

Evaluation Board for the **AD5326** 12-Bit, Quad Channel, Voltage Output Digital-to-Analog Converter (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-AD5326DBZ evaluation board

EVAL-MBnanoDAC-SDZ motherboard

SOFTWARE REQUIRED

EVAL-AD5326DBZ evaluation software

HARDWARE REQUIRED

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

GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the **AD5326** quad channel, voltage output DAC.

The evaluation board is designed to help users quickly prototype new **AD5326** circuits and reduce design time. The **AD5326** operates from a single 2.5 V to 5.5 V supply.

Full data is available in the **AD5326** 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** controller board (**EVAL-SDP-CB1Z**). Software is supplied with the evaluation board to allow the user to program the **AD5326**.

This evaluation board requires **SDP-B** controller board (**EVAL-SDP-CB1Z**), which is available for order on the Analog Devices website at www.analog.com.

EVAL-AD5326DBZ, EVAL-MBnanoDAC-SDZ, AND SDP-B BOARDS

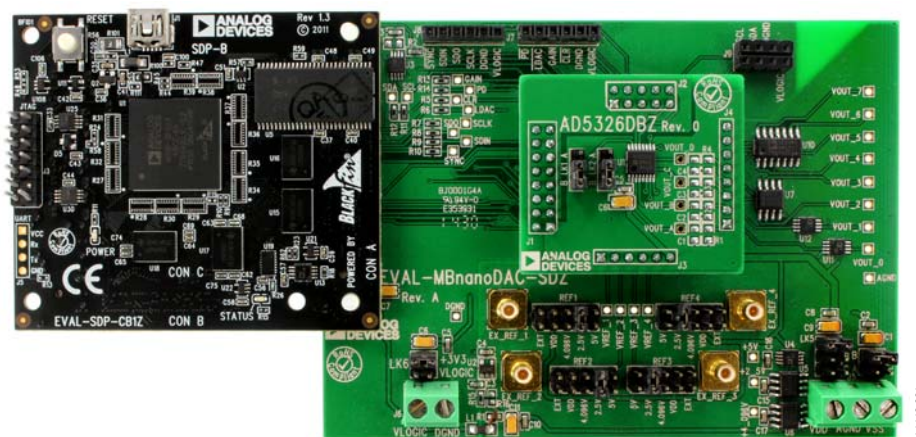


Figure 1.

TABLE OF CONTENTS

Features	1	Daughter Board Link Options.....	3
Package Contents.....	1	Evaluation Board Software Quick Start Procedures.....	4
Software Required	1	Installing the Software	4
Hardware Required	1	Running the Software	4
General Description	1	Software Operation	5
EVAL-AD5326DBZ, EVAL-MBnanoDAC-SDZ, and		Evaluation Board Schematics and Artwork.....	7
SDP-B Boards	1	EVAL-MBnanoDAC-SDZ Motherboard	7
Revision History	2	EVAL-AD5326DBZ Daughter Board	11
Evaluation Board Hardware.....	3	Ordering Information.....	13
Power Supplies	3	Bill of Materials.....	13
Motherboard Link Options.....	3		

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-AD5340DBZ 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 μ F tantalum and 0.1 μ 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 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

Table 4. Link Functions

Link Number	Function
REF1, REF2, REF3, 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 board. Position B selects the internal voltage source, 3.3 V from the ADP121 on the motherboard. Position C selects the external supply voltage, V_{DD} .
LK6	This link selects the V_{LOGIC} 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.

MOTHERBOARD LINK OPTIONS

Various 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 (Default)

Link Number	Position
REF1	2.5V
REF2	EXT
REF3	EXT
REF4	EXT
LK5	C
LK6	+3.3V
LK7	B

DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5340DBZ daughter board has two link options. These links set the least significant bits (LSBs) of the I²C addresses of the DAC. Table 3 describes the function of these links. Set LK1 and LK2 to Position B for proper device operation.

Table 3. Link Options for Daughter Board

Link Number	Label	Position
LK1	A0	B (low, default) A (high)
LK2	A1	B (low, default) A (high)

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

INSTALLING THE SOFTWARE

The [AD5326](#) 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](#) board is recognized when it connects to the PC.

To install the [AD5326](#) evaluation software, take the following steps:

1. Start the Windows operating system.
2. Download the installation software from the [EVAL-AD5326DBZ](#) 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-AD5326DBZ](#) evaluation board to the [SDP-B](#) controller board and connect the [SDP-B](#) board to the PC using the USB cable included in the evaluation kit.
6. When the software detects the [EVAL-AD5326DBZ](#), proceed 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 Power Supplies section.
3. From the **Start** menu, click **All Programs, Analog Devices, AD5326 Evaluation Software**.

