EVAL-AD5683RSDZ User Guide
UG-641

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Evaluating the AD5683R Single-Channel, 16-Bit, Serial, Voltage Output DAC

FEATURES

Full-featured evaluation board for the AD5683R
On-board reference
Various link options
PC control in conjunction with Analog Devices, Inc., SDP
PC software for control of DACs
On-board ADC for voltage readback

EVALUATION KIT CONTENTS

EVAL-AD5683RSDZ evaluation board
AD5683R device

HARDWARE REQUIRED

EVAL-SDP-CB1Z (SDP-B) board or EVAL-SDP-CS1Z (SDP-S) board, must be purchased separately

SOFTWARE REQUIRED

ACE evaluation software, available for download from the EVAL-AD5683RSDZ product page

GENERAL DESCRIPTION

This user guide details the operation of the EVAL-AD5683RSDZ evaluation board for the AD5683R single-channel, serial, voltage output digital-to-analog converter (DAC).

The EVAL-AD5683RSDZ evaluation board is designed to help users quickly prototype AD5683R circuits and reduce design time. The AD5683R operates from a single 2.7 V to 5.5 V supply. The device incorporates an internal 2.5 V on-board reference to give an output voltage span of 2.5 V or 5 V.

The evaluation board interfaces to the USB port of a PC via the system demonstration platform (SDP) board. The analysis control evaluation (ACE) software is available for download from the EVAL-AD5683RSDZ product page to use with the evaluation board to allow the user to program the AD5683R.

This evaluation board requires the EVAL-SDP-CB1Z (SDP-B) board or the EVAL-SDP-CS1Z (SDP-S) board, which are available for purchase from Analog Devices.

For full details, see the AD5683R data sheet, which must be used in conjunction with this user guide when using the EVAL-AD5683RSDZ evaluation board.

EVAL-AD5683RSDZ EVALUATION BOARD CONNECTED TO THE SDP-S BOARD

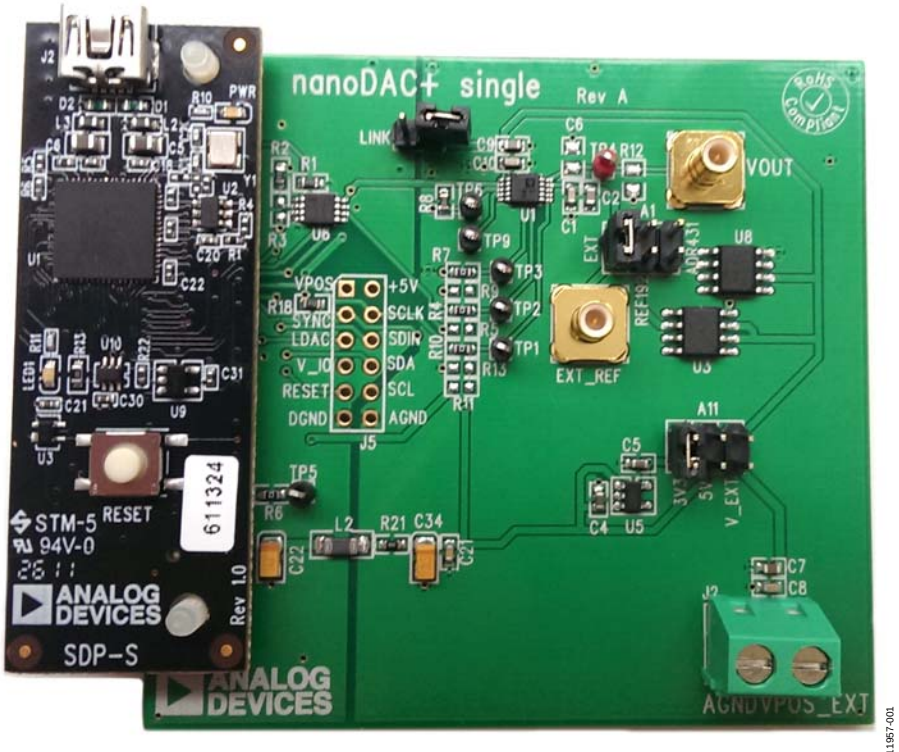

Figure 1.

