

Evaluating the **AD5321** 12-Bit, Single-Channel Voltage Output Digital-to-Analog Converter (DAC)

FEATURES

- Full featured evaluation board (**EVAL-AD5321DBZ**) in conjunction with the nanoDAC motherboard (**EVAL-MBnanoDAC-SDZ**)
- On-board references
- Various link options
- PC control in conjunction with Analog Devices, Inc., system demonstration platform (SDP)

EVALUATION KIT CONTENTS

- EVAL-AD5321DBZ** evaluation board
- EVAL-MBnanoDAC-SDZ** motherboard
- USB cable

SOFTWARE REQUIRED

- EVAL-AD5321DBZ** 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-AD5321DBZ** evaluation board for the **AD5321**.

The **EVAL-AD5321DBZ** evaluation board is designed to quickly prototype **AD5321** circuits and reduce design time. The **AD5321** operates from a single 2.7 V to 5.5 V supply.

The **EVAL-AD5321DBZ** evaluation board interfaces with the USB port of a PC via the **SDP-B** controller board. Software can be downloaded via the **EVAL-AD5321DBZ** product page that allows users to program the **AD5321**.

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

Full data on the **AD5321** can be found in the **AD5321** 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-AD5321DBZ**, **EVAL-MBnanoDAC-SDZ**, AND THE **EVAL-SDP-CB1Z**

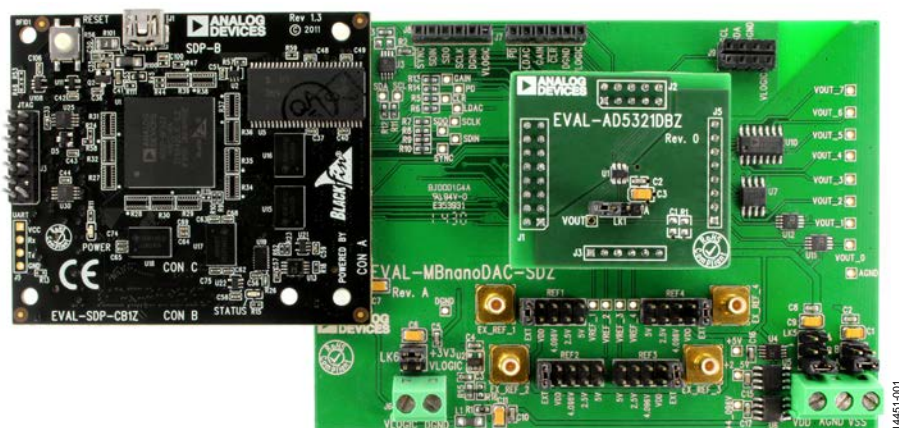


Figure 1.

TABLE OF CONTENTS

| | | | |
|--|---|---|----|
| Features | 1 | Installing the AD5321 Evaluation Software | 4 |
| Evaluation Kit Contents..... | 1 | Running the Software..... | 4 |
| Software Required | 1 | Evaluation Software..... | 5 |
| Hardware Required | 1 | Write to DAC Register | 5 |
| General Description | 1 | Power-Down Control..... | 5 |
| EVAL-AD5321DBZ, EVAL-MBnanoDAC-SDZ, and the EVAL-SDP-CB1Z Boards | 1 | Evaluation Board Schematics and Artwork | 6 |
| Revision History | 2 | EVAL-MBnanoDAC-SDZ Motherboard..... | 6 |
| Evaluation Board Hardware..... | 3 | EVAL-AD5321DBZ Daughter Board | 9 |
| Power Supplies | 3 | Ordering Information | 11 |
| EVAL-AD5321DBZ Daughter board Link Options | 3 | Bill of Materials | 11 |
| Evaluation Software..... | 4 | | |

REVISION HISTORY

3/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

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

The EVAL-AD5321DBZ 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 EVAL-AD5321DBZ. 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 μ F tantalum capacitor and 0.1 μ F 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, Pin1 (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 and must be set for the required operating conditions before using the EVAL-AD5321DBZ. 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 (see Figure 10).

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

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

EVAL-AD5321DBZ DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5321DBZ daughter board has a link option. This link sets the LSB of the I²C address of the DAC. Table 3 describes the function of this link. For proper device operation, set the LK1 position to B.

Table 3. Link Options for Daughterboard

| Link | Pin | Position |
|------|-----|------------------------------|
| LK1 | A0 | A (high) B (low, default) |

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 on the motherboard. 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 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-AD5321DBZ EVALUATION SOFTWARE

The EVAL-AD5321DBZ 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 to the PC.

