NXP Semiconductors
User's Guide

Document Number: MCUXSDKMIMXRT6XXGSUG
Rev. 0, 01/2019

Getting Started with MCUXpresso SDK for MIMXRT600

1 Overview

The MCUXpresso Software Development Kit (SDK) provides comprehensive software support for Kinetis and LPC Microcontrollers. The MCUXpresso SDK includes a flexible set of peripheral drivers designed to speed up and simplify development of embedded applications. Along with the peripheral drivers, the MCUXpresso SDK provides an extensive and rich set of example applications covering everything from basic peripheral use case examples to full demo applications. The MCUXpresso SDK contains FreeRTOS, a USB host and device stack, and various other middleware to support rapid development.

For supported toolchain versions, see the MCUXpresso SDK Release Notes Supporting EVK-MIMXRT685 (document MCUXSDKMIMXRT6XXRN).

For the latest version of this and other MCUXpresso SDK documents, see the MCUXpresso SDK homepage MCUXpresso-SDK: Software Development Kit for MCUXpresso.

Contents

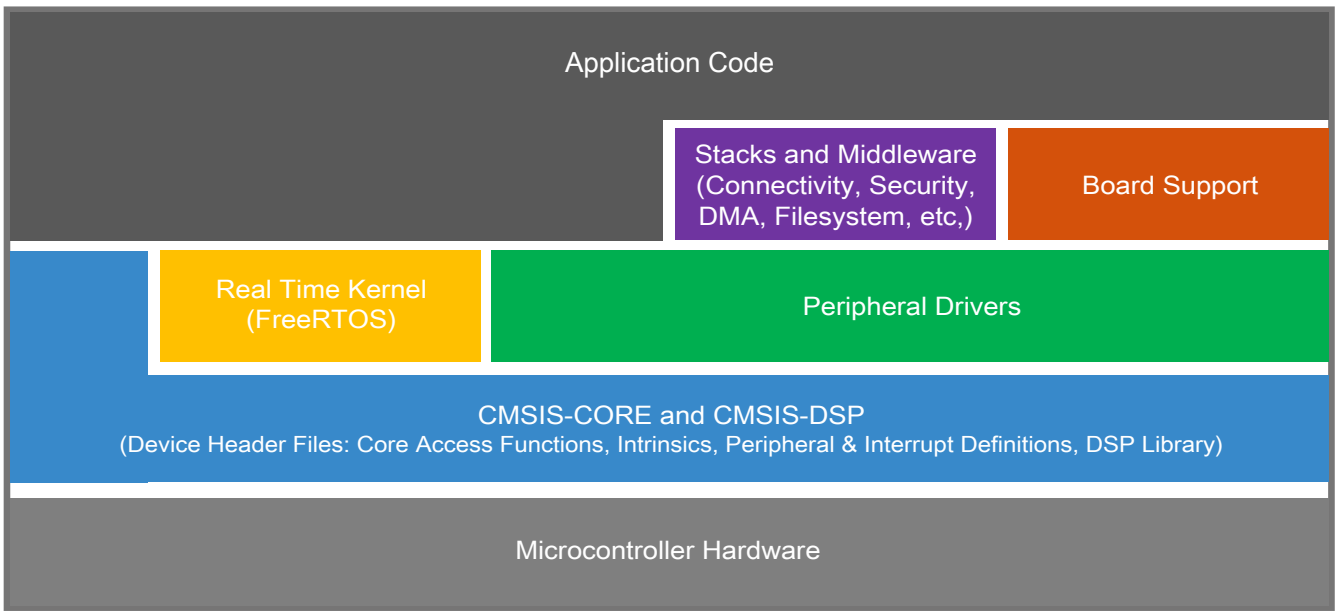

Figure 1. MCUXpresso SDK layers

2 MCUXpresso SDK board support folders

MCUXpresso SDK board support provides example applications for NXP development and evaluation boards for Arm® Cortex®-M cores, including Freedom, Tower System, and LPCXpresso boards. Board support packages are found inside of the top level boards folder, and each supported board has its own folder (an MCUXpresso SDK package can support multiple boards). Within each <board_name> folder, there are various sub-folders to classify the type of examples they contain. These include (but are not limited to):

- cmsis_driver_examples: Simple applications intended to concisely illustrate how to use CMSIS drivers.
- demo_apps: Full-featured applications intended to highlight key functionality and use cases of the target MCU. These applications typically use multiple MCU peripherals and may leverage stacks and middleware.
- driver_examples: Simple applications intended to concisely illustrate how to use the MCUXpresso SDK's peripheral drivers for a single use case. These applications typically only use a single peripheral, but there are cases where multiple are used (for example, SPI conversion using DMA).
- rtos_examples: Basic FreeRTOS™ OS examples showcasing the use of various RTOS objects (semaphores, queues, and so on) and interfacing with the MCUXpresso SDK's RTOS drivers
- usb_examples: Applications that use the USB host/device/OTG stack.

2.1 Example application structure

This section describes how the various types of example applications interact with the other components in the MCUXpresso SDK. To get a comprehensive understanding of all MCUXpresso SDK components and folder structure, see the *MCUXpresso SDK API Reference Manual* document (MCUXSDKAPIRM).

Each <board_name> folder in the boards directory contains a comprehensive set of examples that are relevant to that specific piece of hardware. Although we use the hello_world example (part of the demo_apps folder), the same general rules apply to any type of example in the <board_name> folder.

In the hello_world application folder you see the following contents:

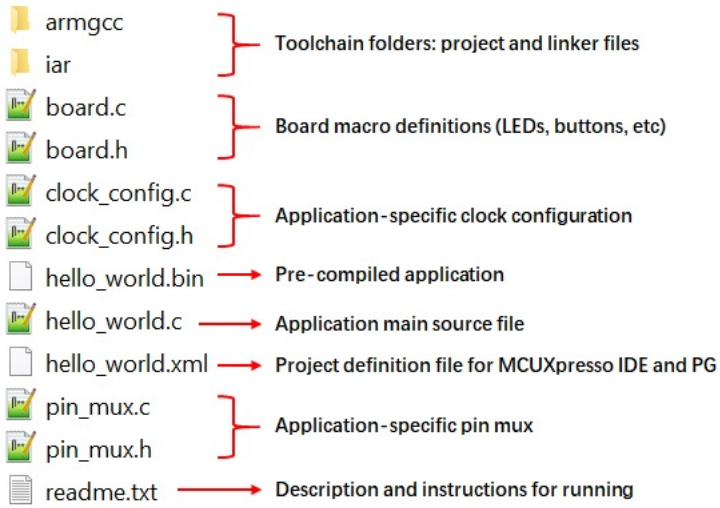

Figure 2. Application folder structure

All files in the application folder are specific to that example, so it is easy to copy and paste an existing example to start developing a custom application based on a project provided in the MCUXpresso SDK.

2.2 Locating example application source files

When opening an example application in any of the supported IDEs (except MCUXpresso IDE), a variety of source files are referenced. The MCUXpresso SDK devices folder is the central component to all example applications. It means the examples reference the same source files and, if one of these files is modified, it could potentially impact the behavior of other examples.

The main areas of the MCUXpresso SDK tree used in all example applications are:

- devices/<device_name>: The device's CMSIS header file, MCUXpresso SDK feature file and a few other things.
- devices/<device_name>/cmsis_drivers: All the CMSIS drivers for your specific MCU.
- devices/<device_name>/drivers: All of the peripheral drivers for your specific MCU.
- devices/<device_name>/<tool_name>: Toolchain-specific startup code. Vector table definitions are here.
- devices/<device_name>/utilities: Items such as the debug console that are used by many of the example applications.

For examples containing an RTOS, there are references to the appropriate source code. RTOSes are in the *rtos* folder. Again, the core files of each of these are shared, so modifying them could have potential impacts on other projects that depend on them.

3 Run a demo using MCUXpresso IDE

NOTE

Ensure that the MCUXpresso IDE toolchain is included when generating the MCUXpresso SDK Package.

This section describes the steps required to configure MCUXpresso IDE v10.3.1 to build, run, and debug example applications. The hello_world demo application targeted for the MIMXRT685-EVK hardware platform is used as an example, though these steps can be applied to any example application in the MCUXpresso SDK.

3.1 Select the workspace location

Every time MCUXpresso IDE launches, it prompts the user to select a workspace location. MCUXpresso IDE is built on top of Eclipse, which uses workspace to store information about its current configuration, and in some use cases, source files for the projects in the workspace. The location of the workspace can be anywhere, but it is recommended that the workspace be outside of the MCUXpresso SDK tree.

3.2 Build an example application

To build an example application, follow these steps.

1. Drag and drop the SDK zip file into the “Installed SDKs” view to install an SDK. In the window that appears, click the “OK” button and wait until the import has finished.

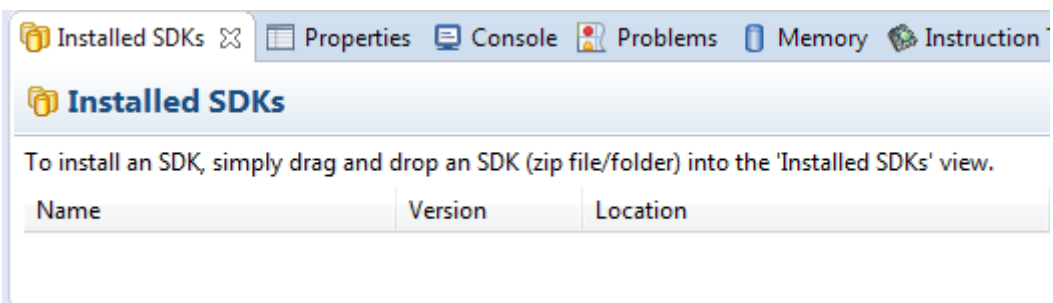

Figure 3. Install an SDK

2. On the *Quickstart Panel*, click “Import SDK example(s)…”.

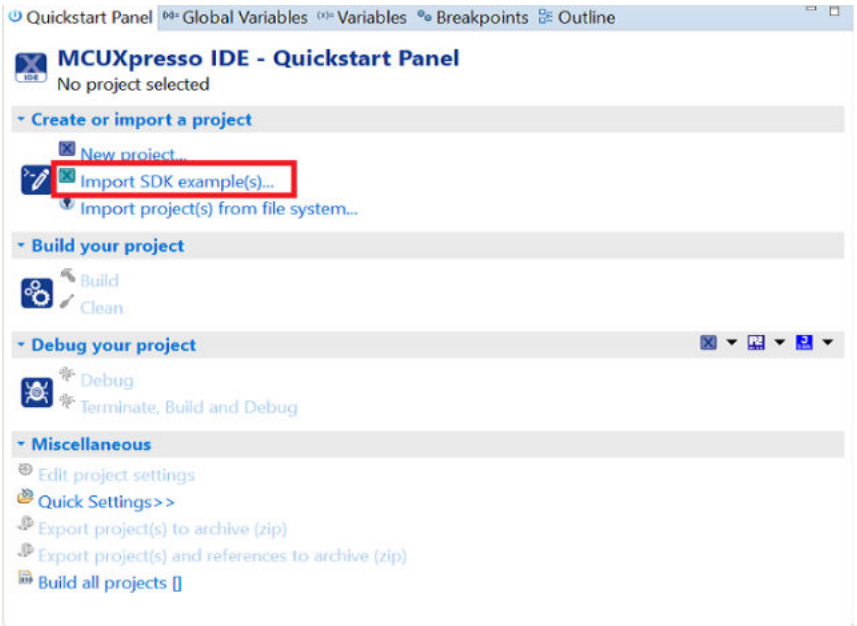

Figure 4. Import an SDK example

3. In the window that appears, expand the “MIMXRT600” folder and select “MIMXRT685S" . Then, select “evkmimxrt685” and click the “Next” button.

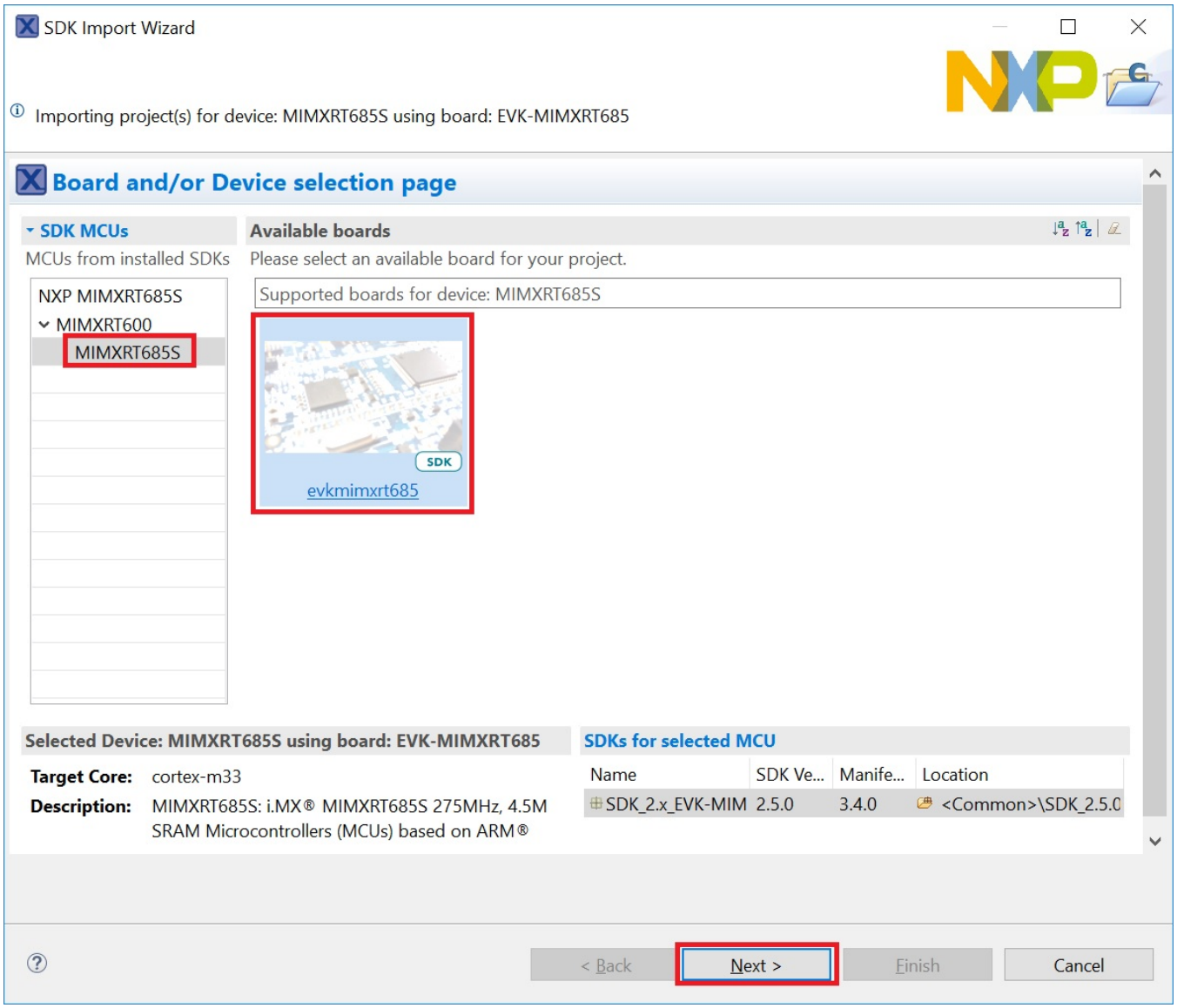

Figure 5. Select MIMXRT685-EVK board

4. Expand the “demo_apps” folder and select “hello_world”. Then, click the "Next” button.

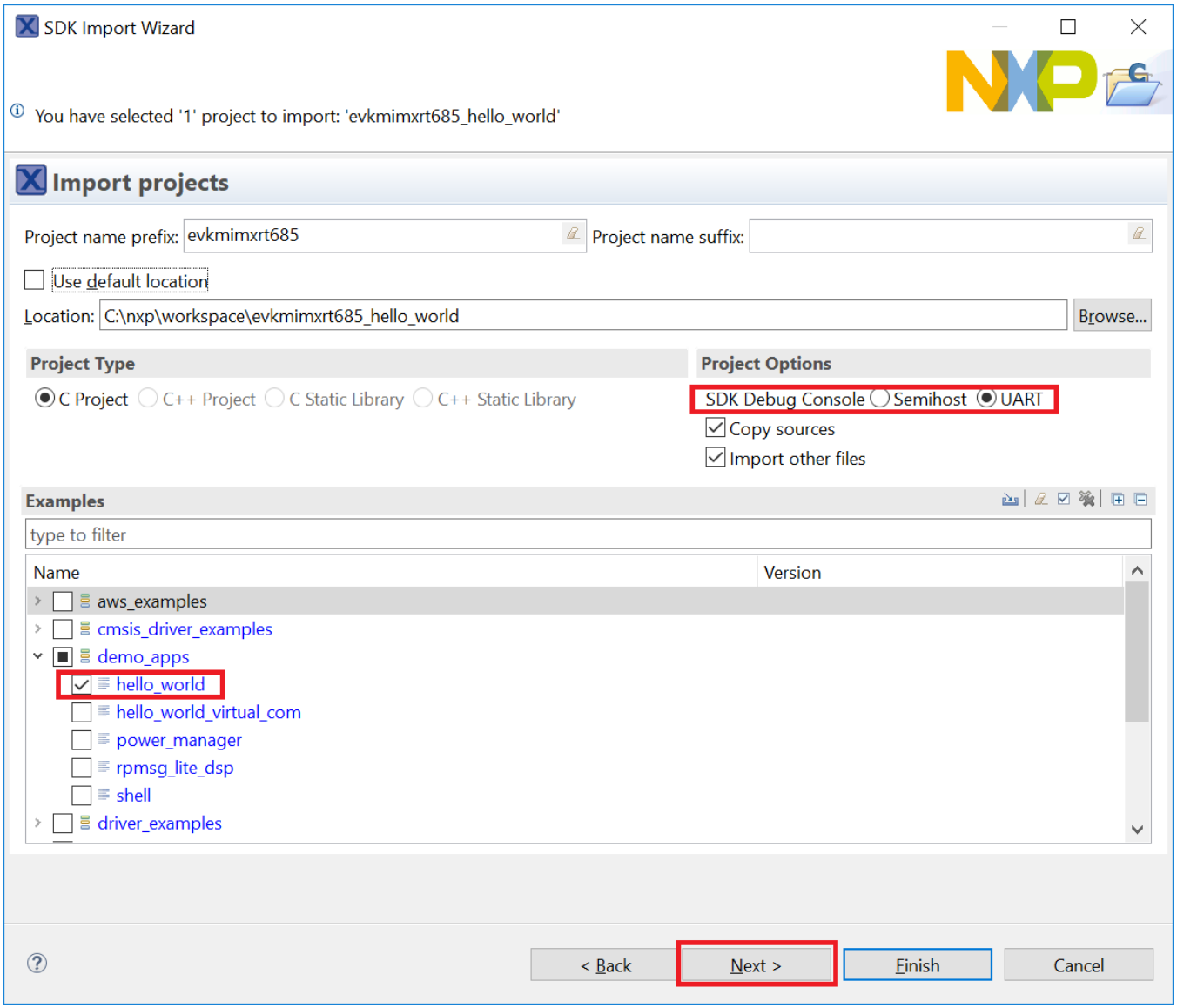

Figure 6. Select "hello_world"

5. Ensure the option “Redlib: Use floating point version of printf” is selected if the cases' print floating point numbers are on the terminal. Otherwise, it is not necessary to select this option. Then, click the “Finish” button.