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REVISION HISTORY

7/2017—Rev. 0 to Rev. A

Reorganized Layout ..... Universal
Deleted Package Contents Section and Additional Equipment Needed Section 1
Added Hardware Required Section and Software Required Section 1
Changes to Title, General Description Section, EVAL-AD5683RSDZ Evaluation Board Connected to the SDP-S Board Section, and Figure 1 Caption 1
Deleted Getting Started Section 3
Added Evaluation Board Quick Start Procedures Section, Initial Setup Section, and Figure 2; Renumbered Sequentially 3
Changes to Installing the Software Section 3
Added Figure 3 4
Deleted How to Use the Software Section, Running the Software Section, Figure 2, Figure 3, and Figure 4 5
Added Block Diagram and Description Section, Figure 4, and Table 1; Renumbered Sequentially 5
Deleted Software Operation Section and Figure 5 6
Added Memory Map Section and Figure 5 6
Moved Evaluation Board Hardware Section 7
Changes to Power Supplies Section, Table 2, Link Options Section, Table 3, and Table 4 7
Changes to Figure 7 8
Changes to Figure 8 Caption 9
Changes to Figure 9 Caption and Figure 10 Caption 10
Deleted Components List Section 11
Added Bill of Materials Section 11
Changes to Table 5 11

1/2014—Revision 0: Initial Version

EVALUATION BOARD QUICK START PROCEDURES

INSTALLING THE SOFTWARE

The EVAL-AD5683RSDZ evaluation board uses the ACE evaluation software, a desktop software application that allows the evaluation and control of multiple evaluation systems.

The ACE installer installs the necessary SDP drivers and the Microsoft® .NET Framework 4 by default. The ACE software is available for download from the EVAL-AD5683RSDZ product page, and must be installed before connecting the SDP board to the USB port of the PC, to ensure that the SDP board is recognized when it connects to the PC. For full instructions on how to install and use this software, see the ACE software page on the Analog Devices website.

After the installation is finished, the EVAL-AD5683RSDZ evaluation board plug in appears when the ACE software is opened.

INITIAL SETUP

To set up the evaluation board, take the following steps:

1. Connect the evaluation board to the SDP board, and then connect a USB cable between the SDP board and the PC.
2. Run the ACE application. The EVAL-AD5683RSDZ evaluation board plug ins appear in the attached hardware pane of the **Start** tab.
3. Double click the board plug in to open the board view shown in Figure 2.
4. Double click the **AD5683R** chip to access the chip block diagram. This view provides a basic representation of functionality of the board. The main function blocks of the board are labeled in Figure 3.

