

TLV320ADC3101-K

This user's guide describes the characteristics, operation, and use of the TLV320ADC3101-K. This evaluation module (EVM) features a low-power stereo audio ADC with several analog inputs, digital output, audio routing, mixing, and digital filter capabilities. A complete circuit description, schematic diagram, and bill of materials are also included. Note that the TLV320ADC3101 uses the I²C™ bus for register control. Any reference to the SPI control bus in this document is due to the presence of this interface on the USB-MODEVM motherboard.

The following related documents are available through the Texas Instruments Web site at www.ti.com.

EVM-Compatible Device Data Sheets

Device	Literature Number
TLV320ADC3101	SLAS553
TAS1020B	SLES025
REG1117-3.3	SBVS001
TPS767D318	SLVS209
SN74LVC125A	SCAS290
SN74LVC1G125	SCES223
SN74LVC1G07	SCES296

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1 EVM Overview

1.1 Features

- Full-featured evaluation board for the TLV320ADC3101 stereo audio analog-to-digital converter (ADC)
- USB connection to PC provides power, control, and streaming audio data for easy evaluation.
- Dual onboard microphones and line inputs for ADC evaluation
- Connection points for external control and digital audio signals for quick connection to other circuits/input devices.

The TLV320ADC3101-K is a complete evaluation kit, which includes a universal serial bus (USB)-based motherboard and evaluation software for use with a personal computer running the Microsoft Windows™ operating system (Windows 2000 or Windows XP™).

1.2 Introduction

The TLV320ADC3101EVM is in the Texas Instruments (TI) modular EVM form factor, which allows direct evaluation of the device performance and operating characteristics and eases software development and system prototyping.

The TLV320ADC3101-K is a complete evaluation/demonstration kit, which includes a USB-based motherboard, called the USB-MODEVM interface board, and evaluation software for use with a personal computer (PC) running the Microsoft Windows operating system.

The TLV320ADC3101-K is operational with one USB cable connection to a PC. The USB connection provides power, control, and streaming audio data to the EVM for reduced setup and configuration. The EVM also provides interfaces for external control signals, audio data, and power. This allows for the TLV320ADC3101 to be connected to the rest of a user development system.

2 EVM Description and Basics

This section provides information on the analog input and output, digital control, power, and general connection of the TLV320ADC3101-K.

2.1 TLV320ADC3101-K Block Diagram

The TLV320ADC3101-K consists of two separate circuit boards, the USB-MODEVM and the TLV320ADC3101EVM. The USB-MODEVM is built around the TAS1020B streaming audio USB controller with an 8051-based core. The motherboard features two positions for modular EVMs, or one double-wide serial modular EVM can be installed. The TLV320ADC3101EVM is one of the double-wide modular EVMs that is designed to work with the USB-MODEVM.

The simple diagram of [Figure 1](#) shows how the TLV320ADC3101EVM is connected to the USB-MODEVM. The USB-MODEVM interface board is intended to be used in USB mode, where control of the installed EVM is accomplished using the onboard USB controller device. Provision is made, however, for driving all the data buses (I²C, SPI™, I²S™, etc.) externally. The source of these signals is controlled by SW2 on the USB-MODEVM. See [Table 1](#) for details on the switch settings.

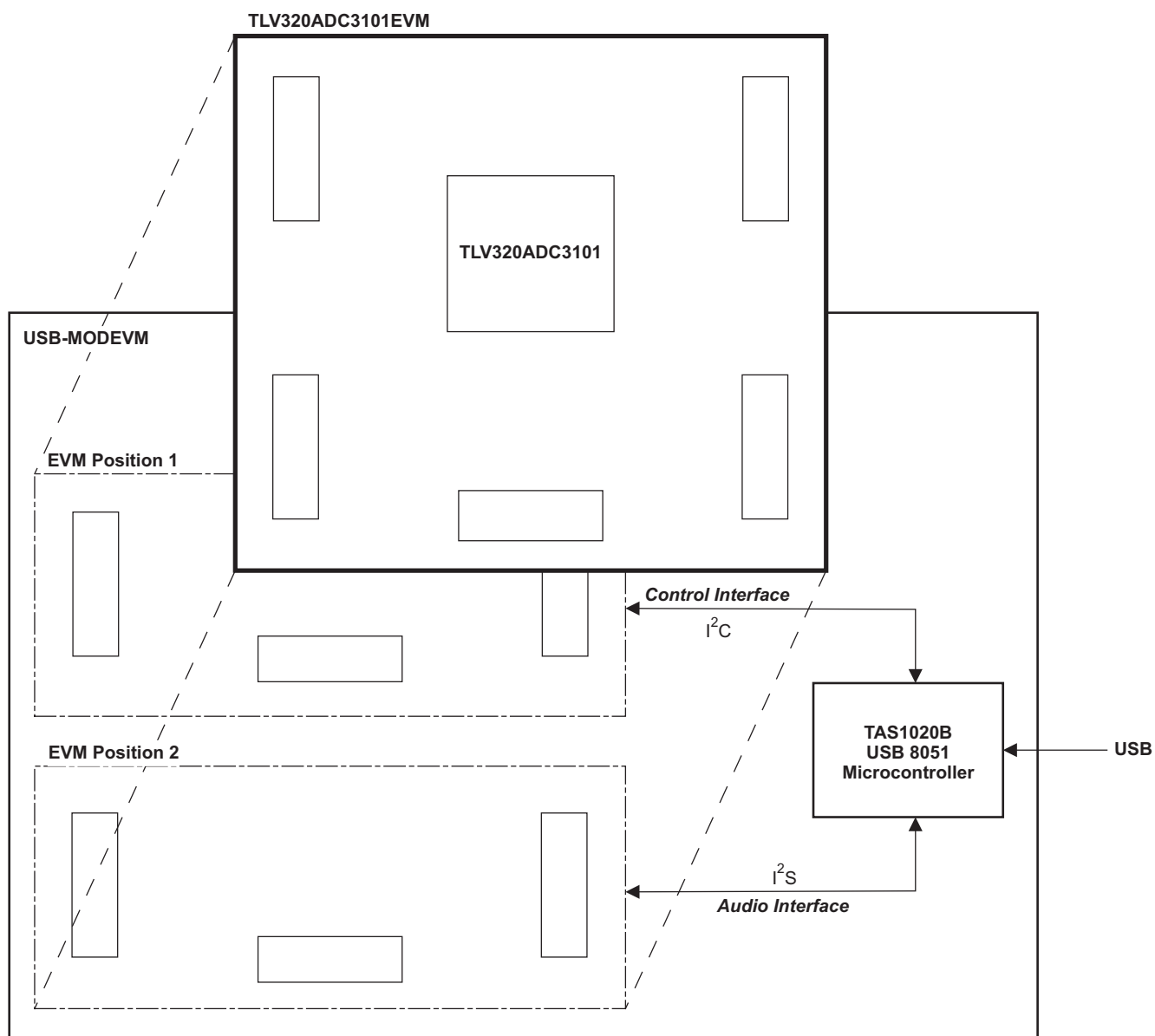
The USB-MODEVM has two EVM positions that allow for the connection of two small evaluation module or one larger evaluation module. The TLV320ADC3101EVM is designed to fit over both of the smaller evaluation module slots as shown in [Figure 1](#).