If the [SDP-B](#) board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 2). Simply 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 [AD5326](#) evaluation software then opens, as shown in Figure 4.

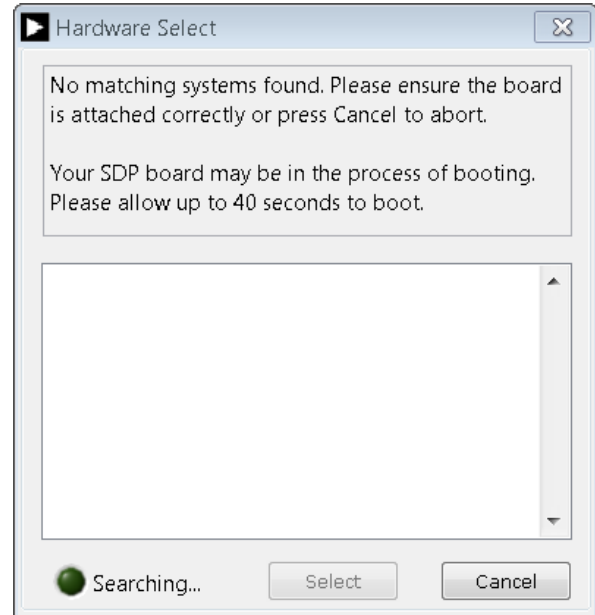


Figure 2. Connectivity Error

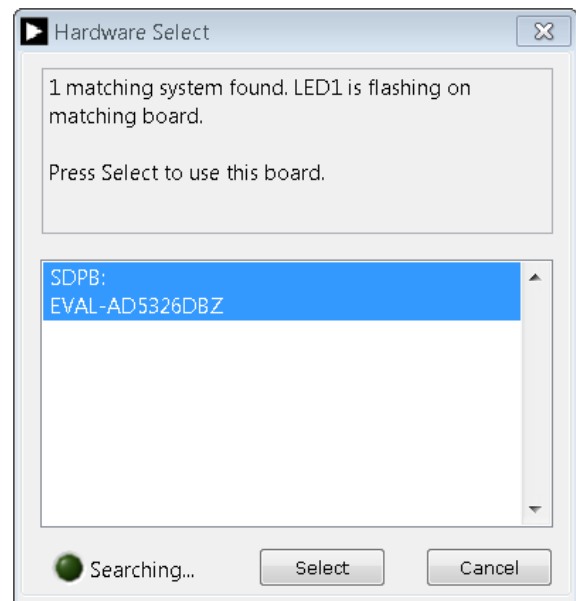


Figure 3. Hardware Select

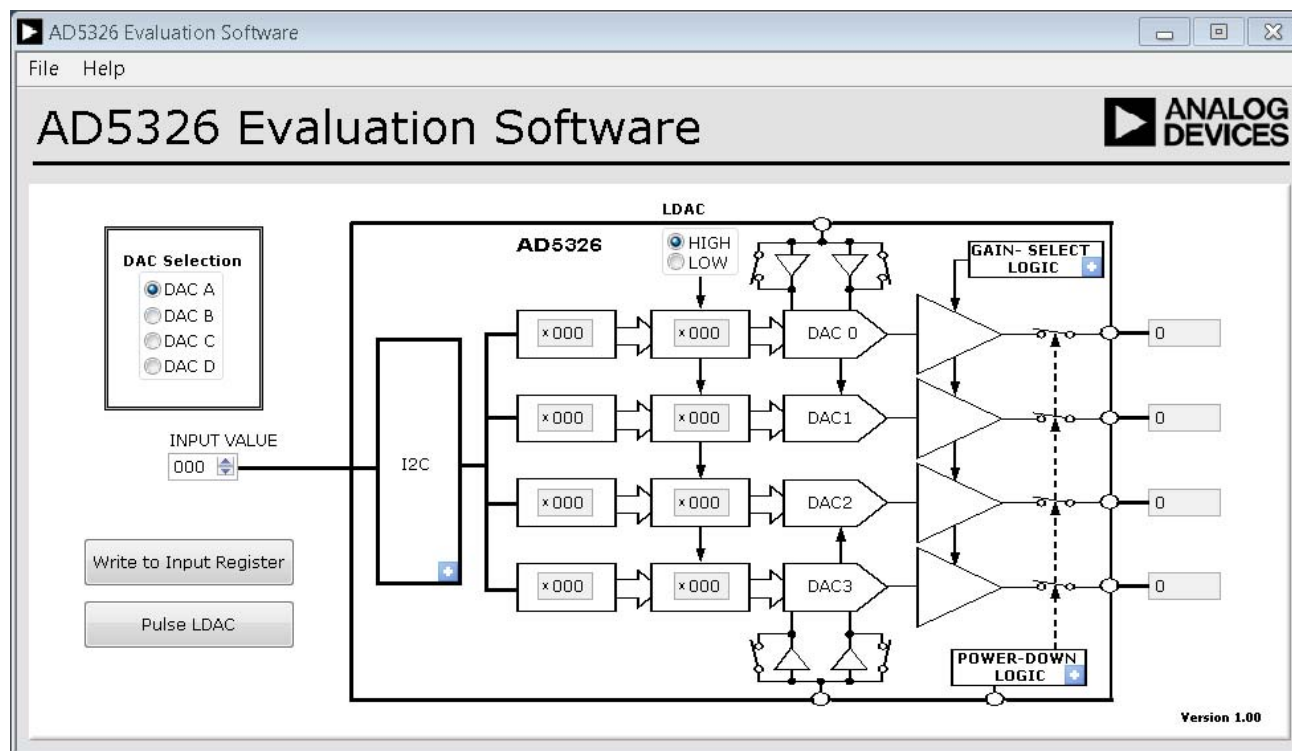


Figure 4. AD5326 Evaluation Board Software Main Window

SOFTWARE OPERATION

The software for the AD5326 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 $\overline{\text{LDAC}}$ pin low and then back to high. Doing this copies the data from the input registers to the DAC registers, and the outputs update accordingly. The $\overline{\text{LDAC}}$ pin can also be set high or low by clicking **HIGH** or **LOW** in the **LDAC** box.

Power-Down Control

All of the DACs can be powered down simultaneously. A selection box allows the device to operate in normal mode or power-down mode. Click the blue