THS4531ADGKEVM Evaluation Module

The THS4531ADGKEVM is an evaluation module for the single THS4531 amplifier in the DGK [8-lead VSSOP (MSOP)] package. This evaluation module is designed to quickly and easily demonstrate the functionality and versatility of the amplifier. The EVM is ready to connect to power, signal source, and test instruments through the use of onboard connectors. The EVM comes configured for easy connection with common 50-Ω laboratory equipment on its inputs and outputs. The amplifier is configured for single-ended input with gain of 1 V/V to differential output at the device pins, which is converted to single-ended via a transformer to the output. It can be easily configured for other functions, gains, and single- or split-supply operation.

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1 Features

- Configured for split-supply operation and easily modified for single supply
- Default gain of 1 configuration can easily be reconfigured for other gains
- Designed for easy connection to standard 50-Ω input/output impedance test equipment
- Inputs and outputs include SMA connectors

2 EVM Specifications

	Single-supply voltage range (V_{S-} = ground)	2.5 V to 5.5 V
$V_S\pm$	Split-supply voltage range	±1.25 V to ±2.75 V
$I_S\pm$	Supply current	250 µA

	Input voltage	V_S±, Max
I_{OUT}	Output drive	±25 mA

3 Power Connections

The THS4531ADGKEVM is equipped with banana jacks for easy connection of power. The positive supply input is labeled V_S+. The negative supply input is labeled V_S–. Ground is labeled GND.

3.1 Split-Supply Operation

To operate as split supply, apply the positive supply voltage to V_S+, negative supply voltage to V_S– , and the ground reference from supply to GND.

3.2 Single-Supply Operation

To operate as single supply, connect jumper V_S– to GND, and apply the positive supply voltage to V_S+. Inputs and outputs must be biased per data-sheet specifications for proper operation.

4 Input and Output Connections

The THS4531ADGKEVM is equipped with SMA connectors for easy connection of signal generators and analysis equipment. As shipped, the EVM is configured for a gain of 1, split supply, single-ended input and output with 50-Ω termination. For best results, signals must be routed to and from the EVM with cables having 50-Ω characteristic impedance. V_{IN+} (J2) is the input connector for single-ended input signals. V_{OUT+} (J10) is the output connector for single-ended output signals. V_{IN-}(J1) is not intended for use with single-ended input signals and has C1 and R6 added to approximate the impedance of an ac-coupled 50-Ω source and to balance the amplifier when V_{IN+} is driven from an ac-coupled, 50-Ω source. The amplifier converts the single-ended input to a differential signal at its output pins. A resistor network (R20, R21, R24) and transformer on the amplifier's output convert the differential signal to single-ended, provides 2-kΩ load to the amplifier when terminated in 50 Ω, and 50-Ω line impedance match at V_{OUT+}. This results in loss, and the overall gain is approximately –38 dB. See the following THS4531 data-sheet applications section, schematics, and layouts for more detail and how to reconfigure the EVM.

