

THS4561DGKEVM

The THS4561EVM is an evaluation module for the single THS4561 amplifier in the DGK (VSSOP-8) 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 or differential input with gain of 1 V/V to differential output at the device pins, which is converted to single-ended through a transformer to the output. The evaluation module can be easily configured for other functions, gains, and single- or split-supply operation.

The THS4561EVM has an onboard load for the amplifier of 1 k Ω . The output transformer and resistor network converts this to a 50- Ω single-ended output.

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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 is easily reconfigured for other gains
- Designed for easy connection to standard 50- Ω 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

| PARAMETER | | VALUE |
|------------|---|----------------------------|
| | Single-supply voltage range ($V_- = \text{ground}$) | 2.85 to 12.6 V |
| V_{\pm} | Split-supply voltage range | ± 1.425 to ± 6.3 V |
| $I_{S\pm}$ | Supply current (no load) | 0.85 mA |
| | Input voltage low | $V_{S-} - 0.1$, Max |
| | Input voltage high | $V_{S+} - 1.1$, Max |
| I_{OUT} | Output drive | ± 50 mA |

3 Power Connections

The THS4561EVM 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 data-sheet specifications for proper operation. The THS4561 output common-mode voltage defaults to midsupply if the V_{cm} connector is left floating.

4 Input and Output Connections

The THS4561DGKEVM 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- Ω termination. For best results, signals must be routed to and from the EVM with cables having 50- Ω characteristic impedance. Either IN+ (J2) or IN- (J1) can be used for single-ended input. The unused connector must be terminated with a 50- Ω resistive SMA load. If no SMA load is available the spaces marked C1 or C2 can be loaded with a 0- Ω resistor to terminate the unused input. Use both IN+ (J2) and IN- (J1) for differential input. OUT+ (J8) is the output connector for single-ended output signals. The amplifier converts the single-ended or differential input to a differential signal at its output pins. A resistor network (R8, R9, R10) and transformer on the output of the amplifier convert the differential output signal to single-ended, and provides a 1-k Ω load to the amplifier when terminated in 50 Ω . A 50- Ω line-impedance match at OUT+ must be preserved. This results in an output measurement loss, and the overall gain is approximately -31 dB. See the applications section, schematics, and layouts in THS4561 data sheet: [THS4561 Low-Power, High Supply Range, 60-MHz, Fully Differential Amplifier](#), for more detail and how to reconfigure the EVM.

4.1 VOVM Input Connections

The Vcm input (J3) is optional and the SMA connector is not loaded in default configuration. This input sets the common mode of the output pins. The THS4561 will automatically self-bias the output common-mode voltage to the mid-supply voltage if the Vocm pin is not connected. This is the optimal voltage for maximum output swing and best linearity.

The valid range of the VOVM is 0.45 V above the negative supply to 1.1 V below the positive supply. For example, on a ± 5 -V split supply, the Vocm pin can be set anywhere from -4.55 V to +3.9 V. With a single 10-V supply, the valid range would be 0.45 V to 8.9 V. Remember, the outputs of the THS4561 can swing from rail to rail; however, the maximum output swing available is reduced when the VOVM pin is set to a voltage other than mid supply.

If providing 50- Ω termination for the Vcm input signal source is desired, C6 can be replaced with a 0- Ω resistor. The board is shipped with C6 populated with 0.22 μ F and VOVM input is set to mid-supply voltage with C6 populated.

4.2 PD Input Connections

The PD jumper (J5) allows the THS4561 to be disabled. An SMA connector can also be loaded at J4 and a signal for the power down function can be applied for high-speed testing. Normally the J5 jumper is used to enable or disable (power down) the amplifier. When jumper J5 is open, the amplifier is **not** powered down, so it is enabled. When the shorting block is connected and J5 is closed, the amplifier is powered down.

For high-speed testing, the C4 can be replaced with 0 Ω to terminate the PD SMA input. The shorting block must be removed from J5 during high-speed testing. Because 0 Ω at C4 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 Ω at C4 must only be used when driving the SMA connector with a high speed, controlled impedance source.

