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Evaluating the AD5311R 10-Bit, Single-Channel Voltage Output Digital-to-Analog Converter (DAC)

FEATURES

- Full featured evaluation board (EVAL-AD5311RDBZ) in conjunction with the *nano*DAC motherboard (EVAL-MBnanoDAC-SDZ)
- On-board references
- Various link options
- PC control in conjunction with Analog Devices, Inc., system demonstration platform (SDP)

PACKAGE CONTENTS

- EVAL-AD5311RDBZ evaluation board
- EVAL-MBnanoDAC-SDZ motherboard
- USB cable

SOFTWARE REQUIRED

- EVAL-AD5311RDBZ evaluation software

HARDWARE REQUIRED

- EVAL-SDP-CB1Z controller board (SDP-B controller board), must be purchased separately

GENERAL DESCRIPTION

This user guide details the operation of the EVAL-AD5311RDBZ evaluation board for the AD5311R.

The EVAL-AD5311RDBZ evaluation board is designed to quickly prototype AD5311R circuits and reduce design time. The evaluation board interfaces with the USB port of a PC via the SDP-B controller board. The AD5311R operates from a single 2.7 V to 5.5 V supply. Software can be downloaded via the EVAL-AD5311RDBZ product page that allows users to program the AD5311R.

This evaluation board requires the SDP-B controller board, which is available for order on the Analog Devices, Inc. website.

Full data on the AD5311R can be found in the AD5311R data sheet available from Analog Devices and should be consulted in conjunction with this user guide when using the evaluation board.

PHOTOGRAPH OF THE EVAL-AD5311RDBZ, EVAL-MBnanoDAC-SDZ, AND EVAL-SDP-CB1Z BOARDS

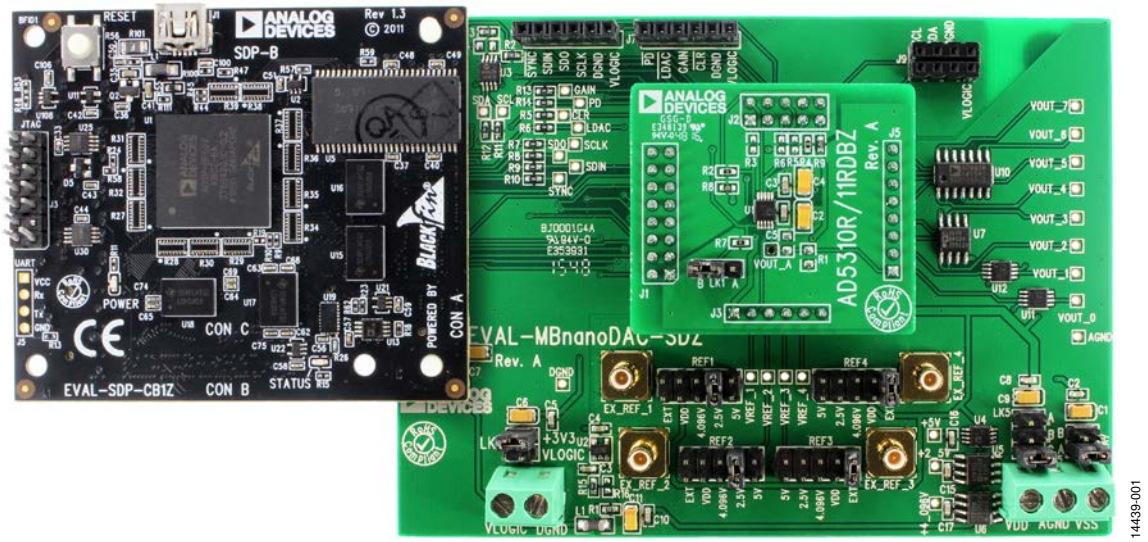

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

3/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The *nano*DAC® EVAL-MBnanoDAC-SDZ motherboard supports single and dual power supplies.

The EVAL-AD5311RDBZ evaluation board can be powered either 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 EVAL-AD5311RDBZ evaluation board. The AGND and DGND planes connect at one location on the EVAL-MBnanoDAC-SDZ. It is recommended that AGND and DGND do not connect elsewhere in the system to avoid ground loop problems.

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

Table 1. Power Supply Connectors

Connector	Label	Voltage
J5, Pin 1 (J5-1)	VDD	Analog positive power supply, V_{DD}; 5.5 V single and dual supply
J5, Pin 2 (J5-2)	AGND	Analog ground
J5, Pin 3 (J5-3)	VSS	Analog negative power supply, V_{SS}; −5.5 V dual supply
J6, Pin 1 (J5-1)	VLOGIC	Digital supply from 1.8 V to V_{DD}
J6, Pin 2 (J5-2)	DGND	Digital ground

Link Options

A number of link options are incorporated in the EVAL-MBnanoDAC-SDZ and must be set for the required operating conditions before using the EVAL-AD5311RDBZ. Table 2 describes the positions of the links to control the evaluation board via the SDP-B controller board using a PC and external power supplies. The functions of these link options are described in detail in Table 4. The positions listed in Table 2 to Table 4 match the evaluation board imprints shown in Figure 11.

