

Evaluating the **AD5544** Current Output/Serial Input DAC

FEATURES

- Full-featured evaluation board for the **AD5544****
- Graphic user interface software for board control and data analysis**
- Connector to **EVAL-SDP-CB1Z** system demonstration platform board**
- Various power supply options**

APPLICATIONS

- Automatic test equipment**
- Instrumentation**
- Digitally controlled calibration**

GENERAL DESCRIPTION

The AD5544 quad, 16-bit, current output, digital-to-analog converter (DAC) is designed to operate in a 2.7 V to 5.5 V supply range. But this voltage is limited up to 3.3 V due to EVAL-SDP-CB1Z restrictions.

The applied external reference input voltage (V_{REFX}) determines the full-scale output current. Integrated feedback resistors (R_{FBX}) provide temperature-tracking, full-scale voltage outputs when combined with an external I-to-V precision amplifier.

A double-buffered serial data interface offers high speed, 3-wire, SPI- and microcontroller-compatible inputs using serial data in (SDI), chip select (\overline{CS}), and clock (CLK) signals. In addition, a serial data out pin (SDO) allows for daisy-chaining when multiple packages are used. A common, level-sensitive, load DAC strobe (\overline{LDAC}) input allows the simultaneous update of all DAC outputs from previously loaded input registers. Additionally, an internal power-on reset forces the output voltage to 0 at system turn on. An MSB pin allows system reset assertion (\overline{RS}) to force all registers to zero code when MSB = 0 or to half-scale code when MSB = 1.

The AD5544 is packaged in a compact 28-lead SSOP.

The EV-AD5544/45SDZ board is used in conjunction with the EVAL-SDP-CB1Z system demonstration platform (SDP) board available from Analog Devices, Inc., which is purchased separately from the evaluation board. The USB-to-SPI communication to the AD5544 is completed using this Blackfin®-based demonstration board. The software offers a waveform generator.

FUNCTIONAL BLOCK DIAGRAM

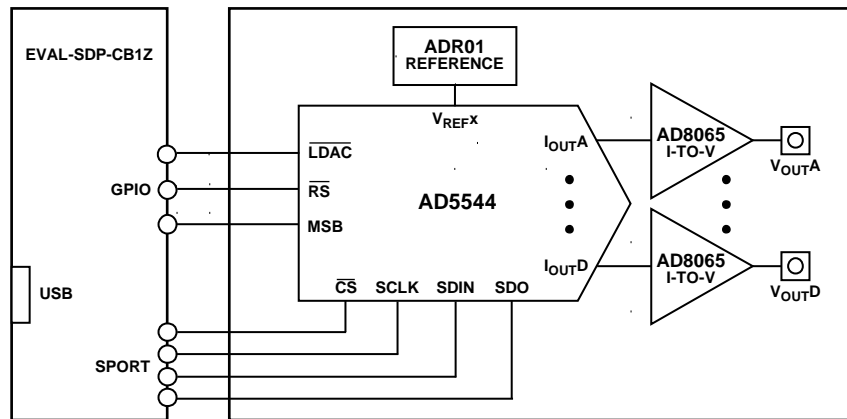


Figure 1.

TABLE OF CONTENTS

Features	1	Running the Software	3
Applications.....	1	Using the Evaluation Board Software	4
General Description	1	Example	4
Functional Block Diagram	1	Evaluation Board Schematics and Artwork.....	5
Revision History	2	Evaluation Board Layout	8
Evaluation Board Software	3	Related Links.....	9
Installing the Software	3		

REVISION HISTORY

5/13—Rev. A to Rev. B

Changed EVAL-AD5544/45SDZ to EV-AD5544/45SDZ
 Universal

5/12—Rev. 0 to Rev. A

Changes to General Description Section 1
 Changes to Figure 2..... 3
 Changes to Evaluation Board Schematics and Artwork Section... 5

