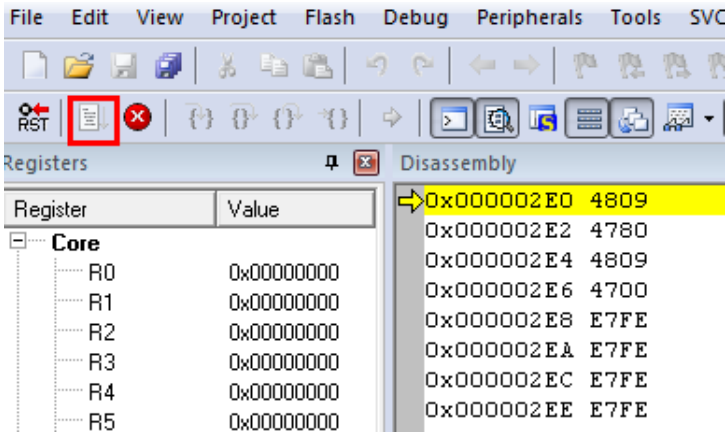


3.3.4 Run the Example

Follow below two steps to do debug configuration, download and run the built binary on the target board

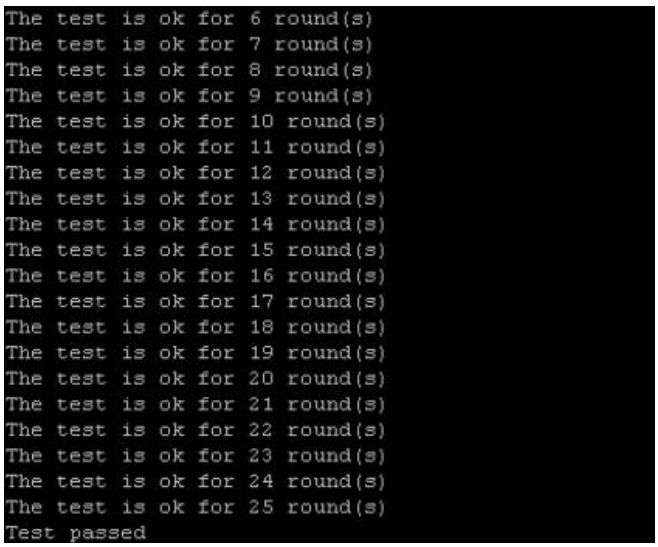
1. From the **Flash** menu select the **Download** sub-menu and then choose the **Start/Stop Debug Session** option from **Debug** menu.

2. Click the **Run** button to start running the application



3.3.5 Test Results

When the application runs it will blink three LEDs on the EZ-Kit, **The test is ok for <num> round(s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds on the console.



4 Running the Examples on the ADuCM4x50 EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Toolchain	Example(s)
ADuCM4050	CrossCore Embedded Studio	Basic Demo
ADuCM4050	IAR Embedded Workbench	Basic Demo
ADuCM4050	Keil MDK	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System.

For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

4.1 Running the Basic Example for ADuCM4x50 EZ-Kit with CrossCore Embedded Studio

4.1.1 Overview

This page describes the steps required to build and run basic example on ADuCM4x50 EZ-KIT board using CrossCore Embedded Studio.

4.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

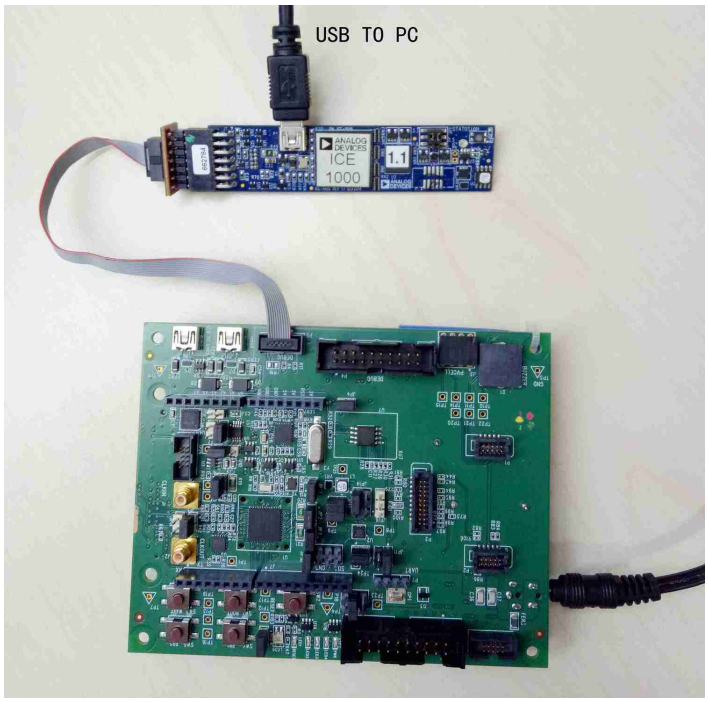
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM4x50 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P5** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 5 volts as in the diagram below



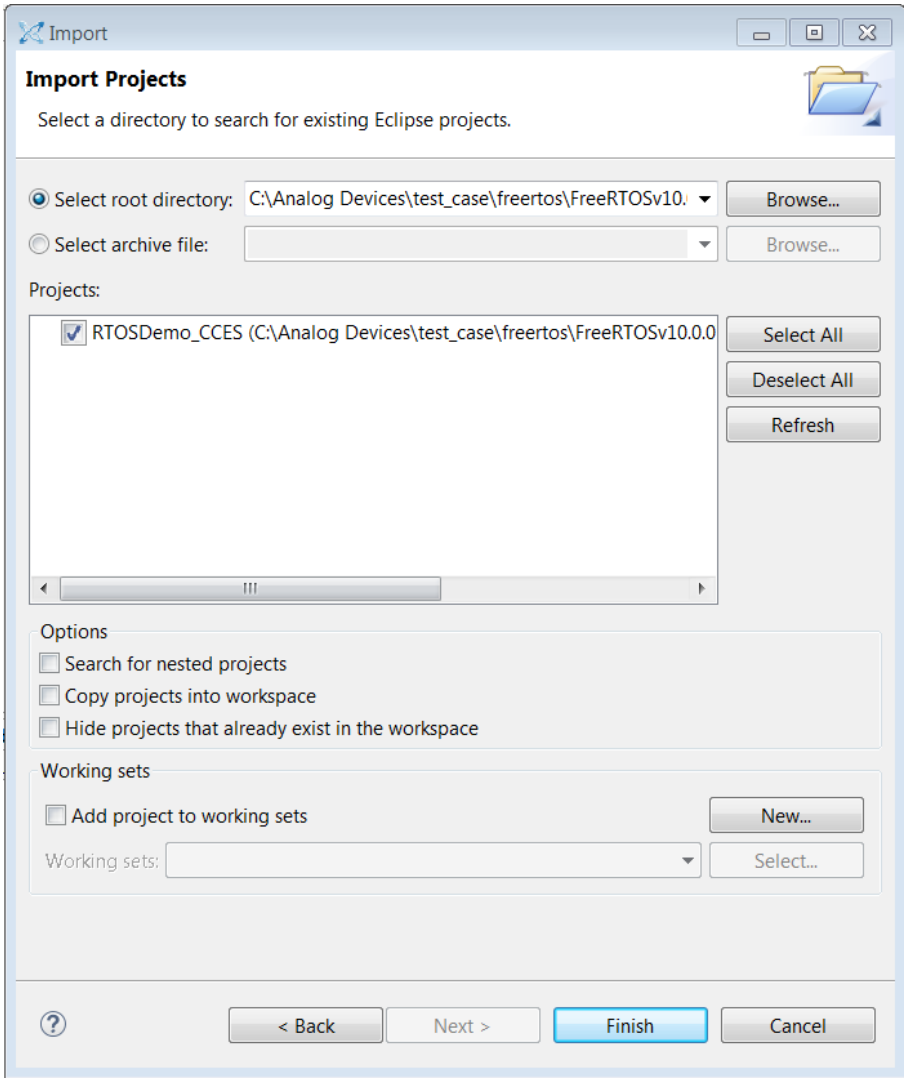
4.1.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Select the **File** menu and then select the **Import** option from the menu and when the **Import** project window appears

- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button

- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\CORTEX_M4_ADuCM4x50_CCES** folder
- Click **OK** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Finish** to Import the project



2. Choose Debug/Release mode to build the project.

3. Build the project in CrossCore Embedded Studio

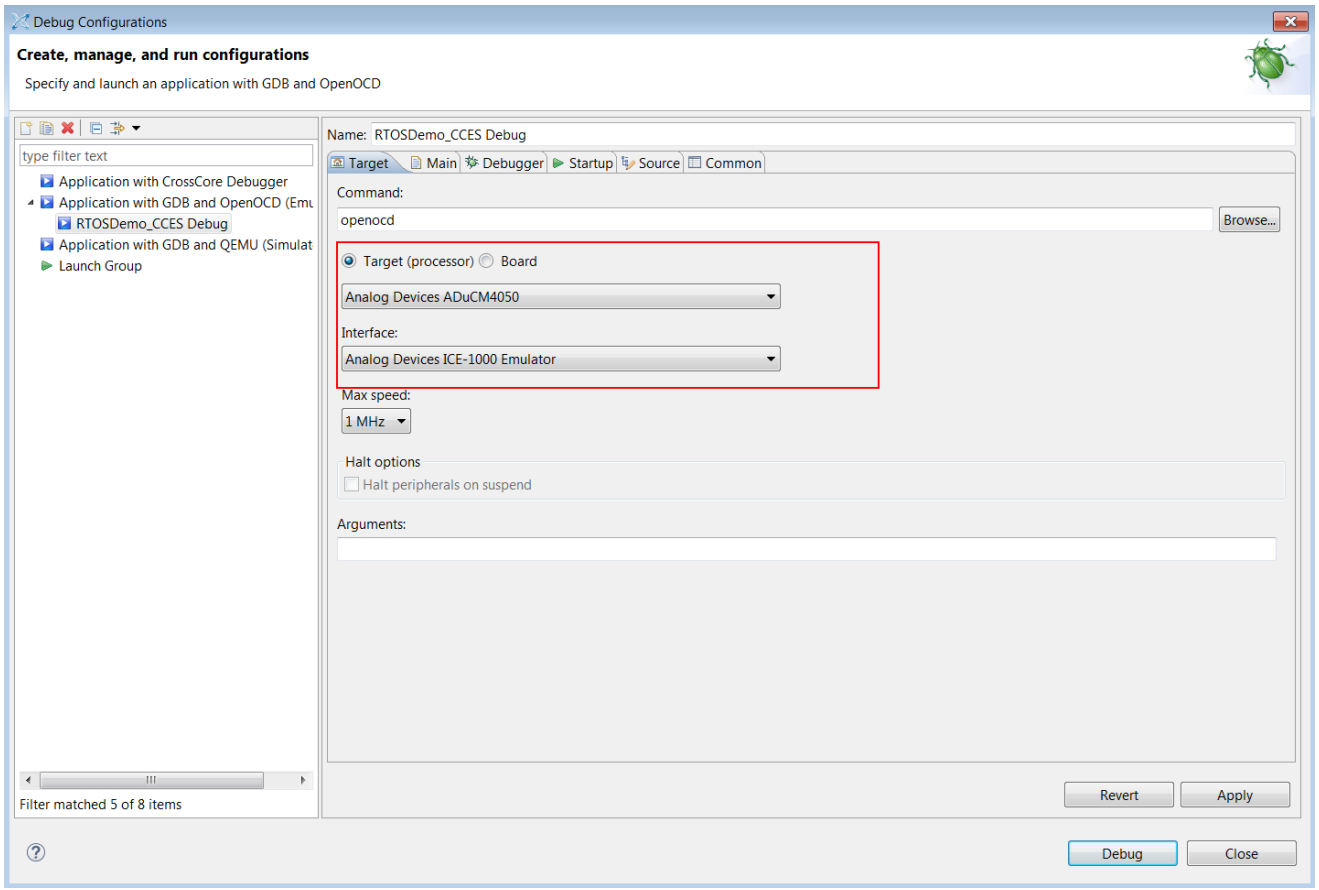
- In the **Project Explorer** right click on the **RTOSDemo_CCES** project and select the **Build Project** option from the menu

4.1.4 Run the Example

Follow below four steps to do debug configuration, download and run the built binary on the target board.

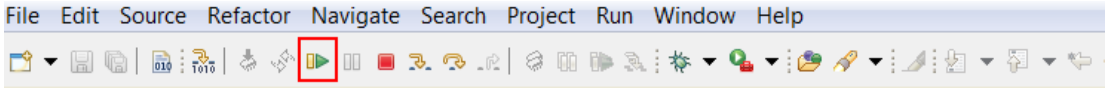
1. In the **Project Explorer** right click on the **RTOSDemo_CCES** project and select the **Debug As** option from the menu

2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



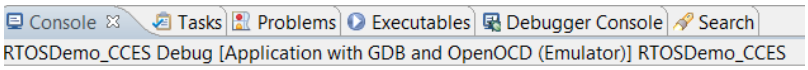
3. Click the **Debug** button to close the **Debug Configuration** window

4. Click the **Run/Resume** button to start running your application



4.1.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit begin to flash. **The test is ok for <num> round(s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds in the console.




```
The test is ok for 9 round(s)

The test is ok for 10 round(s)

The test is ok for 11 round(s)

The test is ok for 12 round(s)

The test is ok for 13 round(s)

The test is ok for 14 round(s)

The test is ok for 15 round(s)

The test is ok for 16 round(s)

The test is ok for 17 round(s)

The test is ok for 18 round(s)

The test is ok for 19 round(s)

The test is ok for 20 round(s)

The test is ok for 21 round(s)

The test is ok for 22 round(s)

The test is ok for 23 round(s)

The test is ok for 24 round(s)

The test is ok for 25 round(s)

Test passed
```

4.2 Running the Basic Example for ADuCM4x50 EZ-Kit with IAR Embedded Workbench

4.2.1 Overview

This page describes the steps required to build and run basic example on ADuCM4x50 EZ-KIT board using IAR Embedded Workbench.

4.2.2 Environment Setup

Before running the basic example with IAR Embedded Workbench, you should make some preparation for environment setup including software and hardware.

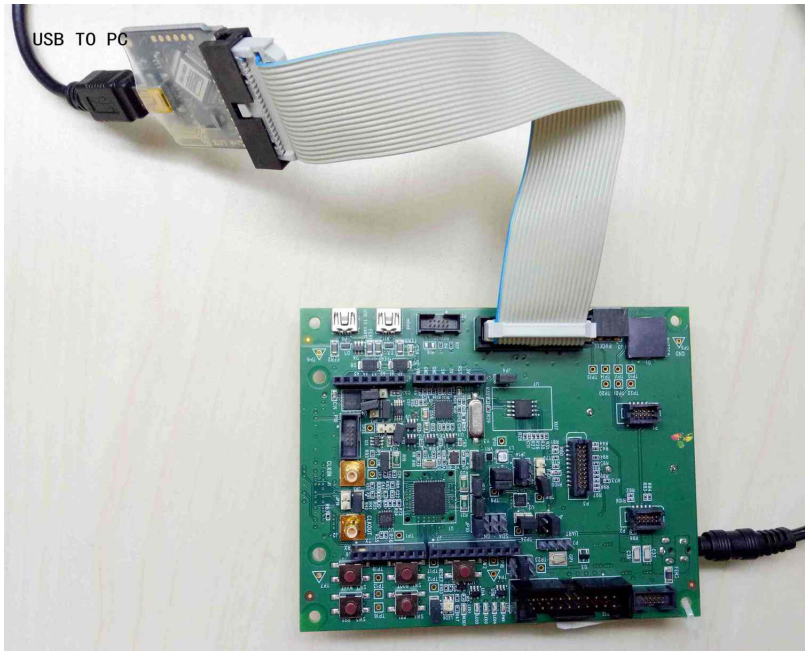
Software Requirement

- Analog Devices IAR Embedded Workbench. For more information please refer to Software environment set up for IAR Embedded Workbench
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM4x50 EZ-Kit board
- A J-Link Lite

Connect **DEBUG P4** port of the EZ-KIT board to a PC running IAR Embedded Workbench using the J-Link and simultaneously connect the power supply with 5 volts as in the diagram below

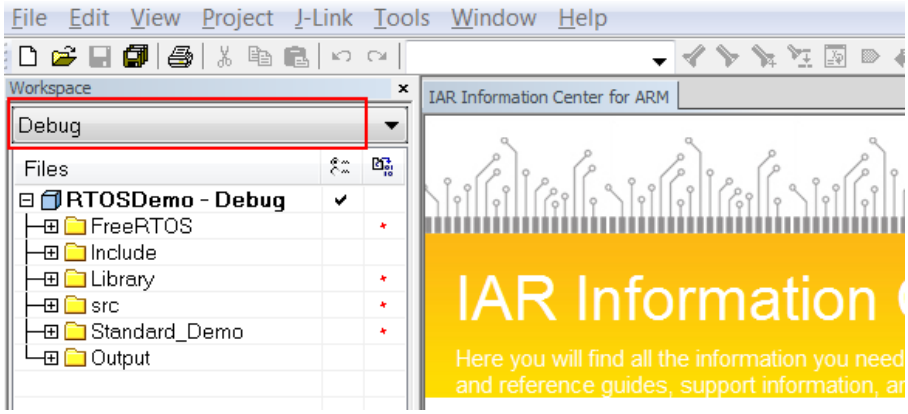


4.2.3 Build the Example

Before you run the FreeRTOS example in IAR Embedded Workbench, follow below three steps to import and build it.

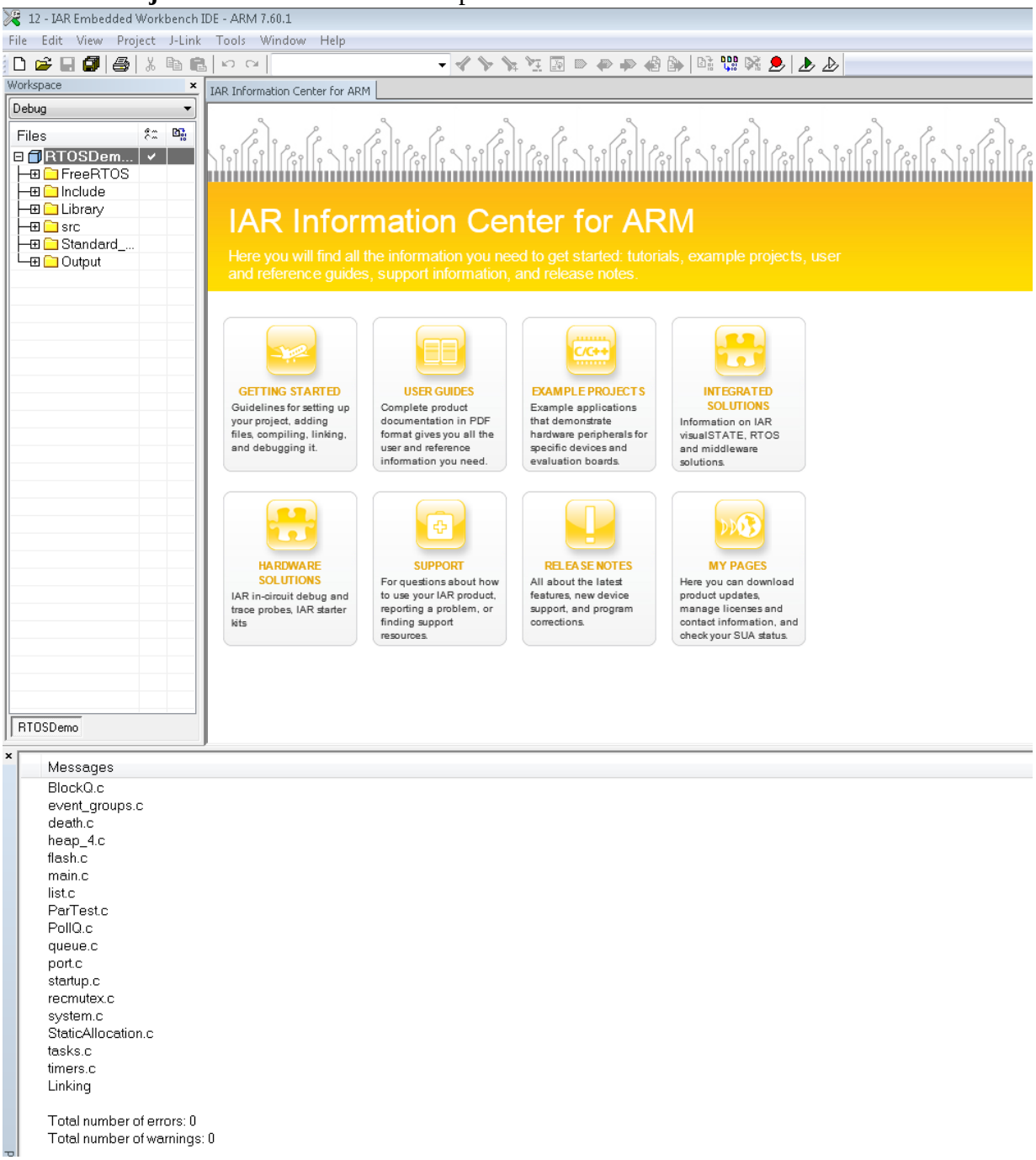
1. Select the **Add Existing Project** from the **Project** Menu and browse to the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_M4_ADuCM4x50_IAR\iar** folder within the FreeRTOS product directory and import the project

2. Choose Debug/Release mode to build the project.



3. Build the project in the IAR workbench

- From the **Project** menu select the **Make** option and enter the file name



4.2.4 Run the Example

Follow below two steps to do debug configuration, download and run the built binary on the target board

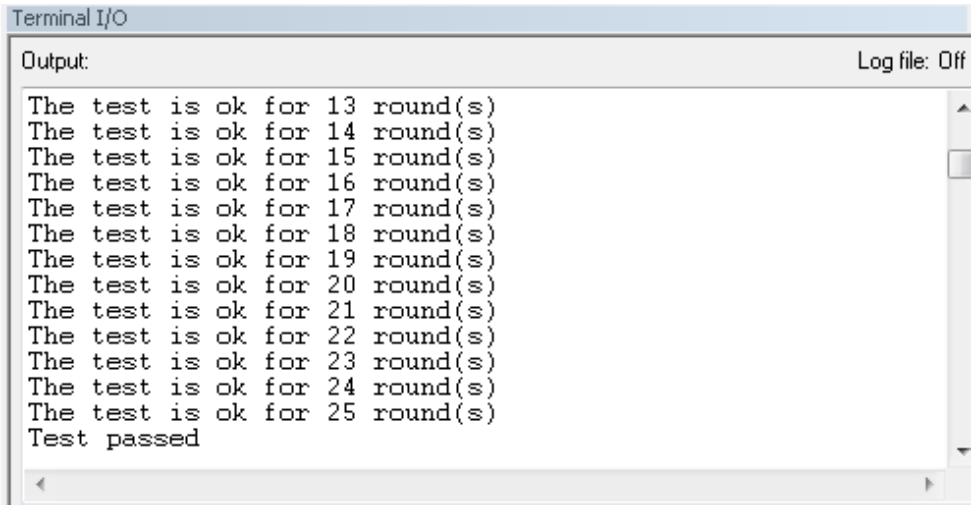
1. From the **Project** menu select the **Download and Debug** option

You may meet the Device Selection window, please select Coretex-M4 device.

2. The application should load and halt at main. Continue the application to see it run.

4.2.5 Test Results

Output from the application should be visible within the **Terminal I/O** window which can be found in View menu in the IAR Embedded Workbench IDE. You should see three LEDs on the EZ-Kit are blinking. **The test is ok for <num> round(s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds in the console.



4.3 Running the Basic Example for ADuCM4x50 EZ-Kit with Keil MDK

4.3.1 Overview

This page describes the steps required to build and run basic example on ADuCM4x50 EZ-KIT board using Keil MDK.

4.3.2 Environment Setup

Before running the basic example with Keil MDK, you should make some preparation for environment setup including software and hardware.

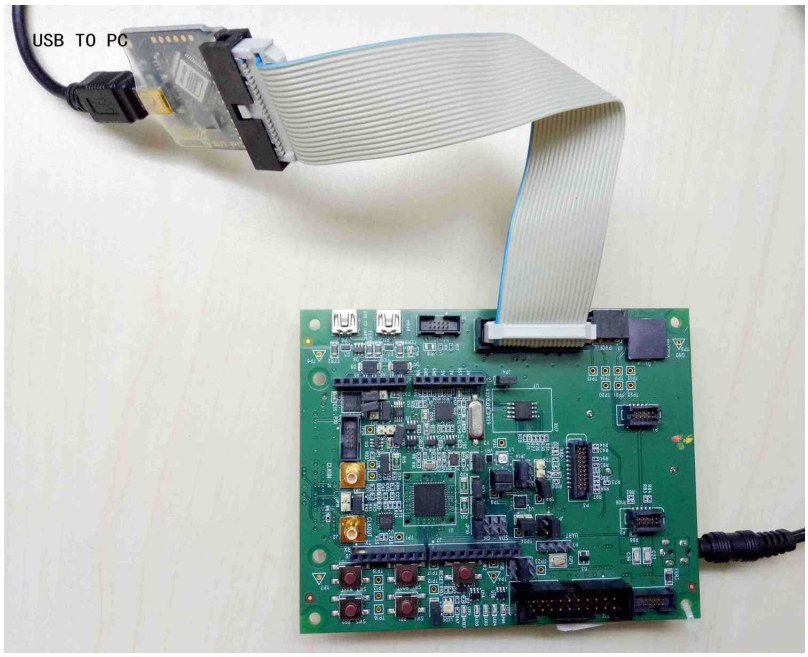
Software Requirement

- Analog Devices Keil MDK. For more information please refer to Software environment set up for Keil MDK
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADuCM4x50 EZ-Kit board
- A J-Link Lite

Connect **DEBUG P4** port of the EZ-Kit to the host PC using the J-Link connector, connect the **USB to UART** port on the EZ-Kit to the host PC using the USB cable provided and simultaneously connect the power supply with 5 volts as in the diagram below



4.3.3 Build the Example

Before you run the FreeRTOS example in Keil MDK, follow below four steps to import and build it.

1. Import the FreeRTOS example into Keil MDK

- Select the **Open Project** option from the **Project** menu
- In the file tree window browse to the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_M4_ADuCM4x50_KEIL** folder in the **FreeRTOS product installation** and select the **RTOSDemo.uvprojx** file.
- Click the **Open** button to import the project

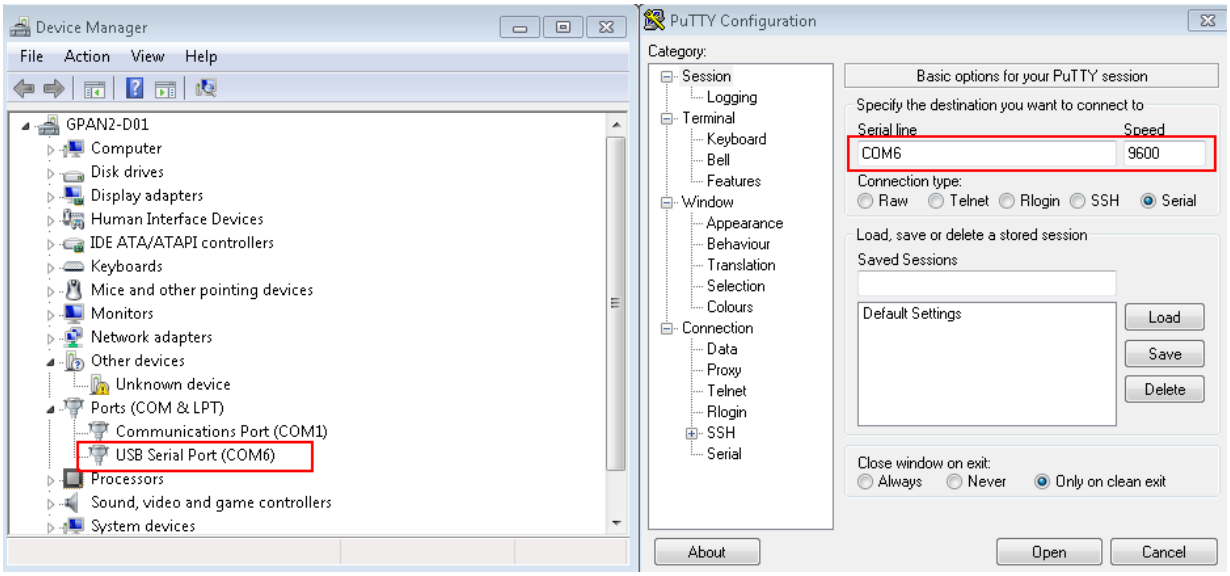
2. Choose Debug/Release mode to build the project.

3. Build the project in Keil MDK

- Select the **Build Target/Rebuild All Target Files** option from the **Project** menu

4. Configure a serial console application of your choice to view the output from the **UART to USB connection** on the HOST PC

- The Keil MDK is unable to output and text to the console within the MDK IDE.The output of the application is transmitted via UART to the serial console. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager.From here identify the COM port.Configure your serial console application to connect to the port with a baud rate of 9600

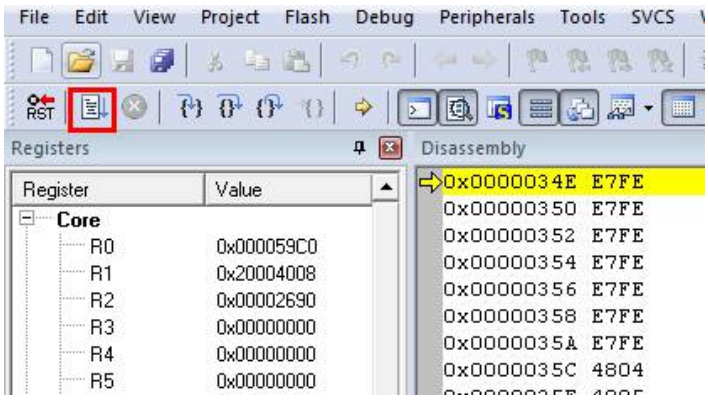


4.3.4 Run the Example

Follow below two steps to do debug configuration, download and run the built binary on the target board

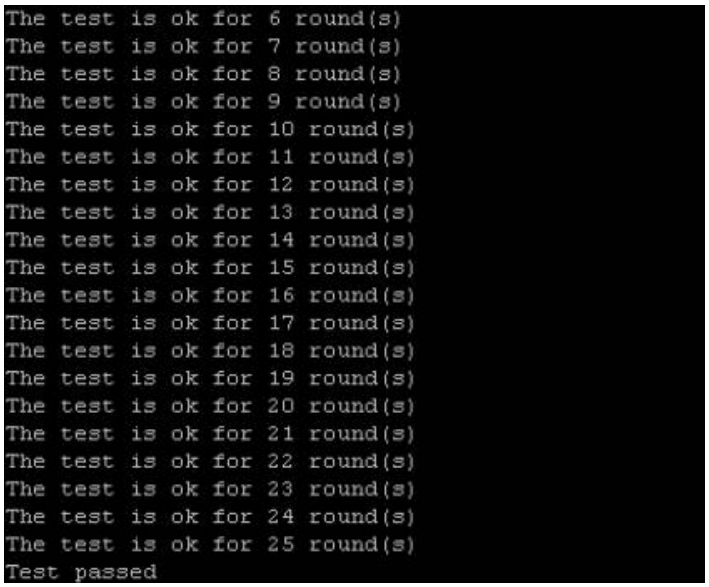
1. From the **Flash** menu select the **Download** sub-menu and then the **Start/Stop Debug Session** option from **Debug** menu.

2. Click the **Run** button to start running the application



4.3.5 Test Results

When the application runs it will blink three LEDs on the EZ-Kit, **The test is ok for <num> round(s)** will be printed constantly and **Test Passed** which means the test is successful will be printed after 25 rounds on the console.



5 Running the Examples on the ADSP-SC589 EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Core	Toolchain	Example(s)
ADSP-SC589	ARM A5	CrossCore Embedded Studio	Basic Demo
ADSP-SC589	ARM A5	CrossCore Embedded Studio	Lwip Demo
ADSP-SC589	SHARC+	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System. For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

5.1 Running the Basic Example for ARM on ADSP-SC589 EZ-Kit with CrossCore Embedded Studio

5.1.1 Overview

This page describes the steps to build and run basic example for ARM on ADSP-SC589 EZ-Kit board using CrossCore Embedded Studio.