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

Link Number	Position
REF1	2.5V
REF2	EXT
REF3	EXT
REF4	EXT
LK5	C
LK6	+3V3
LK7	B

EVAL-AD5311RDBZ DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5311RDBZ daughter board has a link option. This link sets the LSB of the I^2C address of the DAC. Table 3 describes the function of this link. For proper device operation, set position of LK1 to B.

Table 3. Link Options for Daughter Board

Link	Label	Position
LK1	A0	B (low, default) A (high)

Table 4. Link Functions

Link Number	Position
REF1 to REF4	These links select the reference source. Position EXT selects an off board voltage reference via the appropriate EXT_REF 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 controller board. Position B selects the internal voltage source +3.3 V from the ADP121. Position C selects an external supply voltage, V_{DD}.
LK6	This link selects the VLOGIC voltage source. Position +3V3 selects the digital voltage source from the SDP-B controller board (+3V3). 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 SOFTWARE

INSTALLING THE EVAL-AD5311RDBZ EVALUATION SOFTWARE

The EVAL-AD5311RDBZ evaluation software is compatible with Windows® Vista (64-bit/32-bit), and Windows 7 (64-bit/32-bit).

Install the software before connecting the SDP-B board to the USB port of the PC to ensure that the SDP-B controller board is recognized when it connects to the PC.

To install the EVAL-AD5311RDBZ evaluation software, take the following steps:

1. Start the Windows operating system.
2. Download the installation software from the EVAL-AD5311RDBZ evaluation board page.
3. Run the **setup.exe** file from the installer folder if it does not open automatically.
4. After installation is completed, power up the evaluation board as described in the Power Supplies section.
5. Connect the EVAL-AD5311RDBZ to the SDP-B board and the SDP-B to the PC using the USB cable included in the evaluation kit.
6. When the software detects the EVAL-AD5311RDBZ, proceed through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the EVAL-AD5311RDBZ evaluation software, take the following steps:

1. Connect the EVAL-AD5311RDBZ evaluation software to the SDP-B controller board and connect the USB cable between the SDP-B controller board and the PC.
2. Power up the evaluation board as described in the Power Supplies section.
3. Click **Start** > **All Programs** > **Analog Devices** > **AD5311RDBZ evaluation software** to locate the evaluation board.

If the SDP-B controller board is not connected to the USB port when the software launches, a connectivity error displays (see Figure 2).

Connect the SDP-B controller board to the USB port of the PC and wait a few seconds. When the SDP-B controller board and the EVAL-AD5311RDBZ are detected, the display updates (see Figure 3).

