

ADS5522 EVM

User's Guide

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It is important to operate this EVM within the specified input and output voltage ranges described in the EVM User's Guide.

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 60°C. The EVM is designed to operate properly with certain components above 60°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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Overview

This user's guide document gives a general overview of the ADS5522 evaluation module (EVM), and provides a general description of the features and functions to be considered while using this module.

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1.1 Purpose

The ADS5522 EVM provides a platform for evaluating the ADS5522 12-bit, 80 MSPS analog-to-digital converter (ADC) under various signal, input, and supply conditions. This document should be used in combination with the EVM schematic diagram supplied.

1.2 EVM Basic Functions

Analog input to the ADC is provided via external SMA connectors. The single-ended input the user provides is converted into a differential signal at the input of the device. One input path uses a differential amplifier, while the other input is transformer coupled.

The EVM provides external SMA connectors for input of the ADC clock. The single-ended input the user provides is converted into a differential signal at the input of the device. One input path uses an PECL differential driver, while the other input is transformer coupled. The EVM also allows the user to send a single-ended or true differential clock if desired.

Digital output from the EVM is via a 40-pin connector.

Power connections to the EVM are via banana jack sockets. Separate sockets are provided for the ADC analog and buffer supplies, the external buffer supply, and the differential amplifier supply.

1.3 Power Requirements

The EVM can be powered directly with only a single +3.3-V supply if using the module with transformer coupled input and internal reference mode. ± 5 V is required if using the differential amplifier input. Provision has also been made to allow the EVM to be powered with independent supplies to provide higher performance.

Voltage Limits

Exceeding the maximum input voltages can damage EVM components. Under voltage may cause improper operation of some or all of the EVM components.

1.4 ADS5522 EVM Operational Procedure

The ADS5522 EVM provides a flexible means of evaluating the ADS5522 in a number of modes of operation. A basic set-up procedure that can be used as a board confidence check is as follows:

- 1) Verify all jumper settings against the schematic jumper list in the following tables:

Table 1–1. Two-Pin Jumper List

JUMPER	FUNCTION	INSTALLED	REMOVED	DEFAULT
W1	External reference voltage feed (negative)	Provides external reference voltage to REFM	Internal reference used	Removed
W4	External reference voltage feed (positive)	Provides external reference voltage to REFP	Internal reference used	Removed
W3	Access point for providing SCLK for programming ADC internal registers	Connects Pin 2 to GND	Removes Pin 2 from GND	Installed
W6	Access point for providing SDATA for programming ADC internal registers	Connects Pin 3 to GND	Removes Pin 3 from GND	Installed
W7	Access point for providing SEN for programming ADC internal registers	Connects Pin 4 to GND	Removes Pin 4 from GND	Installed

Table 1–2. Three-Pin Jumper List

JUMPER	FUNCTION	LOCATION: PINS 1– 2	LOCATION: PINS 2–3	DEFAULT
SJP1	Common mode voltage from ADC	Provide Common mode voltage to Differential Amplifier	Provide Common mode voltage to Transformer T2	2–3
SJP2	ECL Driver input power select	Provides +5 VDC	Provides +3.3 VDC	1–2
W2	ADC output enable control	ADC output enabled	ADC output disabled	1–2
SJP6	Reset polarity select	Used with active low ADC reset	Used with active high ADC reset	2–3

Table 1–3. Five-Pin Jumper List

JUMPER	FUNCTION	LOCATION	DATA FORMAT	OUTPUT CLOCK POLARITY	DEFAULT
W5	ADC data format and output clock polarity select	Pins 4–5 Pins 3–5 Pins 2–5 Pins 1–5	Straight Binary 2's Compliment Straight Binary 2's Compliment	Data valid on rising edge Data valid on rising edge Data valid on falling edge Data valid on falling edge	Pins 4–5

- 2) Connect supplies to the EVM as follows:
 - +3.3-V ADC output buffer supply to J17 and return to J18.
 - +3.3-V ADC analog supply to J11 and return to J10.
- 3) Switch power supplies on.
- 4) Use a function generator with 50-Ω output to input a 80 MHz, 0-V offset, 1 Vrms sine wave signal into J3. The frequency of the clock must be within the specification for the device speed grade.

-
- 5) Use a frequency generator with a 50- Ω output to provide a 100 MHz, 0-V offset, -1 dBFS amplitude sine wave signal into J7. This provides a transformer coupled differential input signal to the ADC.
 - 6) The digital pattern on the output connector J8 should now represent a sine wave and can be monitored using a logic analyzer.

Circuit Description

This chapter describes the circuit functions of the ADS5520 EVM.

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2.1 Schematic Diagram

The schematic diagram for the EVM is attached to the end of this document.

2.2 Circuit Function

The following paragraphs describe the function of individual circuits. Refer to the relevant data sheet for device operating characteristics.

