Evaluation Board for the AD3531/AD3531R 16-Bit, 4-Channel, Voltage Output DACs

FEATURES

- Full featured evaluation board for the AD3531/AD3531R
- Various link options
- PC control when used in conjunction with the Analog Devices, Inc., SDP board

EVALUATION KIT CONTENTS

- EVAL-AD3531RARDZ

HARDWARE REQUIRED

- EVAL-SDP-CK1Z (SDP-K1) board; must be purchased separately

SOFTWARE REQUIRED

- ACE software with the EVAL-AD3531RARDZ plug-in
- SDP-K1 firmware for EVAL-AD3531RARDZ (included in the plug-in)

GENERAL DESCRIPTION

This user guide details the operation of the EVAL-AD3531RARDZ for the AD3531/AD3531R 16-bit, 4-channel, voltage output, digital-to-analog converters (DACs).

The EVAL-AD3531RARDZ allows users to quickly prototype the AD3531/AD3531R circuits and reduce design time. The AD3531/AD3531R operate from single 2.7V to 5.5V supply ranges. The AD3531/AD3531R incorporate internal 2.5V references to give output voltages of 2.5V or 5V. The EVAL-AD3531RARDZ also incorporates an additional on-board voltage reference, the ADR4525.

The EVAL-AD3531RARDZ interfaces to the USB port of a PC via a system demonstration platform (SDP-K1) board. The Analysis | Control | Evaluation (ACE) software is available for download from the EVAL-AD3531RARDZ product page to use with the evaluation board to allow the user to program the AD3531/AD3531R devices. A peripheral module interface (PMOD) connection is also available to allow the connection of microcontrollers to the evaluation board without the SDP-K1 board. When a microcontroller is used through the PMOD connection, the SDP-K1 board must be disconnected, and the user is unable to operate the ACE software.

The EVAL-AD3531RARDZ is compatible with Analog Devices, Inc., SDP-K1 board, which can be purchased separately.

For full details, see the AD3531/AD3531R data sheet, which must be used in conjunction with this user guide when using the EVAL-AD3531RARDZ.

PLEASE SEE THE LAST PAGE FOR AN IMPORTANT
WARNING AND LEGAL TERMS AND CONDITIONS.

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REVISION HISTORY

4/2025—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

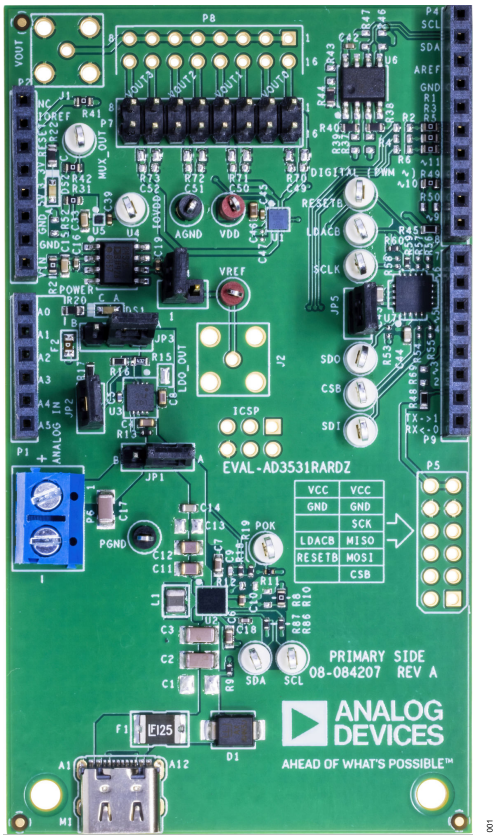

Figure 1. EVAL-AD3531RARDZ Evaluation Board Photograph

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

INSTALLING ACE

The EVAL-AD3531RARDZ uses the ACE evaluation software that allows the evaluation and control of multiple evaluation systems.

The ACE installer installs the necessary SDP-K1 drivers and the Microsoft® .NET Framework 4 by default. The ACE software is available for download from the ACE Software page and must be installed before connecting the SDP-K1 board to the USB port of the PC to ensure that the SDP-K1 board is recognized as connected to the PC. For full instructions on how to install and use this software, see the ACE Software page on the Analog Devices website.

INITIAL SETUP

To set up the evaluation board, take the following steps:

1. Connect the evaluation board to the SDP-K1 board, and then connect the USB cable between the SDP-K1 board and the PC.
2. Run the ACE application. The EVAL-AD3531RARDZ plug-ins appear in the attached hardware section of the **Start** tab.
3. Double-click the board plug-in to open the board view seen in Figure 2. When the correct firmware in the SDP-K1 controller is missing or does not match, a dialogue box shown in Figure 3 will pop-up and will give the option to flash the correct firmware. Press **OK** for initial setup. Press **Cancel** if the firmware has been loaded previously.
4. Double-click the AD3531R chip to access the chip block diagram. This view provides a basic representation of the functionality of the board. The main functions of the board are labeled in Figure 4 .