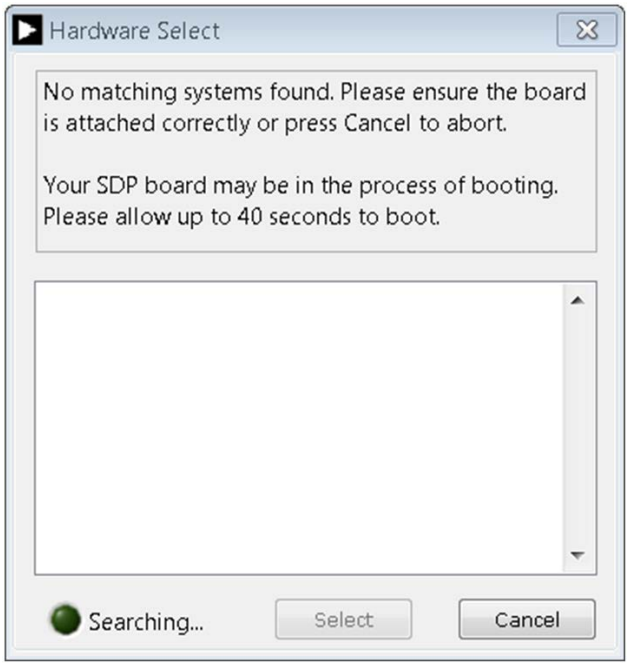

Figure 2. Connectivity Error

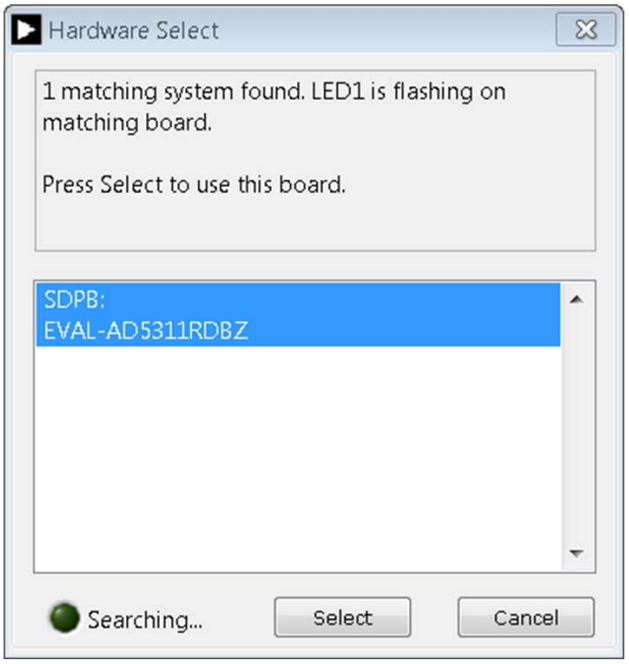

Figure 3. Hardware Select

Alternatively, the EVAL-AD5311RDBZ evaluation software can be used without an evaluation board. The EVAL-AD5311RDBZevaluation software runs in simulation mode displaying expected outputs based on the input data. The main window of the EVAL-AD5311RDBZ evaluation software then opens, as shown in Figure 4.

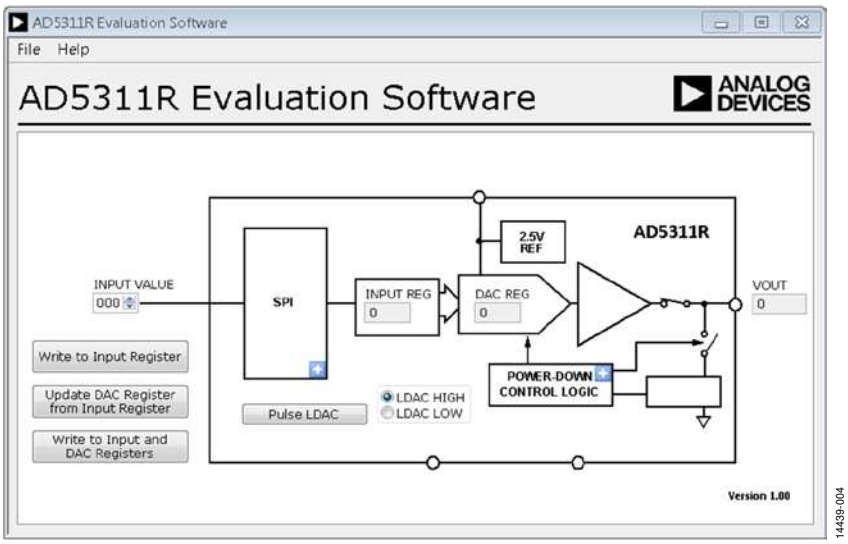

*Figure 4. **AD5311R Evaluation Board Software** Main Window*

SOFTWARE OPERATION

The EVAL-AD5311RDBZ evaluation software allows the user to program values to the input and DAC registers of each DAC individually or collectively.

Write to Input Register

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

Update DAC Register from Input Register

Click the **Update DAC Register from Input Register** button to copy the value in the input register to the DAC register. DAC output is automatically updated with the appropriated voltage.

Write to Input and DAC Registers

Click the **Write to Input and DAC Registers** button to load the code of the input data control to the input register and DAC register of the DAC. The DAC output is automatically updated with the appropriated voltage.

LDAC Control

Click the **Pulse LDAC** button to bring the $\overline{\text{LDAC}}$ pin low and then high, copying the data from the input registers to the DAC registers and updating the outputs accordingly.

The $\overline{\text{LDAC}}$ pin can also be set high or low by clicking **LDAC HIGH** or **LDAC LOW**, respectively.

Power-Down Control

All DACs can be powered down simultaneously. Click the blue progressive disclosure button on the **POWER-DOWN CONTROL LOGIC** block to access the **Gain Config** window, as shown in Figure 5. When the power-down setting for the DAC is selected, click **OK** to write the appropriate values to the AD5311R.

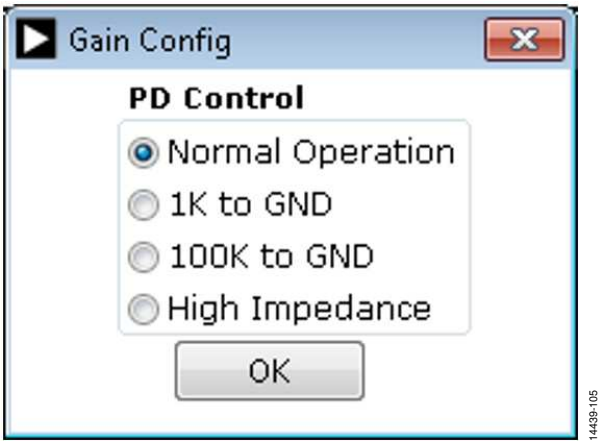

*Figure 5. **Gain Config** Window*

GAIN Control

Set the GAIN pin high or low by clicking the blue progressive disclosure button in the **SPI** block and by selecting the GAIN setting as shown in Figure 6. Select **GAIN X1** to give a full-scale output of 2.5 V, or select **GAIN X2** to give a full-scale output of 5 V.