5.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

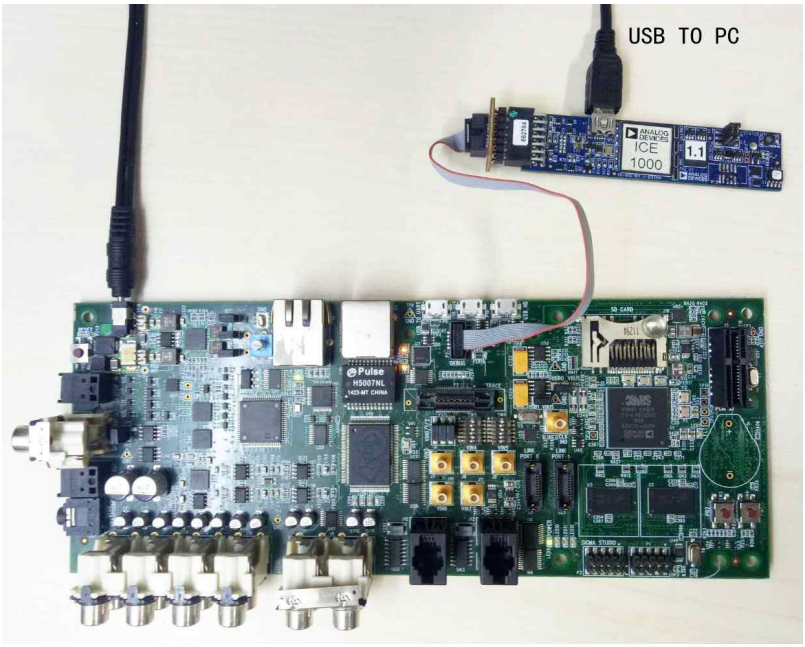
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more information please refer to Get the source code ready

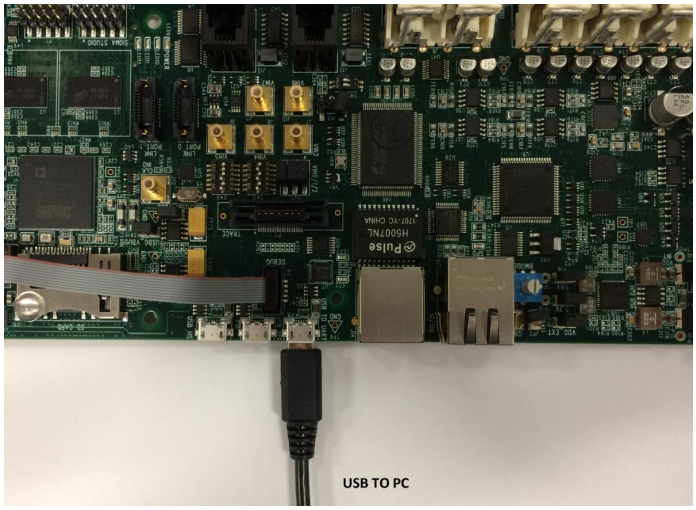
Hardware Setup

- An ADSCP-SC589 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P3** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 5 volts as in the diagram below.



Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:

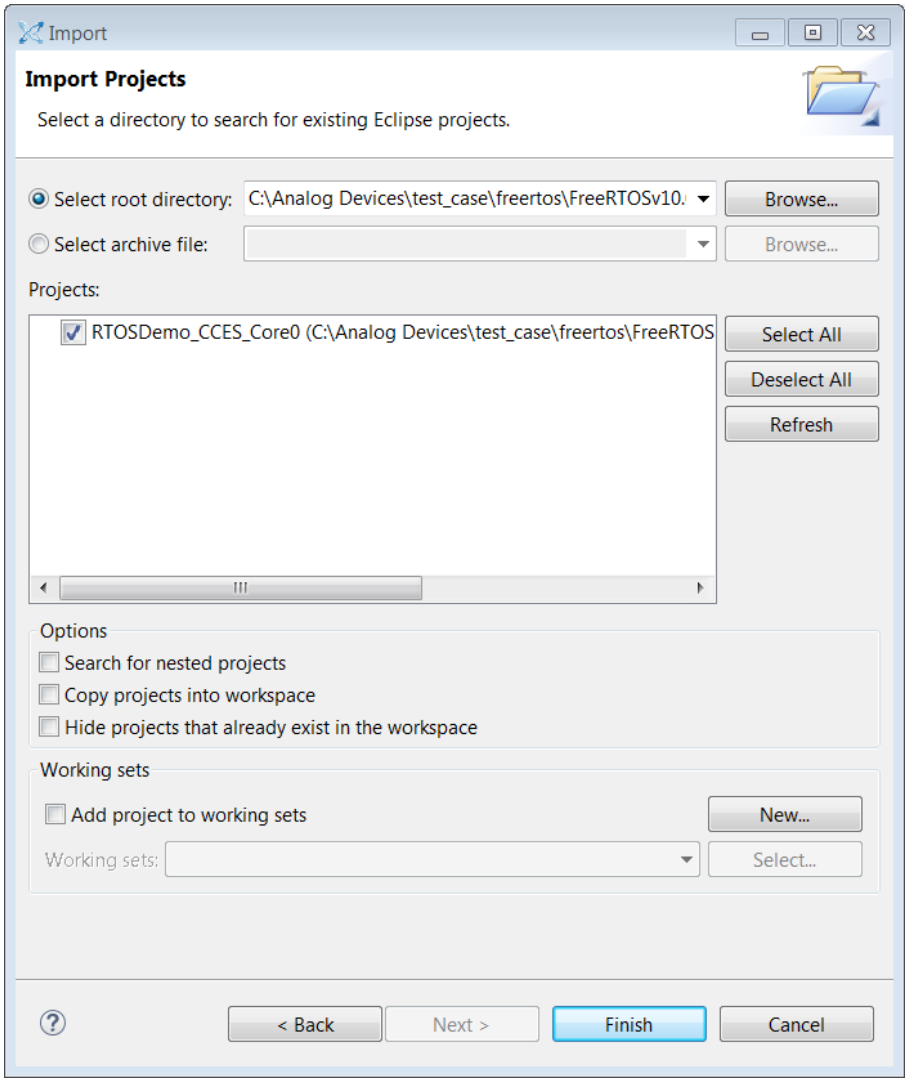


5.1.3 Build the Example

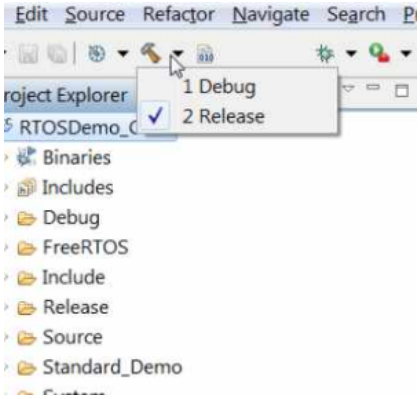
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\CORTEX_A5_ADSP_SC589_CCES** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Import**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

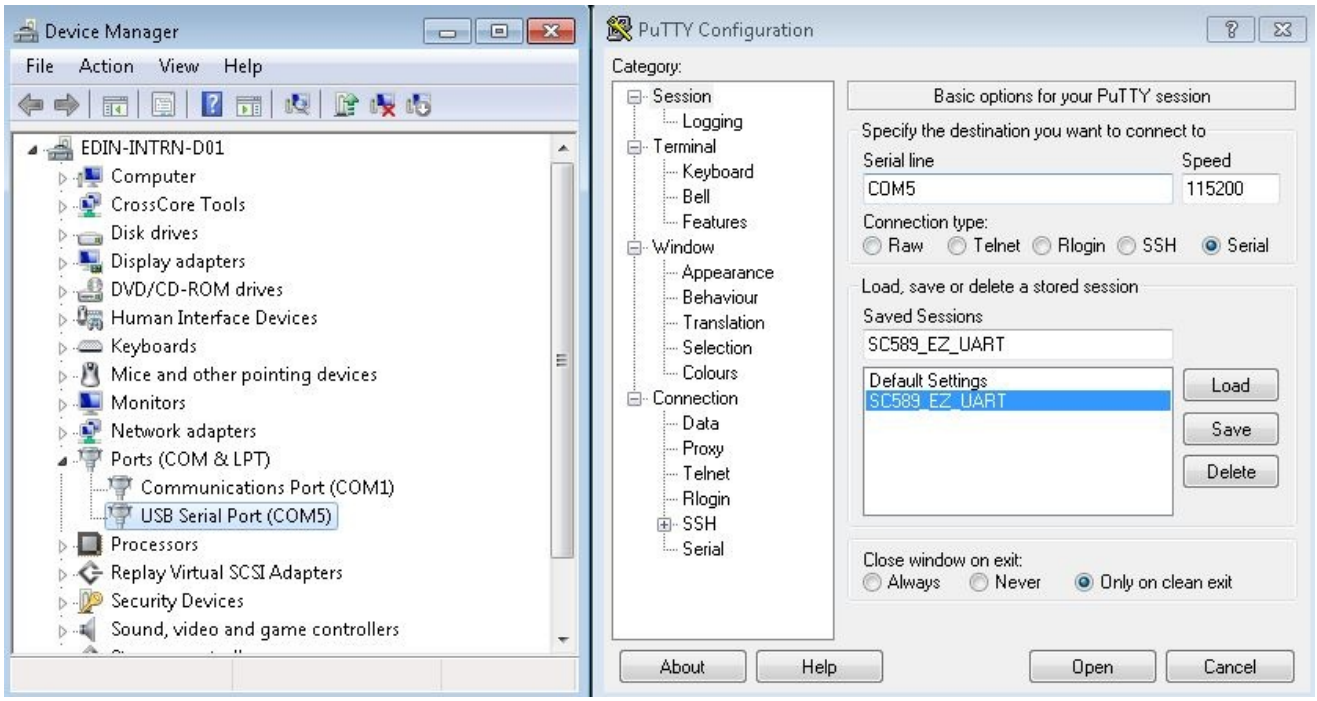
- In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Build Project** option from the menu

5.1.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed outwith a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device).

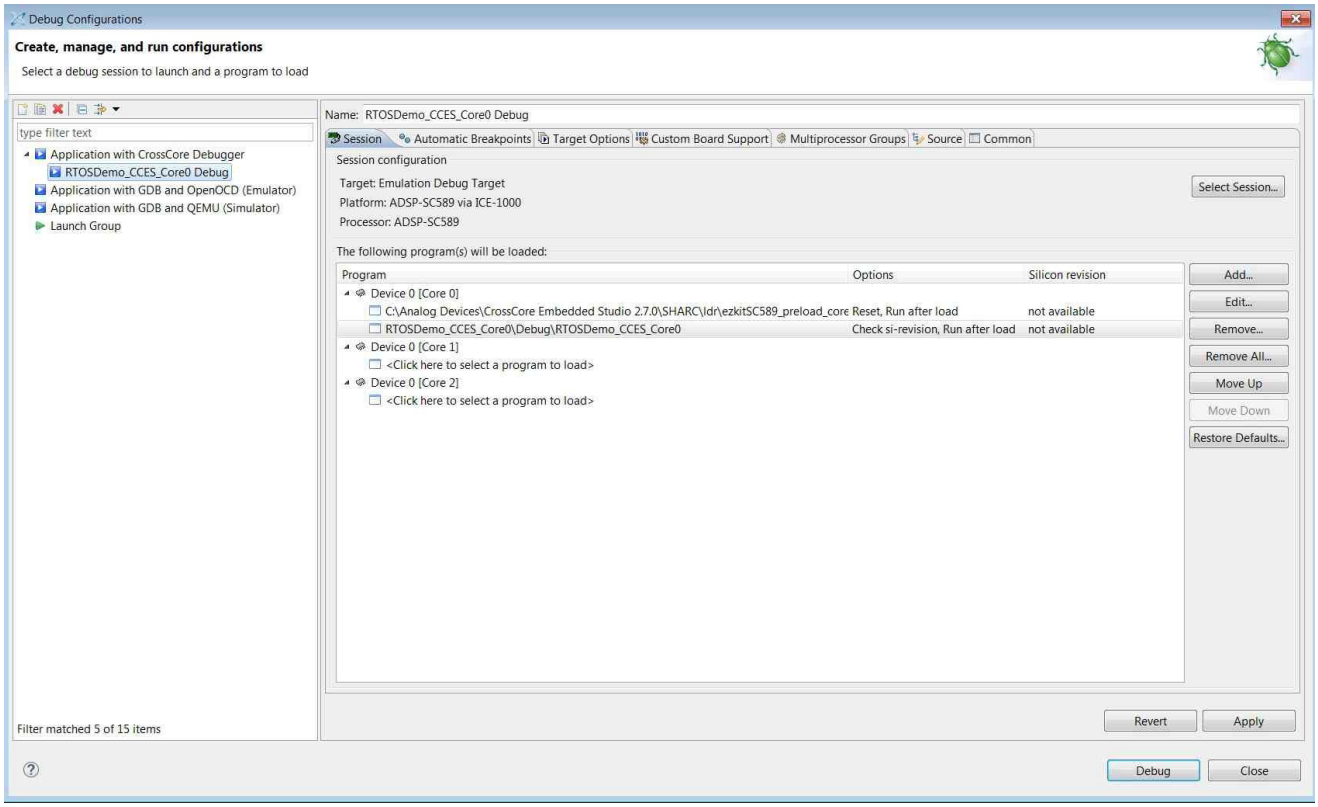
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



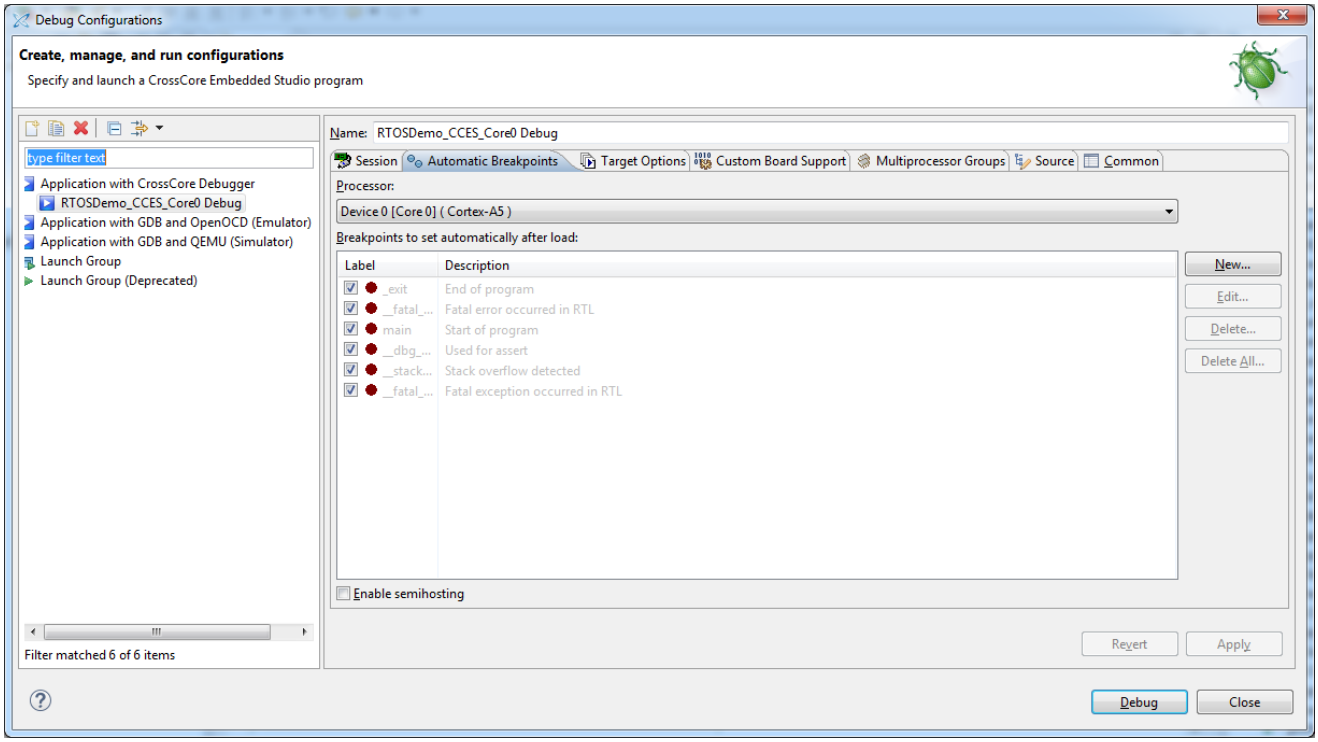
After this, follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Debug As** option from the menu

2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board

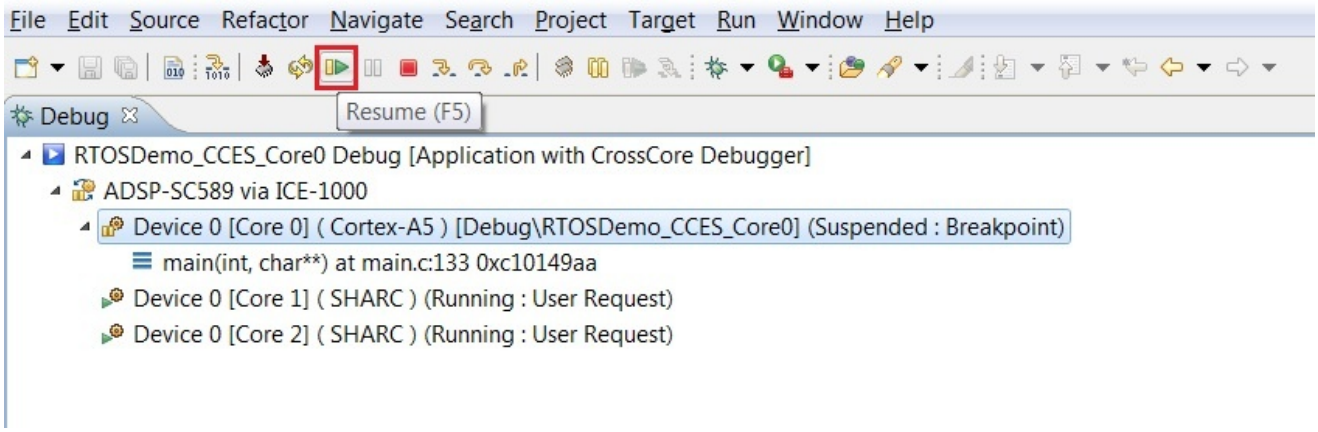


3 . Disable the **semihosting** function in **Automatic Breakpoints**



4. Click the **Debug** button to close the **Debug Configurations** window

5. Click the **Run/Resume** button to start running your application



5.1.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see the LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if all the tests passed.

5.2 Running the Basic Example for SHARC+ on ADSP-SC589 EZ-Kit with CrossCore Embedded Studio

5.2.1 Overview

This page describes the steps to build and run basic example for SHARC+ on ADSP-SC589 EZ-Kit board using CrossCore Embedded Studio.

5.2.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

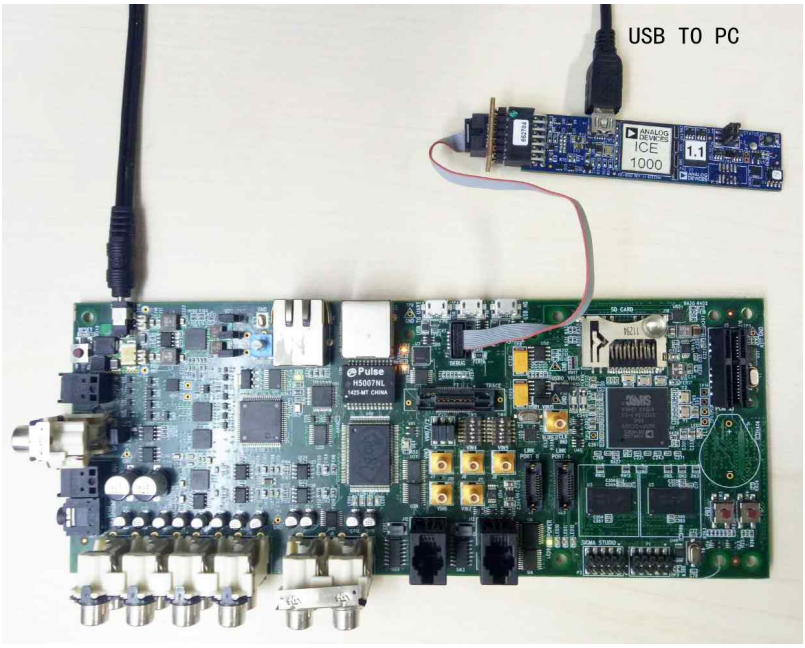
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more information please refer to Get the source code ready

Hardware Setup

- An ADSCP-SC589 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P3** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 5 volts as in the diagram below.

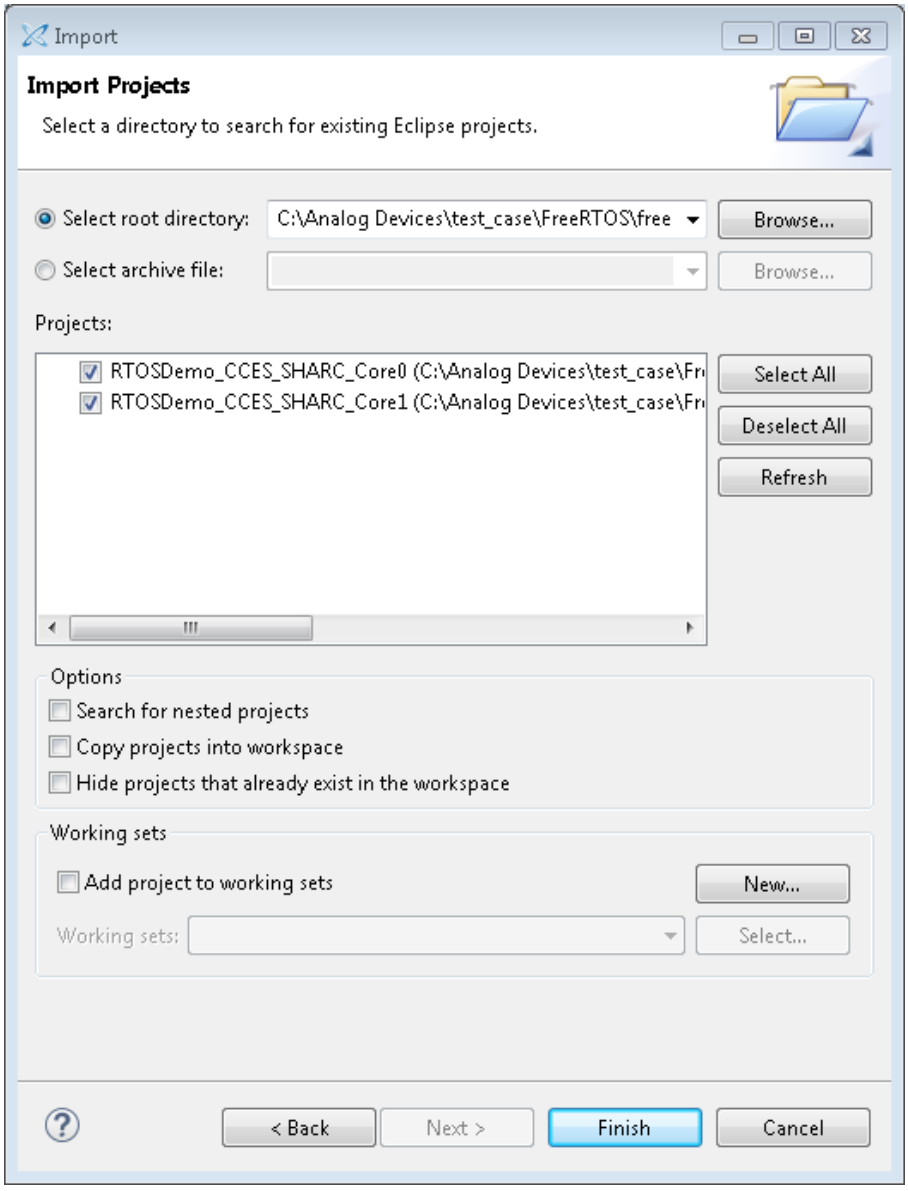


5.2.3 Build the Example

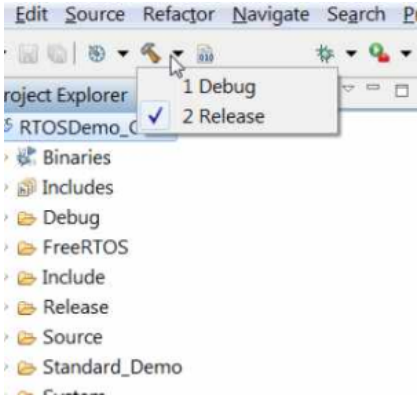
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\SHARC_ADSP_SC589_CCES** folder
- Click **Finish** to close the file browser dialog
- Two projects should appear in the **Project Explorer**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

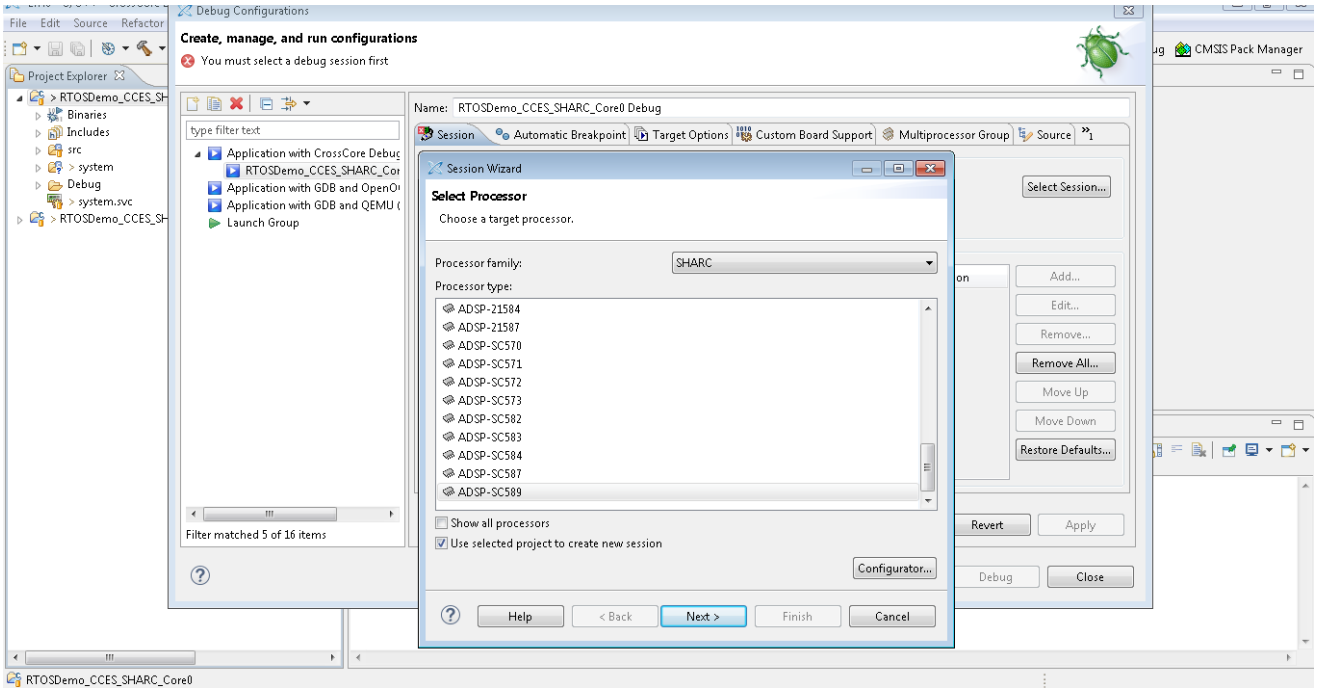
- In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** and **RTOSDemo_CCES_SHARC_Core1** project, then select the **Build Project** option from the menu

5.2.4 Run the Example

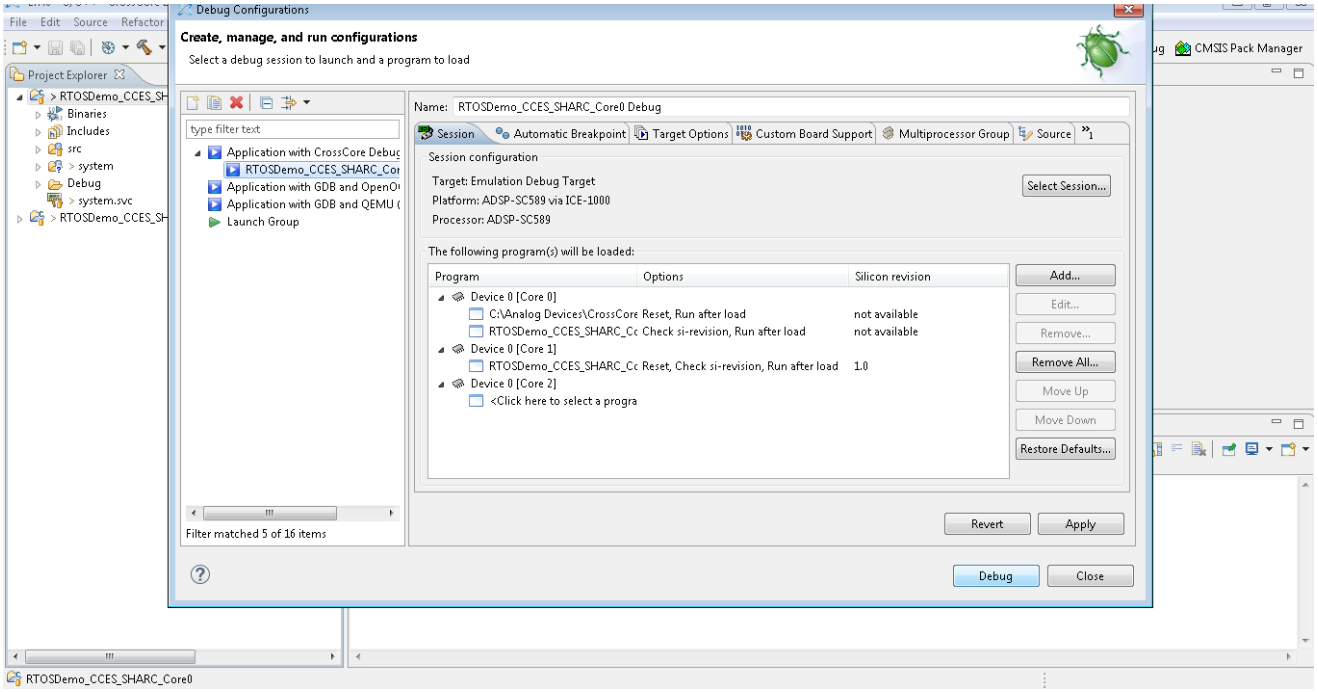
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** project and select the **Debug As** option from the menu

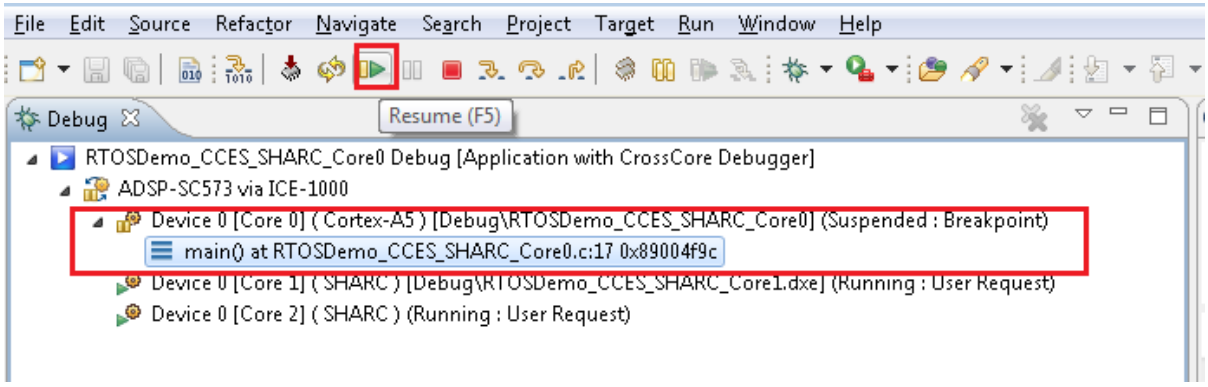
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



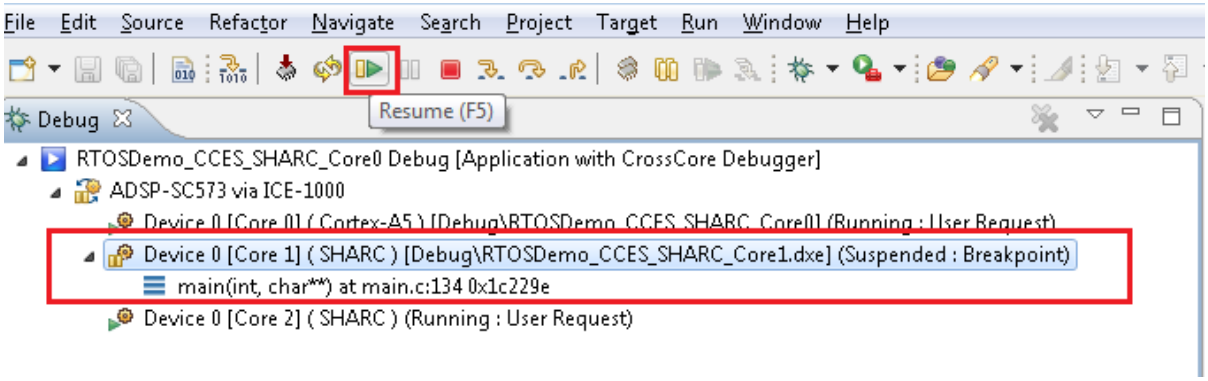
3. Click the **Debug** button to close the **Debug ConfigurationS** window



4. Choose Core0 and click the **Run/Resume** button to start running Core0 application

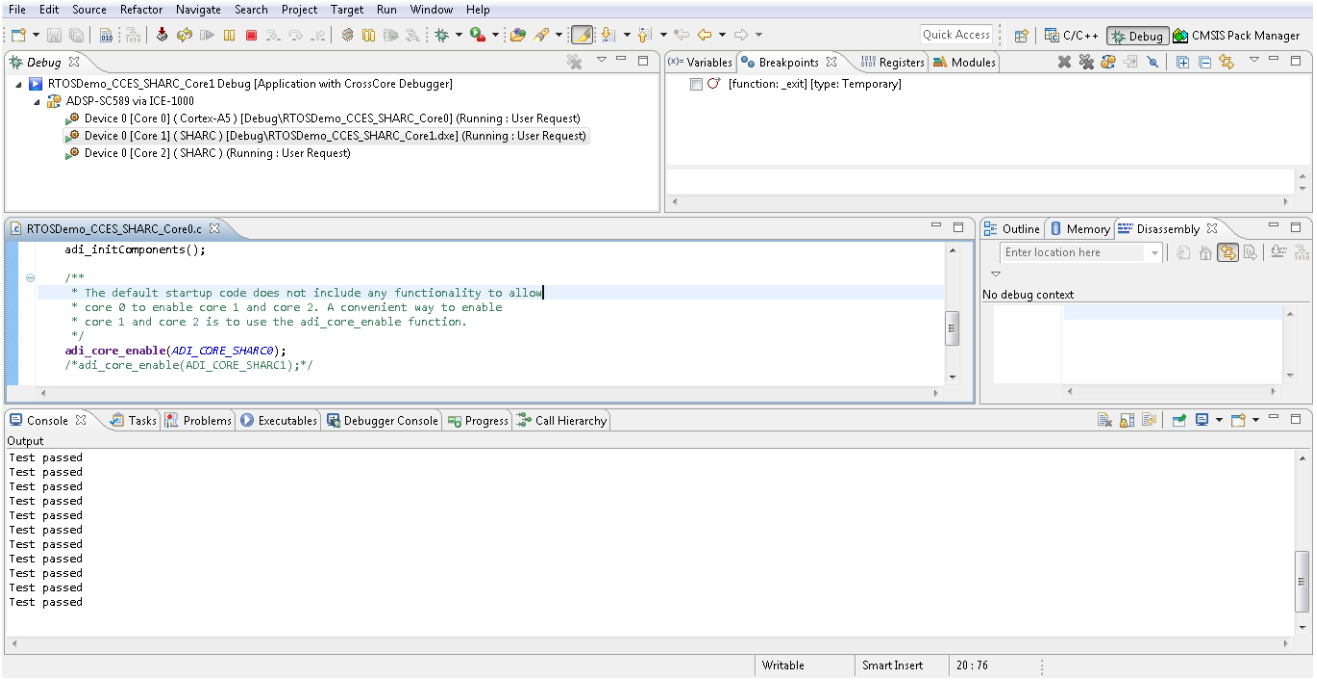


5. Then Choose Core1 and keep to click **Run/Resume** button to start running Core1 application



5.2.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if the all tests passed.



