EVM User's Guide: INA3221EVM

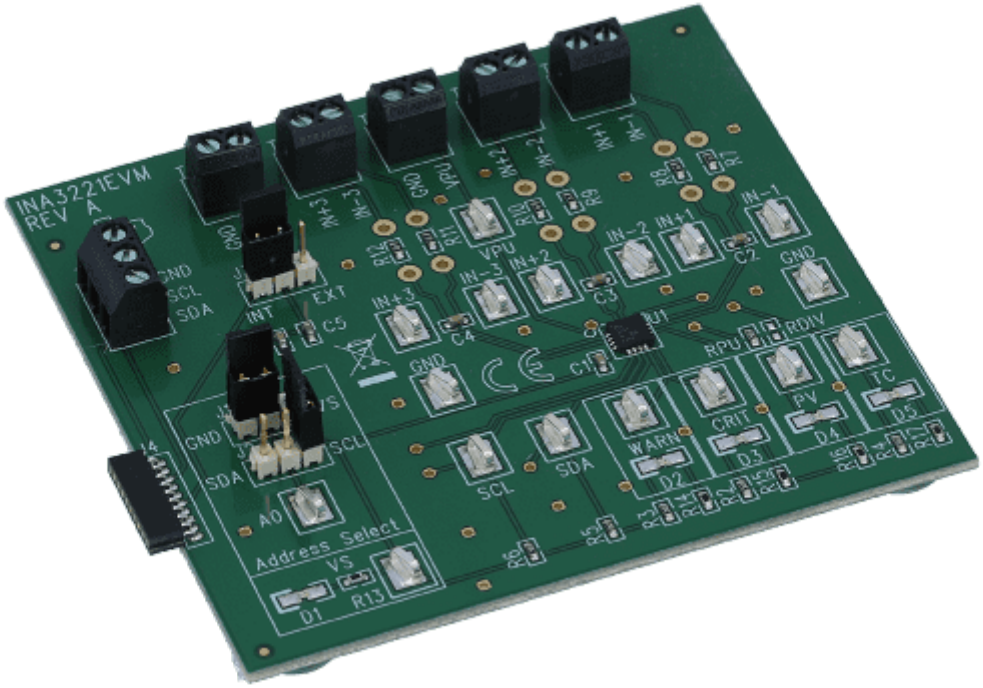
INA3221EVM Rev A Model User's Guide and Software Tutorial

Description

The INA3221 evaluation module (EVM) is a platform to evaluate the main features and performance of the INA3221. The EVM comes the controller (SM-USB-DIG) and graphical user interface (GUI) support to read and write to device registers.

Features

- SM-USB-DIG Platform Included
- GUI support to read and write device registers
- Conveniently powered through SM-USB-DIG, or external source



INA3221EVM

Copyright © 2026 Texas Instruments Incorporated

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the characteristics, operation, and use of the INA3221EVM evaluation board. This document discusses how to set up and configure the software and hardware, and reviews various aspects of the program operation. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the INA3221EVM. This user's guide also includes information regarding operating procedures and input/output connections, an electrical schematic, printed-circuit board (PCB) layout drawings, and a parts list for the EVM.

1.2 Kit Contents

Table 1-1 summarizes the contents of the INA3221EVM kit. Figure 1-1 shows all included hardware. Contact the Texas Instruments Product Information Center nearest you if any component is missing. Check the INA3221 product folder on the TI web site at www.ti.com to verify that you have the latest versions of the related software.

Table 1-1. INA3221EVM Kit Contents

Item	Quantity
INA3221EVM PCB test board	1
SM-USB-DIG platform PCB	1
USB extender cable	1
SM-DIG connector ribbon cable	1
User’s guide CD-ROM	1

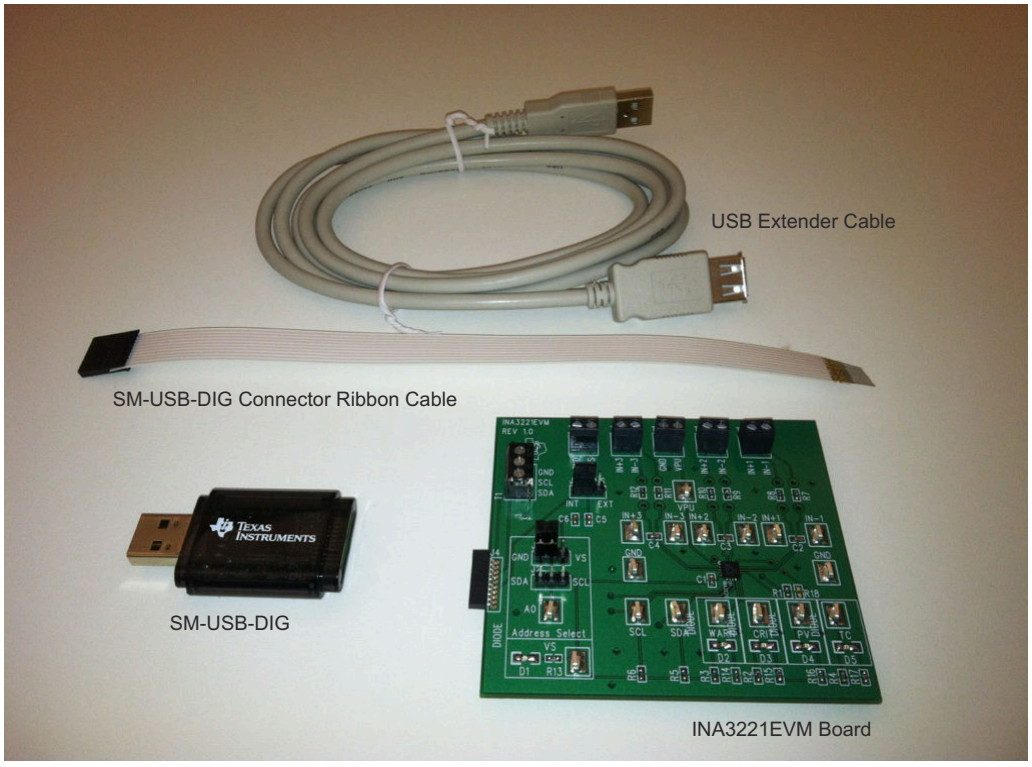


Figure 1-1. Hardware Included With INA3221EVM Kit

Copyright © 2026 Texas Instruments Incorporated

1.3 Device Information

The INA3221 is a three-channel, high-side current sensor and bus voltage monitor with an I2C™ interface. The INA3221 monitors both shunt drops and bus supply voltages with programmable conversion times and averaging modes. The INA3221 offers both critical and warning alerts to detect multiple programmable out-of-range conditions for each channel. This document gives a general overview of the INA3221EVM, and provides a general description of the features and functions to be considered while using this evaluation module.

2 Hardware

2.1 Setup

Figure 2-1 shows the overall INA3221EVM system setup. The PC runs software that communicates with the SM-USB-DIG platform, which in turn generates the analog and digital signals used to communicate with the INA3221 test board. The INA3221 test board connectors allow the user to connect to the system under test conditions to monitor power, current, and voltage.

