

## Evaluation Board for the **AD5322** 12-Bit, Dual-Channel, Voltage Output DAC

### FEATURES

Full featured evaluation board in conjunction with  
**nanoDAC®** 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-AD5322DBZ** evaluation board  
**EVAL-MBnanoDAC-SDZ** motherboard

### SOFTWARE NEEDED

**EVAL-AD5322DBZ** evaluation software

### HARDWARE NEEDED

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

### DOCUMENTS NEEDED

Electronic version of the **AD5322** data sheet  
 Electronic version of the **EVAL-AD5322DBZ** user guide

### GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the **AD5322** dual-channel, voltage output, digital-to-analog converter (DAC).

The evaluation board is designed to help users quickly prototype new **AD5322** circuits and reduce design time. The **AD5322** operates from a single 2.5 V to 5.5 V supply.

For full data, see the **AD5322** 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-AD5322DBZ** evaluation board page to allow the user to program the **AD5322**.

### **EVAL-AD5322DBZ, 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-AD5322DBZ](#) evaluation board can be powered either from the SDP port or externally by the J5 and J6 connectors, as described in Table 1.

Both the 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  $\mu$ F tantalum and 0.1  $\mu$ F ceramic capacitors.

**Table 1. Power Supply Connectors**

| Connector No.    | Label  | Voltage                                                                      |
|------------------|--------|------------------------------------------------------------------------------|
| J5, Pin 1 (J5-1) | VDD    | Analog positive power supply, $V_{DD}$ . Single supply 5 V, dual supply 5 V. |
| J5, Pin 2 (J5-2) | AGND   | Analog ground.                                                               |
| J5, Pin 3 (J5-3) | VSS    | Analog negative power supply, $V_{SS}$ . Dual supply $-5$ 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.                                                              |

**Table 3. Link Functions**

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

### 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 3. The positions listed in Table 2 and Table 3 match the evaluation board imprints (see Figure 12).

**Table 2. Link Options Setup for [SDP-B](#) Control (Default)**

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

## EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

### INSTALLING THE SOFTWARE

The [EVAL-AD5322DBZ](#) 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-AD5322DBZ](#) 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 [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, take the following steps:

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, AD5322 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 [AD5322](#) evaluation software then opens, as shown in Figure 4.