5 THS4531ADGKEVM Schematic, Layout, and Bill of Materials

5.1 Schematic

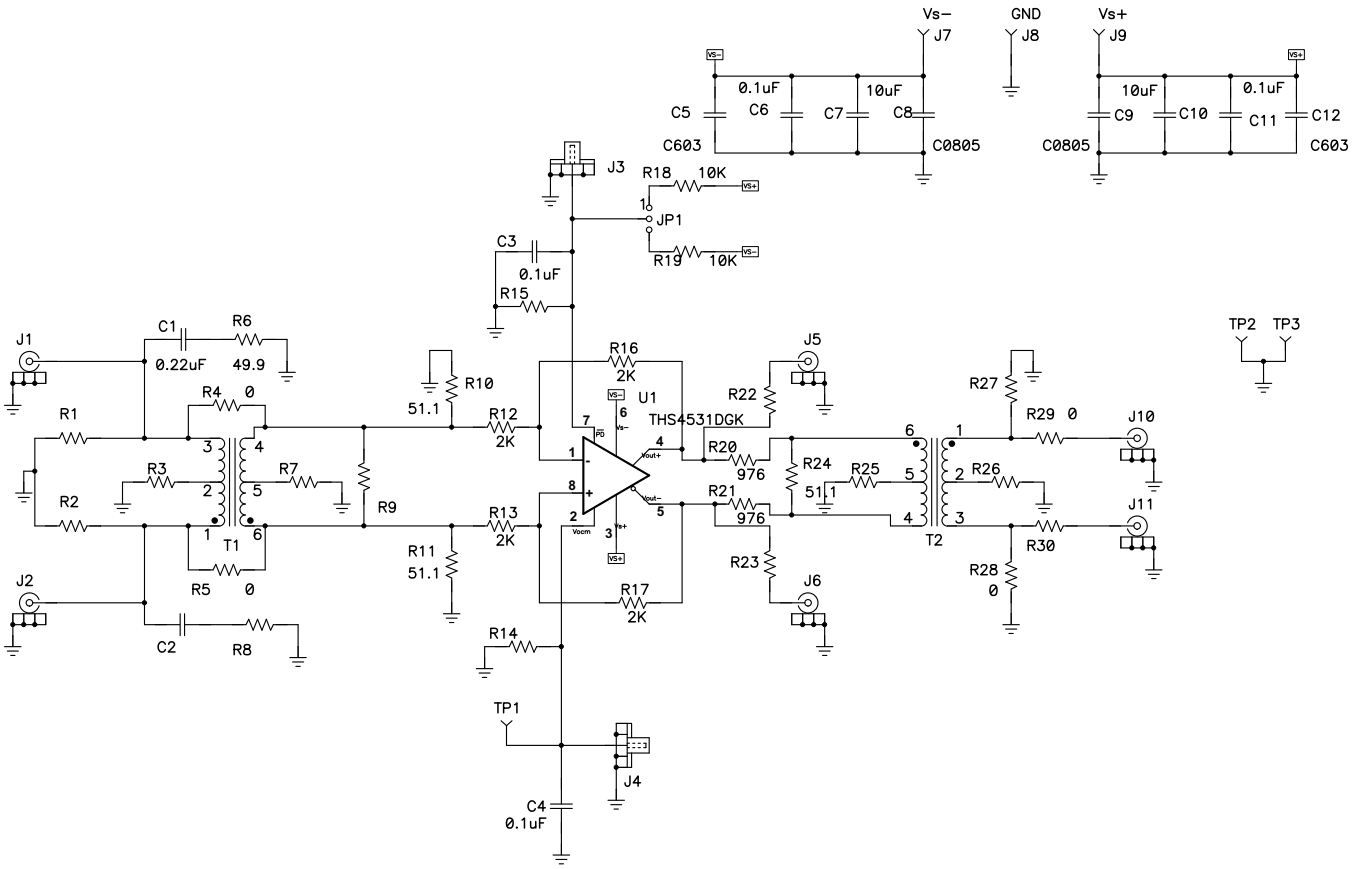

Figure 1. THS4531ADGKEVM Schematic

5.2 THS4531ADGKEVM Layers

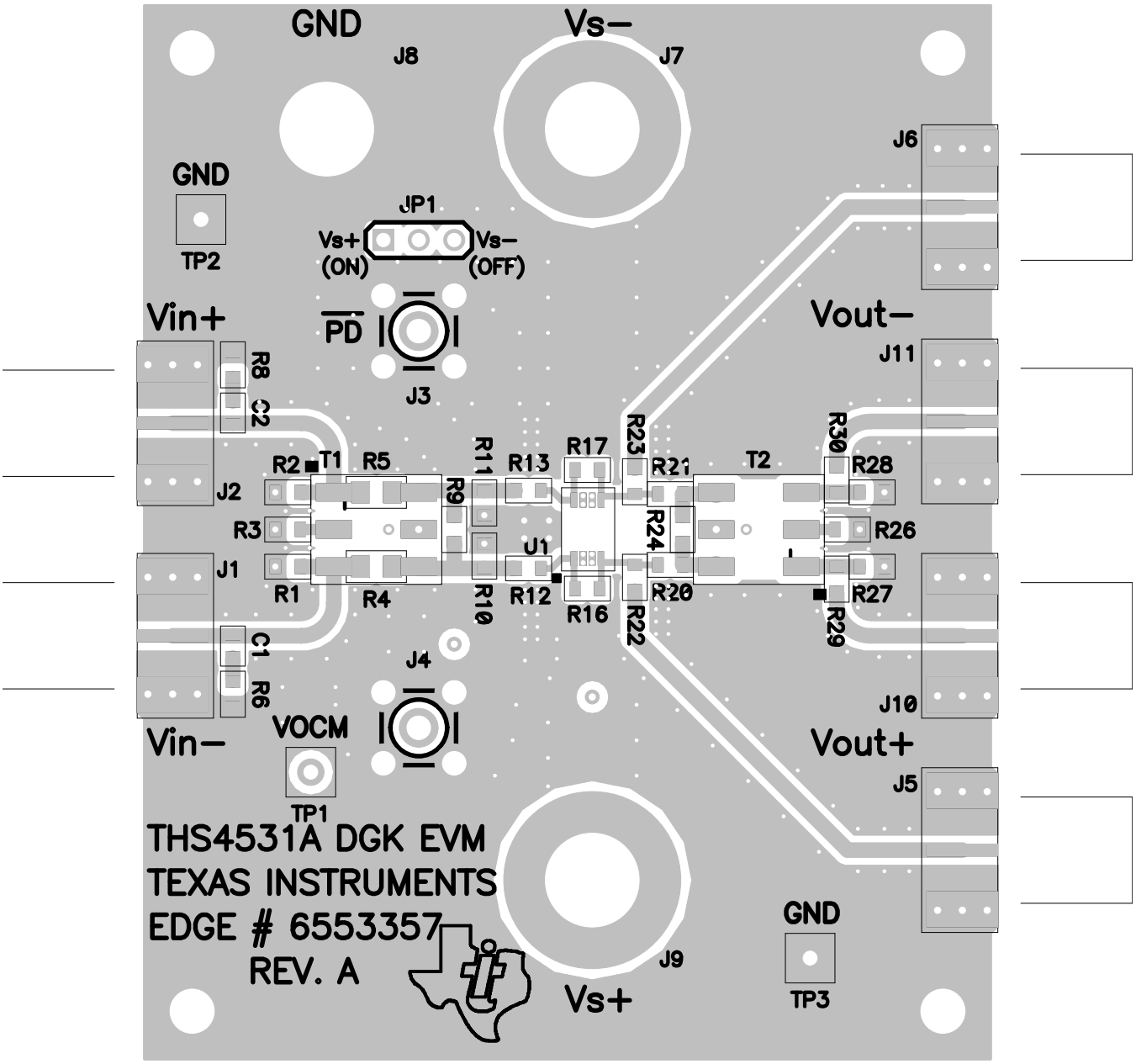

Figure 2. THS4531ADGKEVM Top Layer 1

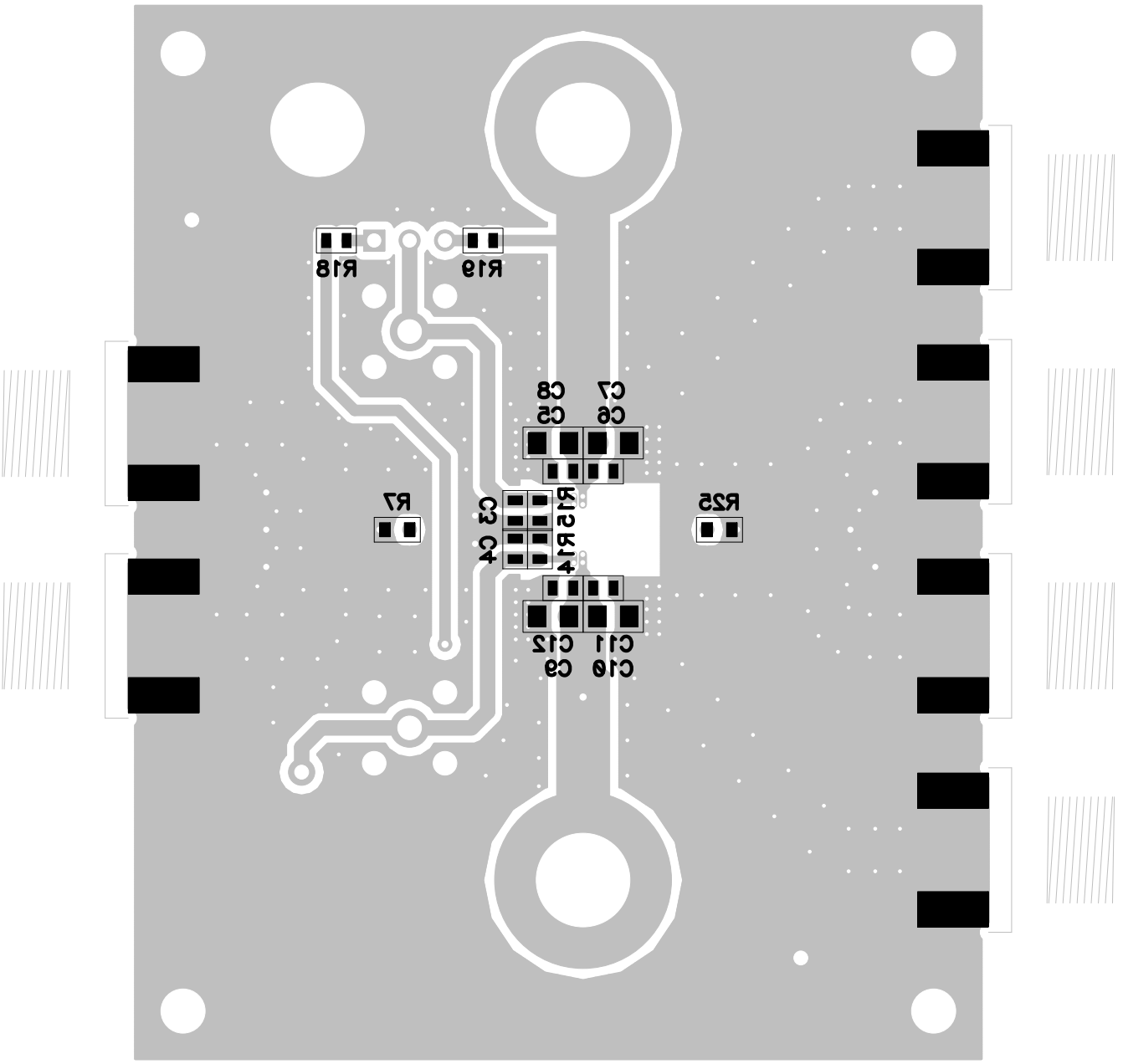

Figure 3. THS4531ADGKEVM Ground Layer 2

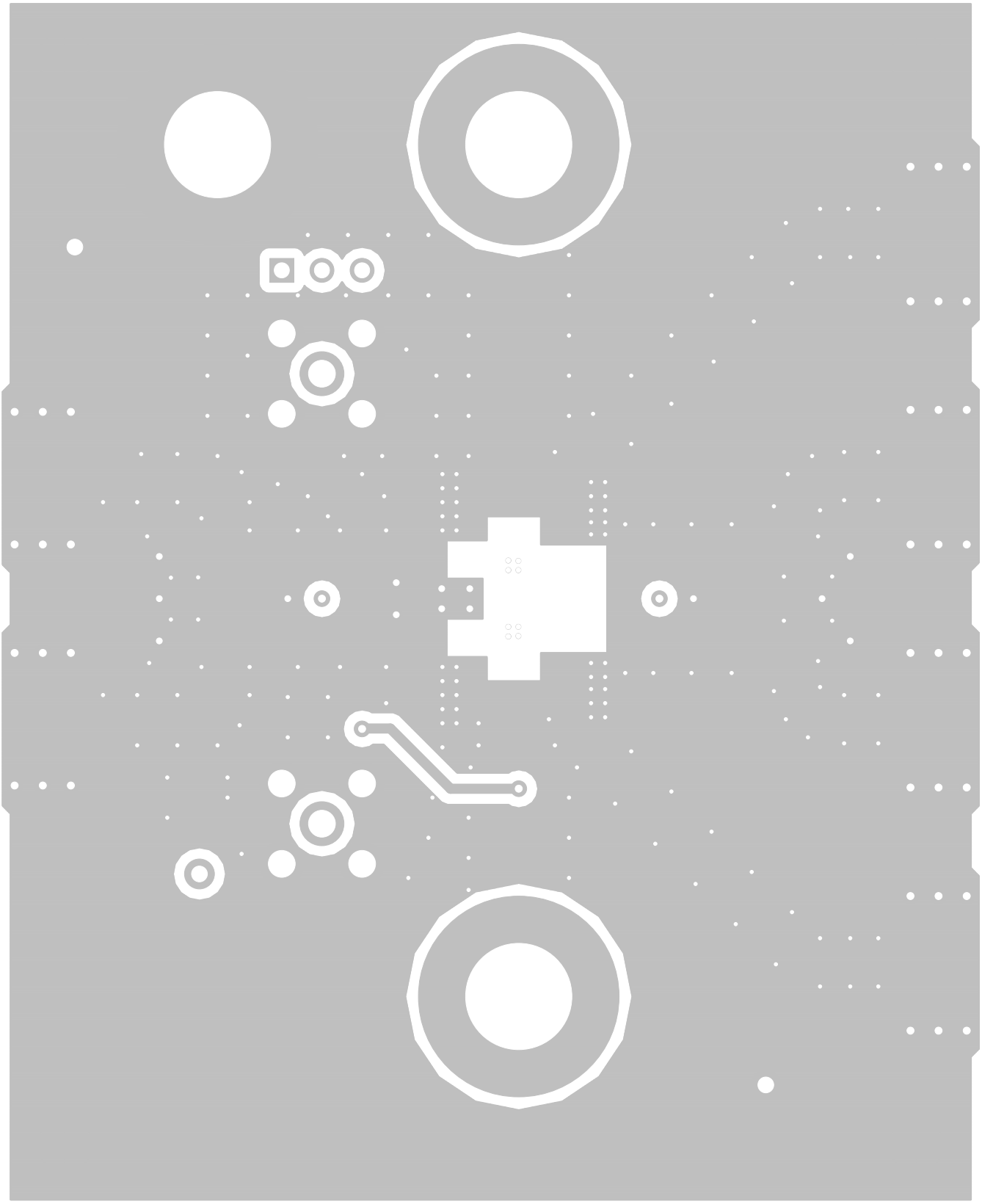

Figure 4. THS4531ADGKEVM Ground Layer 3

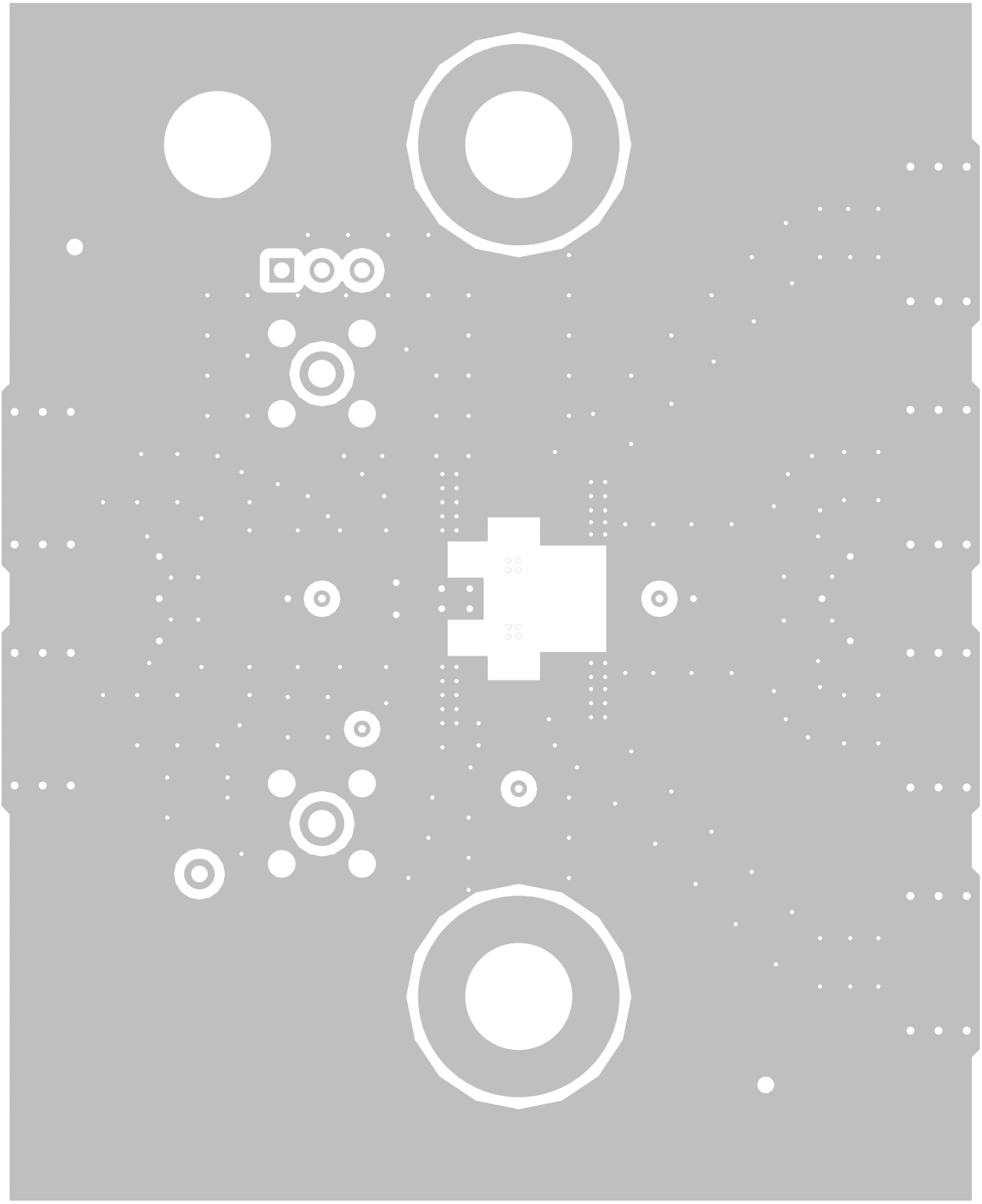

Figure 5. THS4531ADGKEVM Bottom Layer 4

5.3 Bill of Materials

Table 1. THS4531ADGKEVM Bill of Materials

