

## Evaluation Board for **AD5686R/AD5686/AD5684R/AD5684** 16-/12-Bit, Quad Channel Voltage Output DAC

### FEATURES

Full-featured evaluation board for the **AD5686R, AD5686, AD5684R, and AD5684**

On-board references

Various link options

PC control in conjunction with Analog Devices, Inc., **System Demonstration Platform (SDP)**

### PACKAGE CONTENTS

**AD5686/AD5686R or AD5684/AD5684R** evaluation board  
CD includes

Self-installing software that allows users to control the board and exercise all functions of the device

Electronic version of the **AD5686R, AD5686, AD5684R, and AD5684** data sheets

Electronic version of **UG-459**

### GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the **AD5686R, AD5686, AD5684R, and AD5684** quad channel, voltage output digital-to-analog converters (DACs).

The **EVAL-AD5686RSDZ** supports both the **AD5686R** and **AD5686**, and the **EVAL-AD5684RSDZ** supports both the **AD5684R** and **AD5684**.

The AD568x(R) is used in this user guide to refer to the **AD5686R, AD5686, AD5684R, and AD5684**.

The evaluation board is designed to help customers quickly prototype new AD568x(R) circuits and reduce design time. The AD568x(R) operates from a single 2.7 V to 5.5 V supply. The **AD5686R** and **AD5684R** incorporate an internal 2.5 V reference to give an output voltage span of 2.5 V or 5 V. The **AD5686** and **AD5684** require an external reference.

Full data on the AD568x(R) can be found in the appropriate data sheet available from Analog Devices and should 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** board. Software is supplied with the evaluation board to allow the user to program the AD568x(R).

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

### EVALUATION BOARD BLOCK DIAGRAM

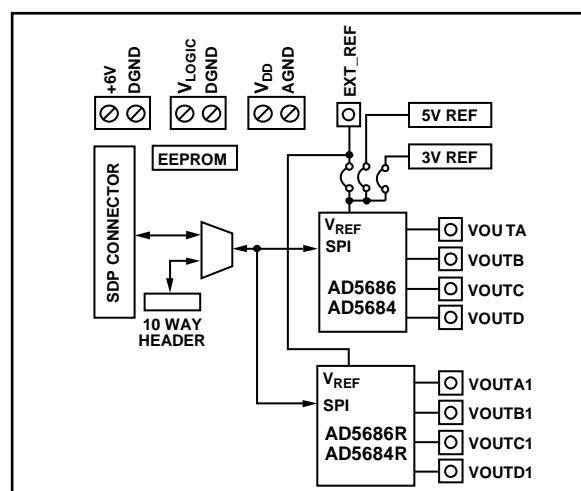


Figure 1.

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**REVISION HISTORY**

9/12—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

To use the evaluation board with the [SDP](#) board, a 6 V power supply is required, which is connected to Connector J3. The evaluation board can be used without the SDP board. In this case, the J1 and J2 connectors are used as the power supply inputs.

Both AGND and DGND inputs are provided on the board. The AGND and DGND planes are connected at one location close to the AD568x(R). 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 Number	Voltage
J1	External, $V_{\text{LOGIC}}$ supply
J2	Analog power supply, $V_{\text{DD}}$
J3	6 V board positive power supply

### LINK OPTIONS

A number of link options are incorporated in the 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 3. Table 2 lists the positions of the different links controlled by PC, via the USB port, and the [SDP](#) board in single-supply mode is required.

