One Technology Way • P.O. Box 9106 • Norwood, MA 02062-9106, U.S.A. • Tel: 781.329.4700 • Fax: 781.461.3113 • www.analog.com

Evaluation Board for the AD5541A and the AD5542A, 16-Bit, Accurate, High Precision DAC in LFCSP with 1 µs Settling Time and 5 kV ESD Ratings

FEATURES

- Full featured evaluation board for the AD5541A and the AD5542A
- On-board reference
- Various link options
- PC control in conjunction with Analog Devices, Inc., EVAL-SDP-CB1Z
- PC software for control of DACs

EVALUATION KIT CONTENTS

- EVAL-AD5541A evaluation board or the EVAL-AD5542A evaluation board
- AD5541A device or the AD5542A device
- CD includes
  - Self installing evaluation software allowing users to control the board and exercise all functions of the device
  - Electronic version of the AD5541A data sheet or the AD5542A data sheet
  - Electronic version of the EVAL-AD5541A user guide or the EVAL-AD5542A user guide
  - AD5541A/42A Evaluation Software
  - USB cable

GENERAL DESCRIPTION

The EVAL-AD5541ASDZ evaluation board and the EVAL-AD5542ASDZ evaluation board are designed to quickly prototype the AD5541A and AD5542A circuits, respectively, and reduce design time. The AD5541A and the AD5542A operate from a single 2.7 V to 5.5 V supply. The REF192 is the on-board reference chip.

The EVAL-AD5541ASDZ evaluation board and the EVAL-AD5542ASDZ evaluation board interface to the USB port of a PC via the EVAL-SDP-CB1Z board. The AD5541A/42A Evaluation Software is available with the evaluation boards or from the evaluation board webpage, which allows the user to program the AD5541A or the AD5542A.

Full specifications for the AD5541A are listed in the AD5541A data sheet and full specifications for the AD5542A are listed in the AD5542A data sheet available from Analog Devices and should be consulted in conjunction with this user guide when using the evaluation boards.

TABLE OF CONTENTS

REVISION HISTORY

6/2017—Revision 0: Initial Version

UNIVERSAL EVALUATION BOARD

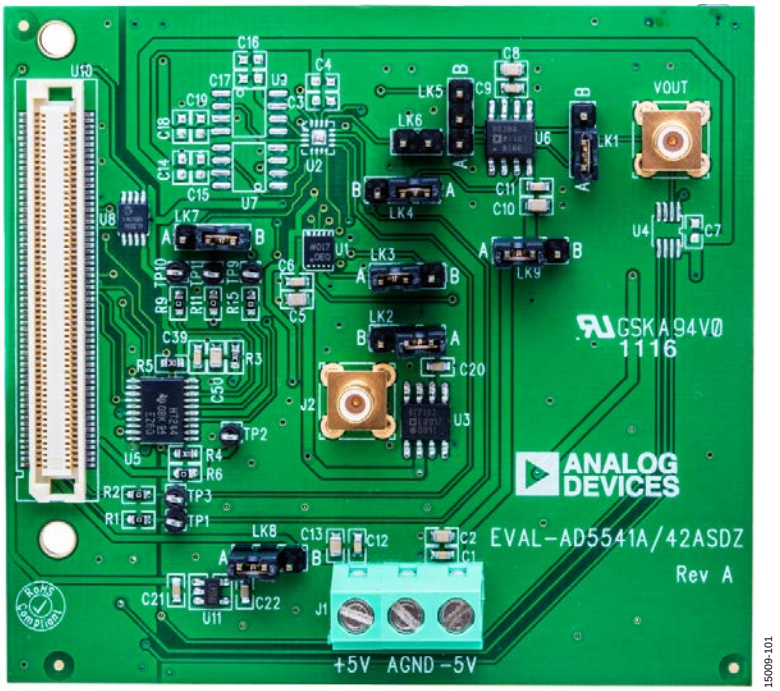

Figure 1.

