ANALOG DEVICES

EVAL-AD5664RDBZ User Guide
UG-986

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Evaluating the AD5664R 16-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-AD5664RDBZ daughter board
- EVAL-MBnanoDAC-SDZ motherboard

SOFTWARE REQUIRED

- EVAL-AD5664RDBZ 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 AD5664R quad-channel, voltage output digital-to-analog converter (DAC).

The EVAL-AD5664RDBZ evaluation board helps users quickly prototype new AD5664R circuits and reduce design time. The AD5664R operates from a single 2.7 V to 5.5 V supply.

For full data, see the AD5664R data sheet, which must be used in conjunction with this user guide when using the EVAL-AD5664RDBZ evaluation board.

The EVAL-AD5664RDBZ evaluation board interfaces to the USB port of a PC via the SDP-B controller board. Software that allows users to program the AD5664R can be downloaded via the EVAL-AD5664RDBZ product page.

The EVAL-AD5664RDBZ evaluation board requires the EVAL-SDP-CB1Z board (SDP-B controller board).

EVAL-AD5664RDBZ, EVAL-MBnanoDAC-SDZ, AND EVAL-SDP-CB1Z BOARDS

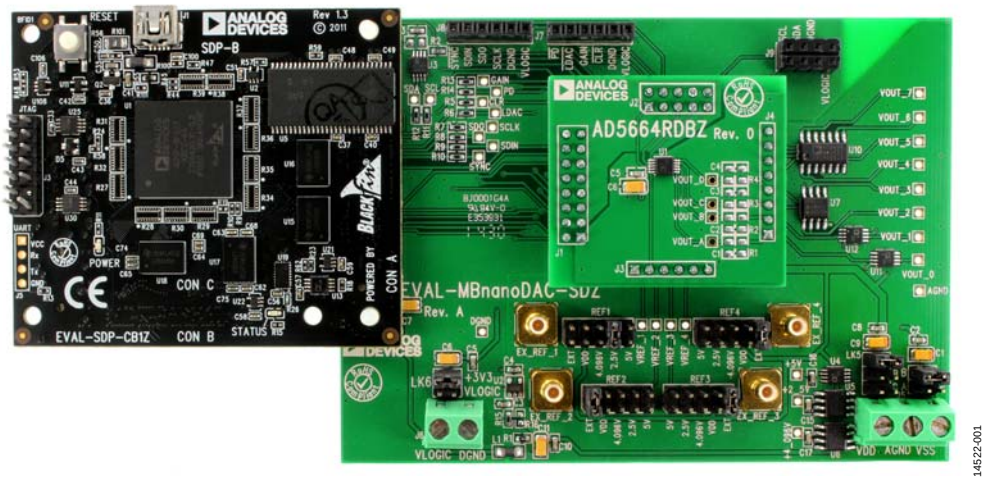

Figure 1.

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REVISION HISTORY

3/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The EVAL-AD5664RDBZ evaluation board can be powered either from the SDP-B port or externally by the J5 and J6 connectors, as described in Table 1.

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

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
J5-1	VDD	Analog positive power supply, V_{DD}; 5.5 V single and dual supply
J5-2	AGND	Analog ground
J5-3	VSS	Analog negative power supply, V_{SS}; −5.5 V dual supply
J6-1	VLOGIC	Digital supply from 1.8 V to V_{DD}
J6-2	DGND	Digital ground

LINK OPTIONS

Various link options are incorporated in the EVAL-MBnanoDAC-SDZ and must be set for the required operating conditions before using the EVAL-AD5664RDBZ 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 11).

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	+3V3
LK7	B

Table 3. 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 +3V3 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-AD5664RDBZ 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.

1. Start the Windows operating system. Download the installation software from the EVAL-AD5664RDBZ evaluation board page at www.analog.com/EVAL-AD5664R.
1. Run the **setup.exe** file from the installer folder if it does not open automatically.
2. Power up the EVAL-AD5664RDBZ evaluation board as described in the Power Supplies section after installation is completed.
3. Connect the EVAL-AD5664RDBZ evaluation board to the SDP-B board and the SDP-B board to the PC using the USB cable included in the box.
4. Proceed through any dialog boxes that appear to finalize the installation when the software detects the EVAL-AD5664RDBZ evaluation board.

RUNNING THE SOFTWARE

To run the program, complete the following steps:

1. Connect the EVAL-AD5664RDBZ 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. Click **Start > All Programs > Analog Devices > AD5664R 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 AD5664R evaluation software then opens, as shown in Figure 4.

