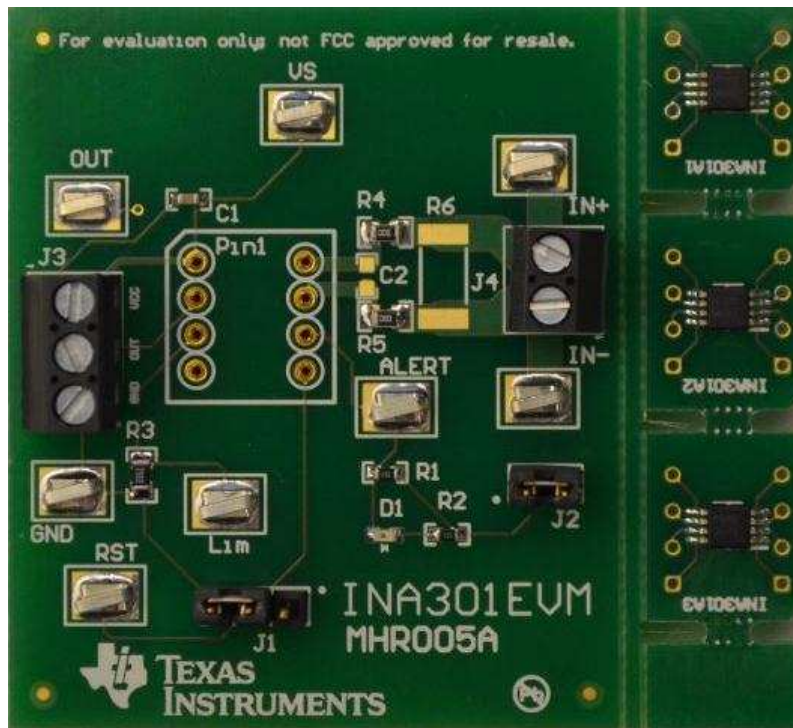


INA301EVM User's Guide



This user's guide describes the characteristics, operation, and use of the INA301EVM evaluation module. This guide discusses how to set up and configure the hardware. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the *INA301EVM*. This document also includes an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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1 Overview

The [INA301](#) is a high- or low-side, current-shunt monitor with an analog output and an open-drain comparator. The integrated comparator features an adjustable threshold that is set using an external limit-setting resistor. The INA301EVM has four PCBs and a PDIP receptacle for accepting the INA301 device attached to coupon boards. All three gain versions are supplied within this EVM package. The EVM also consists of screw-terminals and test points for external hardware connections, placeholder pads to add components for filtering, surface-mount resistors for ease of adjusting the comparator threshold, a jumper to change comparator mode by connecting RESET pin to either VS or GND, and a jumper for enabling or disabling the LED light that is connected to the ALERT pin.

1.1 INA301EVM Kit Contents

[Table 1](#) summarizes the contents of the INA301EVM kit. The included hardware is pictured on the front page. Contact the nearest [Texas Instruments Product Information Center](#) if any component is missing. Make sure to check the [INA301 product folder](#) on the TI web site at www.ti.com for any further information regarding this product.

Table 1. INA301EVM Kit Contents

Item	Quantity
INA301EVM test board	1
INA301A1 coupon board	1
INA301A2 coupon board	1
INA301A3 coupon board	1

1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments' integrated circuits used in the assembly of the INA301EVM. This user's guide is available from the TI web site under literature number [SBOU154](#). 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 (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

Document	Literature Number
INA301 product data sheet	SBOS713

2 INA301EVM Hardware

The INA301EVM requires a 2.7-V to 5.5-V power supply. Connect the VIN+ and VIN– pins across an external shunt resistor in series with a 0-V to 36-V supply to determine the current flowing through that resistor. Use a voltmeter on the OUT pin to measure the voltage output and on the ALERT pin to determine the comparator output. The comparator threshold is set with a resistor. The open-drain comparator output is pulled up to VS and there is also a red LED light that serves as a visual indicator of a tripped comparator.

2.1 Theory of Operation for the INA301EVM

A block diagram of the INA301EVM test board hardware is shown in Figure 1. The INA301 test board contains eight test points, providing access to all eight pins of the INA301 for evaluation. Two terminal blocks also provide additional convenient connection to the DUT pins. Support circuitry is included on the PCB but can be removed or bypassed if needed.

