

Evaluating the ADL6331, 0.38 GHz to 12 GHz TxVGA**FEATURES**

- ▶ Full featured evaluation boards for the ADL6331-EVALZA and the ADL6331-EVALZB
- ▶ Single-supply operation
- ▶ Easy to use interface with [Analysis | Control | Evaluation \(ACE\)](#) software

EQUIPMENT NEEDED

- ▶ 3.3 V DC power supply
- ▶ [EVAL-SDP-CS1Z \(SDP-S\)](#)
- ▶ Signal generator
- ▶ Spectrum analyzer
- ▶ Network analyzer (optional)
- ▶ Microsoft Windows PC with a USB port

DOCUMENTS NEEDED

- ▶ [ADL6331](#) data sheet

SOFTWARE NEEDED

- ▶ ACE software
- ▶ ACE ADL6331 plugin software

GENERAL DESCRIPTION

The ADL6331-EVALZA and ADL6331-EVALZB evaluation boards allow the manual control of the ADL6331 through the USB port on a Microsoft® Windows® PC via an SDP-S interface board.

Additional information on the ADL6331 is provided in the ADL6331 data sheet. Consult the data sheet in conjunction with this user guide when using the ADL6331-EVALZA and ADL6331-EVALZB evaluation boards.

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REVISION HISTORY

5/2024—Rev. 0 to Rev. A

Added ADL6331-EVALZB (Universal).....	1
Moved Figure 1.....	3
Added Figure 2; Renumbered Sequentially.....	3
Changes to Hardware Setup Section and Table 1.....	4
Added Figure 4 and Figure 6.....	4
Changes to Single-Tone Demonstration with ACE Section.....	5
Changes to Figure 8 and Figure 9.....	6
Changes to Losses and Signal-to-Noise Ratio (SNR) Degradation Section.....	7
Added Figure 11.....	7
Added Table 4; Renumbered Sequentially.....	7
Added Figure 17 to Figure 21.....	12
Added Table 6.....	16

2/2024—Revision 0: Initial Version

EVALUATION BOARD CONNECTION DIAGRAM

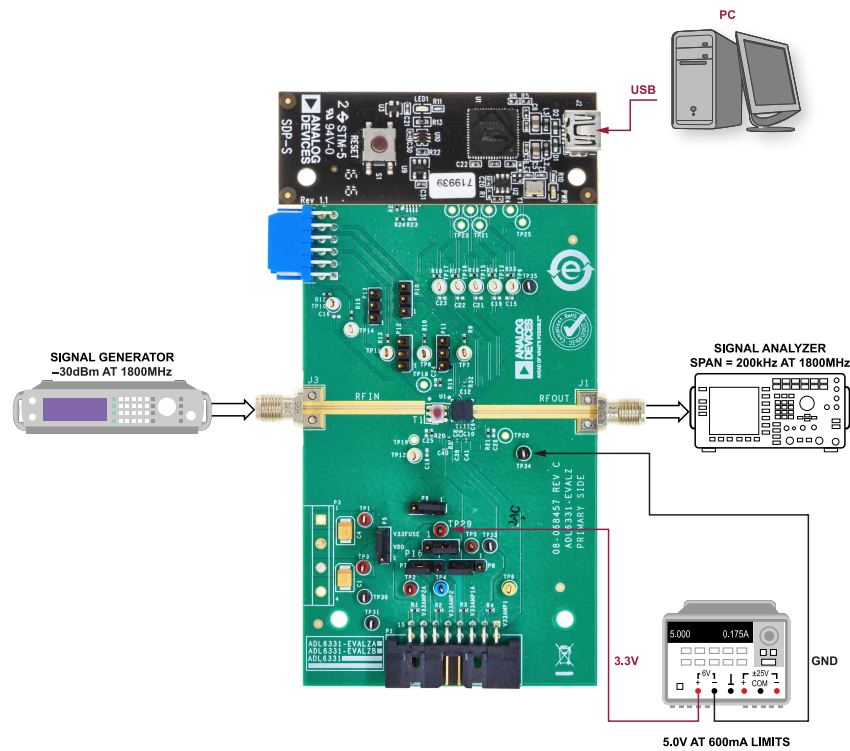


Figure 1. ADL6331-EVALZA Typical Measurement Setup (Option 1)

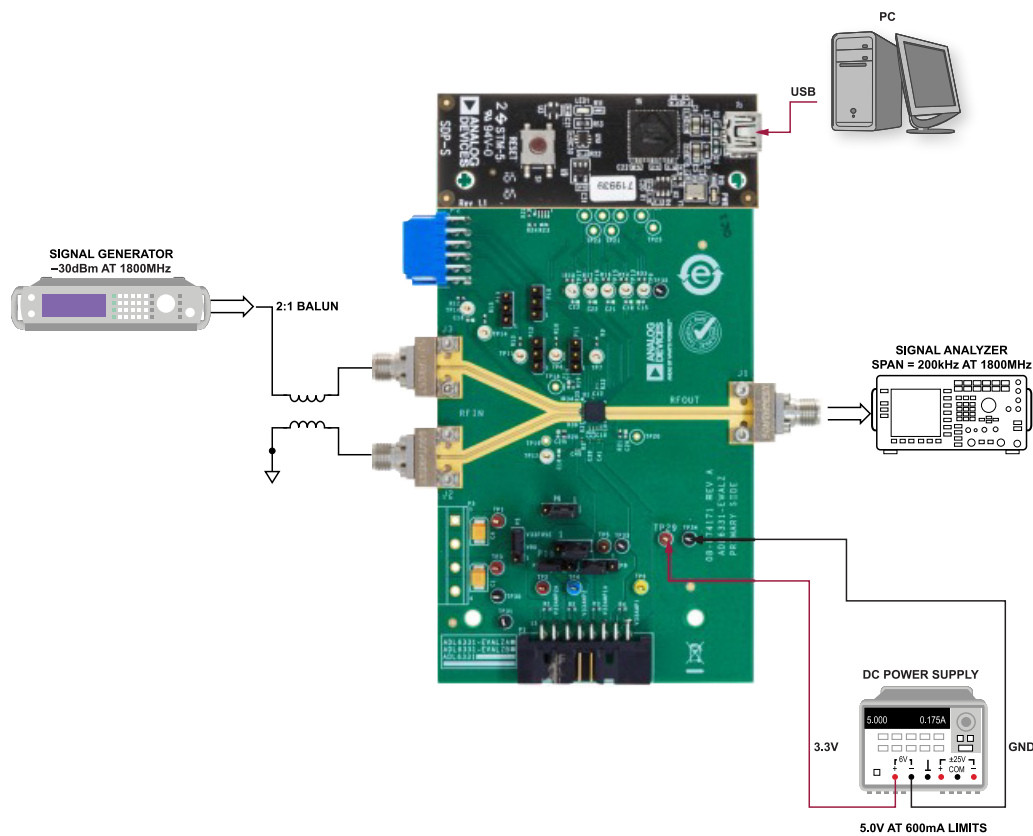


Figure 2. ADL6331-EVALZB Typical Measurement Setup (Option 1)

EVALUATION BOARD HARDWARE

HARDWARE SETUP

The hardware is connected as shown in Figure 3 and Figure 4. To power up the ADL6331-EVALZA and the ADL6331-EVALZB, use a 5 V at 600 mA DC power supply. Connect the SDP-S to the PC through a USB cable.

