ANALOG DEVICES

Applications Engineering Notebook
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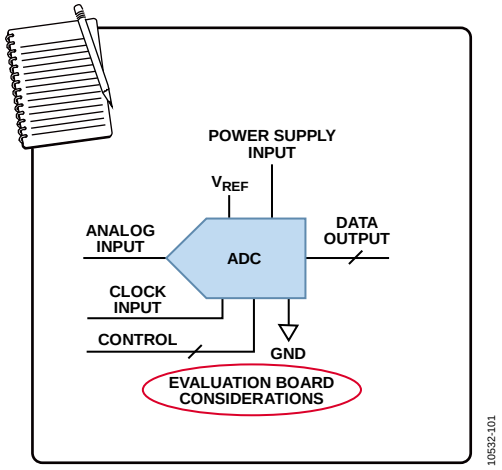
Operating a Typical High Speed ADC Evaluation Board Setup

by the Applications Engineering Group
Analog Devices, Inc.

IN THIS NOTEBOOK

This notebook discusses what to consider when setting up evaluation board hardware and software.



The Applications Engineering Notebook Educational Series

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REVISION HISTORY

2/12—Revision 0: Initial Version

INTRODUCTION

This mini tutorial provides an operating overview and troubleshooting tips for the typical device-under-test (DUT) evaluation board (EVB) setup that is commonly available for high speed analog-to-digital integrated circuits.

To observe and measure the DUT operating under a specific set of user-defined input conditions, the evaluation board generally provides external connections for the analog input and the clocking source. A separate universal data capture board with a control software package connects to the EVB to perform spectral analysis of the ADC's output data.

TYPICAL EVALUATION BOARD

Figure 1 shows the typical real-world bench characterization setup that is available to evaluate the ac performance of a high speed ADC.

For example purposes only, this mini tutorial uses the AD9268 ADC evaluation board and the Analog Devices HSC-ADC-EVALCZ and VisualAnalog® software package. Figures of screen shots of an actual software configuration and of spectral plots of the hardware are included.

The AD9268 is a dual, 16-bit, 80 MSPS/105 MSPS/125 MSPS high performance ADC. As usual in cases for products available in multiple sampling rates, there is an evaluation board specifically designed for each speed range. For example, the part numbers for the various speed ranges of EVBs are AD9268-80EBZ, AD9268-105EBZ, and AD9268-125EBZ.

The typical factory-supplied EVB provides all of the support circuitry required to operate the selected ADC (DUT) in its various modes and configurations.

