

Output Channel Monitoring Using the **AD5380** Multichannel DAC

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
AD5380	40-channel, 14-bit, 3 V/5 V single-supply DAC
AD7476	1 MSPS, 12-bit ADC

The circuit shown in Figure 1 uses the [AD5380](#) 40-channel, 14-bit DAC, which includes an internal multiplexer that allows all 40 output channels to be individually routed to a single output (MON_OUT) pin. This pin is then monitored by an external ADC ([AD7476](#)). This approach uses much less circuitry than is required if each channel was monitored individually.

The [AD5380](#) is a complete, single-supply, 40-channel, 14-bit DAC. All 40 channels have an on-chip output amplifier with rail-to-rail operation. The [AD5380](#) 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 microcontroller or processor can select the output channel to be monitored via its serial output port, and can then read the converted data from the ADC via its serial input port.

The [AD5380-3](#) operates on a 3 V supply, and the [AD5380-5](#) operates on a 5 V supply. The [AD7476](#) ADC offers 12-bit resolution, single 2.35 V to 5.25 V power supply operation, integrated reference, low power, small form factor, and serial interface with throughput rates up to 1 MSPS in a 6-lead SOT-23 package. The conversion rate is determined by the SCLK, allowing throughput rates up to 1 MSPS.

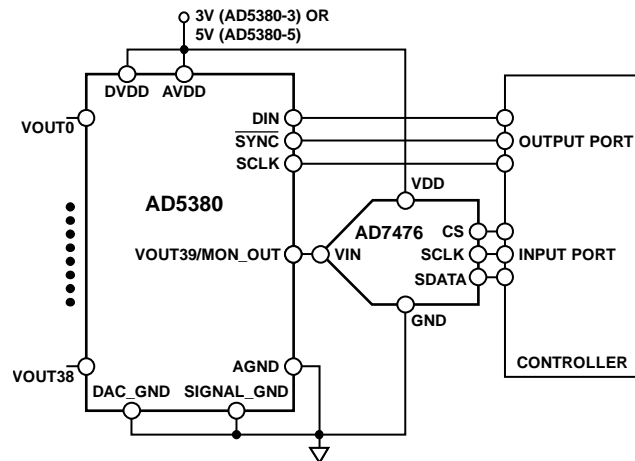


Figure 1. Efficient Channel Monitoring Circuit (Simplified Schematic)

The [AD5380](#) 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.

The power supply traces must be 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 micro-strip 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-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](#).

[AD7476 Data Sheet](#).

REVISION HISTORY

5/13—Rev. 0 to Rev. B

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