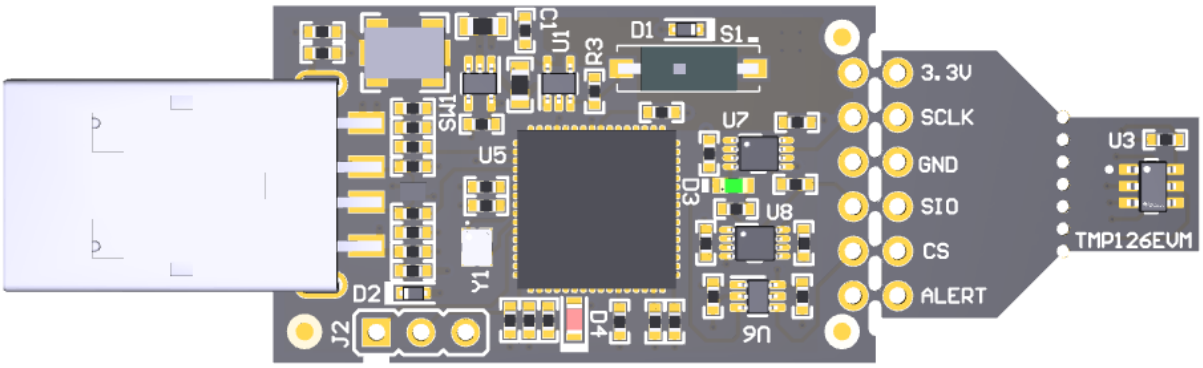
User's Guide

TMP126EVM

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TMP126EVM evaluation board. This user's guide discusses how to set up and configure the software, discusses the hardware, and reviews various aspects of the software operation. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the TMP126EVM. This user's guide also provides information on the operating procedure, input and output connections, an electrical schematic, printed-circuit board (PCB) layout drawings, and a parts list for the EVM.



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1 Trademarks

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2 Overview

The TMP126EVM allows users to evaluate the performance of the TMP126 digital temperature sensor. The EVM comes in a USB stick form factor, with an onboard MSP430F5528 microcontroller that interfaces with both the host computer and the TMP126 device using an I2C interface. The module is designed with perforations between the sensor and host controller on the EVM board. The perforation allows the user flexibility in their evaluation:

- The user can connect the TMP126 to the user's system/host.
- The user can connect the EVM host and software to the user's system with TMP126 devices.
- Small individual boards allow the user to place sensors in the user's system.
- Hole spacing is compatible with common 0.1" prototyping breadboards.

2.1 EVM Kit Contents

Table 2-1 details the contents of the EVM kit. Contact the Texas Instruments Product Information Center nearest you if any components are missing. TI highly recommends that users check the TI website at http://www.ti.com to verify that they have the latest versions of the related software.

Table 2-1. EVM Kit Contents

Item	Quantity
TMP126EVM	1

3 EVM Hardware

3.1 TMP126EVM Board

TMP126EVM shows an image of the TMP126EVM with some of the hardware features of the design labeled.

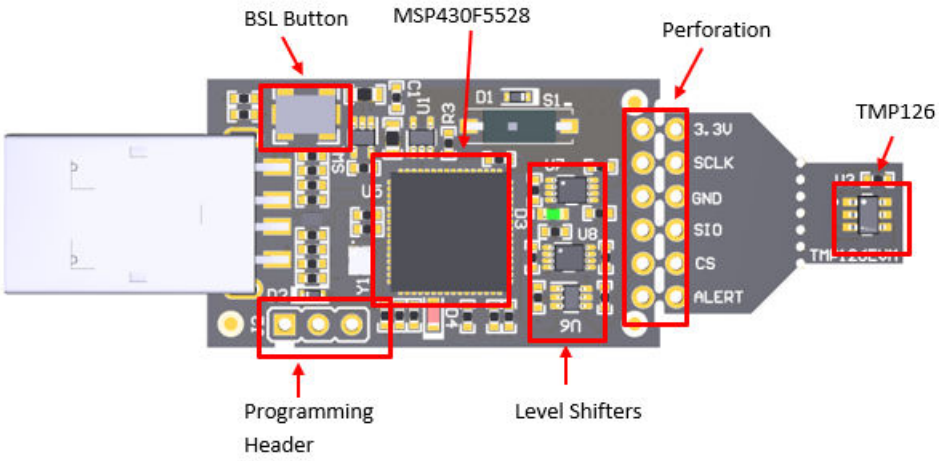

Figure 3-1. TMP126EVM

3.2 Perforations

The perforation between the USB controller board and TMP126 sensor board includes a footprint for a standard 100mil 4 pin header on each side. These pins are labeled with their functions on the board silkscreen, and can be used for either debug, or to provide electrical connection when the TMP126 and controller board need to separated for testing.

3.3 Subregulator

The TMP126 is powered onboard from the TLV700 LDO (U1). The onboard SN74LVC will perform any necessary level shifting of the SPI lines between the external power source and the TMP126EVM controller. When power is supplied to the TMP126 using either method, the green LED D3 will illuminate.

3.4 Logic Level Translator

The translators U6, U7 and U8 separate the MSP430 SPI host from the TMP126 device.