5.3 Running the LwIP Example for ARM on ADSP-SC589 EZ-Kit with CrossCore Embedded Studio

5.3.1 Overview

This page describes the steps to build and run the LwIP Example for ARM on ADSP-SC589 EZ-Kit with CrossCore Embedded Studio.

5.3.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

Software Requirement

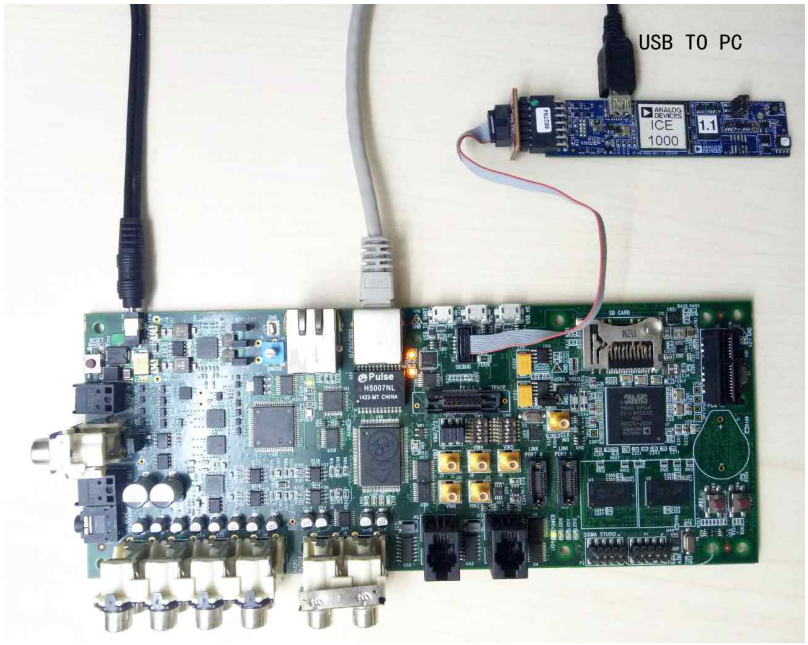
- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio

- FreeRTOS product and the Analog Devices FreeRTOS product. For more information please refer to Get the source code ready

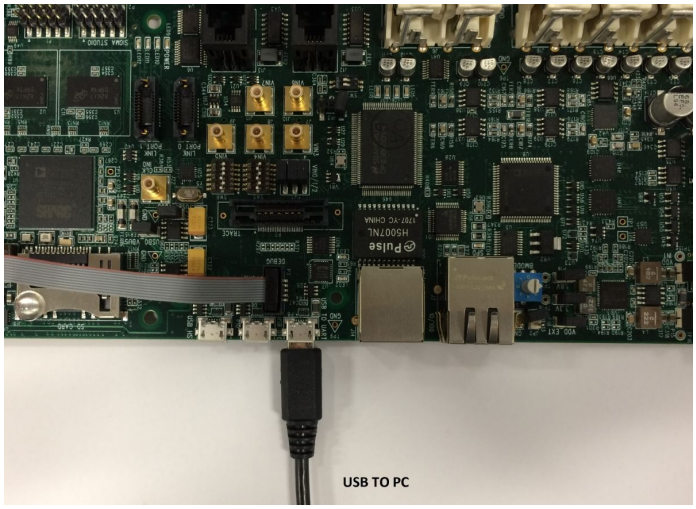
Hardware Setup

- An ADSCP-SC589 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P3** port of EZ-Kit and the host PC using USB cable, connect the target board to the same LAN as PC using standard network cable and simultaneously connect the power supply with 5 volts as in the diagram below.



Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:

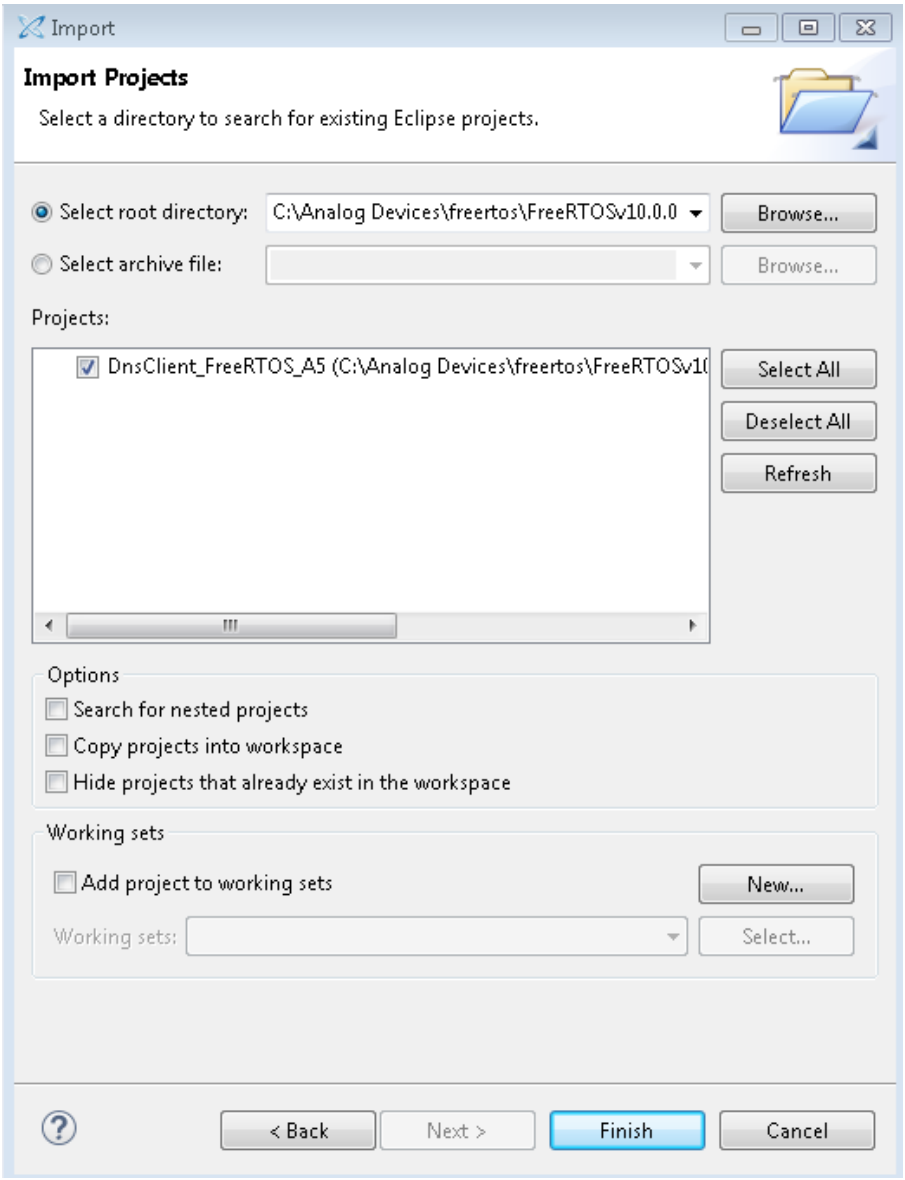


5.3.3 Build the Example

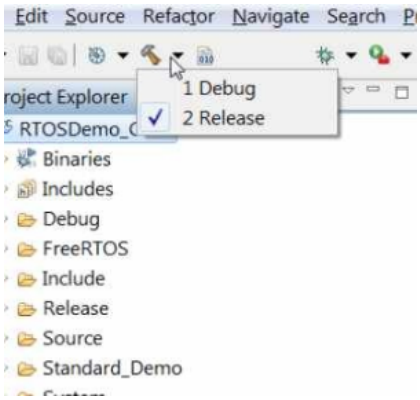
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_A5_ADSP_SC589_CCES_LwIP** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **Project Explorer**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

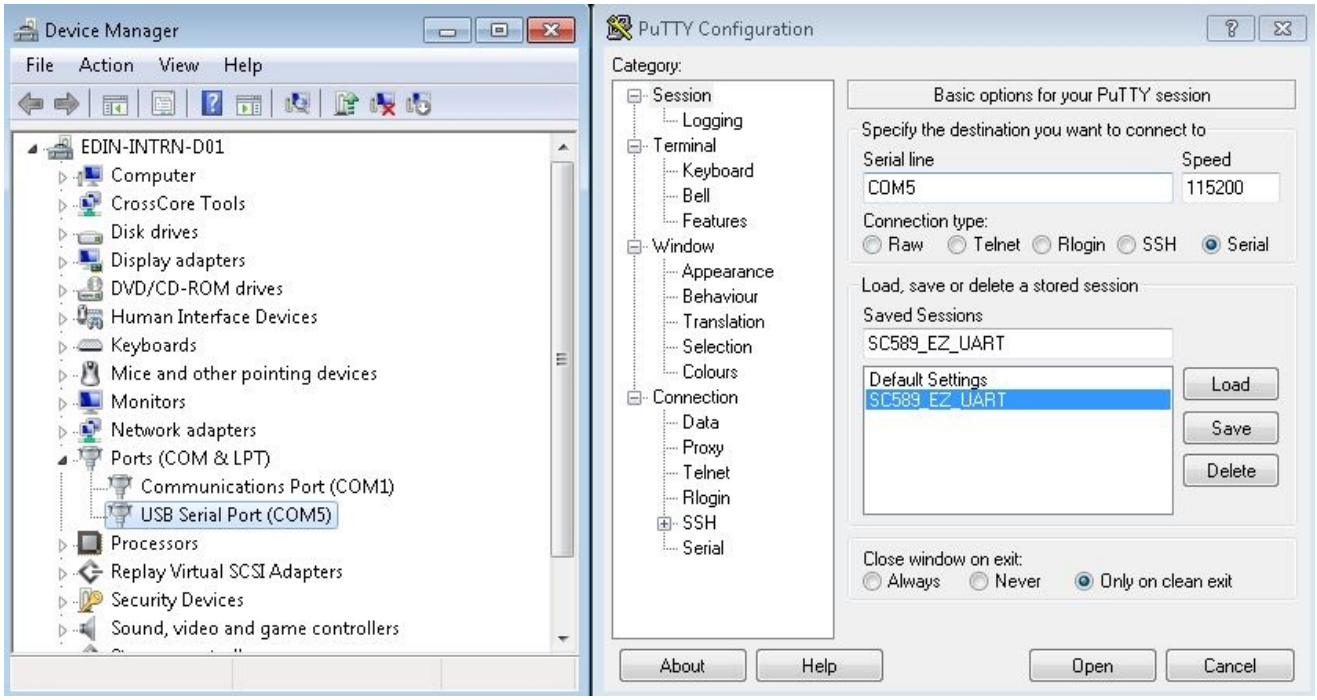
- In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Build Project** option from the menu

5.3.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed out with a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device).

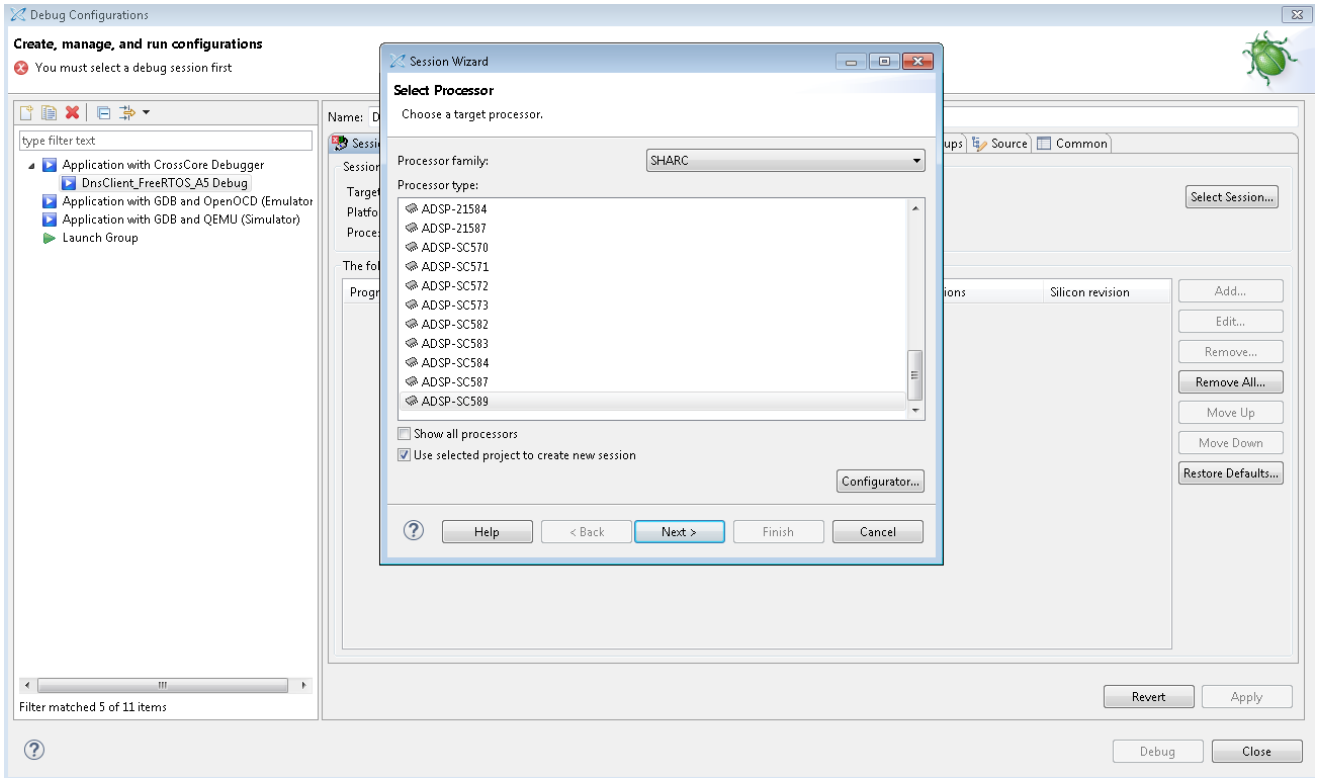
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



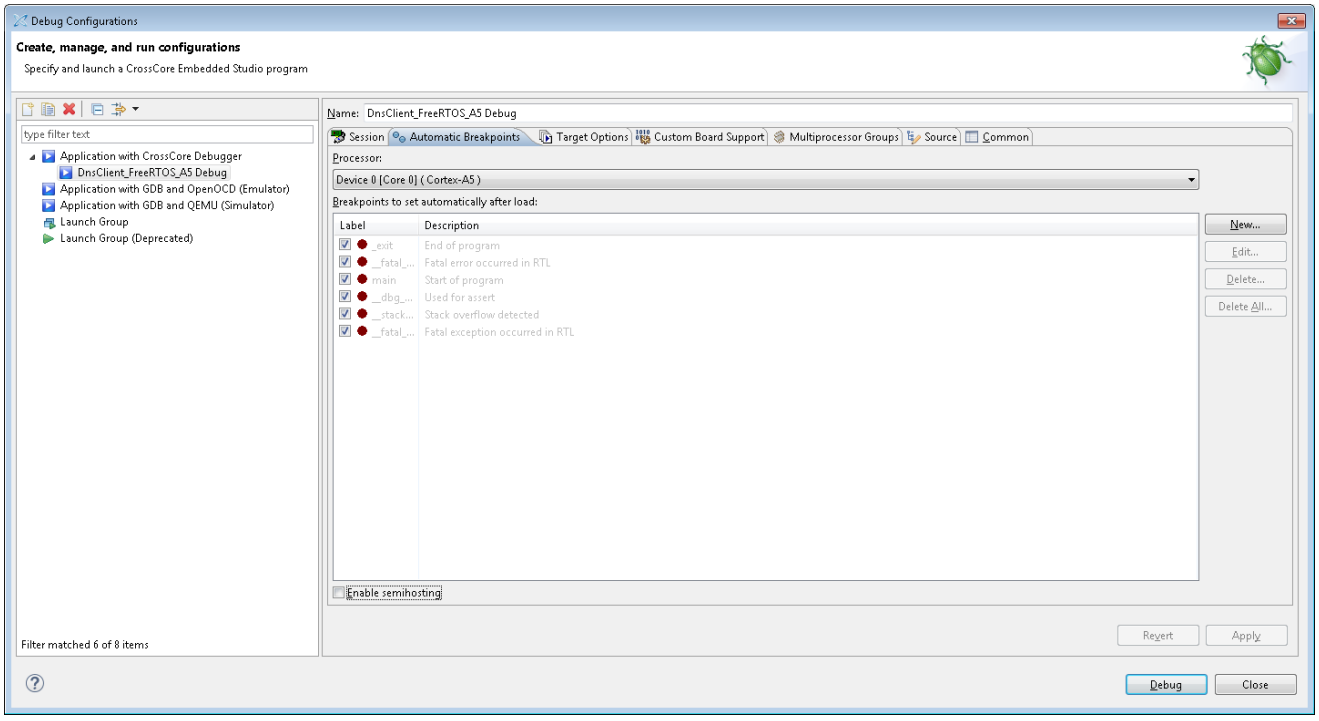
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Debug As** option from the menu

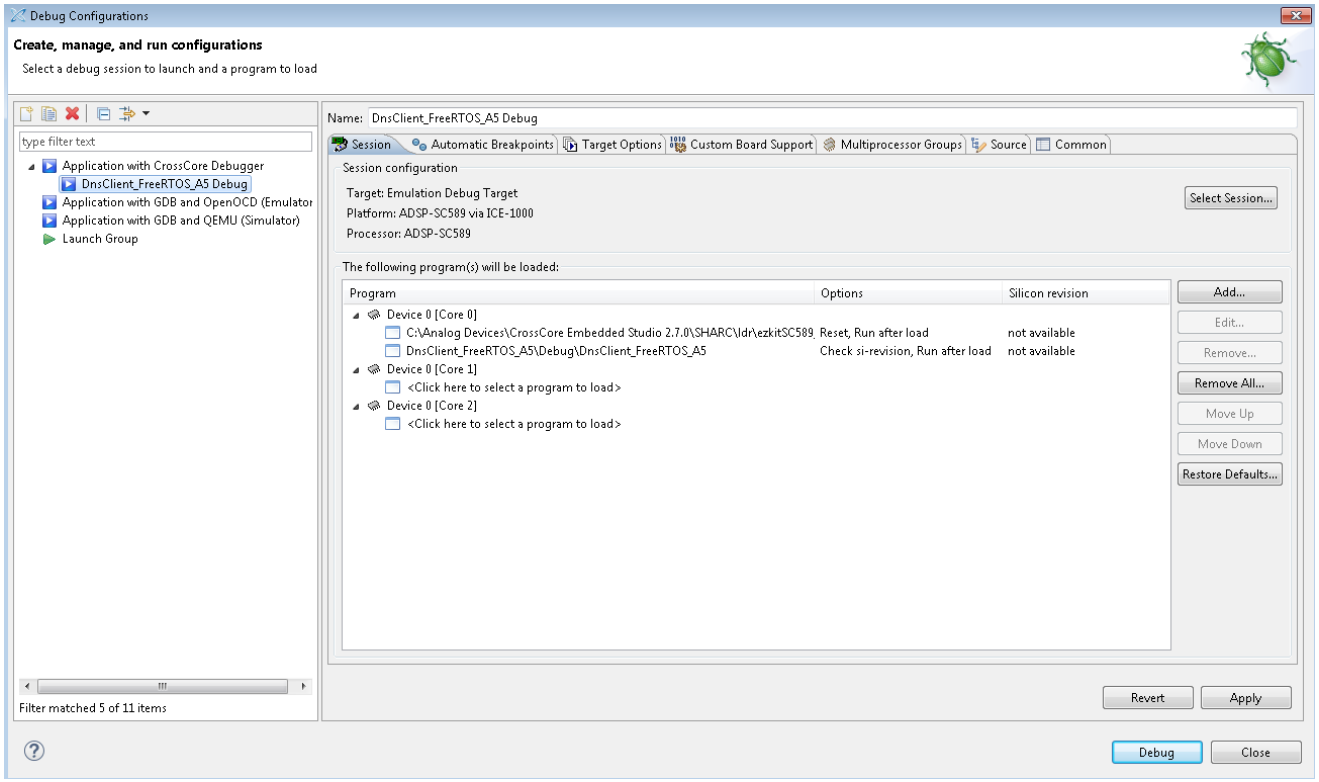
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



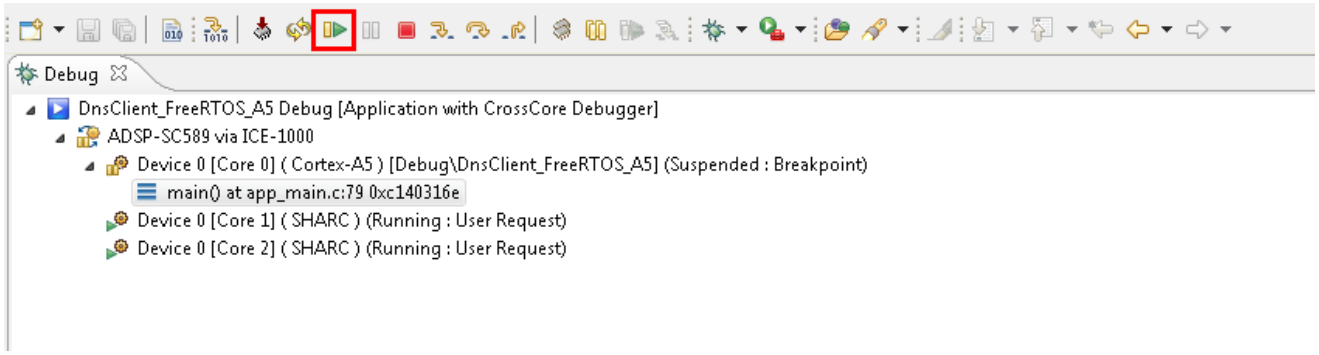
3. Disable the semihosting function in Automatic Breakpoints



4. Click the **Debug** button to close the **Debug Configurations** window

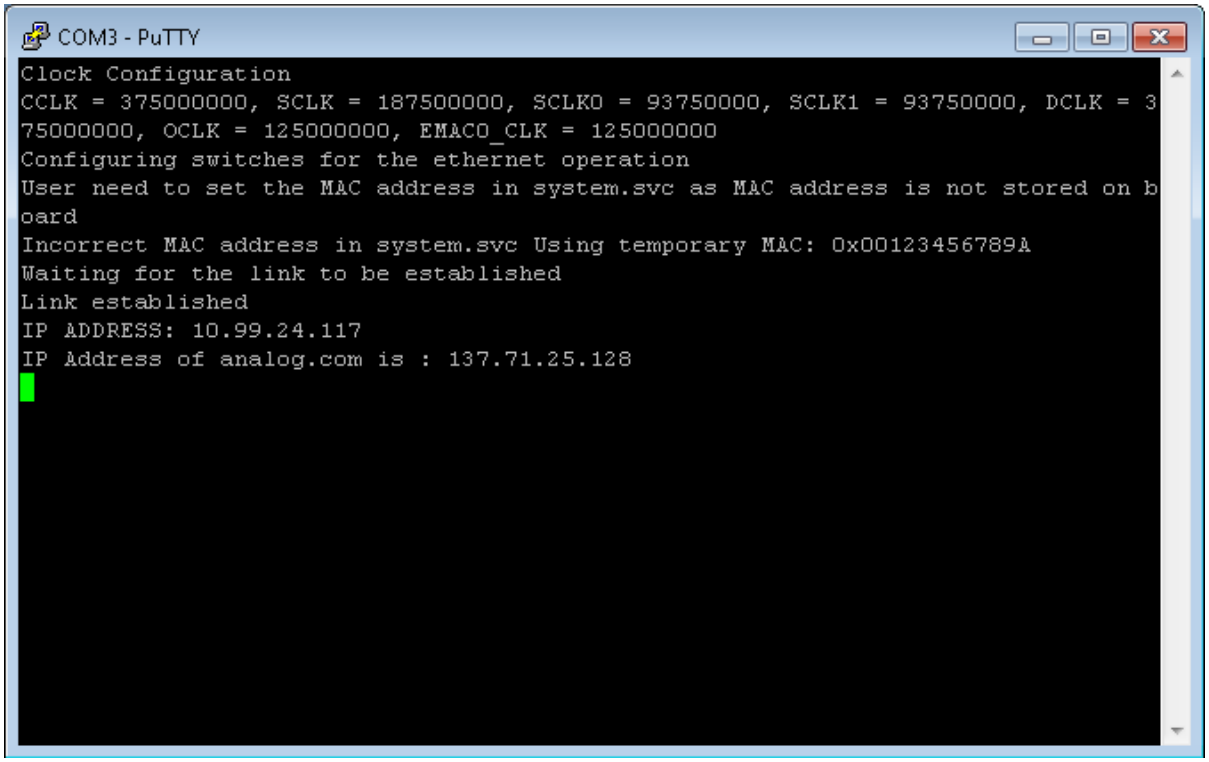


5. Click the **Run/Resume** button to start running your application



5.3.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see link is established, and **IP ADDRESS** assigned from DHCP server will be printed after you install the LwIP.


COM3 - PuTTY
Clock Configuration
CCLK = 375000000, SCLK = 187500000, SCLK0 = 93750000, SCLK1 = 93750000, DCLK = 3
75000000, OCLK = 125000000, EMAC0_CLK = 125000000
Configuring switches for the ethernet operation
User need to set the MAC address in system.svc as MAC address is not stored on b
oard
Incorrect MAC address in system.svc Using temporary MAC: 0x00123456789A
Waiting for the link to be established
Link established
IP ADDRESS: 10.99.24.117
IP Address of analog.com is : 137.71.25.128

6 Running the Examples on the ADSP-SC584 EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Core	Toolchain	Example(s)
ADSP-SC584	ARM A5	CrossCore Embedded Studio	Basic Demo
ADSP-SC584	ARM A5	CrossCore Embedded Studio	Lwip Demo
ADSP-SC584	SHARC+	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System. For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

6.1 Running the Basic Example for ARM on ADSP-SC584 EZ-Kit with CrossCore Embedded Studio

6.1.1 Overview

This page describes the steps to build and run basic example for ARM on ADSP-SC584 EZ-Kit board using CrossCore Embedded Studio.

6.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

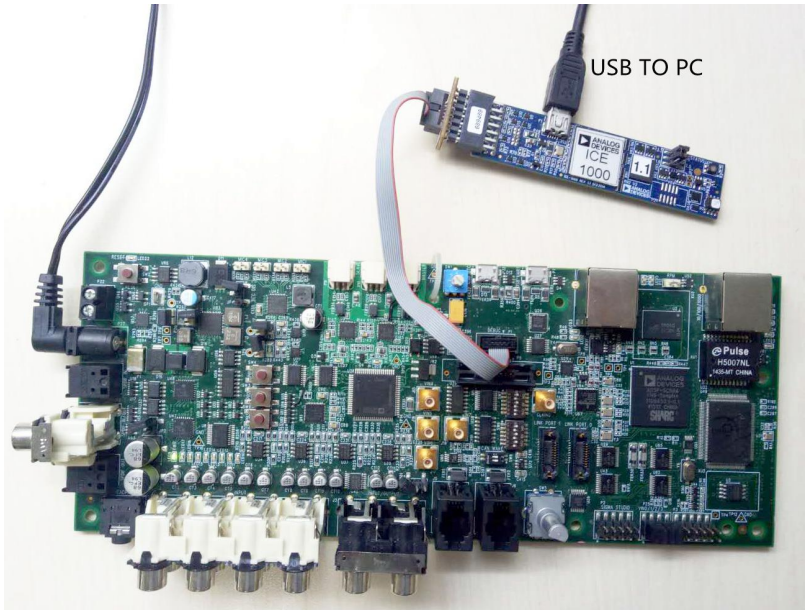
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSCP-SC584 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 12 volts as in the diagram below.



