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Evaluating the AD5341 12-Bit, Single-Channel, Voltage Output, Digital-to-Analog Converter (DAC)

FEATURES

- Full featured evaluation board (EVAL-AD5341DBZ) 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

PACKAGE CONTENTS

- EVAL-AD5341DBZ evaluation board
- EVAL-MBnanoDAC-SDZ motherboard

SOFTWARE REQUIRED

- EVAL-AD5341DBZ 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 evaluation board for the AD5341 single-channel, voltage output DAC.

The EVAL-AD5341DBZ evaluation board helps users quickly prototype new AD5341 circuits and reduce design times. The AD5341 operates from a single 2.5 V to 5.5 V supply.

For full data, see the AD5341 data sheet, which must be used in conjunction with this user guide when using the evaluation board.

The EVAL-AD5341DBZ interfaces to the USB port of a PC via the SDP-B controller board. Software can be downloaded via the EVAL-AD5341DBZ product page that allows users to program the AD5341.

The EVAL-AD5341DBZ evaluation board requires the EVAL-SDP-CB1Z board (SDP-B controller board).

EVAL-AD5341DBZ, EVAL-MBnanoDAC-SDZ, AND EVAL-SDP-CB1Z BOARDS

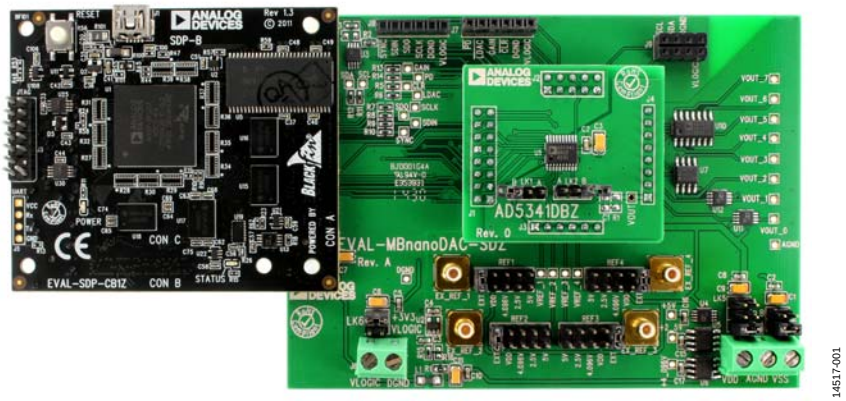

Figure 1.

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REVISION HISTORY

2/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The EVAL-AD5341DBZ 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 EVAL-AD5341DBZ evaluation 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}; 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, Pin 1 (J6-1)	VLOGIC	Digital supply from 1.8 V to V_{DD}
J6, Pin 2 (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-AD5341DBZ. Table 2 describes the positions of the links to control the EVAL-AD5341DBZ 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 to Table 4 match the evaluation board imprints (see Figure 11).

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

DAUGHTER BOARD LINK OPTIONS

The EVAL-AD5341DBZ daughter board has two link options. The links control the settings for the reference BUF and $\overline{CLR}$ pins. Table 3 shows how the links are configured.

Table 3. Link Options for Daughter Board

Link Number	Pin	Position
LK1	BUF	A (unbuffered, default) B (buffered)
LK2	$\overline{CLR}$	A (no operation, default) B (zero scale)

Table 4. Link Functions

Link Number	Function
REF1, REF2	This link selects the reference source. Position EXT selects an off board voltage reference via the appropriate EXT_REF connector. Position VDD selects VDD 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.
REF3, REF4	This link selects the reference source. Position EXT selects an off board voltage reference via the appropriate EXT_REF connector. Position VDD selects VDD 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-AD5341DBZ 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 EVAL-AD5341DBZ software, take the following steps:

1. Start the Windows operating system.
2. Download the installation software from the EVAL-AD5341DBZ evaluation board page.
3. Run the **setup.exe** file from the installer folder if it does not open automatically.
4. Power up the EVAL-AD5341DBZ as described in the Power Supplies section after installation is completed.
5. Connect the EVAL-AD5341DBZ to the SDP-B and the SDP-B to the PC using the USB cable included in the evaluation kit.
6. Proceed through any dialog boxes that appear to finalize the installation when the software detects the EVAL-AD5341DBZ.

RUNNING THE SOFTWARE

To run the EVAL-AD5341DBZ software, take the following steps:

1. Connect the EVAL-AD5341DBZ to the SDP-B and connect the USB cable between the SDP-B and the PC.
2. Power up the EVAL-AD5341DBZ as described in the Power Supplies section.
3. Click **Start > All Programs > Analog Devices > AD5341**.