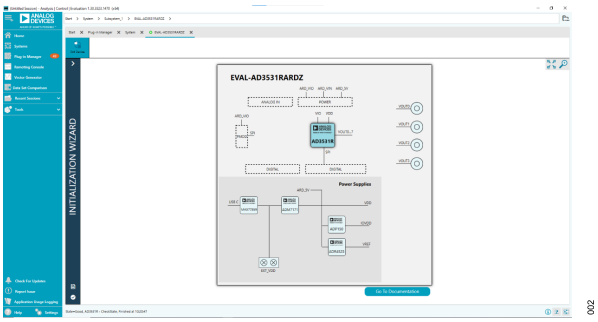

Figure 2. Board View of the EVAL-AD3531RARDZ

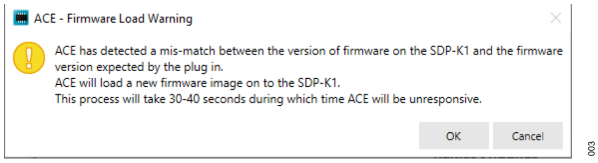

Figure 3. Firmware Loading Dialogue Box

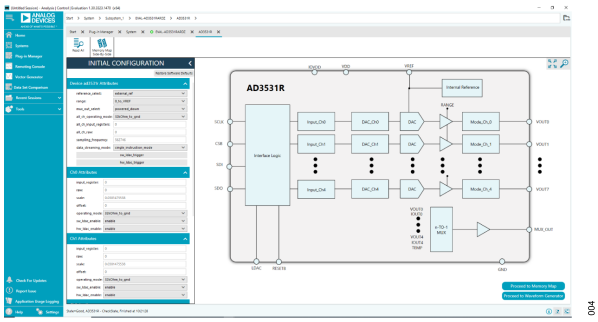

Figure 4. Chip Block Diagram of the AD3531R

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The EVAL-AD3531RARDZ provides on-board 1.8V, 3.3V, and 5V regulators powered through the SDP-K1 or from an external source (USB-C connector or terminal block). If a different supply is required or if the evaluation board is controlled through the PMOD connector, an external supply must be provided by the USB-C connector or through the terminal block. See Table 1 for more details.

LINK OPTIONS

A number of link options are incorporated on the EVAL-AD3531RARDZ and must be set for the required operating conditions before using the board. The functions of these link options are described in Table 2.

Table 1. Power Supply Connectors

Connector Label	Voltage Supplies Description
M1 (USB-C Connector)	5V supply. Requires a USB charger adapter that complies with the USB charging specification 1.2. Use this if the total load of the part is more than 100mA.
P6 (TERM_BLOCK)	5.2V to 6.5V input. Use this if the total load is more than 100mA and if the USB charger adapter is not preferred. JP1 should be set to Position B.
P2, Pin 5 (ARD_5V)	If the overall load required is less than 100mA, ARD_5V can be used as a source and, with SDP-K1, powered through the USB. JP3 should be set to Position B.

Table 2. Link Functions

Link	Default Position	Description
JP1	A	This link selects the external supply for the on board ADM7171 LDO. Position A: External supply used will be through the USB-C connector. An USB-C based charger adapter must be connected. The ADM7171 is powered by a 6V rail coming from the MAX77859. Position B: External supply used will be through the 2-pin terminal block, P6. An acceptable voltage range for this input is 5.2V to 6.5V.
JP2	Short	This link selects the voltage setpoint for the LDO stage (ADM7171). Short: Voltage setpoint is 5V. Open: Voltage setpoint is 3.3V.
JP3	B	This link selects the VDD source. There are two options, as follows: Position A: Takes either 5V or 3.3V generated by LDO stage. Please refer to JP2 orientation. Position B: Takes 5V generated by the SDP-K1 or any controller connected to the Arduino connector. Loads sourced by AD3531/AD3531R should not exceed 100mA.
JP4	Open	This link selects the availability of on-board reference voltage (the ADR4525) to the VREF pin of the device. The options are as follows: Short: VREF supplies reference voltage to the AD3531/AD3531R. The reference control register must be set such that the on-chip reference is disabled. Open: Required if on-chip reference is enabled or reference voltage is supplied through J2.
JP5	Short	This link enables/disables the MAX13030 level shifter. Shorted: Enables the MAX13030. Digital communication can come from either the SDP-K1 controller board or the PMOD connector, P5. Opened: Disables the MAX13030.

EVALUATION BOARD HARDWARE

OTHER ON-BOARD CONNECTORS

Table 3 shows the connectors on the EVAL-AD3531RARDZ.

Table 3. Other On-Board Connectors

Connector	Function
J2 (unmounted)	Male Subminiature Version B (SMB) port for external reference. Prior to use, P11 must be opened, and the on-chip reference of the AD3531/AD3531R must be disabled through the reference control register.
P5 (unmounted)	12-pin SPI PMOD Connector. Use this if a separate digital interface, aside from Arduino form factor controller (the SDP-K1, for example), will be used.
J1 (unmounted)	Male SMB port to measure the DAC output voltage.
P8 (unmounted)	Short a pair of rows to temporarily select the channel to be measured on J1. Mounting one 0Ω on either of the resistors from R78 to R85 can also be used. Only one method and one channel can be selected at a time.
P7	Male headers to monitor or connect external loads to each DAC output channel.