**Table 2. Link Options Setup for SDP Control (Default)**

Link Number	Option
LK1	A
LK2	A
LK3	C
LK4	B
LK5	A
LK6	B

**Table 3. Link Functions**

Link Number	Option
LK1	This link selects the DAC analog voltage source. Position A selects the internal voltage source (INT_VDD) from the <a href="#">ADP3331</a> . Position B selects an external supply voltage (EXT_VDD).
LK2	This link selects the DAC digital voltage source. Position A selects the digital voltage source from the <a href="#">SDP</a> board ( $V_{\text{IO}}$ ). Position B selects an external digital supply voltage (EXT_VLOGIC).
LK3	This link selects the reference source. Position A selects the on-board 2.5 V reference as the reference source. Do not use this option with the <a href="#">AD5686R/AD5684R</a> . Position B selects the on-board 5 V reference as the reference source. Do not use this option with the <a href="#">AD5686R/AD5684R</a> . Position C selects the internal reference of the <a href="#">AD5686R/AD5684R</a> as the reference source for the <a href="#">AD5686/AD5684</a> . Position D selects an off board voltage reference via the EXT_REF connector.
LK4	This link selects the gain setting of the <a href="#">AD5686/AD5684</a> (not populated). Position A selects gain of 2. Position B selects gain of 1.
LK5	This link selects the gain setting of the <a href="#">AD5686R/AD5684R</a> . Position A selects gain of 2. Position B selects gain of 1.
LK6	This link selects whether the <a href="#">AD5686R/AD5684R</a> or <a href="#">AD5686/AD5684</a> is accessed by the software. Position A selects the <a href="#">AD5686/AD5684</a> . Position B selects the <a href="#">AD5686R/AD5684R</a> .

## EVALUATION BOARD SOFTWARE

### INSTALLING THE SOFTWARE

The evaluation kit for the AD568x(R) includes self-installing software on the CD. The software is compatible with Windows® XP, Windows Vista (32-bit) and Windows 7 (32-bit). If users need drivers for 64-bit operating systems, contact [Linear.Apps@analog.com](mailto:Linear.Apps@analog.com).

The software 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.

To install the software, take the following steps:

1. Start the Windows operating system and insert the CD.
2. The installation software should open automatically. If it does not open automatically, run the **setup.exe** file from the CD.
3. After installation is completed, power up the evaluation board as described in the Power Supplies section.
4. Connect the evaluation board to the SDP board and the SDP board into the PC using the USB cable included in the box.
5. When the software detects the evaluation board, 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 board and connected the USB cable between the SDP board and the PC.
2. Power the SDP and evaluation board by connecting 6 V to the J3 connector.

3. Click **Start > All Programs > Analog Devices > AD56x(R)**. Each of the **AD5686R**, **AD5686**, **AD5684R**, and **AD5684** has its own version of software. Click the appropriate one to run the software. As the software connects to the evaluation board, the message in Figure 2 displays.

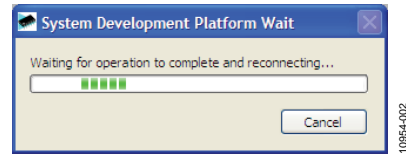


Figure 2. Connection Message

If the SDP board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 3 ). Simply connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

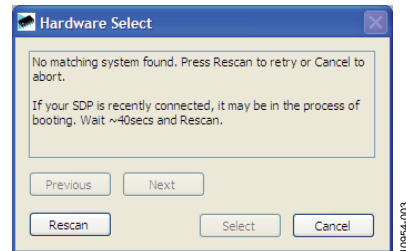


Figure 3. Connectivity Error

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 AD568x(R) evaluation software then opens, as shown in Figure 4.

