AN-1246
APPLICATION NOTE

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Software Configurable 16-Bit Quad Channel Unipolar/Bipolar Voltage Output Using the AD5754 DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit provides, unipolar and bipolar data conversion using the AD5754BREZ, a quad, 16-bit, serial input, unipolar/bipolar voltage output DAC, and the REF192ESZ precision 2.5 V voltage reference. The only additional external components needed for this 16-bit DAC circuit 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

Table 1. Devices Connected/Referenced

Product	Description
AD5754	Complete quad, 16-bit, unipolar/bipolar voltage output DAC
REF192	Precision 2.5 V voltage reference

The AD5754 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 µs settling time. The AD5754 also integrates reference buffers and output amplifiers, which leads to further savings in both cost and board space. Performance is guaranteed over the following supply voltage ranges: AV_{DD} supply range from +4.5 V to +16.5 V and AV_{SS} supply range from −4.5 V to −16.5 V. AV_{SS} 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. The options are 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 twos 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°C ambient temperature is less than 0.06 %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 and MT-101 Tutorial).

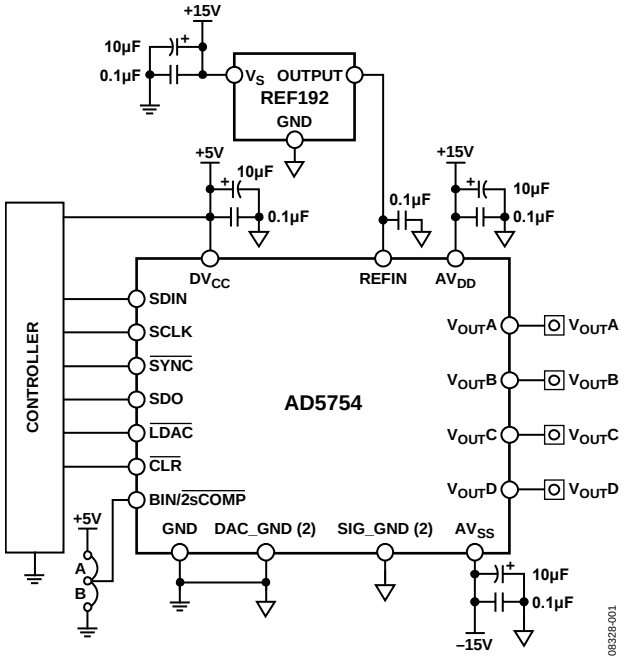

Figure 1. Unipolar/Bipolar Configuration of the AD5754 DAC (Simplified Schematic)

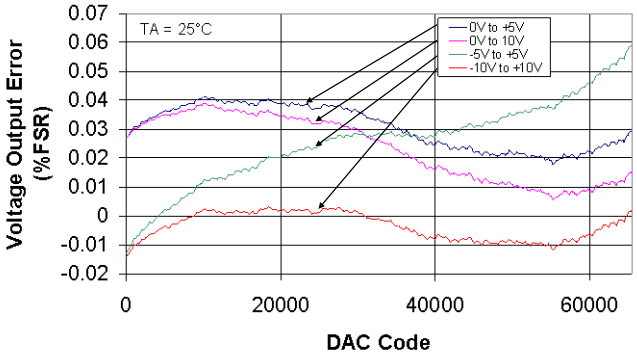

Figure 2. Voltage Output Error

LEARN MORE

Kester, Walt. 2005. *The Data Conversion Handbook*, Chapters 3 and 7. Analog Devices.

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

AD5754 Data Sheet.

REF192 Data Sheet.

AD5754R Evaluation Board (Compatible with AD5754).

REVISION HISTORY

4/13—Rev. 0 to Rev. A

Changed Document Title from CN-0086 to AN-1246 ..... Universal

7/09—Revision 0: Initial Version

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