2.1.1 USB-MODEVM Interface Board

The simple diagram of [Figure 1](#) shows only the basic features of the USB-MODEVM interface board.

Because the TLV320ADC3101EVM is a double-wide modular EVM, it is installed with connections to both EVM positions, which connects the TLV320ADC3101 digital control interface to the I²C port realized using the TAS1020B, as well as the TAS1020B digital audio interface.

In the factory configuration, the board is ready to be used with the USB-MODEVM. To view all the functions and configuration options available on the USB-MODEVM board, see the USB-MODEVM interface board schematic in [Appendix G](#).



B0346-01

Figure 1. TLV320ADC3101-K Block Diagram

2.2 Default Configuration and Connections

2.2.1 USB-MODEVM

Table 1 provides a list of the SW2 settings on the USB-MODEVM. For use with the TLV320ADC3101EVM, SW-2 positions 1, 2, 3, 4, 5, 6, and 7 must be set to ON, whereas SW-2.8 must be set to OFF. If the TLV320ADC3101EVM is to be used with an external audio interface, SW2.4 and SW2.5 must be set to OFF. This interface must be connected as explained in [Section 2.4](#).

Table 1. USB-MODEVM SW2 Settings

SW-2 Switch Number	Label	Switch Description
1	A0	USB-MODEVM EEPROM I ² C Address A0 ON: A0 = 0 OFF: A0 = 1
2	A1	USB-MODEVM EEPROM I ² C Address A1 ON: A1 = 0 OFF: A1 = 1
3	A2	USB-MODEVM EEPROM I ² C Address A2 ON: A2 = 0 OFF: A2 = 1
4	USB I ² S	I ² S Bus Source Selection ON: I ² S bus connects to TAS1020. OFF: I ² S Bus connects to USB-MODEVM J14.
5	USB MCK	I ² S bus MCLK Source Selection ON: MCLK connects to TAS1020. OFF: MCLK connects to USB-MODEVM J14.
6	USB SPI	SPI bus Source Selection ON: SPI bus connects to TAS1020. OFF: SPI bus connects to USB-MODEVM J15.
7	USB RST	RST Source Selection ON: EVM reset signal comes from TAS1020. OFF: EVM reset signal comes from USB-MODEVM J15.
8	EXT MCK	External MCLK Selection ON: MCLK signal is provided from USB-MODEVM J10. OFF: MCLK signal comes from either selection of SW2-5.

2.2.2 TLV320ADC3101 Jumper Locations

Table 2 provides a list of jumpers found on the EVM and their factory default conditions.

Table 2. List of Jumpers and Switches

Jumper Designator	Jumper Type	Default Position	Jumper Description
W1	2-pin	Soldered	Provides +3.3VA voltage source to AVDD input pin 10 of ADC3101.
W2	2-pin	Soldered	Provides IOVDD voltage source to IODD input pin 21 of ADC3101.
W3	2-pin	Soldered	Provides +1.8VD voltage source to DVDD input pin 22 of ADC3101.
W4	2-pin	Installed	Enables audio connector J9 input to IN1L(P) - pin 8 of ADC3101.
W5	2-pin	Installed	Enables audio connector J9 input to IN1R(M) - pin 11 of ADC3101.
W6	3-pin	1–2	Input DMCLK (1–2) or GPIO0 (2–3) to pin 20 of ADC3101.
W7	3-pin	1–2	Input DMDIN (1–2) or GPIO1 (2–3) to pin 19 of ADC3101.
W8	3-pin	2–3	Selects IOVDD voltage source (1–2 selects 1.8 V and 2–3 selects 3.3 V).
W9	2-pin	Not Installed	Use GPIO1.
W10	2-pin	Not Installed	Enable hardware reset if available.
W11	2-pin	Not Installed	When not installed, selects USB-MODEVM EEPROM as firmware source. When installed, selects onboard EEPROM as firmware source.
W12	2-pin	Installed	When installed, enables MICBIAS1 to left microphone (MK1).
W13	2-pin	Installed	When installed, enables MICBIAS2 to right microphone (MK2).