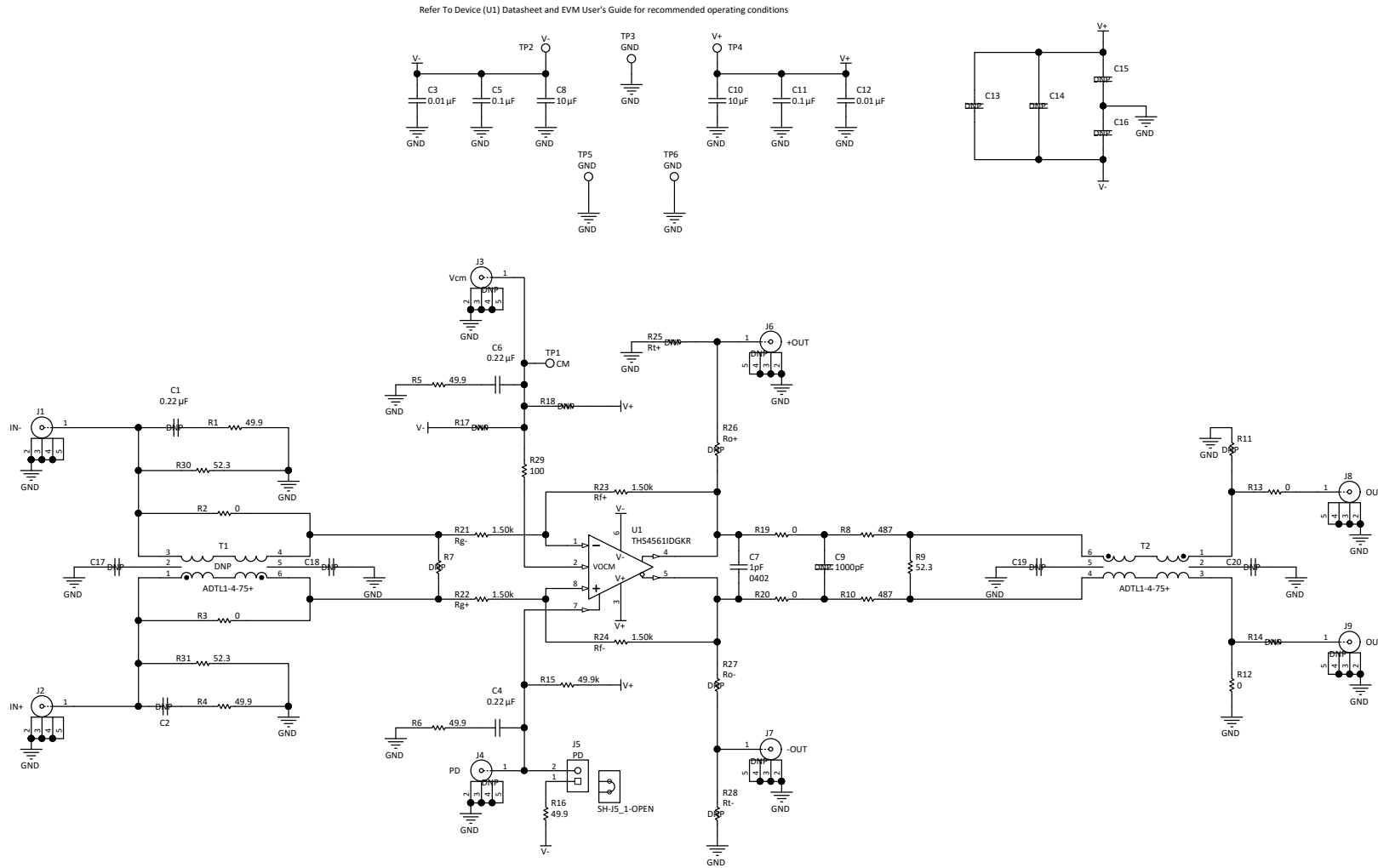
4.3 Using the Optional Differential Outputs (J6, J7)

The THS4561EVM can be reconfigured for fully-differential outputs. By removing resistors R19 and R20, the balun circuit is disconnected from the amplifier output. If 50- Ω resistors are loaded in the R26 and R27 resistor positions, and SMA connectors are loaded in the J6 and J7 connector positions, J6 and J7 can be used for fully-differential output signals. If 50- Ω test equipment is connected to J6 and J7, the total load to the amplifier is 200 Ω . The data-sheet specifications were produced with a 1-k Ω load. In order to match a 1-k Ω load, load R26 and R27 with 475- Ω resistors, and then load R25 and R28 with 56.2- Ω resistors.

5 THS4561EVM Schematic, Layout, and Bill of Materials

5.1 Schematic

Figure 1 illustrates the EVM schematic.