If the SDP-B is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 2).

Connect the SDP-B to the USB port of the PC and wait a few seconds. When the SDP-B and the EVAL-AD5341DBZ are detected, the display updates (see Figure 3).

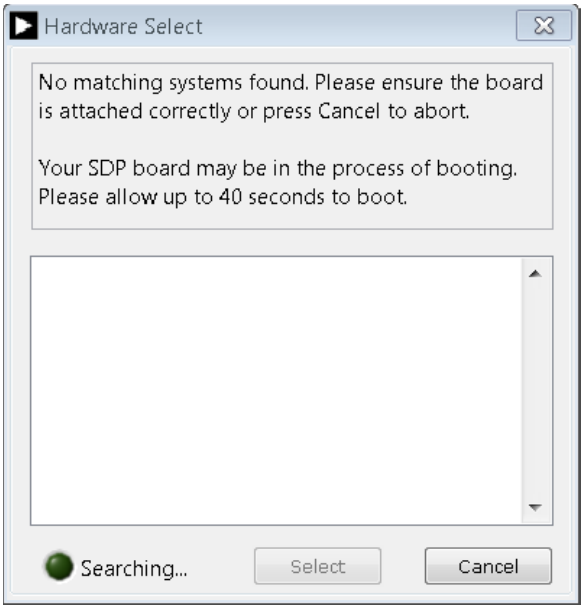

Figure 2. Connectivity Error

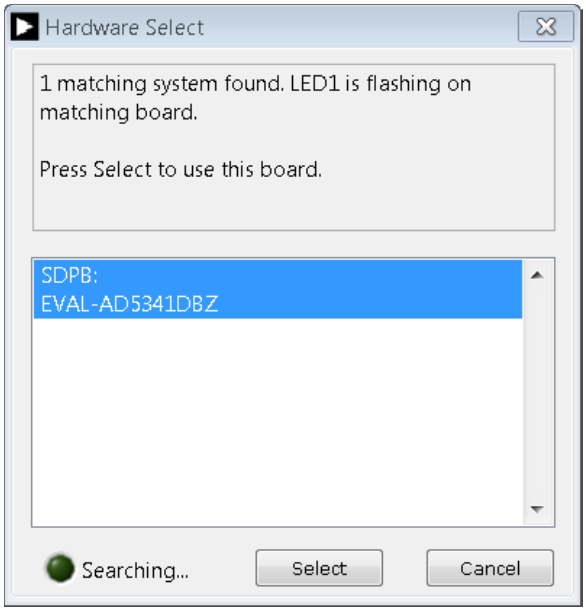

Figure 3. Hardware Select

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 AD5341 evaluation software then opens, as shown in Figure 4.

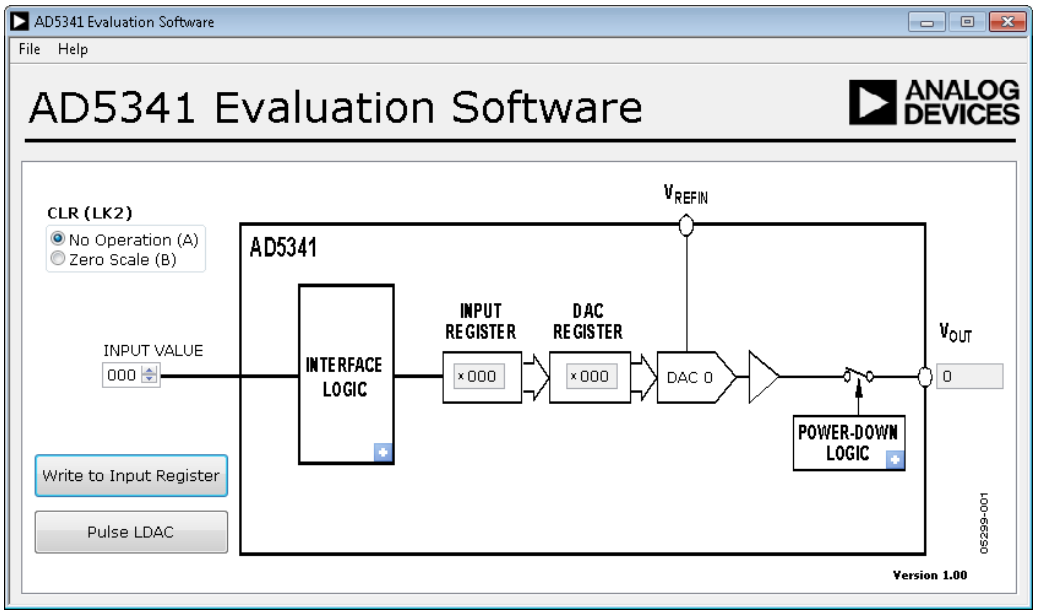

Figure 4. AD5341 Evaluation Board Software Main Window

SOFTWARE OPERATION

The software for the AD5341 allows users to program values to the input and DAC registers of the DAC.