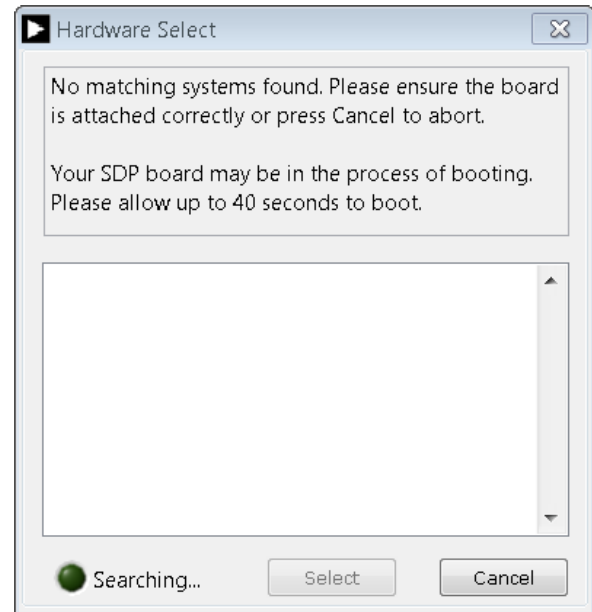


Figure 2. Connectivity Error

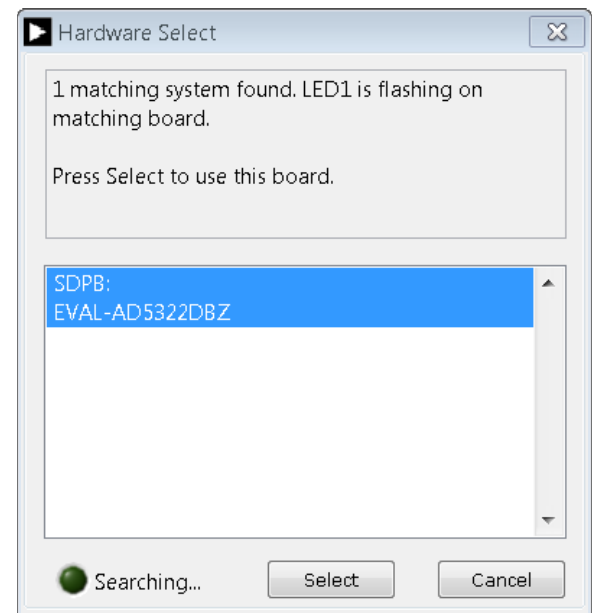


Figure 3. Hardware Select

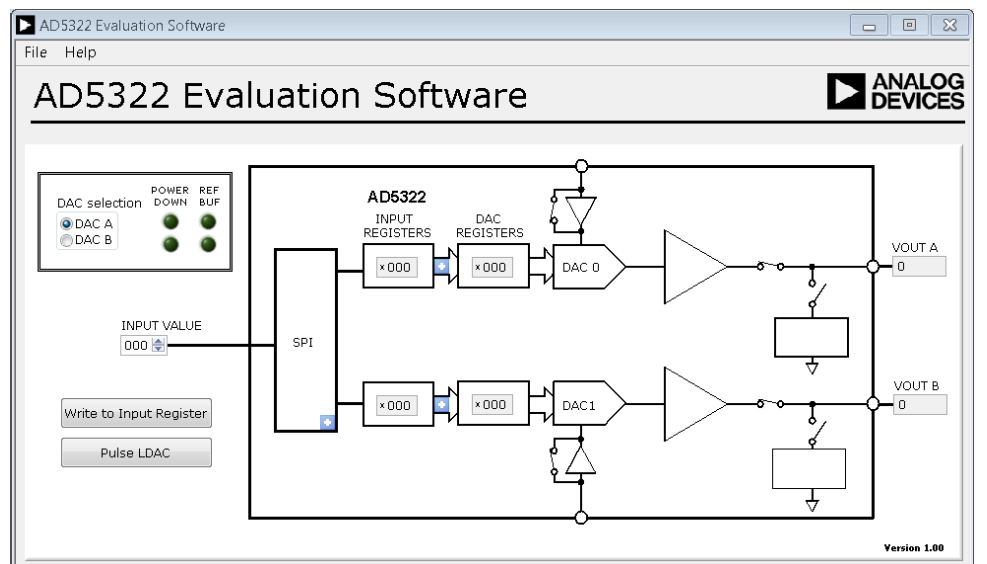


Figure 4. AD5322 Evaluation Software Main Window

## SOFTWARE OPERATION

The software for the AD5322 allows the user to program values to the input and DAC registers of each DAC individually.

### Write to Input Register

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

### LDAC Control

Click **Pulse LDAC** to bring the LDAC pin low and then back high. Doing this copies the data from the input registers to the DAC registers, and the outputs update accordingly.

Click the blue progressive disclosure option on the **SPI** block, and click the appropriate radio option to set the LDAC pin high or low. A dialog box appears that allows the user to select the LDAC setting, as shown in Figure 5.

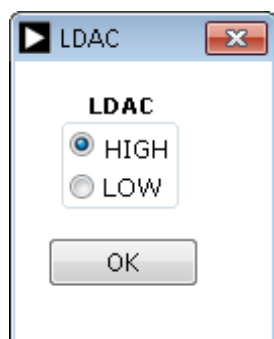


Figure 5. LDAC Selection Box in the LDAC Window

### Power-Down Control

Each of the DACs can be powered down individually. Each DAC has an associated selection box allowing the DAC to operate in normal mode or three different power-down modes. Click the blue progressive disclosure option to access the selection box shown in

Figure 6. When the power-down setting for the selected DAC is set, click **OK** to write the appropriate values to the AD5322.

