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EVAL-AD5310RDBZ User Guide
UG-962

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 AD5310R 10-Bit, Single-Channel, Voltage Output DAC

FEATURES

- Full featured evaluation board in conjunction with *nano*DAC® motherboard (EVAL-MBnanoDAC-SDZ, included in evaluation board package)
- On-board references
- Various link options
- PC control in conjunction with Analog Devices, Inc., system demonstration platform (SDP)

PACKAGE CONTENTS

- EVAL-AD5310RDBZ board
- EVAL-MBnanoDAC-SDZ motherboard

SOFTWARE REQUIRED

- EVAL-AD5310RDBZ evaluation software

HARDWARE REQUIRED

- EVAL-SDP-CB1Z (SDP-B) board or EVAL-SDP-CS1Z (SDP-S) board, must be purchased separately

DOCUMENTS REQUIRED

- Electronic version of the EVAL-AD5310RDBZ user guide
- Electronic version of the AD5310RDBZ data sheet

GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the AD5310R single-channel, voltage output, digital-to-analog converter (DAC).

The EVAL-AD5310RDBZ evaluation board is designed to help users quickly prototype AD5310R circuits and reduce design time. The AD5310R operates from a single 2.7 V to 5.5 V supply.

For full data, see the AD5310R data sheet, which must be used in conjunction with this user guide when using the evaluation board.

The evaluation board interfaces to the USB port of a PC via the SDP board. Software is available for download from the EVAL-AD5310RDBZ evaluation board page to allow the user to program the AD5310R.

This evaluation board requires the EVAL-SDP-CB1Z board (SDP-B controller board) or the EVAL-SDP-CS1Z board (SDP-S controller board), which are available for order on the Analog Devices website.

EVAL-AD5310RDBZ, EVAL-MBnanoDAC-SDZ, AND SDP-B EVALUATION BOARDS PHOTOGRAPH

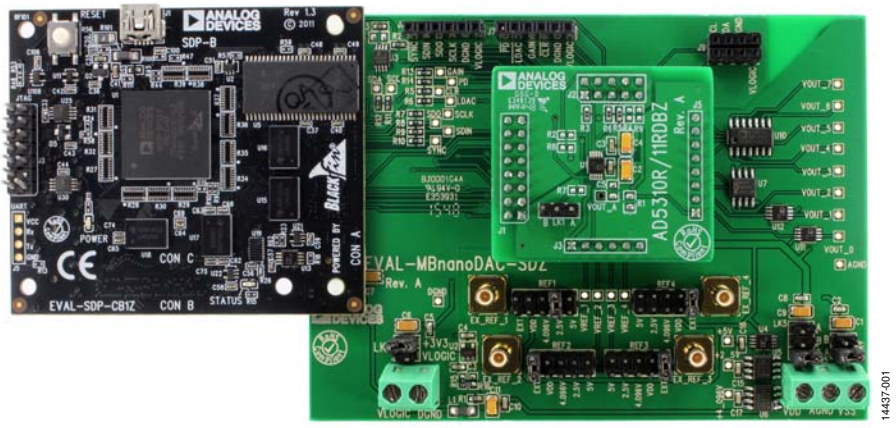

Figure 1.

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REVISION HISTORY

3/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

MOTHERBOARD POWER SUPPLIES

The EVAL-MBnanoDAC-SDZ motherboard supports single and dual power supplies.

The EVAL-AD5310RDBZ evaluation board can be powered from the SDP port or externally by the J5 and J6 connectors, as described in Table 1.

Both AGND and DGND inputs are provided on the board. The AGND and DGND planes connect at one location on the EVAL-MBnanoDAC-SDZ. The AGND and DGND inputs must not be connected elsewhere in the system, because this causes ground loop problems.

All supplies are decoupled to ground with 10 µF tantalum and 0.1 µF ceramic capacitors.

Table 1. Power Supply Connectors

Connector No.	Label	Voltage
J5, Pin 1 (J5-1)	VDD	Analog positive power supply, V_{DD} single and dual supply, 5.5 V.
J5, Pin 2 (J5-2)	AGND	Analog ground.
J5, Pin 3 (J5-3)	VSS	Analog negative power supply, V_{SS} dual supply, −5.5 V.
J6, Pin 1 (J6-1)	VLOGIC	Digital supply from 1.8 V to V_{DD} of the daughter board DAC.
J6, Pin 2 (J6-2)	DGND	Digital ground.

MOTHERBOARD LINK OPTIONS

A number of link options are incorporated in the EVAL-MBnanoDAC-SDZ and must be set to the required operating conditions before using the board. Table 2 describes the positions of the links to control the evaluation board via the SDP-B board using a PC and external power supplies. The functions of these link options are described in detail in Table 3. The positions listed in Table 2 and Table 3 match the evaluation board imprints (see Figure 11).