5/11—Revision 0: Initial Version

EVALUATION BOARD SOFTWARE

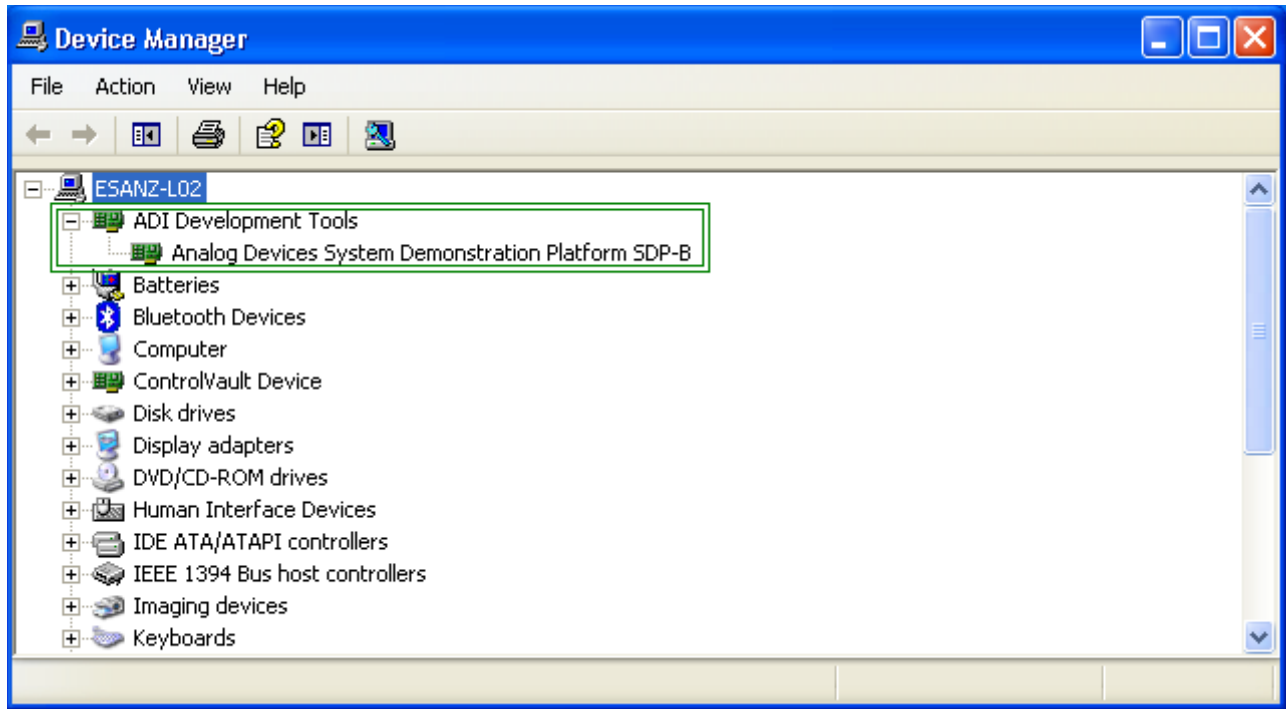


Figure 2. Device Manager Showing the SDP Board Connected

INSTALLING THE SOFTWARE

The EV-AD5544/45SDZ evaluation kit includes the software and drivers on CD. To install the software, do the following:

1. Install the software before connecting the SDP board to the USB port of the PC.
2. Start the Windows® operating system and insert the EV-AD5544/45SDZ evaluation kit CD.
3. Download the EV-AD5544/45SDZ LabVIEW™ software. The correct driver, SDPDriversNET, for the SDP board should download automatically after LabVIEW is downloaded, supporting both 32- and 64-bit systems. However, if the drivers do not download automatically, the driver executable file can also be found in the **Program Files/Analog Devices** folder. Follow the on-screen prompts to install it.
4. After installation of the software and drivers is complete, plug the EV-AD5544/45SDZ into 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 (**Found New Hardware Wizard/Install the Software Automatically** and so on).

RUNNING THE SOFTWARE

To run the evaluation board program, do the following:

1. Click **Start/All Programs/Analog Devices/EV-AD5544/45SDZ**.
2. 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.

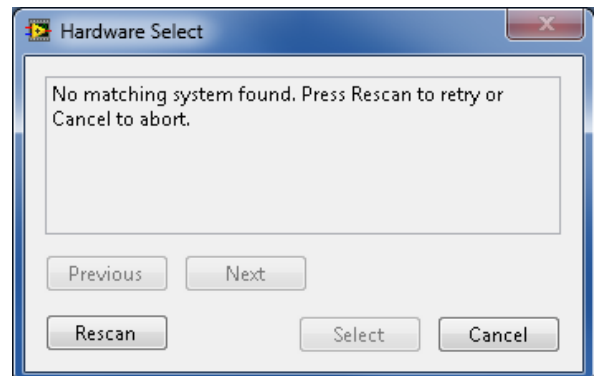


Figure 3.

