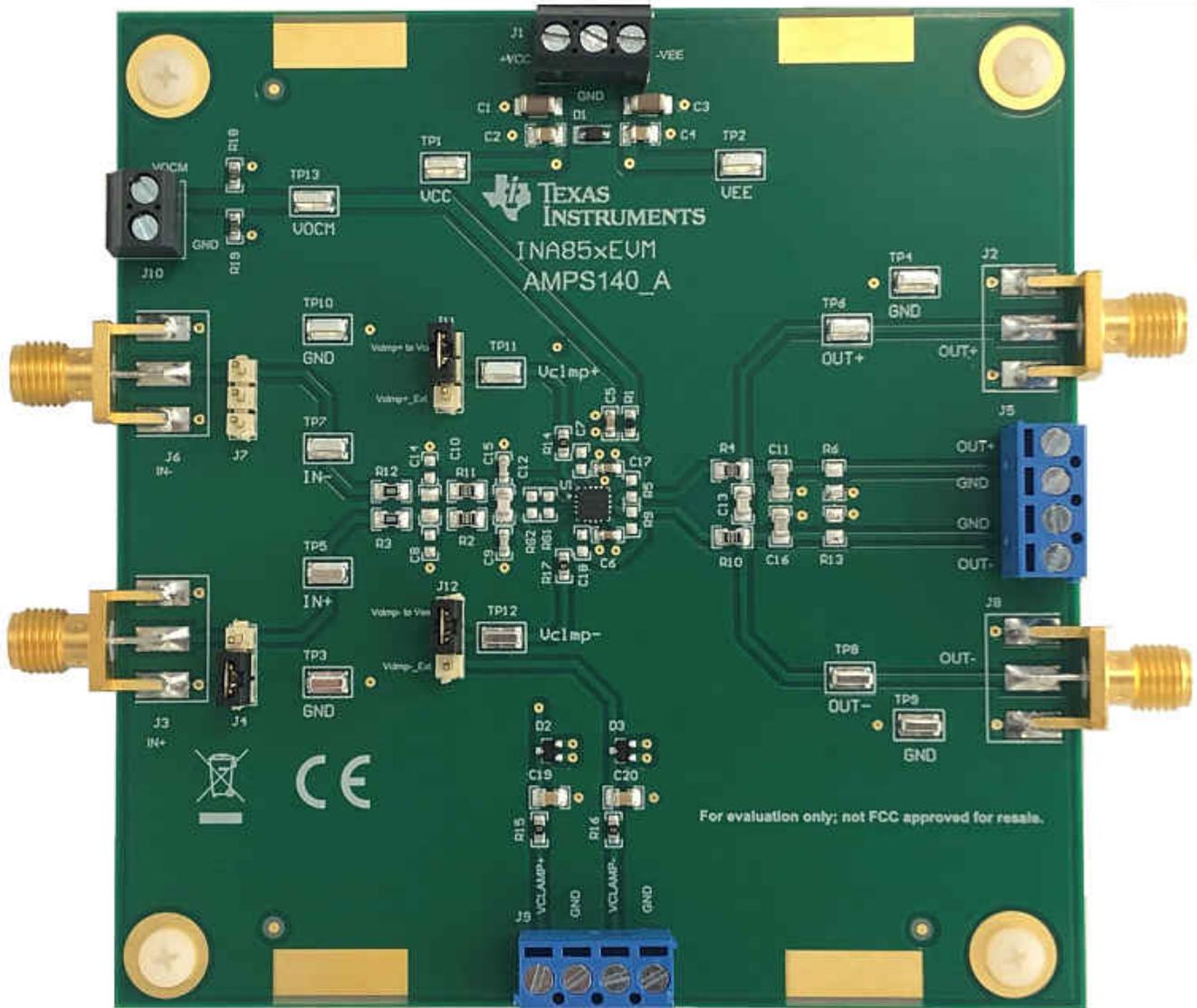


# User's Guide

## INA851 Evaluation Module



### ABSTRACT



This user's guide contains information and support documentation for the INA851 evaluation module (EVM). Included are the circuit description, jumper settings, required connections, printed circuit board (PCB) layout, schematic, and bill of materials of the INA851EVM. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the INA851EVM.

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## Trademarks

All trademarks are the property of their respective owners.

## 1 Overview

The [INA851](#) is a high-precision instrumentation amplifier with differential outputs that is optimized to drive high-performance analog-to-digital converters (ADCs) with fully differential inputs. A single external resistor sets any gain from 0.2 V/V to 10,000 V/V. The device features super-beta input transistors from Texas Instruments, which provide ultra-low input offset voltage, offset drift, input bias current, input voltage noise, and current noise. For a full list of electrical characteristics for the INA851, see the [INA851 Precision, Fully Differential Output, Instrumentation Amplifier data sheet](#).

### 1.1 Related Documentation

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the INA851EVM. This user's guide is available from the TI website under literature number SBOU273. 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 the TI website at <https://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 1-1. Related Documentation**

Device	Literature Number
<a href="#">INA851</a>	<a href="#">SBOS999</a>

### 1.2 Electrostatic Discharge Caution

**CAUTION**

Many of the components on the INA851EVM 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.

### 1.3 Hot Surface Warning

**WARNING**

Device can become hot under high-current conditions. Take care when handling the EVM.

## 2 EVM Circuit Description

This EVM provides access to the features and measures the performance of the INA851. By default, the INA851EVM instrumentation amplifier is configured to a gain of 1 V/V. The evaluation board provides optional footprints for gain resistors RG1 and RG2 to modify the input-stage instrumentation-amplifier gain. Optional footprints R5 and R9 can be populated with 0-Ω jumpers to set the output stage gain to 0.2 V/V.

The INA851 incorporates features that simplify interfacing to a fully-differential ADC. The V<sub>OCM</sub> connector sets the output common-mode voltage. If the V<sub>OCM</sub> connector is not driven, the output common-mode voltage defaults to the INA851 midsupply value. Clamp pins are provided to limit the INA851 output voltage level, which can be applied to the ADC inputs. The output clamp pins, V<sub>CLAMP+</sub> and V<sub>CLAMP-</sub>, are accessible using connector J9. Selectable jumpers J11 and J12 set the output clamp voltage level to the INA851 supplies (default), or to external voltages using connector J9.

Revision A of the INA851EVM allows access to the FDA\_IN- and FDA\_IN+ pins with optional capacitors C7 and C18. These capacitors are in parallel with the INA851 output stage internal feedback resistors to implement noise filtering. A simplified block diagram of the INA851EVM is displayed in Figure 2-1. For a full schematic of the INA851EVM, see Figure 7-1.

