

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 SP2 (32-bit or 64-bit), Windows 7 SP1 (32-bit or 64-bit), Windows 8.1 (32-bit or 64-bit), or Windows 10 (32-bit or 64-bit) 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](#)

ONLINE RESOURCES

- [ACE evaluation software](#)
- [AD7606B ACE plug-in](#)

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.

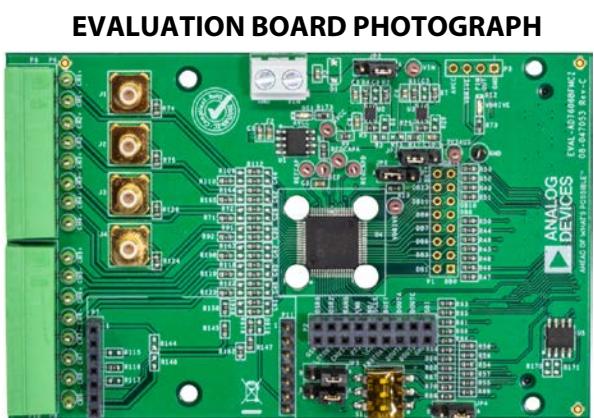


Figure 1.

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REVISION HISTORY

6/2020—Rev. 0 to Rev. A

Changes to Additional Equipment Needed Section and Online Resources Section	1
Changes to Quick Start Guide Section	3
Changes to Table 2	4
Changes to Software Installation Section, Figure 2, Figure 3, and Figure 4.....	6
Changes to Figure 5, Figure 6, Figure 7, and Figure 8	7
Added Disconnecting the EVAL-AD7380FMCZ or EVAL-AD7381FMCZ Section	7

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Added AD7606B Evaluation Software Operation Section, Description of Chip View Section, and Figure 10; Renumbered Sequentially	8
Changes to Figure 11 and Figure 12	9
Changes to Description of Memory Map Window, Figure 13, and Figure 14	10
Changes to Figure 15 and Waveform Tab Section	12
Changes to Histogram Tab Section and Figure 16.....	13
Changes to Figure 17 and Figure 18	14

5/2019—Revision 0: Initial Version

QUICK START GUIDE

To quickly evaluate the [AD7606B](#) ADC, take the following steps:

1. Download and install the [Analysis Control Evaluation \(ACE\)](#) 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 [ACE](#) 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

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 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 STBY pin is tied to V _{DRIVE} . In Position B, the STBY pin is tied to AGND.

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.

Link	Default Position	Function
JP3	A	<p>Use to select the V_{DRIVE} source for the AD7606B.</p> <p>In Position A, the AD7606B is supplied with 3.3 V V_{DRIVE} from the ADP7118.</p> <p>In Position B, the AD7606B is supplied with 3.3 V from the EVAL-SDP-CH1Z (SDP-H1).</p>
JP4	A	<p>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.</p> <p>In Position A, the RANGE pin is tied to V_{DRIVE}, and the ±10 V range is selected.</p> <p>In Position B, the RANGE pin is tied to AGND, and the ±5 V range is selected.</p> <p>In software mode, this pin is ignored.</p>
JP5	A	<p>The EVAL-AD7606BFMCZ evaluation software controls the 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</p> <p>In Position A, the PAR/SER SEL pin is tied to V_{DRIVE}, and the serial interface is selected.</p> <p>In Position B, the PAR/SER SEL pin is tied to AGND, and the parallel interface is selected.</p>
JP6	A	<p>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.</p> <p>In Position A, the REF SELECT pin is tied to AGND, the internal reference is disabled, and the external reference is selected. R1 must be populated.</p> <p>In Position B, the REF SELECT pin is tied to V_{DRIVE}, and the internal reference is enabled and selected. R1 must be unpopulated.</p>
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

Download the ACE evaluation software from the [AD7606B](#) product page. Both the EVAL-AD7606BFMCZ software and the [EVAL-SDP-CH1Z \(SDP-H1\)](#) board drivers must be installed.

Warning

The ACE 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 ACE Evaluation Software

To install the ACE evaluation software, take the following steps:

1. Download the ACE evaluation software to a Windows®-based PC.
2. Double click the **ACEInstall.exe** file to begin the installation. By default, the software is saved to: **C:\Program Files (x86)> Analog Devices > ACE**.
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.
4. Click **Next >** to continue the installation, as shown in Figure 2.



