

ADuCM36x Multi-Functional Tool Getting Started Tutorial

FEATURES

- Graphically configure AFE blocks
 - Easy understanding of AFE blocks
 - Simple configuration of analog block registers with drop-down menus
 - Clear display of analog block register values and ADC configuration status
 - Avoid incorrect configuration through guiding dialog boxes
 - Saving and loading register values
- C code generation for analog blocks based on user configuration
 - Compatible with the low level library functions provided by Analog Devices, Inc.
- Noise analysis
 - Use on the [EVAL-ADuCM360QSPZ](#) evaluation board or a custom evaluation board
 - Analyze system level noise with the AFE blocks configuration
 - Use with any available ADC update rate
 - Select either ADC0 or ADC1 and any input channels
 - Sinc filter simulation
 - Multiple typical configurations are preconfigured for customers
 - Filter parameters and options are easily understandable

DOCUMENTS NEEDED

- [ADuCM360/ADuCM361 data sheet](#)
- [ADuCM362/ADuCM363 data sheet](#)
- [ADuCM360/ADuCM361 Hardware User Guide UG-457](#)

GENERAL DESCRIPTION

The [ADuCM36x Multi-Functional Tool](#) supports the [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) products, and is composed of four parts: a graphical configuration utility for the analog front end (AFE) blocks, C code generator, sinc filter simulator, and a noise performance analysis feature.

The [ADuCM36x Multi-Functional Tool](#) gives customers the ability to quickly and easily evaluate and interact with complex AFE circuits. It allows customers to validate system level AFE performance both on the [EVAL-ADuCM360QSPZ](#) evaluation board or a custom evaluation board with automatically generated code.

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REVISION HISTORY

12/2016—Revision 0: Initial Version

SOFTWARE QUICK START PROCEDURES

BEGINNING INSTALLATION

To begin the installation process, open the **ADuCM36x Tool** folder and double-click **setup.exe**.

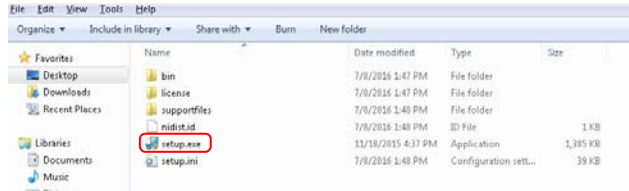


Figure 1. **ADuCM36x Tool** Installation Folder

The directories for the **ADuCM36x Multi-Functional Tool** default to the paths shown in Figure 2. Click the **Browse** button to select custom paths.

After configuring both paths, click the **Next** button and proceed to the next step to complete the installation.

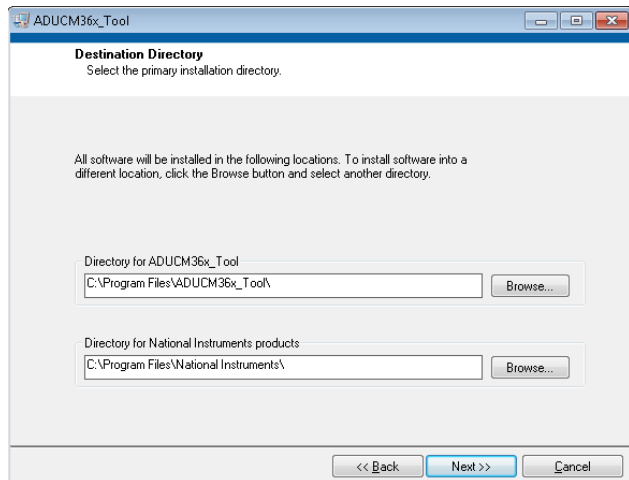


Figure 2. Installation Directory

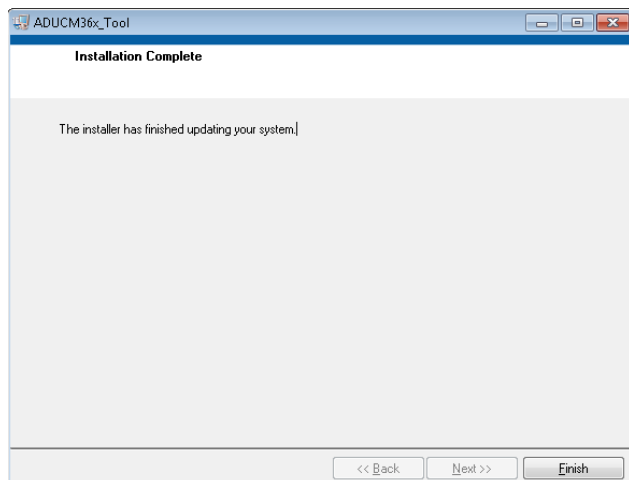


Figure 3. Installation Complete

INSTALLED FOLDER

Double-click **ADUCM36x_Tool.exe** to run the **ADuCM36x Multi-Functional Tool** (see Figure 4).