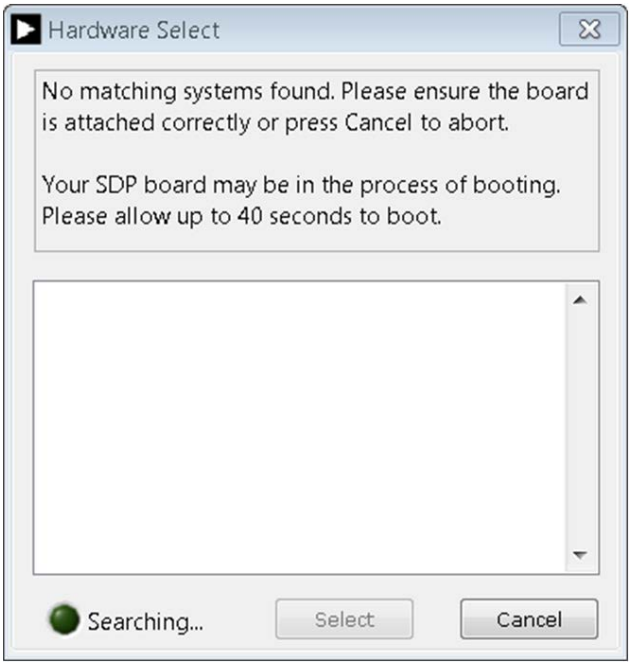

Figure 2. Connectivity Error

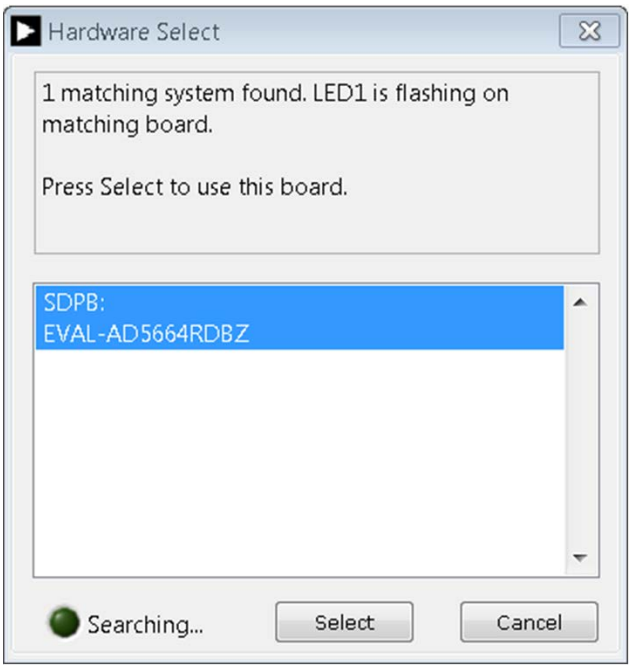

Figure 3. Hardware Select

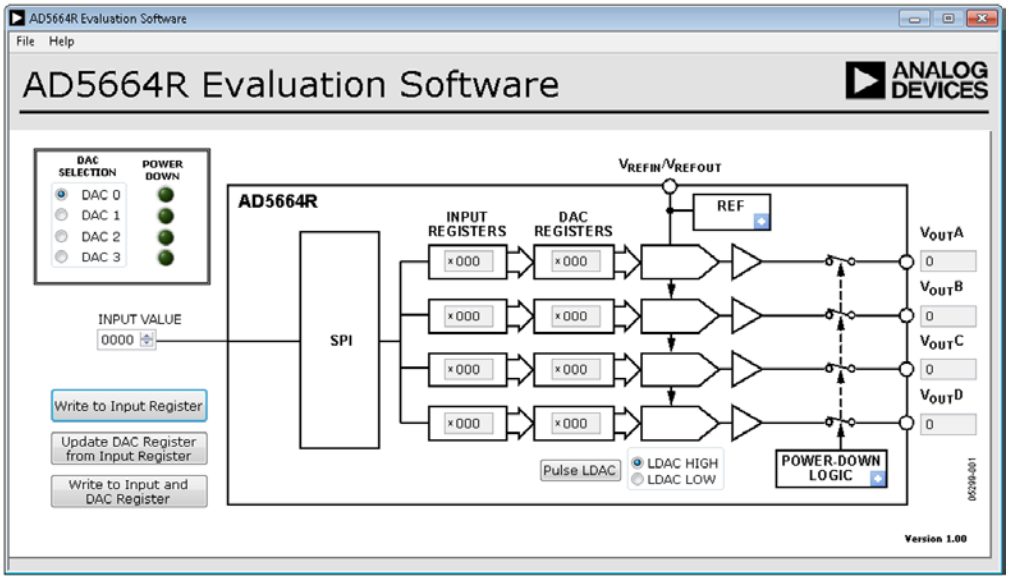

Figure 4. AD5664R Evaluation Board Software Main Window

SOFTWARE OPERATION

The software for the AD5664R 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 the 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. DAC outputs are automatically updated with the appropriate voltage.

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.

LDAC Control

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

The LDAC register can also be set high or low by clicking the appropriate radio button.

Power-Down Control

All of the DACs can be powered down simultaneously. The DACs have a selection box allowing the device to operate in normal mode or three different