Evaluation Board User Guide
UG-327

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Evaluating the AD5443, AD5446, and AD5453 Current Output/Serial Input DACs

FEATURES

- Full-featured evaluation board for the AD5443, AD5446, and AD5453
- 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
- Digital waveform generation

FUNCTIONAL BLOCK DIAGRAM

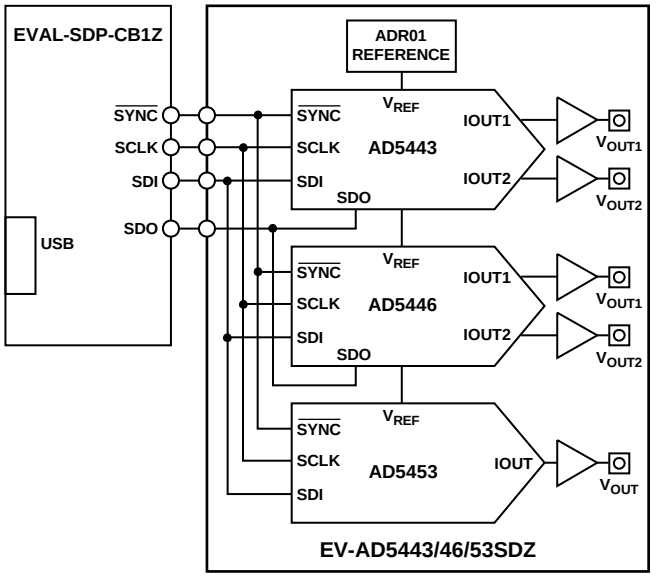

Figure 1.

GENERAL DESCRIPTION

The AD5443, AD5446,and AD5453 are CMOS 12-bit, 14-bit, and 14-bit, respectively, current output, digital-to-analog converters (DACs). The AD5443 operates from a 3 V to 5.5 V power supply, while the AD5446 and AD5453 operate from a single 2.5 V to 5.5 V power supply. These devices are well suited for portable battery-powered and applications such as waveform generation and analog processing.

Because of the CMOS submicron manufacturing process, these parts offer excellent 4-quadrant multiplication characteristics of 10 MHz for the AD5443 and up to 12 MHz for the AD5446 and AD5453 DACs.

These DACs use a double-buffered, 3-wire serial interface that is compatible with SPI, QSPI™, MICROWIRE™, and most DSP interface standards. On power-up, the internal shift register and latches are filled with 0s, and the DAC output is at zero scale. In addition for the AD5443 and AD5446, a serial data out pin (SDO) allows for daisy chaining when multiple packages are used. Data readback allows the user to read the contents of the DAC register via the SDO pin.

The applied external reference input voltage (V_{REF}) determines the full-scale output current. An integrated feedback resistor (R_{FB}) provides temperature tracking and full-scale voltage output when combined with an external current-to-voltage precision amplifier.

The AD5443 and AD5446 are available in small 10-lead MSOP packages, while the AD5453 is available in small 8-lead TSOT, MSOP packages, also comes in 8-lead LFCSP.

The EV-AD5443/46/53SDZ 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 DAC is completed using this Blackfin®-based demonstration board.

PLEASE SEE THE LAST PAGE FOR AN IMPORTANT WARNING AND LEGAL TERMS AND CONDITIONS.

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REVISION HISTORY

6/13—Rev. 0 to Rev. A

Changed EVAL-AD5443SDZ/EVAL-AD5446SDZ/
EVAL-AD5453SDZ to EV-AD5443/46/53SDZ ..... Universal

