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8 to 16 Channels of Programmable Voltage with Excellent Temperature Drift Performance Using the AD5390/AD5391/AD5392 DACs

CIRCUIT FUNCTION AND BENEFITS

This circuit is a multichannel DAC configuration with excellent temperature drift performance. It utilizes the AD5390/AD5391/AD5392 to provide between 8 and 16 DAC channels with 12 to 14 bits of resolution. The ADR421/ADR431 precision voltage reference ensures that the temperature stability of the circuit is typically less than 3 ppm/°C.

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5390/AD5391/AD5392	3 V/5 V, 16-/14-/12-bit digital-to-analog converter
ADR421	Precision 2.5 V voltage reference
ADR431	Precision 2.5 V low noise voltage reference

The AD5390 and AD5391 are complete single-supply, 16-channel, 14-bit and 12-bit DACs, respectively. The AD5392 is a complete single-supply, 8-channel, 14-bit DAC. Devices are available in both 64-lead LFCSP and 52-lead LQFP packages. All channels have an on-chip output amplifier with rail-to-rail operation.

Figure 1 shows a typical configuration for the AD5390/AD5391/AD5392 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 AD5390/AD5391/AD5392 device. On power-up, the AD5390/AD5391/AD5392 defaults to external reference operation.

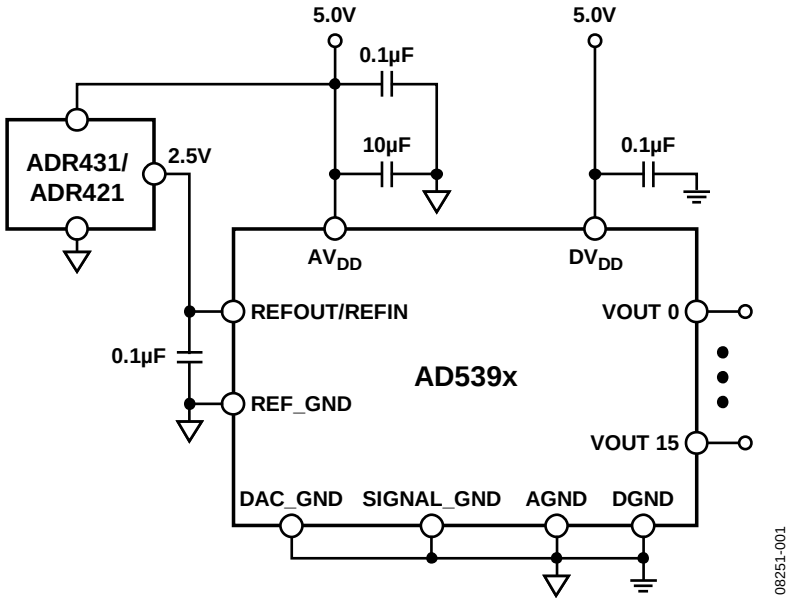

Figure 1. AD5390/AD5391/AD5392 Typical Configuration with External Reference (Simplified Schematic)

This design uses two separate 5.0 V power supplies—one to power the voltage reference and the analog portion of the AD5390/AD5391/AD5392 (AVDD) and the other to power the digital portion of the AD5390/AD5391/AD5392 (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 AD5390/AD5391/AD5392 digital (DVDD) power supply can operate off 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 regular. Refer to the ADIsimPower™ 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 10 µF tantalum capacitor. In this application, the reference for the AD5390/AD5391/AD5392 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 this specification is important. The reference should be decoupled at the REFOUT/REFIN pin of the device with a 0.1 µF capacitor.

COMMON VARIATIONS

A variation of this circuit is the AD5390/AD5391/AD5392 with the ADR280 1.2 V reference where all other connections and components are the same as those outlined previously.

LEARN MORE

ADIsimPower Design Tool.

Kester, Walt. 2005. *The Data Conversion Handbook*. Analog Devices. See 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

AD5390 Data Sheet.

AD5391 Data Sheet.

AD5392 Data Sheet.

ADR421 Data Sheet.

ADR431 Data Sheet.

AD5390/AD5391/AD5392 Evaluation Board.

REVISION HISTORY

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