power-down modes. Click the blue progressive disclosure button on the **POWER-DOWN LOGIC** block to access the selection box. A window opens that allows the user to select the appropriate setting for the DAC. A drop down box allows the user to select the termination at the output of the selected DAC, as shown in Figure 5.Click **OK** to write the appropriate values to the AD5664R.

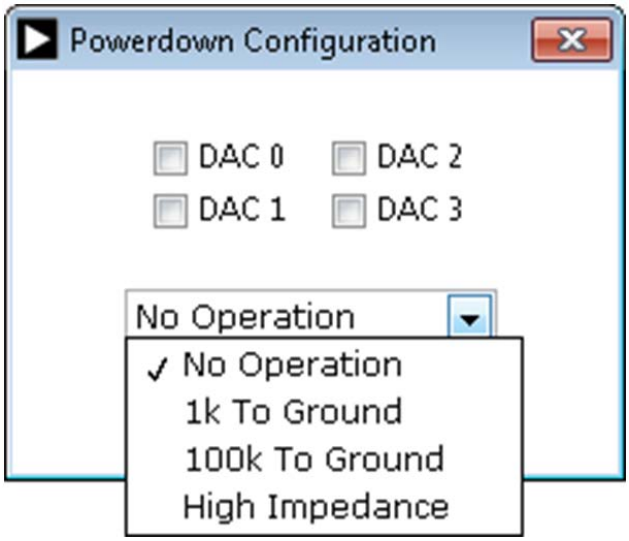

*Figure 5. **Powerdown Configuration** Window*

Reference Control

The DAC references can be set to operate as internal or external. Click the blue progressive disclosure button on the **REF** block to access the control options. A window opens that allows the user to click either an external or internal reference for the DAC, as shown in Figure 6. Click **Confirm** to write the appropriate values to the AD5664R.

