

40 Channels of Programmable Industrial Level Output Span Using the **AD5370** 16-Bit Voltage Output DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit is a multichannel DAC configuration with different output spans on groups of channels. It utilizes the **AD5370** to provide 40 DAC channels with 16 bits of resolution. The **AD5370** is configured to have eight channels with an output span of ± 10 V and 24 channels with an output span of -4 V to $+8$ V.

The **AD5370** is the industry's only 40-channel DAC offering these industrial signal level outputs and the flexibility of multiple output spans with 16-bit resolution. Coupled with the XFET® series of low noise precision references, the total solution represents industry-leading DAC channel density, smallest footprint, flexibility, and performance.

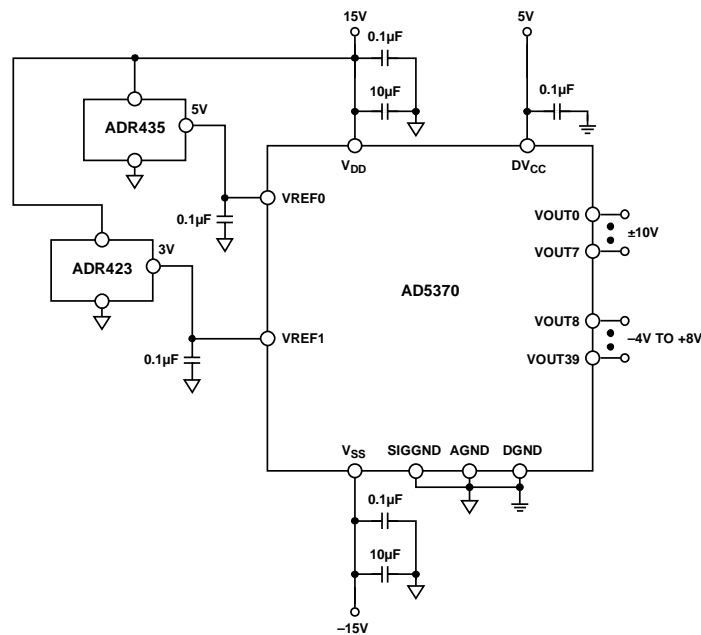


Figure 1. 40 Channels of Programmable Output Voltage Span Using the **AD5370** DAC (Simplified Schematic: Decoupling and All Connections Not Shown)

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5370	40-Channel, 16-Bit Voltage Output DAC
ADR431/ ADR421	2.5 V Ultralow Noise Voltage Reference
ADR423	3 V Ultralow Noise Voltage Reference
ADR435	5 V Ultralow Noise Voltage Reference

The [AD5370](#) is a 40-channel, 16-bit DAC available both in 64-lead LFCSP and 64-lead LQFP packages. The [AD5370](#) has two reference input pins. VREF0 is the reference pin for DAC channels VOUT0 to VOUT7. VREF1 is the reference pin for DAC channels VOUT8 to VOUT39.

Figure 1 shows a typical configuration for the [AD5370](#) using two external references. The nominal output span for the [AD5370](#) is four times the reference voltage. The default offset DAC register values for the [AD5370](#) allow for an output span of -4 V to $+8\text{ V}$ using a 3 V reference. Programming the offset DAC register associated with VOUT0 to VOUT7 allows a span of $\pm 10\text{ V}$ to be achieved using a 5 V reference. The [ADR435](#) is a low noise precision 5 V reference. The [ADR423](#) is a low noise precision 3 V reference. When connected as shown in Figure 1, the [AD5370](#) will have an output span of $\pm 10\text{ V}$ on VOUT0 to VOUT7 and an output span of -4 V to $+8\text{ V}$ on VOUT8 to VOUT39. The [AD5370](#) has two offset DAC registers, which allow the mid-scale point of the span to be adjusted within the limits of part functionality and headroom. The default value of the offset DAC registers is 5461 (0x1555) giving a mid-scale point of 2 V when using a 3 V reference. This gives an output span of -4 V to $+8\text{ V}$ and is the default for VOUT8 to VOUT39. Programming the offset DAC 0 register with 8192 (0x2000) sets the mid-scale point to 0 V . This gives output spans of $\pm 10\text{ V}$ on VOUT0 to VOUT7.

The flexibility of the [AD5370](#) allows systems to be designed with multiple different output ranges, with the same components on the bill of materials.

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 [Tutorial MT-031](#) and [Tutorial MT-101](#)).

COMMON VARIATIONS

The [AD5371](#) is a 40-channel, 14-bit version of the [AD5370](#) with three reference input pins. The [AD5372](#) and [AD5373](#) are 16-bit and 14-bit, 32 channel versions of the [AD5370](#).

The circuit described here can be used with any of the AD537x devices mentioned. The references can also be changed to give different output ranges if required. The [ADR421](#) and [ADR431](#) are 2.5 V references, which can be used to create a $\pm 5\text{ V}$ output.

LEARN MORE

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

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. Analog Devices.

Data Sheets and Evaluation Boards

[AD5370 Data Sheet](#)

[AD5370 Evaluation Board](#)

[AD5371 Data Sheet](#)

[AD5372 Data Sheet](#)

[AD5373 Data Sheet](#)

[ADR421 Data Sheet](#)

[ADR423 Data Sheet](#)

[ADR431 Data Sheet](#)

[ADR435 Data Sheet](#)

REVISION HISTORY

4/13—Rev. 0 to Rev. A

Changed Document Title from CN-0149 to

AN-1215 Universal

4/10—Revision 0: Initial Version