TOUCH SCREEN C8051F7XX EVALUATION BOARD USER'S GUIDE

1. Getting Started

1.1. CP210x USB to UART VCP Driver Installation

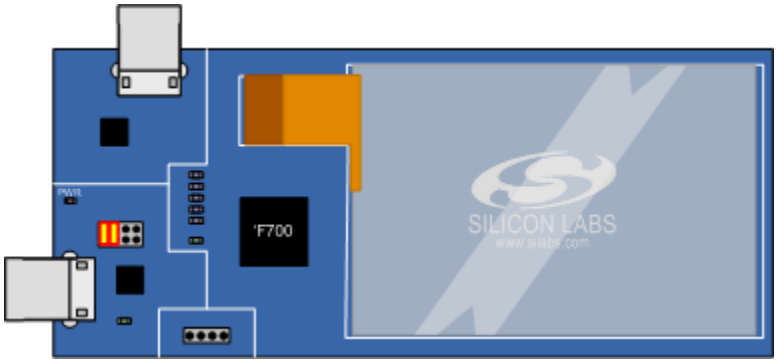
The Touch Screen Evaluation Board includes a Silicon Laboratories CP2103 USB-to-UART Bridge Controller. Device drivers for the CP2103 need to be installed before the PC software can communicate with the evaluation board over the USB connection. The CP210x VCP drivers can be downloaded from the Silicon Labs "Software Downloads" website. After downloading the drivers, launch the "unpacker" utility.

1. Follow the steps to copy the driver files to the desired location. The default directory is *C:\SiLabs\MCU\CP210x*.
2. The final window will give an option to install the driver on the target system. Select the "Launch the CP210x VCP Driver Installer" option if you are ready to install the driver.
3. If selected, the driver installer will now launch, providing an option to specify the driver installation location. After pressing the "Install" button, the installer will search your system for copies of previously installed CP210x Virtual COM Port drivers. It will let you know when your system is up to date. The driver files included in this installation have been certified by Microsoft.
4. If the "Launch the CP210x VCP Driver Installer" option was not selected in step 3, the installer can be found in the location specified in step 2, by default *C:\SiLabs\MCU\CP210x\Windows_2K_XP_S2K3_Vista*. At this location, run *CP210xVCPInstaller.exe*.
5. If needed, the driver files can be uninstalled by selecting "Silicon Laboratories CP210x USB to UART Bridge Driver Removal" option in the "Add or Remove Programs" window.

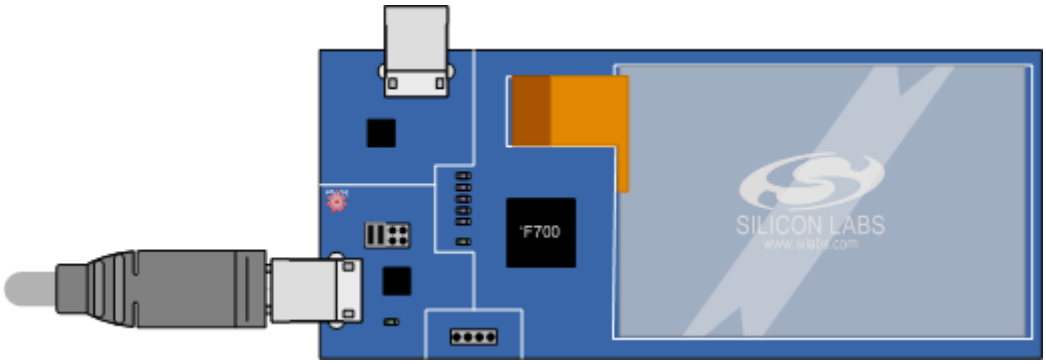
1.2. Running the Demo

Follow these steps to run the Touch Screen Demo:

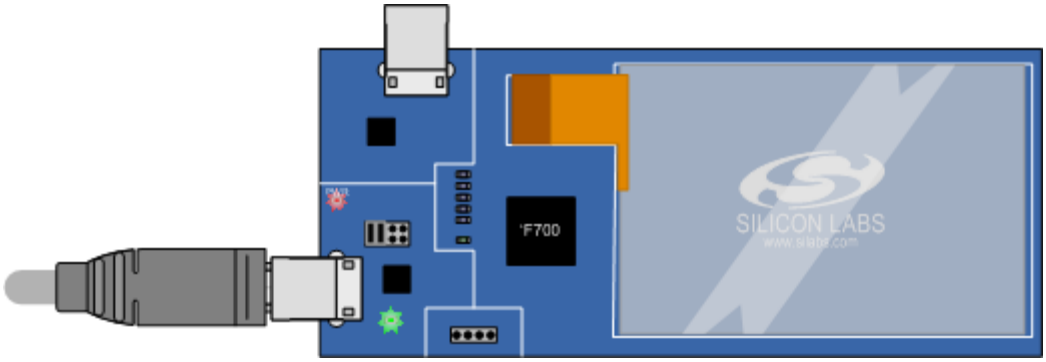
1. Install the Silicon Labs CP210x USB to UART VCP driver on the target PC following the directions in Section 1.1.
2. Verify that jumpers are in place on the F700 Touch Screen board on [TXD-P0.5] and [RXD-P0.4] on the J1 jumper block.