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Figure 1. THS4561EVM Schematic

5.2 THS4561EVM Layers

Figure 2 to Figure 5 show the THS4561EVM layers.

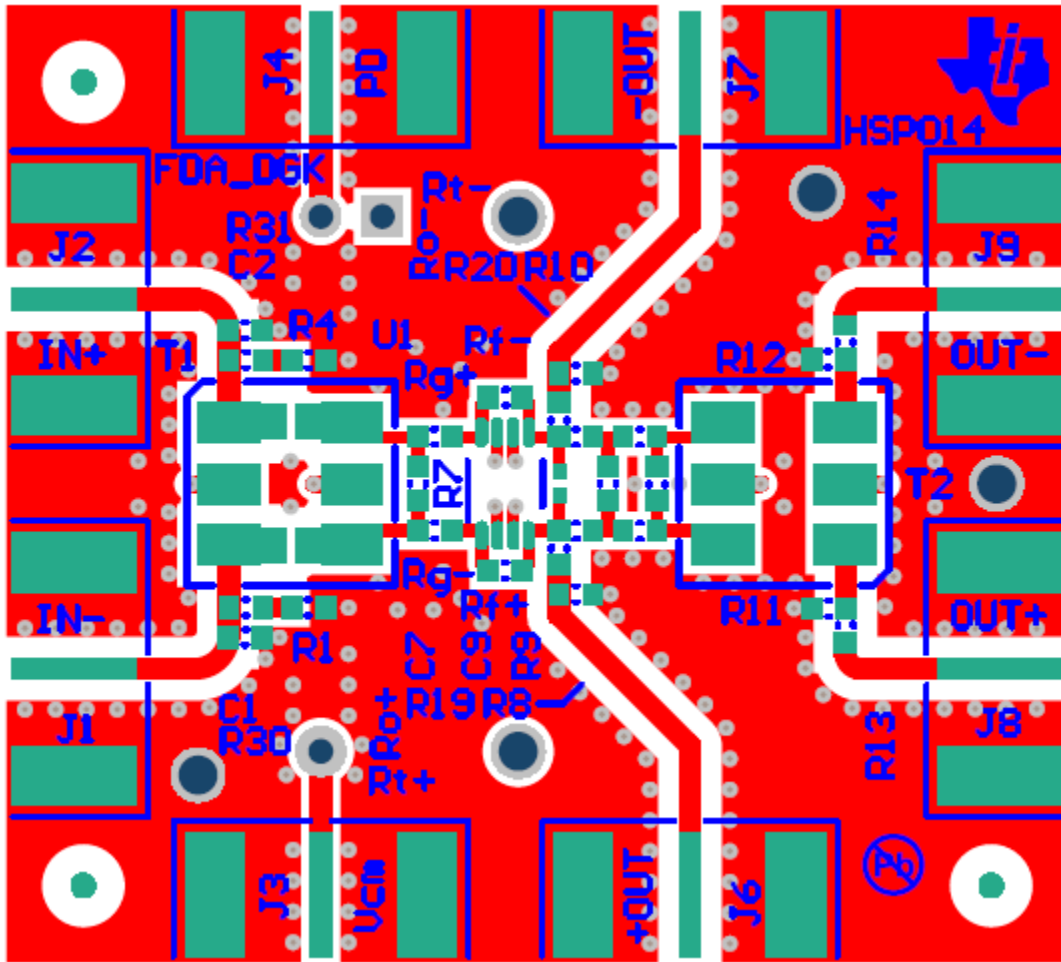


Figure 2. THS4561EVM Top Layer, Signal

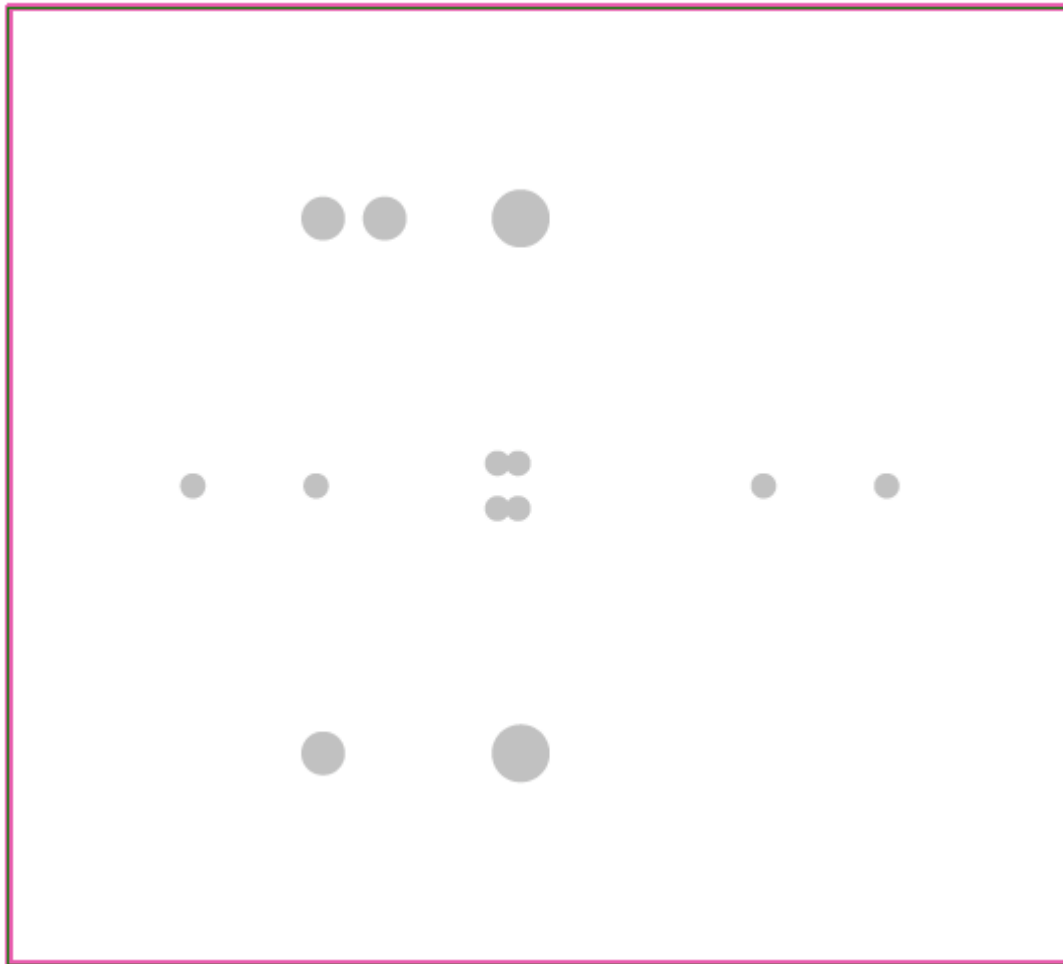


Figure 3. THS4561EVM Layer 2

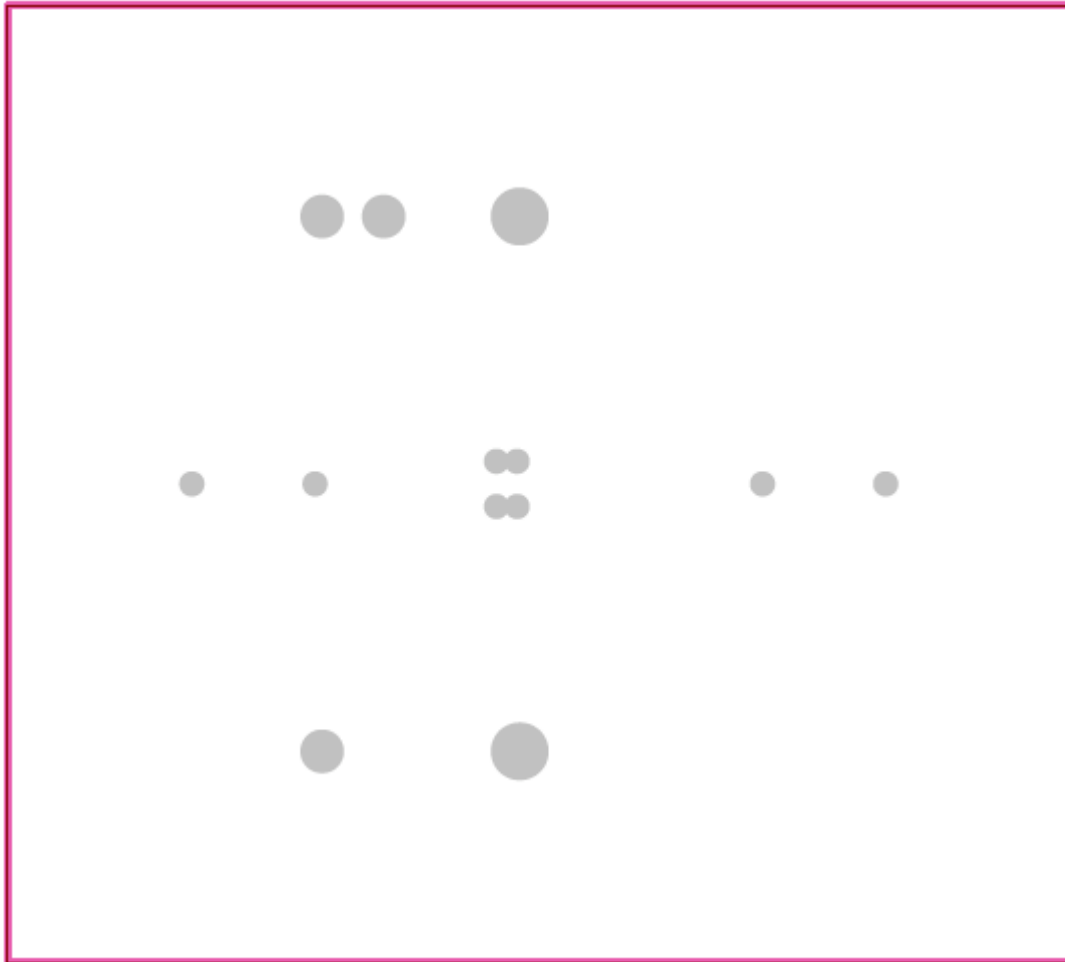


Figure 4. THS4561EVM Layer 3

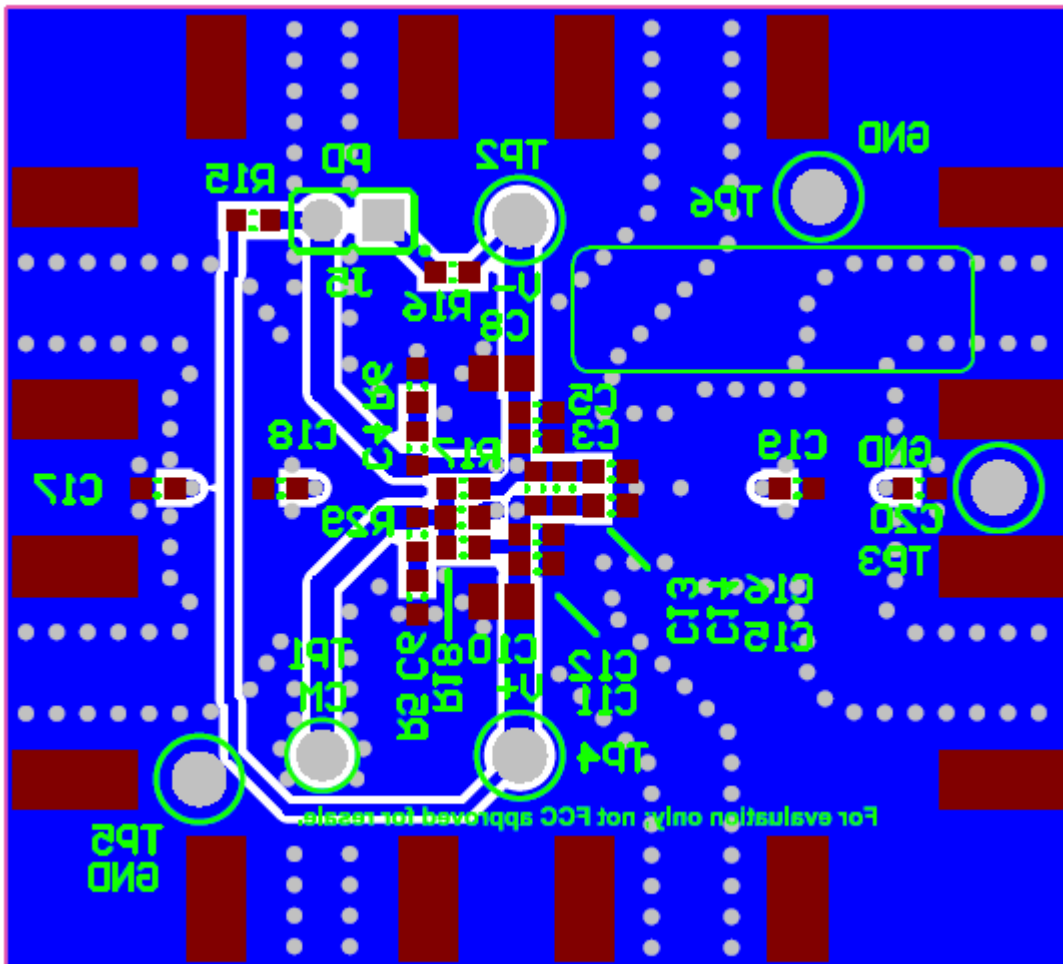


Figure 5. THS4561EVM Bottom Layer

5.3 Bill of Materials

Table 2 lists the EVM bill of materials.

Table 2. THS4561EVM Bill of Materials

| ITEM | PART REFERENCE | QUANTITY | PART NUMBER | MANUFACTURER | DESCRIPTION |
|------|---------------------|----------|--------------------|-----------------------------|---|
| 1 | C3, C12 | 2 | GRM188R71E103KA01D | Murata | CAP, CERM, 0.01uF, 25V, +/-10%, X7R, 0603 |
