EVAL-AD7606BFMCZ User Guide

UG-1225

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Evaluating the AD7606B 8-Channel DAS with 16-Bit, 800 kSPS Bipolar Input, Simultaneous Sampling ADC

FEATURES

- Full featured evaluation board for the AD7606B
- On-board power supplies
- Standalone capability
- SDP-H1 compatible (EVAL-SDP-CH1Z (SDP-H1))
- PC software for control and data analysis (download from the AD7606B product page)
- Time and frequency domain

EVALUATION KIT CONTENTS

- EVAL-AD7606BFMCZ evaluation board

ADDITIONAL EQUIPMENT NEEDED

- System demonstration platform (SDP)—high speed controller board (EVAL-SDP-CH1Z (SDP-H1))
- PC running Windows Vista or Windows 7 with a USB 2.0 port
- DC/ac signal source
- SMB and USB cables
- External supply (optional)

DOCUMENTS NEEDED

- AD7606B data sheet
- EVAL-AD7606BFMCZ user guide
- Schematics
- Layout files
- Bill of materials

REQUIRED SOFTWARE

- AD7606B evaluation software

EVALUATION BOARD DESCRIPTION

The EVAL-AD7606BFMCZ is a full featured evaluation board that allows users to easily evaluate the features of the AD7606B analog-to-digital converter (ADC). The EVAL-AD7606BFMCZ can be controlled by the system demonstration platform controller board (EVAL-SDP-CH1Z (SDP-H1)). The EVAL-SDP-CH1Z (SDP-H1) allows the EVAL-AD7606BFMCZ to be controlled through the USB port of a PC using the AD7606B evaluation software. The software is available for download from the AD7606B product page.

On-board components include an ADP7118 5 V, low noise low dropout regulator (LDO) and an ADR4525 high precision, band gap voltage reference.

Full data on the AD7606B is available in the AD7606B data sheet, which must be consulted in conjunction with this user guide. Full details on the EVAL-SDP-CH1Z are available on the SDP-H1 product page.

EVALUATION BOARD PHOTOGRAPH

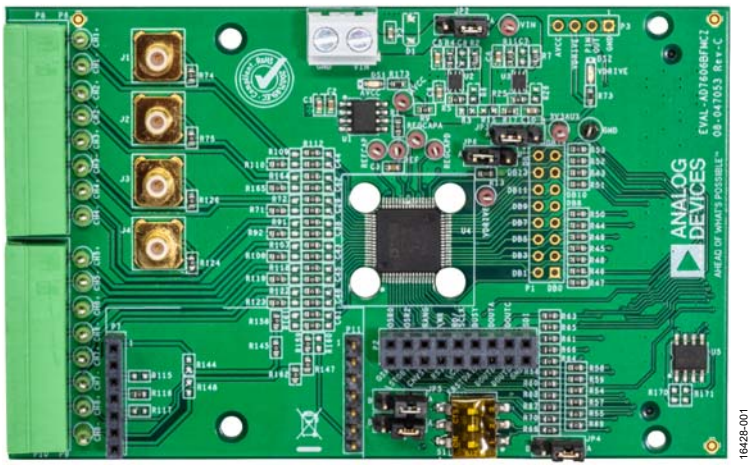

Figure 1.

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REVISION HISTORY

5/2019—Revision 0: Initial Version

QUICK START GUIDE

To quickly evaluate the AD7606B ADC, take the following steps:

1. Install the evaluation software from the AD7606B product pages. Ensure that the EVAL-SDP-CH1Z (SDP-H1) is disconnected from the USB port of the PC while installing the software. Restart the PC after the installation process completes. For complete software installation instructions, see the Software Installation section.
2. Ensure that the various link options are configured as outlined in Table 2.
3. Connect the EVAL-SDP-CH1Z (SDP-H1) board to the EVAL-AD7606BFMCZ. Ensure that these boards are connected firmly together.
4. By default, the power for the EVAL-AD7606BFMCZ is supplied by the EVAL-SDP-CH1Z (SDP-H1) controller board. A number of power options are available, see the Power Supplies section for more information.
5. Connect the EVAL-SDP-CH1Z (SDP-H1) to the 12 V supply and to the PC via the USB cable. Choose to automatically search for the drivers for the EVAL-SDP-CH1Z (SDP-H1) if prompted by the operating system.
6. Launch the evaluation software from the **Analog Devices** subfolder in the **Programs** menu.
7. Connect an input signal via the CH1 to CH8 terminal blocks.

EVALUATION BOARD HARDWARE

DEVICE DESCRIPTION

The AD7606B is a 16-bit, 8-channel, simultaneous sampling successive approximation ADC. The device operates from a single 4.75 V to 5.25 V power supply and features throughput rates of up to 800 kSPS. The device has 5 MΩ input impedance for direct connection from the user sensor outputs to the ADC.

HARDWARE LINK OPTIONS

Table 2 details the link option functions and the default power link options. The EVAL-AD7606BFMCZ can be powered by different sources, as described in the Power Supplies section. By default, the power supply required for the EVAL-AD7606BFMCZ comes from the EVAL-SDP-CH1Z (SDP-H1) controller board. The power supply is regulated by the on-board ADP7118 low dropout (LDO) regulators, which generates the 5 V supply.