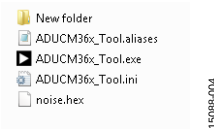


Figure 4. Installed Folder

UART PORT INFORMATION

For noise analysis, use the UART port for data transmission. The **EVAL-ADuCM360QSPZ** evaluation board, or a custom evaluation board, must connect to the PC with the J-Link OB emulator or UART port. Users must ensure that the UART port is recognized. See Figure 5 as an example of using the J-Link OB emulator. For information about the J-Link OB emulator, see [UG-457](#).

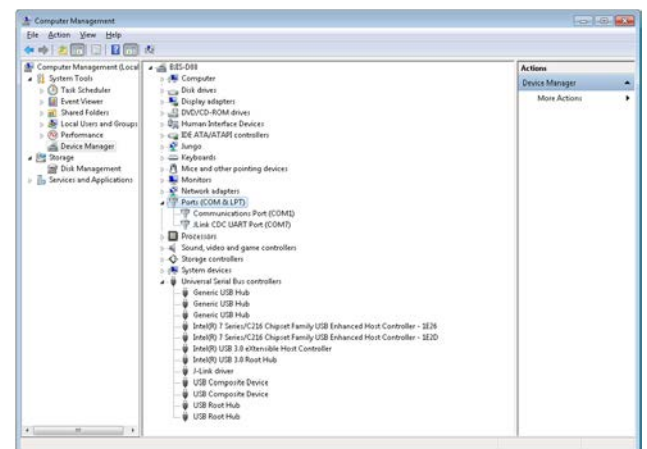


Figure 5. UART Port

DISPLAY

It is recommended to use a smaller font display mode for Windows® 7 operation system and a 1920x1080 display resolution. Otherwise the software can display incompletely. The user can find these settings under **Control Panel > Appearance and Personalization > Display** (see Figure 6).