Figure 2. Evaluation Software Install Confirmation

5. Read the license and click **I Agree**.



Figure 3. License Agreement

6. Choose the install location and click **Next >**.

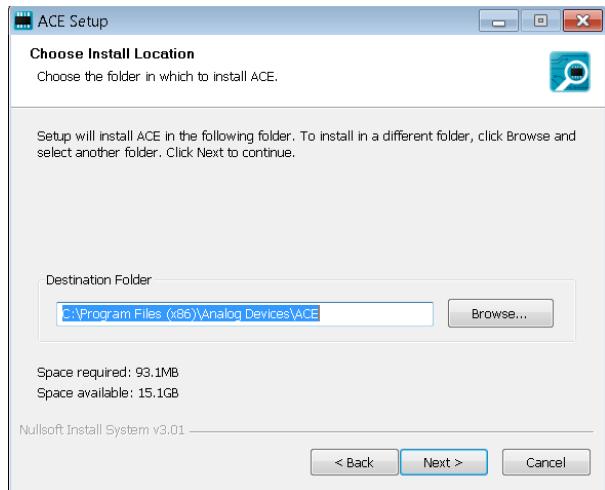


Figure 4. Choose Install Location Window

7. The components to install are preselected. Click **Install**.

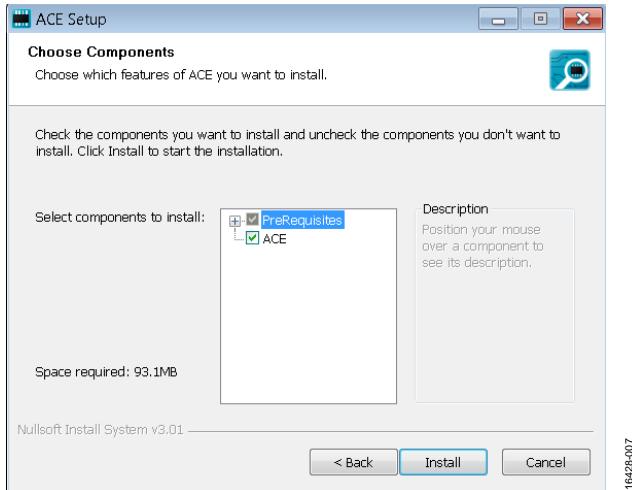


Figure 5. Choose Components

8. The Windows Security window appears. Click **Install**.



Figure 6. Windows Security Window

9. The installation is in progress. No action is required.

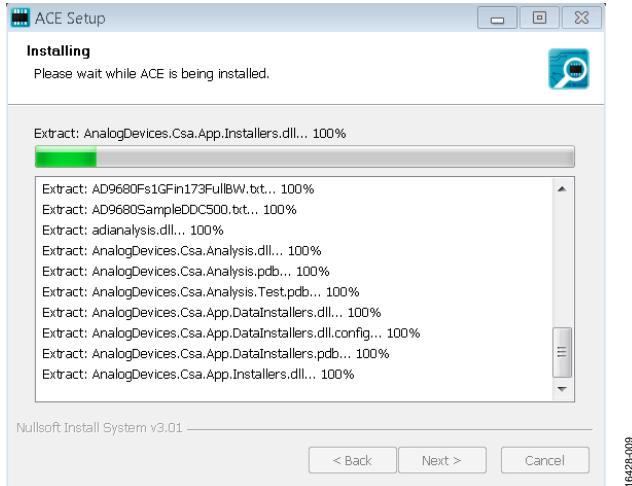


Figure 7. Installation in Progress

10. When the installation is complete, click **Next >**, and then click **Finish** to complete.

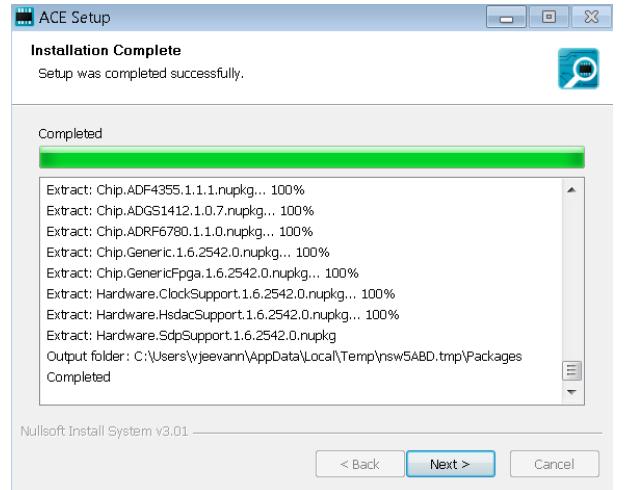


Figure 8. Installation Complete

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 9.



Figure 9. Device Manager Window

Disconnecting the EVAL-AD7380FMCZ or EVAL-AD7381FMCZ

Always disconnect power from the **EVAL-SDP-CH1Z** or press the reset tact switch located alongside the mini USB port before removing the **EVAL-AD7606BFMCZ** evaluation board.

AD7606B EVALUATION SOFTWARE OPERATION

Launching the Software

After the EVAL-AD7606BFMCZ and [EVAL-SDP-CH1Z](#) boards are correctly connected to the PC, launch the [ACE](#) evaluation software.