| 2 | C4, C6 | 2 | GRM188R61E224KA88D | Murata | CAP, CERM, 0.22 μF, 25 V, +/- 10%, X5R, 0603 |
| 3 | C5, C11 | 2 | 06033D104KAT2A | AVX | CAP, CERM, 0.1 μF, 25 V, +/- 10%, X5R, 0603 |
| 4 | C7 | 1 | GRM1555C1H1R0CA01D | Murata | CAP, CERM, 1 pF, 50 V, +/- 5%, COG/NP0, 0402 |
| 5 | C8, C10 | 2 | GRM21BR61E106KA73L | Murata | CAP, CERM, 10 μF, 25 V, +/- 10%, X5R, 0805 |
| 6 | J1, J2, J8 | 3 | 142-0701-806 | Emerson Network Power | Connector, End launch SMA, 50 ohm, SMT |
| 7 | J5 | 1 | PBC02SAAN | Sullins Connector Solutions | Header, 100mil, 2x1, Gold, TH |
| 8 | R1, R4, R5, R6, R16 | 5 | CRCW060349R9FKEA | Vishay-Dale | RES, 49.9, 1%, 0.1 W, 0603 |
| 9 | R2, R3 | 2 | MCR10EZPJ000 | Rohm | RES, 0, 5%, 0.125 W, 0805 |
| 10 | R8, R10 | 2 | CRCW0603487RFKEA | Vishay-Dale | RES, 487, 1%, 0.1 W, 0603 |