3.5 Status LEDs

The TMP126EVM includes two LEDs, D3 and D4, which indicate the status of the board at any time. The green LED D3, illuminates when power is supplied to the VDD net. The VDD net is connected directly to the TMP126, and externally supplied power should not exceed 5.5V.

The red LED D4, is a status LED for the MSP430F5528. Table 3-1 summarizes the functions of D4.

Table 3-1. D4 LED Statuses

D4 LED STATUS	MEANING
Off	USB2ANY controller is unpowered, or still initializing
Blinking	USB2ANY controller is powered, but not connected
On	USB2ANY controller is connected

3.6 Programming Header

The TMP126EVM comes pre-loaded with firmware that is necessary for the correct operation of the USB interface and PC GUI software. The unpopulated header, J2, is provided for Spy-Bi-Wire access to the

MSP430F5528. TI does not recommend that users access this header or reprogram the device. However this header may be required for recovery if firmware corruption of the TMP126EVM occurs at any point.

3.7 BSL Button

The TMP126EVM features push-button SW1 for entering USB BSL mode. This can be used for any necessary firmware updates. This method is preferred over the use of the Spy-Bi-Wire programming header for firmware loading.

3.8 EVM Operating Conditions

The TMP126EVM power is supplied through the USB connector. The LDO (U1) converts the 5V from the USB to 3.3V used by the TMP126 and the MSP430. The EVM may be directly inserted into a USB port on a PC or laptop, or may be connected to the latter using an appropriate USB cable.

The controller and device sides of the EVM have different temperature limits as shown in Table 3-2. These are set by the onboard MSP430F5528 and the TMP126 ICs on the controller and breakout portions respectively.

Table 3-2. TMP114EVM Temperature Limits

BOARD SECTION	CONDITIONS	TEMPERATURE RANGE
Controller Board	Recommended Operating free-air temperature, T_A	-40 °C to 125 °C
	Absolute Maximum junction temperature, T_J	95 °C
TMP126 Breakout	Recommended Operating free-air temperature, T_A	-55 °C to 175 °C
	Absolute Maxmimum junction temperature, T_J	-55 °C to 180 °C

4 Software Download

The PC GUI Software for TMP126EVM runs on TI's GUI Composer framework. The software is available as a live version which runs in your browser, and it is available as a download for offline use. The software is compatible with Windows, Mac, and Linux operating systems.

4.1 Live Software on dev.ti.com

The live software currently works on Chrome, Firefox, and Safari browsers. Internet Explorer is not supported. Users can access the live version through one of the following actions:

- Go to the EVM tool page and click on the View button
- Go to dev.ti.com/gallery and search for TMP126, or go here and select the TMP126 GUI from the gallery.

Click on the application icon within the gallery to launch the software. Click on the prompt to install the TI Cloud Agent Bridge browser plugin.

4.2 Offline Software

4.2.1 Download from dev.ti.com

Users can access the latest version of the offline software by navigating to the live version as noted above. Look for the download icon and download both the application and runtime for the operating system as shown in Figure 4-1.

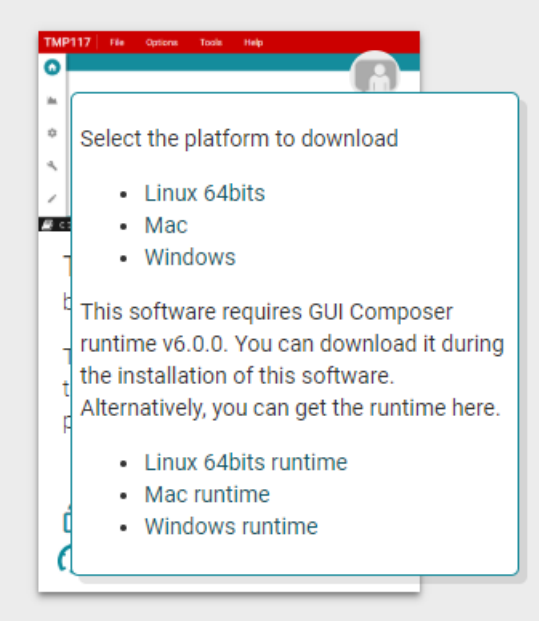

Figure 4-1. Download Pop-Up

5 Software

5.1 Home Tab

The Home Tab is shown at software launch. The "Learn More..." link displays the features of and the functional diagram for the TMP126 device. The icons on the bottom of this tab are shortcuts to the other functional tabs of the GUI, and correspond to the icons on the left hand side of the GUI.