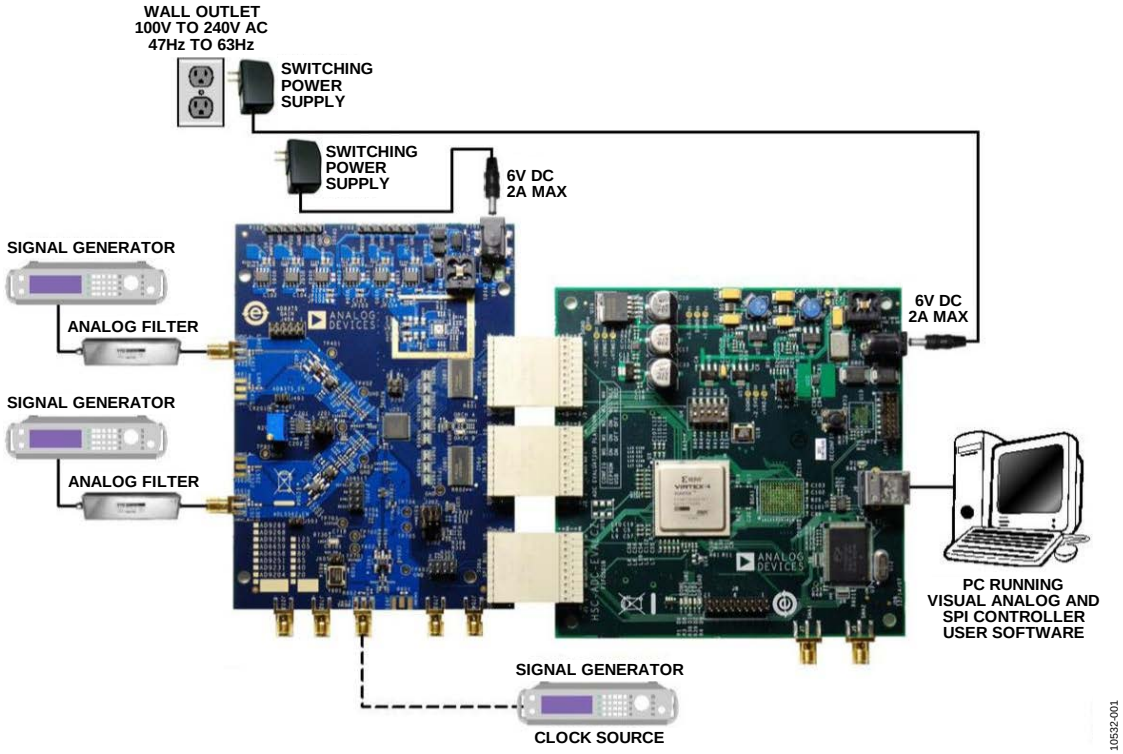

Figure 1. Typical High Speed ADC Evaluation Setup

HARDWARE CONFIGURATION

Evaluation board kits include a user's guide (UG) and set-up software for configuring the EVB and DUT. Follow the instructions and guidelines contained in the UG to insure that optimum performance from the DUT is realized.

The performance of the analog input source, clock source, and power supplies in the setup must be appropriately guard-banded in order to ensure that the DUT can meet the specifications detailed in the product data sheet. The data capture setup also includes user instructions and software, and must be configured per its guidelines to operate most effectively.

Setting Up the Evaluation Board

The following are instructions and considerations for setting up the AD9268 EVB to perform an FFT for spectral analysis of a given input signal. For the ADC evaluation board analog input signal

- Use a clean signal generator with low phase noise to provide an input signal to the desired A and/or B channel(s).
- Use a 1 m, shielded, RG-58, 50 Ω coaxial cable to connect the signal generator.
- For best results, use a narrow-band band-pass filter with 50 Ω terminations and an appropriate center frequency.

USING THE SOFTWARE FOR TESTING

After configuring the desired input signal and clock on the EVB, set up the ADC for data capture using the following steps:

1. Open VisualAnalog on the connected PC.
   If the evaluation platform is properly connected, the dialog box displays an open folder for the particular high speed ADC that is in use as shown in Figure 2.
2. Choose a product model template to begin evaluation of the ADC. If there is no open folder, consult the Troubleshooting Basics section.