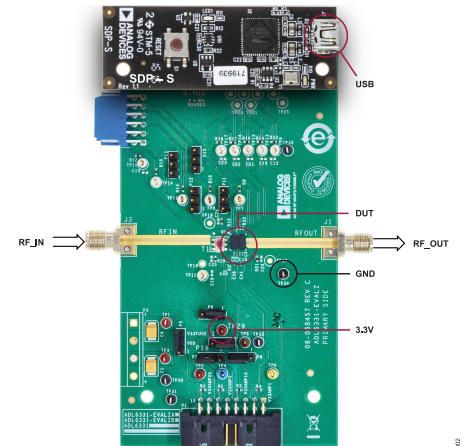


Figure 3. ADL6331-EVALZA and SDP-S Connections

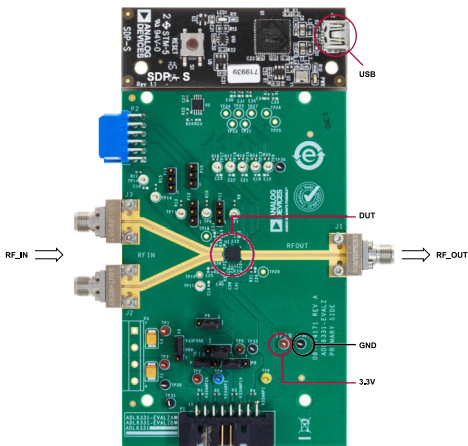


Figure 4. ADL6331-EVALZB and SDP-S Connections

See Table 1 to connect the equipment needed to evaluate the ADL6331-EVALZA and the ADL6331-EVALZB.

Table 1. ADL6331-EVALZA and ADL6331-EVALZB Equipment Connections	
Equipment	Connection
Power Supply	TP29 (3.3 V) TP34 (GND)
Signal Source	RF_IN
Network Analyzer	Connect to one port or two ports on the network analyzer (see Figure 5 and Figure 6)
Signal Generator	Set the source to -20 dBm output signal level (see Figure 1 and Figure 2)
SDP-S	P4
Signal Analyzer	RF_OUT
Spectrum Analyzer	Connect to port (see Figure 1 and Figure 2)

Table 2. SDP-S Connections

Equipment	Connection
PC USB Cable	J2

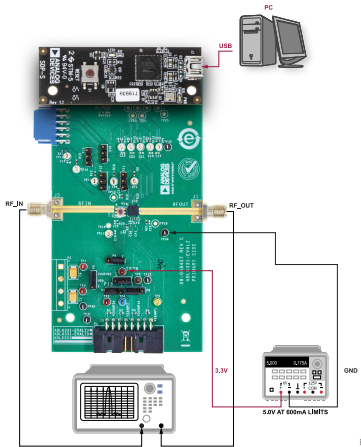


Figure 5. ADL6331-EVALZA Measurement Setup with Network Analyzer (Option 2)

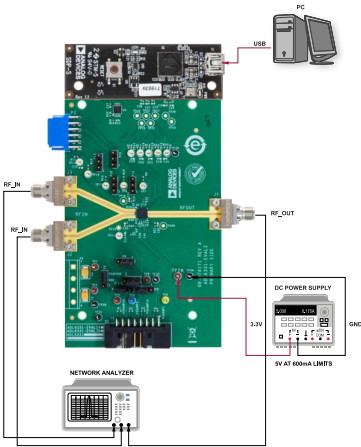


Figure 6. ADL6331-EVALZB Measurement Setup with Network Analyzer (Option 2)

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

INSTALLING THE ACE SOFTWARE AND ADL6331 PLUGINS

The ADL6331-EVALZA and the ADL6331-EVALZB connect to the SDP-S controller board for quick evaluation of the ADL6331. The ADL6331-EVALZA and the ADL6331-EVALZB are configured over a USB from a panel within the ACE software, which can be downloaded from the ACE website. When the ACE software installations are complete, the user must install the evaluation board ACE plugins that are provided with the evaluation package to the hard drive of the PC.

Double click the **Board.ADL6331.1.2022.xxxxx.acezip** file to install the evaluation board plugins.

Ensure that the **Board.ADL6331.1.2022.xxxxx** and the **Chip.ADL6331.1.2022.xxxxx** folders are located inside the **C:\Program-Data\Analog Devices\ACE\Plugins** folder.

SINGLE-TONE DEMONSTRATION WITH ACE

Use the following settings to configure the ADL6331-EVALZA and the ADL6331-EVALZB. The following is an example to amplify a 2000 MHz sine wave using the ACE software:

1. Configure the hardware according to the [Hardware Setup](#) section and shown in [Figure 1](#) and [Figure 2](#), or [Figure 5](#) and [Figure 6](#).
2. Set the frequency of the signal generator to 2000 MHz and the output level to -20 dBm. Connect the spectrum analyzer to the RF_OUT connector.

3. Launch the ACE application. This action displays the initial ACE start page as shown in [Figure 7](#). The ADL6331 is detected automatically and displays under **Attached Hardware**. As soon as the ADL6331 is detected by the ACE software, the ACE software automatically sets ENP to high. However, since the AMP1, AMP2, and DSA blocks are all disabled by default, the current consumption is very low. Approximately 3 mA is observed at the 3.3 V supply.
4. Click the **ADL6331 Board** icon shown in [Figure 7](#) to open the evaluation board level view (see [Figure 8](#)). After opening, click **Reset Chip** before starting configurations.
5. Enable each block of AMP1, AMP2, and DSA. Configure the four RF preconfigurations by selecting the AMP1 and AMP2 bypass modes, as well as setting up the DSA attenuation levels. Use default settings for the bias trim with **Use Fused** boxes checked for the ADL6331-EVALZA only. For the ADL6331-EVALZB, to achieve the optimal OIP3 performance, **CROSS_Z** of both **AMP1** and **AMP2** need to be set to 0 (see [Figure 9](#)).
6. Click **Apply Configuration** for the configurations to take effect.
7. If factory programmed values for the bias trim are needed, click **Read Configuration**. See **Applications Information** of ADL6331 data sheet for more details.
8. Measure the signal levels with a signal analyzer. The gain of the ADL6331 is derived from the following formula:

Gain = Signal Level at SA – Input Signal Level + Board Loss (see [Table 3](#) and [Table 4](#)) + Cable Loss + External Balun Loss (ADL6331-EVALZB only)