CONNECTORS AND SOCKETS

The connectors and sockets on the EVAL-AD7606BFMCZ are outlined in Table 1.

Table 1. On-Board Connectors

Connector	Function
P12	FPGA mezzanine card (FMC) connector
P4	External power terminal block, 7 V to 9 V dc input
P6, P8	8-pin connectors for input to Channel 1 through Channel 4
P9, P10	8-pin connectors for input to Channel 5 through Channel 8
J1 to J4	Analog input Subminiature Version B (SMB) connectors to Channel 1 through Channel 4
P7, P11	Channel 8 surfboard evaluation headers
P1, P2	General connectors for debugging purposes or to connect an external controller

The default interface to the EVAL-AD7606BFMCZ is via the FMC connector, which connects the EVAL-AD7606BFMCZ to the EVAL-SDP-CH1Z (SDP-H1).

POWER SUPPLIES

Before applying power and signals to the EVAL-AD7606BFMCZ, ensure that all link positions are set according to the required operating mode. See Table 2 for the complete list of link options.

The supply required for the EVAL-AD7606BFMCZ comes from the EVAL-SDP-CH1Z (SDP-H1) controller board. Alternatively, the EVAL-AD7606BFMCZ can also be supplied with a dc power supply connected to the P4 terminal block. Select the external power supply or the EVAL-SDP-CH1Z (SDP-H1) supply through JP2. The power supply is then connected to the on-board ADP7118 5 V linear regulator that supplies the correct bias to each of the various sections on the EVAL-AD7606BFMCZ.

CHANNEL INPUT

The J1 to J4 connectors allow users to connect external signals to the ADC channel inputs through the SMB inputs. The EVAL-AD7606BFMCZ is supplied with the AD7606B mounted (U4, see Figure 1). The AD7606B is an 8-channel data acquisition system (DAS) with a simultaneous sampling ADC. External signals can be applied to the P8 to P10 terminal blocks on the EVAL-AD7606BFMCZ.

Table 2. Link Options

Link	Default Position	Function
JP2	A	This link selects the power supply source for the evaluation board. In Position A, the unregulated supply to the on-board LDOs is taken from the EVAL-SDP-CH1Z (SDP-H1) 12 V supply. In Position B, the unregulated external supply to the on-board LDOs is taken from the P4 terminal block connector.
JP1	A	The EVAL-AD7606BFMCZ evaluation software controls the $\overline{\text{STBY}}$ pin. When using the EVAL-AD7606BFMCZ board in standalone mode without running the EVAL-AD7606BFMCZ evaluation software, this jumper allows selection of standby mode. In this case, change the R8 and R10 resistors to 0 Ω links. In Position A, the $\overline{\text{STBY}}$ pin is tied to V_{DRIVE}. In Position B, the $\overline{\text{STBY}}$ pin is tied to AGND.

Link	Default Position	Function
JP3	A	Use to select the V_{DRIVE} source for the AD7606B. In Position A, the AD7606B is supplied with 3.3 V V_{DRIVE} from the ADP7118. In Position B, the AD7606B is supplied with 3.3 V from the EVAL-SDP-CH1Z (SDP-H1).
JP4	A	The EVAL-AD7606BFMCZ evaluation software controls the RANGE pin. If using the EVAL-AD7606BFMCZ board in standalone mode, this jumper allows selection of the analog input range in hardware mode. In this case, change the R20 resistor to a 0 Ω link. In Position A, the RANGE pin is tied to V_{DRIVE}, and the ±10 V range is selected. In Position B, the RANGE pin is tied to AGND, and the ±5 V range is selected. In software mode, this pin is ignored.
JP5	A	The EVAL-AD7606BFMCZ evaluation software controls the $\overline{PAR}$/SER SEL pin. If using the EVAL-AD7606BFMCZ board in standalone mode, this jumper allows digital interface selection. In this case, change the R19 and R21 resistors to 0 Ω links In Position A, the $\overline{PAR}$/SER SEL pin is tied to V_{DRIVE}, and the serial interface is selected. In Position B, the PAR/SER SEL pin is tied to AGND, and the parallel interface is selected.
JP6	A	The EVAL-AD7606BFMCZ evaluation software controls the REF SELECT pin. By default, the internal reference is selected. If switching to the external reference is required through the EVAL-AD7606BFMCZ evaluation software, R1 must be populated. If using the EVAL-AD7606BFMCZ board in standalone mode, this jumper allows reference selection. In this case, change the R13 resistor to a 0 Ω link. In Position A, the REF SELECT pin is tied to V_{DRIVE}, and the internal reference is enabled and selected. R1 must be unpopulated. In Position B, the REF SELECT pin is tied to AGND, the internal reference is disabled, and the external reference is selected. R1 must be populated.
S1	Open	The EVAL-AD7606BFMCZ evaluation software controls the REF SELECT pin. If using the EVAL-AD7606BFMCZ in standalone mode, these switches can select the logic level on the OSx pins.

EVALUATION BOARD SOFTWARE

SOFTWARE INSTALLATION

The EVAL-AD7606BFMCZ kit software is available for download from the AD7606B product page. Both the EVAL-AD7606BFMCZ software and the EVAL-SDP-CH1Z (SDP-H1) board drivers must be installed.