2.2.1 Analog Inputs

The EVM can be configured to provide the ADC with either transformer-coupled or differential amplifier inputs from a single-ended source. The inputs are provided via SMA connectors J7 for transformer coupled input, and J1 and J2 for differential amplifier input. To setup for one of these options, the EVM must be configured as follows:

- 1) For a 1:1 transformer-coupled input to the ADC, a single-ended source is connected to J7. R22, and R35 must be removed and R41 and R45 must be installed. SJP1 must have pins 2 and 3 shorted. This is the default configuration for the EVM.
- 2) For a single-ended input into the differential amplifier, a single-ended source is connected to J1. R22 and R35 must be installed, and R41 and R45 must be removed. SJP1 must have pins 1 and 2 shorted. C12, C32, C35, and R40 provide the user with the option to add filters if desired.
- 3) For a differential input into the amplifier, the positive source is connected to J1 and the negative source to J2. R22 and R35 must be installed, and R41 and R45 removed. SJP1 must have pins 1 and 2 shorted. R8 must be replaced with a 54.9- Ω resistor and R19 with a 383- Ω resistor for proper amplifier termination.

2.2.2 Clock Inputs

The EVM provides three methods for inputs for the ADC clock pins. The initial configuration of the EVM provides a transformer coupled clock to the converter.

2.2.2.1 *Transformer-Coupled Differential ADC Clock*

To provide a transformer-coupled differential clock using a single-ended input source, C25 and C40 must be installed and R11, R25, R32, C36, C39, and C49 must be removed. R31 is 0 Ω for proper transformer configuration. This is the default configuration for the EVM.

2.2.2.2 *True Differential ADC Clock*

To provide a true differential ADC clock input, install J4, R11, R25, C25, C40, replace R31 with a 49.9- Ω resistor, and remove R32, C36, C39, C49, and T3. The positive source should be connected to J3 and the negative source to J4.

2.2.2.3 ECL Differential ADC Clock

To provide an ECL differential clock input, install C36, C39, and C49 and remove C25 and C40. Configure SJP2 to provide either AVDD or +VCC supply to the ECL differential driver supply pin.

2.2.3 Control Inputs

The EVM has three discrete inputs and a 3-pin serial bus to control the operation of the device:

2.2.3.1 Output Enable

With jumper W2 installed between pins 1 and 2, the ADC outputs are enabled. The device outputs are disabled with jumper W2 installed between pins 2 and 3.

2.2.3.2 DFS Control

By adjusting the voltage on the data format and clock polarity select (DFS) pin, the user can set the mode of operation of the device. Test point 10 should be used to monitor this level. Once the appropriate voltage is reached, the ADC automatically sets the corresponding data format and clock polarity setting. Jumper W5 selects the voltage used for this pin. See Table 1-3 for the data format and clock polarity settings determined by the position of the jumper on W5.

2.2.3.3 IREF Control

By adjusting the resistance on pin 31 (IREF), the user can adjust the bias current used by the ADS5520 device. The default value for the EVM is 56.2 k Ω . Care must be taken when changing this value. See the relevant data sheet for more information.

2.2.4 Power

Power is supplied to the EVM via banana jack sockets. A separate connection is provided for a +3.3-V analog supply (J11 and J10), +3.3-V buffer supply (J17 and J18) supply, \pm 5-V amplifier supply (J14, J13, and J12), and +3.3-V external buffer supply (J19 and J20).

2.2.5 Outputs

The data outputs from the ADC are routed to connector J8. This connector is a standard 40-pin header on a 100-mil grid, and allows easy connection to a logic analyzer. The connector pinout is listed in Table 2-2.

Table 2-1. Output Connector J8

J8 PIN	DESCRIPTION	J8 PIN	DESCRIPTION
1	Output Clock	21	Data Bit 6
2	DGND	22	DGND
3	NC	23	Data Bit 7
4	DGND	24	DGND
5	NC	25	Data Bit 8
6	DGND	26	DGND
7	NC	27	Data Bit 9
8	DGND	28	DGND
9	Data Bit 0 (LSB)	29	Data Bit 10
10	DGND	30	DGND
11	Data Bit 1	31	Data Bit 11
12	DGND	32	DGND
13	Data Bit 2	33	Data Bit 12
14	DGND	34	DGND
15	Data Bit 3	35	Data Bit 13 (MSB)
16	DGND	36	DGND
17	Data Bit 4	37	Overflow
18	DGND	38	DGND
19	Data Bit 5	39	NC
20	DGND	40	DGND

Physical Description

This chapter describes the physical characteristics and PCB layout of the EVM and lists the components used on the module.

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3.1 PCB Layout

The EVM is constructed on a 6-layer, 4.5-inch x 4.15-inch, 0.062-inch thick PCB using FR-4 material. The individual layers are shown in the following figures.