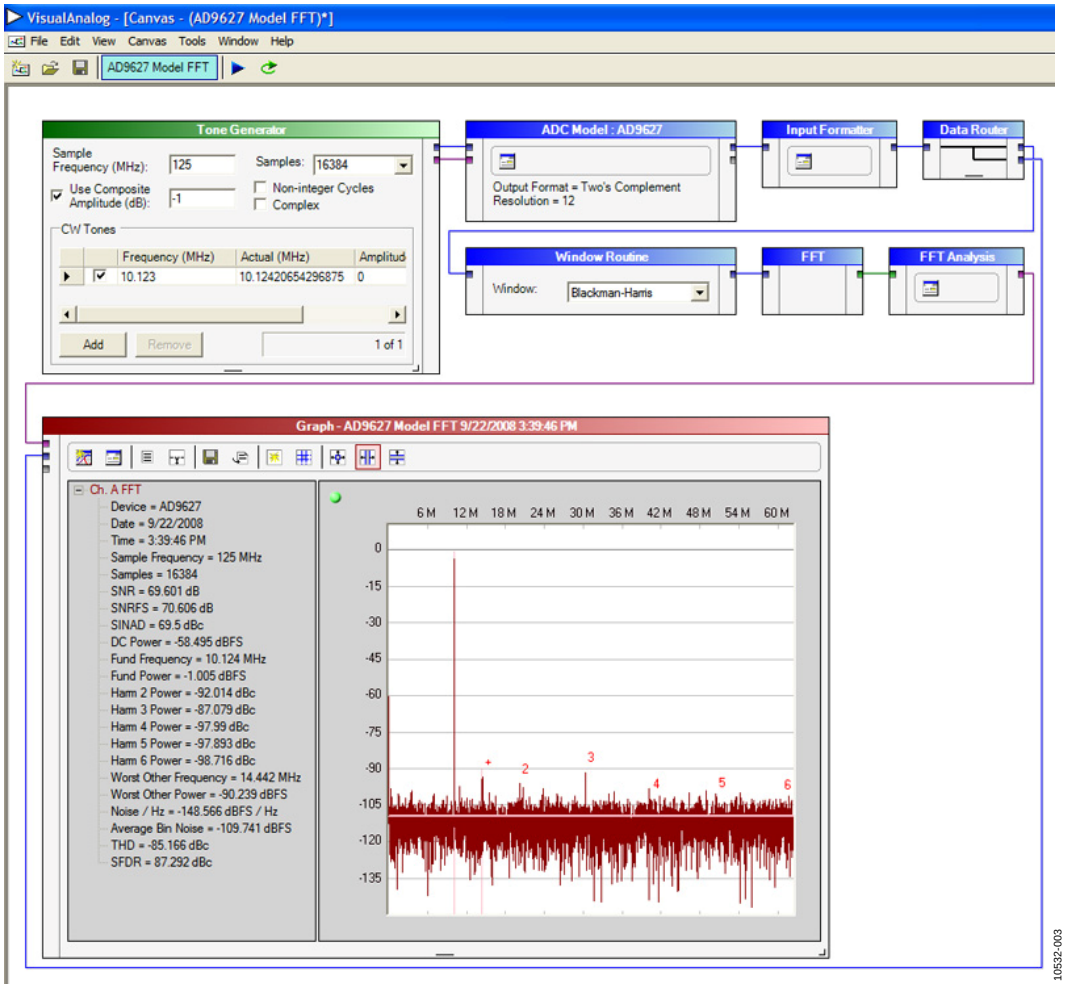

Figure 2. VisualAnalog Product Model Template and Software Setup

Note that once power is applied to the AD9268 evaluation board, the device is powered down. To wake up the device, VisualAnalog automatically pulls the SDIO/PWDN pin low.

3. After the template is selected, a message appears asking if the default configuration can be used to program the FPGA. Click **Yes** to close the window. Figure 3 shows the VisualAnalog screen that appears after a template is selected.