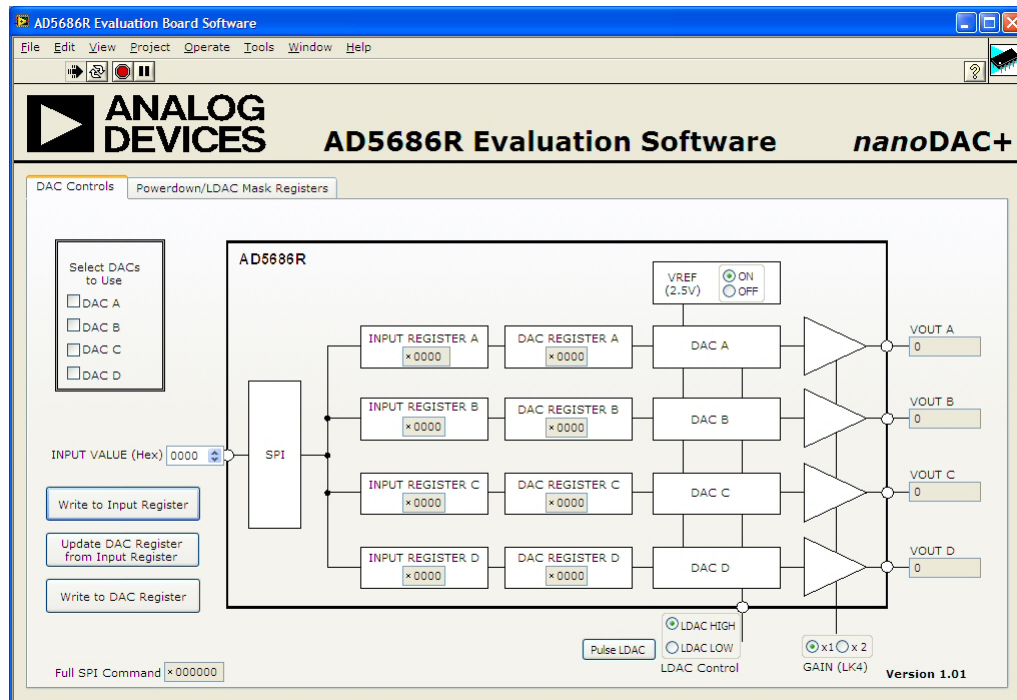


Figure 4. AD568x(R) Evaluation Board Software Main Window

## SOFTWARE OPERATION

The software for the AD568x(R) allows the user to program values to the input and DAC registers of each DAC individually or collectively.

### Write to Input Register

Select **Write to Input Register** to load the value in the input data control to the input register of any DACs selected in the **Select DACs to Use** box.

### Write to DAC Register

Select **Write to DAC Register** to load the value in the input data control to the DAC register of any DACs selected in the **Select DACs to Use** box. The DAC outputs are automatically updated with the appropriated voltage.

### Update DAC Register from Input Register

Select **Update DAC Register from Input Register** to copy the value in a DAC input register to the corresponding DAC register. DAC outputs are automatically updated with the appropriated voltage.

## LDAC CONTROL

Select **Pulse LDAC** to bring the LDAC pin low and then back high. Do this copies the data from the input registers to the DAC registers, and the outputs update accordingly. Any DAC updates disabled by the LDAC mask settings are ignored.

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

## GAIN Control

The logic level of the GAIN pin is set externally by LK4 or LK5. To display the correct voltage, the gain selection must be set to match the level of the pin.

## Reference Control

The AD5686R and AD5684R have an on-chip reference that can be disabled to reduce power consumption. The AD5686R and AD5684R software has a control that allows this function to be used.

The AD5686 and AD5684 require an external reference. The software for the AD5686 and AD5684 has a control that allows the user to set the reference voltage.

## Power-Down Control

Each of the DACs can be powered down individually. Each of the DACs has an associated selection box allowing the part to operate in normal mode, powered down with either a 1 k $\Omega$  or a 100 k $\Omega$  resistor to ground or tristate. When the power-down setting for each DAC are selected, click **Write to Part** to write the appropriate values to the AD568x(R).

## LDAC Mask Register

Each of the DACs can be set to accept or ignore  $\overline{\text{LDAC}}$  pulses. When the  $\overline{\text{LDAC}}$  selections are completed, click **Write to Part** to write the appropriate values to the AD568x(R).

## SPI COMMAND

On both control tabs of the software, the SPI commands sent to the DAC display. This shows what must be written to the AD568x(R) to replicate the function of the evaluation board.