2.3 Analog Signal Connections

2.3.1 Analog Inputs

The analog input sources can be applied directly to terminal blocks J6, J7, and J8 or input jack J9. The connection details can be found in [Appendix A](#).

2.4 Digital Signal Connections

The digital signals (BCLK, WCLK, DOUT, and MCLK) can be monitored via J5. If external digital signals are connected to the EVM, these digital inputs must be connected via J14 on the USB-MODEVM, and the SW2 switch must be changed accordingly (see [Section 2.2.1](#)). The connector details are available in [Section A.2](#).

2.5 Power Connections

The TLV320ADC3101EVM can be powered independently when being used in stand-alone operation or by the USB-MODEVM when it is plugged onto the motherboard.

2.5.1 Stand-Alone Operation

When used as a stand-alone EVM, power is applied to J3 directly, making sure to reference the supplies to the appropriate grounds on that connector.

CAUTION

Verify that all power supplies are within the safe operating limits shown on the [TLV320ADC3101 data sheet](#) before applying power to the EVM.

J3 provides connection to the common power bus for the TLV320ADC3101EVM. Power is supplied on the pins listed in [Table A-5](#).

The TLV320ADC3101-K motherboard (the USB-MODEVM interface board) supplies power to J3 of the TLV320ADC3101EVM. Power for the motherboard is supplied either through its USB connection or via terminal blocks on that board.

2.5.2 USB-MODEVM Operation

The USB-MODEVM interface board can be powered from several different sources:

- USB
- 6-Vdc to 10-Vdc AC/DC external wall supply (not included)
- Laboratory power supply

When powered from the USB connection, JMP6 must have a shunt from pins 1–2 (this is the default factory configuration). When powered from a 6-Vdc to 10-Vdc power supply, either through the J8 terminal block or J9 barrel jack, JMP6 must have a shunt installed on pins 2–3. If power is applied in any of these ways, onboard regulators generate the required supply voltages, and no further power supplies are necessary.

If laboratory supplies are used to provide the individual voltages required by the USB-MODEVM Interface, JMP6 must have no shunt installed. Voltages are then applied to J2 (+5VA), J3 (+5VD), J4 (+1.8VD), and J5 (+3.3VD). The +1.8VD and +3.3VD can also be generated on the board by the onboard regulators from the +5VD supply; to enable this configuration, the switches on SW1 must be set to enable the regulators by placing them in the ON position (lower position, looking at the board with text reading right-side up). If +1.8VD and +3.3VD are supplied externally, disable the onboard regulators by placing SW1 switches in the OFF position.

Each power-supply voltage has an LED (D1–D7) that lights when the power supplies are active.

3 TLV320ADC3101-K Setup and Installation

The following section provides information on using the TLV320ADC3101-K, including setup, program installation, and program usage.

Note: If using the EVM in stand-alone mode, the software must be installed per the following instructions, but the hardware configuration may be different.

3.1 Software Installation

1. Download the latest version of the ADC3101 Control Software (CS) located in the [TLV320ADC3101-K Product Folder](#).
2. Open the installation file.
3. Extract the software to a known folder.
4. Install the EVM software by double-clicking the **Setup** executable, and follow the directions. The user may be prompted to restart the computer.

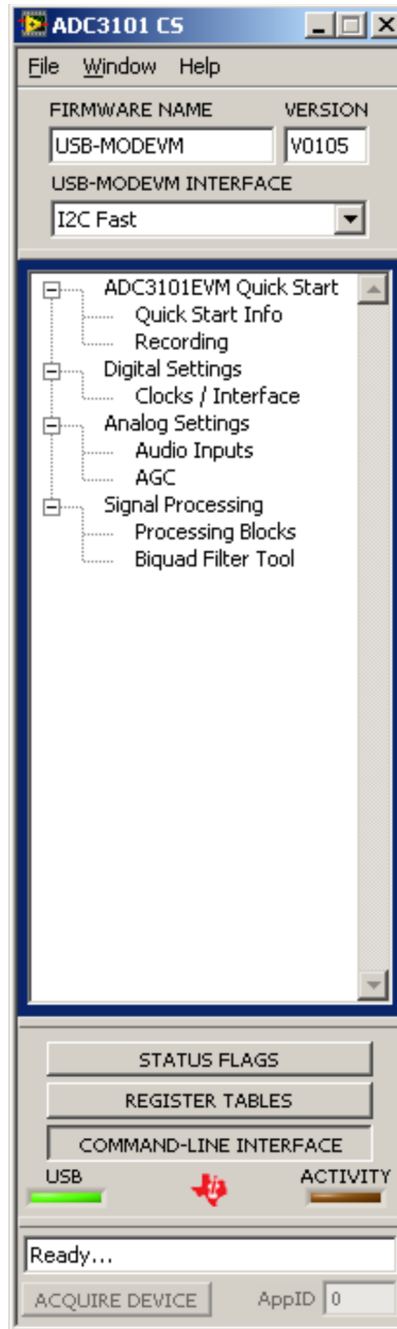
This installs all the TLV320ADC3101-K software and required drivers onto the PC.