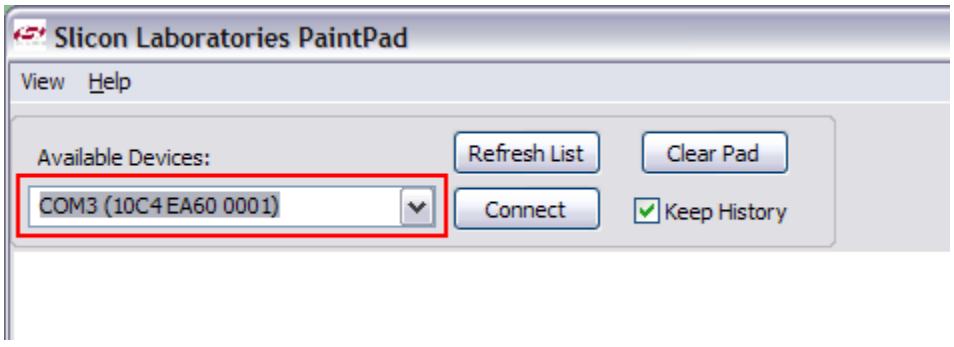
3. Once the VCP drivers are installed, connect the F700 Touch Screen COMM1 (P2) to the PC using a standard USB cable. The red PWR LED (DS7) should light up once the board is connected to the PC.



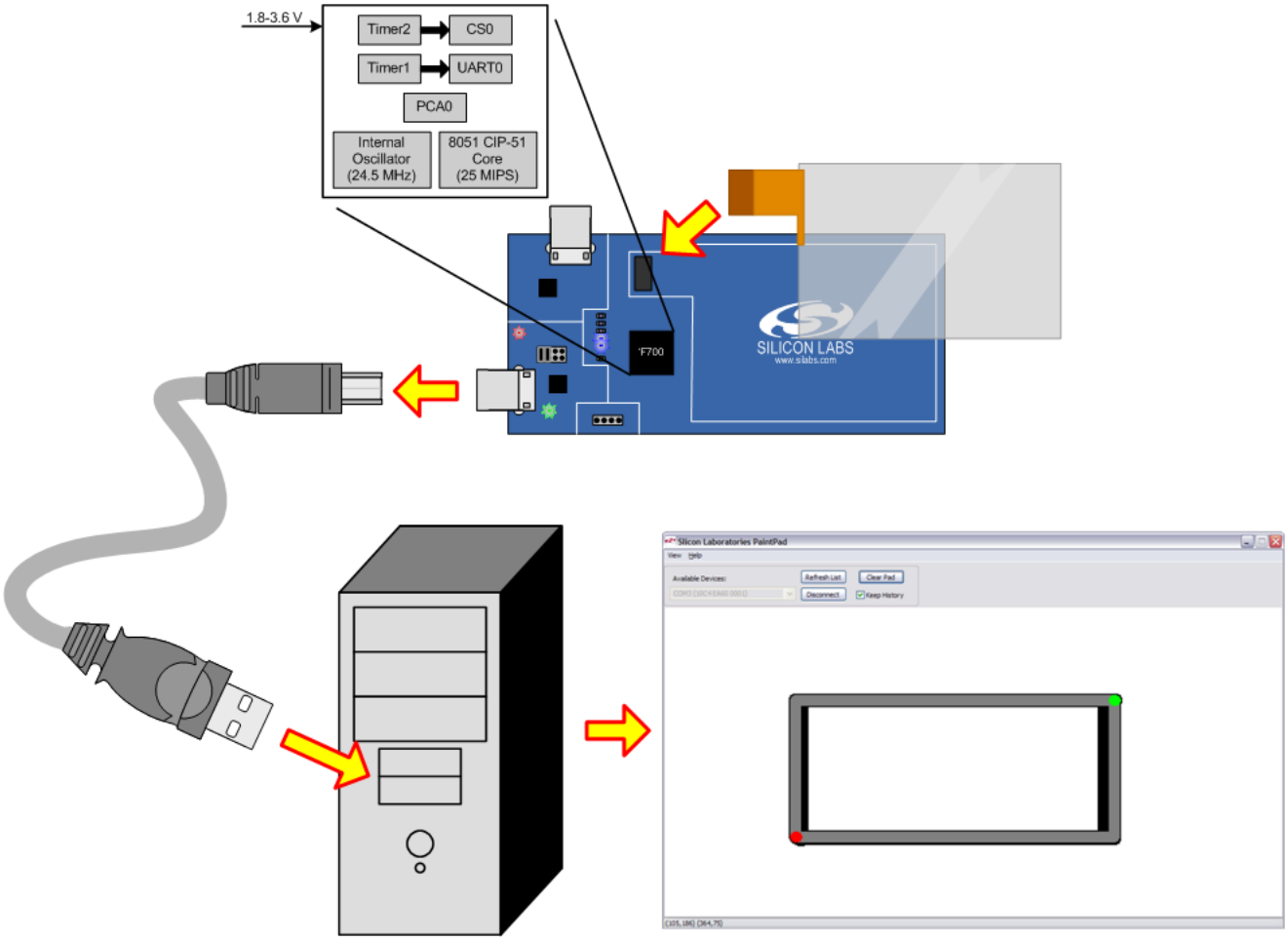
4. Wait until the green COMM1 LED (DS8) lights up. This indicates that the CP210x has enumerated and is ready to communicate to the PC.