1. From the Start menu, select All Programs > Analog Devices > ACE> ACE.exe, which brings up the window shown in Figure 10.
2. If the EVAL-AD7606BFMCZ evaluation board is not connected to the USB port via the [EVAL-SDP-CH1Z](#) when the software is launched, the **AD7606B Eval Board** icon does not show up in the **Attached Hardware** section. Connect the EVAL-AD7606BFMCZ and the [EVAL-SDP-CH1Z](#) to the USB port of the PC and wait a few seconds, and then follow the instructions that appear in the dialogue box.
3. Double-click the **AD7606B Eval Board** icon to view the window shown in Figure 10.
4. Double-click the **AD7606B** chip icon to access the window shown in Figure 11.
5. Click **Software Defaults** and then click **Apply Changes**.

DESCRIPTION OF CHIP VIEW

After completing the steps in the Software Installation section, set up the system for data capture.

Block icons that are dark blue are programmable blocks. Clicking a dark blue block icon opens a configurable pop-up window that allows customization for the data capture, as shown for the Channel 1 input range (see Figure 13).

The available programmable blocks in chip view are as follows:

- Analog input range on a per channel basis through the icon located on each PGA block
- Gain, offset, and phase calibration setting on a per channel basis.
- Diagnostic multiplexer.
- Oversampling ratio lines. By setting all the lines high, the **AD7606B** enters software mode, and the oversampling ratio is set through the memory map. In hardware mode, these lines select the oversampling ratio.
- Data interface, either serial or parallel.
- Reference selection, either internal or external, through the REF SELECT switch.