3.2 EVM Connections

1. Ensure that the TLV320ADC3101EVM is installed on the USB-MODEVM interface board, aligning J1B, J2B, J3B, J4B, and J5B with the corresponding connectors on the USB-MODEVM.
2. Verify that the jumpers and switches are in their default conditions.
3. Attach a USB cable from the PC to the USB-MODEVM interface board. The default configuration provides power, control signals, and streaming audio via the USB interface from the PC. On the USB-MODEVM, LEDs D3, D4, D5, and D7 light to indicate that the USB is supplying power.
4. For the first connection, the PC recognizes new hardware and begins an initialization process. The user may be prompted to identify the location of the drivers or allow the PC to automatically search for them. Allow the automatic detection option.
5. Once the PC confirms that the hardware is operational, D2 on the USB-MODEVM lights to indicate that the firmware has been loaded and the EVM is ready for use. If D2 does not light, verify that the EEPROM jumper and switch settings conform to [Table 1](#) and [Table 2](#).

After the TLV320ADC3101-K software installation (described in [Section 3.2](#)) is complete, evaluation and development with the TLV320ADC3101 can begin.

The TLV320ADC3101-K software can now be launched. The user sees an initial screen that looks similar to [Figure 2](#).



C001

Figure 2. Initial Screen of TLV320ADC3101-K Software

4 ADC3101 Control Software

The ADC3101 Control Software (CS) is an intuitive, easy-to-use, powerful tool to learn, evaluate, and control the TLV320ADC3101. The following sections describe the operation of this software.

Note: For configuration of the device, the TLV320ADC3101 block diagram located in the [TLV320ADC3101](#) data sheet is a good reference to help determine the signal routing.

4.1 Main Panel Window

The main panel window, shown in [Figure 2](#), provides easy access to all the features of the TLV320ADC3101 CS. The FIRMWARE NAME and VERSION boxes provide information about the firmware loaded into the EVM's EEPROM.

Note:

- **Double-click** to access items in the Panel Selection Tree (e.g. "Quick Start Info" or "Recording" Applications)
 - **Single-click** to access "STATUS FLAGS", "REGISTER TABLES" or "COMMAND-LINE INTERFACE" Applications
-

The USB-MODEVM interface drop-down menu allows the user to select which communication protocol the TAS1020B USB Controller uses to communicate with the TLV320ADC3101 or to toggle the TAS1020B GPIO pins. The TLV320ADC3101 supports I²C standard and fast modes. The USB-MODEVM interface selection is global to all panels, including the COMMAND-LINE INTERFACE.

The panel selection tree provides access to typical configurations, features, and other panels that allow the user to control the TLV320ADC3101. The tree is divided into several categories which contain items that pop up panels. A panel can be opened by **double-clicking** any item inside a category in the panel selection tree.

Below the panel-selection tree are three buttons that pop up the following:

- STATUS FLAGS - Allows the user to monitor the TLV320ADC3101 status flags.
- REGISTER TABLES - A tool to monitor register pages.
- COMMAND-LINE INTERFACE - A tool to execute/generate scripts and monitor register activity.

The USB LED indicates if the EVM kit is recognized by the software and the ACTIVITY LED lights every time a command request is sent.

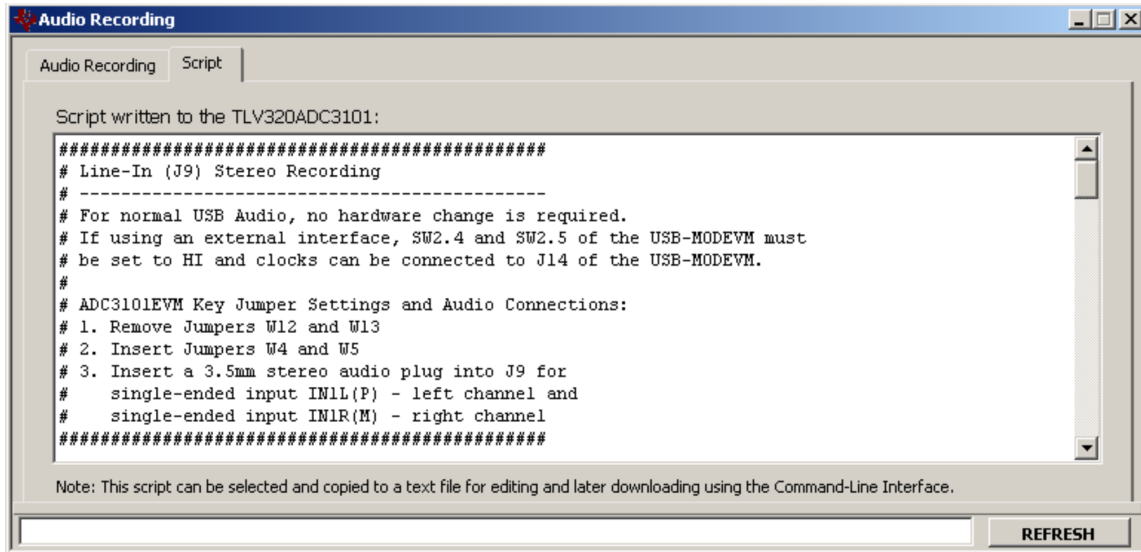
The dialog box at the bottom of the main panel provides feedback of the current status of the software.

