

ABSTRACT

The RUN-FDA-4567-EVM is an unassembled evaluation module for fully differential amplifiers with input common mode control such as the THS4567 in the RUN (VQFN-16) 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 can be configured for easy connection with common 50-Ω laboratory equipment on its inputs and outputs or optionally it can use a differential diode connection as the input. The EVM features multiple connection options for the input common mode, output common mode, and enable control signals. The output has an optional transformer connection to convert the differential output to a single ended signal for use with test equipment.

Table of Contents

1 Trademarks	1
2 Features	2
3 EVM Specifications	2
4 Power Connections	2
4.1 Split-Supply Operation.....	2
4.2 Single-Supply Operation.....	2
5 Input and Output Connections	2
5.1 V _{OCM} and V _{ICM} Input Connections.....	3
5.2 Enable Input Connections.....	3
5.3 Example EVM Configuration Using the THS4567	3
6 RUN-FDA-4567-EVM Schematic, Layout, and Bill of Materials	4
6.1 RUN-FDA-4567-EVM Layers.....	5
6.2 Bill of Materials.....	9
7 References	10

List of Figures

Figure 6-1. RUN-FDA-4567-EVM Schematic and Example Configuration.....	4
Figure 6-2. Top Layer Overlay.....	5
Figure 6-3. Top Layer Solder Mask.....	5
Figure 6-4. Top Layer.....	6
Figure 6-5. Layer 2, Ground.....	6
Figure 6-6. Layer 3, Power.....	7
Figure 6-7. Bottom Layer.....	7
Figure 6-8. Bottom Layer Solder Mask.....	8
Figure 6-9. Bottom Layer Overlay.....	8

List of Tables

Table 6-1. RUN-FDA-4567-EVM Example Bill of Materials.....	9
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1 Trademarks

All trademarks are the property of their respective owners.

2 Features

This EVM supports the following features:

- Can be used with split supply or single supply configuration
- Configurable gain and feedback network capacitors
- Designed for easy connection to standard 50-Ω input and output impedance test equipment
- Inputs, outputs, and control signals include SMA connectors for high speed operation

3 EVM Specifications

Refer to [SBOSA51](#) for specific EVM input, output, and supply voltage ratings.

4 Power Connections

The RUN-FDA-4567-EVM 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.

4.1 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.

4.2 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.

5 Input and Output Connections

The RUN-FDA-4567-EVM is equipped with SMA connectors for easy connection of signal generators and analysis equipment. For best results, voltage 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 should be terminated with a 50-Ω resistive SMA load or balanced with an equivalent resistive load to ground so that both input networks are the same impedance. Use both IN+ (J2) and IN- (J1) for differential voltage input or diode D1 for a differential diode input. OUT+ (J8) or OUT- (J9) can be used for single ended output in conjunction with transformer T1 by terminating the opposite output to ground using R8 or R18 respectively. A resistor network (R5, R6, R7, R15, and R16) provides a load matching network to the amplifier to allow for a larger amplifier load while maintaining a desired terminated characteristic output impedance. For single ended output measurements 50-Ω line-impedance match at the output should be preserved.

5.1 VOCM and VICM Input Connections

The output common mode control (Vocm) can be set by using the resistor divider created by R17 and R26, the test point TP1, or with the SMA connector J3. If providing 50-Ω termination for the Vcm input signal source is desired, C5 can be replaced with a 50-Ω resistor.

The input common mode (Vicm) can be set by using the resistor divider created by R27 and R28, the test point TP7, or with the SMA connector J10. If providing 50-Ω termination for the Vcm input signal source is desired, C20 can be replaced with a 50-Ω resistor.

The EVM also contains a ICM EN input connection to disable or enable the input common mode control functionality. It is set to V+ by default using resistor R21 and can be shorted to V- with jumper J6. For high-speed control, C15 can be replaced with 0 Ω to terminate the PD SMA input with a 50 ohm resistor in R20. The shorting block should be removed from J7 during high-speed testing. Because 0 Ω at C10 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 should only be used when driving the SMA connector with a high speed, controlled impedance source.

5.2 Enable Input Connections

The AMP EN jumper (J4) controls the amplifiers disable function on pin 3 of the device. It is set to V+ by default using resistor R13 and can be shorted to V- with jumper J5.

For high-speed testing, C4 can be replaced with 0 Ω to terminate the PD SMA input with a 50 ohm resistor in R10. The shorting block should 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 should only be used when driving the SMA connector with a high speed, controlled impedance source.