Figure 3–1. Top Layer

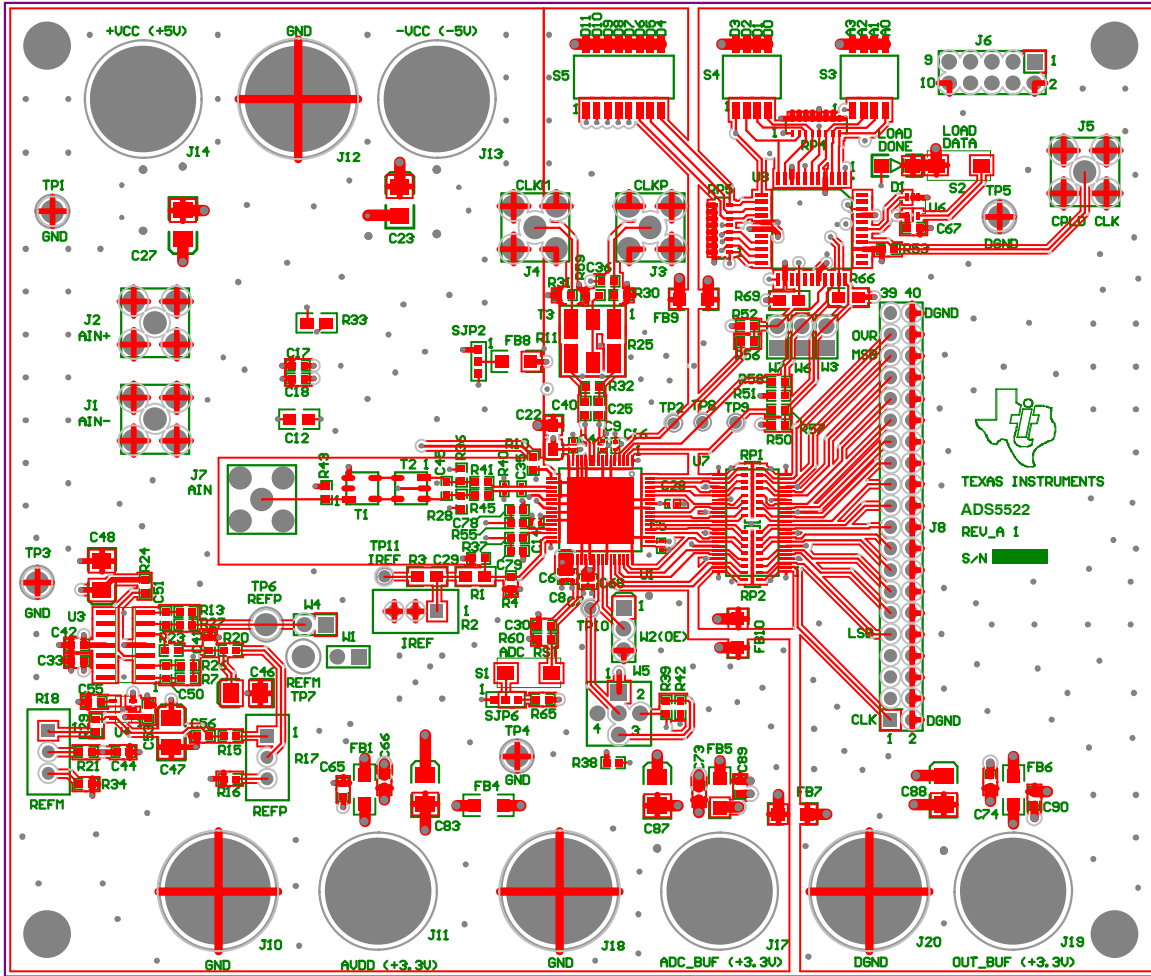


Figure 3-2. Layer 2, Ground Plane