Figure 6. Gain Control Window

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

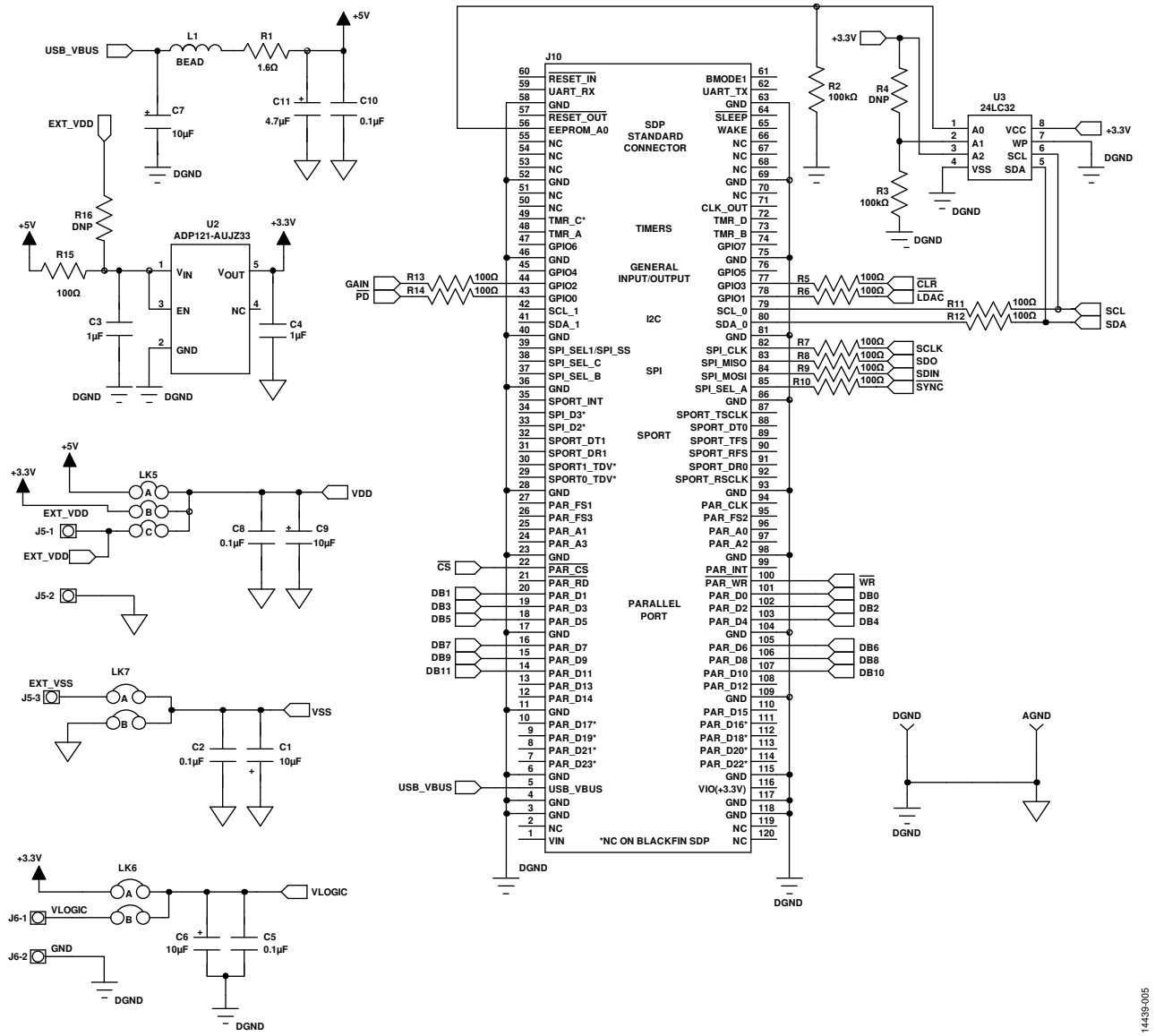

Figure 7. EVAL-MBnanoDAC-SDZ Motherboard, SDP-B Controller Board Connector, and Power Supply