Table 2. Default Link Options Setup for SDP-B Control

Link No.	Position
REF1	2.5V
REF2	EXT
REF3	EXT
REF4	EXT
LK5	C
LK6	3.3V
LK7	B

EVAL-AD5310RDBZ DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5310RDBZ daughter board shares the same printed circuit board (PCB) layout with the EVAL-AD5311RDBZ. To configure the board for AD5310R evaluation, LK1 must be removed to ensure that the SCLK pin is not directly connected to V_{DD}.

Table 3. Motherboard Link Functions

Link No.	Function
REF1 to REF4	These links select the reference source. Position EXT selects an off-board voltage reference via the appropriate EXT_REF_x connector. Position VDD selects V_{DD} as the reference source. Position 4.096V selects the on-board 4.096 V reference as the reference source. Position 2.5V selects the on-board 2.5 V reference as the reference source. Position 5V selects the on-board 5 V reference as the reference source.
LK5	This link selects the positive DAC analog voltage source. Position A selects the internal voltage source from the SDP-B or SDP-S board. Position B selects the internal voltage source 3.3 V from the ADP121 on the motherboard. Position C selects an external supply voltage, V_{DD}.
LK6	This link selects the VLOGIC voltage source. Position 3.3V selects the digital voltage source from the SDP-B or SDP-S board, 3.3 V. Position VLOGIC selects an external digital supply voltage, V_{LOGIC}.
LK7	This link selects the negative DAC analog voltage source. Position A selects V_{SS}. Position B selects AGND.

EVALUATION BOARD SOFTWARE

SOFTWARE INSTALLATION

The EVAL-AD5310RDBZ evaluation software is compatible with Windows® Vista (64-bit/32-bit), and Windows 7 (64-bit/32-bit).

The software must be installed before connecting the SDP-B or SDP-S board to the USB port of the PC to ensure that the SDP-B or SDP-S board is recognized when it connects to the PC.

To install the software, take the following steps:

1. Start the Windows operating system. Download the installation software from the EVAL-AD5310RDBZ evaluation board page.
2. Run the setup.exe file from the installer folder if it does not open automatically.
3. After installation is completed, power up the evaluation board as described in the Motherboard Power Supplies section.
4. Connect the evaluation board to the SDP-B or SDP-S board and plug the SDP-B or SDP-S 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.

LAUNCHING THE SOFTWARE

To launch the software, take the following steps:

1. Connect the evaluation board to the SDP-B or SDP-S board and connect the USB cable between the SDP-B or SDP-S board and the PC.
2. Power up the evaluation board as described in the Motherboard Power Supplies section.
3. From the **Start** menu, click **All Programs, Analog Devices, AD5310R Evaluation Software**.
4. If the SDP-B or SDP-S board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 2). Connect the evaluation board to the USB port of the PC and wait a few seconds. When the SDP-B or SDP-S board is detected, the display is updated (see Figure 3).

Alternatively, the software can be used without an evaluation board. The software runs in simulation mode displaying expected outputs based on the input data. The main window of the AD5310R evaluation software then opens, as shown in Figure 4.