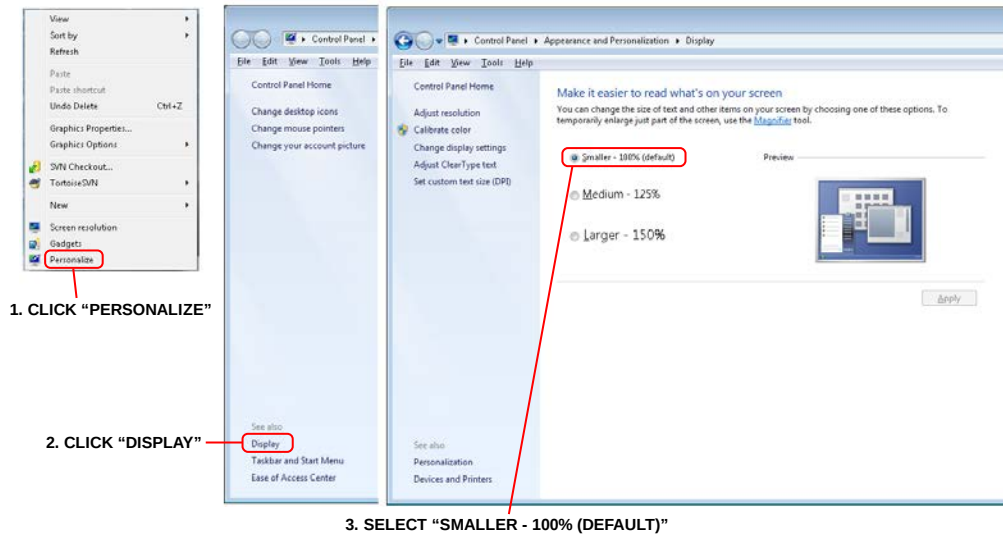


Figure 6. Display Settings

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SOFTWARE FEATURES

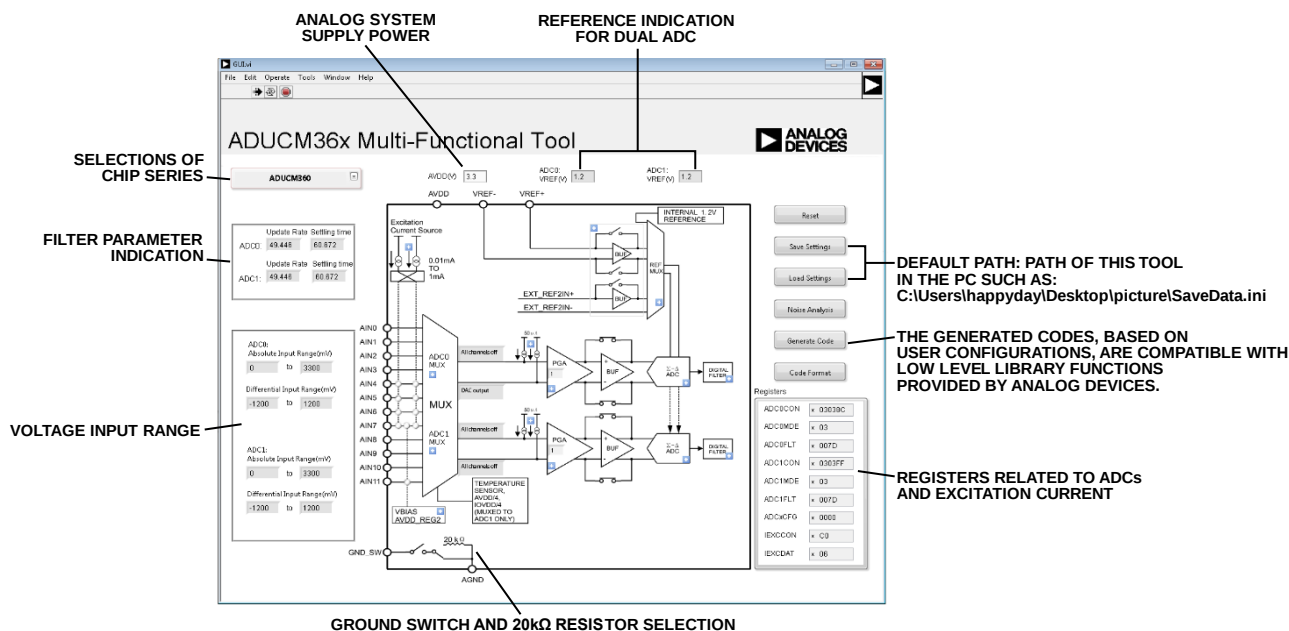


Figure 7. Graphically Configuring AFE GUI

The [ADuCM36x Multi-Functional Tool](#) integrates many useful and powerful features, shown in Figure 7.

PART SELECTION

The [ADuCM36x Multi-Functional Tool](#) supports the [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#). Users must select the device number in the device drop-down menu. The default value is [ADuCM360](#). [ADuCM361](#) and [ADuCM363](#) only support ADC1. [ADuCM360](#) and [ADuCM362](#) support both ADC1 and ADC2.

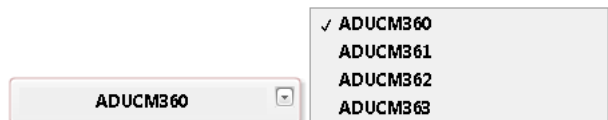


Figure 8. Device Selection

INPUT RANGE

The input voltage range, shown in Figure 9, displays the absolute input range and differential input range according to the configuration set by the user.

Figure 9. Input Ranges

Absolute Input Range (mV)

The **Absolute Input Range(mV)** fields show the maximum voltage that is relative to ground on the AINx pins.

Differential Input Range (mV)

The **Differential Input Range(mV)** fields show the values of voltage difference between AIN+ and AIN-.

AVDD

The **AVDD(V)** field shows the analog power supply of AVDD that is added to the [EVAL-ADuCM360QSPZ](#) evaluation board or a custom evaluation board. The default value is 3.3 V and must be input based on real applications.

ADC0 (VREF) AND ADC1 (VREF)

ADC0: VREF (V) and **ADC1: VREF (V)** fields show the reference source value of both analog-to-digital converters (ADCs) based on the software configuration.

REGISTERS

The registers, see Figure 10, are read only and change as the user operates the [ADuCM36x Multi-Functional Tool](#). Figure 10 shows the default settings.

ADC0CON	x 03038C
ADC0MDE	x 03
ADC0FLT	x 007D
ADC1CON	x 0303FF
ADC1MDE	x 03
ADC1FLT	x 007D
ADCxCFG	x 0000
IEXCCON	x C0
IEXCDAT	x 06

Figure 10. **Registers** Pane

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CHANNEL SELECTION

The **Channel Selection** window allows users to select input channels for AIN+ and AIN- for the ADC0 and ADC0 (see Figure 11).