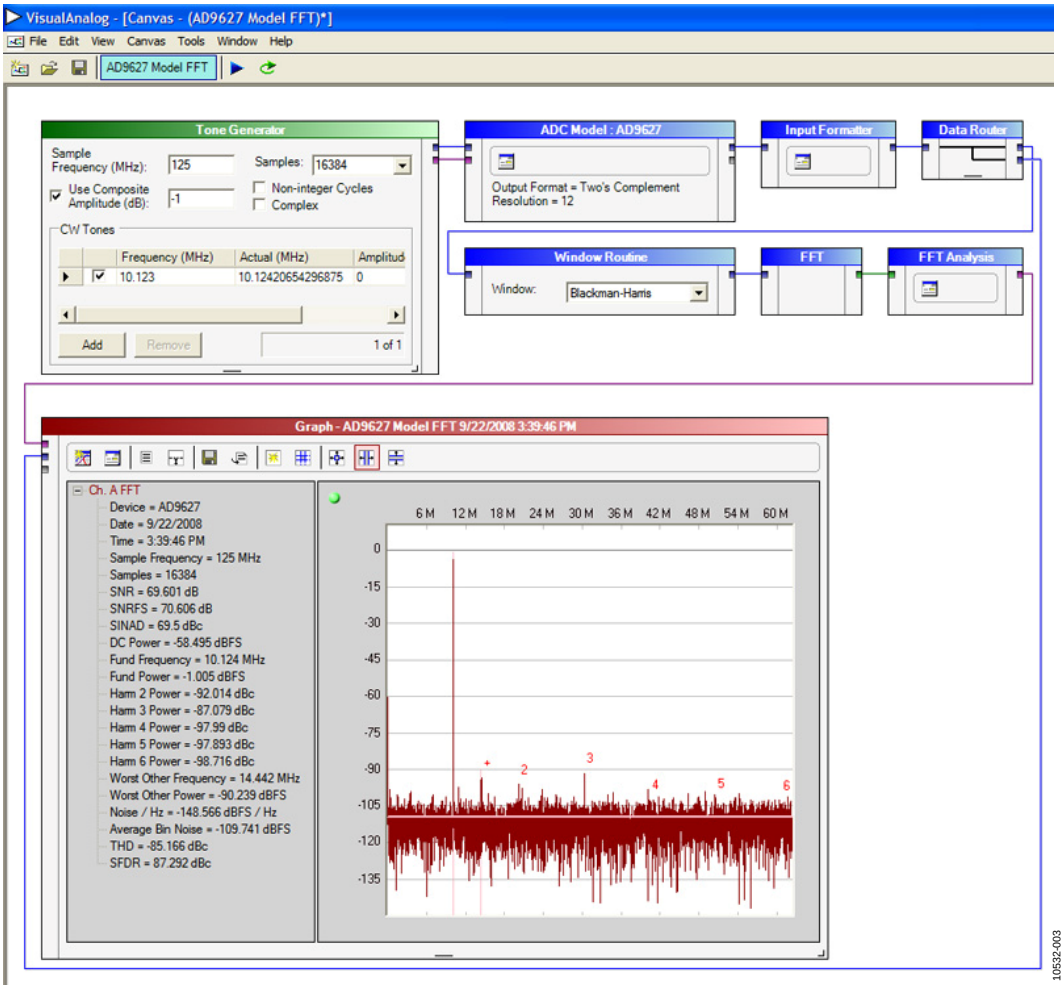

Figure 3. VisualAnalog Software Setup, Working in a Canvas Template

By default, the plot is hidden, but it can be shown by clicking the expand button in the upper right hand corner.
Figure 3 shows an FFT plot from the AD9268 model in ADIsimADC™, the Analog Devices, Inc., analog-to-digital behavioral model that accurately models the typical performance characteristics of many high speed converters. A side-by-side comparison of the model and hardware can be evaluated in VisualAnalog.

4. Open the SPIController software by selecting **Start > SPIController** or by double-clicking the **SPIController software** desktop icon.
5. Click the **New DUT** button in the SPIController window. In the **ADCBase 0** tab of the SPIController window, all global register settings can be accessed. The SPI Controller software can be used to change or understand any of the features that can be enabled via the ADC's SPI port.

BASELINE FFT PERFORMANCE

Figure 4 shows a dialog box of the AD9268 **ADCBase 0** tab and its global features.

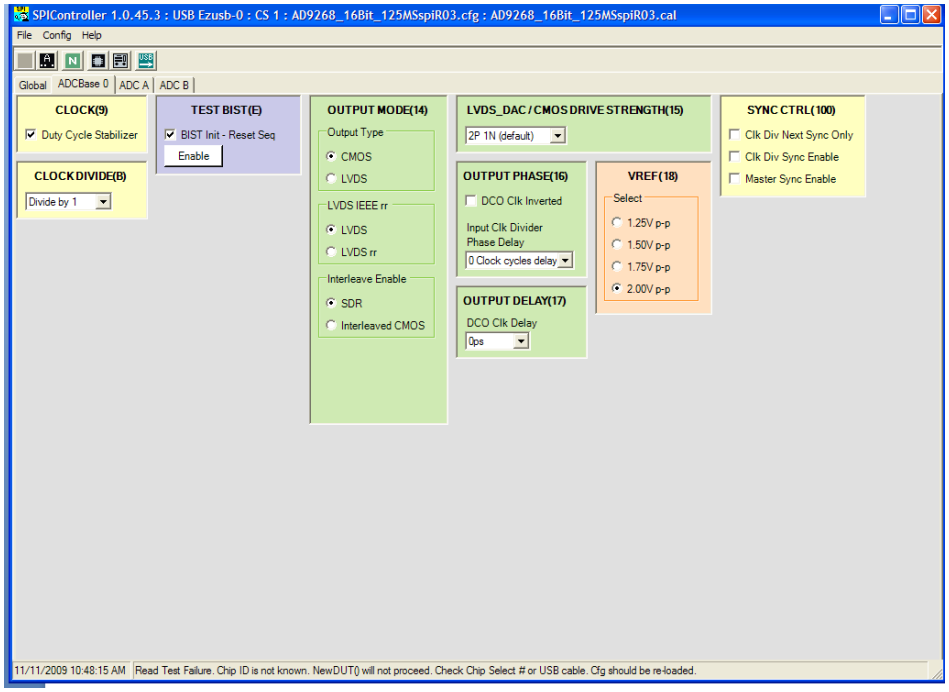

Figure 4. Typical SPIController Software Setup

Figure 5 shows a scaled-up version of the baseline FFT performance from the AD9268 evaluation board based on the setup described in this document.