Write to Input Register

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

LDAC Control

Click **Pulse LDAC** to bring the $\overline{\text{LDAC}}$ pin low and then back to high, which copies the data from the input registers to the DAC registers, and the outputs update accordingly. Alternatively, set the $\overline{\text{LDAC}}$ pin high or low by clicking the blue progressive disclosure button in the **INTERFACE LOGIC** block. A window then opens that allows the user to click the appropriate **LDAC** setting, as shown in Figure 5.

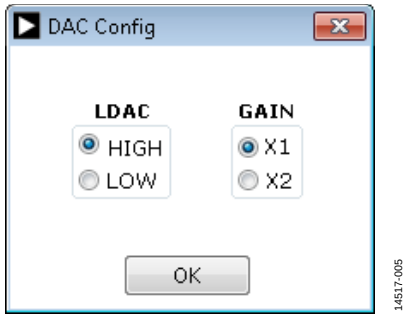

*Figure 5. **DAC Config** Window*

GAIN Control

Set the GAIN pin high or low by clicking the blue progressive disclosure button in the **INTERFACE LOGIC** block. A window then opens that allows the user to click the appropriate **GAIN** setting, as shown in Figure 5. Click **GAIN X1** to set a full-scale output of 2.5 V or click **GAIN X2** to set a full-scale output of 5 V.

Power-Down Control

Click the blue progressive disclosure button in the **POWER-DOWN LOGIC** block to access a selection box that allows the device to operate in normal mode or power-down mode. A window then opens that allows the user to click the power-down setting for the DAC, as shown in Figure 6. Click **OK** to write the appropriate values to the AD5341 when the power-down settings for the DAC are selected.

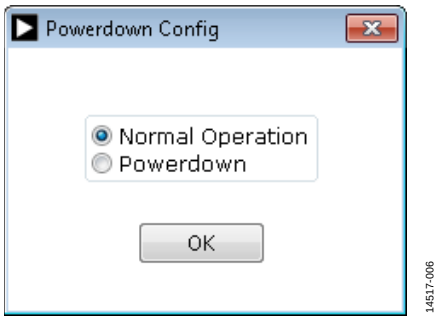

*Figure 6. **Powerdown Config** Window*

CLR Control

Set the $\overline{\text{CLR}}$ pin high or low using LK2 as described in the Daughter Board Link Options section and Table 3. Click the appropriate **CLR (LK2)** setting on the GUI to match the daughter board setting (see Figure 4).