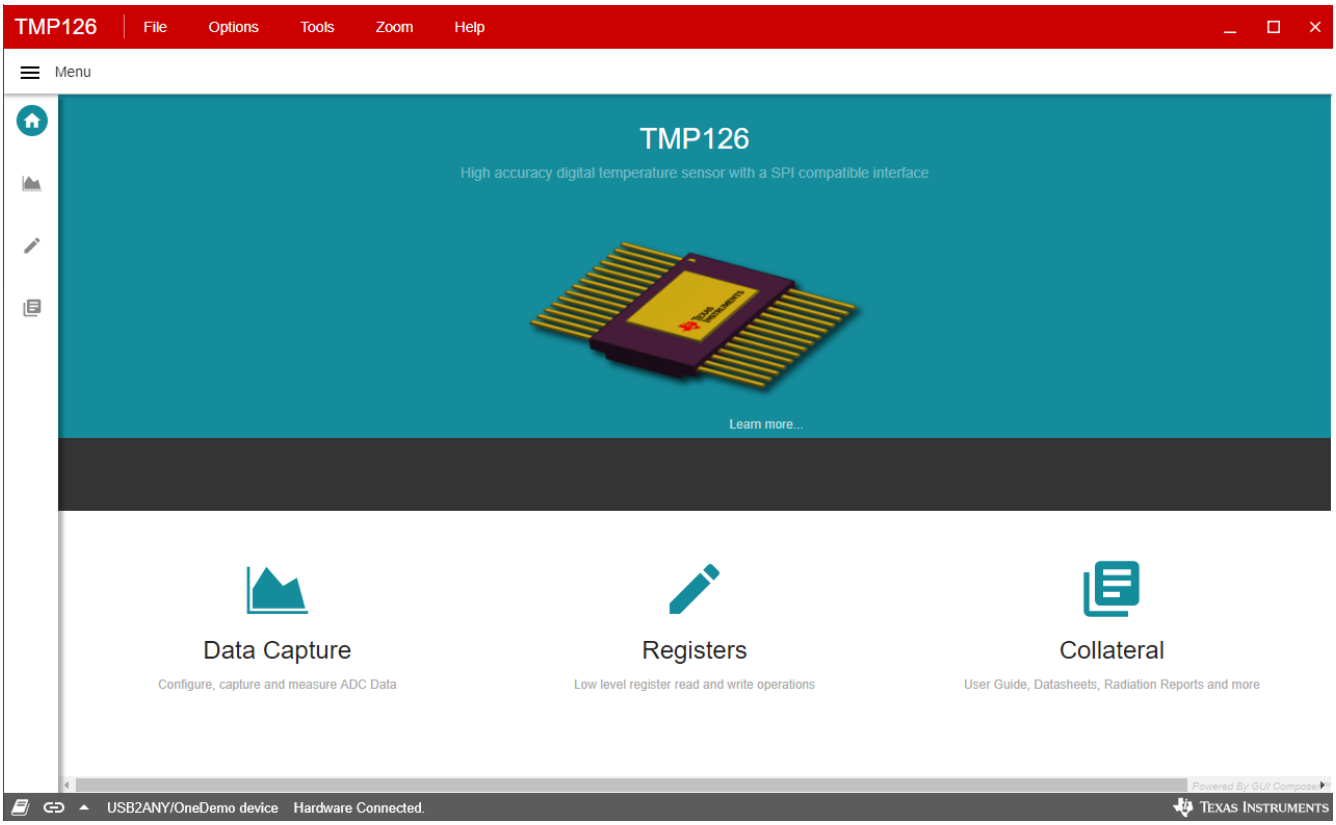

Figure 5-1. Home

5.2 Data Capture Tab

The Data Capture tab reports the temperature from the TMP126 device included on the TMP126EVM. To enable Data Capture, select a refresh rate setting at the bottom of the tab. By default, both raw temperature data and slew rate measurements are shown. The graph display for either of these values can be disabled by clicking on their entries in the legend on the right-hand-side of the graph.

Figure 5-2. Data Capture

5.3 Settings Tab

The Settings tab provides the hardware configuration for the USB to I2C bridge and device features for the TMP126 device.

Selecting the wrong Device I2C Address will cause the GUI to disconnect from the USB device. To use the EVM with a different address, a swap out of the TMP126 device would be required. The link icon in the bottom left corner indicates the current connection status, and the user can click on the area to change the connection status.

The other widgets within the settings tab may be used to easily configure the settings of the TMP126. How these changes are written on the I2C bus will depend on the settings in the registers tab. For example, if the user makes changes to the High and Low Limit sliders, this will trigger an immediate write to the TMP126's limit registers only if Immediate mode is enabled on the Registers tab.