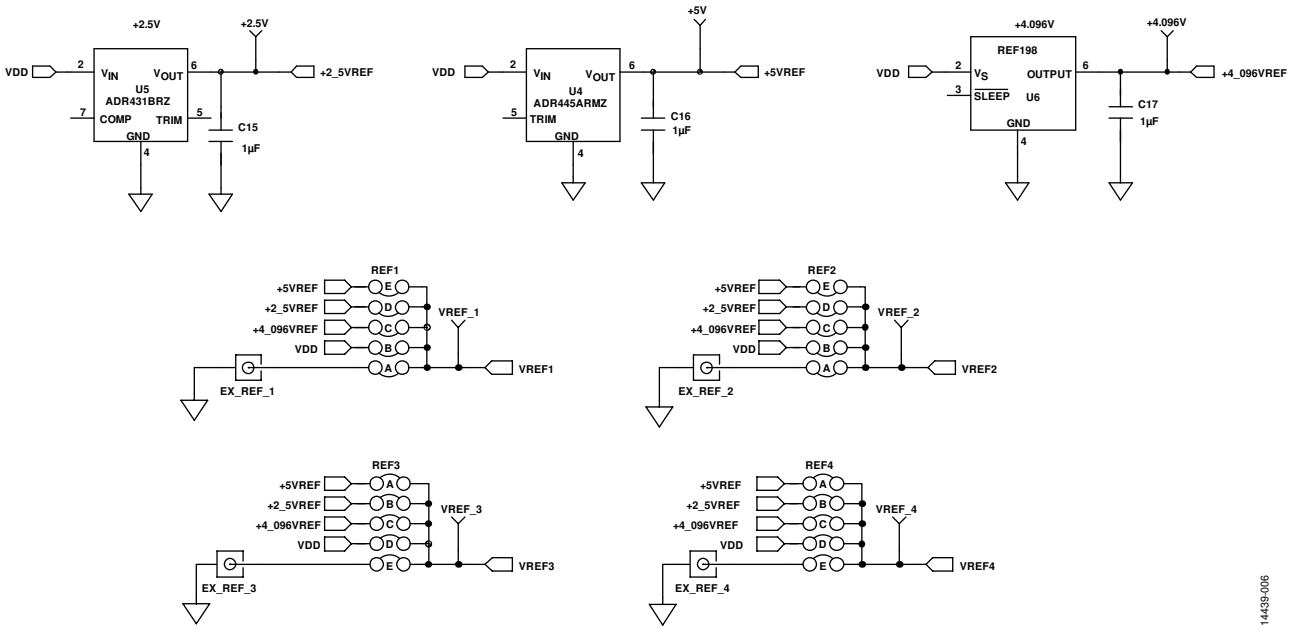

Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

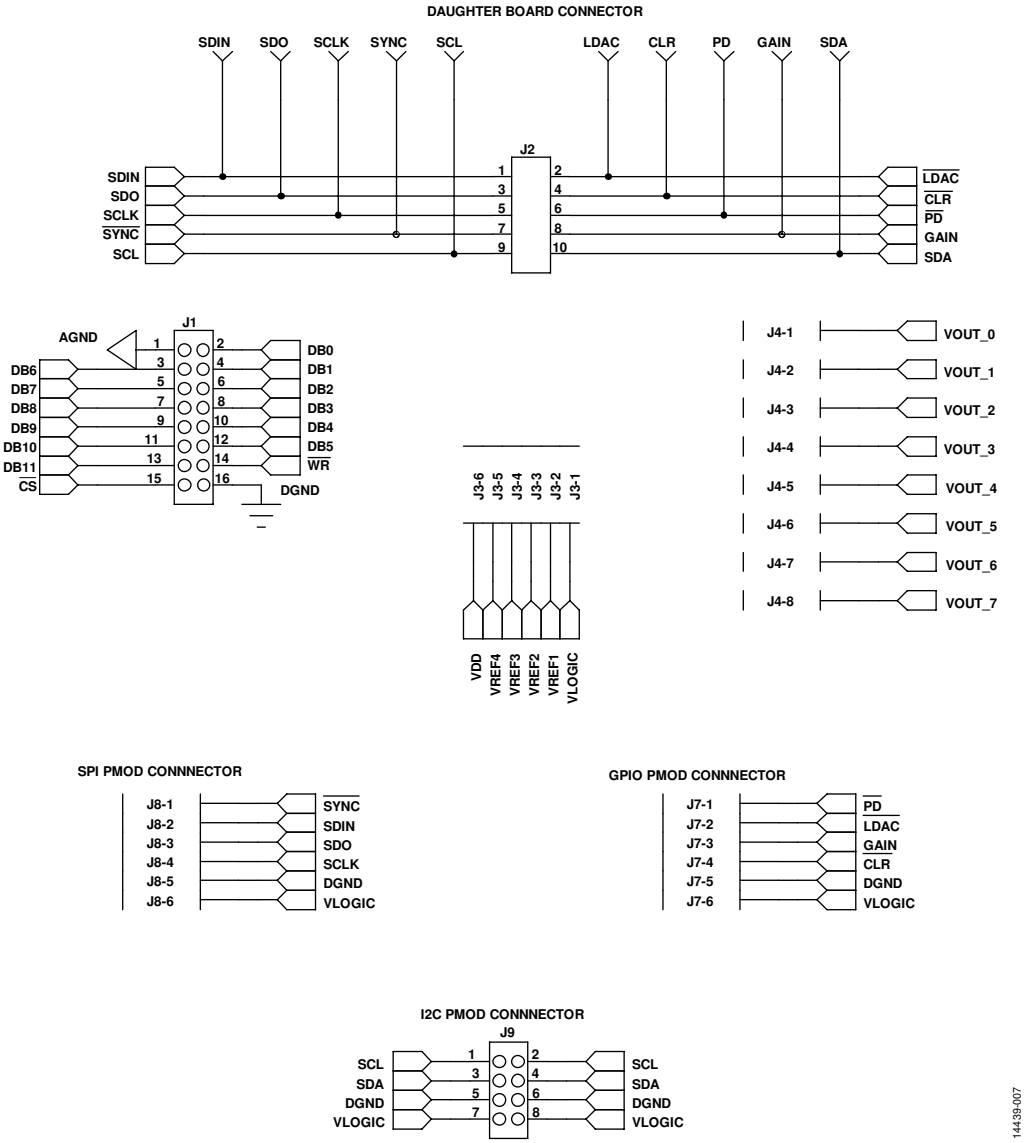

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Connectors to EVAL-AD5311RDBZ Daughter Board Serial Interface