progressive disclosure button in the **Power-Down Logic** block to access the **Powerdown Configuration** window, as shown in Figure 5. Click **OK** to write the appropriate values to the AD5326 when the power-down setting for the DAC is selected.

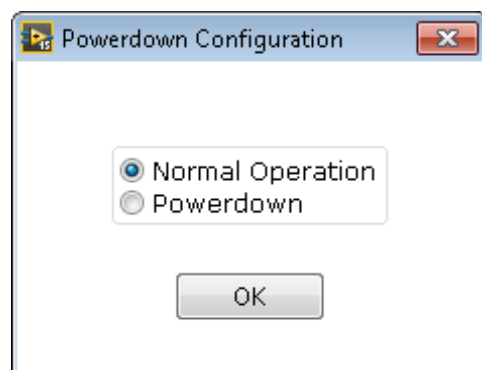


Figure 5. Powerdown Configuration Window

Gain Control

The gain control of each of the DACs can be set individually. Click the blue progressive disclosure button in the **Gain-Select Logic** block to access the **Gain Control** window, as shown in Figure 6. Click **X1** to set a full-scale output of 2.5 V or click **X2** to set a full-scale output of 5 V.

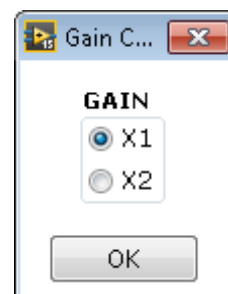


Figure 6. Gain Control Window

Buffer Control

The reference buffer of each of the DACs can be set individually. Click the blue progressive disclosure button in the **I2C** box to access the **Buffer Config** window, as shown in Figure 7. Select the buffer setting and click on **OK** to apply the DAC configuration.