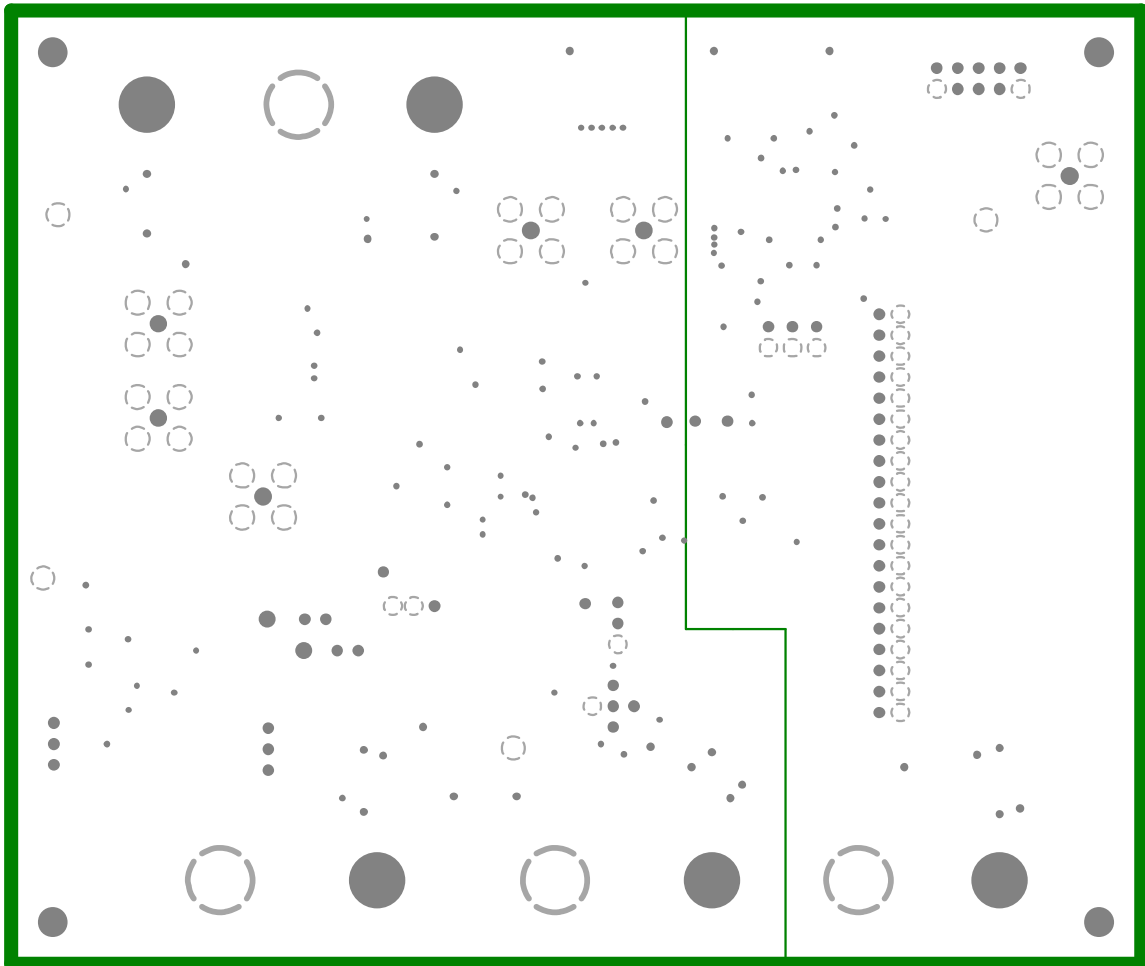


Figure 3-3. Layer 3, Power Plane #1

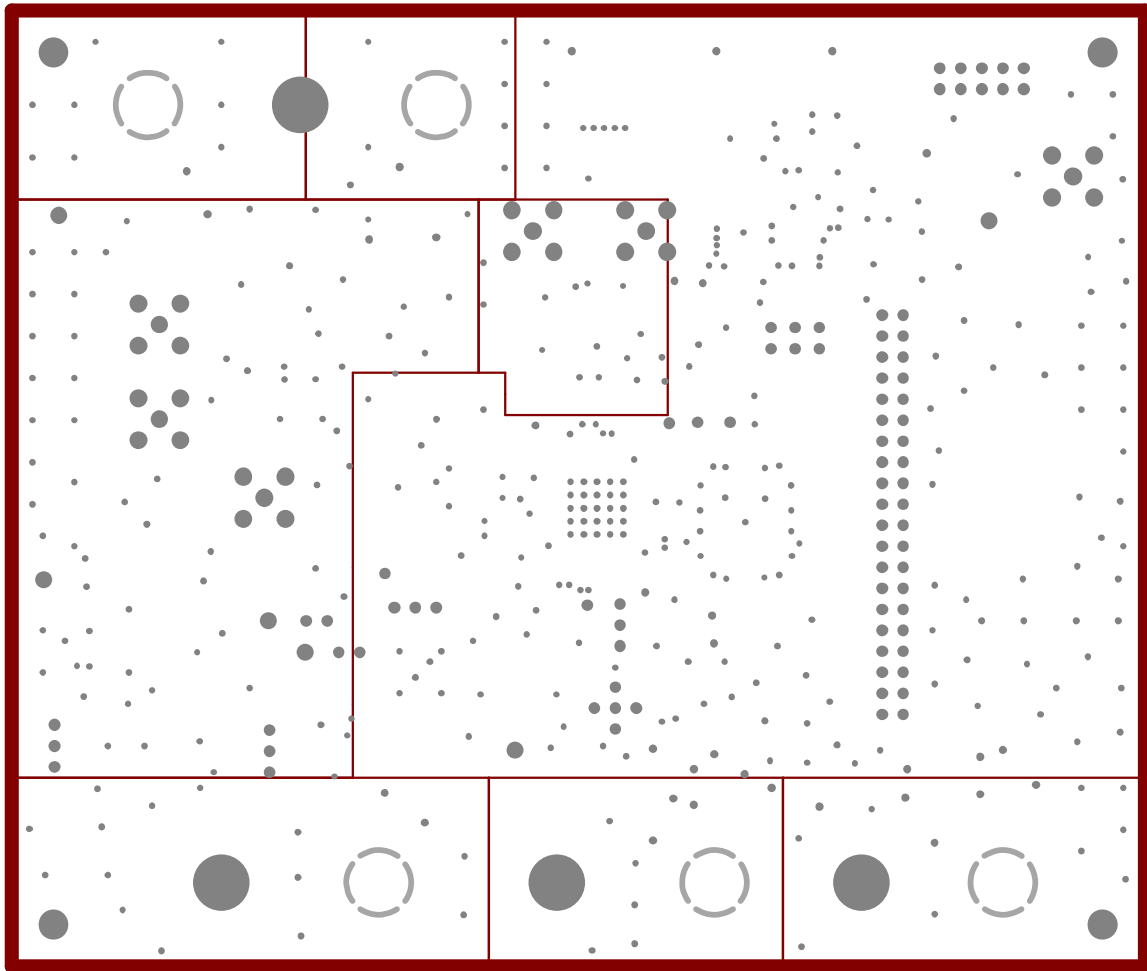