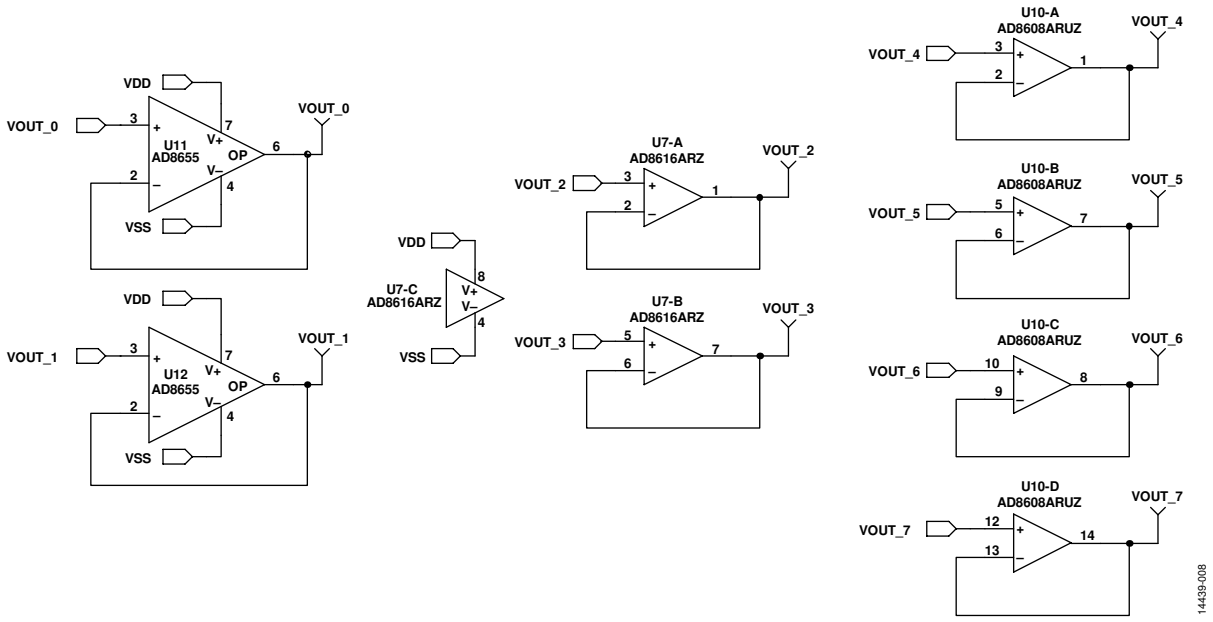

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

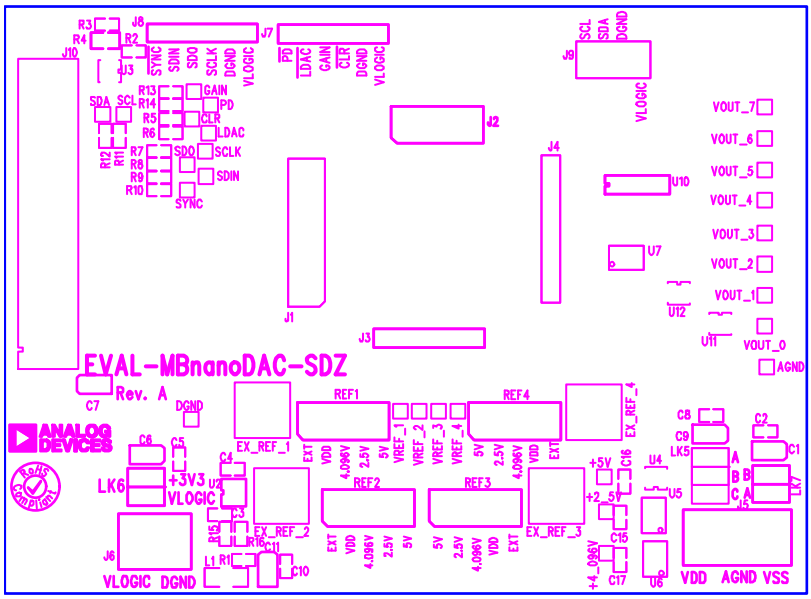

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

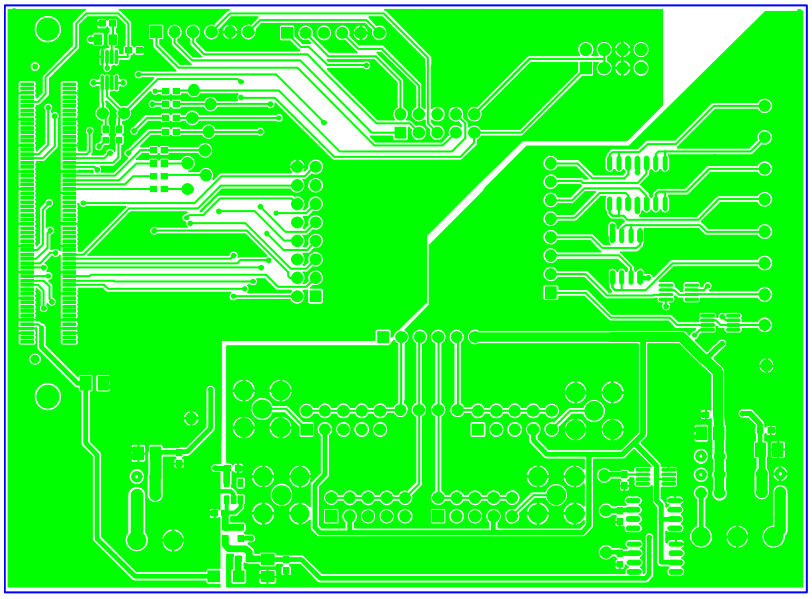

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

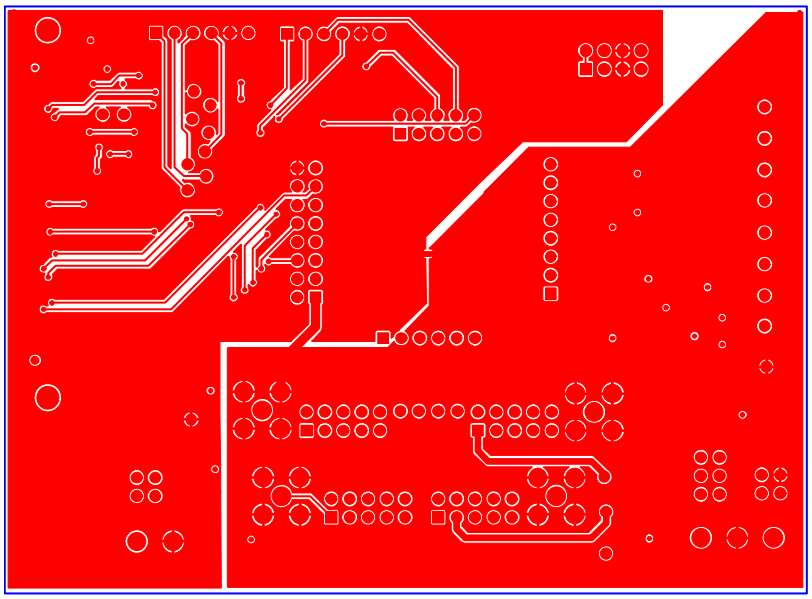

Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

EVAL-AD5311RDBZ DAUGHTER BOARD

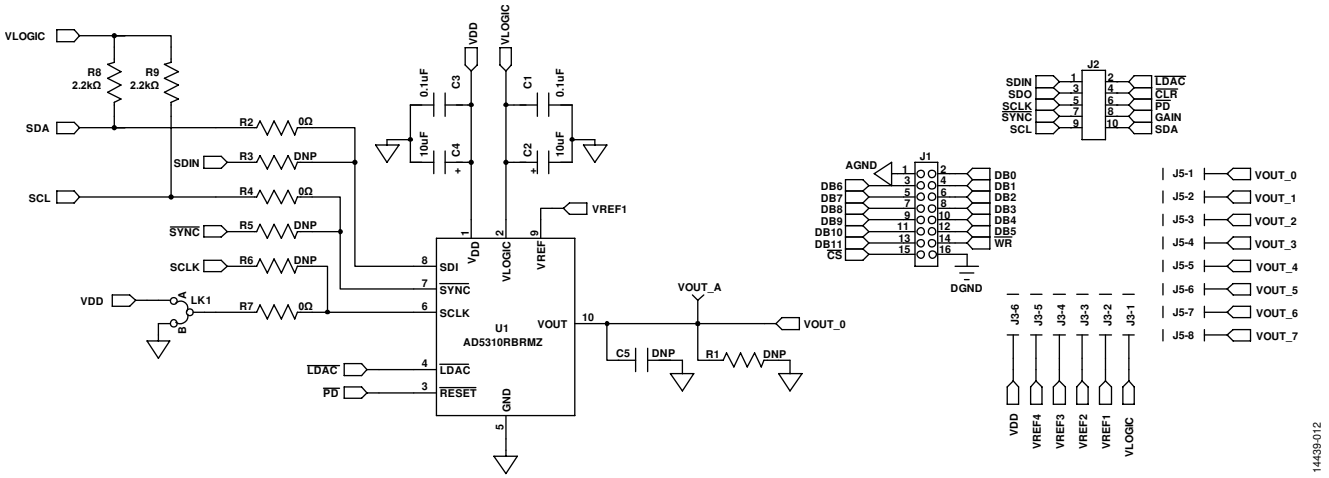

Figure 14. EVAL-AD5311RDBZ Daughter Board Schematic

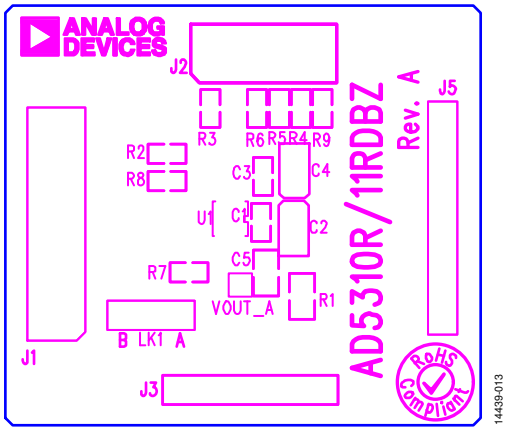

Figure 15. EVAL-AD5311RDBZ Daughter Board Component Placement

