

TI Sensor Control Board User's Guide



ABSTRACT

This user's guide describes how to setup the TI Sensor Control Board (SCB) to use with compatible EVMs. Specifically, it outlines the connection and firmware update process. The SCB is not designed as a standalone module, and is only supported with compatible EVMs. This document includes a schematic, reference printed-circuit board (PCB) layouts, and a complete bill of materials (BOM).

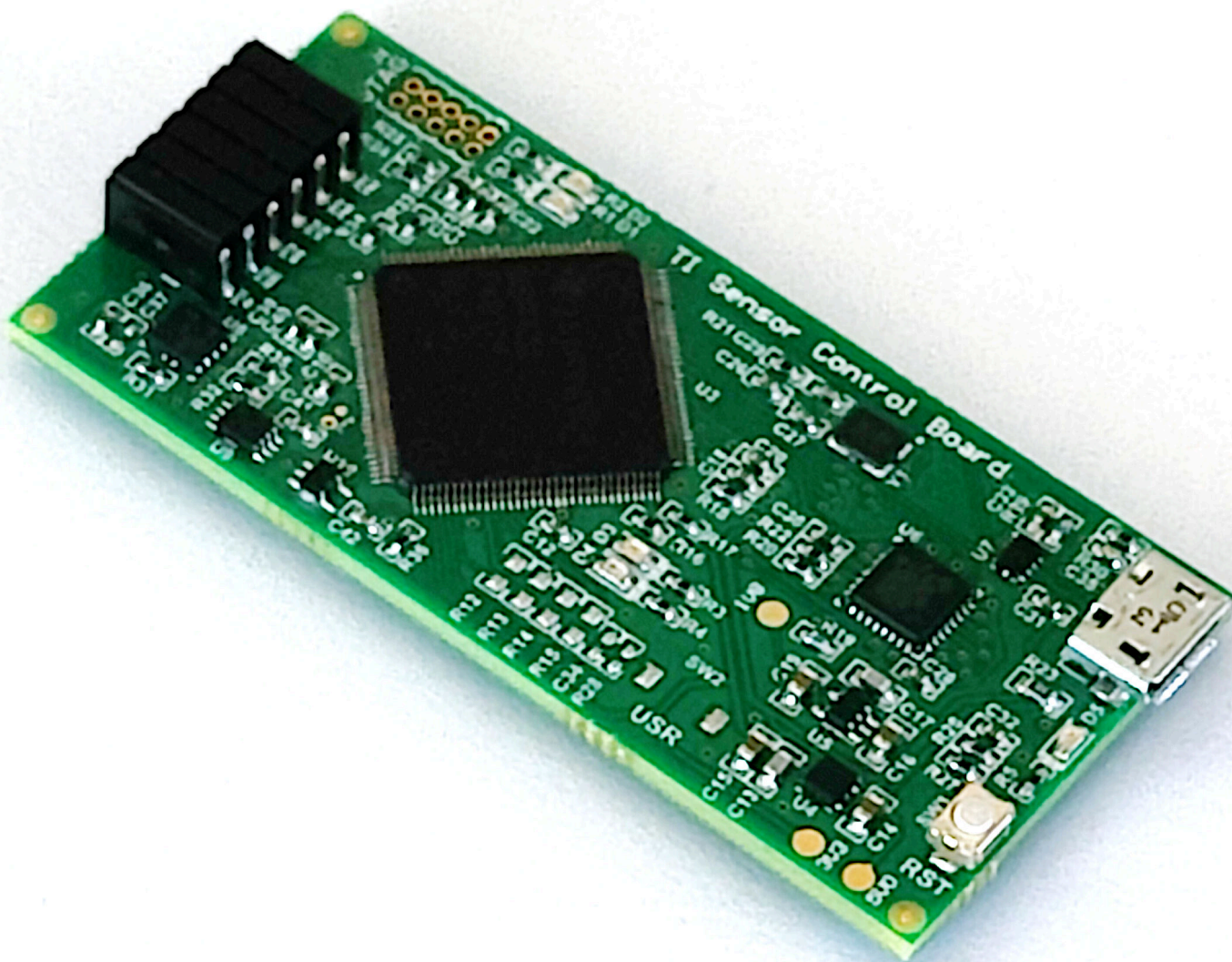


Table of Contents

1 Kit Contents	2
2 Hardware	2
2.1 Features.....	2
3 Operation	3
3.1 Quick Start Setup.....	3
3.2 SCB Operation.....	3
4 Schematics, PCB Layout, and Bill of Materials	6
4.1 Schematics.....	6
4.2 PCB Layout.....	8
4.3 Bill of Materials.....	10

List of Figures

Figure 3-1. EVM (Left) Connected to SCB Controller (Right).....	3
Figure 3-2. Hardware Connected.....	4
Figure 3-3. Device Connected.....	4
Figure 3-4. Change Serial Port.....	4
Figure 3-5. Program Device.....	5
Figure 3-6. Test Points Used to Enter DFU Mode Manually.....	5
Figure 4-1. MSP432E Schematic.....	6
Figure 4-2. USB ULPI Schematic.....	6
Figure 4-3. USB Power Schematic.....	7
Figure 4-4. Hardware Schematic.....	7
Figure 4-5. Top View.....	8
Figure 4-6. Top Layer.....	8
Figure 4-7. Bottom View.....	9
Figure 4-8. Bottom Layer.....	9

List of Tables

Table 1-1. Kit Contents.....	2
Table 4-1. Bill of Materials.....	10

Trademarks

All trademarks are the property of their respective owners.