5.3 Example EVM Configuration Using the THS4567

The example component configuration shown in the [Figure 6-1](#) illustrates a default board setup for evaluating the THS4567 amplifier. In the configuration shown, the board is set for 50-Ω single ended voltage input on IN- (J1) and output on OUT+ (J8). The gain is set to approximately 7 V/V using the input and feedback resistors, and resistor R2 provides the 50-Ω input impedance match while R12 balances the impedance on the non-signal input. The output network created by R6, R7, and R16 form a total load of 1kΩ to the amplifier while still providing a 50-Ω output impedance match. In addition to the impedance matching, the output network also attenuates the total output an additional 32 dB.

The input common mode enable and amplifier enable functions are set by default for easy control using jumpers J7 and J5 respectively. The Vocm and Vicm voltage signals are set up for simple DC voltage control using the test points TP1 and TP7.

The power supply is set up for a split supply configuration with three decoupling capacitors on each supply to provide high speed decoupling performance.

6 RUN-FDA-4567-EVM Schematic, Layout, and Bill of Materials

Section 6 illustrates the EVM schematic with an example configuration for the THS4567 amplifier, the layout prints, and an example bill of materials.

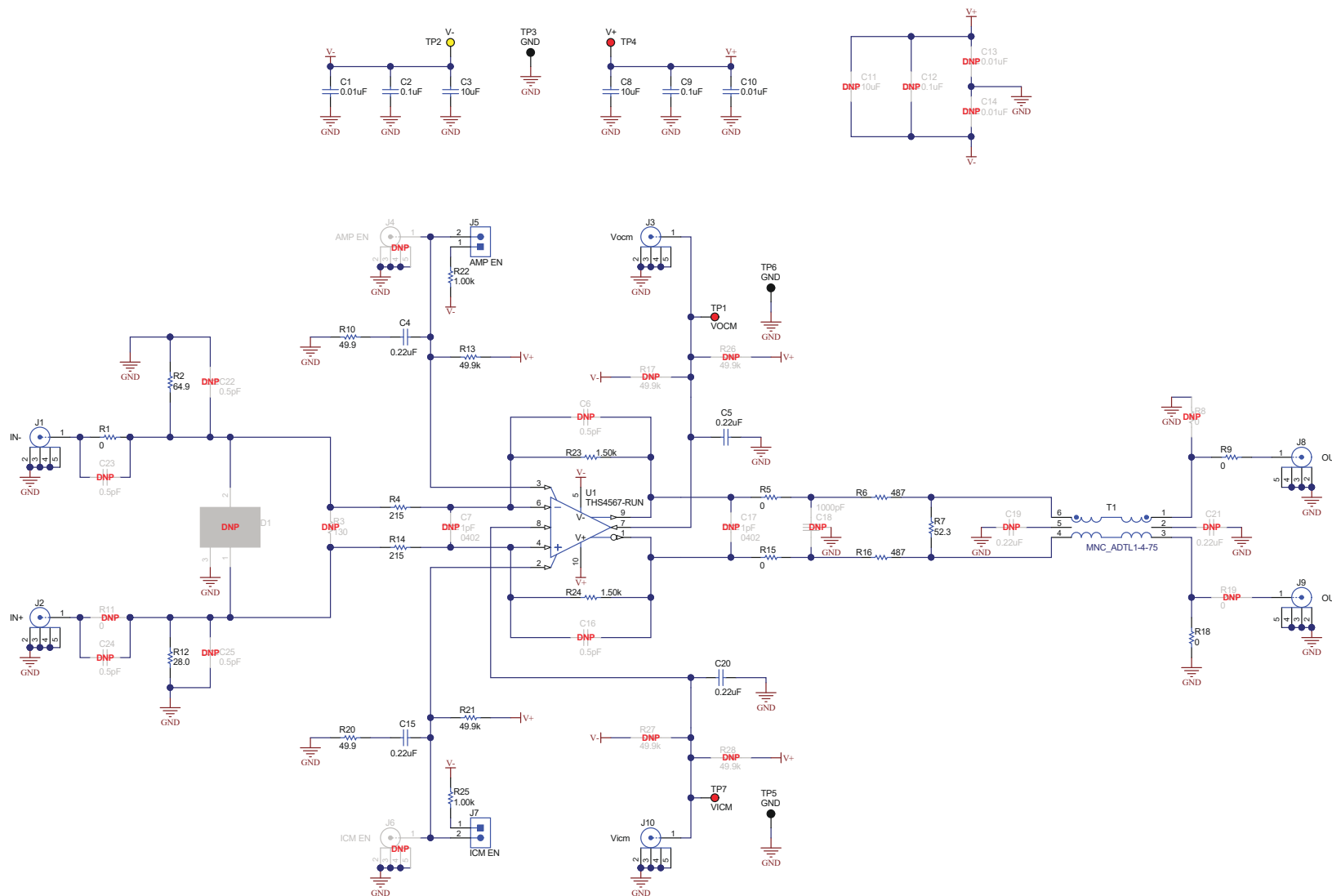


Figure 6-1. RUN-FDA-4567-EVM Schematic and Example Configuration

6.1 RUN-FDA-4567-EVM Layers

Figure 6-2 through Figure 6-9 shows the RUN-FDA-4567-EVMPCB layers.

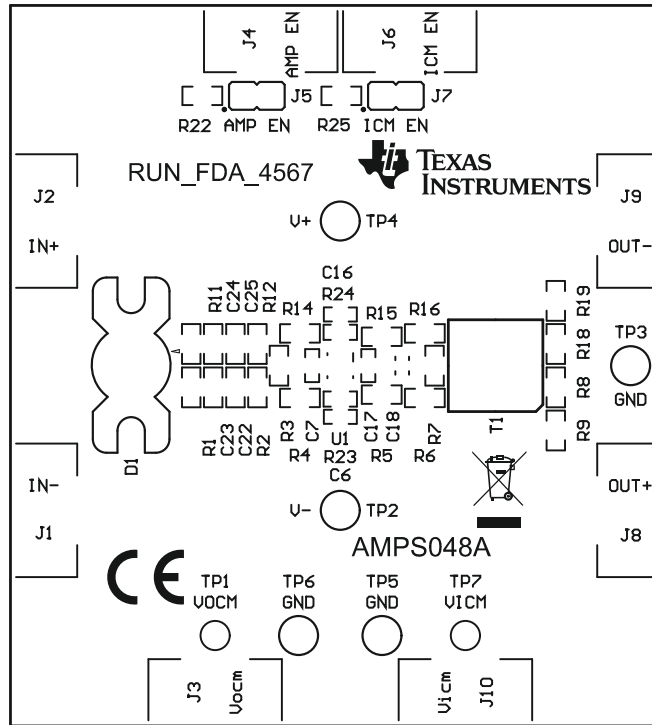


Figure 6-2. Top Layer Overlay

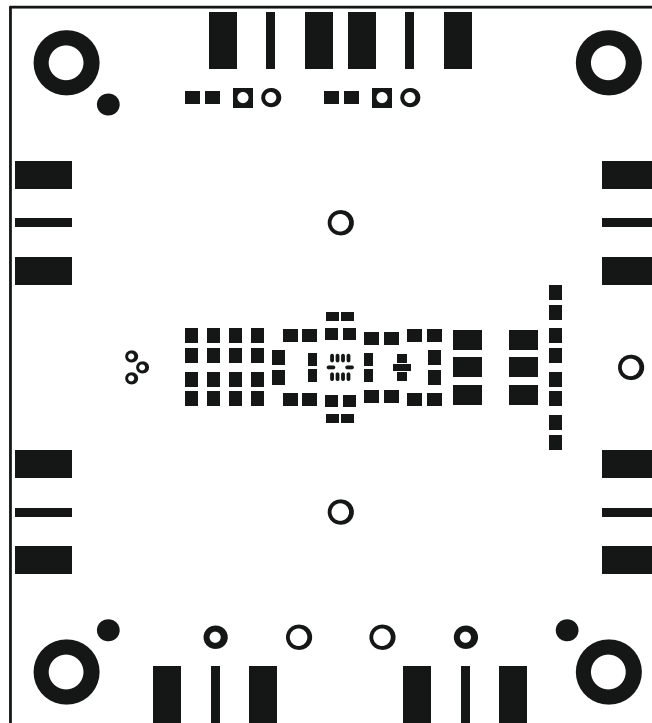


Figure 6-3. Top Layer Solder Mask

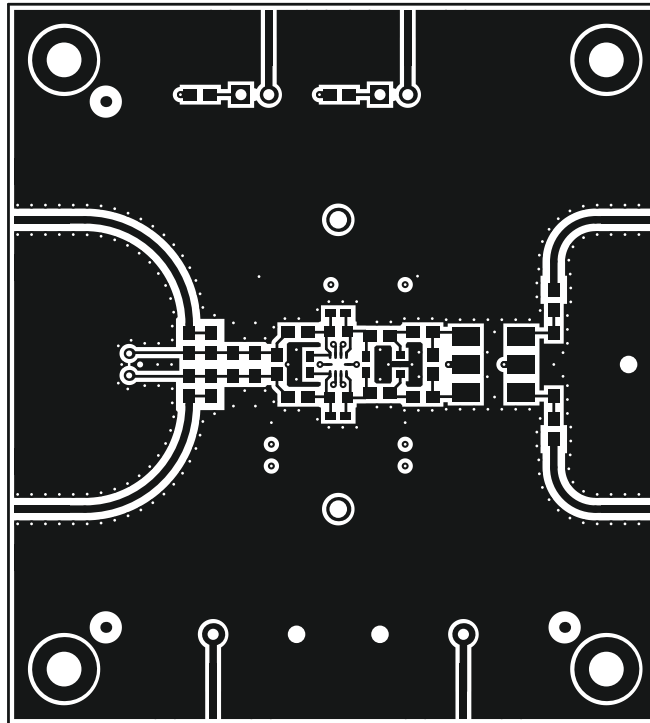


Figure 6-4. Top Layer

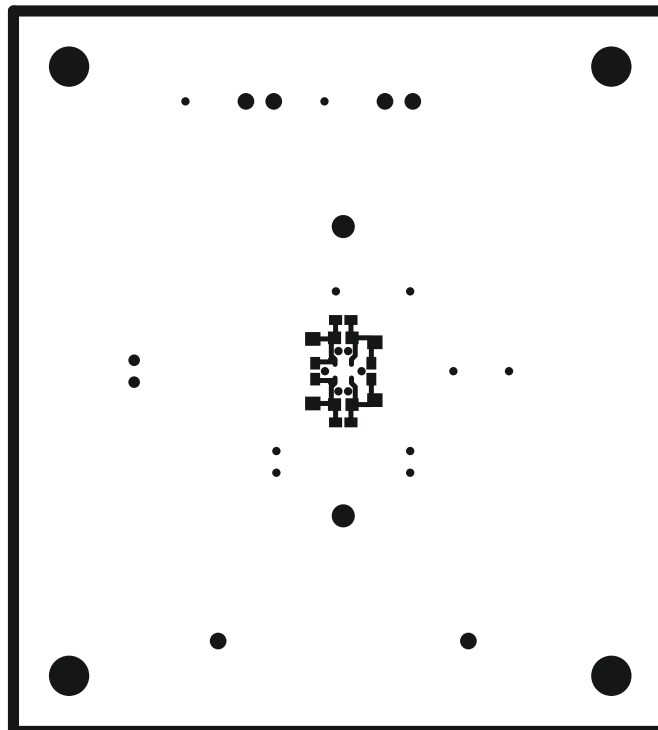


Figure 6-5. Layer 2, Ground

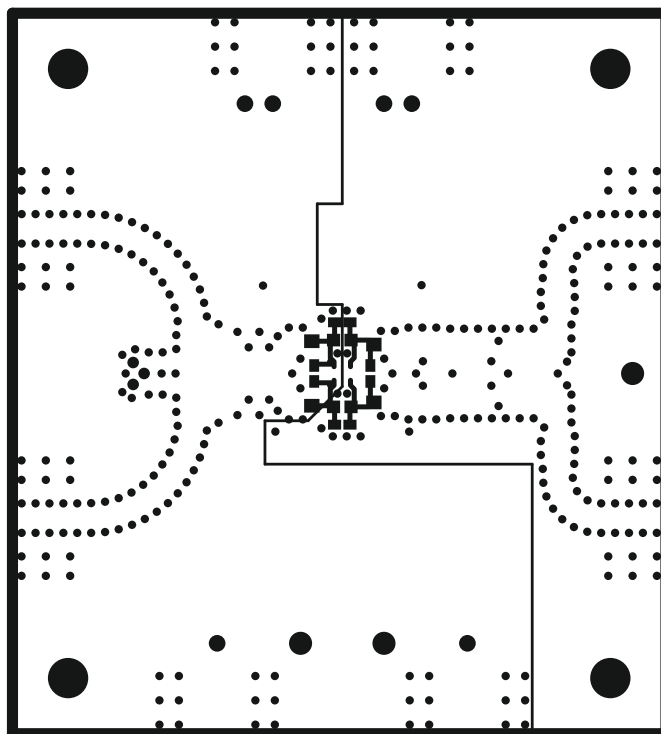


Figure 6-6. Layer 3, Power

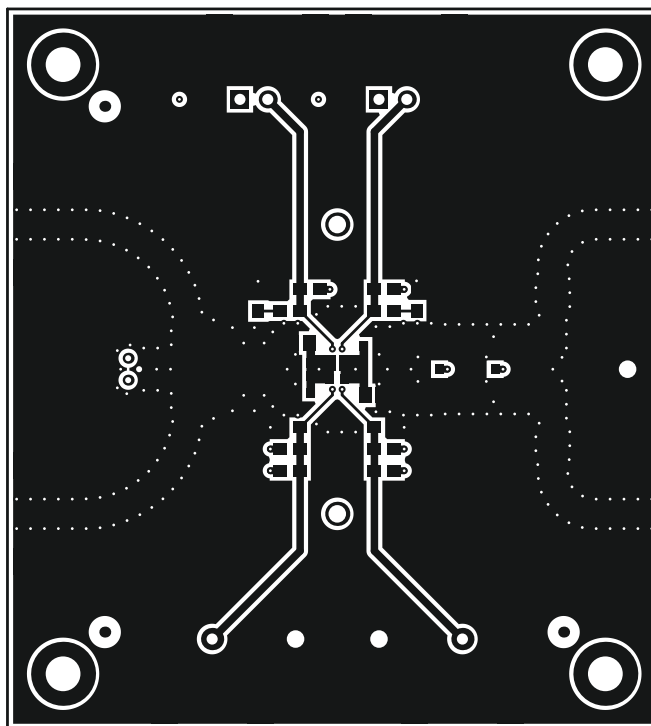


Figure 6-7. Bottom Layer

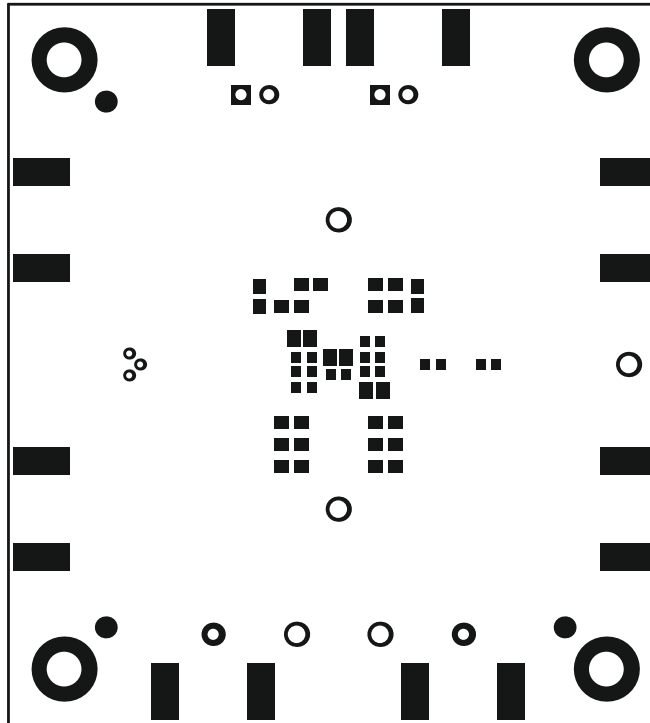


Figure 6-8. Bottom Layer Solder Mask

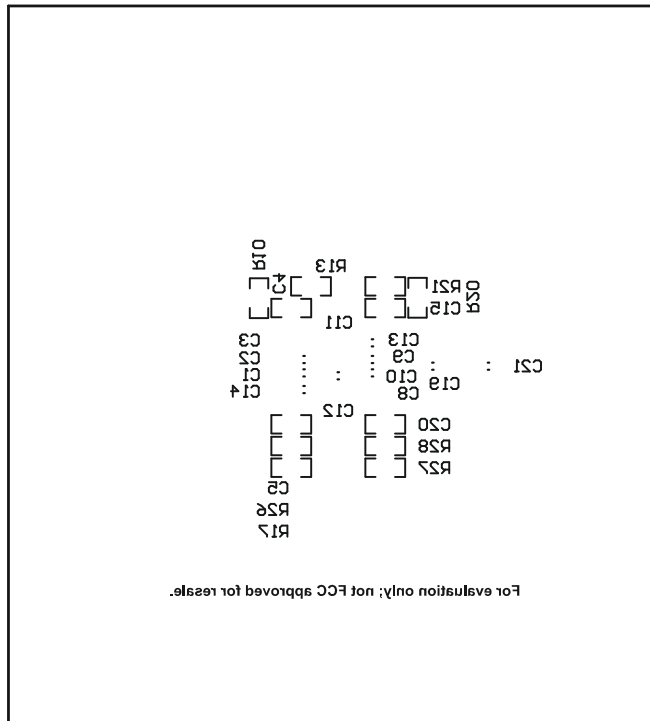


Figure 6-9. Bottom Layer Overlay

6.2 Bill of Materials

Table 6-1 lists the EVM bill of materials.

Table 6-1. RUN-FDA-4567-EVM Example Bill of Materials

Item	Part Reference	Quantity	Part Number	Manufacturer	Description	Note
1	C1, C10	2	C0603H103J3GACTU	Kemet	CAP, CERM, 0.01 μ F, 25 V, \pm 5%, COG/NP0, 0603	
2	C2, C9	2	0603YC104JAT2A	AVX	CAP, CERM, 0.1 μ F, 16 V, \pm 5%, X7R, 0603	
3	C3, C8	2	GRM21BR61C106KE15L	MuRata	CAP, CERM, 10 μ F, 16 V, \pm 10%, X5R, 0805	
4	C4, C5, C15, C20	4	GRM188R61A224KA01D	MuRata	CAP, CERM, 0.22 μ F, 10 V, \pm 10%, X5R, 0603	
5	FID4, FID5, FID6	3	N/A	N/A	Fiducial mark. There is nothing to buy or mount.	
6	H1, H2, H3, H4	4	PMSSS 440 0025 PH	B&F Fastener Supply	MACHINE SCREW PAN PHILLIPS 4-40	
7	H5, H6, H7, H8	4	1891	Keystone	Hex Standoff, #4-40, Aluminum, 1/4 in	
8	J1, J2, J3, J8, J9, J10	6	142-0701-806	Cinch Connectivity	Connector, End launch SMA, 50 Ω , SMT	
9	J5, J7	2	PBC02SAAN	Sullins Connector Solutions	Header, 100 mil, 2x1, Gold, TH	
10	R1, R5, R9, R15, R18	5	MCT06030Z0000ZP500	Vishay/Beyschlag	RES, 0, 5%, 0.125 W, 0603	
11	R2	1	RC0603FR-0764R9L	Yageo America	RES, 64.9, 1%, 0.1 W, 0603	
12	R4, R14	2	RT0603BRD07215RL	Yageo America	RES, 215, 0.1%, 0.1 W, 0603	
13	R6, R16	2	CRCW0603487RFKEA	Vishay-Dale	RES, 487, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	
14	R7	1	RC0603FR-0752R3L	Yageo	RES, 52.3, 1%, 0.1 W, 0603	
15	R10, R20	2	CRCW060349R9FKEA	Vishay-Dale	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	
16	R12	1	RC0603FR-0728R1L	Yageo America	RES, 28.0, 1%, 0.1 W, 0603	
17	R13, R21	2	RC0603FR-0749K9L	Yageo America	RES, 49.9 k, 1%, 0.1 W, 0603	
18	R22, R25	2	ERJ-3EKF1001V	Panasonic	RES, 1.00 k, 1%, 0.1 W, 0603	
19	R23, R24	2	RT0603BRD071K5L	Yageo America	RES, 1.50 k, 0.1%, 0.1 W, 0603	
20	SH-J1, SH-J2	2	382811-6	AMP	Shunt, 100 mil, Gold plated, Black	
21	T1	1	ADTL1-4-75+	Minicircuits	RF Transformer, 75 Ω , 0.5 to 1000 MHz, SMT	
22	TP1, TP7	2	5000	Keystone	Test Point, Miniature, Red, TH	
23	TP2	1	5014	Keystone	Test Point, Multipurpose, Yellow, TH	
24	TP3, TP5, TP6	3	5011	Keystone	Test Point, Multipurpose, Black, TH	
25	TP4	1	5010	Keystone	Test Point, Multipurpose, Red, TH	
26	U1	1	THS4567-RUN	Texas Instruments	High-Speed, Fully-Differential Transimpedance Amplifier, RUN0010A (WQFN-10)	

7 References

- Texas Instruments, [THS4567 220 MHz CMOS Input, Fully Differential Amplifier data sheet](#)

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