USING THE EVALUATION BOARD SOFTWARE

Once the software is launched, the main window pops up (see Figure 4).

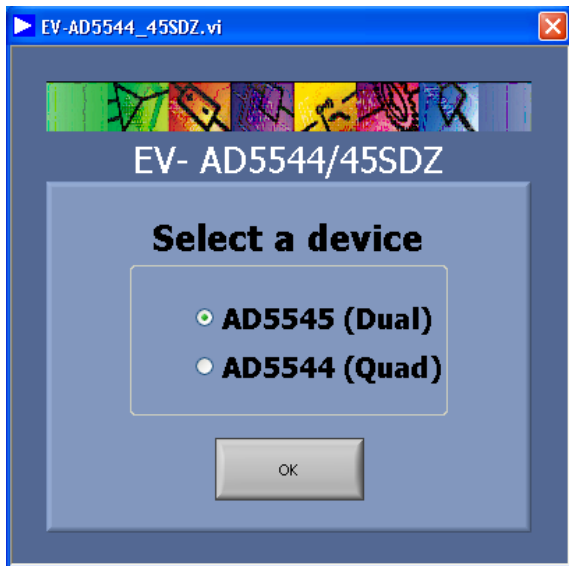


Figure 4. Main Window

The first step is to select the device to use that is connected to the SDP board, in this case the AD5544, and click **OK**.

After selecting the device, the AD5544 evaluation software window appears (see Figure 5) to start writing to the device.

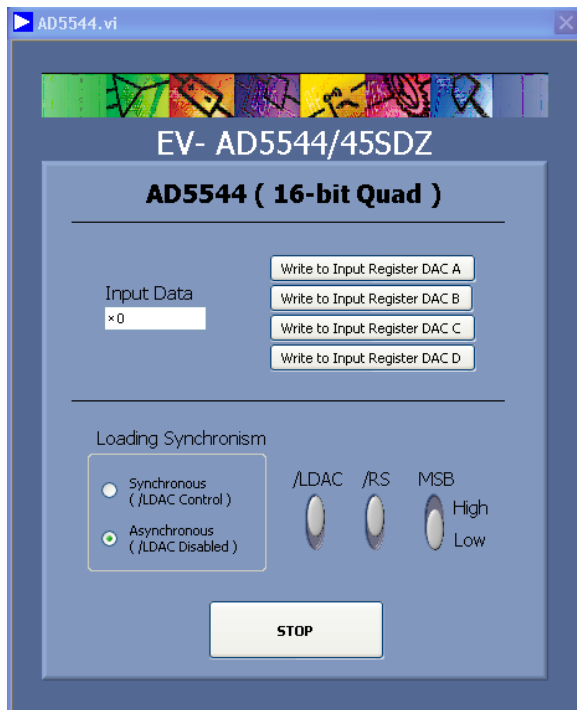


Figure 5. AD5544 Evaluation Software Window

The desired 16-bit data loads and updates one of the four DACs that you selected within the AD5544 part.

There are two modes for loading the data. Synchronous mode enables you to program each channel separately and update them simultaneously. Program $\overline{\text{LDAC}}$ high, load the channels, and finally pull $\overline{\text{LDAC}}$ low. Asynchronous mode enables you to load and update each channel separately (the $\overline{\text{LDAC}}$ button is ignored in this case).

The reset button, $\overline{\text{RS}}$, updates all channel outputs to zero scale or midscale when MSB is pulled low or high.

EXAMPLE

With $\overline{\text{LDAC}}$ and $\overline{\text{RS}}$ tied high for asynchronous loading mode, specify quarter scale (0x4000, 16384d) in the **Input Data** box and click **Load and Update DAC A**. The expected output obtained is

$$V_{OUT} = -V_{REF} \times \frac{D}{65,536} = -10 \times \frac{16,384}{65,536} = -2.5 \text{ V}$$

When you change the loading synchronism mode to synchronous and write the value 0xC000 (49152d), you see no change in the output until $\overline{\text{LDAC}}$ is tied low. The expected output for this case is

$$V_{OUT} = -V_{REF} \times \frac{D}{65,536} = -10 \times \frac{49,152}{65,536} = -7.5 \text{ V}$$