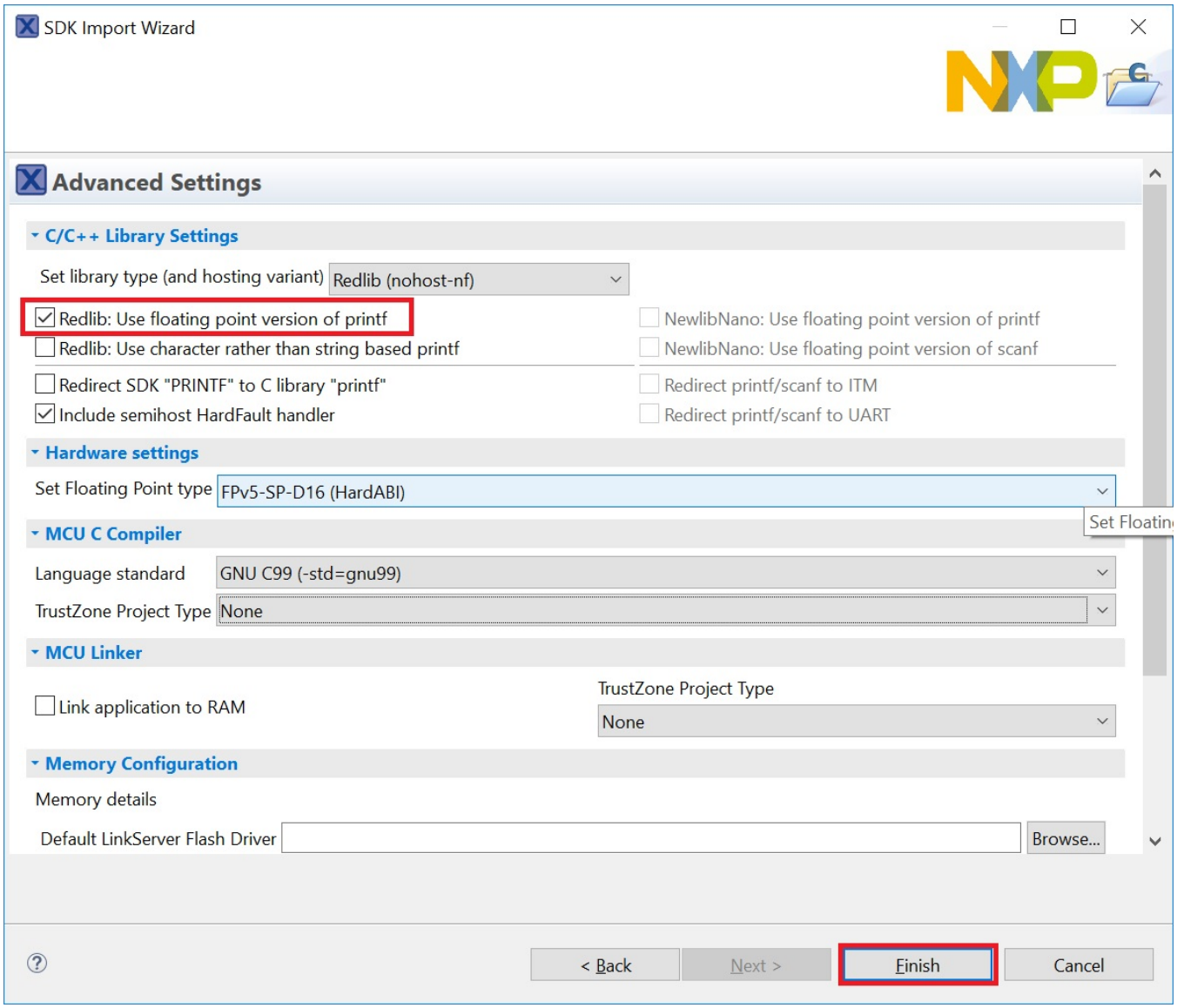

Figure 7. Select "User floating print version of printf"

3.3 Run an example application

For more information on debug probe support in the MCUXpresso IDE v10.3.1, visit community.nxp.com.

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform.
   - For boards with a P&E Micro interface, visit www.pemicro.com/support/downloads_find.cfm and download and install the P&E Micro Hardware Interface Drivers package.
2. Connect the development platform to your PC via USB cable.
3. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
   a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)

b. No parity
c. 8 data bits
d. 1 stop bit

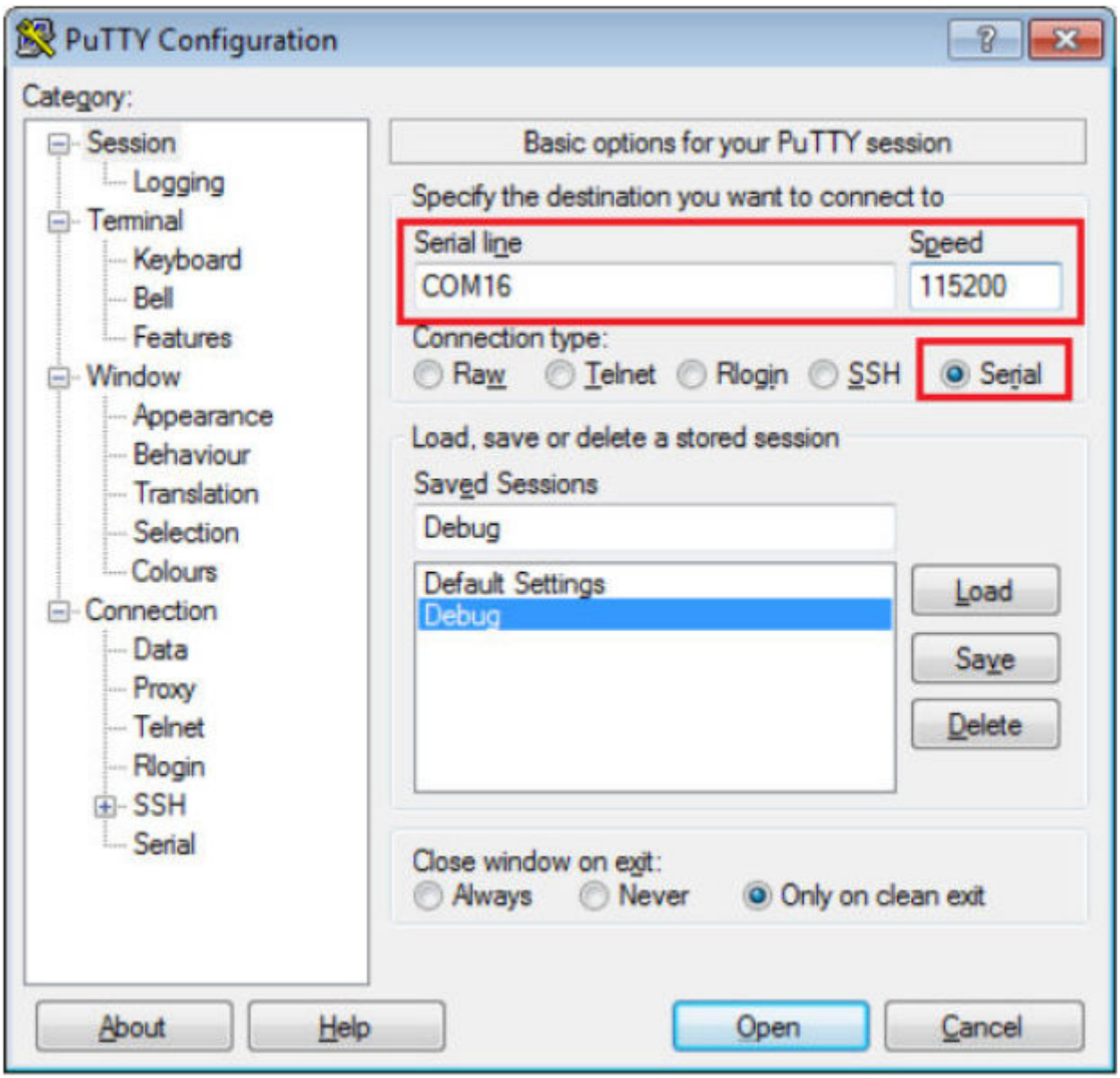

Figure 8. Terminal (PuTTY) configurations

4. On the *Quickstart Panel*, click on "Debug evkmimxrt685_hello_world' [Debug]".

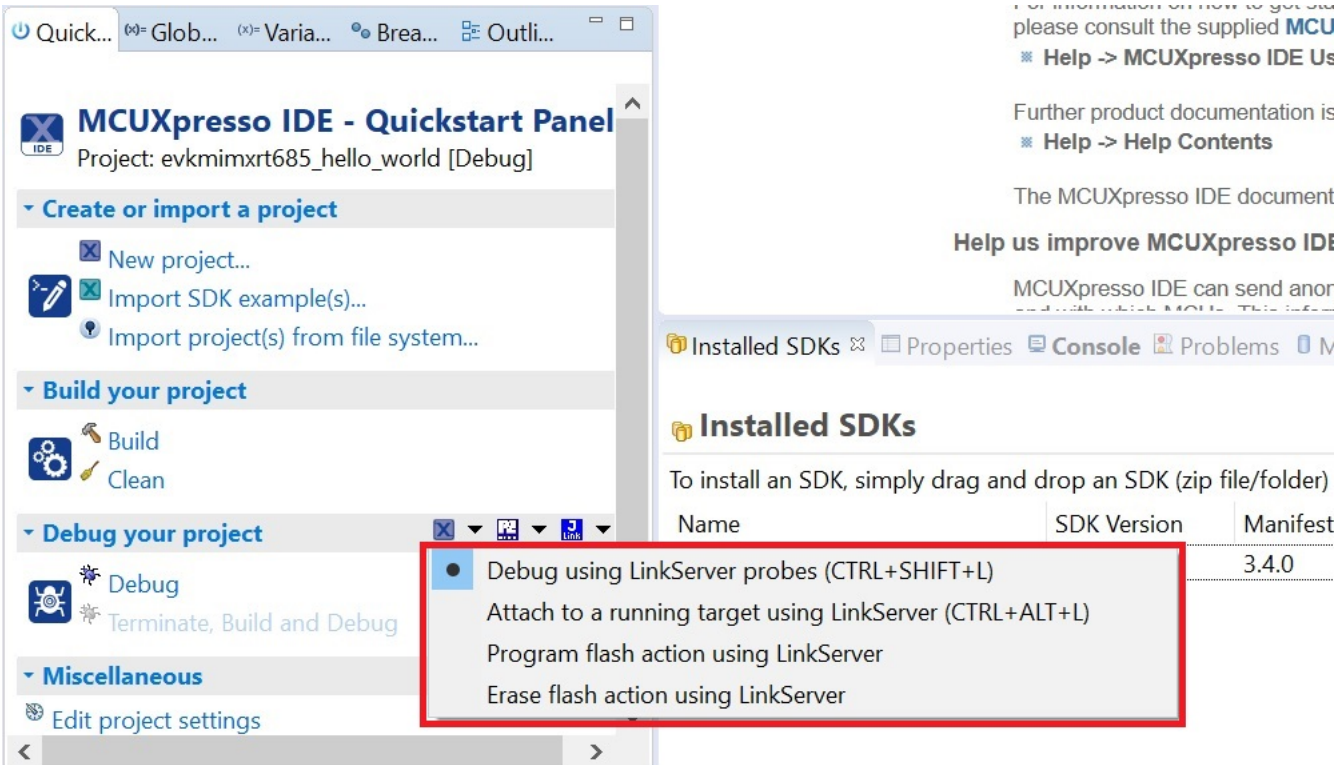

Figure 9. Debug "hello_world" case

5. The first time you debug a project, the Debug Emulator Selection Dialog is displayed, showing all supported probes that are attached to your computer. Select the probe through which you want to debug and click the “OK” button. (For any future debug sessions, the stored probe selection is automatically used, unless the probe cannot be found.)

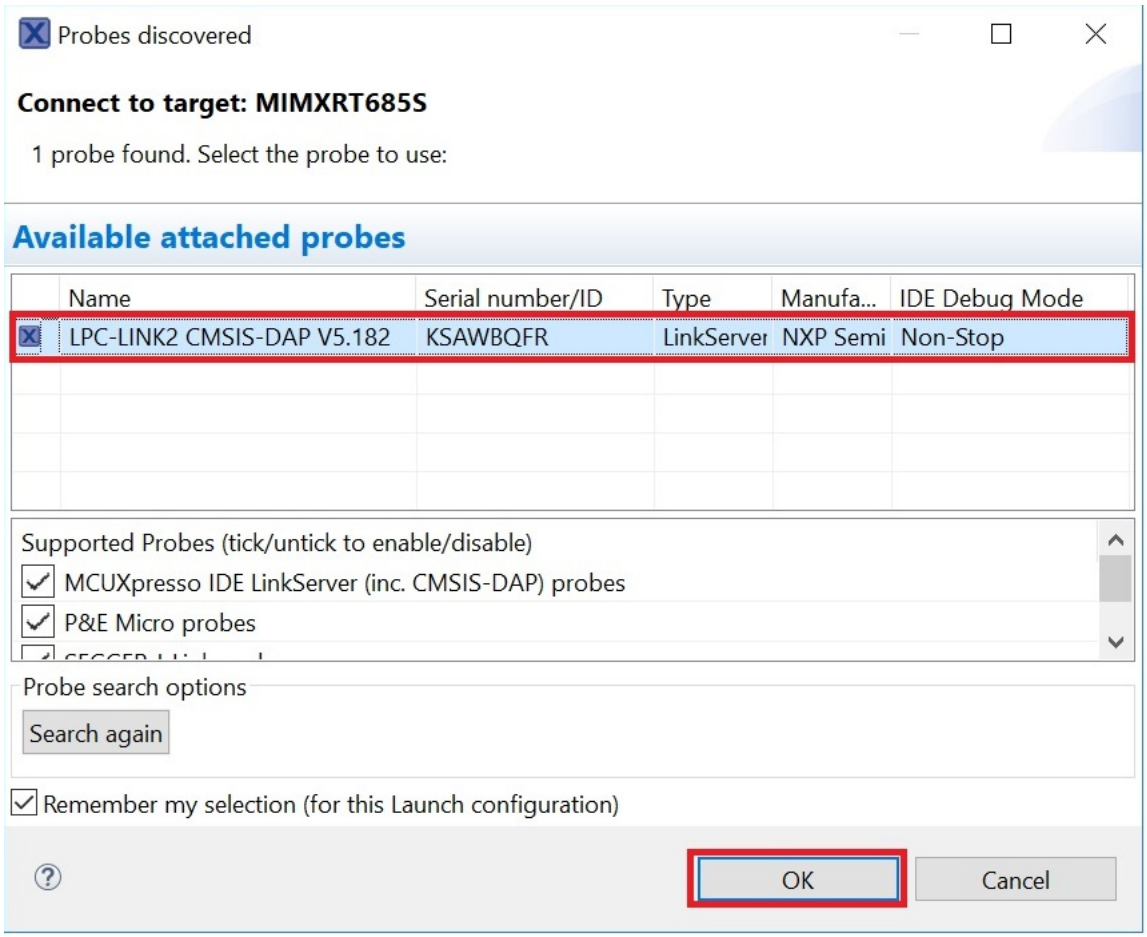

Figure 10. Attached Probes: debug emulator selection

NOTE

If the debug probe is CMSIS-DAP and the debugging application is running in flash, make sure the board is set to QSPI flash boot mode. Otherwise, you should not set to QSPI boot mode when debugging the application. If the debug probe is J-Link, "Reset before running" must be disabled. Double click the <example> J-Link Debug.launch file, then deselect this option under "Debugger->Additional Options" menu.