To install the EVAL-AD5321DBZ Evaluation Software, take the following steps:

1. Start the Windows operating system.
2. Download the installation software from the [EVAL-AD5321DBZ](#) evaluation board page.
3. Run the **setup.exe** file from the installer folder if it doesn't run automatically.
4. After installation is completed, power up the evaluation board as described in the Power Supplies section.
5. Connect the EVAL-AD5321DBZ 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-AD5321DBZ, proceed through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the program, proceed with the following:

1. Connect the EVAL-AD5321DBZ to the SDP-B controller board and connect the USB cable between the board and the PC.
2. Power up the EVAL-AD5321DBZ as described in the Power Supplies section.
3. Click **Start > All Programs > Analog Devices > AD5321 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-AD5321DBZ are detected, the display updates (see Figure 3).

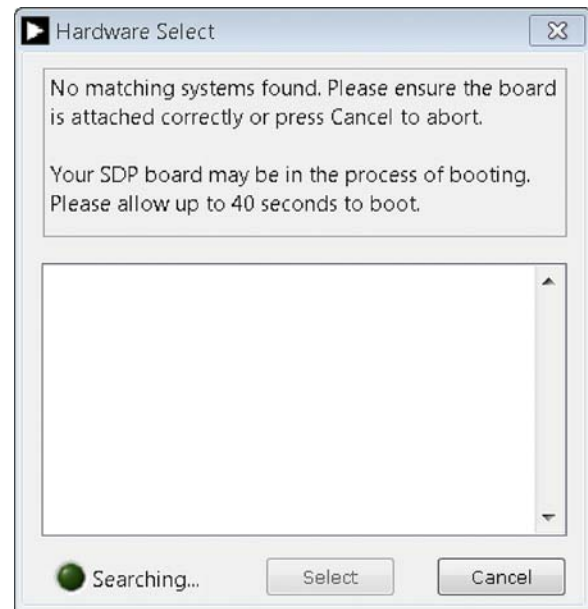


Figure 2. Connectivity Error

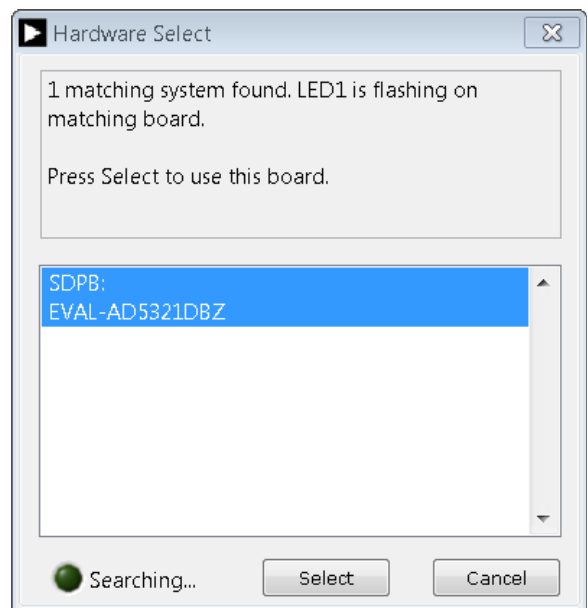


Figure 3. Hardware Select

Alternatively, the EVAL-AD5321DBZ Evaluation Software can be used without an evaluation board. The EVAL-AD5321DBZ Evaluation Software runs in simulation mode displaying expected outputs based on the input data. The main window of the EVAL-AD5321DBZ Evaluation Software then opens, shown in Figure 4.

