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.

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.

INSTALLED FOLDER

Double-click ADuCM36x_Tool.exe to run the ADuCM36x Multi-Functional Tool (see Figure 4).

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.

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).
1. CLICK "PERSONALIZE"

2. CLICK "DISPLAY"

3. SELECT "SMALLER - 100% (DEFAULT)"

Figure 6. Display Settings
SOFTWARE FEATURES

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.

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.

**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.

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.

DIAGNOSTIC CURRENT SELECTION
To detect a connection failure from an external sensor, the ADuCM360/ADuCM361 and ADuCM362/ADuCM363 incorporate a 50 μA 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. 50 μA 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.

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).

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).

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.

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.
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.