5. On the PC, run the “PaintPad.exe” executable. The file “CP210xManufacturing.DLL” must be in the same folder as the PaintPad executable.
6. The “Available Devices” drop-down box should contain the COM port associated with the CP2103 on the Touch Screen board. The VID, PID, and serial number of the device will be shown. Click the “Connect” button to connect to the CP2103 on the board.

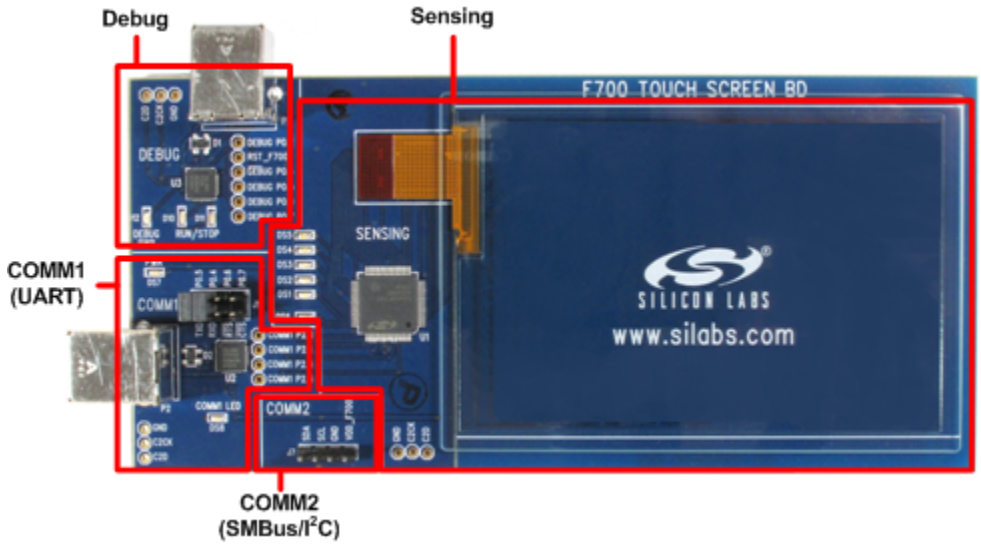


7. Draw on the glass. The calculated XY coordinate will be displayed in the PaintPad program and the blue LEDs (DS1 and DS2) on the Touch Screen board will indicate how many fingers are detected. The final demo setup should look as follows:



2. Hardware Overview

The Touch Screen board has four different areas: sensing, debug, COMM1, and COMM2.



2.1. Sensing

The sensing area of the board includes the C8051F700 microcontroller, the Touch Screen glass, five blue LEDs (DS1-DS5), one green LED (DS6), and three test points for access to the ‘F700 C2 interface. The ‘F700 performs all of the measuring, detection, and finger tracking routines. The LEDs (DS1 and DS2) will light up based on the number of fingers detected on the screen up to two. The screen will not recognize three or more touches.

The ‘F700 is powered from either the Debug or COMM1 USB connection. These power connections can be removed by unsoldering the R7 (COMM1) or R10 (Debug) 0 ohm resistors.

The power consumption of the ‘F700 can be measured independently of other circuitry on the board by removing the R3 resistor and placing an ammeter across the now-empty pads.

The glass is provided by TPK and includes a tail with connector DF30FB-30DS-0.4V (Hirose) that mates with the connector DF30FC-30DP-0.4V (Hirose) on the PCB. The glass is 0.5 mm thick with 2 layers of diamond pattern ITO. The ITO has a characteristic resistance of 75 Ω/square.

2.2. Debug

The debug area contains the ToolStick Base Adapter circuitry. In order to debug with the device, the P3 USB connector should be connected directly to the PC using a standard USB cable. A separate Debug Adapter should not be used. The Silicon Labs IDE can be used to connect to the device, download code to the device, and debug firmware.

2.3. COMM1

COMM1 is the UART communications channel for the ‘F700 on the board. The CP2103 converts the UART traffic to USB traffic and can be connected to on the PC using the CP210x USB-to-UART VCP drivers.

