INA225EVM User's Guide

This user's guide describes the characteristics, operation, and use of the INA225 evaluation module (EVM). This document discusses how to set up the hardware and reviews various aspects of the EVM operation. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the INA225EVM. This user's guide also includes information regarding operating procedures, input and output connections, an electrical schematic, a printed circuit board (PCB) layout drawing, and a parts list for the EVM.

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1 Overview

The INA225 is a voltage-output, current-shunt monitor that senses drops across shunts at common-mode voltages from 0 V to 36 V, independent of the supply voltage. The four gain versions are selectable using the two external gain select pins, GS0 and GS1. These pins allow gains of 25, 50, 100, and 200 V/V to be selected. The low-offset, zero-drift architecture enables current sensing with voltage drops across the shunt as low as 10 mV of full-scale while maintaining high accuracy measurements. The INA225EVM is a platform for evaluating the performance of the INA225 under various signal, shunt, and supply conditions. This document gives a general overview of the INA225EVM, and provides a general description of the features and functions to be considered while using this evaluation module.

For a more detailed description of the INA225 product line, refer to the product data sheet (SBOS612) available from the Texas Instruments web site at www.ti.com. Support documents are listed in the *Related Documentation from Texas Instruments* section.

1.1 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments integrated circuits used in the assembly of the INA225EVM. This document is available from the TI web site under literature number SBOS612. 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 may be available from the TI web site at 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.

Document	Literature Number
INA225 product data sheet	SBOS612
USB DIG platform user's guide	SBOU058

1.2 If You Need Assistance

If you have questions about the INA225 evaluation module, post a question in the amplifiers forum at e2e.ti.com. Include *INA225EVM* in the subject heading.

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1.3 INA225EVM Kit Contents

Table 1 lists the contents of the INA225EVM kit, and Figure 1 shows the included hardware. Contact the Texas Instruments Product Information Center nearest you if any component is missing.