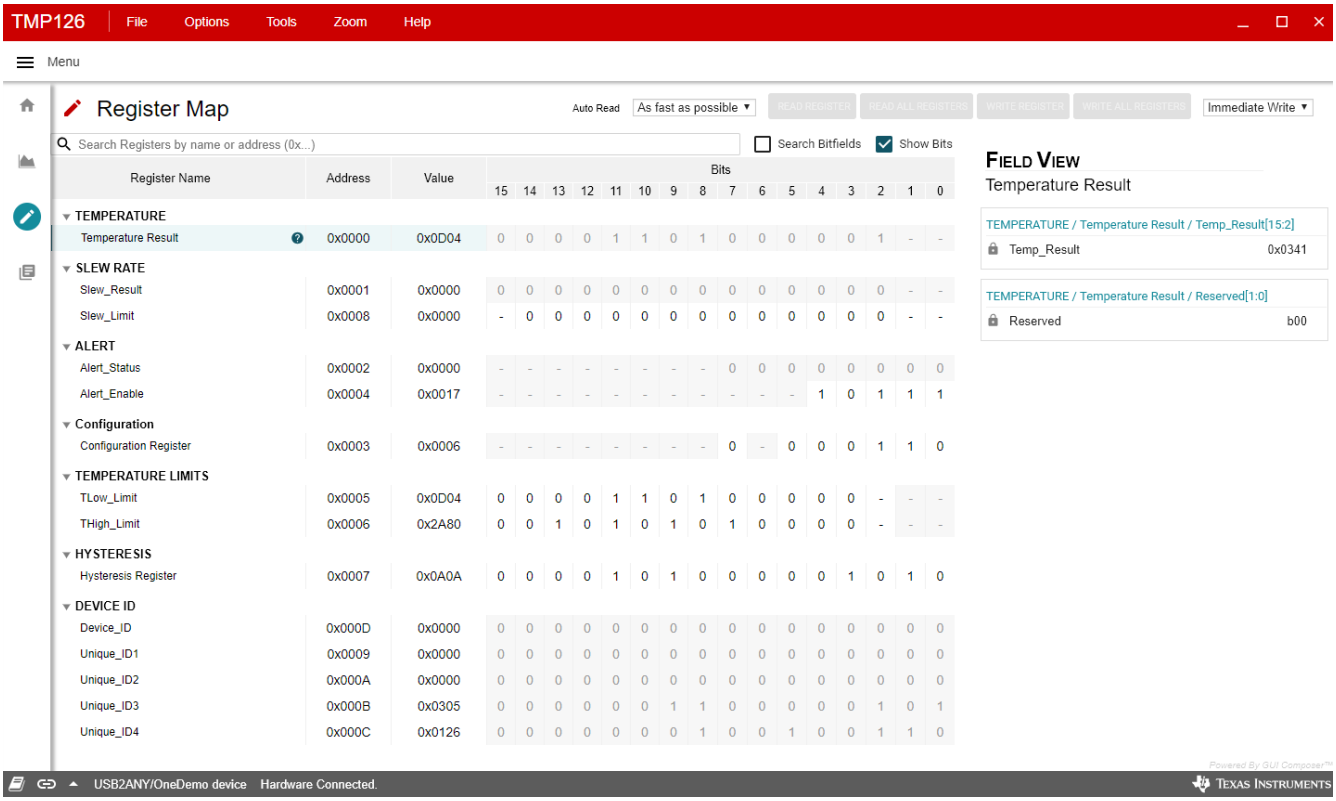

Figure 5-3. Settings

5.4 Registers Tab

The Registers tab interacts with the registers and bits within the TMP126 device.

The Auto Read drop-down box configures polling of register contents. When Auto Read is Off, it is necessary to click Read Register to fetch the contents of the current register. Read All Registers can be used to fetch the contents of all registers at once. The Write Register button is greyed and disabled when the drop-down next to the button is set to Immediate. Immediate mode triggers a Write operation each time a register is modified. When Deferred mode is selected, the Write Register button is enabled, and write operations will not be performed unless the Write Register button is clicked. These settings give the user total control over SPI activity, and enable individual transactions to be easily observed with an oscilloscope, logic analyzer, or bus-sniffing device.