2.4. COMM2

COMM2 provides an I^2C communications channel for the ‘F700. There are locations for I^2C pull-up resistors, if these are desired (unpopulated by default). There is also a connection to ground and VDD in case the board will be powered from the I^2C connection.

3. PC Software Overview

3.1. PaintPad (Touch Screen GUI)

The PaintPad PC GUI for the Touch Screen board displays the following:

- For a single touch, the GUI will display a single XY coordinate.
- For two fingers, the GUI will display a rectangle indicating the two touches and the two “ghost locations.” If the two fingers are in the same row or column, a single line will be displayed.

In all modes, the XY coordinates transmitted to the PC will be listed in the lower-left corner of the GUI.

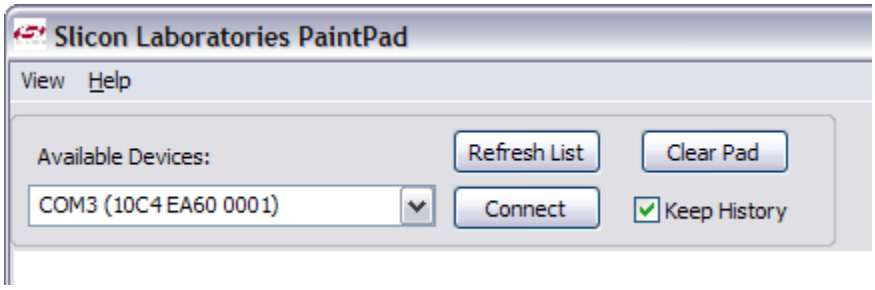
3.1.1. PaintPad System Requirements

The PaintPad Touch Screen GUI requirements:

- Pentium-class host PC running Microsoft Windows 2000 or newer.
- One available USB port.

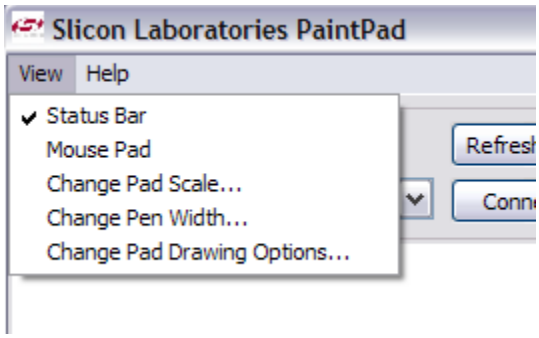
3.1.2. PaintPad Options

3.1.2.1. Main Options



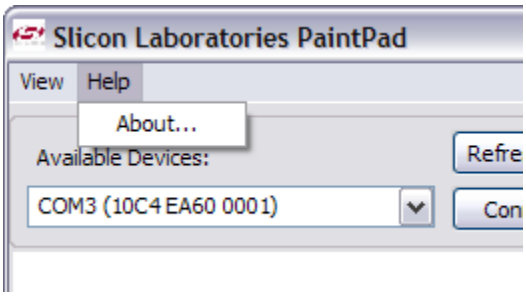
- ***Connect***: This allows the PaintPad GUI to connect to the CP2103 on the Touch Screen board using the CP210x USB-to-UART VCP driver. The driver must be properly installed on the PC in order to connect.
- ***Refresh List***: This will update the list of available COM ports to connect to. This list should automatically update when a board is connected or disconnected from the PC.
- ***Clear Pad***: This will clear any history currently displayed in the drawing area. This can also be accomplished by touching the glass with three or more fingers.
- ***Keep History***: When checked, any past reported locations of the finger or fingers on the Touch Screen will be saved and displayed in the drawing area.

3.1.2.2. View Menu Options



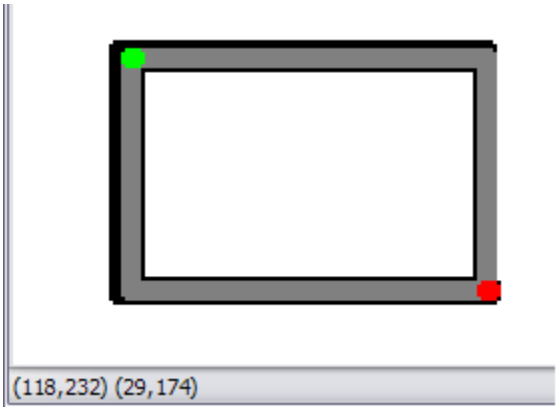
- ***Status Bar***: When checked, this option will enable the status bar at the bottom of the GUI. The status bar reports the XY locations of the finger or fingers.
- ***Mouse Pad***: This option opens a secondary window that allows the user to draw in the drawing area using the mouse cursor in the secondary window. This option is intended for debugging purposes and is not intended to be used under normal circumstances.
- ***Change Pad Scale...***: This option allows the drawing area to be scaled larger or smaller. This option is mostly intended for moving the program between different screen resolutions and increasing the size of the GUI on projectors. This option will not be used under normal circumstances.
- ***Change Pen Width...***: This option scales the size of the pen point used in the drawing area. The default value is 5, which is a good demo size. A size of 1 will display a 1 pixel pen point that represents 1 X and 1 Y unit size.
- ***Change Pad Drawing Options...***: This option allows the cursor to be gray or colored in both single-touch or dual-touch modes. The default option is “Color Highlight” for both single-touch and dual-touch.