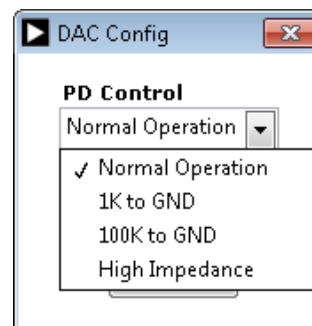


Figure 6. PD Control Dropdown Menu in the DAC Config Window

### Buffer Control

The reference of each DAC can be buffered individually. Each DAC has an associated selection box allowing the reference to be buffered or unbuffered. Click the blue progressive disclosure option to access the selection box shown in Figure 7. When the buffer setting for the selected DAC is set, click **OK** to write the appropriate values to the AD5322.

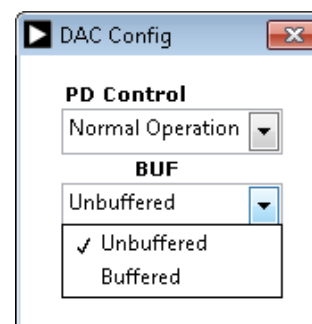


Figure 7. BUF Dropdown Menu in the DAC Config Window

## EVALUATION BOARD SCHEMATICS AND ARTWORK

## EVAL-MBnanoDAC-SDZ MOTHERBOARD

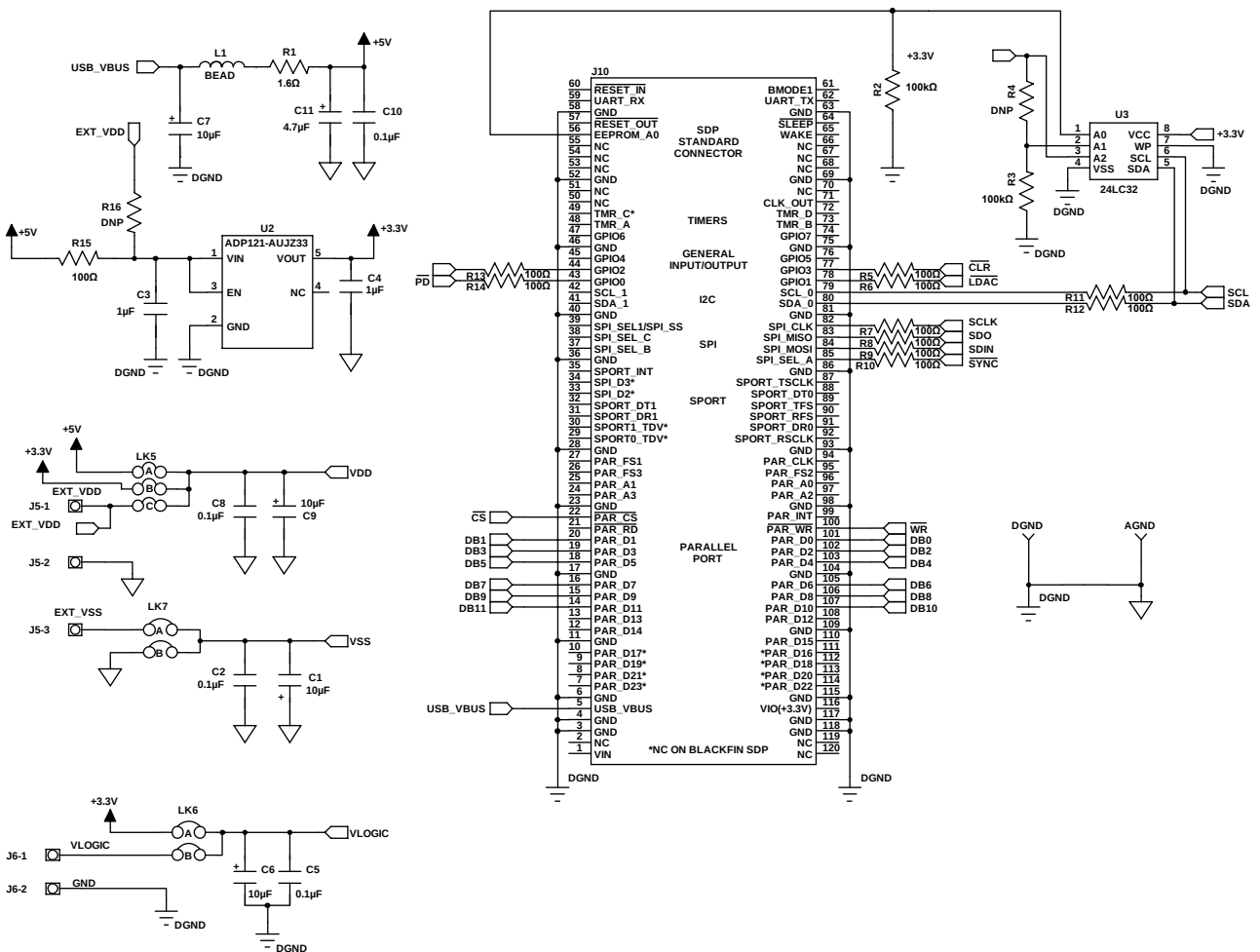