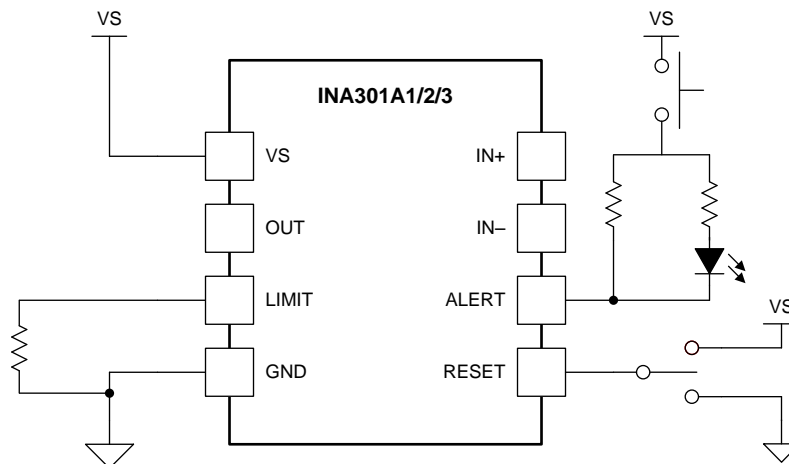


Figure 1. INA301EVM Test Board Block Diagram

2.2 INA301EVM Features

The INA301EVM provides basic functional evaluation of the INA301. The fixture layout is not intended to be a model for the target circuit, nor is it laid out for electromagnetic compatibility (EMC) testing.

The layout of the INA301EVM printed circuit board (PCB) is designed to provide the following features:

- Ease of access to all device pins
- Multiple input signal options
- Space for optional input filtering capacitors and resistors
- A threshold limit resistor for setting comparator input threshold
- A jumper reset for the comparator
- Visual LED indicator of the comparator output with the option to be enabled/disabled through a jumper.

The INA301EVM allows connection to both sides of a remote shunt resistor to measure current, or omit the shunt resistor and apply a differential voltage directly to the device inputs. This flexibility allows the testing of device operation in a simulated manner, as well as an actual application.

See the [product data sheet](#) for comprehensive information about the [INA301](#) family of devices.

2.3 Quick-Start Setup and Use

Follow these procedures to set up and use the INA301EVM:

1. Connect an external dc supply voltage between 2.7 V and 5.5 V to the J3-1 terminal.
2. Connect the desired input to the J4 terminal. This input is either a remote shunt resistor or a differential voltage source with a common-mode voltage of 0 V to 36 V referenced to GND.

2.4 Voltage Inputs

The J4 terminal (VIN+ and VIN-) is used to connect to a remote shunt resistor or a differential voltage source. The voltage differential is multiplied by the 20-V/V device gain of the INA301A1. Other devices in this family are the INA301A2 with 50-V/V gain and the INA301A3 with 100-V/V gain. The full-scale sense input voltage (V_{SENSE}) is defined as $V_{\text{IN}+} - V_{\text{IN}-}$, and has a maximum input of $(V+ - 0.20) / \text{gain}$ in order to achieve linear output. The minimum voltage output is 10 mV.

2.5 Comparator Trip Point

The integrated comparator in the INA301 has a resistor programmable threshold. Connecting an appropriately sized resistor on the LIMIT pin sets up the comparator threshold. Adjust R3 (see [Figure 2](#)) to set the comparator trip point for the intended application. The EVM comes with $R3 = 31.6 \text{ k}\Omega$, which produces a comparator threshold of $80 \mu\text{A} \times 31.6 \text{ k}\Omega = 2.528 \text{ V}$.

For example, if measuring current across a 10-m Ω shunt resistor (and the comparator must be tripped if an excess of 10 A is measured), then $10 \text{ A} \times 10 \text{ m}\Omega = 100 \text{ mV}$, and $100 \text{ mV} \times 20 \text{ V/V gain} = 2 \text{ V}$. To achieve a comparator threshold of 2 V, select R3 so that $R3 \times 80 \mu\text{A} = 2 \text{ V}$. A simple calculation indicates $R3 = 25 \text{ k}\Omega$.

3 Schematic, PCB Layout, and Bill of Materials

3.1 Schematic

Figure 2 shows the complete schematic of the INA301 test board. R3 sets up the voltage threshold of the comparator. R1 is a pullup resistor for the open-drain comparator output pin. D1 is connected to the comparator output pin, and is a visual indicator of an alert condition. D1 can be disabled by disconnecting jumper J2. Use jumper J1 to configure the comparator mode. Install J1 at position 3-2 for transparent mode comparison output and at position 2-1 for latched mode comparison output. C1 is a bypass capacitor for VS. C2 along with R4 and R5 creates an optional filter for the VIN+ and VIN- inputs. R6 is an optional shunt resistor for the INA input.