Note that most controls used in the pop-up panel applications update their status with respect to the register contents in the following conditions:

- A panel is opened.
- The **Execute Command Buffer** button in the **Command-Line Interface** is pressed.
- The **Refresh** button at the bottom right of a panel is pressed.

4.1.1 TLV320ADC3101EVM Quick-Start Panels

The ADC3101 Control Software Quick Start Panels help users to become familiar with the TLV320ADC3101. The Quick Start Info panel shows how to configure the EVM hardware for the USB-MODEVM audio interfaces or external audio interfaces. The Audio Recording panel contains three typical EVM recording configurations. Line-in recording, external microphone recording, and on-board microphone recording scripts and controls are provided. After selecting the configuration, the user can inspect the I²C script by clicking on the Script tab. Each script includes a brief description of the selected configuration including EVM jumpers, as shown in [Figure 3](#).



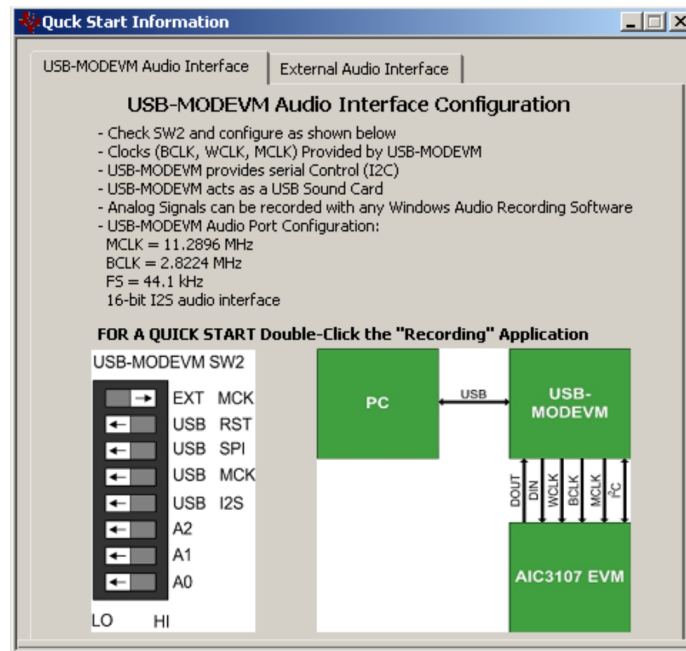
C002

Figure 3. Record Script Tab

4.1.1.1 Quick Start Info

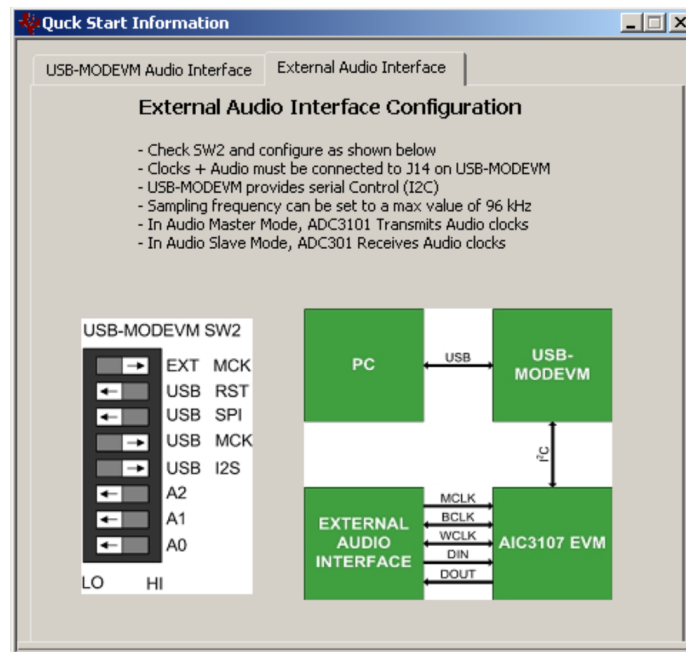
The Quick Start Information panel (shown in [Figure 4](#)) shows the following configurations:

- USB-MODEVM Audio Interface Configuration.
- External Audio Interface Configuration.