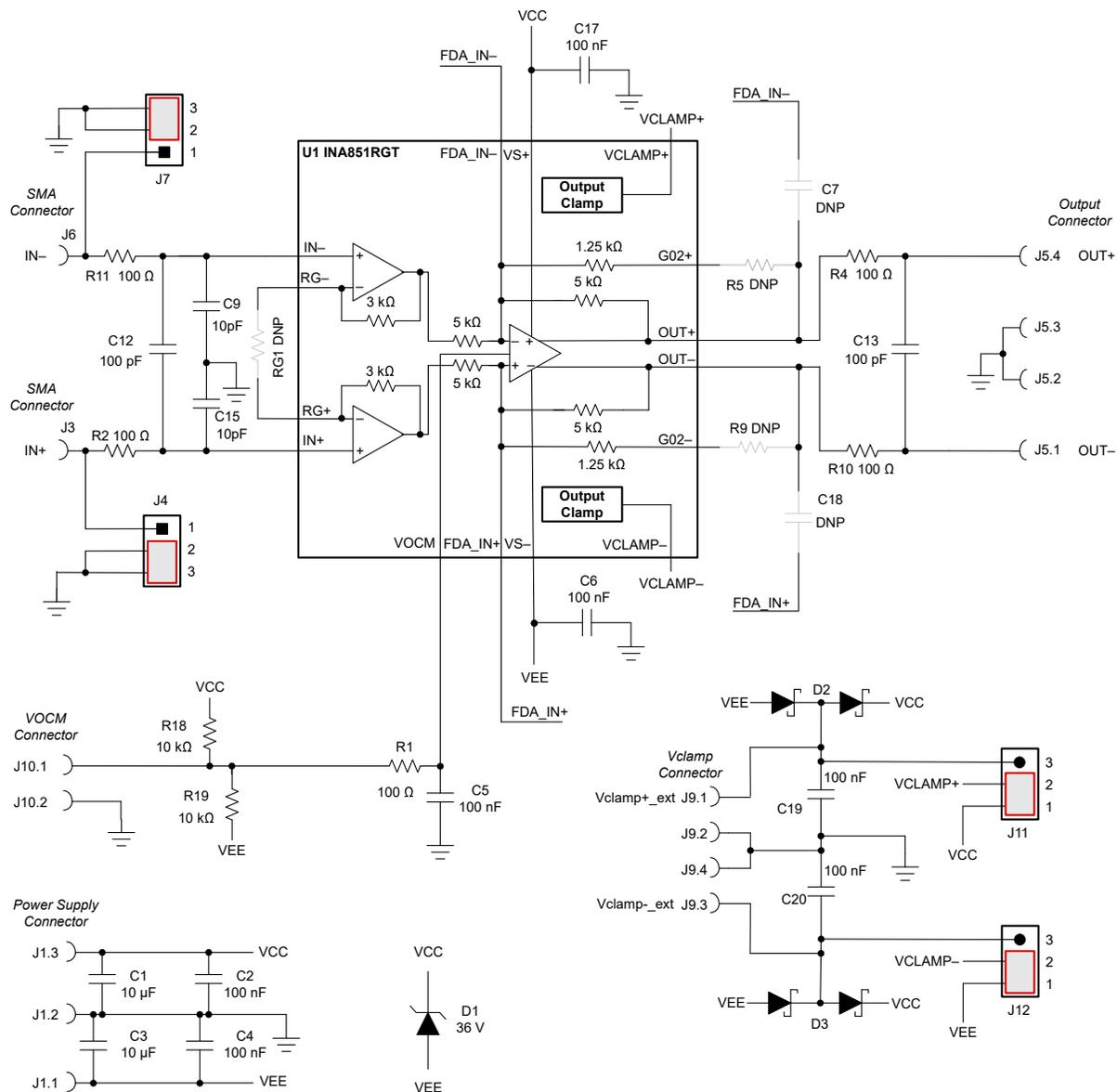


Figure 2-1. INA851EVM Simplified Schematic

### 3 Jumper Settings

Figure 3-1 details the default jumper settings of the INA851EVM. Table 3-1 explains the configuration for these jumpers.