Warning

The EVAL-AD7606BFMCZ evaluation software and drivers must be installed before connecting the EVAL-AD7606BFMCZ evaluation board and the EVAL-SDP-CH1Z (SDP-H1) board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Installing the EVAL-AD7606BFMCZ Evaluation Software

To install the EVAL-AD7606BFMCZ evaluation software, take the following steps:

1. Unzip the installer downloaded from the AD7606B product page.
2. Double click the **setup.exe** file to begin the installation. By default, the software is saved to: **C:\Program Files** > **Analog Devices** > **AD7606B**.
3. A dialog box appears asking for permission to allow the program to make changes to the PC. Click **Yes** to begin the installation process (see Figure 2).

*Figure 2. **User Account Control** Dialog Box*

4. Select a location to install the software and then click **Next** (see Figure 3).

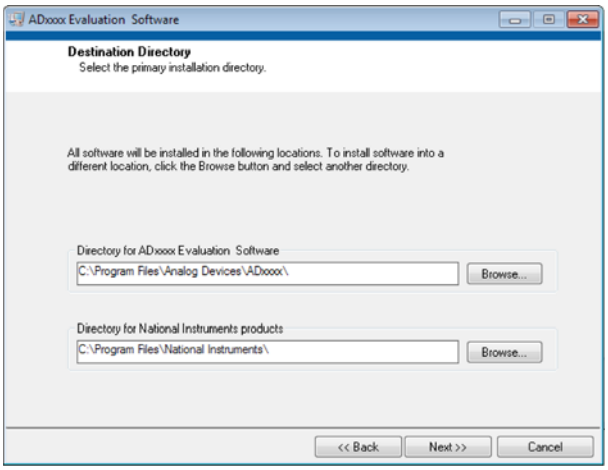

*Figure 3. **Destination Directory** Window*

5. A license agreement then appears. Read the agreement, select **I accept the License Agreement**, and click **Next**.
6. A summary of the installation appears. Click **Next** to continue (see Figure 4).

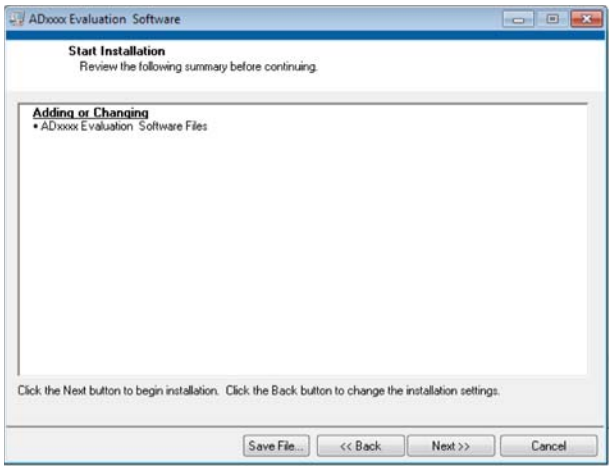

*Figure 4. **Start Installation** Window*

7. A dialog box informs the user when the EVAL-AD7606BFMCZ evaluation software installation is complete (see Figure 5). Click **Next** to proceed with the installation of the SDP drivers.

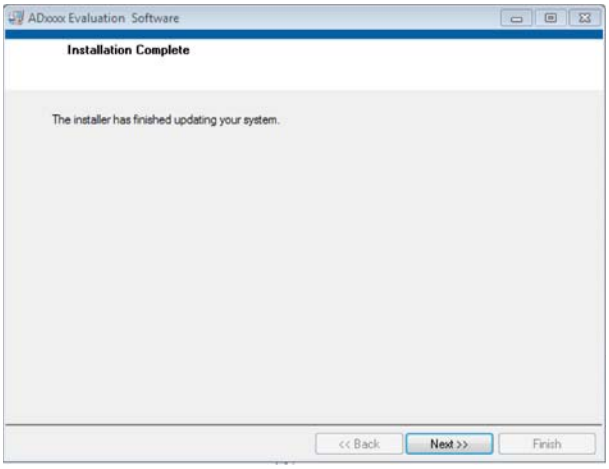

*Figure 5. **Installation Complete** Window*

Installing the SDP Board Drivers

After the EVAL-AD7606BFMCZ evaluation software installation is complete, the **ADI SDP Drivers 1.4.1.0. Setup Wizard** window opens to install the EVAL-SDP-CH1Z (SDP-H1) board drivers as follows:

1. When the **ADI SDP Drivers 1.4.1.0. Setup Wizard** opens, click **Next** to begin the driver installation process (see Figure 6).