ITEM	DESCRIPTION	SMD SIZE	REF DESIGNATOR	PCB QUANTITY	MFG PART #	DISTRIBUTOR'S PART #
1	CAP, 10.0uF, CERAMIC, X7R, 10V	0805	C7, C10	2	(KEMET) C0805C106K8RACTU	(DIGI-KEY) 399-7411-1-ND
2	CAP, 0.1uF, CERAMIC, X7R, 16V	0603	C3, C4, C6, C11	4	(AVX) 0603YC104KAT2A	(DIGI-KEY) 478-1239-1-ND
3	CAP, 0.22uF, CERAMIC, X7R, 10V	0603	C1	1	(AVX) 0603ZC224KAT2A	(DIGI-KEY) 478-1243-1-ND
4	OPEN	0603	C2, C5, C12	3		
5	OPEN	0805	C8, C9	2		
6	OPEN	0603	R1, R2, R3, R7, R8, R9, R14, R15, R22, R23, R25, R26, R27, R30	14		
7	RESISTOR, 0 OHM	0603	R28, R29	2	(ROHM) MCR03EZPJ000	(DIGI-KEY) RHM0.0GCT-ND
8	RESISTOR, 49.9 OHM, 1/10W, 1%	0603	R6	1	(ROHM) MCR03EZPFX49R9	(DIGI-KEY) RHM49.9HCT-ND
9	RESISTOR, 51.1 OHM, 1/10W, 1%	0603	R10, R11, R24	3	(ROHM) MCR03EZPFX51R1	(DIGI-KEY) RHM51.1HCT-ND
10	RESISTOR, 976 OHM, 1/10W, 1%	0603	R20, R21	2	(ROHM) MCR03EZPFX9760	(DIGI-KEY) RHM976HCT-ND
11	RESISTOR, 2K OHM, 1/10W, 1%	0603	R12, R13, R16, R17	4	(ROHM) MCR03EZPFX2001	(DIGI-KEY) RHM2.00KHCT-ND
12	RESISTOR, 10K OHM, 1/10W, 1%	0603	R18, R19	2	(PANASONIC) ERJ-3EKF1002V	(DIGI-KEY) P10.0KHCT-ND
13	RESISTOR, 0 OHM	0805	R4, R5	2	(ROHM) MCR10EZPJ000	(DIGI-KEY) RHM0.0ARCT-ND
14	OPEN		T1	1		