Figure 3-4. Layer 4, Power Plane #2

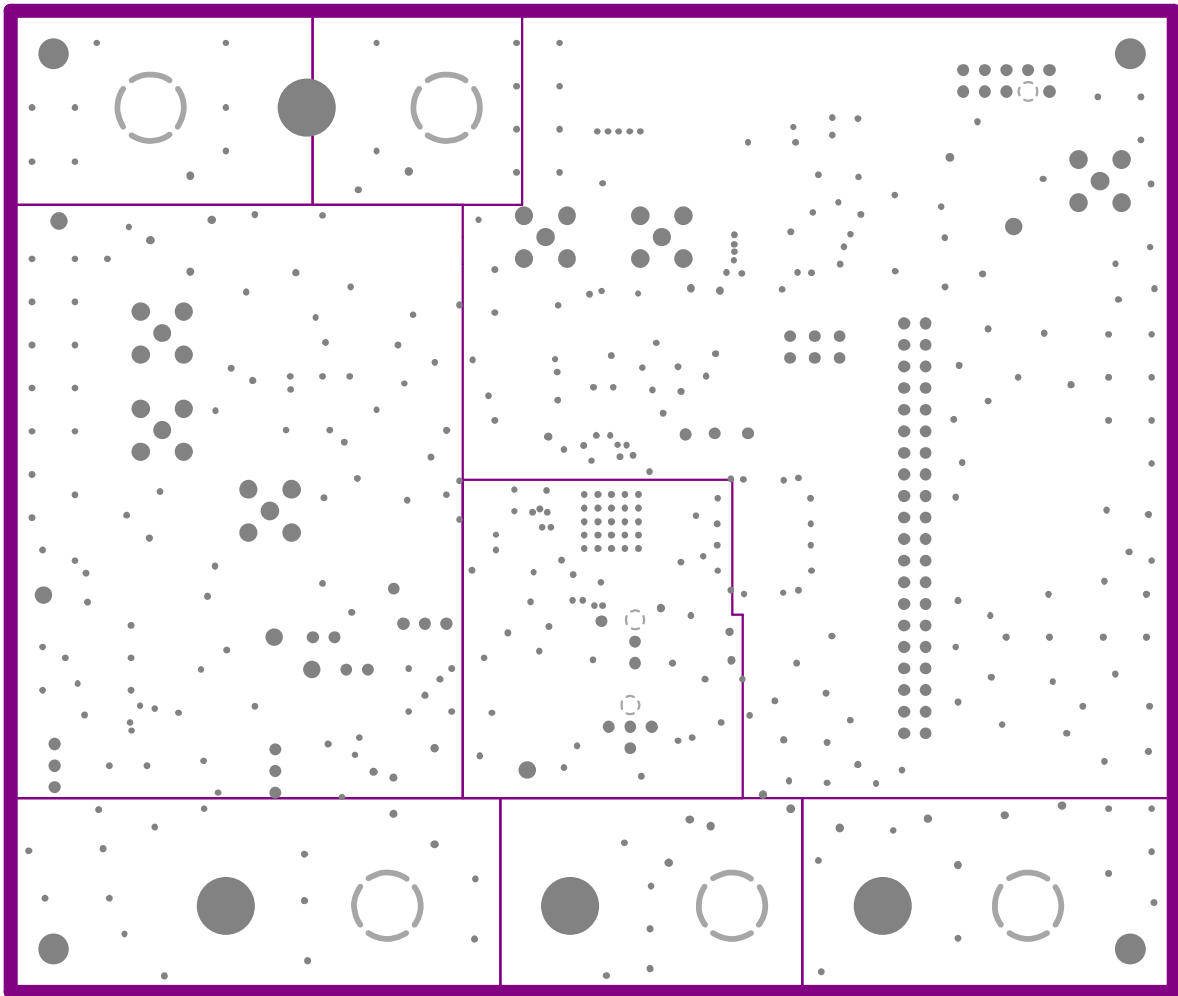


