

EVM User's Guide: INA260EVM

INA260EVM Evaluation Module



Description

The INA260 evaluation module (EVM) is a platform to evaluate the main features and performance of the INA260. The EVM supports current measurements up to 10-A and comes with graphical user interface (GUI) support to read and write to device registers.

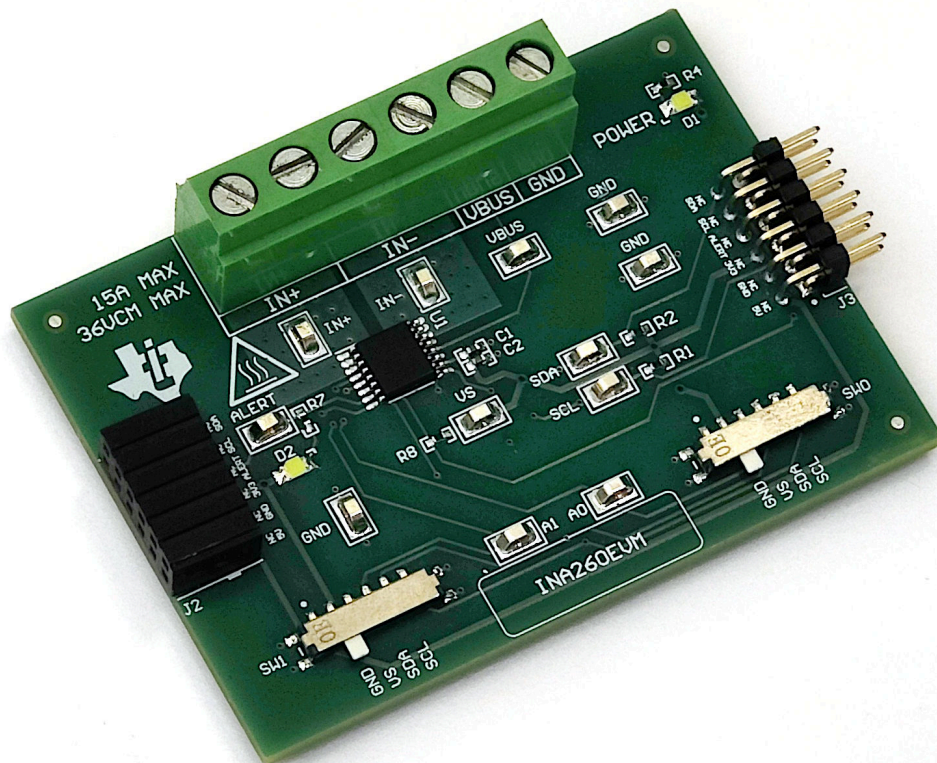
Get Started

1. Buy the INA260EVM evaluation board.
2. Buy the [TI-SCB sensor control board](#).
3. Download and install the [PAMB Windows USB Drivers](#).

4. Read this User's Guide to set up the hardware.
5. Run the [INA260EVM-GUI](#).

Features

- GUI support to read and write device registers as well as view and save results data
- EVM detached from SCB for custom use cases
- Multiple EVM support with single SCB/GUI
- Conveniently powered from a common micro-USB connector through the SCB



1 Evaluation Module Overview

1.1 Introduction

The EVM is an easy-to-use platform for evaluating the main features and performance of the INA260. The EVM supports current measurements up to 10 amps through the PCB, and includes a graphical user interface (GUI) used to read and write device registers as well as view and save results data.

This user's guide describes the characteristics, operation, and use of the INA260 evaluation module (EVM). This EVM is designed to evaluate the performance of the INA260. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the INA260EVM. This document includes a schematic, reference printed circuit board (PCB) layouts, and a complete bill of materials (BOM).

1.2 Kit Contents

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

Table 1-1. Kit Contents

ITEM	QUANTITY
INA260EVM test board	1

Note that this EVM requires the TI Sensor Control Board (SCB), which is sold separately.

1.3 Specification

The EVM is intended to provide basic functional evaluation of the device. The layout is not intended to be a model for the target circuit, nor laid out for electromagnetic compatibility (EMC) testing. The EVM consists of two printed-circuit boards (PCBs). The larger PCB is referred to as the EVM, and has the INA260 installed. The smaller PCB is referred to as the SCB Controller, and is used to interface the EVM with the GUI.

1.4 Device Information

The INA260 is a digital-output, current, power, and voltage monitor with an I2C and SMBus™-compatible interface with an integrated precision shunt resistor. It enables high-accuracy current and power measurements and over-current detection at common-mode voltages that can vary from 0 V to 36 V, independent of the supply voltage. The device is a bidirectional, low- or high-side, current-shunt monitor that measures current flowing through the internal current-sensing resistor. The integration of the precision current-sensing resistor provides calibration-equivalent measurement accuracy with ultra-low temperature drift performance and ensures that an optimized Kelvin layout for the sensing resistor is always obtained.

The INA260 features up to 16 programmable addresses on the I2C-compatible interface. The digital interface allows programmable alert thresholds, analog-to-digital converter (ADC) conversion times, and averaging. To facilitate ease of use, an internal multiplier enables direct readouts of current in amperes and power in watts.

The device operates from a single 2.7V to 5.5V supply, drawing 310µA (typical) of supply current. The INA260 is specified over the operating temperature range between -40°C and +125°C and is available in the 16-pin TSSOP package.

Table 1-2. Device Summary

PRODUCT	DIGITAL PROTOCOL	ADC RESOLUTION	MAX SYSTEM GAIN ERROR	MAX OFFSET CURRENT
INA260	I2C	16-bit	0.15%	±5 mA

2 Hardware

2.1 Quick Start Setup

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

1. Purchase an SCB if you do not already have one.
 - a. To use a PAMB Controller instead, see [PAMB Compatibility](#).

2. Download this driver and install **as an administrator**: <https://www.ti.com/lit/zip/sbac253>.
 - a. Follow the download prompts, a myTI account is required.
 - b. Note that this driver is labeled as a PAMB driver, but is also used for the SCB.
3. Attach the EVM to the SCB Controller as shown in [Figure 2-1](#).
 - a. Refer to [Figure 2-2](#) when connecting multiple EVMs of the same type together.
4. 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.
5. Access the GUI from this link in either Chrome, Firefox, or Safari: https://dev.ti.com/gallery/info/CurrentSensing/INA260EVM_GUI/.
6. Connect the GND reference of the external system to the GND node of the EVM (pin 1 of J1).
7. Provide a current through the IN+ and IN– nodes by connecting the signal leads to J1 pin 5 or 6 and J1 pin 3 or 4 on the EVM as explained in [Current Sensing Operation](#).

