ANALOG DEVICES

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40 Channels of Programmable Voltage with Excellent Temperature Drift Performance Using the AD5381 DAC

CIRCUIT FUNCTION AND BENEFITS

This circuit is a multichannel digital-to-analog converter (DAC) configuration with excellent temperature drift performance. It provides 40 individual output voltage channels with 12 bits of resolution and a temperature stability of typically less than 3 ppm/°C.

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5381	40-channel 12-bit 3 V/5 V single-supply DAC
ADR421	Low noise, 2.500 V XFET® voltage references
ADR431	Ultralow noise XFET voltage references

Figure 1 shows a typical configuration for the AD5381 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 AD5381 device. On power-up, the AD5381 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 AD5381 (AVDD), and the other to power the digital portion of the AD5381 (DVDD). For best performance, always use a linear

regulator to power the analog portion of the circuit. If a switching regulator is used to power the digital portion, taken care to minimize switching noise at the DVDD supply pins. Additional decoupling using a series connected ferrite bead may be required. The AD5381 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, provided that supply 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 circuit, 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. Decouple the reference at the REFOUT/REFIN pin of the device with a 0.1 µF capacitor.

COMMON VARIATIONS

A variation of this circuit uses the AD5381-3 (3 V device) with the ADR280 1.2 V reference where all other connections and components are the same as those previously outlined.
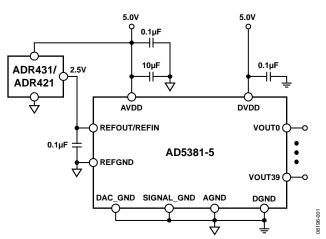

Figure 1. AD5381 Typical Configuration with External Reference (Simplified Schematic)

LEARN MORE

ADIsimPower Design Tool.

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

AD5380/AD5381 Evaluation Board.

AD5381 Data Sheet.

ADR421 Data Sheet.

ADR431 Data Sheet.

REVISION HISTORY

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