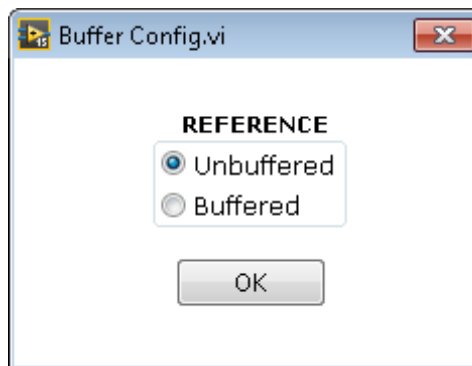


Figure 7. Buffer Configuration Window

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

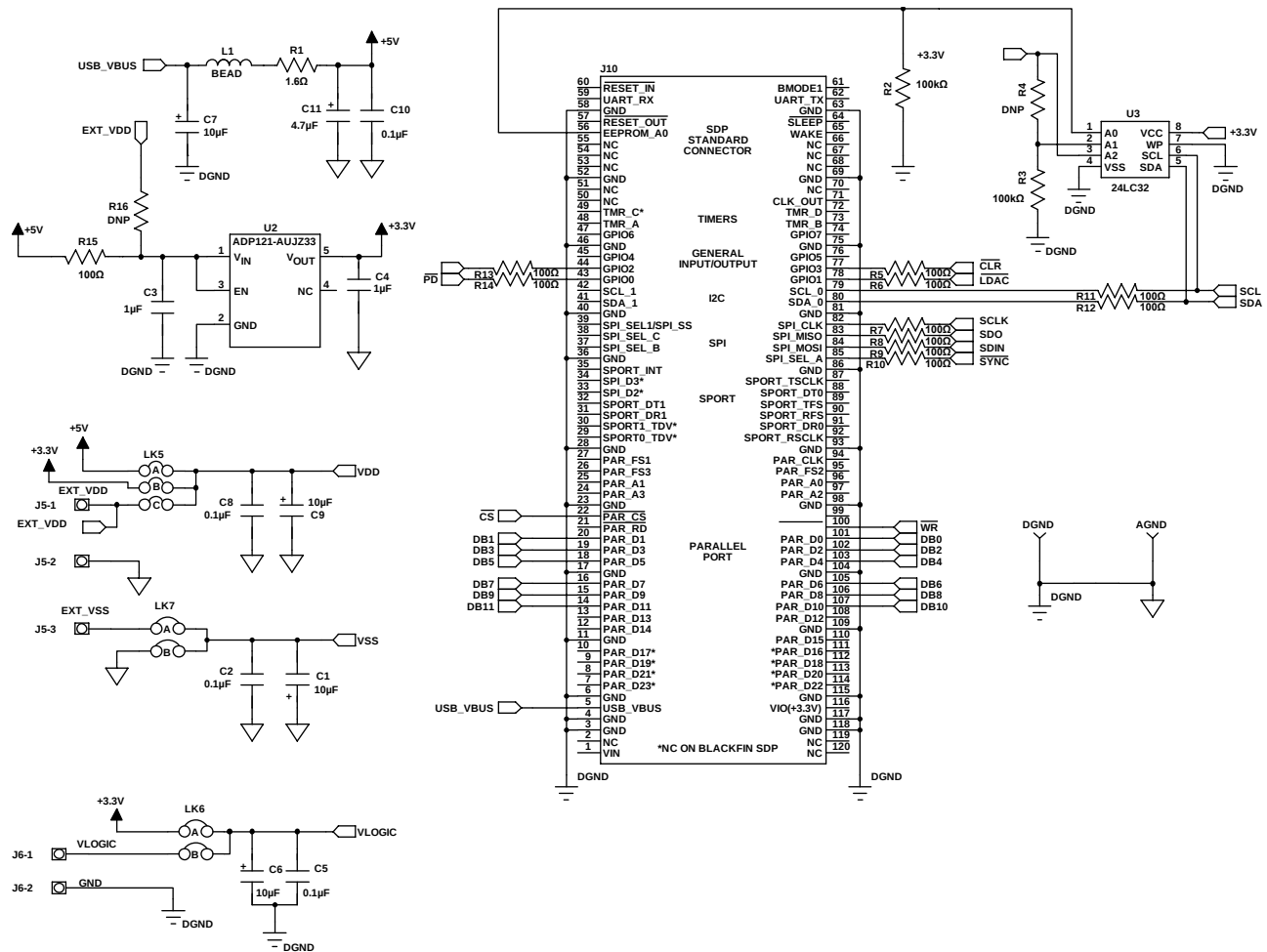


Figure 8. Motherboard SDP-B Connector and Power Supply

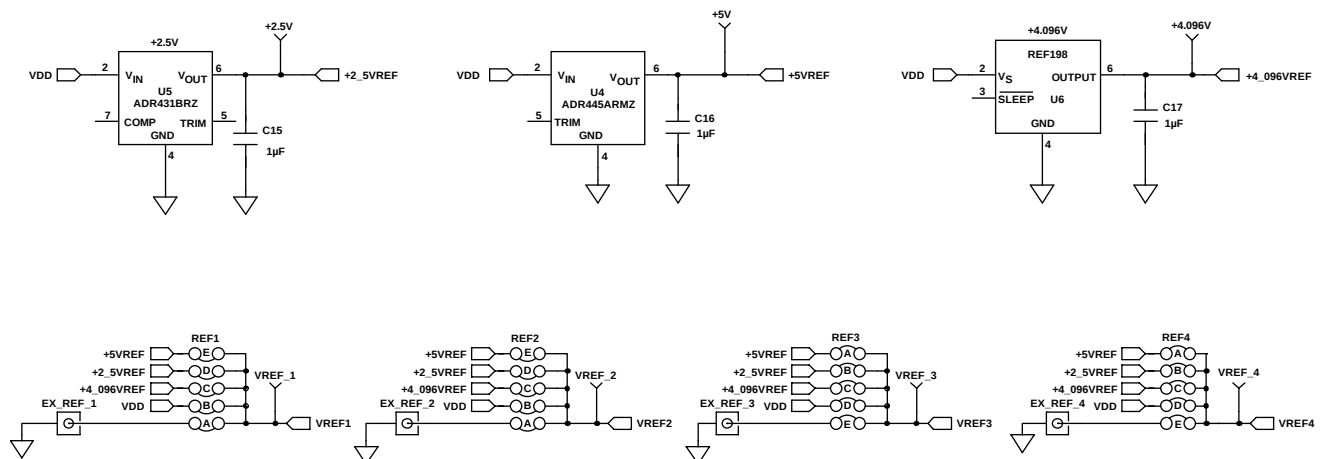


Figure 9. Motherboard Reference Voltage Selector Circuit

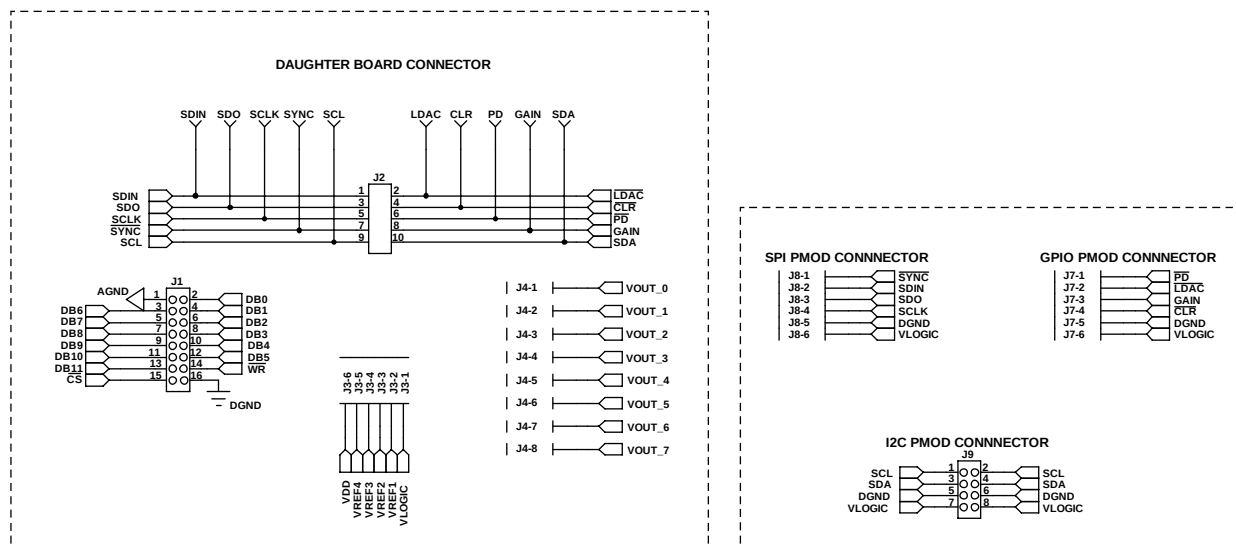


Figure 10. Motherboard Connectors to Daughter Board and Serial Interface

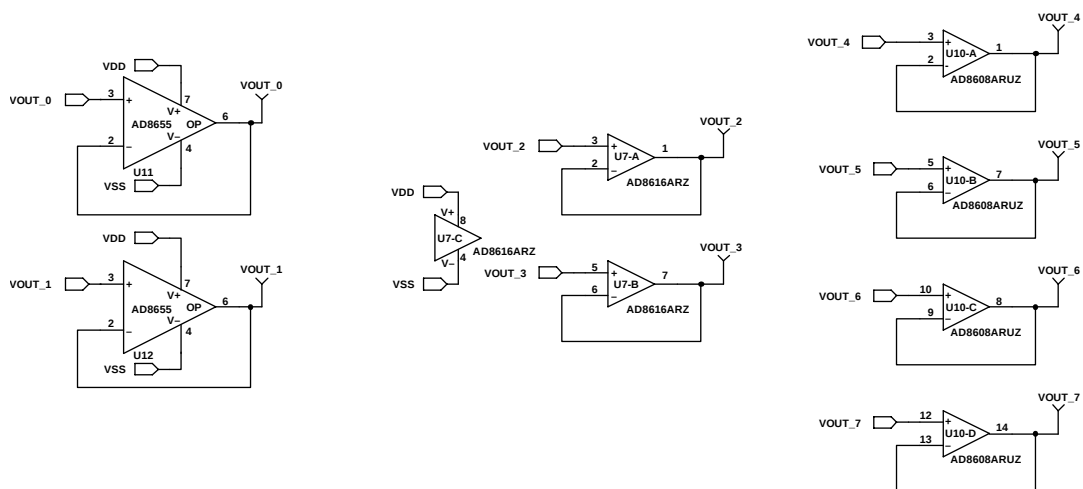


Figure 11. Motherboard Output Amplifier Circuit

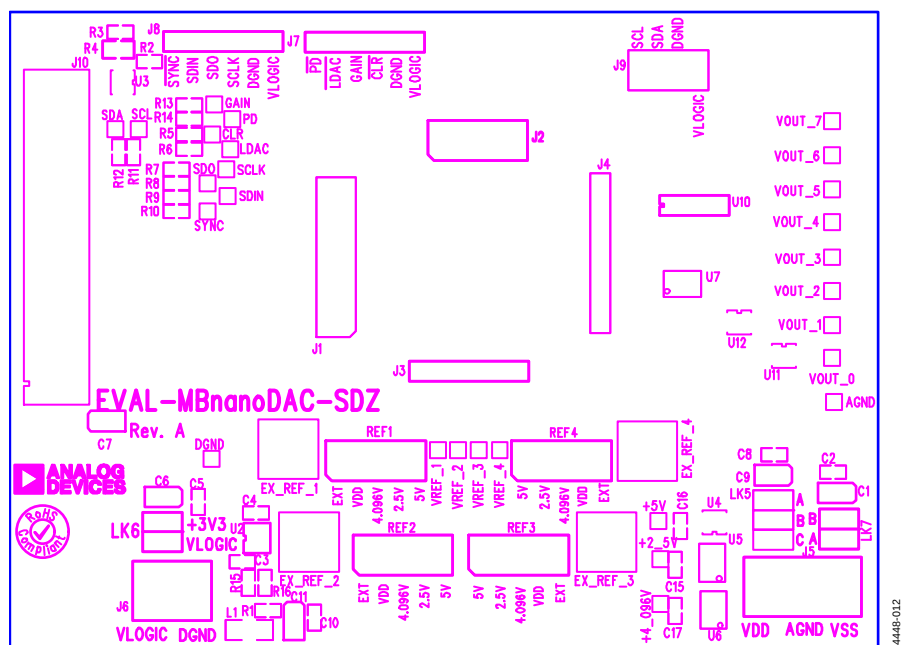


Figure 12. Motherboard Component Placement