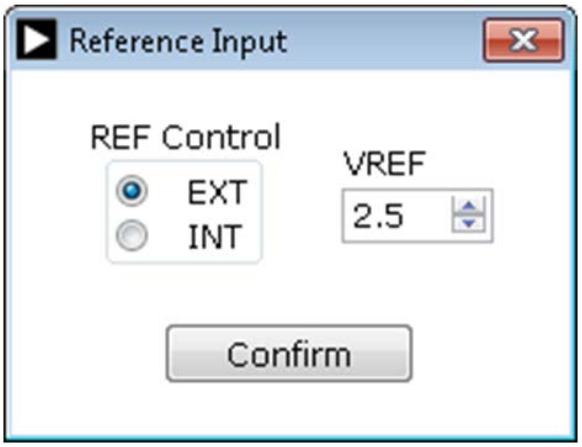

*Figure 6. **Reference Input** Window*

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBNANODAC-SDZ MOTHERBOARD

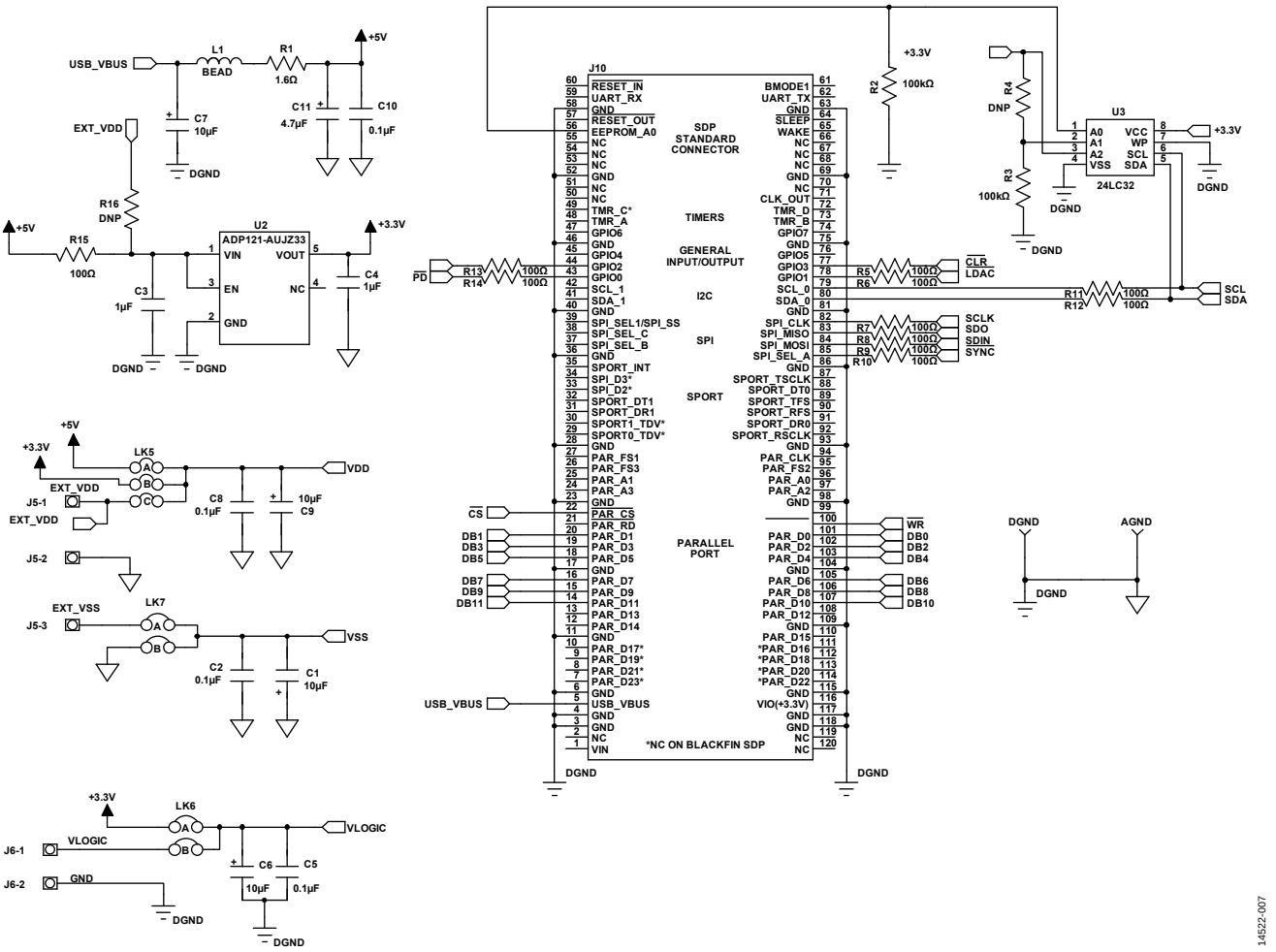

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Figure 7. EVAL-MBnanoDAC-SDZ Motherboard SDP-B Connector and Power Supply

