

## High Speed, Precision, Differential AC-Coupled Drive Circuit for the **AD7625** 16-Bit, 6 MSPS PuLSAR ADC

### CIRCUIT FUNCTION AND BENEFITS

This application note provides a method to drive an ac-coupled differential input signal to the **AD7625**, 16-bit, 6 MSPS PuLSAR® differential analog-to-digital converter (ADC). This circuit is designed to ensure maximum performance of the **AD7625** by providing adequate settling time and low distortion. It uses a buffered common-mode voltage (VCM) output voltage from the **AD7625** to set the common-mode level of each amplifier.

### CIRCUIT DESCRIPTION

The signal source applied to the **AD7625** must be buffered to enable driving the **AD7625** switch capacitor front end and to maintain low distortion. The **ADA4899-1** used on each input provides the required drive, distortion, and settling time to maximize the performance of the **AD7625**.

Figure 1 shows that the differential ac-coupled source has signals 180° out of phase with each other, and the voltage swings around ground on each input. In the test setup, an Audio Precision AP2700 series generator was used to generate the differential input signals. Two 10 μF NP0 capacitors are used to couple the signal into the driver circuit. The two **ADA4899-1** amplifiers are connected in a unity-gain noninverting configuration (the **ADA4899-1** is unity-gain stable) to condition the analog input to the **AD7625** inputs, thereby providing sufficient isolation from the converter switched capacitor transients and also setting the correct common-mode input voltage. For the **AD7625**, the common-mode voltage is half the internal reference voltage, REF/2, where REF = 4.096 V.

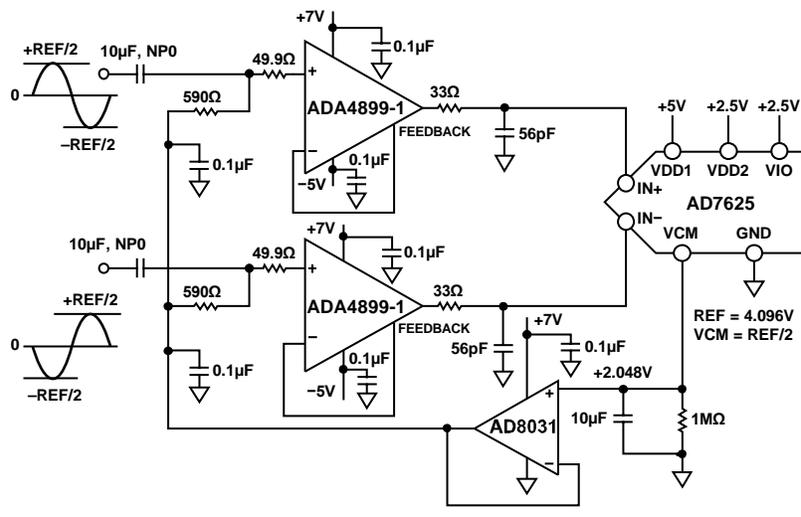


Figure 1. AC-Coupled Differential Drive Circuit for the **AD7625** ADC (Simplified Schematic: All Connections and Decoupling Not Shown)

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**REVISION HISTORY**

**1/2018—Rev. 0 to Rev. A**

Document Title Changed from CN0080 to AN-1526 ..... Universal  
Changes to Circuit Description Section and References Section .... 3

**9/2009—Revision 0: Initial Version**

The VCM output pin of the [AD7625](#) is a useful function that provides half the reference voltage used internally by the [AD7625](#). This VCM output is buffered with the [AD8031](#) rail-to-rail amplifier, thereby providing a precise common-mode voltage for the analog input amplifiers.

Note that the FEEDBACK pin on the [ADA4899-1](#) is internally connected to its output pin, thereby minimizing parasitic capacitance and inductance. The [ADA4899-1](#) also has an exposed pad for heat dissipation, which is recommended to be electrically connected to the ground plane.

To allow sufficient headroom at the output of the [ADA4899-1](#) op amps, both devices are powered with a +7 V and -5 V supply to ensure the output can go to 4.096 V and 0 V. Because the amplifier and the ADC operate on different supply voltages, protection circuits are recommended at the ADC inputs, as described in the [MT-036 Tutorial](#).

Excellent layout, grounding, and decoupling techniques must be utilized to achieve the desired performance from the circuits discussed in this note (see the [MT-031 Tutorial](#) and the [MT-101 Tutorial](#)). As a minimum, it is recommended to use a 4-layer printed circuit board (PCB) with one ground plane layer, one power plane layer, and two signal layers. The [AD7625](#) data sheet also includes information on layout and decoupling practices for the device.

Figure 2 and Figure 3 show the excellent distortion and noise performance obtained with the circuit.

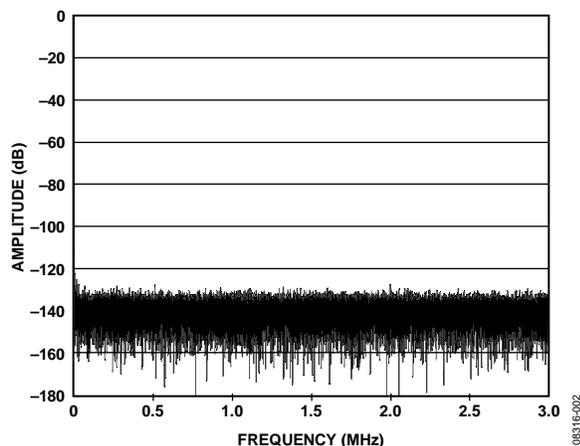


Figure 2. Fast Fourier Transform (FFT) Output with a 2 kHz Input Tone and a Sampling Rate of 6 MSPS

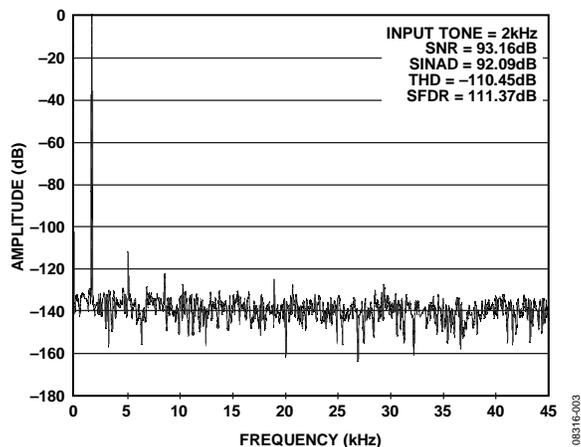


Figure 3. Expanded View of the FFT with a 2 kHz Input Tone and a Sampling Rate of 6 MSPS

## REFERENCES

- [MT-031 Tutorial, Grounding Data Converters and Solving the Mystery of "AGND" and "DGND", Analog Devices, Inc.](#)
- [MT-036 Tutorial, Op Amp Output Phase-Reversal and Input Over-Voltage Protection, Analog Devices.](#)
- [MT-074 Tutorial, Differential Drivers for Precision ADCs, Analog Devices.](#)
- [MT-075 Tutorial, Differential Drivers for High Speed ADCs Overview, Analog Devices.](#)
- [MT-101 Tutorial, Decoupling Techniques, Analog Devices.](#)