3.1.2.3. Help Menu Options



- ***About...***: This option opens a secondary dialog box with the version information for the PaintPad program.

3.1.2.4. Status Bar

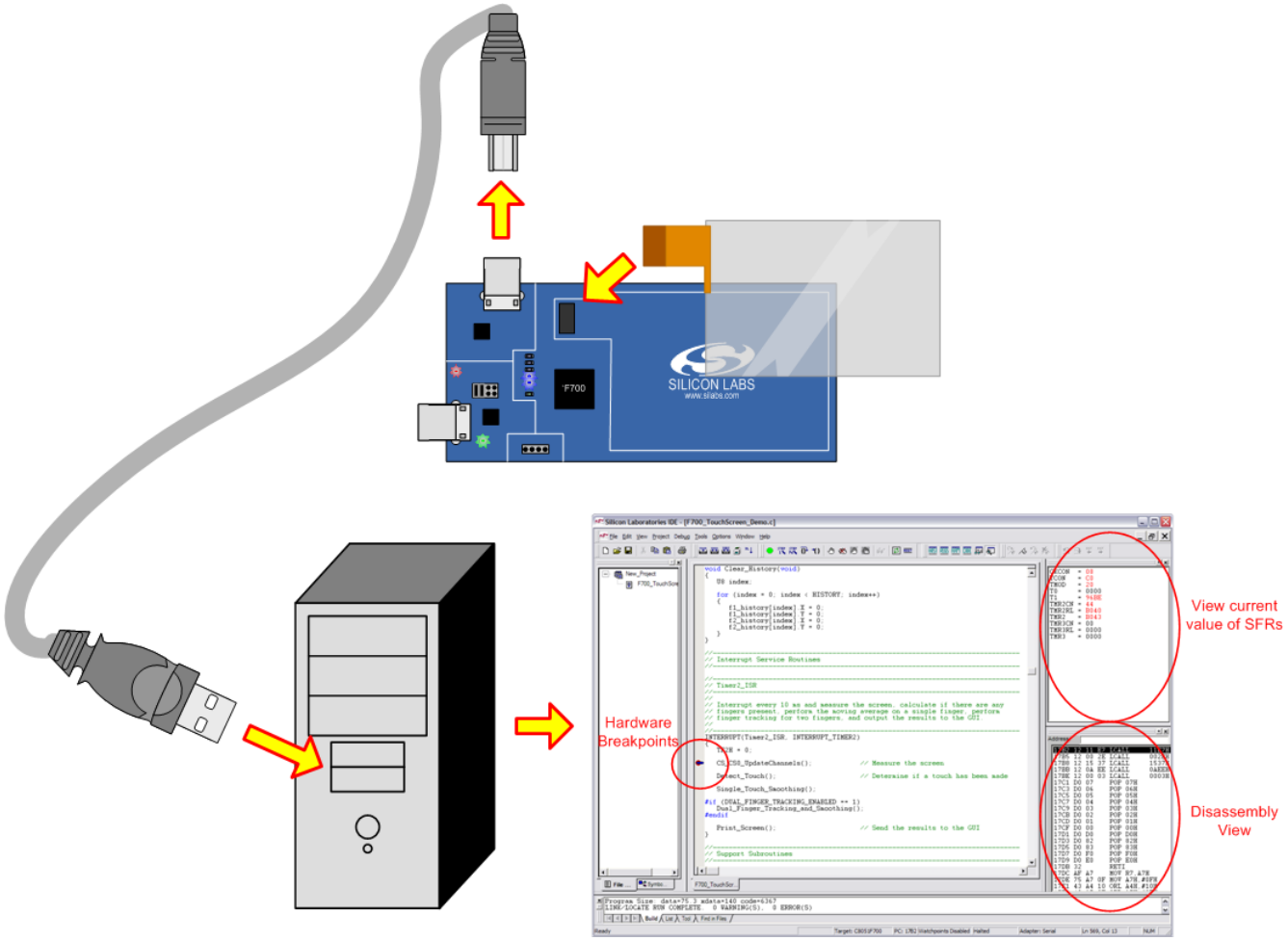


The status bar displays the XY coordinate or coordinates of the fingers as reported by the ‘F700 device on the Touch Screen Evaluation board. The first coordinate listed is the location of the first finger.