EVALUATION BOARD SCHEMATICS AND ARTWORK

500-P5601

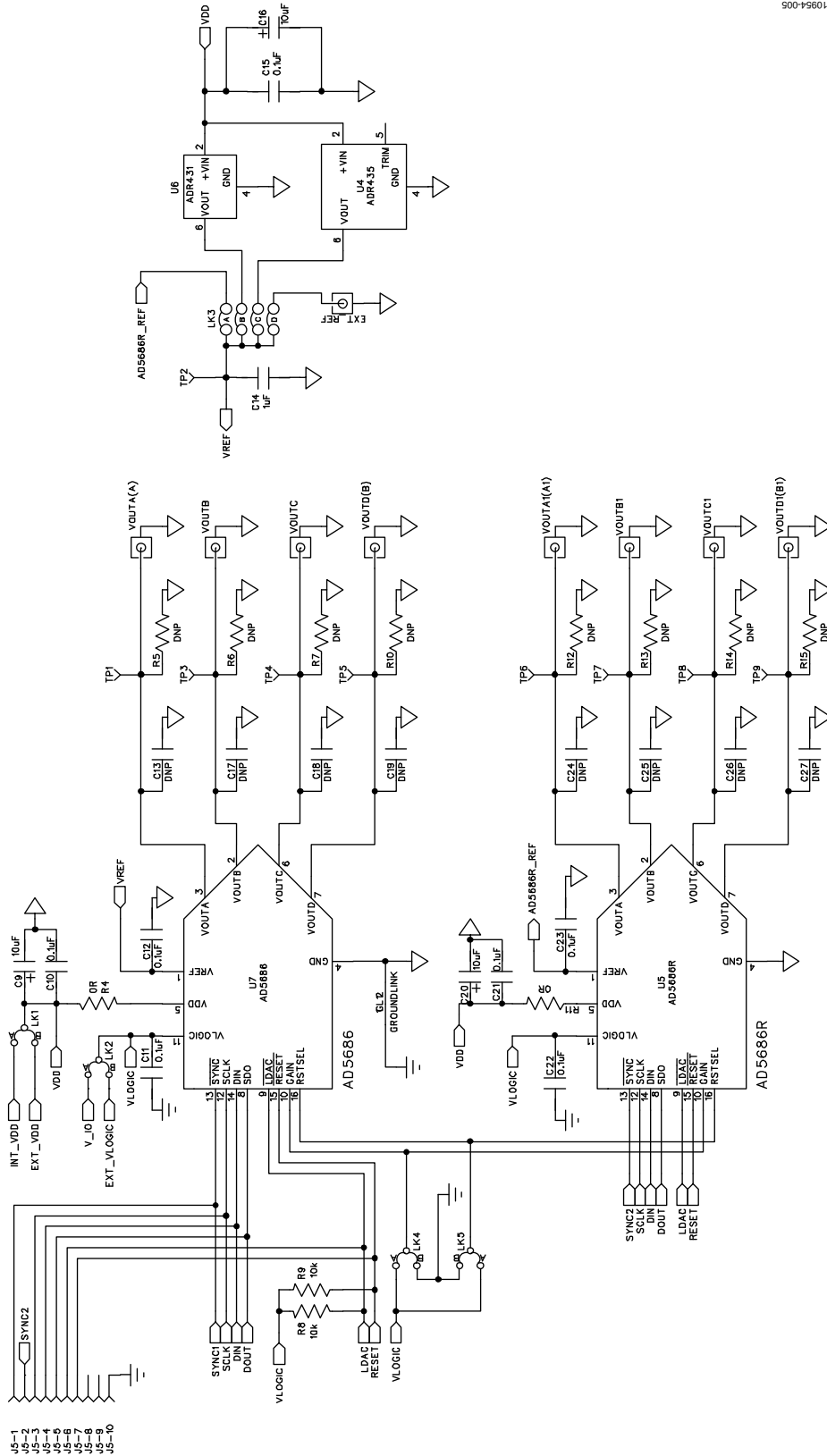


Figure 5. AD568x(R) Schematic (Page 1 of 2)