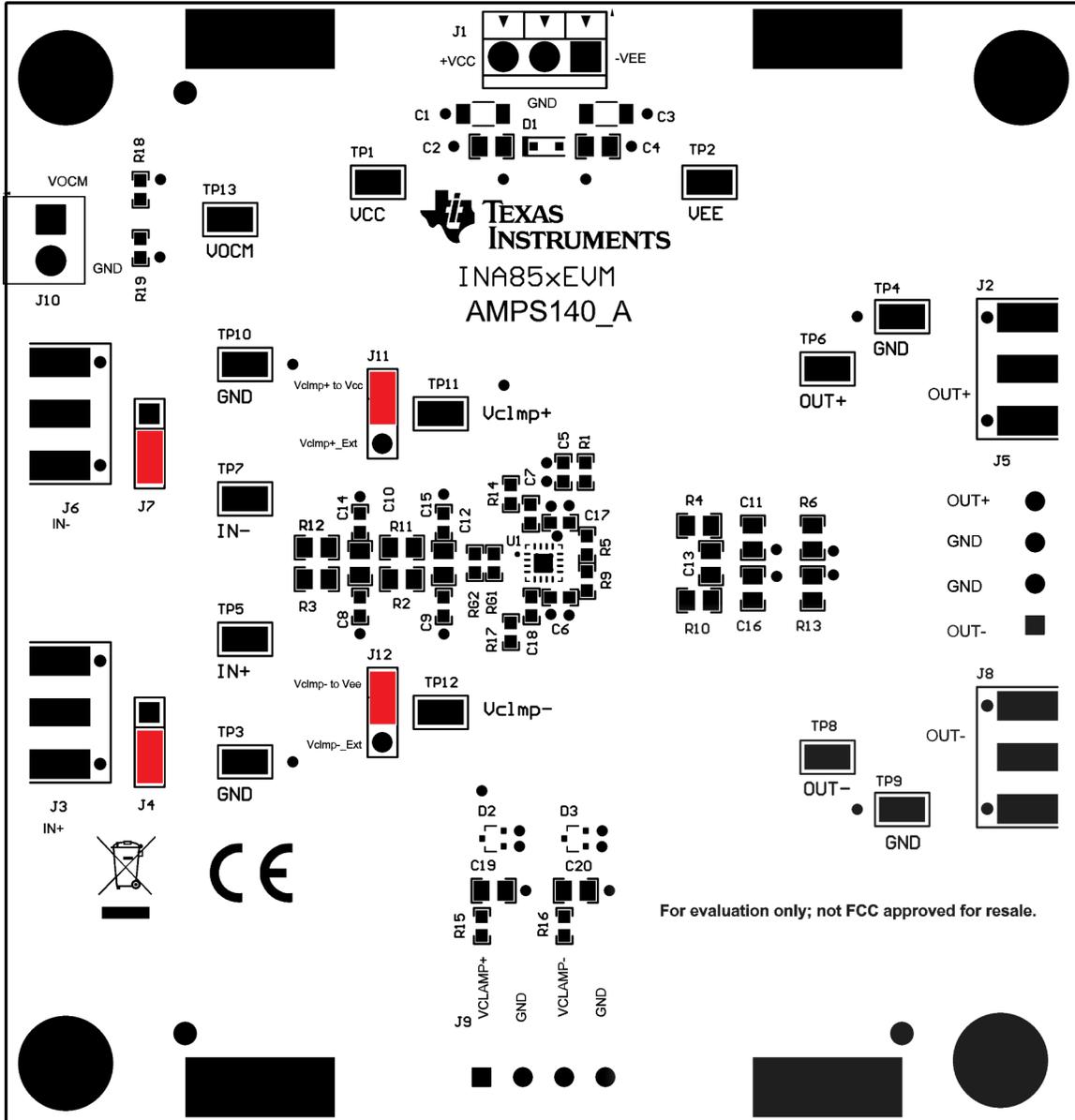


Figure 3-1. INA851EVM Default Jumper Settings

Table 3-1. Default Jumper Configuration

Jumper	Function	Default Position	Description
J4	Positive (noninverting) input, IN+	Shunt 2-3	Shunt 2-3: Input signal to SMA connector J3 Shunt 1-2 connects IN+ to GND
J7	Negative (inverting) input, IN-	Shunt 2-3	Shunt 2-3: Input signal to SMA connector J6 Shunt 1-2 connects IN- to GND
J11	VCLAMP+ connection	Shunt 1-2	Shunt 1-2: Sets level of output VCLAMP+ to +VCC supply Shunt 2-3 connects VCLAMP+ to external connector J9 pin 3
J12	VCLAMP- connection	Shunt 1-2	Shunt 1-2: Sets level of output VCLAMP-to-VEE supply Shunt 2-3 connects VCLAMP- to external connector J9 pin 1

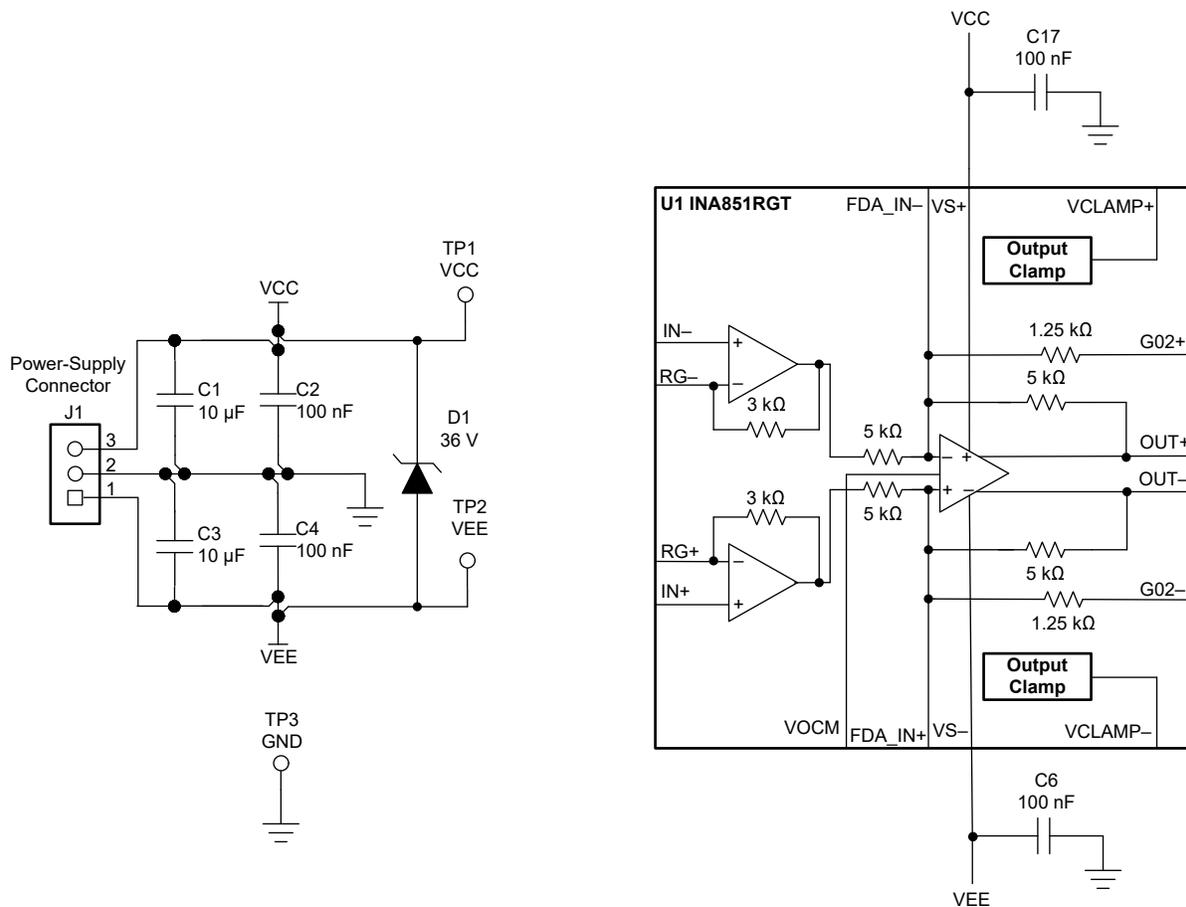
## 4 Power-Supply Connections

The power-supply connections for the INA851EVM are provided through connector J1 at the top of the EVM. The positive power-supply connection is labeled +VCC, the negative power-supply connection is labeled -VEE, and the ground connection is labeled GND. To connect power to the INA851EVM, insert wires into each terminal of J1 and then tighten the screws to make the connection. Table 4-1 summarizes the pin definition for supply connector J1 and the allowed voltage range for each supply connection.

**Table 4-1. INA851EVM Supply-Range Specifications**

Pin Number	Supply Connection	Voltage Range
J1.3	Positive supply (+VCC)	Single supply, $V_S = (+VCC)$ : 8 V to 36 V Dual supply, $V_S = (+VCC) - (-VEE)$ : 4 V to 18 V
J1.2	Ground	0 V
J1.1	Negative supply (-VEE)	Single supply, $V_S = (+VCC)$ : 0 V (GND) Dual supply, $V_S = (+VCC) - (-VEE)$ : -4 V to -18 V

Figure 4-1 shows the INA851EVM voltage supply connections.