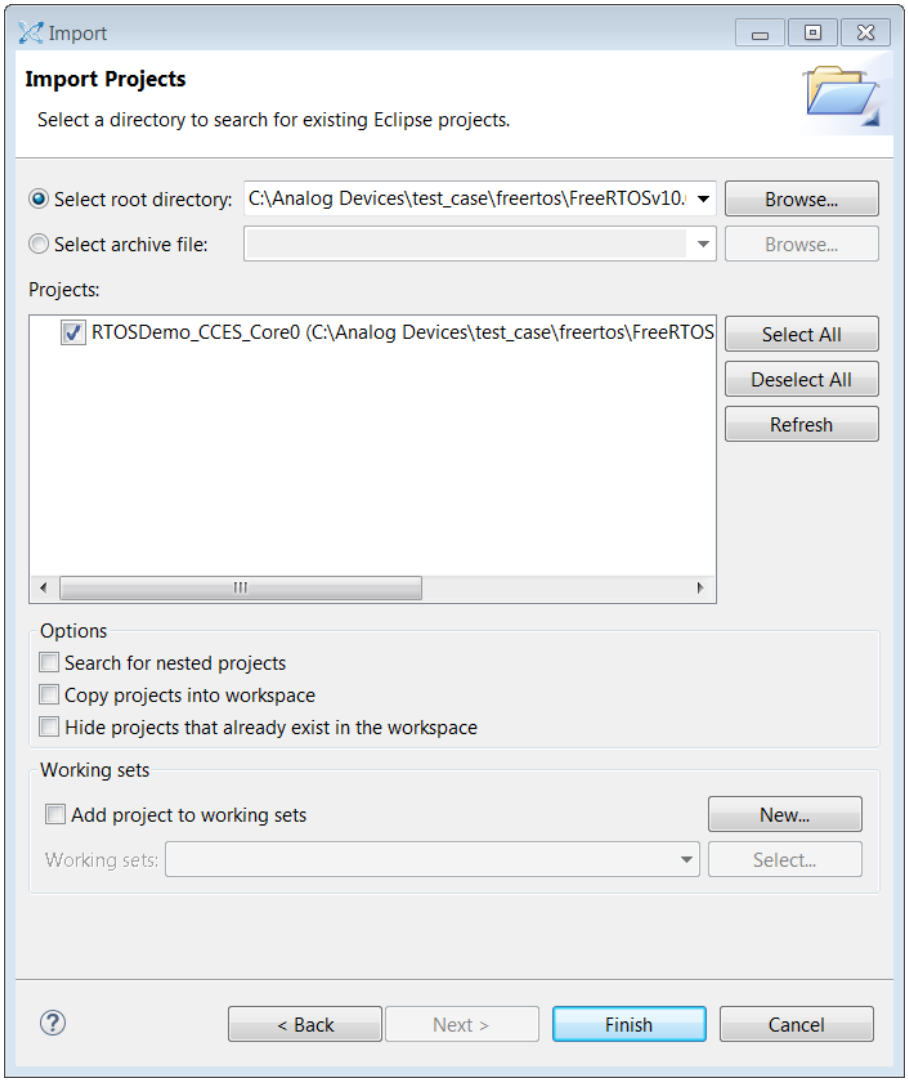
Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:

6.1.3 Build the Example

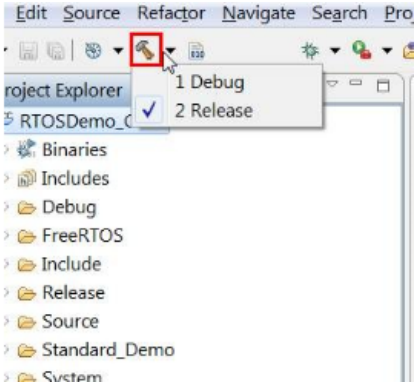
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\CORTEX_A5_ADSP_SC584_CCES** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Import**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

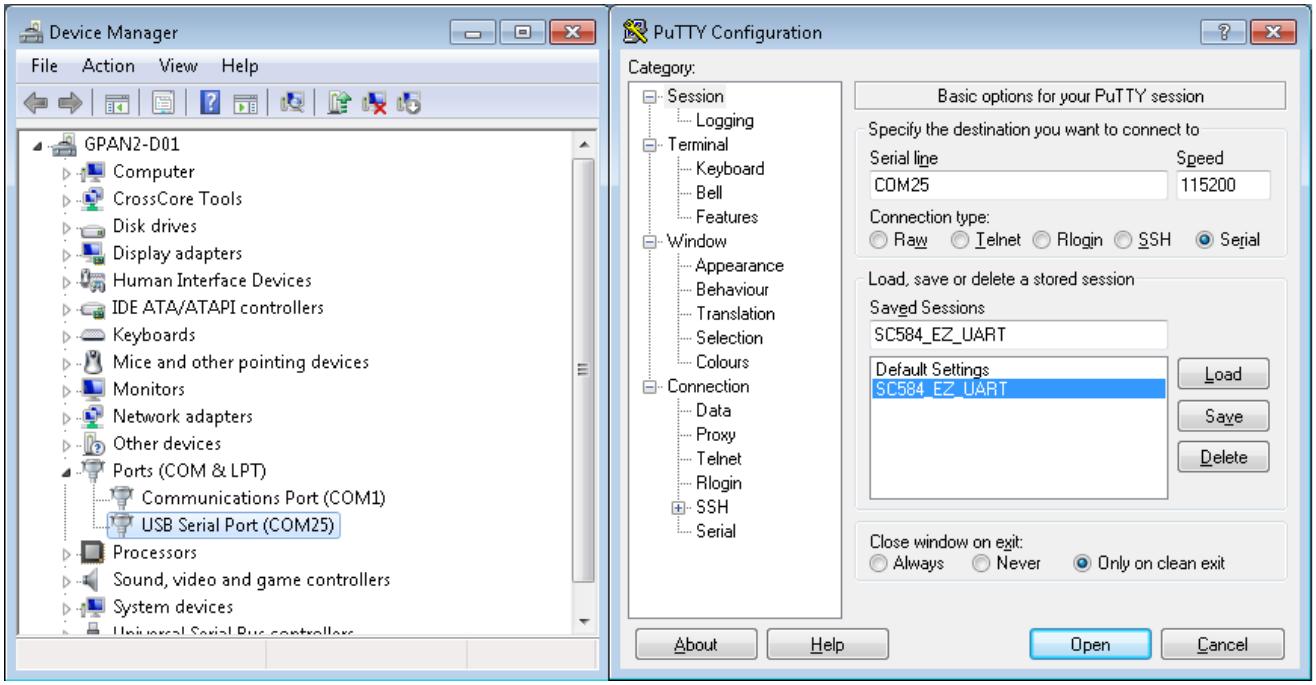
- In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Build Project** option from the menu

6.1.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed outwith a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device.)

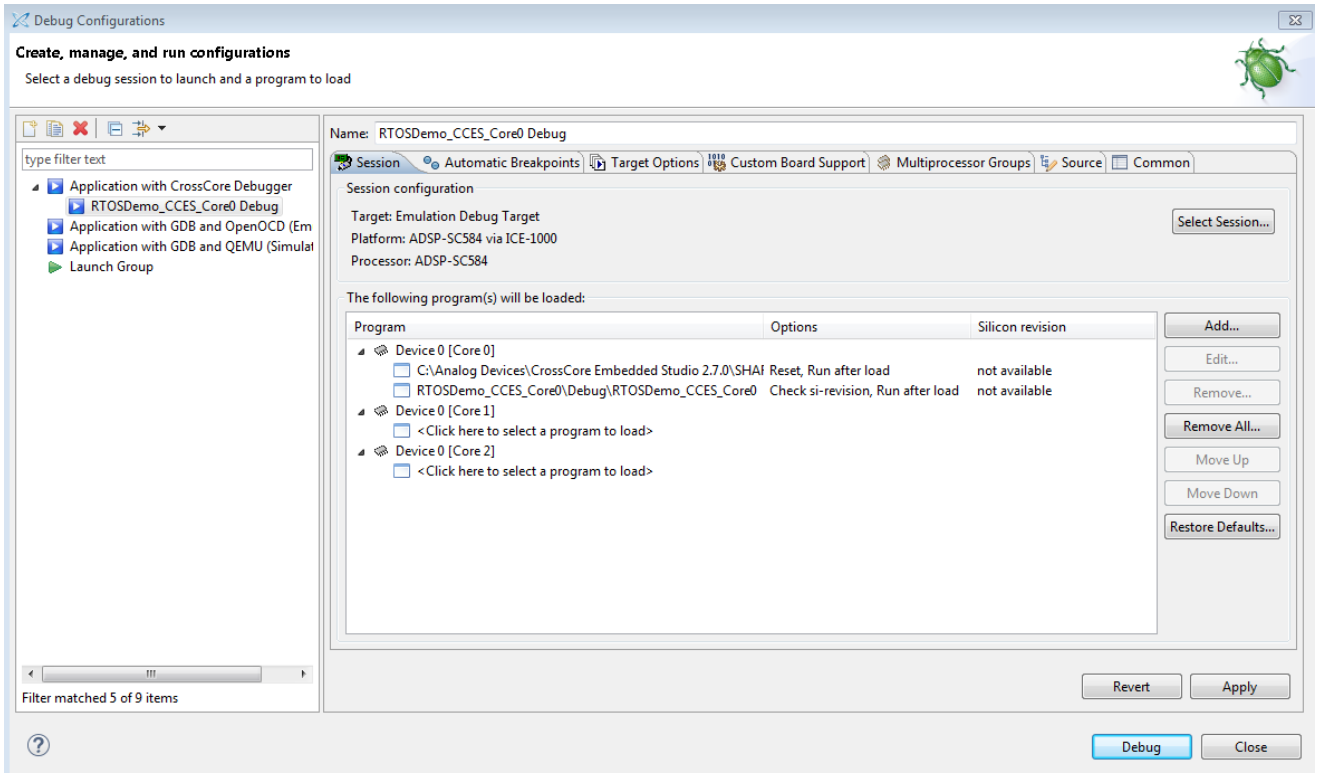
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



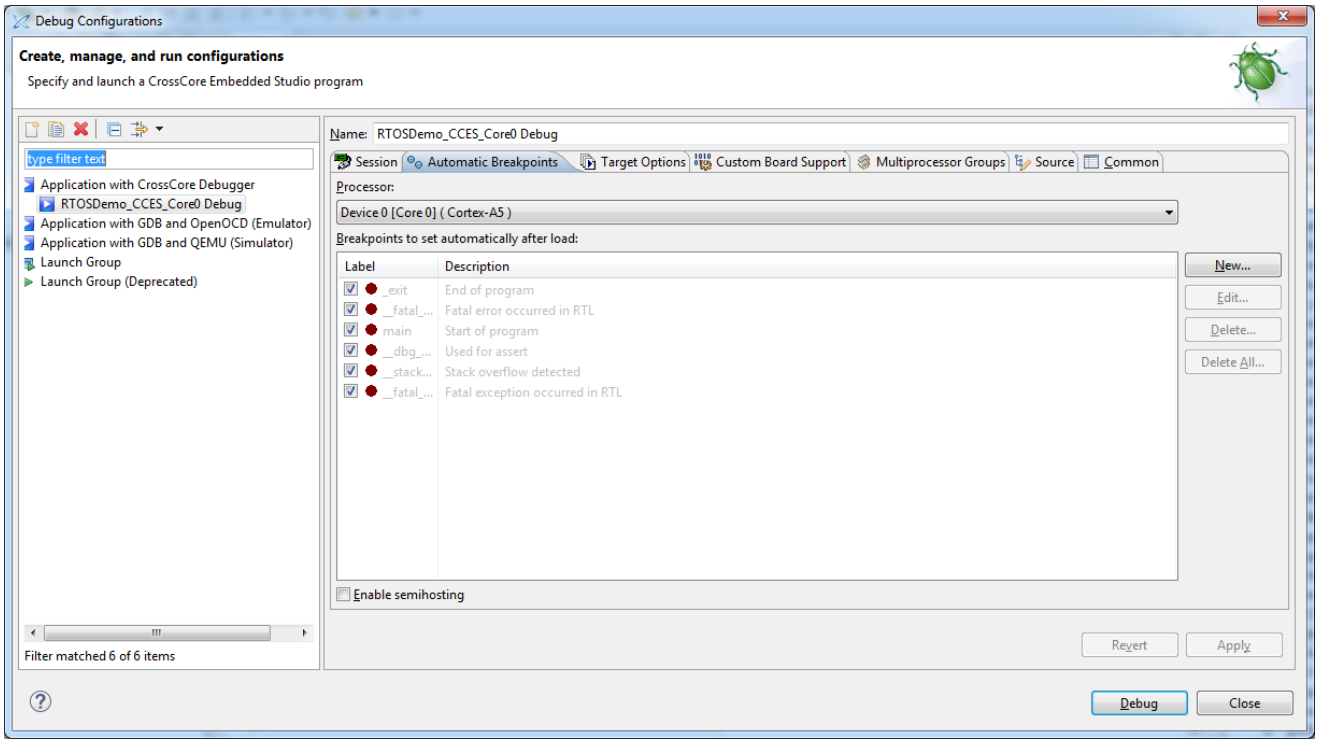
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Debug As** option from the menu

2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board

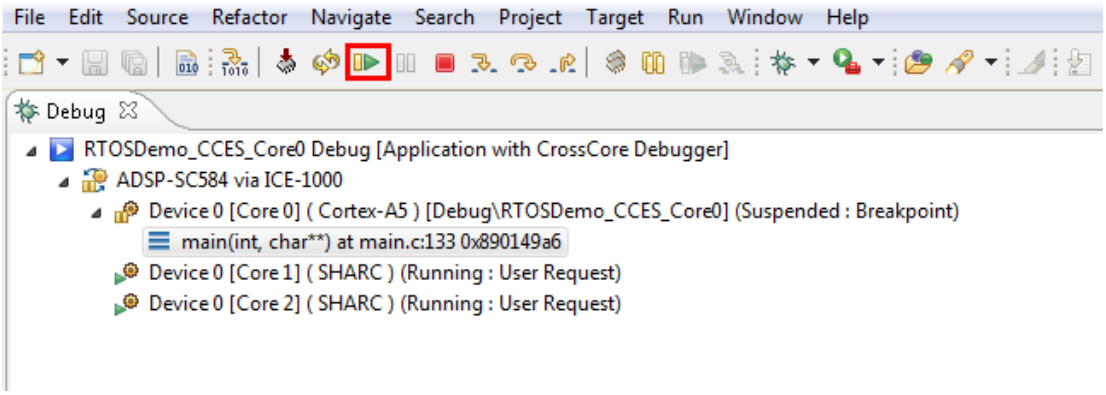


3. Disable the **semihosting** function in **Automatic Breakpoints**



4. Click the **Debug** button to close the **Debug Configurations** window

5. Click the **Run/Resume** button to start running your application



6.1.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see the LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if all the tests passed.

6.2 Running the Basic Example for SHARC+ on ADSP-SC584 EZ-Kit with CrossCore Embedded Studio

6.2.1 Overview

This page describes the steps to build and run basic example for SHARC+ on ADSP-SC584 EZ-Kit board using CrossCore Embedded Studio.

6.2.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

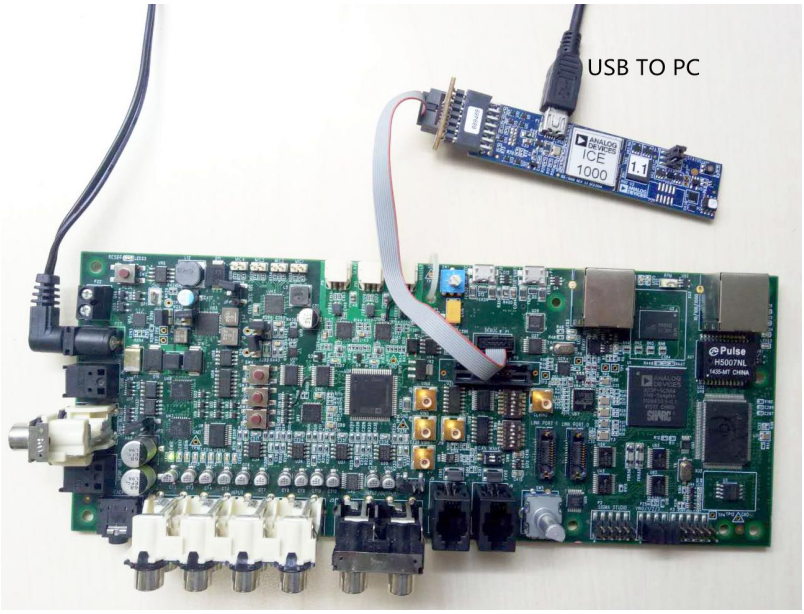
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSCP-SC584 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 12 volts as in the diagram below.

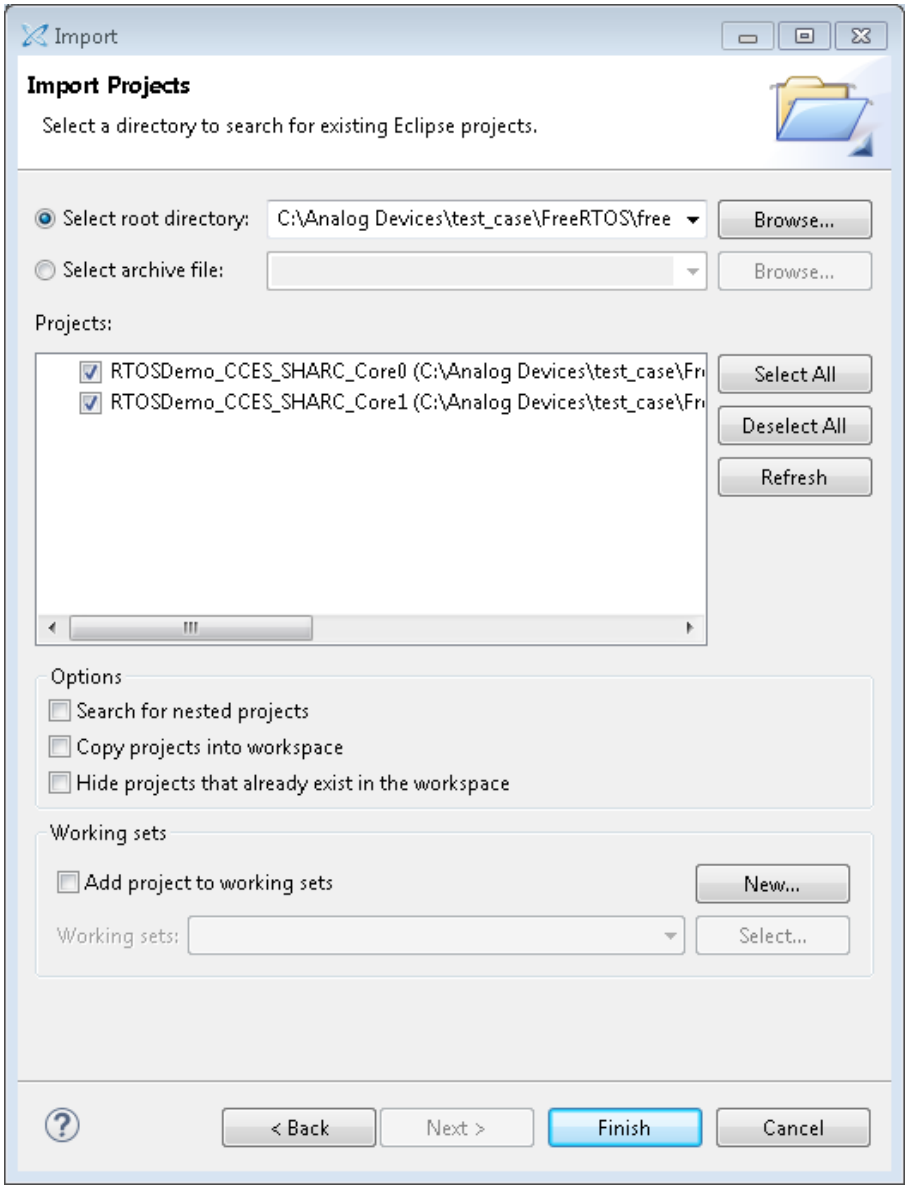


6.2.3 Build the Example

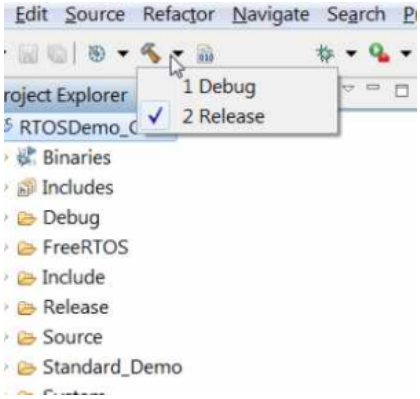
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- When the **Import** project window appears:
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\SHARC_ADSP_SC584_CCES** folder
- Click **Finish** to close the file browser dialog
- Two projects should appear in the **Project Explorer**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

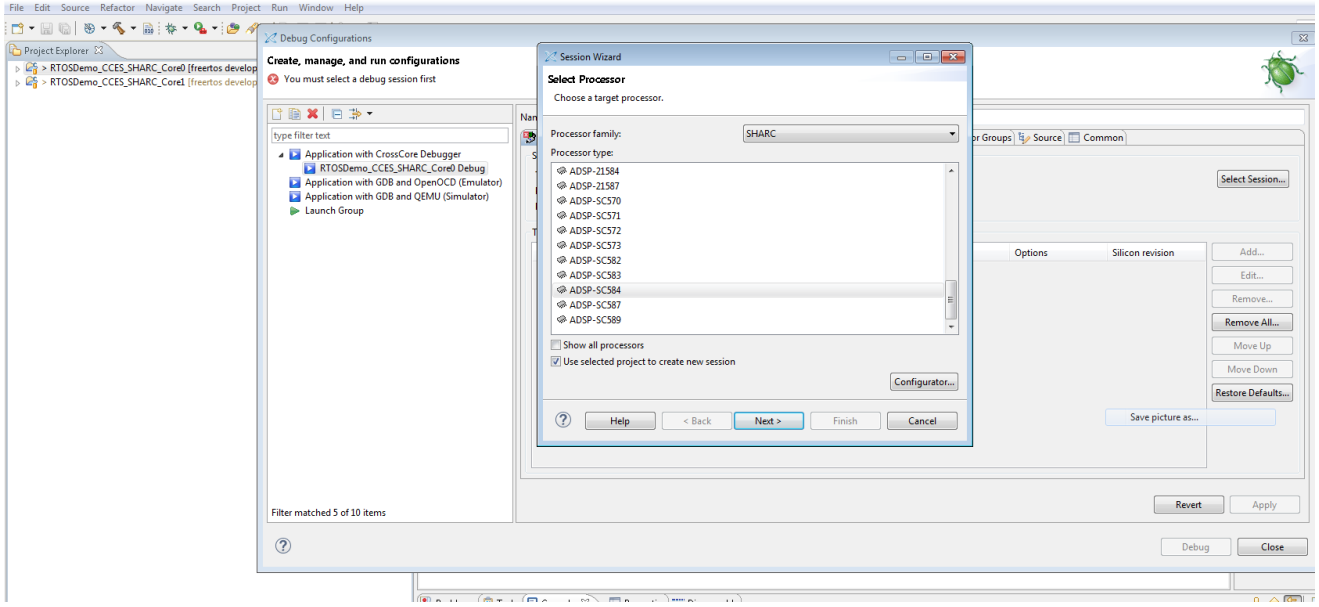
- In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** and **RTOSDemo_CCES_SHARC_Core1** project, then select the **Build Project** option from the menu

6.2.4 Run the Example

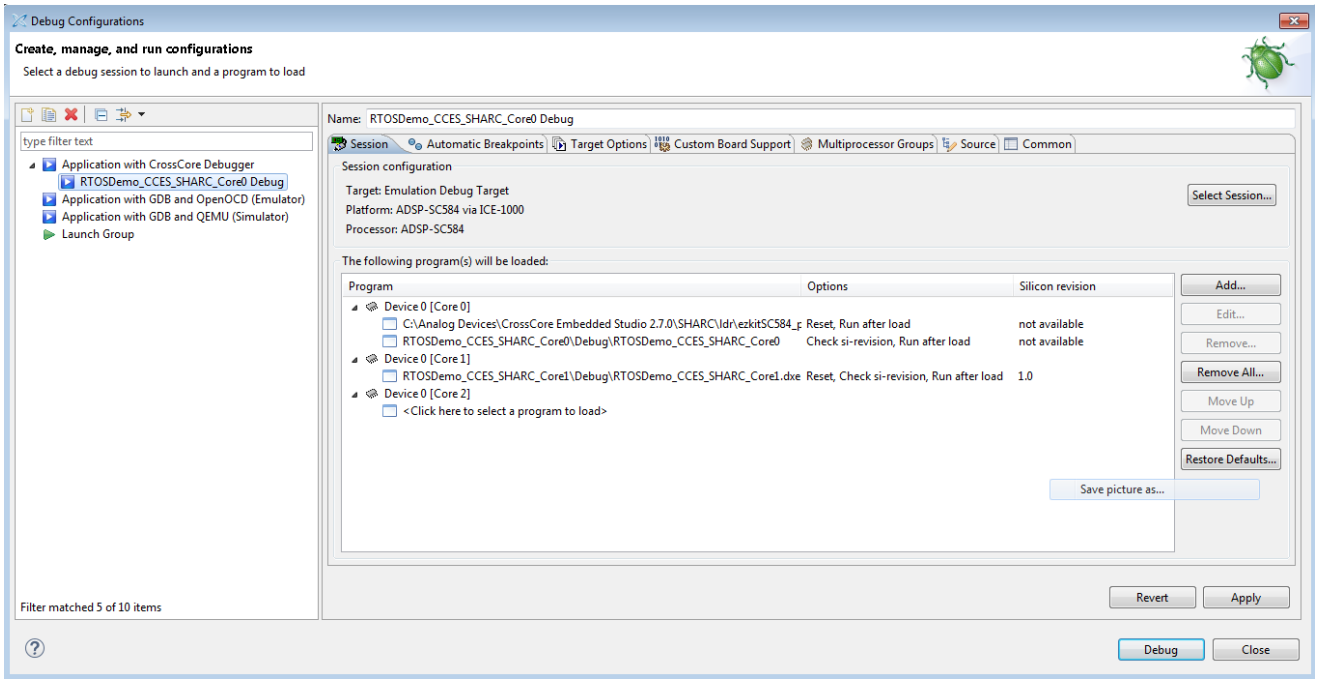
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** project and select the **Debug As** option from the menu

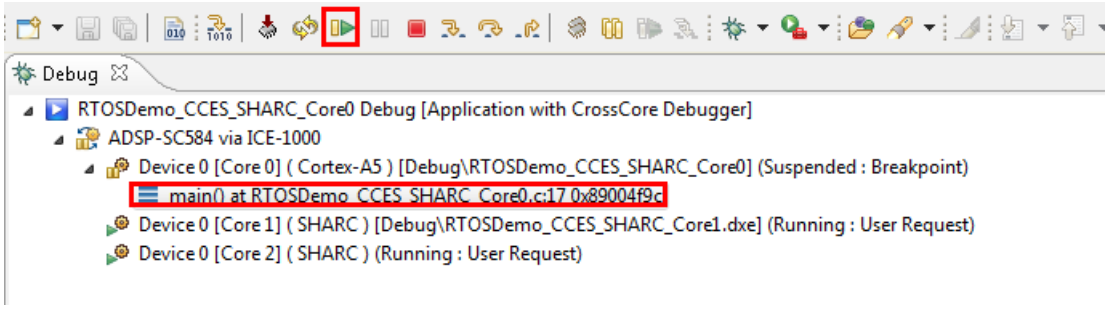
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



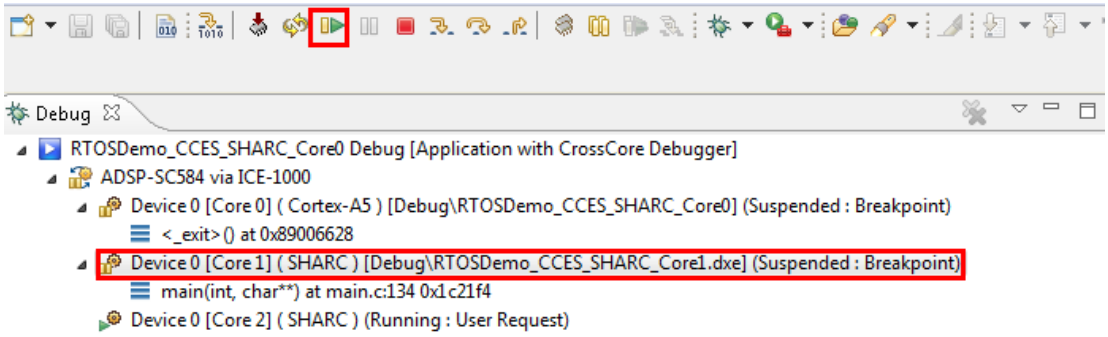
3. Click the **Debug** button to close the **Debug Configurations** window



4. Choose Core0 and click the **Run/Resume** button to start running Core0 application

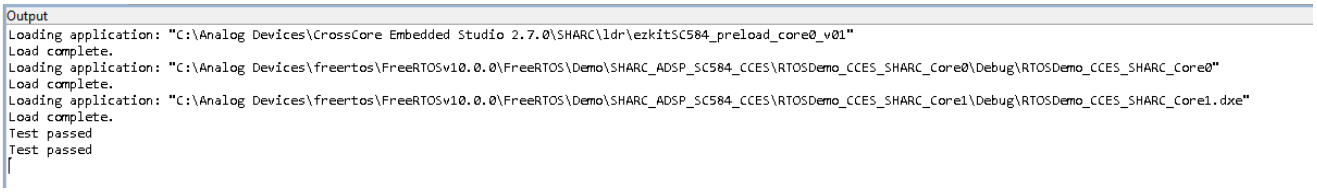


5. Then choose Core1 and keep to click **Run/Resume** button to start running Core1 application



6.2.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if the all tests passed.



6.3 Running the LwIP Example for ARM on ADSP-SC584 EZ-Kit with CrossCore Embedded Studio

6.3.1 Overview

This page describes the steps to build and run the LwIP Example for ARM on ADSP-SC584 EZ-Kit with CrossCore Embedded Studio.

6.3.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

Software Requirement

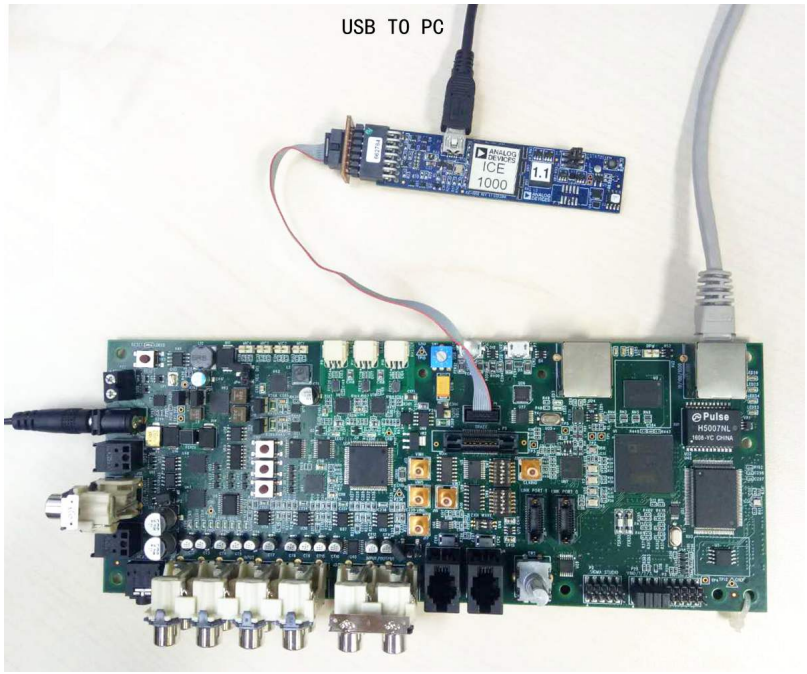
- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSCP-SC584 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable, connect the target board to the same LAN as PC using standard network cable and simultaneously connect the power supply with 12 volts as in the diagram below.

If connect SC584 to the same LAN as PC with 1000M switch, the SC584 EZ-Kit board in **silicon 0.1 can't work with LwIP Example**.



Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:

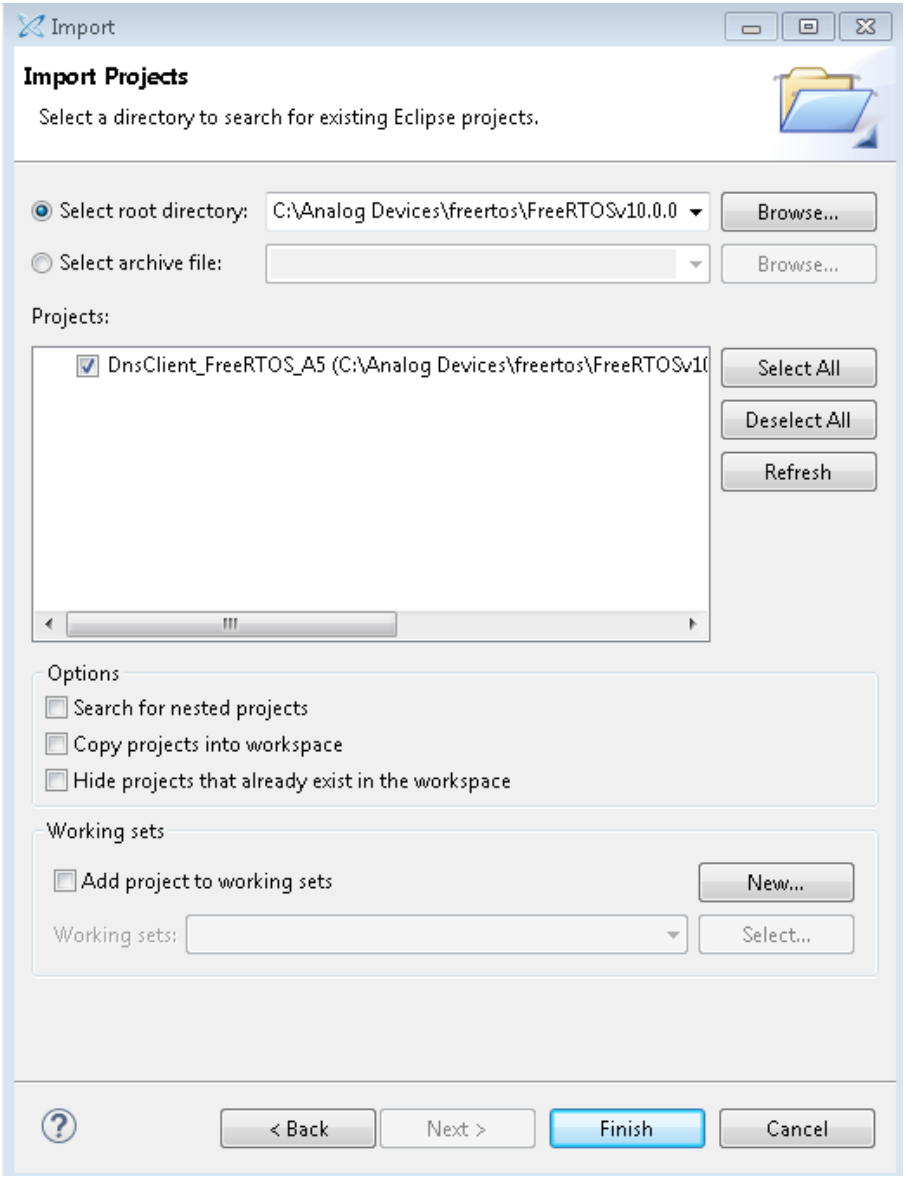
6.3.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

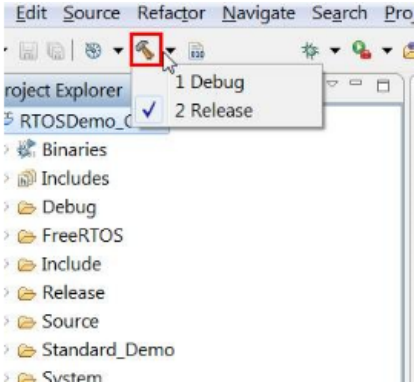
1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button

- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_A5_ADSP_SC584_CCES_LwIP** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Import**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

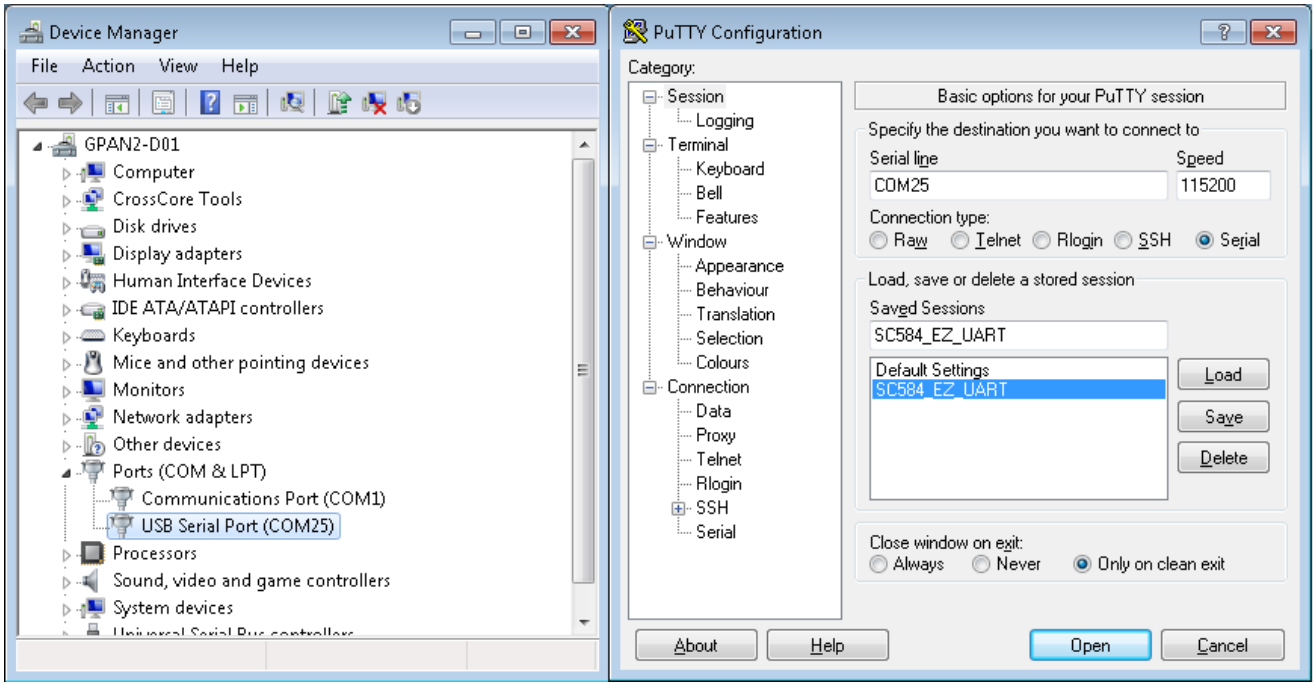
- In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Build Project** option from the menu

6.3.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed outwith a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device.)

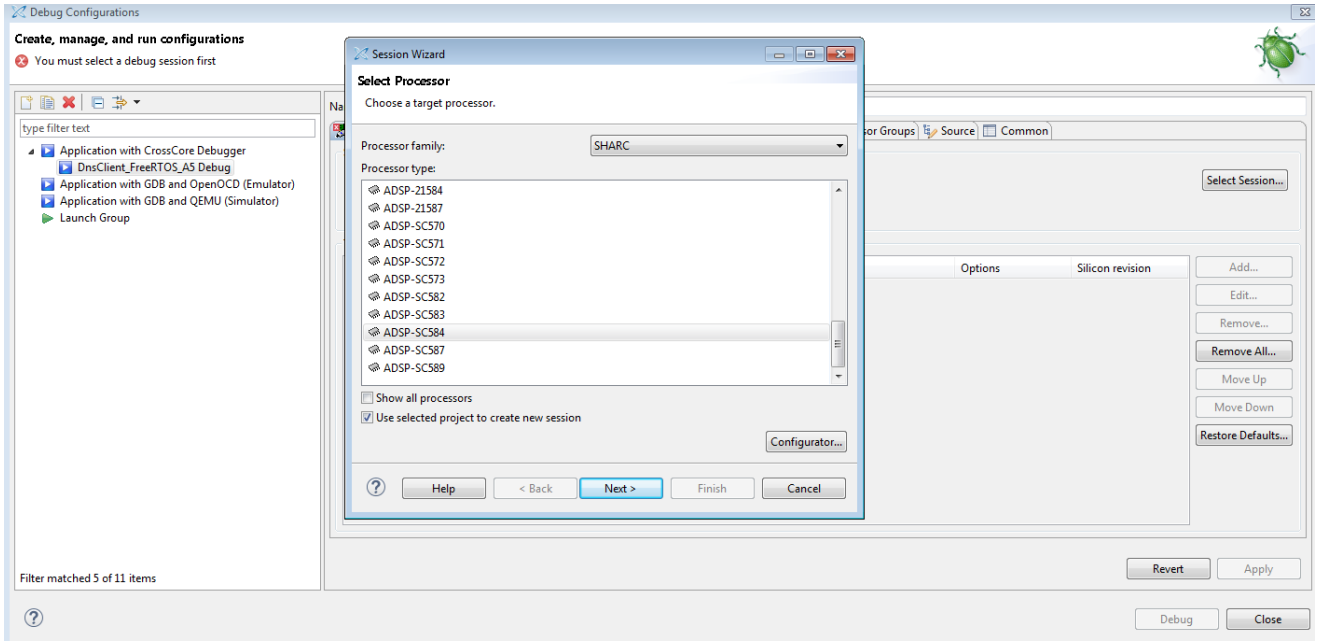
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



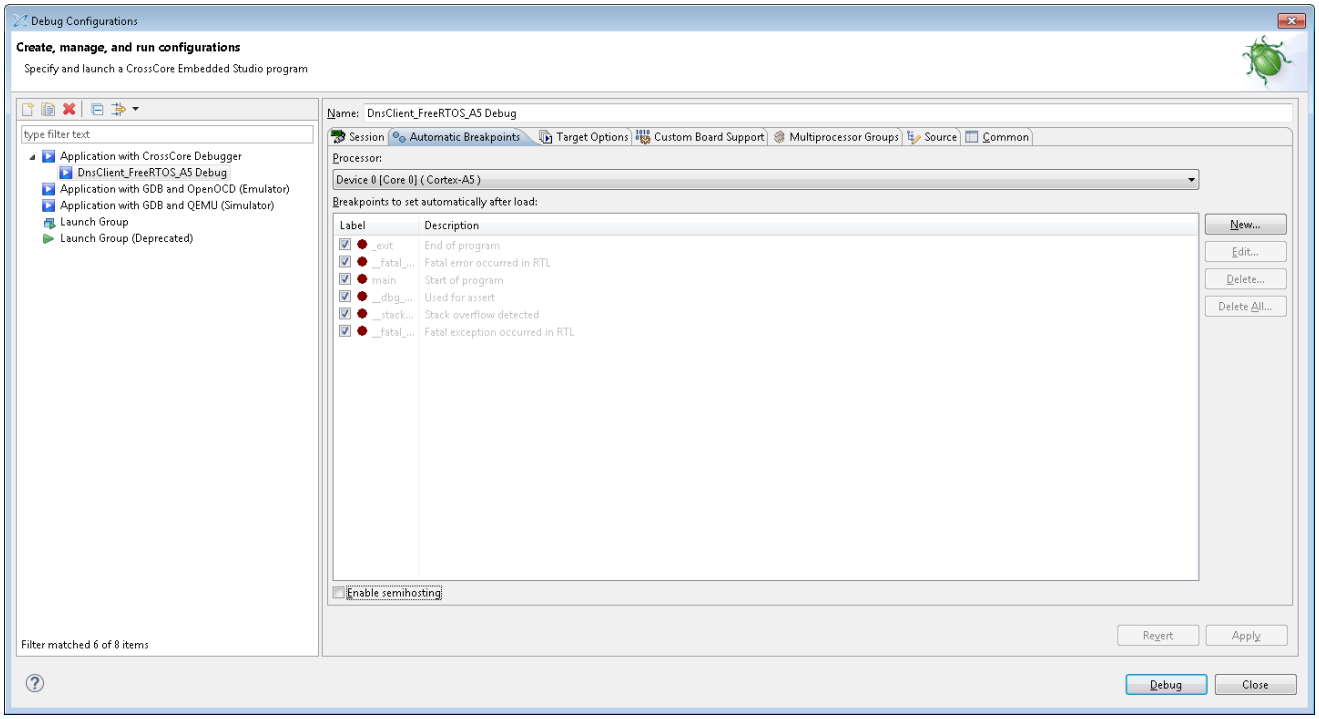
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Debug As** option from the menu

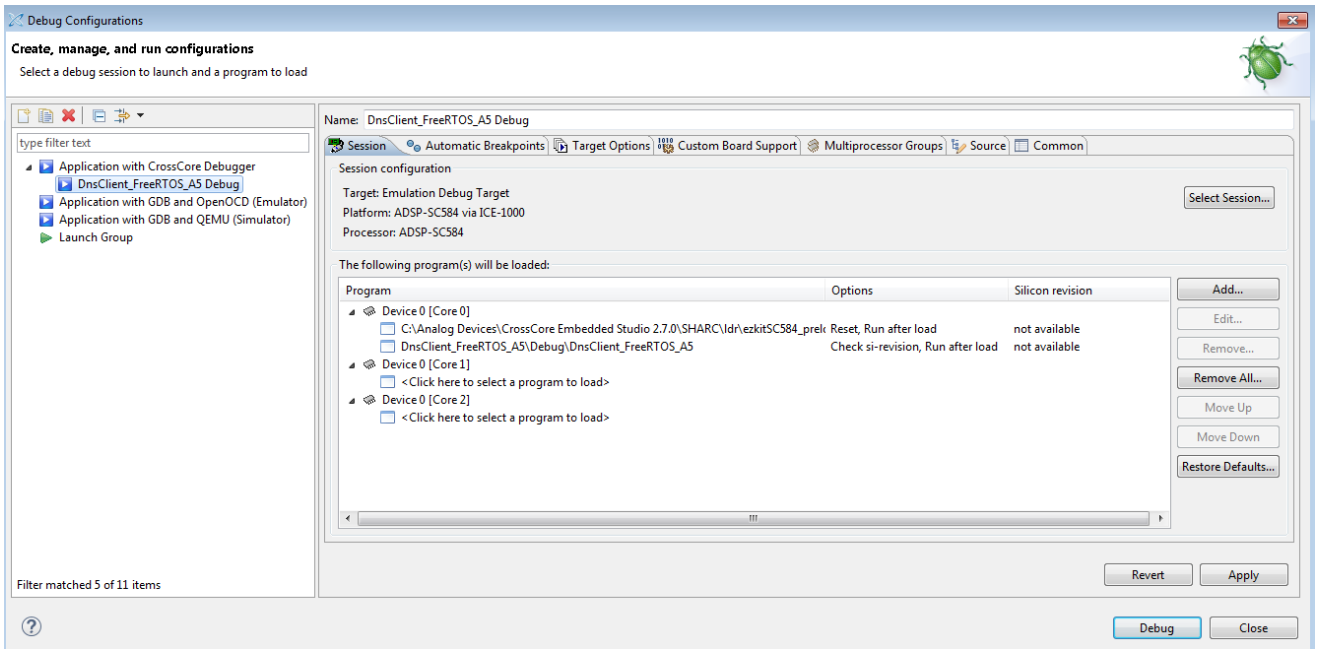
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



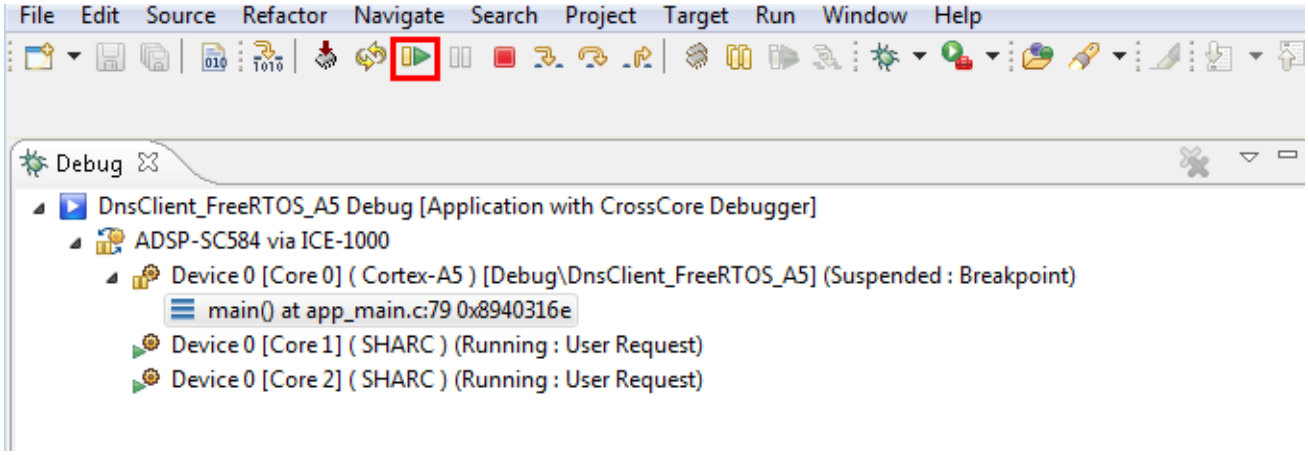
3. Disable the **semihosting** function in **Automatic Breakpoints**



4. Click the **Debug** button to close the **Debug Configurations** window

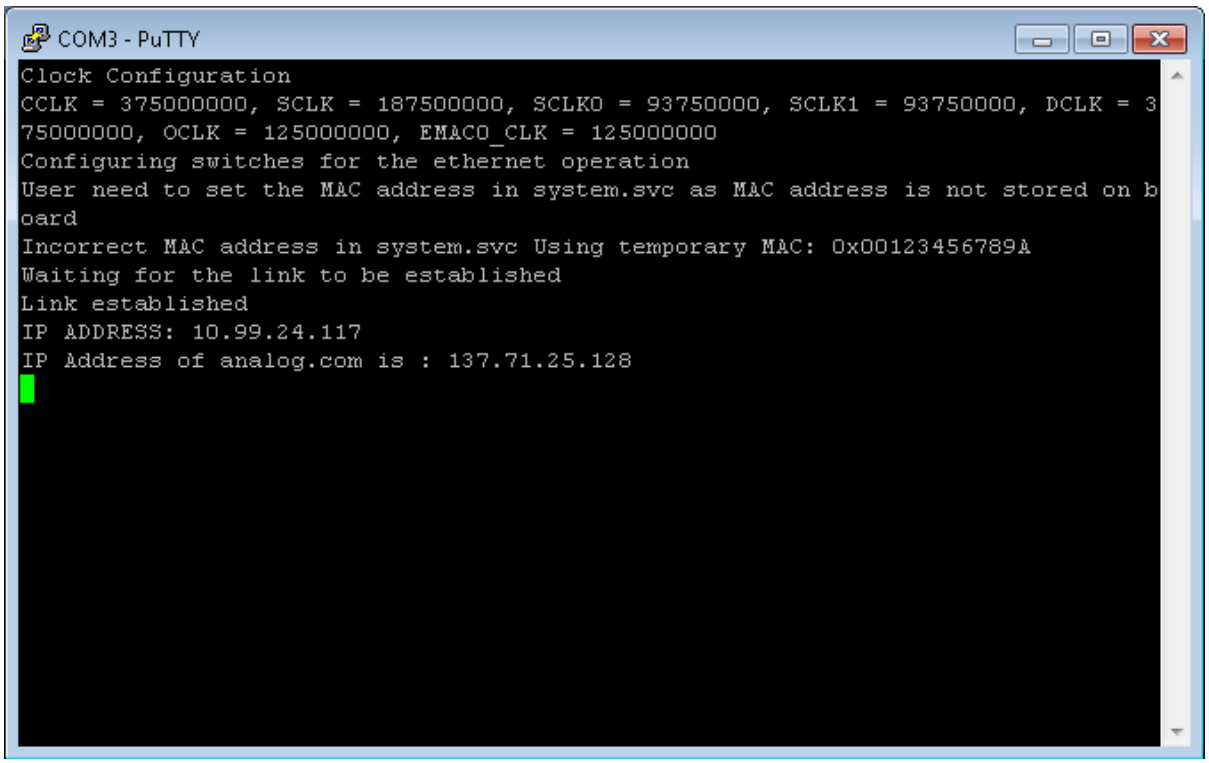


5. Click the **Run/Resume** button to start running your application



6.3.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see link is established, and **IP ADDRESS** assigned from DHCP server will be printed after you install the LwIP.



7 Running the Examples on the ADSP-SC573 EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Core	Toolchain	Example(s)
ADSP-SC573	ARM A5	CrossCore Embedded Studio	Basic Demo
ADSP-SC573	ARM A5	CrossCore Embedded Studio	Lwip Demo
ADSP-SC573	SHARC+	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System.

For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

7.1 Running the Basic Example for ARM on ADSP-SC573 EZ-Kit with CrossCore Embedded Studio

7.1.1 Overview

This page describes the steps to build and run basic example for ARM on ADSP-SC573 EZ-Kit board using CrossCore Embedded Studio.

7.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

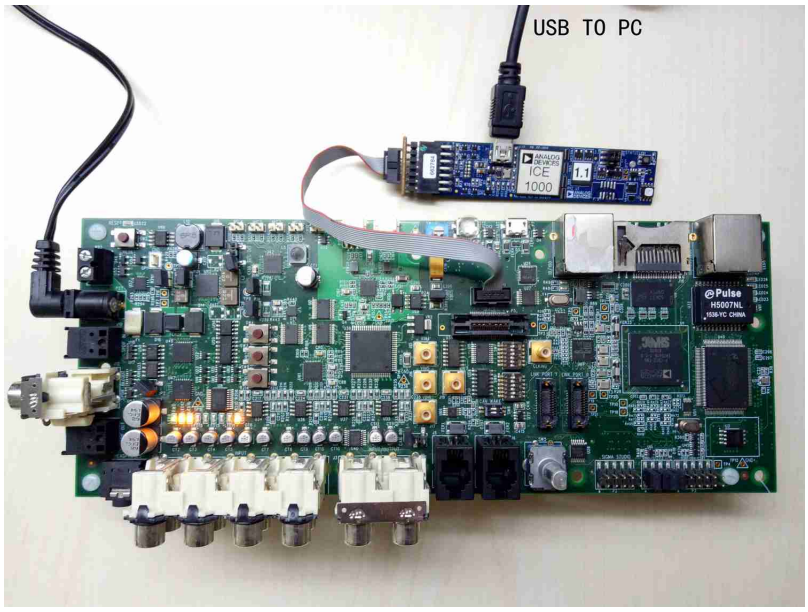
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

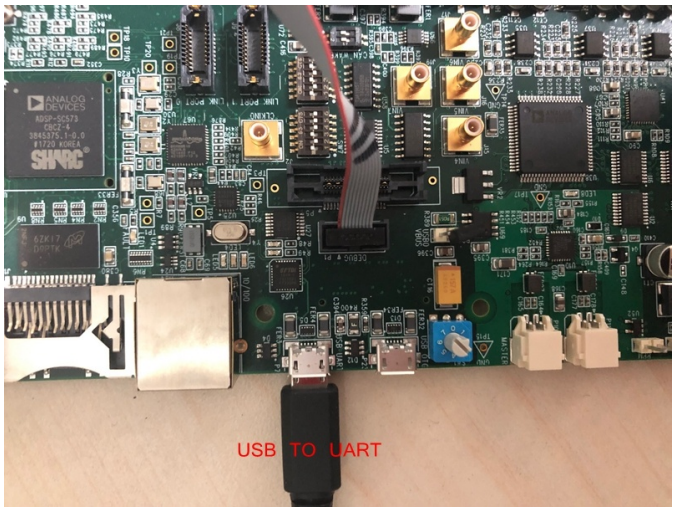
Hardware Setup

- An ADSCP-SC573 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 12 volts as in the diagram below.



Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:

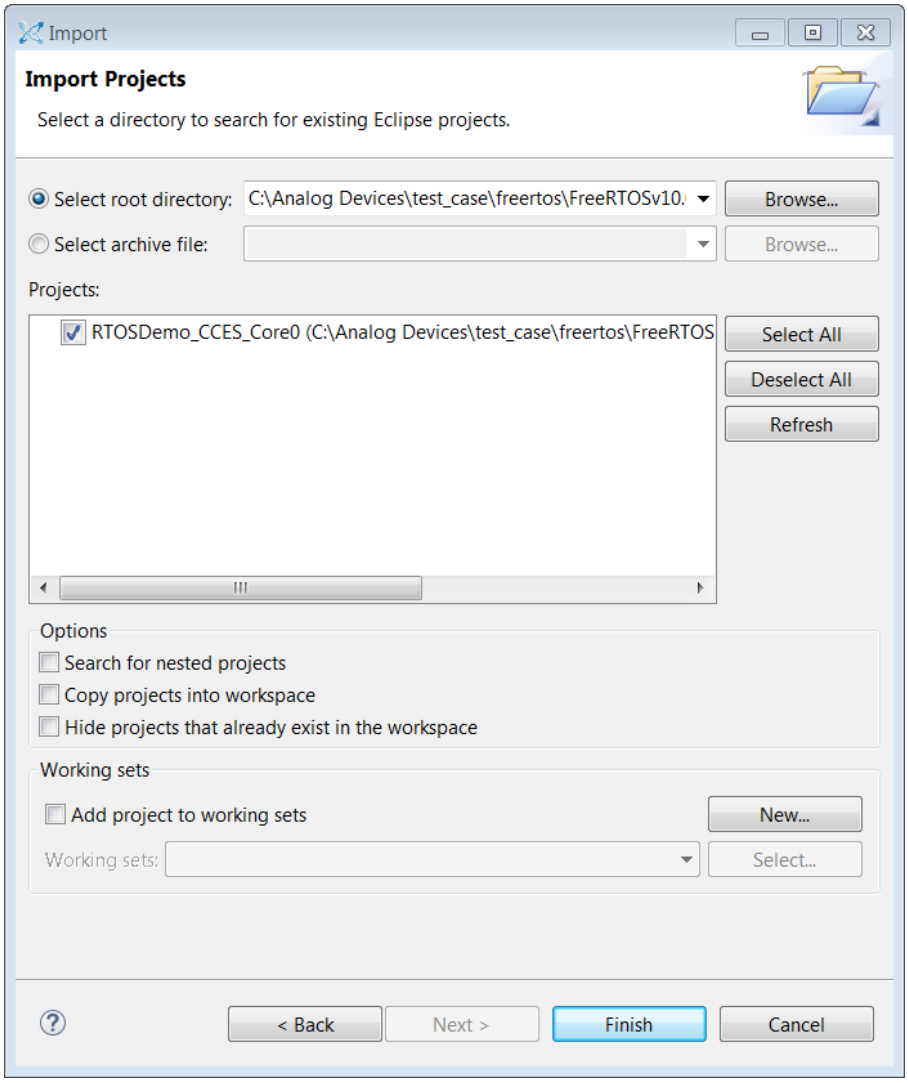


7.1.3 Build the Example

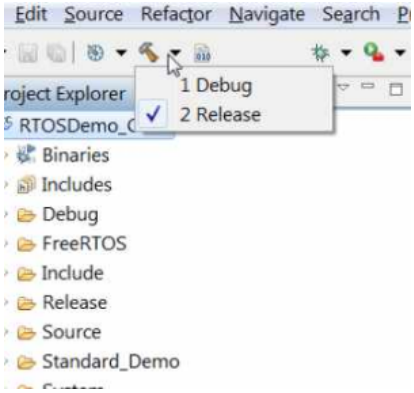
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\CORTEX_A5_ADSP_SC573_CCES** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Import**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

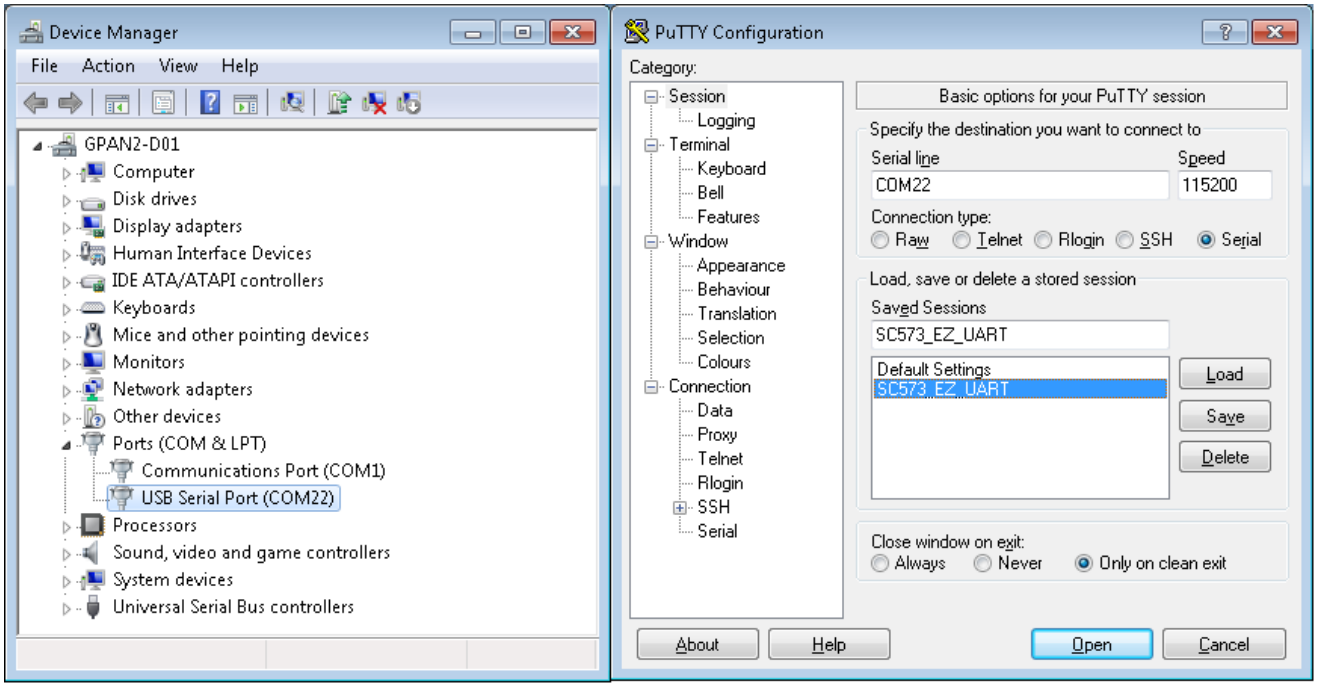
- In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Build Project** option from the menu

7.1.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed outwith a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device).