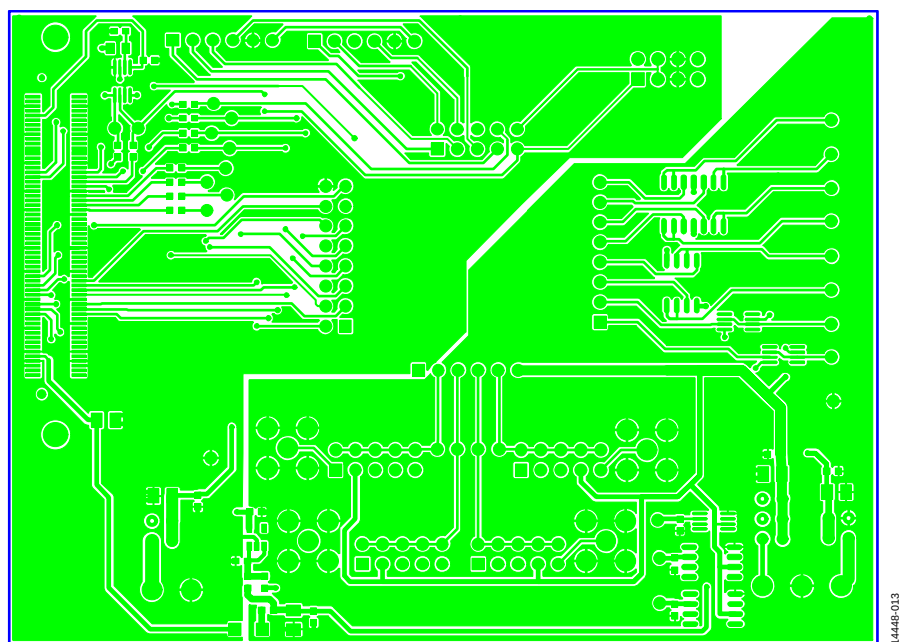


Figure 13. Motherboard Top Side Routing

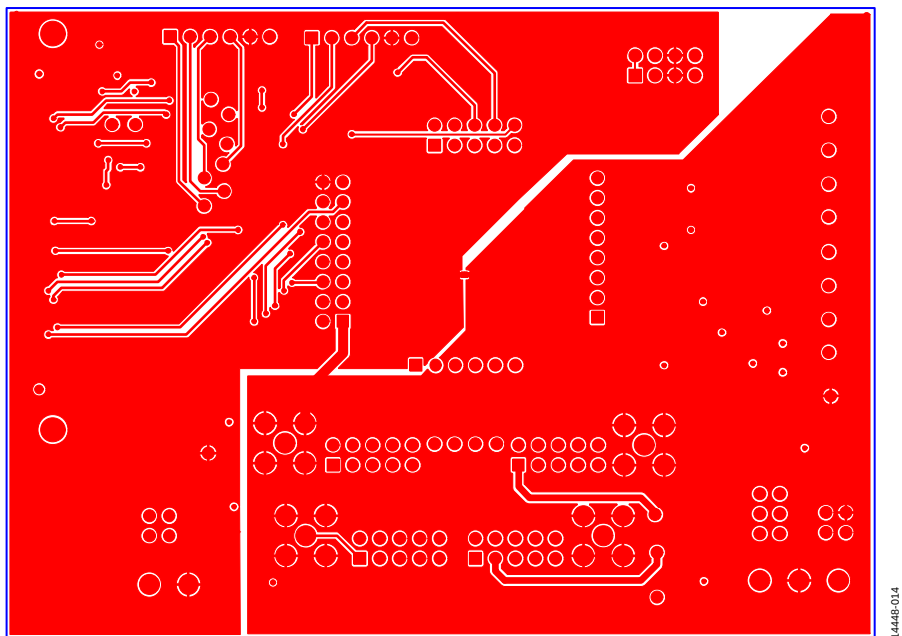


Figure 14. Motherboard Bottom Side Routing

14448-014

EVAL-AD5326DBZ DAUGHTER BOARD

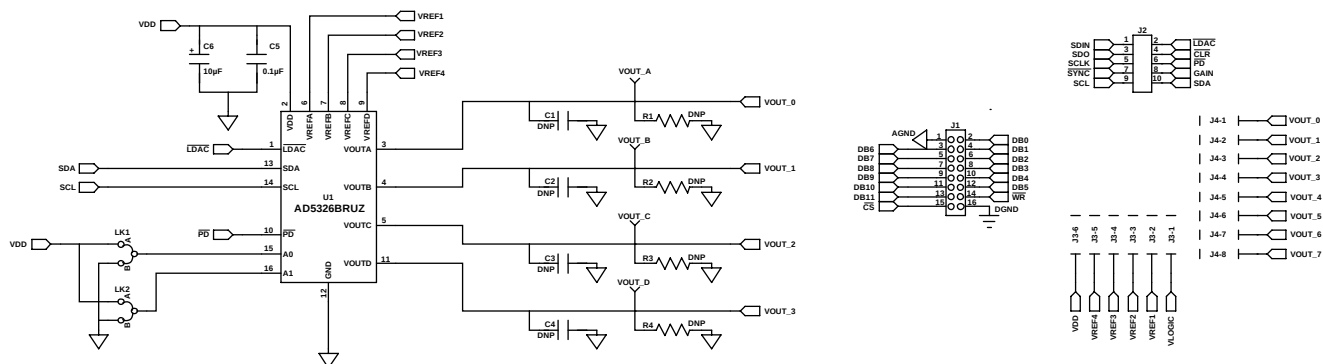


Figure 15. Daughter Board Schematics

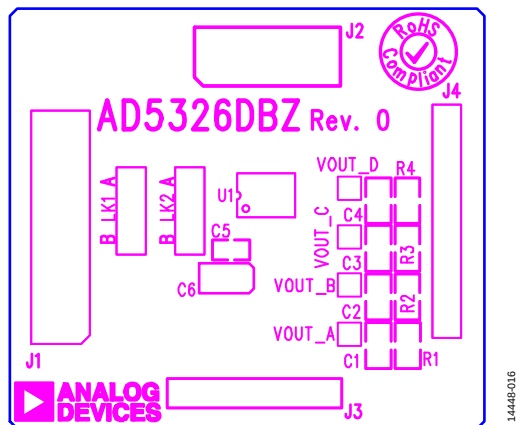


Figure 16. Daughter Board Component Placement

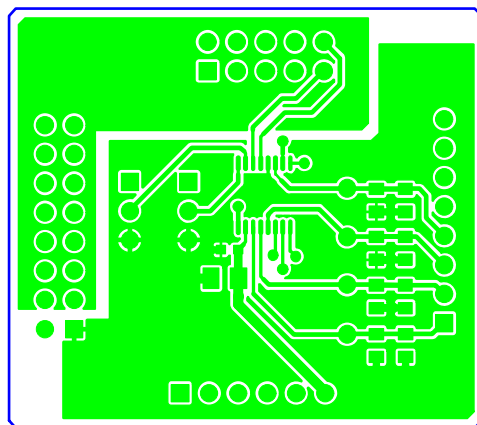


Figure 17. Daughter Board Top Side Routing

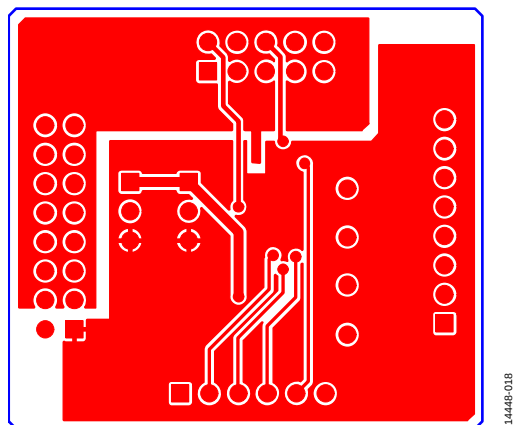


Figure 18. Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. Components List for Motherboard

Qty	Reference Designator	Description	Stock Code/Part Number ^{1, 2}