Table 1. INA225EVM Kit Contents

Item	Quantity
INA225 PCB evaluation board	1

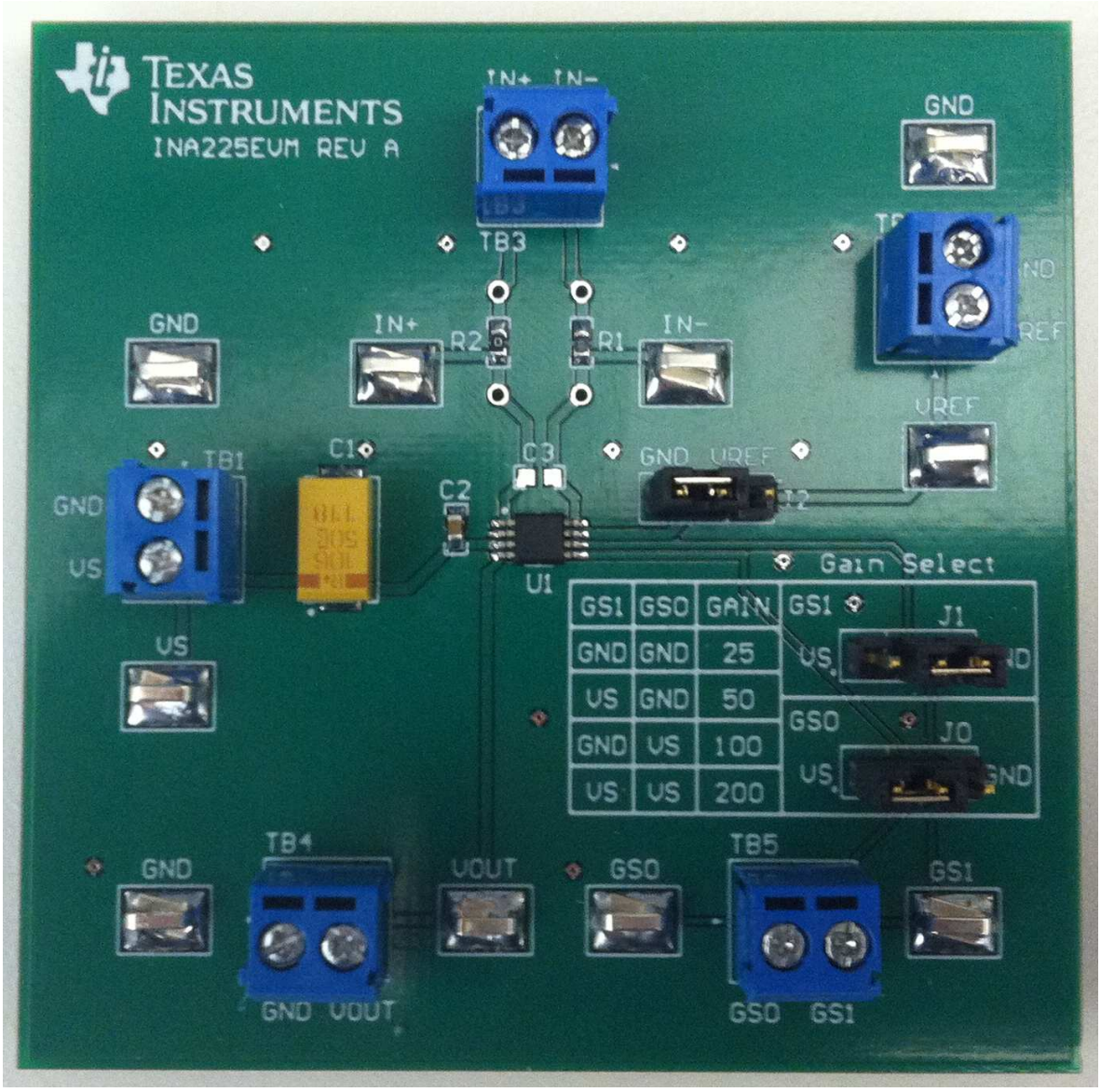


Figure 1. Hardware Included with the INA225EVM Kit

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2 INA225EVM External Connections

2.1 Powering the INA225EVM

Terminal block TB1 contains the power-supply pin (VS) as well as a ground pin. The valid range for TB1 is +2.7 V to +36 V. The supply is decoupled with a 10-µF tantalum capacitor and a 0.1-µF ceramic capacitor near the device. The INA225EVM also contains test points for the supply voltage and ground located next to TB1.

The INA225 can accurately measure beyond the device power-supply voltage, VS. For example, the power supply can be at +5 V, whereas the load supply voltage can be as high as +36 V. However, the voltage output (VOUT) is limited by the voltage on the power-supply pin (VS).

2.2 INA225EVM Inputs

Terminal block TB3 contains the input pins (IN+ and IN–) for the INA225. These pins should be connected as closely as possible to the shunt resistor to minimize any resistance in series with the shunt resistance. Test points are provided for these inputs.

The INA225EVM has an optional input filter. R1 and R2 (which are factory-installed, 0-Ω resistors), in combination with the unpopulated capacitor C3, can be used to form an input filter. R1, R2, and C3 use a standard 0603 footprint.

2.3 INA225 Reference Voltage

Terminal block TB2 contains the reference voltage pin (REF) and a ground connection. The reference allows for the device to be used in both unidirectional and bidirectional applications. Connect J2 to VREF when using an external reference voltage source connected at terminal block TB2, as shown in Figure 2. Otherwise, connect J2 to ground (GND).

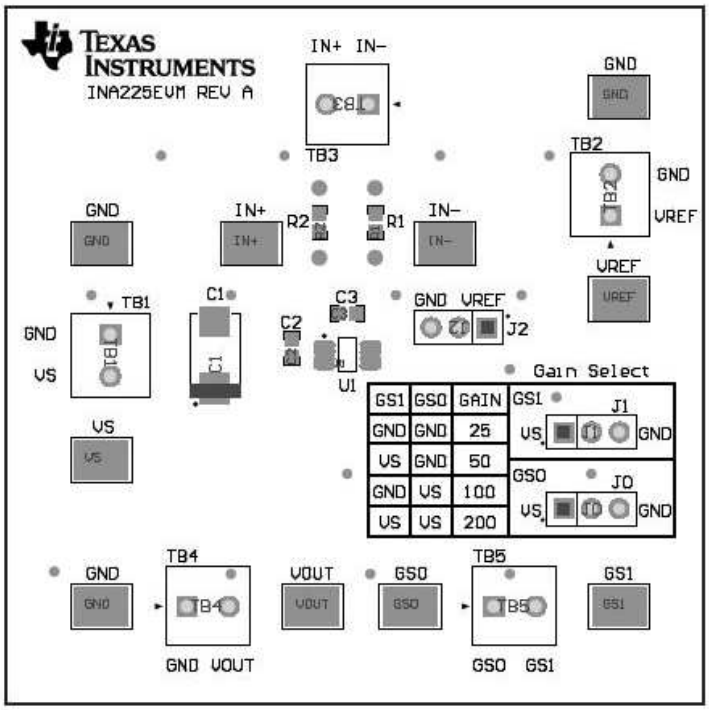


Figure 2. Connecting a Reference Voltage

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2.4 Gain Select Pins

The device has two gain select pins, GS0 and GS1, which are located at J0, J1, and terminal block TB5. The device has selectable gain settings of 25, 50, 100, and 200, as shown in Table 2. Table 2 is also printed on the board; see Figure 1.

Table 2. INA225 Gain Settings

GS0	GS1	Gain
GND	GND	25
GND	VS	50
VS	GND	100
VS	VS	200

2.5 Voltage Output

Terminal block TB4 contains the voltage output (OUT) of the device and a ground connection. The output of the device is the voltage drop across the shunt resistor multiplied by the gain setting. The output is limited by the supply voltage (VS). Test points are provided for VOUT.