Figure 8. EVAL-MBnanoDAC-SDZ Motherboard SDB Connector and Power Supply

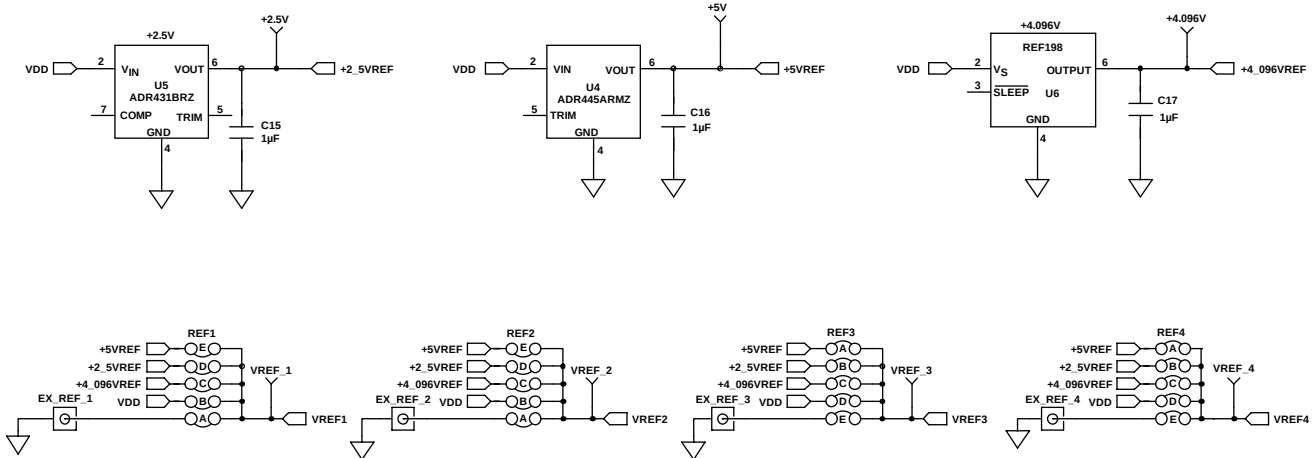


Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

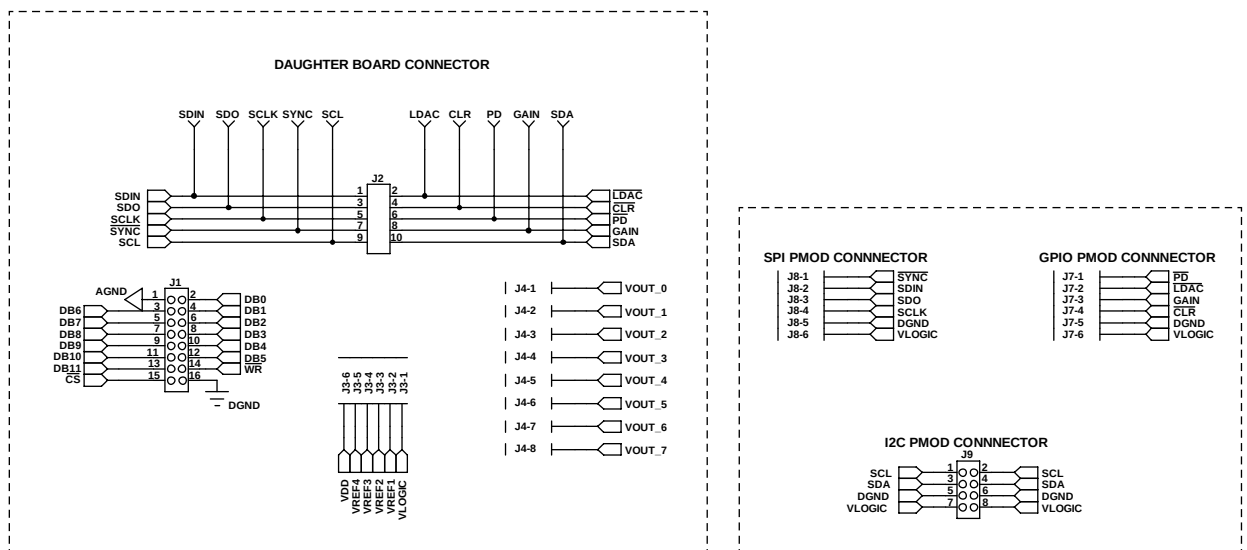


Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

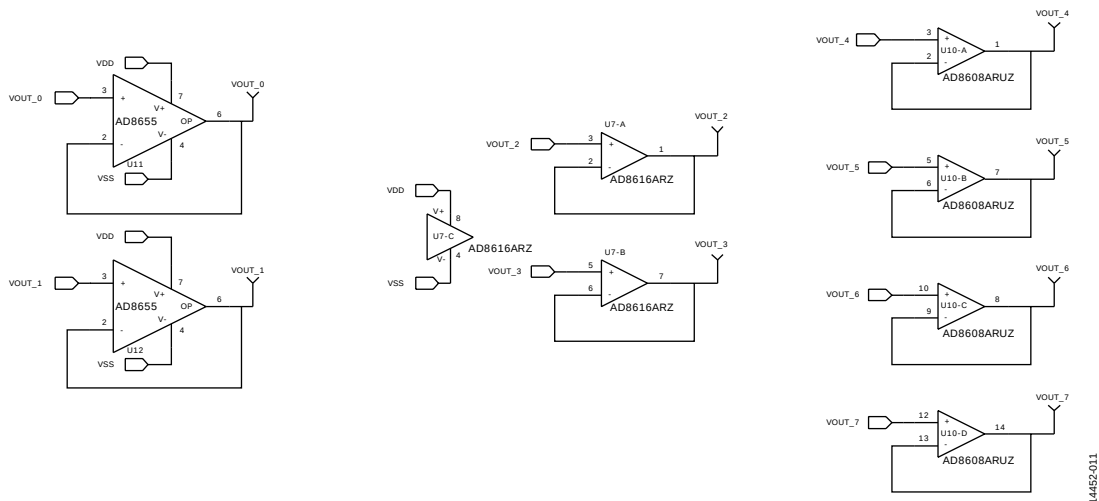


Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

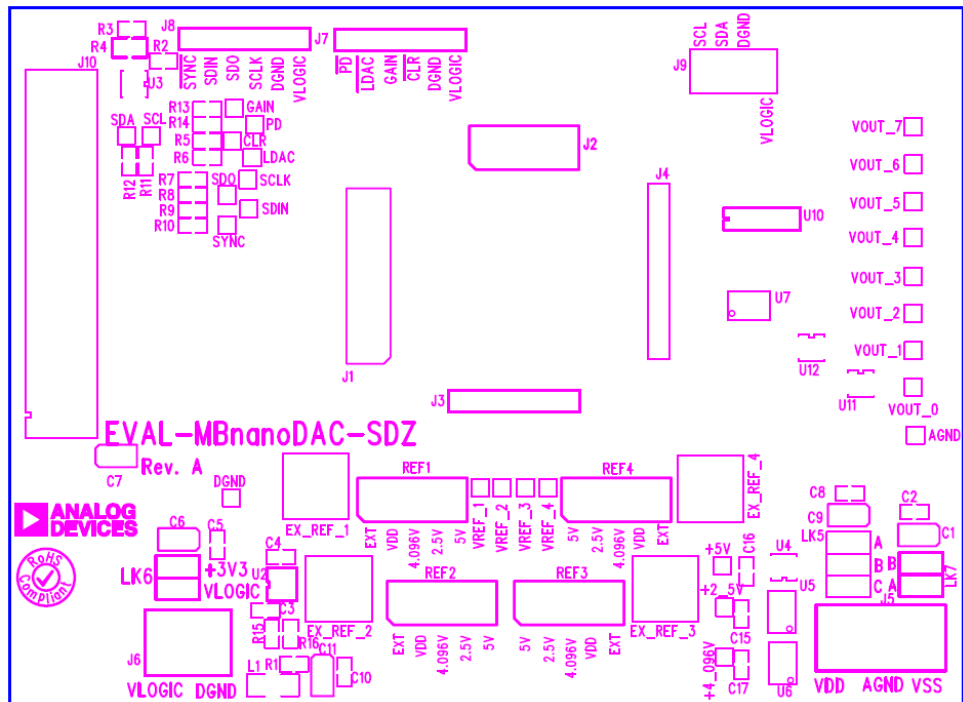


Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

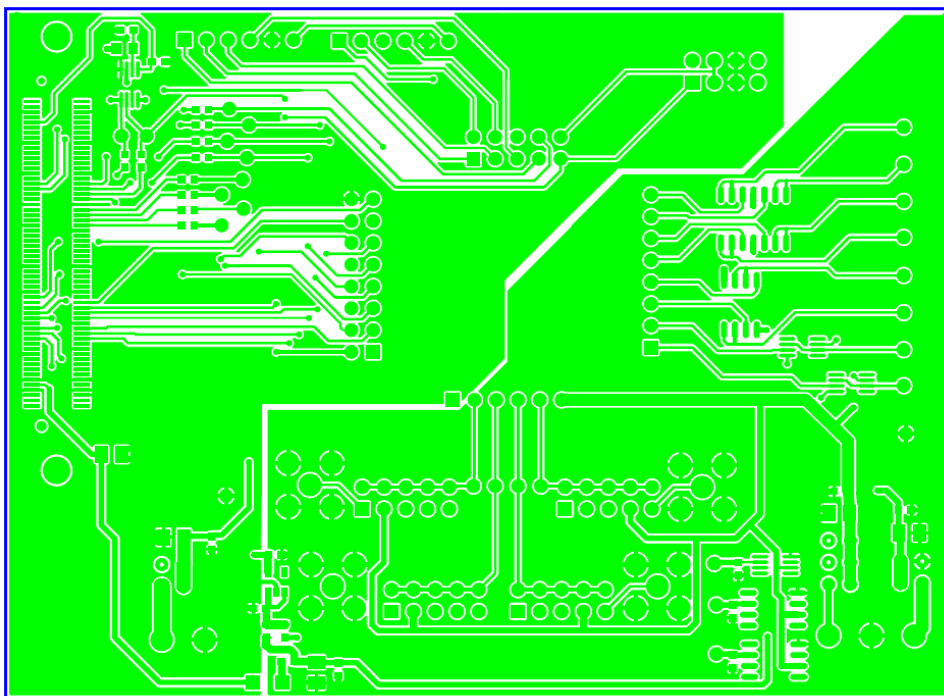


Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing



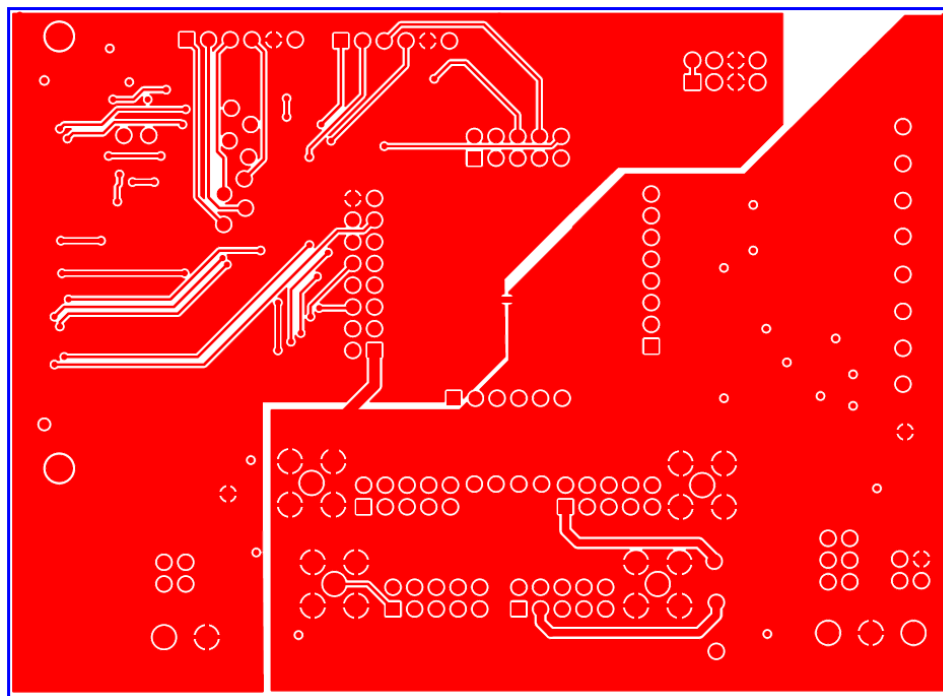


Figure 14. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

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## EVAL-AD5322DBZ DAUGHTER BOARD