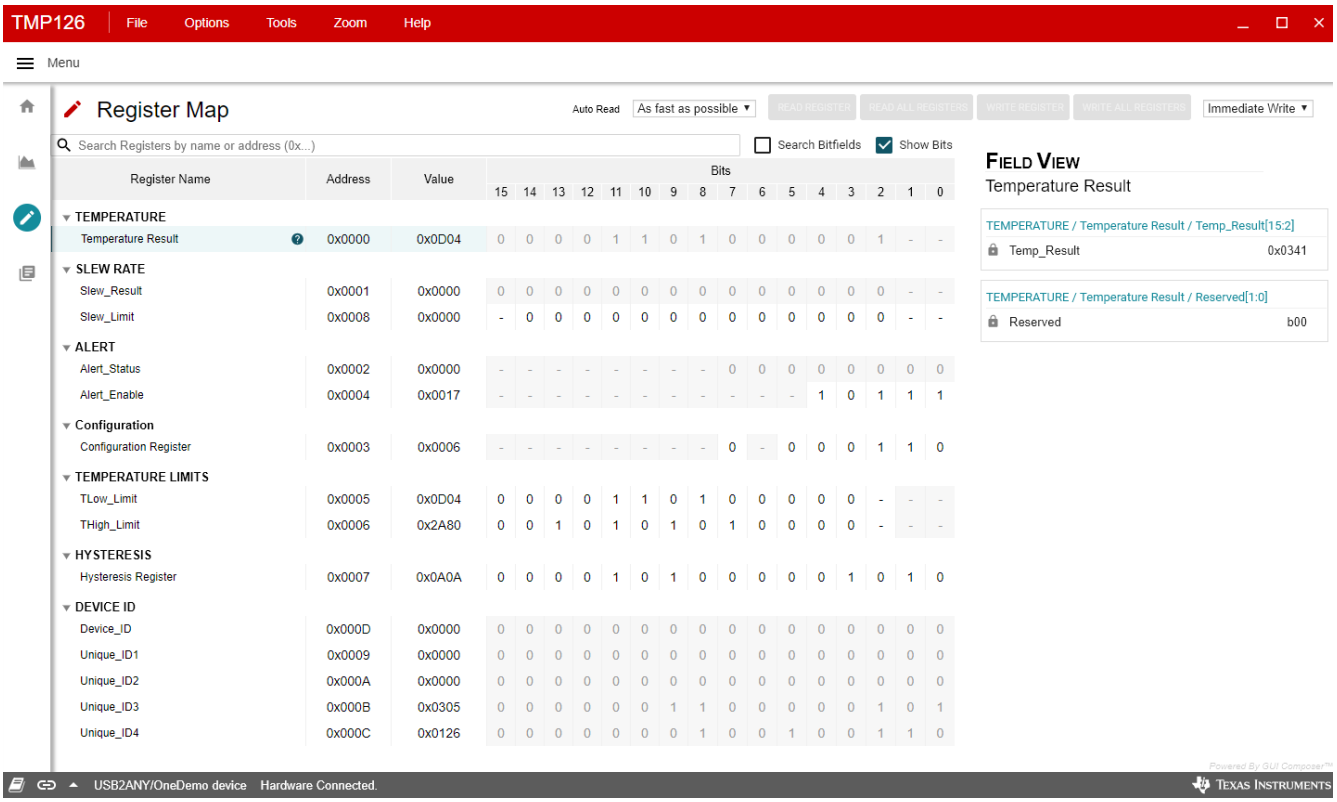

Figure 5-4. Registers

5.5 Collateral Tab

The Collateral tab contains links to the EVM user's guide, the tool page on ti.com, as well as links to the product data sheet and other relevant links.