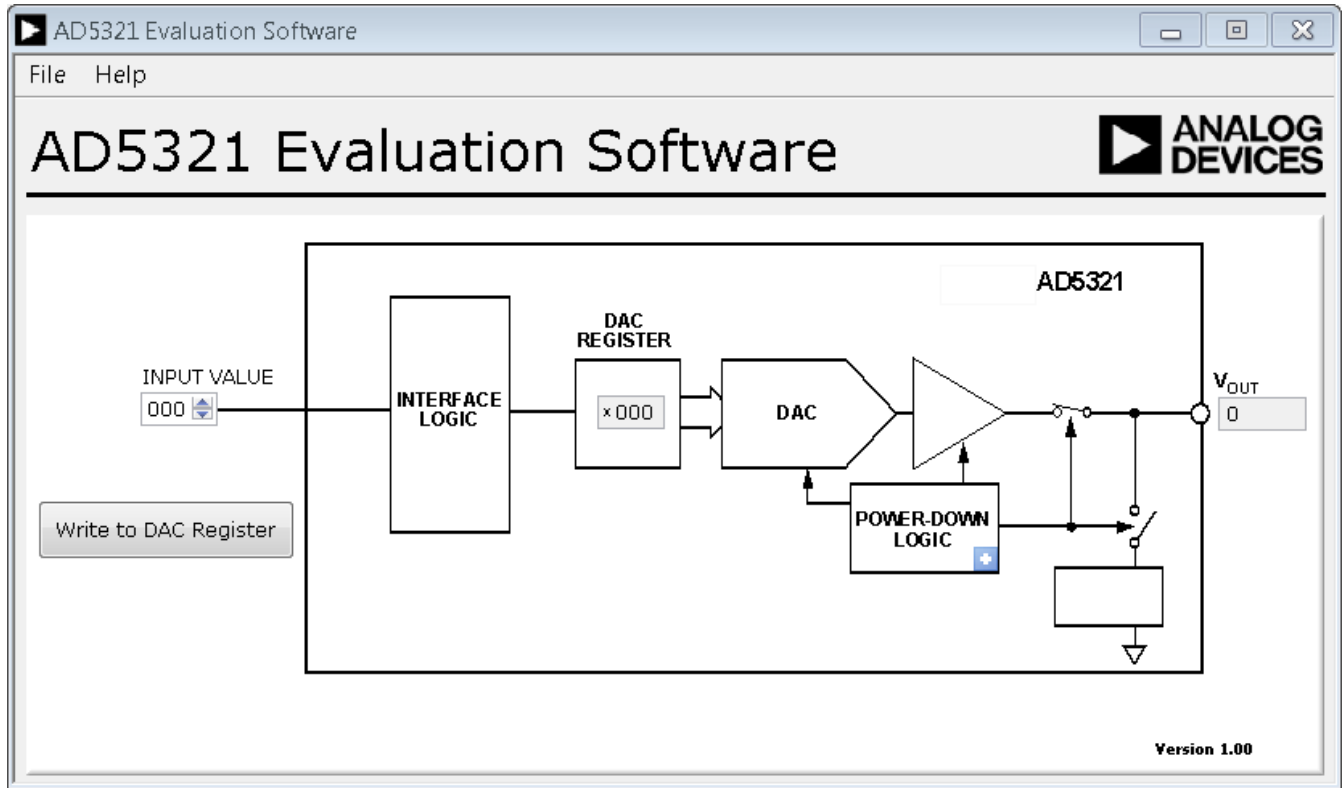


Figure 4. AD5321 Evaluation Board Software Main Window

EVALUATION SOFTWARE

The EVAL-AD5321DBZ evaluation software allows the user to program values to the DAC register.

WRITE TO DAC REGISTER

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

POWER-DOWN CONTROL

Click the blue progressive disclosure button on the **POWER-DOWN LOGIC** block to access the **Powerdown Config** window, as shown in Figure 5. This window allows the user to operate the AD5321 in normal mode or three different power-down modes. When the power-down setting for the DAC is selected, click **OK** to write the appropriate values to the AD5321.