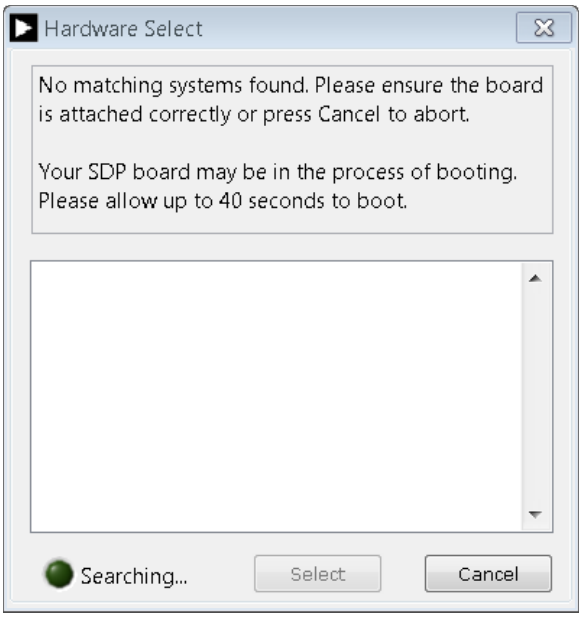

Figure 2. Connectivity Error

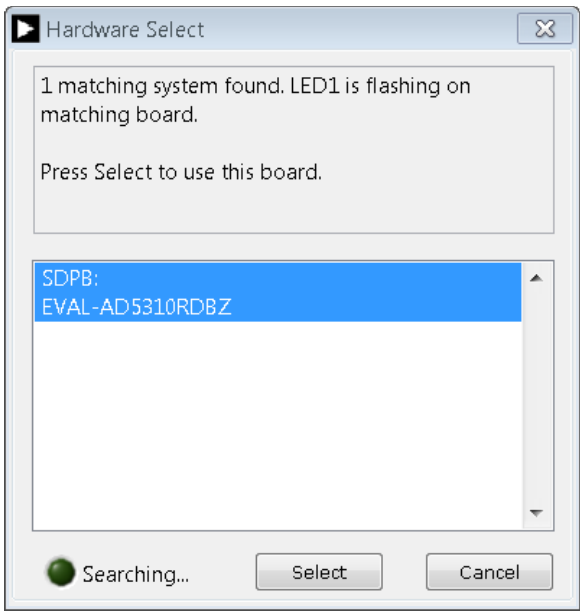

*Figure 3. **Hardware Select** window*

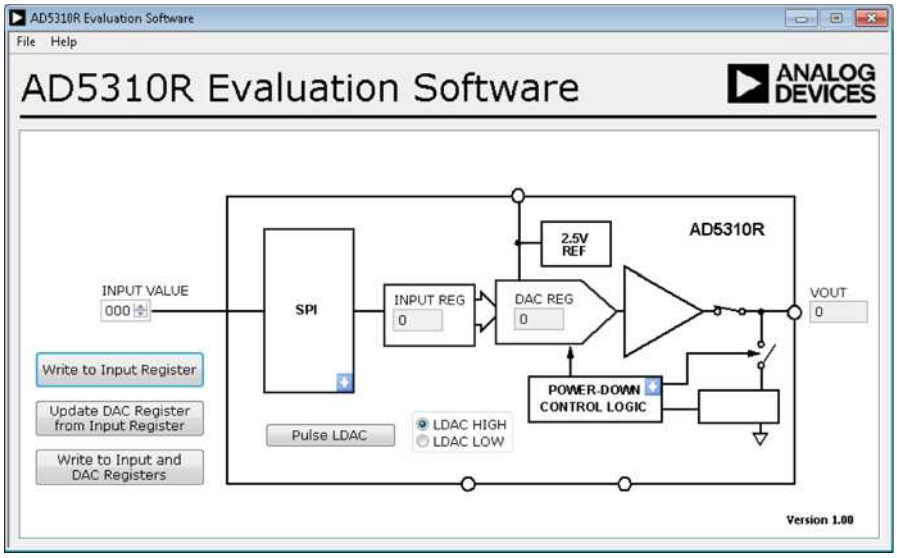

*Figure 4. **AD5310R Evaluation Software** Main Window*

SOFTWARE OPERATION

The software for the AD5310R allows the user to program values to the input and DAC registers of each DAC individually or collectively.

Write to Input Register

Click **Write to Input Register** to load the code of the input data control to the input register of the DAC.

Update DAC Register from Input Register

Click **Update DAC Register from Input Register** to copy the value in the input register to the DAC register. The DAC output automatically updates with the appropriate voltage.

Write to Input and DAC Registers

Click **Write to Input and DAC Registers** to load the code of the input data control to the input register and DAC register of the DAC. The DAC output automatically updates with the appropriate voltage.

LDAC Control

Click **Pulse LDAC** to bring the LDAC pin low and then back high. Doing this copies the data from the input register to the DAC register, and the output updates accordingly.

The LDAC pin can also be set high or low by clicking **LDAC HIGH** or **LDAC LOW**.

Power-Down Control

The DAC has a selection box allowing the device to operate in normal mode or three different power-down modes, as shown in Figure 5. Click the blue expand button on the **POWER-DOWN CONTROL LOGIC** block to access the selection box (see Figure 4). When the power-down setting for the DAC is selected, click **OK** to write the appropriate values to the AD5310R.

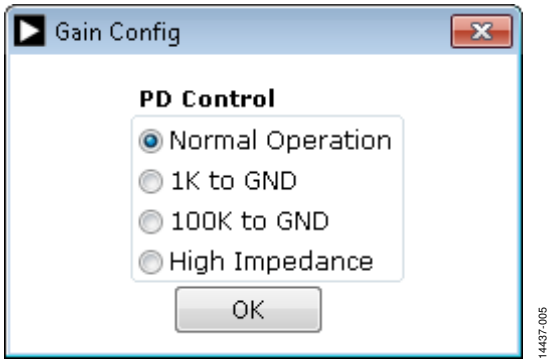

*Figure 5. **PD Control** Selection Box in the **Gain Config** Window*

GAIN Control

The GAIN pin can also be set high or low by clicking the blue expand button on the **SPI** block (see Figure 4). In the **GAIN** selection box of the **Gain Config** window, select **X1** for a full-scale output of 2.5 V or select **X2** for a full-scale output of 5 V, as shown in Figure 6.

