

# THS4552RTWEVM

The THS4552RTWEVM is an evaluation module for the dual THS4552 amplifier in the RTW (24-pin VQFN) 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- $\Omega$  laboratory equipment on its inputs and outputs. The amplifier is configured for single-ended or differential 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. Both the channels can be easily configured for other functions, gains, and single- or split-supply operation.

The THS4552RTWEVM has an onboard load for the amplifier of 1 k $\Omega$  on both channels. The output transformer and resistor network converts this to a 50- $\Omega$  single-ended output.

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## Trademarks

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## 1 Features

This EVM supports the following 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- $\Omega$  input and output impedance test equipment
- Inputs and outputs include SMA connectors

## 2 EVM Specifications

[Table 1](#) lists the EVM specifications:

**Table 1. EVM Specifications**

		Value
	Single-supply voltage range (V- = ground)	2.7 to 5.4 V
V $\pm$	Split-supply voltage range	$\pm$ 1.35 to $\pm$ 2.7 V
I $S\pm$	Supply current (no load)	2.7 mA
	Input voltage	V $S\pm$ , Max
I $_{OUT}$	Output drive	$\pm$ 80 mA

## 3 Power Connections

The THS4552RTWEVM is equipped with test point connectors for easy connection of power. The positive supply input is red and is labeled V+. The negative supply input is yellow and is labeled V-. The Ground is black and is labeled GND.

### 3.1 Split-Supply Operation

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

### 3.2 Single-Supply Operation

To operate as single supply, connect both the V- connector and the GND connector to ground, and apply the positive supply voltage to V+. Inputs and outputs must be biased per datasheet specifications for proper operation. The THS4552 outputs common-mode voltage defaults to mid supply if the Vcm1 and Vcm2 connector is left floating.

## 4 Input and Output Connections

The THS4552RTWEVM 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 or differential input and single-ended output with 50- $\Omega$  termination on both the channels. For best results, signals must be routed to and from the EVM with cables having 50- $\Omega$  characteristic impedance. Either IN1+ (J1) or IN1- (J2) can be used for single-ended input on one channel and IN2+ (J3) or IN2- (J4) can be used for single-ended input on the other channel. The unused connector should be terminated with a 50- $\Omega$  resistive SMA load. If no SMA load is available, the spaces marked C1, C2, C17, or C18 can be loaded with a 0- $\Omega$  resistor to terminate the unused input. Use both IN1+ (J1) and IN1- (J2) for differential input on one channel and both IN2+ (J3) and IN2- (J4) for differential input on the other channel. OUT1+ (J12) is the output connector for single-ended output signal for one channel and OUT2+ (J14) is the output connector for single-ended output signal for the other channel. The amplifier converts the single-ended or differential input to a differential signal at its output pins. A resistor network and transformer on the output of the amplifier convert the differential output signal to single-ended, and provides a 1-k $\Omega$  load to the amplifier when terminated in 50  $\Omega$ . A 50- $\Omega$  line-impedance match at OUT1+ and OUT2+ should be preserved. This results in an output measurement loss, and the overall gain is approximately -30 dB. See the THS4552 datasheet applications section ([SBOS831](#)), schematics, and layouts for more detail and how to reconfigure the EVM.

### 4.1 VOCM Input Connections

The Vcm1 (J7) and Vcm2 (J6) inputs are optional and the SMA connectors are not loaded in default configuration. These inputs set the common mode of the output pins of both the channels independently. The THS4552 will automatically self-bias the output common-mode voltages to the mid-supply voltage if the VOCM1 or VOCM2 pins are not connected. This is the optimal voltage for maximum output swing and best linearity.

The valid range of the VOCM1 and VOCM2 is 0.55 V above the negative supply to 1.5 V below the positive supply. For example, on a  $\pm$ 2.5-V split supply, the VOCM1 and VOCM2 pin can be set anywhere from -1.95 V to 1.0 V. With a single 5-V supply the valid range would be 0.55 V to 3.5 V. Remember, the outputs of the THS4552 can swing from rail to rail; however, the maximum output swing available is reduced when the output common mode is set to a voltage other than mid supply.

