

Software Configurable 16-Bit Quad-Channel Unipolar/Bipolar Voltage Output Using the **AD5754R** DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit provides unipolar and bipolar digital-to-analog conversion using the **AD5754R**, a quad, 16-bit, serial input, unipolar/bipolar voltage output DAC. The only external components needed for this 16-bit DAC are decoupling capacitors on the supply pins and reference input, leading to savings in cost and board space. This circuit is well suited for closed-loop servo control applications.

CIRCUIT DESCRIPTION

The **AD5754R** is a digital-to-analog converter that offers guaranteed 16-bit monotonicity, integral nonlinearity (INL) of ± 16 LSB, 0.1% total unadjusted error (TUE), and 10 μ s settling time. The **AD5754R** also integrates a 2.5 V, 5 ppm/ $^{\circ}$ C voltage reference, reference buffers, and output amplifiers. This provides further savings in both cost and board space. Performance is guaranteed over the following supply voltage ranges: AVDD supply range from +4.5 V to +16.5 V and AVSS supply range from -4.5 V to -16.5 V. The AVSS supply can be connected to 0 V if only unipolar outputs are required. The output range can be individually programmed for each of the four channels with these options: 0 V to +5 V, 0 V to +10 V, 0 V to +10.8 V, -5 V to +5 V, -10 V to +10 V, and -10.8 V to +10.8 V. The input coding is user selectable 2's complement or offset binary for a bipolar output (depending on the state of the BIN/2sCOMP pin). Coding is straight binary for a unipolar output. Figure 2 shows that the typical output error of this circuit at 25 $^{\circ}$ C ambient temperature is less than 0.07 %FSR.

The circuit must be constructed on a multilayer PC board with a large area ground plane. Proper layout, grounding, and decoupling techniques must be used to achieve optimum performance (see [MT-031 Tutorial, Grounding Data Converters and Solving the Mystery of AGND and DGND](#) and [MT-101 Tutorial, Decoupling Techniques](#)).

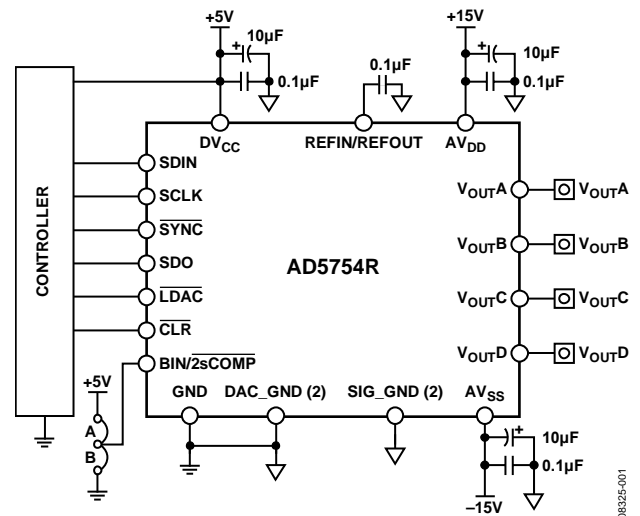


Figure 1. Unipolar/Bipolar Configuration for the **AD5754R** DAC (Simplified Schematic)

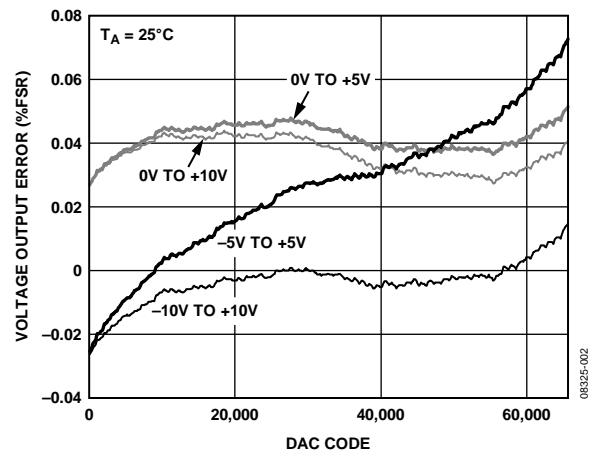


Figure 2. Voltage Output Error

LEARN MORE

[Kester, Walt. 2005. *The Data Conversion Handbook*. Analog Devices. Chapters 3 and 7.](#)

[MT-015 Tutorial, *Basic DAC Architectures II: Binary DACs*. Analog Devices.](#)

[MT-031 Tutorial, *Grounding Data Converters and Solving the Mystery of AGND and DGND*. Analog Devices.](#)

[MT-101 Tutorial, *Decoupling Techniques*. Analog Devices.](#)

[Voltage Reference Wizard Design Tool.](#)

Data Sheets and Evaluation Boards

[AD5754R Data Sheet.](#)

[AD5754R Evaluation Board.](#)

REVISION HISTORY

4/13—Rev. 0 to Rev. A

Changed Document Title from CN-0083 to

AN-1243 Universal

7/09—Revision 0: Initial Version