Figure 6. Setup Wizard Welcome Window

2. Select a destination folder for the SDP drivers and click **Install** (see Figure 7).

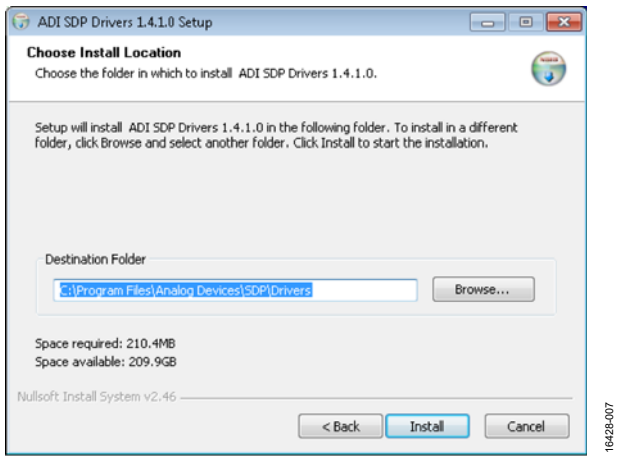

*Figure 7. **Choose Install Location** Window*

3. Click **Install** again to proceed with the installation (see Figure 8).

*Figure 8. **Windows® Security** Dialog Box*

4. When the SDP drivers installation completes, click **Finish** (see Figure 9).

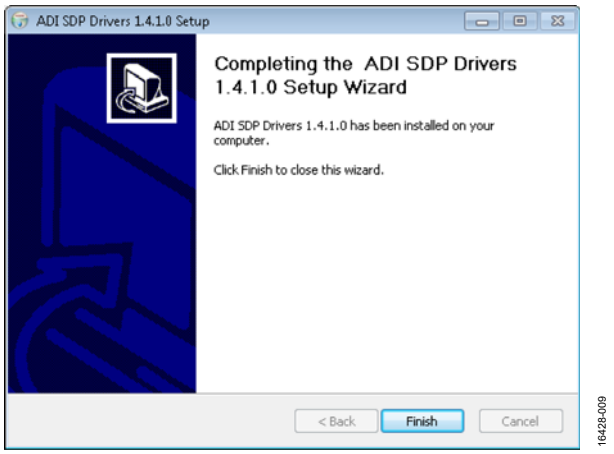

Figure 9. Completion of Installation Window

After the EVAL-AD7606BFMCZ evaluation software installation and SDP drivers installation is complete, connect the EVAL-AD7606BFMCZ to the EVAL-SDP-CH1Z (SDP-H1) as described in the Evaluation Board Hardware section.

When first plugging in the EVAL-SDP-CH1Z (SDP-H1) via the USB cable provided, allow the **Found Hardware Wizard** to run. After the drivers are installed, ensure that the EVAL-SDP-CH1Z (SDP-H1) is connected correctly by looking at the **Device Manager** of the PC. The **Device Manager** can be found by right clicking **My Computer** > **Manage** > **Device Manager** from the list of **System Tools**.

The **Analog Devices SDP-H1** (EVAL-SDP-CH1Z (SDP-H1)) appears under **ADI Development Tools**, as shown in Figure 10.

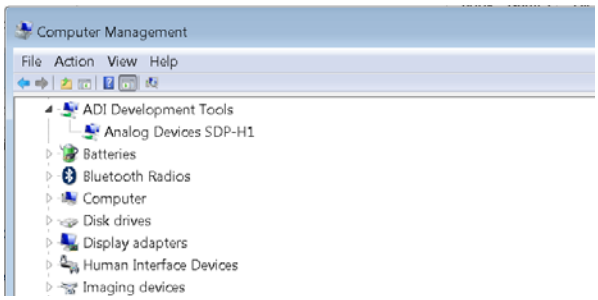

*Figure 10. **Device Manager** Window*

LAUNCHING THE SOFTWARE

The EVAL-AD7606BFMCZ evaluation software can be launched when the EVAL-AD7606BFMCZ and the EVAL-SDP-CH1Z (SDP-H1) controller board are correctly connected to the PC.

To launch the EVAL-AD7606BFMCZ evaluation software, take the following steps:

1. From the **Start** menu, go to **Programs** < **Analog Devices** < **AD7606B Eval**. The main window of the software then displays (see Figure 12).
2. If the EVAL-AD7606BFMCZ evaluation system is not connected to the USB port via the EVAL-SDP-CH1Z (SDP-H1) board when the software launches, the **Select Interface…** dialog box appears (see Figure 11). Connect the EVAL-AD7606BFMCZ to the USB port of the PC, wait a few seconds, and then click **Refresh** to rescan the USB ports. When the connection is established, the **AD7606BFMCZ Evaluation Board** lists in the box. Then, click **Select** to proceed or **Cancel** to exit the software.