2.2 EVM Operation

To use the EVM with the SCB Controller (sold separately), connect the EVM as shown in [Figure 2-1](#).

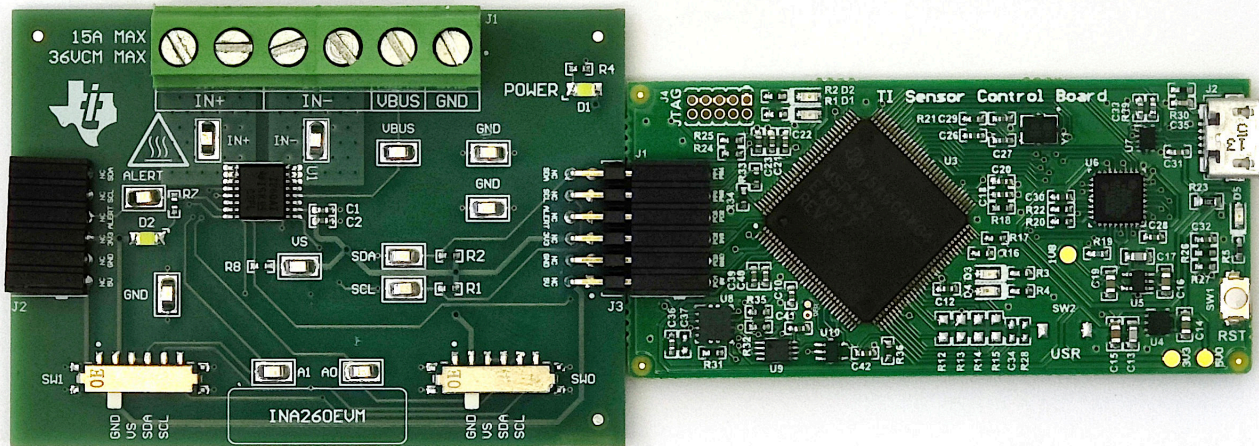


Figure 2-1. EVM (Left) Connected to SCB Controller (Right)

If using multiple EVMs, then connect them as shown in [Figure 2-2](#). Make sure to use a different I2C address for each device. The GUI only supports up to 4 EVMs total.

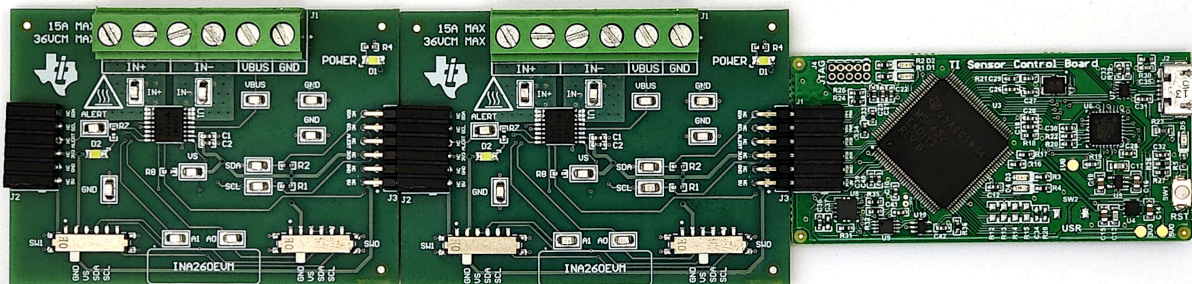


Figure 2-2. Multiple EVMs Connected to SCB Controller

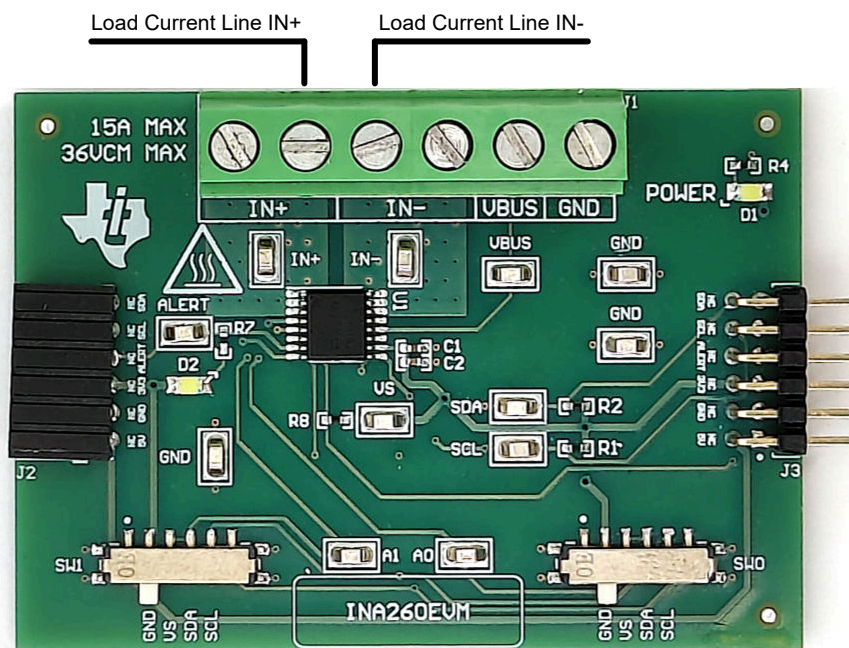
2.2.1 Current Sensing Operation

The INA260 has an integrated shunt resistor, and current input can be input through the terminals of J1. There are two terminals each for IN+ (J1 pins 5 and 6) and IN- (J1 pins 3 and 4) for convenience or for splitting the current between input pins when using running more than 10A.

2.2.1.1 Detailed Setup

To configure a measurement evaluation, follow these steps:

1. With the load powered off, connect the IN+ and IN- terminals in series with the load, as shown in [Figure 2-3](#). Make sure the current does not exceed 15A. If desired, the current can be split across the two terminals for IN+ or IN-. Alternatively, the additional input pins can be used to connect to the VBUS terminal.



a.

Figure 2-3. IN+ and IN- Wiring

WARNING

When measuring current, first make sure that the equipment (wires, connectors, and so on) can support the amperage and power dissipation. Secondly, make sure that the current flowing through J1 does not exceed 15 A. Failure to do so can result in damage to the EVM, or personal injury.

The EVM can get hot.

2. Connect the VBUS terminal (J1 pin 2) to the desired bus voltage (likely either IN+ or IN-).
 - a. If VBUS and dependent features are not being used, then this channel can be used as an ADC input for another voltage.
3. Connect the system ground to the GND terminal (J1 pin 1).
4. Power on the system, and observe the device states and outputs through the GUI.

2.3 Circuitry

This section summarizes the EVM subsystems and components.