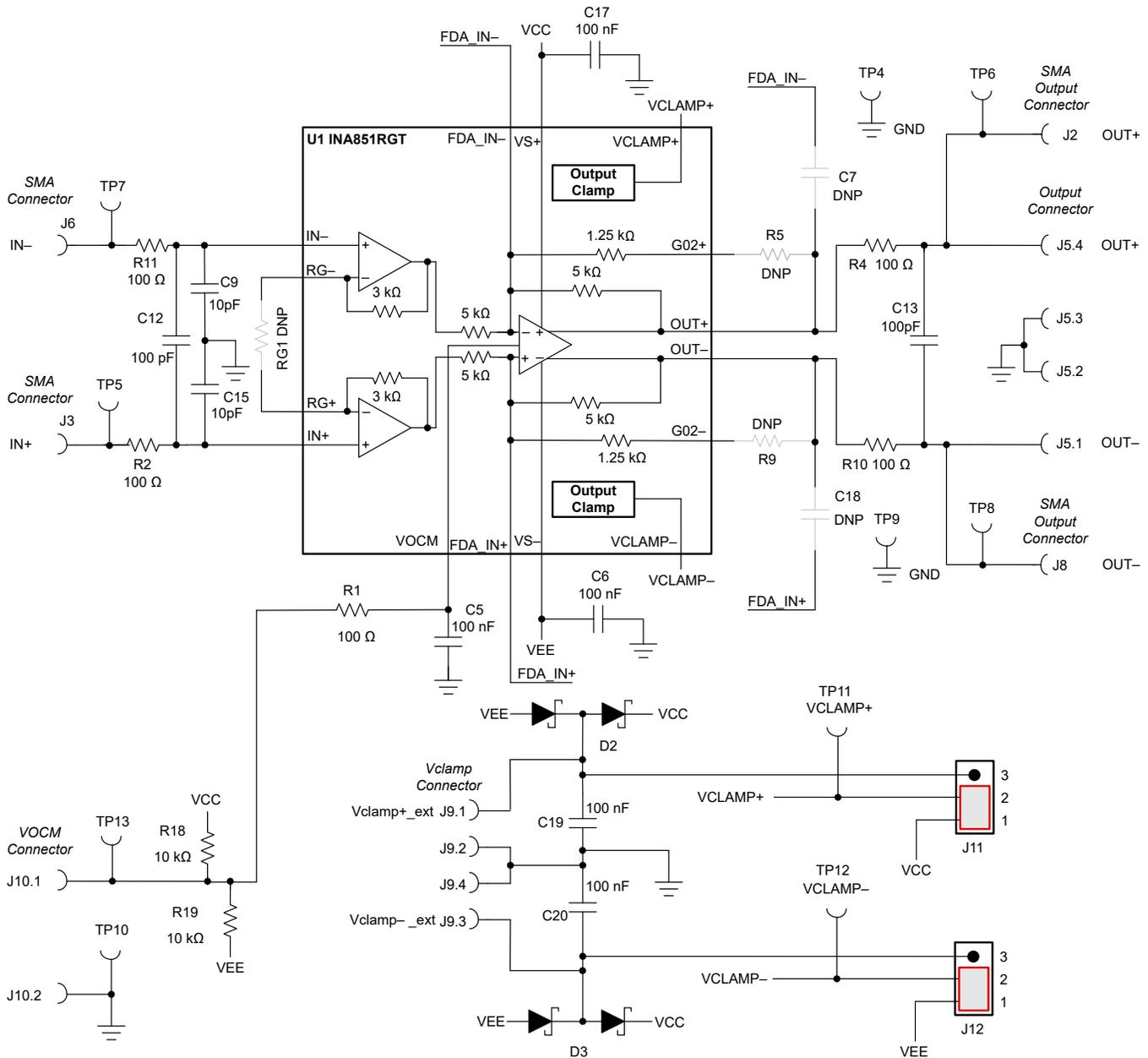
**Figure 4-1. INA851EVM Voltage Supply Connections**

## 5 Input and Output Connections

The instrumentation amplifier input signal connections for the INA851EVM are provided through the use of SMA connectors J3, J6, and test points TP5, TP7, located at the left of the EVM. The VO<sub>CM</sub> input is provided through screw-terminal connector J10, located on the left of the board.

By default, the output clamp voltage levels, VCLAMP+ and VCLAMP-, are set to the INA851 positive (+VCC) and negative (-VEE) supplies, respectively. The VCLAMP+ pin is connected to +VCC through jumper J11 1-2, and the VCLAMP- pin is connected to -VEE through J12 1-2. Screw terminal connector J9 provides access to the output clamp pins. To set the voltage level of the clamps with an external supply, shunt jumper J11 2-3 to access the VCLAMP+ using connector J9.1. In a similar fashion, shunt jumper J12 2-3 to access the VCLAMP- pin using connector J9.3.

The differential output amplifier connections are provided through screw-terminal connector J5, SMA connectors J2 and J8, and test points TP6 and TP8, located at the right side of the EVM. A simplified diagram of the INA851EVM input and output connections is displayed in Figure 5-1.



**Figure 5-1. INA851EVM Input and Output Connections**

Table 5-1 summarizes the input and output connectors and corresponding test points.

**Table 5-1. INA851EVM Input and Output Connections**

Connector Designator	Signal	Comment	Test Point
J3	IN+	SMA	TP5
J6	IN-	SMA	TP7
J2	OUT+	SMA	TP6
J8	OUT-	SMA	TP8
J5.4	OUT+	Screw terminal	TP6
J5.3	GND	Screw terminal	TP4
J5.2	GND	Screw terminal	TP9
J5.1	OUT-	Screw terminal	TP8
J10.1	VOCM	Screw terminal	TP13
J10.2	GND	Screw terminal	N/A
J9.1	VCLAMP+ external	Screw terminal	N/A
J9.2	GND	Screw terminal	N/A
J9.3	VCLAMP- external	Screw terminal	N/A
J9.4	GND	Screw terminal	N/A

## 6 Modifications

By default, the INA851EVM is populated with the INA851 device configured in gain of 1 V/V. However, for flexibility, the PCB layout has additional unpopulated, passive component footprints for gain resistors RG1 and RG2 to set the front-end amplifier gain. Optional footprints for jumper resistors R5 and R6 are provided to set the output stage to gain of 0.2 V/V. In addition, the evaluation board provides footprints R3, R12, C10, C8, and C14 for optional input low-pass filters, and footprints for load resistors R6 and R13. These additional component footprints in the layout allow the user to customize the evaluation circuit. For a full schematic of the INA851EVM, see Figure 7-1.

## 7 Schematic, PCB Layout, and Bill of Materials

This section contains the schematic, PCB layout, and bill of materials for the INA851EVM.

### 7.1 Schematic

Figure 7-1 illustrates the EVM schematic.