EVALUATION BOARD SCHEMATICS AND ARTWORK

SCHEMATICS

900-00660

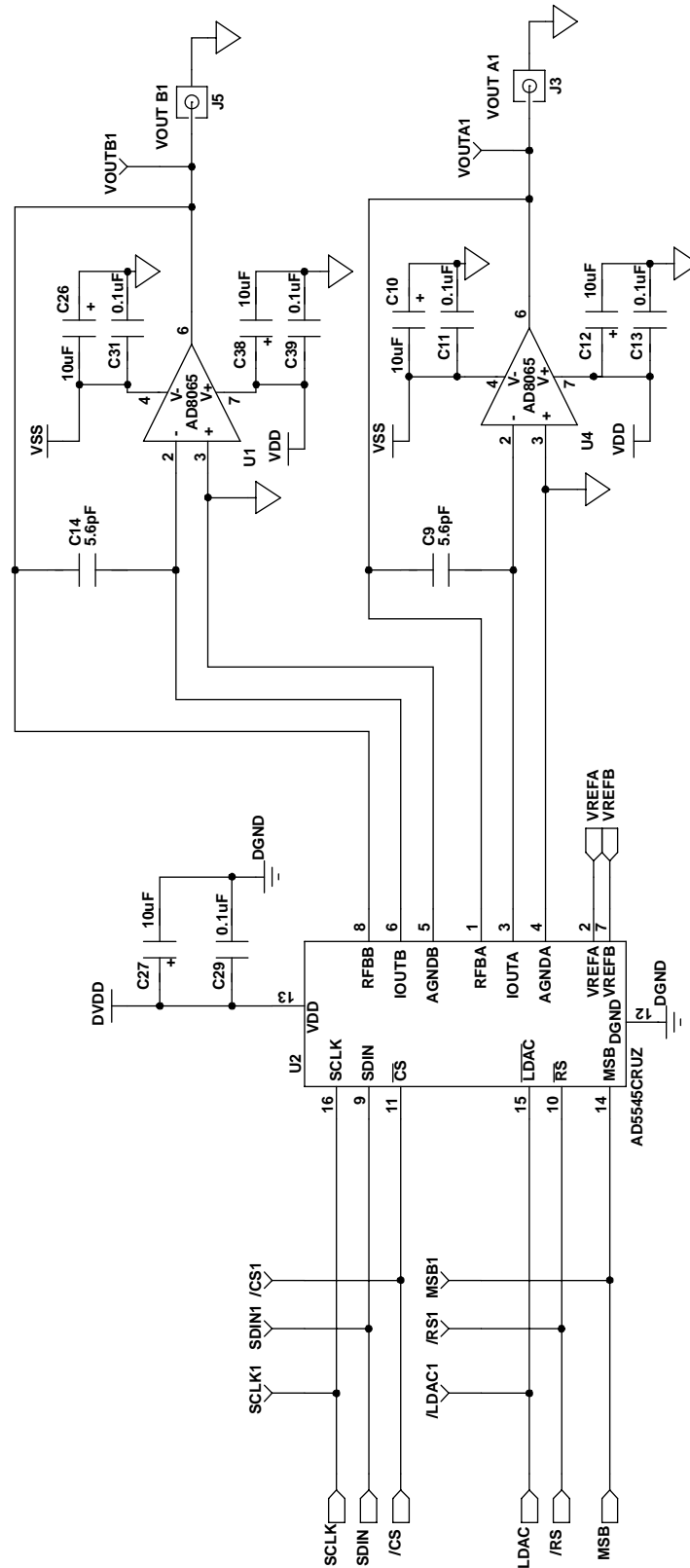


Figure 6. EV-AD5544/45SDZ Schematic Part A

BMODE1: Pull up with a 10K resistor to set SDP to boot from a SPI FLASH on the daughter board