4/12—Revision 0: Initial Version

EVALUATION BOARD SOFTWARE

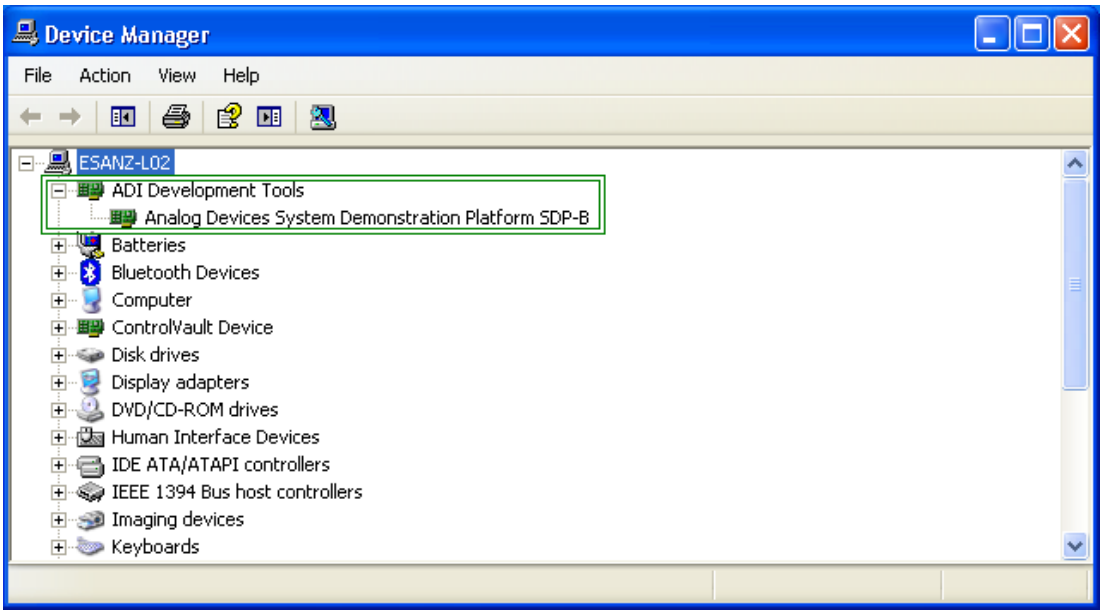

Figure 2. Device Manager Showing the SDP Board Connected

INSTALLING THE SOFTWARE

The EV-AD5443/46/53SDZ evaluation kit includes the software and drivers on CD. To install the software, follow these steps:

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-AD5443/46/53SDZ evaluation kit CD.
3. Download the EV-AD5443/46/53SDZ LabVIEW™ software. The correct driver, SDPDriversNET, for the SDP board should download automatically after LabVIEW is downloaded, supporting both 32-bit 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-AD5443/46/53SDZ 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-AD5443/46/53SDZ**.
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.

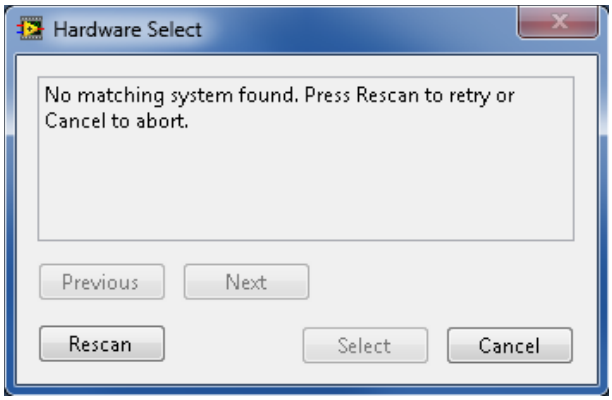

Figure 3. Connectivity Error (See Step 2)