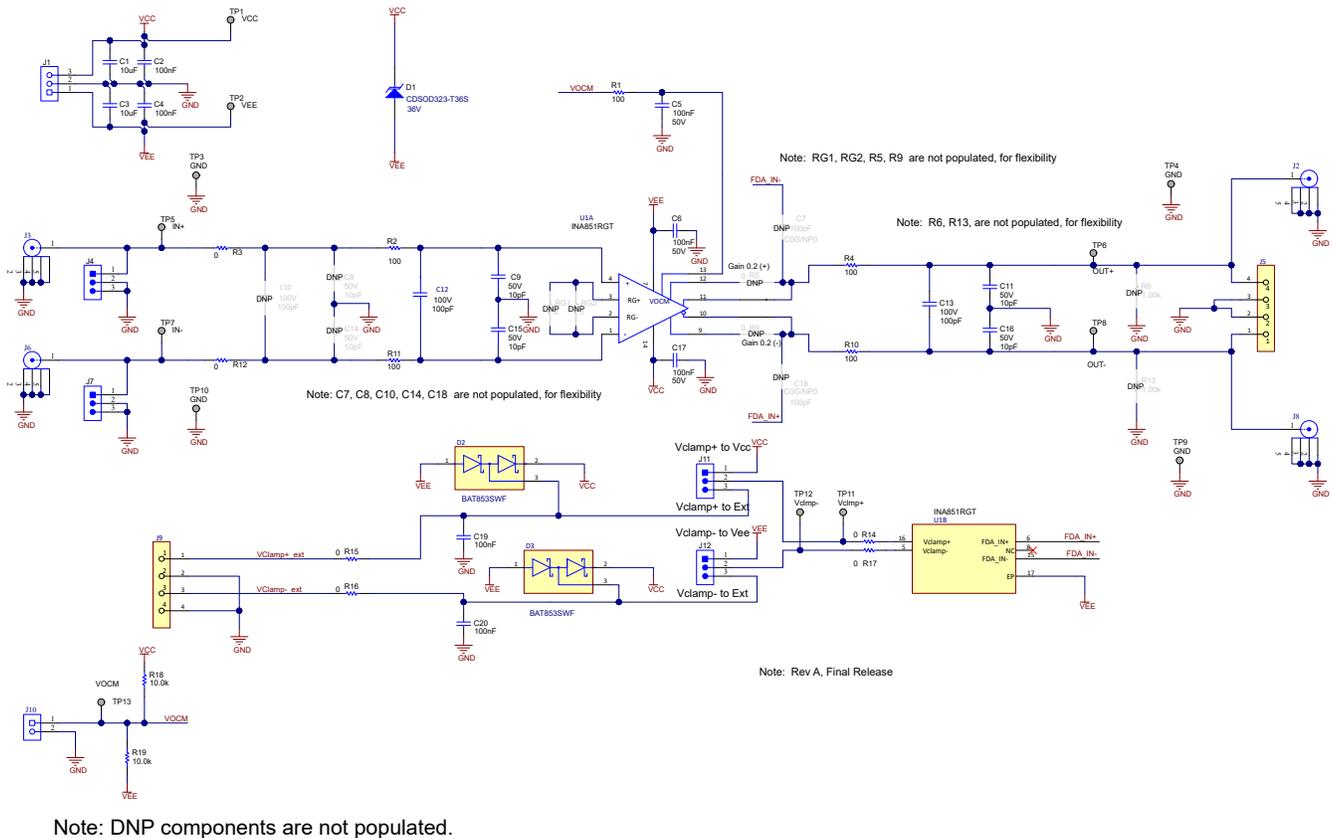


Figure 7-1. INA851EVM Schematic

### 7.2 PCB Layout

The INA851EVM is a four-layer PCB design. Figure 7-2 to Figure 7-6 show the PCB layer illustrations. The top layer consists of all signal path traces, and is poured with a solid ground plane. A symmetrical board layout is used at the differential inputs and outputs to keep good performance matching and improve common-mode noise rejection. Route traces as symmetrically as possible for both positive and negative pathways. Gain resistors RG1 and RG2 are placed on the top layer in close proximity to the device to reduce parasitic capacitance. Capacitor C5 is placed in close proximity to V<sub>OCM</sub> to avoid injecting common-mode noise. Decoupling capacitors C6, and C17 are positioned on the top layer as close as possible to the power-supply pins of the device. The second internal layer is a dedicated solid GND plane. Independent vias are placed at the ground connection of every component to provide a low-impedance path to ground. The third internal layer and bottom layer route the power supplies and the V<sub>CLAMP+</sub> and V<sub>CLAMP-</sub> connections.

