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AD5381 Channel Monitor Function

CIRCUIT FUNCTION AND BENEFITS

In a multichannel digital-to-analog converter (DAC) system, the ability to monitor all outputs at a single point is a significant advantage for troubleshooting and diagnostic analysis. This circuit provides multichannel DAC output channel monitoring using a single-channel, SAR analog-to-digital converter (ADC).

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5381	40-channel, 12-bit, 3 V/5 V single-supply DAC
AD7476	1 MSPS, 12-bit ADC

The circuit shown in Figure 1 uses the internal multiplexer on the AD5381, allowing all 40 DAC output channels to be individually routed to a single output pin (MON_OUT). This pin is then monitored by the external 12-, 10-, or 8-bit ADC (AD7476/AD7477/AD7478). This approach uses much less circuitry than would be required if each channel was monitored individually.

The AD5381 is a complete, single-supply, 40-channel, 12-bit DAC available in a 100-lead LQFP package. All 40 channels have an on-chip output amplifier with rail-to-rail operation. The AD5381 contains a channel monitor function that consists of a multiplexer addressed via the serial interface, allowing any channel output to be routed to the monitor output (MON_OUT) pin for monitoring using an external ADC. The channel monitor function must be enabled in the control register before any channels are routed to MON_OUT. The AD5381 also includes uncommitted inputs to the internal mux that allow the user the facility to monitor inputs from external sources such as references or power supplies.

The AD5381-3 operates on a 3 V supply, and the AD5381-5 operates on a 5 V supply. The AD7476 ADC offers 12-bit resolution, single 2.35 V to 5.25 V power supply, integrated reference, low power operation, small form factor, and serial interface with throughput rates up to 1 MSPS in 6-lead SOT-23 package. The reference for the part is taken internally from VDD, allowing the widest dynamic input range to the ADC. Thus, the analog input range for the part is 0 V to VDD. The conversion rate is determined by the SCLK allowing throughput rates up to 1 MSPS. Pin-compatible versions of the AD7476 (10-bit AD7477, 8-bit AD7478) are available for use in applications where lower resolution conversion is acceptable.
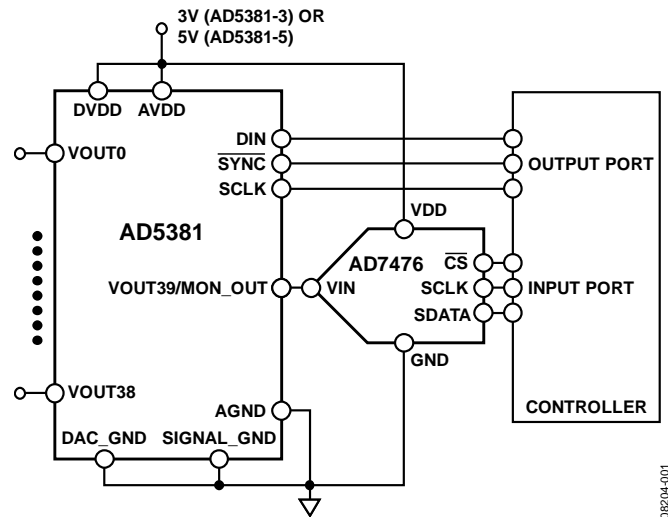

Figure 1. Typical Channel Monitoring Circuit (Simplified Schematic)

The AD5381 and AD7476 must have ample supply bypassing of 10 µF in parallel with 0.1 µF on each supply pin, located as close to the packages as possible, ideally right up against the devices (this is not shown on the simplified diagram). The 10 µF capacitors are the tantalum bead type. The 0.1 µF capacitor must have low effective series resistance (ESR) and low effective series inductance (ESL), such as the common ceramic types, which provide a low impedance path to ground at high frequencies to handle transient currents due to internal logic switching.

Ensure that the power supply traces are as wide as possible to provide low impedance paths and reduce the effects of glitches on the power supply line. Fast switching signals, such as clocks, must be shielded with ground runs to avoid radiating noise to other parts of the board and must never be run near the analog signals. A ground line routed between the SDATA and SCLK lines helps reduce crosstalk between them (not required on a multilayer board, which has a separate ground plane; however, it is helpful to separate the lines). Avoid crossover of digital and analog signals. Run traces on opposite sides of the board at right angles to each other to reduce the effects of feedthrough on the board. A microstrip technique is recommended; however, it is not always possible with a double-sided board. In this technique, the component side of the board is dedicated to the ground plane, and signal traces are placed on the solder side. Best layout and performance is achieved with at least a 4-layer multilayer board where there is a ground plane layer, a power supply layer, and two signal layers.

COMMON VARIATIONS

Pin-compatible versions of the AD7476 are available for use in applications where lower resolution conversion is acceptable in the monitoring function. The AD7477 provides 10-bit resolution, and the AD7478 provides 8-bit resolution.

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.

Data Sheets and Evaluation Boards

AD5380/AD5381 Evaluation Board.

AD5381 Data Sheet.

AD7476 Data Sheet.

REVISION HISTORY

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