The [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) support six fully differential inputs or twelve single-ended inputs; this can be chosen by selecting the **Single-ended** check box (see Figure 11 and Figure 12).

If selecting **Single-ended**, the **AIN-: Negative input channel** drop-down menu changes to **AGND** automatically.

If the **AIN+: Positive input channel** and **AIN-: Negative input channel** boxes are changed by the user, the Register ADCxCON Bits[10:0] changes instantaneously.

Figure 11. **Single-Ended Channel Selection**

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DIAGNOSTIC CURRENT SELECTION

To detect a connection failure from an external sensor, the [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) incorporate a 50 μ A constant (burnout) current source on the selected analog input channels to both ADCs. These can switch on or off via the Register ADCxCON Bits[11:10]. The **Diagnostic current selection** window allows users to select the diagnostic current status on the corresponding input channel (see Figure 13).

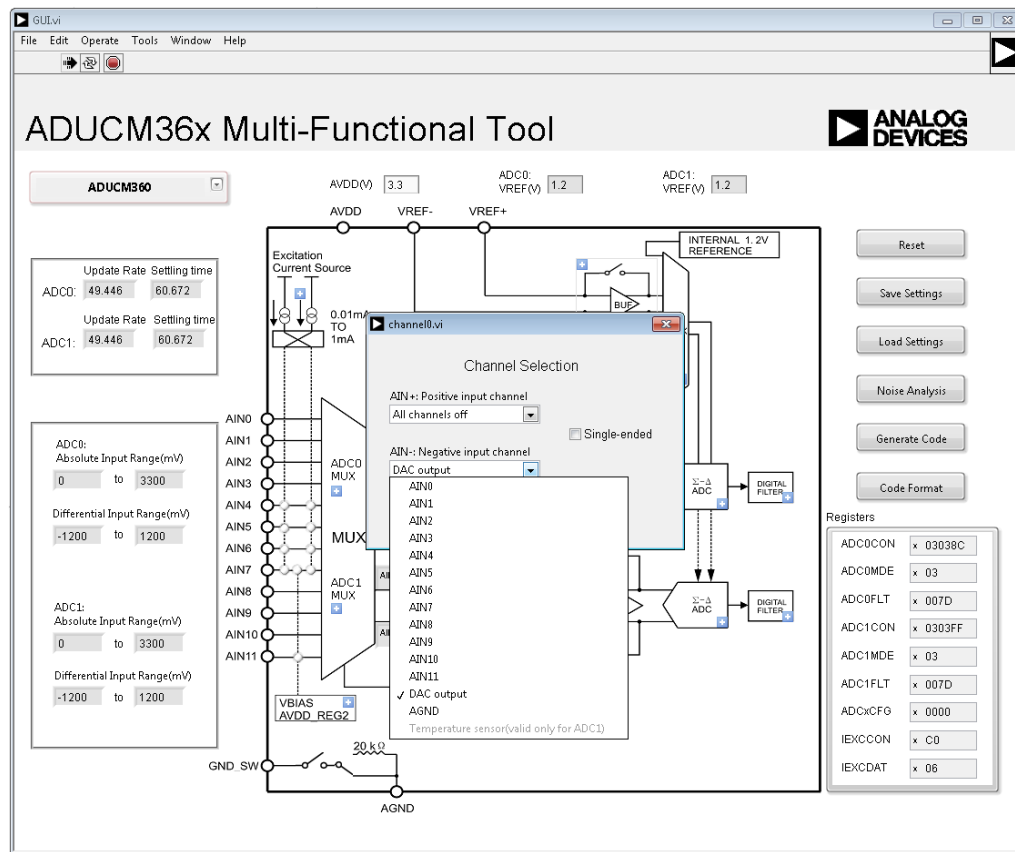


Figure 12. Input Channels Selection

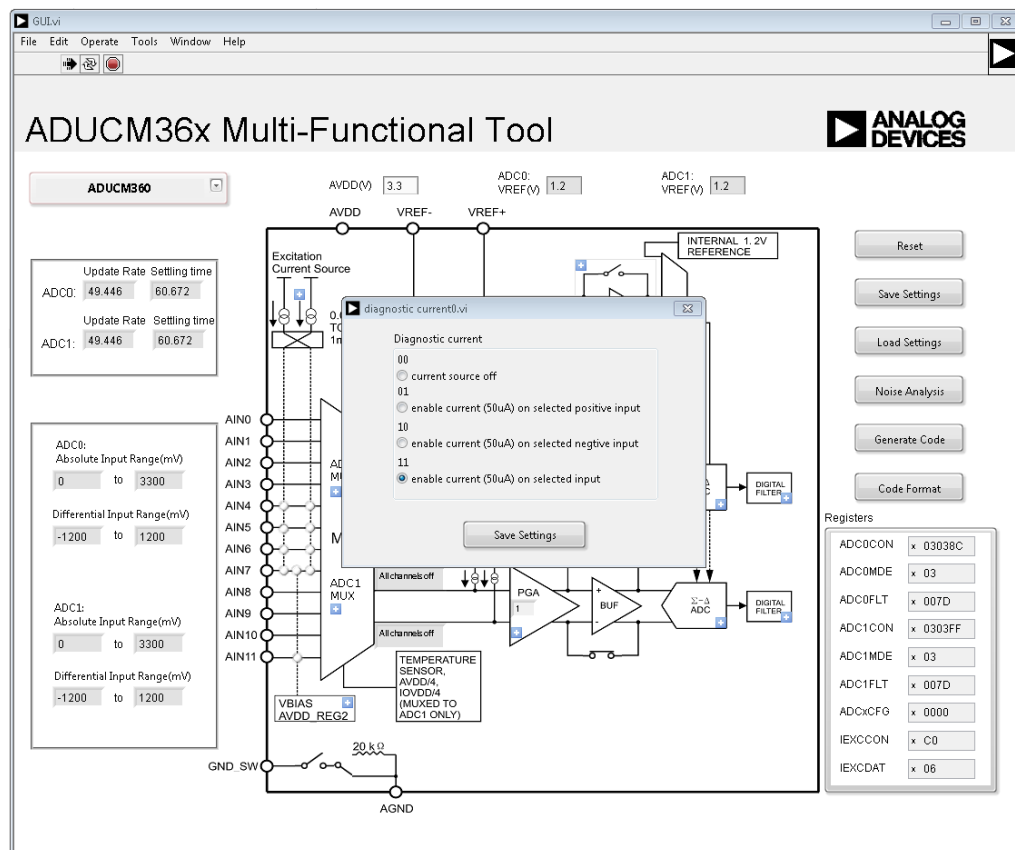


Figure 13. 50µA Diagnostic Current Selection

GAIN SETTING

The ADuCM360/ADuCM361 and ADuCM362/ADuCM363 incorporate an on-chip programmable gain amplifier (PGA). The PGA can be programmed through eight different settings, resulting in a range of 1 to 128 (see Figure 14).

An optional extra gain of 2 can be added in the ADC modulator. That is, a gain of 2 can be added to the output of the PGA. It is recommended that when gain equals 1, 2, 4, or 8, do not select ADCMOD2. When gain equals 1, the buffer in front of the corresponding ADC is unavailable.

Input Buffers Selection

Click the switch icon to bypass or not bypass buffers in front of ADC modulator. For the ADuCM360/ADuCM361, positive and negative buffers must be bypassed when gain equals 1.

OPERATION MODE SELECTION

The ADuCM360/ADuCM361 and ADuCM362/ADuCM363 support eight operation modes (see Figure 15); refer to the ADuCM360/ADuCM361 Hardware User Guide for details on each operation mode.