1 Kit Contents

[Table 1-1](#) lists the contents that come in the kit. Contact the nearest [Texas Instruments Product Information Center](#) if any component is missing.

Table 1-1. Kit Contents

ITEM	QUANTITY
TI Sensor Control Board (SCB)	1
USB cable	1

2 Hardware

The SCB is designed to be used with specific EVM setups. Each EVM will have an individual user's guide that will explain how to use the SCB with that specific EVM.

If desired, the SCB can be repurposed and programmed manually by adding the JTAG connector to J4, but technical assistance for this use case is not supported.

2.1 Features

- Connects to a variety of detachable EVMs with custom GUI's
- Conveniently powered from a common micro-USB connector

3 Operation

3.1 Quick Start Setup

The following instructions describe how to set up and use the EVM.

1. Download this driver and install it **as an administrator**: <https://www.ti.com/lit/zip/sbac253>.
 - a. Follow the download prompts, a myTI account will be required.
 - b. Note that this driver is labeled as a PAMB driver, but is also used for the SCB.
2. Attach a compatible EVM to the SCB Controller, such as the one in [Figure 3-1](#).
3. Connect the EVM to the PC using the provided USB cable.
 - a. Insert the micro USB cable into the SCB Controller onboard USB receptacle J2.
 - b. Plug the other end of the USB cable into a PC.
4. Launch the appropriate EVM GUI, per instructions from the EVM specific user's guide in either Chrome, Firefox, or Safari.
5. Connect the GUI to the SCB, and update the firmware.
 - a. Press the connect symbol in the bottom left corner.
 - b. Go to File -> Program Device...
 - c. For more details see [Section 3.2.2.1](#).
6. Use the EVM/SCB as described in the EVM-specific user's guide.

3.2 SCB Operation

To use the SCB Controller with an EVM, connect them together as shown in [Figure 3-1](#).

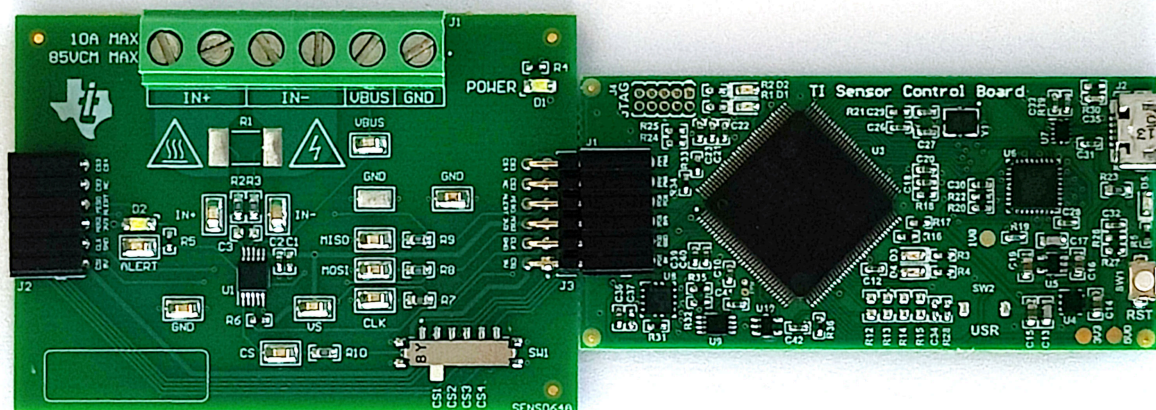


Figure 3-1. EVM (Left) Connected to SCB Controller (Right)

3.2.1 Setup

3.2.1.1 Driver Installation

Download and install this driver: <https://www.ti.com/lit/zip/sbac253>. This is a one-time step per computer, and will require a myTI account. Note that this driver is labeled as a PAMB driver, but is also used for the SCB. Unzip the folder and **run the .exe file with administrator privileges**.

3.2.2 SCB Connection and Firmware Update

Launch the appropriate EVM GUI, per instructions from the EVM specific user's guide in either Chrome, Firefox, or Safari.

3.2.2.1 GUI to SCB Connection and Firmware Update

To connect the GUI to the SCB and update the firmware, follow these steps:

1. Setup and launch the GUI as described in the EVM specific user's guide.
2. With the EVM plugged in, after launching the GUI, close the README.md file page to initiate the connection. If successful, "Hardware Connected" should be visible near the bottom left corner of the GUI as shown in [Figure 3-2](#).




