

Using the S5U13781R01C100 Shield TFT Board with mbed Compatible Platforms

Document Number: X94A-G-011-01.03

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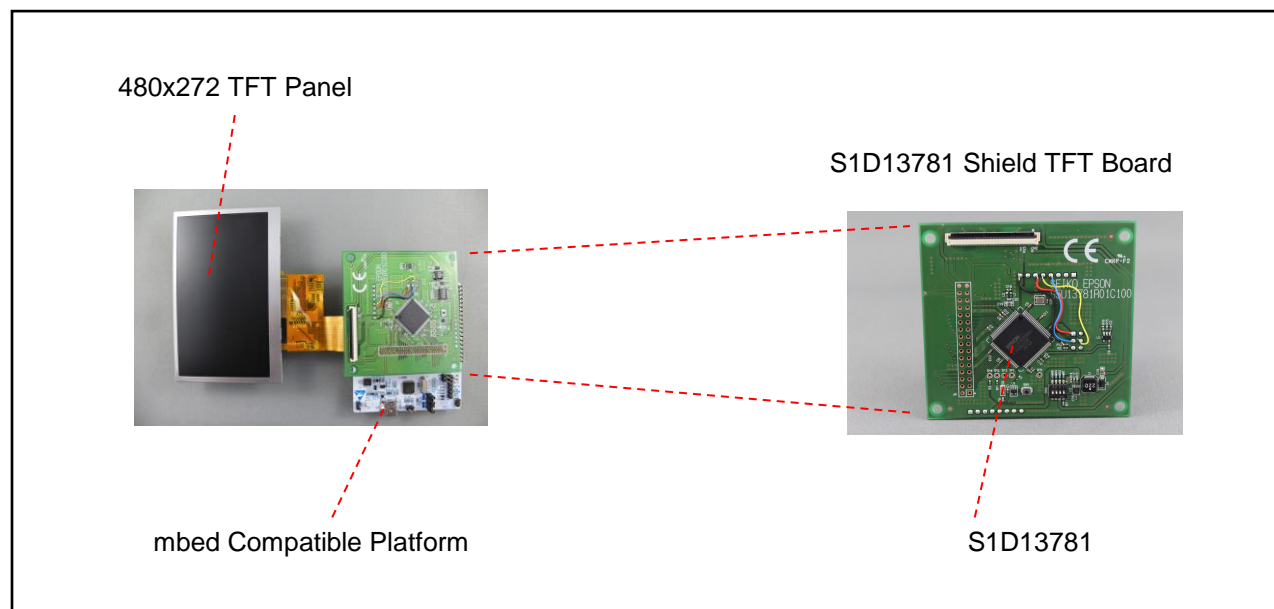
1 Introduction

This manual describes how the S5U13781R01C100 Shield TFT board can be used with mbed compatible platforms. The S1D13781 Shield TFT board is used to add a WQVGA (480x272) or QVGA (320x240) LCD display (not included on the board) to a mbed compatible platform.

The S1D13781 Shield TFT board, part number S5U13781R01C100, includes an Epson S1D13781 Simple LCD Controller. For further information on the S5U13781R01C100 Shield TFT board and the S1D13781 LCDC, visit the website at vdc.epson.com.

Please visit our Youtube channel, EPSONVDC Productions, where we offer videos which demonstrate the installation and use of our products.

We appreciate your comments on our documentation, Please contact us via email at vdc-documentation@ea.epson.com.



S1D13781 Shield TFT Board Overview

2 Platform Support

The S1D13781 Shield TFT board was developed to connect to the Arduino Due platform, but it can be modified for use with platforms meeting the following requirements:

- Arduino compatible headers (for details see Section 3, S1D13781 Shield TFT Board Modifications)
- mbed compiler compatibility (for details see Section 4, mbed Compiler Compatibility)
- 3.3V IO (for details refer to the *S5U13781R01C100 Shield Board Users Manual*, document number x94ag010-xx, which is available at vdc.epson.com)

NOTE:

Connecting the S1D13781 Shield TFT board to a platform that **does not provide 3.3V IO** may result in damage to the S1D13781 Shield board.

2.1 Supported Platforms

The S1D13781 Shield TFT board has been tested with the following platforms using the mbed compiler and the S1D13781 Graphics Library for mbed.

Refer to the notes section of the following table for specific details on each platform. Platforms not listed may require additional hardware changes, software changes, or have limitation due to available flash and/or SRAM memory.

Please note that this information may change as new platforms become available and older platforms are discontinued.

Manufacturer	Board	MCU	Notes
Arduino	Due	Cortex M3 (SAM3X83)	No modifications necessary. The Arduino Due is not supported by the mbed online compiler. To use the Arduino Due, please use the Graphics Library developed for use with the Arduino Sketch IDE or Atmel Studio IDE.
STMicroelectronics	Nucleo-F303RE	Cortex M4	Modifications as described in Section 3.1 are required to re-wire SPI pins. Fully compatible with mbed online compiler.
STMicroelectronics	Nucleo-F401RE	Cortex M4	Modifications as described in Section 3.1 are required to re-wire SPI pins. Fully compatible with mbed online compiler.
STMicroelectronics	Nucleo-F411RE	Cortex M4	Modifications as described in Section 3.1 are required to re-wire SPI pins. Fully compatible with mbed online compiler.

NOTE:

Due to limitations of available Flash and/or SRAM memory on some platforms, not all demonstration applications will run without modifications on all platforms. Also, for some platforms with limited memory, some features of the S1D13781 Graphics Library may not be available.

2.2 Panel Support

The S1D13781 Shield TFT board does not include an LCD display. The board has FPC connectors, CN1 and CN2, which allow direct connection of compatible WQVGA or QVGA LCD displays. For information on supported panels, refer to the *S5U13781R01C100 Shield Board Users Manual*, document number x94ag010-xx, which is available at vdc.epson.com.

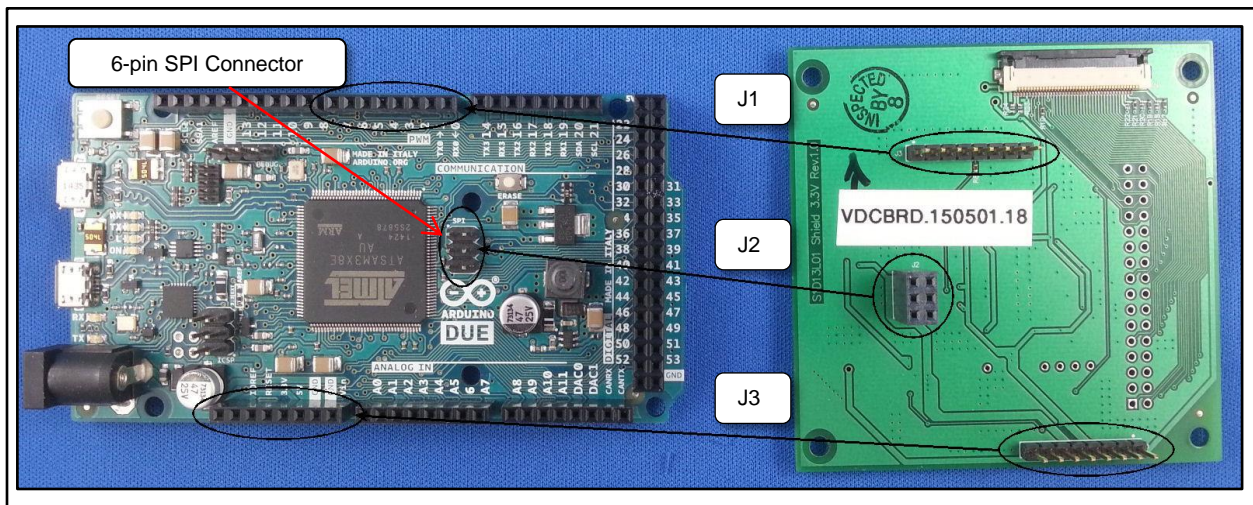
3 S1D13781 Shield TFT Board Modifications

The S1D13781 Shield TFT board is designed to connect to the Arduino Due board using 3 connectors:

- J1 - which also provides power
- J2 - which has the SPI signals
- J3 - which has the slave select signal for the Arduino Due

In the design, the S1D13781 is configured to use the SPI host interface which is provided on the Arduino Due by a 6-pin SPI connector. However, this connector is not available on many platforms that provide “Arduino Compatible” headers. If a compatible 6-pin SPI connector is available on your selected platform, it is likely that no hardware modifications will be required to use the S1D13781 Shield. For specific notes on each supported platform, see Section 2.1, Supported Platforms.