EVALUATION BOARD SCHEMATICS AND ARTWORK

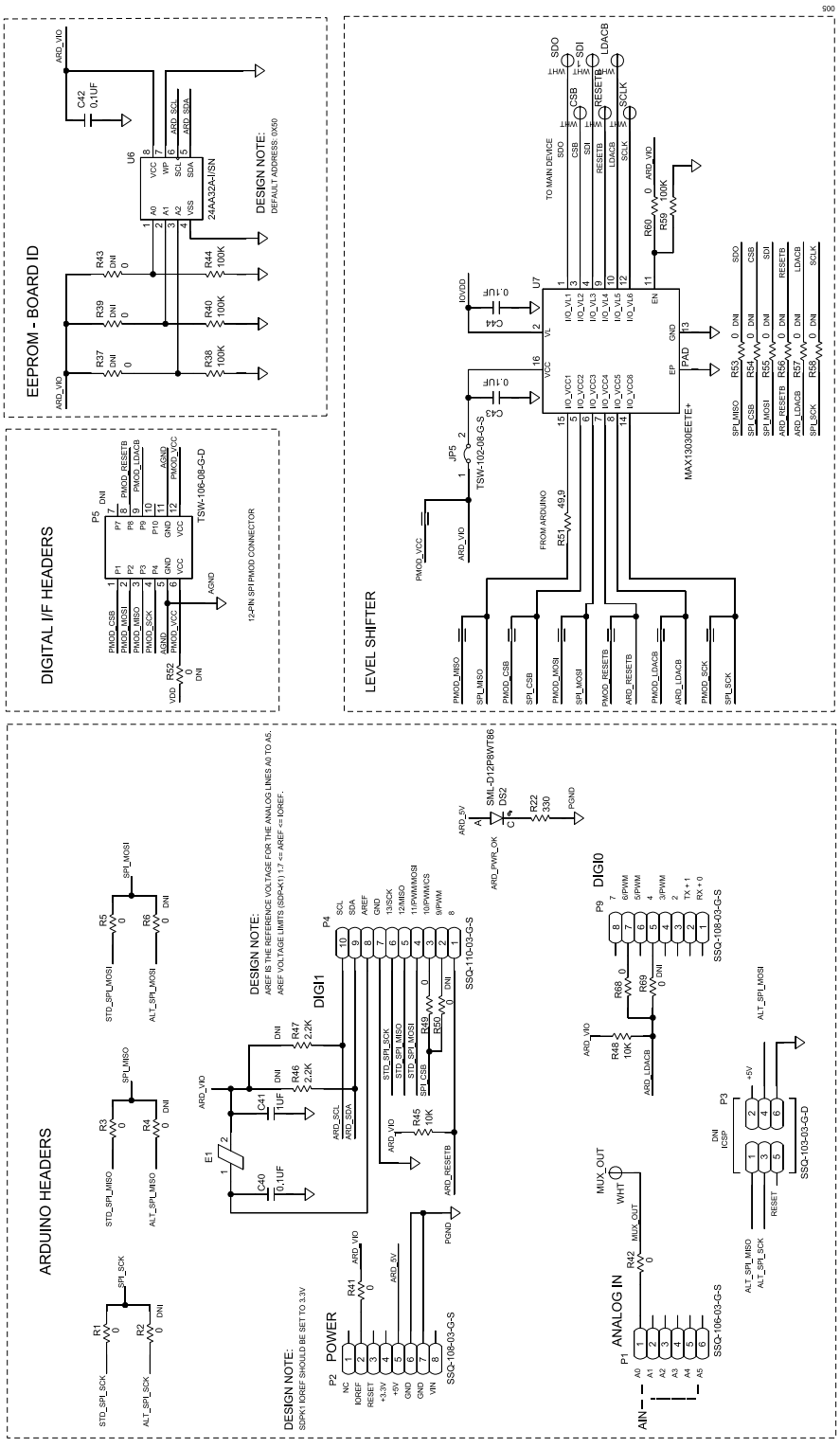

Figure 5. EVAL-AD3531RARDZ Schematic, SDP, Arduino-Compatible, and PMOD Connectors