Figure 3-5. Layer 5, Ground Plane

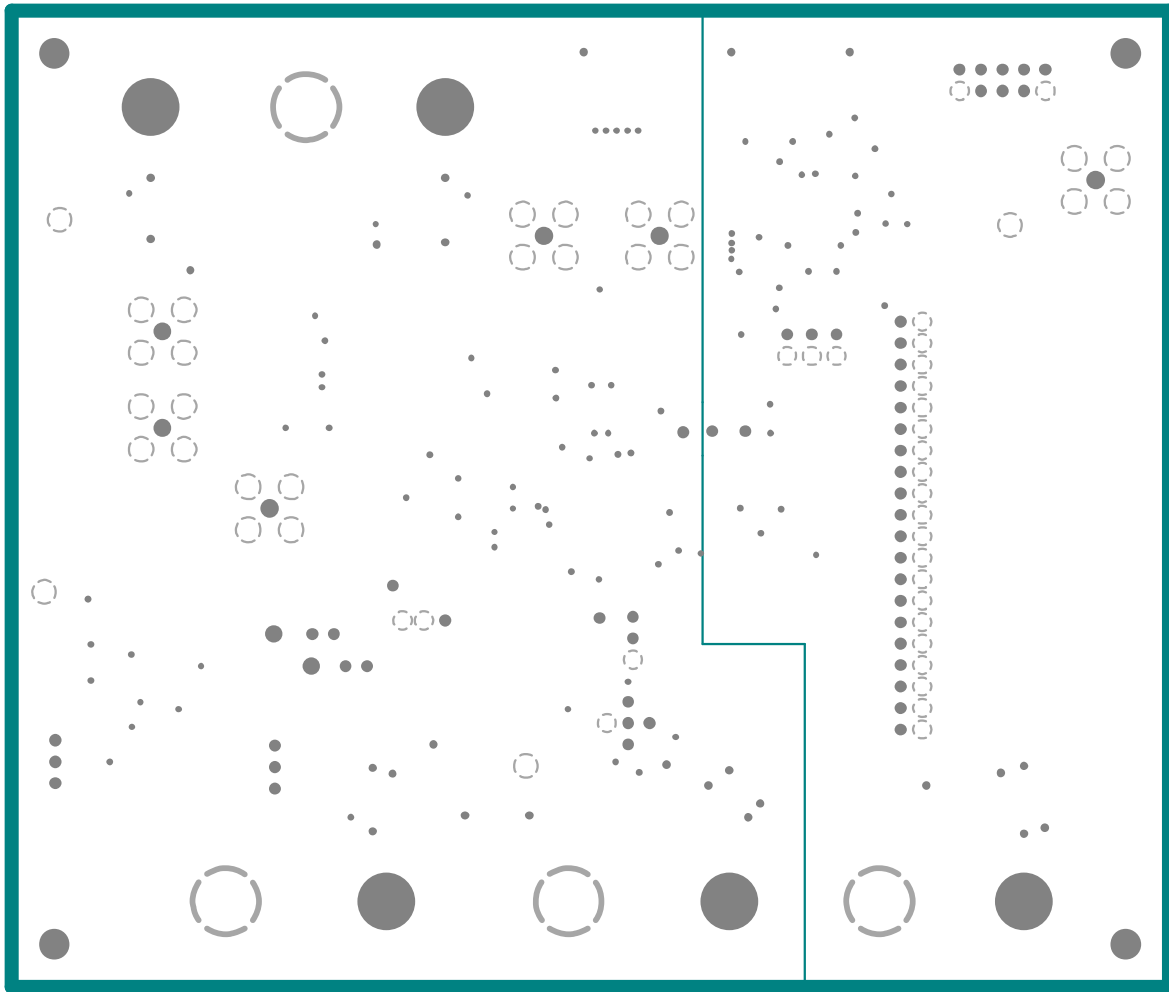
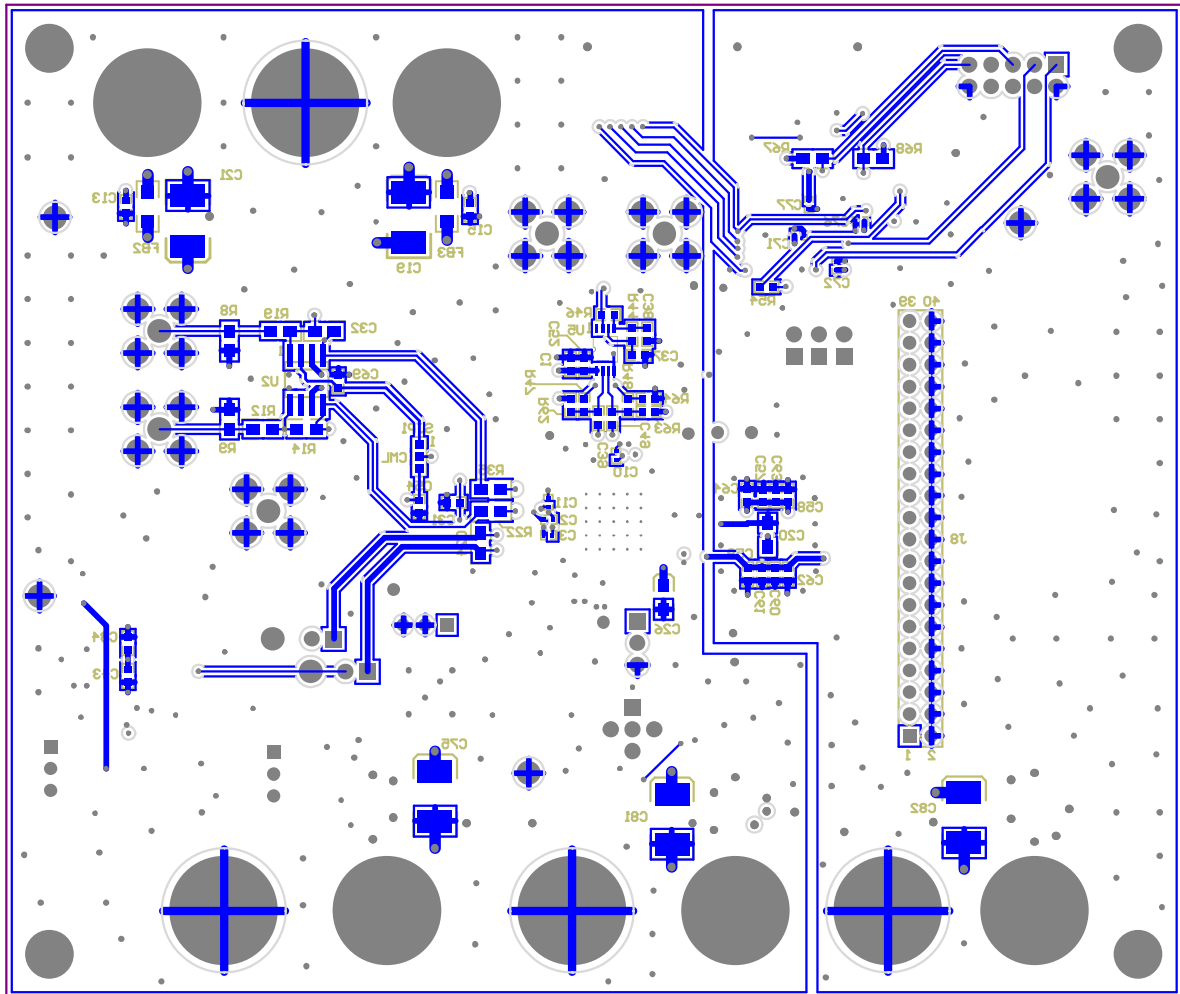