6. The application is downloaded to the target and automatically runs to main():

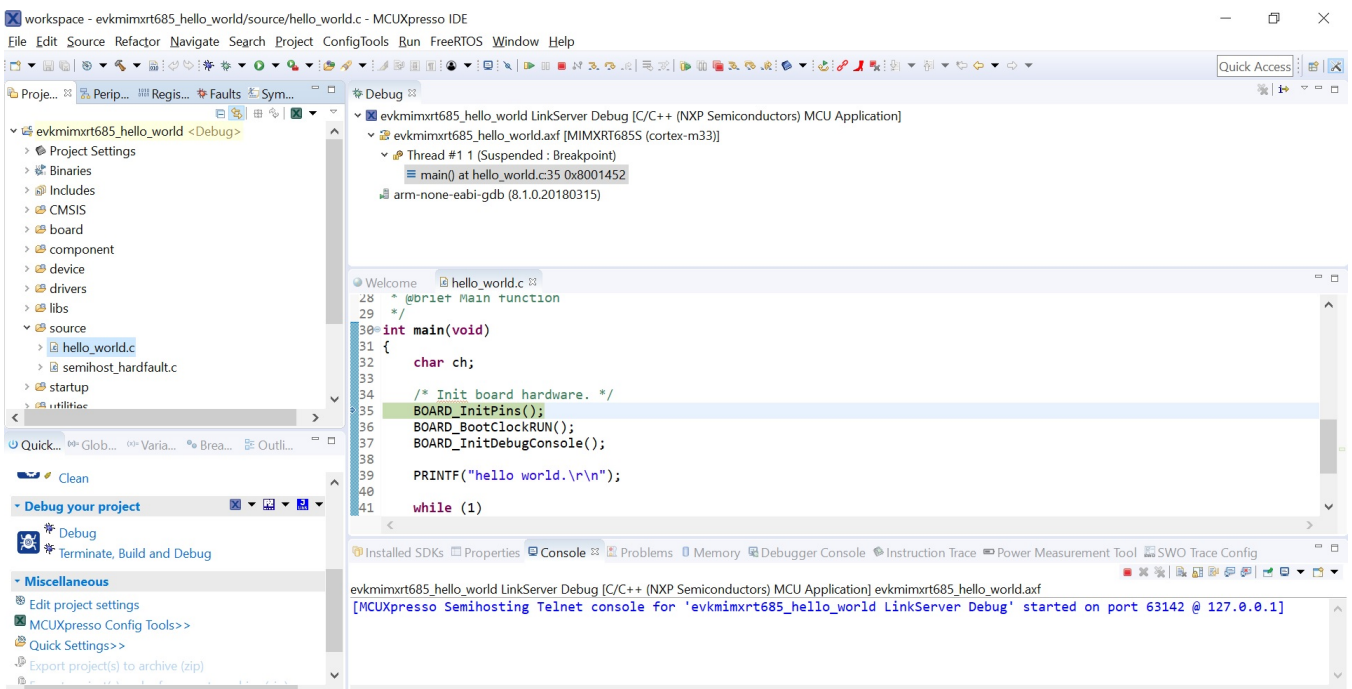

Figure 11. Stop at main() when running debugging

7. Start the application by clicking the "Resume" button.

Figure 12. Resume button

The hello_world application is now running and a banner is displayed on the terminal. If this is not the case, check your terminal settings and connections.

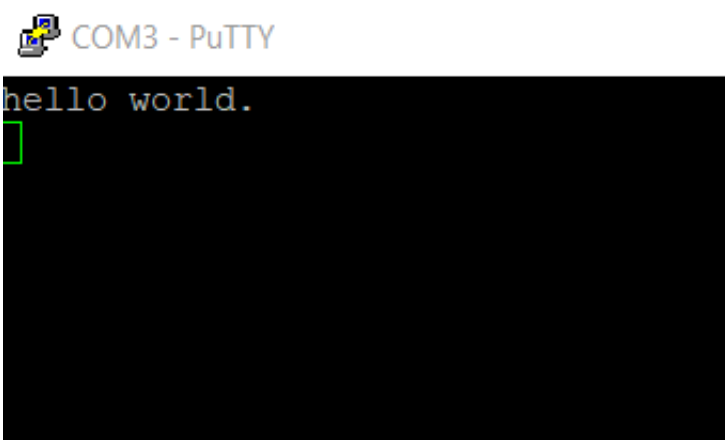

Figure 13. Text display of the hello_world demo

3.4 Build a TrustZone example application

This section describes the steps required to configure MCUXpresso IDE v10.3.1 to build, run, and debug TrustZone example applications. The trustzone version of the hello_world example application targeted for the MIMXRT685-EVK hardware platform is used as an example, though these steps can be applied to any TrustZone example application in the MCUXpresso SDK.

1. TrustZone examples are imported into the workspace in a similar way as single core applications. When the SDK zip package for MIMXRT685-EVK is installed and available in the "Installed SDKs" view, click "Import SDK example(s) …" on the Quickstart Panel. In the window that appears, expand the "MIMXRT600" folder and select "MIMXRT685S". Then, select "evkmimxrt685" and click the "Next" button.

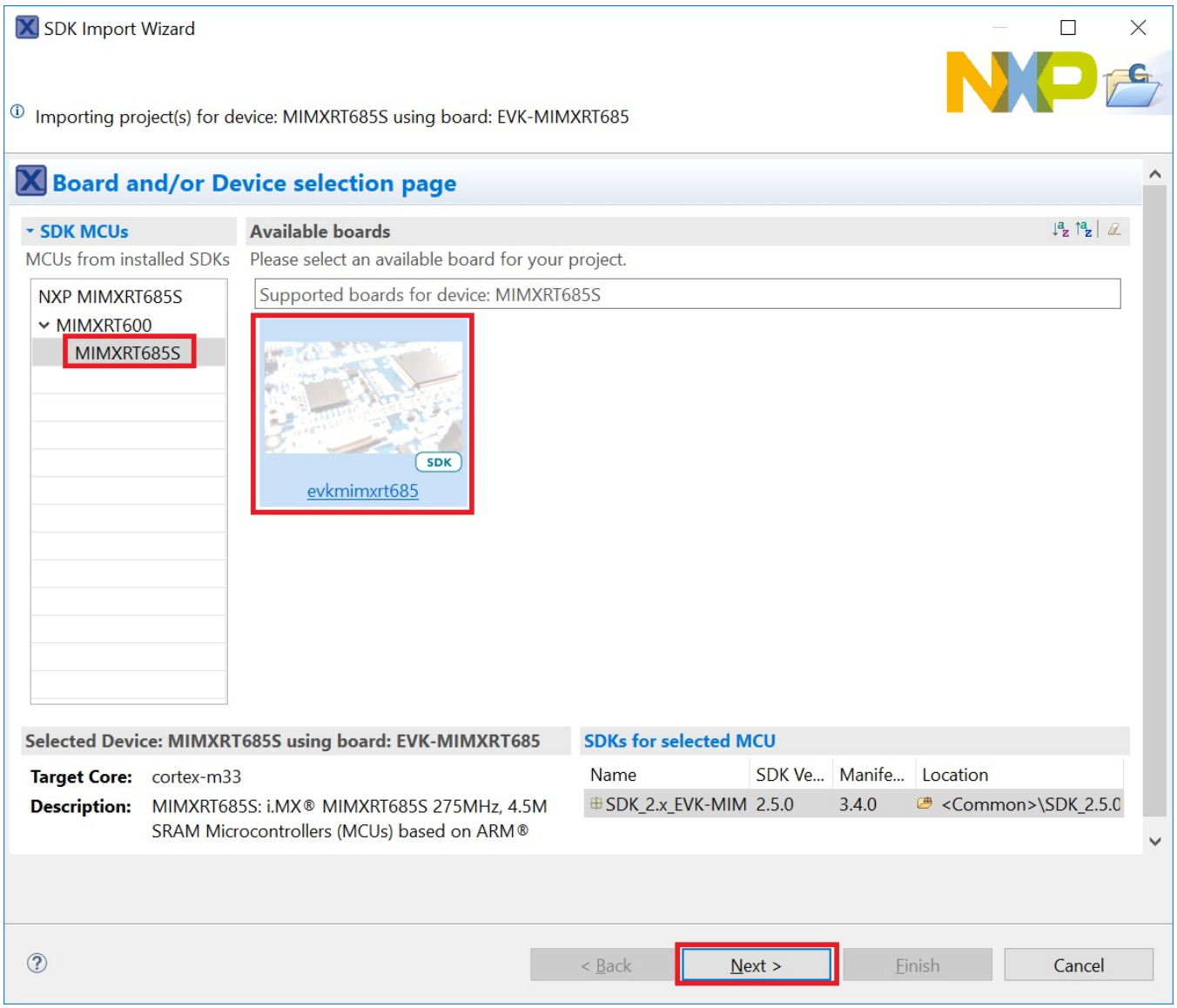

Figure 14. Select the MIMXRT685-EVK board

2. Expand the *trustzone_examples/* folder and select "hello_world_s". Because TrustZone examples are linked together, the non-secure project is automatically imported with the secure project, and there is no need to select it explicitly. Then, click the "Finish" button.

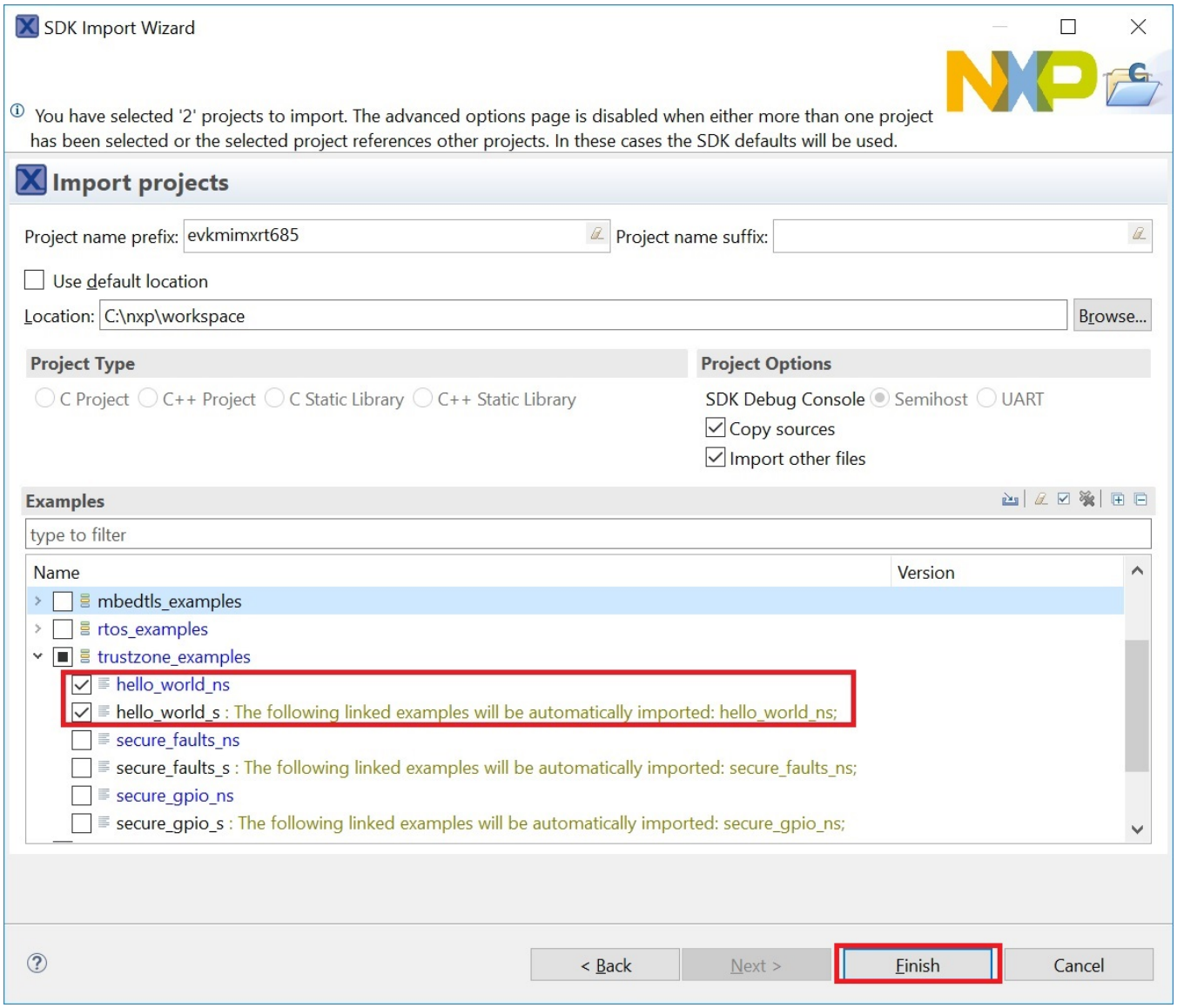

Figure 15. Select the hello_world TrustZone example

3. Now, two projects should be imported into the workspace. To start building the TrustZone application, highlight the evkmimxrt685_hello_world_s project (TrustZone master project) in the Project Explorer. Then, choose the appropriate build target, "Debug" or "Release", by clicking the downward facing arrow next to the hammer icon, as shown below. For this example, select the "Debug" target.

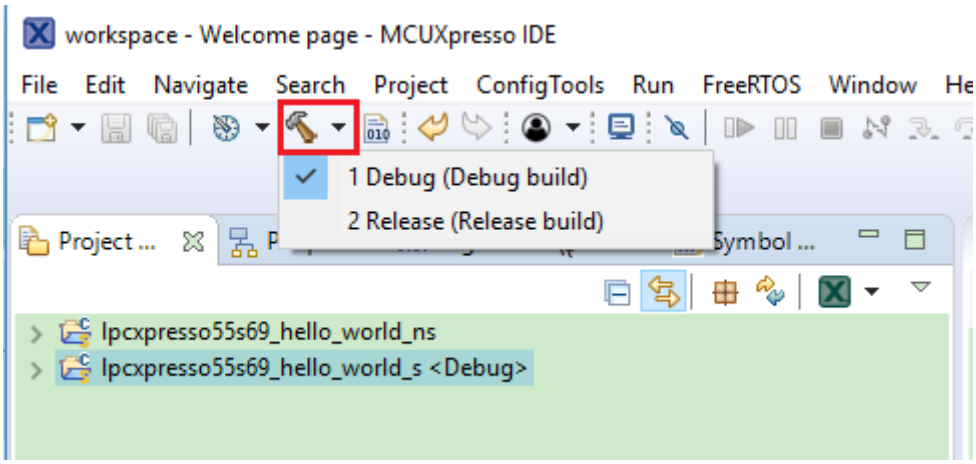

Figure 16. Selection of the build target in MCUXpresso IDE

The project starts building after the build target is selected. It is requested to build the application for the secure project first, because the non-secure project needs to know the secure project since CMSE library when running the linker. It is not possible to finish the non-secure project linker when the secure project since CMSE library is not ready.

NOTE

When the 'Release' build is requested, it is necessary to change the build configuration of both the secure and non-secure application projects first. To do this, select both projects in the Project Explorer view by clicking to select the first project, then using shift-click or control-click to select the second project. Right click in the Project Explorer view to display the context-sensitive menu and select 'Build Configurations->Set Active- >Release'. This also possible to do using the menu item 'Project->Build Configuration- >Set Active->Release'. After switching to the 'Release' build configuration, please build the application for the secure project first.

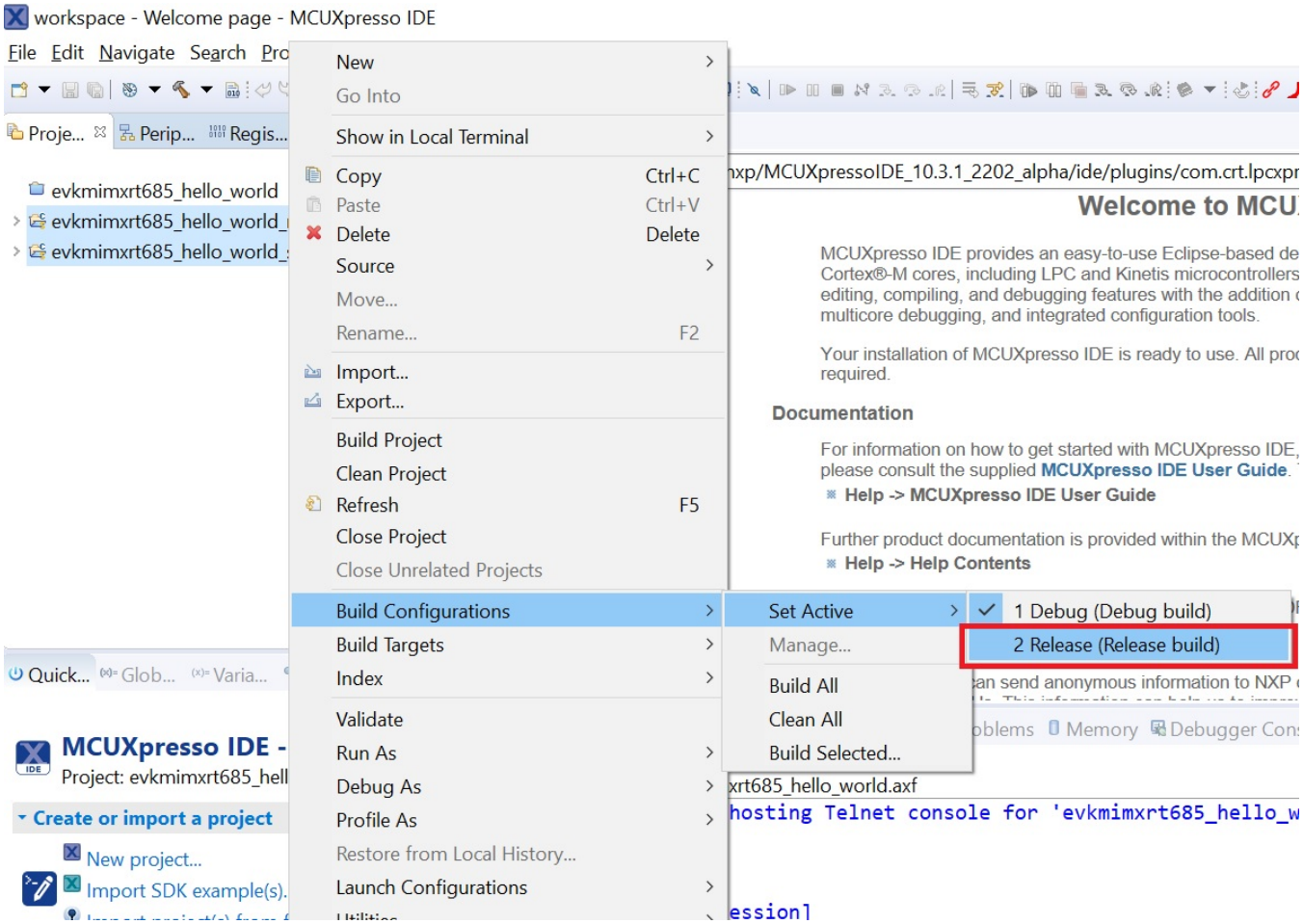

Figure 17. Switching TrustZone projects into the Release build configuration

3.5 Run a TrustZone example application

To download and run the application perform all steps as described in *Section 3.3, "Run an example application"*. These steps are common for single core, and TrustZone applications, ensuring evkmimxrt685_hello_world_s is selected for debugging. In the Quickstart Panel, click “Debug 'evkmimxrt685__hello_world_s’ [Debug]” to launch the second debug session.