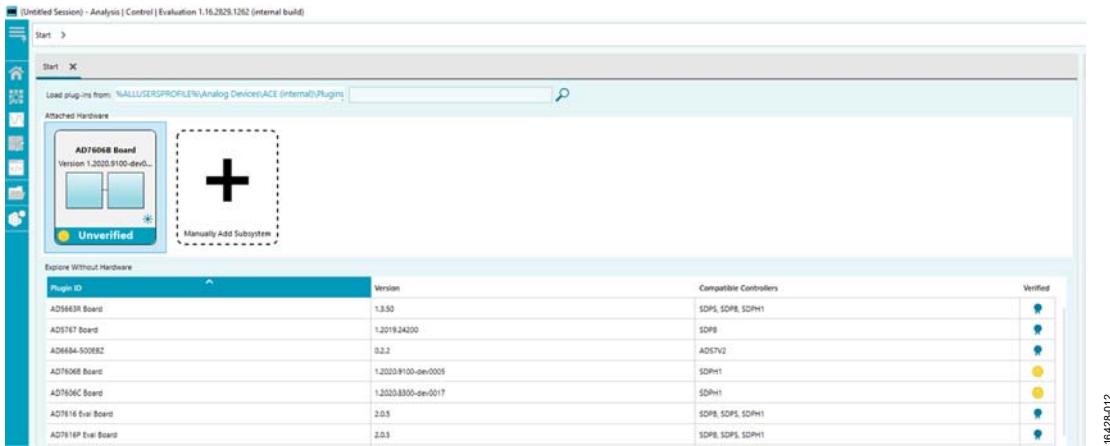


Figure 10. [ACE](#) Software Main Window

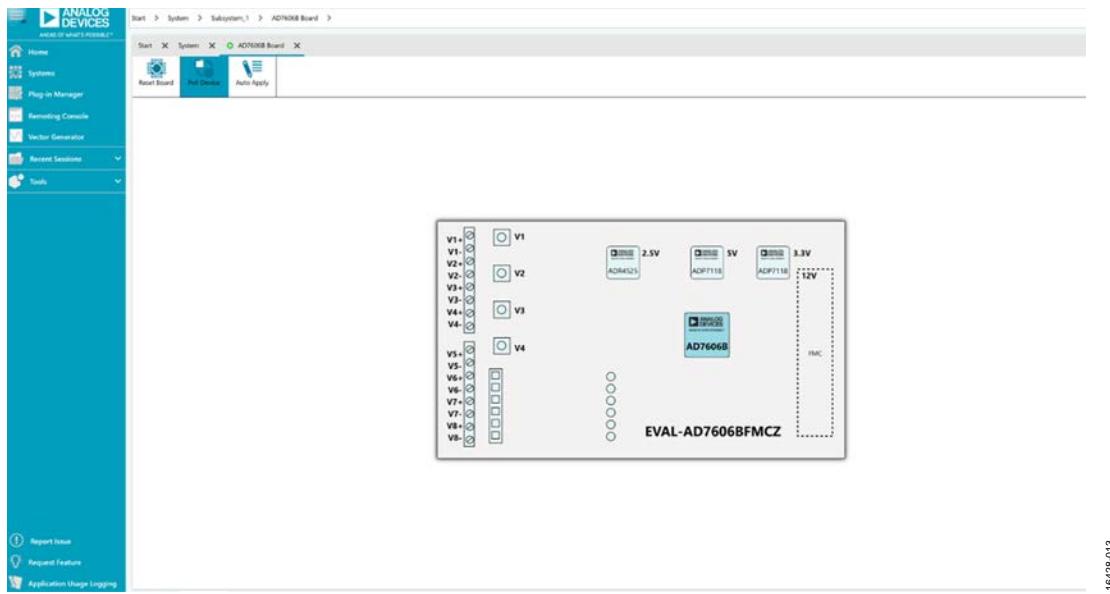


Figure 11. Board View

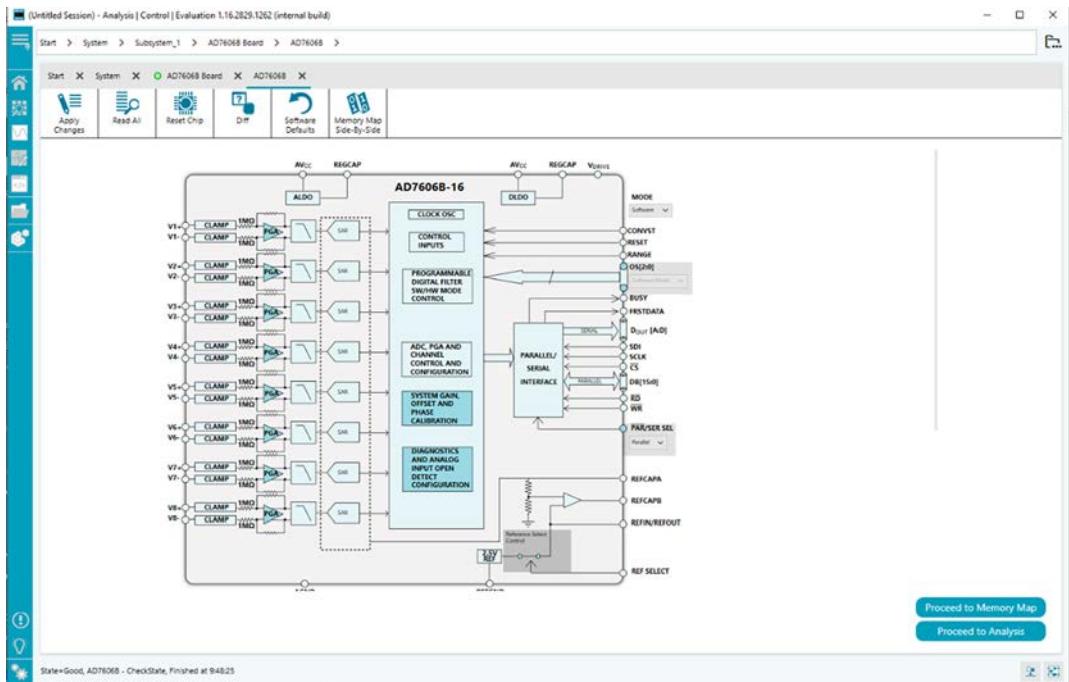


Figure 12. Chip View

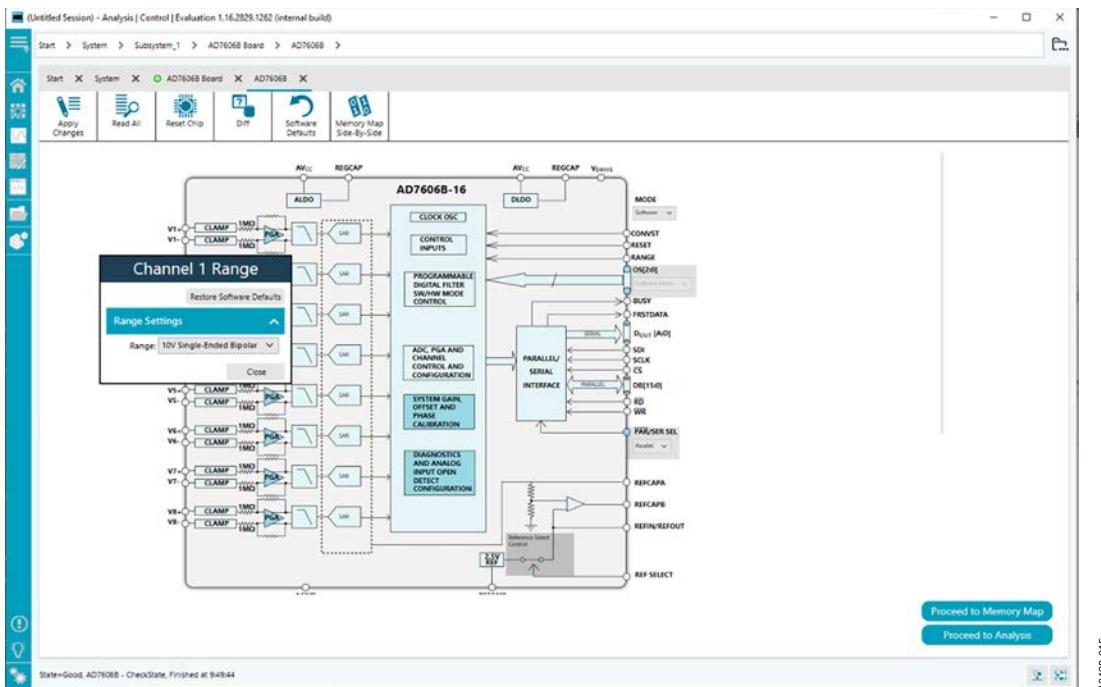


Figure 13. Pop-Up Configurable Window

The screenshot shows the "Memory Map" view. On the left, there are filters for "Registers", "Bit Fields", and "Bit Field Search". The main area is a table of memory registers:

Address (Hex)	Name	Data (Hex)	Data (Binary)
0x000001	*STATUS	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000002	CONFIG	08	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0x000003	*RANGE_CH1_CH2	33	0 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0
0x000004	*RANGE_CH3_CH4	33	0 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0
0x000005	*RANGE_CH5_CH6	33	0 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0
0x000006	*RANGE_CH7_CH8	33	0 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0
0x000008	OVERSAMPLING	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000009	*CH1_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000A	*CH2_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000B	*CH3_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000C	*CH4_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000D	*CH5_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000E	*CH6_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00000F	*CH7_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000010	*CH8_GAIN	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000011	CH1_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000012	CH2_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000013	CH3_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000014	CH4_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000015	