If providing 50- $\Omega$  termination for the Vcm1 or Vcm2 input signal source is desired, C6 or C20 can be replaced with a 0- $\Omega$  resistor, respectively. The board is shipped with C6 and C20 populated with 0.22  $\mu$ F and output common mode voltages of both channels are set to mid-supply voltage with C6 and C20 populated.

### 4.2 PD Input Connections

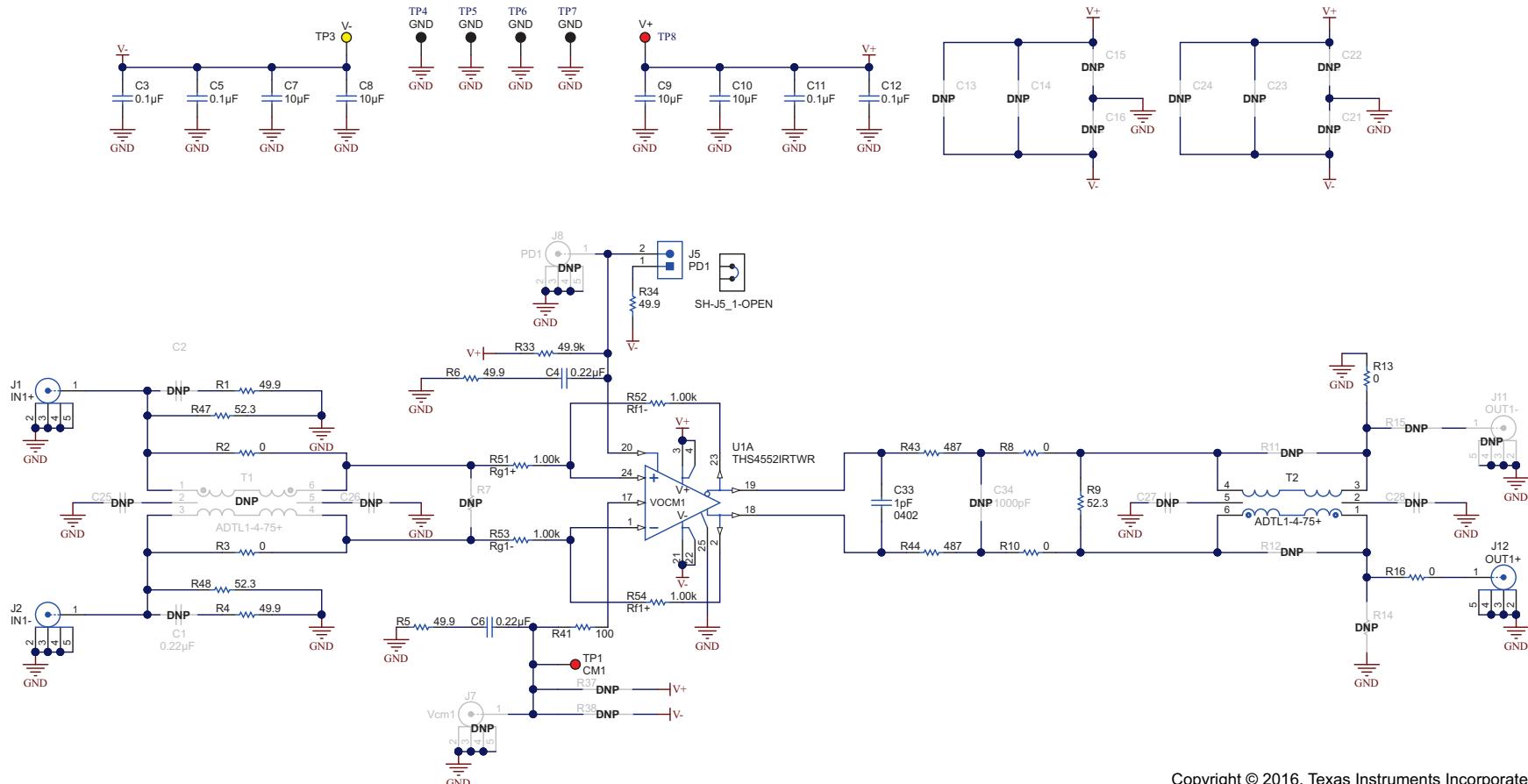
The PD1 (J5) and PD2 (J10) jumpers allow both THS4552 channels to be disabled independently. SMA connectors can also be loaded at J8 and J9 and a signal for the power down function can be applied for high-speed testing. Normally the J5 and J10 jumpers are used to enable or disable (power down) the corresponding channels of the dual-channel amplifier. When the jumpers are open, the amplifier is **not** powered down, so it is enabled. When the shorting block is connected and J5 or J10 is closed, the amplifier channel corresponding to the jumper is powered down.