15	TRANSFORMER, RF		T2	1	(MINI-CIRCUITS) ADT1-1WT+	
16	JACK, BANANA RECEPTANCE, 0.25" DIA. HOLE		J7, J8, J9	3	(SPC) 15459	(NEWARK) 79K5034
17	OPEN		J1, J3, J4, J5, J6, J11	6		
18	CONNECTOR, EDGE, SMA PCB JACK		J2, J10	2	(JOHNSON) 142-0701-801	(NEWARK) 90F2624
19	HEADER, 0.1" CTRS, 0.025" SQ. PINS	3 POS.	JP1	1	(SULLINS) PBC36SAAN	(DIGI-KEY) S1011E-36-ND
20	SHUNTS		JP1	1	(SULLINS) SSC02SYAN	(DIGI-KEY) S9002-ND
21	TEST POINT, RED		TP1	1	(KEYSTONE) 5000	(DIGI-KEY) 5000K-ND
22	TEST POINT, BLACK		TP2, TP3	2	(KEYSTONE) 5001	(DIGI-KEY) 5001K-ND
23	IC, THS4531A		U1	1	(TI) THS4531A IDGK	
24	STANDOFF, 4-40 HEX, 0.625" LENGTH			4	(KEYSTONE) 1808	(DIGI-KEY) 1808K-ND
25	SCREW, PHILLIPS, 4-40, .250"			4	PMSSS 440 0025 PH	(DIGI-KEY) H703-ND
26	BOARD, PRINTED CIRCUIT			1	(TI) EDGE# 6528462 REV.A	

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It is important to operate this EVM within the input voltage range of 2.5 V to 5.5 V and the output voltage range of 2.5 V to 5.5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

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   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

3 *Regulatory Notices:*

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

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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。
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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of 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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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:*

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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.

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