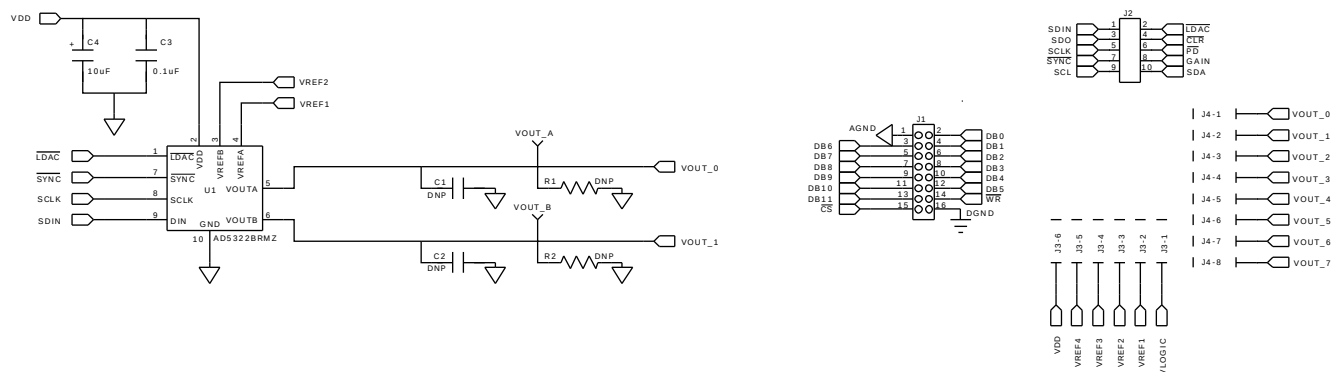


Figure 15. EVAL-AD5322DBZ Daughter Board Schematics

14452-015

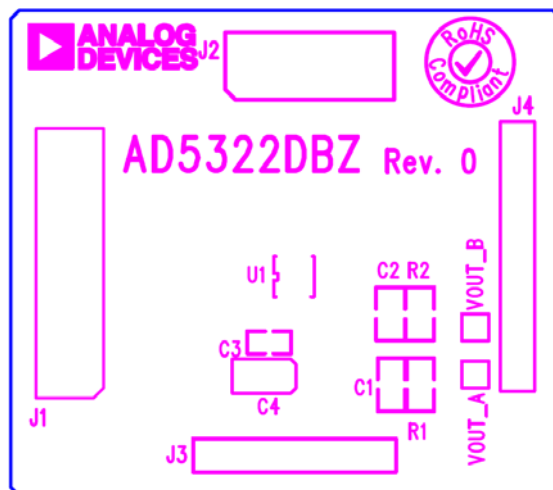


Figure 16. EVAL-AD5322DBZ Daughter Board Component Placement

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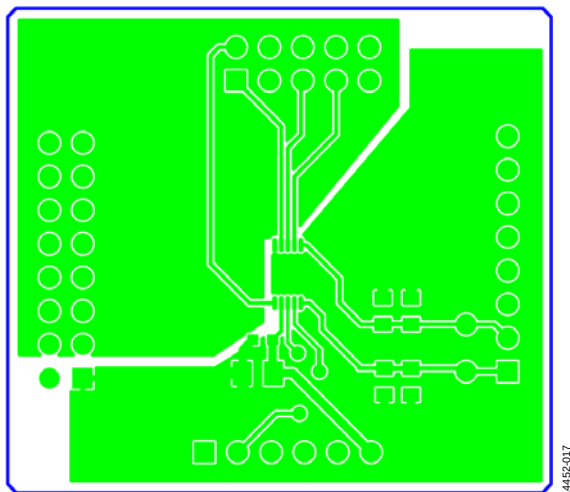


Figure 17. EVAL-AD5322DBZ Daughter Board Top Side Routing

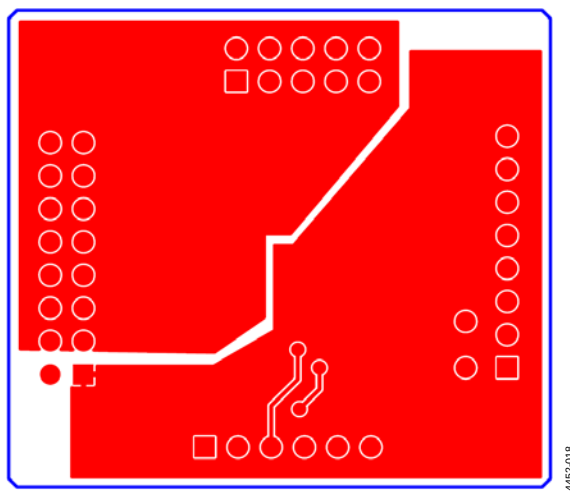


Figure 18. EVAL-AD5322DBZ Daughter Board Bottom Side Routing

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 4. **EVAL-MBnanoDAC-SDZ** Motherboard

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

<sup>1</sup> FEC refers to Farnell Electronic Component Distributors.

<sup>2</sup> GRM refers to Murata Manufacturing Company.

Table 5. **EVAL-AD5322DBZ** Daughter Board

| Qty | Reference Designator | Description                                          | Supplier/Part Number <sup>1</sup>          |
|-----|----------------------|------------------------------------------------------|--------------------------------------------|
| 2   | C1, C2               | Not applicable                                       | Not inserted                               |
| 1   | C3                   | 50 V, X7R, ceramic capacitor                         | FEC/1759122                                |
| 1   | C4                   | 6.3 V, tantalum capacitor (Case A)                   | FEC/1190107                                |
| 1   | J1                   | 16-pin (2 $\times$ 8) header                         | FEC/2308428 inserted from solder side      |
| 1   | J2                   | 10-pin (2 $\times$ 5) straight header, 2.54 mm pitch | FEC/9689583 inserted from solder side      |
| 1   | J3                   | 6-pin (1 $\times$ 6) straight header, 2.54 mm pitch  | FEC/9689508 inserted from solder side      |
| 1   | J4                   | Header, 2.54 mm, PCB, 1 $\times$ 8-way               | FEC/1766172 inserted from solder side      |
| 1   | R1, R2               | Not applicable                                       | Not inserted                               |
| 1   | U1                   | 12-bit DAC                                           | Analog Devices/ <a href="#">AD5322BRMZ</a> |
| 1   | VOUT_A               | Red test point                                       | FEC/8731144 (pack)                         |
| 1   | VOUT_B               | Red test point                                       | FEC/8731144 (pack)                         |

<sup>1</sup> FEC refers to Farnell Electronic Component Distributors.

## NOTES

I<sup>2</sup>C 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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