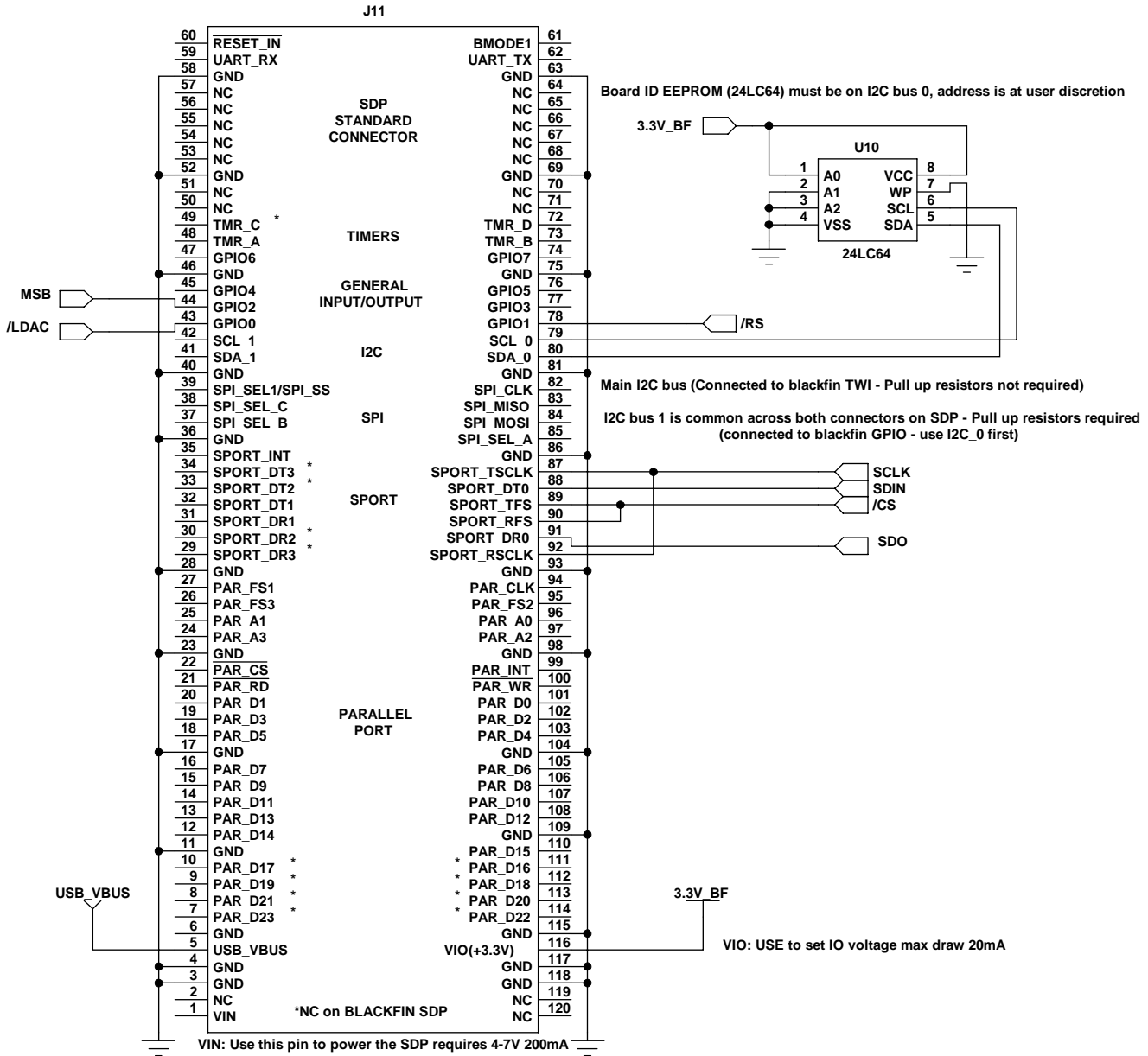


Figure 7. EV-AD5544/45SDZ Schematic Part B

09900-107

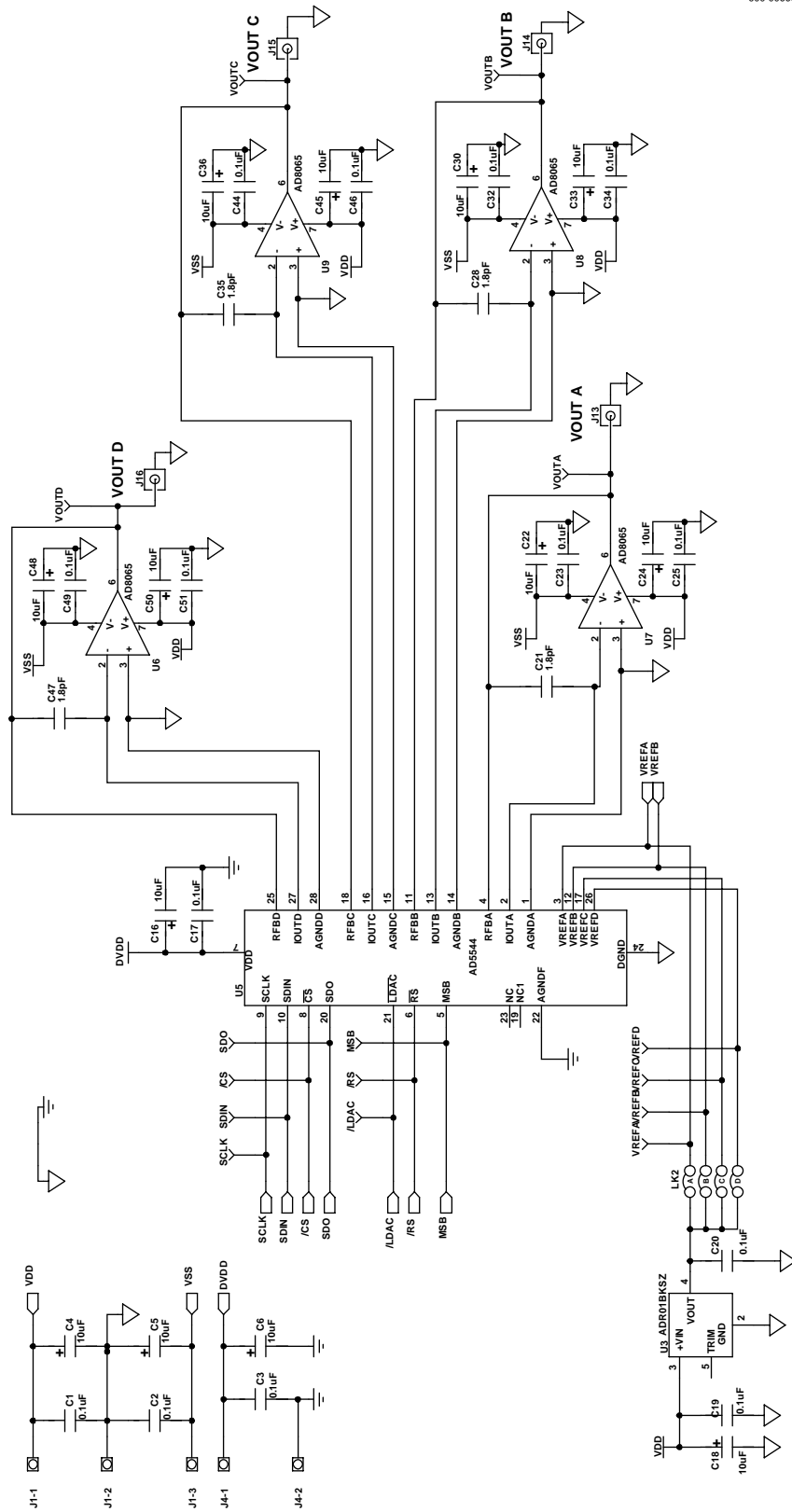


Figure 8. EV-AD5544/45SDZ Schematic Part C

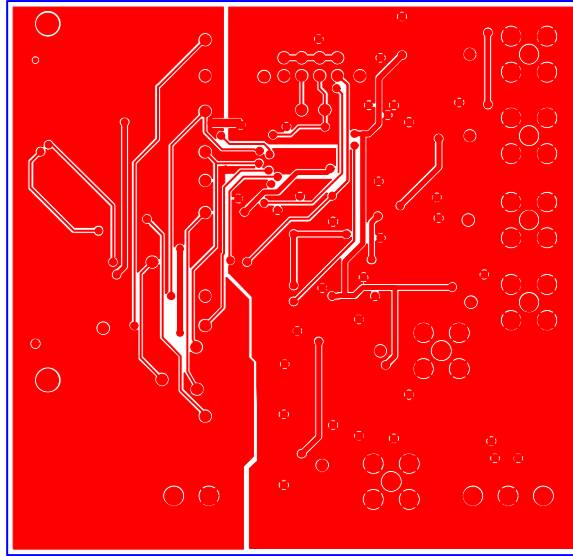


Figure 11. Solder Side

RELATED LINKS

Resource	Description
AD5545	Product Page, AD5545 Precision Dual 16-Bit DAC in Compact TSSOP Packages
AD5544	Product Page, AD5544 Quad, Current-Output, Serial-Input 16-Bit DAC
ADR01	Product Page, ADR01 Ultracompact, Precision 10.0 V Voltage Reference
AD8065	Product Page, AD8065 High Performance, 145 MHz FastFET™ Op Amp
EVAL-SDP-CB1Z	Product Page, System Demonstration Platform

NOTES

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.

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.