Figure 3-2. Hardware Connected

- a. A green indicator with the device type and the text "DEVICE CONNECTED" should also be visible near the top left of the GUI, as shown in [Figure 3-3](#).



Figure 3-3. Device Connected

3. If you receive a pop up message asking you to update the firmware, do so.
 - a. It is possible that this fails the first time if the SCB didn't properly connect first. In this case, just connect to the GUI following the steps below before updating the firmware.
4. If "Hardware Connected" and "DEVICE CONNECTED" do not show in the GUI, it is possible that the SCB is already in Device Firmware Update (DFU) mode. If so, then the **Program Device...** button under **File >> Program Device...** will not be grayed out. Click the button to begin the firmware update.
 - a. You may need to close another popup message or so letting you know that the GUI couldn't connect to the SCB.
 - b. If the firmware fails to update, try the same connectivity steps outlined in step [5.c](#).
5. If the **Program Device...** button is grayed out, then the device is not in DFU mode. In this case, try to connect the GUI to the SCB by doing any of the following:
 - a. Press the  (connect) symbol in the bottom left corner.
 - b. Check different hardware COM ports under **Options >> Serial Port**, as shown in [Figure 3-4](#).

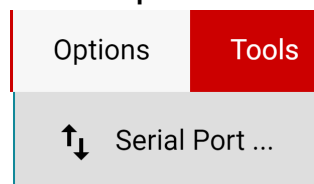


Figure 3-4. Change Serial Port

- c. If neither of those work, many connectivity issues can be addressed by doing one of the following:
 - i. Long-press the RESET button on the SCB with the EVM and SCB connected to each other.
 1. Refreshing the GUI can also sometimes help.
 - ii. Connect the SCB using a different USB port.
 1. Avoid using long cables and USB hubs.
 2. If using a desktop PC, try a USB port on the back.
- d. If the hardware still does not connect, you may need to update the firmware manually, as described in [Section 3.2.3.1](#).
6. After the SCB has connected to the GUI, update the firmware by going to **File >> Program Device...**, as shown in [Figure 3-5](#).

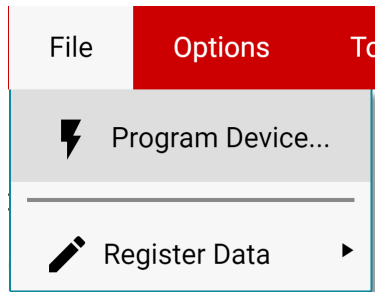


Figure 3-5. Program Device

- a. If the firmware fails to update, try the same connectivity steps outlined in step 5.c.
 - b. If the Firmware still fails to update, you may need to update the firmware manually, as described in [Section 3.2.3.1](#).
7. Once the firmware has been updated, the SCB can be used with the EVM and GUI per the EVM-specific user's guide.

3.2.3 Firmware

Firmware updates will be pushed through the GUI (requires previous driver to be installed). Downloaded offline GUIs will only update the SCB Controller with the latest firmware available at the time of download. To check for the latest GUI or Firmware updates, launch the latest GUI version from the web browser.

3.2.3.1 Firmware Debug

If the firmware must be manually reinstalled for any reason, follow these steps to reinstall the firmware. After the firmware update (if the EVM is not already connected), power down the SCB, connect the EVM to the SCB, and then power them up together.

1. See if the GUI can program the firmware already by following the steps in [Section 3.2.2.1](#).
2. If that is unsuccessful (or if the "Program Device" button is grayed out, and the SCB will not connect), manually configure the MCU on the SCB Controller to be in DFU Mode. This can be done through either of the below methods with the SCB Controller powered on and connected to the PC:
 - a. Through software:
 - i. Send the command 'bsl' on the SCB's USB Serial (COM) port.
 - b. Through hardware:
 - i. For safety, **turn off and disconnect all load sources and external voltages.**
 - ii. While shorting the two test points labeled "DFU" (shown in [Figure 3-6](#)) with a pair of tweezers (or wire), press and release the RESET button.

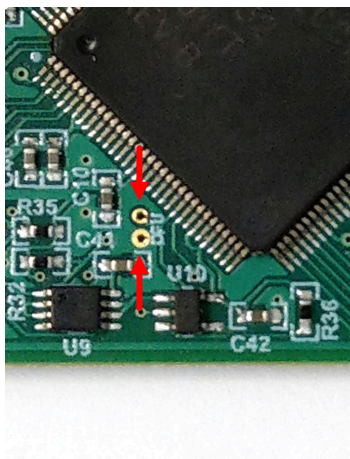


Figure 3-6. Test Points Used to Enter DFU Mode Manually

With the MCU in DFU mode, the firmware can now be uploaded through the method outlined in [Section 3.2.2.1](#).