EVALUATION BOARD HARDWARE

POWER SUPPLIES

To power the EVAL-AD5542ASDZ evaluation board, supply 5 V between the +5V input and AGND input for the analog supply and −5 V between the −5V input and AGND input for the negative analog supply of the evaluation board.

To power the EVAL-AD5541ASDZ evaluation board, connect the evaluation board to the EVAL-SDP-CB1Z board, which is powered by the USB interface on the PC.

All supplies are decoupled to ground with 10 µF tantalum capacitors and 0.1 µF ceramic capacitors. Table 1 describes the power supply connectors.

Table 1. Power Supply Connectors

Connector	Voltage
J1	Analog positive power supply is +5 V and AGND. Analog negative power supply is −5 V and AGND. Single-supply operation supply is +5 V and −5 V.

LINK OPTIONS

A number of link and switch options are incorporated in the EVAL-AD5541ASDZ and EVAL-AD5542ASDZ evaluation boards that must be set for the required operating conditions before using the evaluation boards. Table 2 and Table 3 describe the positions of the different links controlling the evaluation boards by PC via the USB port. The functions of these link options are described in detail in Table 4.

Table 2. Link Position Setup for the EVAL-AD5541ASDZ

Link	Position
LK1	A
LK2	A
LK3	A
LK4	A
LK5	Not inserted
LK6	Not inserted
LK7	B
LK8	A
LK9	B

Table 3. Link Position Setup for the EVAL-AD5542ASDZ

Link	Position
LK1	B
LK2	A
LK3	B
LK4	B
LK5	B
LK6	Inserted
LK7	A
LK8	B
LK9	A

Table 4. Link Functions

Link	Functions[1]
LK1	This link selects the output configuration of the OP777 or the AD8628. Position A connects the noninverting input of the OP777 or the AD8628 to V_{OUT}. Position B connects the output of the buffer of the OP777 or the AD8628 to V_{OUT}.
LK2	This link selects the reference source. Position A selects the on-board 2.5 V reference as the reference source. Position B selects J2 as the reference source.
LK3	This link selects which digital-to-analog converter (DAC) connects to the reference source. Position A connects the reference source to the AD5541A. Position B connects the reference source to the AD5542A.
LK4	This link selects which DAC connects to the noninverting input of the OP777 or the AD8628. Position A connects the noninverting input of the buffer to the AD5541A. Position R connects the noninverting input of the buffer to the AD5542A.
LK5	This link selects which connection connects to the output (feedback path) of the OP777 or the AD8628. Position A connects the inverting input of the OP777 or the AD8628 to the output of the OP777 or the AD8628. Position B connects the R_{FB} pin of the AD5542A to the output of the OP777 or the AD8628.
LK6	Connects the INV pin of the AD5542A to the inverting terminal of the OP777 or the AD8628.
LK7	This link determines which DAC is being addressed via the serial interface by switching the $\overline{CS}$ line between both DACs. Position A connects the digital circuitry to the AD5542A. Position B connects the digital circuitry to the AD5541A.
LK8	This link selects the positive voltage supply for the EVAL-AD5541ASDZ and the EVAL-AD5542ASDZ evaluation boards. Position A connects the positive board supply from the ADP121. The ADP121 is powered by the PC USB interface. Position B connects the positive board supply voltage to the J1_+5V power connector for the EVAL-AD5541ASDZ and the EVAL-AD5542ASDZ evaluation boards.
LK9	This link selects the negative voltage supply for the board. Position A connects the negative voltage supply to the J1_−5V power connector (EVAL-AD5542ASDZ evaluation board only). Position B connects the negative voltage supply to GND (EVAL-AD5541ASDZ evaluation board only).