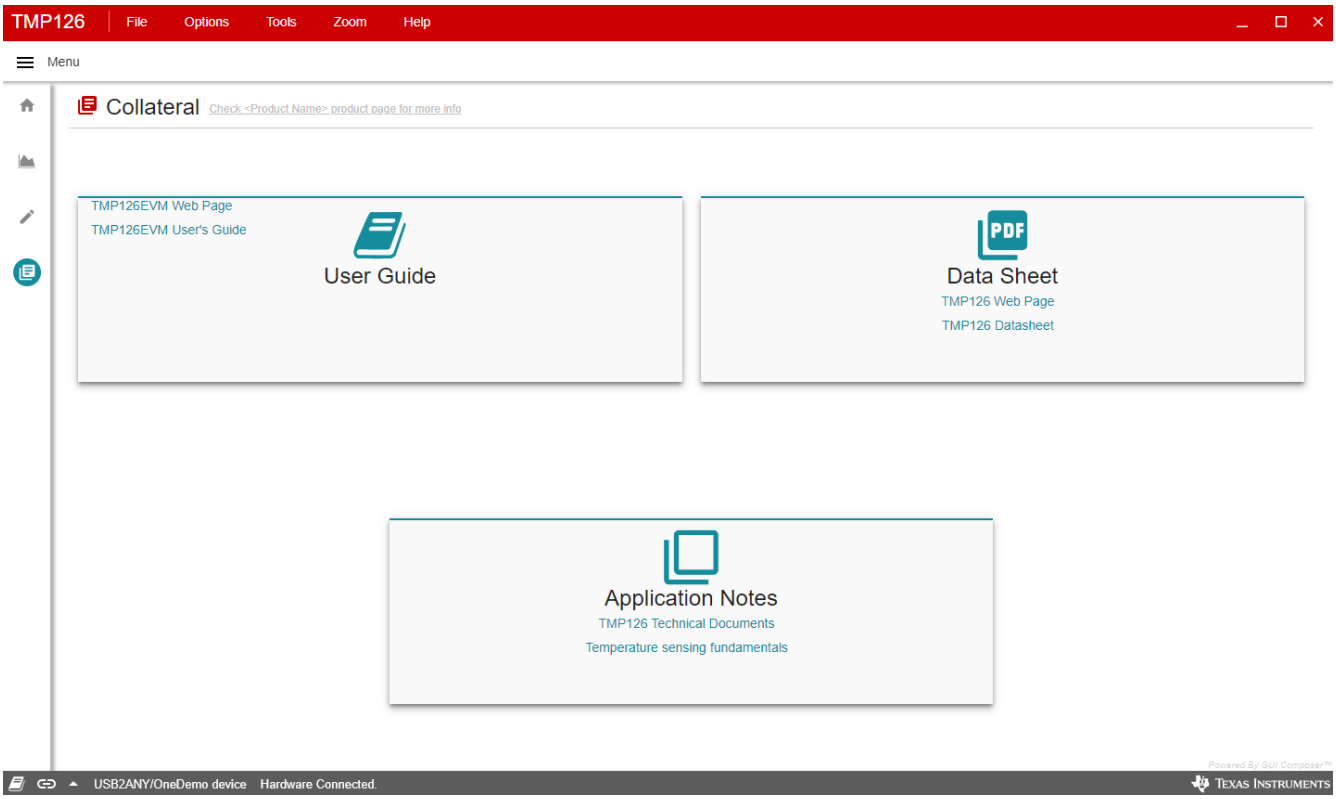

Figure 5-5. Collateral

6 Schematic, Board Layout and Bill of Materials

6.1 Schematic

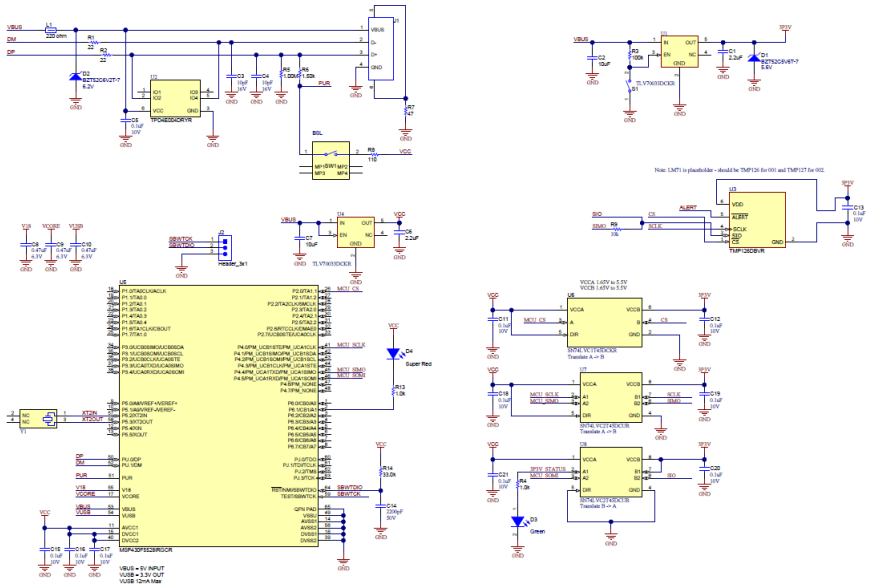

Figure 6-1. Schematic

6.2 Printed-Circuit Board