4 Schematics, PCB Layout, and Bill of Materials

Note

Board layouts are not to scale. These figures are intended to show how the board is laid out. The figures are not intended to be used for manufacturing EVM PCBs.

4.1 Schematics

Figure 4-1 through Figure 4-4 show the schematic of the EVM. Figure 4-1 shows the circuitry related to the MSP432E. Figure 4-2 shows the circuitry related to the USB ULPI feature. Figure 4-3 shows the circuitry related to power. Figure 4-4 shows the mechanical components included with the EVM.

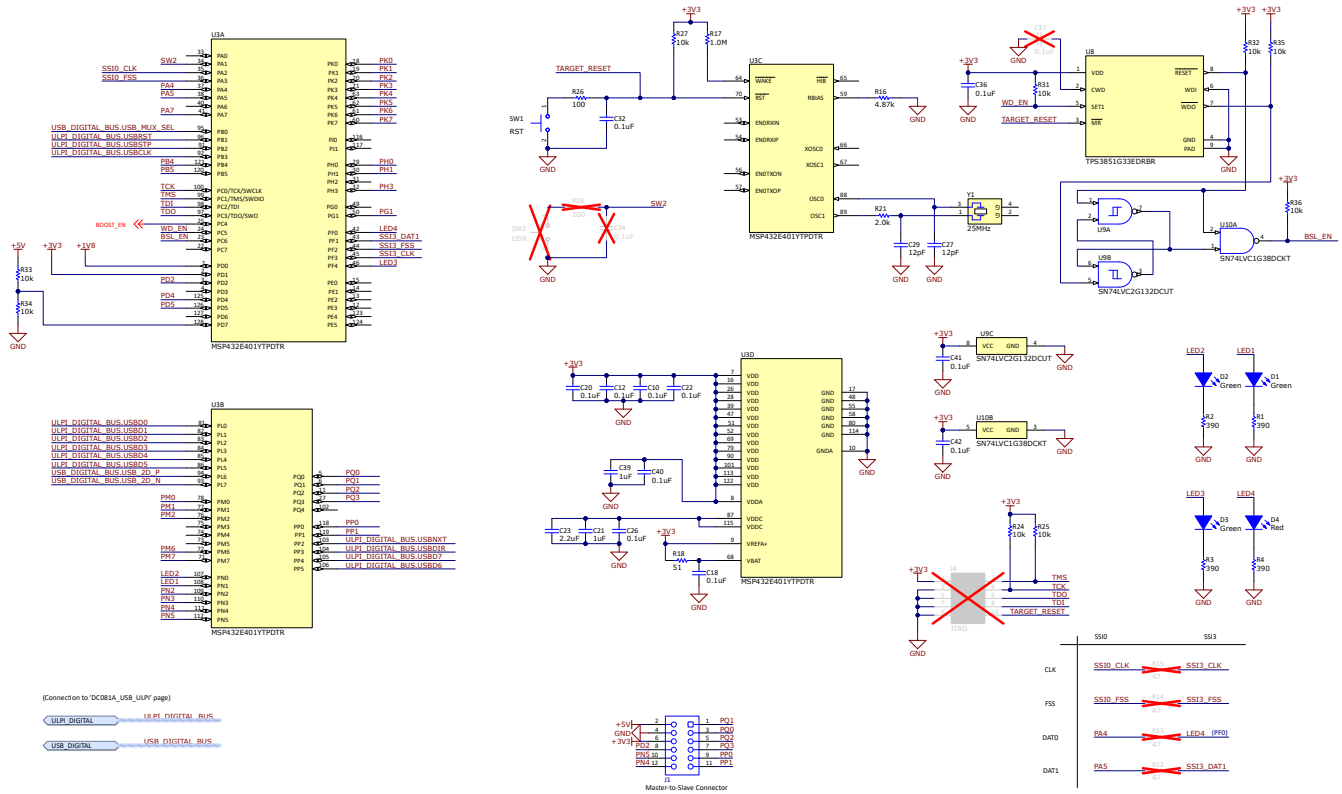