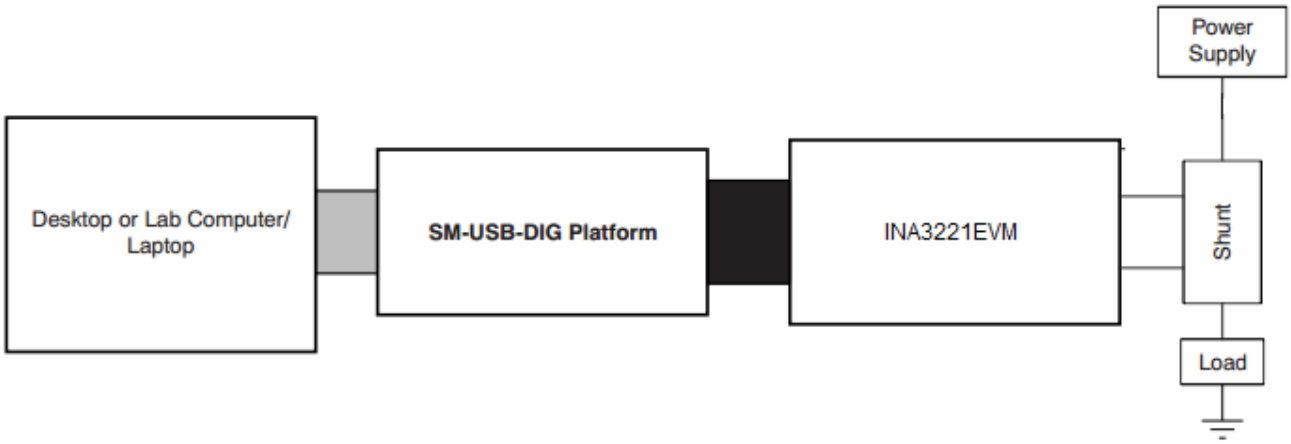


Figure 2-1. INA3221EVM Hardware Setup

2.1.1 INA3221 Hardware Theory of Operation

A block diagram of the INA3221 test board hardware setup is shown in Figure 2-2. PCB functionality provides connections to the I^2C interface and general-purpose inputs/outputs (GPIOs) on the SM-USB-DIG platform board. The PCB also provides connection points for external shunt voltage, bus voltage, and ground connections.

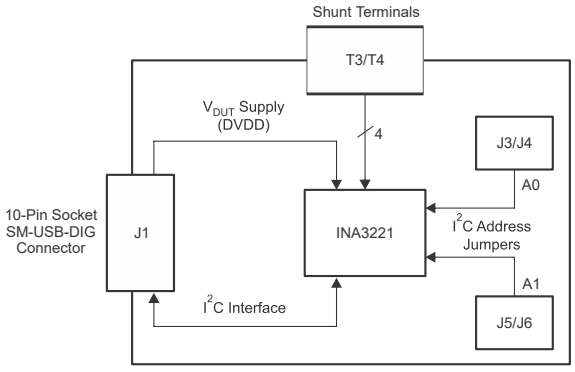


Figure 2-2. INA3221EVM Test Board Block Diagram

Copyright © 2026 Texas Instruments Incorporated

2.1.2 H1 Signal Definitions (10-Pin Male Connector Socket)

Table 2-1 lists the pinout for the 10-pin connector socket used to communicate between the INA3221EVM and the SM-USB-DIG. Note that the INA3221EVM only uses the necessary I^2C communication lines (pins 1 and 3) and the V_{DUT} and GND pins (pin 6 and pin 8) to issue commands to the INA3221 chip.

Table 2-1. Pin Connections

Pin on U1	Signal	Description
1	I2C_SCL	I^2C clock signal (SCL)
2	CTRL/MEAS4	GPIO: control output or measure input
3	I2C_SDA1	I^2C data signal (SDA)
4	CTRL/MEAS5	GPIO: control output or measure input
5	SPI_DOUT1	SPI data output (PICO)
6	VDUT	Switchable DUT power supply: +3.3V, +5V, Hi-Z (disconnected)(1)
7	SPI_CLK	SPI clock signal (SCLK)
8	GND	Power return (GND)
9	SPI_CS1	SPI chip select signal ($\overline{CS}$)
10	SPI_DIN1	SPI data input (POCI)

(1) When VDUT is Hi-Z, all digital I/O are Hi-Z as well.

Copyright © 2026 Texas Instruments Incorporated

2.1.2.1 SM-USB-DIG Platform Theory of Operation

Figure 2-3 shows a block diagram for the SM-USB-DIG platform. This platform is a general-purpose data acquisition system that is used on several different Texas Instruments' evaluation modules. The details of operation are included in a separate document. The block diagram shown in Figure 2-3 is given as a brief overview of the platform.

The primary control device of the SM-USB-DIG platform is the TUSB3210. The TUSB3210 is an 8052 microcontroller that has a built-in USB interface. The microcontroller receives information from the host computer that is interpreted into power, I^2C, SPI, and other digital I/O patterns. During the digital I/O transaction, the microcontroller reads the response of any device connected to the I/O interface. The response from the device is sent back to the PC where the information is interpreted by the host computer.

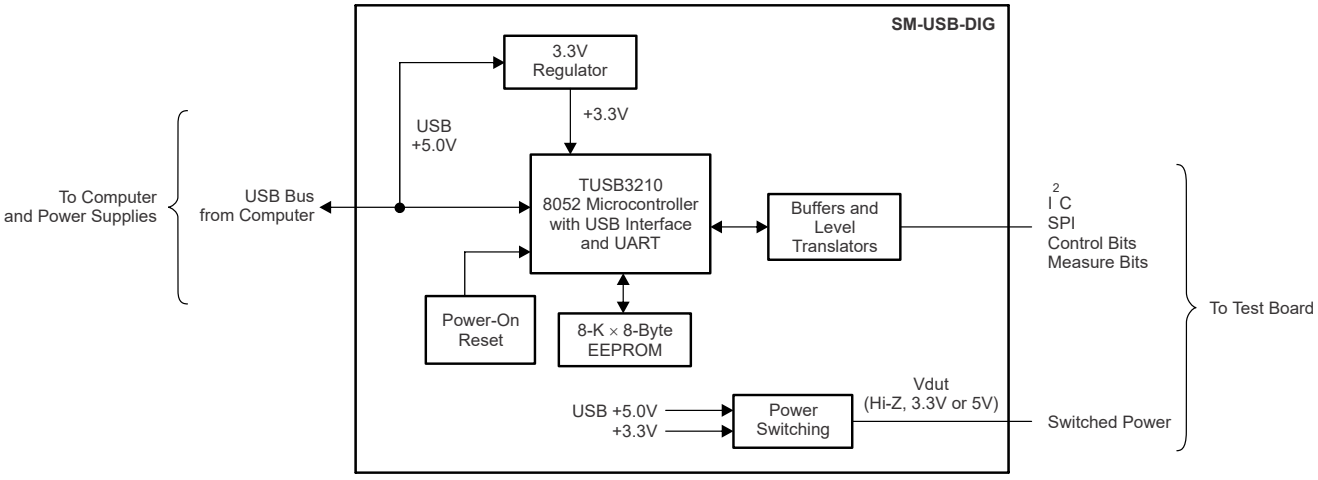


Figure 2-3. SM-USB-DIG Platform Block Diagram

2.2 INA3221EVM Hardware Overview

Setting up the INA3221EVM hardware involves connecting the two EVM PCBs together, applying power, connecting the USB cable, and setting the jumpers. This section presents the details of this procedure.

2.2.1 Electrostatic Discharge Warning

CAUTION

Many of the components on the INA3221EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

2.2.2 Connecting the Hardware

To connect the INA3221EVM and SM-USB-DIG platform together, gently slide the socket and plug ends of the 10-pin connectors together. Verify that the two connectors are completely pushed together; loose connections can cause intermittent operation.

Copyright © 2026 Texas Instruments Incorporated

2.2.3 Connecting the USB Cable to the SM-USB-DIG Platform

Figure 2-4 shows the typical response to connecting the SM-USB-DIG platform board to a PC USB port for the first time. The connection between the SM-USB-DIG and PC USB port is shown in Figure 2-5. Typically, the computer responds with a *Found New Hardware, USB Device* pop-up dialog. The pop-up window typically changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The SM-USB-DIG platform uses the human interface device drivers that are part of the Microsoft®Windows® operating system.

In some cases, the Windows *Add Hardware Wizard* can pop up. If this prompt appears, allow the system device manager to install the human interface drivers by clicking **Yes** when requested to install drivers. Windows then confirms installation of the drivers with the message shown in Figure 2-4.