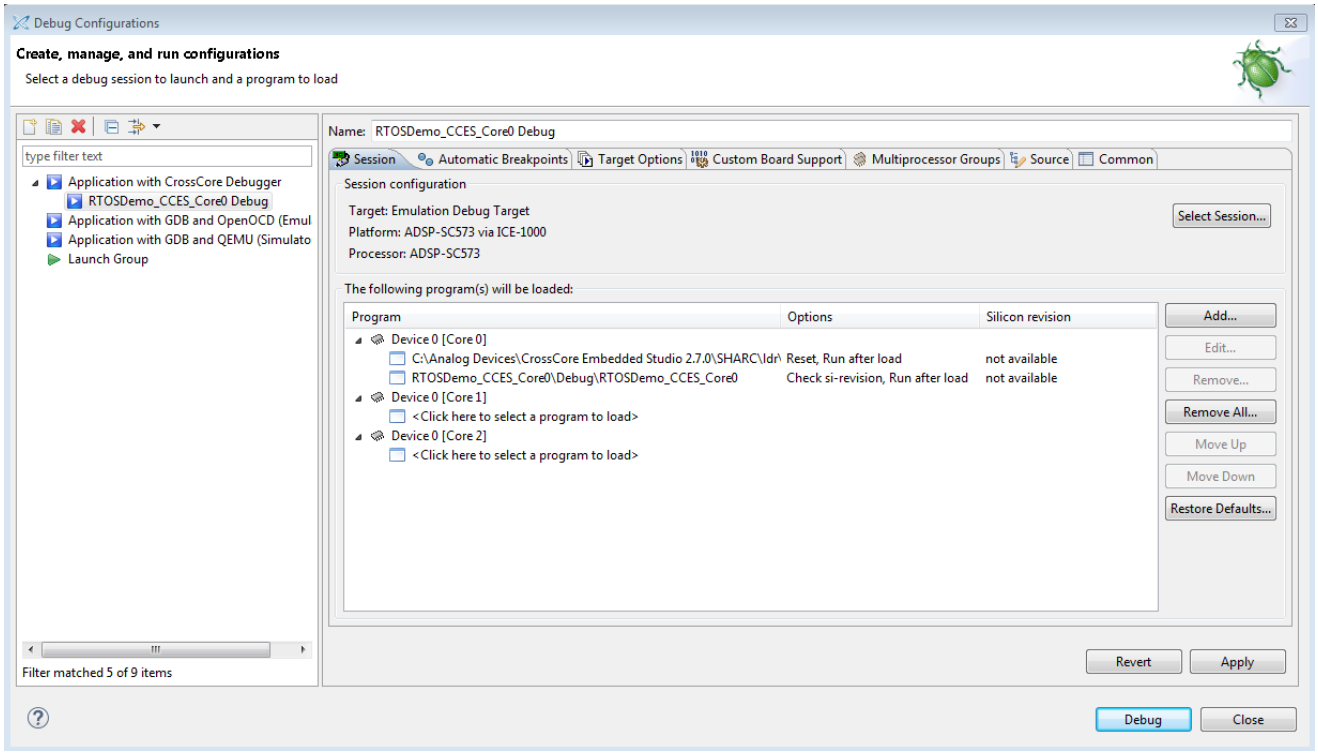
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



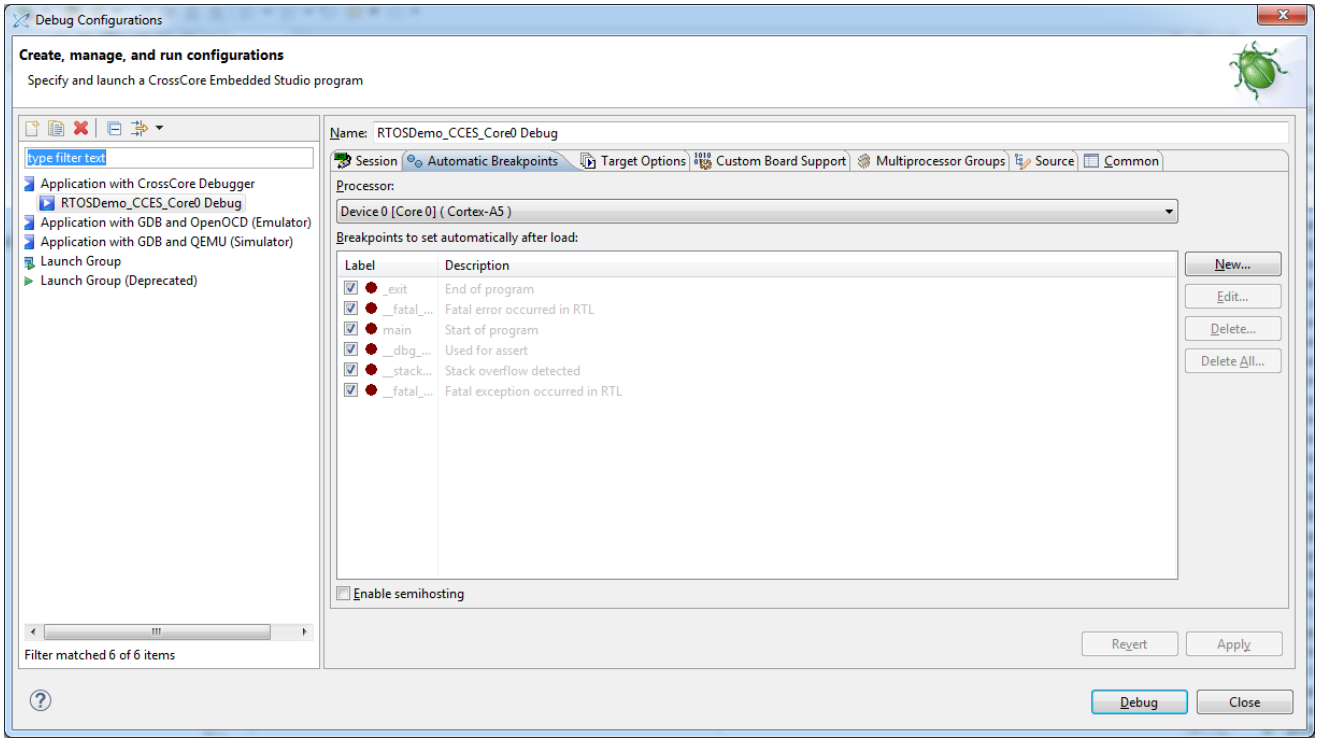
After this, follow the steps below to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_Core0** project and select the **Debug As** option from the menu

2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board

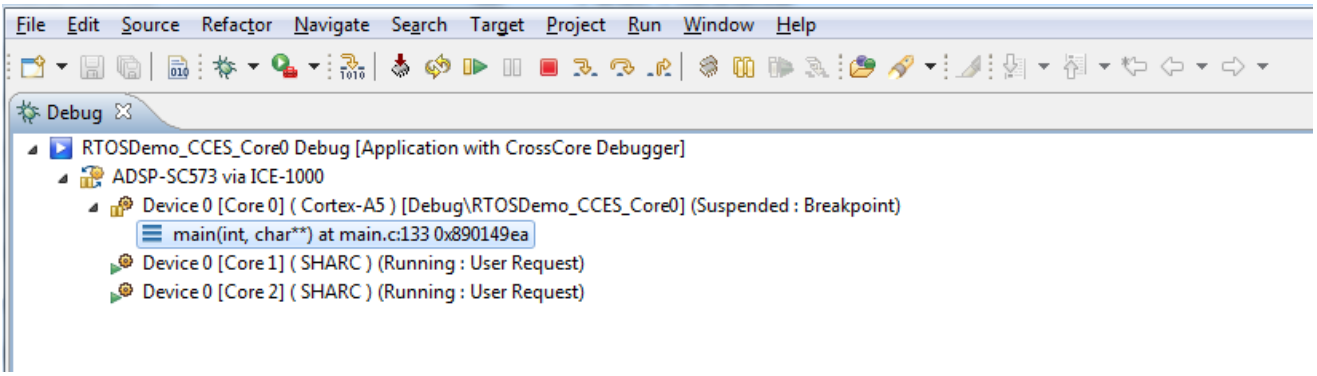


3. Disable the **semihosting** function in **Automatic Breakpoints**



4. Click the **Debug** button to close the **Debug Configurations** window

5. Click the **Run/Resume** button to start running your application



7.1.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see the LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if all the tests passed.

7.2 Running the Basic Example for SHARC+ on ADSP-SC573 EZ-Kit with CrossCore Embedded Studio

7.2.1 Overview

This page describes the steps to build and run basic example for SHARC+ on ADSP-SC573 EZ-Kit board using CrossCore Embedded Studio.

7.2.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

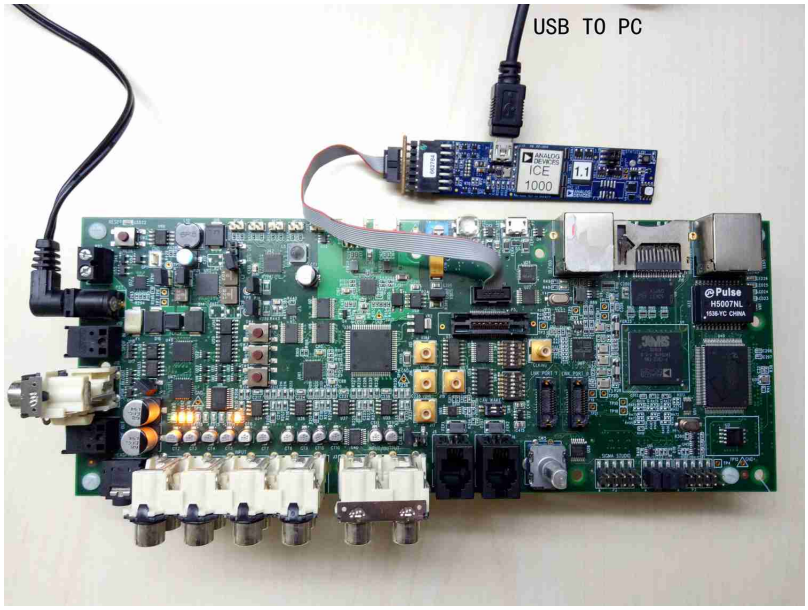
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSCP-SC573 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 12 volts as in the diagram below.

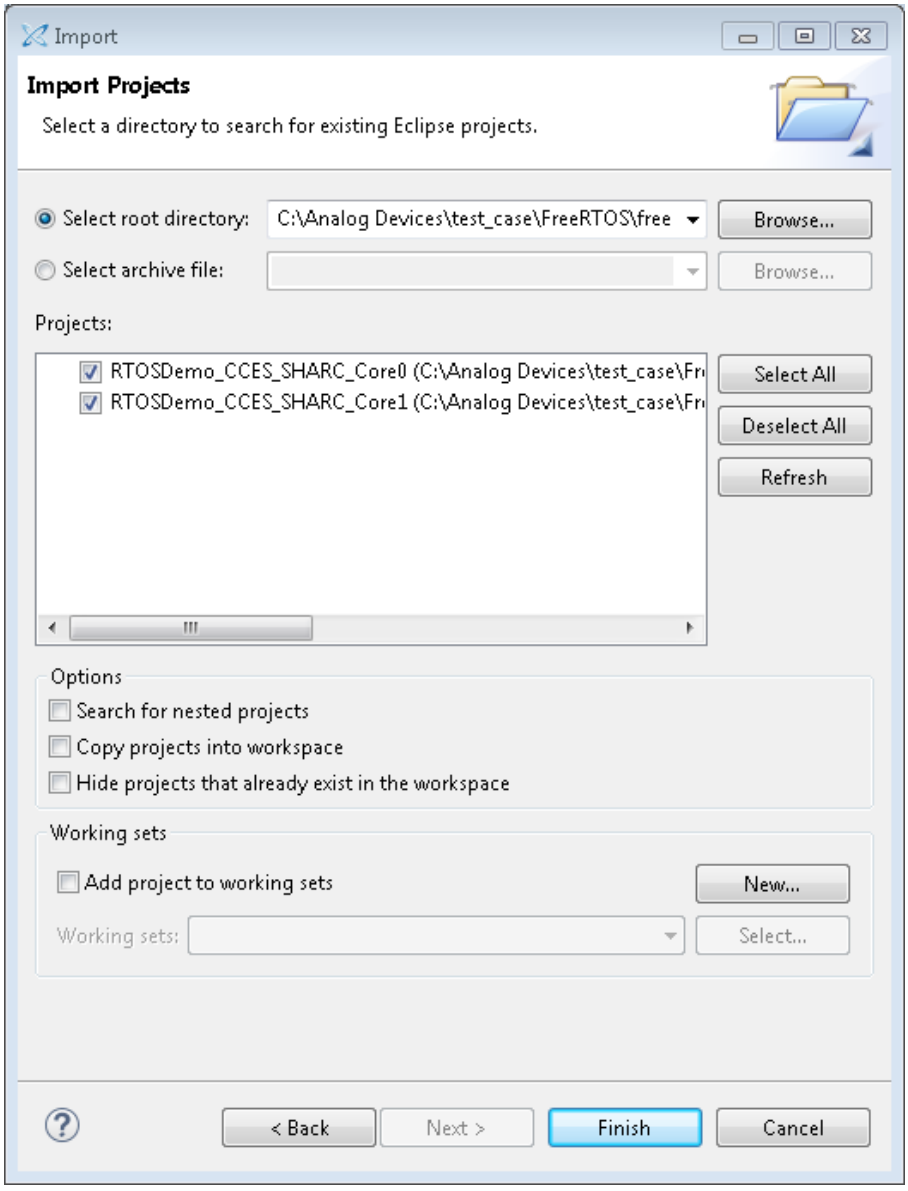


7.2.3 Build the Example

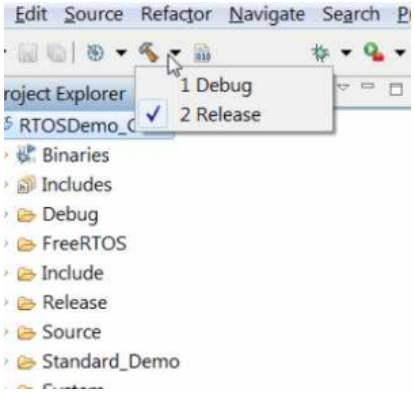
Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- When the **Import** project window appears:
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\SHARC_ADSP_SC573_CCES** folder
- Click **Finish** to close the file browser dialog
- Two projects should appear in the **Project Explorer**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

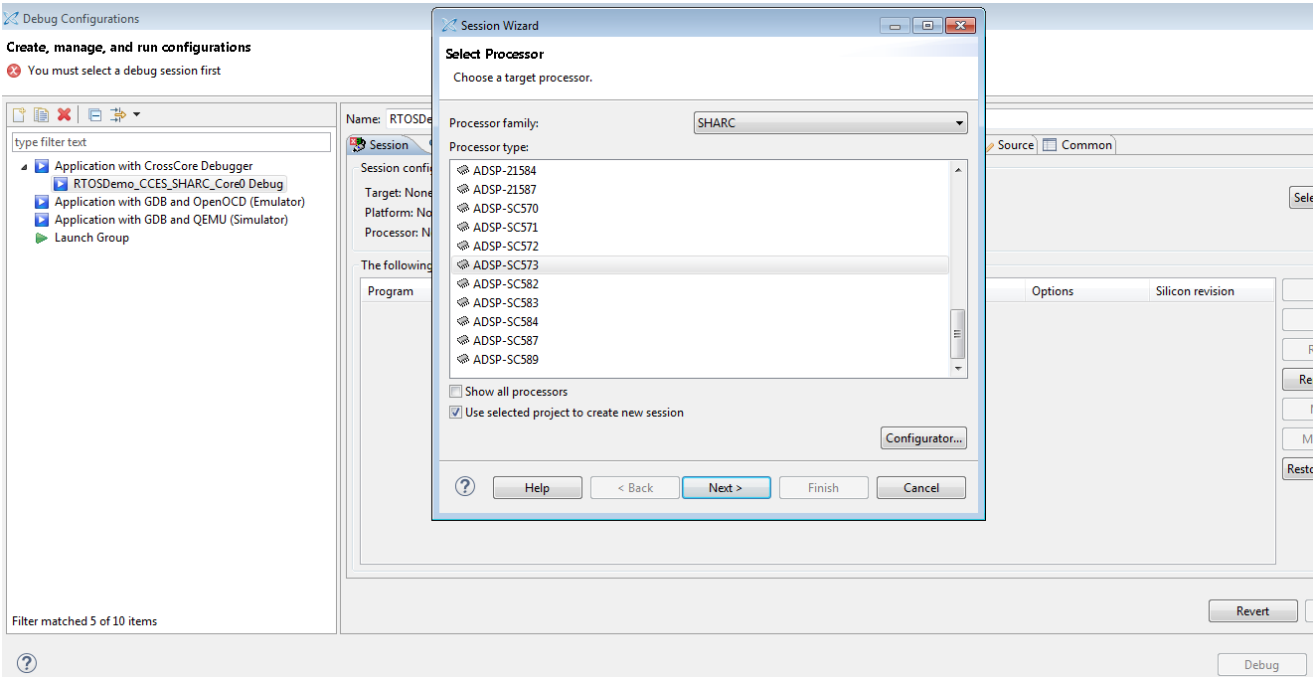
- In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** and **RTOSDemo_CCES_SHARC_Core1** project, then select the **Build Project** option from the menu

7.2.4 Run the Example

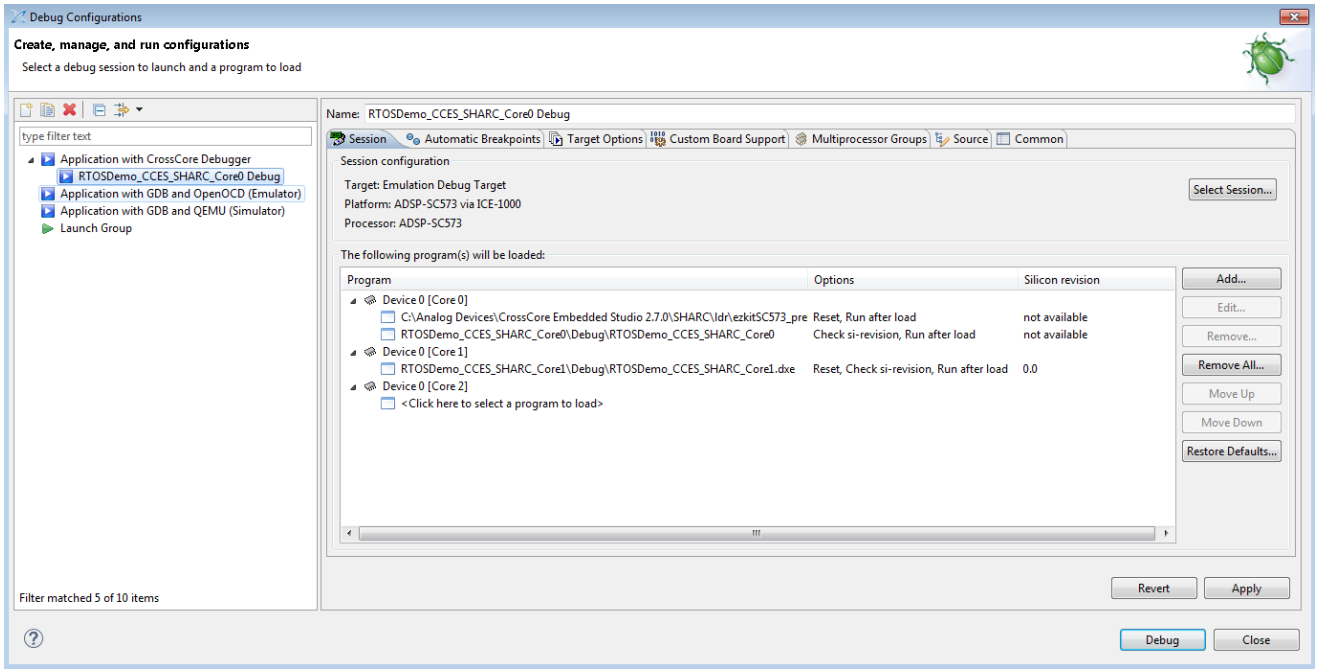
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_Core0** project and select the **Debug As** option from the menu

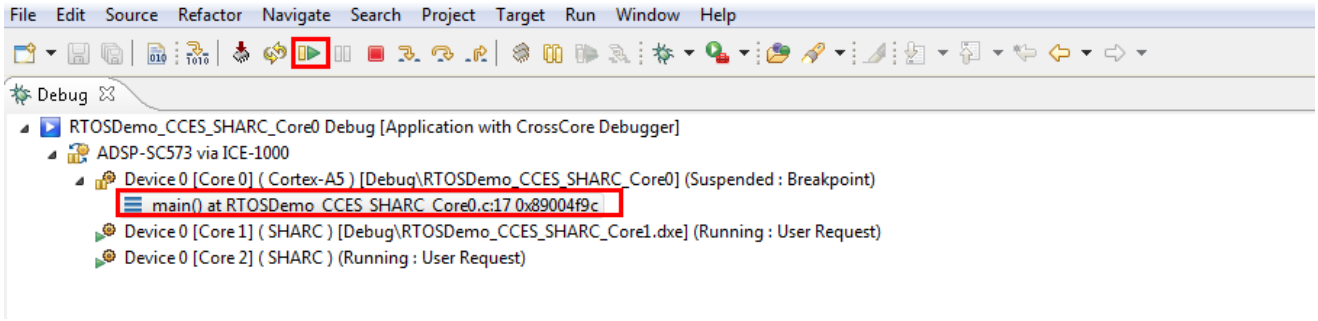
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



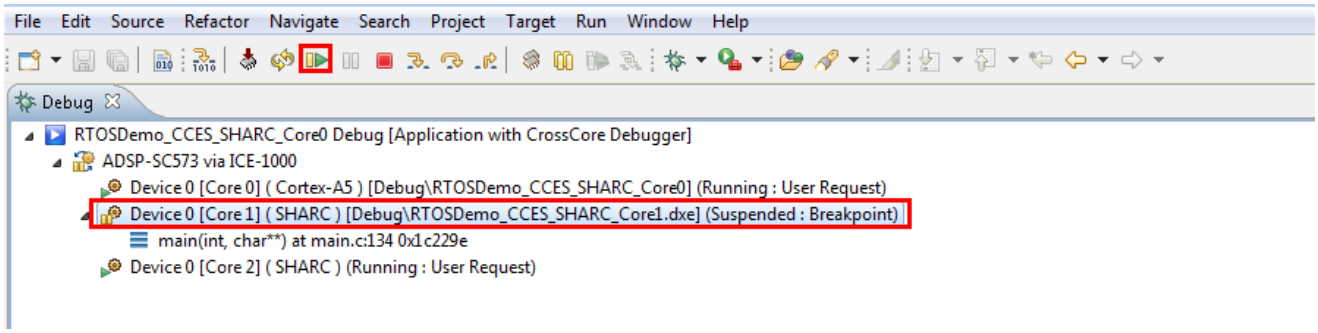
3. Click the **Debug** button to close the **Debug Configurations** window



4. Choose Core0 and click the **Run/Resume** button to start running Core0 application

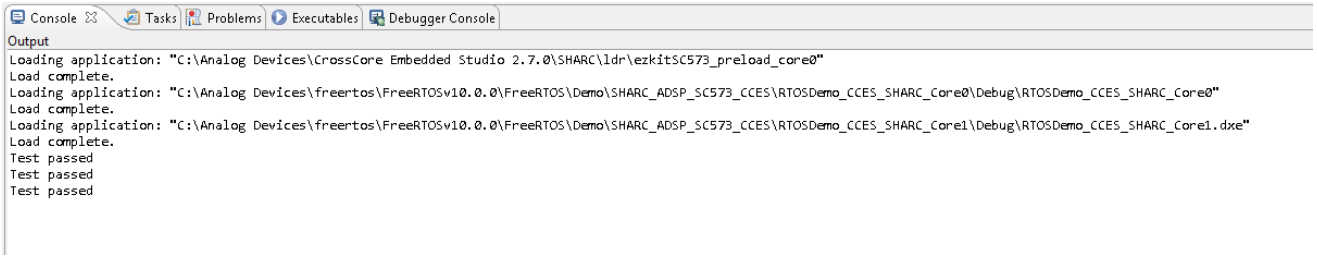


5. Then choose Core1 and keep to click **Run/Resume** button to start running Core1 application



7.2.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if the all tests passed.



7.3 Running the LwIP Example for ARM on ADSP-SC573 EZ-Kit with CrossCore Embedded Studio

7.3.1 Overview

This page describes the steps to build and run the LwIP Example for ARM on ADSP-SC573 EZ-Kit with CrossCore Embedded Studio.

7.3.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

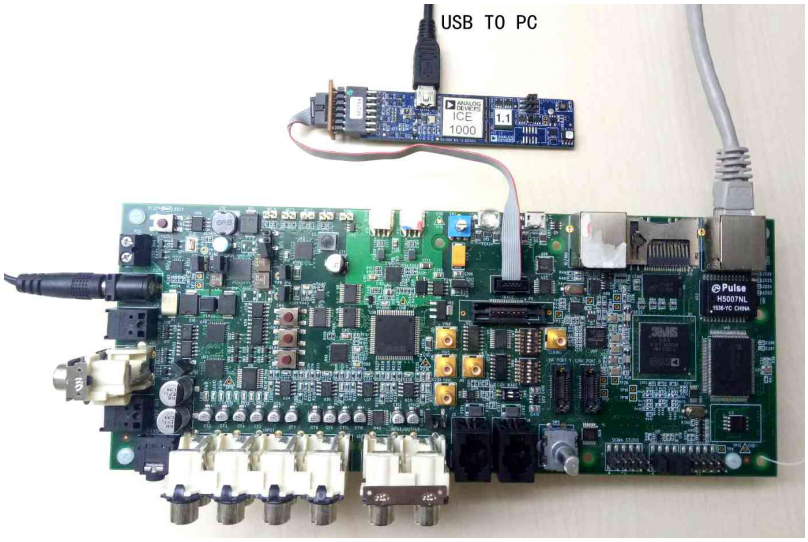
Software Requirement

- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio
- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

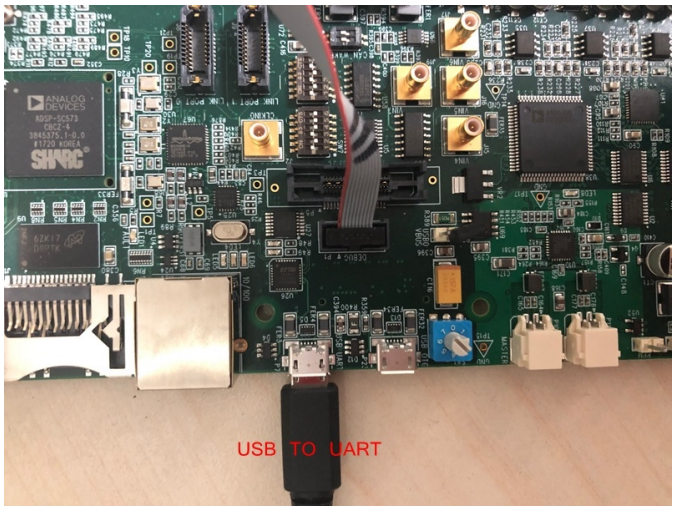
Hardware Setup

- An ADSCP-SC573 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P1** port of EZ-Kit and the host PC using USB cable, connect the target board to the same LAN as PC using standard network cable and simultaneously connect the power supply with 12 volts as in the diagram below.



Connect the **USB to UART** port of the EZ-Kit to the host PC with a USB cable as shown below:



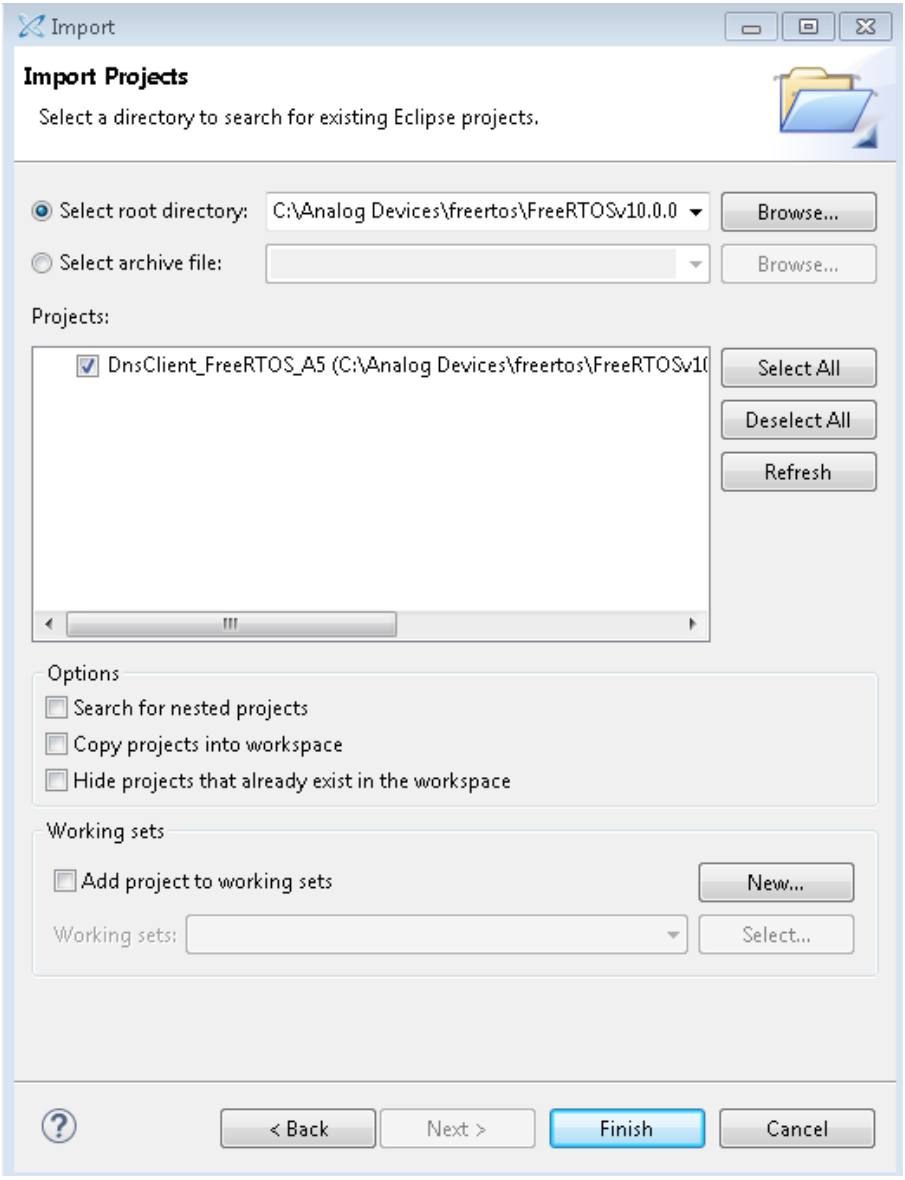
7.3.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

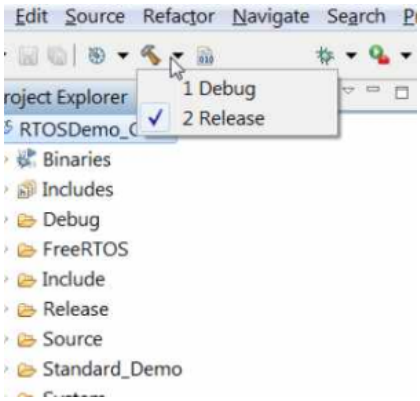
1. Import the FreeRTOS example into CrossCore Embedded Studio:

- Select the **File** menu and then select the **Import** option from the menu
- When the **Import** project window appears:
- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button

- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0 \FreeRTOS\Demo\CORTEX_A5_ADSP_SC573_CCES_LwIP** folder
- Click **Finish** to close the file browser dialog
- A single project should appear in the **Project Explorer**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio:

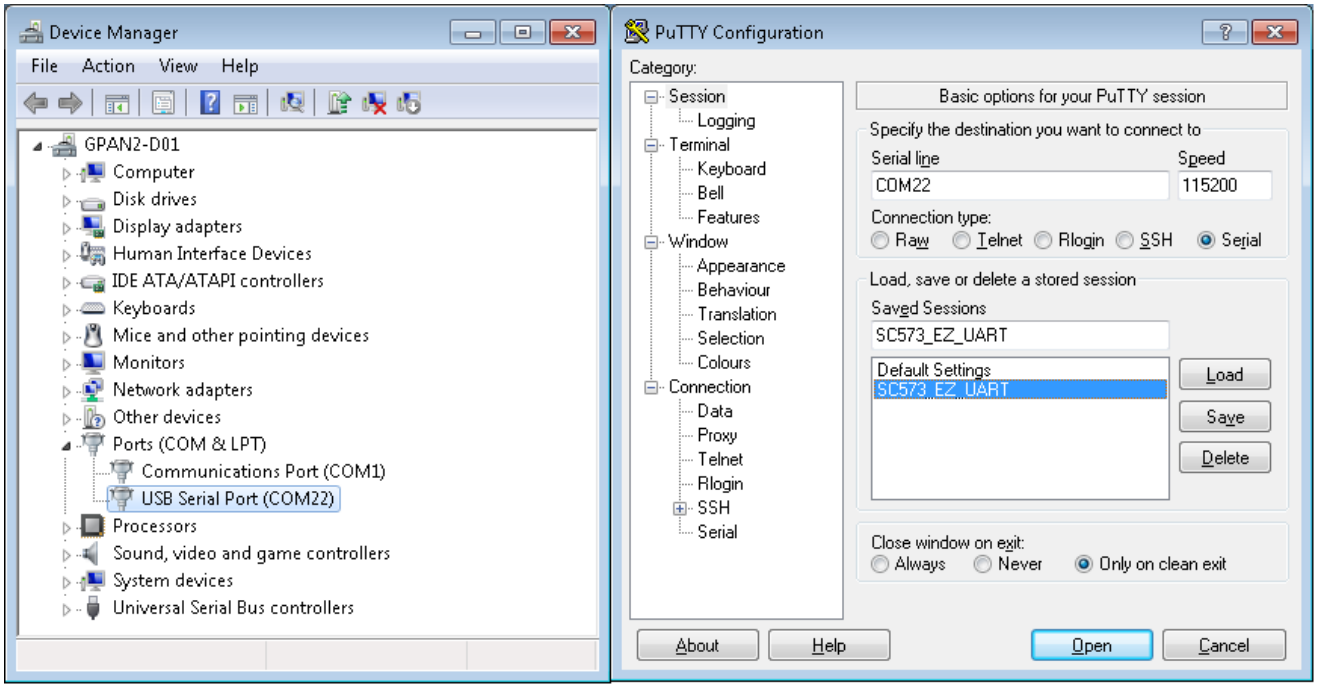
- In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Build Project** option from the menu

7.3.4 Run the Example

The semihosting I/O mechanism, which writes to the CCES console during debug sessions, uses SWI interrupts. This is incompatible with default GCC-compiled I/O code which also uses SWI interrupts. For this reason, stdio function calls initiated on the ARM core are routed out over UART instead and shall be read with a serial terminal external to CCES. Importantly, note that:

1. This is currently only supported *within* FreeRTOS threads, any stdio function call performed out with a thread will crash the application.
2. If you need to use other peripherals, you should take care not to change the power service clock rate (which is set in the UART I/O device).