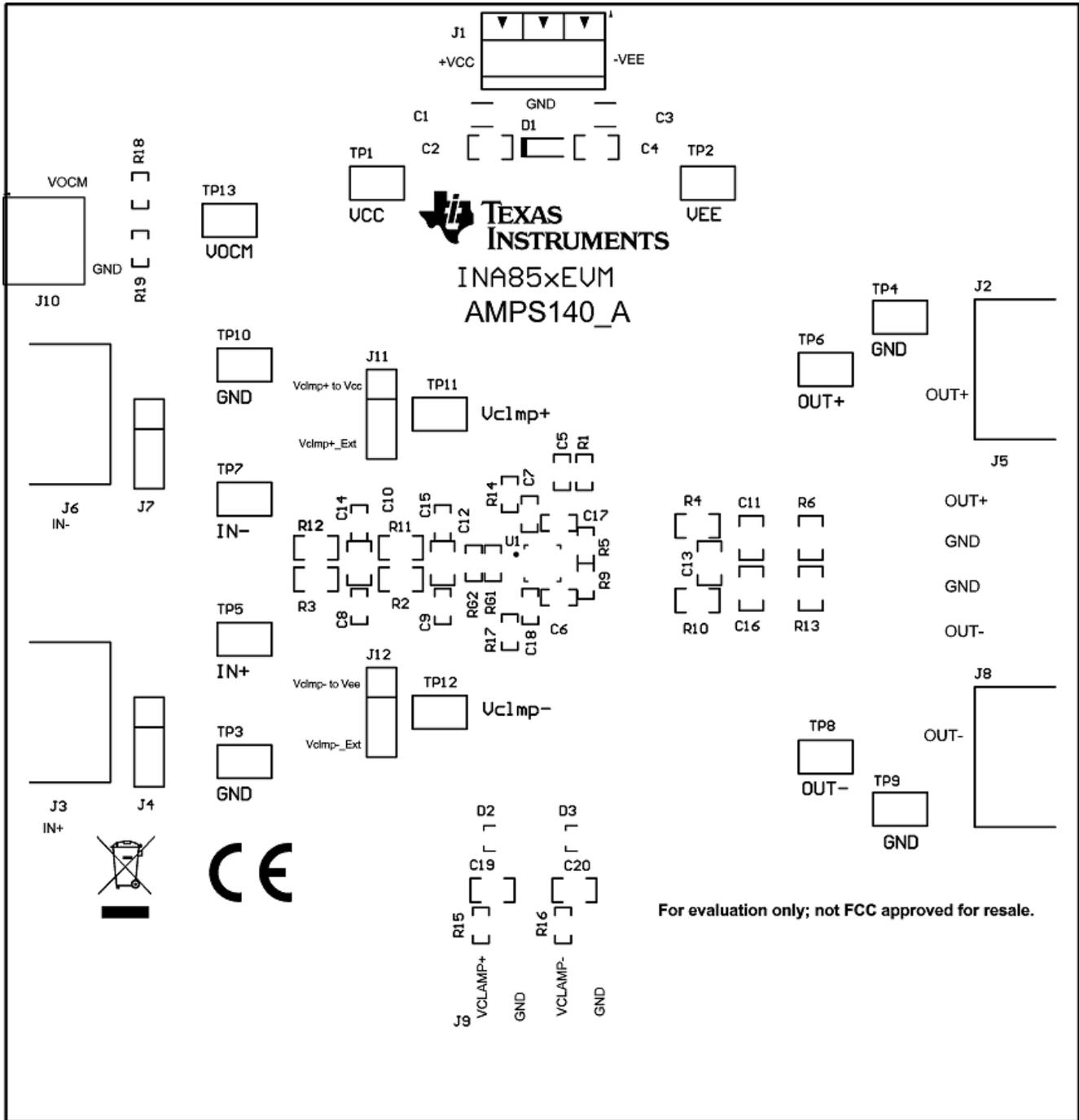


Figure 7-2. Top Overlay PCB Layout

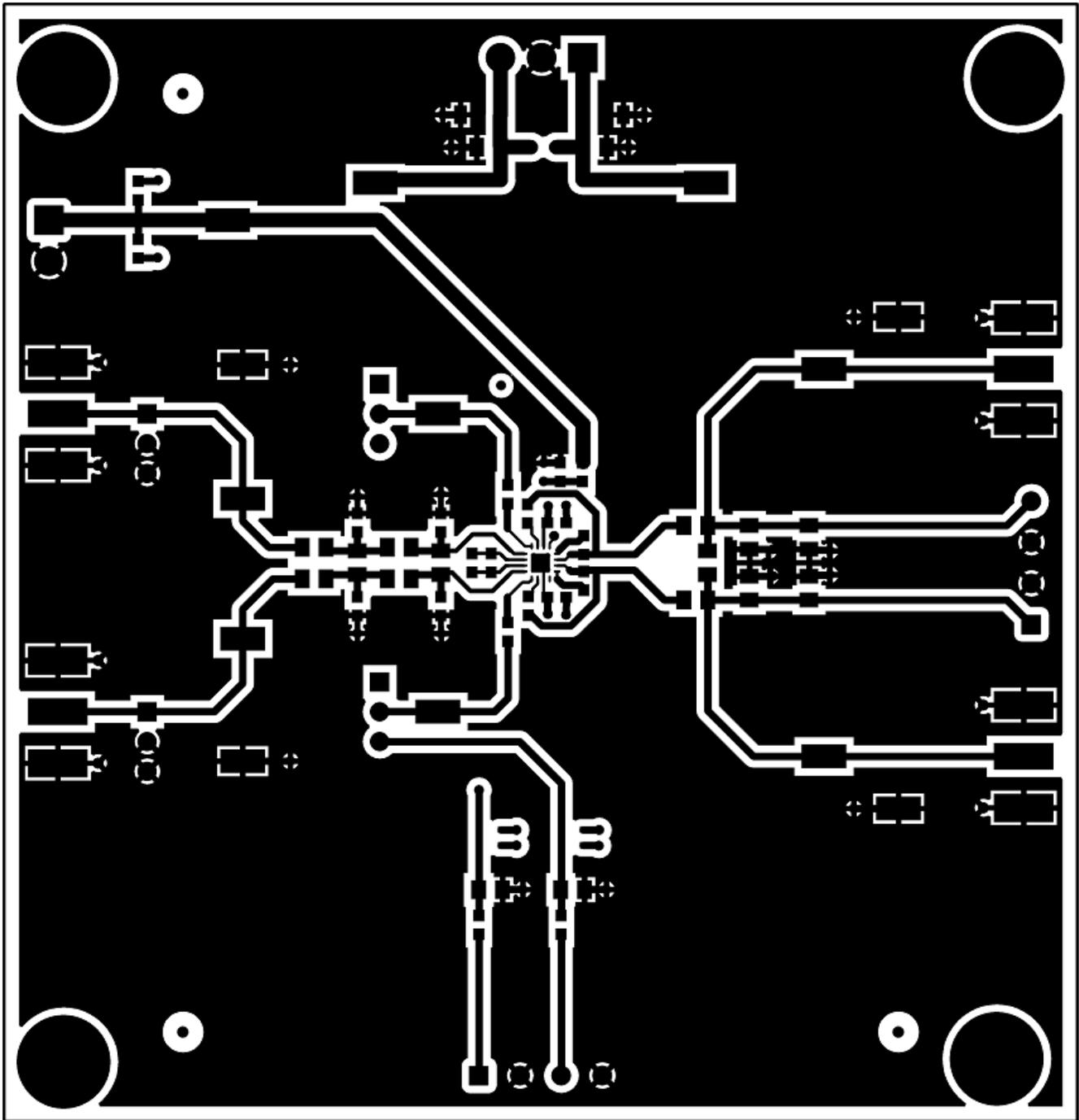


Figure 7-3. Top Layer PCB Layout

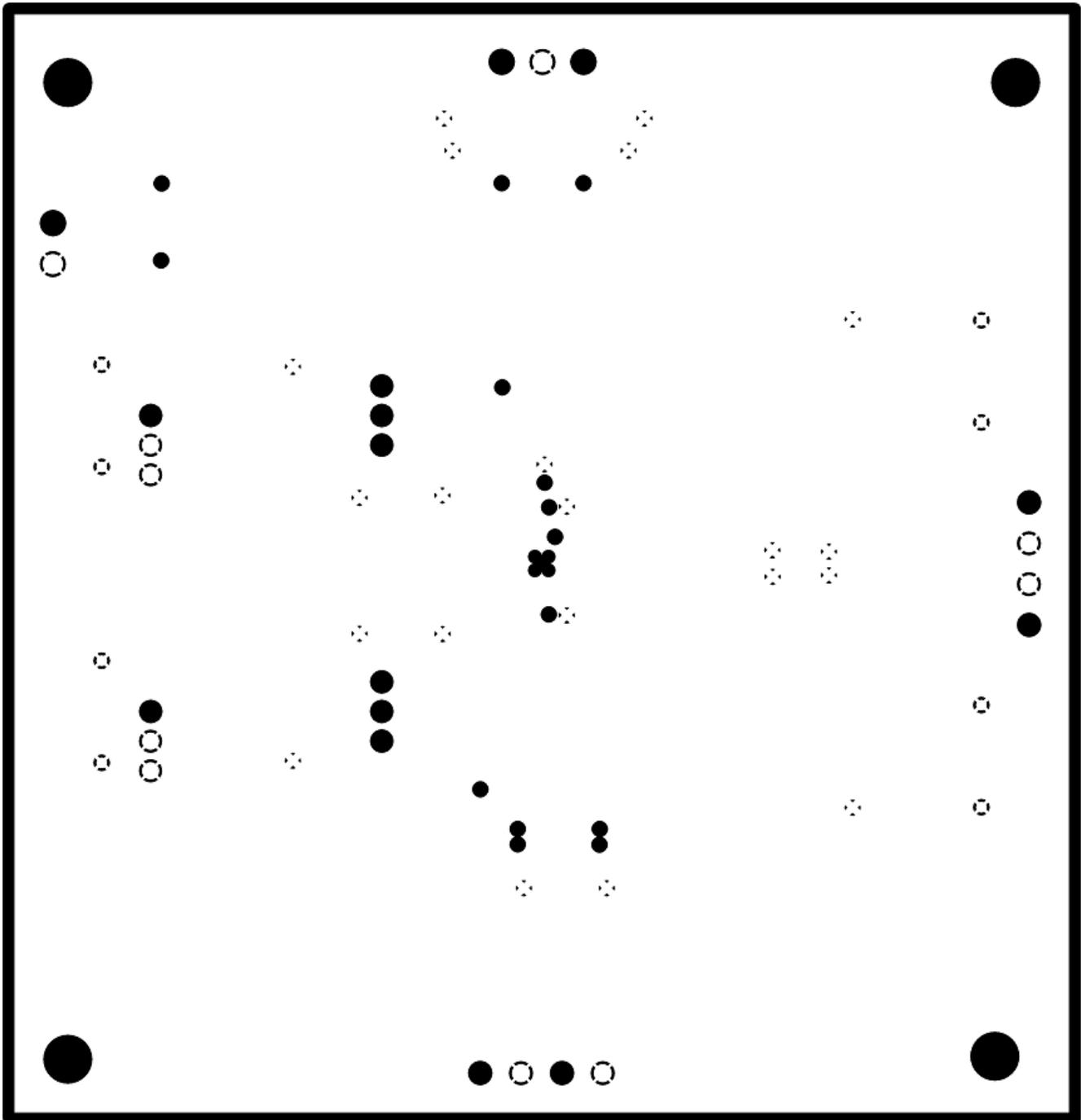


Figure 7-4. Ground Layer PCB Layout

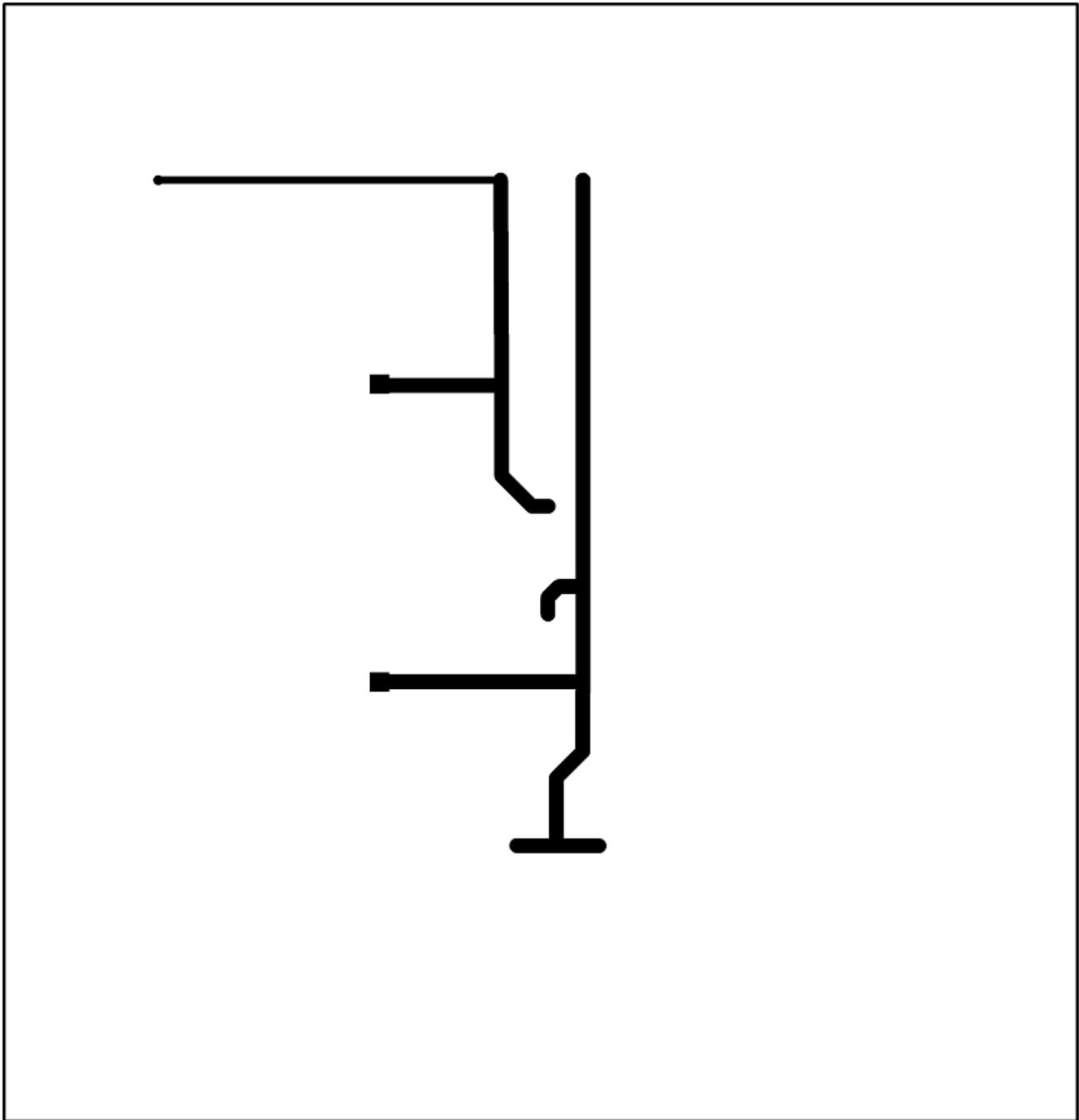


Figure 7-5. Power Layer PCB Layout

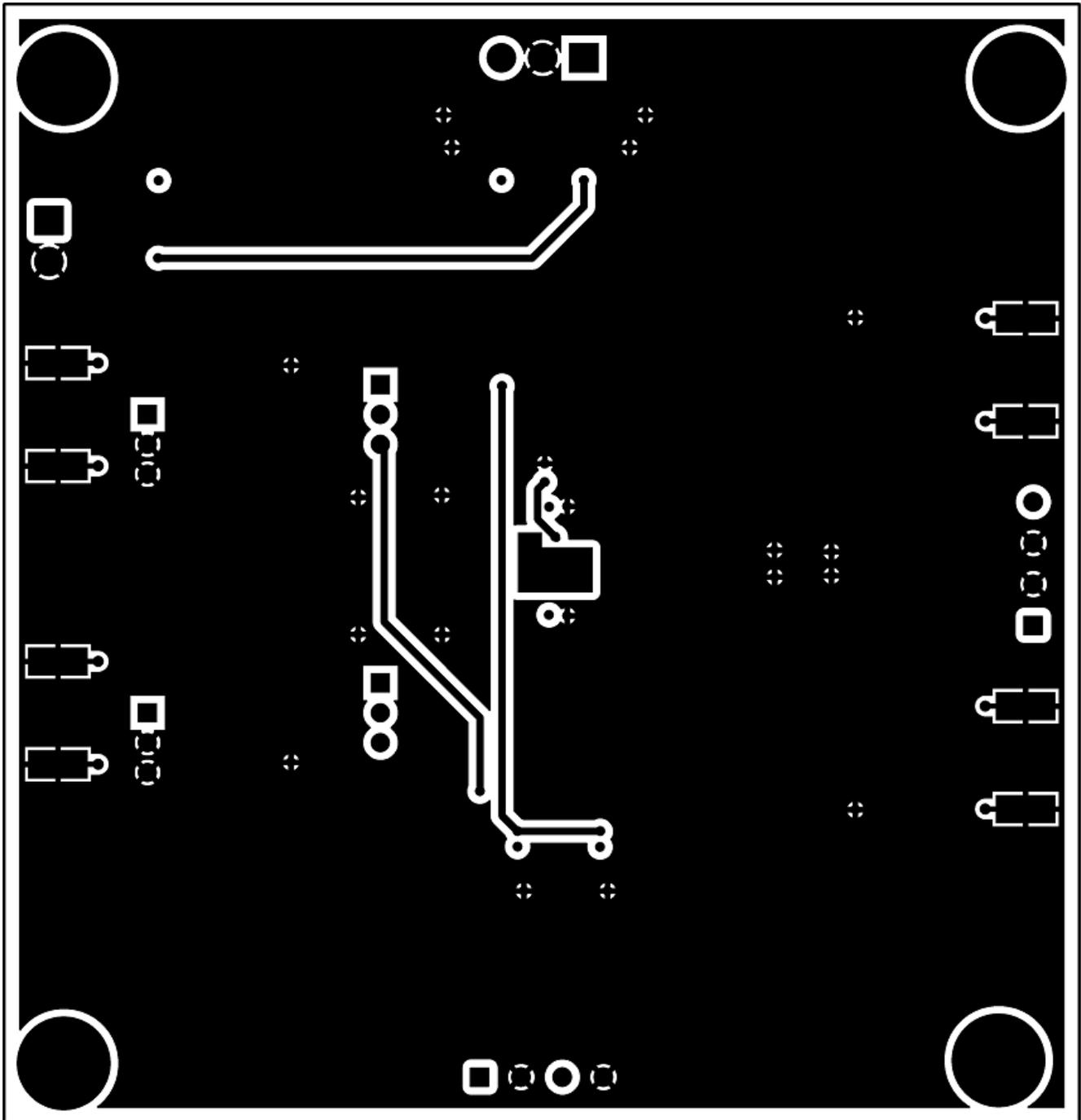


Figure 7-6. Bottom Layer PCB Layout

## 7.3 Bill of Materials

Table 7-1 lists the INA851EVM bill of materials (BOM).

**Table 7-1. INA851EVM Bill of Materials**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		AMPS140	Any
C1, C3	2	10 $\mu$ F	CAP, CERM, 10 uF, 35 V, +/- 10%, X7R, 1206	1206	C3216X7R1V106K160AC	TDK
C2, C4, C19, C20	4	0.1 $\mu$ F	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0805	0805	08055C104KAT2A	AVX
C5, C6, C17	3	0.1 $\mu$ F	CAP, CERM, 0.1 uF, 50 V, +/- 5%, X7R, 0603	0603	C0603C104J5RACTU	Kemet
C9, C15	2	10 pF	CAP, CERM, 10 pF, 50 V, +/- 1%, C0G/NP0, 0603	603	C0603C100F5GAC7867	Kemet
C11, C16	2	10 pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0805	0805	08055A100JAT2A	AVX
C12, C13	2	100 pF	CAP, CERM, 100 pF, 100 V, +/- 5%, C0G/NP0, 0805	0805	C0805C101J1GACTU	Kemet
D1	1	39 V	Zener Diode 39 V 200 mW $\pm$ 5% Surface Mount SOD-323	SOD-323	BZX384C39-E3-08	Vishay Semiconductor
D2, D3	2		Diode Array 1 Pair Series Connection Schottky 40 V 200 mA (DC) Surface Mount SC-70, SOT-323	SOT-323	BAT854SWF	Nexperia
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1	1		Terminal Block, 3.5mm Pitch, 3x1, TH	10.5x8.2x6.5mm	ED555/3DS	On-Shore Technology