3.2. Silicon Laboratories IDE

The Silicon Laboratories IDE integrates a source-code editor, a source-level debugger, and an in-system Flash programmer. The Keil Evaluation Toolset includes a compiler, linker, and assembler and easily integrates into the IDE. The use of third-party compilers and assemblers is also supported.

When using the Silicon Labs IDE with the Touch Screen board, the setup should be as follows:



3.2.1. IDE System Requirements

The Silicon Laboratories IDE requirements:

- Pentium-class host PC running Microsoft Windows 2000 or newer.
- One available USB port.

3.2.2. Third Party Toolsets

The Silicon Laboratories IDE has native support for many 8051 compilers. The full list of natively supported tools is:

- Keil
- IAR
- Raisonance
- Tasking
- Hi-Tech
- SDCC

Please note that the demo applications for the Touch Screen Evaluation Board are written to work with the Keil toolset.

4. Demo Information

4.1. Demo Statistics

4.1.1. Glass

The glass is a 2-layer ITO projected capacitance screen with an 11x16 (11 rows, 16 columns) configuration. There is no ground layer associated with the glass.

4.1.2. Firmware

The demo firmware uses:

- 6 kB of the available 16 kB of code space
- 236 bytes of the available 512 bytes of RAM (XRAM included)

Using a 10 ms scan or refresh rate, the MCU performs each function:

- Capacitive scan using CS0 for all 27 channels = 2.17 ms
- Finger detection = up to 490 µs for 2 fingers
- Smoothing/Averaging algorithm = 0.01 ms
- I^2C reporting = 0.66 ms
- Total: 3.33 ms

This means that there are approximately 6 ms available to perform other functions or sleep.

4.2. Demo Performance

4.2.1. Power

From the C8051F700 data sheet, the theoretical power consumption is as follows:

- 3.0 V active current = 6.5 mA; suspend current = 85 µA
  - 0-finger = 2 mA average current [6 mW]
  - 1-finger = 2.16 mA average current [6.5 mW]
  - 2-finger = 2.22 mA average current [6.7 mW]
- 1.8 V active current = 5.5mA; suspend current = 85 µA
  - 0-finger = 1.7 mA average current [3 mW]
  - 1-finger = 1.83 mA average current [3.3 mW]
  - 2-finger = 1.89 mA average current [3.4 mW]

If the I^2C reporting is performed in parallel with the screen measurement and calculation, there are approximately 7 ms available for other functions or sleep. This provides an additional power savings.