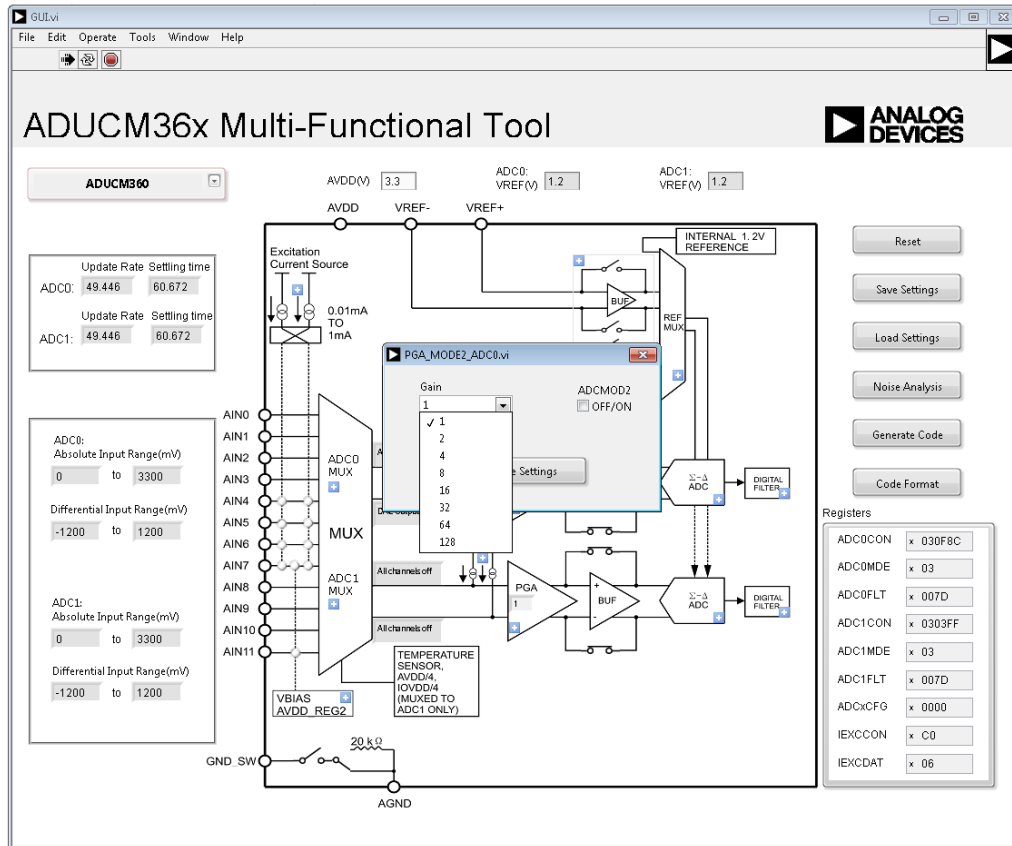


Figure 14. Gain Setting



Figure 15. Operation Mode Selection

FILTER SELECTION

The control parameters in the **Digital Filter_ADC0.vi** window (see Figure 16) include the following:

- **CHOP OFF/ON** check box
- **RAVG2 OFF/ON** check box
- **NOTCH2 OFF/ON** check box
- **SIN3** and **SINC4** button
- **SF** spin box
- **AF** spin box
- **Typical Update Rate (Hz)** drop-down menu

Indication parameters include the following:

- **Update Rate(Hz)** field
- **Settling Time(ms)** field
- **Digital Filter Frequency Response** graph

After the control parameters are changed, click the **Configure** button to update the indication parameters of the **Update Rate(Hz)** and **Settling Time(ms)** fields.

When setting the **Typical Update Rate (Hz)** drop-down menu, the indication parameters update automatically.

The following information appears in the **Digital Filter_ADC0.vi** window parameters:

- The **SF** range is 0 to 127.
- When **SINC4** is enabled, **AF** is 0.
- When **SINC3** is enabled, the **AF** range is 0 to 15.
- When **CHOP** is enabled, **RAVG2** activates.

The **ADuCM360_361_Digital_Filter_Response_Model.xlsx** is available on the [ADuCM360/ADuCM361](#) product page.

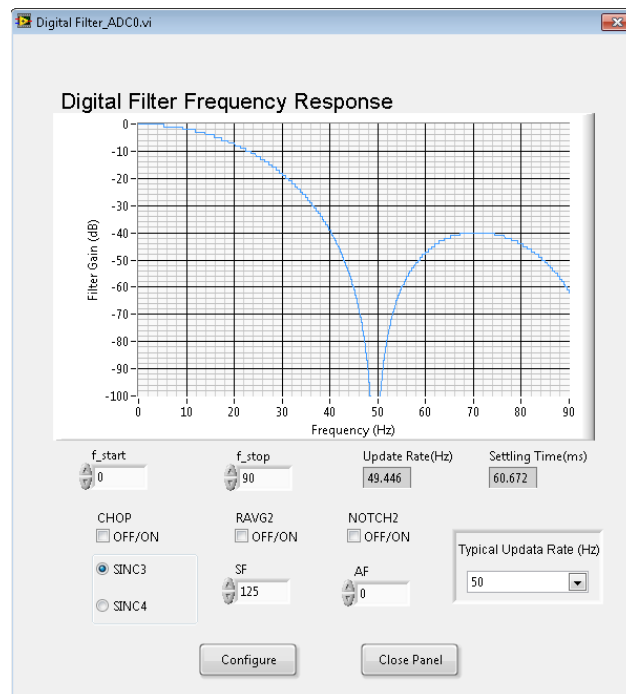


Figure 16. **Digital Filter_ADC0.vi** Window

REFERENCE SELECTION

Reference selection for the ADC0 and ADC1 is available in the **Reference_choose.vi** window (see Figure 17). **EXTREF** is available for ADC0 and ADC1 and **EXTREF2** is only valid for ADC1. The minimum differential voltage for **EXTREN** and **EXTREN2IN** is 400 mV.