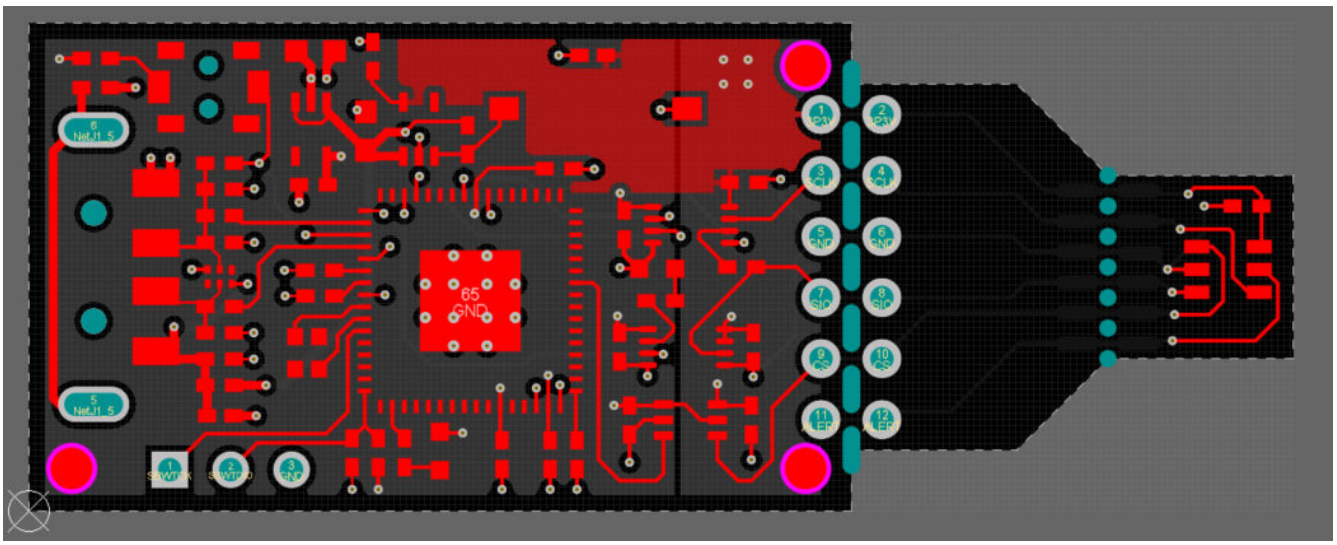

Figure 6-2. Top View

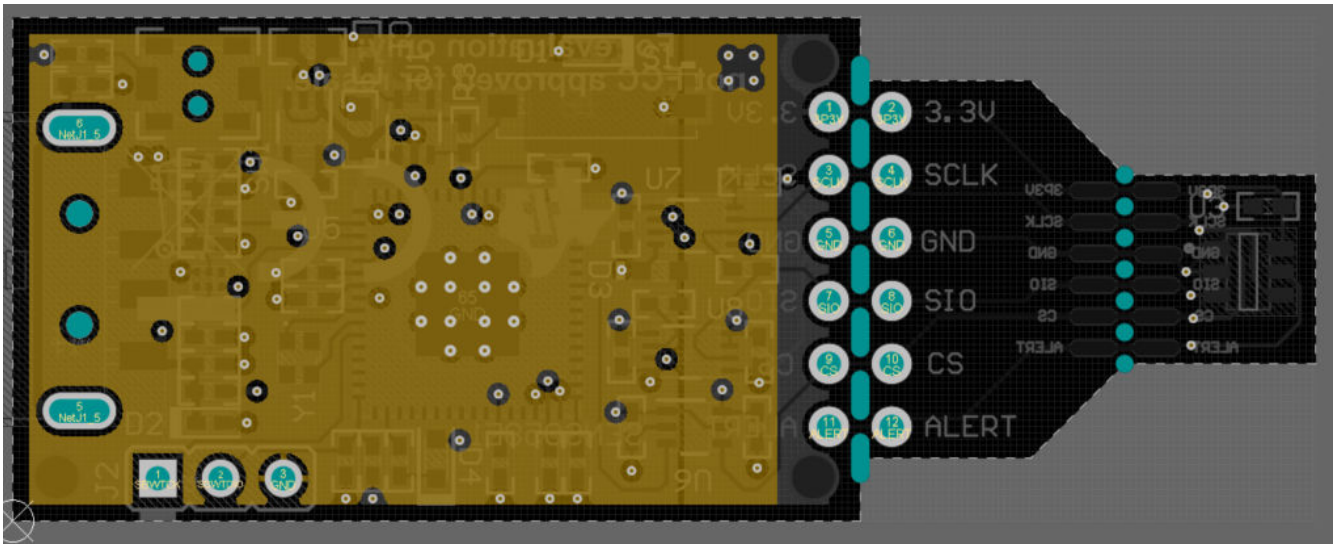

Figure 6-3. Layer 1 (Ground Plane)

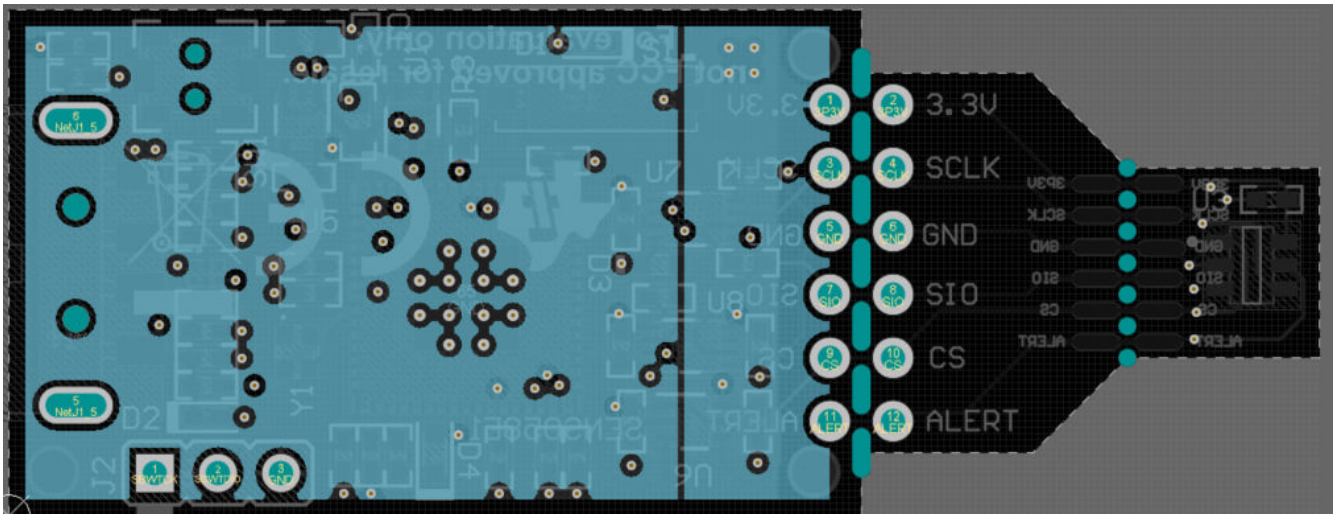

Figure 6-4. Layer 2 (Power Plane)