Figure 2-4. Confirmation of SM-USB-DIG Platform Driver Installation

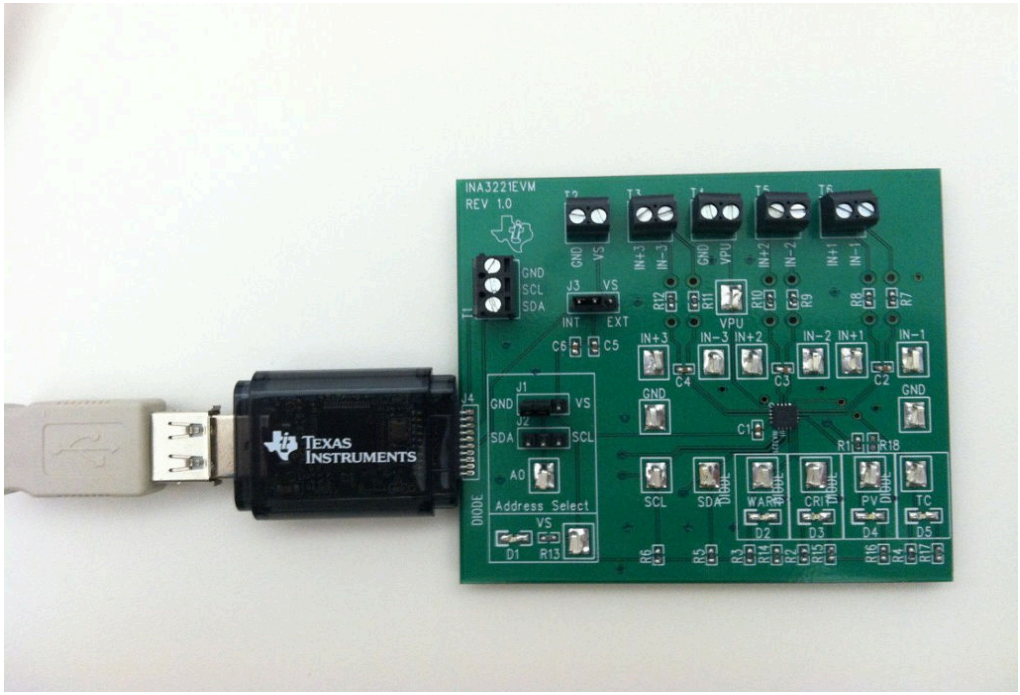


Figure 2-5. Connecting the USB Cable to the SM-USB-DIG Platform

2.2.4 INA3221EVM Features

This section describes some of the hardware features present on the INA3221EVM test board.

2.2.4.1 J3: I^2C V_S Control Setting

Jumper J3 selects what the INA3221 supply pin is connected to. If J3 is set to the INT position, the VS pin is connected to the switchable V_{DUT} signal generated from the SM-USB-DIG platform. This voltage can be set to either 3.3V or 5V, depending on how the voltage is configured in the software. While J3 is set in the INT position, the VS Power button in the INA3221EVM software is able to control whether the V_{DUT} supply voltage is turned on or off. When J3 is set in the EXT position, an external supply connected to terminal T2 can be used to provide the INA3221 supply voltage.

Copyright © 2026 Texas Instruments Incorporated

2.2.4.2 J1 and J2: I²C Address Hardware Setting (A0)

Jumpers J1 and J2 are used to set the hardware setting for the A0I²C address pin on the INA3221. Using J1, the A0 address can be set to either a logic '1' or a logic '0'. Using J2, the A0 address can be set to either the SCL or SDA communication line. Make sure to only have either J1 or J2 connected individually; failure to keep these lines separate can lead to board shorts and problems with the I²C communication lines. See Section 3.2.2.1 on how to configure the INA3221EVM software to match the J1 and J2 hardware setting.

2.2.4.3 External I²C Lines and Terminal Block T1

The INA3221EVM I²C communication lines are tied to two sources: the internal I²C communication lines from the SM-USB-DIG and terminal block T1. If the user wants to add external signals separate from the SM-USB-DIG, simply disconnect the SM-USB-DIG from the INA3221EVM board and hook up the necessary SDA, SCL, and GND lines. Also, remember to apply an external DVDD to the lines compatible with the I²C communication device being used.

Note

Failure to disconnect the SM-USB-DIG while using external I²C communication can cause damage to the SM-USB-DIG or any connected external communication devices.

Copyright © 2026 Texas Instruments Incorporated

2.2.4.4 Shunt Monitor Configuration and Terminal Blocks T3, T5, and T6

The INA3221 is typically used in a high-side shunt configuration, as shown in Figure 2-6. Terminal blocks T3, T5, and T6 represent V_{IN+} and V_{IN-} for channels 1, 2, and 3, respectively. Depending on application requirements, either of these configurations can be used without applying changes to the INA3221EVM board or software.

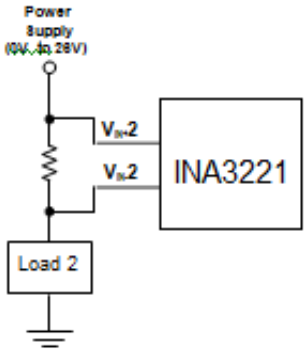


Figure 2-6. INA3221 Shunt Configurations

2.3 Power Requirements

2.3.1 Connecting Power

After the EVM and SM-USB-DIG are conjoined, as shown in Figure 2-7, connect the channels intended to be measured. The source for V_{IN} is not included with the kit, and the voltage can differ depending on specific testing requirements.

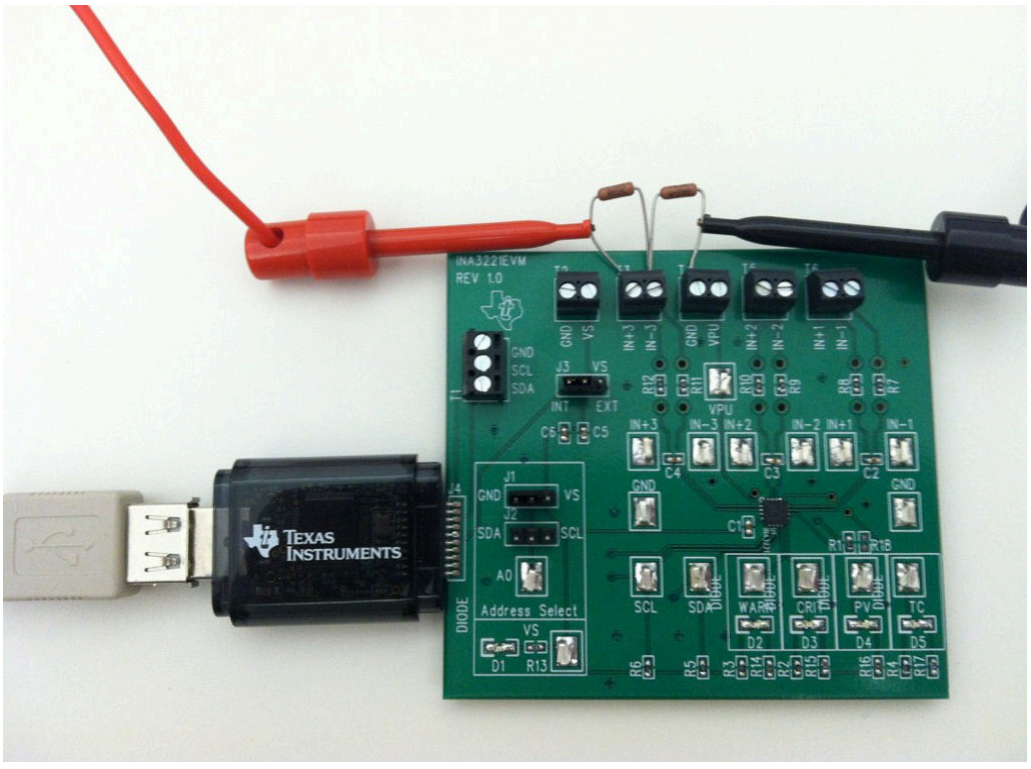


Figure 2-7. Typical INA3221EVM Hardware Test Connections

Copyright © 2026 Texas Instruments Incorporated

2.4 Jumper Information

2.4.1 Default Jumper Settings

INA3221EVM Default Jumper Settings shows the default jumper configuration for the INA3221EVM. Some of the jumpers on the INA3221EVM board can be changed to match specific configuration requirements. For example, a specific I²C address can be set by configuring jumpers J1 and J2.