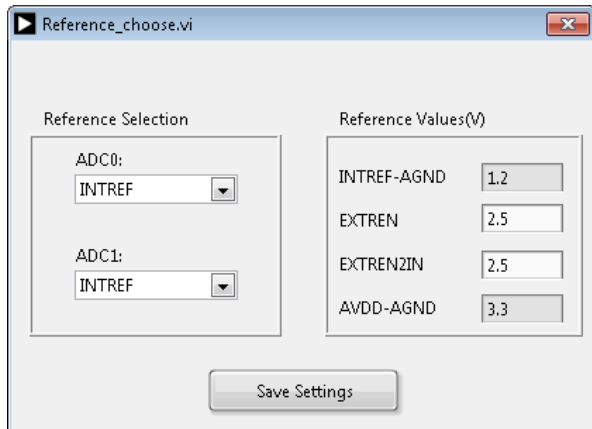


Figure 17. Reference Selection

REFERENCE BUFFER

If the user chooses the external reference as an ADC reference, the [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) provide an option to internally buffer the external reference. The **Reference Buffers** window shows these four available reference buffer options (see Figure 18).

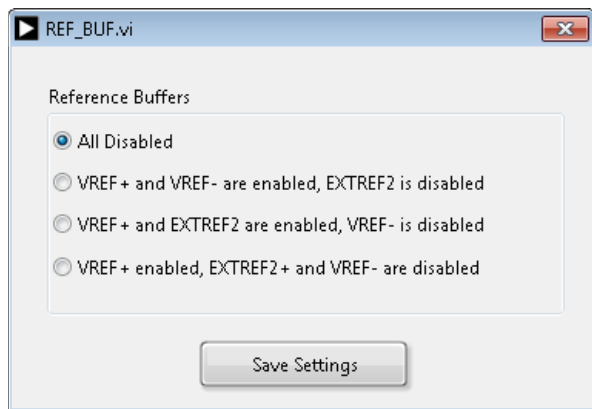


Figure 18. Reference Buffer Options

BIPOLAR/UNIPOLAR MODE SELECTION

[ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) supports two kinds of code output format: bipolar or unipolar.

EXCITATION CURRENT SELECTION

The [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) incorporate two matched software configurable excitation current sources. Users can use the **Excitation current source** window to choose the output pin and current value for each excitation current source (see Figure 19).

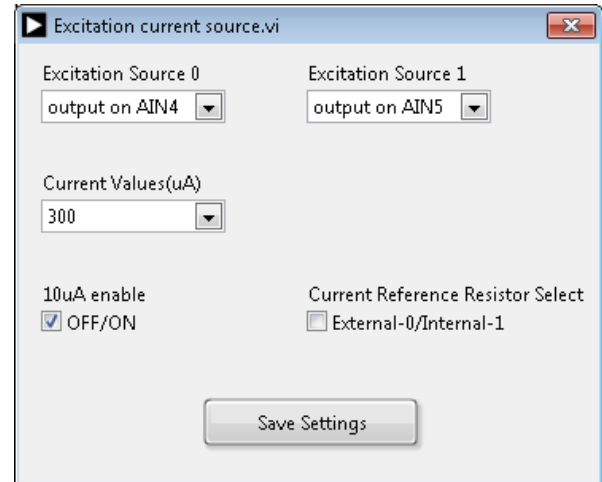


Figure 19. Excitation Current Selection

SAVE/LOAD SETTING

The [ADuCM36x Multi-Functional Tool](#) integrates save and load functions. The default path (see Figure 20) saves the [ADuCM36x Multi-Functional Tool](#) to the PC. The user can also set a custom path for save and load functions.