Figure 3-6. Layer 6, Bottom Layer



3.2 Parts List

Table 3-1 lists the parts used in constructing the EVM.

Table 3-1. ADS5522 Bill of Materials

VALUE	QTY	PART NUMBER	VENDOR	REF DES	NOT INSTALLED
CAPACITORS					
47 uF, tantalum, 20%, 10V	5	ECS-T1AD476R	Panasonic	C19 C21 C75 C81 C82	
10 uF, 10V, 20% Capacitor	5	ECS-T1AX106R	Panasonic	C23 C27 C83 C87 C88	C46 C47 C48
10 uF, 10V, 10% Capacitor	3	T491A106K010AS	KEMET	C20 C22 C26	
0.1uF,16V, 10% Capacitor	0	ECJ-2VB1C104K	Panasonic		C24
6.8pF,50V, ±.25pF Capacitor	0	08055A6R8CAT2A	AVX		C12 C32
470 pF,50V, 10% Capacitor	4	ECJ-1VB2A471K	Panasonic	C57 C59 C61 C63	C33 C34
0.047uF,16V, 10% Capacitor	0	ECJ-1VB1C473K	Panasonic		C50 C51
10 pF, 50V, ±.5pF Capacitor	0	ECJ-1VC1H100D	Panasonic		C45
0.01uF, 50V,10% Capacitor	4	ECJ-1VB1C103K	Panasonic	C31 C52 C54 C69	C55
0.1uF,16V, 10% Capacitor	19	ECJ-1VB1C104K	Panasonic	C1 C13 C15 C17 C18 C25 C37 C38 C40 C58 C60 C62 C64 C65 C66 C73 C74 C89 C90	C29 C30 C36 C39 C41 C42 C43 C44 C49 C67
1uF, 6.3V,10% Capacitor	2	ECJ-1VB0J105K	Panasonic	C78 C79	C53
2.2uF, 6.3V,±80%/-20% Capacitor	0	ECJ-1VF0J225Z	Panasonic		C56
0.1uF,16V, ±80%/-20% Capacitor	14	ECJ-0EF1C104Z	Panasonic	C2-C11 C14 C16 C28 C68	C71 C72 C76 C77
27pF, 50V, 5% Capacitor	0	ECU-E1H270JCQ	Panasonic		C35
RESISTORS					
0 Ohm resistor, 1/16 W, 1 %	1	ERJ-6ENF0R00V	Panasonic	R8	
54.9 Ohm resistor, 1/16 W, 1 %	1	ERJ-6ENF54R9V	Panasonic	R9	
383 Ohm resistor, 1/16 W, 1 %	1	ERJ-6ENF3830V	Panasonic	R12	
392 Ohm resistor, 1/16 W, 1 %	2	ERJ-6ENF3920V	Panasonic	R14 R33	
412 Ohm resistor, 1/16 W, 1 %	1	ERJ-6ENF4120V	Panasonic	R19	
1K Ohm resistor, 1/16 W, 1%	0	ERJ-6ENF1001V	Panasonic		R66 R67 R68 R69
10K Ohm resistor, 1/16 W, 1%	0	ERJ-6ENF1002V	Panasonic		R3
20K Ohm resistor, 1/16 W, 1%	0	ERJ-6ENF2002V	Panasonic		R1
0 Ohm resistor, 1/16 W, 1 %	5	9C06031A0.0JLHFT	YAGEO	R31 R56 R57 R58 R59	R11 R25
1 Ohm resistor, 1/16 W, 5 %	2	9C0603A1 JLHFT	Panasonic	R37 R55	
100 Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF1000V	Panasonic		R23 R24
113 Ohm resistor, 1/16 W, 1%	1	ERJ-3EKF1130V	Panasonic	R64	
24.9 Ohm resistor, 1/16 W, 1%	2	ERJ-3EKF24R9V	Panasonic	R41 R45	
36.5 Ohm resistor, 1/16 W, 1%	2	ERJ-3EKF36R5V	Panasonic	R28 R36	
49.9 Ohm resistor, 1/16 W, 1%	4	ERJ-3EKF49R9V	Panasonic	R10 R30 R47 R48	R7 R13 R43 R53 R62 R63
82.5 Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF82R5V	Panasonic		R54
200 Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF200V	Panasonic		R32
402 Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF402V	Panasonic		R22 R35
499 Ohm resistor, 1/16 W, 1%	2	ERJ-3EKF499V	Panasonic	R44 R46	R15
1K Ohm resistor, 1/16 W, 1%	3	ERJ-3EKF1001V	Panasonic	R38 R39 R42	
2K Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF2001V	Panasonic		R26 R27
2.55K Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF2551V	Panasonic		R34
2.87K Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF2871V	Panasonic		R29
4.7K Ohm resistor, 1/16 W, 1%	1	ERJ-3EKF4701V	Panasonic	R65	
5.62K Ohm resistor, 1/16 W, 1%	0	ERJ-3EKF5621V	Panasonic		R16
49.9K Ohm resistor, 1/16 W, 1%	3	ERJ-3EKF4992V	Panasonic	R50 R51 R52	