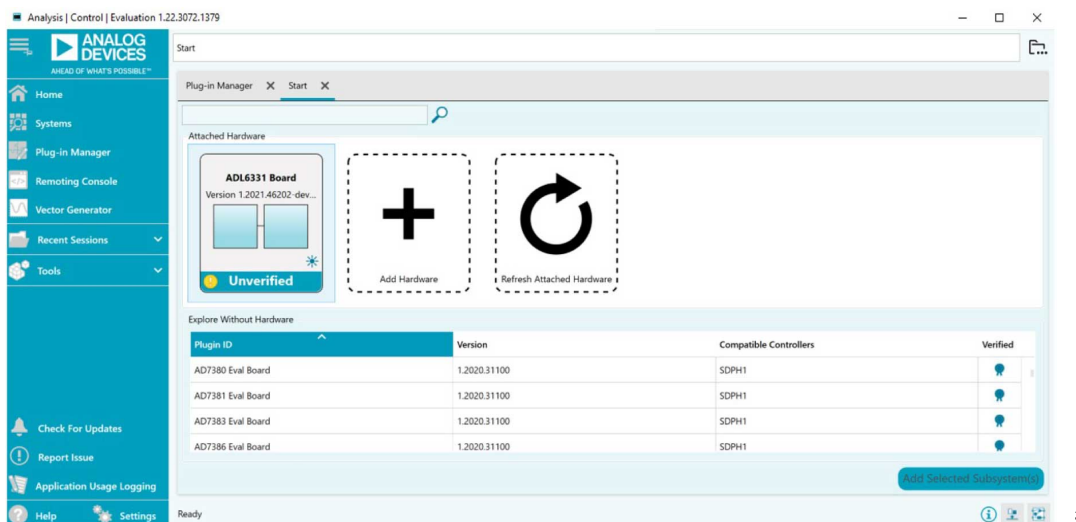


Figure 7. Initial ACE Start Page

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

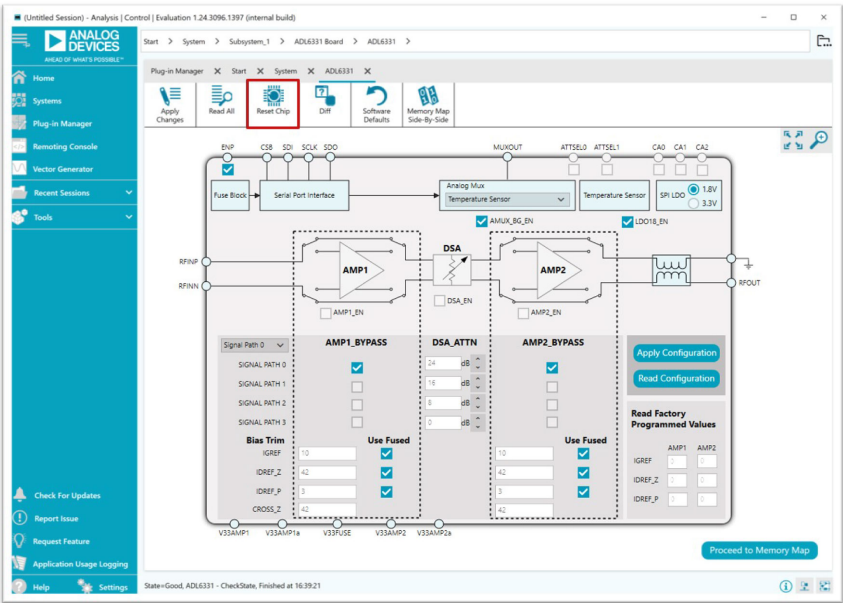


Figure 8. ADL6331-EVALZA and ADL6331-EVALZB Board Level View (After Reset Chip and ENP Set to High)

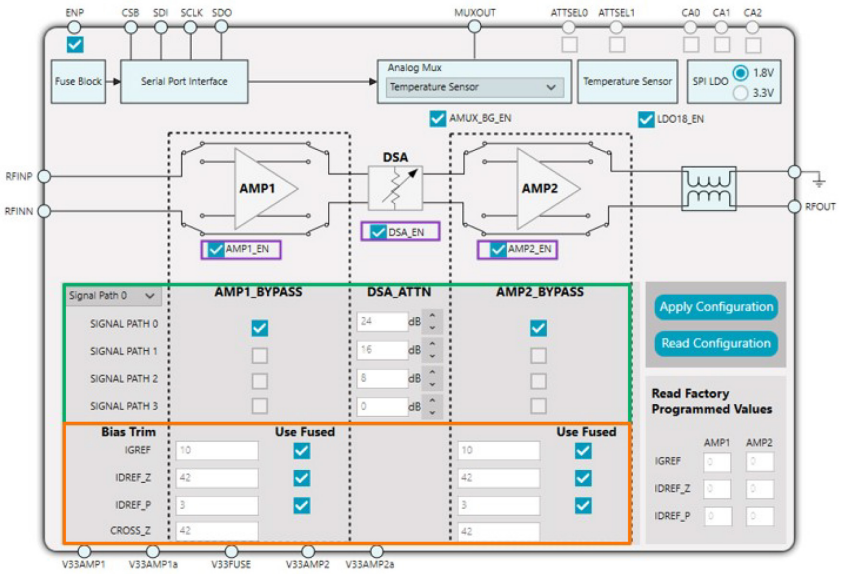


Figure 9. ADL6331 IC Level View (ENP Set to High)

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

LOSSES AND SIGNAL-TO-NOISE RATIO (SNR) DEGRADATION

The on-board balun MABA-011082 (Macom) is used to transform the single-ended board input to the differential inputs of the ADL6331 for the ADL6331-EVALZA only (see Figure 10). For the ADL6331-EVALZB, the on-board resistive matching network is used to transform the 100 Ω differential board inputs to the 50 Ω differential inputs of the IC (see Figure 11). Consider the board losses to derive the accurate RF performance, conversion gain, noise figure, and output third-order intercept (OIP3) of the device. Table 3 details the board losses including the balun and 2.92 mm connectors on the ADL6331-EVALZA, whereas Table 4 details the differential board losses including the 2.92 mm connectors and resistive matching network on the ADL6331-EVALZB.

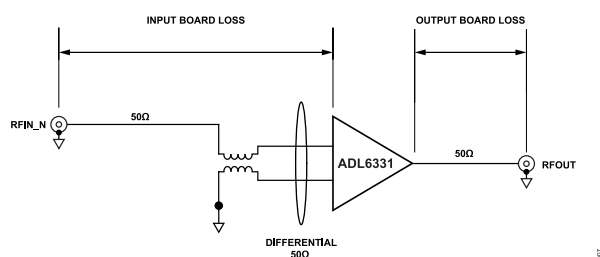


Figure 10. Losses and SNR Degradation for ADL6331-EVALZA

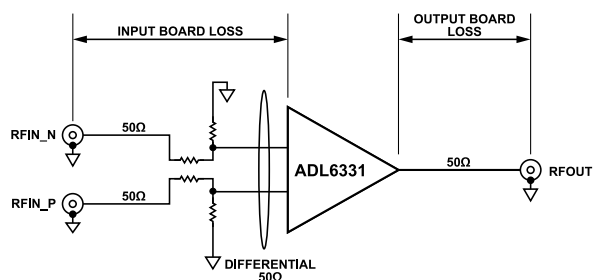


Figure 11. Losses and SNR Degradation for ADL6331-EVALZB

Table 4. Board Loss Table for the ADL6331-EVALZB

Frequency (GHz)	Loss (dB)		
	Input	Output	Total
1	7.89	0.24	8.13
2	8.07	0.42	8.49
3	8.06	0.48	8.54
4	8.11	0.57	8.68
5	8.19	0.65	8.84
6	8.18	0.72	8.90
7	8.21	0.84	9.05
8	8.30	0.97	9.27
9	8.22	1.03	9.25
10	8.26	1.17	9.43
11	8.37	1.30	9.67
12	8.18	1.33	9.51