CH5_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000016	CH6_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000017	CH7_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000018	CH8_OFFSET	00	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x000019	CH1_PHASE	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0x00001A	CH2_PHASE	00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Figure 14. Memory Map View

DESCRIPTION OF MEMORY MAP WINDOW

Click **Proceed to Memory Map** in the chip view to open the window shown in Figure 14. The memory map shows all registers of the AD7606B.

Apply Changes

The registers are in default values when powered up. To implement the values changed in all of the registers, click **Apply Changes** to write to the registers.

Apply Selected

In some cases, the values of all registers are changed, but the user wants to implement changes on a selected register only. Click **Apply Selected** to write the new value on the selected register to the [AD7606B](#).

Read All

Clicking **Read All** results in a read of the values of all the registers from the chip.

Read Selected

Clicking **Read Selected** results in a read of the selected register from the chip.

Reset Chip

Clicking **Reset Chip** causes the software to reset the [AD7606B](#).

Diff

Clicking **Diff** checks for difference in register values between software and chip.

Software Defaults

To revert the register values back to their defaults, click **Software Default**, and then click **Apply Changes** to write to the [AD7606B](#).

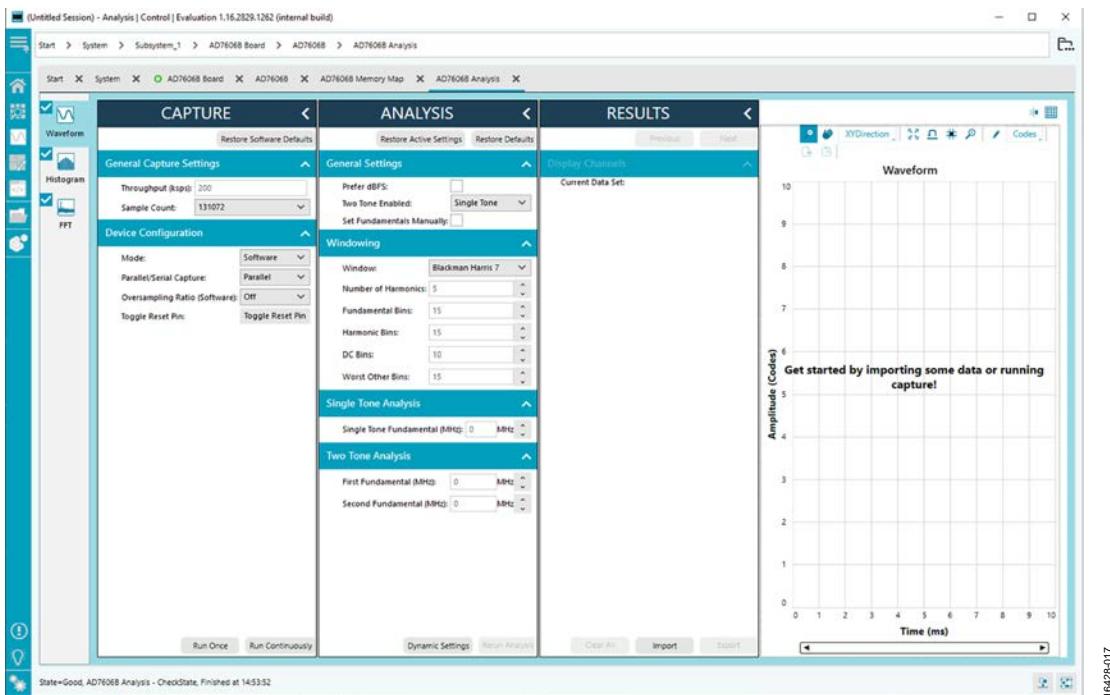


Figure 15. Analysis View

DESCRIPTION OF ANALYSIS WINDOW

Click **Proceed to Analysis** in the chip view to open the window, as shown in Figure 15. The analysis view contains the **Waveform** tab, **Histogram** tab, and **FFT** tab.