3 INA225EVM Basic Setup

The INA225EVM basic setup overview involves connecting the shunt and load resistor to the EVM, applying power, setting the jumpers, and measuring the output. This section presents the details of this procedure. More information can be found in the INA225 data sheet.

3.1 Electrostatic Discharge Warning

Many components on the INA225EVM 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.

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3.2 Jumper Configuration

In this example, an outside voltage reference is not used, so connect J2 to GND. Set the device gain to 100 by connecting J0 (GS0) to VS and J1 (GS1) to GND. These jumper settings are shown in Figure 3.

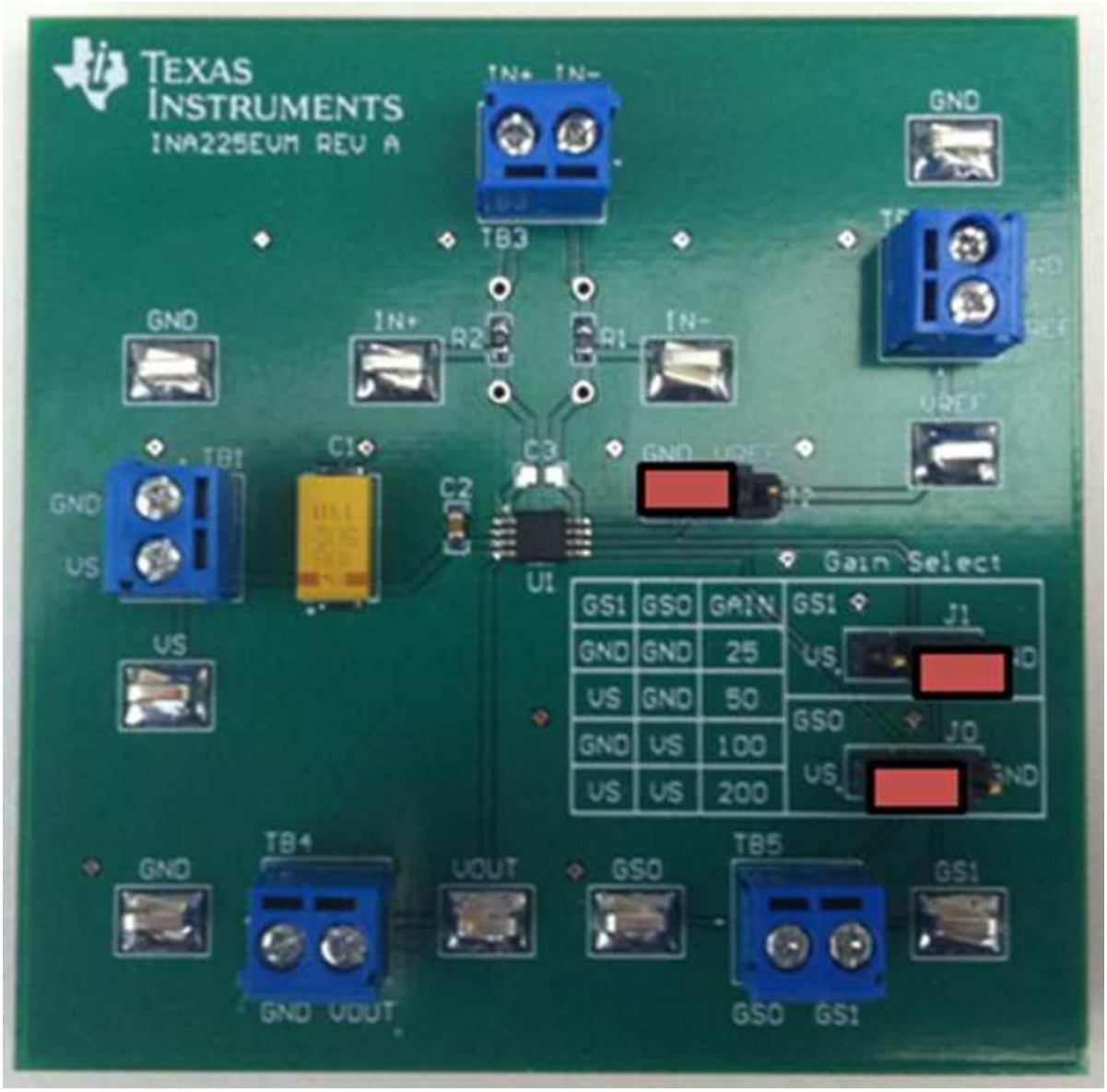


Figure 3. Jumper Configuration

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3.3 Connecting the Shunt and Load Resistors

In this example, a 50-Ω shunt resistor is used along with a 10-kΩ load resistor. Attach the shunt resistor from IN+ to IN– on terminal block TB3. Next, attach the load resistor from IN– to GND. The 10-kΩ load resistor can be grounded at terminal block TB2 because this setup does not use VREF, as shown in Figure 4.