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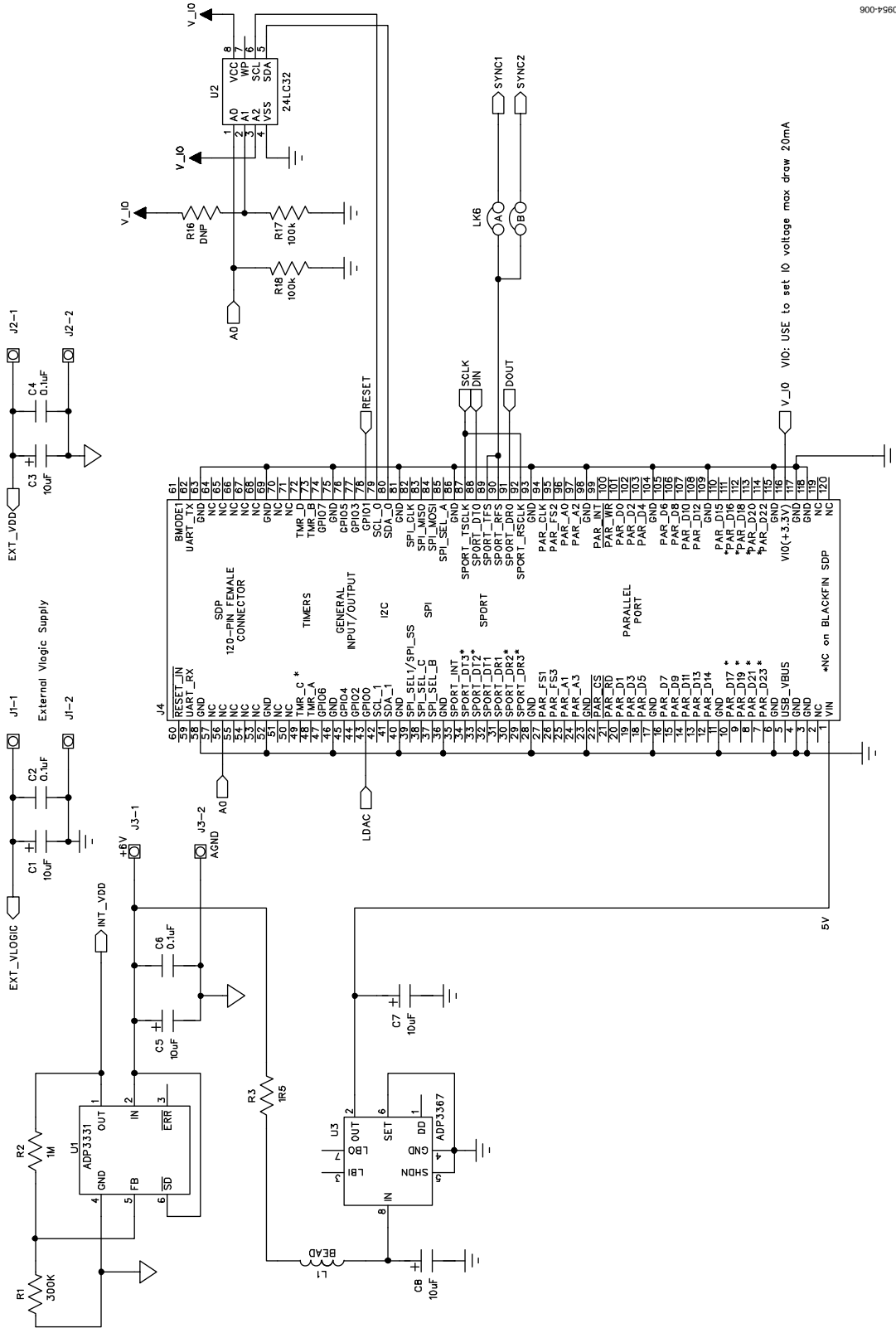