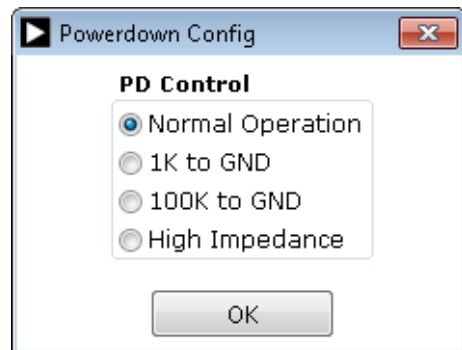


Figure 5. Powerdown Config Window

EVALUATION BOARD SCHEMATICS AND ARTWORK
 EVAL-MBnanoDAC-SDZ MOTHERBOARD

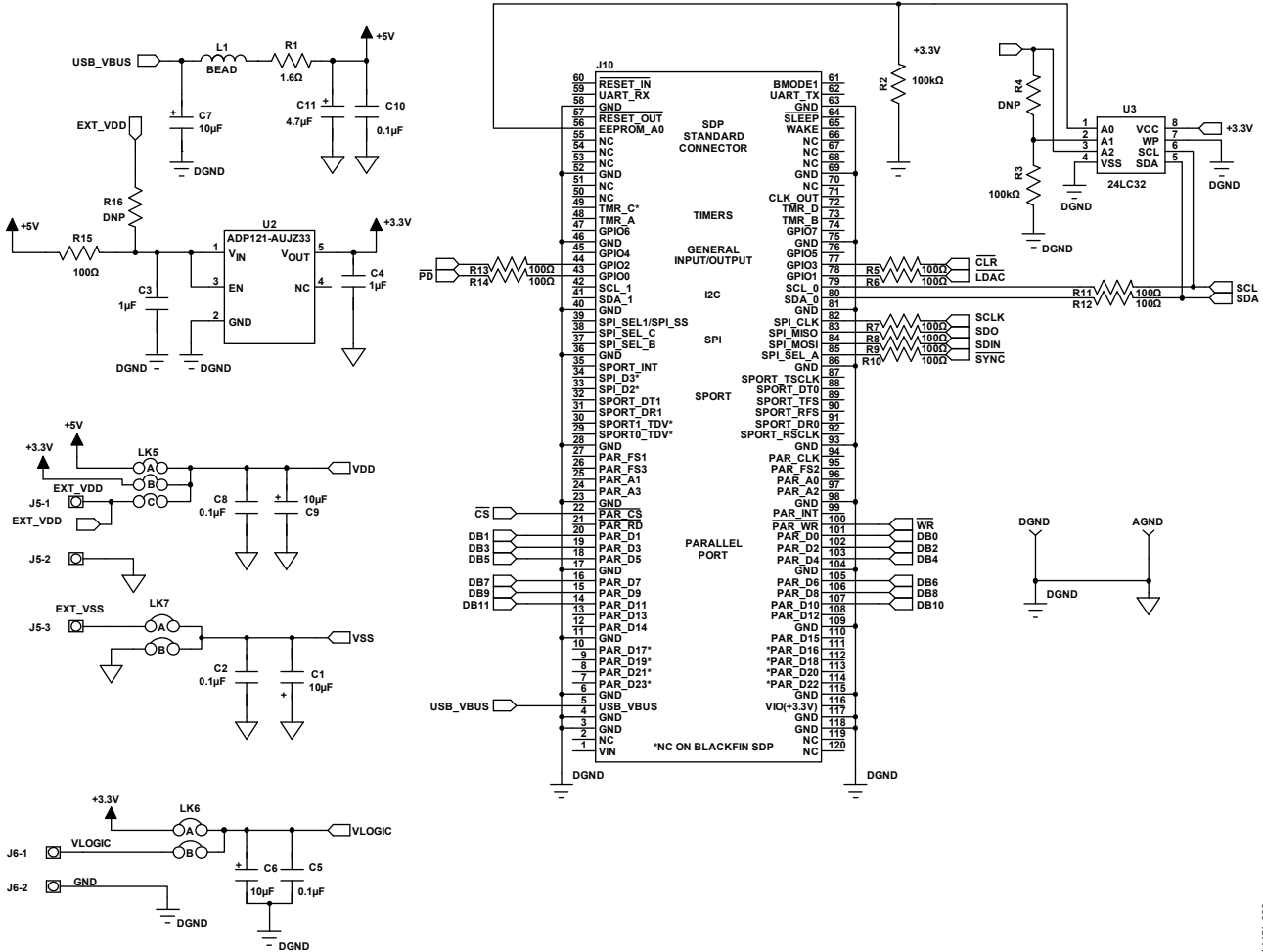


Figure 6. EVAL-MBnanoDAC-SDZ Motherboard, SDP-B Controller Board Connector, and Power Supply