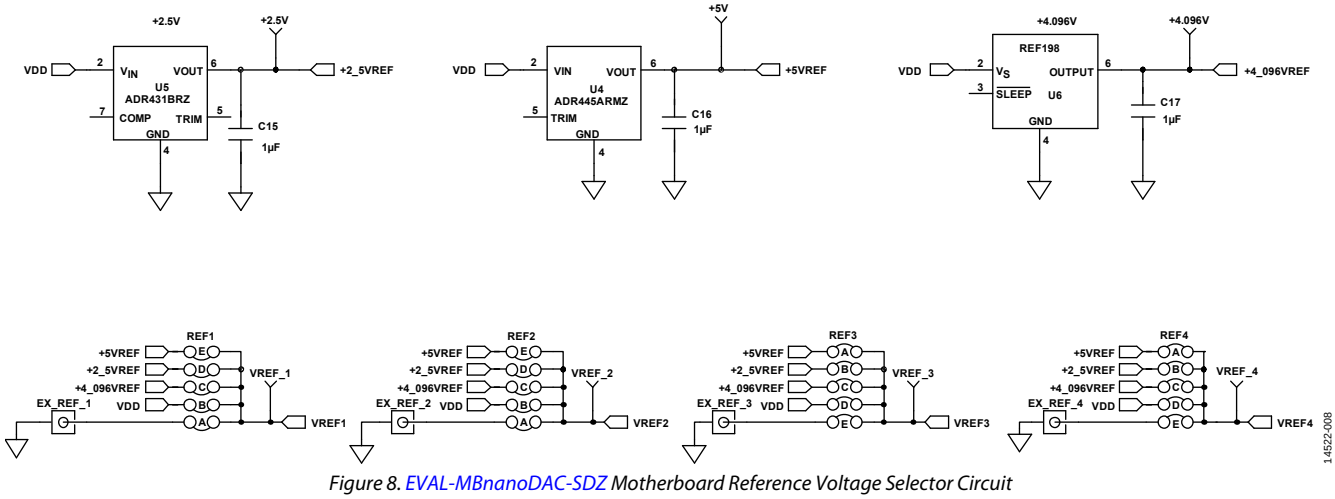

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Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

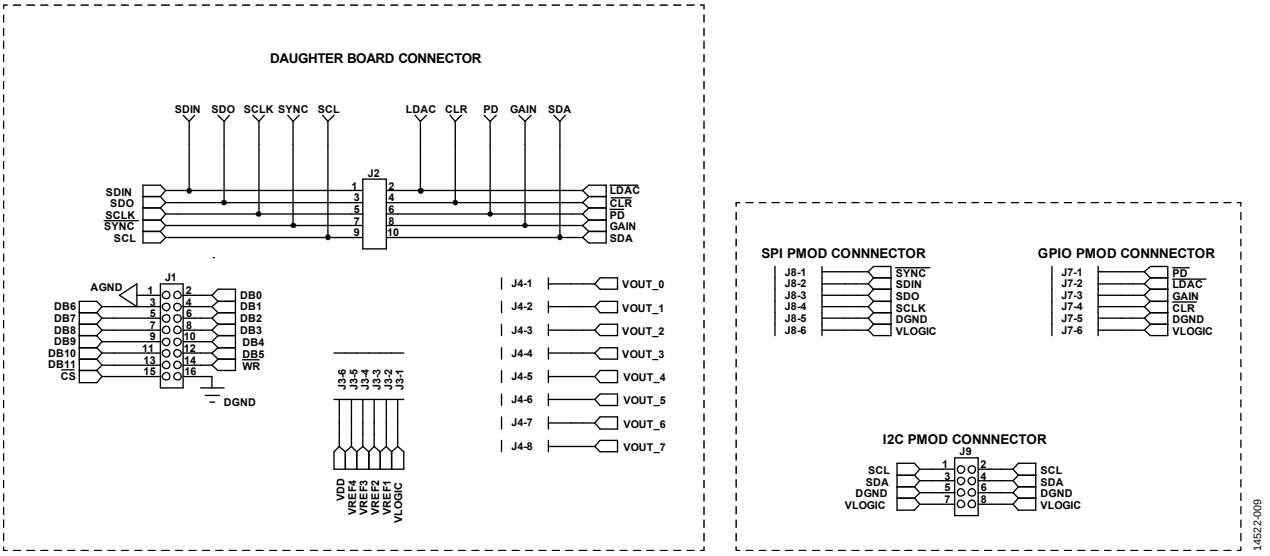

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Connectors to EVAL-AD5664RDBZ Daughter Board and Serial Interface

