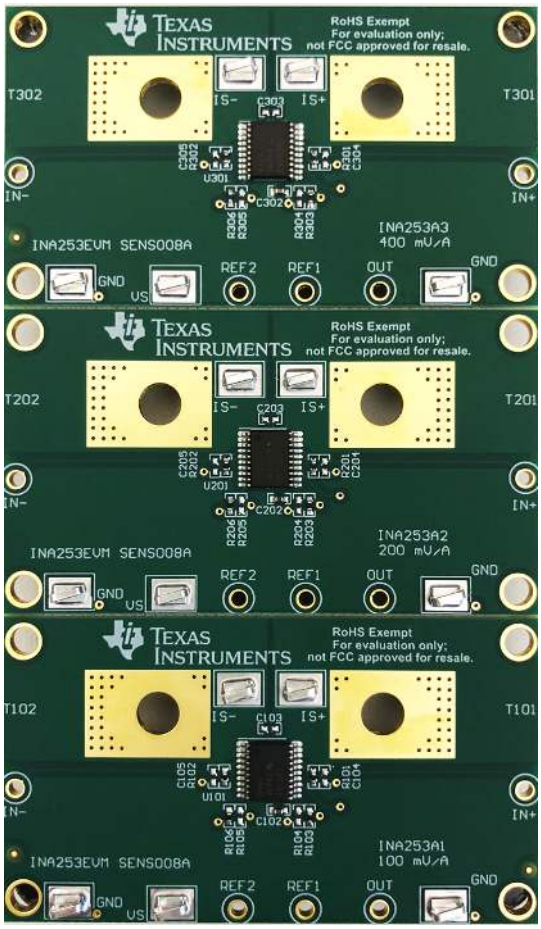
INA253EVM



This user's guide describes the characteristics, operation, and use of the INA253EVM evaluation module. The user's guide discusses how to set up and configure the hardware and reviews various aspects of the hardware operation. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the INA253EVM. This document also includes an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

Contents

List of Figures

List of Tables

Trademarks

1 Overview

The INA253 is a family of voltage-output current-shunt monitors that integrates an internal shunt resistor to enable high-accuracy current measurements. The INA253 family of devices consists of the following device versions: INA253A1, INA253A2, and INA253A3 (all referred to as INA253Ax).

The INA253EVM consists of one PCB with an option to cut out three individual PCBs. Each of the PCB cutouts consists of the INA253Ax device (where Ax is A1, A2, and A3, for boards 1 through 3, respectively), and test points for external hardware connections.

1.1 INA253EVM Kit Contents

Table 1 lists the contents of the INA253EVM kit. Contact the nearest Texas Instruments Product Information Center if any component is missing. Check the INA253 device product folder on the TI web site at www.ti.com for any further information regarding this product.

Table 1. INA253EVM Kit Contents

Item	Quantity
INA253 test board	1

1.2 Related Documentation from Texas Instruments

The following document provides information regarding Texas Instruments' integrated circuits used in the assembly of the INA253EVM. This user's guide is available from the TI web site under literature number SBOU194. 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 be 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 2. Related Documentation

Device	Literature Number
INA253	SLOS954

2 Hardware

Each of the PCBs on the INA253EVM requires a 2.7-V to 5.5-V power supply connected between the VS and GND test points.

The INA253 family of devices have an integrated shunt of value 2 mΩ between the IS+ and IS– pins. Connect a current source and an optional load in series with test points IS+ and IS–. Use a voltmeter on the OUT test point to measure the voltage output of the INA253. Keep the voltage on the IS+ and IS- in the range of –4 V to +80 V at all times.

For the following components, x = 1 to 3, respective to the INA253A1, A2, or A3 devices.

Cx02 are supply bypass capacitors for the INA253Ax.

Rx01 is a 0-Ω resistor that ties SH+ to IN+.

Rx02 is a 0-Ω resistor that ties SH– to IN–.