[1] The EVAL-AD5542ASDZ uses the OP777 and the EVAL-AD5541ASDZ uses the AD8628.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD5541ASDZ and the EVAL-AD5542ASDZ evaluation kits include self installing evaluation software on the provided CD, and can also be downloaded from the EVAL-AD5541A or the EVAL-AD5542A product pages. The software is compatible with Windows® XP, Windows Vista (32-bits), and Windows 7 (32-bits).

Install the software before connecting the EVAL-SDP-CB1Z board to the USB port of the PC to ensure the PC recognizes the EVAL-SDP-CB1Z board when it connects to the PC.

1. Start the Windows operating system and insert the CD.
2. The installation software opens automatically. If it does not open automatically, run the **setup.exe** file from the CD.
3. After the installation is complete, power up the evaluation board as described in the Power Supplies section.
4. Plug the EVAL-AD5541A or EVAL-AD5542ASDZ into the EVAL-SDP-CB1Z board and the EVAL-SDP-CB1Z board into the PC using the USB cable included in the evaluation kit.
5. When the software detects the evaluation board, proceed through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the software, do the following:

1. Click **Start** > **All Programs** > **Analog Devices** > **AD5541A_42A** > **AD5541A_42A Evaluation Software**.
2. If the EVAL-SDP-CB1Z board does not connect to the USB port when the software launches, a connectivity error displays (see Figure 2). Connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

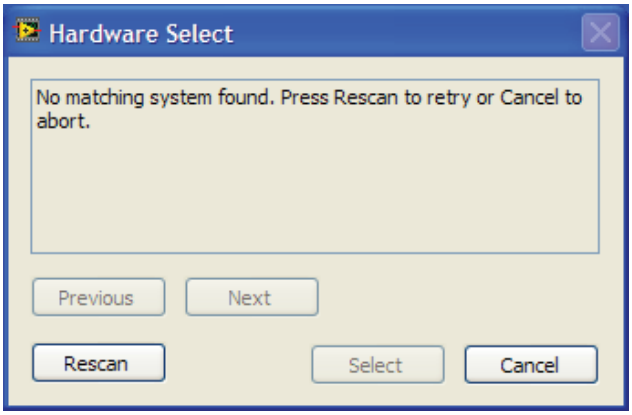

*Figure 2. **Hardware Select** Window*

3. If the EVAL-SDP-CB1Z board does not connect to the PC, the **ERROR CONNECTION** window appears, shown in Figure 3. Check the connection between the EVAL-SDP-CB1Z and EVAL-AD5541A board or EVAL-AD5542ASDZ board and run the program again.