2.3.1 Current Sensing IC

This section describes the INA260 and supporting components.

U1 is the INA260 current-sensing device. C1 and C2 are bypass capacitors that are placed near the sensor to help mitigate power supply noise and provide current quickly to the device when needed. LED D1 with current limiting resistor R4 are used to indicate when the EVM is powered on.

The device pins can be monitored directly through the test points TP1 – TP12. Note that there are two extra test points on GND for convenience.

2.3.2 Input Signal Path

This section describes the circuitry of the input signal path.

J1 is the main connection terminal. Pin 1 of J1 is used to tie the system ground to the EVM ground. Pin 2 of J1 is used for the VBUS measurement within the sensor. Pins 3 and 4 are tied to IN⁻, and Pins 5 and 6 are tied to IN⁺. There are two pins each for IN⁻ and IN⁺ for convenience.

2.3.3 Digital Circuitry

This section describes the digital circuitry around the device.

J2 and J3 are the main header pins that connect the digital and power pins to the SCB Controller or other EVMs. J3 connects to the EVM/SCB on the right, while J2 connects to more EVMs on the left. R1 and R2 are used as pullup resistors for the main digital IO pins.

SW0 and SW1 set the I2C address of the device. This can be useful when using the EVM with a custom controller (other than the SCB Controller), or when connecting multiple EVMs together. Currently the SCB Controller and GUI are set up to use four EVMs at a time.

R8 is used as a pullup resistor for the ALERT pin, which is routed to both J2 and J3. LED D2 and current limiting resistor R7 are used to indicate when the ALERT has triggered. Header J4 and jumper SH-J1 are used to disconnect the ALERT pin from the EVM ALERT bus by disconnecting from J3. This is primarily used when working with multiple EVMs, so that the individual ALERT LEDs can be seen on each EVM when the ALERT bus is not needed.

2.4 PAMB Compatibility

If desired, then this EVM and GUI can be used with the PAMB Controller (DC081A) by jumper wiring the pin headers of the PAMB to the EVM. [Figure 2-4](#) shows which pins on the PAMB correspond to the EVM header pins. Note not to add too much resistance in the jumper wire connection setup or the signal can degrade and cause communication errors.

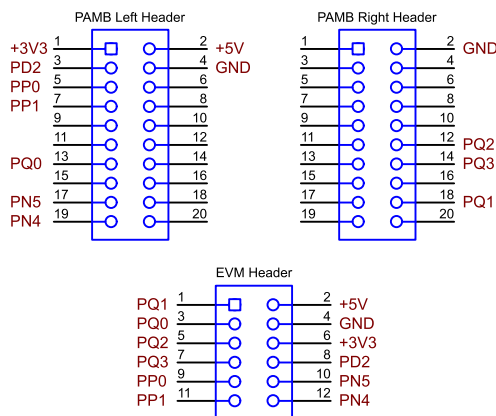


Figure 2-4. EVM to PAMB Connection

3 Software

3.1 Setup

3.1.1 Driver Installation

Download and install this driver: <https://www.ti.com/lit/zip/sbac253>. This is a one-time step per computer, and requires 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**.

3.1.2 Firmware

Firmware updates are pushed through the GUI if the previous driver is installed. Downloaded offline GUIs 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.

3.1.2.1 Firmware Debug

If the firmware must be manually reinstalled for any reason, then follow these steps to reinstall the firmware. Make sure the EVM is connected to the SCB before being powered on.

1. First, see if the GUI can program the firmware.
 - a. Plug in the SCB controller to the PC.
 - i. Make sure the EVM is connected to the SCB first.
 - b. Launch the GUI and close the README.md window.
 - c. If the MCU is already in Device Firmware Update (DFU) mode, then a popup window appears saying "Connection Failure - No SCB controller detected".
 - i. Close this window.
 - d. If the GUI does not update automatically, then go to *File > Program Device...*
 - i. If the *Program Device...* button is still grayed out, then click the connect button in the lower left corner and then try again.
2. If step 1 is unsuccessful (or if the *Program Device...* button is still grayed out), then 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:
 - a. Through software:
 - Send the command 'bsl' on the SCB's USB Serial (COM) port.
 - b. Through hardware:
 - For safety, **turn off and disconnect all load sources and external voltages**.
 - While shorting the two test points labeled *DFU* (shown in [Figure 3-1](#)) with a pair of tweezers (or wire), press and release the RESET button.

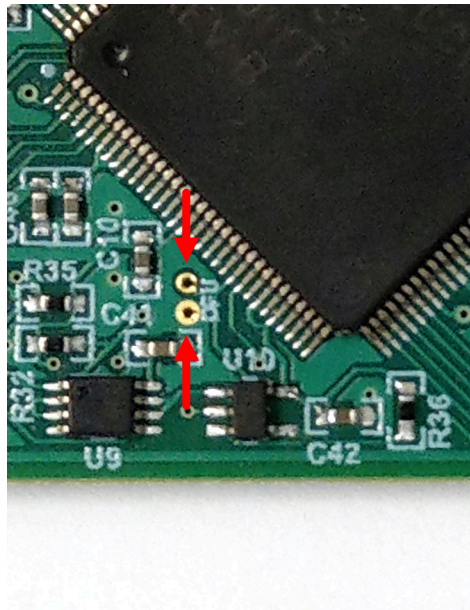


Figure 3-1. Test Points Used to Enter DFU Mode Manually

- If the PAMB board is being used instead, then these test points are located near PK1 and PK2.

With the MCU in DFU mode, the firmware can now be uploaded through the method outlined in [Step 1](#).

3.1.3 GUI Setup and Connection

You can access the GUI from this link in either Chrome, Firefox, or Safari: https://dev.ti.com/gallery/info/CurrentSensing/INA260EVM_GUI/.

3.1.3.1 Initial Setup

To set up the GUI the first time:

1. Make sure that the previously mentioned driver was installed successfully so that everything works properly and that the GUI can update the EVM firmware, if necessary.
2. Check to make sure the EVM and SCB Controller unit is plugged into the PC, then go to the previously-provided GUI link.
 - a. Verify that the EVM is connected to the SCB before plugging the SCB into a USB port.
3. Open the *GUI Composer* application to launch the GUI from the web browser (see [Figure 3-2](#)).