Figure 4-1. MSP432E Schematic

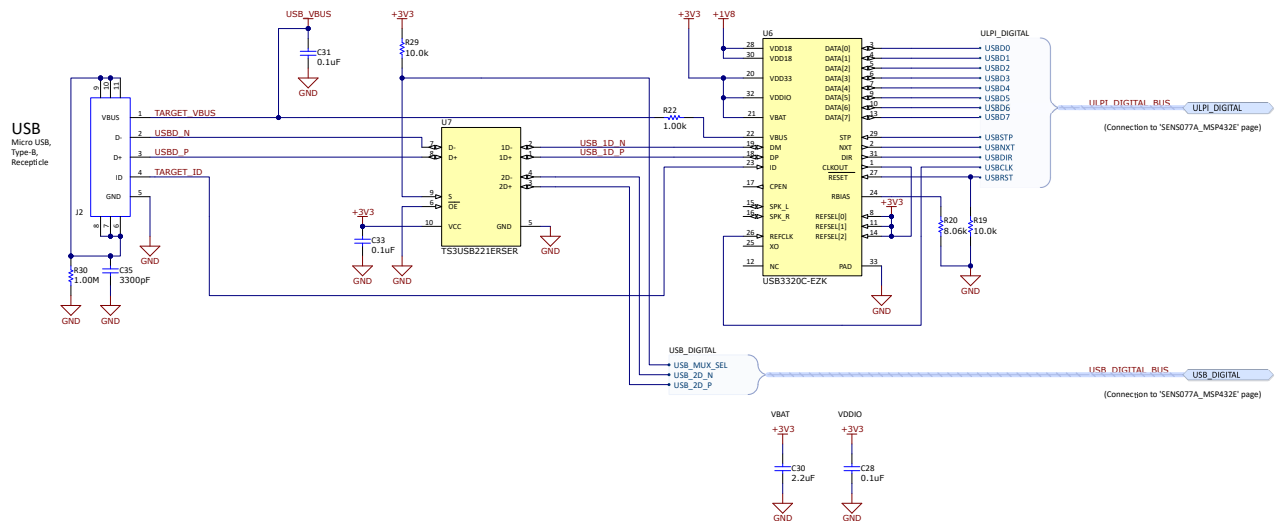


Figure 4-2. USB ULPI Schematic

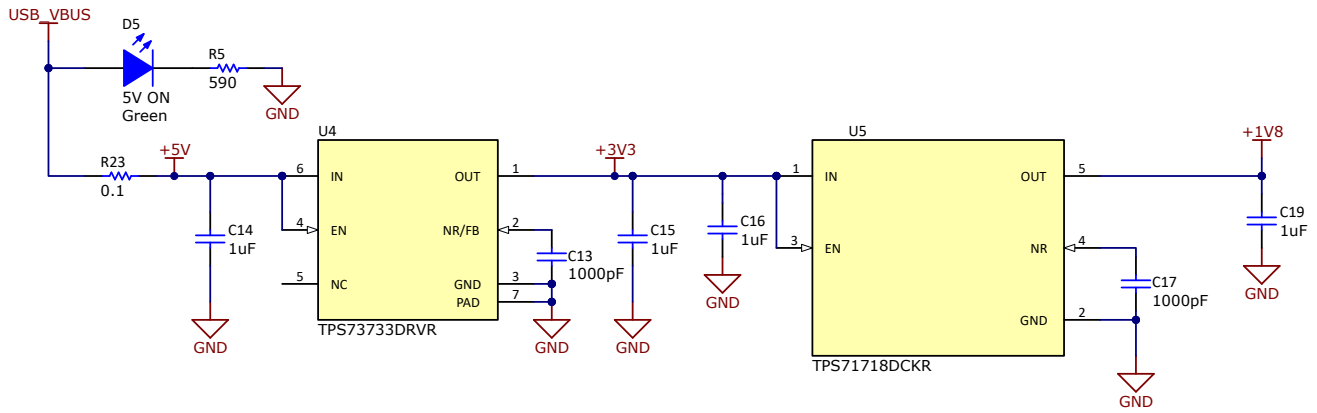
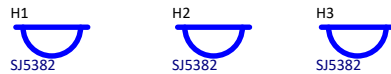


Figure 4-3. USB Power Schematic



SENS077

PCB Number: SENS077
PCB Rev: A

PCB LOGO
Texas Instruments



PCB LOGO
WEEE logo

PCB LOGO
FCC disclaimer

PCB LOGO
ESD Logo1

CBL1
MECH
3025010-03

ZZ2
Assembly Note
These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Figure 4-4. Hardware Schematic

4.2 PCB Layout

Figure 4-5 through Figure 4-8 illustrate the PCB layers of the EVM.