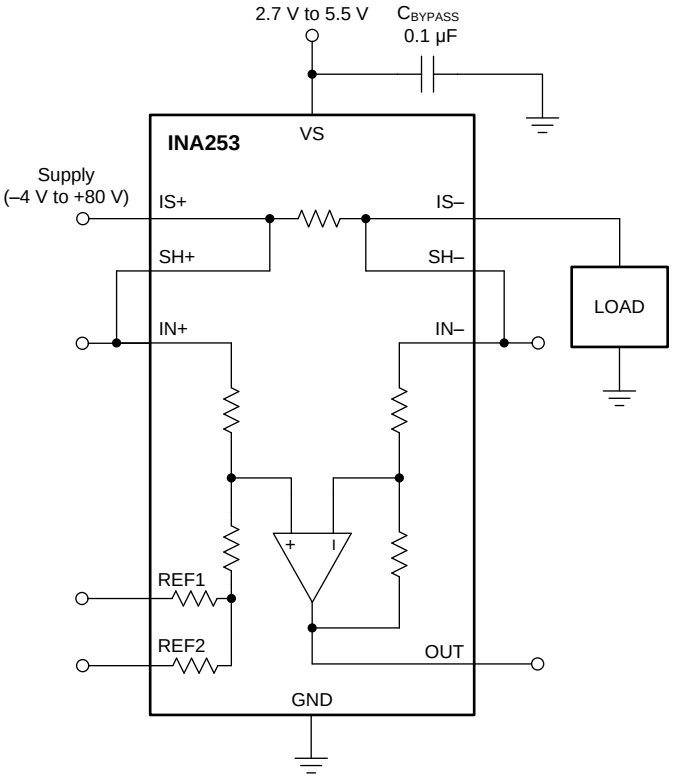
Rx03 is a 0-Ω resistor that ties REF1 to VS.

Rx06 is a 0-Ω resistor that ties REF2 to GND.

Components Rx01, Rx02, Cx03, Cx04, and Cx05 can be added or replaced to provide optional filtering of the voltages out of the SH+ and SH– pins, and into the IN+ and IN– pins of the INA253.

2.1 Theory of Operation

A block diagram of the INA253 device is shown in Figure 1. There are test points located on each of the PCB boards that access the functional pins of the device. Minimal support circuitry is included on the PCB, and can be reconfigured, removed, or bypassed as needed.



NOTE: This single block diagram is functionally equivalent for all EVM breakout boards.

Figure 1. INA253 Block Diagram

2.2 Features

The INA253EVM provides basic functional evaluation of this device family. The fixture layout is not intended for electromagnetic compatibility (EMC) testing.

The INA253EVM PCB provides the following features:

- All INA253 devices are provided
- Easy access to all pins
- Board layout and construction that supports ±15-A current through the device across the full –40°C to +85°C temperature range (see *Section 3.2*)
- Place holders on the PCB for configurations other than the default configuration

For comprehensive information about this family of current sense amplifiers, refer to the INA253 data sheet (SLOS954).

2.3 Quick-Start Setup and Use

Follow these procedures to setup and use the INA253EVM:

1. Connect an external dc supply voltage between 2.7 V and 5.5 V to the VS test point, and connect the ground reference of that supply to the GND test point.
2. Connect a current source across the IS+ and IS– test points, to provide current flowing through the integrated shunt resistor. The common-mode voltage on the IS+ and IS– pins must be between –4 V and +80 V (referenced to the GND pin).
3. The OUT pin quiescent voltage level is midsupply, and increases or decreases when there is a current load flowing through IS+ and IS–, as set up in the previous step.

2.4 Current Input

The current flowing across the IS+ and IS– pins develops a differential voltage across the 2-mΩ shunt and is amplified by the current shunt amplifier. The current flowing across this integrated shunt is multiplied by the current gain of the INA253A1 (100 mV/A), INA253A2 (200 mV/A), or INA253A3 (400 mV/A). Do not use this integrated shunt resistor as a stand-alone component. See the *Integrated Shunt Resistor* section of the INA253 data sheet (SLOS954) for more information.

3 Schematic, PCB Layout, and Bill of Materials

3.1 Schematic

Figure 2 shows the complete schematic of the INA253Ax test board. The functional pins are accessed through test points. The IS+ and IS– pins are shorted to VIN+ and VIN– using 0-Ω resistors, respectively. The reference pins are in the split supply configuration through installed 0-Ω resistors Rx03 and Rx06.