For high-speed testing, the C4 and C19 can be replaced with 0  $\Omega$  to terminate the PD1 and PD2 SMA inputs, respectively. The shorting block should be removed from J5 and J10 during high-speed testing. Because 0  $\Omega$  at C4 or C19 terminates to the ground and not to the supplies, the state of the amplifier will be undefined when the signal source is disconnected. For this reason, 0  $\Omega$  at C4 or C19 should only be used when driving the SMA connector with a high-speed, controlled-impedance source.

## 5 THS4552RTWEVM Schematic, Layout, and Bill of Materials

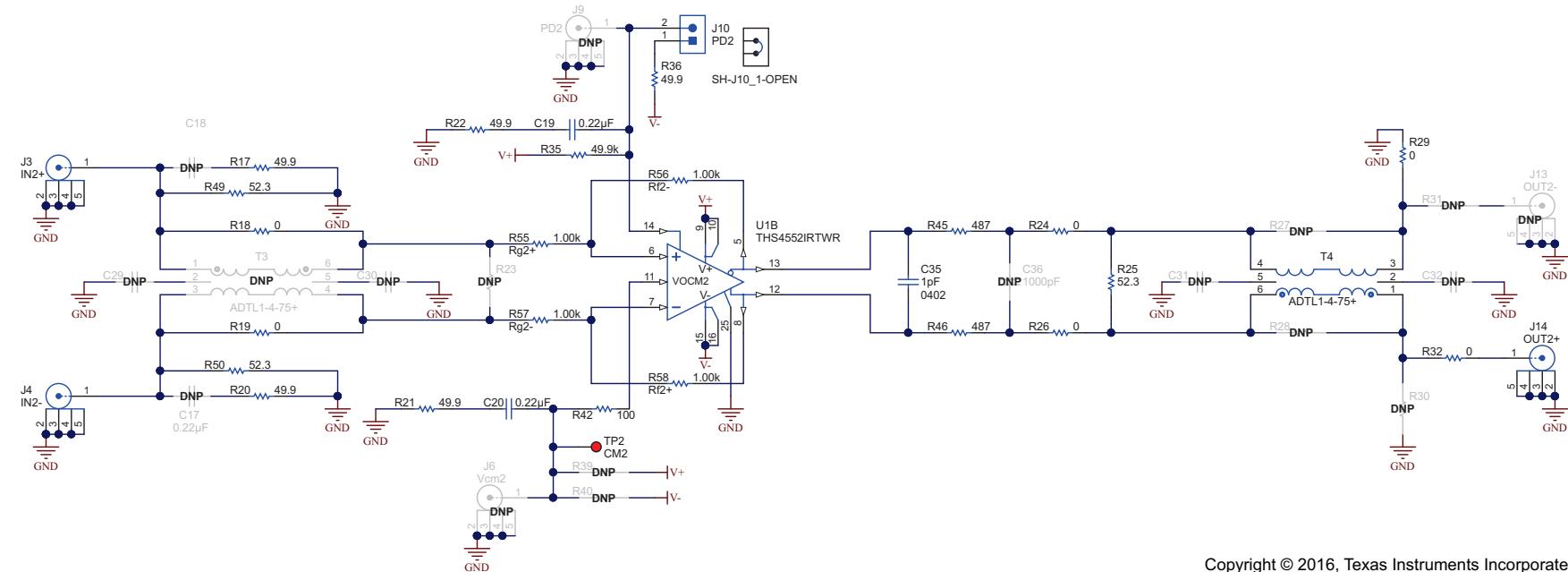
### 5.1 Schematics

Figure 1 and Figure 2 illustrate the EVM schematics.



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Figure 1. THS4552RTWEVM Schematic

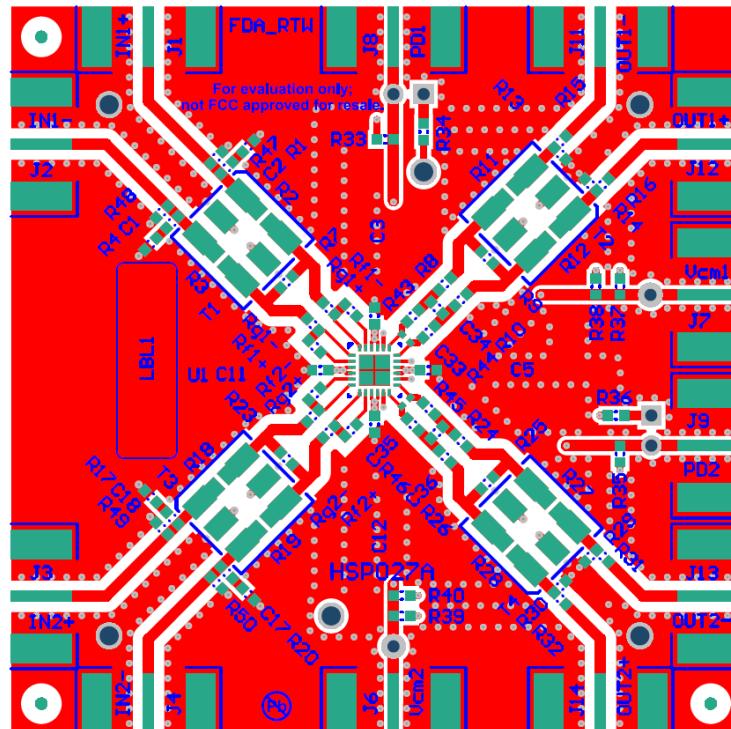


**Figure 2. THS4552RTWEVM Schematic**

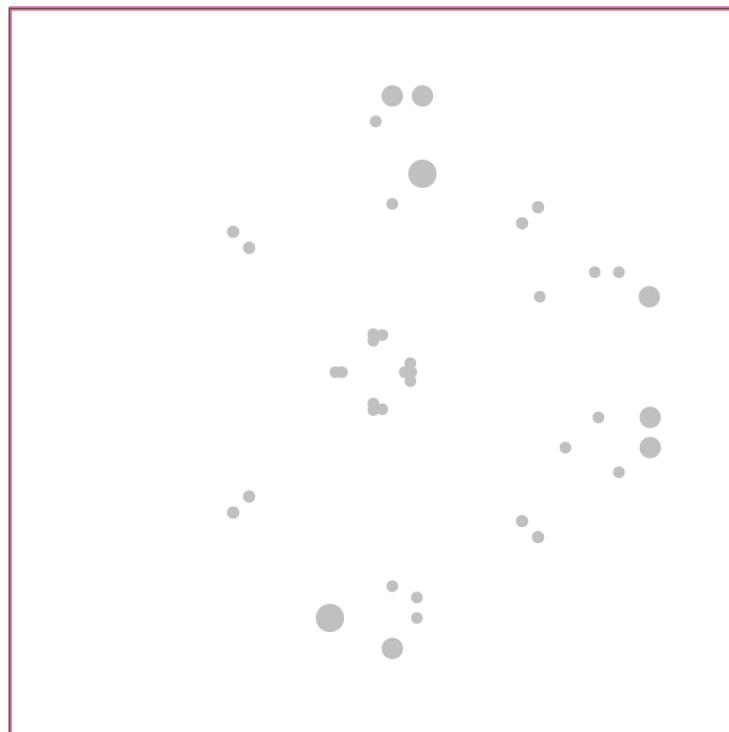
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## 5.2 THS4552RTWEVM Layers