Table 3. Board Loss Table for the ADL6331-EVALZA

Frequency (MHz)	Loss (dB)		
	Input	Output	Total
400	1.63	0.03	1.66
1000	1.58	0.12	1.70
2000	1.54	0.26	1.80
3000	1.69	0.34	2.03
4000	1.69	0.40	2.09
5000	1.68	0.49	2.17
6000	1.79	0.56	2.35
7000	2.31	0.66	2.97
8000	2.80	0.73	3.53

EVALUATION BOARD SCHEMATICS AND ARTWORK

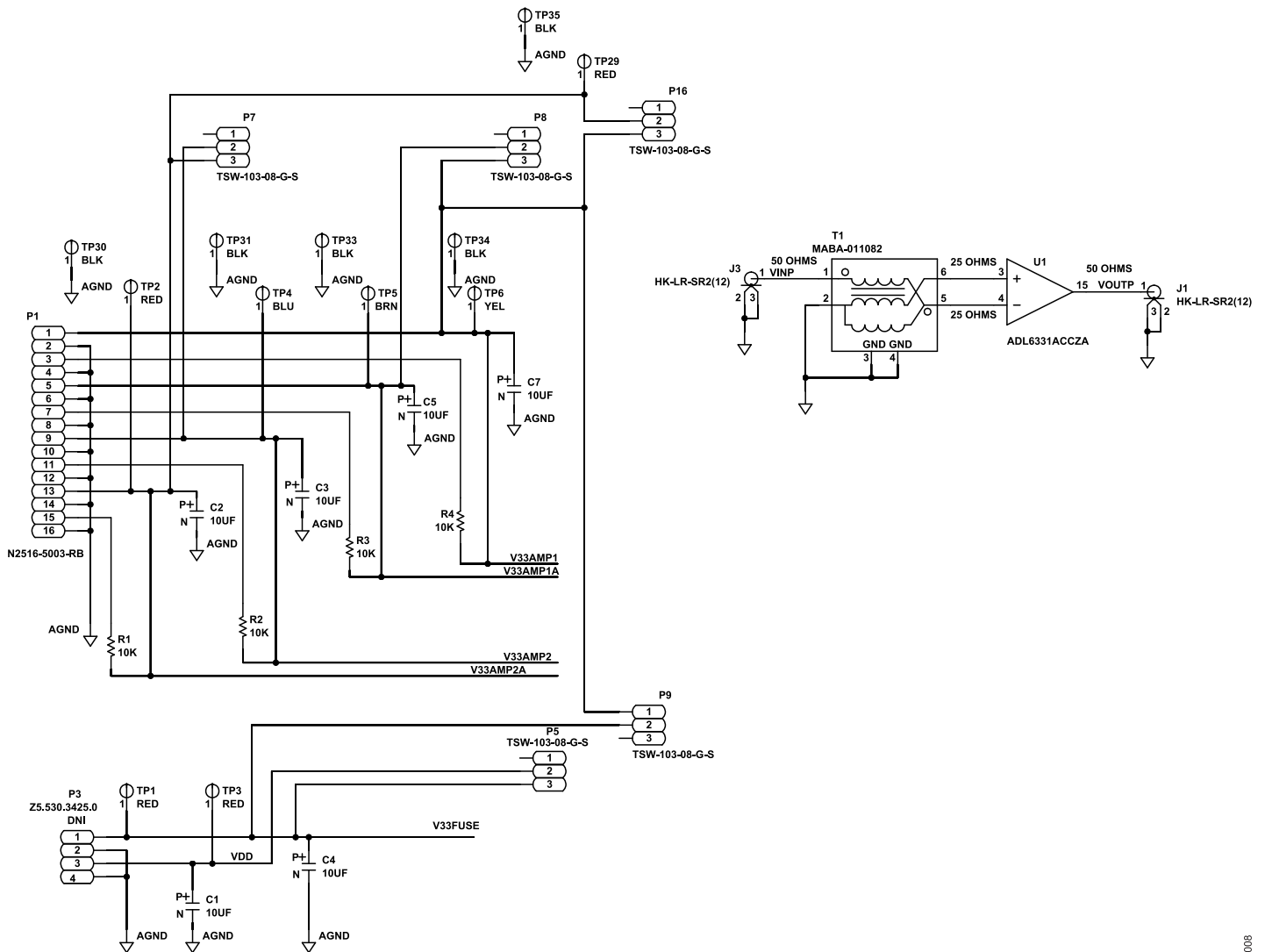


Figure 12. ADL6331-EVALZA Schematic

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EVALUATION BOARD SCHEMATICS AND ARTWORK