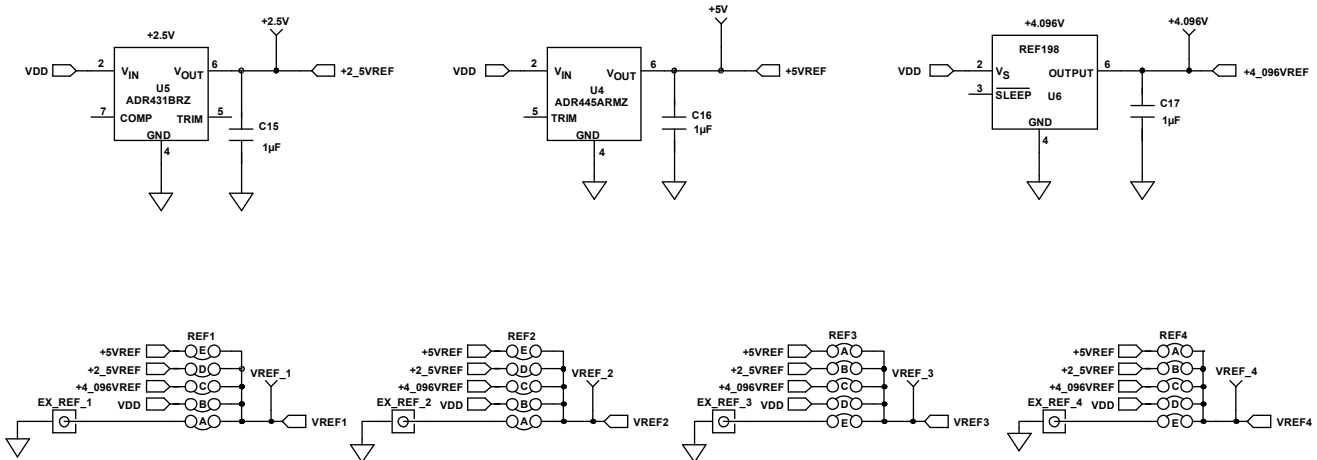


Figure 7. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

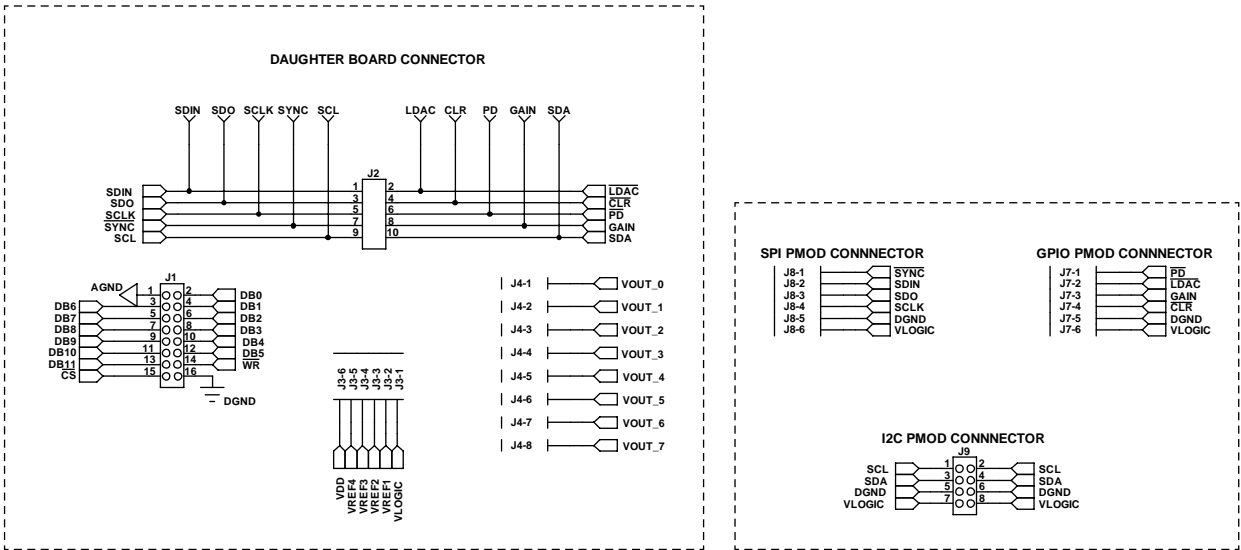


Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

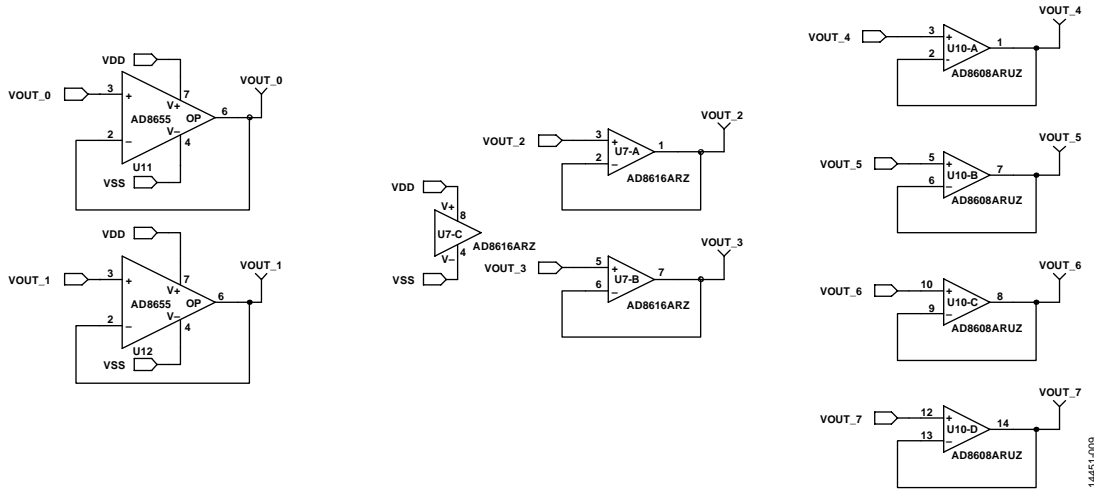


Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

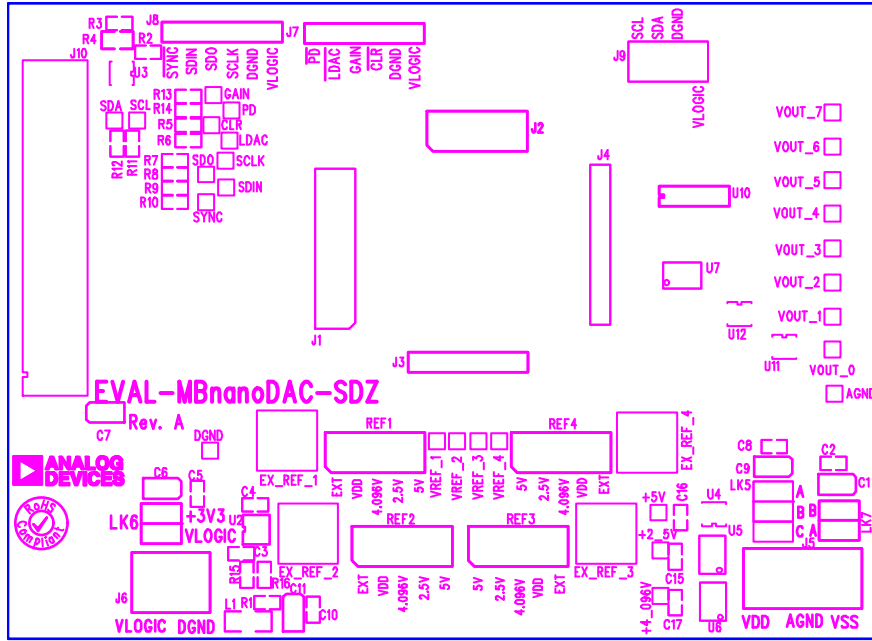


Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

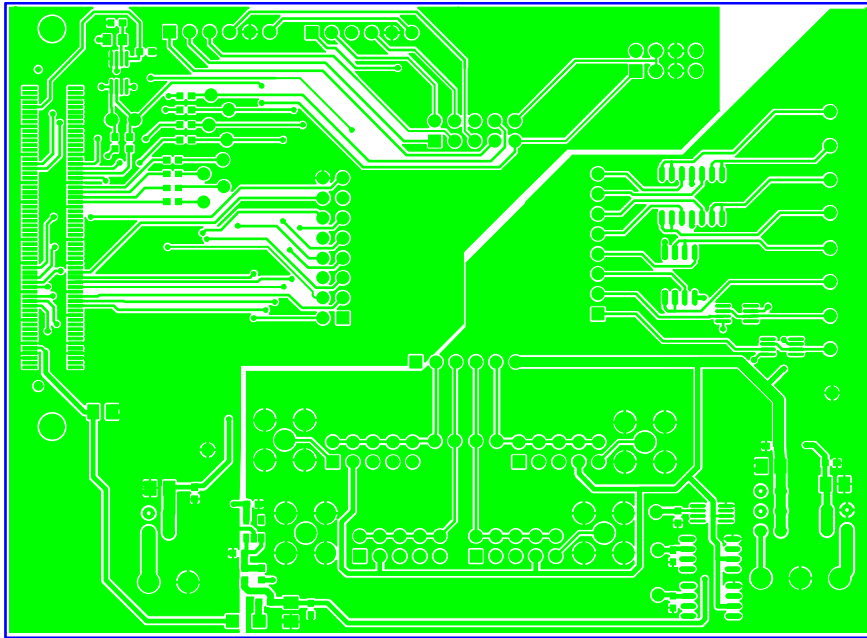
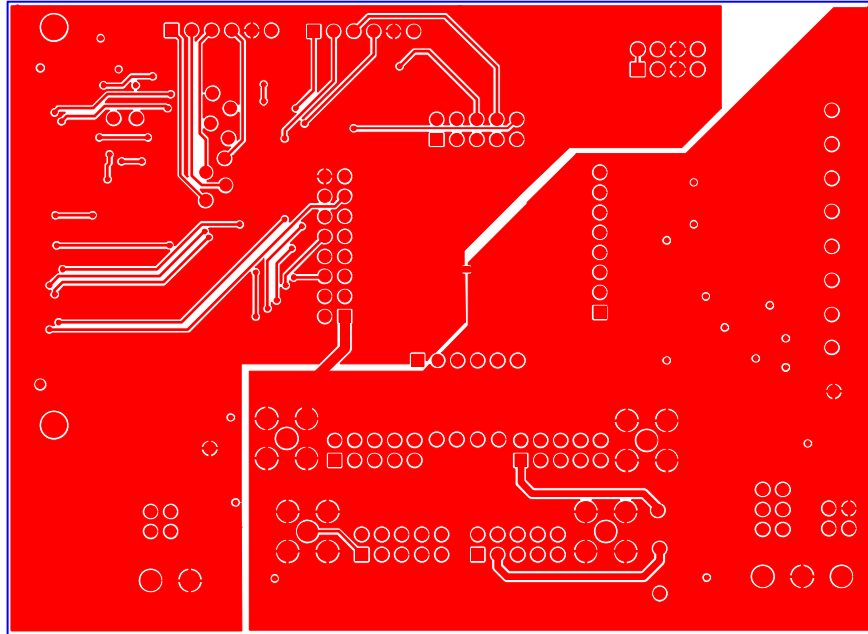


Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing



14451-012

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

EVAL-AD5321DBZ DAUGHTER BOARD

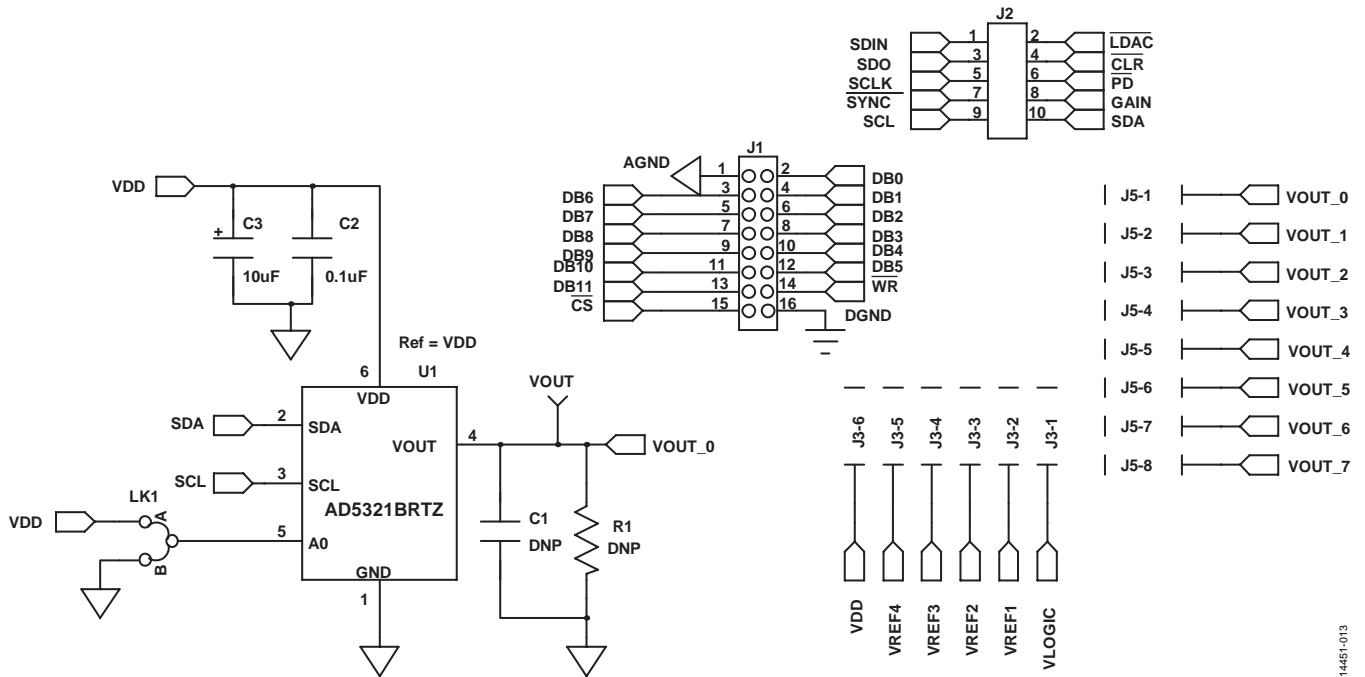


Figure 13. EVAL-AD5321DBZ Daughter Board Schematics

14451-013

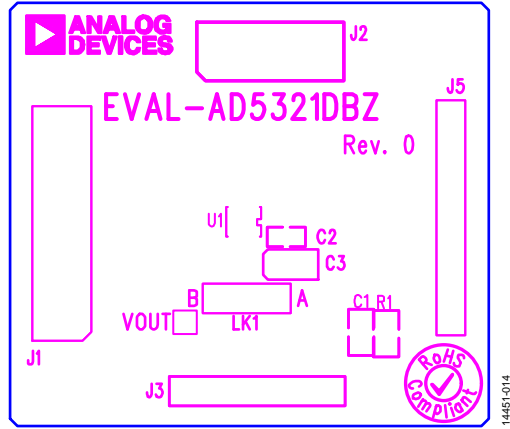


Figure 14. EVAL-AD5321DBZ Daughter Board Component Placement

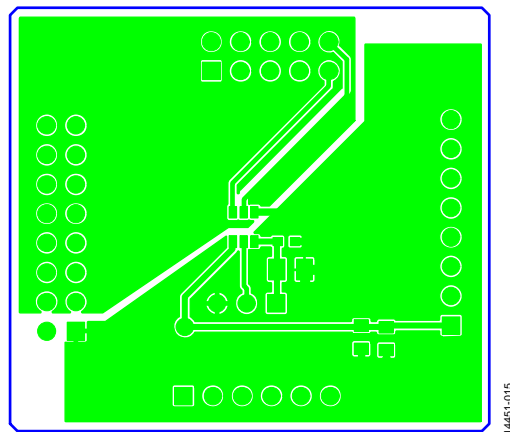


Figure 15. EVAL-AD5321DBZ Daughter Board Top Side Routing

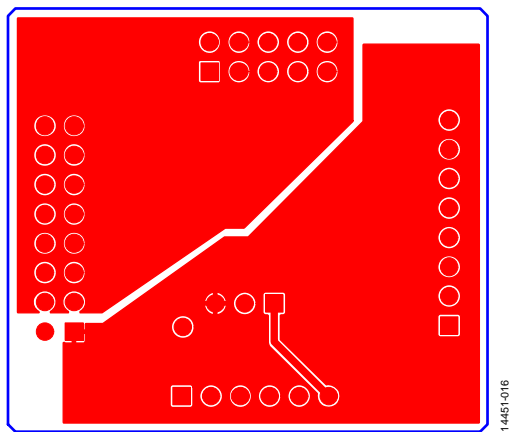


Figure 16. EVAL-AD5321DBZ Daughter Board Bottom Side Routing

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 μ F, \pm 20% | FEC 1190107 |
| C2, C5, C8, C10, C15 to C17 | 50 V, X7R ceramic capacitors, 0.1 μ F, \pm 10% | FEC 1759122 |
| C3, C4 | 10 V, X5R ceramic capacitors, 1 μ F, \pm 10% | GRM188R61A105KA61D ² |
| C11 | 6.3 V tantalum capacitor (Case A), 4.7 μ F, \pm 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 \times 8-way | FEC 2308428 |
| J2 | Header, 2.54 mm, 2 \times 5-way | FEC 9689583 |
| J3, J7, J8 | Headers, 2.54 mm, 1 \times 6-way | FEC 9689508 |
| J4 | Header, 2.54 mm, 1 \times 8-way | FEC 1766172 |
| J5 | 3-pin terminal block | FEC 1667472 |
| J6 | 2-pin terminal block | FEC 151789 |
| J9 | Header, 2.54 mm, 2 \times 4-way | FEC 1667509 |
| J10 | 120-way connector | FEC 1324660 |
| L1 | Inductor, SMD, 600 Ω | FEC 9526862 |