EVALUATION BOARD SCHEMATICS AND ARTWORK

EVAL-MBnanoDAC-SDZ MOTHERBOARD

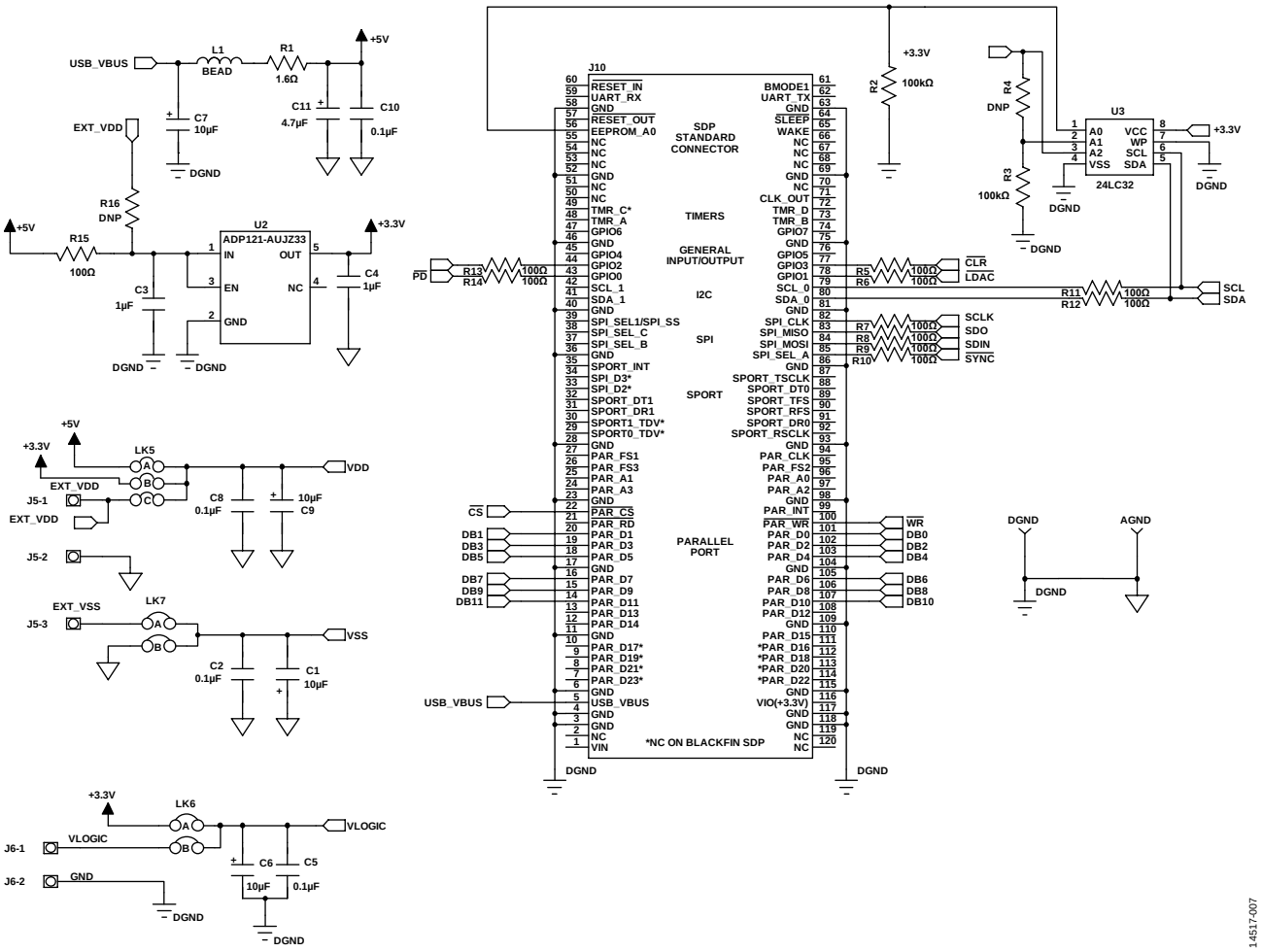

Figure 7. EVAL-MBnanoDAC-SDZ Motherboard SDP-B Connector and Power Supply

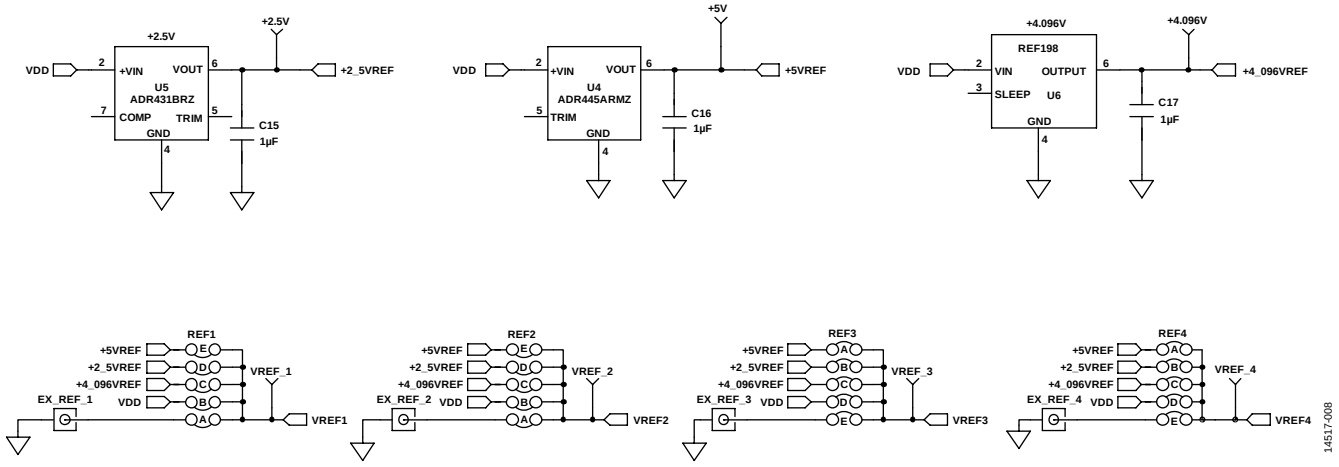