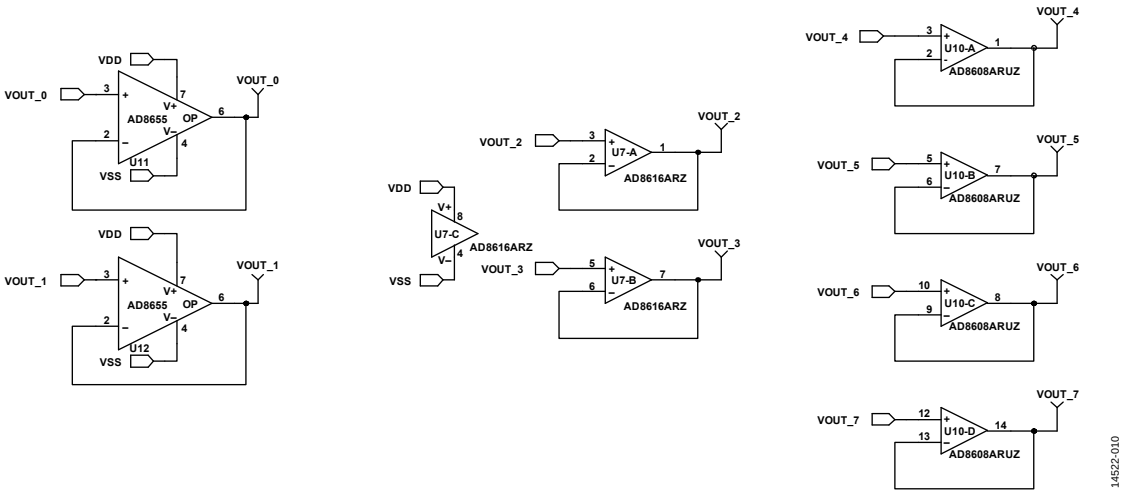

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

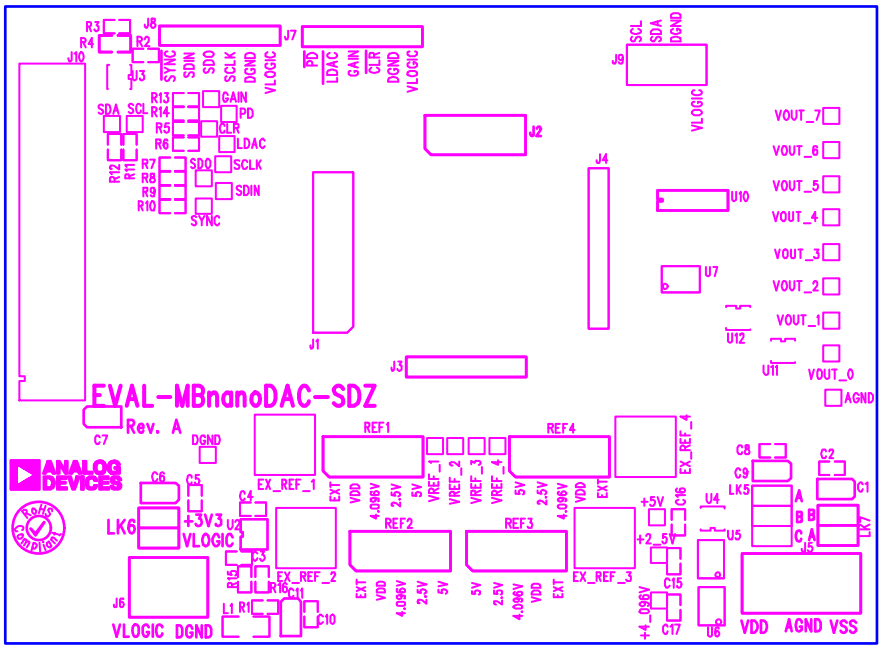

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

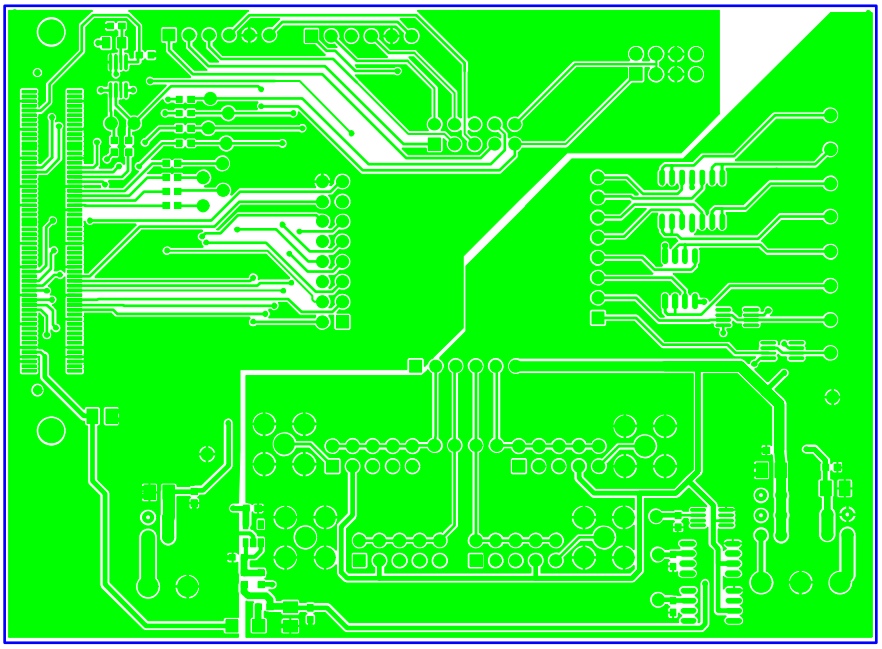

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

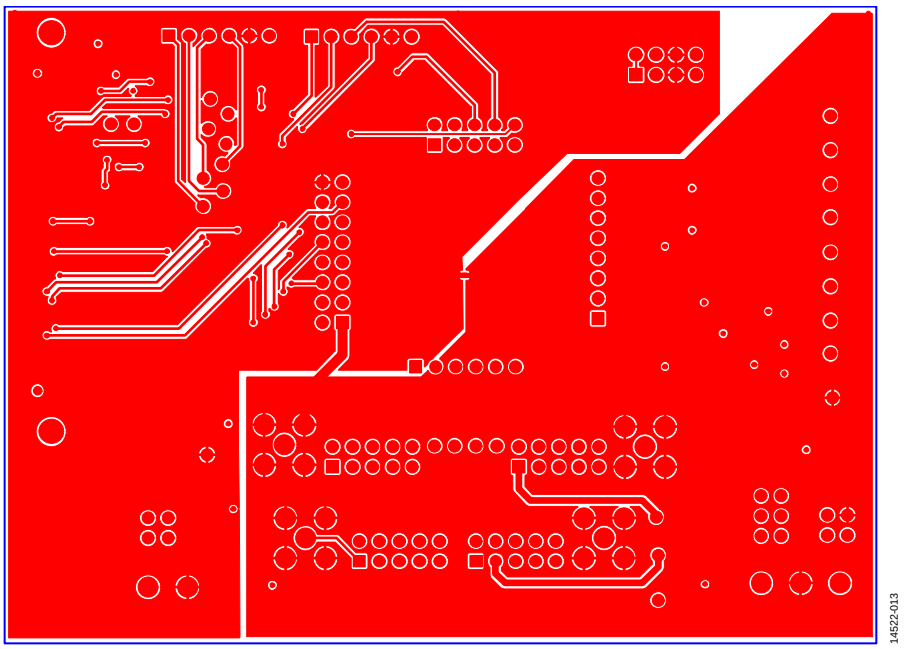

Figure 13. EVAL-MBnanoDAC-SDZZ Motherboard Bottom Side Routing

EVAL-AD5664RDBZ DAUGHTER BOARD

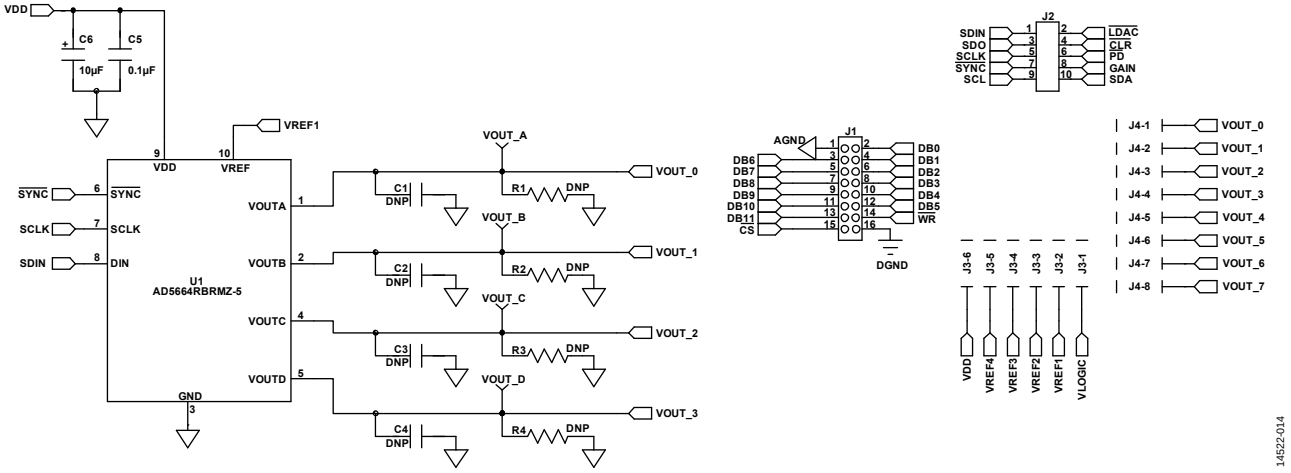

Figure 14. EVAL-AD5664RDBZ Daughter Board Schematics

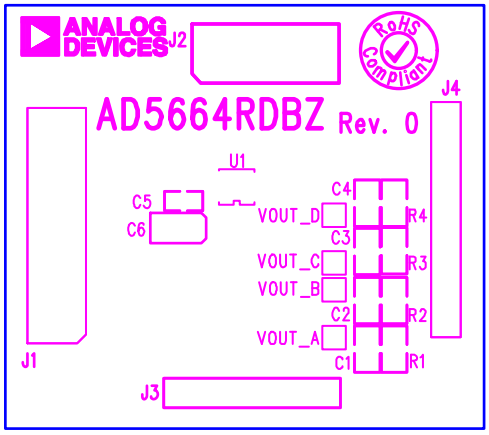

Figure 15. EVAL-AD5664RDBZ Daughter Board Component Placement

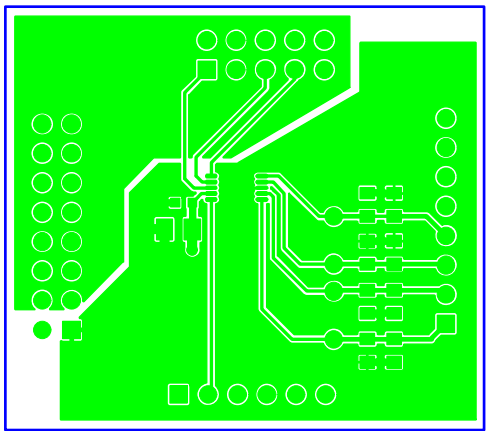

Figure 16. EVAL-AD5664RDBZ Daughter Board Top Side Routing

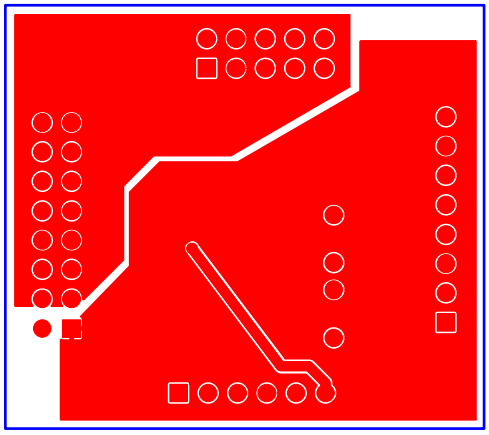