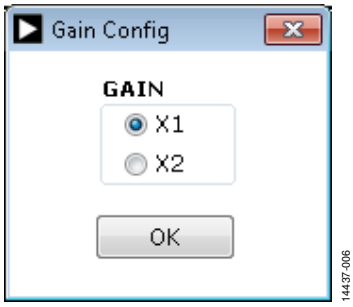

*Figure 6. **GAIN** Selection Box in the **Gain Config** Window*

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

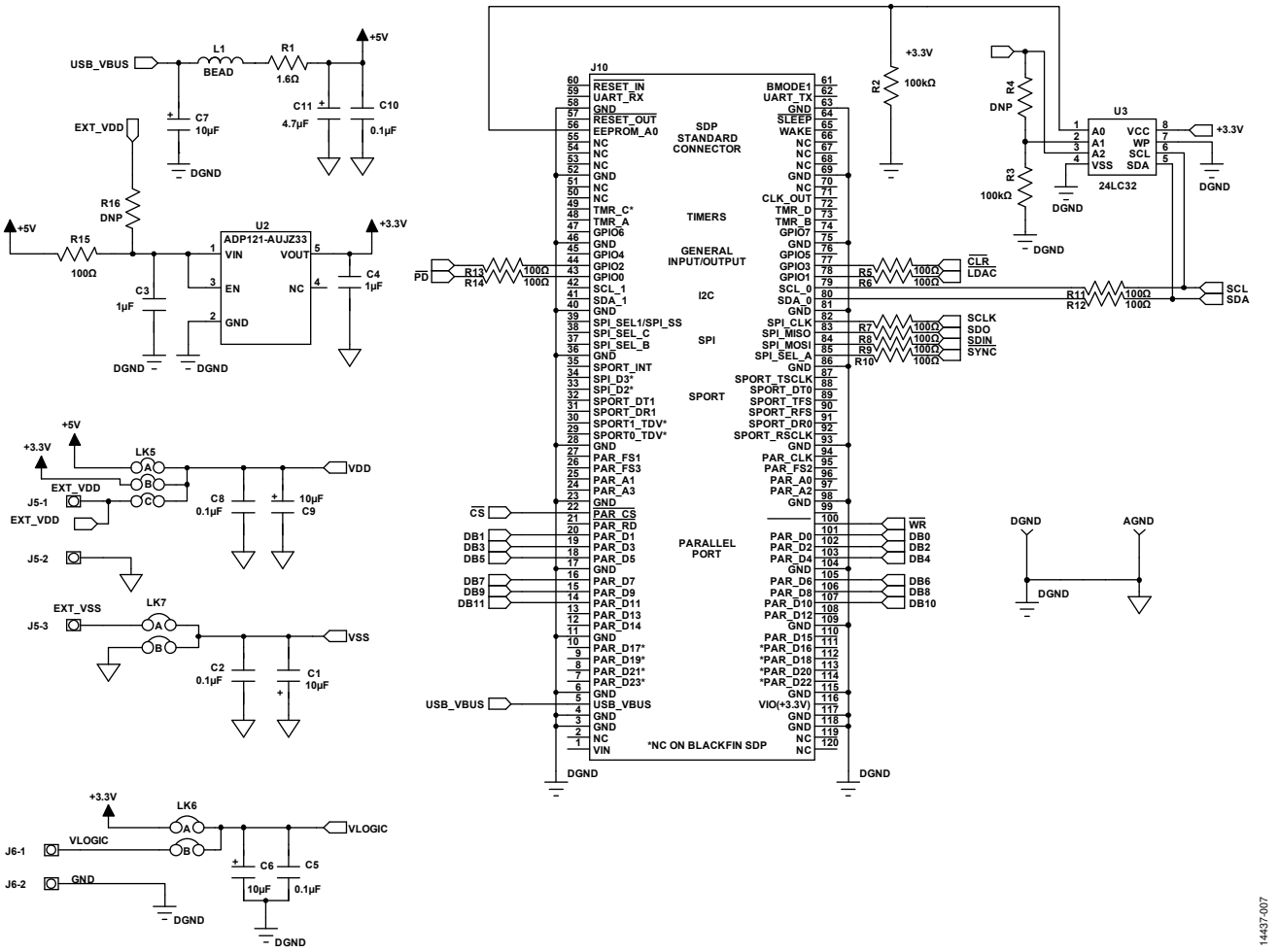

Figure 7. EVAL-MBnanoDAC-SDZ Motherboard, SDP-B Connector, and Power Supply

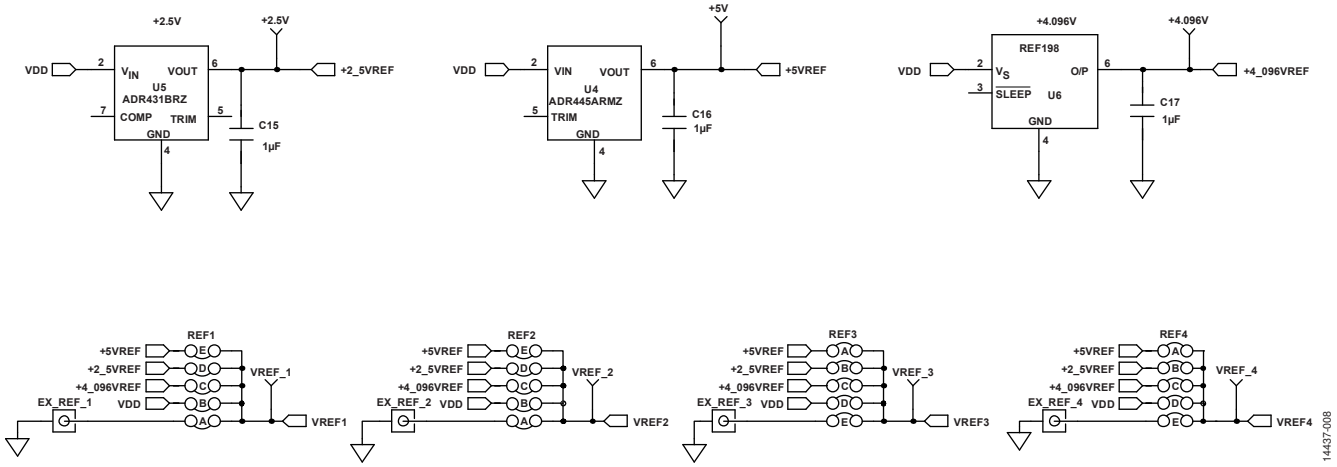

Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

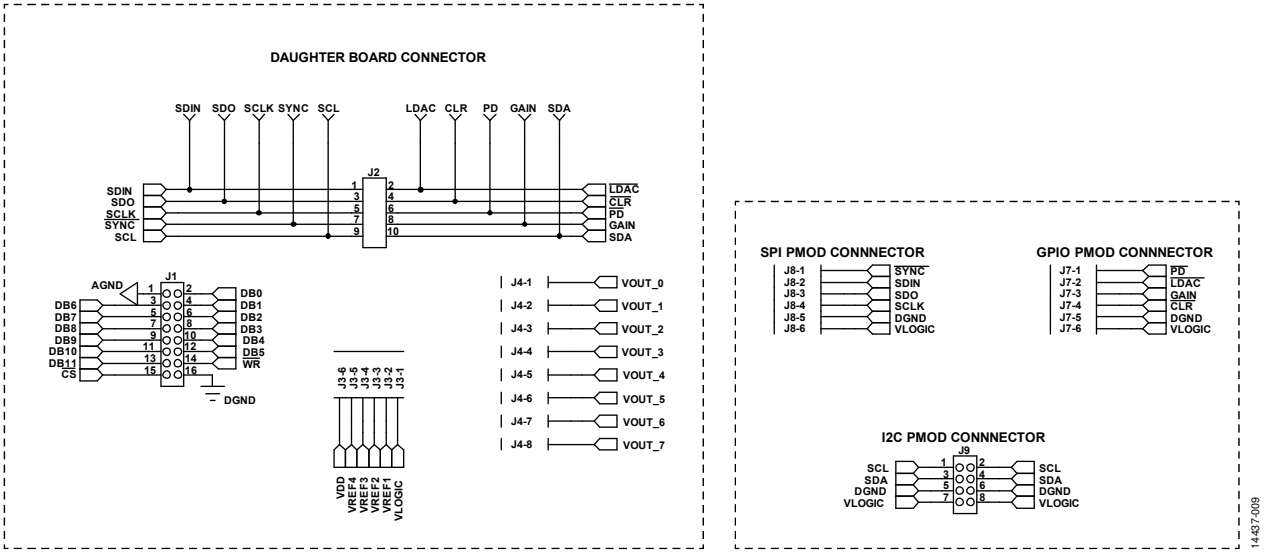

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

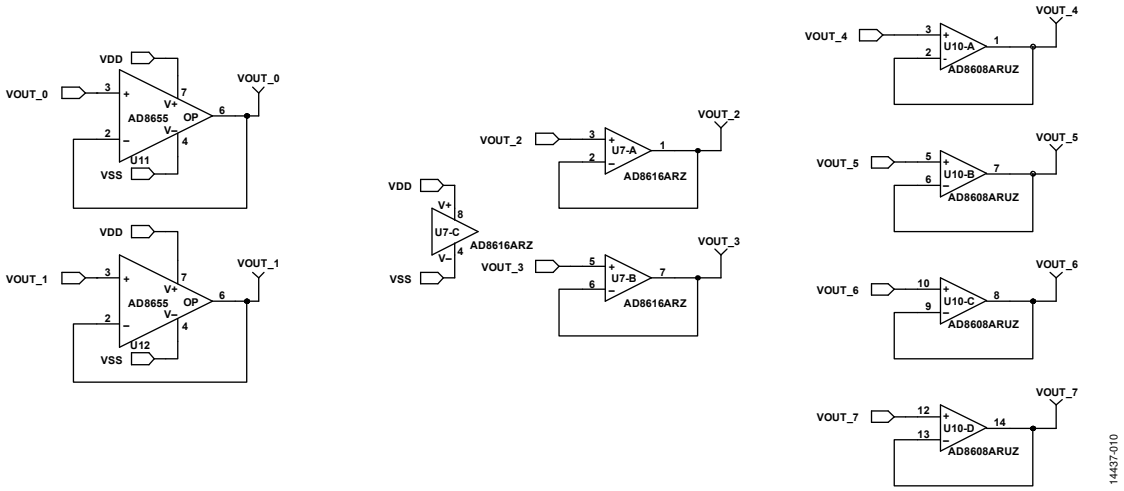

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

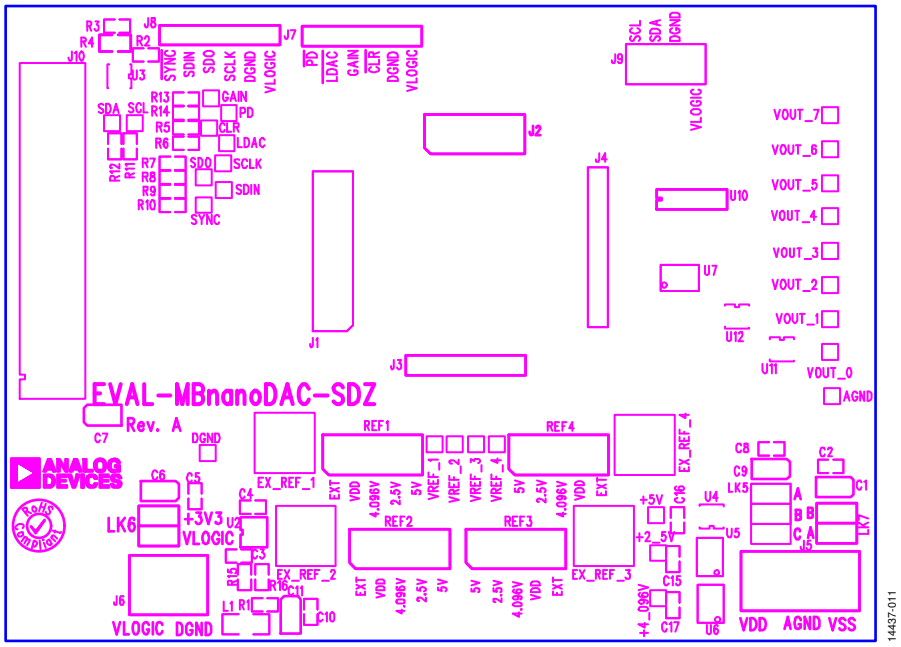

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