EVALUATION BOARD SCHEMATICS AND ARTWORK

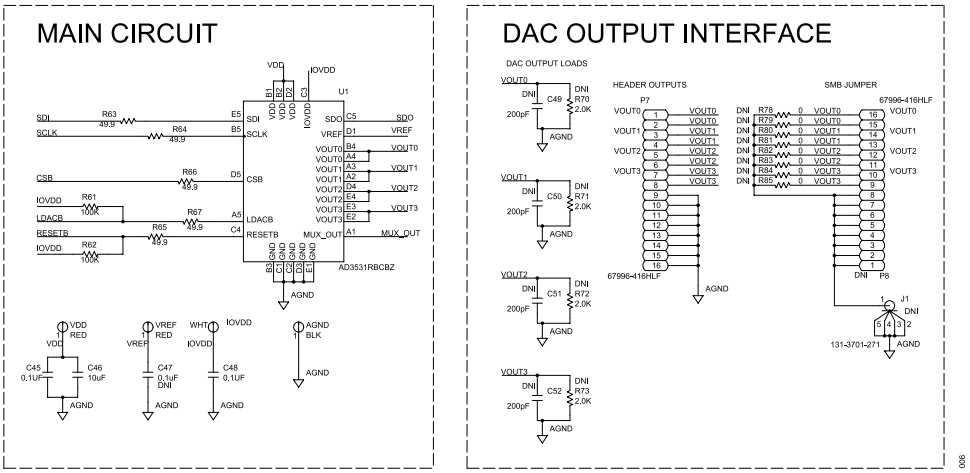

Figure 6. EVAL-AD3531RARDZ Schematic, Main Circuit, and Output Connectors

EVALUATION BOARD SCHEMATICS AND ARTWORK

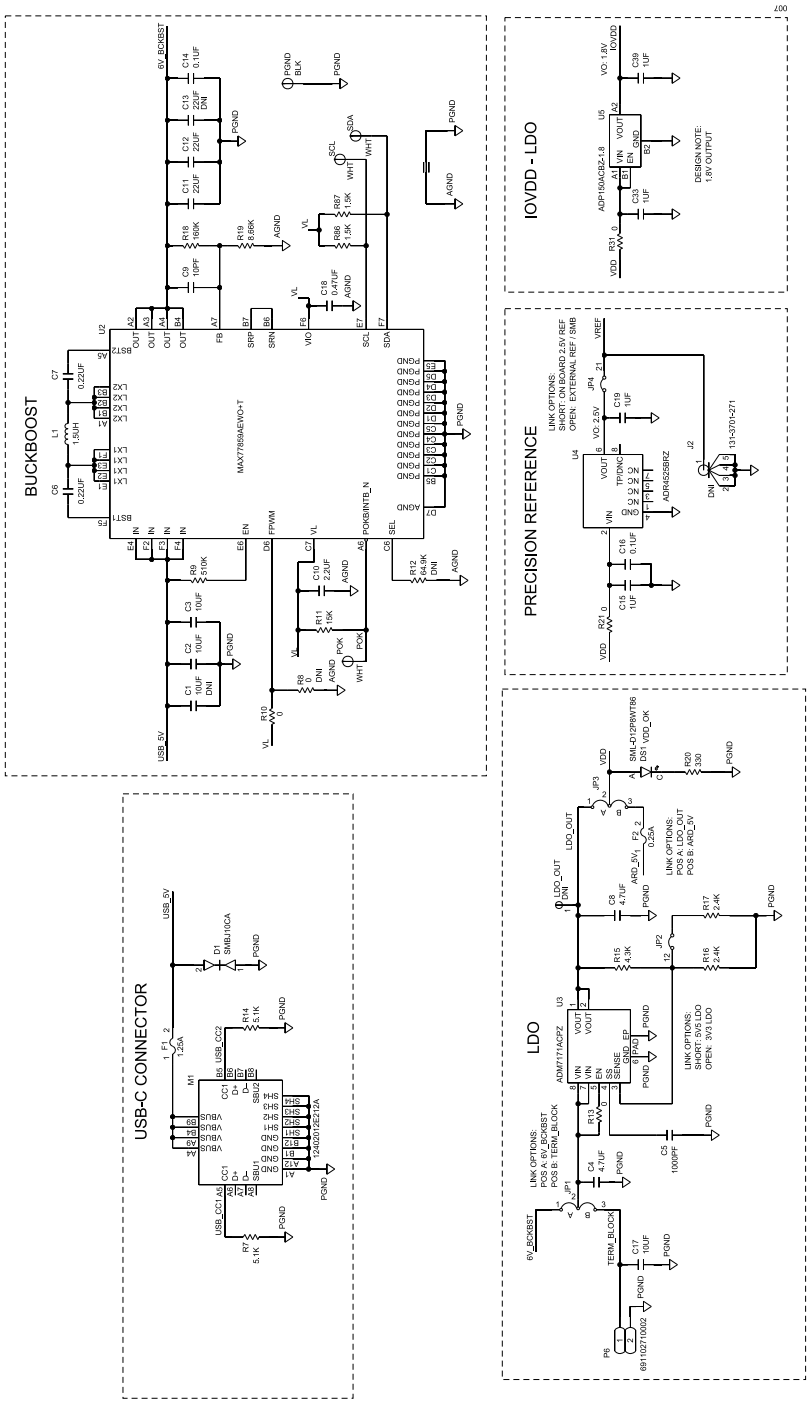

Figure 7. EVAL-AD3531RARDZ Schematic, Power Tree, and On-Board Reference

EVALUATION BOARD SCHEMATICS AND ARTWORK

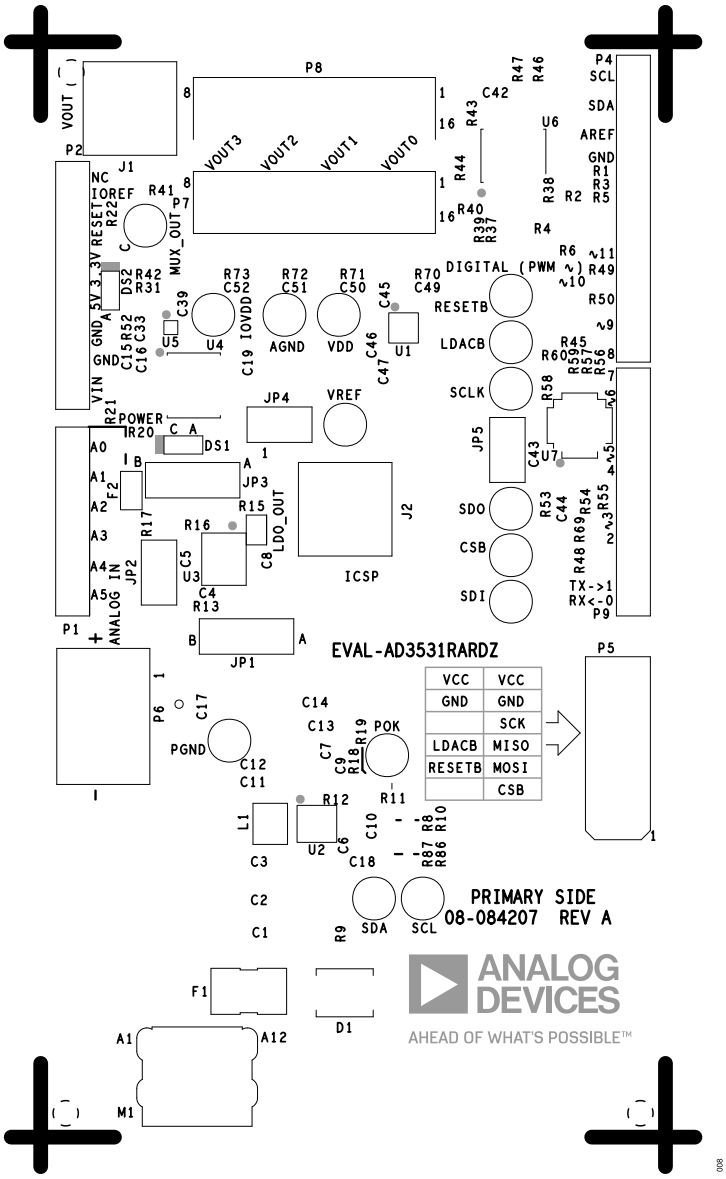

Figure 8. EVAL-AD3531RARDZTop Side Component Placement

EVALUATION BOARD SCHEMATICS AND ARTWORK

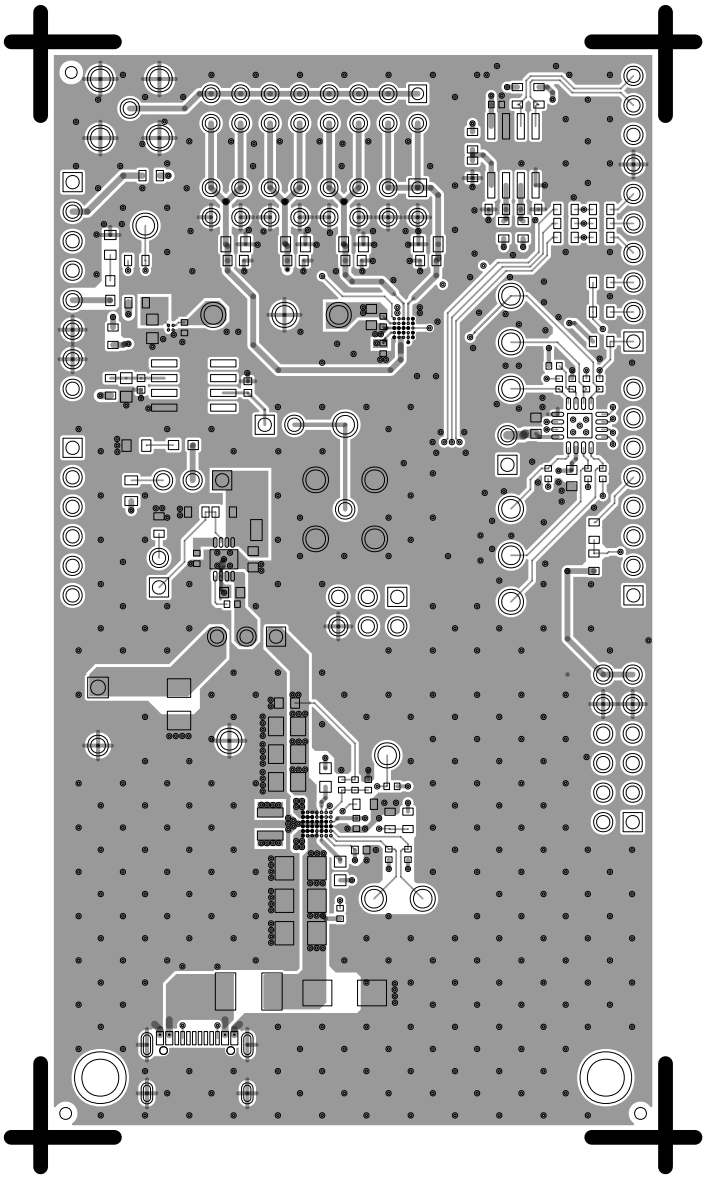

Figure 9. EVAL-AD3531RARDZ Top Side Routing

EVALUATION BOARD SCHEMATICS AND ARTWORK

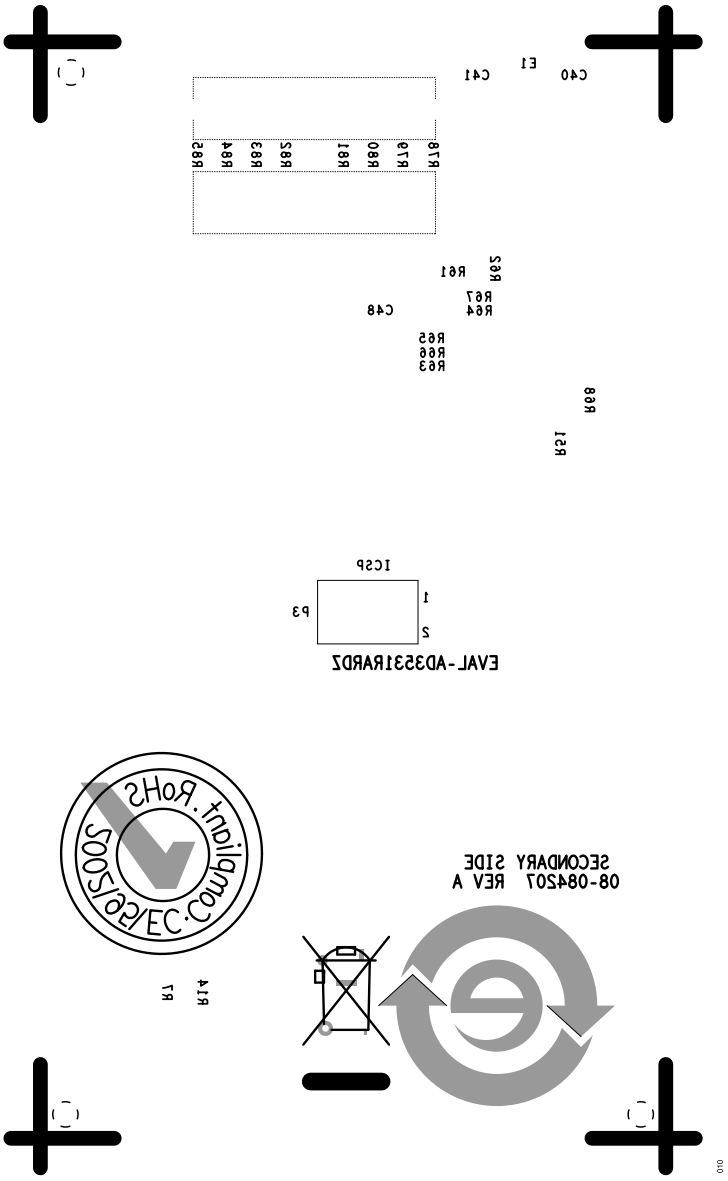

Figure 10. EVAL-AD3531RARDZ Bottom Side Component Placement

EVALUATION BOARD SCHEMATICS AND ARTWORK

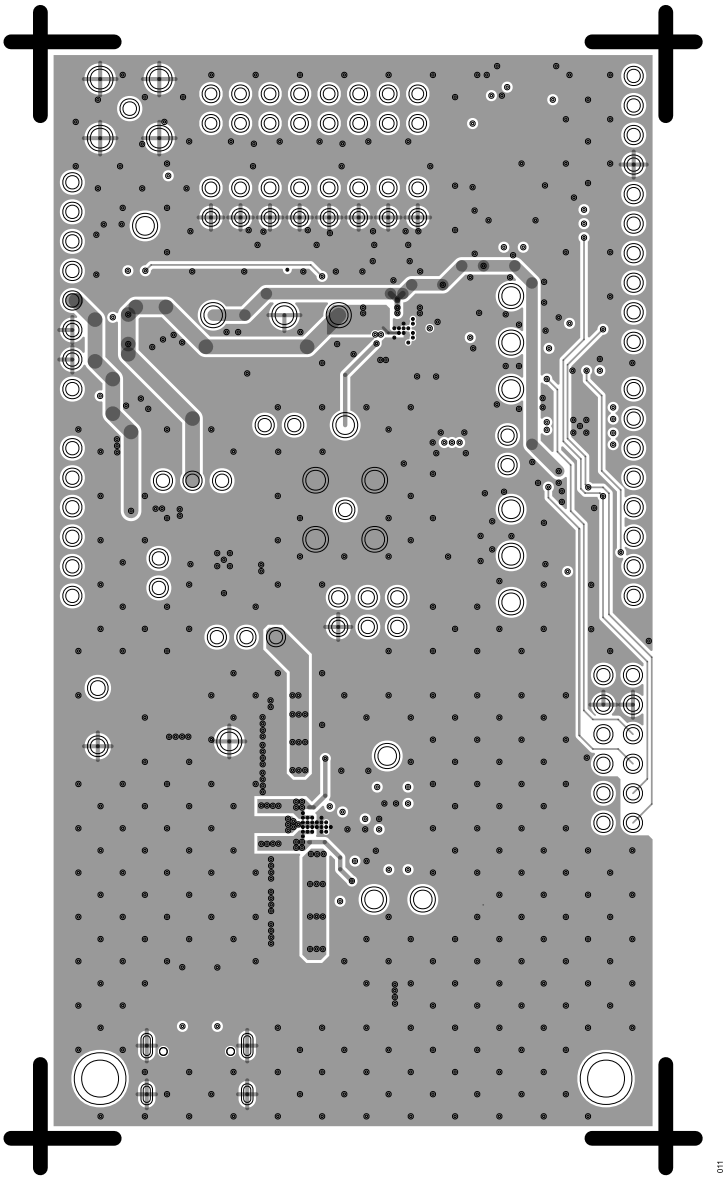

Figure 11. EVAL-AD3531RARDZ Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 4. Bill of Materials

Quantity	Reference Designator	Description	Supplier, Part Number[1]
1	U1	IC-ADI AD3531RBCBZ 4-Channel, 16-Bit Voltage Output DAC, On-Chip Reference, SPI	Analog Devices, Inc., AD3531RBCBZ