Figure 8. EVAL-MBnanoDAC-SDZ Motherboard Reference Voltage Selector Circuit

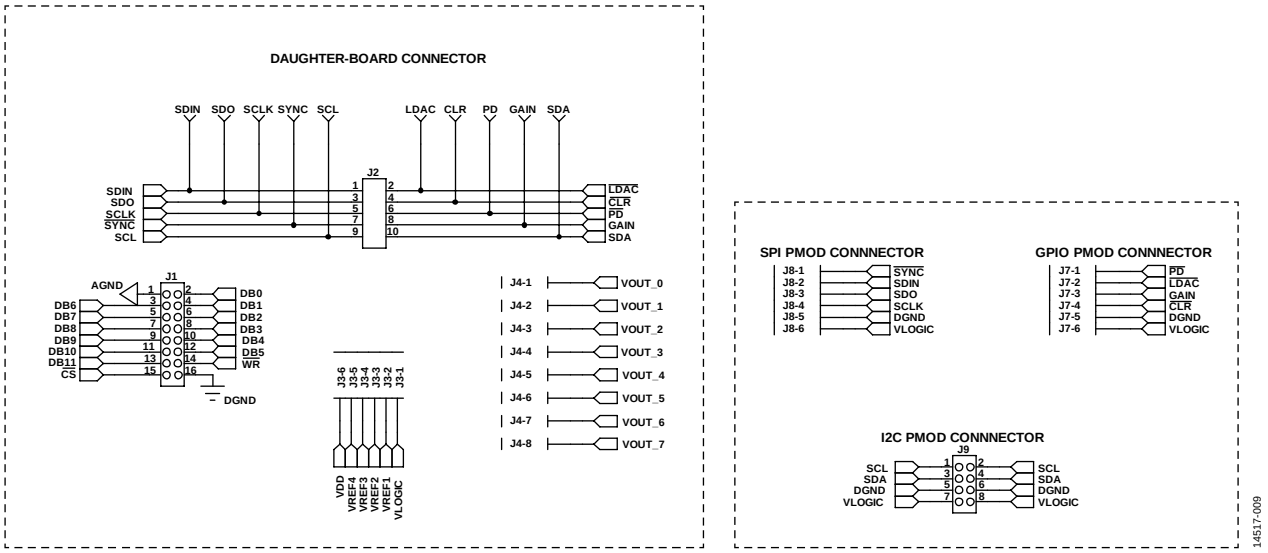

Figure 9. EVAL-MBnanoDAC-SDZ Motherboard Connectors to Daughter Board and Serial Interface