| 11 | R9, R30, R31 | 3 | CRCW060352R3FKEA | Vishay-Dale | RES, 52.3, 1%, 0.1 W, 0603 |
| 12 | R12, R13, R19, R20 | 4 | CRCW06030000Z0EA | Vishay-Dale | RES, 0, 5%, 0.1 W, 0603 |
| 13 | R15 | 1 | RC0603FR-0749K9L | Yageo America | RES, 49.9 k, 1%, 0.1 W, 0603 |
| 14 | R21, R22, R23, R24 | 4 | CRCW06031K50FKEA | Vishay-Dale | RES, 1.50 k, 1%, 0.1 W, 0603 |
| 15 | R29 | 1 | CRCW0603100RFKEA | Vishay-Dale | RES, 100, 1%, 0.1 W, 0603 |
| 16 | SH-J5_1-OPEN | 1 | 382811-6 | AMP | Shunt, 100mil, Gold plated, Black |
| 17 | T2 | 1 | ADTL1-4-75+ | Minicircuits | RF Transformer, 75 ohm, 0.5 to 1000 MHz, SMT |
| 18 | TP1 | 1 | 5000 | Keystone | Test Point, Miniature, Red, TH |
| 19 | TP2 | 1 | 5014 | Keystone | Test Point, Multipurpose, Yellow, TH |
| 20 | TP3, TP5, TP6 | 3 | 5011 | Keystone Electronics | Test Point, TH, Multipurpose, Black |
| 21 | TP4 | 1 | 5010 | Keystone Electronics | Test Point, TH, Multipurpose, Red |
| 22 | U1 | 1 | THS4561 | Texas Instruments | Low Power, Precision, 60MHz, Fully Differential Amplifier |

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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.

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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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- 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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3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

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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.

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