The following image shows the connections and highlights the 6-pin SPI connector position on the Arduino Due. If the 6-pin SPI connector is not on your platform, refer to section 3.1, Modifying the S1D13781 Shield.



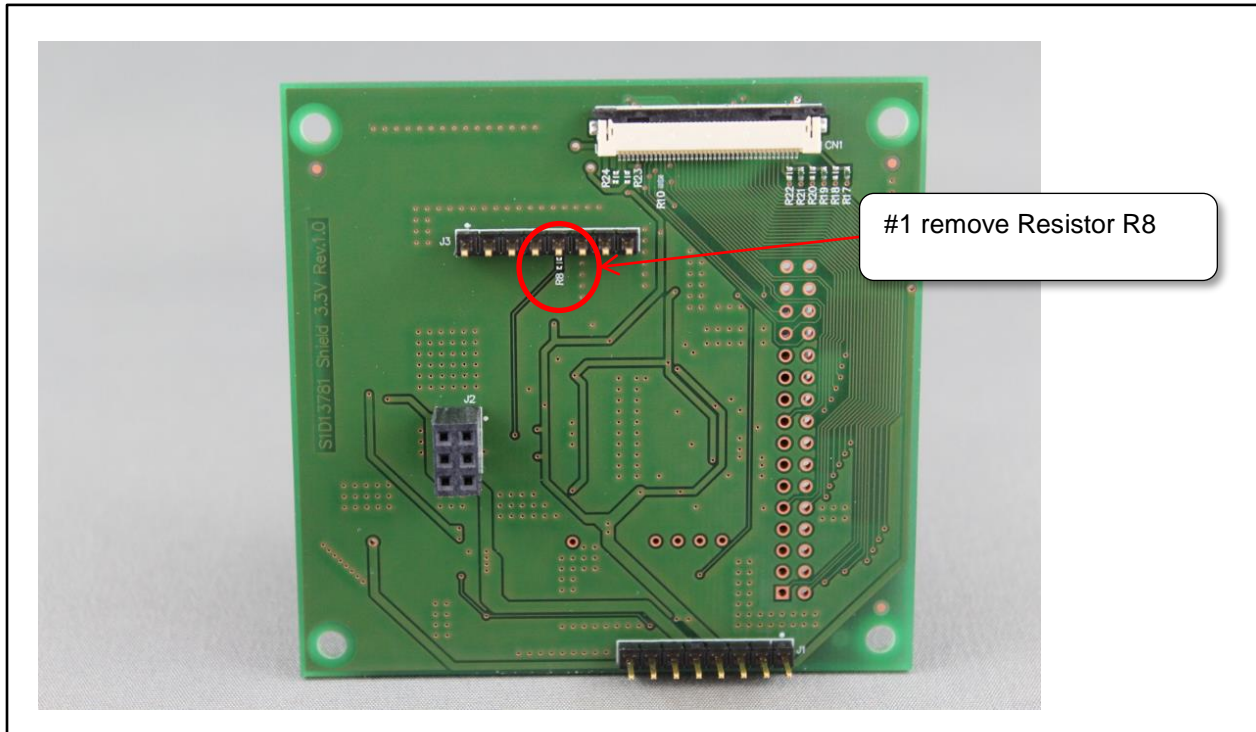
S1D13781 Shield to Arduino Due Connections

3.1 Modifying the S1D13781 Shield

If a compatible 6-pin SPI connector is not available on your selected platform, the following modifications must be made to route the SPI signals to available pins on the Arduino Headers.

On the bottom of the S1D13781 Shield board, make the following modifications. Locations are shown in the following image.

1. Remove resistor R8. R8 is located on the bottom side of S1D13781 Shield board.

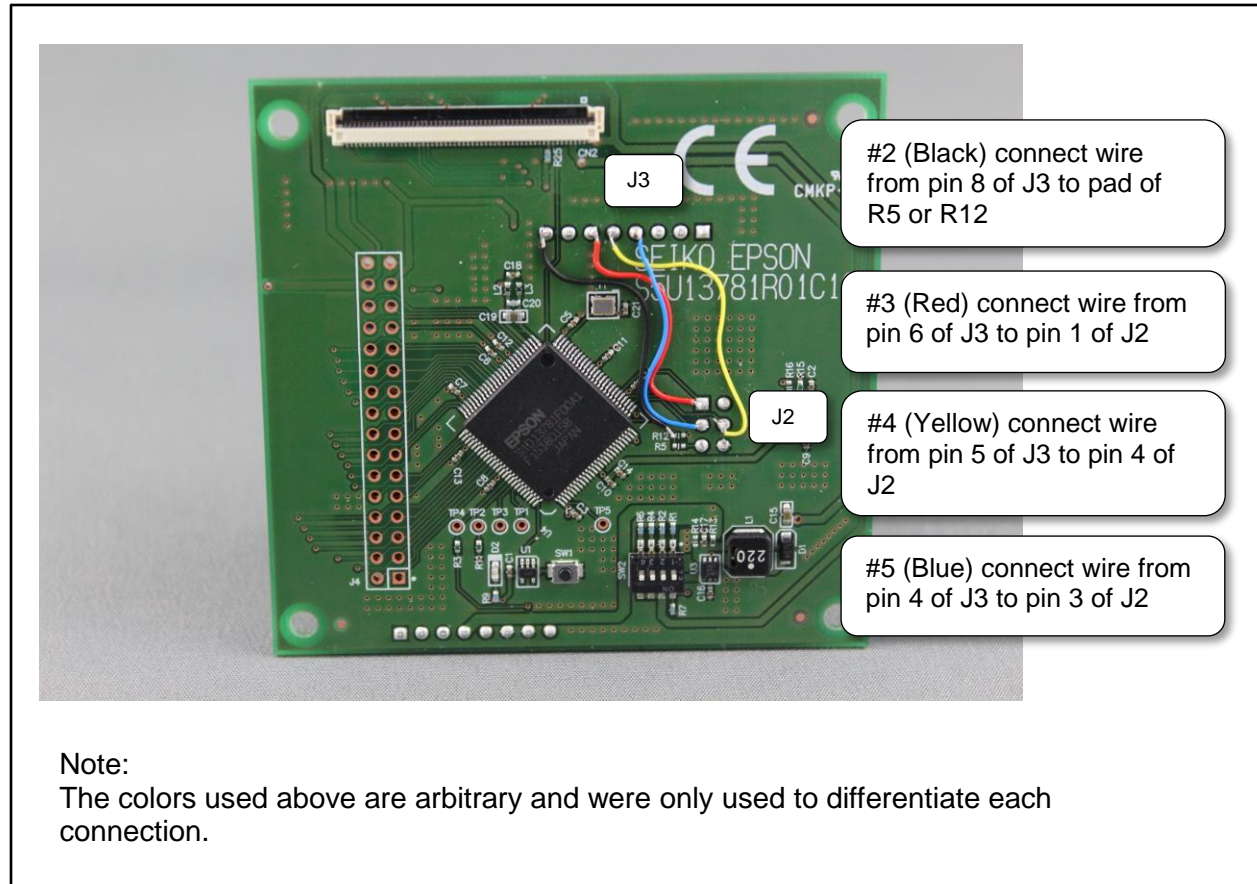


S1D13781 Shield Modifications (Bottom)

S1D13781 Shield TFT Board Modifications

On the top of the S1D13781 Shield board, make the following modifications. Locations are shown in the following image.