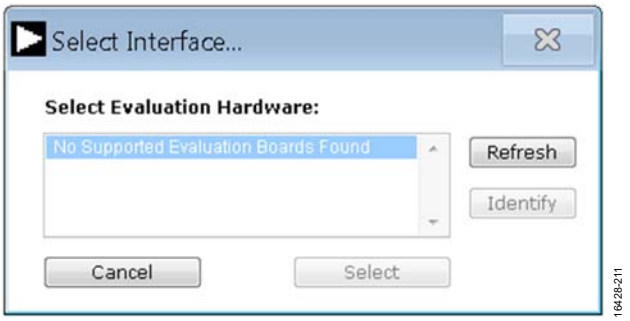

Figure 11. Select Interface … Dialog Box

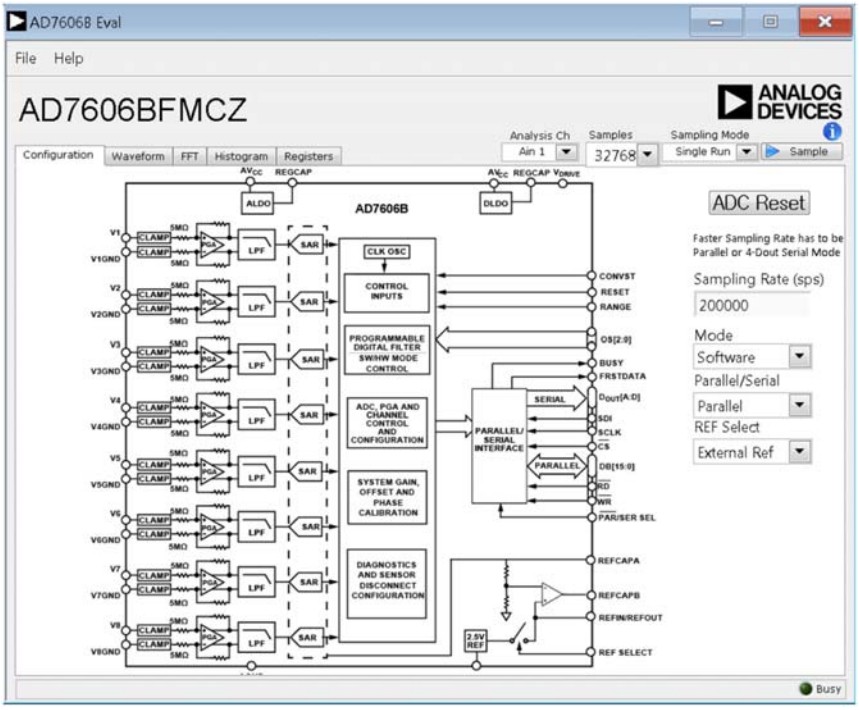

Figure 12. EVAL-AD7606BFMCZ Evaluation Software Main Window

DESCRIPTION OF MAIN WINDOW

The main window of the software displays the controls and analysis indicators of the EVAL-AD7606BFMCZ evaluation software, allowing the user to control the operation of the software and the capturing and displaying of data from the ADC. When the software launches, the main EVAL-AD7606BFMCZ evaluation software window opens (see Figure 12).

The main EVAL-AD7606BFMCZ evaluation software window shown in Figure 12 has the following features:

- Menu bar.
- Control buttons.
- **Configuration** tab, **Waveform** tab, **FFT** tab, and **Histogram** tab.

Note that if software mode is selected, the **Registers** tab also appears in the main EVAL-AD7606BFMCZ evaluation software window.

MENU BAR

The menu bar (see Figure 12) consists of the **File** and **Help** menus.

The **File** menu includes the following options:

- The **Save Data** option saves captured data, from all eight channels, in comma separated value (.csv) format for future analysis.
- The **Load Data** option loads previously captured data in .csv format for analysis.
- The **Exit** option exits the program.

The **Help** menu includes an **Analog.com** link option.

CONFIGURATION TAB

The **Configuration** tab contains controls to configure the AD7606B. Available controls include the sampling rate, operating mode (hardware or register), data interface, range, and oversampling.

Sampling Rate

Use the **Sampling Rate (sps)** field in Figure 12 to increase the rate of the converted start pulses to the AD7606B. This control accepts values from 3052 SPS to 800,000 SPS on the AD7606B. To achieve 800 kSPS, use the parallel interface in both hardware and software mode. When using the serial interface, to achieve 800 kSPS, users must select software mode, and DOUT_FORMAT must be configured as four lines in the CONFIG register within the **Registers** tab.

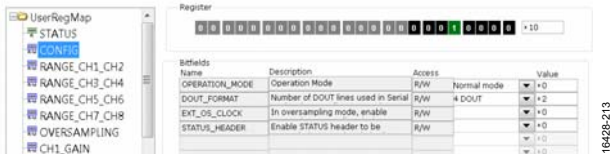

*Figure 13. Use the DOUT_FORMAT Configuration in the **Registers** Tab to Achieve High Throughput Rates in the Serial Interface*

If oversampling is enabled, the maximum sampling limit is decreased. Next time the **Sampling rate (sps)** field is written to after changing the oversampling ratio, this field automatically overwrites the maximum sampling frequency if attempting to write a higher value.

Parallel/Serial

The **Parallel/Serial** dropdown menu in Figure 12 allows users to select between a serial or parallel interface. When changing the interface, the software automatically resets the AD7606B.

REF Select

The **REF Select** dropdown menu in Figure 12 allows users to select between an internal and an external reference. When changing the interface, the software automatically resets the AD7606B. To use the external reference, R1 must be populated on the PCB.

Mode

The **Mode** dropdown menu in Figure 12 allows users to select between hardware or software mode. If software mode is selected, the software sets all oversampling pins high, and the **Register** tab enables granting access to the whole memory map. If hardware mode is selected, there is no memory map available. Therefore, the range and oversampling modes are only selected through the corresponding pins. To configure these pins, **Range** and **Oversampling mode** dropdown menus enable in hardware mode.

Range

The **Range** dropdown menu in **Configuration** tab, which is enabled in hardware mode, allows users to select the RANGE pin logic level and the range used by the software. The signal analysis calculations for the **Histogram**, **Waveform**, and **FFT** tabs are then calculated according to the range selected.

Oversample Mode

The **Oversample Mode** dropdown menu in **Configuration** tab, which is enabled in hardware mode, allows users to enable or disable oversampling and to choose from oversampling rates of 2, 4, 8, 16, 32, and 64. See the AD7606B data sheet for more information on the digital filter profile. The maximum output data rate of the AD7606B is limited by the selected oversampling rate.