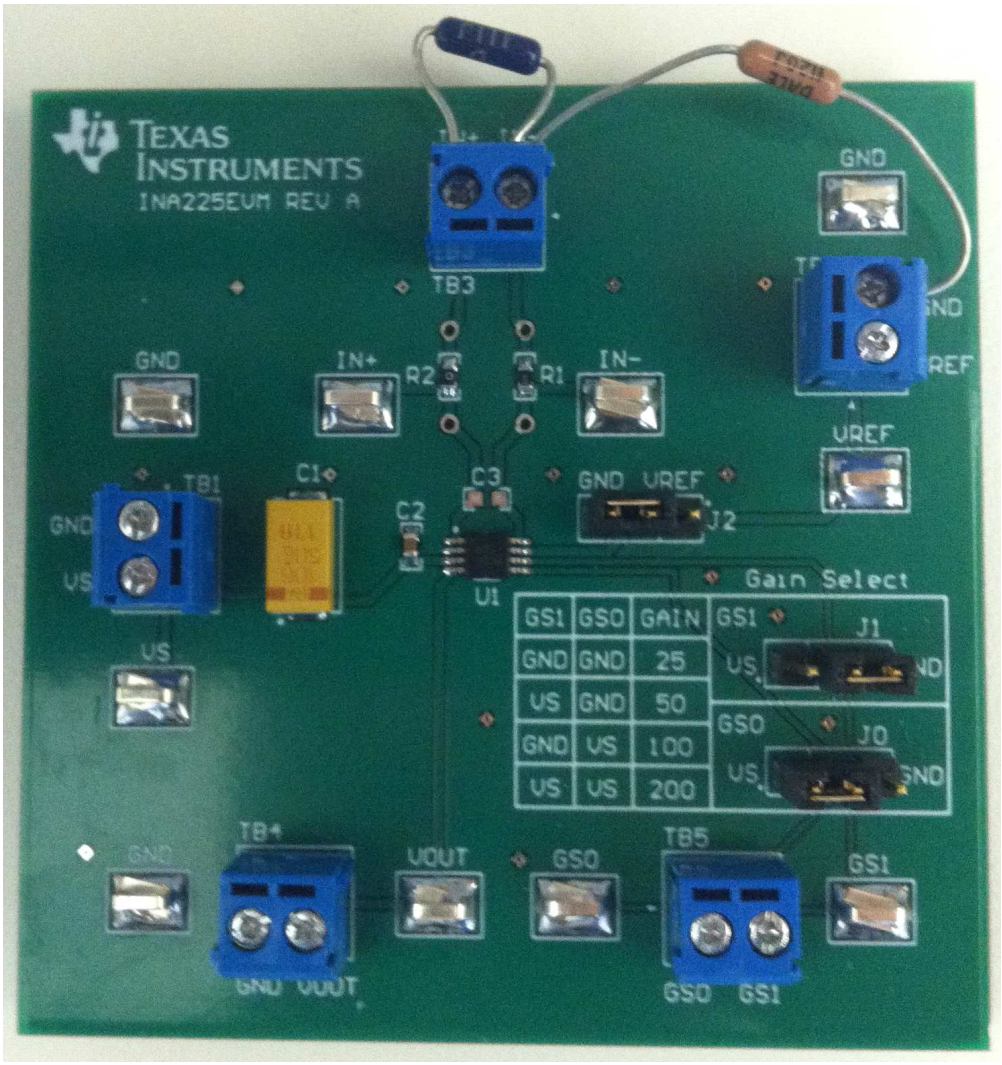


Figure 4. Basic Hardware Setup for the INA225EVM

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3.4 Applying Power

First, connect a +2.7-V to +36-V supply voltage to the VS terminal on the INA225EVM and ground the board. Next, attach a supply to IN+ and ground it. In this case, a 5-V supply is used. Finally, measure VOUT at terminal block TB4. Note that VOUT is limited by the supply voltage VS. Figure 5 shows the basic setup of the process described in this section.