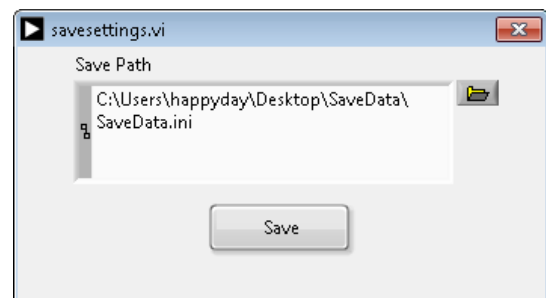


Figure 20. Save/Load Settings

NOISE ANALYSIS

Before using the noise analysis feature, the user must download the **noise.hex** file, provided in the installation folder, into the [ADuCM360](#), [ADuCM361](#), [ADuCM362](#), or [ADuCM363](#). Refer to the [UG-457](#) for more information about how to download a hex file to the [ADuCM360](#), [ADuCM361](#), [ADuCM362](#), or [ADuCM363](#) with the CM3WSD.exe tool. The CM3WSD.exe tool is available for download on the [ADuCM360/ADuCM361](#) and [ADuCM362/ADuCM363](#) product pages.

Select the **COM Port**, **Sample Points**, and **ADC Choice**. 256 or 512 sample points are available. The selected ADC configuration is configured through the graphical user interface (GUI), shown in Figure 21.

Clicking the **Write** button shows the real noise performance and ADC data in the **Noise Analysis** window (see Figure 7).

To view the ADC raw data shown in Figure 21, right click the **Waveform Graph > Export > Export Data to Excel**.

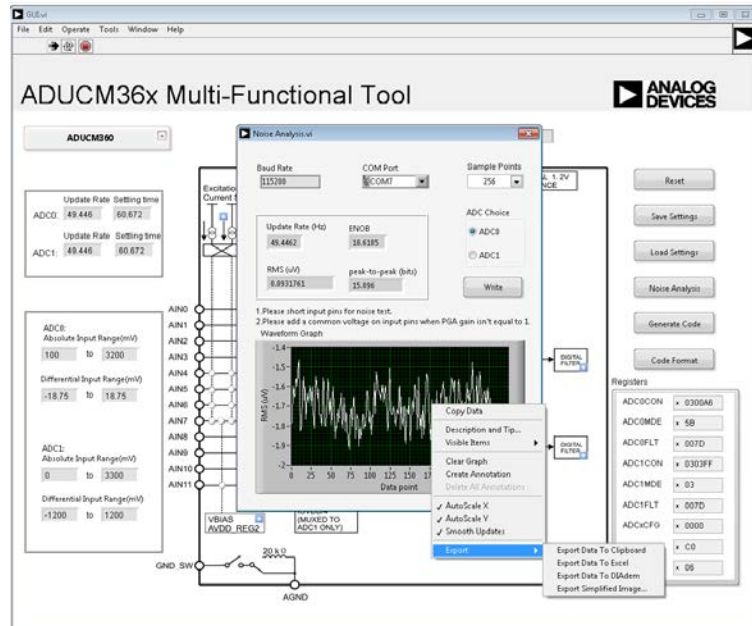


Figure 21. Noise Analysis

GENERATE CODE

Click the **Generate Code** button to open the **INIT_CODE.vi** window. Choose either a single ADC or both **ADC0** and **ADC1**. Click the **Generate Code** button to generate code, shown in Figure 22.

If the user selects a single ADC, the function name is **ADC0_Init** or **ADC1_Init**. If the user selects both **ADC0** and **ADC1**, the function name is **ADC_Init**.

The generated code is compatible with low level library functions provided by Analog Devices.

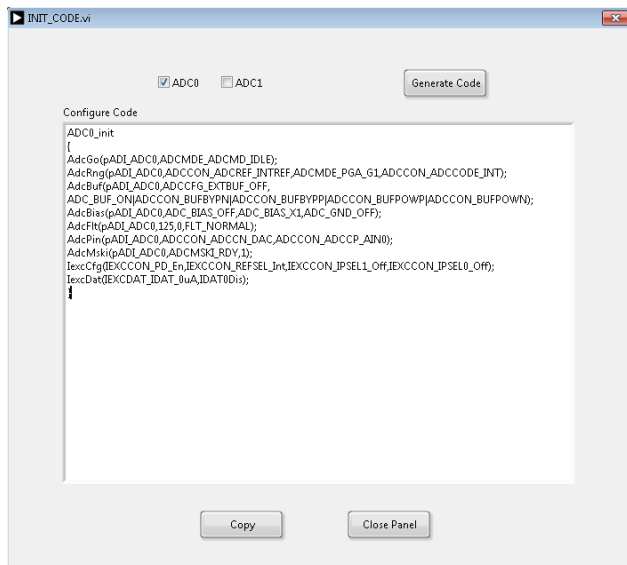


Figure 22. Generate Code Window

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.

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