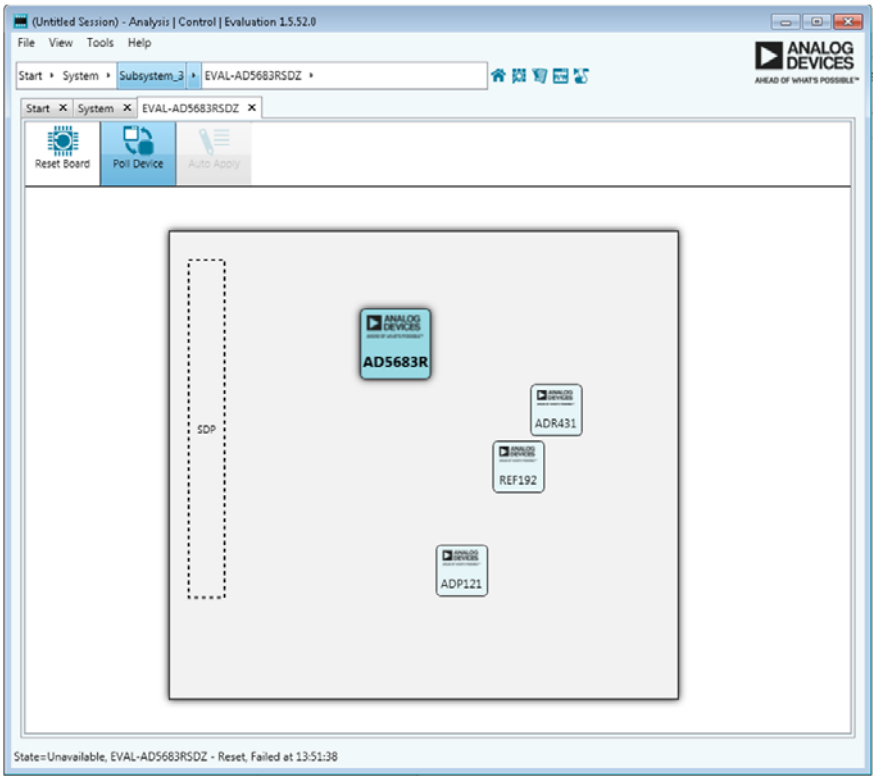

Figure 2. Board View of the EVAL-AD5683RSDZ

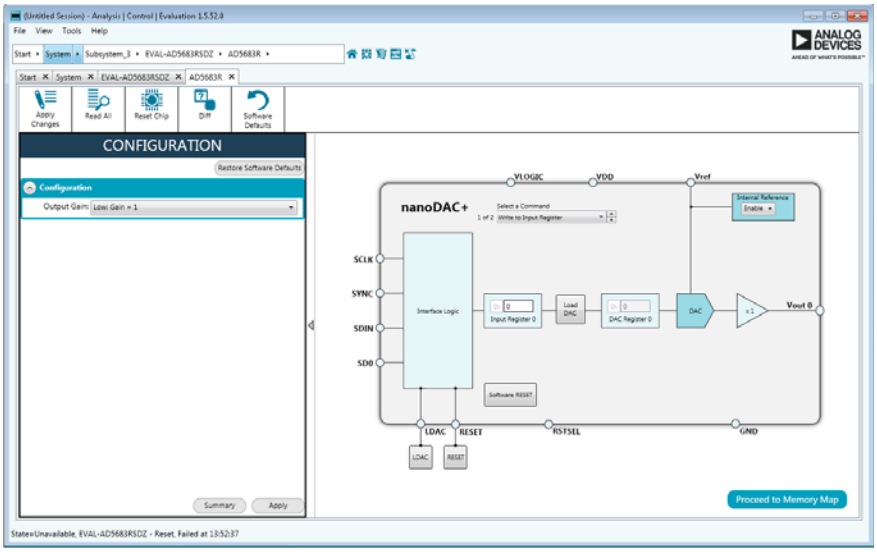

Figure 3. Chip Block Diagram View for the AD5683R

BLOCK DIAGRAM AND DESCRIPTION

The EVAL-AD5683RSDZ software is organized to appear similar to the functional block diagram shown in the AD5683R data sheet. Therefore, correlating the functions on the EVAL-AD5683RSDZ evaluation board with the description in the AD5683R data sheet is simplified.

For a full description of each block, register, and its settings, see the AD5683R data sheet.

Some of the blocks and their functions are described in this section as they pertain to the evaluation board. The block diagram is shown in Figure 4. Table 1 describes the functionality of each block.

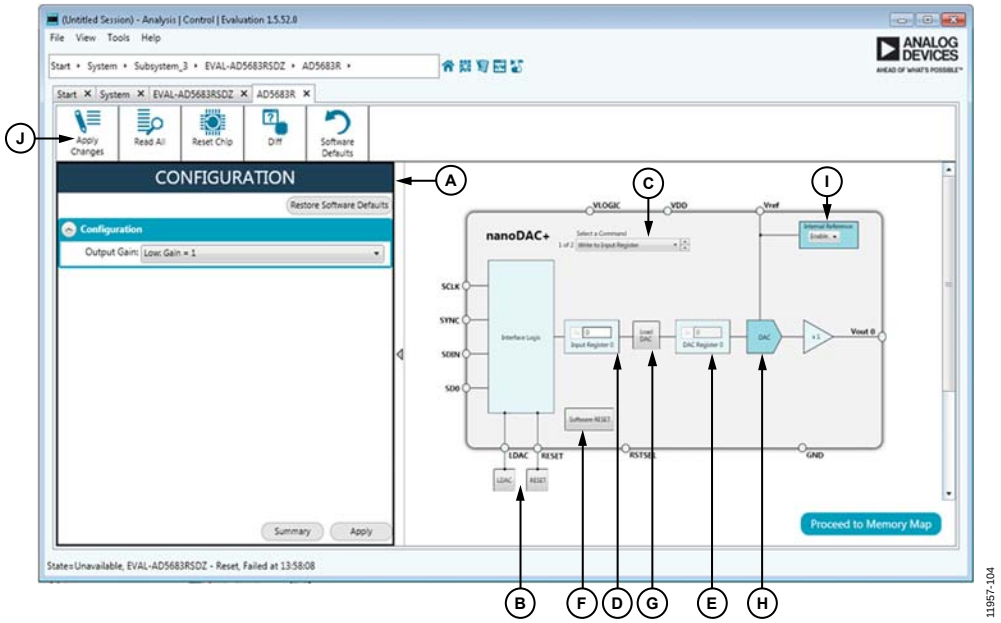

Figure 4. AD5686R Block Diagram with Labels

Table 1. Block Diagram Functions (See Labels in Figure 4)