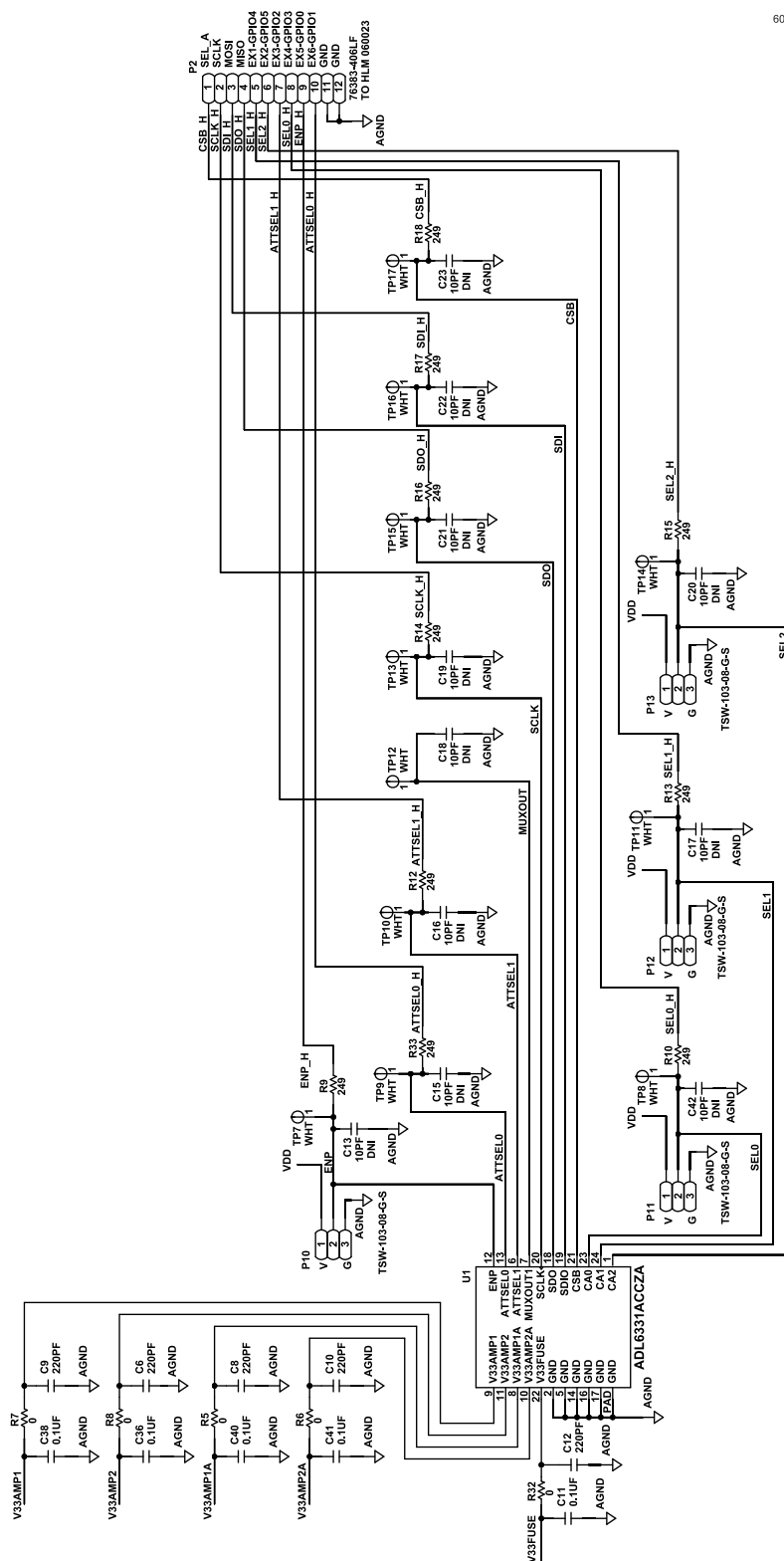


Figure 13. ADL6331-EVALZA Schematic 2

EVALUATION BOARD SCHEMATICS AND ARTWORK

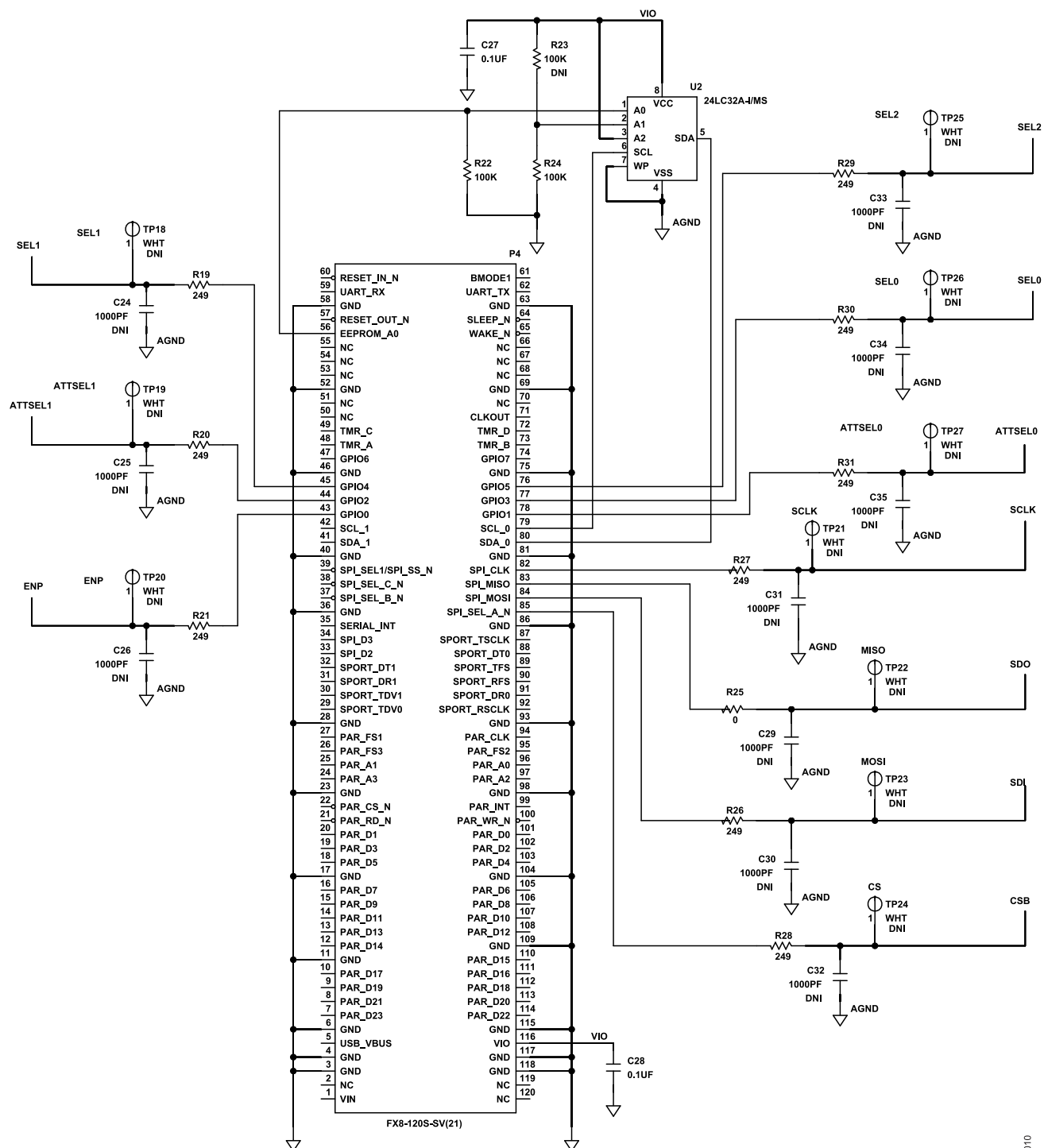


Figure 14. ADL6331-EVALZA Schematic 3

EVALUATION BOARD SCHEMATICS AND ARTWORK

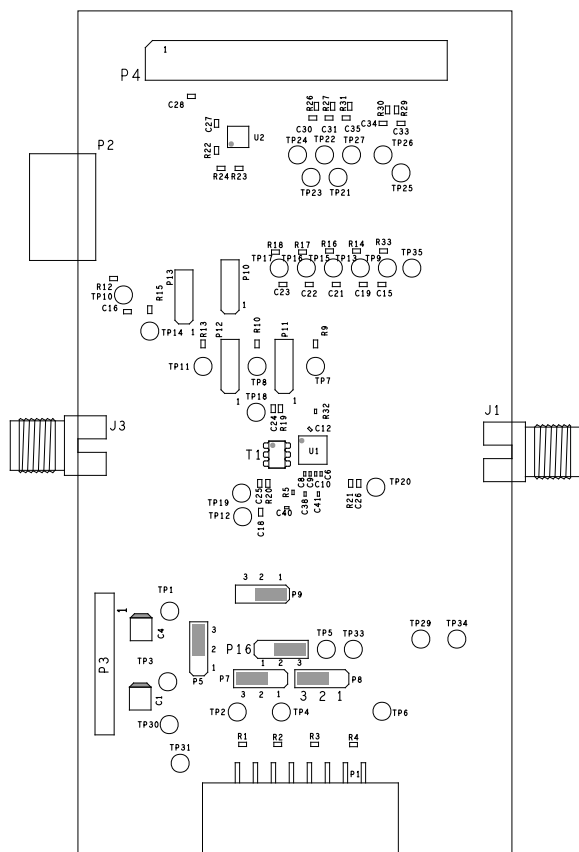