C003

Figure 4. Quick Start Information – USB-MODEVM Audio Interface Configuration



C004

Figure 5. External Audio Interface Configuration Panel

4.1.1.2 Audio Recording

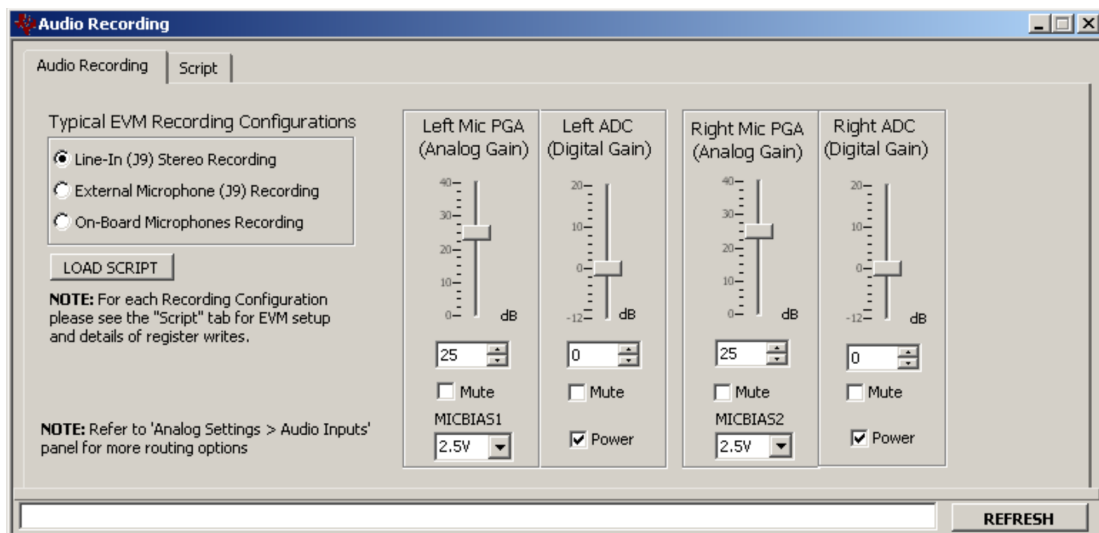
The Audio Recording panel (shown in Figure 6) provides the following configurations:

- Line-In (J9) Stereo Recording – this configuration programs the TLV320ADC3101 to record a line-level signal input at EVM audio connector J9.

- External Microphone (J9) Recording – this configuration programs the TLV320ADC3101 to record a microphone-level signal input at EVM audio connector J9.
- On-Board Microphones Recording – this configuration programs the TLV320ADC3101 to record the EVM on-board microphones MK1 (left channel) and MK2 (right channel). Jumpers related to the onboard microphone must be set to their default configuration as described in [Table 2](#).

To use one of the configurations, perform the following steps:

- Select the desired EVM recording configuration.
- Inspect the command script (Script tab [Figure 3](#)) and configure the EVM jumpers as shown.
- Click the *Load Script* button.
- Capture and analyze the TLV320ADC3101 digital output signal.



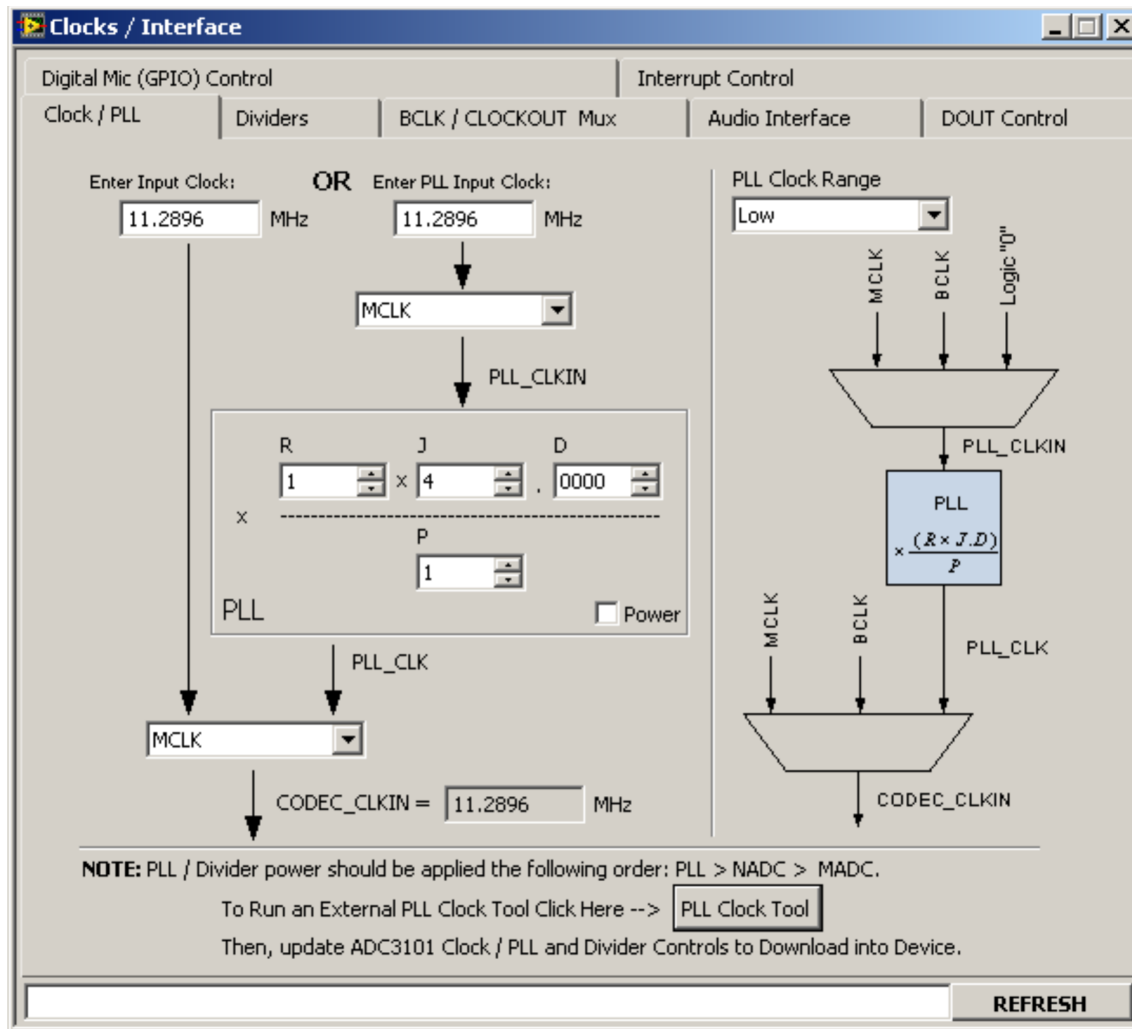
C005

Figure 6. Recording Panel

4.1.2 Digital Settings – Clocks / Interface Panel

The **Digital Settings – Clocks / Interface Panel** allows the user to set the clocks and audio interface for the TLV320ADC3101. This panel provides the following tabs:

- **Clock / PLL Tab** – Input clocks and PLL parameters can be specified.
- **Dividers Tab** – Specify NADC, MADC, and AOSR
- **BCLK / CLOCKOUT Mux Tab** – Specify BCLK and CLOOUT (DOUT)
- **Audio Interface Tab** – Audio Bus Settings, WCLK and BCLK Direction, Data Offsets, etc.
- **DOUT Control Tab** – DOUT pin control (Primary, In/Out, Interrupts, etc.)
- **Digital Mic (GPIO) Control Tab** – DMCLK and DMDIN Controls (Digital Mic, GPIO, Interrupts, Secondary Audio Clocks, etc.)
- **Interrupt Control Tab** – INT1 and INT2 Interrupt Control



C006

Figure 7. Clocks / Interface Panel

4.1.3 Analog Settings

The TLV320ADC3101 software allows access to two analog panels:

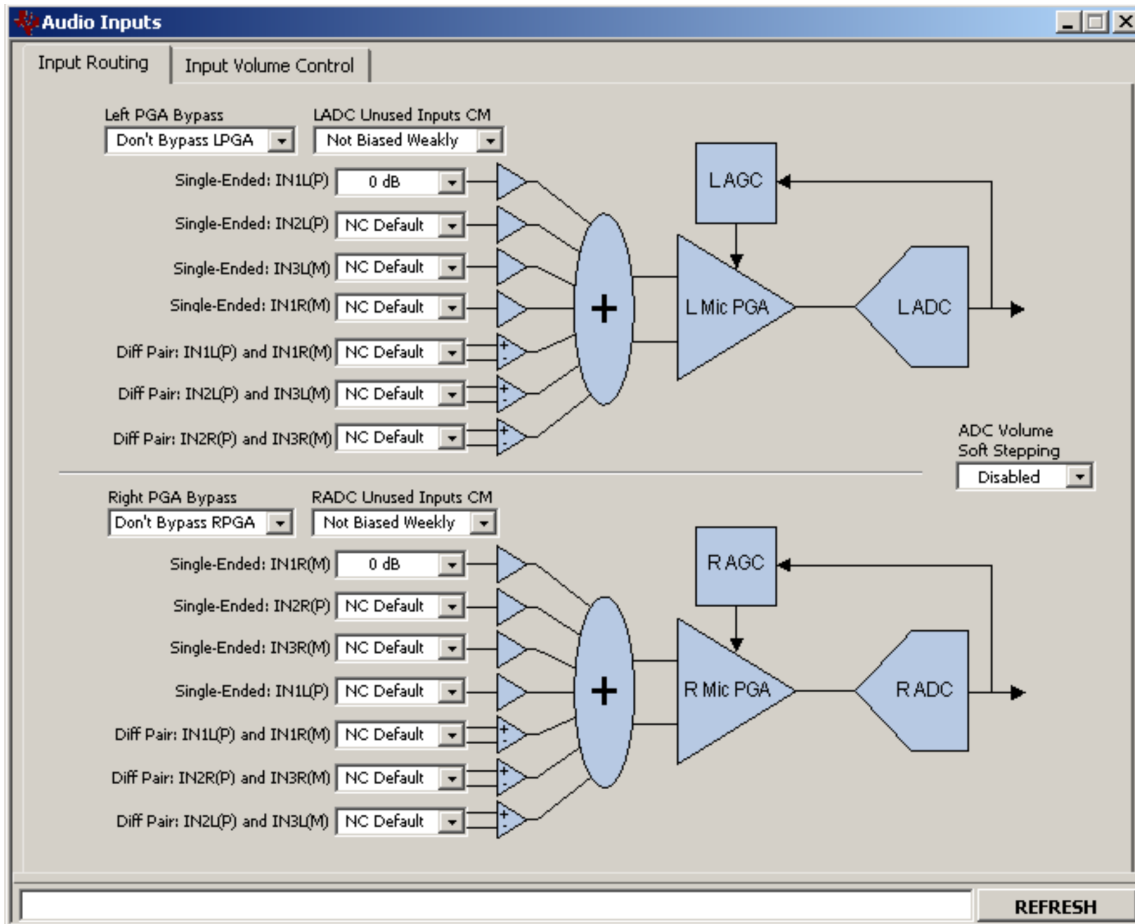
1. Audio Inputs – This panel allows the user to access the Input Routing and Input Volume Control tabs shown in [Figure 8](#).
2. Automatic Gain Control (AGC) – This panel allows the user to configure the AGC. Note that the TLV320ADC3101 supports the left and right channel AGCs, which are identical. The software supports the left AGC only. See [Figure 10](#).

Before changing a control, see the data sheet to ensure that a particular control is compatible with the current state of the device. As an example, some controls in the analog settings panels must be modified in a particular order as described in the data sheet.