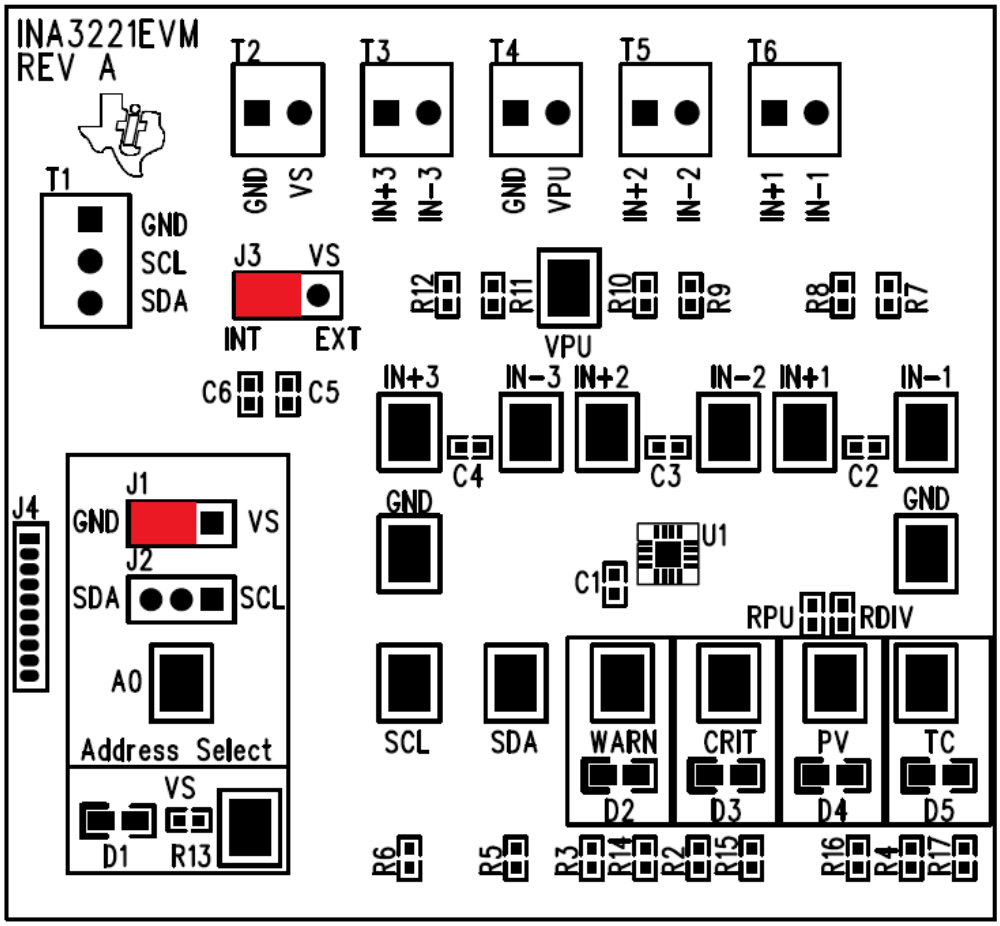


Figure 2-8. INA3221EVM Default Jumper Settings

Jumper 3 on the INA3221EVM is typically set to the INT position. When set to the INT position, the INA3221 supply voltage is generated and controlled by the SM-USB-DIG platform. When this jumper is set to the EXT position, VS connects to terminal strip T2.

Jumpers J1 and J2 control the INA3221 I²C address pin. **These jumpers can set the address (A0) pin to either high, low, SCL, or SDA. Make sure to only connect one jumper at a time, never both.** Failure to properly connect jumpers can cause shorts or interruptions in the communication lines. For more information on the INA3221 addressing, refer to the INA3221 product data sheet.

Table 2-2 summarizes the function of the INA3221 test board jumpers. For most applications, all jumpers must be left in the respective default configurations.

Table 2-2. INA3221EVM Test Board Jumper Functions

Jumper	Default	Purpose
J1	GND	These jumpers select the I²C A0 address selection. Four separate I²C addresses can be selected, depending upon whether J1 is set high or low or whether J2 is set to SDA or SCL.
J2	Open	

Copyright © 2026 Texas Instruments Incorporated

Table 2-2. INA3221EVM Test Board Jumper Functions (continued)

Jumper	Default	Purpose
J3	INT	This jumper selects whether the INA3221 DVDD pin is connected to the V_{DUT} signal generated from the SM-USB-DIG platform or whether the digital supply pin is connected to terminal T2, allowing for an external supply to power the digital circuitry. The default INT position connects the DVDD pin to the V_{DUT} control signal.

3 Software

3.1 INA3221EVM Software Setup

This section discusses how to install the INA3221EVM software.

3.1.1 INA3221EVM Software Operating Systems

The INA3221EVM software has been tested on Microsoft®Windows® XP operating systems (OS) with United States and European regional settings. The software is designed to also function on other Windows OS platforms.

Copyright © 2026 Texas Instruments Incorporated

3.1.2 Software Installation

The INA3221EVM software is included on the CD shipped with the EVM kit. The device is also available through the INA3221EVM product folder on www.ti.com. To install the software to your system, insert the disc into an available CD-ROM drive. Navigate to the drive contents and open the INA3221EVM software folder. Locate the compressed file (*INA3221EVM.zip*) and open the file. Using WinZIP®, or a similar file compression program, extract the INA3221EVM files into a specific INA3221EVM folder (for example, *C:\INA3221EVM*) on your hard drive.

When the files are extracted, navigate to the INA3221EVM folder you created on the hard drive. Locate the *setup.exe* file and execute the file to start the installation. The INA3221 software installer file then begins the installation process, as shown in INA3221EVM Software Installation Window.