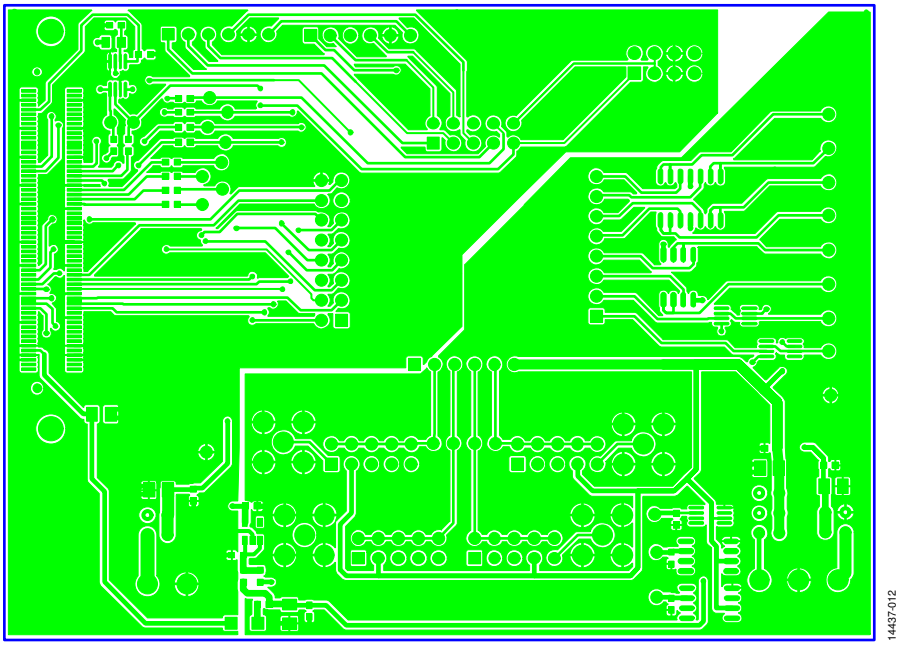

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

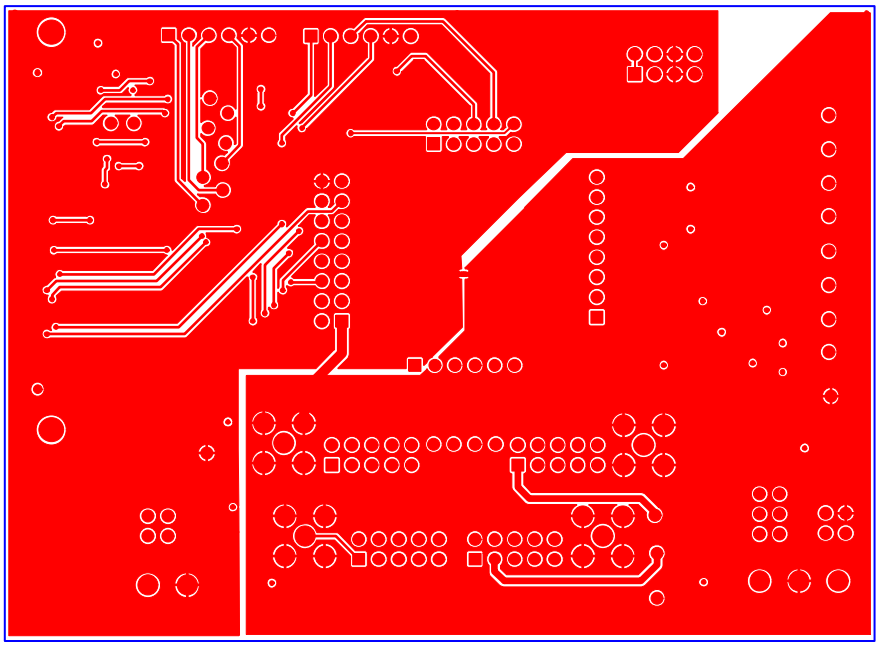

Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

EVAL-AD5310RDBZ DAUGHTER BOARD

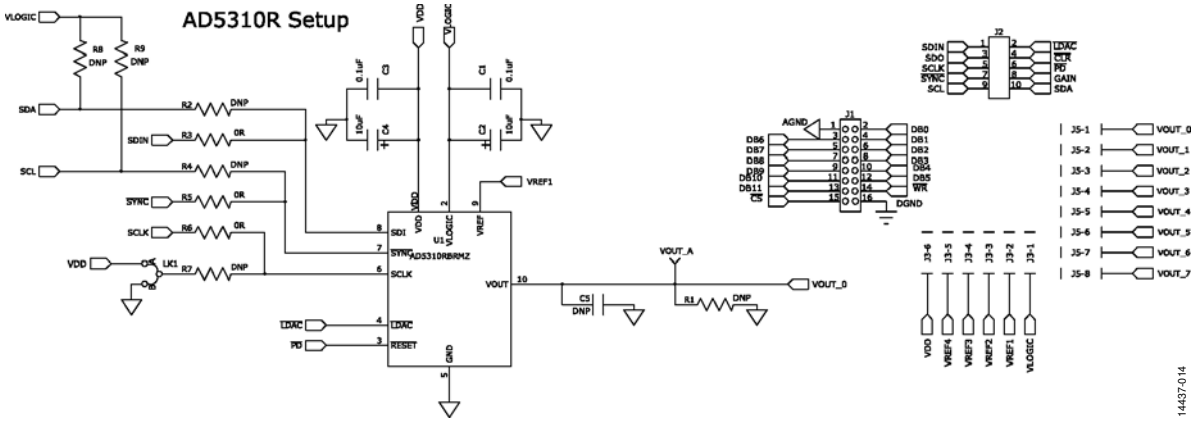

Figure 14. EVAL-AD5310RDBZ Daughter Board Schematics

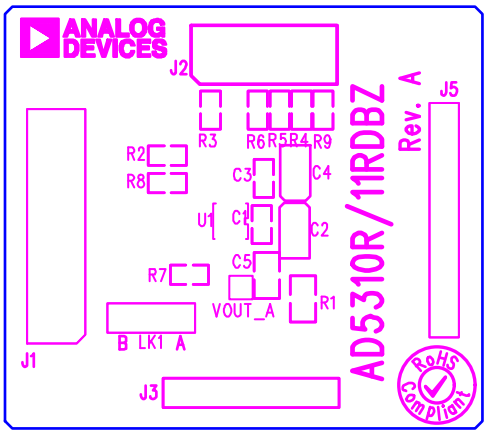