Label	Button/Function Name	Function
A	**CONFIGURATION** wizard	Used to set the initial configuration for the board. Select the reference gain case from the **Output Gain** dropdown menu. A gain of 1 is the default. After setting up the initial configuration, click **Apply Changes** (J) to apply the values. These settings can be modified at any stage while evaluating the board.
B	**LDAC** and **RESET** (GPIO buttons)	Act as external GPIO pulses to the $\overline{\text{LDAC}}$ and $\overline{\text{RESET}}$ pins. The **LDAC** button transfers data from the input registers (D) to the DAC registers (E). The **RESET** button clears all data from input registers and DAC registers. These buttons are live; therefore, there is no need to click **Apply Changes** (J).
C	**Select a Command**	Command option dropdown menu selects how the data being transferred to the device affects the input and DAC registers. After a data value is entered in an input register (D), this menu determines the internal DAC registers affected by updating the input register (D). After a new value is written in the input register (D), the data can be transferred to the DAC input register, or to the DAC input register and the DAC register simultaneously. If the data is transferred to both registers, the channel DAC register (E) reflects the new value.
D	Input register	16-bit data word to be transferred to the device. Click **Apply Changes** (J) to transfer this 16-bit data word to the device.
E	DAC register	Displays the value that is currently present in the DAC register on the device. Update the DAC register by selecting the appropriate command option or by toggling **LDAC** (B).
F	**Software RESET**	This board returns the evaluation board and software to default values. This button is live; therefore, there is no need to click **Apply Changes** (J).
G	**Load DAC**	Users can individually control which channel loads the values from the input register to the DAC register.
H	**DAC**	DAC configuration options provide access to individual channel configuration options, such as power-down options and hardware $\overline{\text{LDAC}}$ mask enable/disable settings.
I	**Internal Reference**	Select **Enable** from this setting to enable the on-chip reference for the evaluation board. If **Disable** is selected, an external reference must be applied. This control is only available on the AD5683R.
J	**Apply Changes**	Applies all modified values to the device. Note that if an evaluation board is not connected, values entered into the input register are not transferred to the DAC register.

MEMORY MAP

All registers are fully accessible from the **AD5683R Memory Map** tab, shown in Figure 5. To navigate to this tab, click the **Proceed to Memory Map** button, shown in Figure 4. This tab allows registers to be edited at the bit level. The bits shaded in dark gray are read only bits and cannot be accessed from the ACE software. All other bits are toggled.

Clicking the **Apply Changes** button transfers data to the device. All changes made in the memory map tab correspond to the block diagram. For example, if the internal register bit is enabled, it displays as enabled on the block diagram. Any bits or registers that are shown in bold in the memory map tab are modified values that have not been transferred to the evaluation board (see Figure 6). Click **Apply Changes** to transfer the data to the evaluation board.

*Figure 5. **AD5683R Memory Map** Tab*

*Figure 6. AD5683R Memory Map with Unapplied Changes in the **DAC0_Input** Register*

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The AD5683R evaluation board can be powered either from the SDP or externally by the VPOS_EXT and AGND connectors.

Both AGND and DGND inputs are provided on the board. The AGND and DGND planes are connected at one location close to the AD5683R. To avoid ground loop problems, it is recommended that AGND and DGND not be connected elsewhere in the system.

All supplies are decoupled to ground with 10 µF tantalum and 0.1 µF ceramic capacitors.

Table 2. Power Supply Connectors

Connector No.	Voltage
J2, Pin 1	Analog positive power supply, V_EXT
J2, Pin 2	AGND

LINK OPTIONS

A number of link and switch options are incorporated on the EVAL-AD5683RSDZ evaluation board and must be set for the required operating conditions before using the board. The functions of these link options are described in detail in Table 4.

Table 3 describes the positions of the different links to control the evaluation board by the PC via the USB port. An SDP board operating in single-supply mode is required.