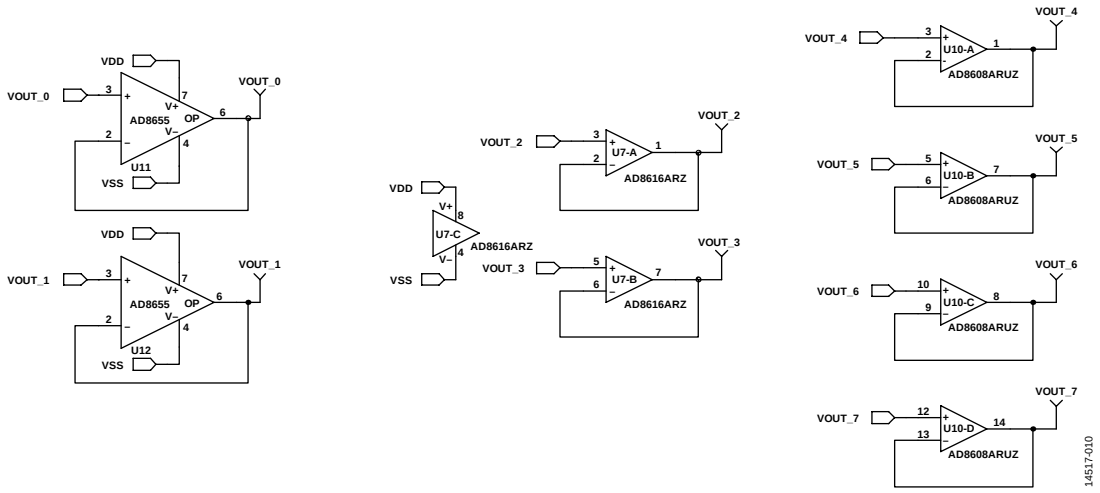

Figure 10. EVAL-MBnanoDAC-SDZ Motherboard Output Amplifier Circuit

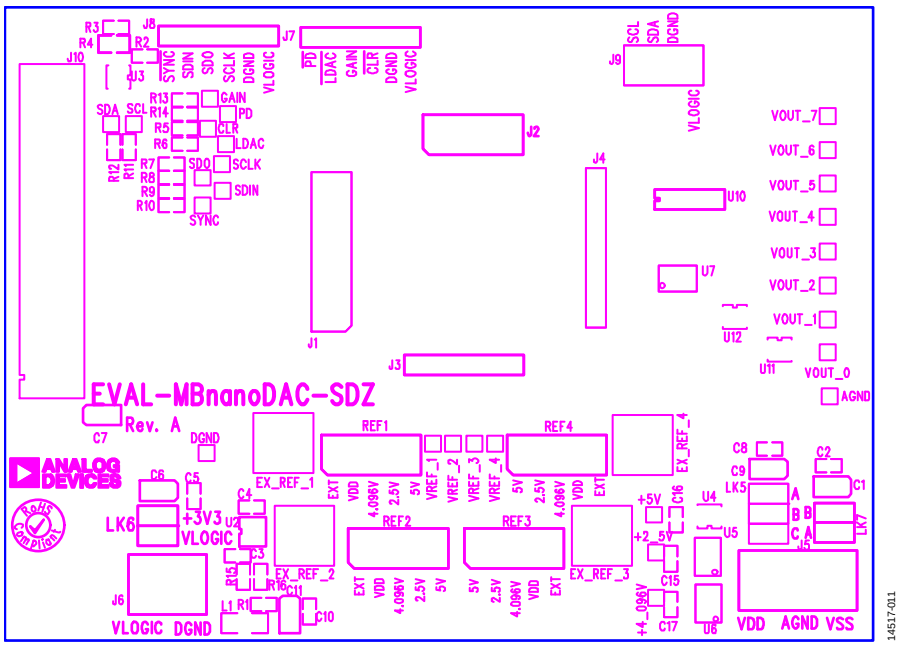

Figure 11. EVAL-MBnanoDAC-SDZ Motherboard Component Placement

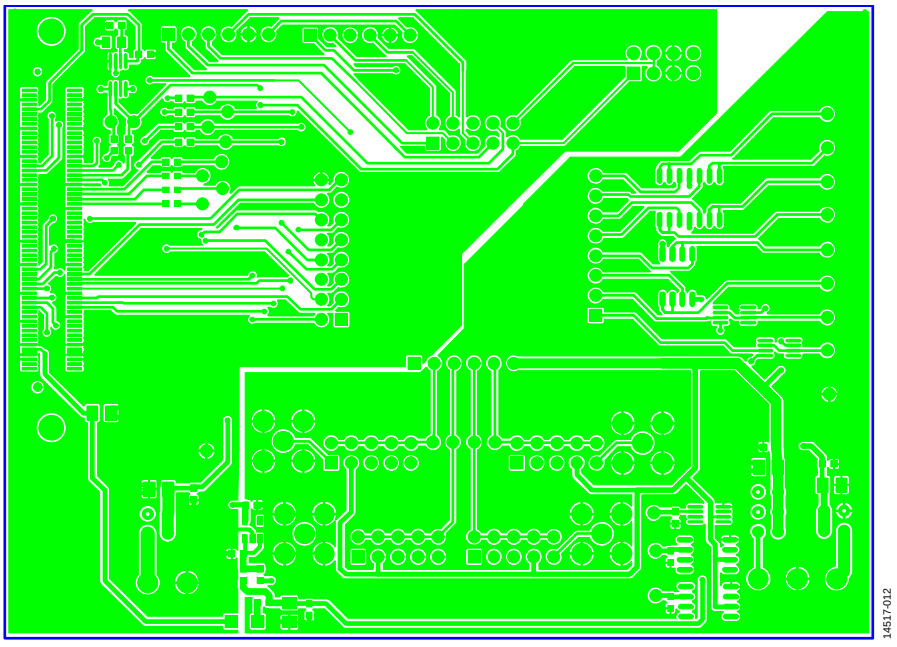

Figure 12. EVAL-MBnanoDAC-SDZ Motherboard Top Side Routing

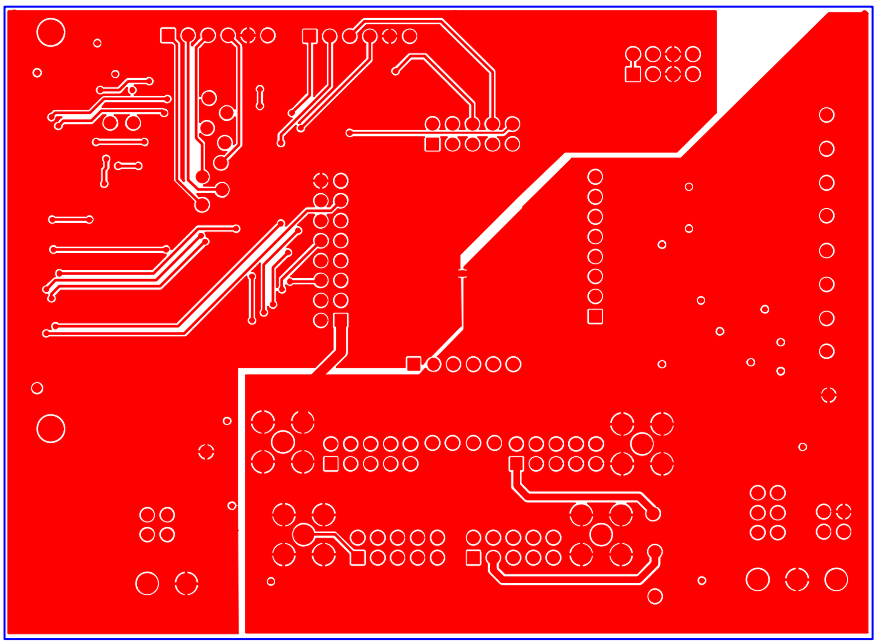

Figure 13. EVAL-MBnanoDAC-SDZ Motherboard Bottom Side Routing

EVAL-AD5341DBZ DAUGHTER BOARD

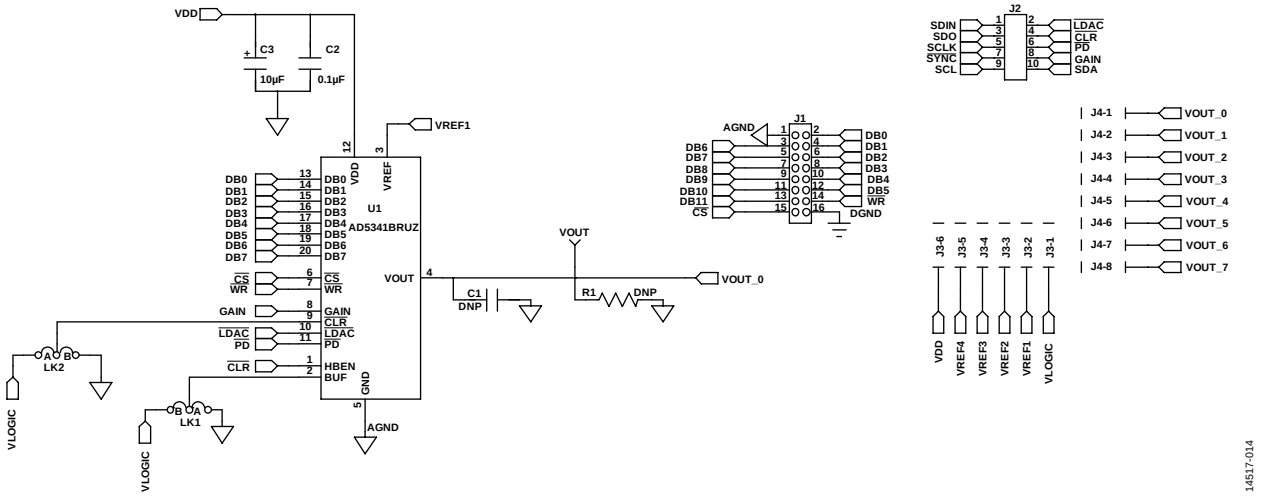

Figure 14. EVAL-AD5341DBZ Daughter Board Schematics

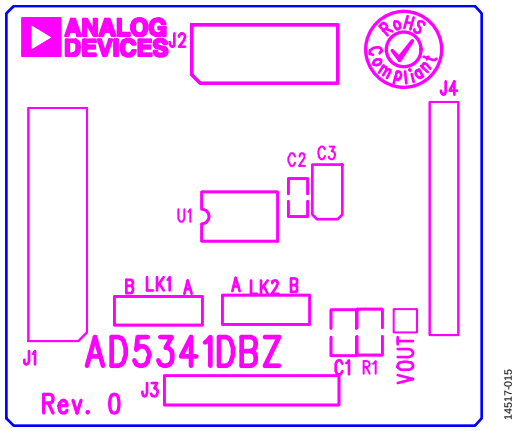

Figure 15. EVAL-AD5341DBZ Daughter Board Component Placement

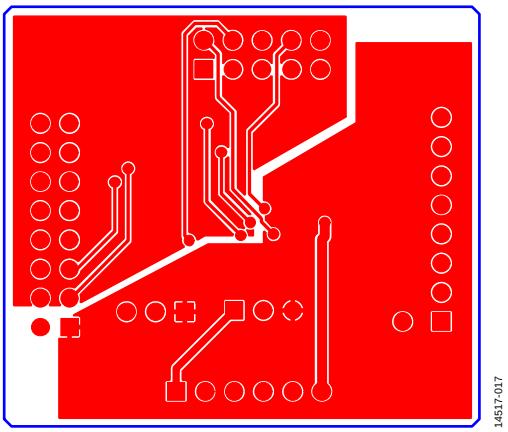

Figure 17. EVAL-AD5341DBZ Daughter Board Bottom Side Routing

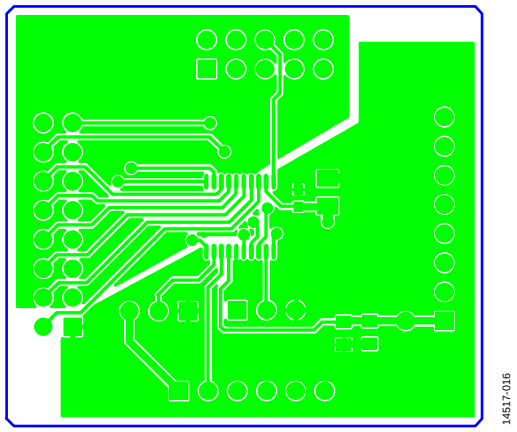

Figure 16. EVAL-AD5341DBZ Daughter Board Top Side Routing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. Components List for the EVAL-MBnanoDAC-SDZ Motherboard

Quantity	Reference Designator	Description	Stock Code/Part Number[1]