Figure 15. ADL6331-EVALZA Front Side

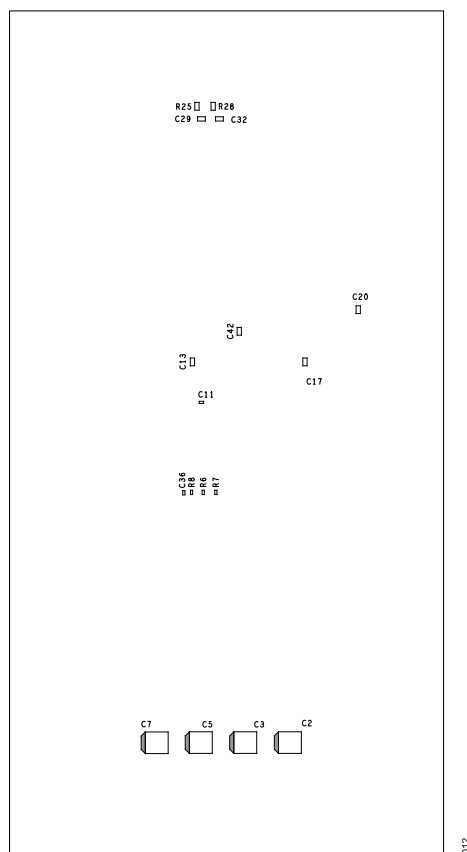


Figure 16. ADL6331-EVALZA Back Side

EVALUATION BOARD SCHEMATICS AND ARTWORK

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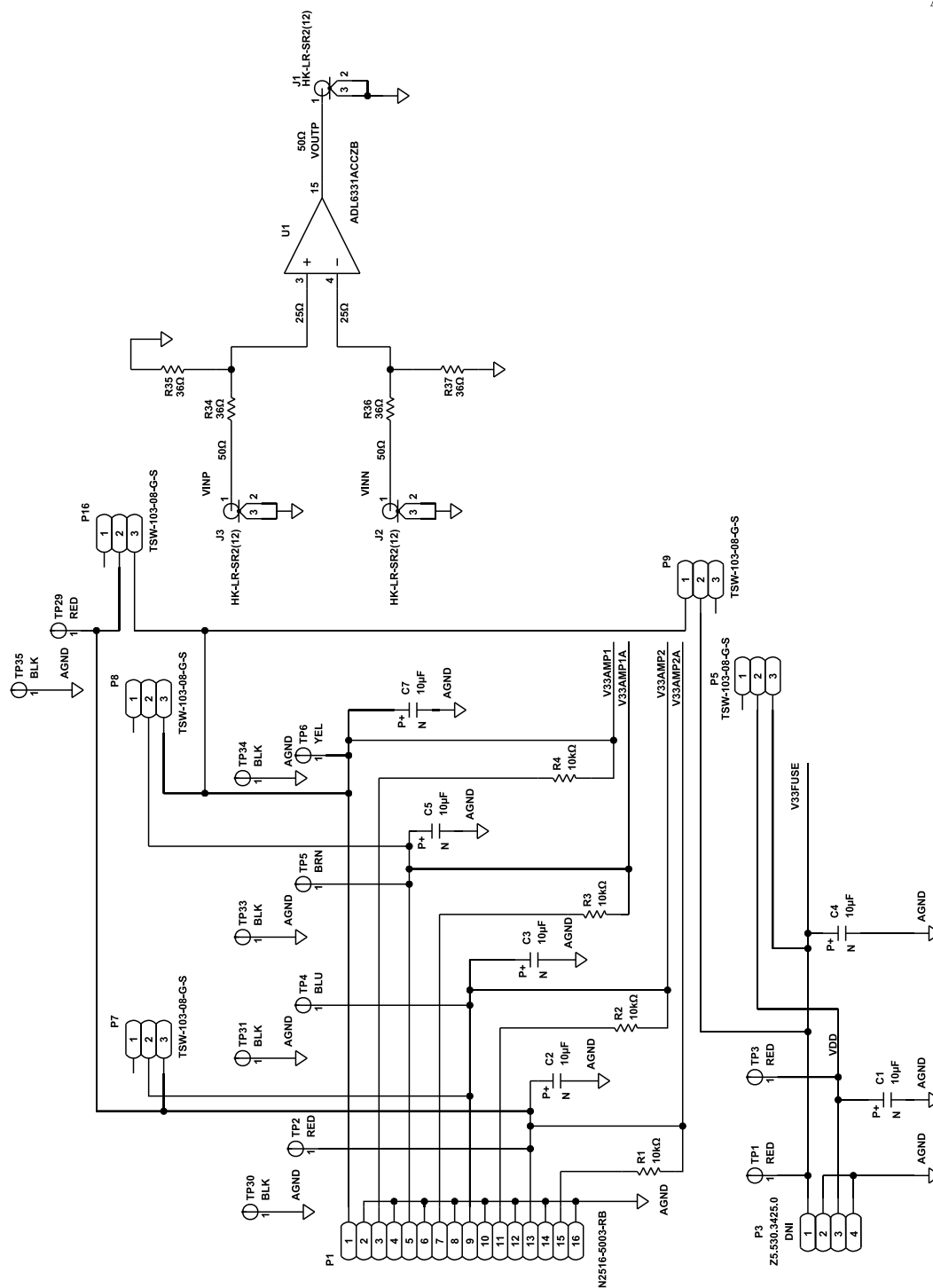