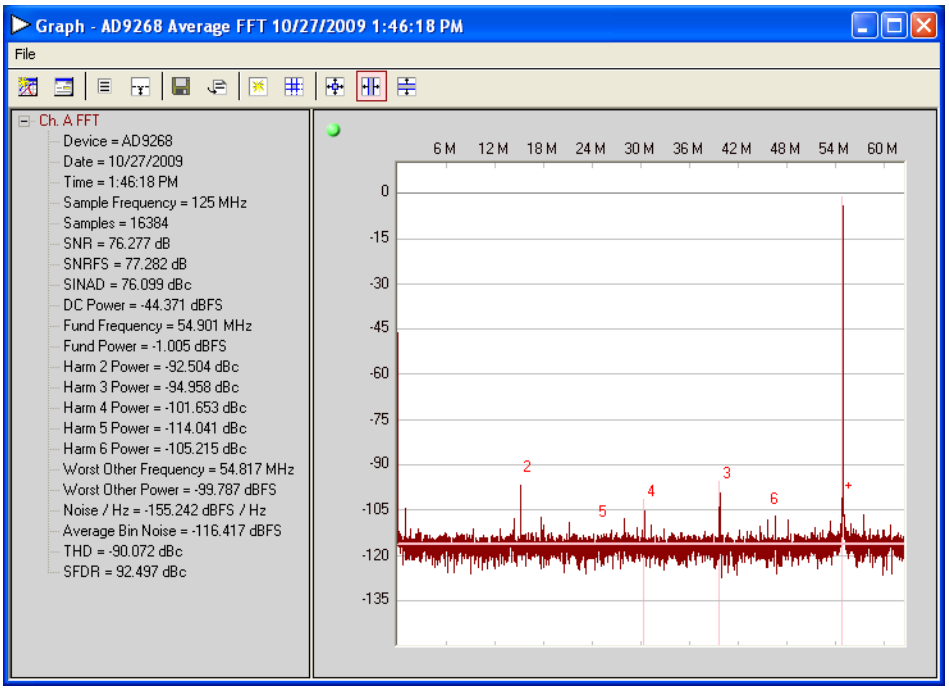

Figure 5. Typical Frequency Domain Performance

Figure 6 shows a scaled-up version of baseline time domain performance from the AD9268 evaluation board based on the setup described.

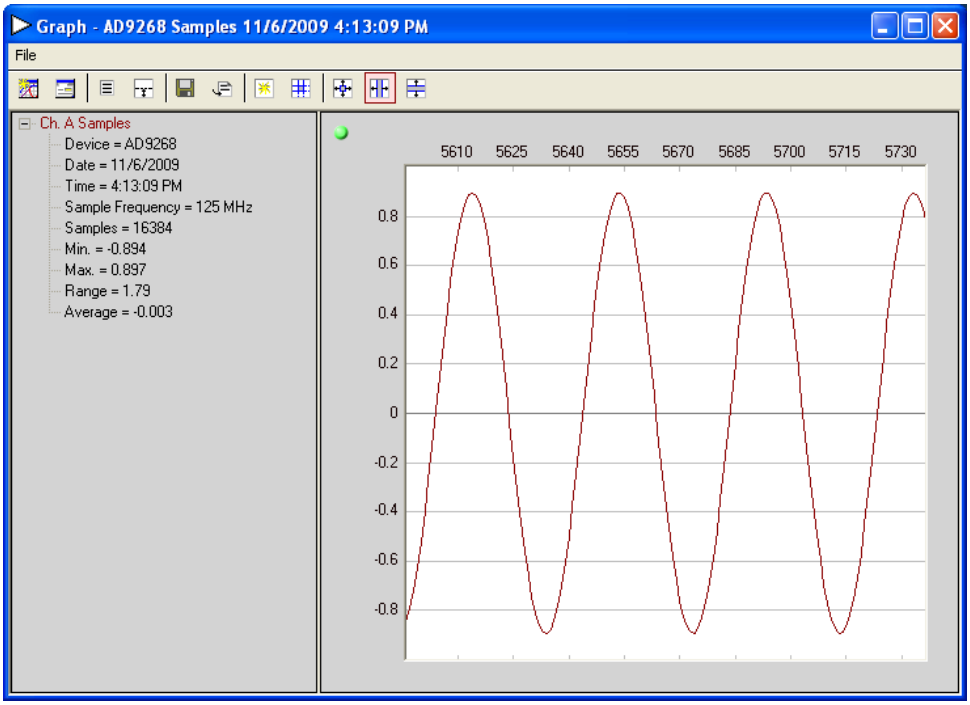

Figure 6. Typical AD9268 Time Domain Performance

Figure 7 shows a scaled-up version of baseline FFT performance from the AD9268 evaluation board using the setup, but without a filter on the output of the signal generator. Note that all signal generators, regardless of their jitter performance rating, have significant spurious content. Use a good filter with excellent stop-band rejection to eliminate the signal generator's spurious content. See AN-835 Application Note, *Understanding High Speed ADC Testing and Evaluation* for the type of filters that are recommended for ADC evaluation.