Table 3. Link Options Setup for SDP Control (Default)

Link No.	Options
A11	A
LIN	Disconnected
A1	A

Table 4. Link Functions

Link No.	Option
A1	This link selects the DAC digital voltage source: Position A selects an external reference source via the SMB input, EXT_REF. Position B selects the REF192 external reference. Position C selects the ADR431 external reference.
LINK	Connect only if the EVAL-AD5683RSDZ board of the AD5683R is controlled through the PMOD connector and the SDP board is not connected.
A11	This link selects the DAC analog voltage source: Position A VPOS is powered at 3.3 V. Position B VPOS is powered from an unregulated USB supply. Position C VPOS is powered from an external supply voltage, V_EXT.

EVALUATION BOARD SCHEMATICS AND ARTWORK

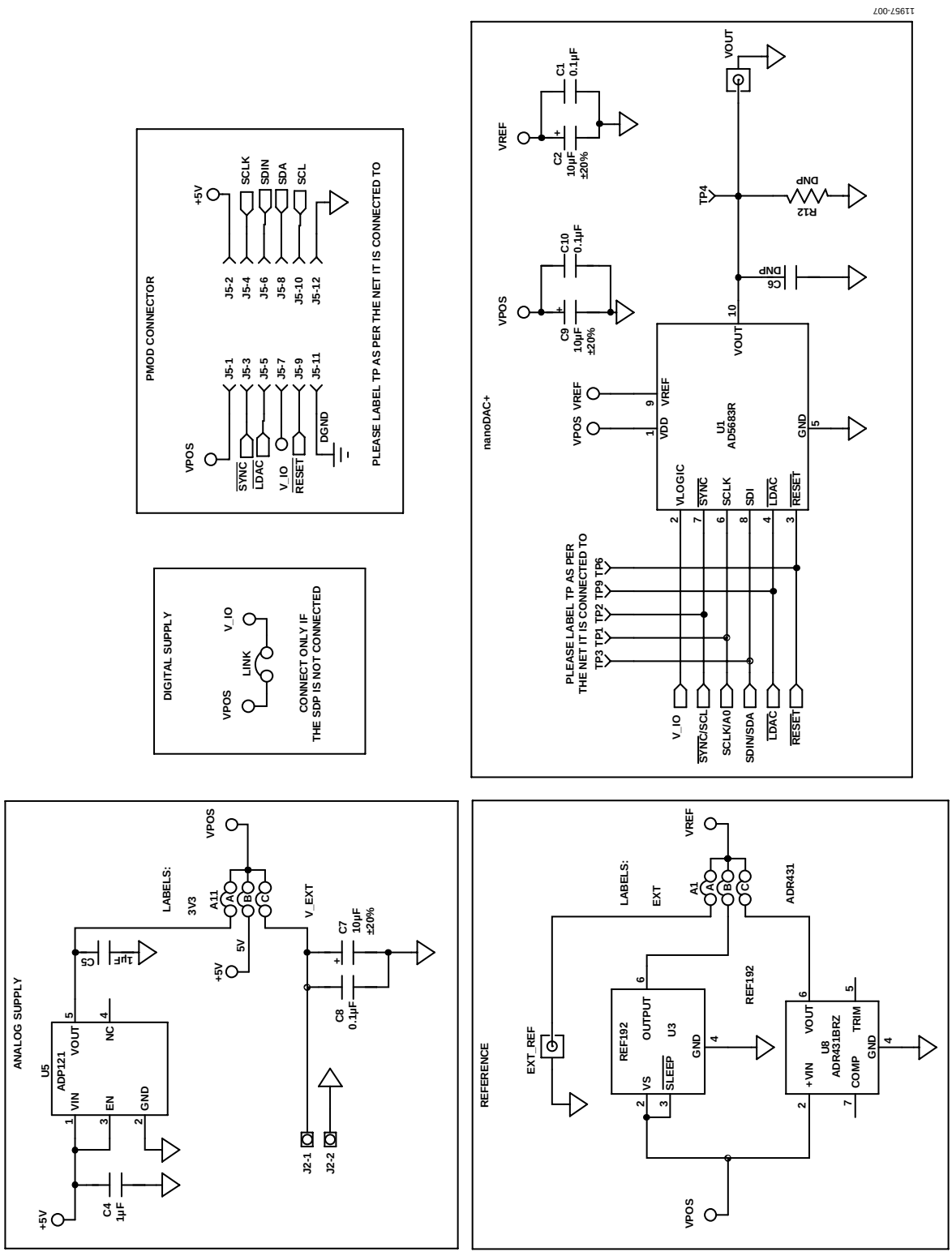