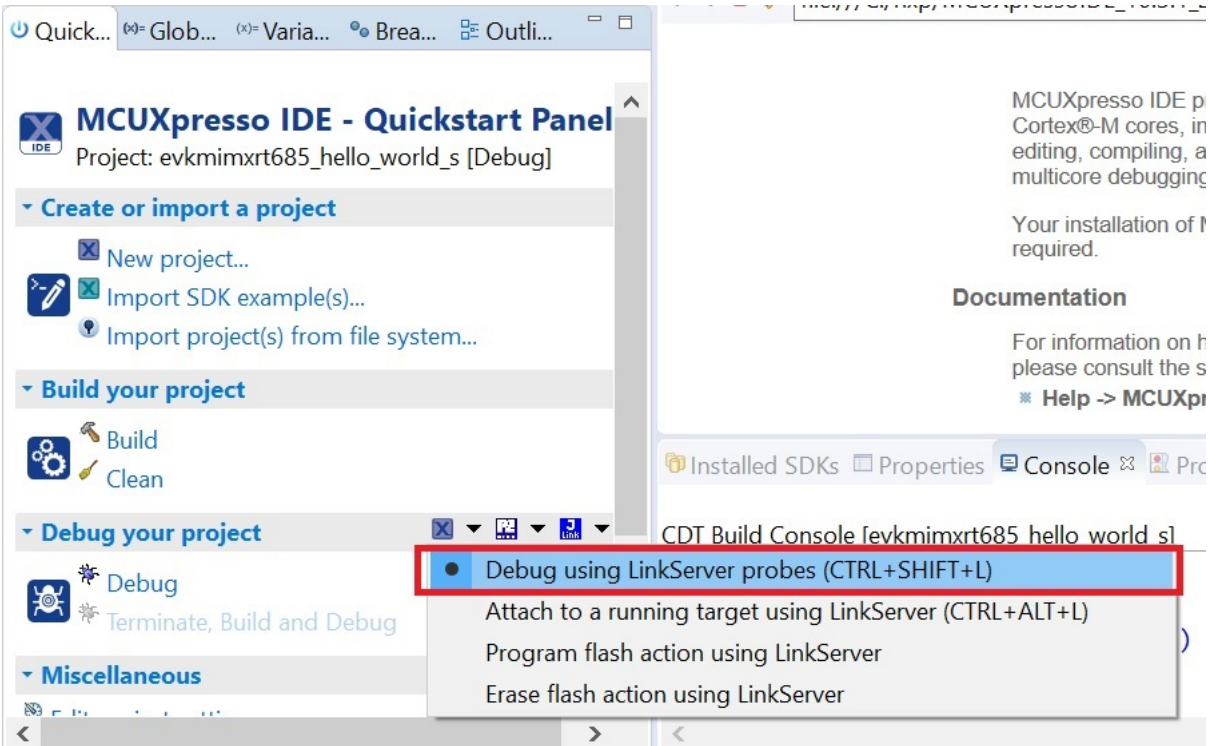

Figure 18. Debug "evkmimxrt685_hello_world_s" case

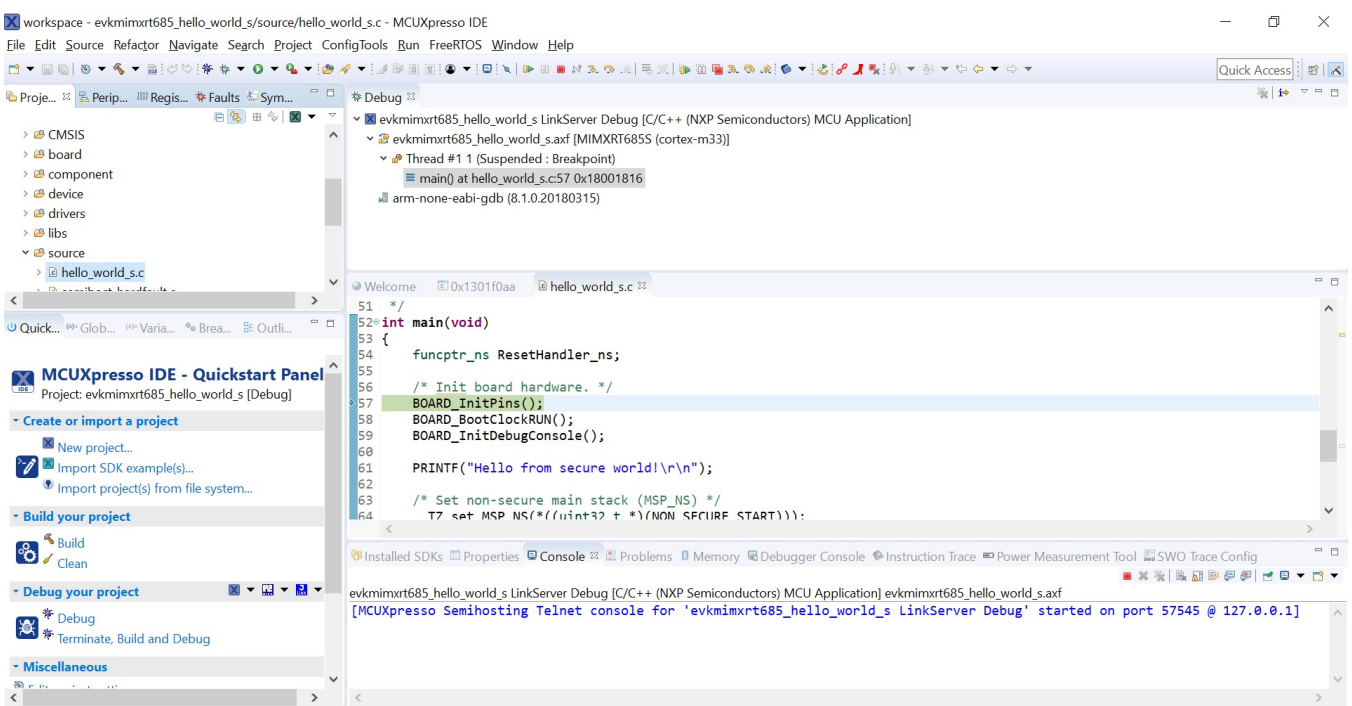

Figure 19. TrustZone debug sessions

Now, the TrustZone sesions should be opened. Click the "Resume" button. The hello_world TrustZone application then starts running, and the secure application starts the non-secure application during run time.

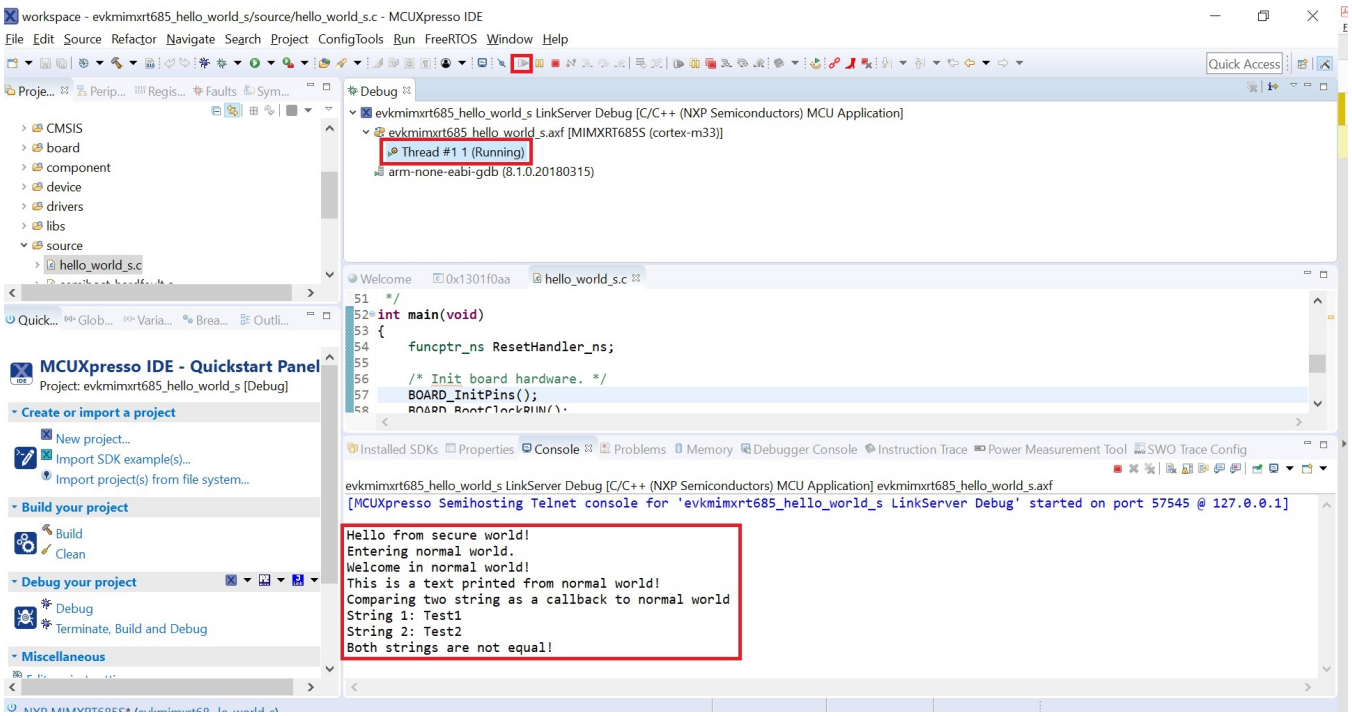

Figure 20. Run Hello World trustzone example and get the message

4 Run a demo application using IAR

This section describes the steps required to build, run, and debug example applications provided in the MCUXpresso SDK.

NOTE

IAR Embedded Workbench for Arm version 8.32.1 is used as an example to show below steps, and the IAR toolchain should correspond to the latest supported version, as described in the *MCUXpresso SDK Release Notes* (document MCUXSDKRN).

4.1 Build an example application

The following steps guide you through opening the hello_world example application. These steps may change slightly for other example applications as some of these applications may have additional layers of folders in their path.

1. If not already done, open the desired demo application workspace. Most example application workspace files can be located using the following path:

   <install_dir>/boards/<board_name>/<example_type>/<application_name>/iar

   Using the MIMXRT685-EVK hardware platform as an example, the hello_world workspace is located in

   <install_dir>/boards/evkmimxrt685/demo_apps/hello_world/iar/hello_world.eww

2. Select the desired build target from the drop-down. For this example, select the “hello_world – Debug” target.

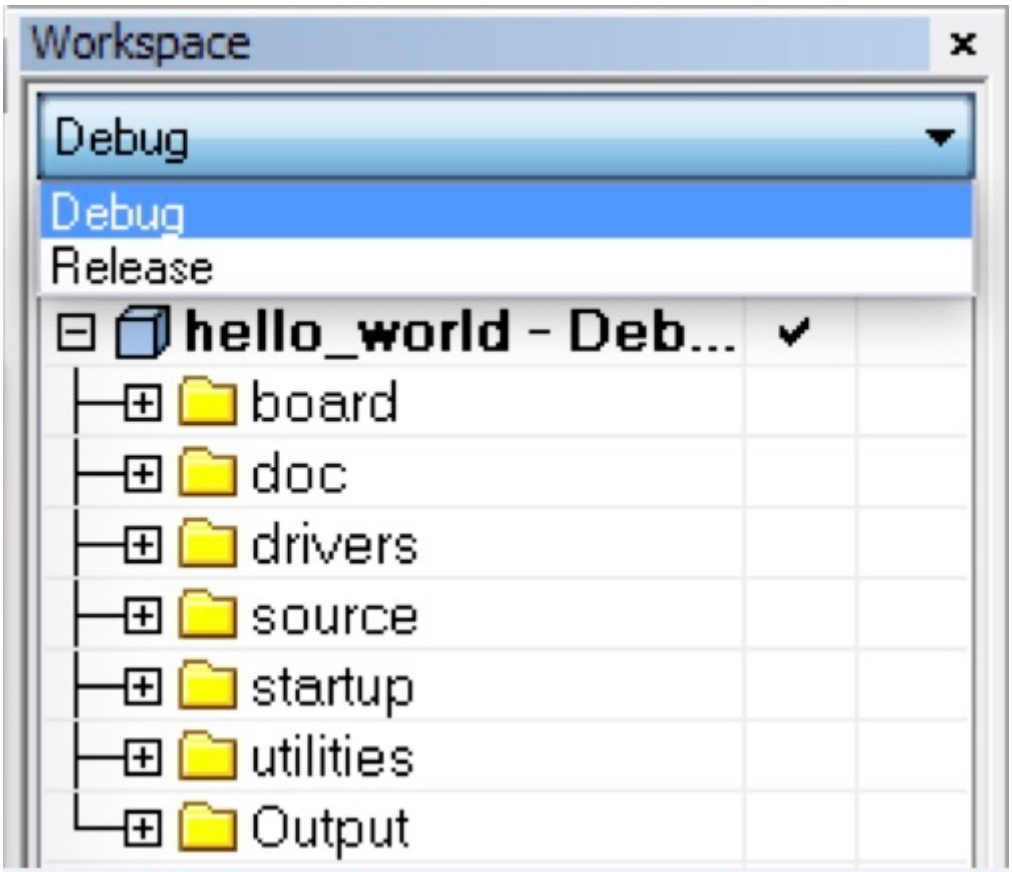

Figure 21. Demo build target selection

3. To build the demo application, click the “Make” button, highlighted in red below.

4. The build completes without errors.

4.2 Run an example application

To download and run the application, perform these steps:

1. Reference the table in Appendix B to determine the debug interface that comes loaded on your specific hardware platform.
2. Connect the development platform to your PC via USB cable.
3. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug COM port (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
   a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
   b. No parity
   c. 8 data bits
   d. 1 stop bit

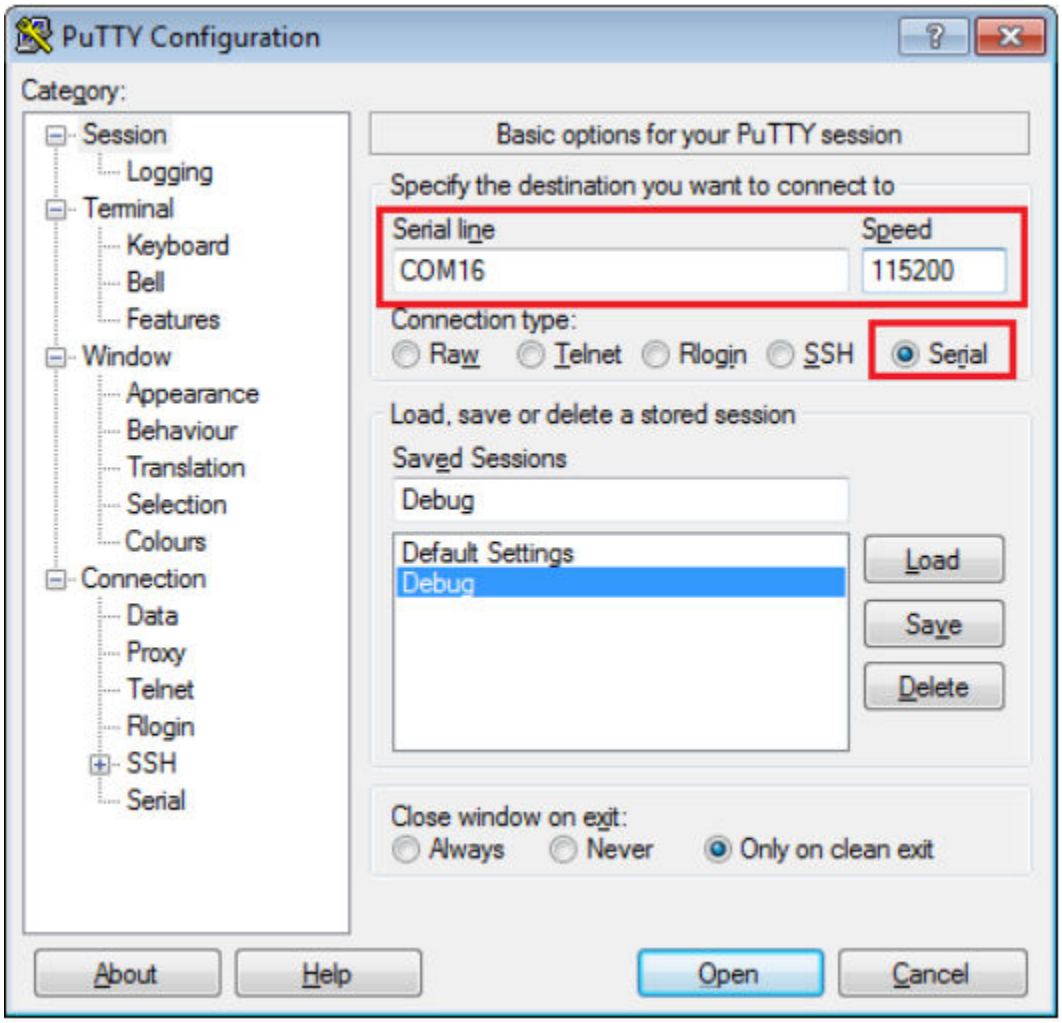

Figure 22. Terminal (PuTTY) configuration

4. In IAR, click the "Download and Debug" button to download the application to the target.

Figure 23. Download and Debug button

5. The application is then downloaded to the target and automatically runs to the main() function.

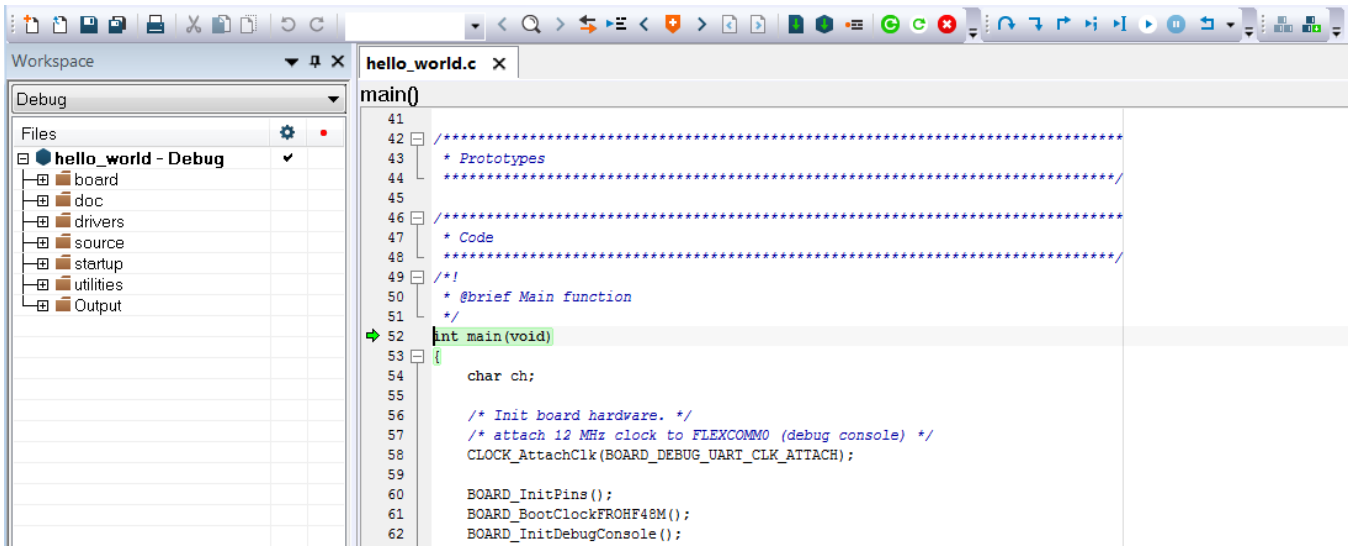

Figure 24. Stop at main() when running debugging

6. Run the code by clicking the "Go" button to start the application.

Figure 25. Go button

7. The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

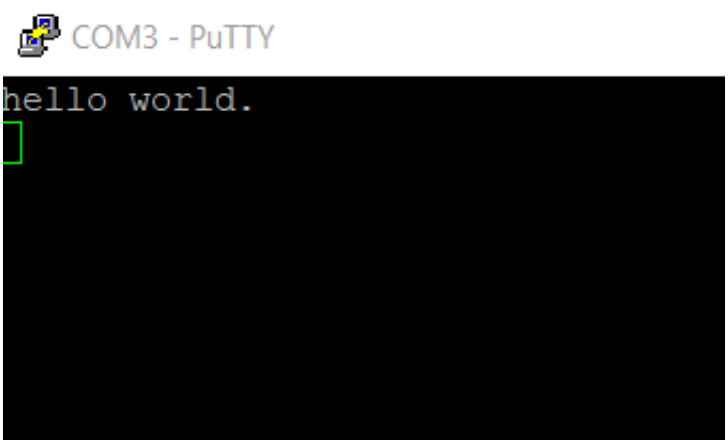

Figure 26. Text display of the hello_world demo

4.3 Build a TrustZone example application

This section describes the particular steps that need to be done in order to build and run a TrustZone application. The demo applications workspace files are located in this folder:

<install_dir>/boards/<board_name>/trustzone_examples/<application_name>/[<core_type>]/iar/<application_name>_ns/iar<install_dir>/boards/<board_name>/trustzone_examples/<application_name>/[<core_type>]/iar/<application_name>_s/iar

Begin with a simple TrustZone version of the Hello World application. The TrustZone Hello World IAR workspaces are located in this folder:

<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_ns/iar/hello_world_ns.eww<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_s/iar/hello_world_s.eww<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_s/iar/hello_world.eww

This project `hello_world.eww` contains both secure and non-secure projects in one workspace and it allows the user to easily transition from one project to another. Build both applications separately by clicking the “Make” button. It is requested to build the application for the secure project first, because the non-secure project needs to know the secure project, since the CMSE library is running the linker. It is not possible to finish the non-secure project linker with the secure project since CMSE library is not ready.

4.4 Run a TrustZone example application

The secure project is configured to download both secure and non-secure output files, so debugging can be fully managed from the secure project. To download and run the TrustZone application, switch to the secure application project and perform steps 1 – 4 as described in *Section 4.2, "Run an example application"*. These steps are common for both single core, and TrustZone applications in IAR. After clicking the “Download and Debug" button, both the secure and non-secure image are loaded into the device memory, and the secure application is executed. It stops at the Rest_Hander function.

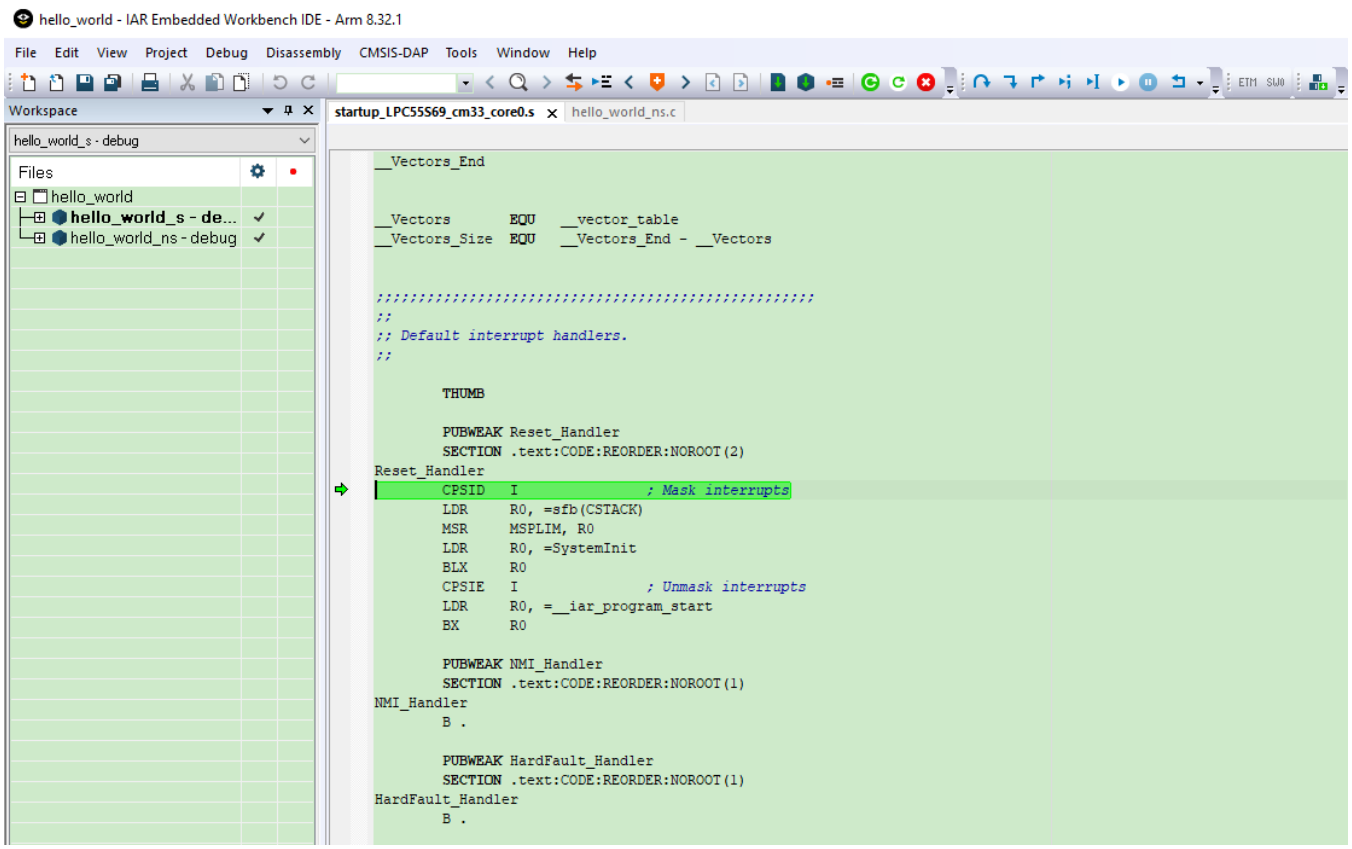

Figure 27. Stop at Rest_Hander when running debugging

Run the code by clicking the "Go" button to start the application.

Figure 28. Go button

The TrustZone hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

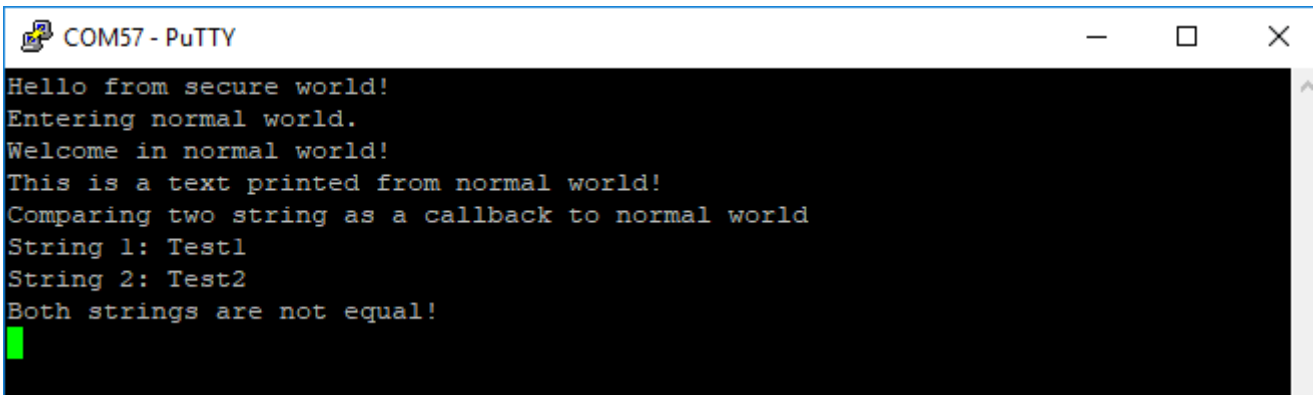

Figure 29. Text display of the trustzone hello_world application

NOTE

If the application is running in RAM (debug/release build target), "Use flash loader(s)" must be disabled in Options->Debugger setting. This can avoid the _ns download issue on i.MXRT600.

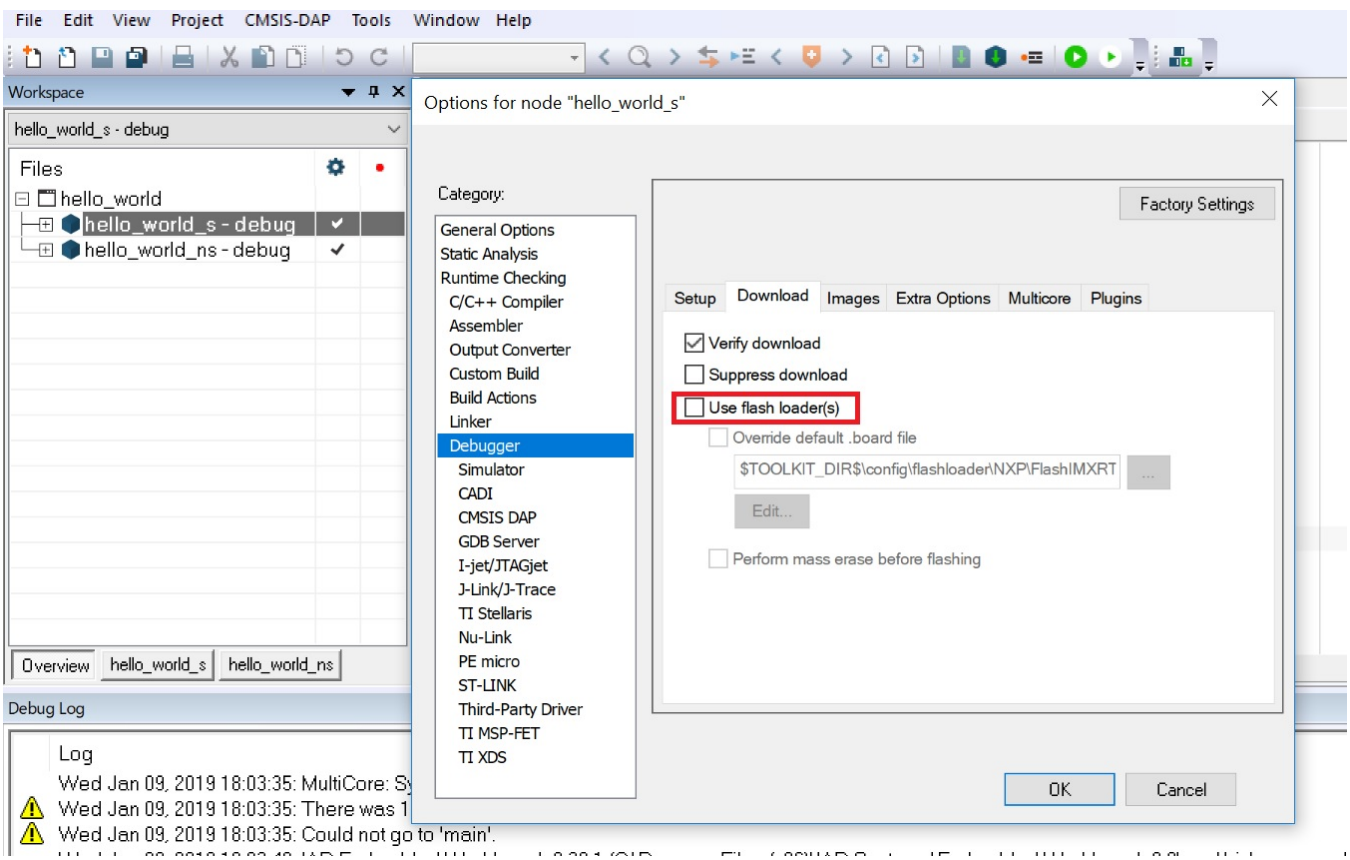

Figure 30. Disable "Use flash loader(s)"

5 Run a demo using Arm® GCC

This section describes the steps to configure the command line Arm® GCC tools to build, run, and debug demo applications and necessary driver libraries provided in the MCUXpresso SDK. The hello_world demo application is targeted for the MIMXRT685-EVK hardware platform is used as an example, though these steps can be applied to any board, demo or example application in the MCUXpresso SDK.

NOTE

ARMGCC version 7-2018-q2 is used as an example in this document, the latest GCC version for this package is as described in the *MCUXpresso SDK Release Notes* (document MCUXSDKMIMXRT6XXRN).

5.1 Set up toolchain

This section contains the steps to install the necessary components required to build and run a MCUXpresso SDK demo application with the Arm GCC toolchain, as supported by the MCUXpresso SDK. There are many ways to use Arm GCC tools, but this example focuses on a Windows operating system environment.

5.1.1 Install GCC Arm Embedded tool chain

Download and run the installer from developer.arm.com/open-source/gnu-toolchain/gnu-rm. This is the actual toolset (in other words, compiler, linker, and so on). The GCC toolchain should correspond to the latest supported version, as described in the *MCUXpresso SDK Release Notes*. (document MCUXSDKRN).

5.1.2 Install MinGW (only required on Windows OS)

The Minimalist GNU for Windows (MinGW) development tools provide a set of tools that are not dependent on third party C-Runtime DLLs (such as Cygwin). The build environment used by the MCUXpresso SDK does not utilize the MinGW build tools, but does leverage the base install of both MinGW and MSYS. MSYS provides a basic shell with a Unix-like interface and tools.

1. Download the latest MinGW mingw-get-setup installer from sourceforge.net/projects/mingw/files/Installer/.
2. Run the installer. The recommended installation path is C:\MinGW, however, you may install to any location.

NOTE

The installation path cannot contain any spaces.

3. Ensure that the “mingw32-base” and “msys-base” are selected under Basic Setup.

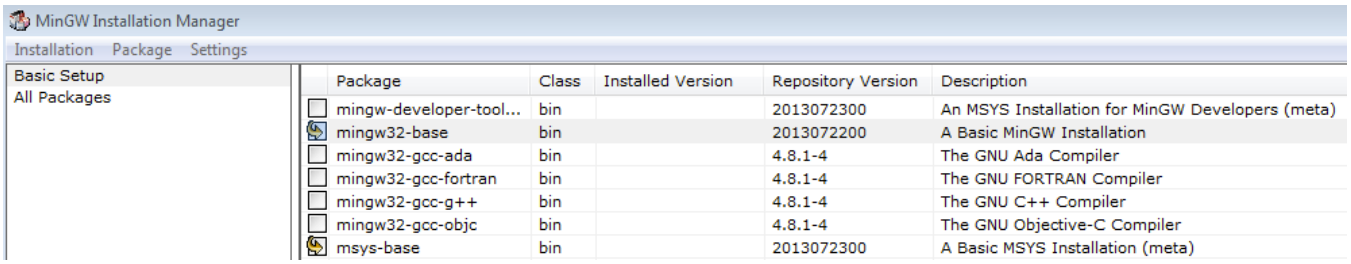

Figure 31. Setup MinGW and MSYS

4. Click “Apply Changes” in the “Installation” menu and follow the remaining instructions to complete the installation.

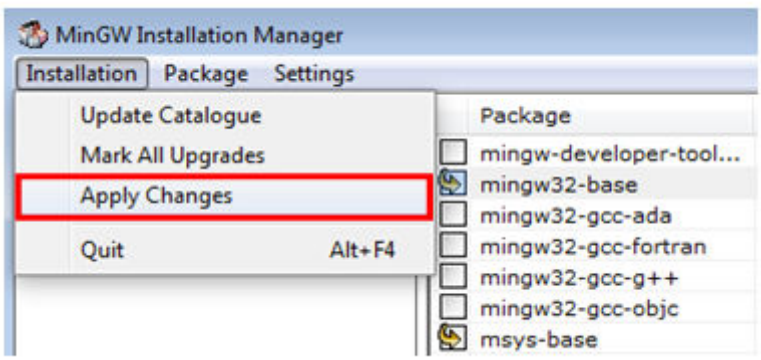

Figure 32. Complete MinGW and MSYS installation

5. Add the appropriate item to the Windows operating system path environment variable. It can be found under *Control Panel -> System and Security -> System -> Advanced System Settings* in the "Environment Variables..." section. The path is:

   <mingw_install_dir>\bin

   Assuming the default installation path, C:\MinGW, an example is shown below. If the path is not set correctly, the toolchain does not work.

NOTE

If you have "C:\MinGW\msys\x.x\bin" in your PATH variable (as required by Kinetis SDK 1.0.0), remove it to ensure that the new GCC build system works correctly.