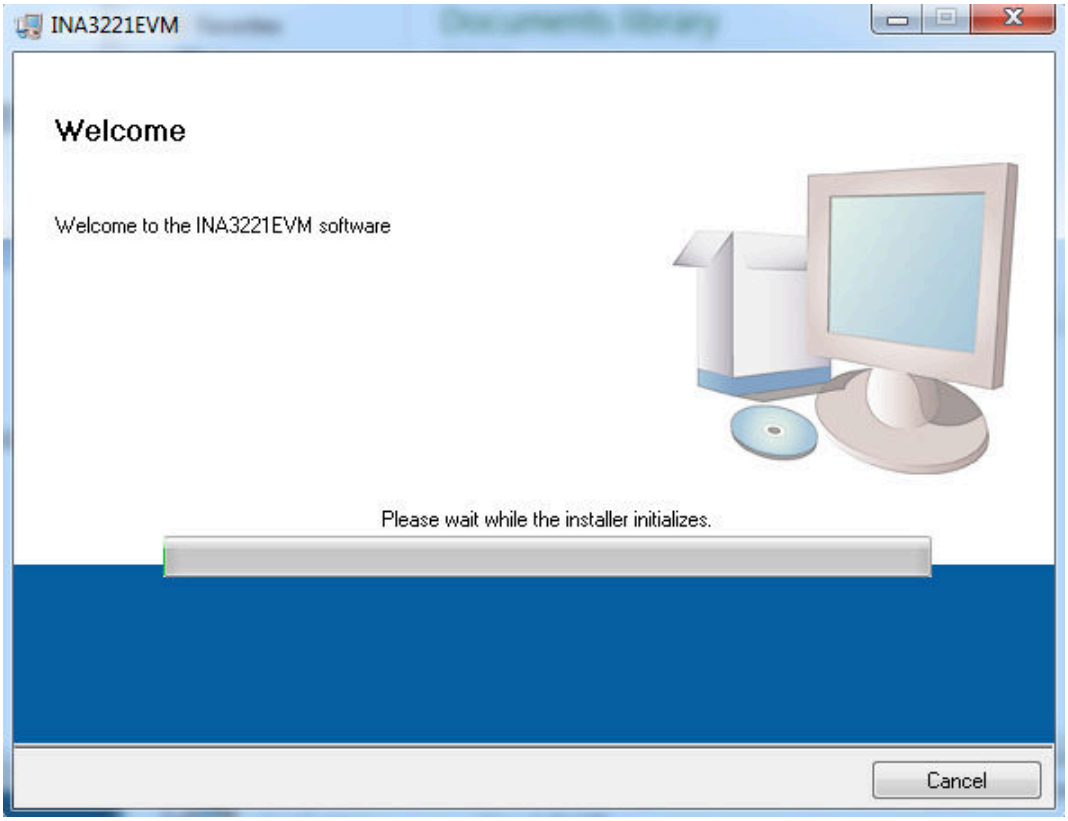


Figure 3-1. INA3221EVM Software Installation Window

After the installation process initializes, the user is given the choice of selecting the directory in which to install the program; the default location is *C:\Program Files\INA3221* and *C:\Program Files\National Instruments*. Following this option, two license agreements are presented that must be accepted, as illustrated in INA3221EVM License Agreements. After accepting the Texas Instruments and National Instruments license agreements, the progress bar opens and shows the installation of the software, refer to INA3221EVM Software Installation Progress. When the installation process is completed, select **Finish**.

Copyright © 2026 Texas Instruments Incorporated

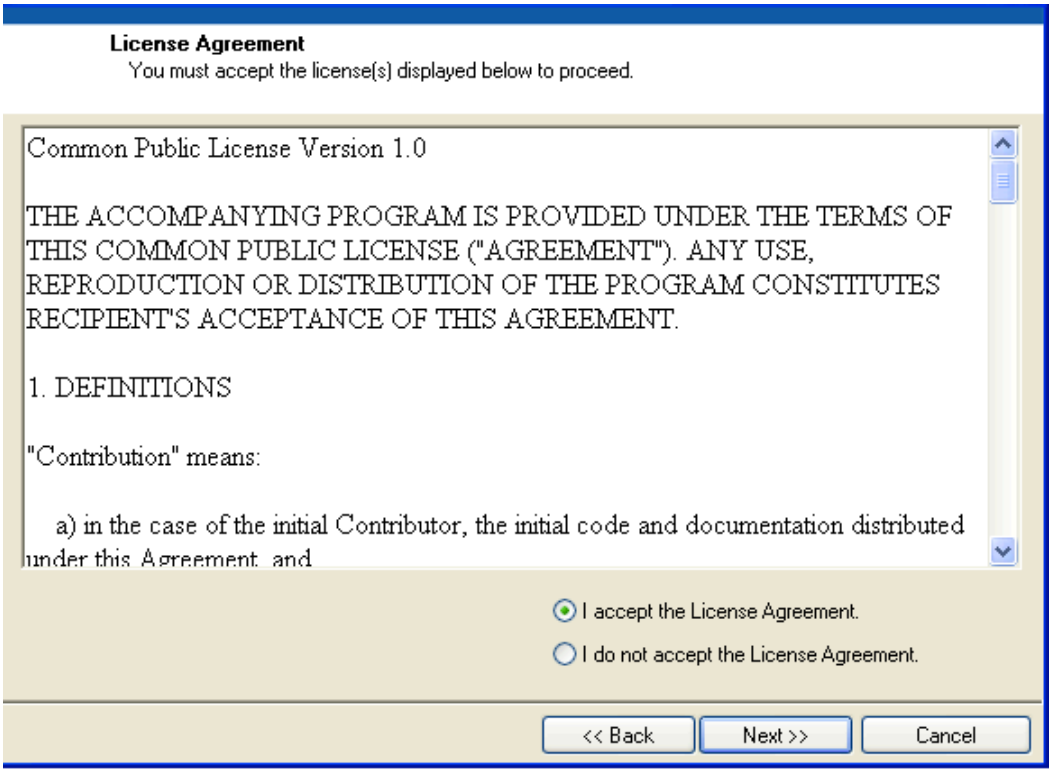


Figure 3-2. INA3221EVM License Agreements

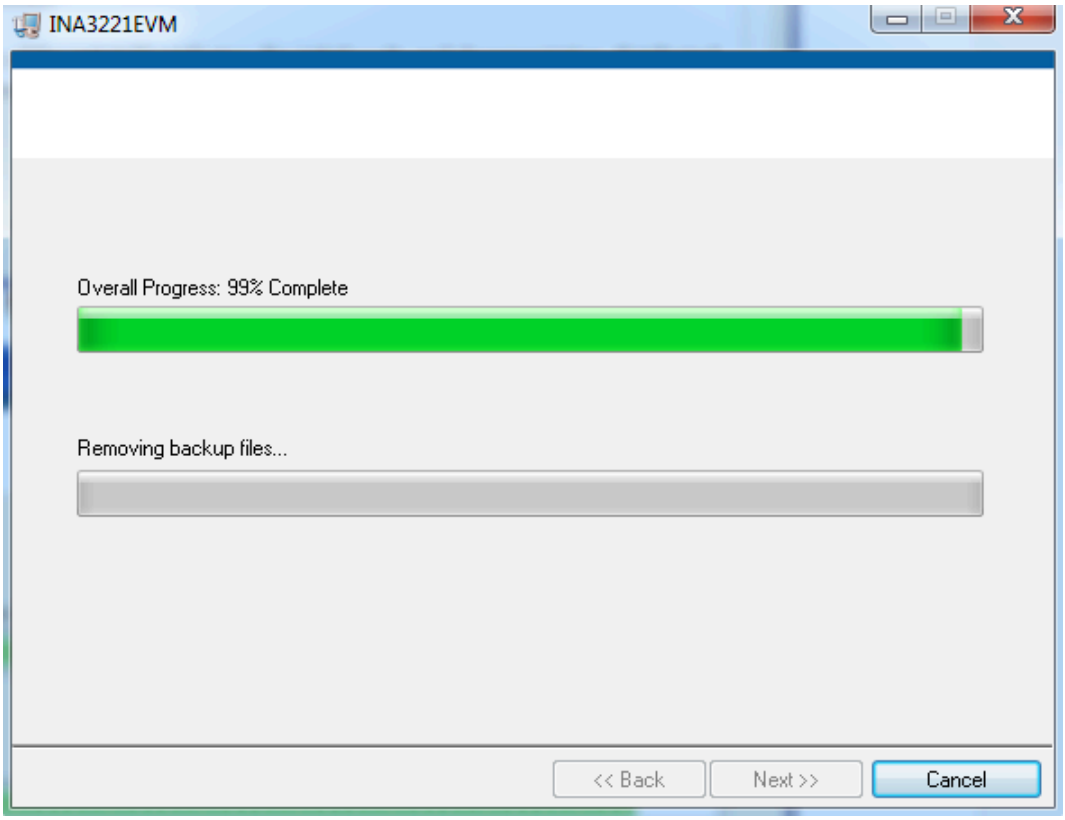


Figure 3-3. INA3221EVM Software Installation Progress

Copyright © 2026 Texas Instruments Incorporated

3.2 INA3221EVM Software Overview

This section discusses how to use the INA3221EVM software. Software operation involves a two-step process: INA3221 configuration and operation.