2. Connect a wire from pin 8 of connector J3 to the pad of R5 or R12, closest to Epson IC, U4. Resistors R5 and R12 are located on top side of S1D13781 Shield board.
3. On top side of S1D13781 Shield board, connect a wire from pin 6 of connector J3 to pin 1 of connector J2.
4. On top side of S1D13781 Shield board, connect a wire from pin 5 of connector J3 to pin 4 of connector J2.
5. On top side of S1D13781 Shield board, connect a wire from pin 4 of connector J3 to pin 3 of connector J2.



S1D13781 Shield Modifications (Top)

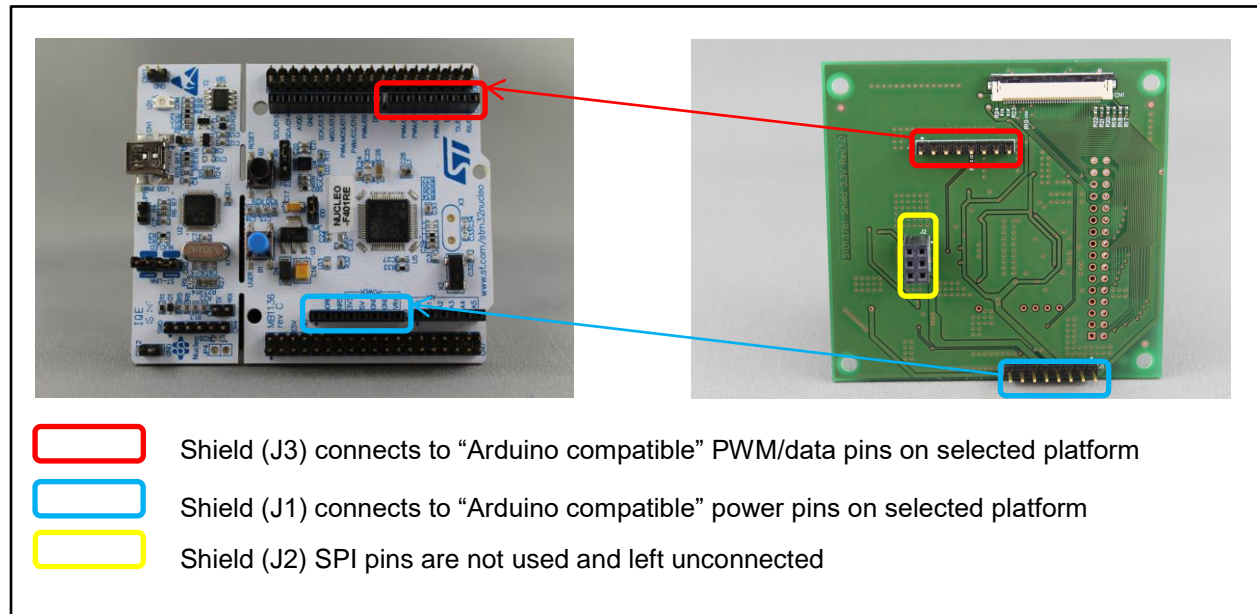
For detailed schematics of the S1D13781 Shield TFT board, refer to the *S5U13781R01C100 Shield Board Users Manual*, document number x94ag010-xx, which is available at vdc.epson.com

3.2 Connecting the Modified S1D13781 Shield to an mbed Platform

Once the modifications are complete (see Section 3.1, Modifying the S1D13781 Shield), the S1D13781 Shield board can be connected to the “Arduino Headers” on the selected Arduino compatible platform.

The example shown below shows an STMicroelectronics Nucleo F401RE:

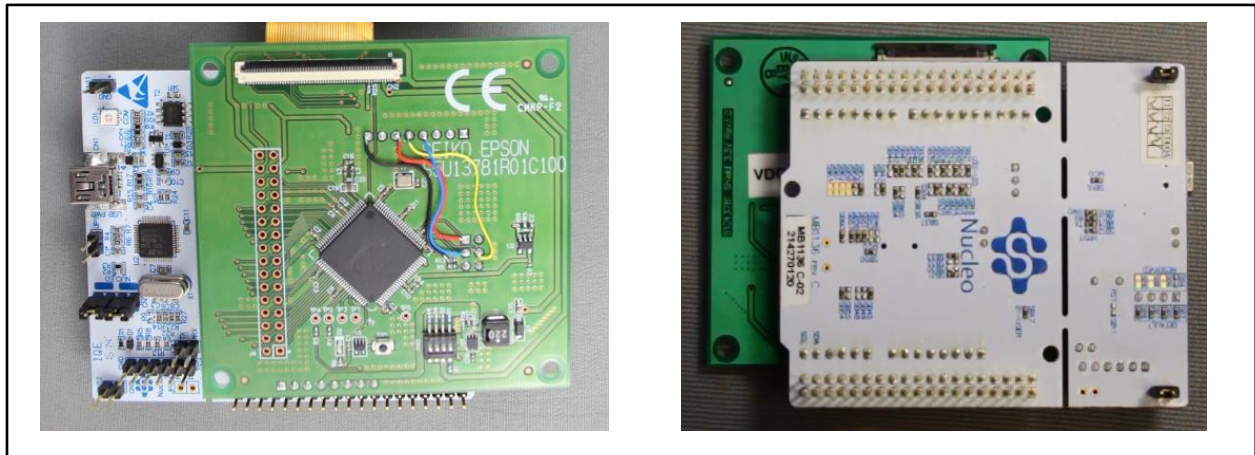
- Shield connector J1 is connected to the “Arduino compatible” power pins on the selected platform board
- Shield connector J2 is not used and left unconnected
- Shield connector J3 is connected to the “Arduino compatible” PWM/data pins on the selected platform board



Modified S1D13781 Shield to Arduino Compatible mbed Platform Connections

S1D13781 Shield TFT Board Modifications

Once the connections are complete, the S1D13781 Shield board and mbed platform should look similar to the following image.



Connected S1D13781 Shield and Arduino Compatible mbed Platform

Please visit our Youtube channel, EPSONVDC Productions, where we offer videos which demonstrate the installation and use of our products.

For additional details on supported TFT panels and TFT panel connection instructions, see the document “S5U13781R01C100 Shield Board Users Manual” available at vdc.epson.com.