1	U2	IC-ADI 2.5V to 22V input, 7.8A switching current high-efficiency buck-boost converter for USB power delivery (USB-PD)/programmable power supply (PPS) applications	Analog Devices, MAX77859AEWO+T
1	U3	IC-ADI 6.5 V, 1 A, ultra-low noise, high PSRR, fast transient response complementary metal-oxide semiconductor (CMOS) low dropout (LDO) regulator	Analog Devices, ADM7171ACPZ-R7
1	U4	IC-ADI ultra-low noise, high-accuracy, 2.5V voltage reference	Analog Devices, ADR4525BRZ
1	U5	IC-ADI ultra-low noise, 150 mA CMOS linear regulator	Analog Devices, ADP150ACBZ-1.8-R7
1	U6	IC 32Kbit, serial electrically erasable programmable read-only memory (EEPROM)	Analog Devices, 24AA32A-I/SN
1	U7	IC-ADI 6-channel bidirectional high speed logic-level translator	Analog Devices, MAX13030EETE+
2	AGND, PGND	Connector, printed circuit board (PCB) receptacle test point block	Generic
1	C10	Ceramic capacitor, 2.2µF, 25V, 20%, X5R, 0402	Generic
2	C11, C12	Ceramic capacitors, 22µF, 25V, 20%, X5R, 0805	Generic