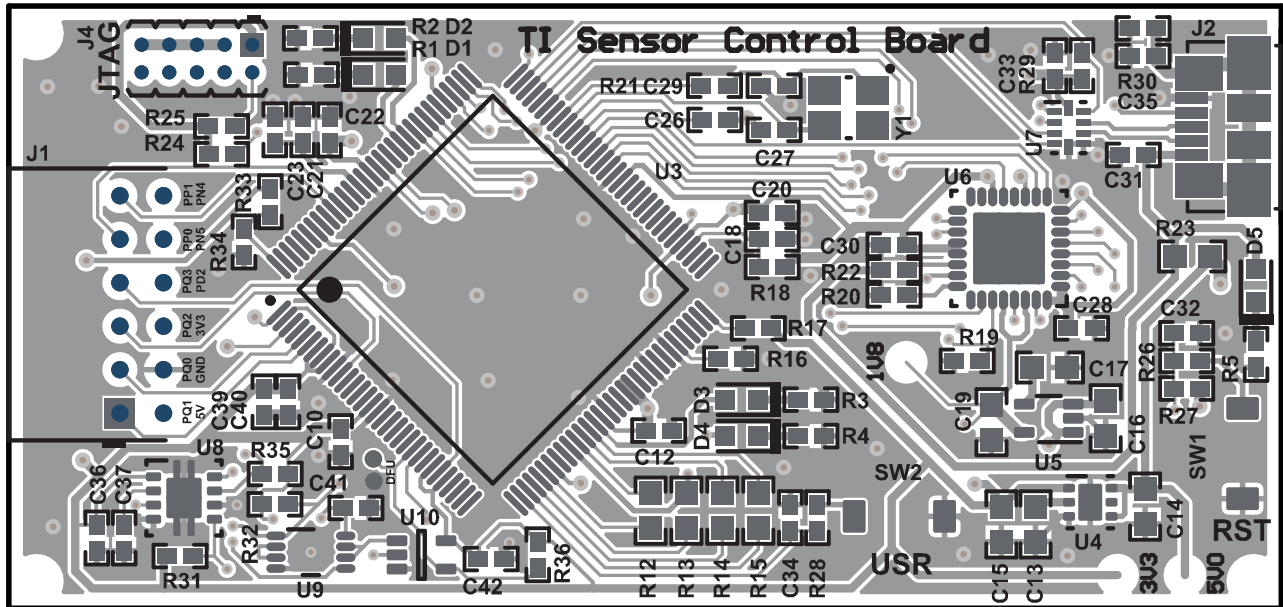


Figure 4-5. Top View

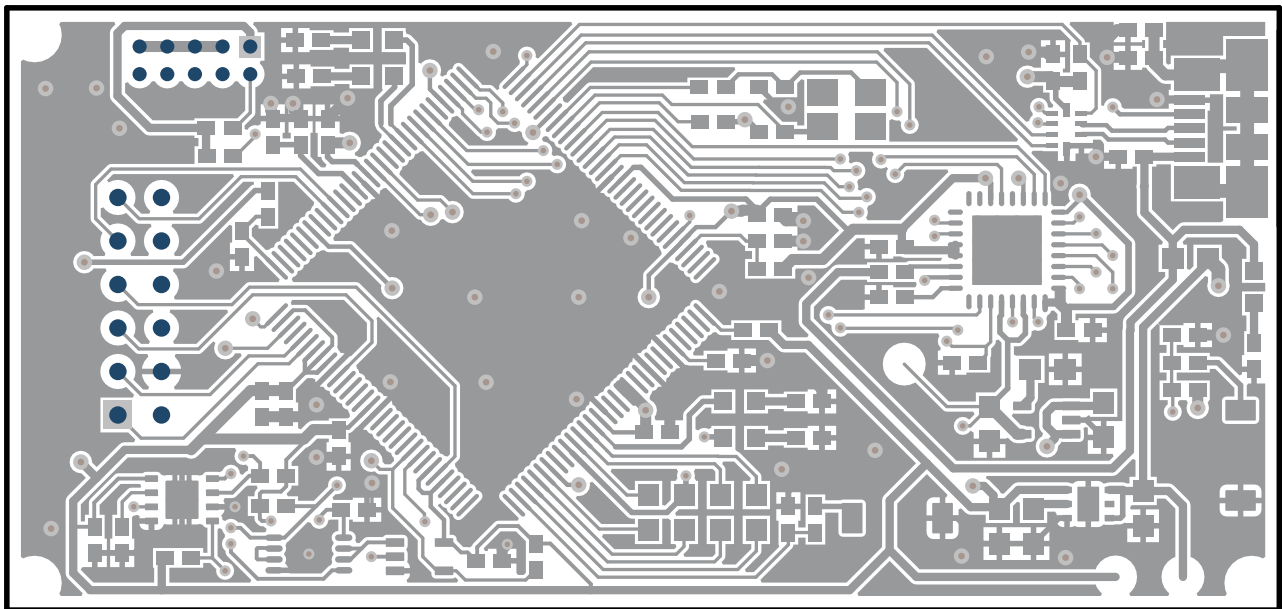


Figure 4-6. Top Layer

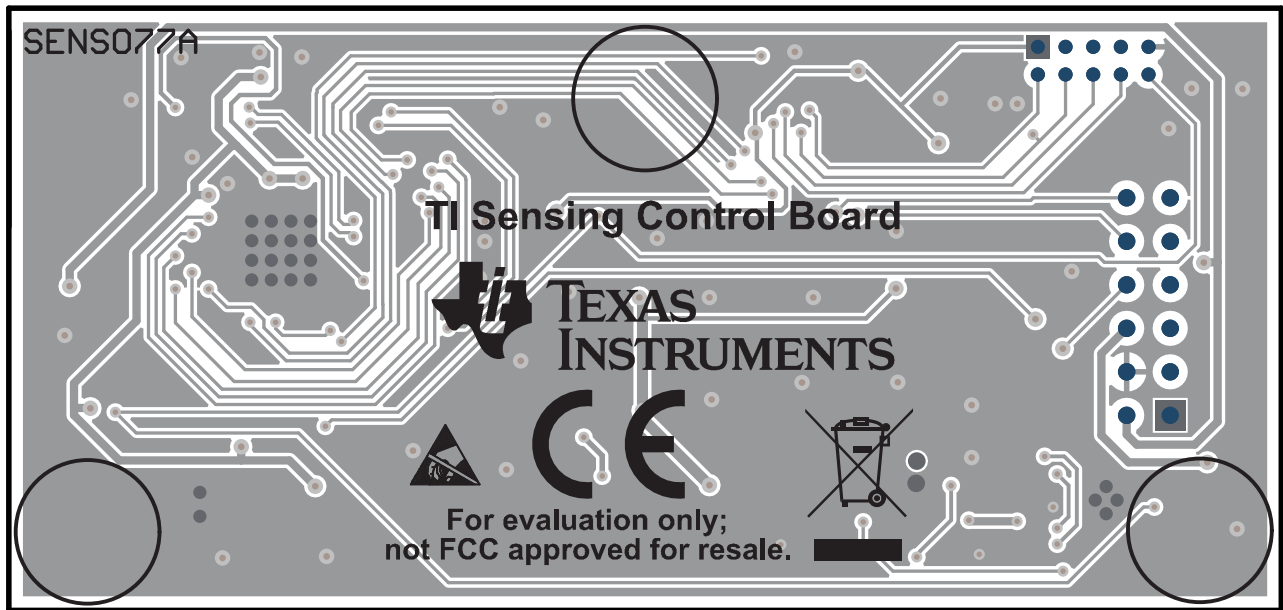