Figure 17. ADL6331-EVALZB Schematic

EVALUATION BOARD SCHEMATICS AND ARTWORK

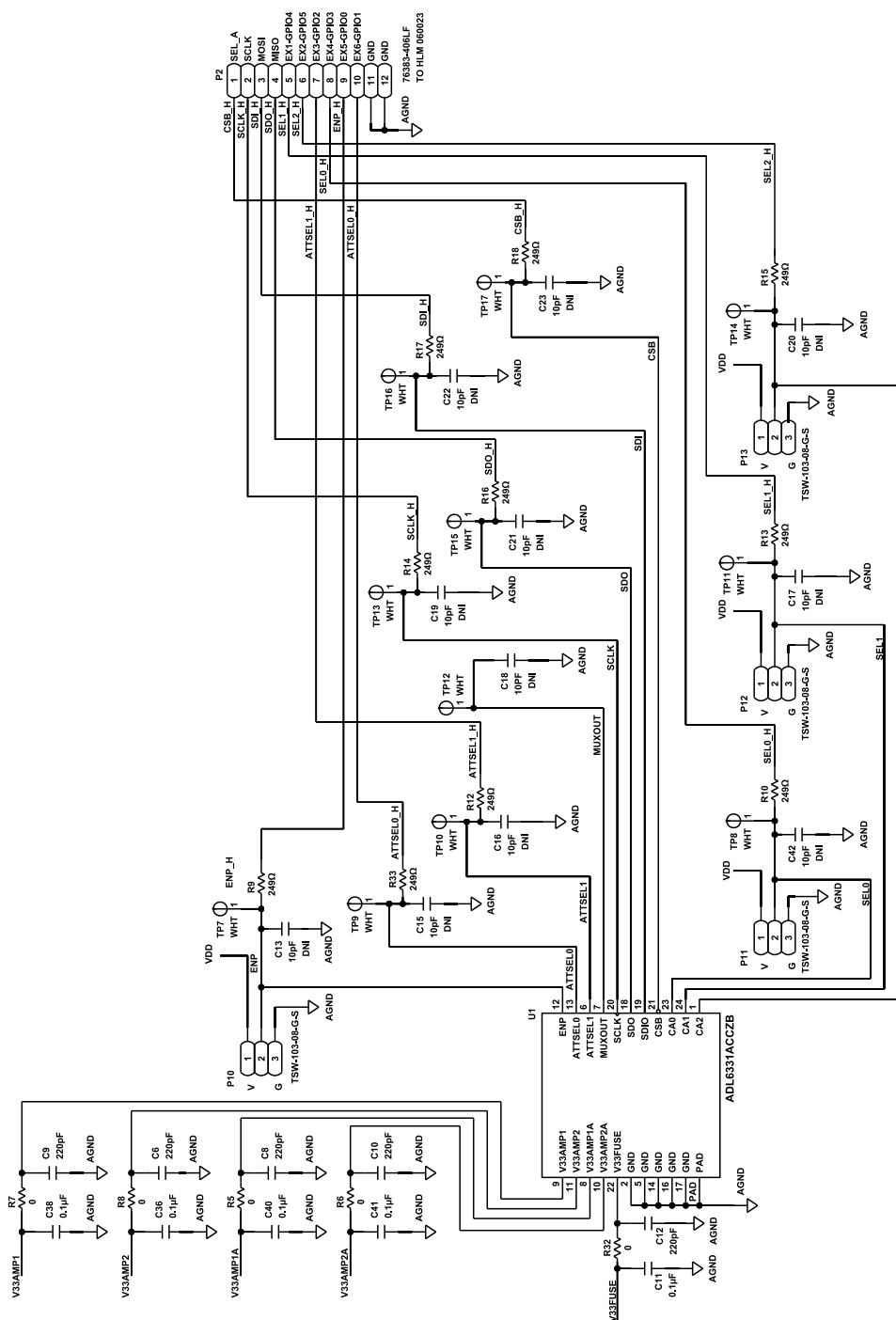


Figure 18. ADL6331-EVALZB Schematic 2

EVALUATION BOARD SCHEMATICS AND ARTWORK

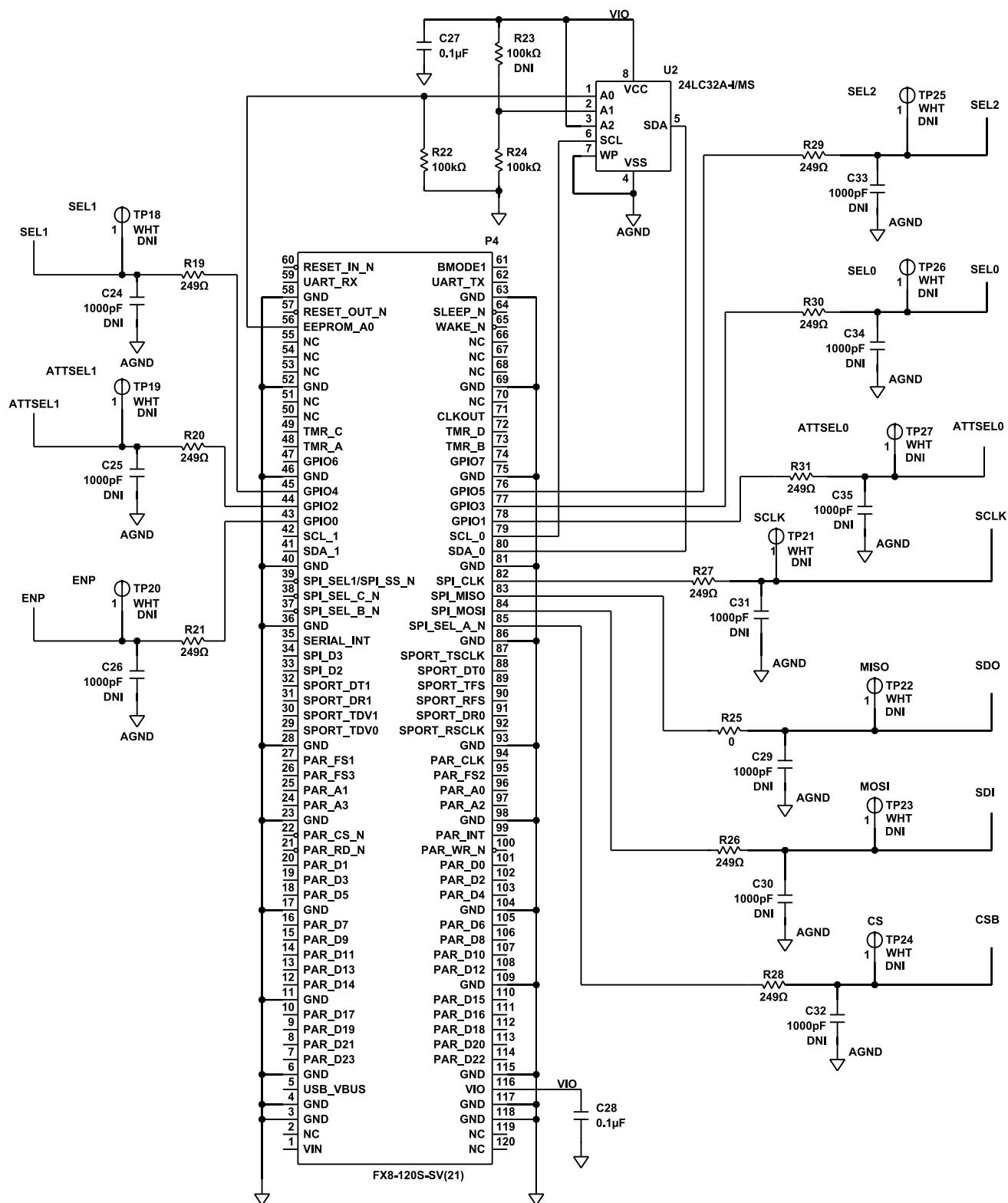
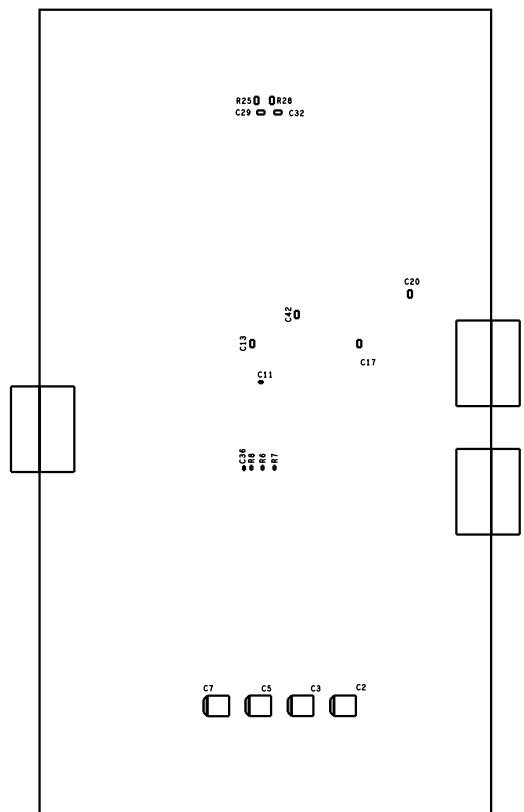