WAVEFORM TAB

The **Waveform** tab displays data in form of time vs. discrete data values with the results, as shown in Figure 16. The **Capture** pane contains capture settings, which reflect into the registers automatically before data capture.

Capture

General Capture Settings

The **Sample Count** list allows the user to select the number of samples per channel per capture.

The user can enter the input sample frequency in kSPS in the **Throughput(kSPS)** box. Refer to the [AD7606B](#) data sheet to determine the maximum sampling frequency for the selected mode.

Device Configuration

The **Mode** list can be set between hardware mode, meaning that the device is configured through digital input pins, or software mode, which allows reading and writing the memory map and enables a wider range of features. Refer to the [AD7606B](#) data sheet to determine the benefits of each mode.

The **Parallel/Serial Capture** list allows the user to select the data interface between parallel or serial.

The **Oversampling Ratio** list can be set between 2 and 64 (in hardware mode) or 256 (in software mode) and provides improved signal-to-noise ratio (SNR) performance. Refer to the

[AD7606B](#) data sheet to determine the maximum oversampling ratio for the selected oversampling mode.

The **Input Range**, when hardware mode is enabled, allows selection between ± 10 V and ± 5 V. In software mode, the input span is selected either in the memory map or the pop-up menu in chip view (see Figure 13).

The **Toggle Reset Pin** button allows the user to issue a full reset to the [AD7606B](#). Refer to the [AD7606B](#) data sheet for information on the different types of reset available on the device.

Run Once

Click **Run Once** to start a data capture of the samples at the sample rate specified in the **Throughput(KSPS)** box for the number of samples stated in **Sample Count** list. These samples are stored on the FPGA device and are only transferred to the PC when the sample frame is complete.

Run Continuously

Click **Run Continuously** to start a data capture that gathers samples continuously with one batch of data at a time. The **Run Once** operation is run continuously.

Results

Display Channels

Display Channels allows the user to select the channels to capture. The channel data is shown only if that channel is selected before the capture.

Waveform Results

Waveform Results displays amplitude, sample frequency, and noise analysis data for the selected channels.

Export Capture Data

Click **Export** to export captured data. The waveform, histogram, and FFT data is stored in .xml files along with the values of parameters at capture.

Waveform Graph

The data waveform graph shows each successive sample of the ADC output. The user can zoom and pan the waveform using the embedded waveform tools. The channels to display can be selected in **Display Channels**.

Display Units and Axis Controls

Click the **Display Units** dropdown list to select whether the data graph displays in units of hexadecimal, volts, or codes. The axis controls are dynamic.

