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Evaluating the AD5323 12-Bit, Dual-Channel Voltage Output Digital-to-Analog Converter (DAC)

FEATURES

Full featured evaluation board (EVAL-AD5323DBZ) in conjunction with *nano*DAC motherboard (EVAL-MBnanoDAC-SDZ)
On-board references
Various link options
PC control in conjunction with the Analog Devices, Inc., system demonstration platform (SDP)

EVALUATION KIT CONTENTS

EVAL-AD5323DBZ evaluation board
EVAL-MBnanoDAC-SDZ motherboard
USB cable

SOFTWARE REQUIRED

EVAL-AD5323DBZ

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-AD5323DBZ evaluation board for the AD5323. The AD5323 is a dual-channel, voltage output digital-to-analog converter (DAC).

The EVAL-AD5323DBZ evaluation board helps users quickly prototype new AD5323 circuits and reduce design time. The AD5323 operates from a single 2.5 V to 5.5 V supply.

The EVAL-AD5323DBZ interfaces with the USB port of a PC via the SDP-B controller board. Software is supplied with the evaluation board to allow the user to program the AD5323.

The EVAL-AD5323DBZ evaluation board requires the SDP-B controller board, which is available for order on the Analog Devices, Inc., website at www.analog.com.

Full specifications for the AD5323 are listed in the AD5323 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-AD5323DBZ, EVAL-MBnanoDAC-SDZ, AND SDP-B

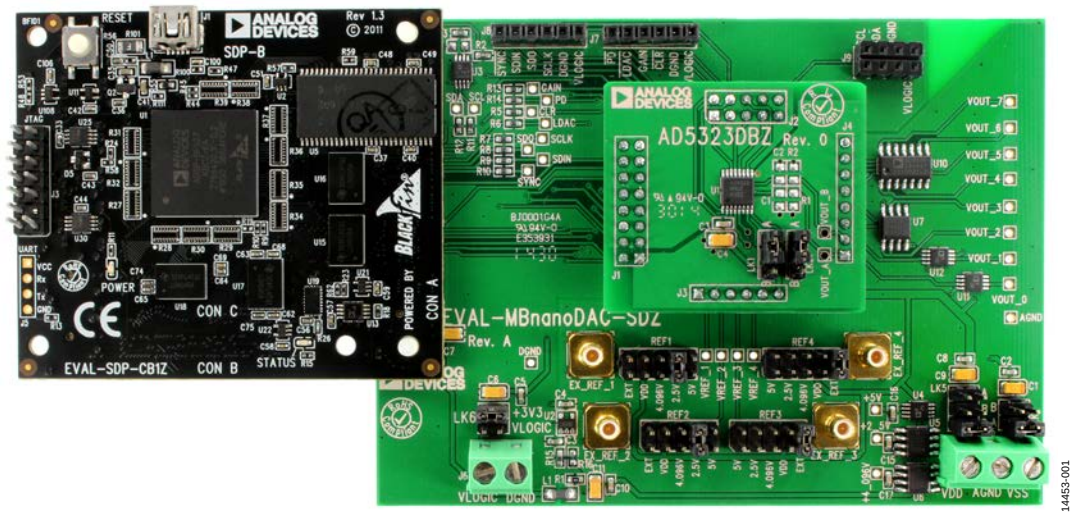

Figure 1.

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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.

Power the EVAL-AD5323DBZ evaluation board from either the SDP-B port or externally by the J5 and J6 connectors, as described in Table 1.

Both the AGND and DGND inputs are provided on the EVAL-AD5323DBZ evaluation board. The AGND and DGND planes are connected 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 a 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
J5, Pin 1 (J6-1)	VLOGIC	Digital supply from 1.8 V to V_{DD}
J6, Pin 2 (J6-2)	DGND	Digital ground

Link Options

A number of link options are incorporated in the EVAL-MBnanoDAC-SDZ that must be set to the required operating conditions before using the evaluation board. Table 2 describes the positions of the links that control the evaluation board via the EVAL-SDP-CB1Z controller board using a PC and external power supplies. The positions listed in Table 2 to Table 4 match the evaluation board imprints (see Figure 11).

Table 2. Link Position Setup for the SDP-B Controller Board (Default)

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

DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5323DBZ daughter board has two link options. The links control the setting of the output voltage control. The functions of these link options are described in detail in Table 3. Table 4 shows how these links are configured.

Table 3. Link Position for the EVAL-AD5323DBZ Daughter Board

Link Number	Pin	Position
LK1	BUF A	A (unbuffered, default) B (buffered)
LK2	BUF B	A (unbuffered, default) B (buffered)

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 BOARD SOFTWARE QUICK START PROCEDURES

INSTALLING THE EVAL-AD5323DBZ EVALUATION SOFTWARE

The EVAL-AD5323DBZ 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 controller board to the USB port of the PC to ensure the PC recognizes the SDP board when it connects to the PC.

To install the software, take the following steps:

1. Start the Windows operating system.
2. Download the installation software from the EVAL-AD5323DBZ evaluation board page.
3. Run the **setup.exe** file from the installer folder if it does not open automatically.
4. After the installation is complete, power up the evaluation board as described in the Power Supplies section.
5. Connect the EVAL-AD5323DBZ to the SDP-B controller board and the SDP-B controller board to the PC using the USB cable included in the evaluation kit.
6. When the software detects the EVAL-AD5323DBZ, proceed through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the EVAL-AD5323DBZ evaluation software, proceed with the following steps:

1. Connect the EVAL-AD5323DBZ to the SDP-B controller board and connect the USB cable between the SDP-B controller board and the PC.
2. Power up the EVAL-AD5323DBZ as described in the Power Supplies section.
3. Click **Start** > **All Programs** > **Analog Devices** > **AD5323 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. Once the SDP-B controller board and the EVAL-AD5323DBZ daughter board are detected, the display updates (see Figure 3).

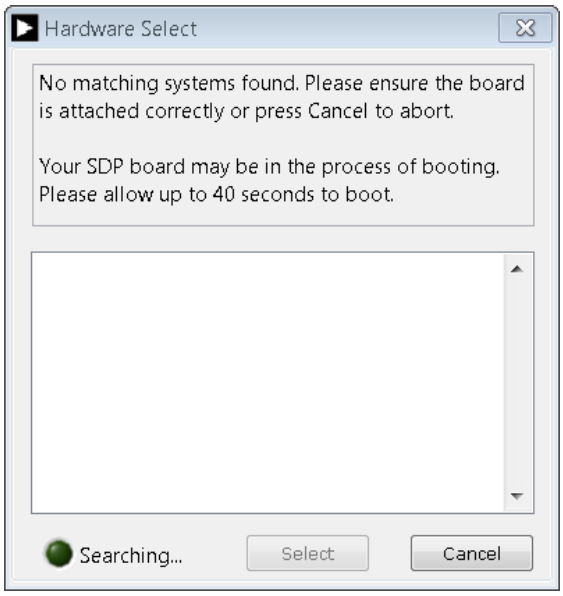

Figure 2. Connectivity Error

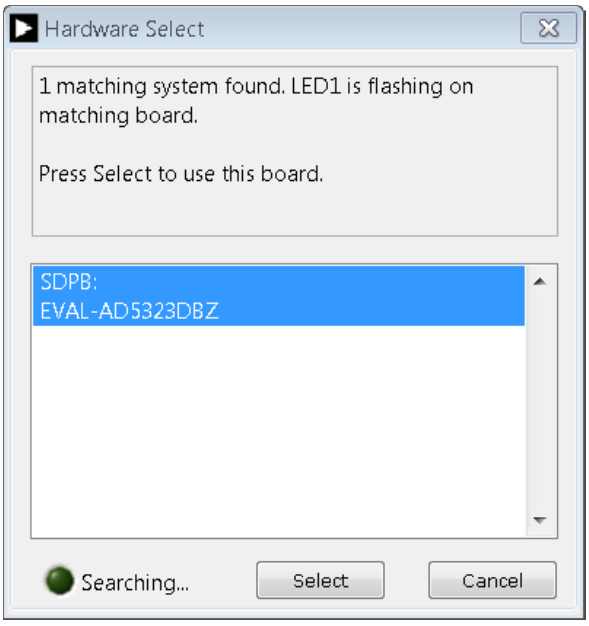

*Figure 3. **Hardware Select** Window*

Alternatively, the EVAL-AD5323DBZ evaluation software can be used without an evaluation board. The EVAL-AD5323DBZ evaluation software runs in simulation mode displaying expected outputs based on the input data. The main window of the EVAL-AD5323DBZ evaluation software then opens, as shown in Figure 4.

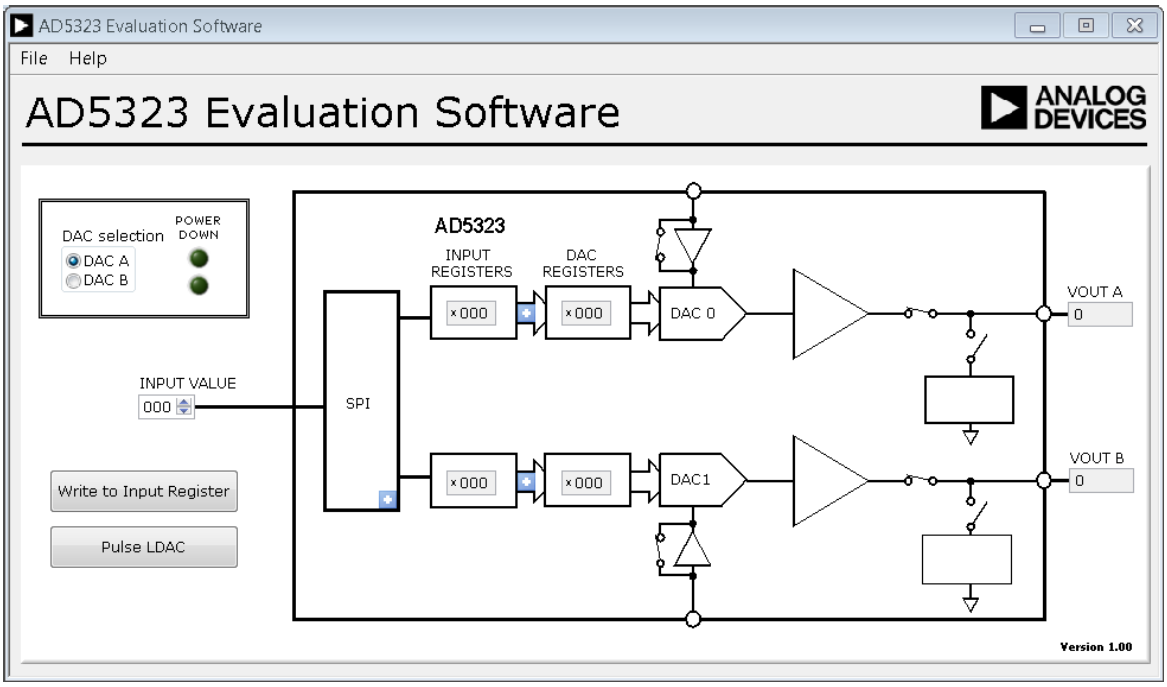

*Figure 4. **AD5323 Evaluation Software** Main Window*

SOFTWARE OPERATION

The EVAL-AD5323DBZ evaluation software allows the user to program values to the input and DAC registers of each DAC individually (see Figure 4).

Write to Input Register

Select the **Write to Input Register** button to load the code of the **INPUT VALUE** spin box to the input register of the DAC selected in the **DAC selection** block.

LDAC Control

Select 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 the blue progressive disclosure button on the **SPI** block, which opens the **DAC Config** window. Choose the **LDAC** setting by selecting logic high (**HIGH**) or logic low (**LOW**), shown in Figure 5.

*Figure 5. **DAC Config** Window*

Power-Down Control

All of the DACs can be powered down simultaneously. Click the blue progressive disclosure buttons between the **INPUT REGISTERS** and **DAC REGISTERS** blocks to access the **Powerdown Configuration** window, as shown in Figure 6. When the power-down setting for the DAC is selected, click **OK** to write the appropriate values to the AD5323.

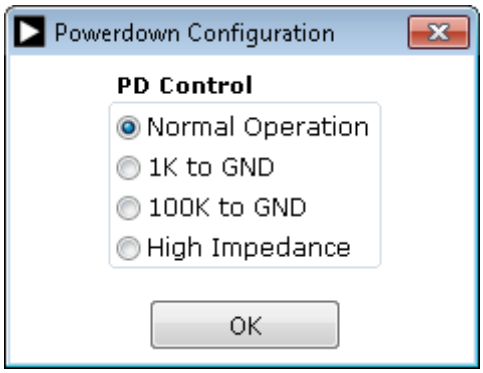

*Figure 6. **Powerdown Configuration** Window*

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

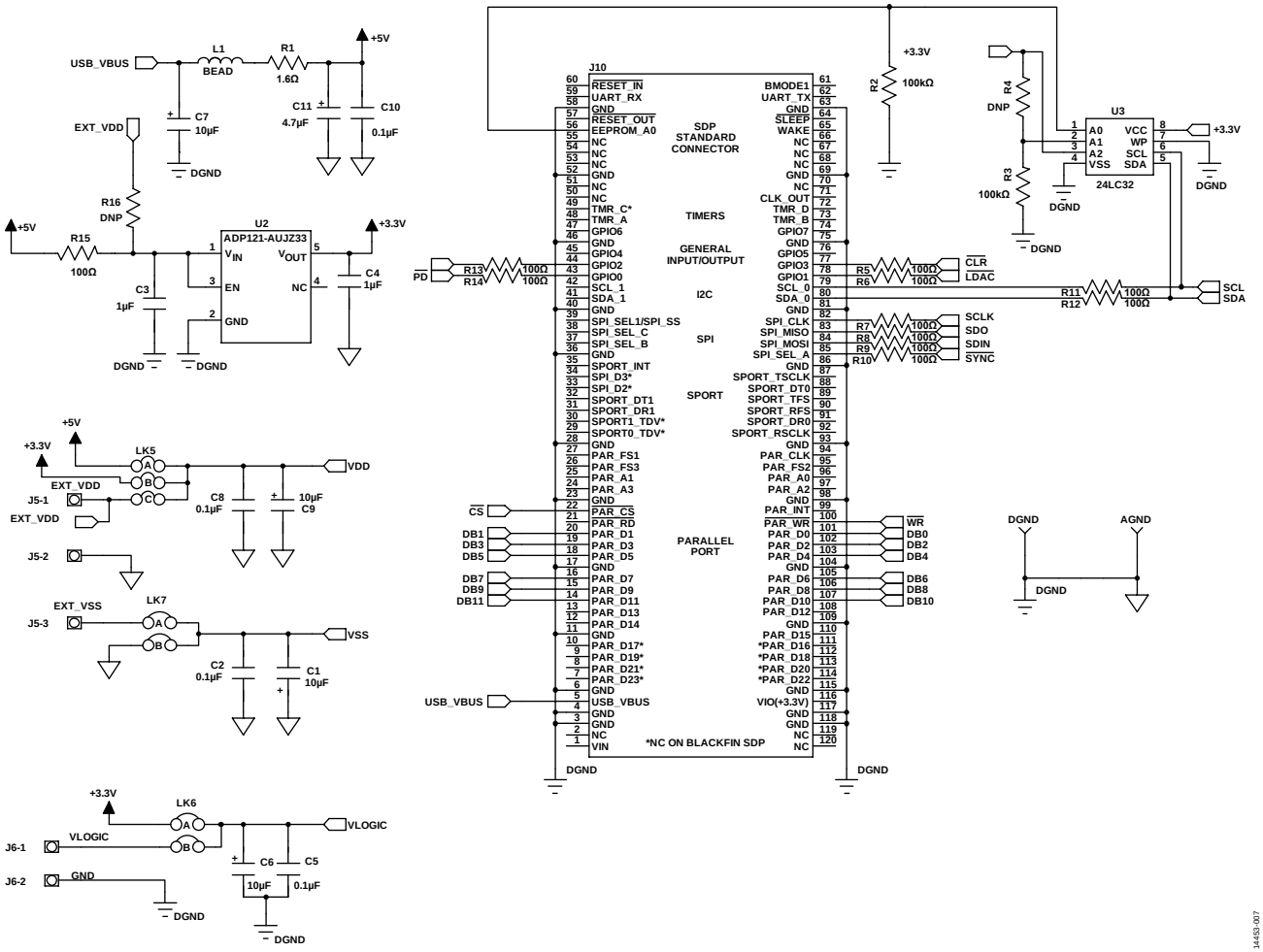

Figure 7. EVAL-MBnanoDAC-SDZ Motherboard, SDP-B Controller Board Connector, and Power Supply

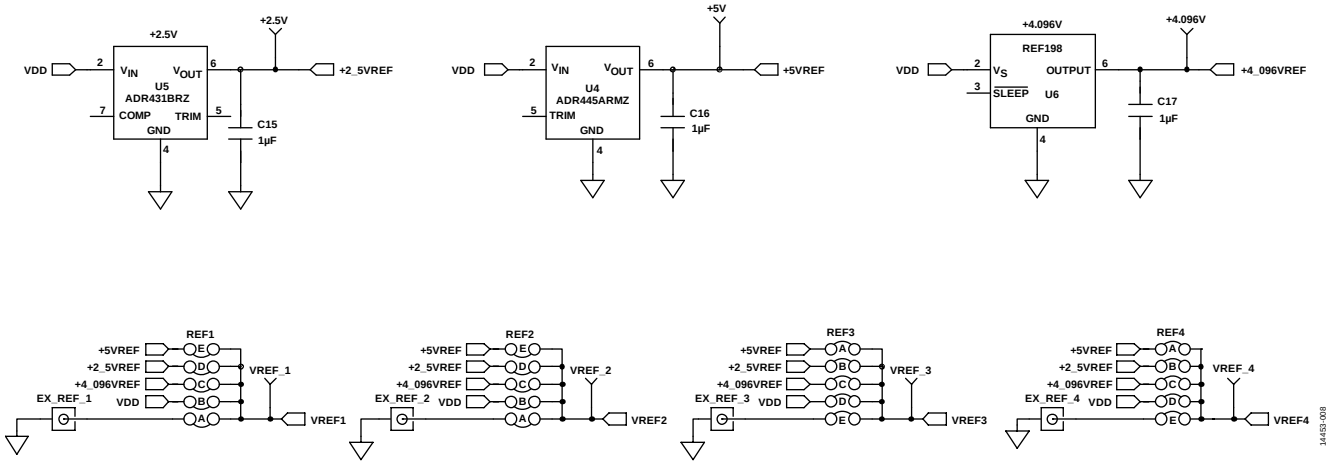

Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

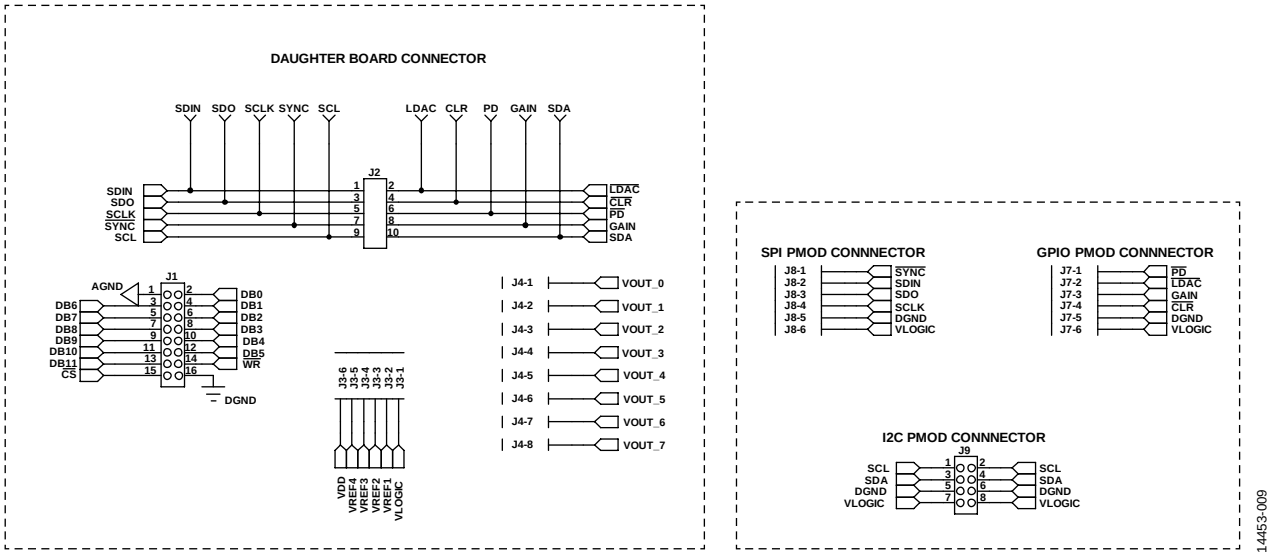

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

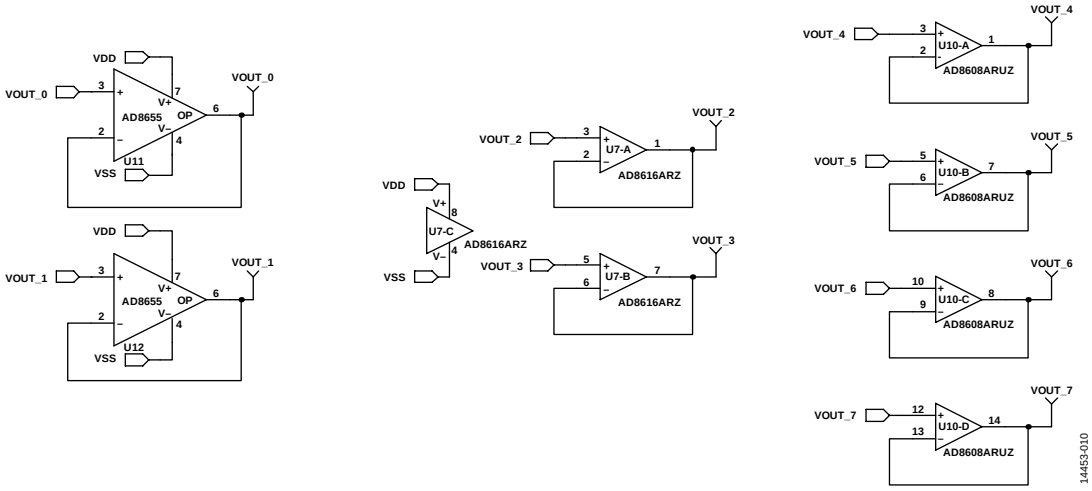

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

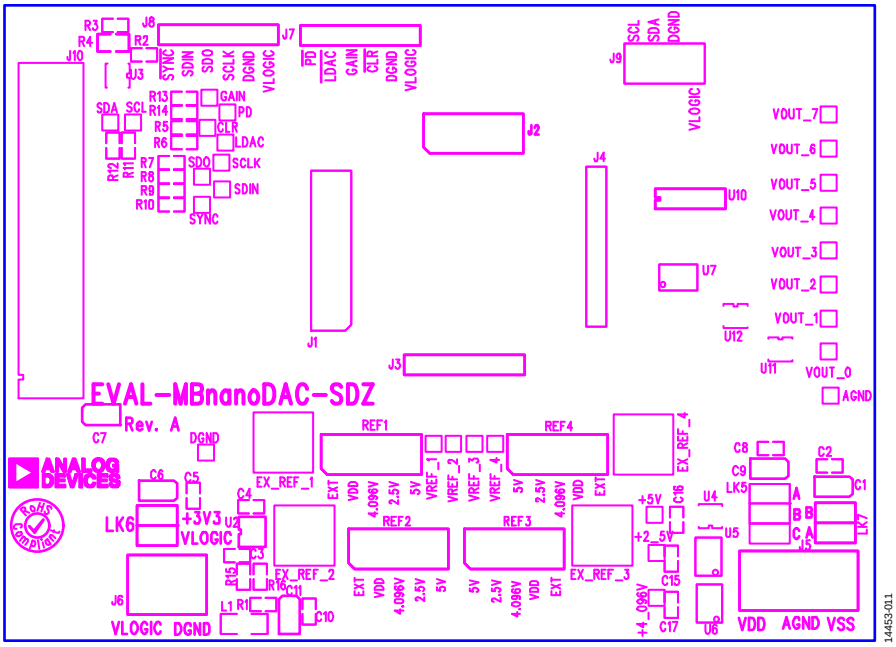

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

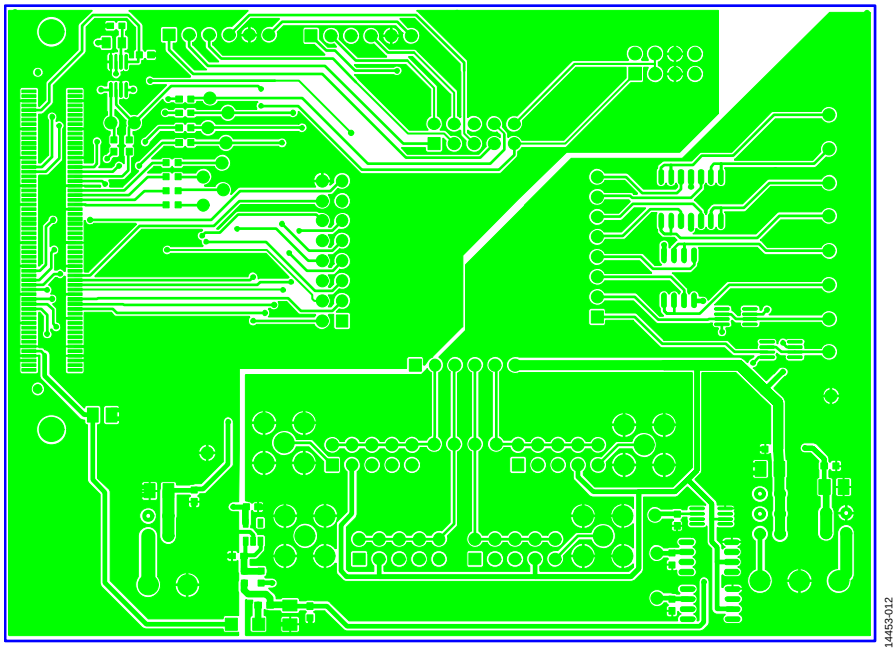

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

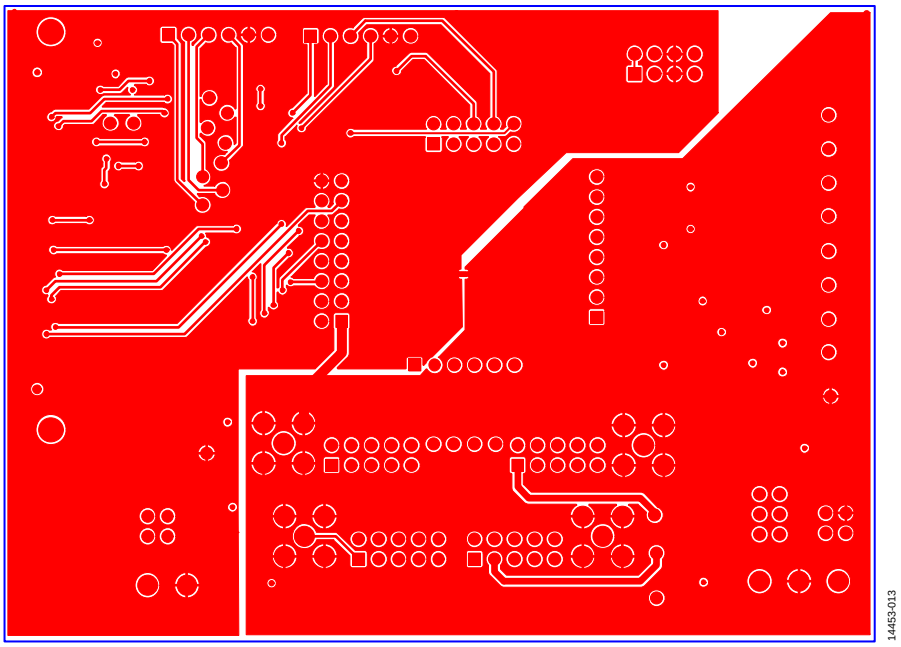

Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

EVAL-AD5323DBZ DAUGHTER BOARD

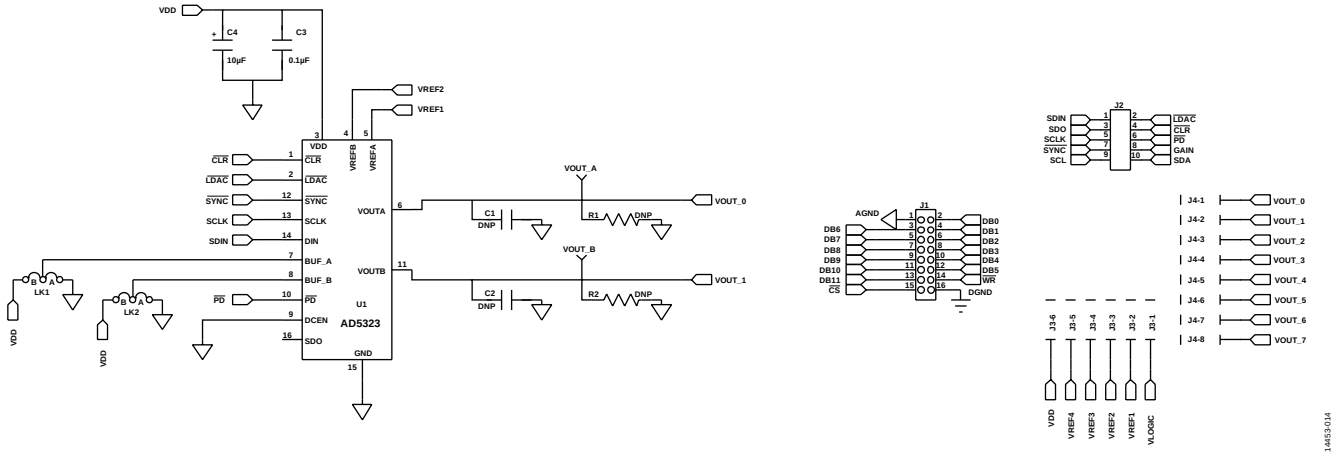

Figure 14. EVAL-AD5323DBZ Daughter Board Schematics

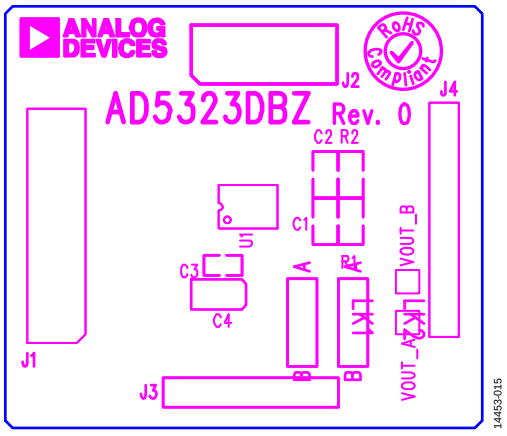

Figure 15. EVAL-AD5323DBZ Daughter Board Component Placement

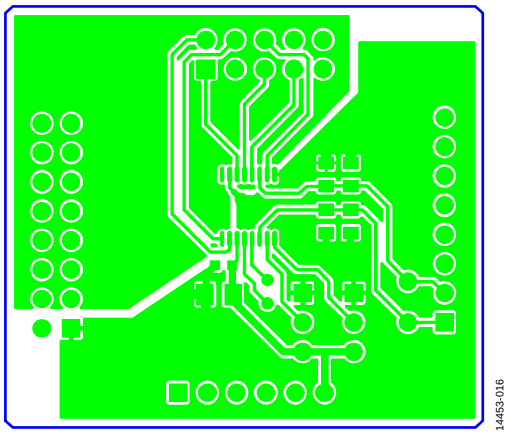

Figure 16. EVAL-AD5323DBZ Daughter Board Top Side Routing

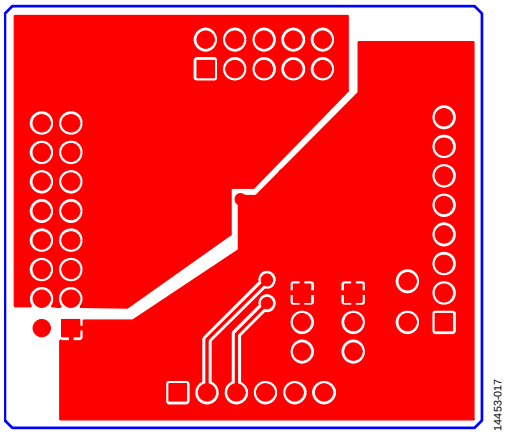

Figure 17. EVAL-AD5323DBZ Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. EVAL-MBnanoDAC-SDZ Motherboard

Reference Designator	Description	Supplier[1]/Part Number
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-way	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-AD5323DBZ Daughter Board