4 mbed Compiler

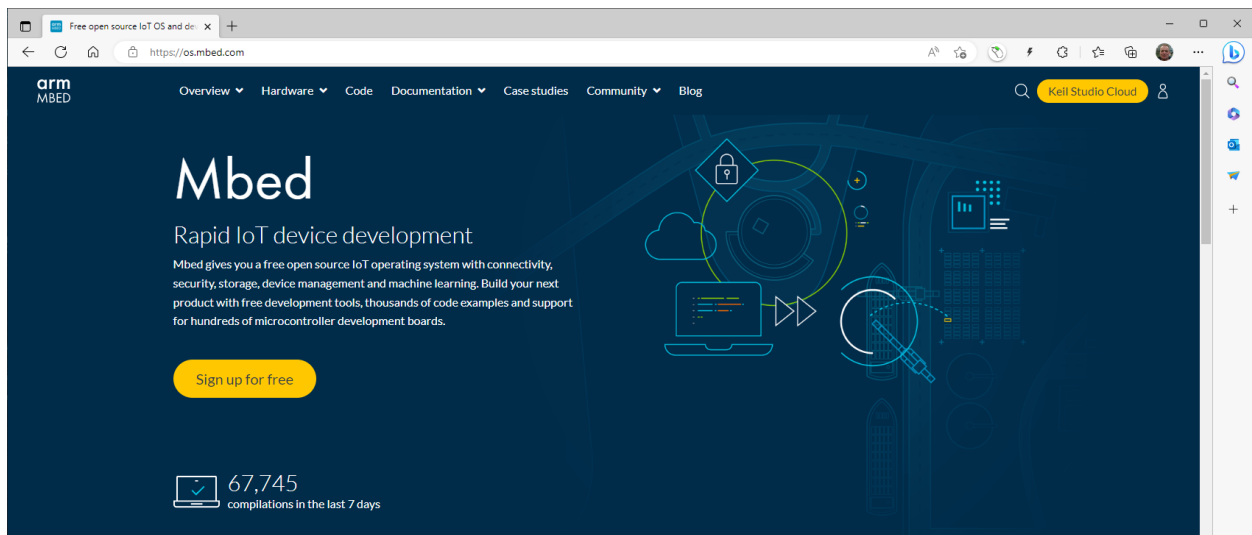
The mbed sample code is intended for use with Keil Studio Cloud which is a replacement for the older mbed online compiler. As a new tool it is still being developed which can cause application and connectivity issues.

Keil Studio Cloud offers support for numerous platforms from a variety of manufacturers.

The following section deals with how to select a platform using the Keil Studio Cloud online compiler. However, it is not intended to be a tutorial on using the online compiler. For more information on using the compiler refer to the help topics available after logging into Keil Studio Cloud.

4.1 Using Keil Studio Cloud

To begin visit the website, <https://os.mbed.com/>.



mbed Compiler

Click on the Keil Studio Cloud button. If you have an account, proceed to login, otherwise you will need to create an account first.

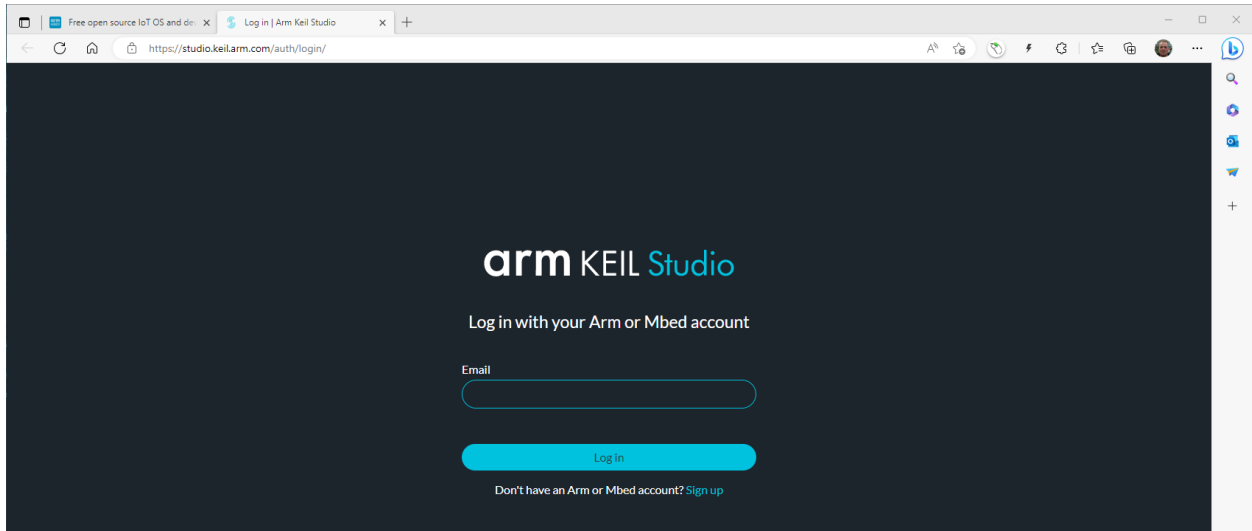
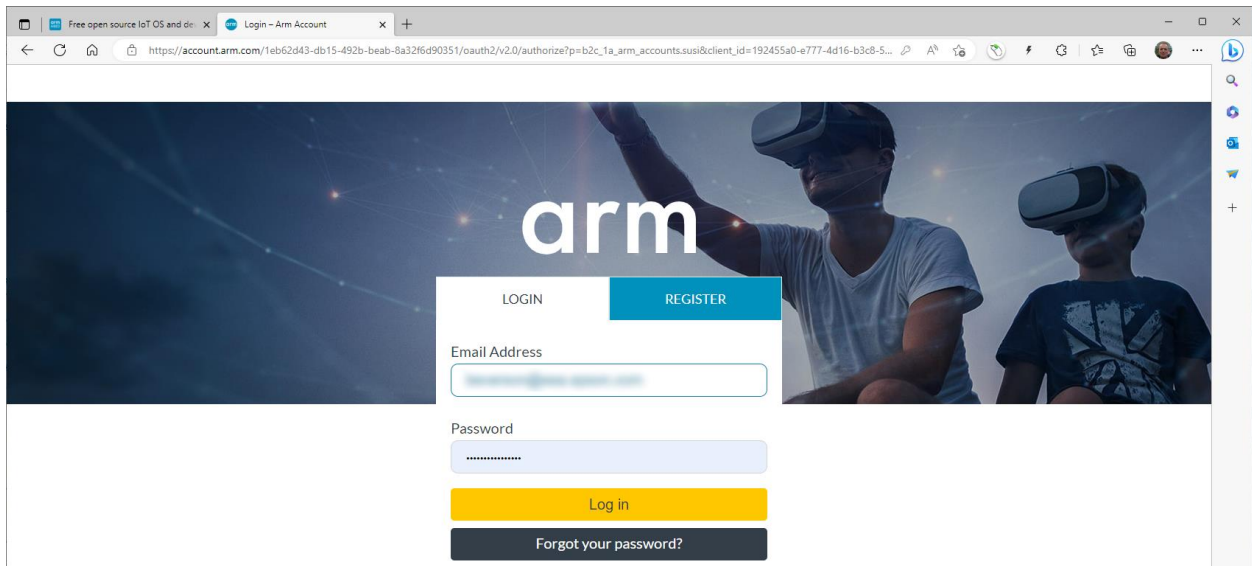
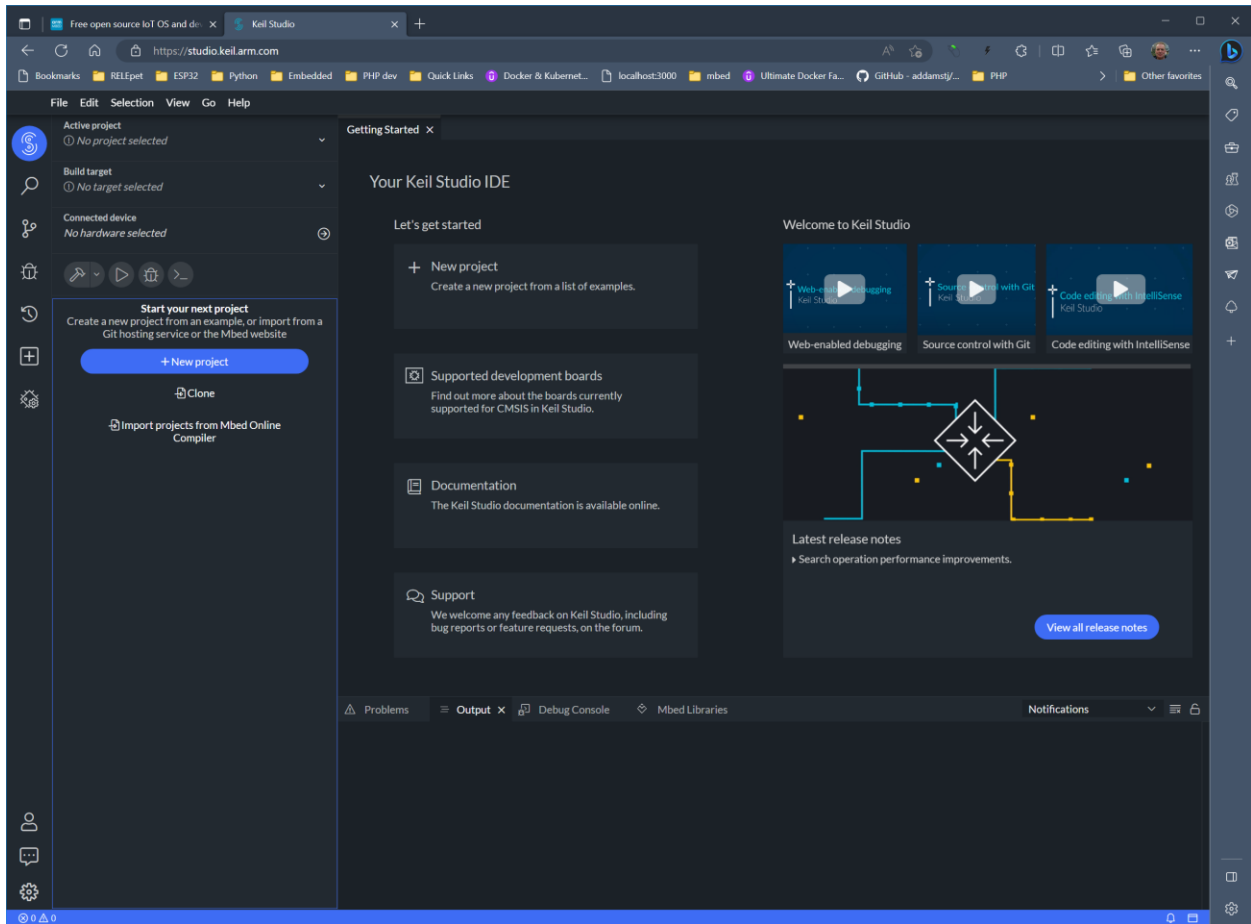