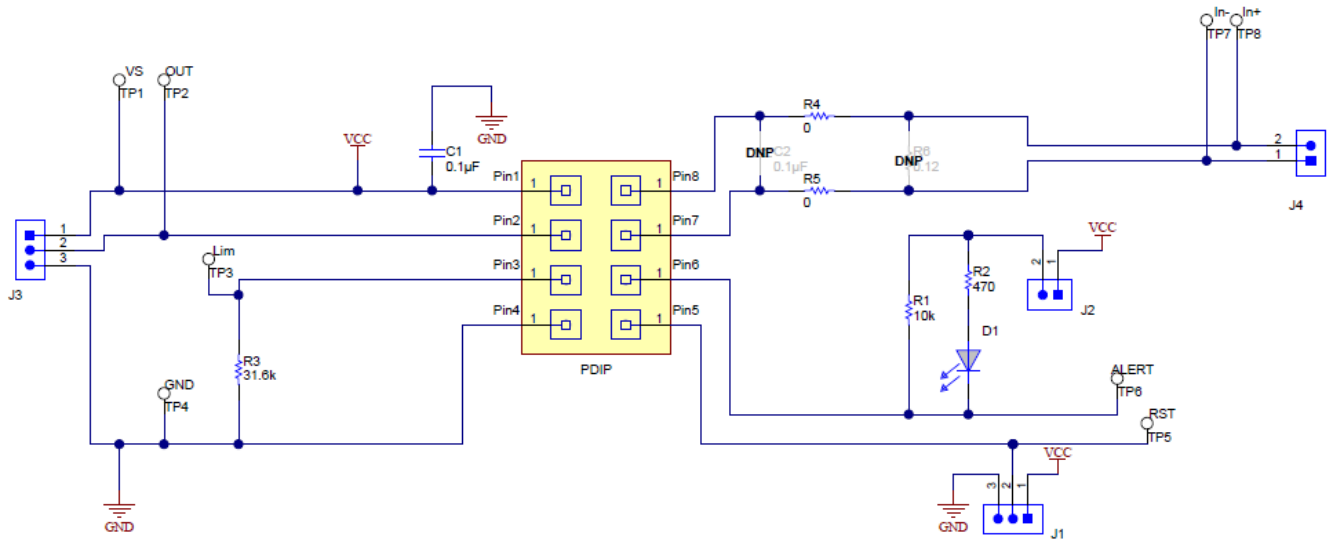


Figure 2. INA301EVM Test Board Schematic

3.2 PCB Layout

Figure 3 shows the component placement on the INA301EVM test board. There are no components on the bottom layer. Figure 4 and Figure 5 illustrate the top and bottom layers, respectively, of the test board.