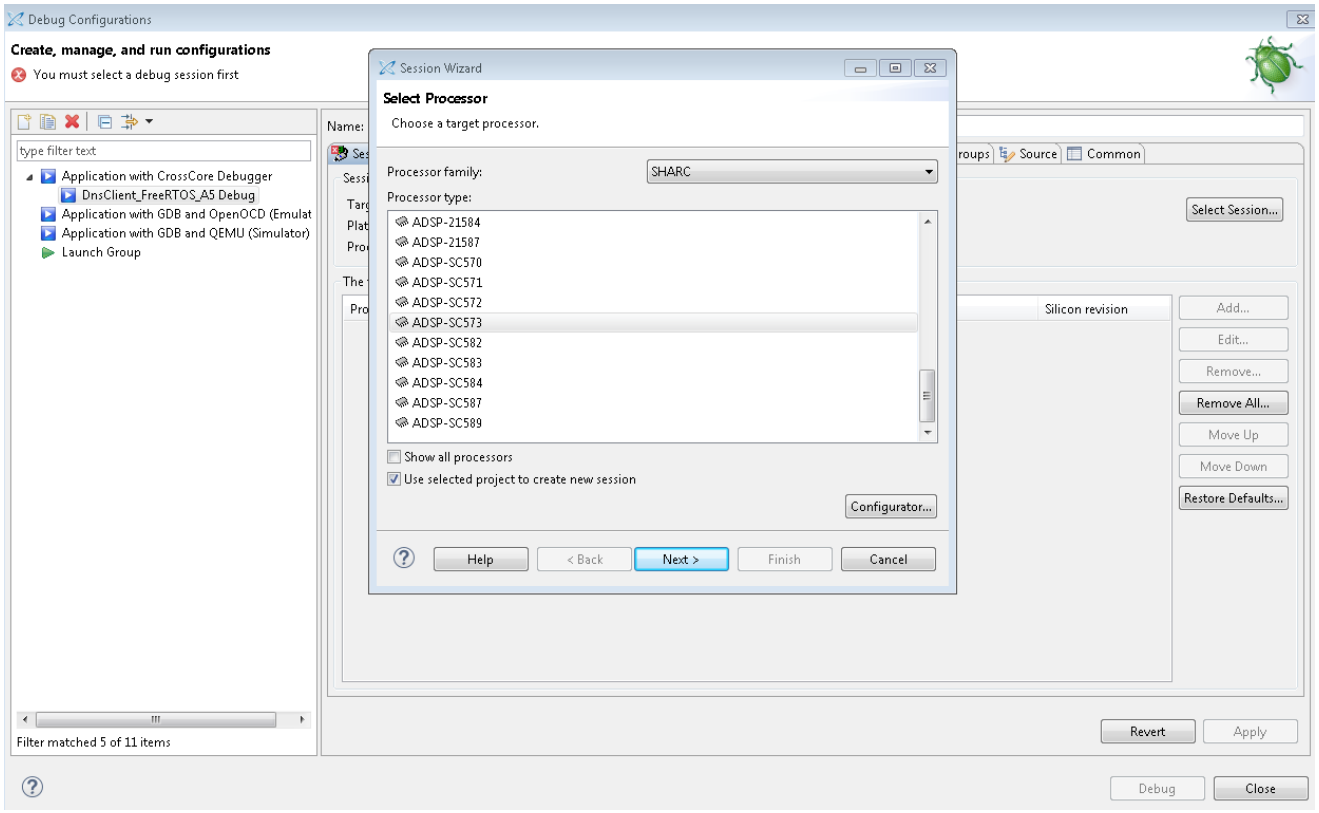
Before running the example, you need to setup the serial terminal of your choice to read the Cortex core output from the **UART to USB connection** on the HOST PC. The easiest way to determine the correct USB device is to view the **Ports** entry in the Windows Device Manager. From here identify the COM port. Configure your serial console application to connect to the port with a baud rate of 115,200.



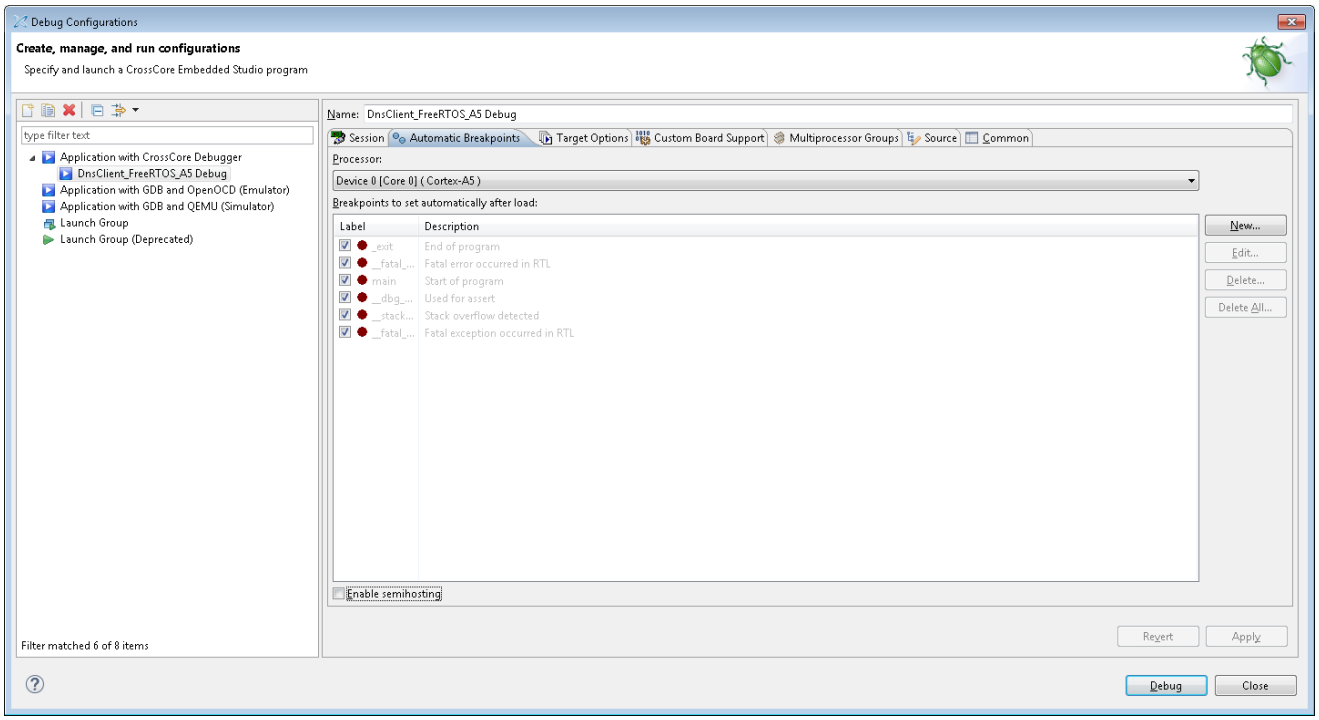
Follow below five steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **DnsClient_FreeRTOS_A5** project and select the **Debug As** option from the menu

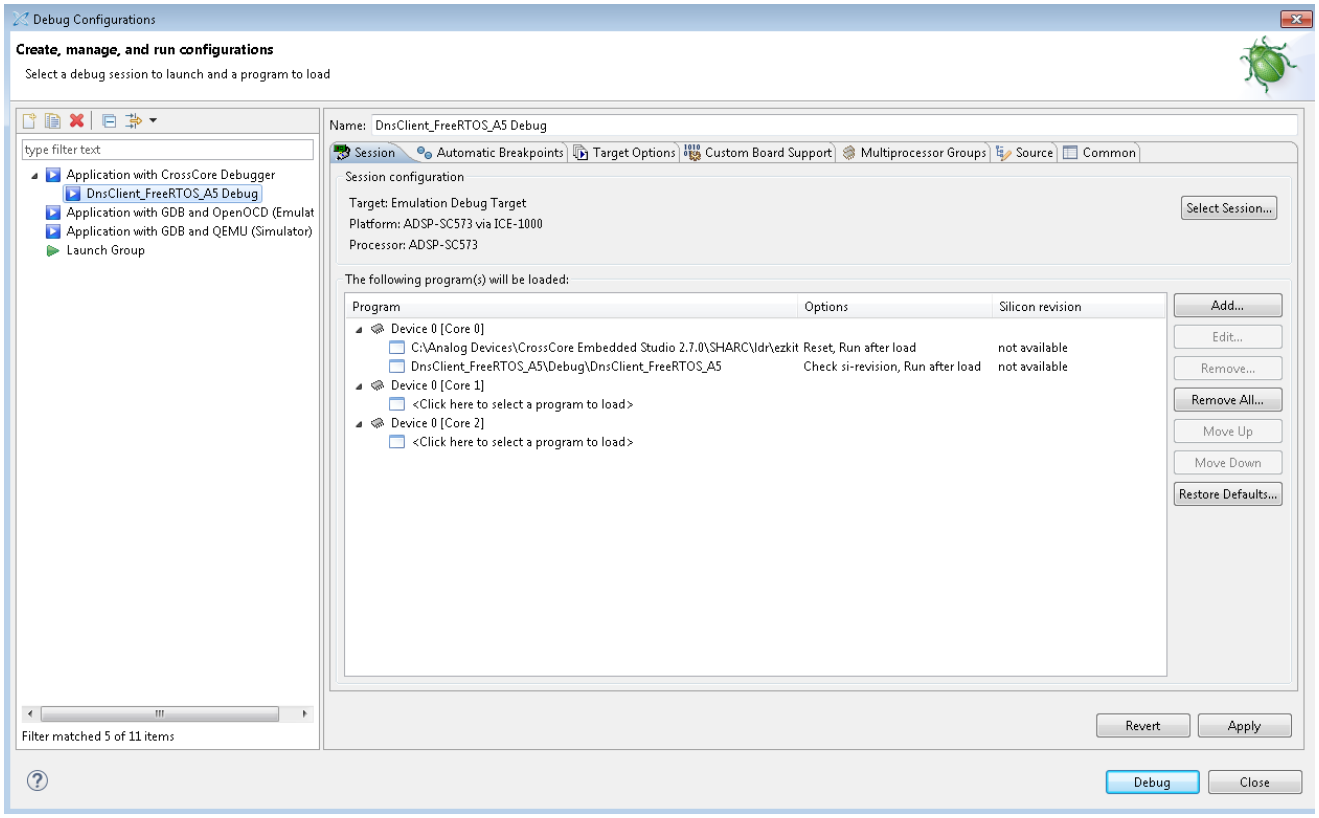
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



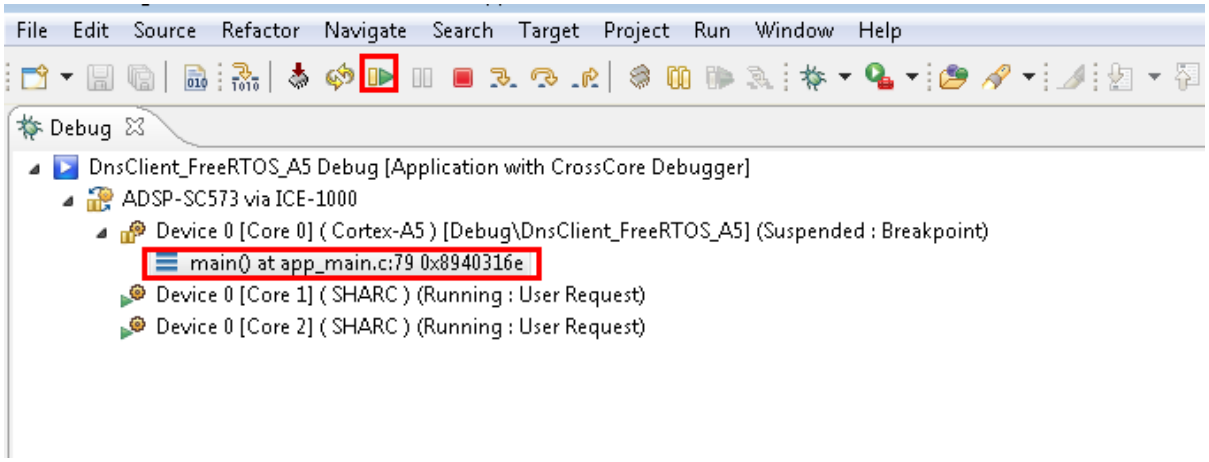
3. Disable the **semihosting** function in **Automatic Breakpoints**



4. Click the **Debug** button to close the **Debug Configurations** window

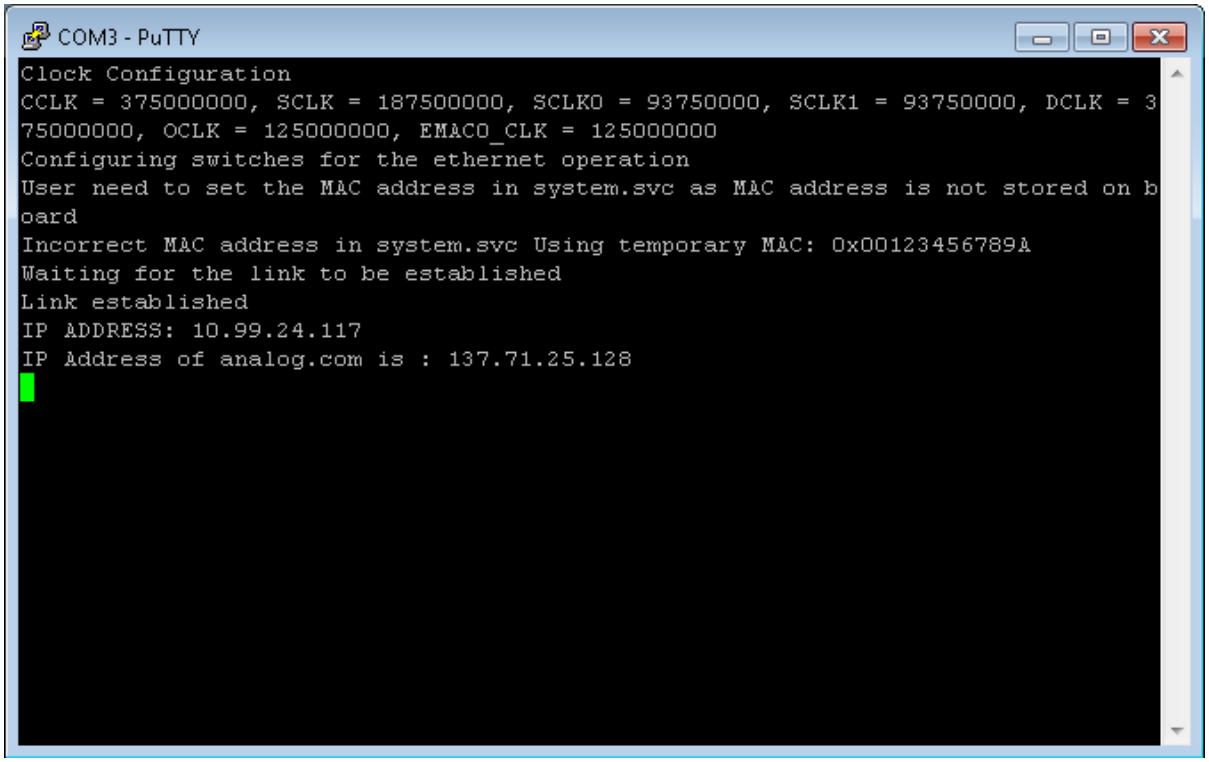


5. Click the **Run/Resume** button to start running your application



7.3.5 Test Results

Output from the application should be visible within the TTY terminal (e.g. PuTTY/TeraTerm). You should see link is established, and **IP ADDRESS** assigned from DHCP server will be printed after you install the LwIP.


COM3 - PuTTY
Clock Configuration
CCLK = 375000000, SCLK = 187500000, SCLK0 = 93750000, SCLK1 = 93750000, DCLK = 3
75000000, OCLK = 125000000, EMAC0_CLK = 125000000
Configuring switches for the ethernet operation
User need to set the MAC address in system.svc as MAC address is not stored on b
oard
Incorrect MAC address in system.svc Using temporary MAC: 0x00123456789A
Waiting for the link to be established
Link established
IP ADDRESS: 10.99.24.117
IP Address of analog.com is : 137.71.25.128

8 Running the Examples on the ADSP-BF7XX EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Toolchain	Example(s)
ADSP-BF707	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System.

For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

8.1 Running the Basic Example for ADSP-BF707 EZ-Kit with CrossCore Embedded Studio

8.1.1 Overview

This page describes the steps required to build and run basic example on ADSP-BF707 EZ-Kit board using CrossCore Embedded Studio.

8.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

Software Requirement

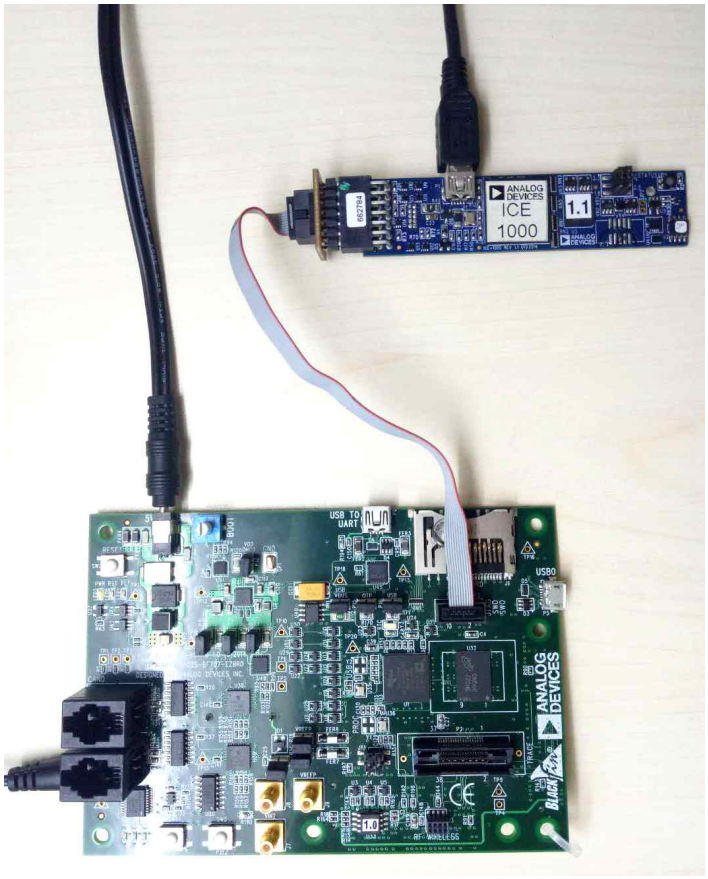
- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio

- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSP-BF707 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P3** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 5 volts as in the diagram below



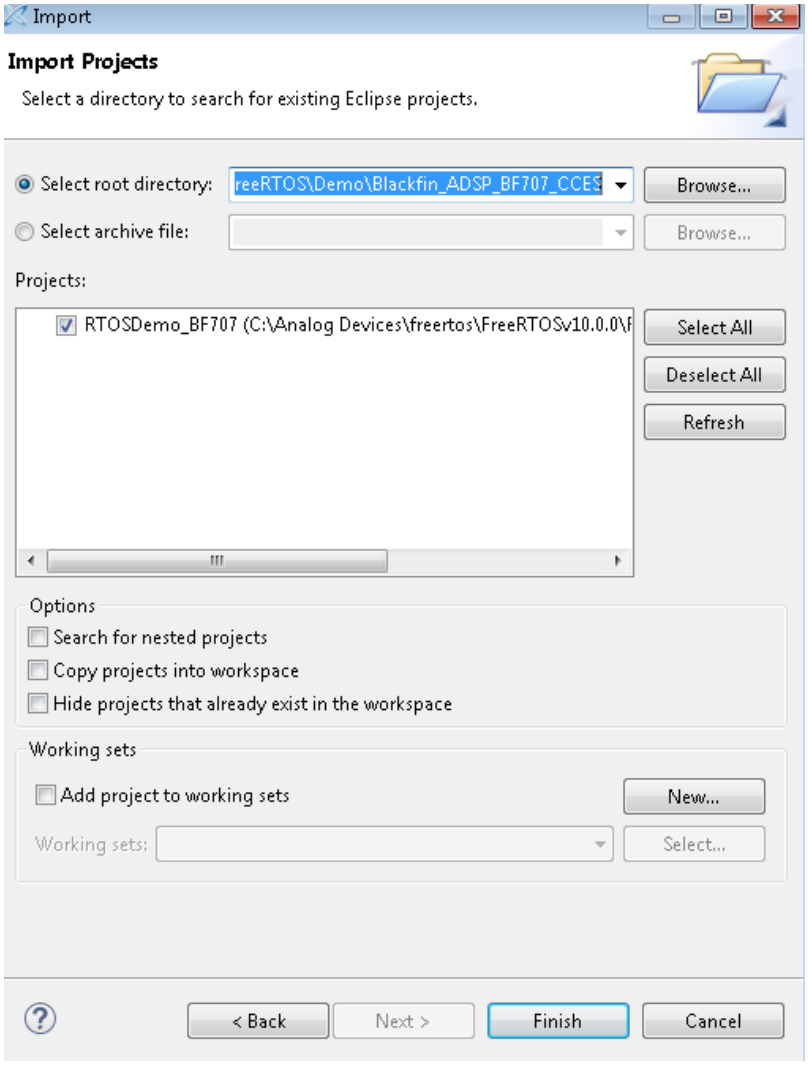
8.1.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

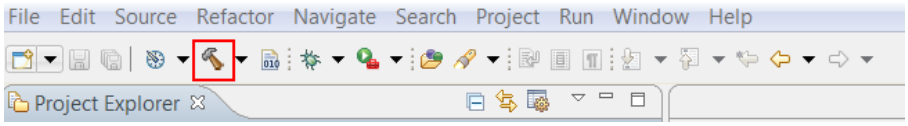
1. Select the **File** menu and then select the **Import** option.

- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button

- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0\FreeRTOS\Demo\Blackfin_ADSP_BF707_CCES** folder
- Click **OK** to close the file browser dialog
- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Finish**



2. Choose Debug/Release mode to build the project.



3. Build the project in CrossCore Embedded Studio

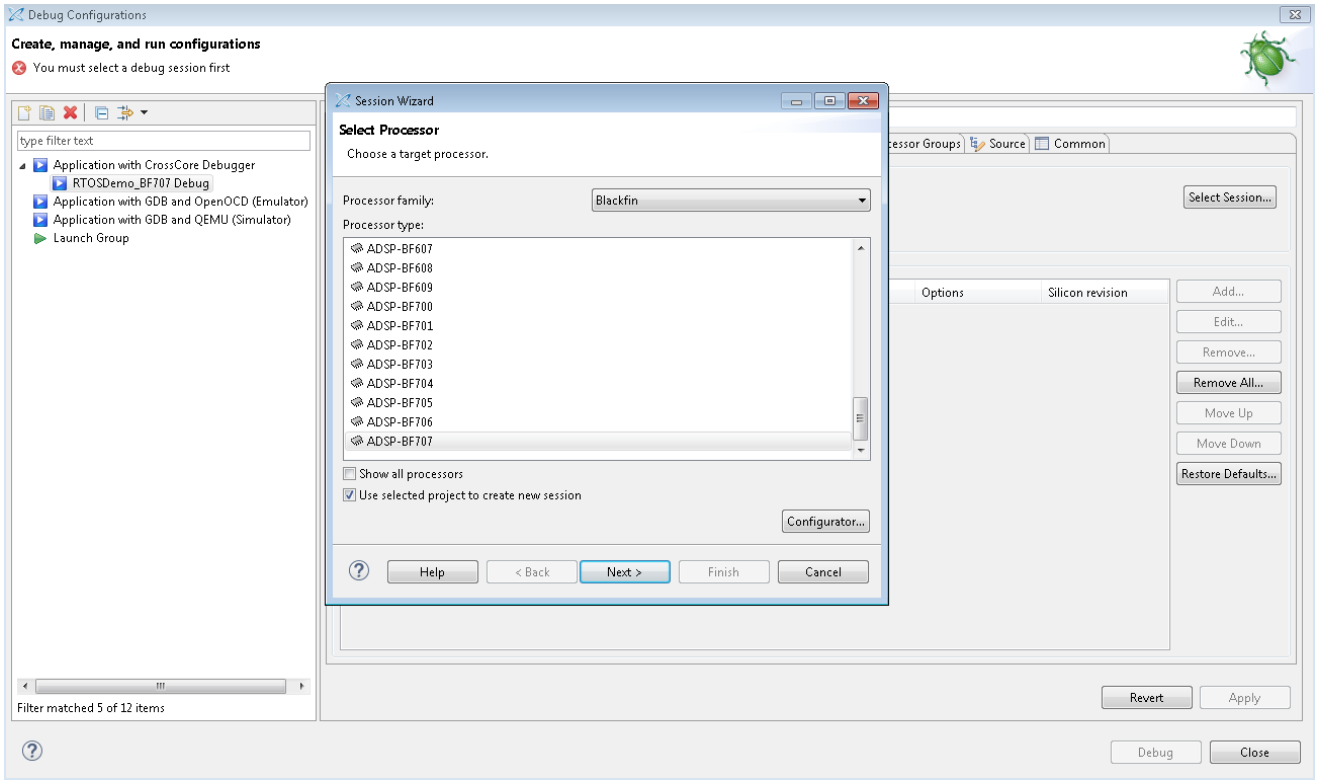
- In the **Project Explorer** right click on the **RTOSDemo_BF707** project and select the **Build Project** option from the menu

8.1.4 Run the Example

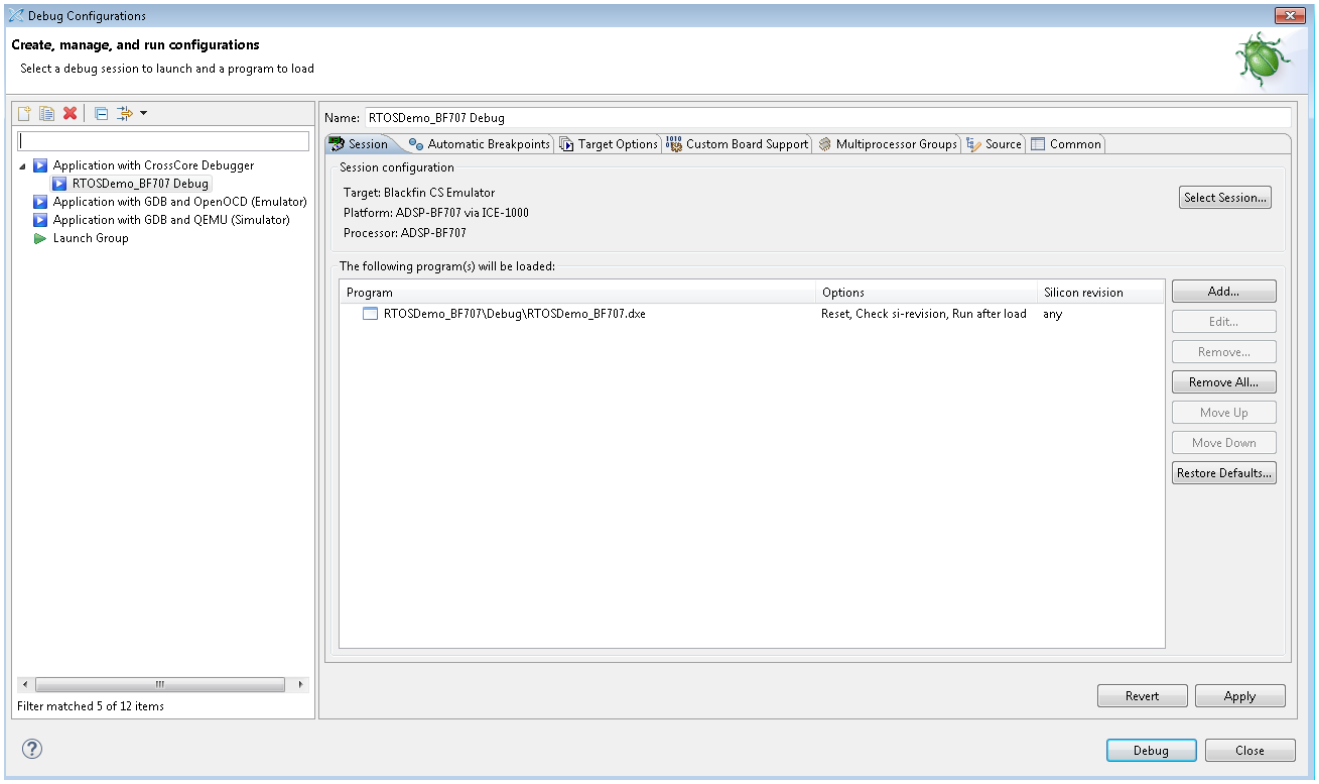
Follow below four steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_BF707** project and select the **Debug As** option from the menu

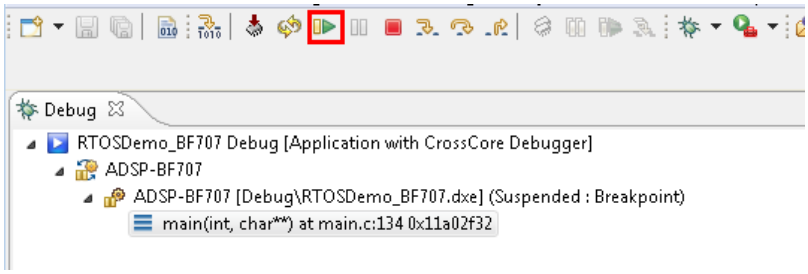
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator and target board



3. Click the **Debug** button to close the **Debug Configuration** window

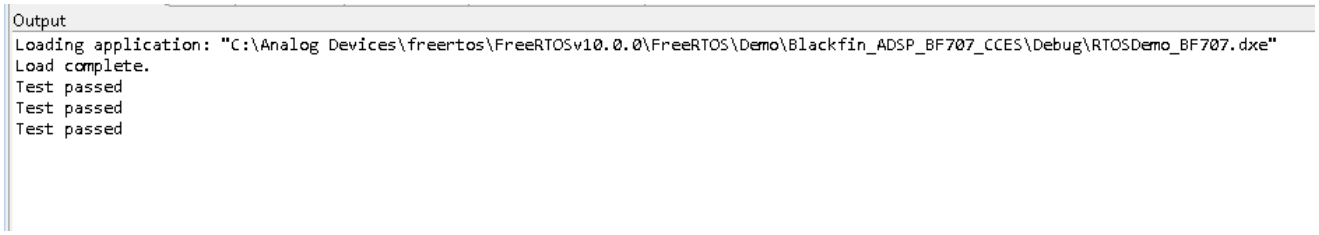


4. Click the **Run/Resume** button to start running your application



8.1.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see three LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if the all tests passed.