Samples

The user can select the number of samples captured from the **Samples** dropdown menu in Figure 12. The default number of samples is 32768. However, the number of samples can be changed through the dropdown menu.

Taking Samples

To initiate the conversion process and capture the sampled data, click **Sample**.

When **Sample** is clicked, the software instructs the EVAL-SDP-CH1Z (SDP-H1) board to take the required number of samples at the required sampling rate from the EVAL-AD7606BFMCZ. After the required number of samples are captured, the capturing process stops, and the data displayed in the **Waveform**, **Histogram**, or **FFT** tabs updates.

When **Continuous** is clicked, the label on this button changes to **Stop**, and the software repeats the capture of the selected number of samples indefinitely until the user clicks **Stop**. While the software is in the continuous capture mode, the data in the **Waveform**, **Histogram**, or **FFT** tab is also continuously updated.

WAVEFORM TAB

Waveform Graph and Controls

The **Waveform** tab (see Figure 15) shows each successive sample of the ADC output. The control tools on the bottom right in the Waveform graph (see Figure 14) allow the user to zoom in on the data. Change the scales on the graph by typing values into the x-axis and y-axis.

Figure 14. Chart Tools

Channel Selection

The channel selection control (**Analysis Ch** dropdown box) allows the user to choose which channels display in the waveform analysis section. These controls only affect the display of the channels, and do not have any effect on the channel settings in the ADC register map.

Display Units and Axis Controls

Use the display units dropdown menu (see **Units: Volts** in Figure 15) to select whether the data graph displays in units of voltages or codes. Note that this selection affects both the waveform graph and the histogram graph.

If the unit is selected as **Code (Hex)**, the x-axis of the graph shows the original data (twos complement).

The axis controls can be switched between dynamic and fixed. When dynamic is selected, the axis automatically adjusts to show the entire range of the ADC results after each batch of samples. When fixed is selected, the user can program the axis ranges manually, and the ranges do not adjust automatically after each sample batch.

Save Data

Click **Captured Data** to save the samples to an external file.

Waveform Analysis

The **Waveform Analysis** section displays the results of the noise analysis for the selected analysis channel in the **Analysis Ch** dropdown menu.

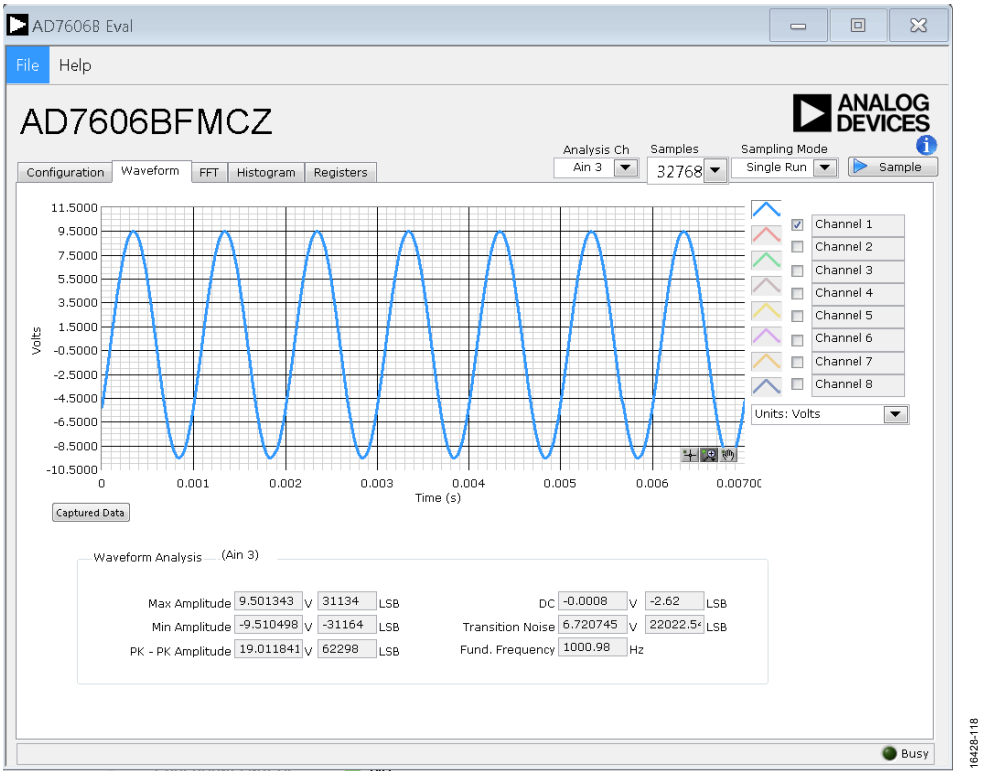

*Figure 15. **Waveform** Tab*

AC TESTING—FAST FOURIER TRANSFORM (FFT) CAPTURE

Figure 16 shows the **FFT** tab. The **FFT** tab analyzes the performance of an ADC in the frequency domain. The **FFT** tab tests the traditional ac characteristics of the converter and displays a FFT of the results. The **FFT** tab shows a plot of the computed FFT data.