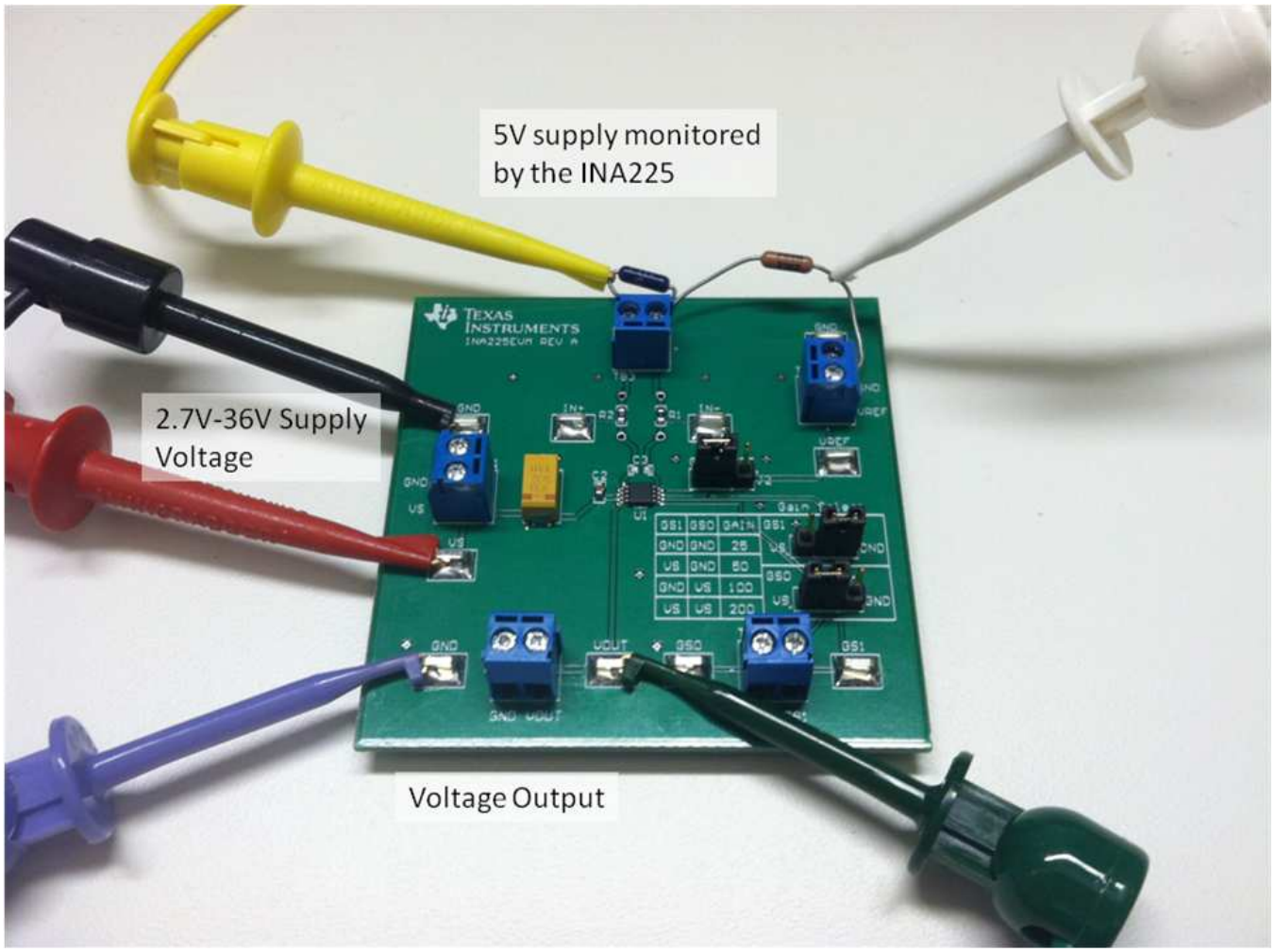


Figure 5. Basic Setup of the INA225EVM

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4 INA225EVM Documentation

This section contains the complete bill of materials and schematic diagram for the INA225EVM. Documentation information for the USB DIG platform can be found in the USB DIG Platform User's Guide (SBOU058), available at the TI web site at www.ti.com.

4.1 INA225EVM Board Schematic

Figure 6 shows the schematic for the INA225EVM board.