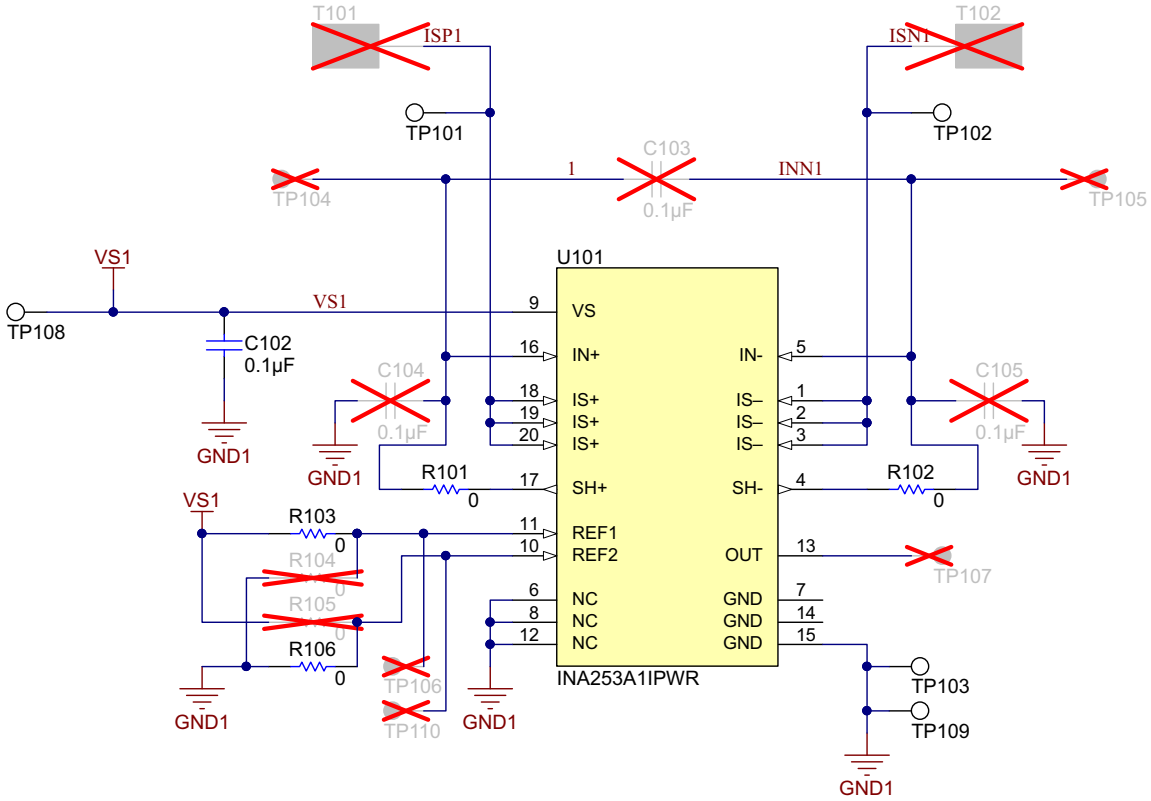


Figure 2. INA253Ax Test Board Schematic

3.2 PCB Layout

Figure 3 shows the component placement on the top overlay of the test board. The two-layer EVM PCB measures 2.4-in × 4.2-in and is fabricated with a 1-oz copper pour. The bottom layer has no components but contains a solid copper ground plane that provides a low-impedance path for return currents.

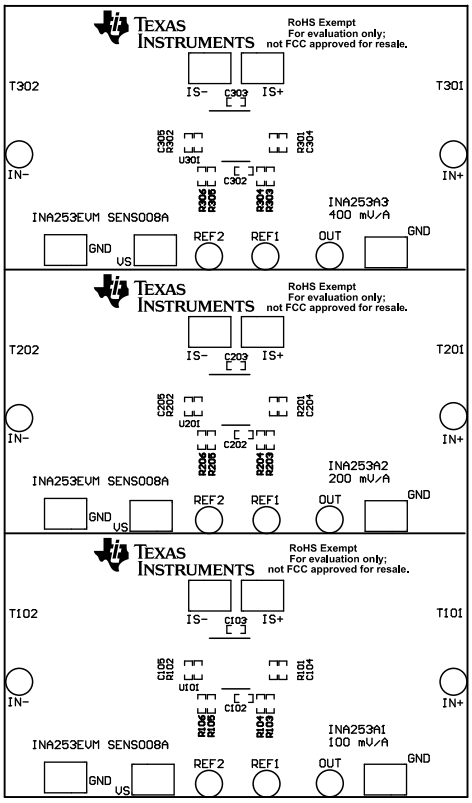


Figure 3. PCB Top Overlay

The top layer of the PCB consists of power planes tied to the IS+ and IS– pins. The INA253 is rated to support a 15-A continuous current over temperature. Enhance the current handling capability by using proper layout techniques that facilitate heat dissipation. Combine the large power planes at the IS+ and IS– pins. Use a 2-oz copper pour to improve the heat-dissipation capabilities, and thus increase the continuous-load current capacity.