J2, J3, J6, J8	4		Connector, End launch SMA, 50 ohm, SMT	End Launch SMA	142-0701-801	Cinch Connectivity
J4, J7, J11, J12	4		Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions
J5, J9	2		TERM BLOCK 3.5MM VERT 4POS PCB	HDR4	OSTTE040161	On Shore Technology
J10	1		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology
R1	1	100 $\Omega$	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo
R2, R4, R10, R11	4	100 $\Omega$	RES, 100, 0.1%, 0.125 W, 0805	0805	RT0805BRD07100RL	Yageo America
R3, R12	2	0 $\Omega$	RES, 0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	ERJ-6GEY0R00V	Panasonic
R14, R15, R16, R17	4	0 $\Omega$	RES, 0, 5%, 0.1 W, 0603	0603	RC0603JR-070RL	Yageo
R18, R19	2	10.0 k $\Omega$	RES, 10.0 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1002V	Panasonic
SH-J1, SH-J2, SH-J3	3	1 $\times$ 2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13	13		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		Precision, Fully Differential Output, Instrumentation Amplifier	VQFN16	INA851RGT	Texas Instruments

## 8 Revision History

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

<b>Changes from Revision * (February 2022) to Revision A (November 2022)</b>	<b>Page</b>
• Changed INA851EVM photo to show updated revision A board.....	1
• Added text to Section 2, <i>EVM Circuit Description</i> , regarding PCB revision A.....	4
• Changed Figure 2-1, <i>EVM Simplified Schematic</i> , to show updated FDA_IN– and FDA_IN+ connections.....	4
• Changed Figure 3-1, <i>INA851EVM Default Jumper Settings</i> , to show updated RTM Revision A silkscreen.....	5
• Changed Figure 4-1, <i>INA851EVM Voltage Supply Connections</i> , to show FDA_IN– and FDA_IN+ pins.....	6
• Changed Figure 5-1, <i>INA851EVM Input and Output Connections</i> , to show PCB revision A changes.....	7
• Changed Figure 7-1, <i>INA851EVM Schematic</i> , to show PCB revision A.....	9
• Changed Figure 7-2 to 7-6 to show the latest PCB Revision A layout.....	9
• Changed Table 7-1, <i>Bill of Materials</i> , to show PCB revision A updates.....	15

## 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 DEGRADATION 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/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/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。  
[http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page)

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.

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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。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see [http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_02.page](http://www.tij.co.jp/lstds/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。  
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#### 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.

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- 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, INDEMNITY 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.

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