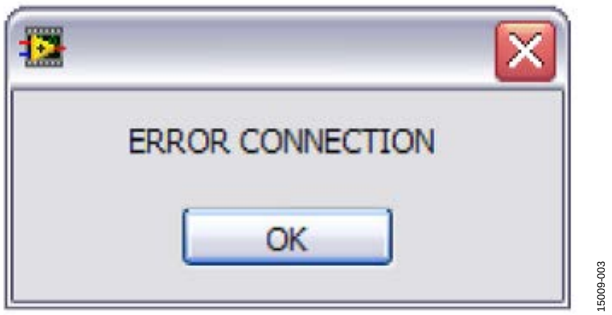

*Figure 3. **ERROR CONNECTION** Window*

4. If the EVAL-SDP-CB1Z board connects, the **System Development Platform Wait** window displays.

*Figure 4. **System Development Platform Wait** Window*

5. The **Select Device** window opens, shown in Figure 5, allowing the user to select the AD5541A or the AD5542A.

*Figure 5. **Select Device** Window*

6. The **AD5542A/41A Evaluation Software** window opens, as shown in Figure 6.

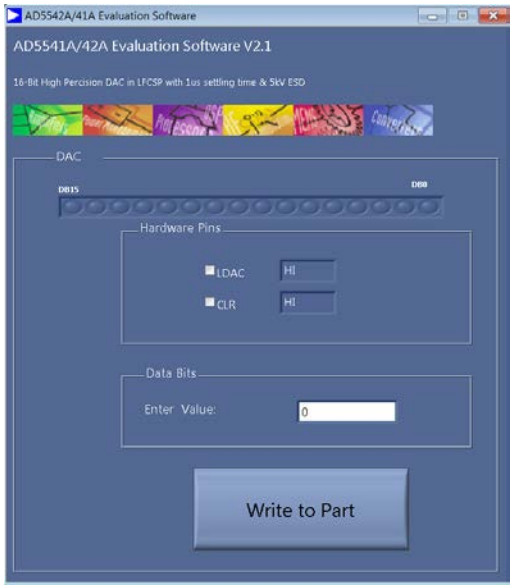

Figure 6. ***AD5541A/42A Evaluation Software V2.1*** *Window*

SOFTWARE OPERATION

The **AD5542A/41A Evaluation Software** main window is shown in Figure 6. The data programmed into the 16-bit input shift register displays.

To write data to the 16-bit input register, type the data in decimal format under **Data Bits**. To execute, click **Write to Part**.

The EVAL-AD5541ASDZ evaluation board and the EVAL-AD5542ASDZ evaluation board lets users set up the $\overline{\text{LDAC}}$ pin to load data from the input register to the DAC output register.

The $\overline{\text{CLR}}$ pin is only available on the EVAL-AD5542ASDZ evaluation board, and when activated, the DAC register is cleared to the model selectable midscale. Consult the AD5541A data sheet and the AD5542A data sheet to see which device has a $\overline{\text{CLR}}$ pin and what its function is for each model.

Set $\overline{\text{LDAC}}$ pin or the $\overline{\text{CLR}}$ pin to high or low by clicking **LDAC** or **CLR**, respectively. This command executes immediately, so there is no need to click **Write to Part**.

For the AD5541A, it is suggested that users connect a voltmeter to LK4 and measure the output voltage at this point.