Figure 4-7. Bottom View

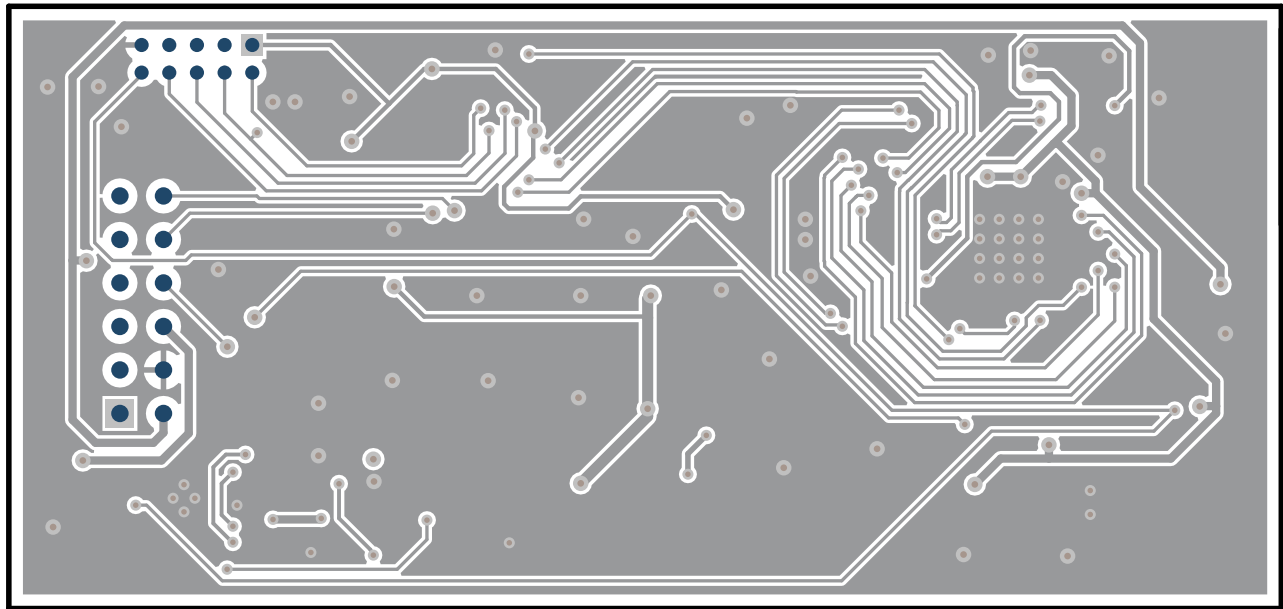


Figure 4-8. Bottom Layer

4.3 Bill of Materials

Table 4-1 provides the parts list for the SCB.