The **FFT Analysis** pane contains additional information about the analysis, such as the calculated values of signal-to-noise ratio (SNR), signal-to-noise-and-distortion (SINAD), and total harmonic distortion (THD) (see Figure 16).

The user can choose to display the information for one, several, or all eight channels in the **FFT** tab using the checkboxes beside each channel.

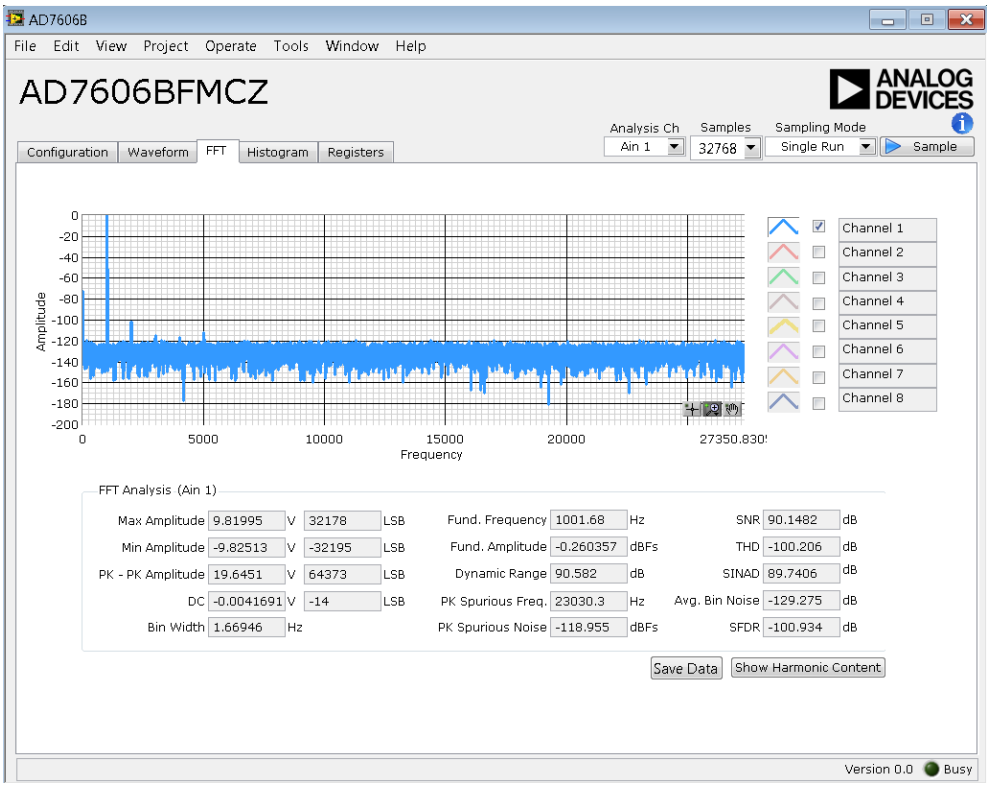

*Figure 16. **FFT** Tab*

HISTOGRAM TAB

Histogram and Controls

The data histogram shows the number of times each sample of the ADC output occurs (see Figure 17). The control tools in the graph allow the user to zoom in on the data. Change the scales on the graph by typing values into the x-axis and y-axis.

Histogram Analysis

The **Histogram Analysis** section shows the analysis of the channel selected via the **Analysis Ch** control.