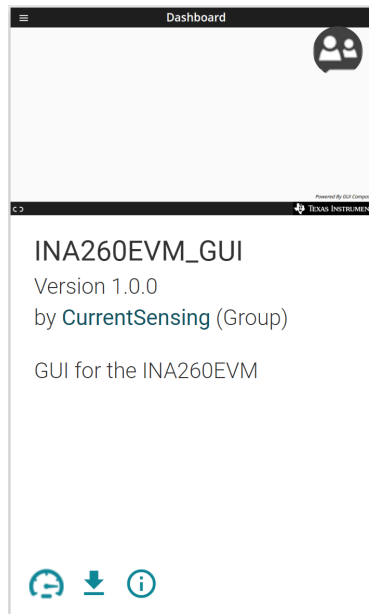


Figure 3-2. GUI Composer Application

- a. The GUI link brings up all versions of the GUI. TI recommends launching the newest version available.
- b. For first-time GUI Composer setup, follow the prompts to download the *TI Cloud Agent* and browser extension (see [Figure 3-3](#)). These prompts appear after you close the *README.md* dialog box.


TI Cloud Agent Installation

Hardware interaction requires additional one time set up. Please perform the actions listed below and try your operation again.(What's this?)

- Step 1: **INSTALL** browser extension
- Step 2: **DOWNLOAD** and install the TI Cloud Agent Application
- Help. I already did this

FINISH

Figure 3-3. TI Cloud Agent

4. Optionally, to download the GUI for offline use, click the  icon in the GUI Composer application and follow the prompts (see [Figure 3-2](#)).

3.1.3.2 GUI to EVM Connection

To connect the GUI to the EVM, follow these steps:

1. Setup and launch the GUI as described in [Initial Setup](#).
 - a. Make sure to connect the EVM to the SCB before powering on.
2. Close the *README.md* file page to initiate a connection between the EVM and the GUI. If successful, then the text *Hardware Connected* is visible near the bottom left corner of the GUI.



Figure 3-4. Hardware Connected

- a. A green indicator with the device type and the text *DEVICE CONNECTED* is also visible near the top left of the GUI.

DEVICE CONNECTED



Figure 3-5. Device Connected

- b. If *Hardware Connected* and *DEVICE CONNECTED* do not show in the GUI, then long-press the RESET button on the EVM to try again.
 - i. If that option does not work, then check different hardware COM ports under *Options > Serial Port*.

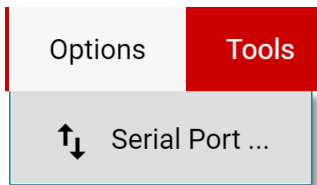


Figure 3-6. Change Serial Port

- c. If the hardware still does not connect, then make sure the correct GUI and EVM combination is being used.
 - i. If you are using the correct GUI and EVM combination, then you may need to reprogram the firmware of the SCB, as described in [Firmware Debug](#).
 - ii. Many connectivity issues can be addressed by doing one of the following:
 1. Long-press the RESET button on the EVM with the EVM and SCB connected to each other.
 - Refreshing the GUI can also sometimes help this.
 2. Connect the EVM to a different USB port.
 - Avoid using long cables and USB hubs.
 - If using a desktop PC, try a USB port on the back.

3.2 GUI Operation

Setup, launch, and connect the GUI to the EVM per [GUI Setup and Connection](#). Refer to the sections below for a description on how to use each page of the GUI.

3.2.1 Home Tab

The GUI starts out on the Home tab. To get to this page from anywhere, click the (Home) icon on the menu on the left.

From the homepage, you can easily confirm successful GUI to EVM connection (see [GUI to EVM Connection](#)), as well as access helpful resources through the buttons on the bottom (see [Figure 3-7](#)).

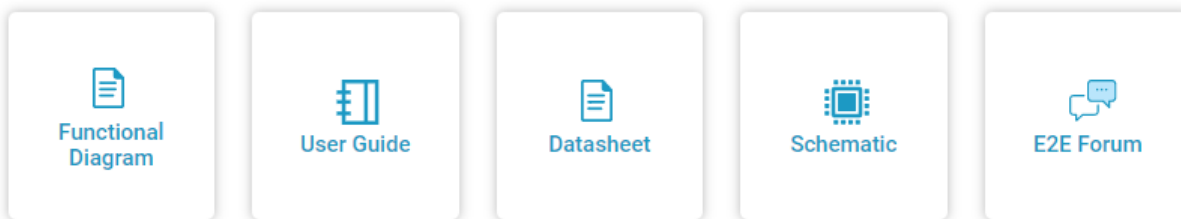


Figure 3-7. Home Tab Links

3.2.2 Registers Tab

To view and edit the device registers, click the (Registers) icon on the menu to the left. The Registers tab looks like the one shown in [Figure 3-8](#).

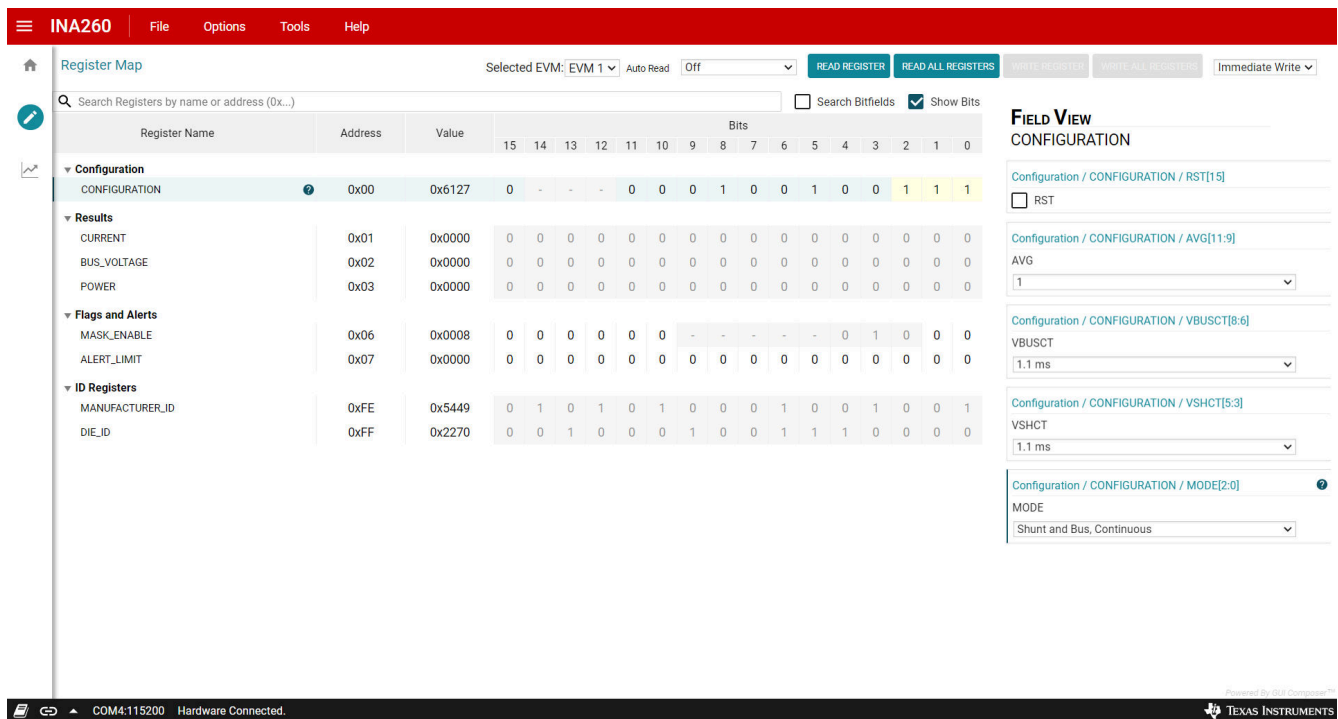



Figure 3-8. GUI Registers Tab

From this page, you can read and write device registers on the EVM. Here are some important notes:

- Use the *Selected EVM* drop-down menu at the top to choose which device to work with on the Registers page.
 - Note, changing this here also changes the same setting for the Configuration tab.
 - Functionally, this setting sets the default read/write address in the MCU and then reads all register values back to update the Registers page. Note that if data is being collected at a high frequency, then this can cause a minor delay in the data collection. To prevent this, set device settings before you start collecting data.
- By default, all changes are automatically written to the device. If desired, then change the *Immediate Write* setting to *Deferred Write* to only allow writing when ready.
 - The user can modify writable register values from any of these methods:
 - Through the widget settings in the *Field View* section on the right.
 - Changing the *Value* directly with either hex or decimal values.
 - Double-clicking on any individual bit.
- Turning on *Auto Read* only updates registers in the Registers page, and not the plots in the *Results Data* section.
 - Leaving *Auto Read* on while collecting data for plots can interfere with data collection timing.
- For questions about a register or register bit field, select the  icon.
 - For even more questions about registers, check the data sheet.
- For convenience, register settings can be saved and loaded back later to any device with the same register map. To do this, go to *File > Register Data*, as shown in [Figure 3-9](#).

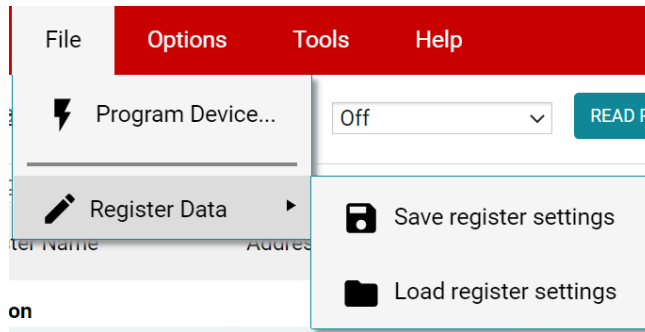



Figure 3-9. Save and Load Register Settings

- Press the *Read All Registers* button after loading data to update the Registers page with the actual device values in case the loaded registers were not compatible with the connected device.

3.2.3 Results Data Tab

To view and collect results data over time, click the  (Results Data) icon on the menu to the left. [Figure 3-10](#) shows part of the results data page for reference, which can look different depending on the number of connected EVMs.

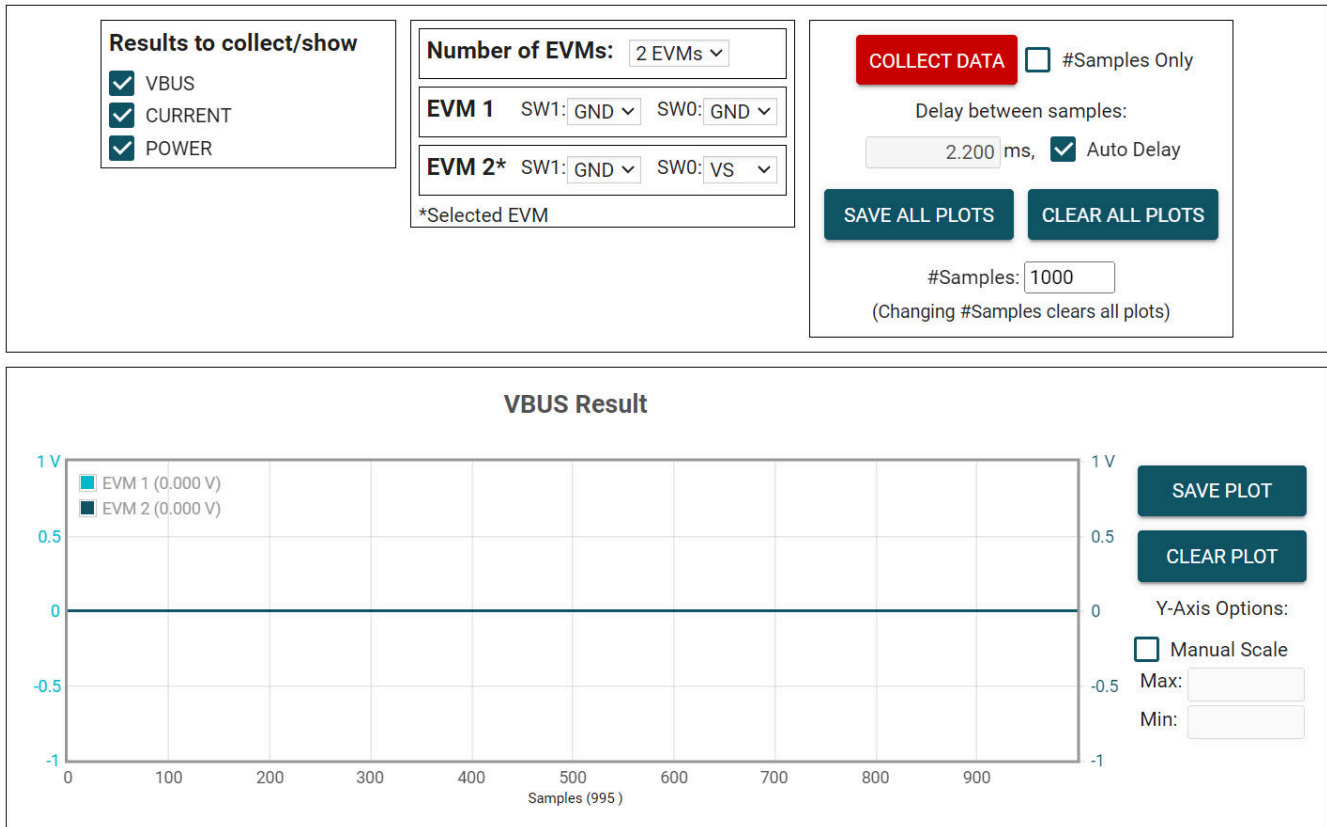


Figure 3-10. Results Page and Settings

Below is a description of how to use the buttons and settings at the top of the Results Data tab and next to each plot:

- Results to collect/show
 - Use this section to select which register values to collect data for. If a results register is unselected before the *COLLECT DATA* button is pressed, then the plot below is hidden and the EVM does not try to read this register during the collect cycle (even if the conversion is enabled).
 - If one of these settings is disabled while the EVM is collecting data, then the plot does not show, but data is still collected and the plot updates in the background. Reselect to show data.
- Number of EVMs
 - Set the *Number of EVMs* drop-down menu to the number of EVMs currently in use.
 - See [Figure 2-2](#) for how to attach multiple EVMs together.
 - Changing this here also changes the same setting in the Configuration tab.
 - The GUI only supports up to 4 INA260EVMs at a time.
 - Switch settings
 - Use the onboard switches to select a different address for each EVM.
 - Set the switch settings in the GUI to match the setting for each connected EVM.
 - *EVM 1* automatically populates with the lowest addressed device unless a setting has already been selected.
 - Changing this here also changes the same setting in the Configuration tab.
 - If more than one device is being used, then an asterisk symbol (*) appears next to the selected EVM that is being used on the Registers and Configuration tabs.

- Changing the switch settings of any EVM sets that EVM as the selected EVM.
- Collect/Plots settings
 - Collect Data
 - Press the *COLLECT DATA* button to start data collection.
 - In this mode, the MCU reads and sends the selected result values for each device over a USB BULK channel. All results from one device are read before moving on to the next device.
 - All result values from all EVMs together are considered one "sample set".
 - Although the user can read and write to other registers through the Registers tab while collecting data, this can add a delay to the data being collected.
 - Press the *STOP COLLECT* button to stop collecting data.
 - #Samples Only
 - If this checkbox is selected, then the GUI automatically stops collecting data after the number of samples specified in the #Samples box have been collected.
 - If not selected, then the GUI continues collecting data and only stores the most recent #Samples.
 - Delay between samples
 - Sets the delay between the start of each sample set.
 - Desired delay time is not obtainable if set faster than the read loop, which depends on the number of results being collected, the number of EVMs, and the CPU being used.
 - Although the user can read and write to other registers through the Registers tab while collecting data, this can add a delay to the data being collected.
 - Auto Delay
 - Sets delay based on conversion times, averaging, and number of channels being converted.
 - If multiple EVMs are being used, then the time put in the delay box is from the EVM with the shortest calculated delay value.
 - Save All Plots
 - Press the *SAVE ALL PLOTS* button to save the data for each currently selected result from the *Results to collect/show* section in a spreadsheet.
 - Press the *SAVE PLOT* button next to each plot to save just the data from that plot in a spreadsheet.
 - Clear All Plots
 - Press the *CLEAR ALL PLOTS* button to clear the data from all plots together.
 - Press the *CLEAR PLOT* button next to each plot to clear the data from just that plot.
 - #Samples
 - Change the number in this box to change the number of samples shown in each plot.
 - Changing this number clears out the plot buffers, so the plots are cleared on the next read.
 - Y-Axis Options
 - Manual Scale
 - Checking this box sets all EVM results in this plot to the same scale value specified by the Max and Min fields.
 - When this is not selected, each EVM has a separate Y-axis scale based on the minimum and maximum values currently in the plot for that EVM.
 - Max
 - The maximum Y-axis value to use for all EVMs in this plot.
 - If this field is empty when Manual Scale is selected, then the plot auto-populates with the maximum value currently in the plot.
 - Min
 - The minimum Y-axis value to use for all EVMs in this plot.
 - If this field is empty when *Manual Scale* is selected, then the plot auto-populates with the minimum value currently in the plot.

3.3 Direct EVM USB Communication

If desired, the EVM can be communicated with directly without the use of the GUI through the USB port. This is done by sending the desired command string over the serial COM port and receiving the results either through the COM port or the USB BULK channel, based on the mode. This is useful for interfacing the EVM with custom setups, scripts, or GUIs.

3.3.1 Standard USB Read and Write Operations

Use the serial COM port to read and write registers through USB commands using the following format:

- Set device address format: `setdevice DEVID`
 - Where `setdevice` is always lower case, and `DEVID` is defined as:
 - The 4 LSBs of the address in decimal format. Ex, for an address of `0x4A`, use `10`.
 - Note, when the SCB is reset while one or more EVMs are connected, the address defaults to the lowest address found.
 - The SCB checks for I2C or SPI at start up. If no device is attached, then the device defaults to SPI. Reset the SCB with an I2C EVM connected to use I2C.
 - For example, to set the INA260 with a register address of `0x4A`, send the command: `setdevice 10`
 - For this example, the EVM returns the acknowledgment and state ("idle" or "collecting") in JSON format:

```

{"acknowledge":"setdevice 10"}
{"evm_state":"idle"}

```
- Read register format: `rreg ADR`
 - Where `ADR` is the address in hex, and `rreg` is always lower case.
 - Register addresses can be in upper or lower case, and do not need to be led by '0x'. 0 padding register addresses is also optional. For example, to read register address `0x02`, some valid commands include:
 - `rreg 2`
 - `rreg 0002`
 - `rreg 0x02`
 - When '0x' is used, the 'x' must be lower case.
 - For this example, the EVM returns the results and state ("idle" or "collecting") in JSON format:

```

{"acknowledge":"rreg 0x02"}
{"register":{"address":2,"value":2637}}
{"evm_state":"idle"}

```
- Write register format: `wreg ADR VAL`
 - Where `ADR` and `VAL` are in hex, and `wreg` is always lower case.
 - Register addresses and values can be in upper or lower case, and do not need to be led by '0x'. 0 padding register addresses and values is also optional. For example, to write register address `0x0` with the value `0x436f`, some valid commands include:
 - `wreg 0 436f`
 - `wreg 00 0x436f`
 - `wreg 0x00 0x436F`
 - When '0x' is used, the 'x' must be lower case.
 - For this example, the EVM returns the results and state ("idle" or "collecting") in JSON format:

```

{"acknowledge":"wreg 0x00 0x436f"}
{"console":"Writing 0x436f to CONFIGURATION register"}
{"evm_state":"idle"}

```

3.3.2 Collect Data Through the USB BULK Channel

The *Collect Data* function reads the desired result registers and sends the data based on the specified settings. This function works best with continuous conversion mode and does not configure the EVM or associated register settings for you. Collect mode is started and stopped through the serial COM port, however the results are sent over the USB BULK channel. To use this mode, use the following format:

- Start collecting data format: collect timerPeriod collectFlags channelAddressIDs numDevices
 - Where collect is always lower case, and each parameter is the decimal representation of the value in the following format:
 - timerPeriod
 - The timer delay used in the MCU to allow data collection sample sets (in μ s, unsigned 32bit value).
 - collectFlags
 - a byte of data that has a 1 to collect and a 0 to not collect each register value type, according to the following definitions:
 - VSHUNT = 0b1000
 - VBUS = 0b0100
 - CURRENT = 0b0010
 - POWER = 0b0001
 - channelAddressIDs
 - This is the 4 LSBs of each I2C address chained together, starting with the LSBs.
 - For example, if EVM 1 is on address 0x41 and EVM 2 is on 0x43, the value here is 0b00110001
 - NumDevices
 - The number of EVMs chained together (1-4).
 - For example, to start data collection for VSHUNT and VBUS every 2.2ms, for two INA260EVMs with EVM 1 address = 0x41 and EVM 2 address = 0x43, send: collect 2200 12 49 2
 - For this example, the EVM returns the acknowledgment and state in JSON format:


```

          {"acknowledge":"collect 2200 12 49 2"}
          {"evm_state":"collecting"}
          
```
 - The USB BULK channel receives data in the format: frameID deviceNumID address registerSize data
 - Where each parameter is the decimal representation of the value in the following format:
 - frameID (1 byte)
 - Always reads 0. Used to verify data is aligned.
 - deviceNumID (1 byte)
 - An ID number corresponding to the EVM number.
 - From the above example, this is 1 if reading from EVM 1 which had address set to 0x41, and 2 if reading from EVM 2 which had a address set to 0x43.
 - address (1 byte)
 - The register address that was read from the device.
 - registerSize (1 byte)
 - The number of bytes that the following data has.
 - data (1 byte at a time)
 - The register data value, given in bytes with the most significant byte first.
- Stop collecting data format: stop
 - Where stop is always lower case.
 - The EVM returns the acknowledgment and state in JSON format:


```

          {"acknowledge":"stop"}
          {"evm_state":"idle"}
          
```

4 Hardware Design Files

4.1 Schematics

Figure 4-1 and Figure 4-2 show the schematic of the INA260EVM. Figure 4-1 shows the circuitry for the EVM. Figure 4-2 shows the mechanical components included with the EVM.

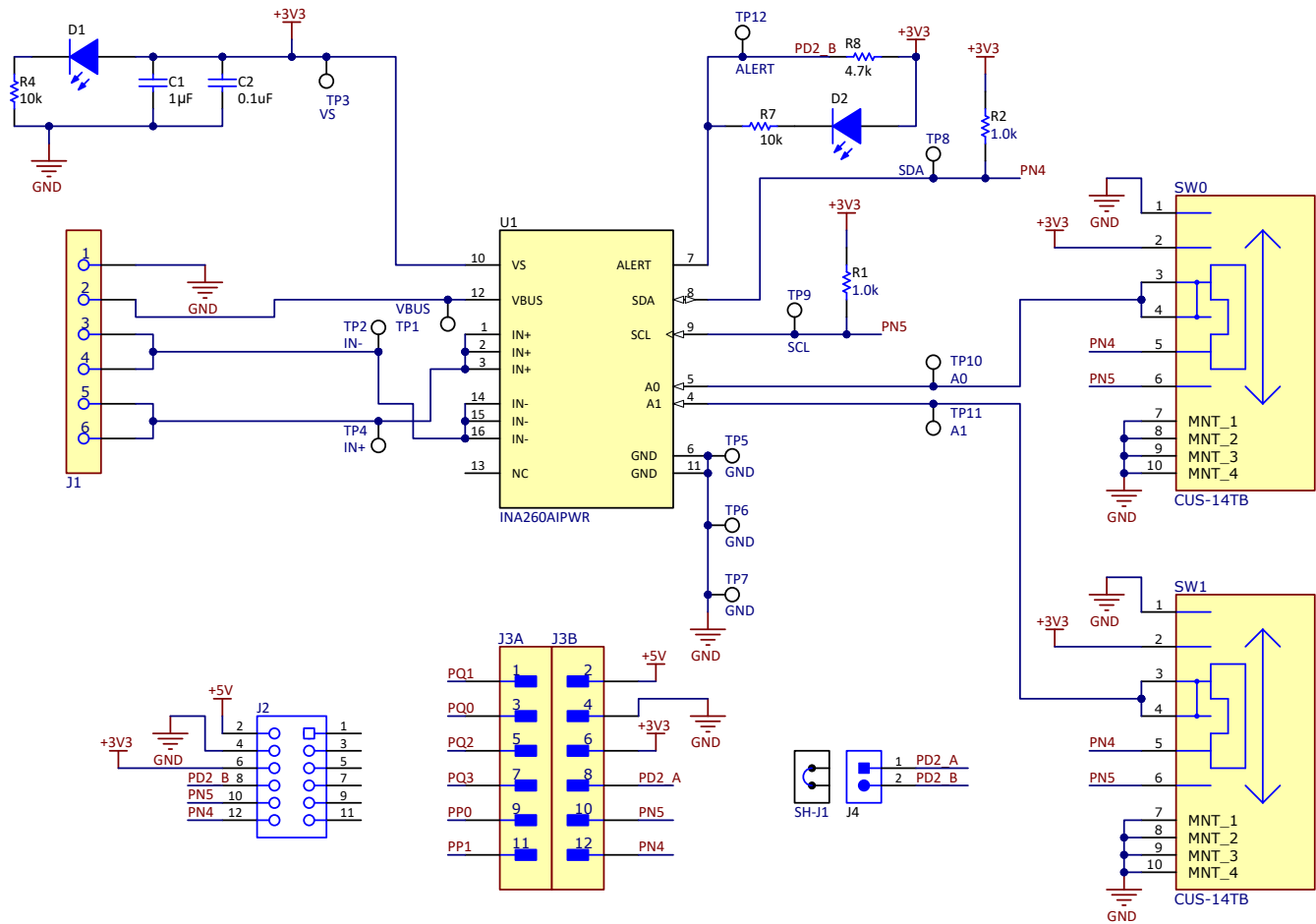


Figure 4-1. Schematic Circuitry



PCB Number: INA260EVM
PCB Rev: B

PCB LOGO
Texas Instruments



PCB LOGO
FCC disclaimer

PCB LOGO
WEEE logo



LBL1
PCB Label
THT-14-423-10
Size: 0.65" x 0.20 "

ZZ1
Label Assembly Note
This Assembly Note is for PCB labels only

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.

ZZ5
Assembly Note
Trim the leads under J1 (back of PCB) to give clearance from surface

Variant/Label Table	
Variant	Label Text
001	INA226EVM

Figure 4-2. Hardware Schematic

4.2 PCB Layout

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.