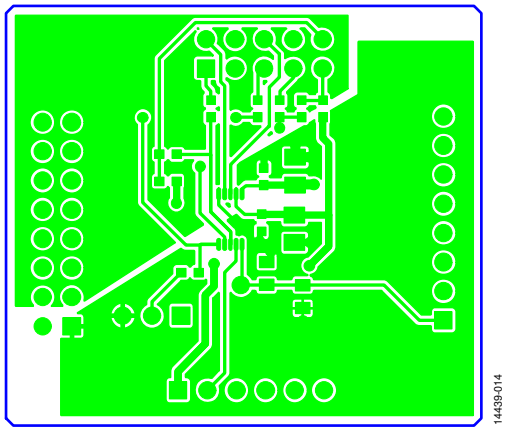

Figure 16. EVAL-AD5311RDBZ Daughter Board Top Side Routing

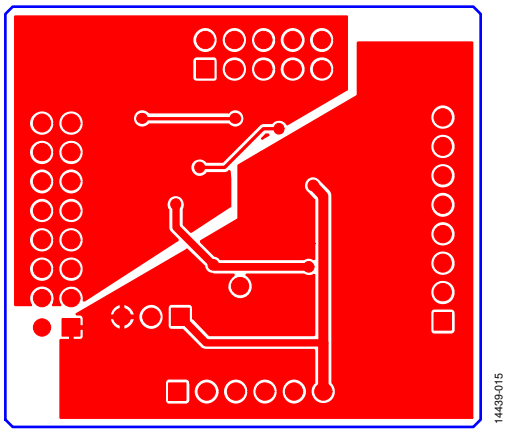

Figure 17. EVAL-AD5311RDBZ Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. EVAL-MBnanoDAC-SDZ Motherboard

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

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

Table 6. EVAL-AD5311RDBZ Daughter Board

Reference Designator	Description	Supplier[1]/Part Number
C1, C3	50 V, X7R, ceramic capacitors, 0.1 µF, ±10%	FEC 1759122
C2, C4	6.3 V tantalum capacitors (Case A)), 10 µF, ±20%	FEC 1190107
C5	Do not insert	Do not insert
J1	16-pin (2 × 8) header	FEC 2308428 inserted from solder side
J2	10-pin (2 × 5) straight header, 2.54 mm pitch	FEC 9689583
J3	6-pin (1 × 6) straight header, 2.54 mm pitch	FEC 9689508
J5	Header, 2.54 mm, PCB, 1× 8-way	FEC 1766172 inserted from solder side
LK1	Jumper block using 3-pin SIP header	FEC 1022248 and FEC 150410
R1	Do not insert	Do not insert
R2, R7, R4	Resistors, 0603, 1%, 0 Ω	FEC 9331662
R3, R5, R6	Resistors	Do not insert
R8 and R9	SMD Resistors	FEC 9330402
U1	10-bit DAC	AD5311RBRMZ
VOUT_A	Red test point	Do not insert

[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.

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