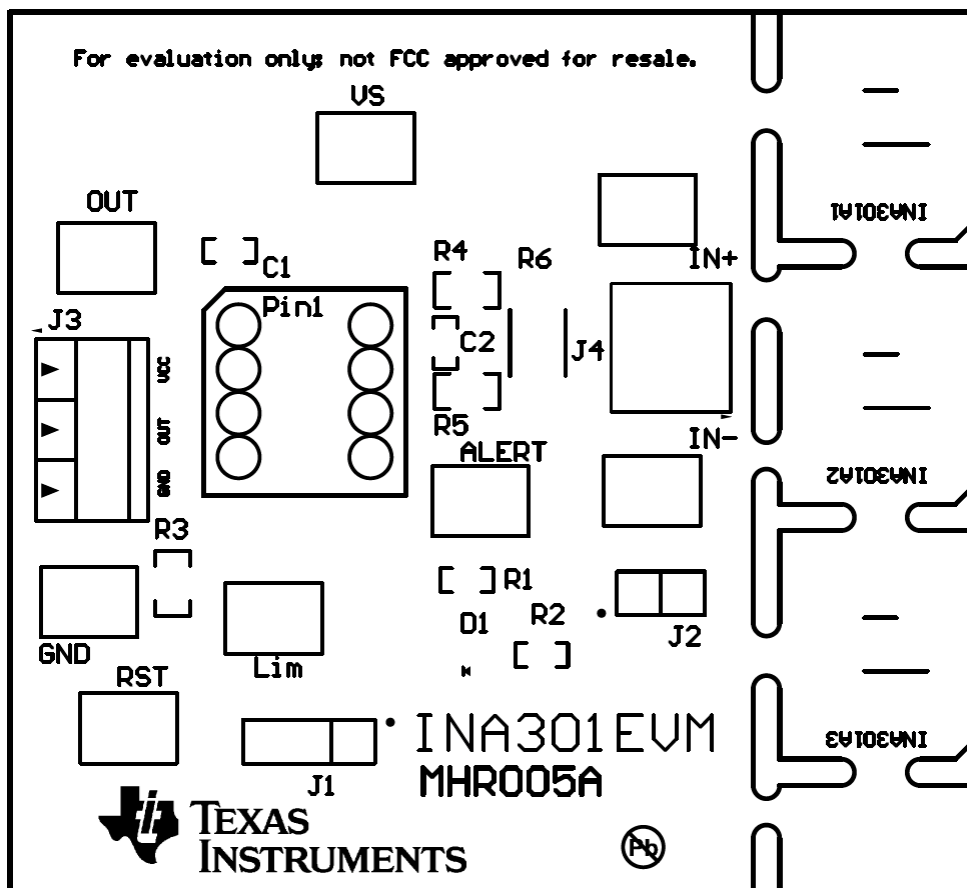


Figure 3. INA301EVM Component Placement

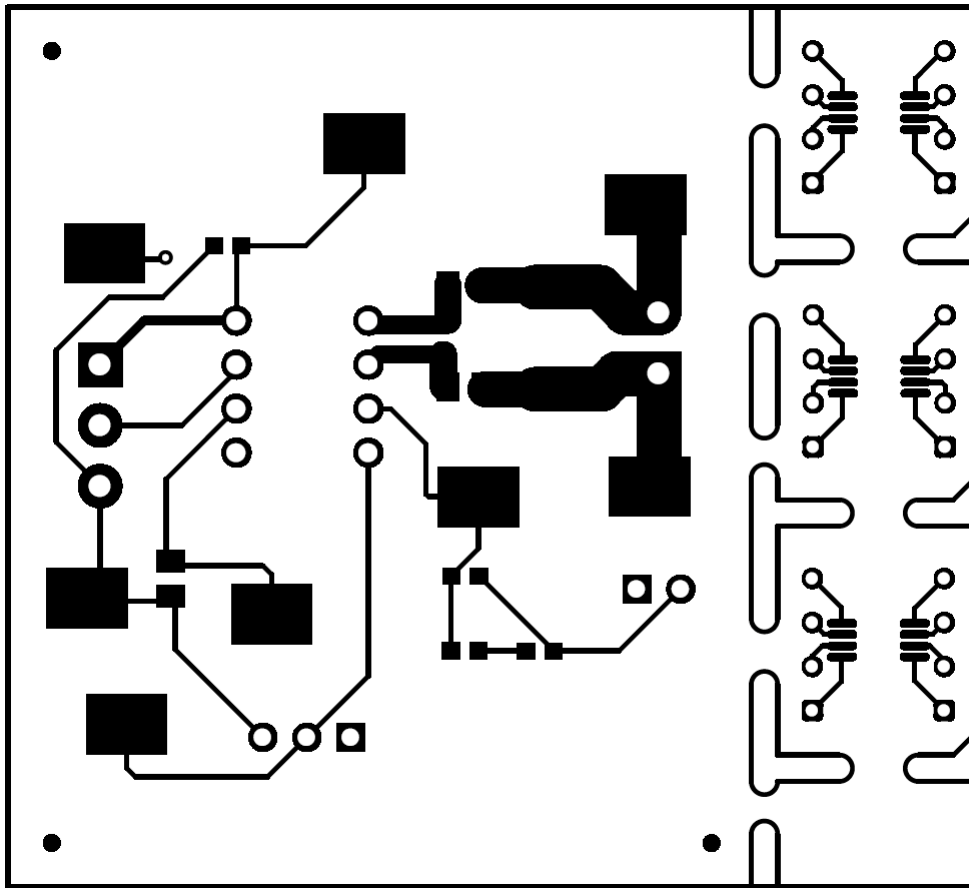


Figure 4. PCB Top Layer

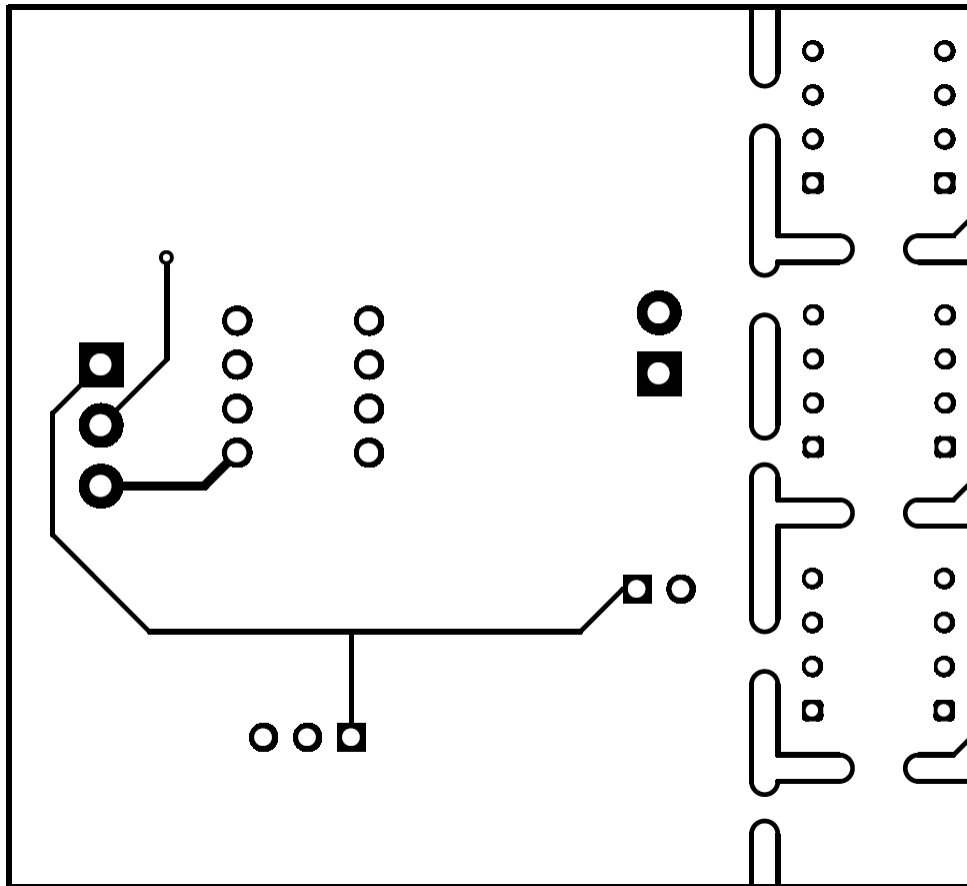


Figure 5. PCB Bottom Layer

3.3 Bill of Materials

Table 3 lists the bill of materials (BOM) for the INA301 test board.

Table 3. INA301 Test Board BOM

Qty	RefDes	Description	Part Number	MFR
8	RST, LIM, OUT, GND, V+, VIN+, VIN-, ALERT	Test Point, Compact, SMT	5016	Keystone
1	C1	CAP, CERM, 0.1 μ F, 16 V, +/- 5%, X7R, 0603	0603YC104JAT2A	AVX Corp.
1	D1	Diode, LED, Red, 2.1-V, 20-mA, 6-mcd	LTST-C190CKT	Lite On
4	H9-H12	Bumpon, Hemisphere, 0.44 X 0.20, Clear	SJ-5303 (CLEAR)	3M
1	J1	Header, 100mil, 3x1, Gold, TH	TSW-103-07-G-S	Samtec
1	J2	Header, 100mil, 2x1, Gold, TH	TSW-102-07-G-S	Samtec
1	J3	Terminal Block, 6A, 3.5mm Pitch, 3-Pos, TH	ED555/3DS	On-Shore Technology
1	J4	Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	ED555/2DS	On-Shore Technology
6	J5-J10	Header, 100mil, 4x1, Gold, TH	342-10-104-00-591000	Mill-Max
8	J11-J18	Socket, 1x1, Height 4.27mm, TH	50935	TE Connectivity
1	R1	RES, 10 k, 5%, 0.1 W, 0603	CRCW060310K0JNEA	Vishay-Dale
1	R2	RES, 470, 5%, 0.1 W, 0603	CRCW0603470RJNEA	Vishay-Dale
1	R3	RES, 31.6 k, 1%, 0.125 W, 0805	CRCW080531K6FKEA	Vishay-Dale
2	R4, R5	RES, 0, 5%, 0.125 W, 0805	ERJ-6GEY0R00V	ERJ-6GEY0R00V
1	U2	High- or Low-Side Current-Sense Amplifier with High-Speed Comparator, DGK0008A	INA301A1IDGKR	Texas Instruments
1	U3	High- or Low-Side Current-Sense Amplifier with High-Speed Comparator, DGK0008A	INA301A2IDGKR	Texas Instruments
1	U4	High- or Low-Side Current-Sense Amplifier with High-Speed Comparator, DGK0008A	INA301A3IDGKR	Texas Instruments

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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.

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