3.2.1 Starting the INA3221EVM Software

The INA3221 software can be operated through the Windows *Start* menu. From Start, select *All Programs*; then select the *INA3221EVM* program.

Figure 3-4 illustrates how the software must appear if the INA3221EVM is functioning properly.



Figure 3-4. INA3221EVM Software Interface

Copyright © 2026 Texas Instruments Incorporated

Figure 3-5 shows an error window that pops up if the computer cannot communicate with the EVM. If this error is received, first verify that the USB cable is properly connected on both ends. This error can also occur if the USB cable is connected before the SM-USB-DIG platform power source. Another possible source for this error is a problem with the PC USB Human Interface Device driver. Make sure that the device is recognized when the USB cable is plugged in; recognition is indicated by a Windows-generated confirmation sound.

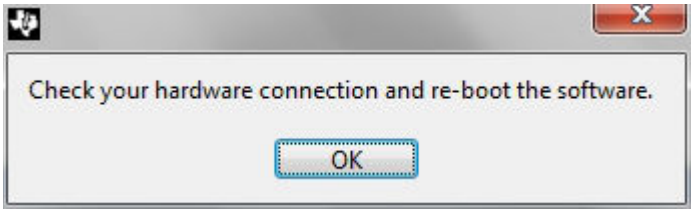


Figure 3-5. INA3221EVM Software: Communication Error With the SM-USB-DIG Platform

3.2.2 Using the INA3221EVM Software

This section describes the basic operation of the device, and offers guidelines for interpreting the graphic user interface (GUI).

3.2.2.1 INA3221 Bus Voltage, Shunt Voltage, and Shunt Voltage Sum Reading Bar

The bottom bar of the INA3221 software, as shown in Figure 3-6, allows the user to constantly check the status of the INA3221 device. These values are updated each time the **Read All Reg** button is pressed at the top of the software. In addition to the register values stored in the device, the software also includes flags for when the device is ready to trigger another conversion and when the Critical, Warning, and Power Valid flags are triggered.

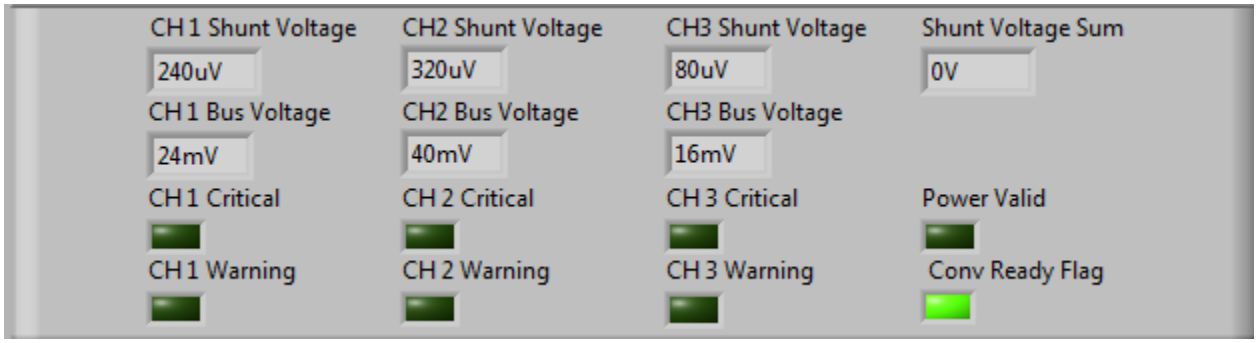


Figure 3-6. INA3221 Results Bar

Copyright © 2026 Texas Instruments Incorporated

3.2.2.2 Register Tab

The Register tab contains information on the internal INA3221 registers. Each register can be changed on a bit-by-bit basis to allow the user to have total control of the device beyond the general functionality of the GUI alone. Most of this functionality is displayed in the Configuration tab, but by selecting the appropriate register and clicking on the **Help With Reg** button on the Register tab, as shown in Figure 3-7, the individual uses of each bit in each register can be diagnosed.

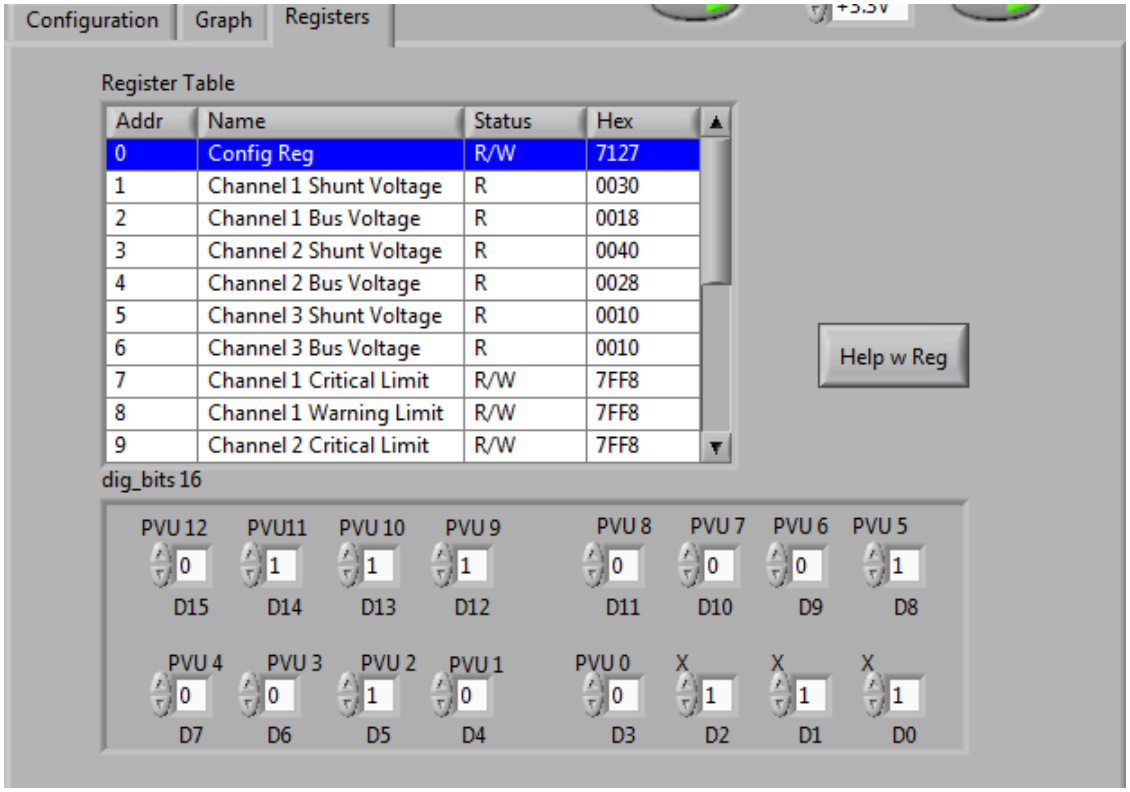


Figure 3-7. Registers Tab

Copyright © 2026 Texas Instruments Incorporated

3.2.2.3 Graph Tab

The Graph tab, shown in Figure 3-8, contains a plot window that shows the progression of data over time on the INA3221. All seven variables at the bottom of the EVM software ($CH1V_{SHUNT}$, $CH2V_{SHUNT}$, $CH3V_{SHUNT}$, $CH1V_{BUS}$, $CH2V_{BUS}$, $CH3V_{BUS}$, and V_{SHUNT} Sum) can be plotted using the drop-down box directly above the graph. After the desired plot has been selected, toggle the **Continuously Poll Data** button above the plot to begin polling for data. If the user desires to save the data from the plot, simply select the *USB Controls* drop-down at the top of the page, then select the *Start Graph Log* option. When the *Start Graph Log* is selected, the user is prompted to select a location for the data and to name the file.