EVALUATION BOARD SCHEMATICS AND ARTWORK

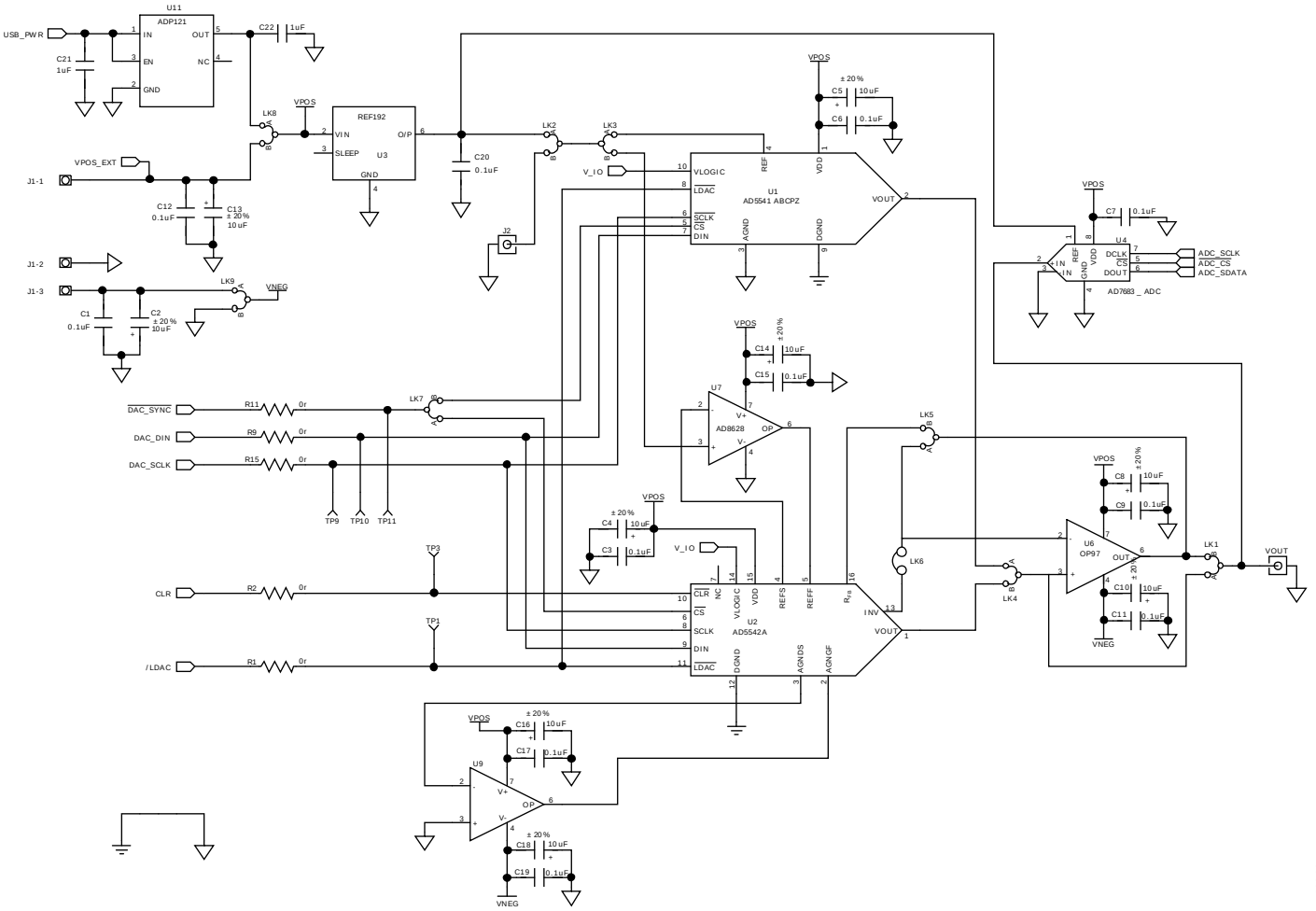

Figure 7. Schematic of Evaluation Circuitry

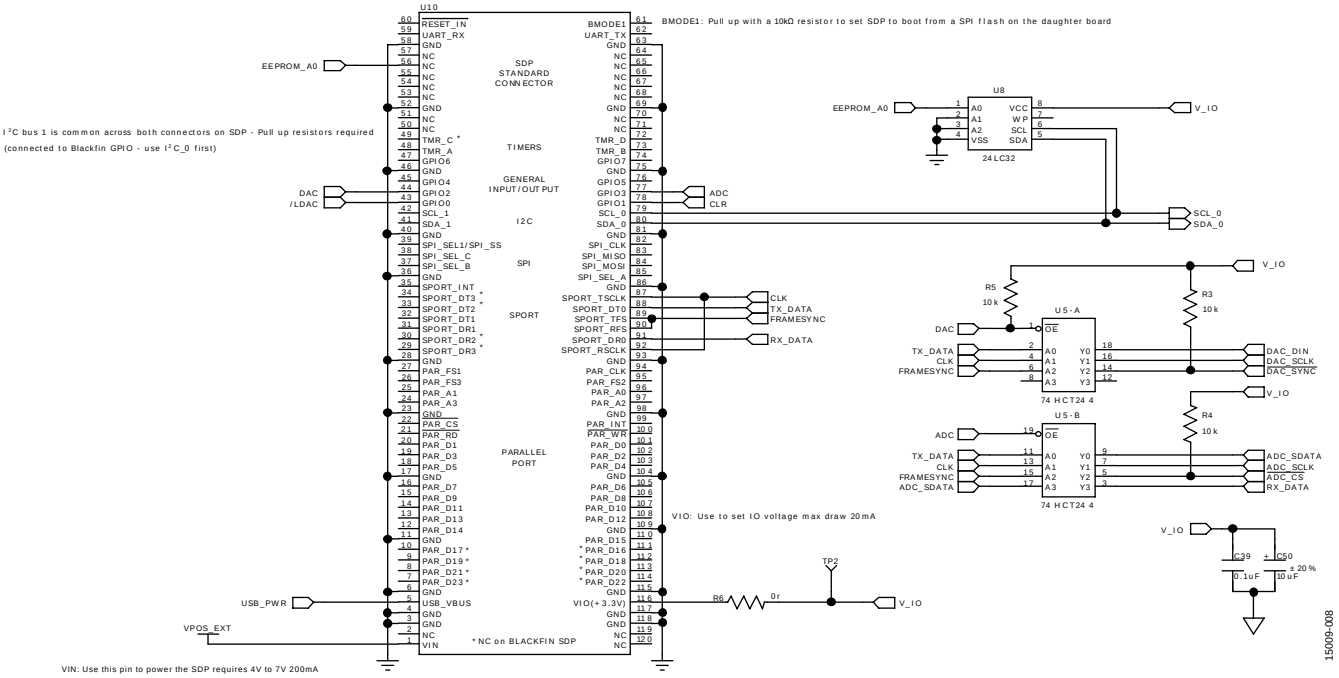

Figure 8. Schematic of SDP Connector

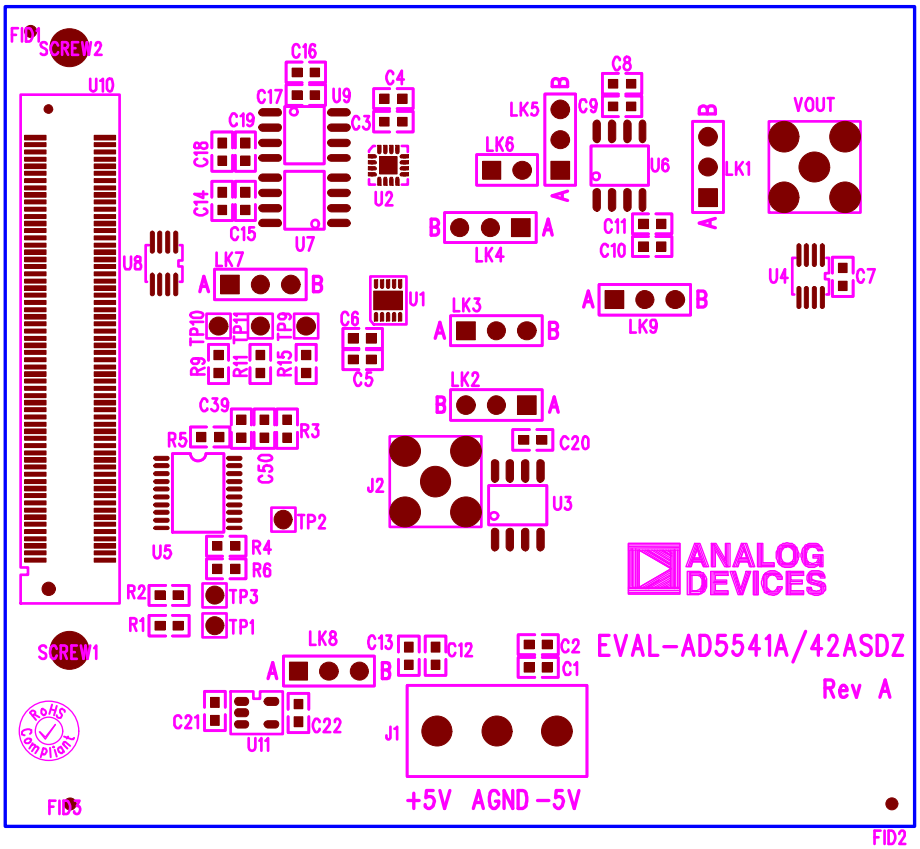

Figure 9. Component Placement Drawing

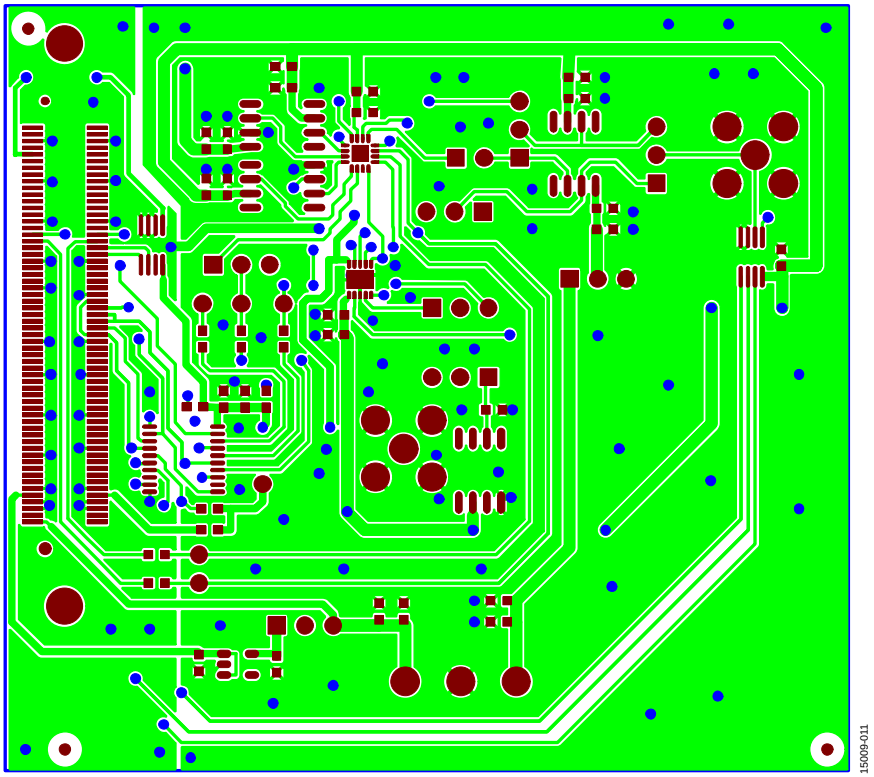

Figure 10. Component Side PCB Drawing

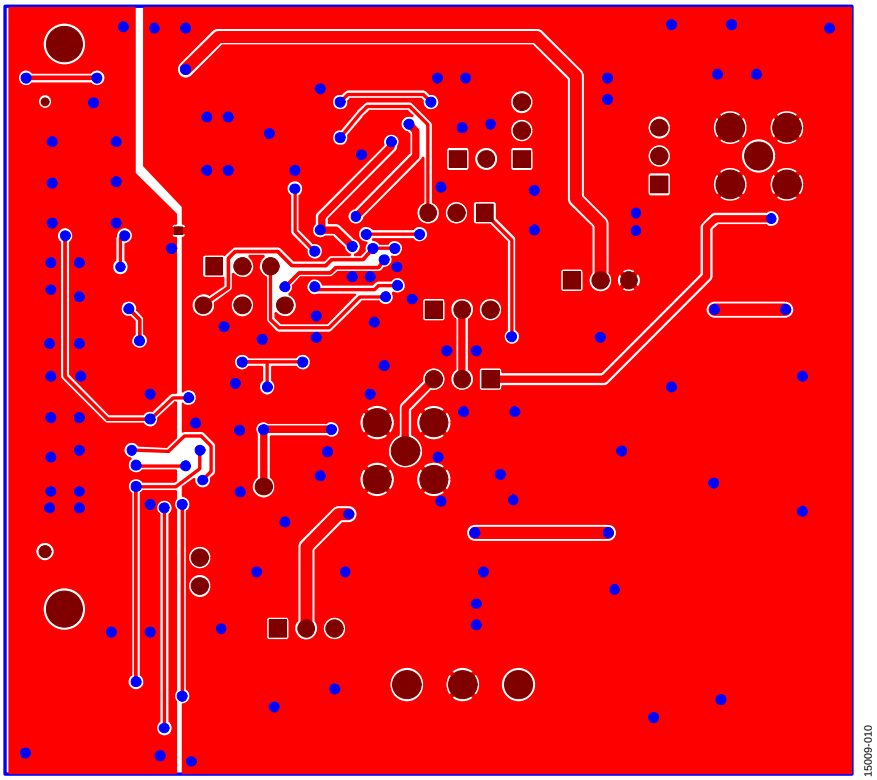

Figure 11. Solder Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. EVAL-AD5541ASDZ Board

Reference Designator	Description	Part Number
U1	Precision 16-bit, 1 µs setting time DAC	AD5541A
U6	Low power, precision CMOS amplifier	AD8628
U11	3.3 V linear regulator	ADP121