Figure 15. EVAL-AD5310RDBZ Daughter Board Component Placement

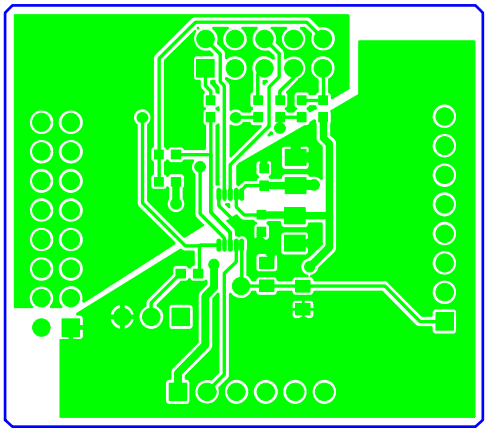

Figure 16. EVAL-AD5310RDBZ Daughter Board Top Side Routing

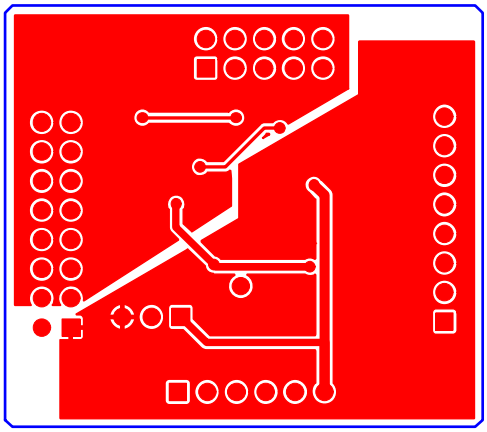

Figure 17. EVAL-AD5310RDBZ Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 4. EVAL-MBnanoDAC-SDZ Motherboard