Figure 6. AD568x(R) Schematic (Page 2 of 2)

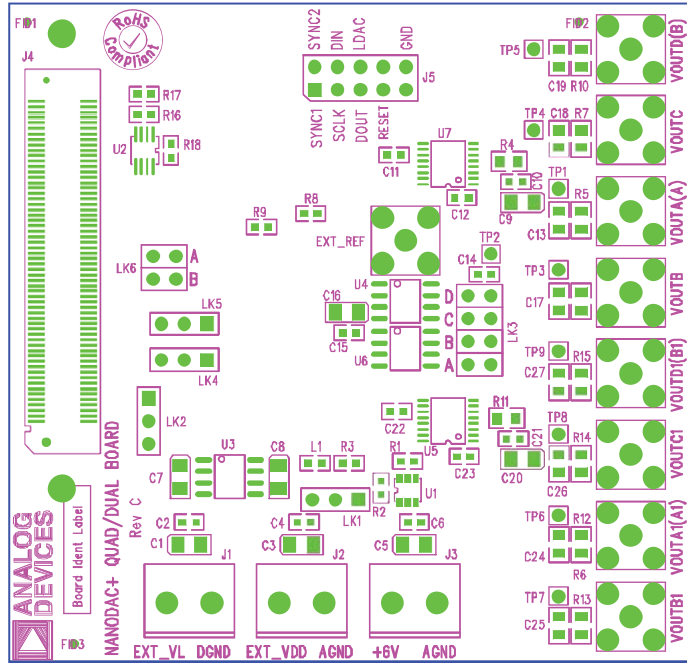


Figure 7. AD568x(R) Component Silkscreen

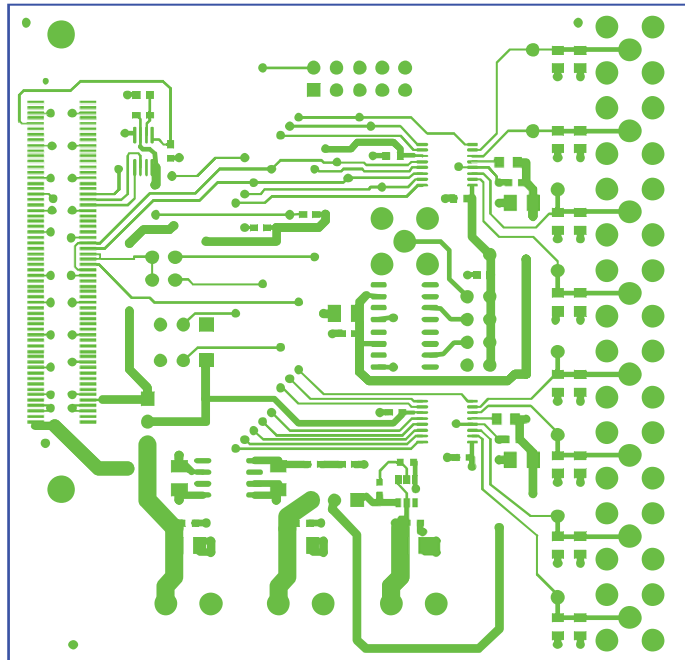
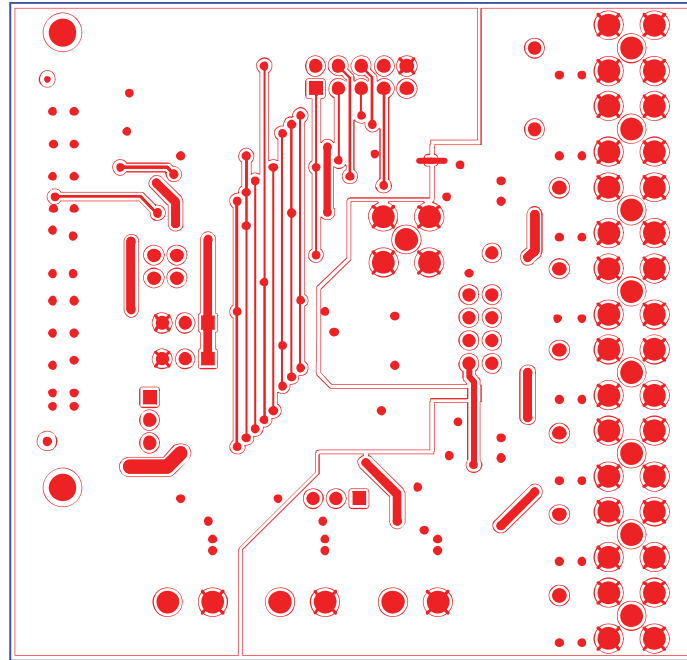