LK6	2-pin (0.1" pitch) headers	FEC 1022247
LK1 to LK5, LK7 to LK9	3-pin (0.1" pitch) headers	FEC 1022249
J2, VOUT	50 Ω straight SMB jacks	FEC 1111349
C1, C6, C9, C11, C12, C20, C39	0.1 µF, 16 V, X7R ceramic capacitors	FEC 1216538
U10	120-way connector, 0.6 mm pitch	FEC 1324660
J1	3-pin terminal block, 5 mm pitch	FEC 151-790
C21, C22	1 µF, 16 V, X7R, ceramic capacitors	FEC 1658870
C2, C5, C8, C10, C13, C50	Ceramic capacitors,10 µF, 10 V, X5R, 0603	FEC 1853538
SCREW1, SCREW2	Screws, cheese, nylon, M3X16, PK100	FEC 7070615
TP1 to TP3, TP9 to TP11	Test points	FEC 8731128
R1 to R3, R11, R15	0 Ω resistors	FEC 9331662
R3 to R5	10 kΩ resistors	FEC 933-2413
U5	Octal buffer/line driver three-state outputs	FEC 9591915
U8	32 K I^2C serial EEPROM	FEC1331330
U3	Reference	REF192ESZ

Table 6. EVAL-AD5542ASDZ Board

Reference Designator	Description	Part Number
U2	Precision 16-bit, 1 µs setting time DAC	AD5542A
U7	Low power, precision CMOS amplifier	AD8628
U9	Precision CMOS amplifier	AD8638
U11	3.3 V linear regulator	ADP121
LK6	2-pin (0.1" pitch) header	FEC 1022247
U6	Operational amplifier	OP777
LK1 to LK5, LK7 to LK9	3-pin (0.1" pitch) headers	FEC 1022249
J2, VOUT	50 Ω straight SMB jacks	FEC 1111349
C1, C3, C9, C11, C12, C15, C17, C19, C20, C39	0.1 µF, 16 V, X7R ceramic capacitors	FEC 1216538
U10	120-way connector, 0.6 mm pitch	FEC 1324660
J1	3-pin terminal block, 5 mm pitch	FEC 151-790
C21, C22	1 µF, 16 V, X7R, ceramic capacitors	FEC 1658870
C2, C4, C8, C10, C13, C14, C16, C18, C50	Ceramic capacitors, 10 µF, 10 V, X5R, 0603	FEC 1853538
SCREW1, SCREW2	Screws, cheese, nylon, M3X16, PK100	FEC 7070615
TP1 to TP3, TP9 to TP11	Test points	FEC 8731128
R1, R2, R3, R9, R11, R15	0 Ω resistors	FEC 9331662
R3 to R5	10 kΩ resistors	FEC 933-2413
U5	Octal buffer/line driver three-state outputs	FEC 9591915
U8	32 K I^2C serial EEPROM	FEC1331330
U3	Reference	REF192ESZ

NOTES

I²C refers to a communication protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

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.

UG15009-0-6/17(0)

www.analog.com