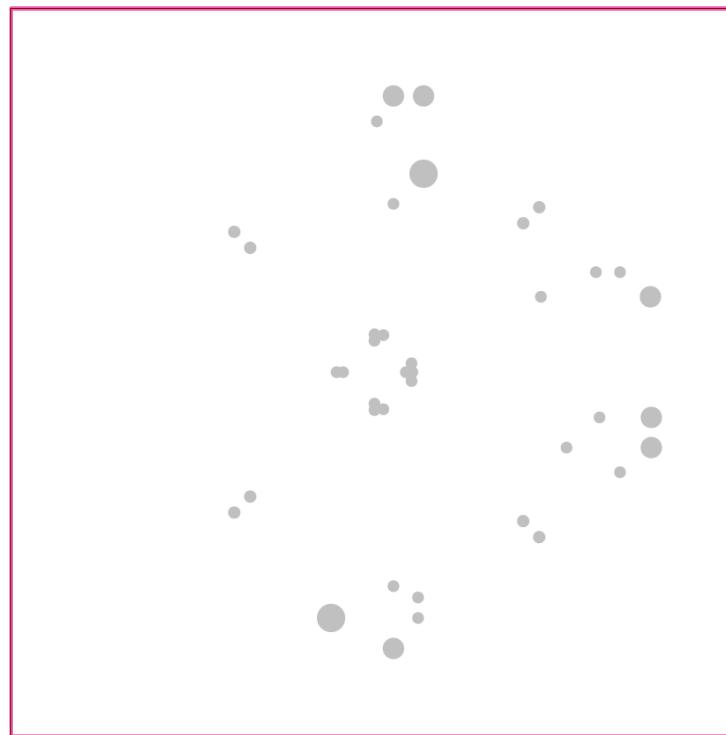
Figure 3 through Figure 6 show the THS4552RTWEVM layers.



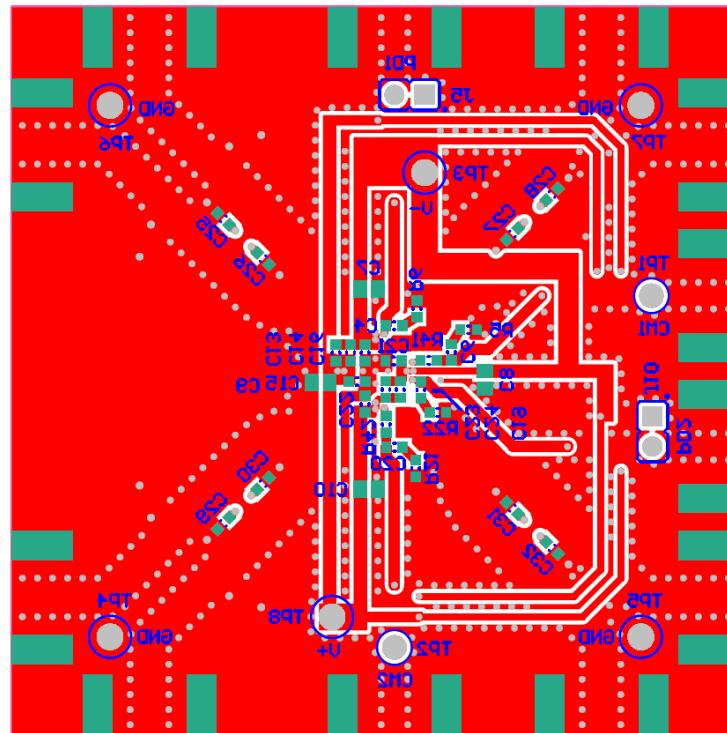
**Figure 3. THS4552RTWEVM Top Layer, Signal**



**Figure 4. THS4552RTWEVM Layer 2**



**Figure 5. THS4552RTWEVM Layer 3**



**Figure 6. THS4552RTWEVM Bottom Layer**

### 5.3 Bill of Materials

lists the EVM bill of materials.