3	C14, C43, C44	Ceramic capacitors, 0.1µF, 50V, 10%, X7R, 0603	Generic
2	C15, C33	Ceramic capacitors, 1µF, 50V, 10%, X5R, 0603, AEC-Q200	Generic
5	C16, C40, C42, C45, C48	Ceramic capacitors, 0.1µF, 50V, 10%, X7R, 0402	Generic
3	C2,C3,C17	Ceramic capacitors, 10µF, 50V, 10%, X7R, 1206	Generic
1	C18	Ceramic capacitor, 0.47µF, 10V, 10%, X7S, 0402, AEC-Q200	Generic
3	C19, C39, C41	Ceramic capacitors, 1µF, 50V, 10%, X5R, 0402	Generic
2	C4,C8	Ceramic capacitors, 4.7µF, 25V, 10%, X5R, 0603	Generic
1	C46	Ceramic capacitor, 10µF, 35V, 20%, X5R, 0603	Generic
1	C5	Ceramic capacitor, 1000pF, 50V, 5%, C0G, 0402	Generic
2	C6,C7	Ceramic capacitors, 0.22µF, 50V, 10%, X7R, 0603, AEC-Q200	Generic
1	C9	Ceramic capacitor, 10pF, 50V, 5%, C0G, 0402, AEC-Q200	Generic
11	CSB, IOVDD, LDACB, MUX_OUT, POK,RESETB, SCL, SCLK, SDA, SDI, SDO	Connector-PCB TST PNT WHT	Generic
1	D1	Diode, transient voltage suppression (TVS), bidirectional, 10V, 600W, 35.3A, 17V, (clamping) Subminiature Version B (SMB)	Generic