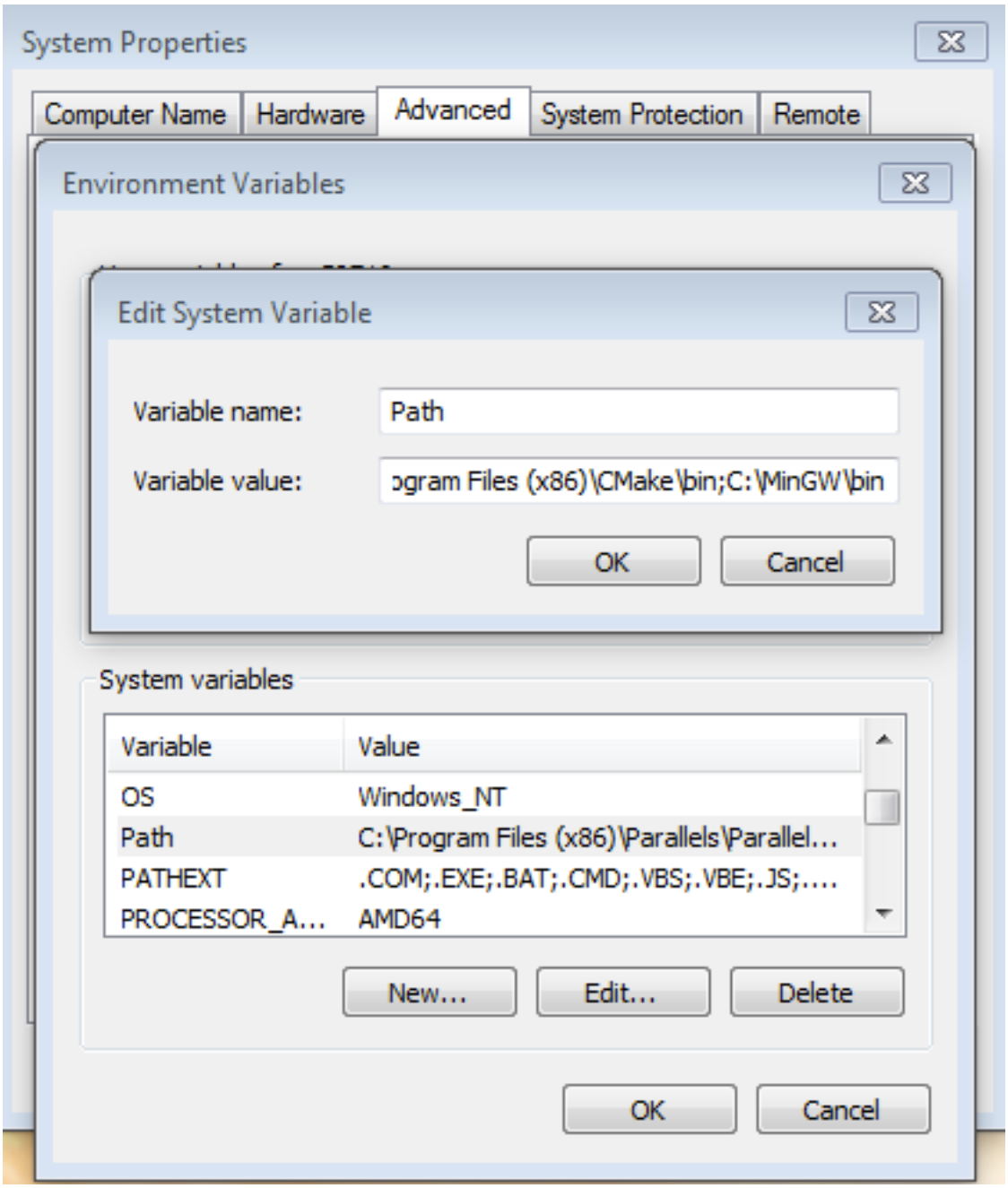

Figure 33. Add Path to systems environment

5.1.3 Add a new system environment variable for ARMGCC_DIR

Create a new *system* environment variable and name it ARMGCC_DIR. The value of this variable should point to the Arm GCC Embedded tool chain installation path. For this example, the path is:

Reference the installation folder of the GNU Arm GCC Embedded tools for the exact path name of your installation.

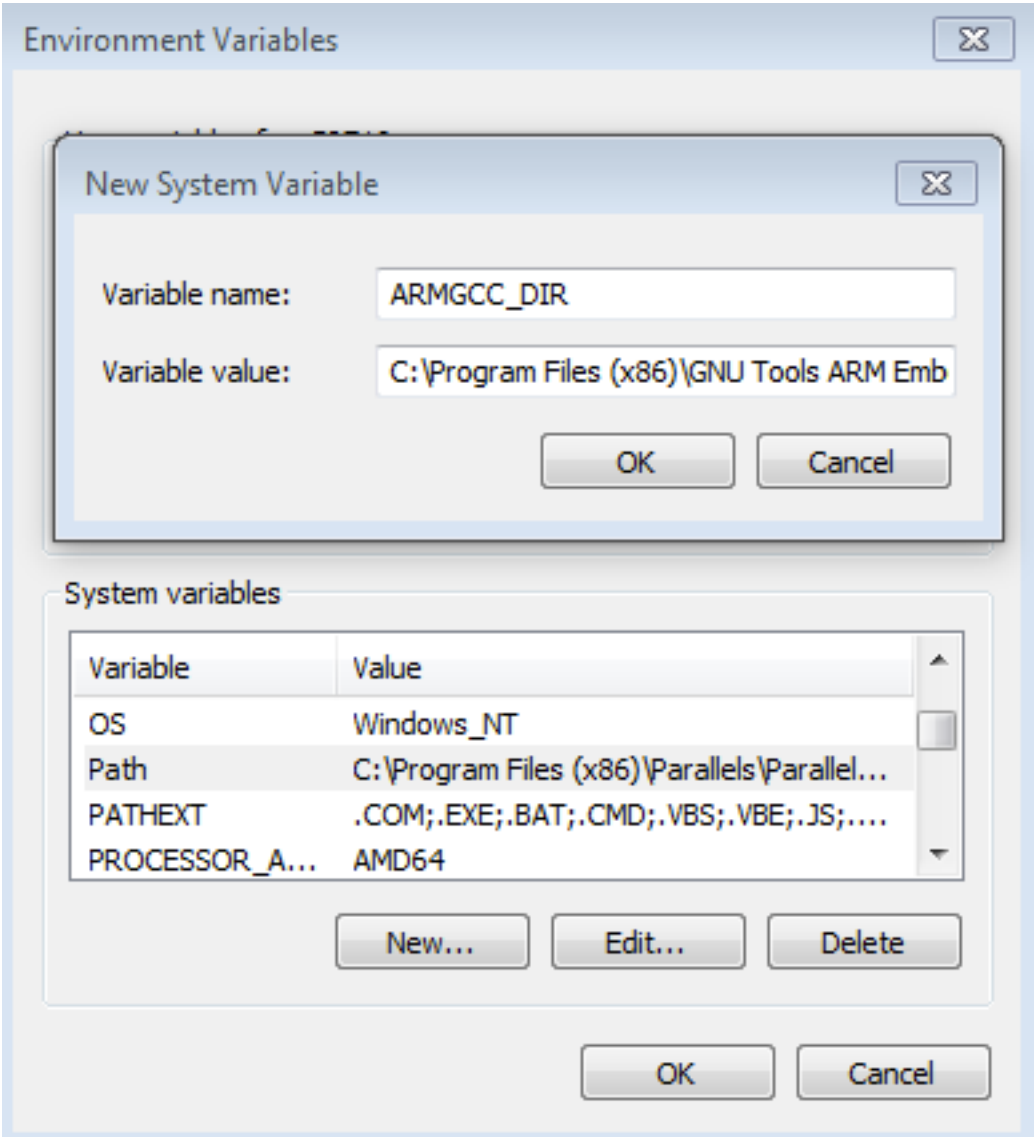

Figure 34. Add ARMGCC_DIR system variable

5.1.4 Install CMake

1. Download CMake 3.0.x from www.cmake.org/cmake/resources/software.html.
2. Install CMake, ensuring that the option "Add CMake to system PATH" is selected when installing. The user chooses to select whether it is installed into the PATH for all users or just the current user. In this example, it is installed for all users.

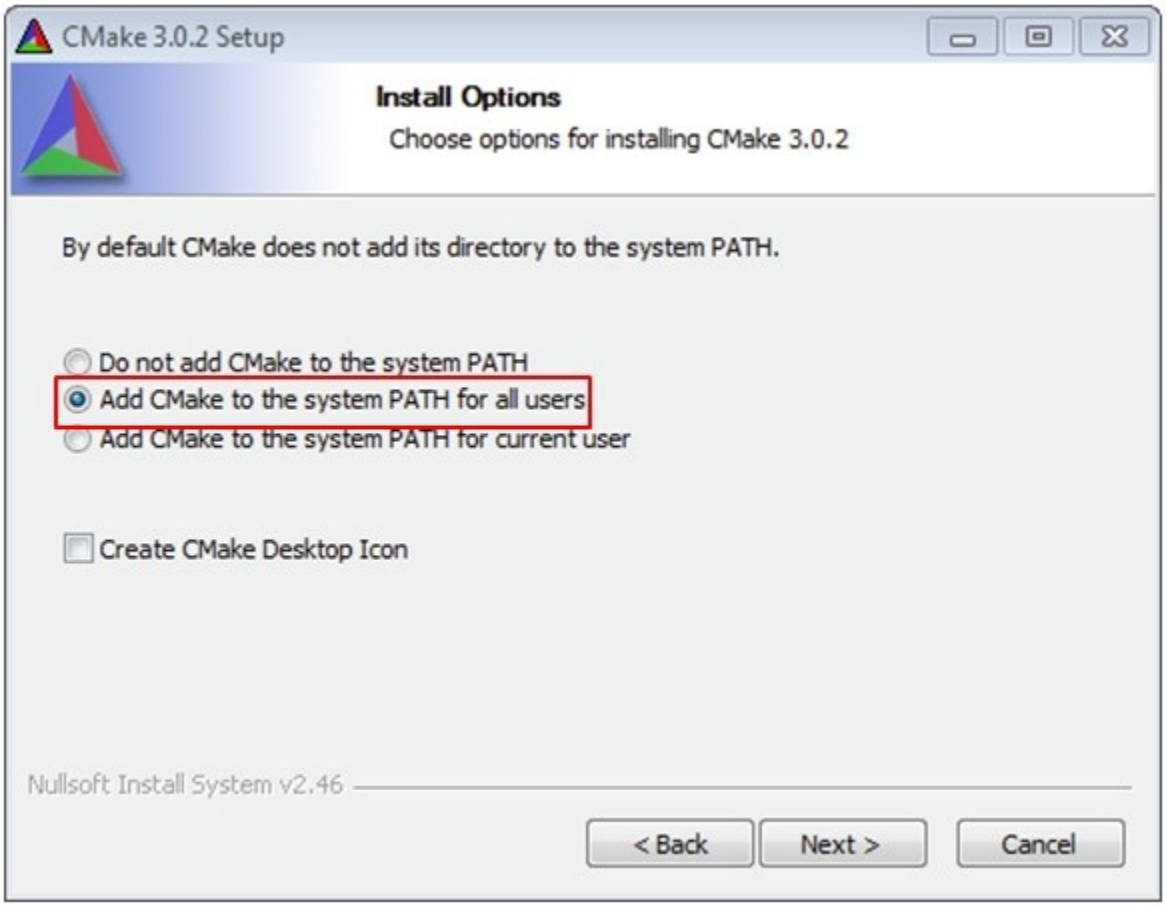

Figure 35. Install CMake

3. Follow the remaining instructions of the installer.
4. You may need to reboot your system for the PATH changes to take effect.
5. Make sure "sh.exe" is not in the Environment Variable PATH. This is a limitation of mingw32-make.

5.2 Build an example application

To build an example application, follow these steps.

1. Open a GCC Arm Embedded tool chain command window. To launch the window, from the Windows operating system Start menu, go to “Programs -> GNU Tools ARM Embedded <version>” and select “GCC Command Prompt”.

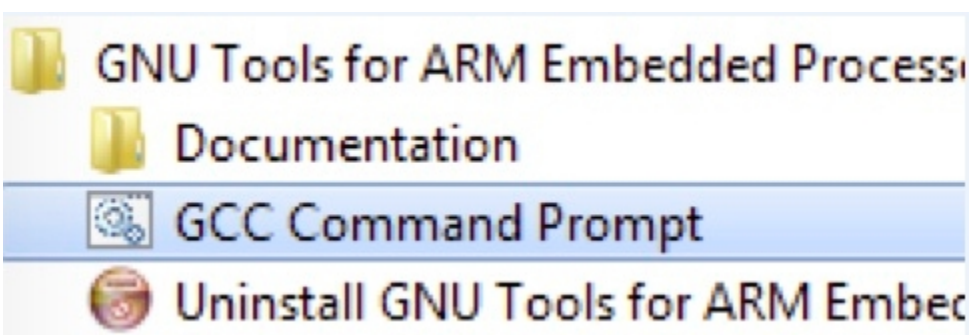

Figure 36. Launch command prompt

2. Change the directory to the example application project directory, which has a path similar to the following:

   <install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc

   For this example, the exact path is: *<install_dir>/examples/evkmimxrt685/demo_apps/hello_world/armgcc*

   NOTE

   To change directories, use the 'cd' command.

3. Type “build_debug.bat” on the command line or double click on the "build_debug.bat" file in Windows Explorer to perform the build. The output is shown in this figure:

```
[ 85%] Building C object CMakeFiles/hello_world.elf.dir/C_/nxp/SDK_2.5.0_EVK-MIMXRT685/devices/MIMXRT685S/drivers/fsl_fl
excomm.c.obj
[ 90%] Building C object CMakeFiles/hello_world.elf.dir/C_/nxp/SDK_2.5.0_EVK-MIMXRT685/devices/MIMXRT685S/drivers/fsl_gp
io.c.obj
[ 95%] Building C object CMakeFiles/hello_world.elf.dir/C_/nxp/SDK_2.5.0_EVK-MIMXRT685/devices/MIMXRT685S/drivers/fsl_re
set.c.obj
[100%] Linking C executable debug\hello_world.elf
[100%] Built target hello_world.elf

C:\nxp\SDK_2.5.0_EVK-MIMXRT685\boards\evkmimxrt685\demo_apps\hello_world\armgcc>IF "" == "" (pause )
Press any key to continue . . .
```

Figure 37. hello_world demo build successful

5.3 Run an example application

This section describes steps to run a demo application using J-Link GDB Server application. To perform this exercise, two things must be done:

- Make sure that either:
  - The OpenSDA interface on your board is programmed with the J-Link OpenSDA firmware. To determine if your board supports OpenSDA, see Appendix B. For instructions on reprogramming the OpenSDA interface, see Appendix C. If your board does not support OpenSDA, a standalone J-Link pod is required.
  - You have a standalone J-Link pod that is connected to the debug interface of your board. Note that some hardware platforms require hardware modification in order to function correctly with an external debug interface.

After the J-Link interface is configured and connected, follow these steps to download and run the demo applications:

1. Connect the development platform to your PC via USB cable between the OpenSDA USB connector and the PC USB connector. If using a standalone J-Link debug pod, also connect it to the SWD/JTAG connector of the board.
2. Open the terminal application on the PC, such as PuTTY or TeraTerm, and connect to the debug serial port number (to determine the COM port number, see Appendix A). Configure the terminal with these settings:
   a. 115200 or 9600 baud rate, depending on your board (reference BOARD_DEBUG_UART_BAUDRATE variable in board.h file)
   b. No parity
   c. 8 data bits
   d. 1 stop bit

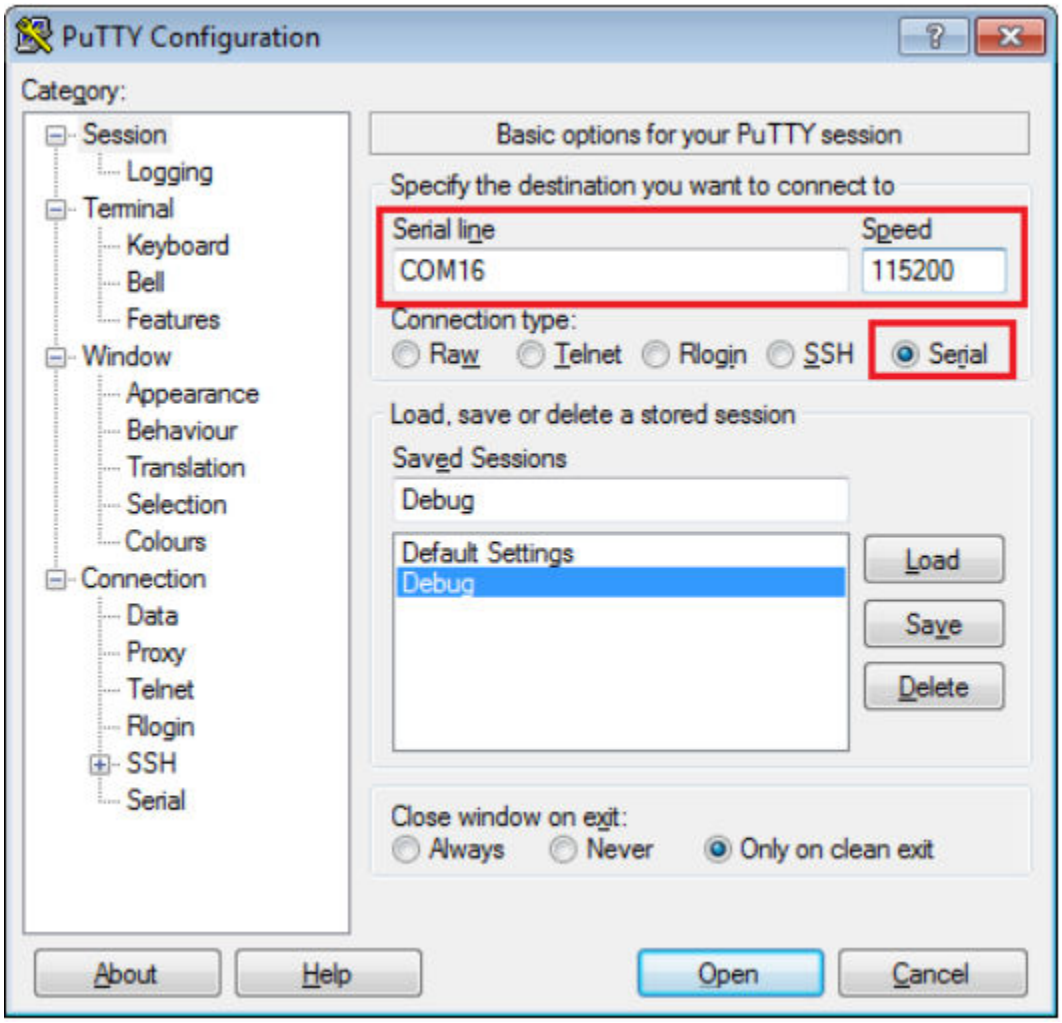

Figure 38. Terminal (PuTTY) configurations

3. Open the J-Link GDB Server application. Assuming the J-Link software is installed, the application can be launched by going to the Windows operating system Start menu and selecting “Programs -> SEGGER -> J-Link <version> J-Link GDB Server”.
4. Modify the settings as shown below. The target device selection chosen for this example is the MIMXRT685_M33.
5. After it is connected, the screen should resemble this figure:

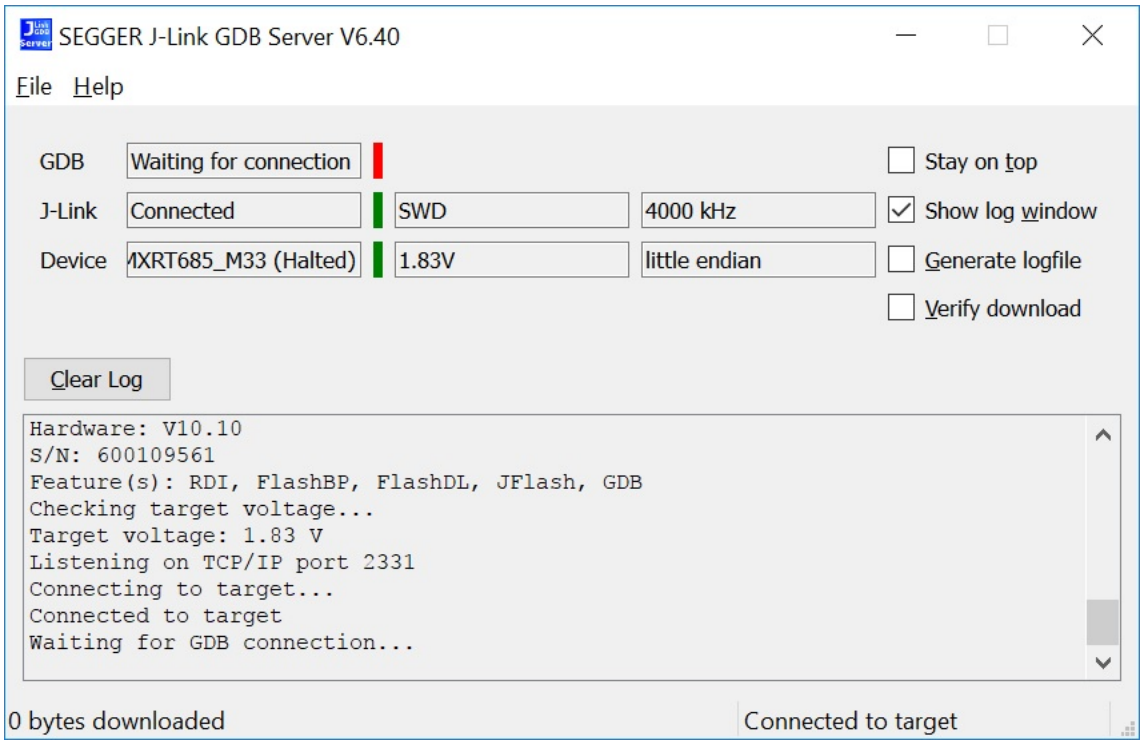

Figure 39. SEGGER J-Link GDB Server screen after successful connection

6. If not already running, open a GCC Arm Embedded tool chain command window. To launch the window, from the Windows operating system Start menu, go to "Programs -> GNU Tools Arm Embedded <version>" and select "GCC Command Prompt".

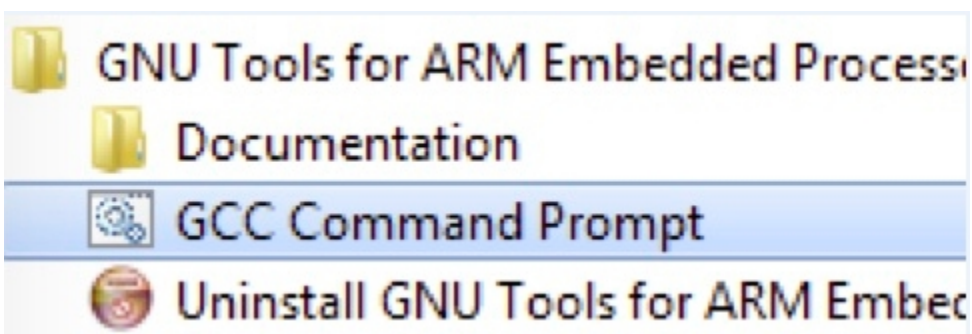

Figure 40. Launch command prompt

7. Change to the directory that contains the example application output. The output can be found in using one of these paths, depending on the build target selected:

   <install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc/debug

   <install_dir>/boards/<board_name>/<example_type>/<application_name>/armgcc/release

   For this example, the path is:

   <install_dir>/boards/evkmimxrt685/demo_apps/hello_world/armgcc/debug
8. Run the command "arm-none-eabi-gdb.exe <application_name>.elf". For this example, it is "arm-none-eabi-gdb.exe hello_world.elf".

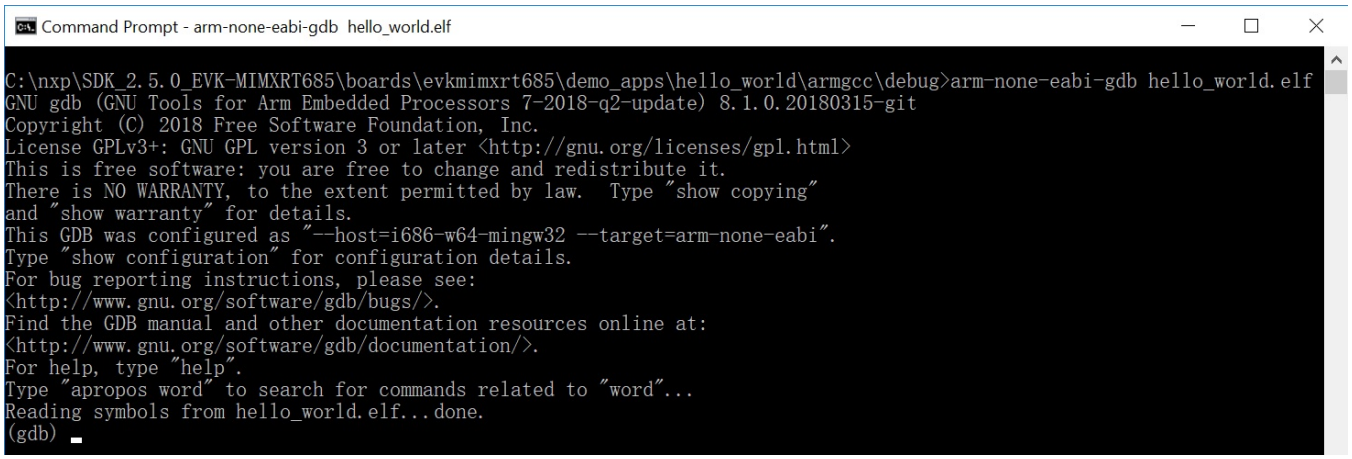

Figure 41. Run arm-none-eabi-gdb

9. Run these commands:
   a. "target remote localhost:2331"
   b. "monitor reset"
   c. "monitor halt"
   d. "load"
10. The application is now downloaded and halted at the reset vector. Execute the “monitor go” command to start the demo application.

    The hello_world application is now running and a banner is displayed on the terminal. If this is not true, check your terminal settings and connections.

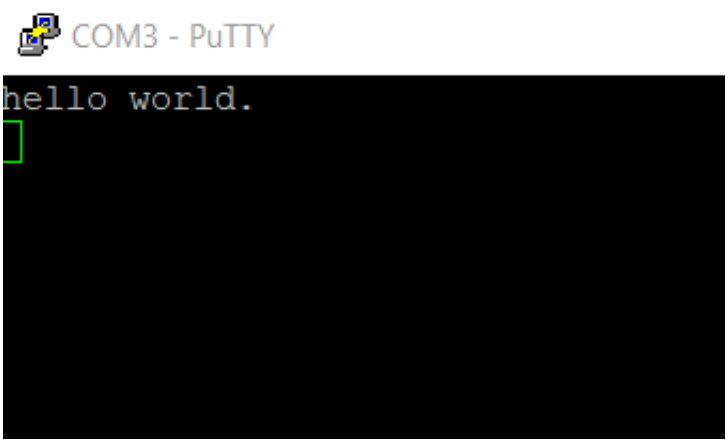

Figure 42. Text display of the hello_world demo

5.4 Build a TrustZone example application

This section describes the steps to build and run a TrustZone application. The demo application build scripts are located in this folder:

<install_dir>/boards/<board_name>/trustzone_examples/<application_name>/[<core_type>]/<application_name>_ns/armgcc

<install_dir>/boards/<board_name>/trustzone_examples/<application_name>/[<core_type>]/<application_name>_s/armgcc

Begin with a simple TrustZone version of the Hello World application. The TrustZone Hello World GCC build scripts are located in this folder:

<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_ns/armgcc/build_debug.bat

<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_s/armgcc/build_debug.bat

Build both applications separately, following steps for single core examples as described in *Section 6.2, "Build an example application"*. It is requested to build the application for the secure project first, because the non-secure project needs to know the secure project, since CMSE library is running the linker. It is not possible to finish the non-secure project linker with the secure project because the CMSE library is not ready.

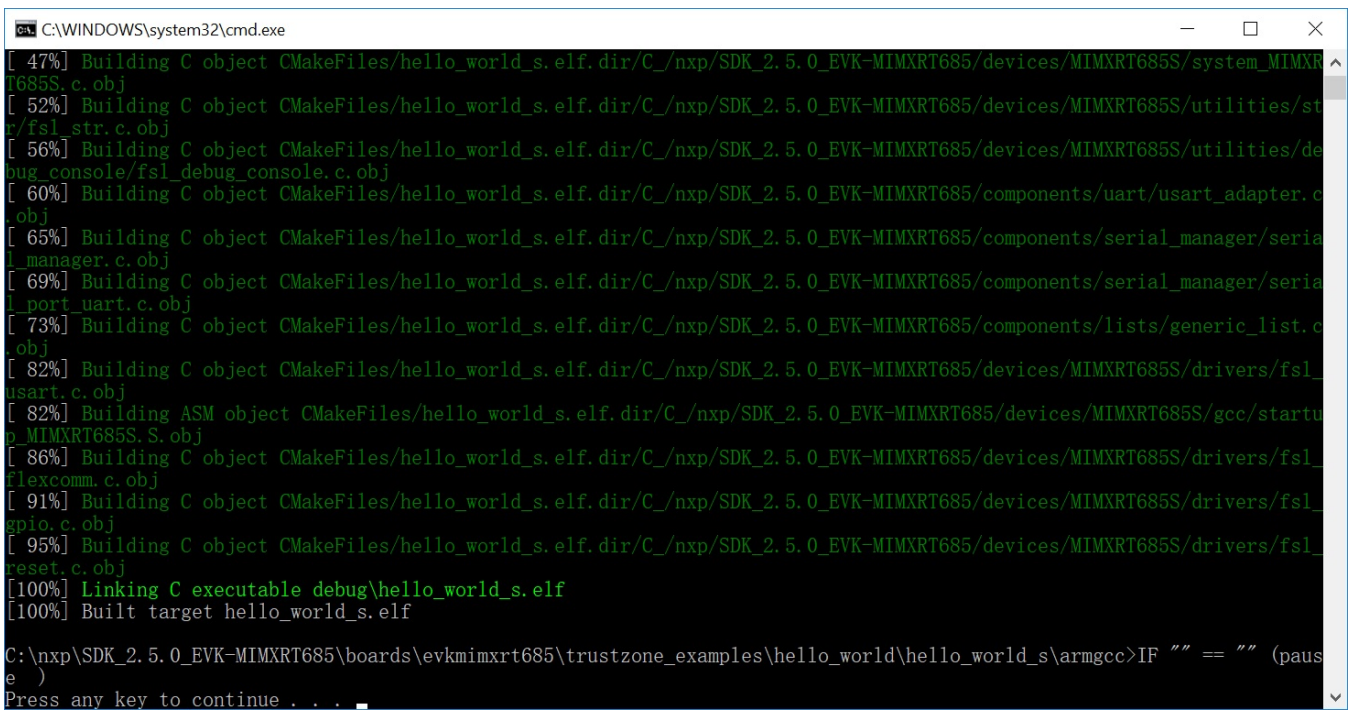

Figure 43. hello_world_s example build successful

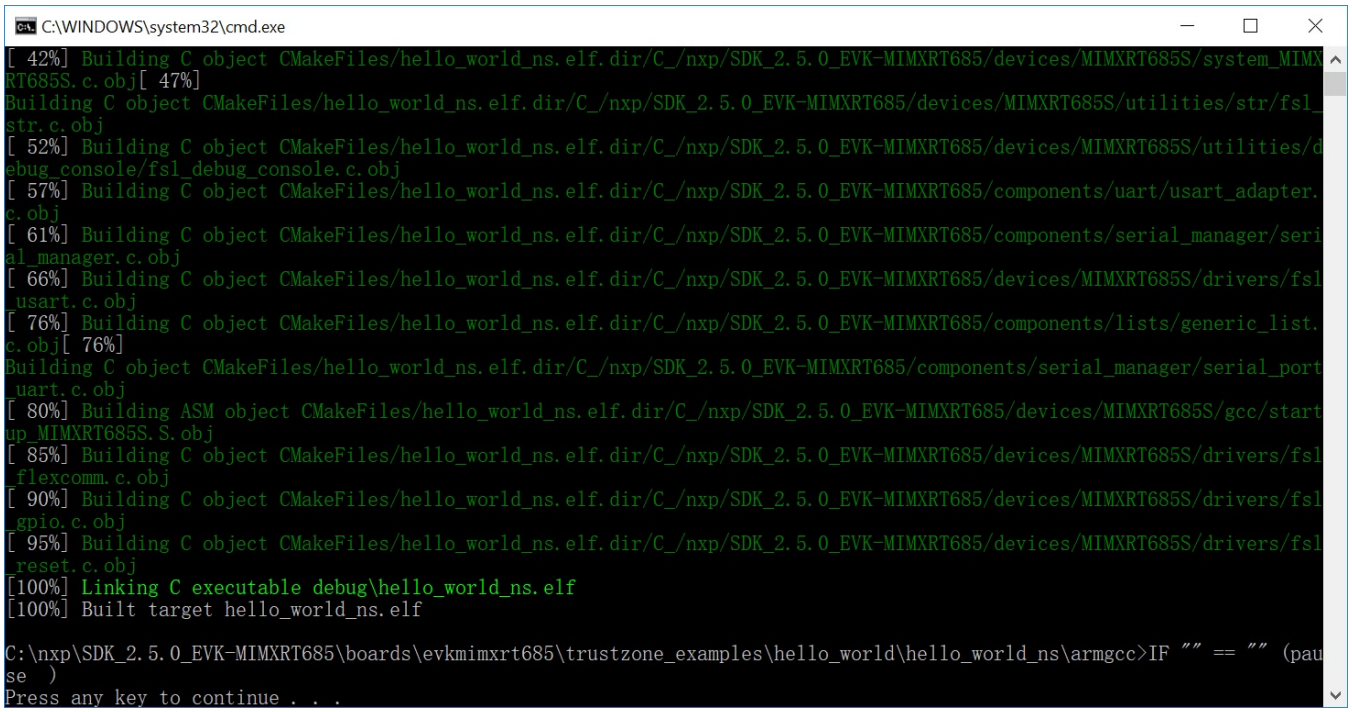

Figure 44. hello_world_ns example build successful

5.5 Run a TrustZone example application

When running a TrustZone application, the same prerequisites for J-Link/J-Link OpenSDA firmware, and the serial console as for the single core application, apply, as described in *Section 6.3, "Run an example application"*.

To download and run the TrustZone application, perform steps 1 to 10, as described in *Section 5.3, "Run an example application"*. These steps are common for both single core and trustzone applications in Arm GCC.

Then, run these commands:

1. "arm-none-eabi-gdb.exe"
2. "target remote localhost:2331"
3. "monitor reset"
4. "monitor halt"
5. "load *<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_ns/armgcc/debug/hello_world_ns.elf*"
6. "load *<install_dir>/boards/evkmimxrt685/trustzone_examples/hello_world/hello_world_s/armgcc/debug/hello_world_s.elf*"

The application is now downloaded and halted at the reset vector. Execute the “monitor go” command to start the demo application.