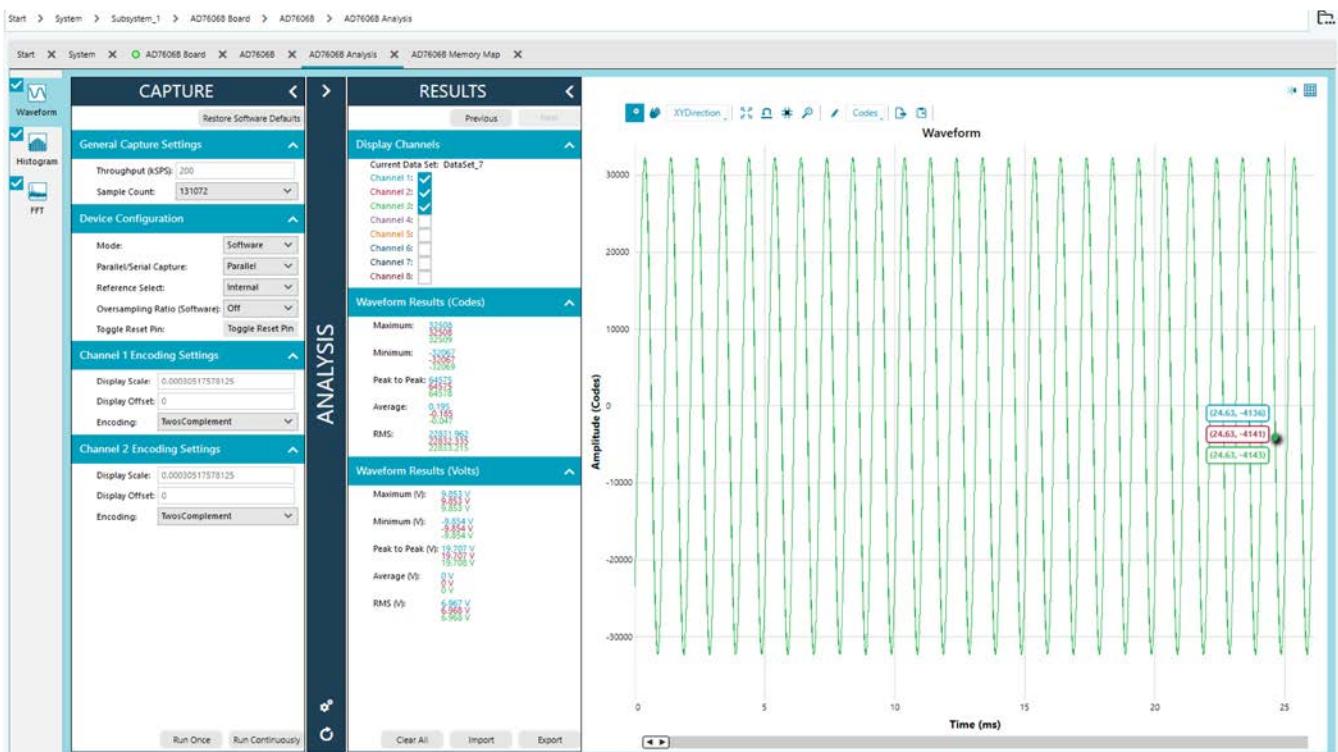


Figure 16. **Waveform Tab**

When selecting either y-scale dynamic or x-scale dynamic, the corresponding axis width automatically adjusts to show the entire range of the ADC results after each batch of samples.

HISTOGRAM TAB

The **Histogram** tab contains the histogram graph and the results pane, as shown in Figure 17.

Results

Results displays the information related to the dc performance.

Histogram Graph

The histogram graph displays the number of hits per code within the sampled data. This graph is useful for dc analysis and indicates the noise performance of the device.