2	DS1,DS2	Light-emitting diode (LED) exceled lamp trade chip, 560NM, 0.020A, green	Generic
1	E1	Ferrite bead inductor, 0.150Ω, maximum direct current resistance (DCR), 1A	Generic
1	F1	Polymeric positive temperature coefficient (PTC) resettable fuse	Generic
1	F2	Fast-acting fuse, 250MA, 32V, 0603	Generic
2	JP1, JP3	PCB connector, 3 position, male header, unshrouded single row, 2.54MM pitch, 3MM solder tail	Generic
3	JP2, JP4, JP5	PCB connector, 2 position header	Generic
1	L1	Inductor, power, wirewound, 1.5UH, 20%, 1MHZ, 3.2A, 0.054Ω, DCR, 1008	Generic
1	M1	Module, USB 2.0, Type-C, right angle	Generic
1	P1	Connector PCB receptacle 25MIL, square post, 2.54MM pitch	Generic
2	P2,P9	Connector PCB receptacle 25MIL, square post, 2.54MM pitch	Generic
1	P4	Connector PCB receptacle 25MIL, square post, 2.54MM pitch	Generic
1	P6	Connector, PCB, 2-position, terminal block, side entry, 5MM pitch	Generic
1	P7	Connector, header, 16 positions header, 100 strands tin	Generic
7	R1, R3, R5, R41, R42, R49, R68	Surface mount device (SMD) resistor, 0Ω, jumper, 1/10W, 0603, AEC-Q200	Generic