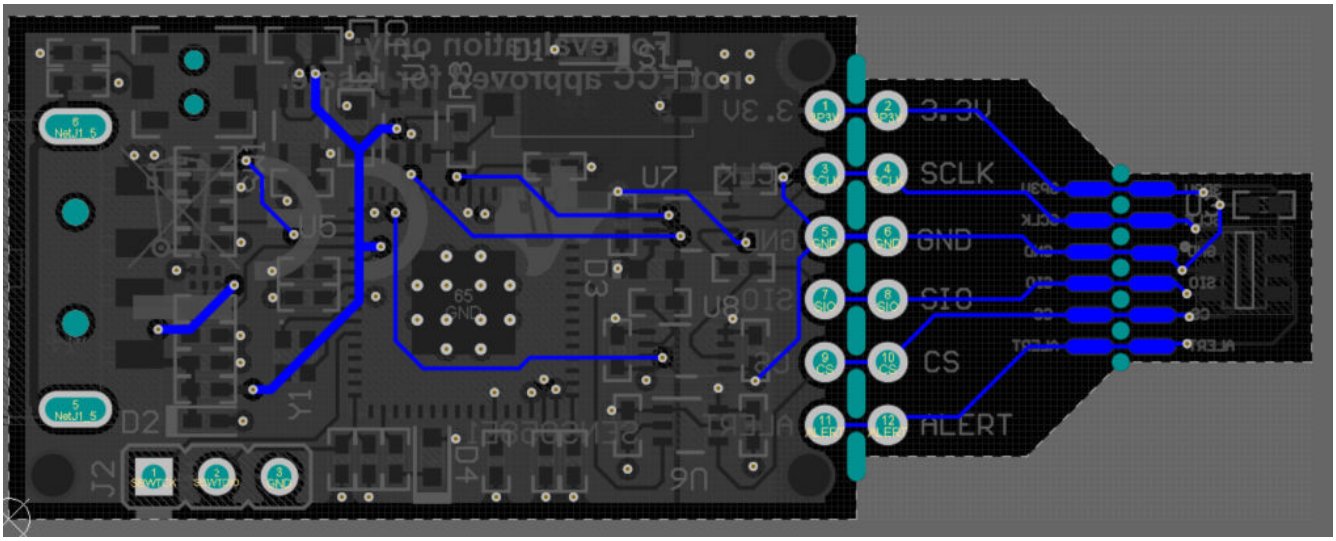

Figure 6-5. Bottom View

6.3 Bill of Materials

Table 6-1. Bill of Materials

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
!PCB1	1		Printed Circuit Board		SENS060	Any
C1, C6	2	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X5R, 0402	0402	GRM155R61C225KE11D	MuRata
C2, C7	2	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK
C3, C4	2	10pF	CAP, CERM, 10 pF, 16 V,+/- 10%, C0G, 0402	0402	C0402C100K4GACTU	Kemet

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
C5, C11, C12, C13, C15, C16, C17, C18, C19, C20, C21	11	0.1uF	CAP, CERM, 0.1 uF, 10 V,+/- 10%, X5R, 0402	0402	LMK105BJ104KV-F	Taiyo Yuden
C8, C9, C10	3	0.47uF	CAP, CERM, 0.47 uF, 6.3 V, +/- 10%, X7R, 0402	0402	JMK105B7474KV HF	Taiyo Yuden
C14	1	2200pF	CAP, CERM, 2200 pF, 50 V, +/- 5%, X7R, 0402	0402	CL05B222JB5NN NC	Samsung Electro-Mechanics
D1	1	2.4V	Diode, Zener, 2.4 V, 300 mW, SOD-523	SOD-523	BZT52C2V4T-7	Diodes Inc.
D2	1	6.2V	Diode, Zener, 6.2 V, 300 mW, SOD-523	SOD-523	BZT52C6V2T-7	Diodes Inc.
D3	1	Green	LED, Green, SMD	LED, GREEN, 0603	SML-LX0603GW-TR	Lumex
D4	1	Super Red	LED, Super Red, SMD	LED_0603	150060SS75000	Wurth Elektronik
J1	1		Connector, Plug, USB Type A, R/A, Top Mount SMT	USB Type A right angle	48037-1000	Molex
L1	1	220 ohm	Ferrite Bead, 220 ohm @ 100 MHz, 0.45 A, 0402	0402	BLM15AG221SN1 D	MuRata
R1, R2	2	22	RES, 22, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ220X	Panasonic
R3	1	100.0k	RES, 100 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ104X	Panasonic
R4, R13	2	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ102X	Panasonic
R5	1	1.00Meg	RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1M0 0	Stackpole Electronics Inc
R6	1	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1K5 0	Stackpole Electronics Inc
R7	1	47	RES, 47, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ470X	Panasonic

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
R8	1	110	RES, 110, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF1100X	Panasonic
R9, R10	2	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	RC0603JR-0710KL	Yageo
R11, R12	2	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ103X	Panasonic
R14	1	33.0k	RES, 33.0 k, 1%, 0.063 W, 0402	0402	RC0402FR-0733KL	Yageo America
S1	1		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	Switch, Single Top Slide, 2.5x8x2.5mm	CHS-01TB	Copal Electronics
SW1	1		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	3.9x2.9mm	PTS820 J20M SMTR LFS	C&K Components
U1, U4	2		Single Output LDO, 200 mA, Fixed 3.3 V Output, 2 to 5.5 V Input, with Low IQ, 5-pin SC70 (DCK), -40 to 125 degC, Green (RoHS & no Sb/Br)	DCK0005A	TLV70033DCKR	Texas Instruments
U2	1		4-Channel ESD Protection Array for High-Speed Data Interfaces, DRY0006A (USON-6	DRY0006A	TPD4E004DRYR	Texas Instruments
U3	1		±0.51 °C Accuracy, Digital Temperature Sensor with 175 °C Temperature support and 3-Wire SPI Compatible Interface	SOT23-6	TMP126DBVR	Texas Instruments
U5	1		16-Bit Ultra-Low-Power Microcontroller, 128KB Flash, 8KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, RGC0064B (VQFN-64)	RGC0064B	MSP430F5528IRGCR	Texas Instruments

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
U6	1		Single-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs, DCK0006A, LARGE T&R	DCK0006A	SN74LVC1T45DCKR	Texas Instruments
U7, U8	1		2-Bit Dual Supply Transceiver with Configurable Voltage-Level Shifting and 3-State Outputs, DCU0008A (VSSOP-8)	DCU0008A	SN74LVC2T45DCUR	Texas Instruments
Y1	1		Crystal, 24 MHz, SMD	2x1.6mm	XRCGB24M000F2P00R0	MuRata
J2	1		Header, 2.54 mm, 3x1, Gold, TH	Header, 2.54 mm, 3x1, TH	GBC03SAAN	Sullins Connector Solutions

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