USING THE EVALUATION BOARD SOFTWARE

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

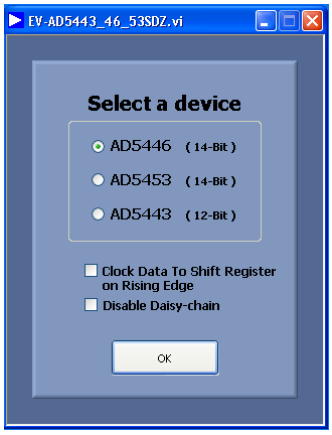

Figure 4. Main Window

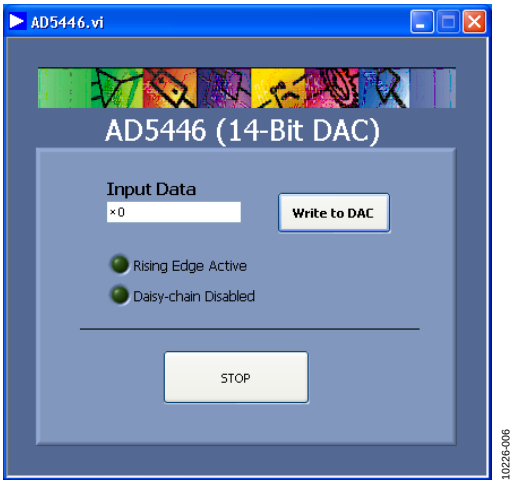

Figure 6. AD5446 Evaluation Software Window

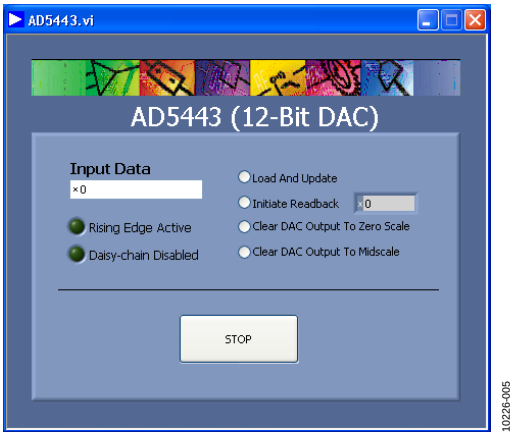

Figure 5. AD5443 Evaluation Software Window

Figure 7. AD5453 Evaluation Software Window

EXAMPLE 1

Select the AD5453 part from the main window. Check the **Clock Data To Shift Register on Rising Edge** box, and click the **OK** button. The **AD5453 Evaluation Software Window** should appear. The LED indicator with the **Rising Edge Active** label should be lit indicating the actual functionality mode (see Figure 5).

Enter Data 0x2000 (half scale) in the **Input Data** control and click the **Write to DAC** button. Data is clocked on the rising edge instead of the falling edge (by default). There is no loss of data; therefore, the output shows the expected −5 V value. The only change is the way the data is clocked.

$$V_{OUT} = -V_{REF} \times \frac{D}{2^n} = -10 \times \frac{8{,}192}{16{,}384} = -5\ \text{V}$$

EXAMPLE 2

Select the AD5446 part from the main window and click the **OK** button. The **AD5446 Evaluation Software Window** should appear. Enter Data 0x3FFF (full scale) in the **Input Data** control and click the **Write to DAC** button. The output shows −10 V, and because this write was the first action on the DAC after powering up, the data on the SDO pin is not taken into account because the data is not given any information.

$$V_{OUT} = -V_{REF} \times \frac{D}{2^n} = -10 \times \frac{16{,}383}{16{,}384} = -10\ V$$

Write Data 0x1000 (quarter scale) to the DAC. The output changes its voltage from −10 V to −2.5 V, and the previous data written to the part will appear on the SDO pin (in this example, −10 V).

$$V_{OUT} = -V_{REF} \times \frac{D}{2^n} = -10 \times \frac{16{,}383}{16{,}384} = -10\ V$$

To finish evaluating the part, push the **STOP** button.

To disable daisy-chain mode, check the **Disable Daisy-chain** box in the **Main Window** after launching the application and before clicking the **OK** button. The LED indicator with the **Daisy-chain Disabled** label will be lit indicating the functionality mode.