ORDERING INFORMATION

Table 4. Bill of Materials (Continued)

Quantity	Reference Designator	Description	Supplier, Part Number[1]
3	R10, R21, R31	SMD resistor, 0Ω, jumper, 1/10W, 0603, AEC-Q200, precision power	Generic
1	R11	SMD resistor, 15KΩ, 1%, 1/16W, 0402, AEC-Q200	Generic
2	R13, R60	SMD resistor 0Ω, jumper, 1/10W, 0402, AEC-Q200	Generic
2	R7, R14	SMD resistor, 5.1KΩ, 5%, 1/10W, 0402, AEC-Q200	Generic
1	R15	SMD resistor, 4.3KΩ, 0.1%, 1/10W, 0603, AEC-Q200, high reliability	Generic
2	R16, R17	SMD resistor, 2.4KΩ, 1%, 1/10W, 0603, AEC-Q200	Generic
1	R18	SMD resistor, 160KΩ, 1%, 1/10W, 0402, AEC-Q200	Generic
1	R19	SMD resistor, 8.66KΩ, 1%, 1/10W, 0402, AEC-Q200	Generic
2	R25, R27	SMD resistor, 330Ω, 1%, 1/10W, 0603, AEC-Q200	Generic
3	R38, R40, R44	SMD resistor, 100KΩ, 1%, 1/10W, 0603	Generic
2	R45, R48	SMD resistor, 10KΩ, 1/10W, 1%, 0603, AEC-Q200	Generic
6	R51, R63, R64, R65, R66, R67	SMD resistor, 49.9Ω, 1%, 1/10W, 0402, AEC-Q200	Generic
3	R59, R61, R62	SMD resistor, 100KΩ, 1%, 1/10W, 0402, AEC-Q200	Generic
2	R86, R87	SMD resistor, 1.5KΩ, 1%, 1/10W, 0402, AEC-Q200	Generic
1	R9	SMD resistor, 510KΩ, 1%, 1/10W, 0402, AEC-2200	Generic
2	VDD, VREF	Connectors, PCB, test point, red	Generic
1	C1	Ceramic capacitor 10µF 50V 10% X7R 1206	Do not install
1	C13	Ceramic capacitor 22µF 25V 20% X5R 0805	Do not install
1	C47	Ceramic capacitor 0.1µF 16V 10% X7R 0402 AEC-Q200	Do not install
4	C49, C50, C51, C52	Ceramic capacitors 200pF 50V 1% C0G 0603	Do not install
2	J1,J2	Connector, PCB, SMB, PC mount, straight jack receptacle	Do not install
1	LDO_OUT	Connector, PCB, SMD, test point tin	Do not install
1	P3	Connector, PCB, receptacle, 25MIL, square post, dual row, 2.54MM pitch	Do not install
1	P5	Connector, PCB, header, straight, male, peripheral module (PMOD)	Do not install
1	P8	Connector, header, 16 position, 100 strands, tin	Do not install
1	R12	SMD resistor, 64.9KΩ, 1%, 1/10W, 0603, AEC-Q200	Do not install
6	R2, R4, R6, R50, R52, R69	SMD resistor, 0Ω jumper, 1/10W, 0603, AEC-Q200	Do not install
4	R8, R37, R39, R43	SMD resistor, 0 Ω jumper, 1/10W, 0603, AEC-Q200, precision power	Do not install
2	R46, R47	SMD resistor, 2.2KΩ, 1%, 1/10W, 0603, AEC-Q200	Do not install
14	R53, R54, R55, R56, R57, R58, R78, R79, R80, R81, R82, R83, R84, R85	SMD resistor, 0Ω jumper, 1/10W, 0402, AEC-Q200	Do not install
4	R70, R71, R72, R73	SMD resistor, 2.0KΩ, 0.1%, 1/8W, 0805, AEC-Q200, high reliability	Do not install

[1] Generic indicates that any part with the specified value, size, and rating can be used.

ORDERING INFORMATION

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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