4	C1, C6, C7, C9	6.3 V, tantalum capacitor (Case A), 10 μ F, $\pm$ 20%	FEC 1190107
7	C2, C5, C8, C10, C15 to C17	50 V, X7R, ceramic capacitor, 0.1 μ F, $\pm$ 10%	FEC 1759122
2	C3, C4	10V, X5R, ceramic capacitor, 1 μ F, $\pm$ 10%	GRM188R61A105KA61D
1	C11	6.3 V, tantalum capacitor (Case A), 4.7 μ F, $\pm$ 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 $\times$ 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 Ω	FEC 9526862
1	LK5	6-pin (3 $\times$ 2), 0.1 inch header and shorting block	FEC 148-535 and 150-411 (36-pin strip)
2	LK6, LK7	4-pin (2 $\times$ 2), 0.1 inch header and shorting block	FEC 148-535 and 150-411 (36-pin strip)
4	REF1, REF2, REF3, REF4	10-pin (5 $\times$ 2), 0.1 inch 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 k Ω , 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 ² C serial EEPROM	FEC 1331330
1	U4	5 V reference, 8-lead 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 electronic component distributors.

Table 6. Components List for Daughter Board

Qty	Reference Designator	Description	Stock Code/Part Number ¹
1	C1	Not applicable	Not inserted
1	C2	Not applicable	Not inserted
1	C3	Not applicable	Not inserted
1	C4	Not applicable	Not inserted
1	C5	50 V, X7R, ceramic capacitor, 0.1 μ F, $\pm$ 10%	FEC 1759122
1	C6	6.3 V, tantalum capacitor (Case A), 10 μ F, $\pm$ 20%	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
2	LK1, LK2	Jumper block using 3-pin, single in-line header	FEC 1022248 and 150410
1	R1	Not applicable	Not inserted
1	R2	Not applicable	Not inserted
1	R3	Not applicable	Not inserted
1	R4	Not applicable	Not inserted
1	U1	DAC	Analog Devices AD5326BRUZ
1	VOUT_A	Red test point	Do not insert
1	VOUT_B	Red test point	Do not insert
1	VOUT_C	Red test point	Do not insert
1	VOUT_D	Red test point	Do not insert

¹ FEC refers to Farnell electronic component distributors

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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.