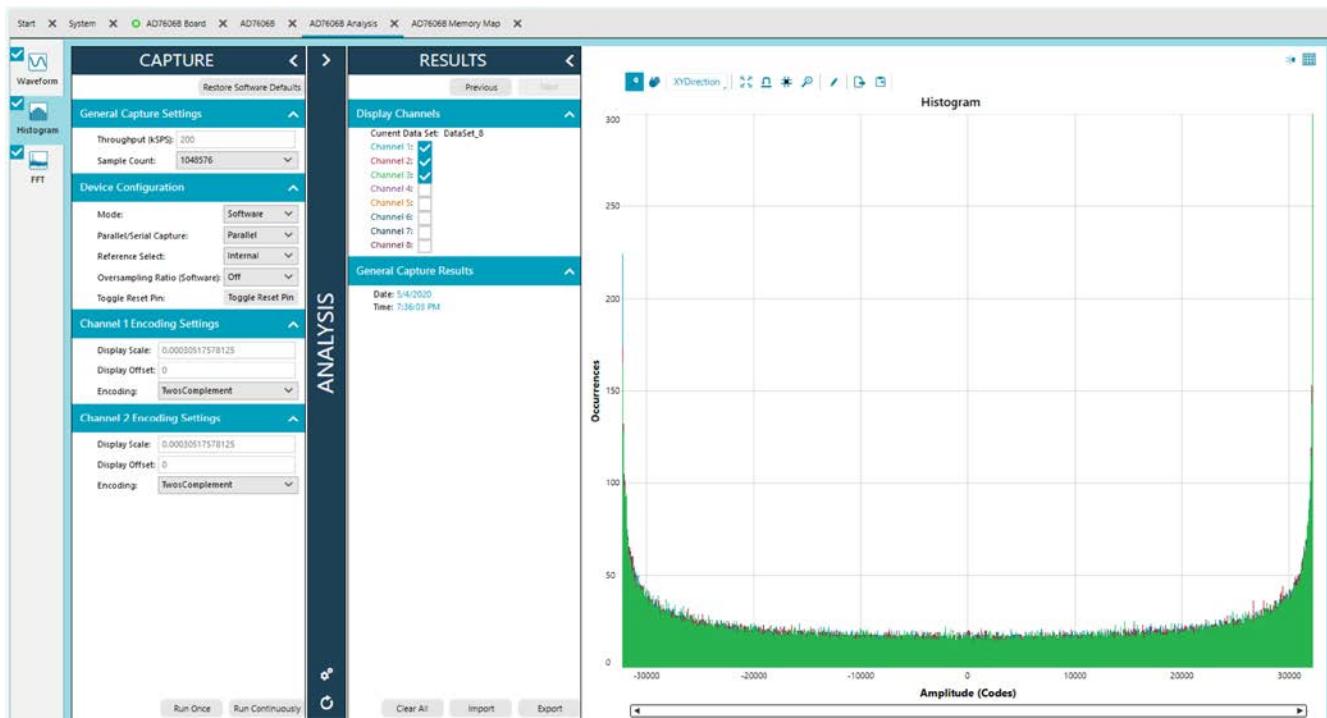


Figure 17. Histogram Tab

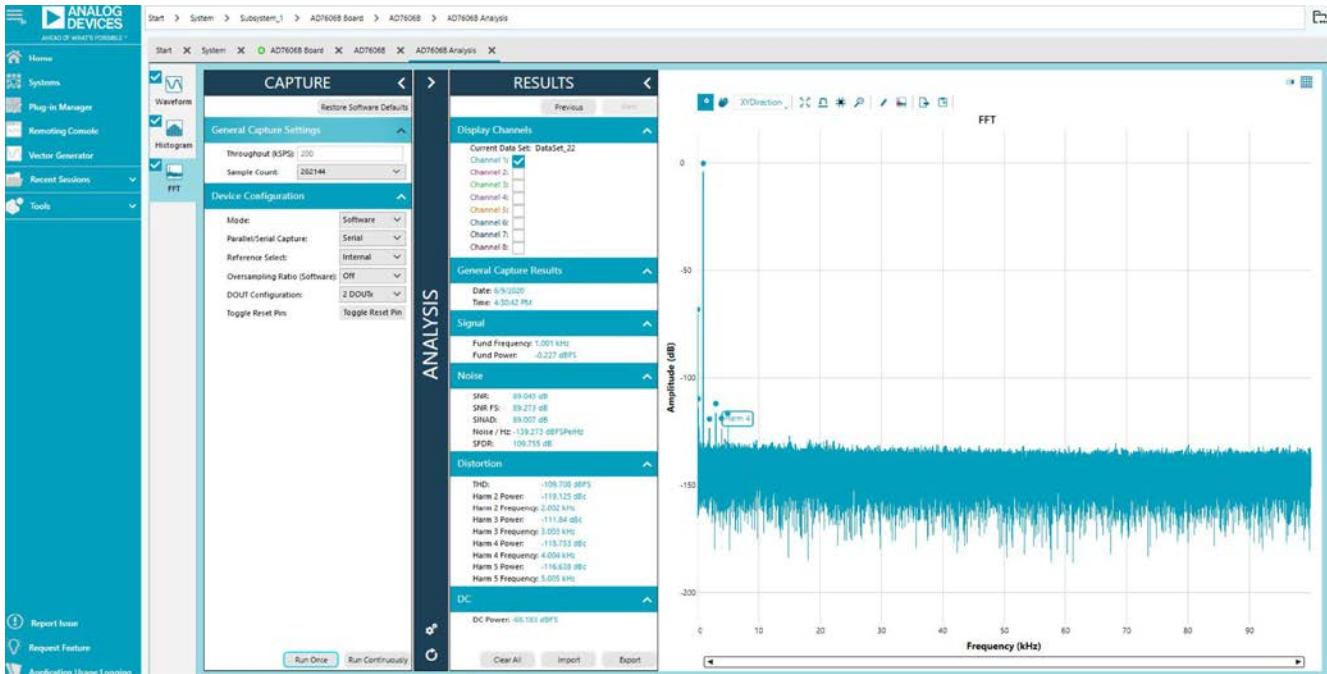


Figure 18. FFT Tab

FFT TAB

Figure 18 shows the FFT tab, which displays fast Fourier transform (FFT) information for the last batch of samples gathered.

Analysis

General Settings

The **General Settings** pane allows the user to set up the preferred configuration of the FFT analysis, including how many tones are analyzed. The fundamental is set manually.

Windowing

The **Windowing** pane allows the user to select the windowing type used in the FFT analysis, the number of harmonic bins, and the number of fundamental bins that must be included.

Single Tone Analysis and Two Tone Analysis

The **Single Tone Analysis** and **Two Tone Analysis** panes allow the user to select the fundamental frequency included in the FFT analysis. Use **Two Tone Analysis** when there are two frequencies that must be analyzed.

Results

Signal

The **Signal** pane displays the sample frequency, fundamental frequency, and fundamental power.

Noise

The **Noise** pane displays the SNR and other noise performance results.

Distortion

The **Distortion** pane displays the harmonic content of the sampled signal and dc power when viewing the FFT analysis.

EXITING THE SOFTWARE

To exit the software, click **File** and then click **Exit**.



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. **CONFIDENTIALITY.** This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. **ADDITIONAL RESTRICTIONS.** Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. **TERMINATION.** ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. **LIMITATION OF LIABILITY.** THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). **EXPORT.** Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. **GOVERNING LAW.** This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.