Figure 17. EVAL-AD5664RDBZ Daughter Board Bottom Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 4. Components List for EVAL-MBnanoDAC-SDZ Motherboard

Qty	Reference Designator	Description	Stock Code/Part Number[1]
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[2]
1	C11	6.3 V tantalum capacitor (Case A), 4.7 µF, ±20%	FEC 1432350
4	EXT_REF_1, EXT_REF_2, EXT_REF_3, 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, 600 Ω	FEC 9526862
1	LK5	6-pin (3 × 2), 0.1 inch header and shorting block	FEC 148-535 and 150-411 (36-pin strip)
2	LK6, LK7	4-pin (2 × 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 × 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 kΩ, 1%, 0603	FEC 9330402
11	R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15	SMD resistor, 100 Ω, 1%, 0603	FEC 9330364
1	U2	3.3 V linear regulator	Analog Devices ADP121-AUJZ33R7
1	U3	32 kb I²C 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 manufacturing company.

Table 5. Components List for EVAL-AD5664RDBZ 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 µF, ±10%	FEC 1759122
1	C6	6.3 V tantalum capacitor (Case A), 10 µF, ±20%	FEC 1190107
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
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	Quad 16-bit DAC	Analog Devices AD5664RBRMZ-5
1	$V_{OUT}A$	Red test point	Do not insert
1	$V_{OUT}B$	Red test point	Do not insert
1	$V_{OUT}C$	Red test point	Do not insert
1	$V_{OUT}D$	Red test point	Do not insert

[1] FEC refers to Farnell electronic component distributors

I^2C 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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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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