| LK5 | 6-pin (3 \times 2) 0.1" header and shorting block, 36-pin strip | FEC 148-535 and FEC 150-411 |
| LK6, LK7 | 4-pin (2 \times 2) 0.1" header and shorting blocks, 36-pin strip | FEC 148-535 and FEC 150-411 |
| REF1 to REF4 | 10-pin (5 \times 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 k Ω , 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 k Ω I ² C 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-AD5321DBZ Daughterboard

| Reference Designator | Description | Supplier/Part Number |
|----------------------|---|----------------------------|
| C1 | 0805 capacitor location | Do not insert |
| C2 | 50 V, X7R, ceramic capacitor | FEC 1759122 |
| C3 | 6.3 V tantalum capacitor (Case A) | FEC 1190107 |
| J1 | 16-pin (2 \times 8) header, inserted from solder side | FEC 2308428 |
| J2 | 10-pin (2 \times 5) straight header, 2.54 mm pitch | FEC 9689583 |
| J3 | 6-pin (1 \times 6) straight header, 2.54 mm pitch | FEC 9689508 |
| J5 | Header, 2.54 mm, PCB, 1 \times 8-way, inserted from solder side | FEC 1766172 |
| LK1 | Jumper block using 3-pin SIP header | FEC 1022248 and FEC 150410 |
| R1 | 0805 resistor location | Do not insert |
| U1 | 12-bit DAC | AD5321BRTZ |
| VOUT | Red test point | Do not insert |

¹ FEC refers to Farnell Electronic Component Distributors.

NOTES

¹²C 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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