EXAMPLE 3

Select the AD5443 part from the **Main Window** and click the **OK** button. The **AD5443 Evaluation Software Window** should appear. Enter Data 0x800 (half scale) in the **Input Data** control and select **Load And Update**. The output shows the expected −5 V value.

$$V_{OUT} = -V_{REF} \times \frac{D}{2^n} = -10 \times \frac{2{,}048}{4{,}096} = -5\ V$$

Select **Clear DAC Output To Zero Scale** to get a voltage value of 0 V on the output.

To put the part in three-quarter scale, write 0xBFD in the **Input Data** control and select **Load And Update**.

$$V_{OUT} = -V_{REF} \times \frac{D}{2^n} = -10 \times \frac{3{,}069}{4{,}096} = -7.5\ V$$

To verify the data in the DAC register is correct, select **Initiate Readback** and the indicator window beside this option shows −7.5 V.

EVALUATION BOARD SCHEMATICS AND ARTWORK

SCHEMATICS

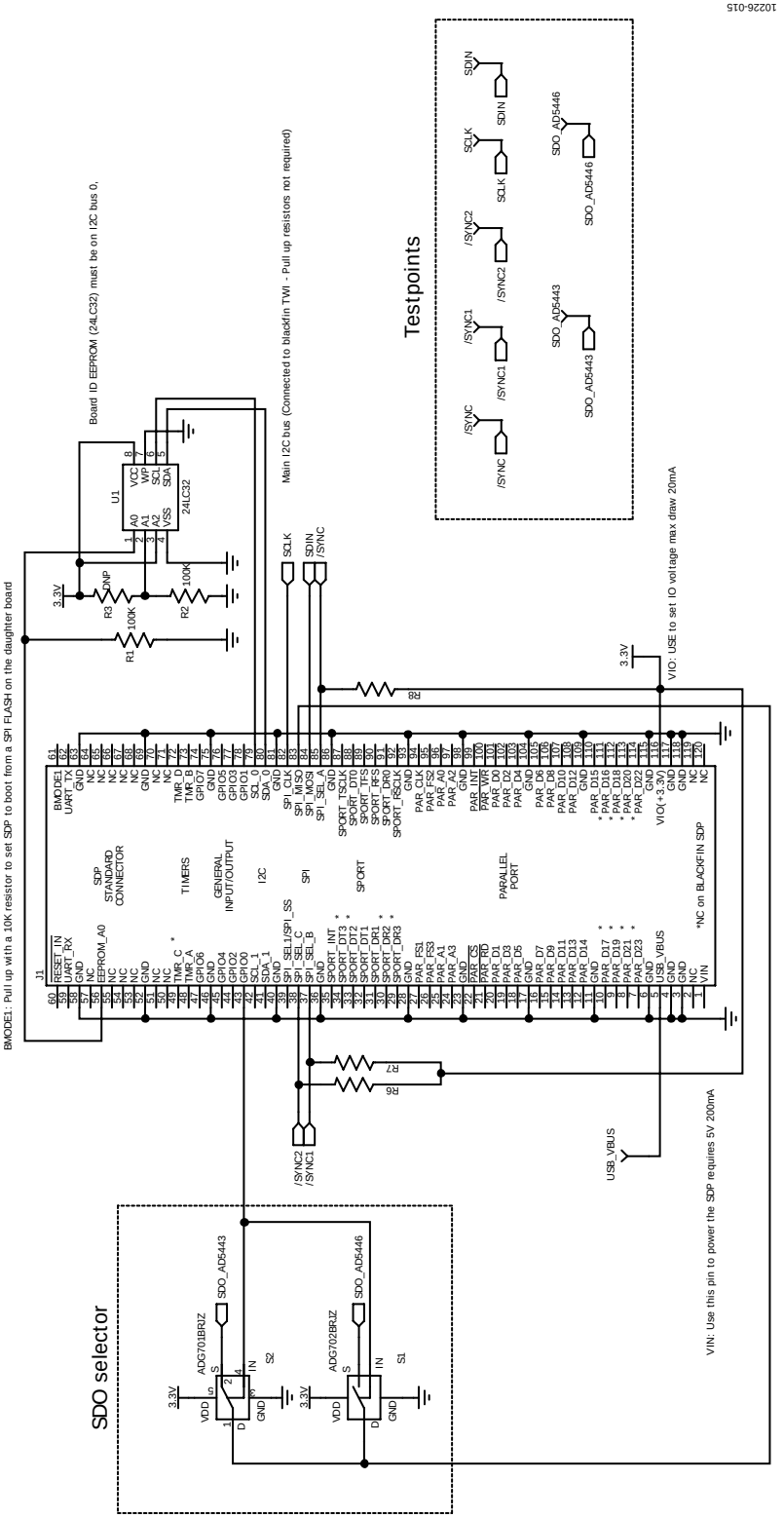

Figure 8. EV-AD5443/46/53SDZ Schematic, SDP Connector

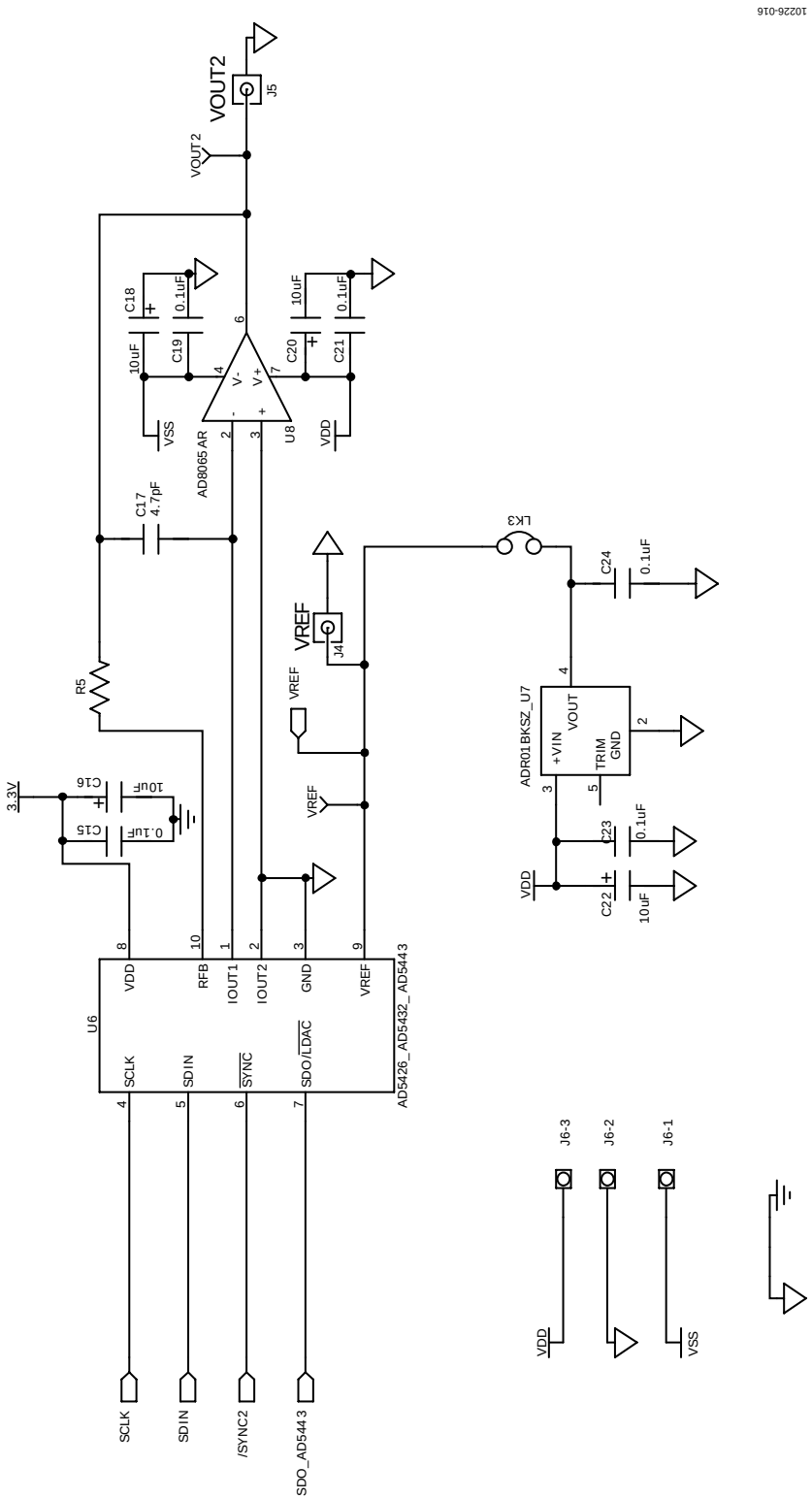