Figure 4-3 through Figure 4-6 illustrate the PCB layers of the INA260EVM.

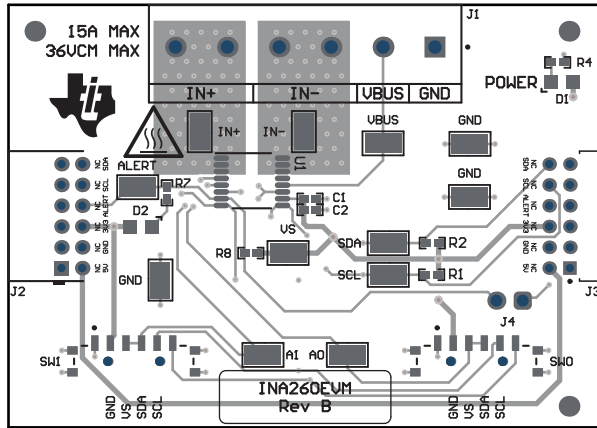


Figure 4-3. Top View

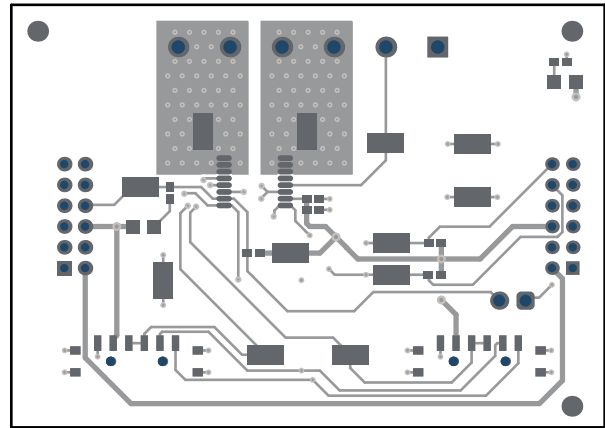


Figure 4-4. Top Layer

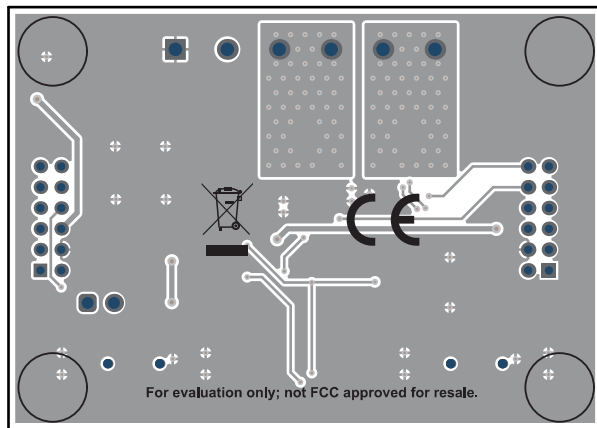


Figure 4-5. Bottom View

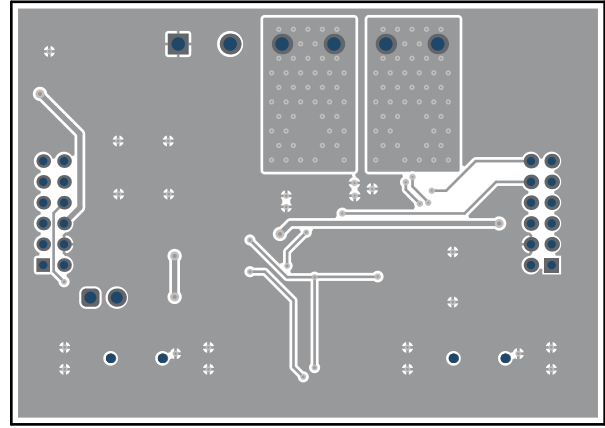


Figure 4-6. Bottom Layer

4.3 Bill of Materials

Table 4-1 provides the parts list for the INA260EVM.

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		INA260EVM	Any
C1	1	1uF	CAP, CERM, 1 μ F, 16 V,+/- 20%, X5R, 0402	0402	GRM155R61C105MA12D	MuRata
C2	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 20%, X7R, 0402	0402	GRM155R71H104ME14D	MuRata
D1, D2	2	White	LED, White, SMD	0805	VAOL-S8WR4	Visual Communications Company, LLC
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.25 X 0.075, Clear	75x250 mil	SJ5382	3M
J1	1		TERM BLK 6POS SIDE ENTRY 5MM PCB ASSEMBLY NOTE: Trim leads per ZZ5	HDR6	691137710006	Wurth Electronics
J2	1		Receptacle, 2mm, 6x2, Gold, R/A, TH	Receptacle, 2mm, 6x2, R/A, TH	NPPN062FJFN-RC	Sullins Connector Solutions
J3	1		Connector Header Through Hole, Right Angle 12 position 0.079" (2.00mm)	HDR12	NRPN062PARN-RC	Sullins Connector Solutions
J4	1		Header, 2.54 mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	61300211121	Wurth Elektronik
R1, R2	2	1.0k	RES, 1.0 k, 5%, 0.063 W, 0402	0402	CRCW04021K00JNED	Vishay-Dale
R4, R7	2	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNED	Vishay-Dale
R8	1	4.7k	RES, 4.7 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04024K70JNED	Vishay-Dale
SH-J1	1		Shunt, 2.54mm, Gold, Black	Shunt, 2.54mm, Black	60900213421	Wurth Elektronik
SW0, SW1	2		Slide Switch SP4T Surface Mount, Right Angle	SMT_SW_11MM3_4M M1	CUS-14TB	Nidec Copal Electronics
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12	12		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone
U1	1		Integrated Shunt High-Side or Low-Side Measurement, Bi-Directional Current and Power Monitor with I2C Compatible Interface, PW0016A (TSSOP-16)	PW0016A	INA260AIPWR	Texas Instruments
C3	0	0.1uF	CAP, CERM, 0.1 uF, 100 V, +/- 10%, X7S, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7S2A104K080AB	TDK
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
LBL1	0		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady

5 Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

6 Related Documentation From Texas Instruments

This user's guide is available from the TI website under literature number [SBOU307](#). Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions are available from www.ti.com or the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number. [Table 6-1](#) lists documentation related to the EVM. Click the links in [Table 6-1](#) for further information. The device name links to the product web folder on www.ti.com. The literature number links to the document PDF.

Table 6-1. Related Documentation

DOCUMENT TITLE	DOCUMENT LITERATURE NUMBER
INA260 data sheet	SBOS547
INA260-Q1 data sheet	SBOS743
Getting Started with Digital Power Monitors	SBOA511

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3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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-
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