Using the INA253EVM board with this robust layout and airflow, the INA253 device safely accommodates up to 15 A of current over the entire –40°C to +85°C temperature range. Figure 4 and Figure 5 show the top and bottom layers, respectively, of the test board.

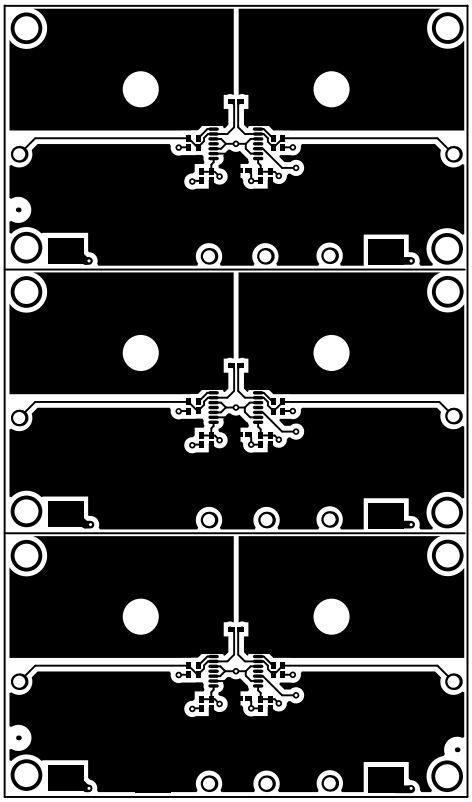


Figure 4. PCB Top Layer

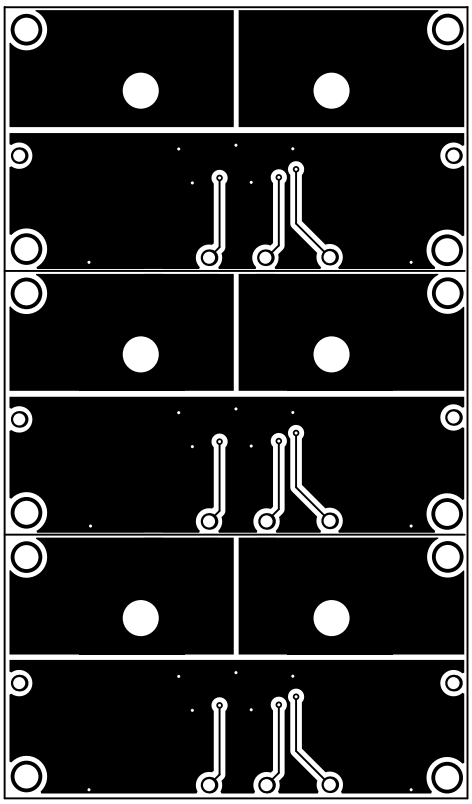


Figure 5. PCB Bottom Layer

3.3 Bill of Materials

Table 3 lists the bill of materials (BOM) for the INA253EVM.

Table 3. Bill of Materials

Quantity	Designator	Description	PartNumber	Manufacturer
3	C102, C202, C302	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R, 0402	GRM155R71C104KA88D	MuRata
4	H13, H14, H15, H16	Bumpon, Hemisphere, 0.375 X 0.235, Black	SJ61A2	3M
12	R101, R102, R103, R106, R201, R202, R203, R206, R301, R302, R303, R306	RES, 0, 5%, 0.063 W, 0402	ERJ-2GE0R00X	Panasonic
15	TP101, TP102, TP103, TP108, TP109, TP201, TP202, TP203, TP208, TP209, TP301, TP302, TP303, TP308, TP309	Test Point, Compact, SMT	5016	Keystone
1	U101	Low- or High-Side, Bidirectional, Zero-Drift, Current-Shunt Monitor with Integrated Precision Low Inductive Shunt Resistor, PW0020A (TSSOP-20)	INA253A1IPWR	Texas Instruments
1	U201	Low- or High-Side, Bidirectional, Zero-Drift, Current-Shunt Monitor with Integrated Precision Low Inductive Shunt Resistor, PW0020A (TSSOP-20)	INA253A2IPWR	Texas Instruments
1	U301	Low- or High-Side, Bidirectional, Zero-Drift, Current-Shunt Monitor with Integrated Precision Low Inductive Shunt Resistor, PW0020A (TSSOP-20)	INA253A3IPWR	Texas Instruments

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      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.

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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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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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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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