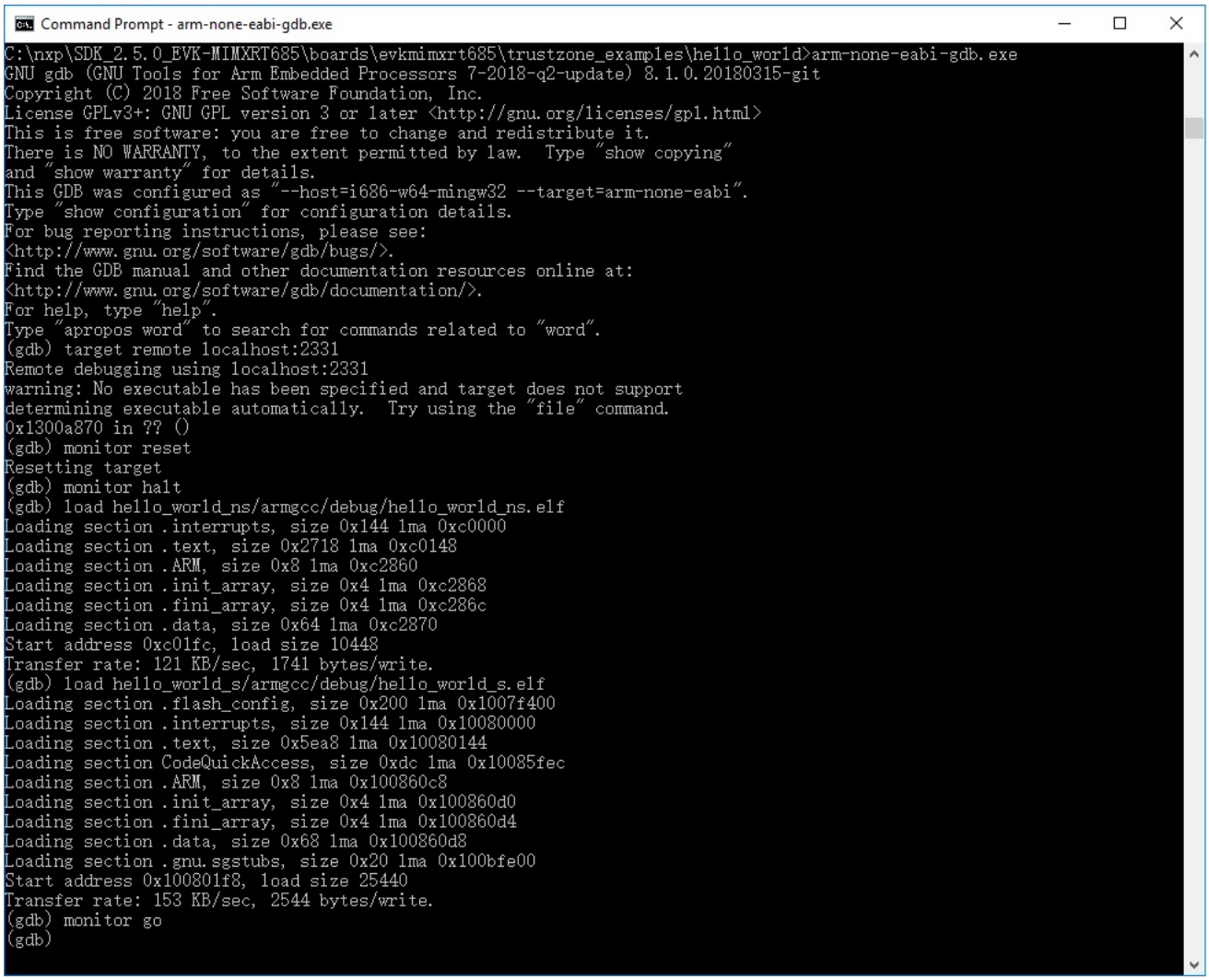

Figure 45. Loading and running the trustzone example

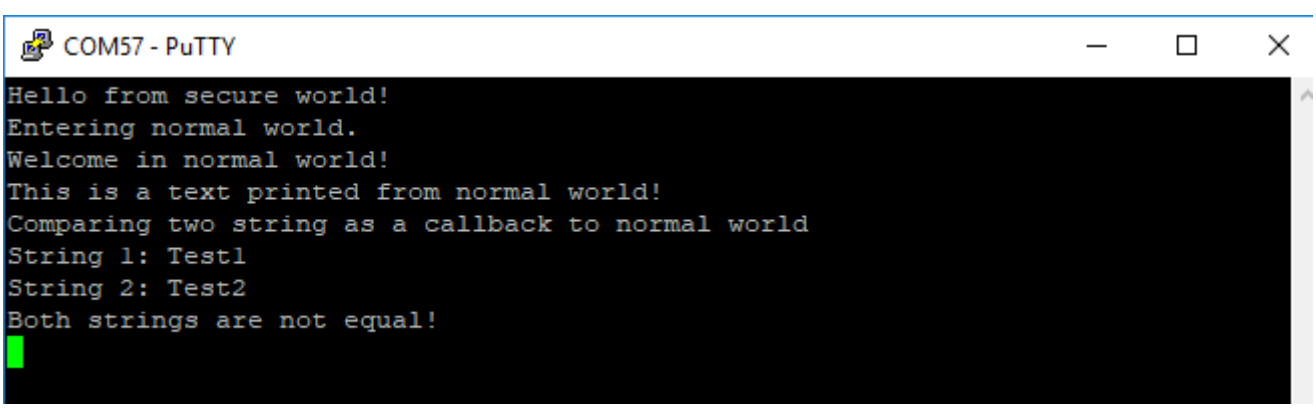

Figure 46. Text display of the trustzone hello_world application

6 MCUXpresso IDE New Project Wizard

MCUXpresso IDE features a new project wizard. The wizard provides functionality for the user to create new projects from the installed SDKs (and from pre-installed part support), offers the flexibility to select/change many builds, includes a library, and provides source code options. The source code is organized as software components, categorized as driver, utilities, and middleware.

To use the wizard, start the MCUXpresso IDE. This is located in the *QuickStart Panel* at the bottom left of the MCUXpresso IDE window. Select the "New project" option, shown in the below figure.

Figure 47. MCUXpresso IDE Quickstart Panel

For more details of the usage of new project wizard, see the "MCUXpresso_IDE_User_Guide.pdf" in the MCUXpresso IDE installation folder.

7 Appendix A - How to determine COM port

This section describes the steps necessary to determine the debug COM port number of your NXP hardware development platform.

1. **Linux:** The serial port can be determined by running the following command after the USB Serial is connected to the host:

   ```
   $ dmesg | grep "ttyUSB"
                       [503175.307873] usb 3-12: cp210x converter now attached to ttyUSB0
                       [503175.309372] usb 3-12: cp210x converter now attached to ttyUSB1
   ```

   There are two ports, one is Cortex-A core debug console, another is for Cortex M4.

2. **Windows:** To determine the COM port, open the Windows operating system Device Manager. This can be achieved by going to the Windows operating system Start menu and typing "Device Manager" in the search bar, as shown below:

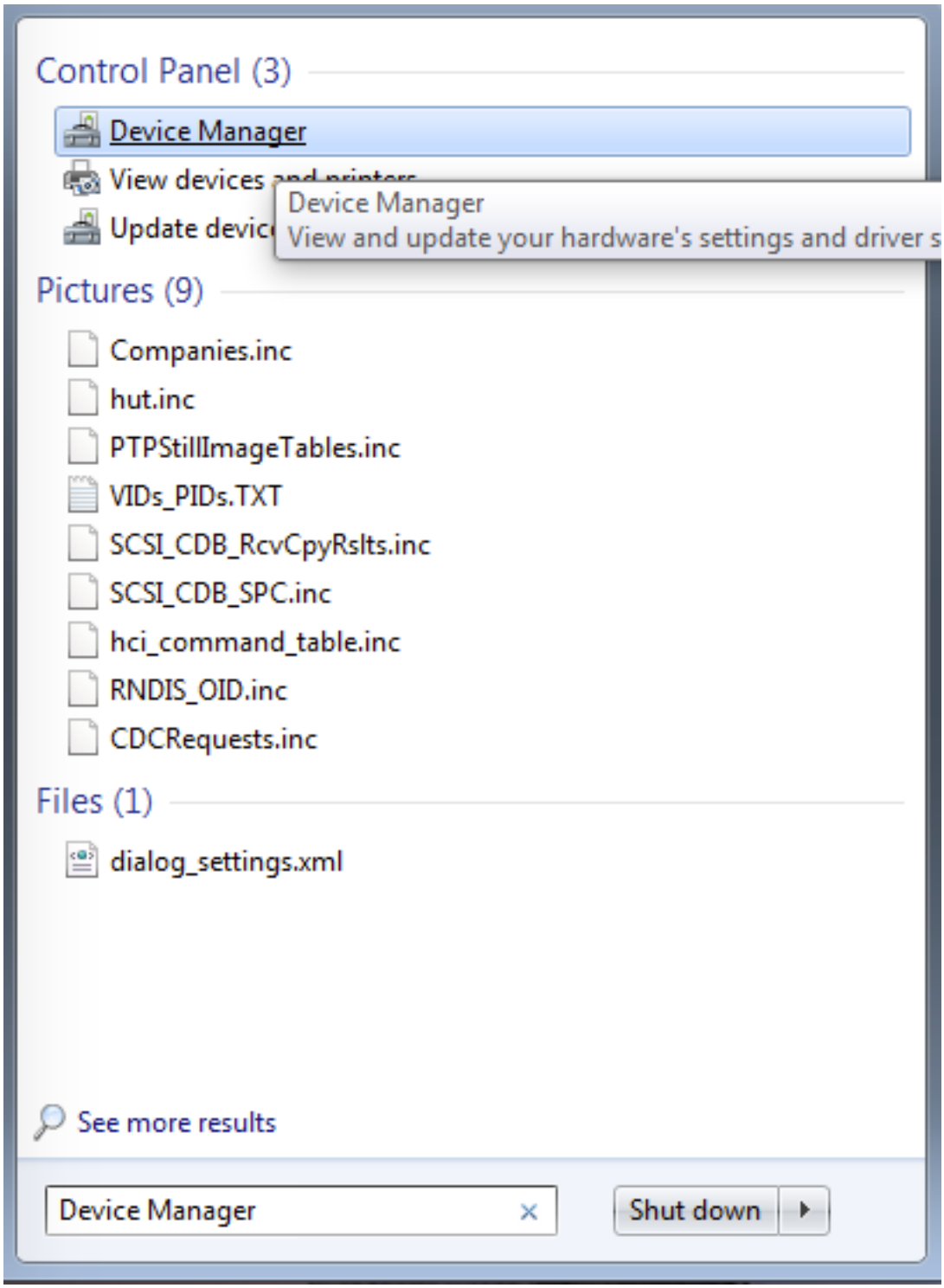

Figure 48. Device manager

3. In the Device Manager, expand the “Ports (COM & LPT)” section to view the available ports. Depending on the NXP board you’re using, the COM port can be named differently:

8 Appendix B - Default debug interfaces

Appendix B - Default debug interfaces

The MCUXpresso SDK supports various hardware platforms that come loaded with a variety of factory programmed debug interface configurations. The following table lists the hardware platforms supported by the MCUXpresso SDK, their default debug interface, and any version information that helps differentiate a specific interface configuration.

NOTE

The 'OpenSDA details' column of the following table is not applicable to LPC.

Table 1. Hardware platforms supported by SDK

Hardware platform	Default interface	OpenSDA details
EVK-MIMXRT685	CMSIS-DAP	N/A
FRDM-K22F	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.1
FRDM-K28F	DAPLink	OpenSDA v2.1
FRDM-K32W042	CMSIS-DAP	N/A
FRDM-KE16Z	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.2
FRDM-K64F	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.0
FRDM-K66F	J-Link OpenSDA	OpenSDA v2.1
FRDM-K82F	CMSIS-DAP	OpenSDA v2.1
FRDM-KE15Z	DAPLink	OpenSDA v2.1
FRDM-KL02Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL03Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL25Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL26Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL27Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL28Z	P&E Micro OpenSDA	OpenSDA v2.1
FRDM-KL43Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL46Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KL81Z	CMSIS-DAP	OpenSDA v2.0
FRDM-KL82Z	CMSIS-DAP	OpenSDA v2.0
FRDM-KV10Z	CMSIS-DAP	OpenSDA v2.1
FRDM-KV11Z	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KV31F	P&E Micro OpenSDA	OpenSDA v1.0
FRDM-KW24	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.1
FRDM-KW36	DAPLink	OpenSDA v2.2
FRDM-KW41Z	CMSIS-DAP/DAPLink	OpenSDA v2.1 or greater
Hexiwear	CMSIS-DAP/mbed/DAPLink	OpenSDA v2.0
MAPS-KS22	J-Link OpenSDA	OpenSDA v2.0
TWR-K21D50M	P&E Micro OSJTAG	N/AOpenSDA v2.0
TWR-K21F120M	P&E Micro OSJTAG	N/A
TWR-K22F120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K24F120M	CMSIS-DAP/mbed	OpenSDA v2.1
TWR-K60D100M	P&E Micro OSJTAG	N/A
TWR-K64D120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K65D180M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K65D180M	P&E Micro OpenSDA	OpenSDA v1.0

Table continues on the next page...

Table 1. Hardware platforms supported by SDK (continued)

TWR-KV10Z32	P&E Micro OpenSDA	OpenSDA v1.0
TWR-K80F150M	CMSIS-DAP	OpenSDA v2.1
TWR-K81F150M	CMSIS-DAP	OpenSDA v2.1
TWR-KE18F	DAPLink	OpenSDA v2.1
TWR-KL28Z72M	P&E Micro OpenSDA	OpenSDA v2.1
TWR-KL43Z48M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KL81Z72M	CMSIS-DAP	OpenSDA v2.0
TWR-KL82Z72M	CMSIS-DAP	OpenSDA v2.0
TWR-KM34Z75M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV10Z32	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV11Z75M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV31F120M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV46F150M	P&E Micro OpenSDA	OpenSDA v1.0
TWR-KV58F220M	CMSIS-DAP	OpenSDA v2.1
TWR-KW24D512	P&E Micro OpenSDA	OpenSDA v1.0
USB-KW24D512	N/A External probe	N/A
USB-KW41Z	CMSIS-DAP\DAPLink	OpenSDA v2.1 or greater
USB-KW41Z	CMSIS-DAP\DAPLink	OpenSDA v2.1 or greater
USB-KW41Z	CMSIS-DAP\DAPLink	OpenSDA v2.1 or greater
LPC54018 IoT Module	N/A	N/A
LPCXpresso54018	CMSIS-DAP	N/A
LPCXpresso54018	CMSIS-DAP	N/A
LPCXpresso54102	CMSIS-DAP	N/A
LPCXpresso54114	CMSIS-DAP	N/A
LPCXpresso51U68	CMSIS-DAP	N/A
LPCXpresso54608	CMSIS-DAP	N/A
LPCXpresso54618	CMSIS-DAP	N/A
LPCXpresso54628	CMSIS-DAP	N/A
HVP-KE18F	DAPLink	OpenSDA v2.2
HVP-KV46F150M	P&E Micro OpenSDA	OpenSDA v1
HVP-KV11Z75M	CMSIS-DAP	OpenSDA v2.1
HVP-KV58F	CMSIS-DAP	OpenSDA v2.1
HVP-KV31F120M	P&E Micro OpenSDA	OpenSDA v1

9 Appendix C - Updating debugger firmware

9.1 Updating OpenSDA firmware

Any NXP hardware platform that comes with an OpenSDA-compatible debug interface has the ability to update the OpenSDA firmware. For reference, OpenSDA firmware files can be found at the links below:

- J-Link: Download appropriate image from www.segger.com/opensda.html**.** Chose the appropriate J-Link binary based on the table in Appendix B. Any OpenSDA v1.0 interface should use the standard OpenSDA download (in other words, the one with no version). For OpenSDA 2.0 or 2.1, select the corresponding binary.
- P&E Micro: Downloading P&E Micro OpenSDA firmware images requires registration with P&E Micro (www.pemicro.com).

These steps show how to update the OpenSDA firmware on your board for Windows operating system and Linux OS users:.

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. When the board re-enumerates, it shows up as a disk drive called "MAINTENANCE".

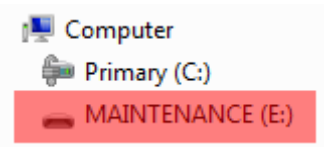

Figure 49. MAINTENANCE drive

4. Drag the new firmware image onto the MAINTENANCE drive in Windows operating system Explorer, similar to how you would drag and drop a file onto a normal USB flash drive.

NOTE

If for any reason the firmware update fails, the board can always re-enter maintenance mode by holding down the "Reset" button and power cycling.

These steps show how to update the OpenSDA firmware on your board for Mac OS users.

1. Unplug the board's USB cable.
2. Press the board's "Reset" button. While still holding the button, plug the board back in to the USB cable.
3. For boards with OpenSDA v2.0 or v2.1, it shows up as a disk drive called "BOOTLOADER" in Finder. Boards with OpenSDA v1.0 may or may not show up depending on the bootloader version. If you see the drive in Finder, proceed to the next step. If you do not see the drive in Finder, use a PC with Windows OS 7 or an earlier version to either update the OpenSDA firmware, or update the OpenSDA bootloader to version 1.11 or later. The bootloader update instructions and image can be obtained from P&E Microcomputer website.
4. For OpenSDA v2.1 and OpenSDA v1.0 (with bootloader 1.11 or later) users, drag the new firmware image onto the BOOTLOADER drive in Finder, similar to how you would drag and drop the file onto a normal USB Flash drive.
5. For OpenSDA v2.0 users, type these commands in a Terminal window:

```
> sudo mount -u -w -o sync /Volumes/BOOTLOADER
> cp -X  <path to update file> /Volumes/BOOTLOADER
```

NOTE

If for any reason the firmware update fails, the board can always re-enter bootloader mode by holding down the "Reset" button and power cycling.

9.2 Updating LPCXpresso board firmware

The LPCXpresso hardware platform comes with a CMSIS-DAP-compatible debug interface (known as LPC-Link2). This firmware in this debug interface may be updated using the host computer utility called LPCScrypt. This typically used when switching between the default debugger protocol (CMSIS-DAP) to SEGGER J-Link, or for updating this firmware with new releases of these. This section contains the steps to re-program the debug probe firmware.

NOTE

If MCUXpresso IDE is used and the jumper making DFUlink is installed on the board (JP5 on some boards, but consult the board user manual or schematic for specific jumper number), LPC-Link2 debug probe boots to DFU mode, and MCUXpresso IDE automatically downloads the CMSIS-DAP firmware to the probe before flash memory programming (after clicking the "Debug" button). Using DFU mode ensures most up-to-date/compatible firmware is used with MCUXpresso IDE.

NXP provides the LPCScrypt utility, which is the recommended tool for programming the latest versions of CMSIS-DAP and J-Link firmware onto LPC-Link2 or LPCXpresso boards. The utility can be downloaded from www.nxp.com/lpcutilities.

These steps show how to update the debugger firmware on your board for Windows operating system. For Linux OS, follow the instructions described in LPCScrypt user guide (www.nxp.com/lpcutilities, select LPCScrypt, then select documentation tab).

1. Install the LPCScript utility.
2. Unplug the board's USB cable.
3. Make the DFU link (install the jumper labelled DFUlink).
4. Connect the probe to the host via USB (use Link USB connector).
5. Open a command shell and call the appropriate script located in the LPCScrypt installation directory (<LPCScrypt install dir>).
    a. To program CMSIS-DAP debug firmware: `<LPCScrypt install dir>/scripts/program_CMSIS`
    b. To program J-Link debug firmware: `<LPCScrypt install dir>/scripts/program_JLINK`
6. Remove DFU link (remove the jumper installed in step 3).
7. Re-power the board by removing the USB cable and plugging it again.

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Document Number MCUXSDKMIMXRT6XXGSUG
Revision 0, 01/2019