**Table 2. THS4552RTWEVM Bill of Materials**

Item	Part Reference	Quantity	Part Number	Manufacturer	Description	Note
1	C4, C6, C19, C20	4	GRM188R61A224KA01D	Murata	CAP, CERM, 0.22 $\mu$ F, 10 V, +/- 10%, X5R, 0603	
2	C3, C5, C11, C12	4	0603YC104JAT2A	AVX	CAP, CERM, 0.1 $\mu$ F, 16 V, +/- 5%, X7R, 0603	
3	C33, C35	2	GRM1555C1H1R0CA01D	Murata	CAP, CERM, 1 pF, 50 V, +/- 5%, C0G/NP0, 0402	
4	C7, C8, C9, C10	4	GRM21BR61C106KE15L	Murata	CAP, CERM, 10 $\mu$ F, 16 V, +/- 10%, X5R, 0805	
5	J1, J2, J3, J4, J12, J14	6	142-0701-806	Emerson Network Power	Connector, End launch SMA, 50 ohm, SMT	
6	J5, J10	2	PBC02SAAN	Sullins Connector Solutions	Header, 100mil, 2x1, Gold, TH	
7	R1, R4, R5, R6, R17, R20, R21, R22, R34, R36	10	CRCW060349R9FKEA	Vishay-Dale	RES, 49.9, 1%, 0.1 W, 0603	
8	R2, R3, R18, R19	4	MCR10EZPJ000	Rohm	RES, 0, 5%, 0.125 W, 0805	
9	R43, R44, R45, R46	4	CRCW0603487RFKEA	Vishay-Dale	RES, 487, 1%, 0.1 W, 0603	
10	R9, R25, R47, R48, R49, R50	6	CRCW060352R3FKEA	Vishay-Dale	RES, 52.3, 1%, 0.1 W, 0603	
11	R8, R10, R13, R16, R24, R26, R29, R32	8	CRCW0603000Z0EA	Vishay-Dale	RES, 0, 5%, 0.1 W, 0603	
12	R33, R35	2	RC0603FR-0749K9L	Yageo America	RES, 49.9 k, 1%, 0.1 W, 0603	
13	R51, R52, R53, R54, R55, R56, R57, R58	8	CRCW06031K00FKEA	Vishay-Dale	RES, 1.00 k, 1%, 0.1 W, 0603	
14	R41, R42	2	CRCW0603100RFKEA	Vishay-Dale	RES, 100, 1%, 0.1 W, 0603	
15	SH-J5_1-OPEN, SH-J10_1-OPEN	2	382811-6	AMP	Shunt, 100mil, Gold plated, Black	
16	T2, T4	2	ADTL1-4-75+	Minicircuits	RF Transformer, 75 ohm, 0.5 to 1000 MHz, SMT	
17	TP1, TP2	2	5000	Keystone	Test Point, Miniature, Red, TH	
18	TP3	1	5014	Keystone	Test Point, Multipurpose, Yellow, TH	
19	TP4, TP5, TP6, TP7	4	5011	Keystone Electronics	Test Point, TH, Multipurpose, Black	
20	TP8	1	5010	Keystone Electronics	Test Point, TH, Multipurpose, Red	
21	U1	1	THS4552IRTWR	Texas Instruments	Low Power, Precision, 150MHz, Fully Differential Amplifier	

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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:*

- 3.1 *United States*

- 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.

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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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- 4.1 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:*
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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.
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