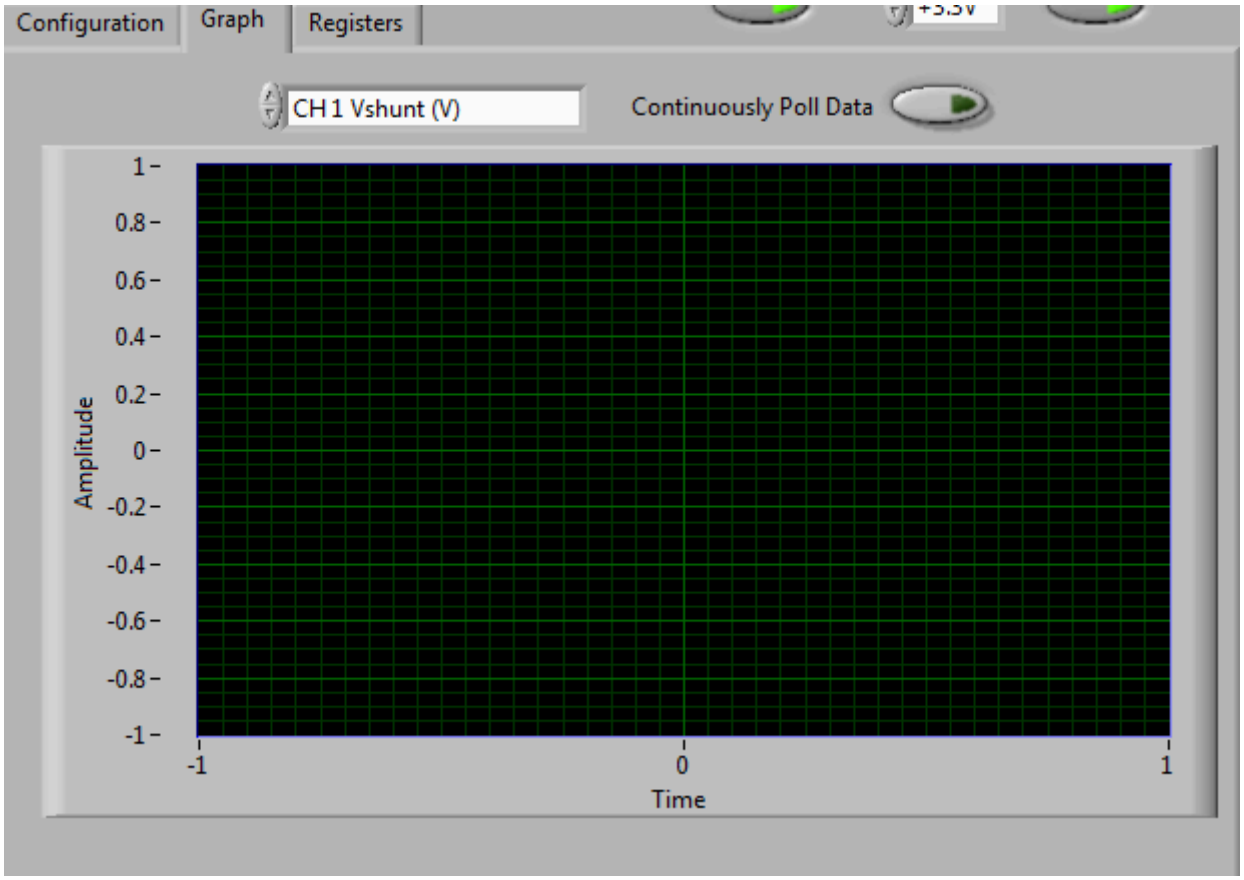


Figure 3-8. Graphing INA3221 Data

3.2.2.4 Auto-Write and DVDD Voltage

The INA3221EVM software allows customization of the board level voltage, regulated by the SM-USB-DIG. By selecting either 3.3V or 5V, the user can designate which voltage the device operates at.

The software also includes an Auto-Write feature, as shown in Figure 3-9, which is enabled by default. This feature automatically updates the register table whenever a change is made. When this feature is enabled, the **Write All Registers** button serves little purpose and is only used as an alternative to when this button is disabled.

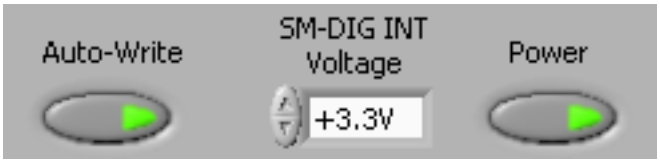


Figure 3-9. Auto-Write, Power Button, and Voltage Control

Copyright © 2026 Texas Instruments Incorporated

4 Hardware Design Files

This section contains the complete bill of materials, schematic diagram, and PCB layout for the INA3221EVM. Documentation information for the USB DIG Platform can be found in the *USB DIG Platform User's Guide* (SBOU058), available for download at www.ti.com.

4.1 Schematic

Figure 4-1 shows the INA3221EVM schematic.

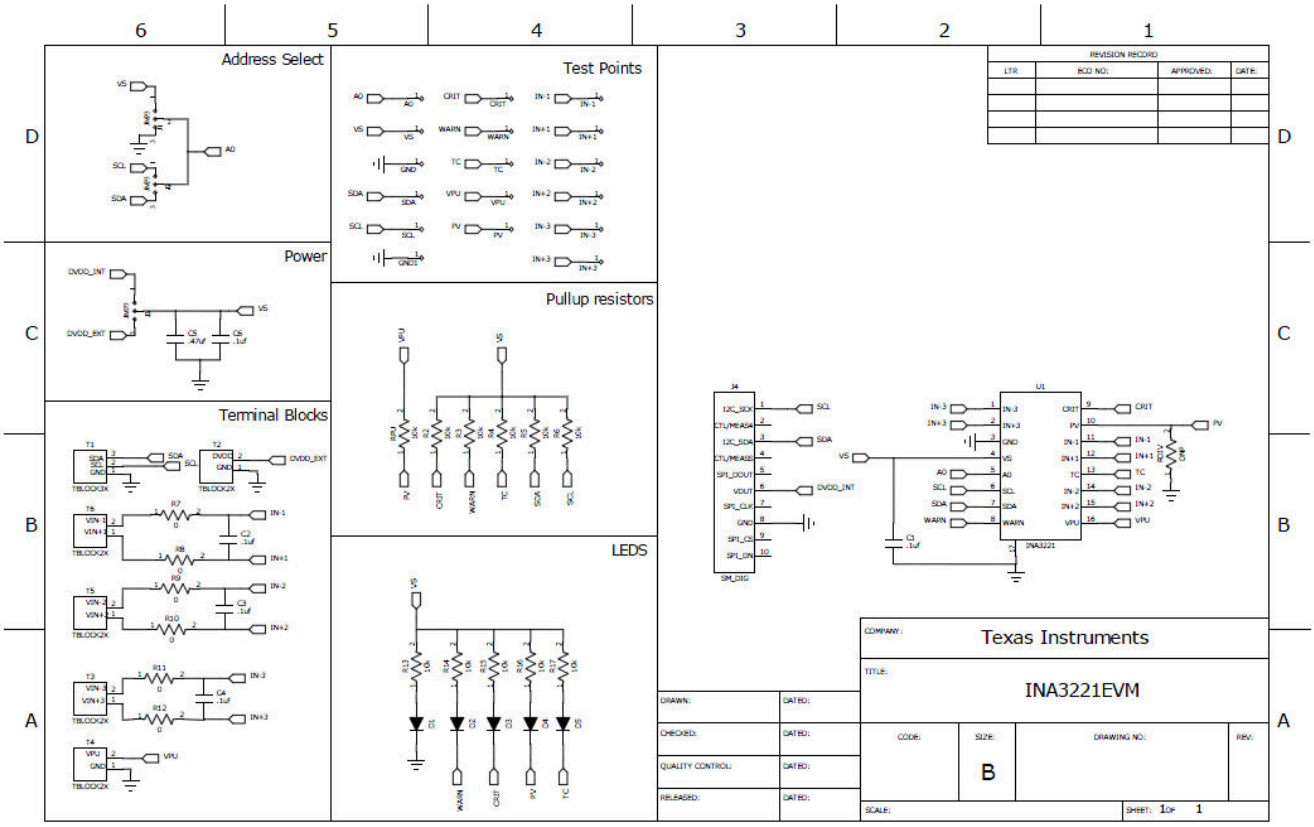


Figure 4-1. INA3221EVM Schematic

Copyright © 2026 Texas Instruments Incorporated

4.2 PCB Layout

Figure 4-2 shows the INA3221EVM PCB component layout.