5. Schematics

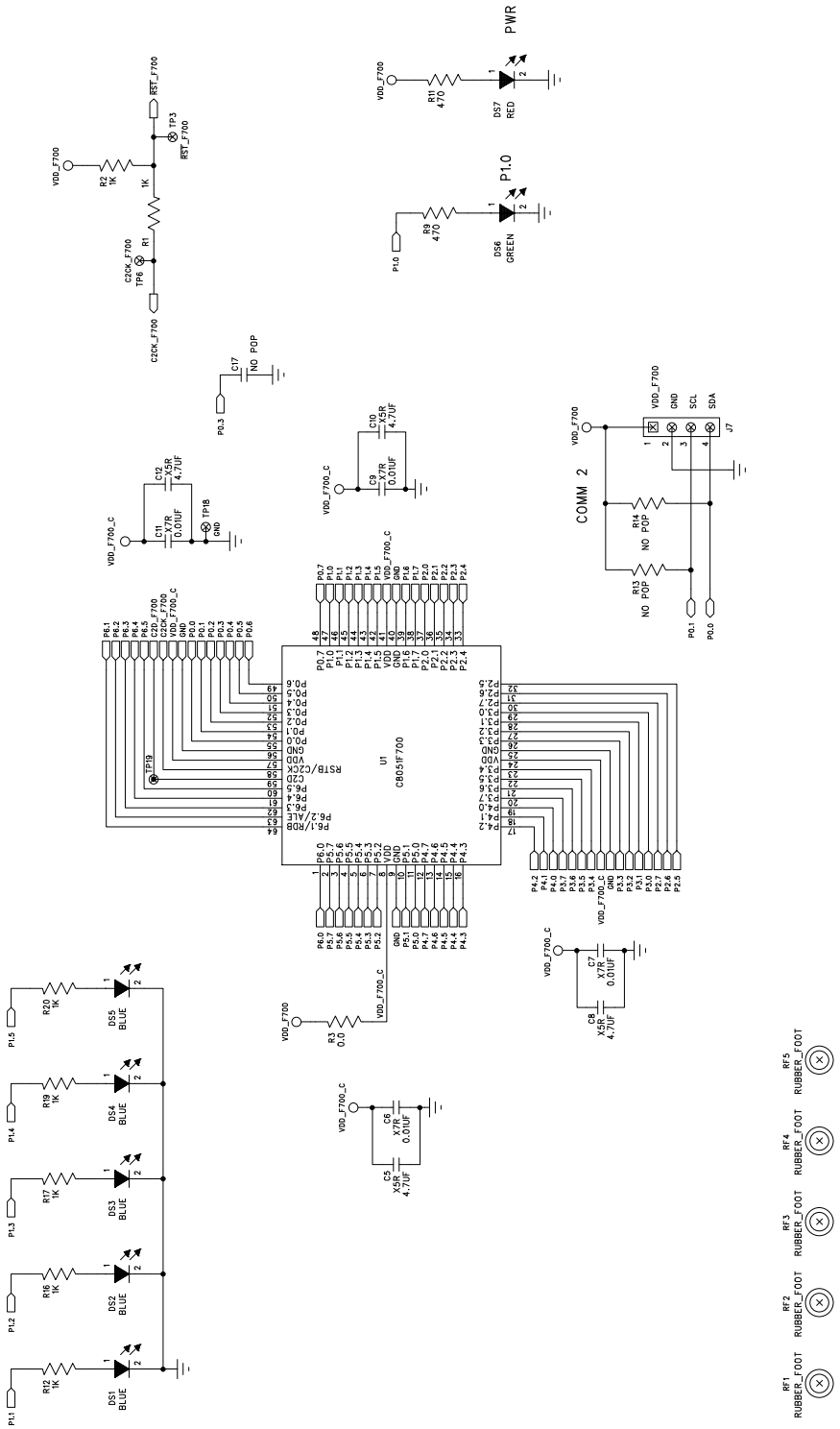


Figure 1. Touch Screen Eval Board Schematic (Page 1 of 3)

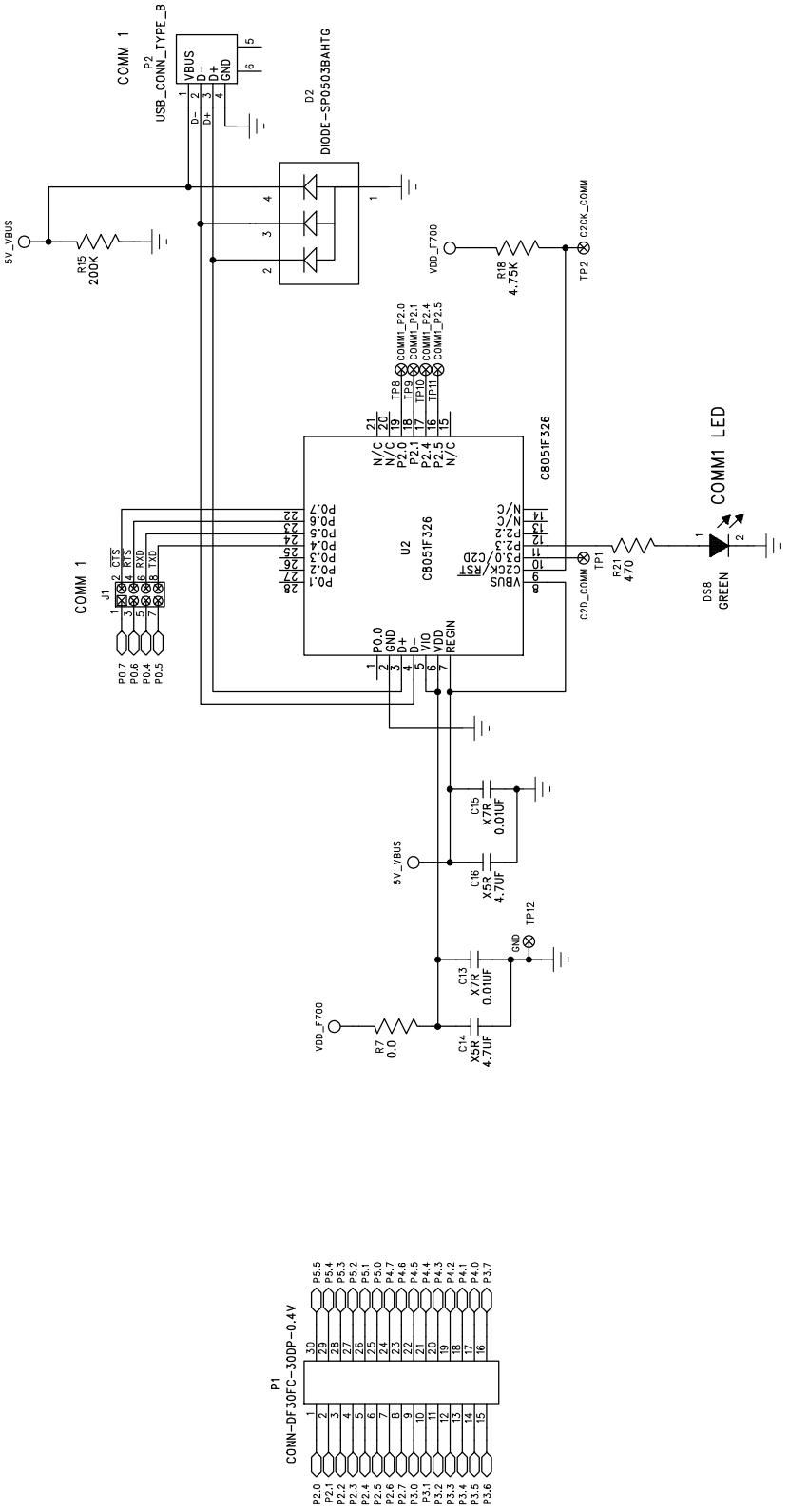


Figure 2. Touch Screen Eval Board Schematic (Page 2 of 3)