4	C1, C6, C7, C9	6.3 V tantalum capacitors (Case A), 10 µF, ±20%	FEC 1190107
7	C2, C5, C8, C10, C15, C16, C17	50 V, X7R ceramic capacitors, 0.1 µF, ±10%	FEC 1759122
2	C3, C4	10 V, X5R ceramic capacitors, 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 jacks, 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	Headers, 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 headers and shorting blocks	FEC 148-535 and 150-411 (36-pin strip)
4	REF1, REF2, REF3, REF4	10-pin (5 × 2), 0.1 inch headers and shorting blocks	FEC 1022227 and 150-411
1	R1	Resistor, surge, 1.6 Ω, 1%, 0603	FEC 1627674
2	R2, R3	SMD resistors, 100 kΩ, 1%, 0603	FEC 9330402
11	R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15	SMD resistors, 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 amps	Analog Devices AD8655ARMZ

[1] FEC refers to Farnell Electronic Component Distributors.
[2] GRM refers to Murata Manufacturing Company.

Table 6. Components List for the EVAL-AD5341DBZ Daughter Board

Quantity	Reference Designator	Description	Stock Code/Part Number[1]
1	C1	Not applicable	Not inserted
1	C2	50 V, X7R ceramic capacitor 0.1 µF, ±10%	FEC 759122
1	C3	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, 2.5 mm, PCB, 1 × 8-way	FEC 1766172 inserted from solder side
1	LK1	3-pin straight in line (SIL) header and shorting link	FEC 1022248 and 150-411
1	LK2	3-pin SIL header and shorting link	FEC 1022248 and 150-411
1	R1	Not applicable	Not inserted
1	U1	Single 12-bit DAC	Analog Devices AD5341BRUZ
1	V_{OUT}	Red test point	Do not insert

[1] FEC refers to Farnell Electronic Component Distributors

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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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- 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.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

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(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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