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AC Signal Processing Using the AD5426/AD5432/AD5443 Current Output DACs

CIRCUIT FUNCTION AND BENEFITS

This circuit provides two-quadrant signal multiplication using the AD5426/AD5432/AD5443 current output, digital-to-analog converters (DACs) and an operational amplifier. It provides multiplying bandwidth up to 10 MHz, which allows accurate conditioning of ac signals with bandwidths up to this frequency. The circuit is well suited for ac signal conditioning applications in communications, industrial, and medical applications.

CIRCUIT DESCRIPTION

Table 1. Devices Connected/Referenced

Product	Description
AD5426/AD5432/AD5443	8-bit/10-bit/12-bit multiplying DACs
AD8038	Low power, high performance amplifier

The AD5426, AD5432, and AD5443 are CMOS 8-bit/10-bit/12-bit current output DACs, respectively. These devices operate from a 2.5 V to 5.5 V power supply, making them suitable for battery powered applications, signal attenuation, channel equalization, and waveform generation. The maximum signal range can be up to ±12 V; however, the supply voltage of the amplifier limits the output swing. Figure 1 shows a typical application circuit for a current output DAC for ac signal processing. Using a single op amp, these devices can easily be configured to provide either a two-quadrant multiplying operation or a unipolar output voltage swing, as shown in Figure 1. When an output amplifier is connected in unipolar mode, the output voltage is given by

$$V_{OUT} = -V_{REF} \times (D/2^N)$$

where:
D is the digital word loaded to the DAC.
N is the number of bits: D = 0 to 255 (8-bit AD5426), D = 0 to 1023 (10-bit AD5432), and D = 0 to 4095 (12-bit AD5443).
V_{REF} can be an ac input signal.

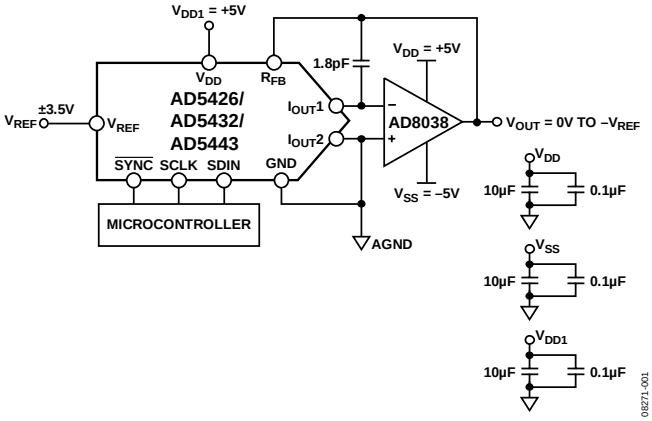

Figure 1. AC Signal Processing Configuration Using a Multiplying Current Output DAC (Simplified Schematic)

Figure 2 shows the ac multiplying bandwidth, which is essentially the frequency response of the DAC when an ac reference is applied to the V_{REF} input pin. Figure 2 shows that the circuit can handle a ±3.5 V ac waveform up to approximately 10 MHz.

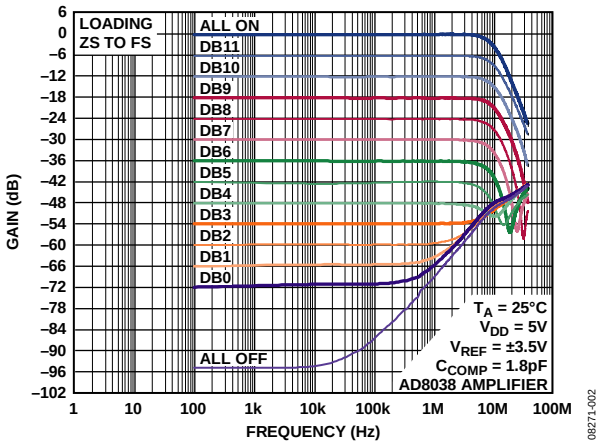

Figure 2. AC Multiplying Bandwidth Performance

LEARN MORE

ADIsimPower Design Tool. Analog Devices

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-033 Tutorial, *Voltage Feedback Op Amp Gain and Bandwidth*. Analog Devices.

MT-035 Tutorial, *Op Amp Inputs, Outputs, Single-Supply, and Rail-to-Rail Issues*. Analog Devices.

MT-101 Tutorial, *Decoupling Techniques*. Analog Devices.

Voltage Reference Wizard Design Tool. Analog Devices.

Data Sheets

AD5426 Data Sheet.

AD5432 Data Sheet.

AD5443 Data Sheet.

AD8038 Data Sheet.

REVISION HISTORY

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