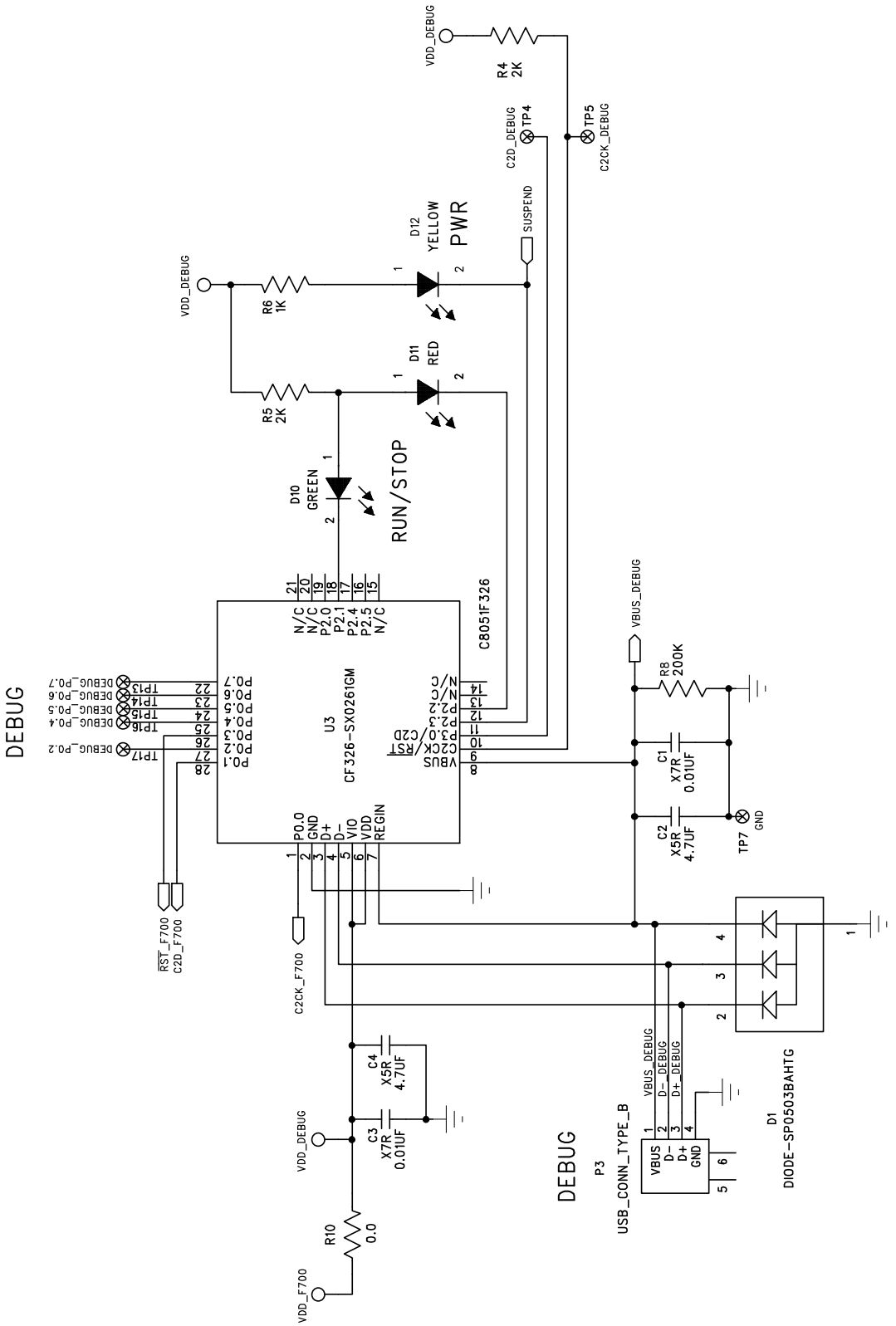


Figure 3. Touch Screen Eval Board Schematic (Page 3 of 3)

CONTACT INFORMATION

Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
Tel: 1+(512) 416-8500
Fax: 1+(512) 416-9669
Toll Free: 1+(877) 444-3032

Please visit the Silicon Labs Technical Support web page and register to submit a technical support request.