Figure 1: Login to Keil Studio

On your first login the window will resemble this. You may also have to login to your arm account



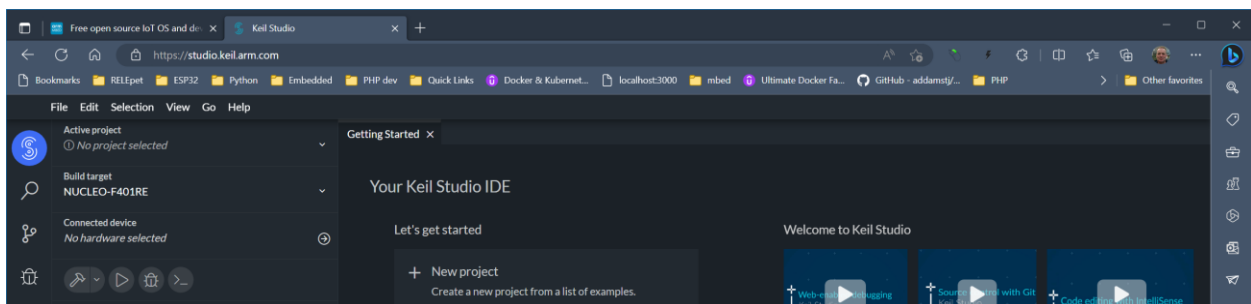
After logging in, you will see a window similar to the following:



4.2 Connecting to the Development Platform

Keil Studio Cloud supports numerous platforms from a wide variety of manufacturers. The S1D13781 Shield TFT board can be modified for use with some of them.

1. The first step should be to select “Build target” and ensure your target development platform is selected. The following image shows the Nucleo-F401RE has been selected.

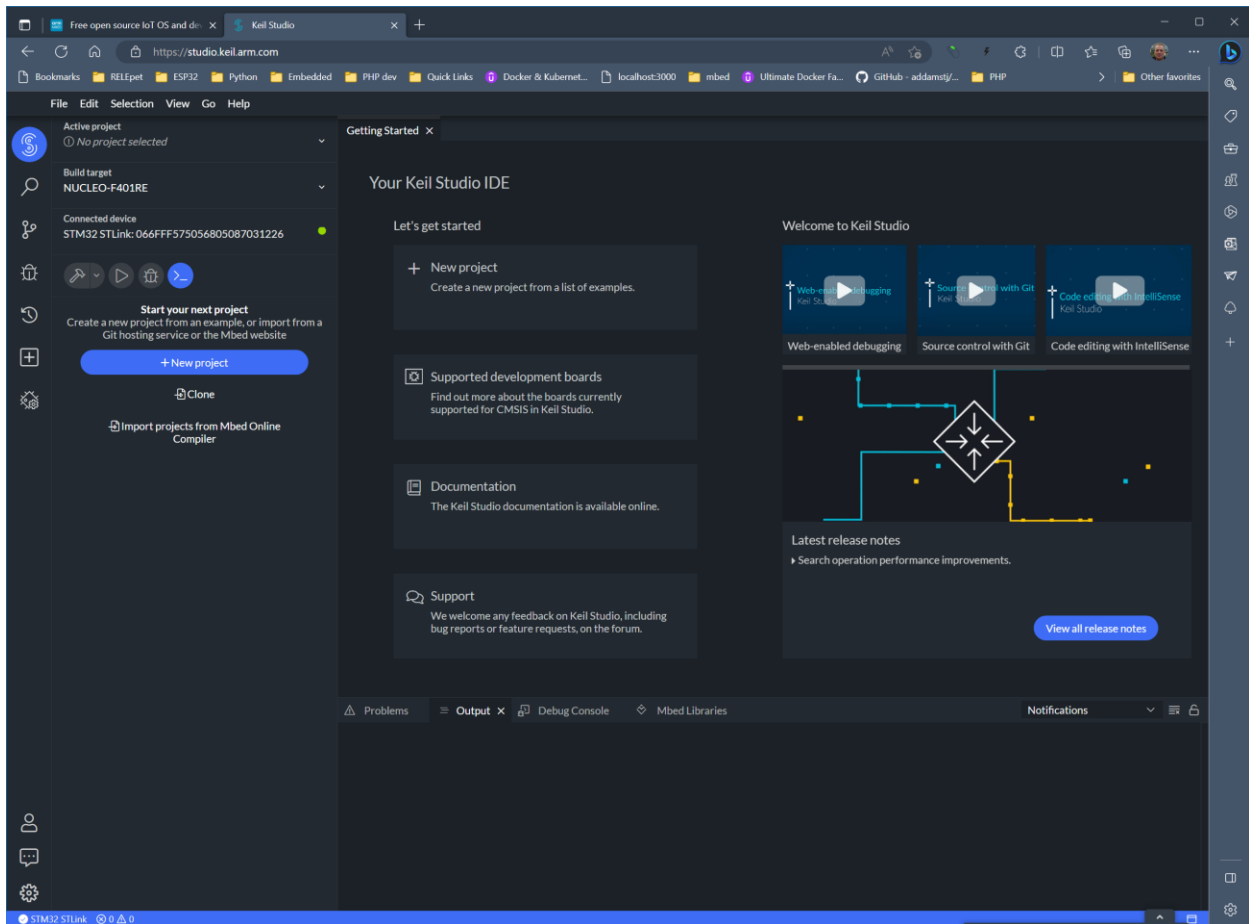


mbed Compiler

2. Before proceeding with the connection, there may be USB interface drivers that must be installed for your platform. For instance, the ST Micro boards in the example require the driver STSW-LINK009 to be installed before proceeding (see www.st.com).

