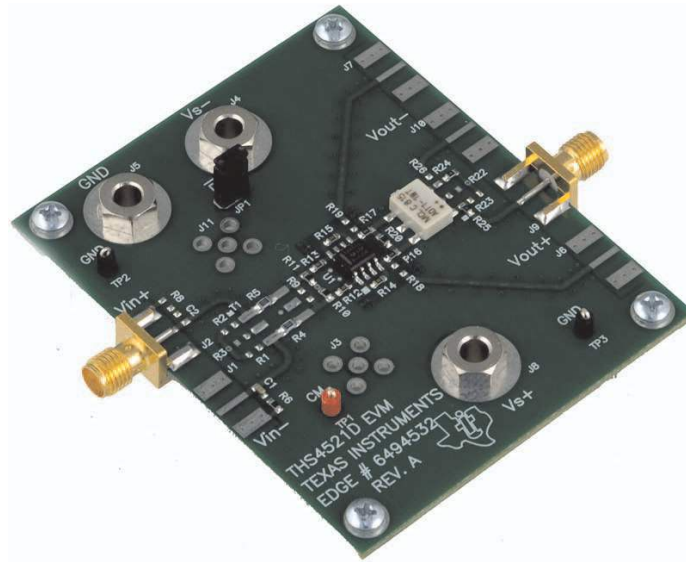


# THS4521/2/4EVM



**THS4521EVM**

**Features:**

- Configured for split-supply operation; easily modified for single-supply operation.
- Default single-ended input configuration can easily be reconfigured for differential input.
- Default single-ended output configuration can easily be reconfigured for differential output.
- Designed for easy connection to standard 50-Ω input/output impedance test equipment.
- Inputs and outputs include SMA connectors.

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## 1 Description

The [THS4521](#), [THS4522](#), and [THS4524](#) family of devices are very low-power, fully differential operational amplifiers with rail-to-rail output and an input common-mode range that includes the negative rail. These amplifiers are designed for low-power data-acquisition systems and high-density applications where power dissipation is a critical parameter.

The THS4521EVM is an evaluation module (EVM) for the single version, THS4521, in an SO-8 (D) package. The THS4522EVM is an evaluation module for the dual version, THS4522, in a TSSOP-16 (PW) package. The THS4524EVM is an evaluation module for the quad version, THS4524, in a TSSOP-32 (DBT) package.

The THS4521/2/4EVMs are designed to quickly and easily demonstrate the functionality and versatility of these amplifiers. Each EVM is ready to connect to power, a signal source, and a variety of test instruments through the use of onboard connectors. The default amplifier configuration for each module is a single-ended input, single-ended output (via transformer), and split-supply operation. The EVMs can be easily configured for differential input, differential output, and single-supply operation. Throughout this document, the acronym *EVM* and the phrases *evaluation module* and *evaluation board* are synonymous with the THS4521/2/4EVMs. For clarity of reading, the abbreviation *THS4521/2/4EVMs* refers to the THS4521EVM, THS4522EVM, and THS4524EVM, unless otherwise noted.

The electrical specifications for the THS4521/2/4EVMs are summarized in [Table 1](#).

**Table 1. EVM Specifications**

Parameter	Units
Single-supply voltage range ( $V_{S-}$ = ground)	2.5 V to 5.5 V
Split Supply voltage range ( $V_{S\pm}$ )	$\pm 1.25$ V to 2.75 V
Supply current ( $I_{S\pm}$ )	1.1 mA/A, typ
Input voltage ( $V_I$ )	$V_{S\pm}$ , max
Output drive ( $I_O$ )	$\pm 55$ mA, typ

## 2 Power Connections

The THS4521/2/4EVMs are equipped with banana jacks for easy power connections. The positive supply input is labeled  $V_{S+}$ . The negative supply input is labeled  $V_{S-}$ . Ground is labeled *GND*.

### 2.1 Split-Supply Operation

For split-supply operation, apply the positive supply voltage to  $V_{S+}$ , the negative supply voltage to  $V_{S-}$ , and the ground reference from supply to *GND*.

### 2.2 Single-Supply Operation

For single-supply operation, connect  $V_{S-}$  to *GND* with a jumper, and apply the positive supply voltage to  $V_{S+}$ .

## 3 Input and Output Connections

The THS4521/2/4EVMs are equipped with SMA connectors for easy connection of signal generators and analysis equipment. As shipped from the factory, the EVMs are configured for single-ended input and output with termination for connection to 50-Ω test equipment. For best results, the signal should be routed to and from the EVM with cables that have 50-Ω characteristic impedance. Refer to the [THS4521](#), [THS4522](#), [THS4524 product data sheet](#), and the schematics and layouts provided in this user guide for details on how to reconfigure the EVM board for differential input or output operation.

### 3.1 Power-Down Operation

The THS4521/2/4EVMs enable normal operation of the respective devices, or they can each be placed into a power-down mode through the placement of jumpers, as shown in [Table 2](#).

**Table 2. Jumper Configuration**

EVM	Jumper	Operating Mode
THS4521EVM	JP1	Open
		Shorted
THS4522EVM	JP1	Open
		Shorted
	JP2	Open
		Shorted
THS4524EVM	JP1	Open
		Shorted
	JP2	Open
		Shorted
	JP3	Open
		Shorted
	JP4	Open
		Shorted

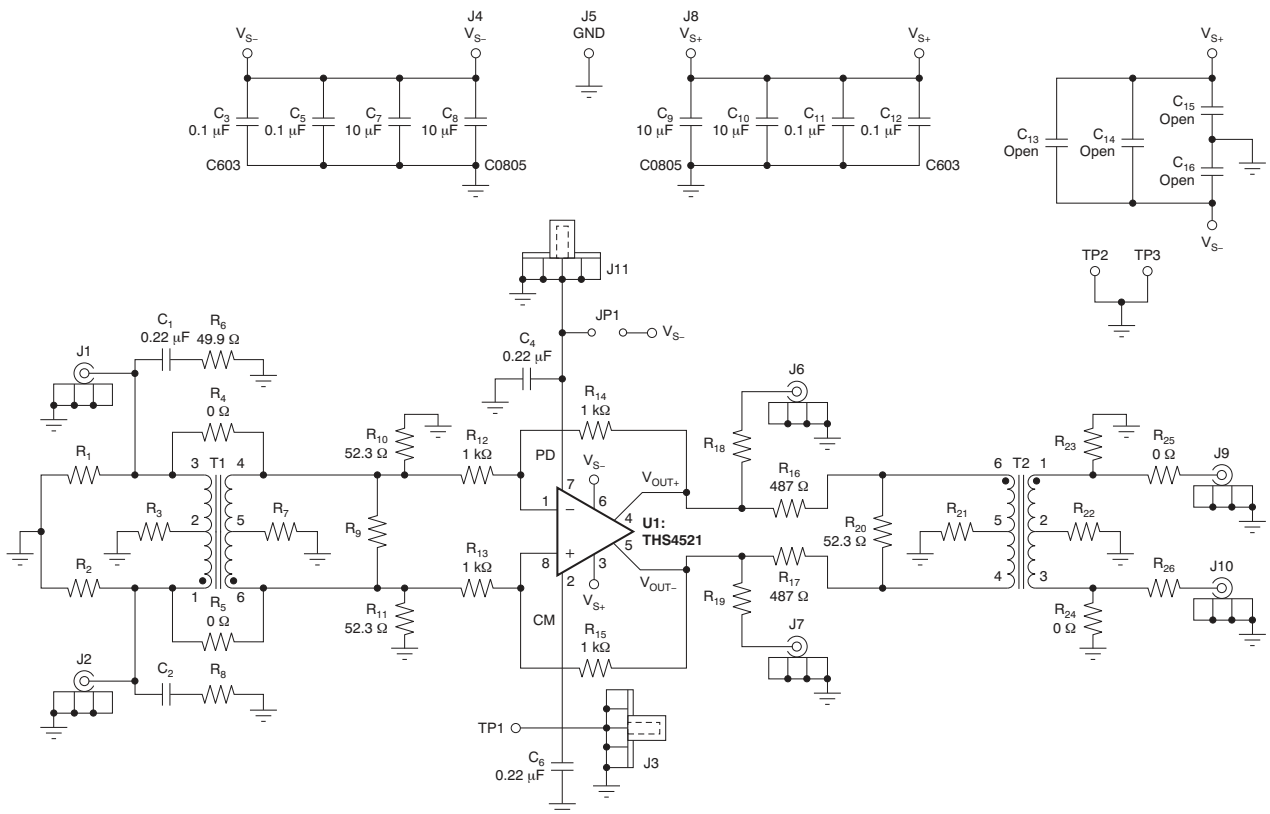
#### 4 THS4521EVM Schematic, Layout, and Bill of Materials (BOM)

Table 3 lists the bill of materials for the THS4521EVM.

Figure 1 through Figure 5 show the schematic and printed circuit board (PCB) layouts, respectively, for the THS4521EVM.

**Table 3. THS4521 Parts List**

Item	Description	SMD Size	Reference Designator	Qty	Manufacturer Part Number
1	Capacitor, 10.0 $\mu$ F, ceramic, X5R, 6.3 V	0805	C7-C10	4	(AVX) 08056D106KAT2A
2	Capacitor, 0.1 $\mu$ F, ceramic, X7R, 16 V	0603	C3, C5, C11, C12	4	(AVX) 0603YC104KAT2A
3	Capacitor, 0.22 $\mu$ F, ceramic, X7R, 10 V	0603	C1, C4, C6	3	(AVX) 0603ZC224KAT2A
4	Open	0603	C2, C13-C16	5	
5	Open	0603	R1-R3, R7-R9, R18, R19, R21-R23, R26	12	
6	Resistor, 0 $\Omega$	0603	R24, R25	2	(ROHM) MCR03EZPJ000
7	Resistor, 49.9 $\Omega$ , 1/10W, 1%	0603	R6	1	(ROHM) MCR03EZPFX49R9
8	Resistor, 52.3 $\Omega$ , 1/10W, 1%	0603	R10, R11, R20	3	(ROHM) MCR03EZPFX52R3
9	Resistor, 487 $\Omega$ , 1/10W, 1%	0603	R16, R17	2	(ROHM) MCR03EZPFX4870
10	Resistor, 1k $\Omega$ , 1/10W, 1%	0603	R12-R15	4	(ROHM) MCR03EZPFX1001
11	Resistor, 0 $\Omega$	0805	R4, R5	2	(ROHM) MCR10EZPJ000
12	Open		T1	1	
13	Transformer, RF		T2	1	(MINI-CIRCUITS) ADT1-1WT
14	Jack, banana receptance, 0.25-in diameter hole		J4, J5, J8	3	(SPC) 813
15	Open		J1, J3, J6, J7, J10, J11	6	
16	Connector, edge, SMA PCB jack		J2, J9	2	(JOHNSON) 142-0701-801
17	Header, 0.1 in CTRS, 0.025-in sq. pins	2 POS.	JP1	1	(SULLINS) PBC36SAAN
18	Shunts		JP1	1	(SULLINS) SSC02SYAN
19	Test point, red		TP1	1	(KEYSTONE) 5000
20	Test point, black		TP2, TP3	2	(KEYSTONE) 5001
21	IC, THS4521		U1	1	(TI) THS4521D
22	Standoff, 4-40 hex, 0.625 in			4	(KEYSTONE) 1808
23	Screw, Phillips, 4-40, 0.250 in			4	SHR-0440-016-SN
24	Board, printed circuit			1	(TI) EDGE# 6494532



**Figure 1. THS4521EVM Schematic**



## 5 THS4522EVM Schematic, Layout, and Bill of Materials (BOM)

Table 4 lists the bill of materials for the THS4522EVM.

Figure 6 through Figure 11 show the schematic and PCB layouts, respectively, for the THS4522EVM.

**Table 4. THS4522EVM Parts List**

Item	Description	SMD Size	Reference Designator	Qty	Manufacturer Part Number
1	Capacitor, 10.0 $\mu$ F, ceramic, X5R, 6.3 V	0805	C7-C10	4	(AVX) 08056D106KAT2A
2	Capacitor, 0.1 $\mu$ F, ceramic, X7R, 16 V	0603	C3, C5, C11, C12	4	(AVX) 0603YC104KAT2A
3	Capacitor, 0.22 $\mu$ F, ceramic, X7R, 10 V	0603	C2, C4, C6, C18-C20	6	(AVX) 0603ZC224KAT2A
4	Open	0603	C1, C13-C17, C21-C24	10	
5	Resistor, 52.3 $\Omega$ , 1/16W, 1%	0402	R10, R11, R36, R37	4	(KOA) RK73H1ETTP52R3F
6	Resistor, 487 $\Omega$ , 1/16W, 1%	0402	R16, R17, R42, R43	4	(KOA) RK73H1ETTP4870F
7	Resistor, 1 k $\Omega$ , 1/16W, 1%	0402	R12-R15, R38-R41	8	(KOA) RK73H1ETTP1001F
8	Open	0603	R1-R3, R6-R8, R19, R22, R23, R26-R29, R32-R34, R45, R48, R49, R52	20	
9	Resistor, 0 $\Omega$	0603	R24, R25, R50, R51	4	(ROHM) MCR03EZPJ000
10	Resistor, 49.9 $\Omega$ , 1/10W, 1%	0603	R9, R35	2	(ROHM) MCR03EZPFX49R9
11	Resistor, 52.3 $\Omega$ , 1/10W, 1%	0603	R18, R44	2	(ROHM) MCR03EZPFX52R3
12	Open	0805	R20, R21, R46, R47	4	
13	Resistor, 0 $\Omega$	0805	R4, R5, R30, R31	4	(ROHM) MCR10EZPJ000
14	Open		T1, T3	2	
15	Transformer, RF		T2, T4	2	(MINI-CIRCUITS) ADT1-1WT
16	Jack, banana receptance, 0.25-in diameter hole		J3-J5	3	(SPC) 813
17	Open		J1, J7, J8, J11-J15	8	
18	Connector, edge, SMA PCB jack		J2, J6, J9, J10	4	(JOHNSON) 142-0701-801
19	Header, 0.1 in CTRS, 0.025-in sq. pins	2 POS.	JP1, JP2	2	(SULLINS) PBC36SAAN
20	Shunts		JP1, JP2	2	(SULLINS) SSC02SYAN
21	Test point, red		TP1, TP4	2	(KEYSTONE) 5000
22	Test point, black		TP2, TP3	2	(KEYSTONE) 5001
23	IC, THS4522		U1	1	(TI) THS4522PW
24	Standoff, 4-40 hex, 0.625 in			4	(KEYSTONE) 1808
25	Screw, Phillips, 4-40, 0.250 in			4	(BF) PMS4400031PH
26	Board, printed circuit			1	(TI) EDGE# 6494533, REV.A

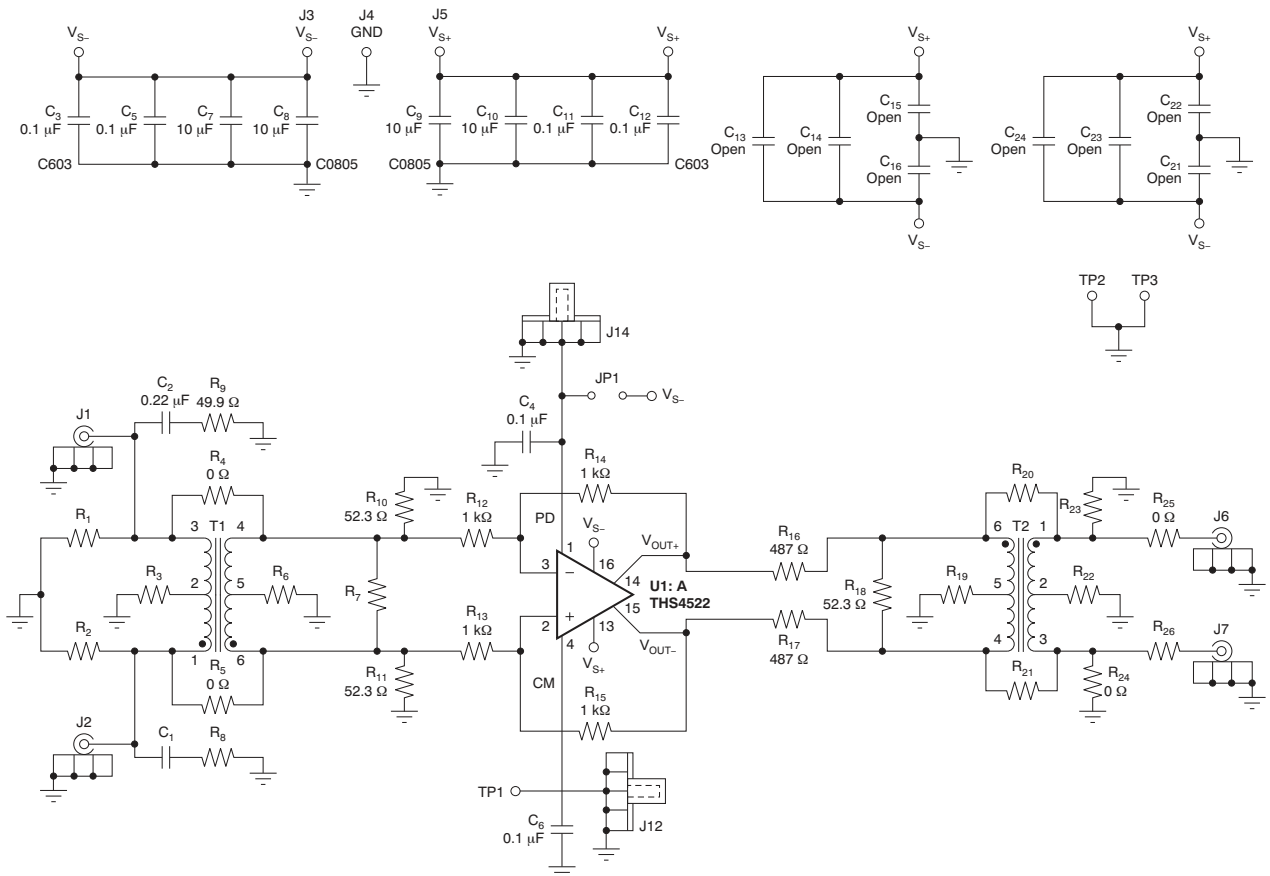


Figure 6. THS4522EVM: Schematic 1

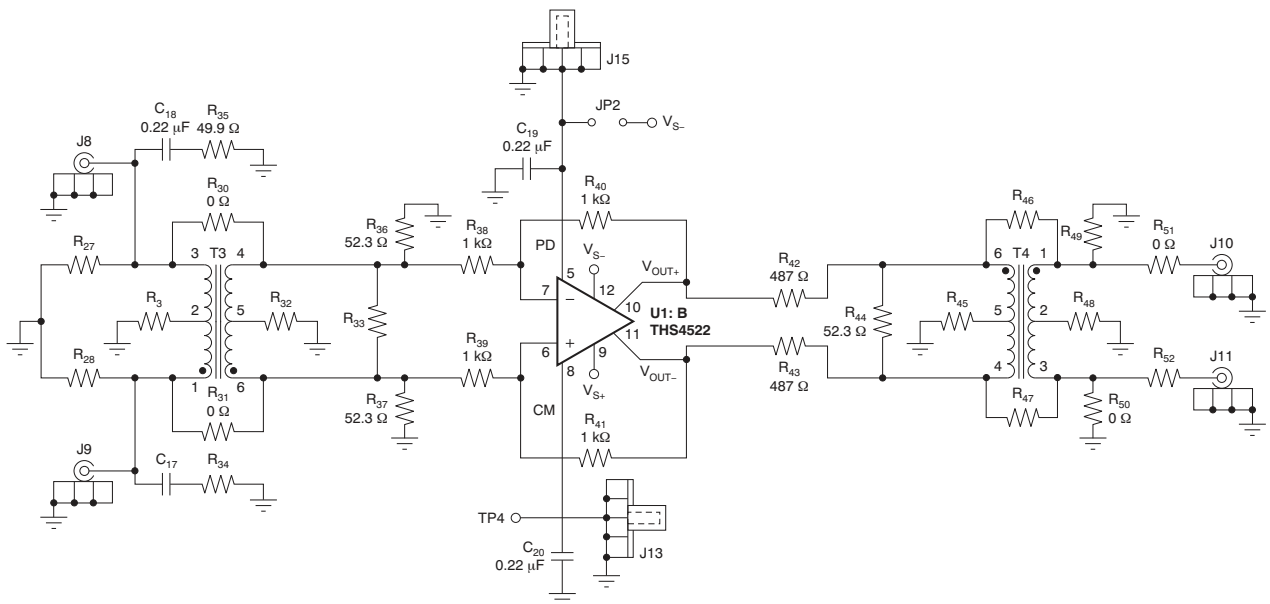


Figure 7. THS4522EVM: Schematic 2



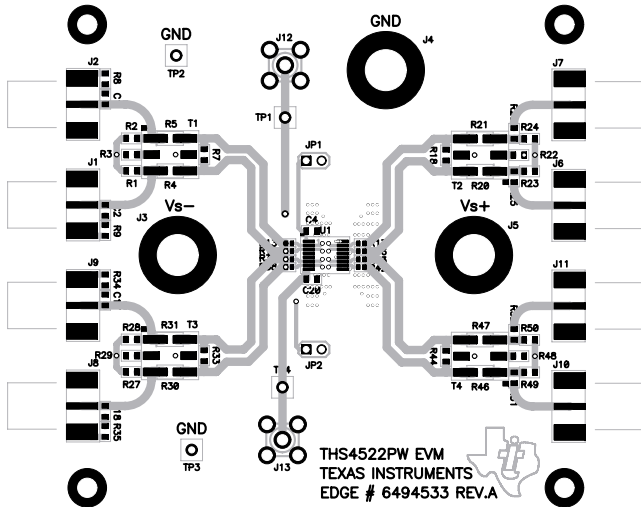


Figure 8. THS4522EVM: Top Layer (Layer 1)

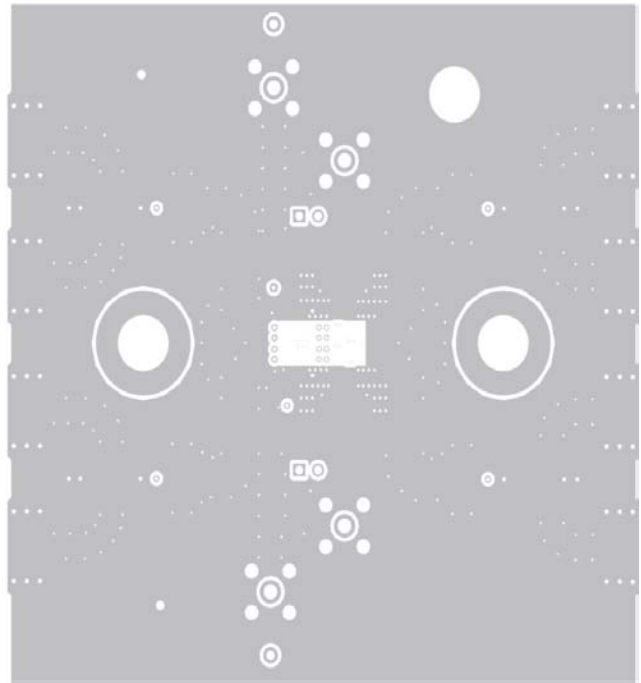


Figure 9. THS4522EVM: Ground Layer (Layer 2)

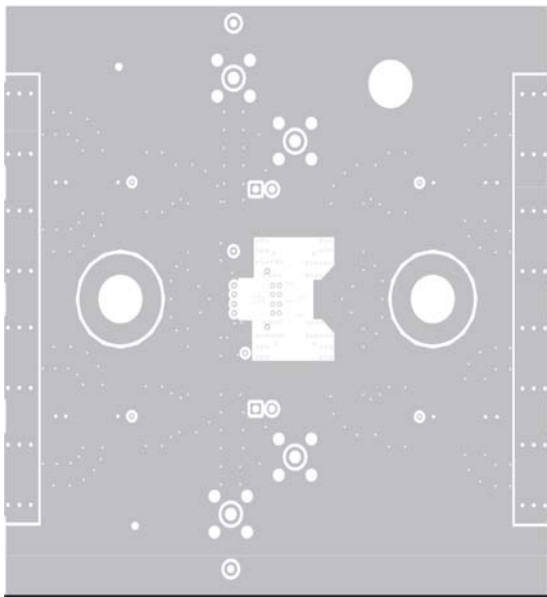


Figure 10. THS4522EVM: Ground Layer (Layer 3)

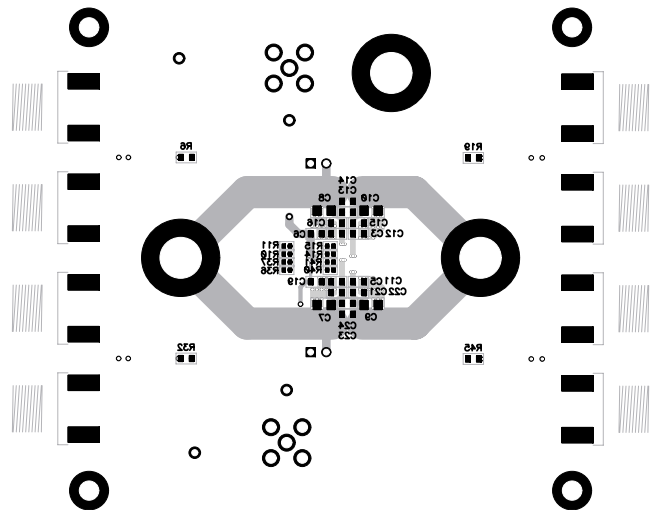


Figure 11. THS4522EVM: Bottom Layer (Layer 4)

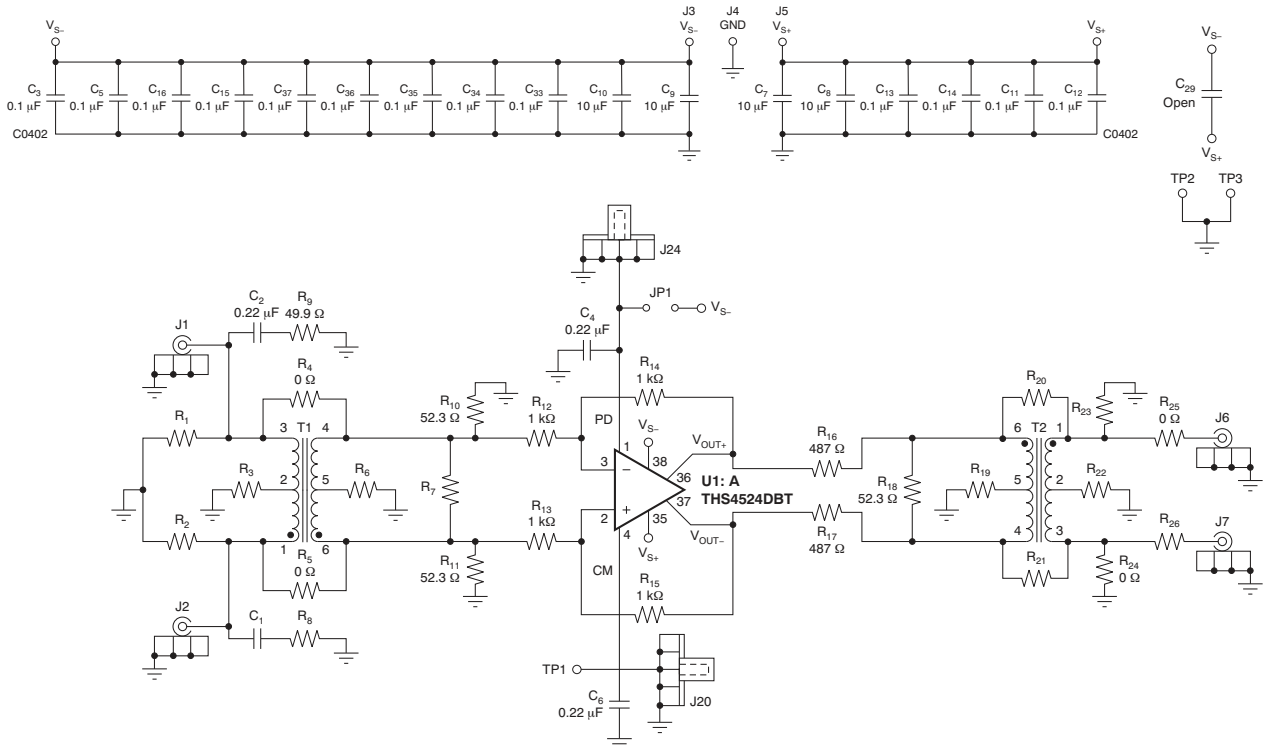
## 6 THS4524EVM Schematic, Layout, and Bill of Materials (BOM)

Table 5 lists the bill of materials for the THS4524EVM.

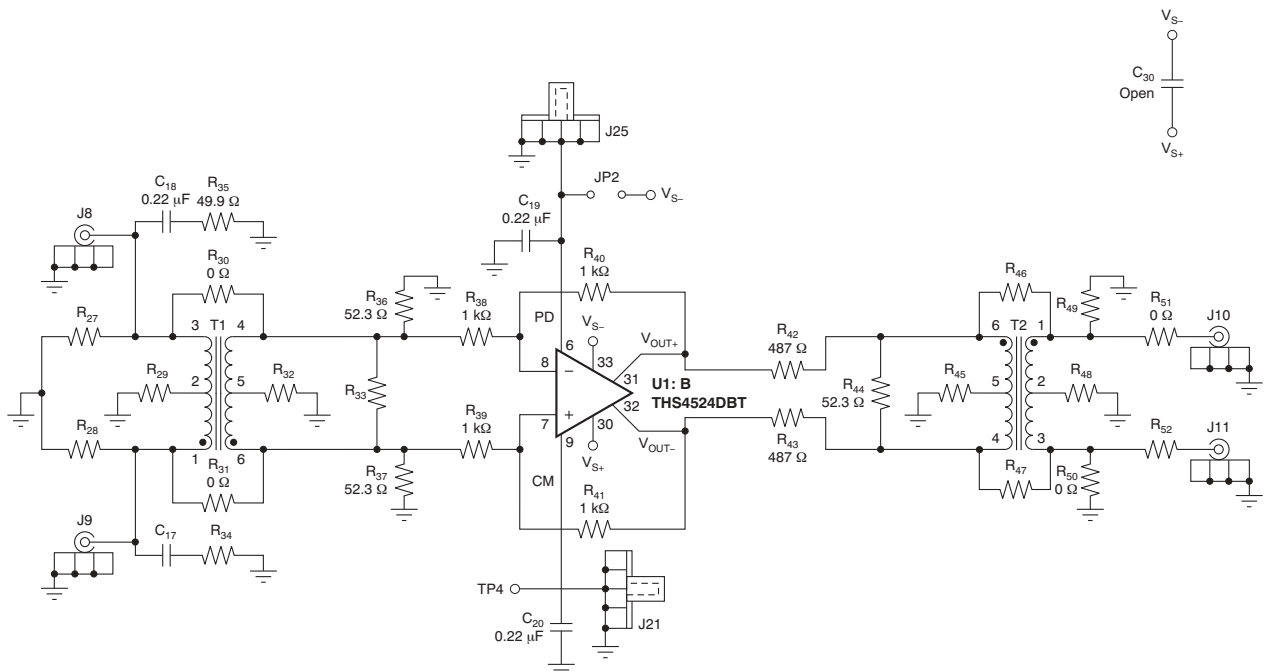
Figure 12 through Figure 19 show the schematics and PCB layouts, respectively, for the THS4524EVM.

**Table 5. THS4524EVM Parts List**

Item	Description	SMD Size	Reference Designator	Qty	Manufacturer Part Number
1	Capacitor, 10.0 $\mu$ F, ceramic, X5R, 6.3 V	805	C7-C10, C33	5	(AVX) 08056D106KAT2A
2	Open	402	C29-C32	4	
3	Capacitor, 0.1 $\mu$ F, ceramic, X7R, 16 V	402	C3, C5, C11-C16, C34-C37	12	(MURATA) GRM155R71C104KA88D
4	Capacitor, 0.22 $\mu$ F, ceramic, X7R, 10 V	603	C2, C4, C6, C18-C21, C23-C25, C27, C28	12	(AVX) 0603ZC224KAT2A
5	Open	603	C1, C17, C22, C26	4	
6	Resistor, 52.3 $\Omega$ , 1/16W, 1%	402	R10, R11, R36, R37, R53, R54, R79, R90	8	(KOA) RK73H1ETTP52R3F
7	Resistor, 487 $\Omega$ , 1/16W, 1%	402	R16, R17, R42, R43, R77, R78, R103, R104	8	(KOA) RK73H1ETTP4870F
8	Resistor, 1 k $\Omega$ , 1/16W, 1%	402	R12-R15, R38-R41, R70, R71, R74, R76, R96, R97, R100, R102	16	(KOA) RK73H1ETTP1001F
9	Open	603	R1-R3, R6-R8, R19, R22, R23, R26-R29, R32-R34, R45, R48, R49, R52, R57, R59, R60, R62, R63, R65, R66, R69, R72, R75, R83, R85, R86, R88, R89, R91, R92, R95, R98, R101	40	
10	Resistor, 0 $\Omega$	603	R24, R25, R50, R51, R55, R73, R81, R99	8	(ROHM) MCR03EZPJ000
11	Resistor, 49.9 $\Omega$ , 1/10W, 1%	603	R9, R35, R61, R87	4	(ROHM) MCR03EZPFX49R9
12	Resistor, 52.3 $\Omega$ , 1/10W, 1%	603	R18, R44, R64, R90	4	(ROHM) MCR03EZPFX52R3
13	Open	805	R20, R21, R46, R47, R56, R58, R82, R84	8	
14	Resistor, 0 $\Omega$	805	R4, R5, R30, R31, R67, R68, R93, R94	8	(ROHM) MCR10EZPJ000
15	Open		T1, T3, T5, T7	4	
16	Transformer, RF		T2, T4, T6, T8	4	(MINI-CIRCUITS) ADT1-1WT
17	Jack, banana receptance, 0.25-in diameter hole	2 POS.	J3, J4, J5	3	(SPC) 813
18	Open		J1, J7, J8, J11, J13, J14, J17, J18, J20-J27	16	
19	Connector, edge, SMA PCB jack		J2, J6, J9, J10, J12, J15, J16, J19	8	(JOHNSON) 142-0701-801
20	Header, 0.1 in CTRS, 0.025-in sq. pins		JP1-JP4	4	(SULLINS) PBC36SAAN
21	Shunts		JP1-JP4	4	(SULLINS) SSC02SYAN
22	Test point, red		TP1, TP4-TP6	4	(KEYSTONE) 5000
23	Test point, black		TP2, TP3	2	(KEYSTONE) 5001
24	IC, THS4524		U1	1	(TI) THS4524DBT
25	Standoff, 4-40 hex, 0.625 in			4	(KEYSTONE) 1808
26	Screw, Phillips, 4-40, 0.250 in			4	(BF) PMS4400031PH
27	Board, printed circuit			1	(TI) EDGE# 6494534, REV.A



**Figure 12. THS4524EVM: Schematic 1**



**Figure 13. THS4524EVM: Schematic 2**

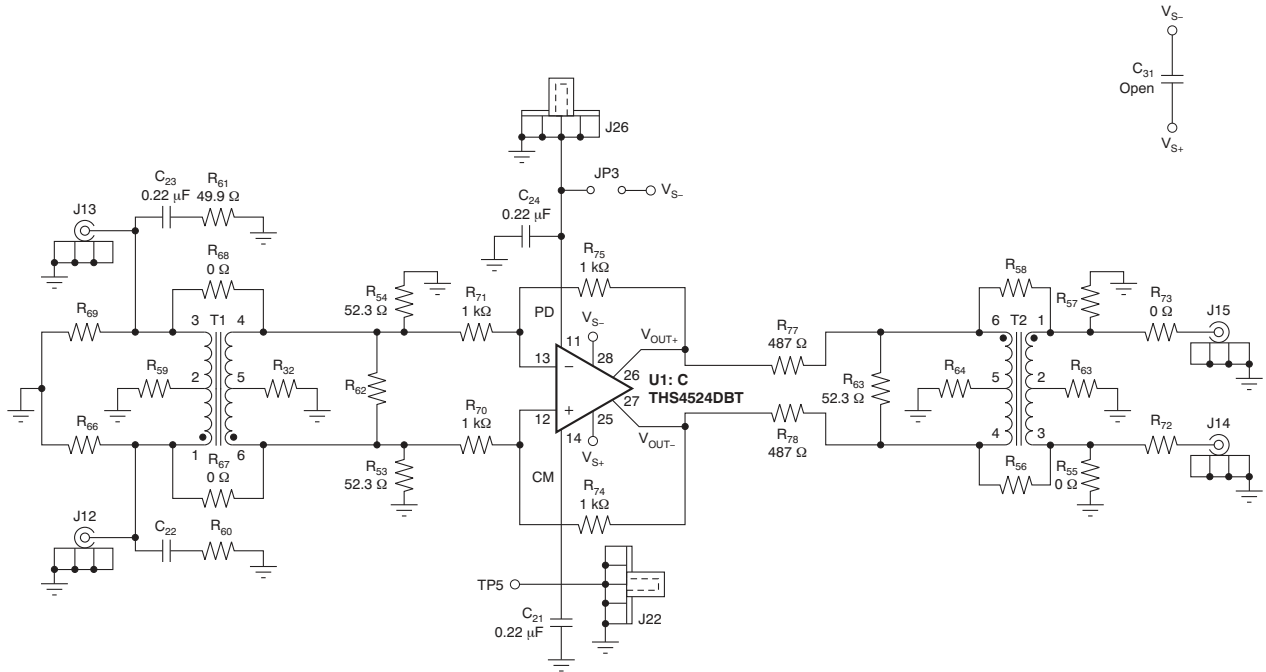


Figure 14. THS4524EVM: Schematic 3

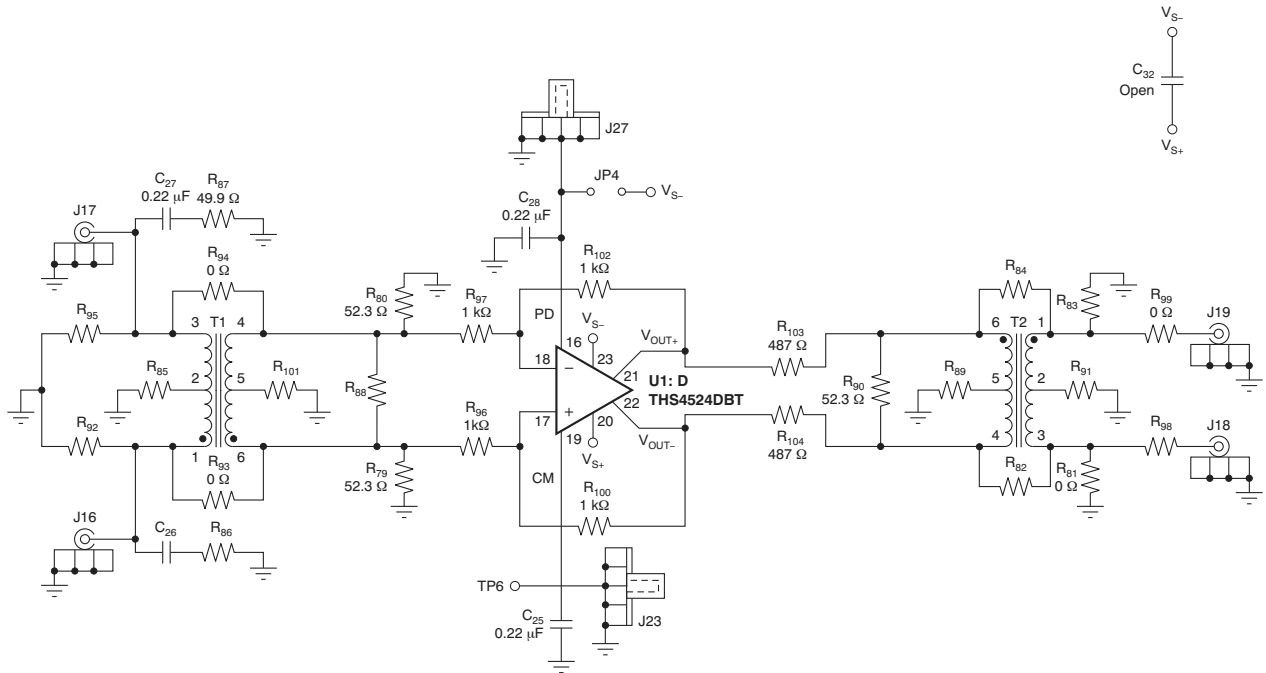


Figure 15. THS4524EVM: Schematic 4

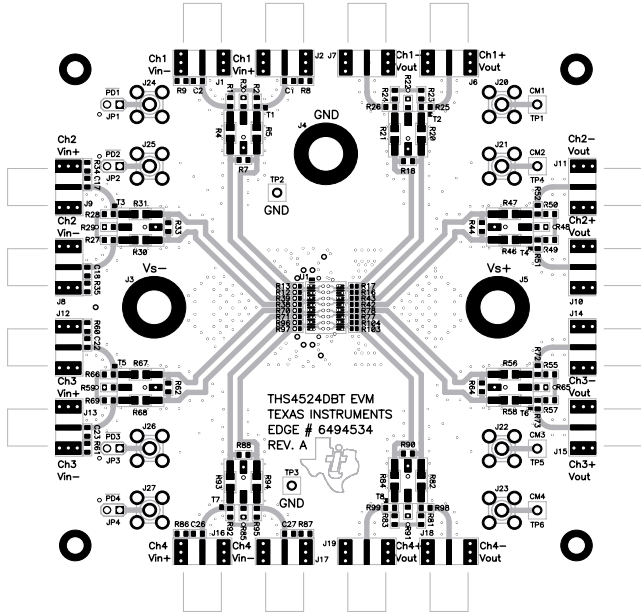


Figure 16. THS4524EVM: Top Layer (Layer 1)

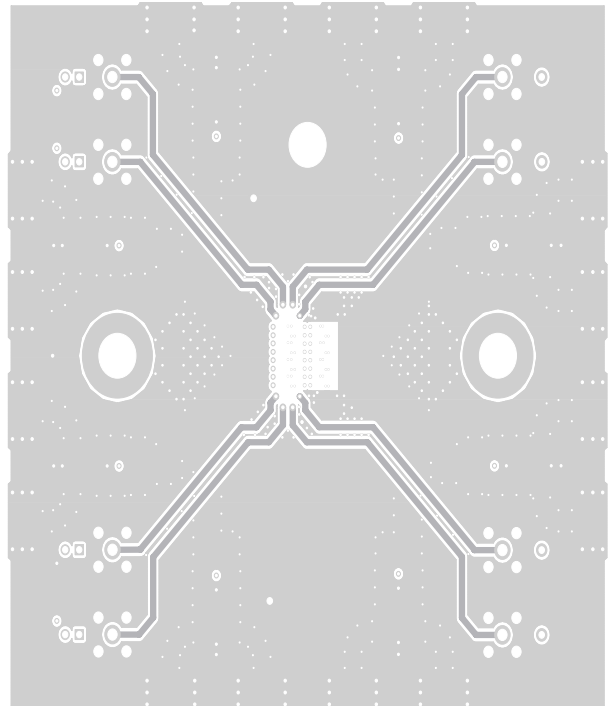


Figure 17. THS4524EVM: Ground Layer (Layer 2)

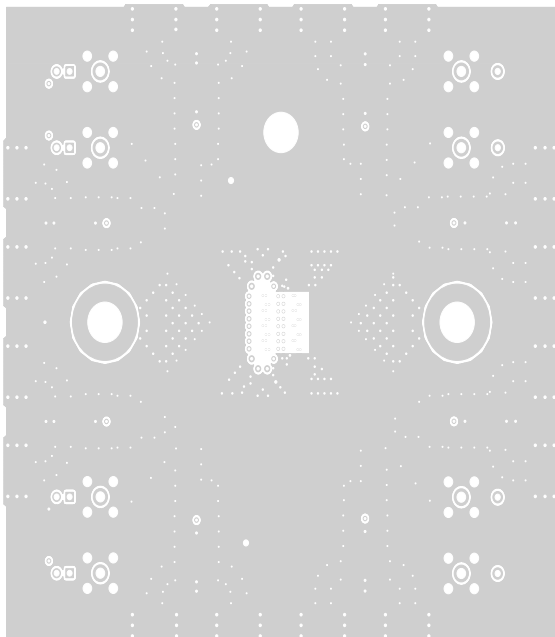


Figure 18. THS4524EVM: Ground Layer (Layer 3)

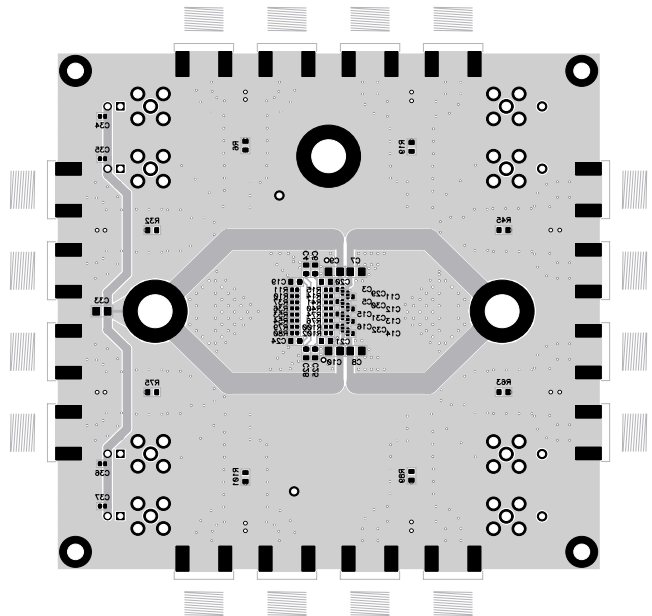


Figure 19. THS4524EVM: Bottom Layer (Layer 4)

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### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 0 V to 5.5 V and the output voltage range of 3 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.

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