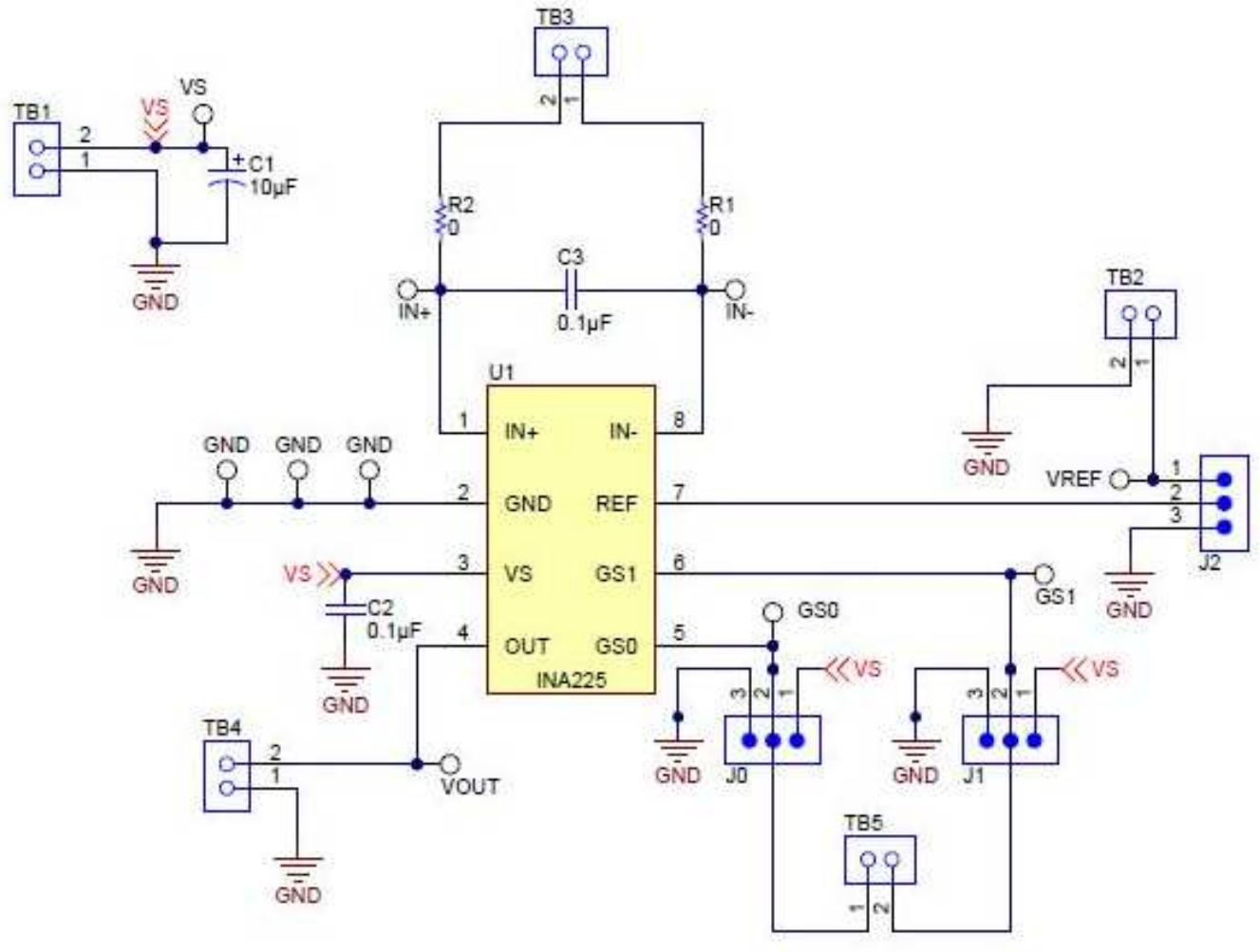


Figure 6. INA225EVM Board Schematic

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4.2 INA225EVM PCB Components Layout

Figure 7 shows the component layout for the INA225EVM board.

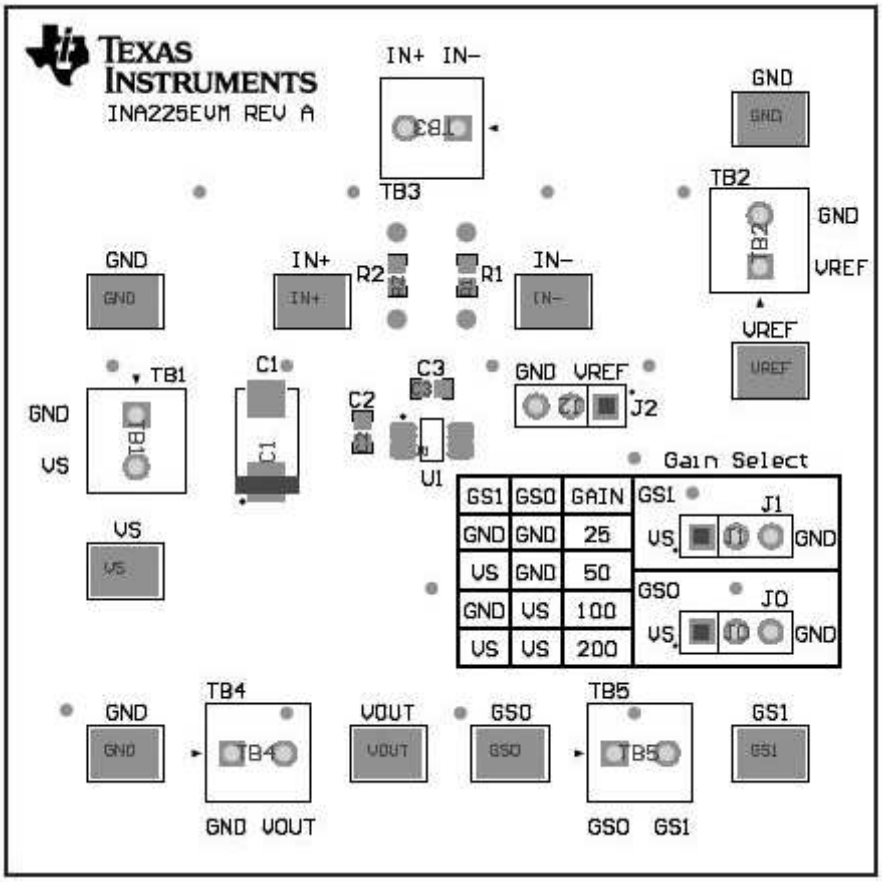


Figure 7. INA225EVM PCB Components Layout

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Figure 8 and Figure 9 show the top and bottom layer, respectively, of the EVM.