9 Running the Examples on the ADSP-21569 EZ-Kit

The FreeRTOS product for Analog Devices processors contains the following examples:

Processor	Toolchain	Example(s)
ADSP-21569	CrossCore Embedded Studio	Basic Demo

The basic demo example is based on the **Standard Demo Tasks** that FreeRTOS recommend are provided for each port of the FreeRTOS Operating System.

For more information on the Standard Demo Tasks please refer to http://www.freertos.org/a00013.html.

The tasks performed in the Analog Devices Basic Demo include:

- LED flash
- Polled queue tasks
- Recursive Mutex tasks
- Blocking Queue tasks
- Statically allocated tasks
- Suicidal tasks

9.1 Running the Basic Example for ADSP-21569 EZ-Kit with CrossCore Embedded Studio

9.1.1 Overview

This page describes the steps required to build and run basic example on ADSP-21569 EZ-Kit board using CrossCore Embedded Studio.

9.1.2 Environment Setup

Before running the basic example with CrossCore Embedded Studio, you should make some preparation for environment setup including software and hardware.

Software Requirement

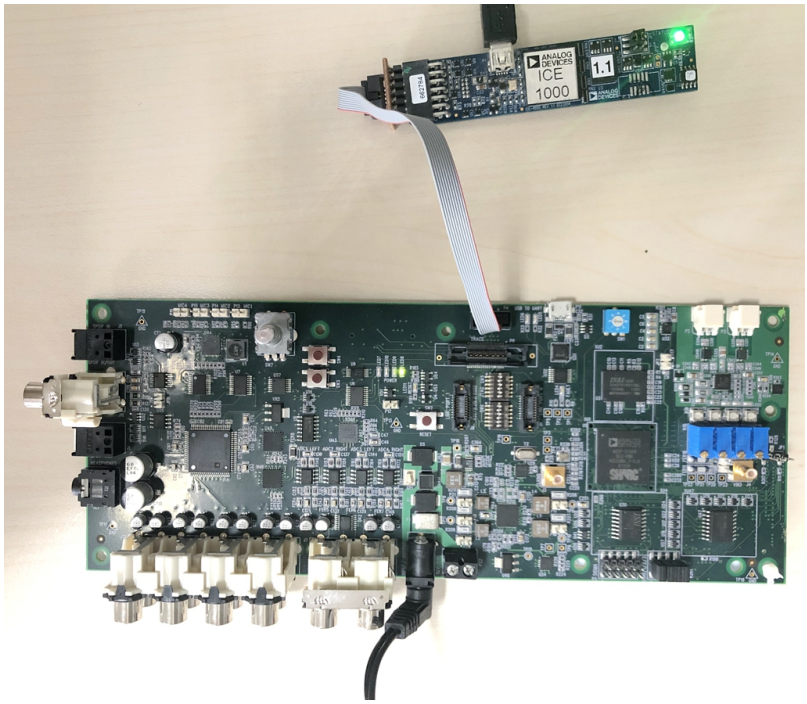
- Analog Devices CrossCore Embedded Studio. For more information please refer to Software environment set up for CrossCore Embedded Studio

- FreeRTOS product and the Analog Devices FreeRTOS product. For more inormation please refer to Get the source code ready

Hardware Setup

- An ADSP-21569 EZ-Kit board
- An ICE1000 or ICE2000 emulator

Connect the ICE1000 or ICE2000 emulator to **DEBUG P4** port of EZ-Kit and the host PC using USB cable and simultaneously connect the power supply with 12 volts as in the diagram below



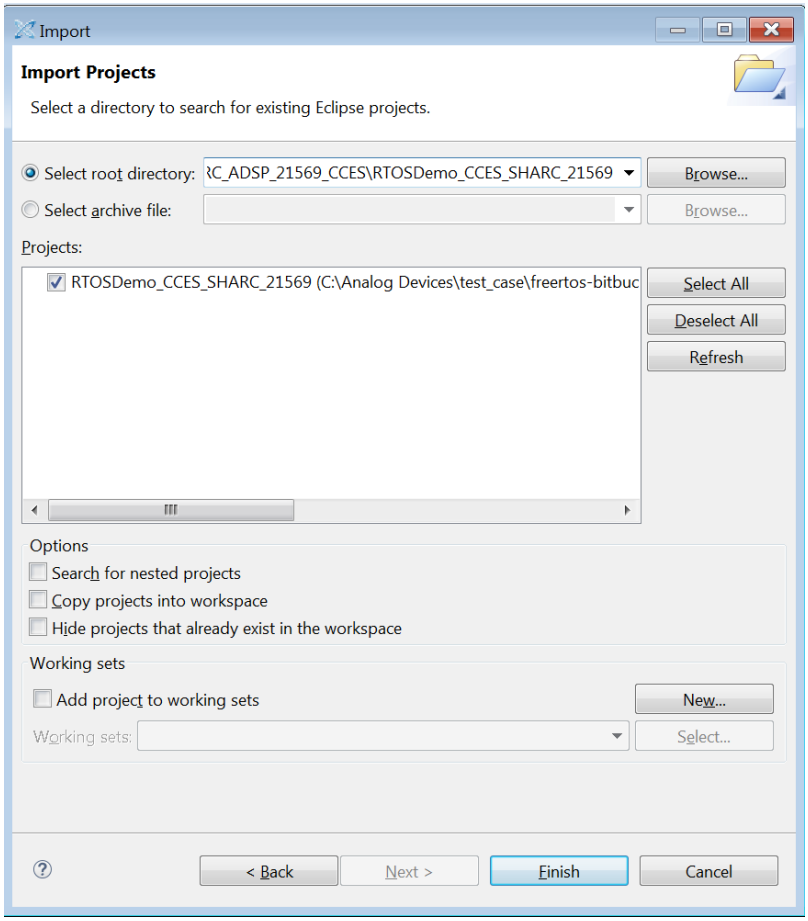
9.1.3 Build the Example

Before you run the FreeRTOS example in CrossCore Embedded Studio, follow below three steps to import and build it.

1. Select the **File** menu and then select the **Import** option.

- Click on the **General** folder, then click on the **Existing Projects into Workspace** entry, and click **Next**
- Click the **Select root directory** radio button and then click the **Browse** button
- Browse the root folder where you previously installed the FreeRTOS product and then browse down into the **FreeRTOSv10.0.0 \FreeRTOS\Demo\SHARC_ADSP_21569_CCES\RTOSDemo_CCES_SHARC_21569** folder
- Click **OK** to close the file browser dialog

- A single project should appear in the **projects** pane of the **Import** window
- Check the entry in the **projects** pane and click **Finish**



2. Choose Debug/Release mode to build the project.

3. Build the project in CrossCore Embedded Studio

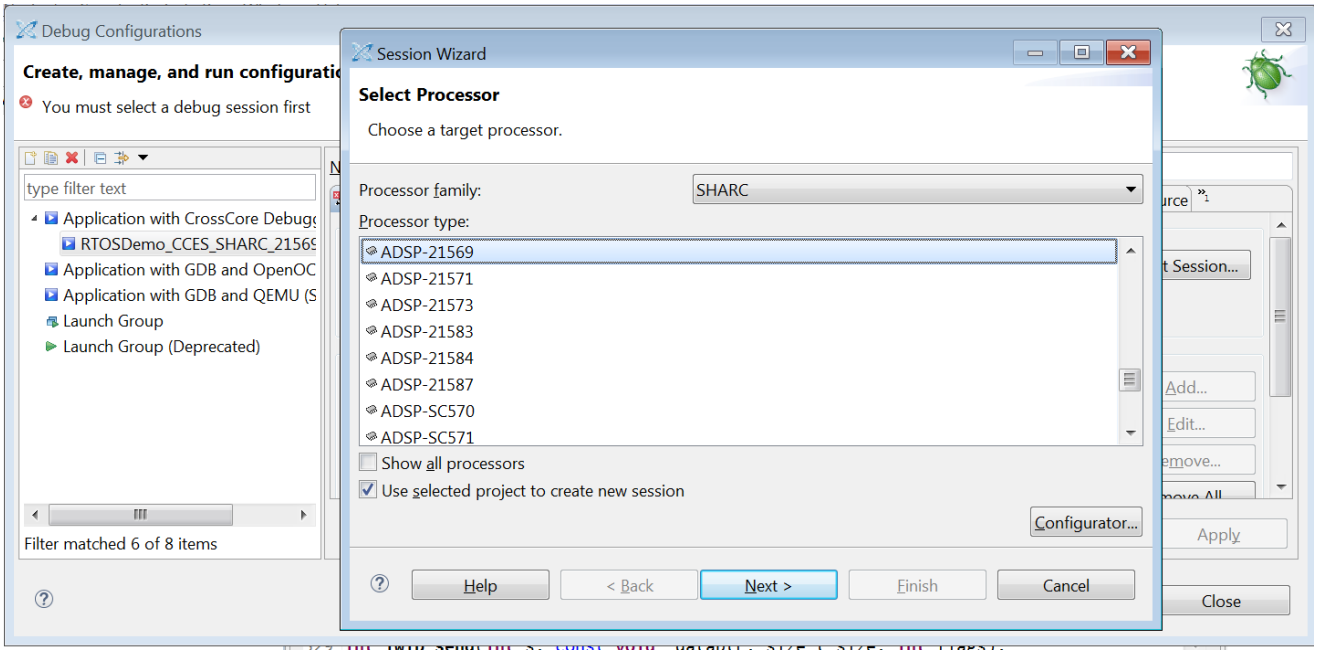
- In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_21569** project and select the **Build Project** option from the menu

9.1.4 Run the Example

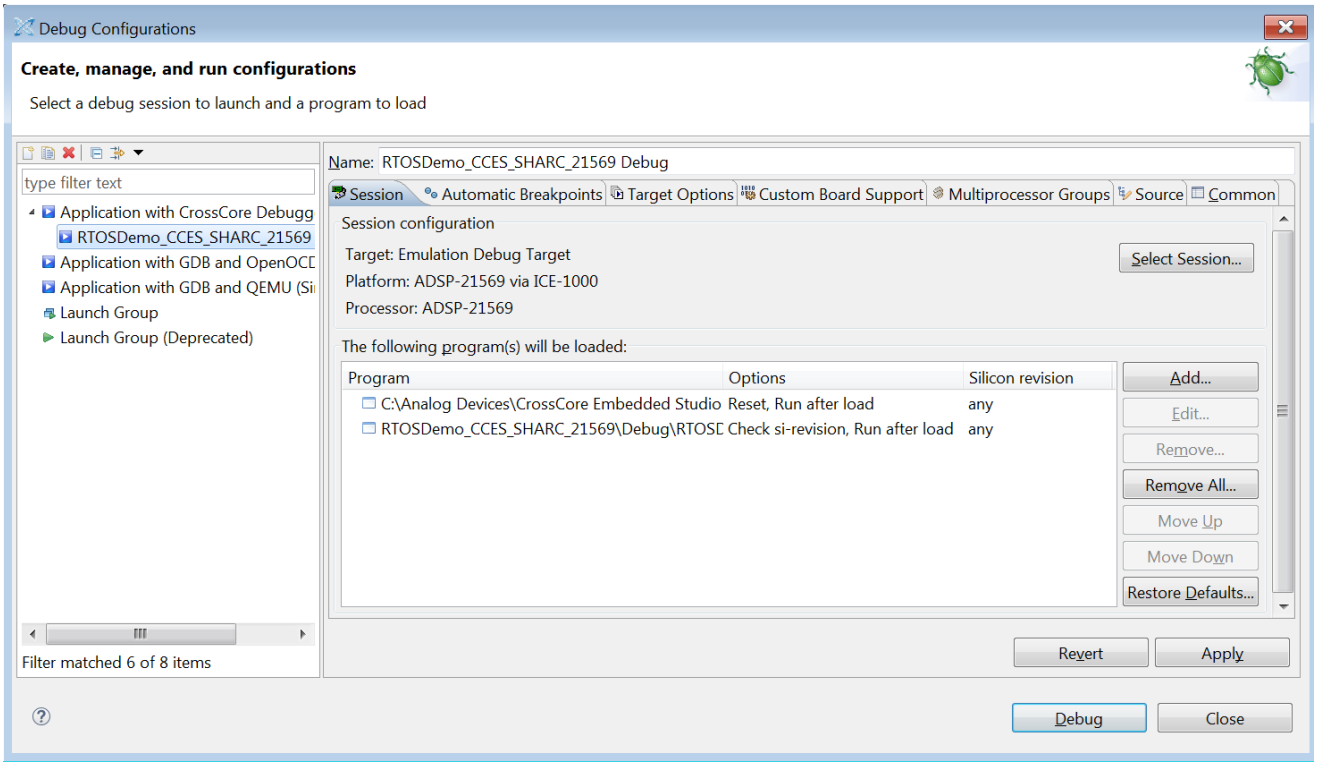
Follow below four steps to do debug configuration, download and run the built binary on the target board.

1. In the **Project Explorer** right click on the **RTOSDemo_CCES_SHARC_21569** project and select the **Debug As** option from the menu

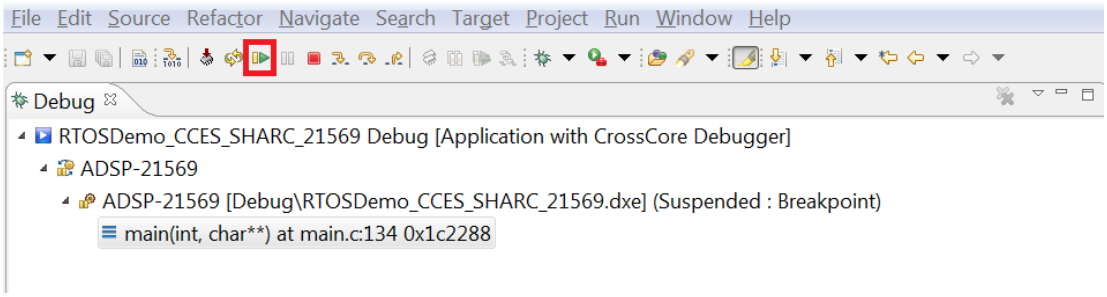
2. From the popup menu select **Debug Configurations** option to create a new debug configuration that matches your emulator(ICE1000 or ICE2000) and target board



3. Click the **Debug** button to close the **Debug Configurations** window

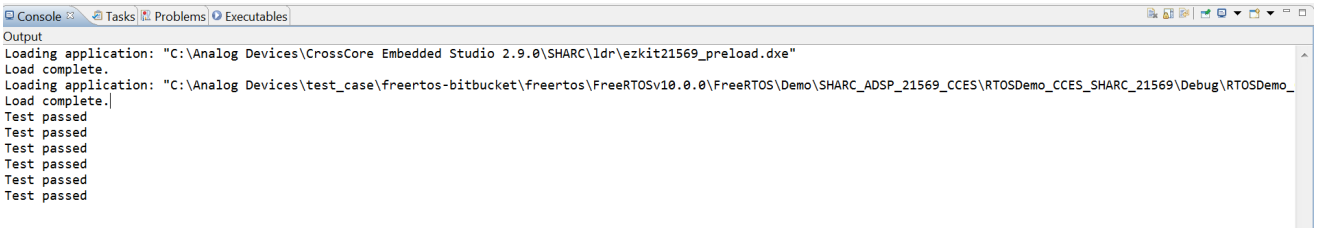


4. Click the **Run/Resume** button to start running your application



9.1.5 Test Results

Output from the application should be visible within the **Console** window in the CrossCore Embedded Studio IDE. You should see the LEDs on the EZ-Kit begin to flash. **Test Passed** will be printed if the all tests passed.



10 Using CrossCore Embedded Studio System Services and Device Drivers with FreeRTOS

Note: This section of the document applies to the ADSP-SC5xx (Cortex-A and SHARC+) and ADSPBF7xx processors. It does not apply to the ADuCM* processor families.

CrossCore Embedded Studio provides support for the on-chip peripherals and EZ-KIT hosted device drivers that are provided for its processors.

In order to use these features with FreeRTOS the source based versions of the drivers must be used rather than the default pre-built libraries that are provided.

Use of the library based version of the System Services and Device Drivers is not compatible with FreeRTOS. Use of the pre-built libraries may result in run-time corruption and execution failure.

To use the System Services and Device Drivers in your CrossCore Embedded Studio project:

1. Ensure that the pre-processor macro __ADI_FREERTOS is defined for all assembler,C/C++ and linker operations.
   This requires the pre-processor macro to defined in three separate locations in the project settings.
2. Ensure that the pre-built libdrv library is not linked into the application.
   a. For Cortex-A projects this is controlled by adding the following option to the Settings >Tool Settings > CrossCore ARM Bare Metal C Linker > Additional Options settings: -specs=PATH_TO_FREERTOS\FreeRTOS\FreeRTOSv10.0.0 \FreeRTOSSource\portable\CCES\ARM_CA5\freertos.specs where PATH_TO_FREERTOS is replaced with the path to the installation of your FreeRTOS product.
   b. For SHARC+ and Blackfin projects this is controlled by checking the Settings > Tool Settings > CrossCore Blackfin/SHARC Linker > Libraries > Omit device driver library checkbox
3. Enable the source based version of the required services and drivers:
   a. Double click the system.svc file in the Project Explorer
   b. Click the Add button in the System Configuration Overview
   c. Browse the list of Device Drivers and System Services to add new components to the project

4. Build the project

The provided demo examples for the EZ-KITs contain all the appropriate project settings already configured and are an easy way to get started with a new FreeRTOS project

11 Appendix A: FreeRTOS Performance

The following appendix contains code size and performance data for Analog Devices specific ports of FreeRTOS.

Timer Cycles

The following benchmarks report time and cycle count measurements for post and pending operations using varying methods of communication.

Benchmark data is available for the following EZ-Kits:

- ADSP-SC589 EZ-Kit (Cortex A5 Core)
- ADSP-SC589 EZ-Kit (SHARC+ Core)
- ADSP-SC573 EZ-Kit (Cortex A5 Core)
- ADSP-21569 EZ-Kit (SHARC Core)
- ADSP-BF707 EZ-Kit
- ADuCM3029 EZ-Kit
- ADuCM4050 EZ-Kit
- The following projects are executed to gather the benchmark data:
- **ISR:** calculate Interrupt service time and Time to return from an ISR when in FreeRTOS system.
- **FLAG ISR:** calculate FLAG Post/Pend available time,context switch time when unavailable, Interrupt service time and Time to return from an ISR when in FreeRTOS system
- **MSG ISR:** calculate Message queue Post/Pend available time,context switch time when unavailable, Interrupt service time and Time to return from an ISR when in FreeRTOS system
- **SEM ISR:** calculate Semaphore Post/Pend available time,context switch time when unavailable, Interrupt service time and Time to return from an ISR when in FreeRTOS system
- **MUT ISR:** calculate Mutex Post/Pend available time,context switch time when unavailable, Interrupt service time and Time to return from an ISR when in FreeRTOS system

Spaces

The following benchmarks report code size for several common RTOS operations within FreeRTOS. The benchmark data is available for the following EZ-Kits:

- ADSP-SC589 EZ-Kit (Cortex A5 Core)

- ADSP-SC589 Ez-Kit (SHARC+ Core)
- ADSP-21569 EZ-Kit (SHARC Core)
- ADSP-BF707 EZ-Kit

The following projects are executed to gather the benchmark data:

- **NONE:** Basic project
- **Message Queues:** Basic project using 1 static object / Basic project using 2 static objects
- **Flags:** Basic project using 1 static object / Basic project using 2 static objects
- **Mutexes:** Basic project using 1 static object / Basic project using 2 static objects
- **Semaphores:** Basic project using 1 static object / Basic project using 2 static objects
- **ALL:** Basic project using 1 static object / Basic project using 2 static objects

11.1 ADSP-21569 (SHARC Core) Benchmark Data

ADSP-21569 SHARC Core Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	314
	xEventGroupWaitBits (flag unavailable, context switch to new task)	1244
	xEventGroupSetBits (no task pending, no context switch)	255
	xEventGroupSetBits (task waiting, context switch to pending task)	1156
	xEventGroupSetBits (from an ISR, switching to a pending task)	3742
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	227
	Time to return from an ISR (FreeRTOS, no task switch)	174
FreeRTOS_MSGISR	xQueueReceive(message available)	298
	xQueueReceive(message unavailable, context switch to new task)	2108
	xQueueSend(no task pending, no context switch)	363

		cycles
	xQueueSend(task waiting, context switch to pending task)	1434
	xQueueSend(from an ISR, switching to a pending task)	1097
FreeRTOS_MUTISR	xSemaphoreTake(mutex available)	238
	xSemaphoreTake(mutex unavailable, context switch to new task	2411
	xSemaphoreGive(no task pending, no context switch)	329
	xSemaphoreGive(task waiting, context switch to pending task)	1540
FreeRTOS_SEMISR	xSemaphoreTake(semaphore available)	213
	xSemaphoreTake(semaphore unavailable, context switch to new task)	2097
	xSemaphoreGive(no task pending, no context switch)	313
	xSemaphoreGive(task waiting, context switch to pending task)	1293
	xSemaphoreGive (from an ISR, switching to a pending task)	1029

ADSP-21569 SHARC Core Sizing Metrics

		Data	Code	Total
NONE	Basic project	59307	29842	89149
Message Queues	Basic project using 1 static object	59403	29970	89373
	Basic project using 2 static objects	59483	29970	89453
Flags	Basic project using 1 static object	59459	31702	91161
	Basic project using 2 static objects	59491	31702	91193

		Data	Code	Total
Mutexes	Basic project using 1 static object	59395	32114	91509
	Basic project using 2 static objects	59483	32114	91597
Semaphores	Basic project using 1 static object	59395	31982	91377
	Basic project using 2 static objects	59483	31982	91465
ALL	Basic project using 1 static object	59547	34198	93745
	Basic project using 2 static objects	59667	34198	93865

11.2 ADSP-SC589 (Cortex-A Core) Benchmark Data

ADSP-SC589 Cortex-A Core Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	321
	xEventGroupWaitBits (flag unavailable, context switch to new task)	1129
	xEventGroupSetBits (no task pending, no context switch)	324
	xEventGroupSetBits (task waiting, context switch to pending task)	1095
	xEventGroupSetBits (from an ISR, switching to a pending task)	3158
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	109
	Time to return from an ISR (FreeRTOS, no task switch)	24
FreeRTOS_MSGISR	xQueueReceive(message available)	287
	xQueueReceive(message unavailable, context switch to new task)	2290
	xQueueSend(no task pending, no context switch)	309

		cycles
	xQueueSend(task waiting, context switch to pending task)	1309
	xQueueSend(from an ISR, switching to a pending task)	648
FreeRTOS_MUTISR	xSemaphoreTake(mutex available)	239
	xSemaphoreTake(mutex unavailable, context switch to new task	2630
	xSemaphoreGive(no task pending, no context switch)	274
	xSemaphoreGive(task waiting, context switch to pending task)	1438
FreeRTOS_SEMISR	xSemaphoreTake(semaphore available)	212
	xSemaphoreTake(semaphore unavailable, context switch to new task)	2442
	xSemaphoreGive(no task pending, no context switch)	317
	xSemaphoreGive(task waiting, context switch to pending task)	1344
	xSemaphoreGive (from an ISR, switching to a pending task)	638

ADSP-SC589 Cortex-A Core Sizing Metrics

		Data	Code	Total
NONE	Basic project	97812	18624	116436
Message Queues	Basic project using 1 static object	97812	18680	116492
	Basic project using 2 static objects	97812	18680	116492
Flags	Basic project using 1 static object	97812	19096	116908
	Basic project using 2 static objects	97812	19096	116908

		Data	Code	Total
Mutexes	Basic project using 1 static object	97812	18704	116516
	Basic project using 2 static objects	97812	18704	116516
Semaphores	Basic project using 1 static object	97812	18664	116476
	Basic project using 2 static objects	97812	18664	116476
ALL	Basic project using 1 static object	97812	19264	117076
	Basic project using 2 static objects	97812	19256	117068

11.3 ADSP-SC589 (SHARC+ Core) Benchmark Data

ADSP-SC589 SHARC+ Core Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	440
	xEventGroupWaitBits (flag unavailable, context switch to new task)	1708
	xEventGroupSetBits (no task pending, no context switch)	340
	xEventGroupSetBits (task waiting, context switch to pending task)	1586
	xEventGroupSetBits (from an ISR, switching to a pending task)	4643
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	236
	Time to return from an ISR (FreeRTOS, no task switch)	182
FreeRTOS_MSGISR	xQueueReceive(message available)	409
	xQueueReceive(message unavailable, context switch to new task)	2710

		cycles
	xQueueSend(no task pending, no context switch)	476
	xQueueSend(task waiting, context switch to pending task)	1877
	xQueueSend(from an ISR, switching to a pending task)	1160
FreeRTOS_MUTISR	xSemaphoreTake(mutex available)	321
	xSemaphoreTake(mutex unavailable, context switch to new task	3199
	xSemaphoreGive(no task pending, no context switch)	484
	xSemaphoreGive(task waiting, context switch to pending task)	2117
FreeRTOS_SEMISR	xSemaphoreTake(semaphore available)	275
	xSemaphoreTake(semaphore unavailable, context switch to new task)	2711
	xSemaphoreGive(no task pending, no context switch)	404
	xSemaphoreGive(task waiting, context switch to pending task)	1718
	xSemaphoreGive (from an ISR, switching to a pending task)	1019

ADSP-SC589 SHARC+ Core Sizing Metrics

		Data	Code	Total
NONE	Basic project	59838	29764	89602
Message Queues	Basic project using 1 static object	59934	29896	89830
	Basic project using 2 static objects	59934	29896	89830
Flags	Basic project using 1 static object	59966	31692	91658

		Data	Code	Total
	Basic project using 2 static objects	59966	31692	91658
Mutexes	Basic project using 1 static object	59926	32184	92110
	Basic project using 2 static objects	59926	32184	92110
Semaphores	Basic project using 1 static object	59926	32048	91974
	Basic project using 2 static objects	59926	32048	91974
ALL	Basic project using 1 static object	60054	34340	94394
	Basic project using 2 static objects	60054	34340	94394

11.4 ADuCM3029 Benchmark Data

ADuCM3029 Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	258
	xEventGroupWaitBits (flag unavailable, context switch to new task)	604
	xEventGroupSetBits (no task pending, no context switch)	199
	xEventGroupSetBits (task waiting, context switch to pending task)	529
	xEventGroupSetBits (from an ISR, switching to a pending task)	942
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	128
	Time to return from an ISR (FreeRTOS, no task switch)	45
FreeRTOS_MSGISR	xQueueReceive (message available)	213

		cycles
	xQueueReceive (message unavailable, context switch to new task)	1043
	xQueueSend (no task pending, no context switch)	243
	xQueueSend (task waiting, context switch to pending task)	647
	xQueueSend (from an ISR, switching to a pending task)	309
FreeRTOS_MUTISR	xSemaphoreTake (mutex available)	184
	xSemaphoreTake (mutex unavailable, context switch to new task	1252
	xSemaphoreGive (no task pending, no context switch)	232
	xSemaphoreGive (task waiting, context switch to pending task)	754
FreeRTOS_SEMISR	xSemaphoreTake (semaphore available)	175
	xSemaphoreTake (semaphore unavailable, context switch to new task)	1068
	xSemaphoreGive (no task pending, no context switch)	207
	xSemaphoreGive (task waiting, context switch to pending task)	578
	xSemaphoreGive (from an ISR, switching to a pending task)	266

ADuCM3029 Sizing Metrics

		Data	Code	Total
NONE	Basic project	4168	7632	11800
Message Queues	Basic project using 1 static object	4172	7692	11864
	Basic project using 2 static objects	4244	7692	11936

		Data	Code	Total
Flags	Basic project using 1 static object	4124	8136	12260
	Basic project using 2 static objects	4152	8136	12288
Mutexes	Basic project using 1 static object	4168	7728	11896
	Basic project using 2 static objects	4240	7728	11968
Semaphores	Basic project using 1 static object	4168	7680	11848
	Basic project using 2 static objects	4240	7680	11920
ALL	Basic project using 1 static object	4272	8320	12592
	Basic project using 2 static objects	4444	8320	12764

11.5 ADuCM4050 Benchmark Data

ADuCM4050 Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	259
	xEventGroupWaitBits (flag unavailable, context switch to new task)	594
	xEventGroupSetBits (no task pending, no context switch)	208
	xEventGroupSetBits (task waiting, context switch to pending task)	532
	xEventGroupSetBits (from an ISR, switching to a pending task)	993
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	386
	Time to return from an ISR (FreeRTOS, no task switch)	157
FreeRTOS_MSGISR	xQueueReceive (message available)	217

		cycles
	xQueueReceive (message unavailable, context switch to new task)	1039
	xQueueSend (no task pending, no context switch)	236
	xQueueSend (task waiting, context switch to pending task)	668
	xQueueSend (from an ISR, switching to a pending task)	330
FreeRTOS_MUTISR	xSemaphoreTake (mutex available)	193
	xSemaphoreTake (mutex unavailable, context switch to new task	1217
	xSemaphoreGive (no task pending, no context switch)	234
	xSemaphoreGive (task waiting, context switch to pending task)	791
FreeRTOS_SEMISR	xSemaphoreTake (semaphore available)	165
	xSemaphoreTake (semaphore unavailable, context switch to new task)	1034
	xSemaphoreGive (no task pending, no context switch)	216
	xSemaphoreGive (task waiting, context switch to pending task)	607
	xSemaphoreGive (from an ISR, switching to a pending task)	273

ADuCM4050 Sizing Metrics

		Data	Code	Total
NONE	Basic project	4168	8084	12252
Message Queues	Basic project using 1 static object	4172	8144	12316
	Basic project using 2 static objects	4244	8144	12388

		Data	Code	Total
Flags	Basic project using 1 static object	4124	8588	12712
	Basic project using 2 static objects	4152	8588	12740
Mutexes	Basic project using 1 static object	4168	8180	12348
	Basic project using 2 static objects	4240	8180	12420
Semaphores	Basic project using 1 static object	4168	8132	12300
	Basic project using 2 static objects	4240	8132	12372
ALL	Basic project using 1 static object	4272	8772	13044
	Basic project using 2 static objects	4444	8772	13216

11.6 ADZS-BF707 Benchmark Data

ADZS-BF707 Performance Metrics

		cycles
FreeRTOS_FLGISR	xEventGroupWaitBits (flag available)	420
	xEventGroupWaitBits (flag unavailable, context switch to new task)	1856
	xEventGroupSetBits (no task pending, no context switch)	356
	xEventGroupSetBits (task waiting, context switch to pending task)	1866
	xEventGroupSetBits (from an ISR, switching to a pending task)	3158
FreeRTOS_ISR	Interrupt service time (FreeRTOS)	98
	Time to return from an ISR (FreeRTOS, no task switch)	126

		cycles
FreeRTOS_MSGISR	xQueueReceive(message available)	447
	xQueueReceive(message unavailable, context switch to new task)	2937
	xQueueSend(no task pending, no context switch)	630
	xQueueSend(task waiting, context switch to pending task)	2412
	xQueueSend(from an ISR, switching to a pending task)	1417
FreeRTOS_MUTISR	xSemaphoreTake(mutex available)	337
	xSemaphoreTake(mutex unavailable, context switch to new task	3553
	xSemaphoreGive(no task pending, no context switch)	663
	xSemaphoreGive(task waiting, context switch to pending task)	2624
FreeRTOS_SEMISR	xSemaphoreTake(semaphore available)	271
	xSemaphoreTake(semaphore unavailable, context switch to new task)	2943
	xSemaphoreGive(no task pending, no context switch)	504
	xSemaphoreGive(task waiting, context switch to pending task)	2093
	xSemaphoreGive (from an ISR, switching to a pending task)	1235

ADZS-BF707 Sizing Metrics

		Data	Code	Total
NONE	Basic project	6535	13698	20233
Message Queues	Basic project using 1 static object	6623	13762	20385

		Data	Code	Total
	Basic project using 2 static objects	6707	13762	20469
Flags	Basic project using 1 static object	6567	14402	20969
	Basic project using 2 static objects	6599	14402	21001
Mutexes	Basic project using 1 static object	6619	14682	21301
	Basic project using 2 static objects	6703	14682	21385
Semaphores	Basic project using 1 static object	6619	14618	21237
	Basic project using 2 static objects	6703	14618	21321
ALL	Basic project using 1 static object	6655	15506	22161
	Basic project using 2 static objects	6771	15506	22277