After installing any necessary drivers and logging into Keil Studio Cloud, connect your device using a USB cable. Your device may be recognized and connect automatically, or you may have to click on “Connected device” and select your device interface.

The following image shows the Nucleo-F041RE board connected to the IDE.



Note the list of supported platforms may change as new platforms are introduced and new manufacturers are supported by the Keil Cloud Online compiler.

Although most platforms that have Arduino Compatible headers should be able to be modified for use with the S1D13781 Shield TFT board, not all platforms that are listed have been tested. For a list of tested platforms, see Section 2.1, Supported Platforms.

Note: Please ensure that your selected platform supports 3.3V IO.

4.3 Adding S1D13781 Shield Graphics Library and Demo Projects

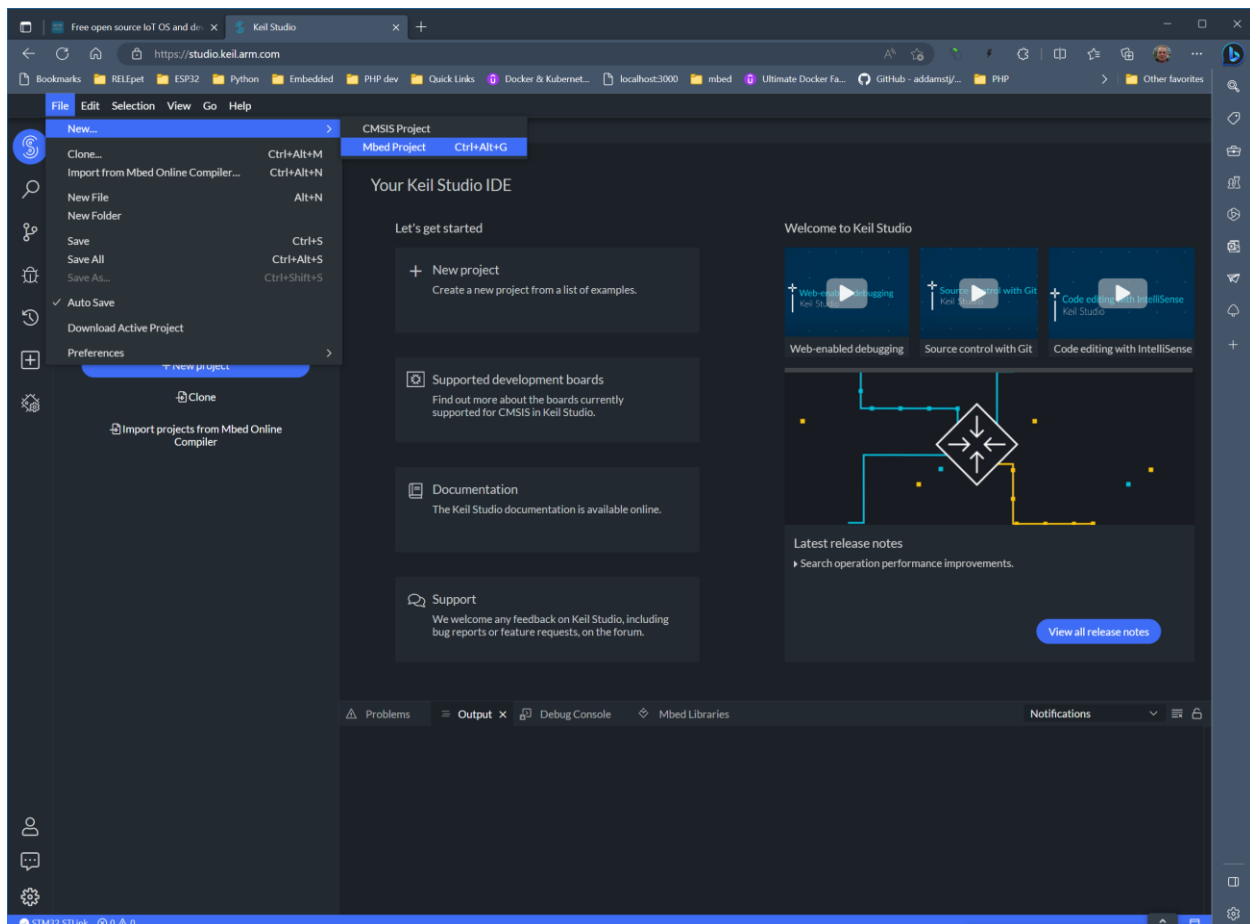
Once a platform is selected, programs can be added to the Keil Studio workspace. The demo package includes the S1D13781Gfx library, a program template, and the following sample projects.

- S1D13781 Shield BitBLT Demo
- S1D13781 Shield Graphics Library Demo
- S1D13781 Shield LUT Demo
- S1D13781 Shield Memory Test
- S1D13781 Shield Register Test

Note that due to limitations of available Flash and/or SRAM memory on some platforms, not all demonstration applications will run without modifications on all platforms. Also, for some platforms with limited memory, some features of the S1D13781 Graphics Library may not be available.

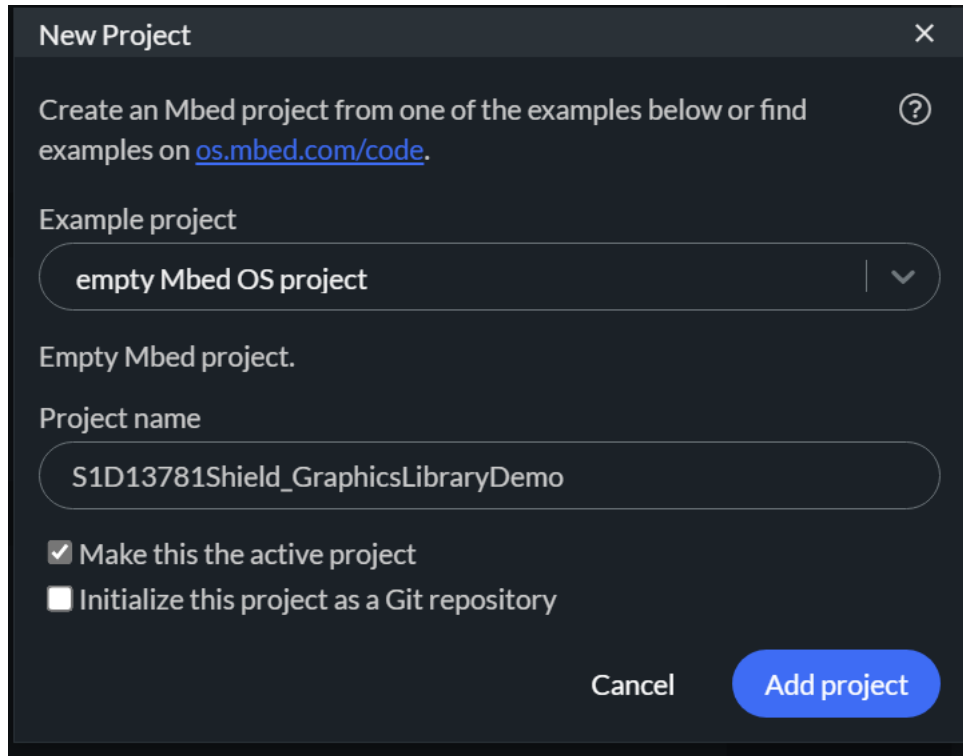
To load a sample project, perform the following steps.