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	PartNumber	Manufacturer
!PCB	1		Printed Circuit Board		SENS077	Any
C10, C12, C18, C20, C22, C26, C28, C31, C32, C33, C36, C40, C41, C42	14	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 20%, X7R, 0402	0402	GRM155R71H104ME14D	MuRata
C13, C17	2	1000pF	CAP, CERM, 1000 pF, 100 V, +/- 5%, X7R, 0603	0603	06031C102JAT2A	AVX
C14, C15, C16, C19	4	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
C21, C39	2	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X5R, 0402	0402	GRM155R6YA105KE11D	MuRata
C23, C30	2	2.2uF	CAP, CERM, 2.2 uF, 35 V, +/- 10%, X5R, 0402	0402	C1005X5R1V225K050BC	TDK
C27, C29	2	12pF	CAP, CERM, 12 pF, 50 V, +/- 5%, C0G/ NP0, 0402	0402	CL05C120JB5NNNC	Samsung Electro- Mechanics
C35	1	3300pF	CAP, CERM, 3300 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71H332KA37D	MuRata
CBL1	1		Cable, USB-A to micro USB-B, 0.3 m. Kitting item.		3025010-03	Qualtek
D1, D2, D3, D5	4	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On
D4	1	Red	LED, Red, SMD	Red LED, 1.6x0.8x0.8mm	LTST-C190CKT	Lite-On
H1, H2, H3	3		Bumpon, Hemisphere, 0.25 X 0.075, Clear	75x250 mil	SJ5382	3M
J1	1		Receptacle, 2mm, 6x2, Gold, R/A, TH	Receptacle, 2mm, 6x2, R/A, TH	NPPN062FJFN-RC	Sullins Connector Solutions
J2	1		Connector, Receptacle, Micro-USB Type B, R/A, Bottom Mount SMT	7.5x2.45x5mm	473460001	Molex
R1, R2, R3, R4	4	390	RES, 390, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402390RJNED	Vishay-Dale
R5	1	590	RES, 590, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402590RFKED	Vishay-Dale
R16	1	4.87k	RES, 4.87 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04024K87FKED	Vishay-Dale
R17	1	1.0Meg	RES, 1.0 M, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021M00JNED	Vishay-Dale
R18	1	51	RES, 51, 5%, 0.0625 W, 0402	0402	RC0402JR-0751RL	Yageo America

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	PartNumber	Manufacturer
R19, R29	2	10.0k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic
R20	1	8.06k	RES, 8.06 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04028K06FKED	Vishay-Dale
R21	1	2.0k	RES, 2.0 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K00JNED	Vishay-Dale
R22	1	1.00k	RES, 1.00 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1001X	Panasonic
R23	1	0.1	RES, 0.1, 1%, 0.1 W, AEC-Q200 Grade 1, 0603	0603	ERJ-L03KF10CV	Panasonic
R24, R25, R27, R31, R32, R33, R34, R35, R36	9	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNED	Vishay-Dale
R26	1	100	RES, 100, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100RJNED	Vishay-Dale
R30	1	1.00Meg	RES, 1.00 M, 1%, 0.1 W, 0402	0402	ERJ-2RKF1004X	Panasonic
SW1	1		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch
U3	1		MSP432E401YTPDPT, PDT0128A (TQFP-128)	PDT0128A	MSP432E401YTPDTR	Texas Instruments
U4	1		Single Output LDO, 1A, Adj. (1.2 to 5.0V), Reverse Current Protection, DRV0006A (WSON-6)	DRV0006A	TPS73733DRVR	Texas Instruments
U5	1		150mA, High PSRR, Low Quiescent Current, Low Noise LDO, DCK0005A (SOT-SC70-5)	DCK0005A	TPS71718DCKR	Texas Instruments
U6	1		Highly Integrated Full Featured Hi-Speed USB 2.0 ULPI Transceiver, QFN-32	5x5 QFN-32	USB3320C-EZK	Microchip
U7	1		High-Speed USB 2.0 (480 Mbps) 1:2 Multiplexer / Demultiplexer Switch with Single Enable, 6 ohm RON, 2.5 to 3.3V, -40°C to 85°C, 10-Pin UQFN (RSE), Green (RoHS & no Sb/Br)	RSE0010A	TS3USB221ERSER	Texas Instruments
U8	1		High-Accuracy Voltage Supervisor With Integrated Watchdog Timer, DRB0008A (VSON-8)	DRB0008A	TPS3851G33EDRBR	Texas Instruments
U9	1		Dual 2-Input NAND Gate with Schmitt-Trigger Inputs, DCU0008A, SMALL T&R	DCU0008A		Texas Instruments
U10	1		Single 2-Input NAND Gate with Open Drain Output, DCK0005A, SMALL T&R	DCK0005A		Texas Instruments
Y1	1		Crystal, 25 MHz, 8pF, SMD	3.2x0.75x2.5mm	NX3225GA-25.000M-STD-CRG-2	NDK

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	PartNumber	Manufacturer
C34, C37	0	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 20%, X7R, 0402	0402	GRM155R71H104ME14D	MuRata
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J4	0		Header, 1.27 mm, 5x2, Au, TH	Header, 1.27mm, 5x2, TH	20021111-00010T4LF	FCI
R12, R13, R14, R15	0	47	RES, 47, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060347R0JNEA	Vishay-Dale
R28	0	100	RES, 100, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100RJNED	Vishay-Dale
SW2	0		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated