EVAL-AD5338RDBZ User Guide
UG-979

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Evaluation Board for the AD5338R 10-Bit, Dual-Channel, Voltage Output DAC

FEATURES

- Full featured evaluation board in conjunction with *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-AD5338RDBZ evaluation board
- EVAL-MBnanoDAC-SDZ motherboard

SOFTWARE REQUIRED

- EVAL-AD5338RDBZ evaluation software

HARDWARE REQUIRED

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

DOCUMENTS REQUIRED

- Electronic version of the AD5338R data sheet
- Electronic version of EVAL-AD5338RDBZ user guide

GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the AD5338R dual-channel, voltage output, digital-to-analog converter (DAC).

The evaluation board is designed to help users quickly prototype new AD5338R circuits and reduce design time. The AD5338R operates from a single 2.7 V to 5.5 V supply.

Full details can be found in the AD5338R data sheet, which must be consulted 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-B board. Software is available for download from the EVAL-AD5338RDBZ evaluation board page to allow the user to program the AD5338R.

EVAL-AD5338RDBZ, EVAL-MBnanoDAC-SDZ, AND SDP-B BOARDS

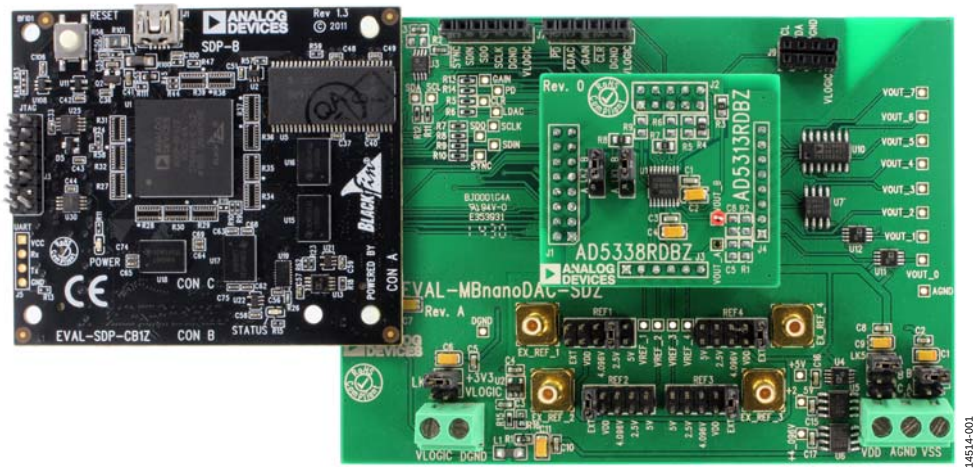

Figure 1.

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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-AD5338RDBZ evaluation board can be powered either from the SDP-B 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 are connected at one location on the EVAL-MBnanoDAC-SDZ. It is recommended that AGND and DGND not be connected elsewhere in the system to avoid 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}.
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 for 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 4. The positions listed in Table 2 and Table 4 match the evaluation board imprints (see Figure 12).

Table 2. 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

DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5338R daughter board has two link options. This links set the least significant bits (LSBs) of the I^2C addresses of the DACs. Table 4 describes the function of these links. For proper device operation, position LK1 and LK2 to B.

Table 3. Link Options for Daughter Board

Link No.	Pin	Option
LK1	SCLK	B (low, default), A (high)
LK2	SDIN	B (low, default), A (high)

Table 4. Link Functions

Link No.	Function
REF1, REF2, REF3, 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 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 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 QUICK START PROCEDURES

INSTALLING THE SOFTWARE

The EVAL-AD5338RDBZ 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 board to the USB port of the PC to ensure that the SDP-B 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-AD5338RDBZ 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 board and the SDP-B board into the PC using the USB cable included in the evaluation kit.
5. When the software detects the evaluation board, click through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the program, do the following:

1. Connect the evaluation board to the SDP-B board and connect the USB cable between the SDP-B 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, AD5338R Evaluation Software**.
4. If the SDP-B 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 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 AD5338R evaluation software then opens, as shown in Figure 4.

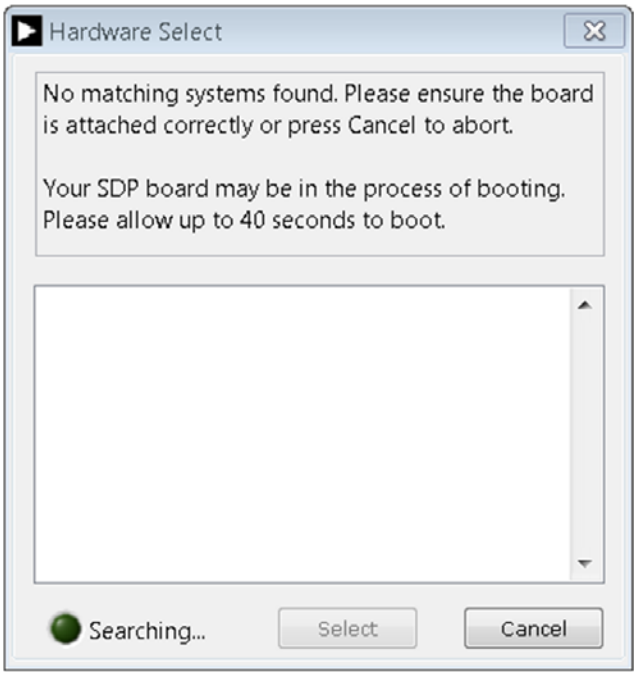

Figure 2. Connectivity Error

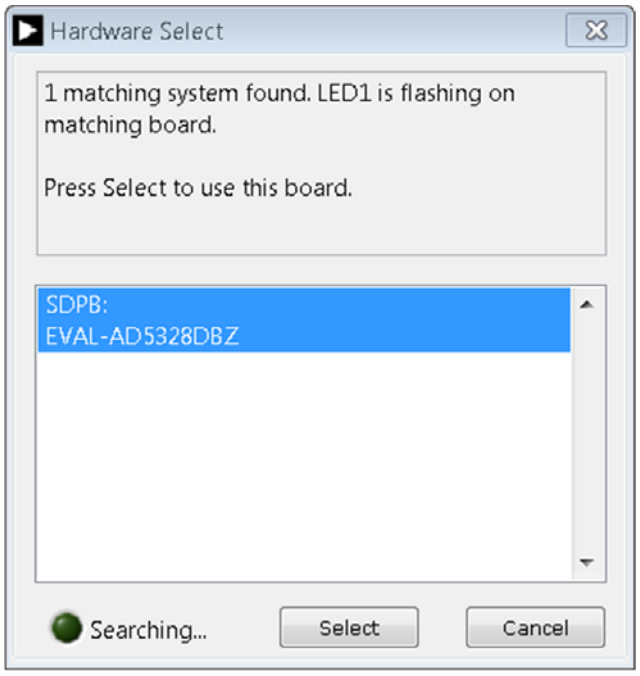

*Figure 3. **Hardware Select***

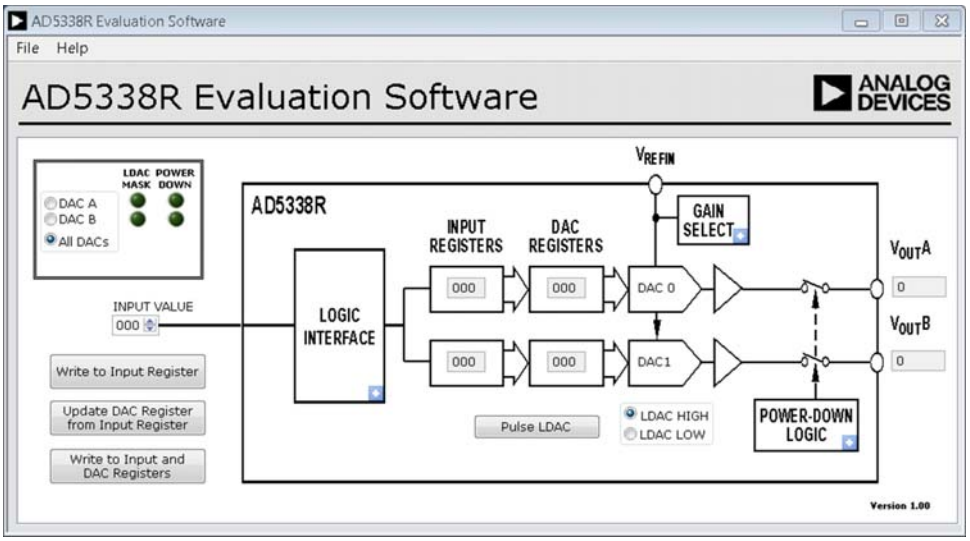

Figure 4. ***AD5338R Evaluation Software*** *Main Window*

SOFTWARE OPERATION

The software for the AD5338R 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 selected DAC in the DAC selection box.

Update DAC Register from Input Register

Click **Update DAC Register from Input Register** to copy the value in the input register to the corresponding DAC register. The DAC outputs are automatically updated with the appropriate voltage. The LDAC mask register setting is ignored.

Write to Input and DAC Register

Click **Write to Input and DAC Register** to load the code of the input data control to the input register and DAC register of the selected DAC. The DAC outputs are automatically updated with the appropriate voltage. The LDAC mask is ignored.

LDAC Control

Click **Pulse LDAC** to bring the LDAC pin low and then back high. This action copies the data from the input registers to the DAC registers, and the outputs update accordingly. Any DAC updates disabled by the LDAC mask settings are ignored.

Alternatively, the LDAC pin can also be set high or low by clicking **LDAC HIGH** or **LDAC LOW**, respectively.

Power-Down Control

Each DAC can be powered down individually, and has an associated selection box allowing the selected DAC to operate in normal mode or power-down mode. Click the blue progressive disclosure option on the **POWER-DOWN LOGIC** block to access the **Powerdown Configuration** 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 AD5338R. The **POWER DOWN** indicator LED lights up accordingly when a DAC is powered down.

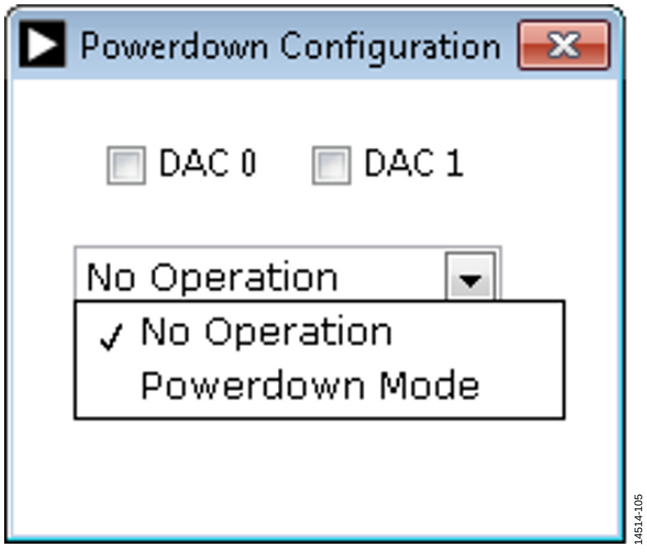

Figure 5. ***Powerdown Configuration*** *Window*

GAIN Control

To set the GAIN pin high or low, click the blue progressive disclosure option on the **GAIN SELECT** block to access the **Gain Control** window, as shown in Figure 6. In the **GAIN** selection box, select **X1** for a full-scale output of 2.5 V or select **X2** for a full-scale output of 5 V.

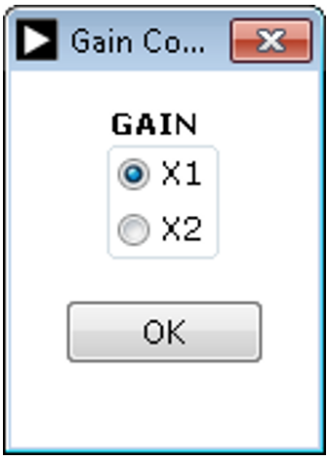

Figure 6. ***Gain Control*** *Window*

LDAC Mask Register

Each DAC can be configured to respond to or ignore the LDAC pin settings in the **LDAC Configuration** dropdown menu. Click the blue progressive disclosure option on the **LOGIC INTERFACE** block to access the **LDAC Configuration** window, as shown in Figure 7. When the LDAC selections are completed, click **OK** to write the appropriate values to the AD5338R. The **LDAC MASK** indicator LED lights up accordingly when the LDAC mask of the DAC is enabled.

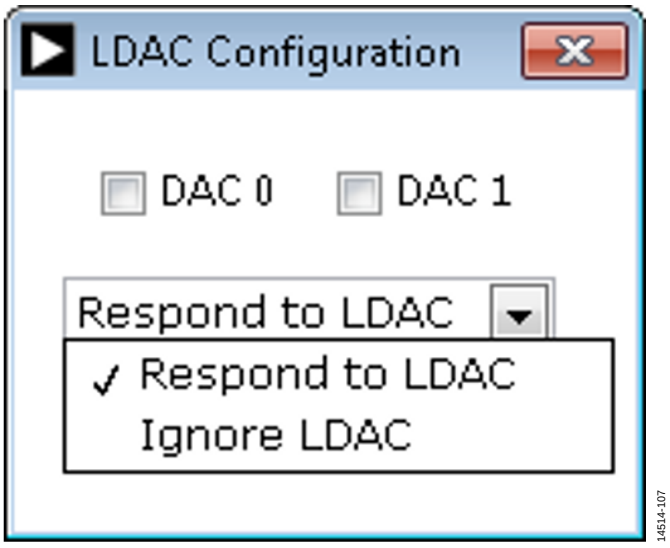

Figure 7. ***LDAC Configuration*** *Window*

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

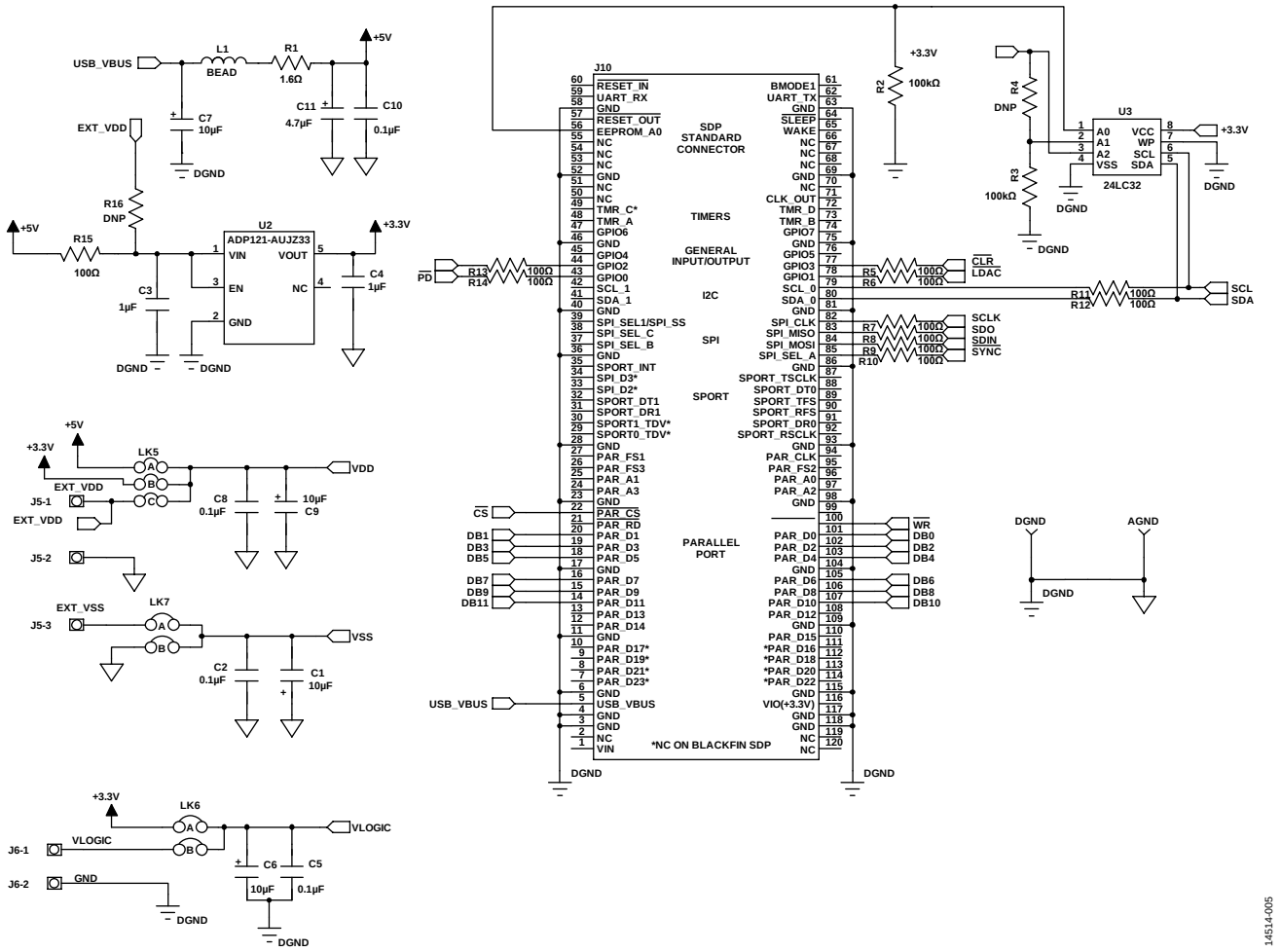

Figure 8. EVAL-MBnanoDAC-SDZ Motherboard SDP-B Connector and Power Supply

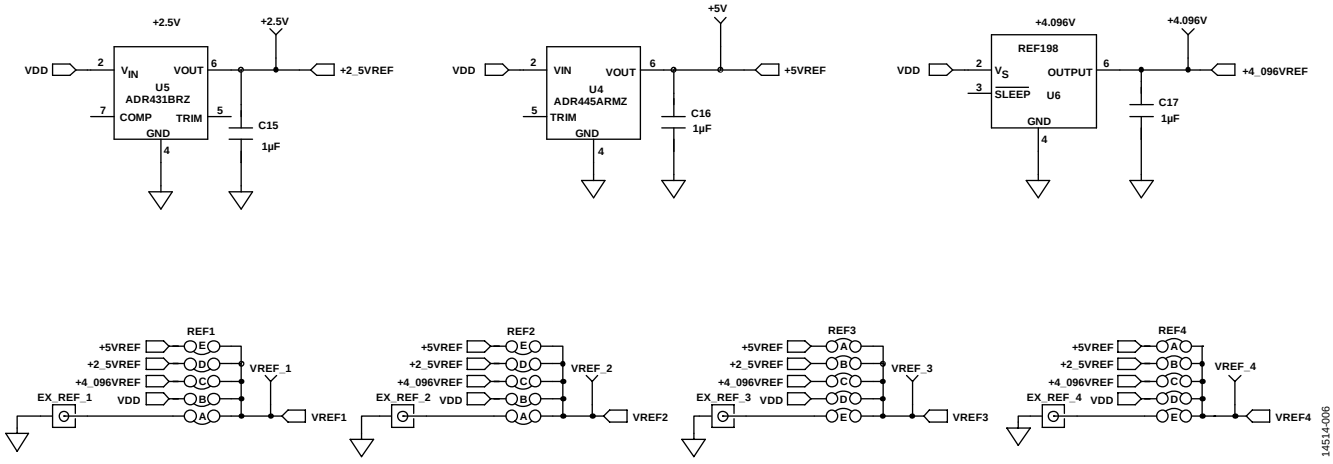

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

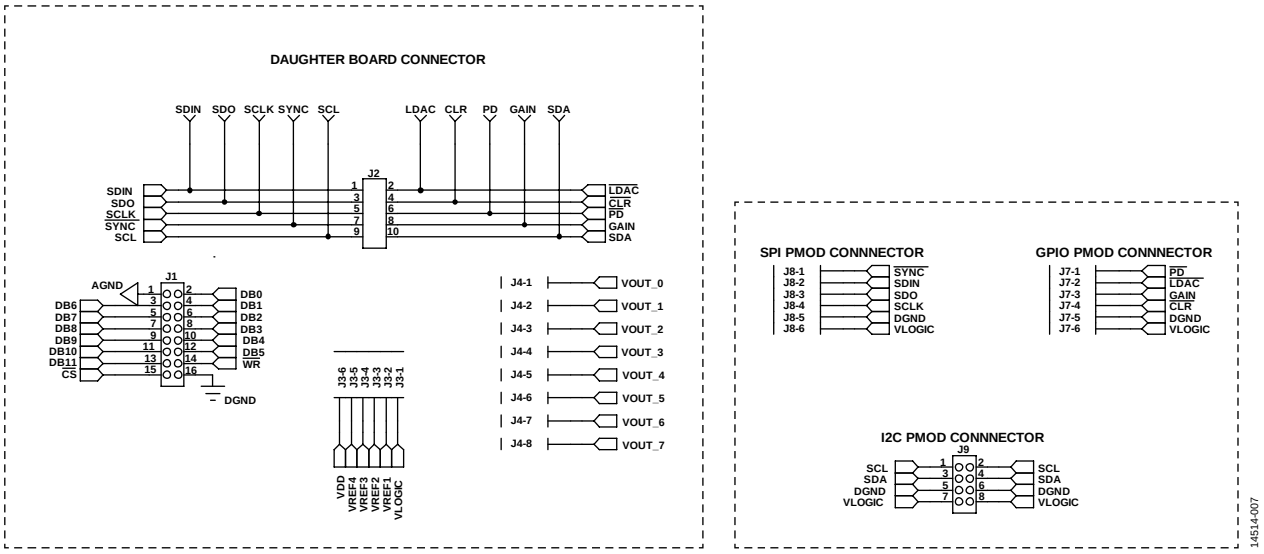

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

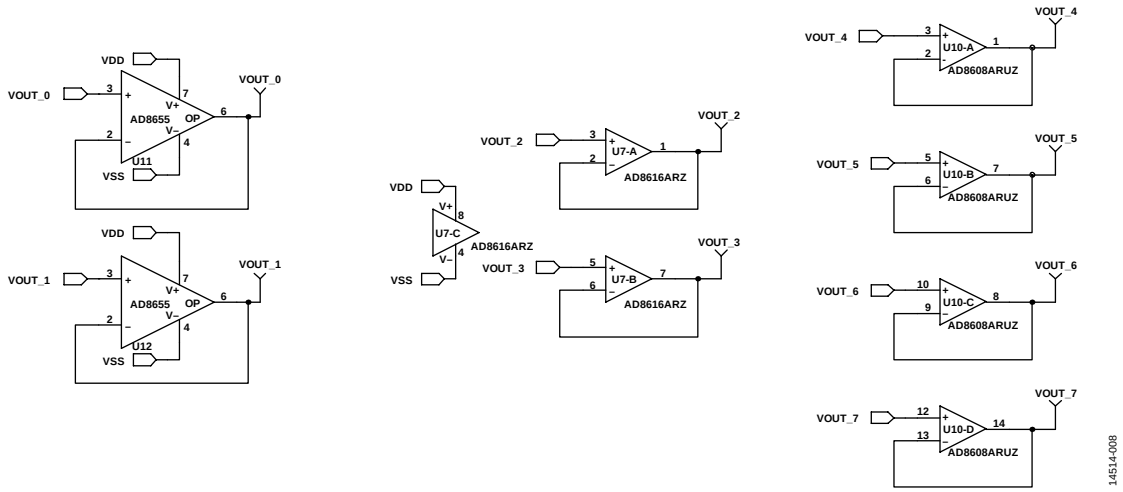

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

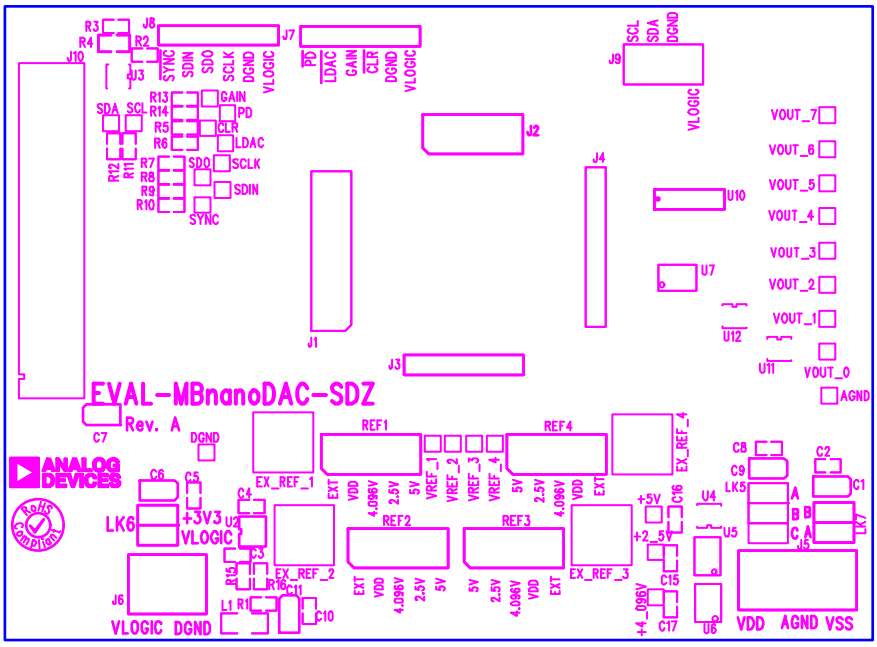

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

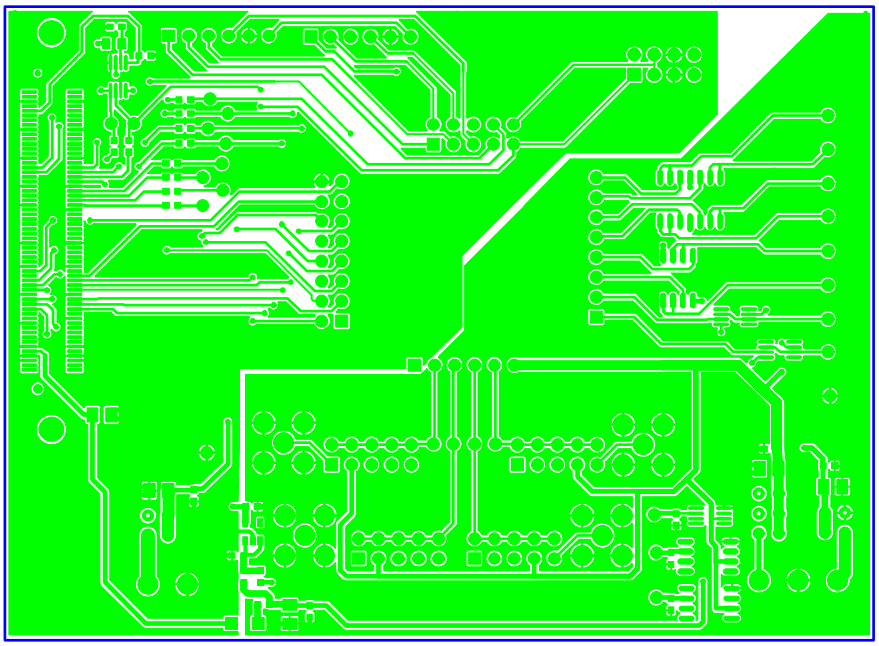

Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

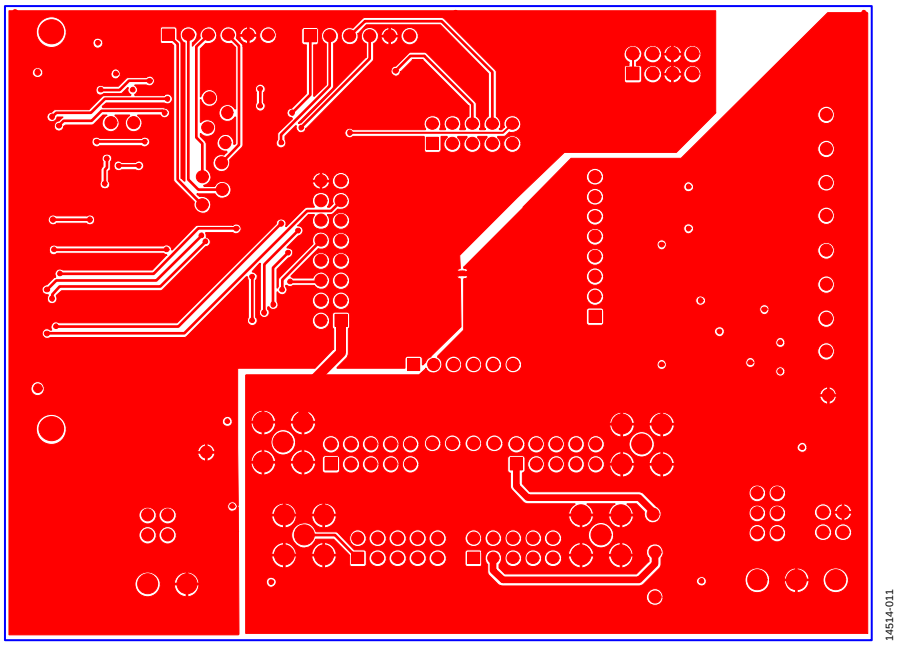

Figure 14. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

EVAL-AD5338RDBZ DAUGHTER BOARD

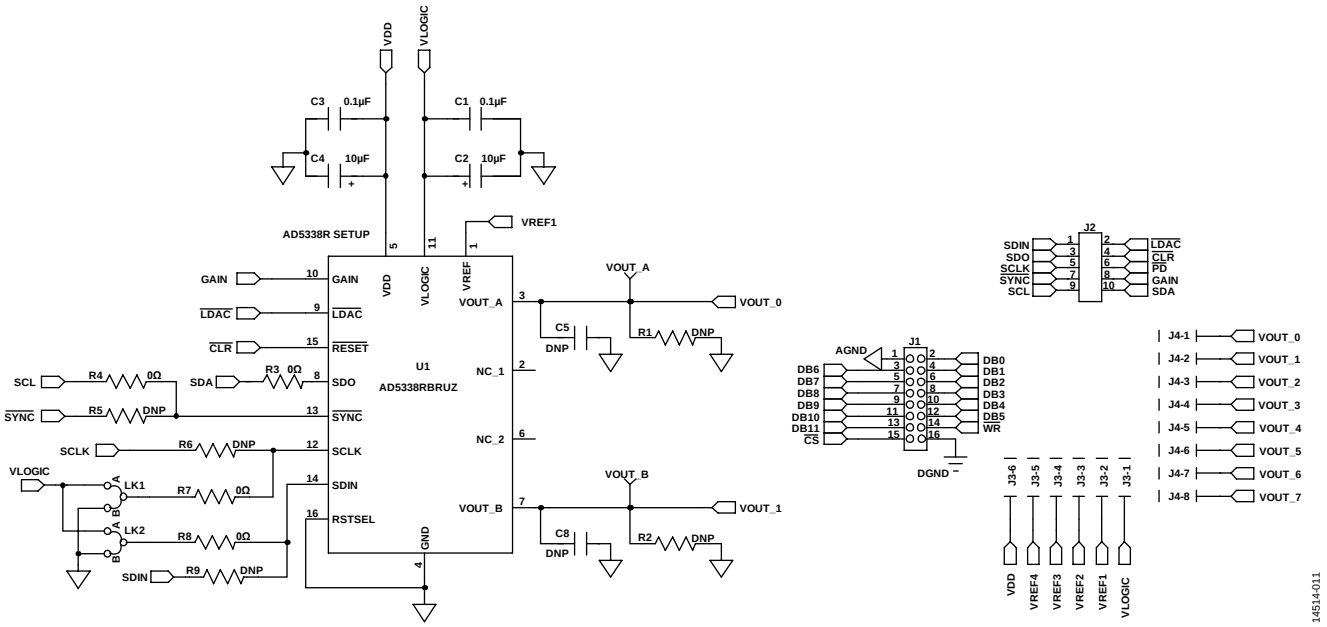

Figure 15. EVAL-AD5338RDBZ Daughter Board Schematics

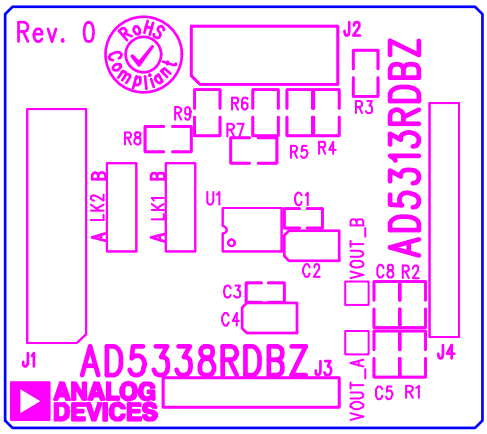

Figure 16. EVAL-AD5338RDBZ Daughter Board Component Placement

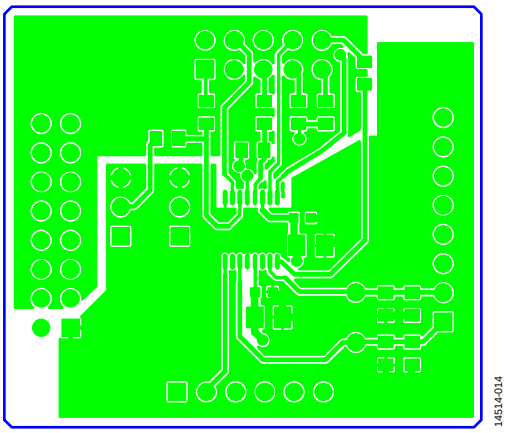

Figure 17. EVAL-AD5338RDBZ Daughter Board Top Side Routing

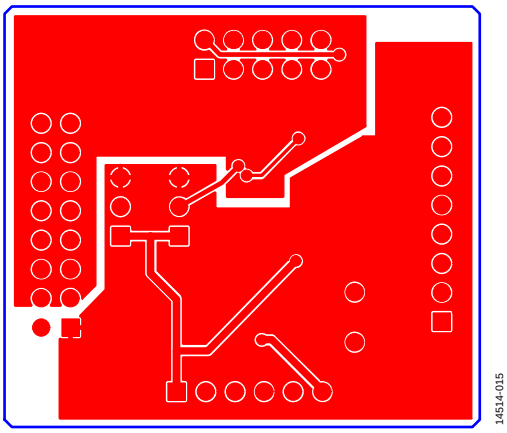

Figure 18. EVAL-AD5338RDBZ Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. 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, 600Z	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 I^2C 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 6. EVAL-AD5338RDBZ Daughter Board

Qty	Reference Designator	Description	Supplier/Part Number[1]
2	C1, C3	50 V, X7R, ceramic capacitor	FEC/1759122
2	C2, C4	6.3 V, tantalum capacitor (Case A)	FEC/1190107
2	C5, C8	Not applicable	Not inserted
1	J1	16-pin (2 × 8) header	FEC/2308428 inserted from solder side
1	J2	10-pin (2 × 5) straight header, 2.54 mm pitch	FEC/9689583 inserted from solder side
1	J3	6-pin (1 × 6) straight header, 2.54 mm pitch	FEC/9689508 inserted from solder side
1	J4	Header, 2.54 mm, PCB, 1 × 8-way	FEC/1766172 inserted from solder side
2	LK1, LK2	Jumper block using 3-pin sip header	FEC/1022248 and 150410
2	R1, R2	Do not insert	Do not insert
4	R3, R4, R7, R8	Resistor, thick film, 0 Ω, 0.125 W, 1%	FEC/2309112
3	R5, R6, R9	Do not insert	Do not insert
1	U1	10-bit DAC	Analog Devices/AD5338RBRUZ
1	VOUT_A	Red test point	Do not insert
1	VOUT_B	Red test point	FEC/8731144 (Pack)

[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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