1. From the Keil Studio workspace, click “File” >> “New” >> “Mbed Project”.

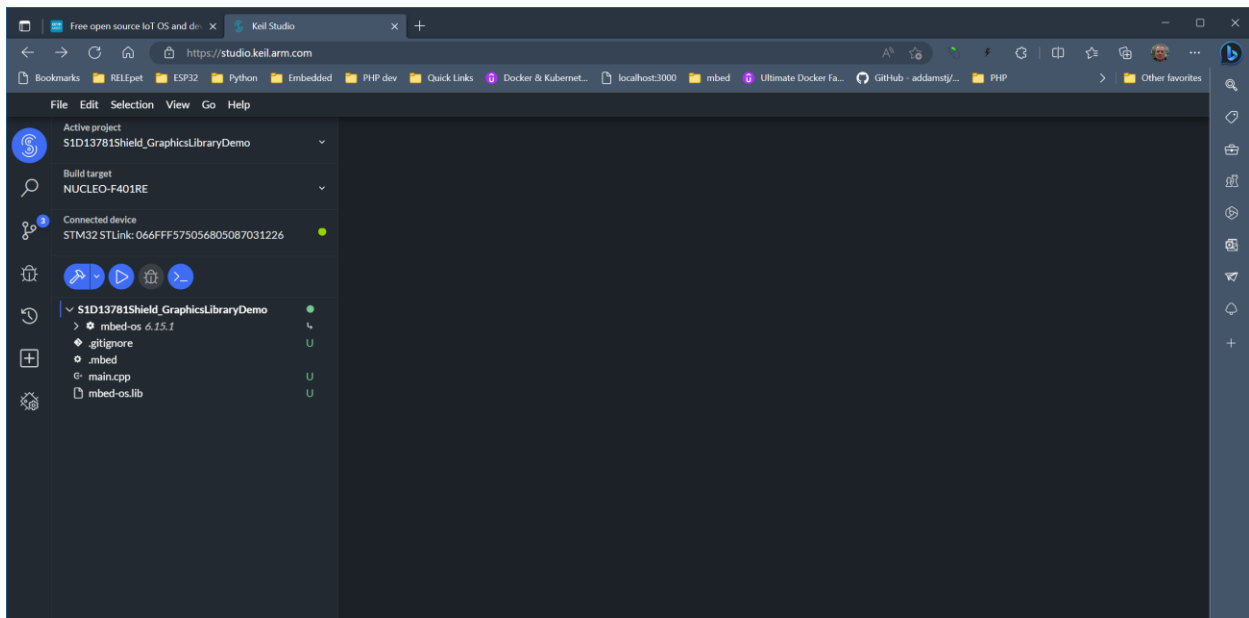


mbed Compiler

2. In the New Project pop-up window, for Example project select “empty Mbed OS project”. For Project name, select one of the sample projects. The below example targets the S1D13781Shield_GraphicsLibraryDemo. The new project will be automatically selected as the active project.

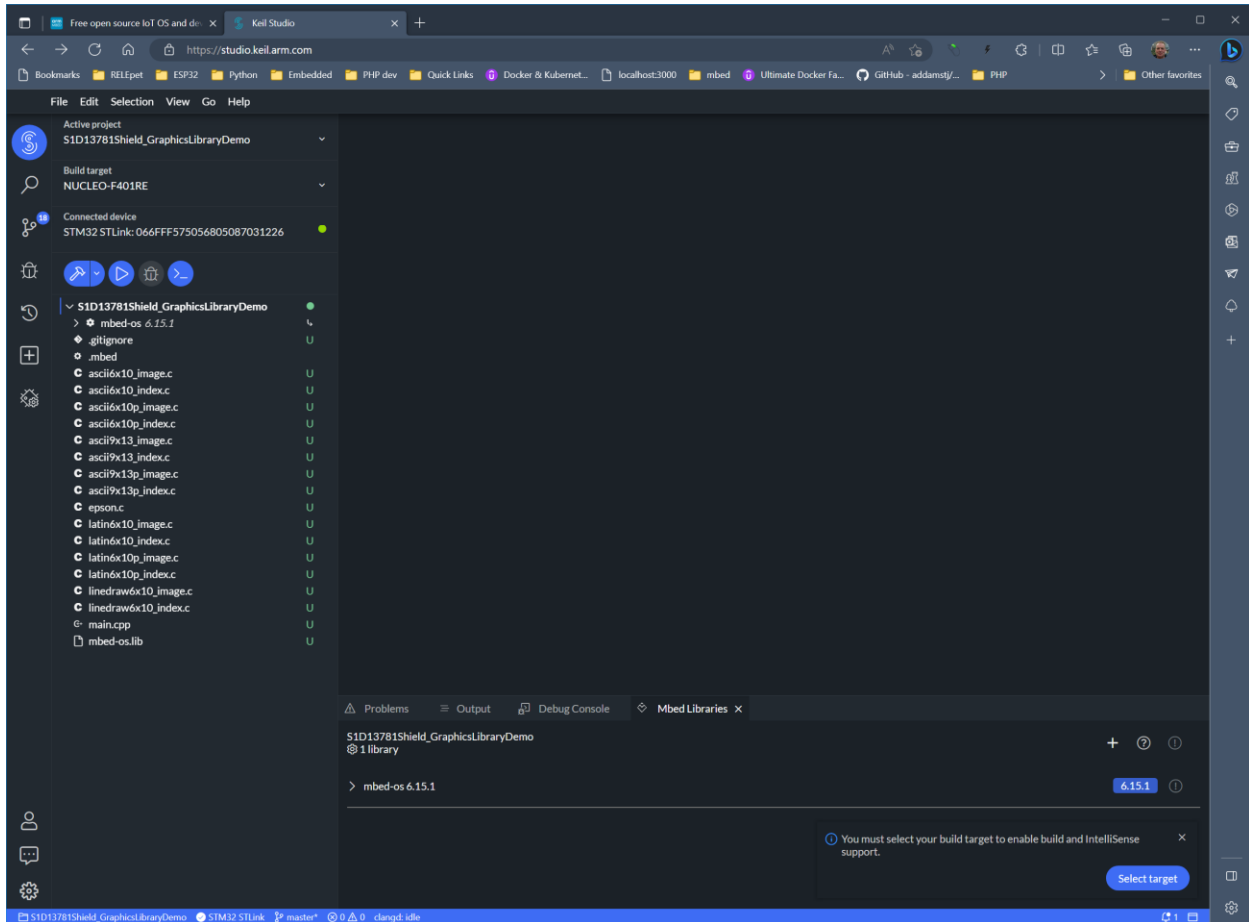


Now an empty project window is displayed.