Reference Designator	Description	Supplier[1]/Part Number
C1	Not inserted	Not applicable
C2	Not inserted	Not applicable
C3	50 V, X7R ceramic capacitor	FEC 1759122
C4	6.3 V tantalum capacitor (Case A)	FEC 1190107
J1	16-pin (2 × 8-way) header, inserted from solder side	FEC 2308428
J2	10-pin (2 × 5-way) straight header, 2.54 mm pitch, inserted from solder side	FEC 9689583
J3	6-pin (1 × 6-way) straight header, 2.54 mm pitch, inserted from solder side	FEC 9689508
J4	Header, 2.54 mm, PCB, 1 × 8-way, inserted from solder side	FEC 1766172
LK1	3-pin single inline (SIL) header and shorting link	FEC 1022248 and FEC150-411
LK2	3-pin SIL header and shorting link	FEC 1022248 and FEC 150-411
R1	Not inserted	Not applicable
R2	Not inserted	Not applicable
U1	12-bit DAC	AD5323BRUZ
VOUT_A	Red test point, do not insert	Not applicable
VOUT_B	Red test point, do not insert	Not applicable

[1] FEC refers to Farnell Electronic Component Distributors.

NOTES

I²C refers to a communications protocol originally developed by Phillips Semiconductors (not 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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