Table 3-1 ADS4040 Bill of Materials (continued)

VALUE	QTY	PART NUMBER	VENDOR	REF DES	NOT INSTALLED
56.2K Ohm resistor, 1/16 W, 1%	1	ERJ-3EKF5622V	Panasonic	R4	
10K Ohm resistor, 1/16 W, 1%	1	ERJ-3EKF1002V	Panasonic	R60	R20 R21
174 Ohm resistor, 1/16 W, 1 %	0	ERJ-2RFK1740X	Panasonic		R40
1K variable resistor	0	CT94W102	CERMET		R17 R18
100K variable resistor	0	CT94W104	CERMET		R2
0 Ohm R-Pack	2	742C163000JCT	CTS	RP1 RP2	
100K Ohm R-Pack	0	742C163100KJCT	CTS		RP4 RP5
CONNECTORS, JUMPERS, HEADERS, FERRITE BEADS, TRANSFORMERS, IC's					
Ferrite Bead	7	EXC-ML32A680U		FB1 FB2 FB3 FB5 FB6 FB8 FB10	FB4 FB7 FB9
Transformer	2	TC4-1W	Mini-Circuits	T1 T2	
Transformer	1	ADT4-1WT	Mini-Circuits	T3	
SMA connectors	4	2262-0000-09	NEWARK	J1 J2 J3 J7	J4 J5
Black test point	4	5011K-ND	Keystone	TP1 TP3 TP4 TP5	
RED test point	0	5010K-ND	Keystone		TP6 TP7
RED test point	4	5000K-ND	Keystone	TP2 TP8 TP9 TP10	TP11
2POS_header	3	TSW-150-07-L-S	Samtec	W3 W6 W7	W1 W4
3POS_header	1	TSW-150-07-L-S	Samtec	W2	
5 Circuit Jumpers	1			W5	
SWITCH	1	EVQ-PJX04M	Panasonic	S1	S2
SWITCH 4 POSITION	0	DHS4S	APEM		S3 S4
SWITCH 8 POSITION	0	DHS8S	APEM		S5
40 pin IDC Connector	1	TSW-120-07-L-D	Samtec	J8	
10 pin IDC Connector	0	TSW-120-07-L-D	Samtec		J6
Red Banana Jacks	5	ST-351A	ALLIED	J11 J13 J14 J17 J19	
Black Banana Jacks	4	ST351B	ALLIED	J10 J12 J18 J20	
Green LED	0	CMD15-21VGC/ TR8	Panasonic		D1
ADS5522	1	ADS5522	TI	U1	
THS4503	1	THS4503ID	TI	U2	
OPA4227UA	0	OPA4227UA	TI		U3
TPS79225	0	TPS79225DBVR	TI		U4
MC10EP16DT	1	MC10EP16DT	ON Semiconductor	U5	
TPS3801	0	TPS3801K33DCKR	TI		U6
SN74AVC16244	0	SN74AVC16244DG GR	TI		U7
EPM7032BTC44	0	EPM7032BTC44-3	ALTERA		U8
Screws	4				
Stand Off Hex (1/4 x .5")	4	1902CK-ND	allied		