Qty	Reference Designator	Description	Supplier/Part Number[1, 2]
4	C1, C6, C7, C9	6.3 V, tantalum capacitor (Case A), 10 µF, ±20%	FEC/1190107
7	C2, C5, C8, C10, C15, C16, C17	50 V, X7R, ceramic capacitor, 0.1 µF, ±10%	FEC/1759122
2	C3, C4	10 V, X5R, ceramic capacitor, 1 µF, ±10%	GRM188R61A105KA61D
1	C11	6.3 V, tantalum capacitor (Case A), 4.7 µF, ±20%	FEC/1432350
4	EXT_REF_1 to EXT_REF_4	Straight PCB mount SMB jack, 50 Ω	FEC/1206013
1	J1	Header, 2.54 mm, 2 × 8-way	FEC/2308428
1	J2	Header, 2.54 mm, 2 × 5-way	FEC/9689583
3	J3, J7, J8	Header, 2.54 mm, 1 × 6-way	FEC/9689508
1	J4	Header, 2.54 mm, 1 × 8-way	FEC/1766172
1	J5	3-pin terminal block	FEC/1667472
1	J6	2-pin terminal block	FEC/151789
1	J9	Header, 2.54 mm, 2 × 4-way	FEC/1667509
1	J10	120-way connector	FEC/1324660
1	L1	Inductor, SMD, 600 Ω	FEC/9526862
1	LK5	6-pin (3 × 2) 0.1", header and shorting block	FEC/148-535 and 150-411 (36-pin strip)
2	LK6, LK7	4-pin (2 × 2) 0.1", header and shorting block	FEC/148-535 and 150-411 (36-pin strip)
4	REF1 to REF4	10-pin (5 × 2) 0.1", header and shorting block	FEC/1022227 and 150-411
1	R1	Resistor, surge, 1.6 Ω, 1%, 0603	FEC/1627674
2	R2, R3	SMD resistor, 100 kΩ, 1%, 0603	FEC/9330402
11	R5 to R15	SMD resistor, 100 Ω, 1%, 0603	FEC/9330364
1	U2	3.3 V linear regulator	Analog Devices/ADP121-AUJZ33R7
1	U3	32 kb I²C serial EEPROM	FEC/1331330
1	U4	5 V, reference MSOP	Analog Devices/ADR445ARMZ
1	U5	Ultralow noise XFET voltage reference	Analog Devices/ADR431BRZ
1	U6	4.096 V reference	Analog Devices/REF198ESZ
1	U7	Dual op amp	Analog Devices/AD8616ARZ
1	U10	Quad op amp	Analog Devices/AD8608ARMZ
2	U11, U12	Op amp	Analog Devices/AD8655ARMZ

[1] FEC refers to Farnell Electronic Component Distributors.
[2] GRM refers to Murata Manufacturing Company.

Table 5. EVAL-AD5310RDBZ Daughter Board

Qty	Reference Designator	Description	Supplier/Part Number[1]
2	C1, C3	50 V, X7R, ceramic capacitor, 0.1 µF, ±10%	C0603C104K5RAC-TU
2	C2, C4	6.3 V, tantalum capacitor (Case A), 10 µF, ±20%	MCCTA106M006
1	C5	Not applicable	Not applicable
1	J1	16-pin (2 × 8) header	BCS-108-L-D-TE
1	J2	10-pin (2 × 5) straight header, 2.54 mm pitch	1241050-5
1	J3	6-pin (1 × 6) straight header, 2.54 mm pitch	1241150-6
1	J5	Header, 2.54 mm, PCB, 1 × 8-way	BBS-108-T-A
1	LK1	Jumper block using 3-pin SIP header	M20-9990345 and M7567-05
1	R1	Not applicable	Not applicable
3	R2, R4, R7	Resistor, 0603, 1%, 0 Ω	FEC/9331662
3	R3, R5, R6	Resistor, 0603, 1%, 0 Ω	Do not insert
2	R8, R9	SMD resistor, 0603, 1%, 2.2 kΩ	Do not insert
1	U1	10-bit DAC	Analog Devices/AD5310RBRMZ
1	VOUT_A	Red test point	20-313137

[1] FEC refers to Farnell Electronic Component Distributors.

NOTES

I²C refers to a communications 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.

ANALOG DEVICES

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