Figure 8. AD568x(R) Top Side Routing





10954-009

Figure 9. AD568x(R) Bottom Side Routing

## ORDERING INFORMATION

## COMPONENTS LIST

Table 4.

Qty	Reference Designator	Description	Supplier/Part Number
1	U7	Quad, 16-bit/12-bit nanoDAC+ with SPI interface	Analog Devices <a href="#">AD5686/AD5684</a>
1	U5	Quad, 16-bit/12-bit nanoDAC+ with 2 ppm/°C on-chip reference and SPI interface	Analog Devices <a href="#">AD5686R/AD5684R</a>
1	U1	High accuracy, ultralow quiescent current LDO, SOT-23	Analog Devices <a href="#">ADP3331</a>
1	U3	5 V fixed, adjustable low dropout linear voltage regulator	Analog Devices <a href="#">ADP3367</a>
1	U6	Ultralow noise XFET 2.5 V voltage reference with current sink and source capability	Analog Devices <a href="#">ADR431</a>
1	U4	Ultralow noise XFET 5.0 V voltage reference with current sink and source capability	Analog Devices <a href="#">ADR435</a>
8	VOUTA, VOUTA1, VOUTB, VOUTB2, VOUTC, VOUTC1, VOUTD, VOUTD1	50 Ω SMB jack	FEC 1206013
1	L1	Ferrite bead, 600 Ω at 100 MHz	Digi-Key 490-1024-1-ND
1	R1	0603, 300 kΩ resistor	Digi-Key 541-300KHCT-ND
1	R2	Resistor, 1 MΩ, 1%, 0.063W, 0603	Digi-Key RMCF1/161MFRCT-ND
1	J4	120-pin female connector	FEC 1324660 or Digi-Key H1219-ND
1	U2	32K, I <sup>2</sup> C serial EEPROM (24LC32)	FEC 1331330
1	C14	Capacitor, 0603, 1 μF, 10 V	FEC 318-8840
1	R3	Resistor, 1.5 Ω, 5%, 0.063W, 0603	FEC 9331832
2	R8, R9	10 kΩ SMD resistor	FEC 9330399
2	R17, R18	100 kΩ SMD resistor	FEC 9330402
2	R4, R11	0 Ω resistor, 0805	FEC 9333681
3	J5, LK3, LK6	Terminal block, 8-pin (4 × 2) 0.1" header	FEC 1022244
3	J1, J2, J3	2-pin terminal block	FEC 151789
4	LK1, LK2, LK4, LK5	Jumper block using 3-pin SIP header	FEC 1022248 and FEC 150410
8	C1, C3, C5, C7, C8, C9, C16, C20	Case A, 10 μF capacitor	FEC 197-130
9	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9	Red test point	FEC 8731144 (pack)
10	C2, C4, C6, C10, C11, C12, C15, C21, C22, C23	Capacitor, 0.1 μF, 50 V, 0603	FEC 8820023
17	C13, C17, C18, C19, C24, C25, C26, C27, R5, R6, R7, R10, R12, R13, R14, R15, R16	Do not populate (DNP)	Not Inserted

**NOTES**

## NOTES

**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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