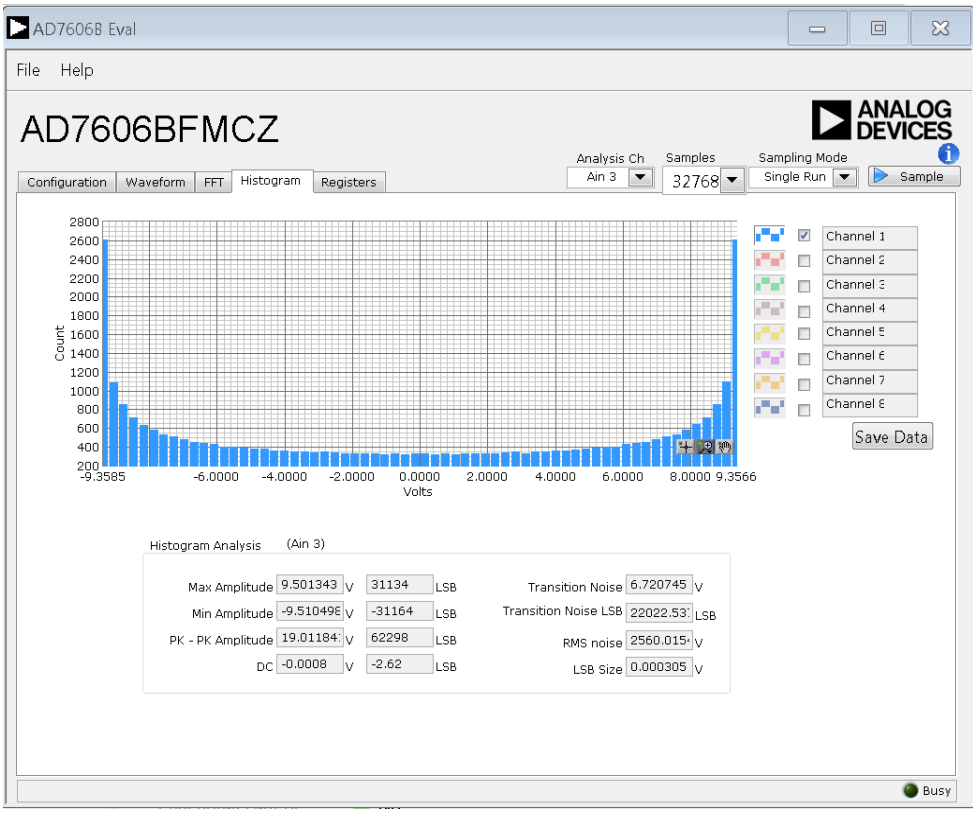

*Figure 17. **Histogram** Tab*

REGISTERS TAB

Register Tree

The register tree on the left side of Figure 18 shows the full register map in a tree control. Each register is shown. Click the expand button next to each register to show the bitfields contained within that register.

Register Control

The **Register** control allows the user to change the individual bits of the register selected in the register tree. Click on each bit to toggle the value or to program the register value directly into the number control field on the right.

Bitfields List

The **Bitfields** list shows the bitfields of the register selected in the register tree, for example, the Channel 1 and Channel 2 input range in Figure 18. The values can be changed using the dropdown box or by entering a value directly into the numeric control on the right.

Documentation

The **Documentation** section contains the documentation for the register and bitfield selected in the register tree.

Save and Load

The **Save** button allows users to save the current register map setting to a file, and the **Load** button allows users to load the setting from the current register map setting file.

EXITING THE SOFTWARE

To exit the software, click **Close** at the top, right corner of the main window.

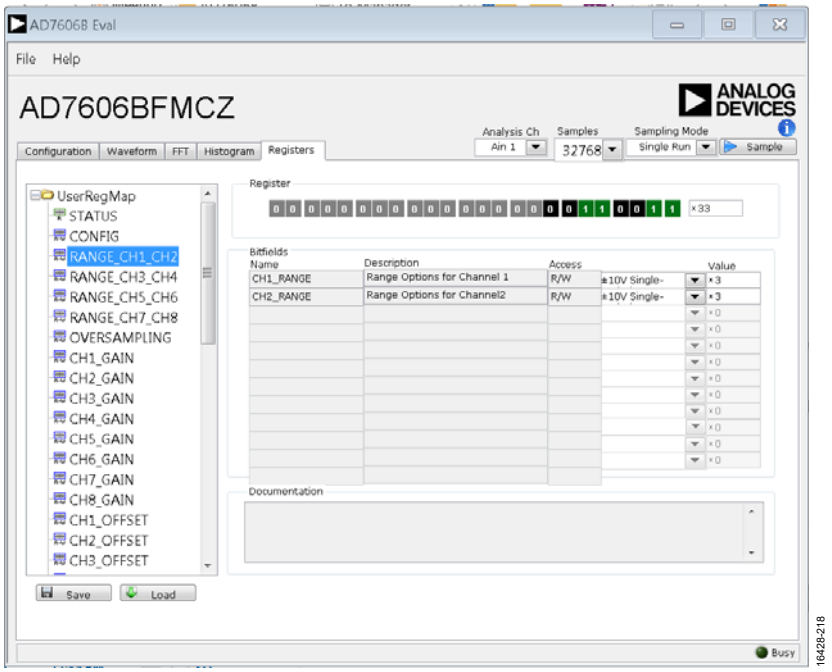

*Figure 18. **Registers** Tab*

SAVING FILES

The EVAL-AD7606BFMCZ evaluation software can save the captured data for future analysis. The software can capture the current plot images and the current device configuration, as well as the raw waveform data, histogram data, and ac spectrum data.

Saving Data

To save data, go to the **File** menu and click **Save Data** (see Figure 19). This action saves the raw data captured as seen in the **Waveform** tab in tab separated value (.tsv) format. Alternatively, there is a button on each tab to save the data stored on each graph: waveform, FFT, or histogram.

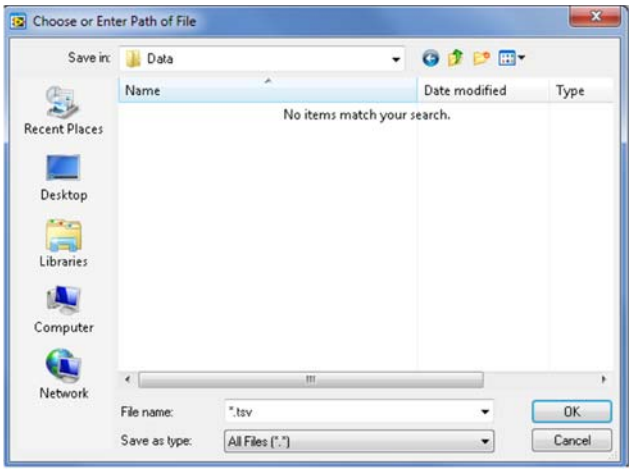

*Figure 19. **Save As** Data Dialog Box*

Saving Plot Images

To save plot images, go to the **Waveform** tab, **FFT** tab, or **Histogram** tab, click the **File** menu, and then click **Save As Picture.**

The images are saved in .jpeg format and do not contain any raw data information. Plots saved as images cannot be loaded back into the evaluation environment.

NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ANALOG DEVICES

www.analog.com