Figure 7. EVAL-AD5683RSDZ Schematic—Power Supply and Signal Routes

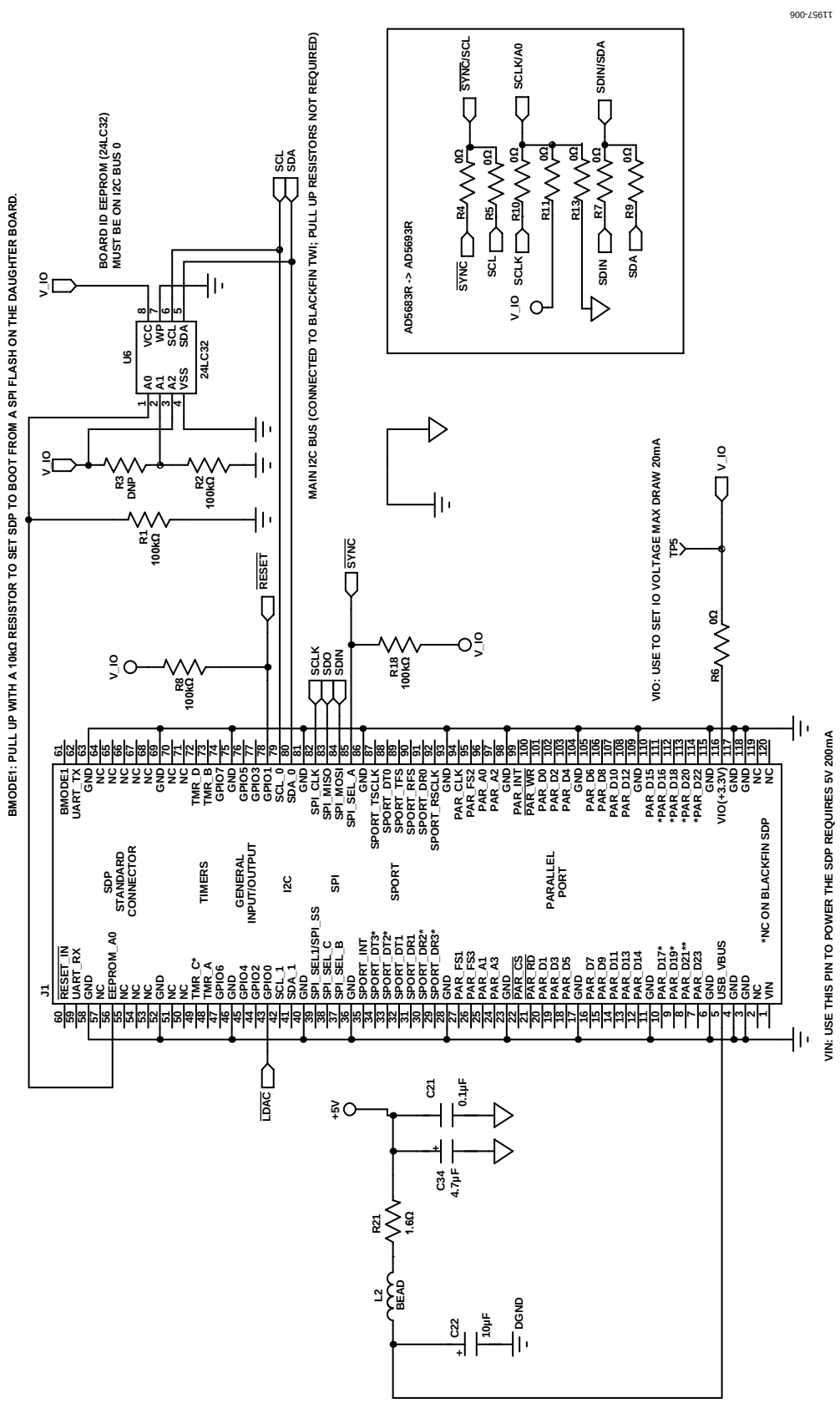

Figure 8. EVAL-AD5683RSDZ Schematic—SDP Connector

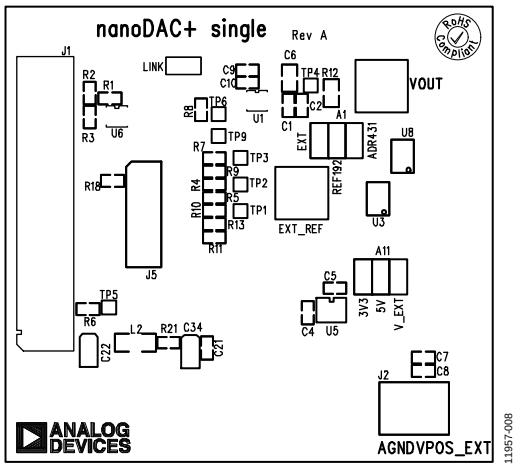

Figure 9. EVAL-AD5683RSDZ Component Placement Drawing

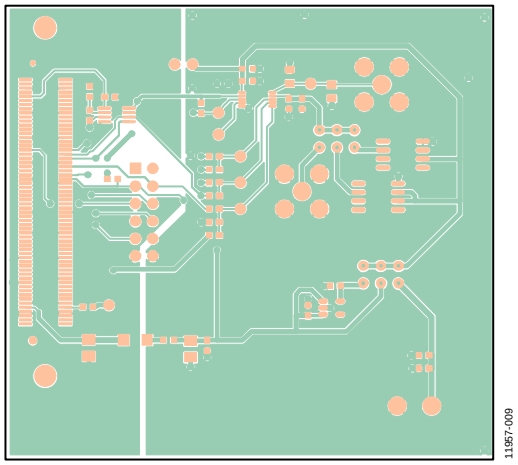

Figure 10. EVAL-AD5683RSDZ Component Side PCB Drawing

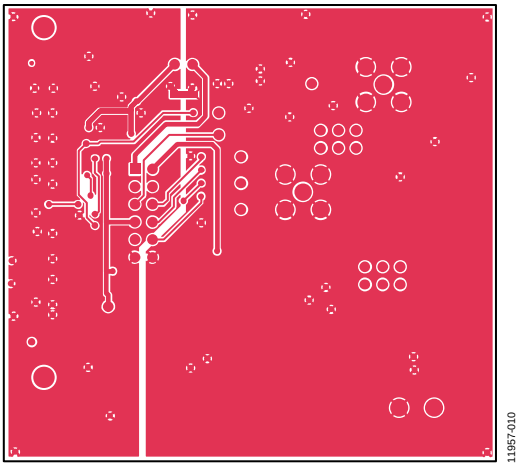

Figure 11. EVAL-AD5683RSDZ Solder Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 5.

Qty.	Reference	Description	Supplier/Part Number[1]
1	U1	AD5683R	Analog Devices/AD5683R
1	U3	2.5 V reference	Analog Devices/REF192
1	U5	3.3 V regulator	Analog Devices/ADP121
1	U6	32 kb, I^2C serial EEPROM	FEC/1331330
1	U8	Ultralow noise, XFET voltage references	Analog Devices/ADR431BRZ
1	LINK	2-pin link	FEC/1022249
2	A1, A11	3-pin link	FEC/148535
2	VOUT, EXT_REF	SMB jack, 50 Ω	FEC/1206013
1	J1	120-way female connector	FEC/1324660
1	J2	2-pin terminal block	FEC/151789
3	C1, C8, C10	0.1 µF, 16 V, X7R, ceramic capacitor	FEC/1216538
1	C21	0.1 µF, 50 V, X7R ceramic capacitor	FEC/1759122
2	C4, C5	1 µF, 16 V, X7R ceramic capacitor	FEC/1658870
3	C2, C7, C9	10 µF, 10 V, X5R, 0603	FEC/1853538
1	C22	10 µF, 6.3 V, tantalum capacitor	FEC/1190107
1	L2	Inductor	FEC/9526862
7	TP1, TP2, TP3, TP4, TP5, TP6, TP9	Test point	FEC/8731128
4	R1, R2, R8, R18	100 kΩ, SMD, resistor	FEC/9330402
1	R21	1.6 Ω, SMD, resistor	FEC/1627674
4	R4, R6, R7, R10	0 Ω, resistor	FEC/9331662

[1] FEC refers to Farnell Electronic Component Distributors.

NOTES

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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