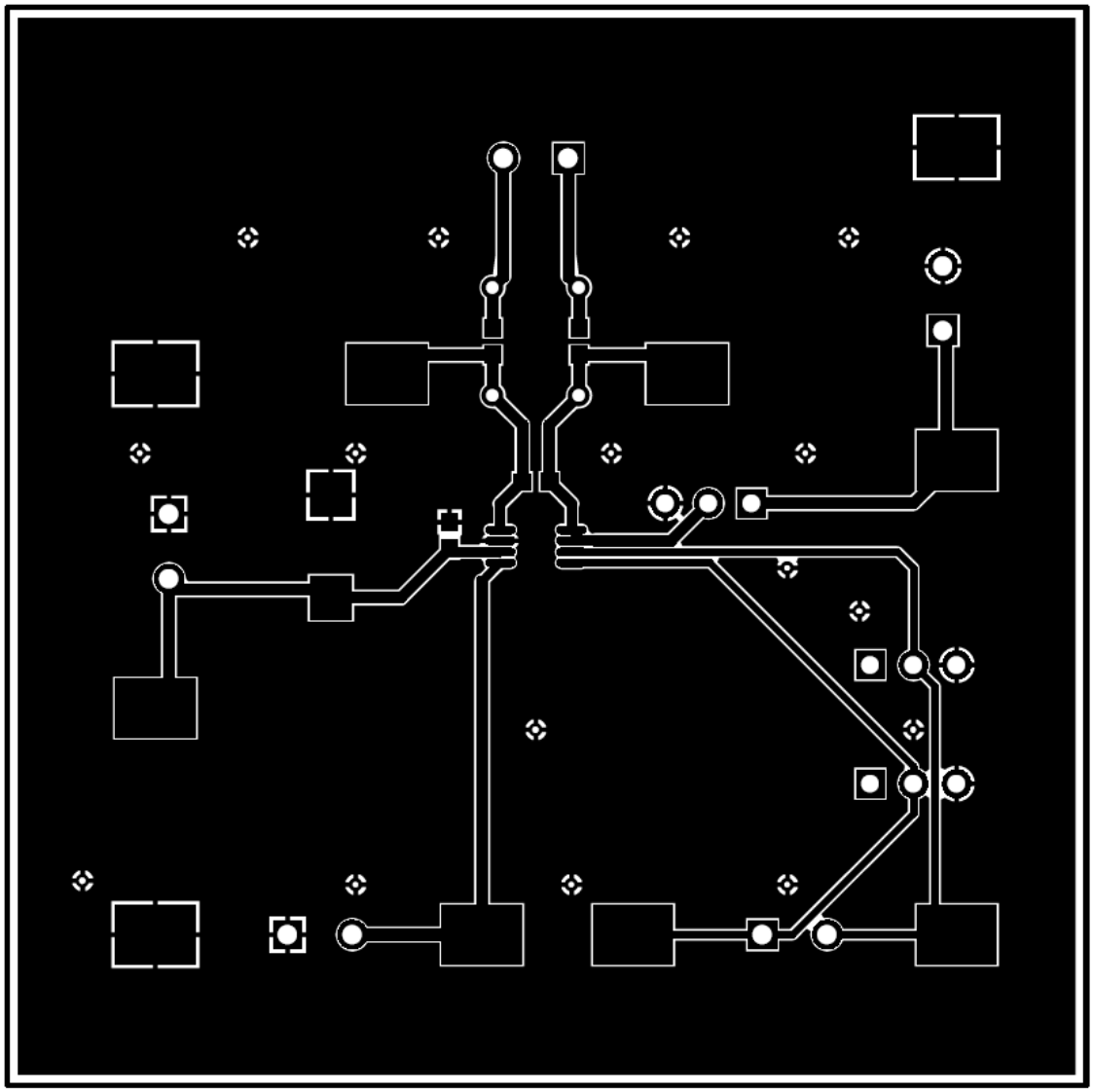


Figure 8. Top Layer

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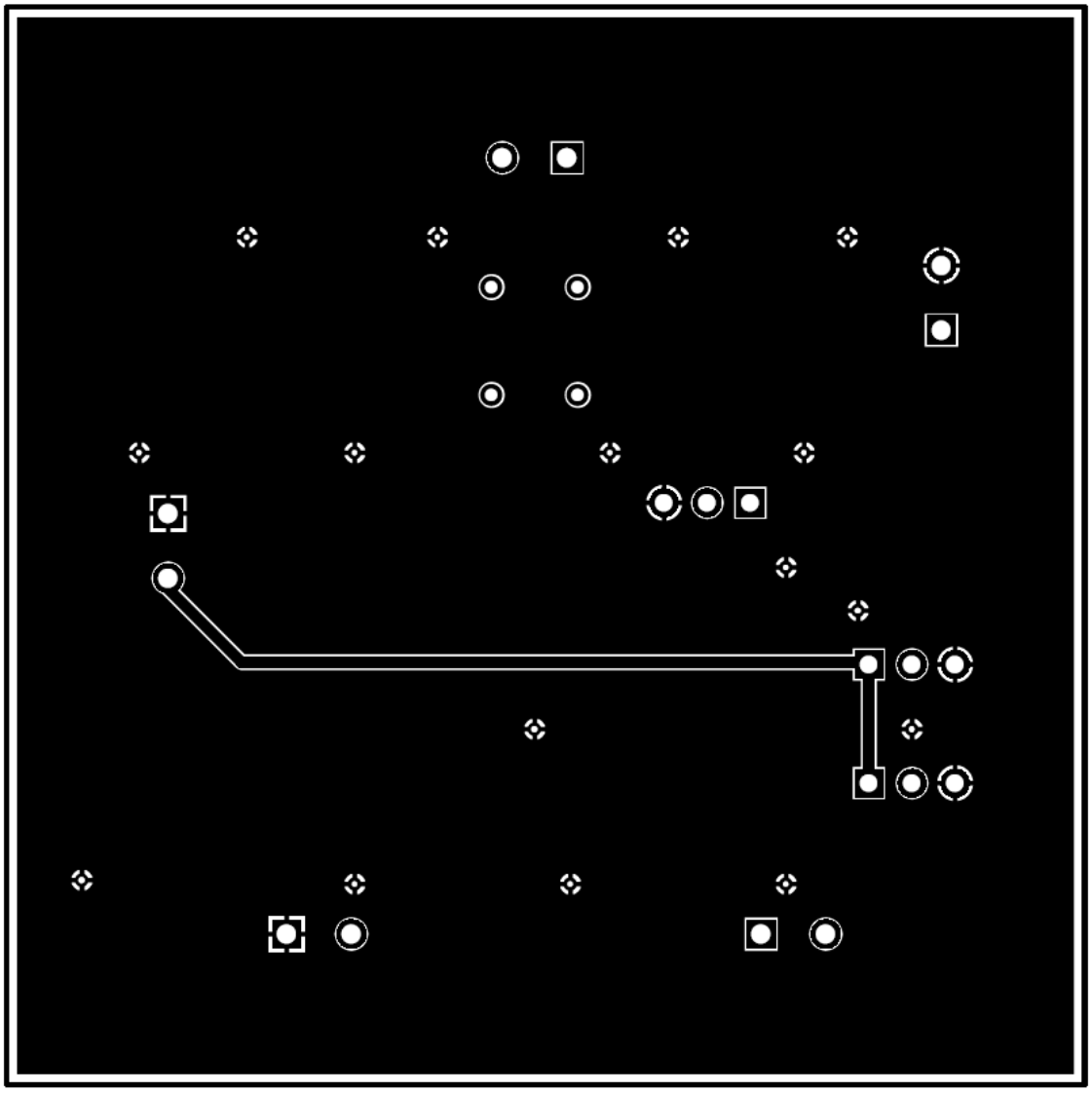


Figure 9. Bottom Layer

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4.3 INA225 Test Board Bill of Materials

Table 3 lists the bill of materials for the INA225 test board.

Table 3. INA225 Test Board Bill of Materials

Ref Des	Description	Vendor	Digi-Key Part Number	Manufacturer Part Number
R1, R2	RES 0.0 OHM 1/10W 0603 SMD	Stackpole Electronics	RMCF0603ZT0R00CT-ND	RMCF0603ZT0R00
C1	CAP TANTALUM 10UF 50V 10% SM 2917	Kermit	399-3893-1-ND	T495X106K050ATE300
C2	CAP CER .10UF 25V X7R 10% 0603	TDK Corp.	445-1316-1-ND	C1608X7R1E104K
C3	DNP	—	—	—
U1	INA225	Texas Instruments	—	—
Jumpers, all	CONN HEADER 50POS .100" SGL GOLD	Samtec	SAM1029-50-ND	TSW-150-07-G-S
Jumpers, all	SHUNT LP W/HANDLE 2 POS 30AU	Tyco Electronics	A26242-ND	881545-2
Test points, all	PC TEST POINT COMPACT SMT	Keystone Electronics	5016KCT-ND	5016
T1, T2, T3, T4	2-Block Terminal 3,5 mm	On Shore Technology Inc	ED1514-ND	ED555/2DS
Bumpons	BUMPON HEMISPHERE .50X.14 CLEAR	3M	SJ5312-7-ND	SJ-5312 (CLEAR)

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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 could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

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 its own expense.

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- 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.

Industry Canada Compliance (English)

For EVMs Annotated as IC – INDUSTRY CANADA Compliant:

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs Including Radio Transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Canada Industry Canada Compliance (French)

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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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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EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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