Figure 19. ADL6331-EVALZB Schematic 3

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BILL OF MATERIALS

Table 5. Bill of Materials for ADL6331-EVALZA

Quantity	Reference Designator	Description	Manufacturer	Part Number
6	C1, C2, C3, C4, C5, C7	Capacitors, 10 μ F, 16 V, C3528 package	AVX	TAJB106K016RNJ
5	C6, C8, C9, C10, C12	Capacitors, 220 pF, 50 V, C0201 package	MURATA	GRM0335C1H221JA01D
5	C11, C36, C38, C40, C41	Capacitors, 0.1 μ F, 16 V, C0201 package	MURATA	GRM033Z71C104ME14D
2	C27, C28	Capacitors, 0.1 μ F, 16 V, C0402 package	KEMET	C0402C104J4RACTU
2	J1, J3	Edge mount, 2.92 mm connectors	Hirose Electric CO.	HK-LR-SR2(12)
1	P1	Connector header through hole, right angle 16 position	3M	N2516-5003-RB
9	P5, P7, P8, P9, P10, P11, P12, P13, P16	Connector headers through hole, 3 position	SAMTEC	TSW-103-08-G-S
1	P2	Connector header through hole, right angle 12 position	AMPHENOL FCI	76383-406LF
1	P4	120 position connector receptacle, center strip contacts	Hirose Electric CO.	FX8-120S-SV(21)
4	R1, R2, R3, R4	Resistors, 10 k Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK1002X
10	R9, R10, R12, R13, R14, R15, R16, R17, R18, R33	Resistors, 249 Ω , 0.063 W, 0402 package	VENKEL	CR0402-16W-2490FT
9	R19, R20, R21, R26, R27, R28, R29, R30, R31	Resistors, 249 Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK12490X
2	R22, R24	Resistors, 100 k Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK1003X
1	R25	Resistor, 0 Ω , 0.063 W, 0402 package	SAMSUNG	RC1005J000CS
5	R5, R6, R7, R8, R32	Resistors, 0 Ω , 0.05 W, 0201 package	Panasonic	ERJ-1GN0R00C
1	T1	Transformer balun, 1:1 ratio, 5 to 8000 MHz	MACOM	MABA-011082
18	TP1 to TP17, TP29	PCB test point connectors	KEYSTONE ELECTRONICS	5xxx
5	TP30, TP31, TP33, TP34, TP35	PCB Test Point Connector	COMPONENTS CORPORATION	TP-105-01-00
1	U2	32 K bit, serial electrically erasable programmable read-only memory (EEPROM)	MICROCHIP TECHNOLOGY	24LC32A-I/MS
1	U1	0.38 GHz to 8.0 GHz TxVGA	Analog Devices, Inc.	ADL6331ACCZA
1	PCB	Evaluation board	Analog Devices	ADL6331-EVALZA

Table 6. Bill of Materials for ADL6331-EVALZB

Quantity	Reference Designator	Description	Manufacturer	Part Number
6	C1, C2, C3, C4, C5, C7	Capacitors, 10 μ F, 16 V, C3528 package	AVX	TAJB106K016RNJ
5	C6, C8, C9, C10, C12	Capacitors, 220 pF, 50 V, C0201 package	MURATA	GRM0335C1H221JA01D
5	C11, C36, C38, C40, C41	Capacitors, 0.1 μ F, 16 V, C0201 package	MURATA	GRM033Z71C104ME14D
2	C27, C28	Capacitors, 0.1 μ F, 16 V, C0402 package	KEMET	C0402C104J4RACTU
2	J1, J2, J3	Edge mount, 2.92 mm connectors	Hirose Electric CO.	HK-LR-SR2(12)
1	P1	Connector header through hole, right angle 16 position	3M	N2516-5003-RB
9	P5, P7, P8, P9, P10, P11, P12, P13, P16	Connector headers through hole, 3 position	SAMTEC	TSW-103-08-G-S
1	P2	Connector header through hole, right angle 12 position	AMPHENOL FCI	76383-406LF
1	P4	120 position connector receptacle, center strip contacts	Hirose Electric CO.	FX8-120S-SV(21)
4	R1, R2, R3, R4	Resistors, 10 k Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK1002X
10	R9, R10, R12, R13, R14, R15, R16, R17, R18, R33	Resistors, 249 Ω , 0.063 W, 0402 package	VENKEL	CR0402-16W-2490FT
9	R19, R20, R21, R26, R27, R28, R29, R30, R31	Resistors, 249 Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK12490X
2	R22, R24	Resistors, 100 k Ω , 0.1 W, 0402 package	Panasonic	ERJ-2RK1003X
1	R25	Resistor, 0 Ω , 0.063 W, 0402 package	SAMSUNG	RC1005J000CS
5	R5, R6, R7, R8, R32	Resistors, 0 Ω , 0.05 W, 0201 package	Panasonic	ERJ-1GN0R00C
4	R34, R35, R36, R37	Resistors, 36 Ω , 0.05 W, 0201 package	Panasonic	ERJ-1GNF36R0C

BILL OF MATERIALS

Table 6. Bill of Materials for ADL6331-EVALZB (Continued)

Quantity	Reference Designator	Description	Manufacturer	Part Number
18	TP1 to TP17, TP29	PCB test point connectors	KEYSTONE ELECTRONICS	5xxx
5	TP30, TP31, TP33, TP34, TP35	PCB Test Point Connector	COMPONENTS CORPORATION	TP-105-01-00
1	U2	32 K bit, serial electrically erasable programmable read-only memory (EEPROM)	MICROCHIP TECHNOLOGY	24LC32A-I/MS
1	U1	1.0 GHz to 12.0 GHz TxVGA	Analog Devices, Inc.	ADL6331ACCZB
1	PCB	Evaluation board	Analog Devices	ADL6331-EVALZB

**ESD Caution**

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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