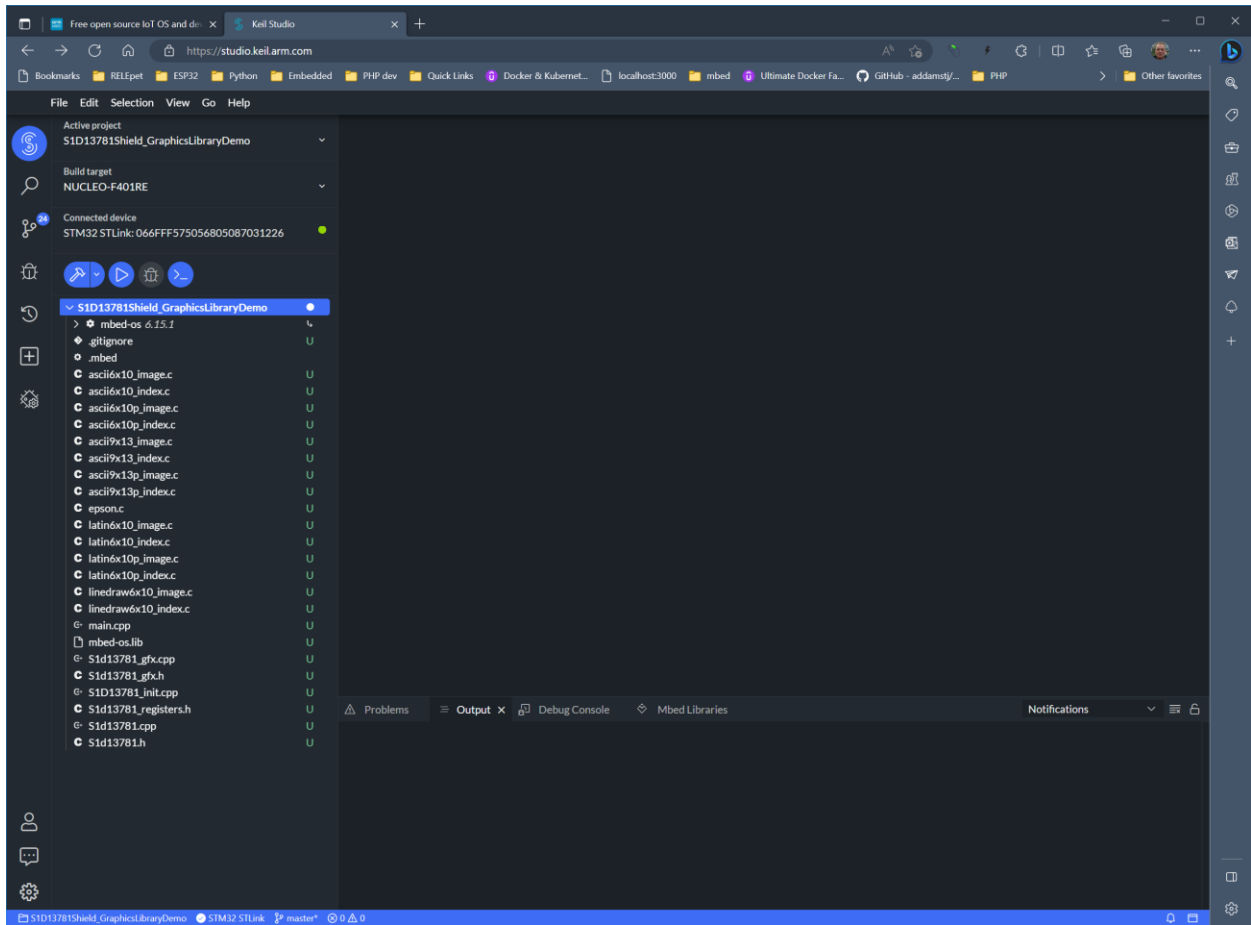
- The next step is to add the files for this project. Each sample project requires both the project code and the library code (S1D13781Gfx_library) which is common to all projects.


Add the project code by selecting “File” >> “Upload Files”. In the pop-up file dialog select all the files in the sample project and click the “Open” button. You will be asked if you wish to overwrite “main.cpp. Select “Replace”.



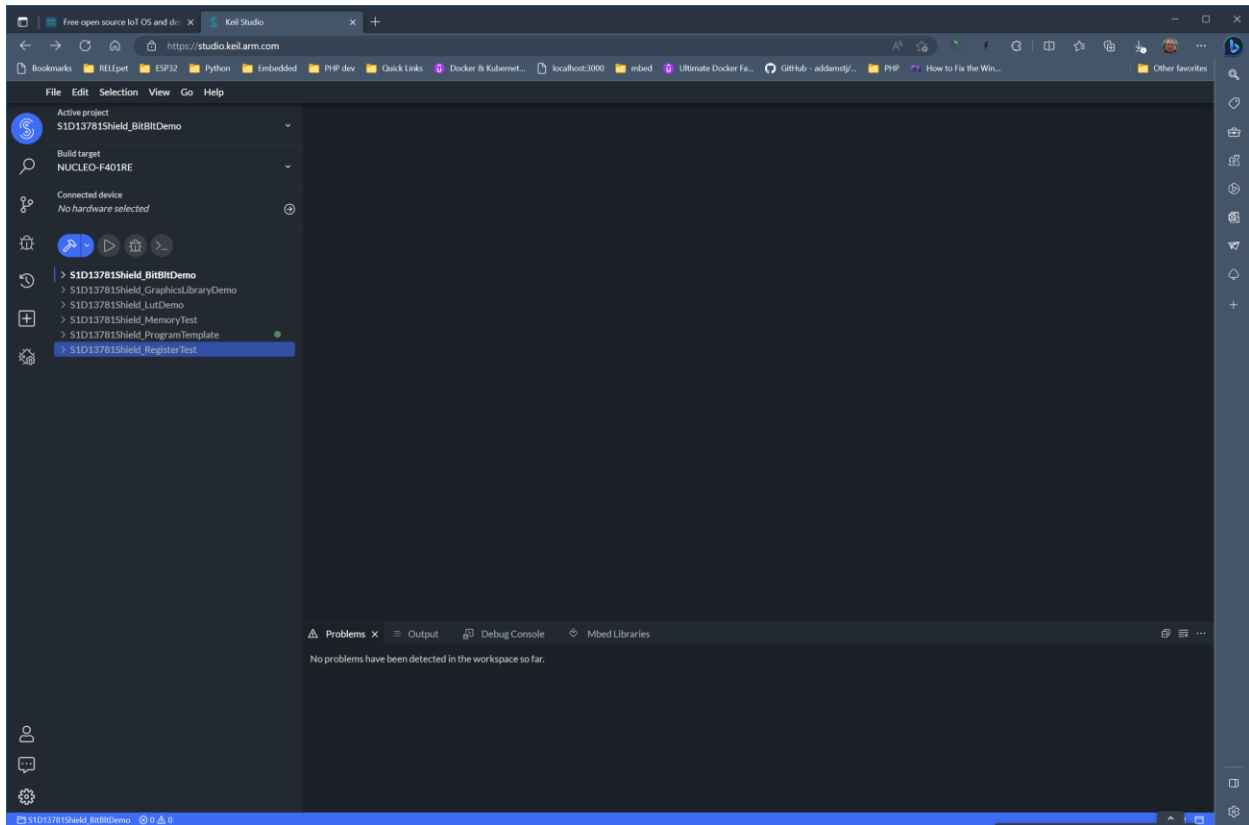
mbed Compiler

- Next add the common library code to the project by selecting “File” >> “Upload Files”. In the pop-up file dialog, browse to the “S1D13781Gfx_library” directory and select all the files. Then click the “Open” button.



- The project is now ready to be compiled, written to the platform, and run. To start a clean build of the project, click the  button. If the build is successful, then the default configuration will attempt to download the binary file after the build is complete. You may save the binary or cancel the save.

6. The same process can be used to import all the remaining S1D13781 Shield demonstration projects.



For further information on the S1D13781 LCDC, S1D13781 Shield TFT board, or S1D13781 Shield Graphics Library and demonstration projects, visit the website at vdc.epson.com.

For more information on the ARM mbed compiler, see <https://developer.mbed.org/handbook/mbed-Compiler>.

5 Change Record

X94A-G-011-01 Revision 1.03 - Issued: May 23, 2023

- Updated to demonstrate how to use with Keil Studio Cloud

X94A-G-011-01 Revision 1.02 - Issued: April 9, 2018

- Maintenance release to update contacts and format

X94A-G-011-01 Revision 1.01 - Issued: December 16, 2015

- Section 2.1, clarified the Notes section of the table on Supported Platforms

X94A-G-011-01 Revision 1.0 - Issued: November 26, 2015

- Section 1, Added Youtube channel to Introduction
- Section 2.1, updated wording and table in Platform Support section to clarify HW and SW support
- Section 3.2, added image of connected board and additional references

X94A-G-011-00 Revision 0.2 - Issued: November 19, 2015

- Updated board images with colored wiring
- Minor typo fixes

X94A-G-011-00 Revision 0.1 - Issued: November 12, 2015

- Initial document

6 Sales and Technical Support

For more information on Epson Display Controllers, visit the Epson Global website.

https://global.epson.com/products_and_drivers/semicon/products/display_controllers/



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https://global.epson.com/products_and_drivers/semicon/information/support.html

