

Software Configurable 12-Bit Quad-Channel Unipolar/Bipolar Voltage Output Using the **AD5724** DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit provides unipolar and bipolar data conversion using the [AD5724BREZ](#), a quad, 12-bit, serial input, unipolar/bipolar voltage output DAC and the [REF192ESZ](#) precision 2.5 V voltage reference. The only other external components needed for this 12-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
AD5724	Complete, quad, 12-bit, serial input, unipolar/bipolar voltage output DAC
REF192	Precision 2.5 V voltage reference

The [AD5724](#) is a digital-to-analog converter (DAC) that offers guaranteed 12-bit monotonicity, integral nonlinearity (INL) of ± 1 LSB, 0.1% total unadjusted error (TUE), and 10 μ s settling time. The [AD5724](#) also integrates reference buffers and output amplifiers. This leads to 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.
- AVSS supply range from -4.5 V to -16.5 V. AVSS can be connected to 0 V if only unipolar outputs are required.

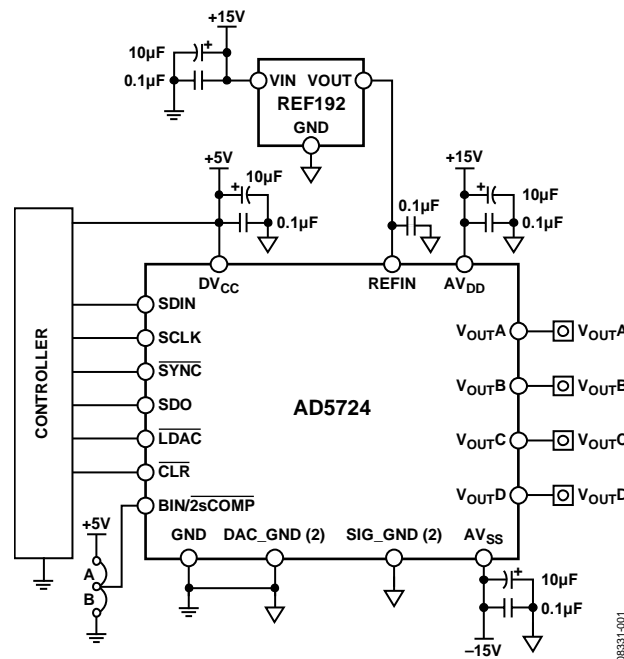


Figure 1. Unipolar/Bipolar Configuration for the [AD5724](#) DAC (Simplified Schematic)

The output range can be individually programmed for each of the four outputs 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 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 printed circuit board (PCB) 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*](#)).

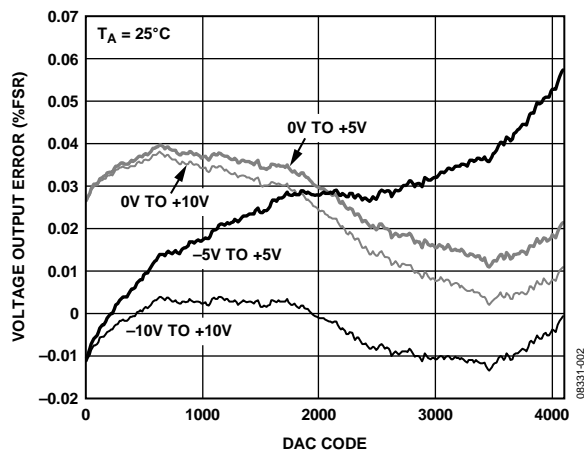


Figure 2. Voltage Output Error

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

AD5724 Data Sheet.

REF192 Data Sheet.

AD5754R Evaluation Board (Compatible with AD5724).

REVISION HISTORY

4/13—Rev. 0 to Rev. A

Document Title Changed from CN-0088 to AN-1195 Universal

7/09—Revision 0: Initial Version