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40 Channels of Programmable Voltage with Excellent Temperature Drift Performance Using the AD5380 DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit is a multichannel DAC configuration with excellent temperature drift performance. It provides 40 individual output voltage channels with 14 bits of resolution and a temperature stability of typically less than 3 ppm/°C.

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5380	40-Channel, 14-Bit, Voltage Output DAC
ADR421	Low Noise, 2.500 V XFET® Voltage Reference
ADR431	Ultralow Noise XFET Voltage Reference

Figure 1 shows a typical configuration for the AD5380-5 when configured for use with an external reference. In the circuit shown, all AGND, SIGNAL_GND, and DAC_GND pins are tied together to a common AGND. AGND and DGND are connected together at the AD5380 device. On power-up, the AD5380 defaults to external reference operation.

This design uses two separate 5.0 V power supplies—one to power the voltage reference and the analog portion of the AD5380 (AVDD) and the other to power the digital portion of the AD5380 (DVDD). For best performance, a linear regulator should always be used to power the analog portion of the circuit. If a switching regulator is used to power the digital portion, care should be taken to minimize switching noise at the DVDD supply pins. Additional decoupling using a series connected ferrite bead may be required. The AD5380 digital (DVDD) power supply can operate from a 3 V or 5 V supply, which provides for maximum flexibility when interfacing to digital components. Both supplies can be tied together to a common 5 V supply; it is derived from a linear regulator. Refer to the ADIsimPower™ design tool for guidance on the power supply designs.

It is recommended to decouple each power pin close to the device with a 0.1 µF ceramic and a 10 µF tantalum capacitor. In this application, the reference for the AD5380 is provided externally from either an ADR421 or ADR431 2.5 V reference. The ADR431 provides a lower output voltage noise specification for applications where that specification is important. The reference should be decoupled at the REFOUT/REFIN pin of the device with a 0.1 µF capacitor.

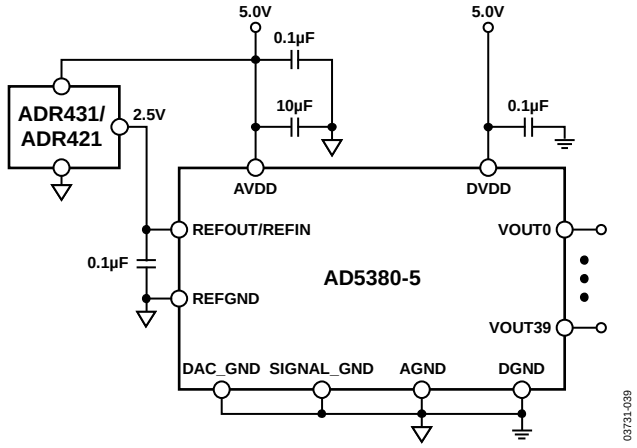

Figure 1. AD5380 Typical Configuration with External Reference (Simplified Schematic)

COMMON VARIATIONS

A variation of this circuit uses the AD5380-3 (3 V device) with the ADR280 1.2 V reference. All other components are the same as those outlined above.

LEARN MORE

ADIsimPower Design Tool.

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

MT-101 Tutorial, *Decoupling Techniques*. 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.

Voltage Reference Wizard Design Tool.

Data Sheets and Evaluation Boards

AD5380 Data Sheet.

AD5380 Evaluation Board.

ADR421 Data Sheet.

ADR431 Data Sheet.

REVISION HISTORY

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