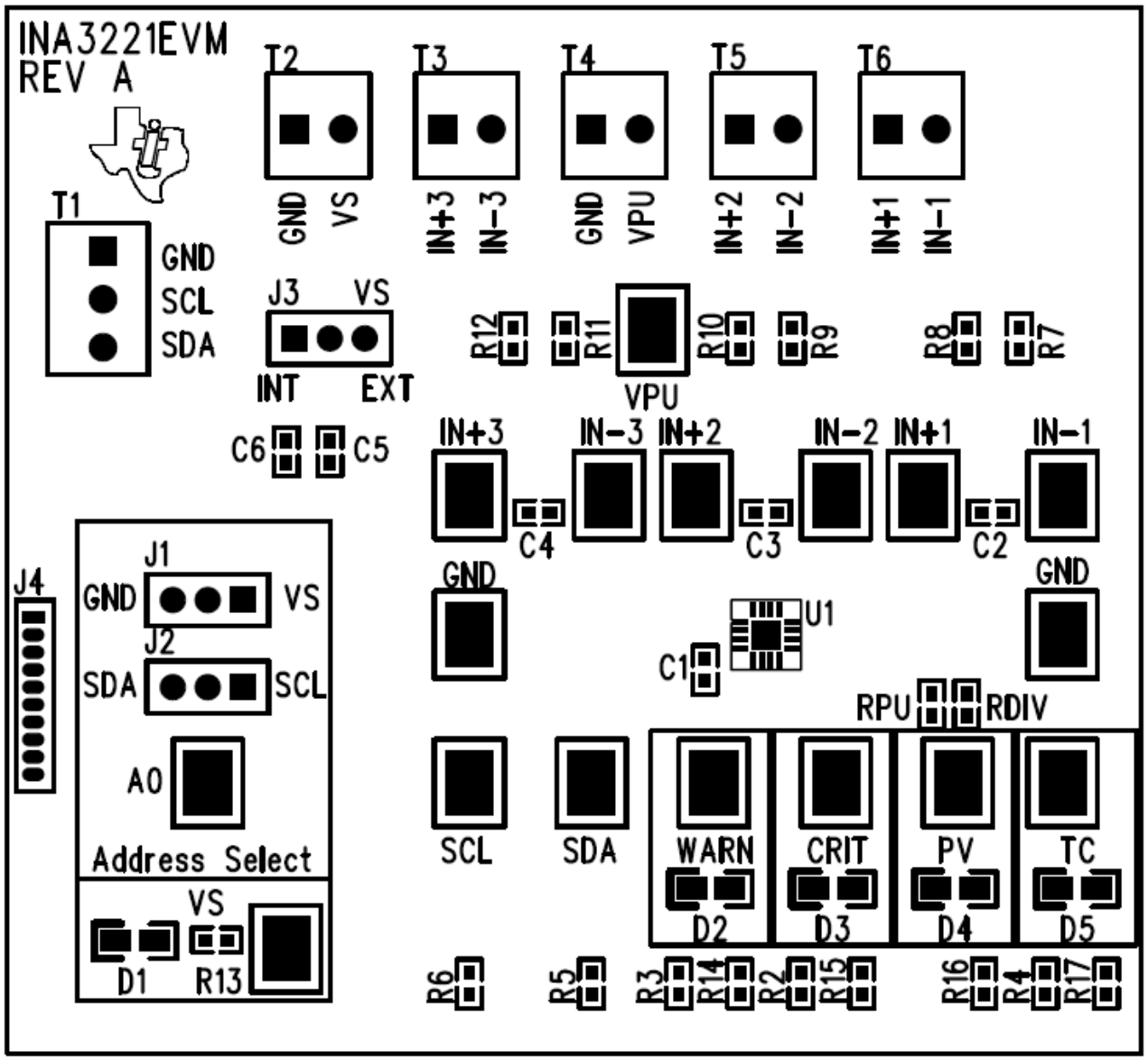


Figure 4-2. INA3221EVM PCB Top Layer (Component Side)

Copyright © 2026 Texas Instruments Incorporated

4.3 Bill of Materials

Table 4-1 lists the INA3221EVM bill of materials.

Table 4-1. Bill of Materials

Item No.	Ref Des	Description	Vendor/Mfr	Digi-Key Part Number	Manufacturer Part Number
1	RPU, R2R6	RES 10K OHM 1/10W 5% 0603 SMD	Stackpole Electronics	RMCF0603JT10K0CT-ND	RMCF0603JT10K0
2	R13R17	RES 300 OHM 1/10W 5% 0603 SMD	Panasonic	P300GCT-ND	ERJ-3GEYJ301V
3	R7R12	RES 0.0 OHM 1/10W 0603 SMD	Stackpole Electronics	RMCF0603ZT0R00CT-ND	RMCF0603ZT0R00
4	RDIV	DNI	—	—	—
5	C5	CAP CER 4.7UF 16V 10% X5R 0603	TDK Corp.	445-7412-2-ND	C1608X7R1V474K
6	C1C4, C6	CAP CER .10UF 25V X7R 10% 0603	TDK Corp.	445-1316-1-ND	C1608X7R1E104K
7	D1D5	LED GREEN WIDE ANGLE 0603 SMD	Panasonic	P14140CT-ND	LNJ3W0C83RA
8	U1	INA3221	Texas Instruments	—	—
9	Jumpers, All	CONN HEADER 50POS .100" SGL GOLD	Samtec	SAM1029-50-ND	TSW-150-07G-S
10	J3, J1	SHUNT LP W/HANDLE 2 POS 30AU	Tyco Electronics	A26242-ND	881545-2
11	Test Points, All	PC TEST POINT COMPACT SMT	Keystone Electronics	5016KCT-ND	5016
12	T1	3Block Terminal 3.5mm	On Shore Technology Inc	ED1515-ND	ED555/3DS
13	T2T6	2Block Terminal 3.5mm	On Shore Technology Inc	ED1514-ND	ED555/2DS
14	Bumpons	BUMPON HEMISPHERE .50X.14 CLEAR	3M	SJ5312-7-ND	SJ-5312 (CLEAR)
15	J4	CONN SOCKET RT ANG 1POS .050	Mill-Max Manufacturing	ED8850-ND	851-93-10-20-001000

Copyright © 2026 Texas Instruments Incorporated

5 Related Documentation

The following documents provide information regarding Texas Instruments' integrated circuits used in assembly of the INA3221EVM. This user's guide is available from www.ti.com under literature number SBOU126. 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 call 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 5-1. Related Documentation

Document	Literature Number
INA3221 product data sheet	SBOS576
SM-USB-DIG platform user guide	SBOU098
USB DIG platform user's guide	SBOU058

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (April 2012) to Revision A (October 2026) **Page**

- Updated the numbering format for tables, figures, and cross-references throughout the document..... 1
- Updated the document title to match family conventions..... 1
- Changed the front page description into the *Description* section..... 2
- Changed the *Overview* section to the *Device Information* section..... 3
- Changed the *INA3221EVM Documentation* section to the *Hardware Design Files* section..... 17

Copyright © 2026 Texas Instruments Incorporated

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

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

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), 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 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, TI’s General Quality Guidelines, 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. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

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

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025