Figure 9. EV-AD5443/46/53SDZ Schematic, AD5443 DAC

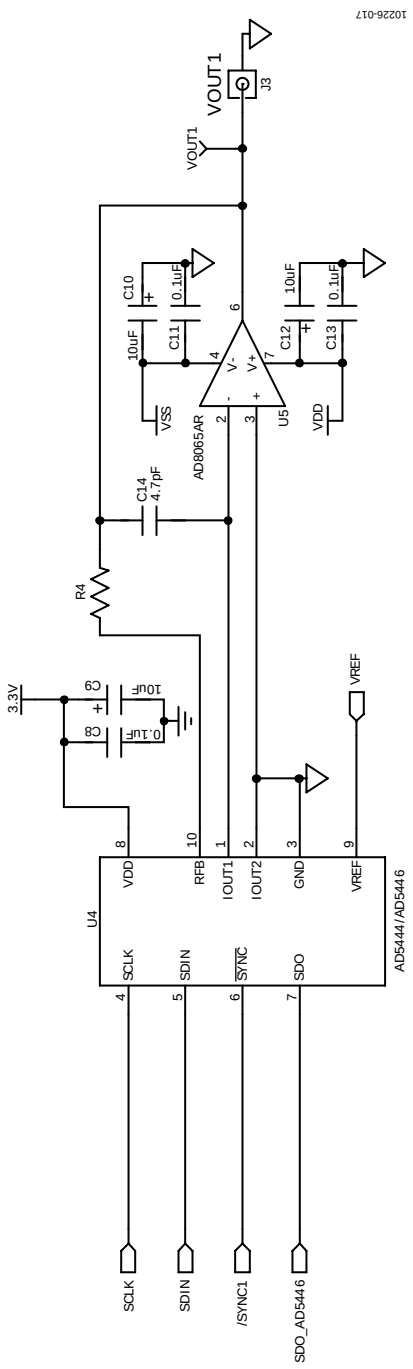

Figure 10. EV-AD5443/46/53SDZ Schematic, AD5446 DAC

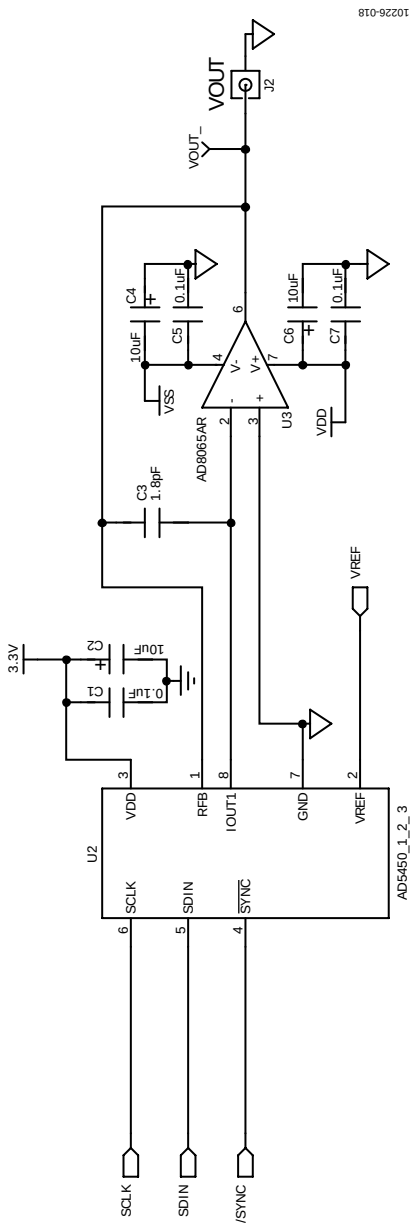

Figure 11. EV-AD5443/46/53SDZ Schematic, AD5453 DAC

EVALUATION BOARD LAYOUT

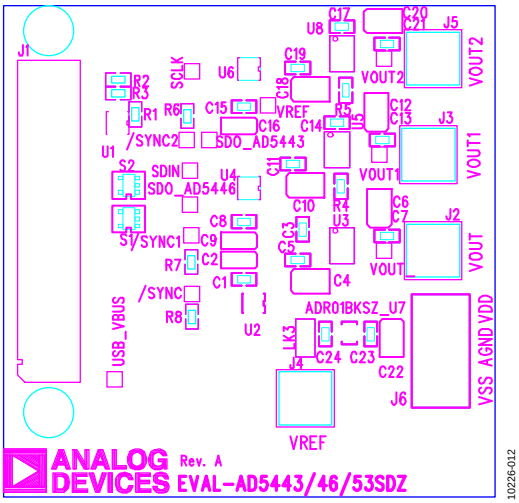

Figure 12. EV-AD5443/46/53SDZ Silkscreen

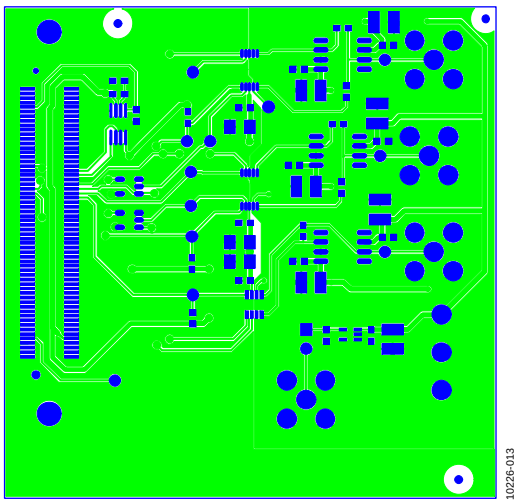

Figure 13. EV-AD5443/46/53SDZ Component Side

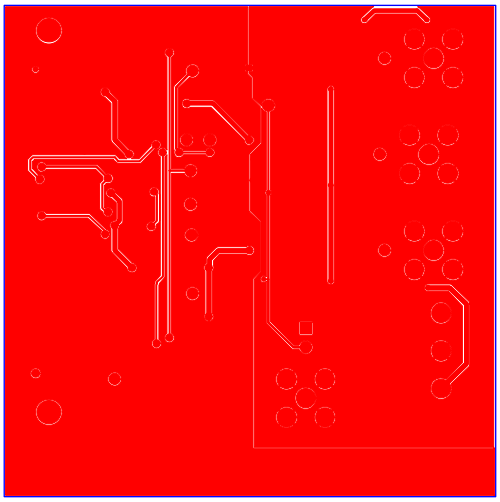

Figure 14. EV-AD5443/46/53SDZ Solder Side

RELATED LINKS

Resource	Description
AD5443	Product Page, AD5443 High Bandwidth CMOS 12-Bit Serial Interface Multiplying D/A Converter
AD5446	Product Page, AD5446 14-Bit High Bandwidth Multiplying DAC with Serial Interface
AD5453	Product Page, AD5453 14-Bit High Bandwidth Multiplying DACs with Serial Interface
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-Blackfin

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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