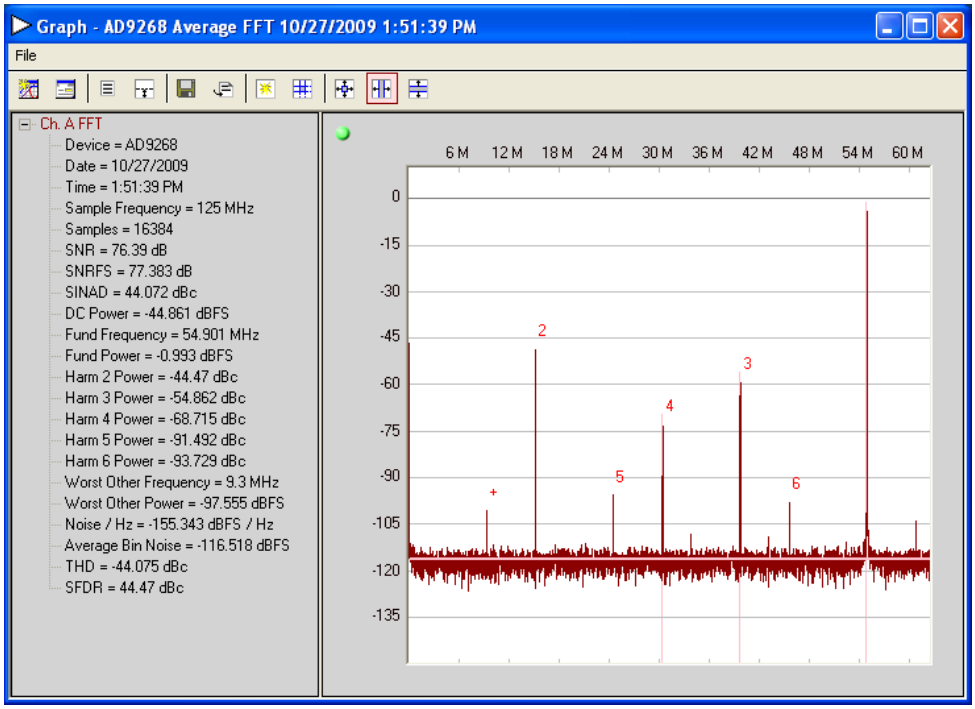

Figure 7. AD9268 FFT Plot with No Input Filter Applied to Analog Input

TROUBLESHOOTING BASICS

Follow these basic troubleshooting steps if you experience difficulty operating a high speed ADC evaluation setup:

- Verify that there is power at the IC, ADC, or DUT. Many problems are solved when the correct supply bias is applied to the correct pins.
- Verify that the part is soldered down correctly. Poor manufacturing can lead to half-soldered down parts because there is either too much solder paste or not enough. When appropriate, check that the solder slug/ Epad is correctly applied. Misapplication can lead to shorted connections, or poor electrical and thermal connectivity to the PCB.
- Look for faulty test set-up connections. Sometimes faulty cables and connectors make data converter performance poor or result in intermittent operation. Very long USB cables connecting the DUT to the PC can also create data capture problems.
- The latest evaluation software and tools may have part recognition, be pre-programmed, and have configured canvases, but make sure the software is configured correctly.
- Sometimes the selected test equipment lacks the performance guard band to properly measure the data converter's data sheet performance. This may include signal generators, clock sources, filters, cables, oscillators, and so on.

FOR FURTHER INFORMATION

For more detailed information, see the AD9268 data sheet as well as the following application notes, available on analog.com:

- AN-835 Application Note, *Understanding High Speed ADC Testing and Evaluation*
- AN-877 Application Note, *Interfacing to High Speed ADCs via SPI*
- AN-878 Application Note, *High Speed ADC SPI Control Software*