4.1.3.1 Analog Audio Inputs

The Input Routing tab allows selection of all available single-ended and differential inputs including any gain associated with the input. Also available are PGA bypass controls, unused inputs biasing, and ADC volume stepping.

The Input Volume Control tab allows the user to change the PGA gain (analog domain) and the ADC gain (digital domain). Also available is an ADC Phase Compensation block. MICBIAS1 and MICBAS2 controls are included on this tab.



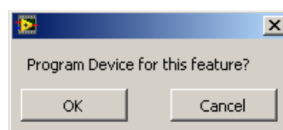
C011

Figure 8. Audio Inputs Panel

4.1.3.2 Automatic Gain Control (AGC)

To use the AGC feature, double-click the AGC text in the Panel Selection Tree. When the application pops up Figure 9, select OK to program the TLV320ADC3101 for the AGC feature. Otherwise, select Cancel.

The left-channel automatic gain control (AGC) can be enabled by checking the **Enable Left AGC** box (Figure 10). Pressing the **Capture Audio** button records the left-channel audio. Its corresponding data is displayed in the audio capture graph window. The small white window located at the bottom right of the AGC tab displays the audio waveform of the recorded data. Ensure that the AIC32x4 EVM is selected as the computer's default audio capture device before pressing this button. To set the TLV320ADC3101-K as the default audio device, open the Windows™ Control Panel → Sounds and Audio Devices Properties and set the AIC32x4 EVM as the default audio recording device. Also, do not use any other media player or audio recording software while the control software is recording.



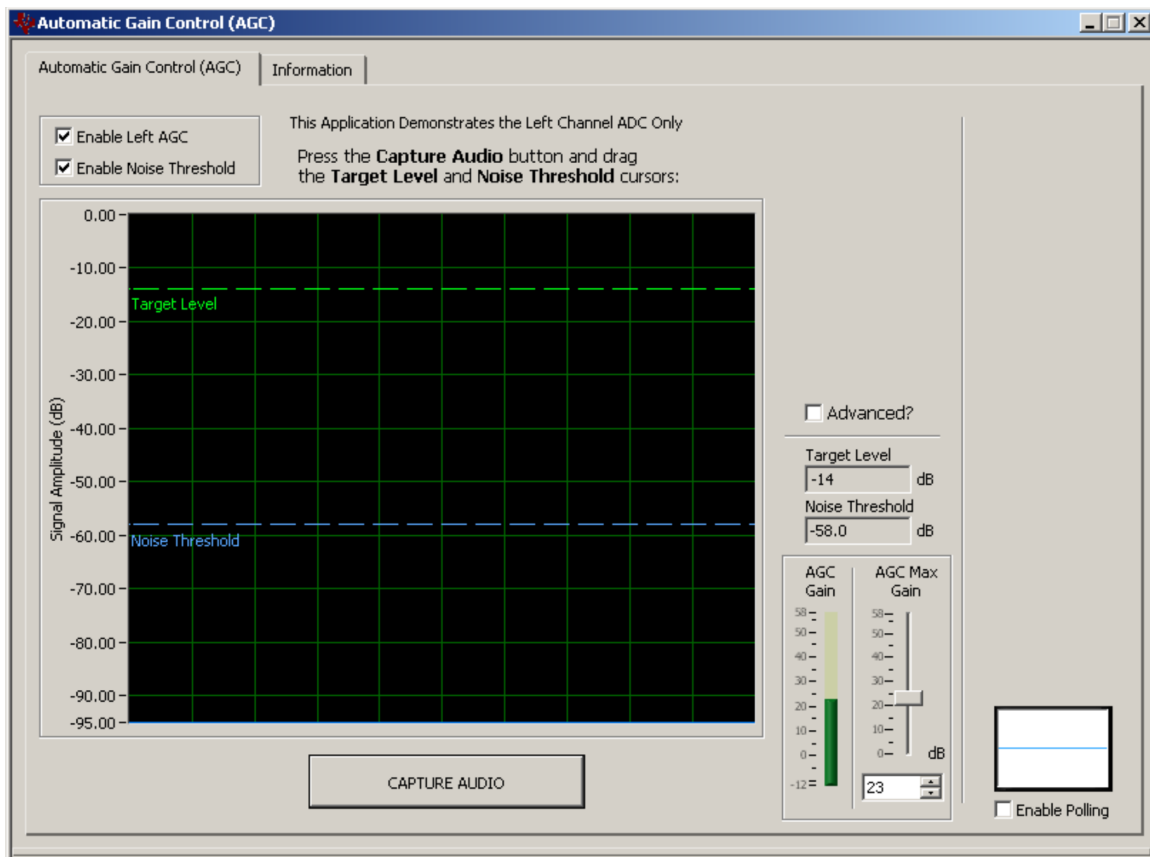
C017

Figure 9. Program Device for This Feature

The **target level** and **noise threshold** parameters can be modified by dragging the horizontal cursor lines located in the audio-capture graph window. Its numeric values are displayed to the right of the graph. Noise threshold can be disabled by unchecking the **Enable Noise Threshold** box. The **AGC Max Gain** control sets the maximum allowed AGC PGA gain. The **AGC Gain** indicator bar continuously displays the contents of Page 0/Register 93 if the **Enable Polling** box is checked.

Other parameters can be accessed by checking the **Advanced?** box. For more information about AGC, see the **Information** tab and the data sheet.

Other flags related to this feature can be accessed at the **Status Flags** panel.



C008

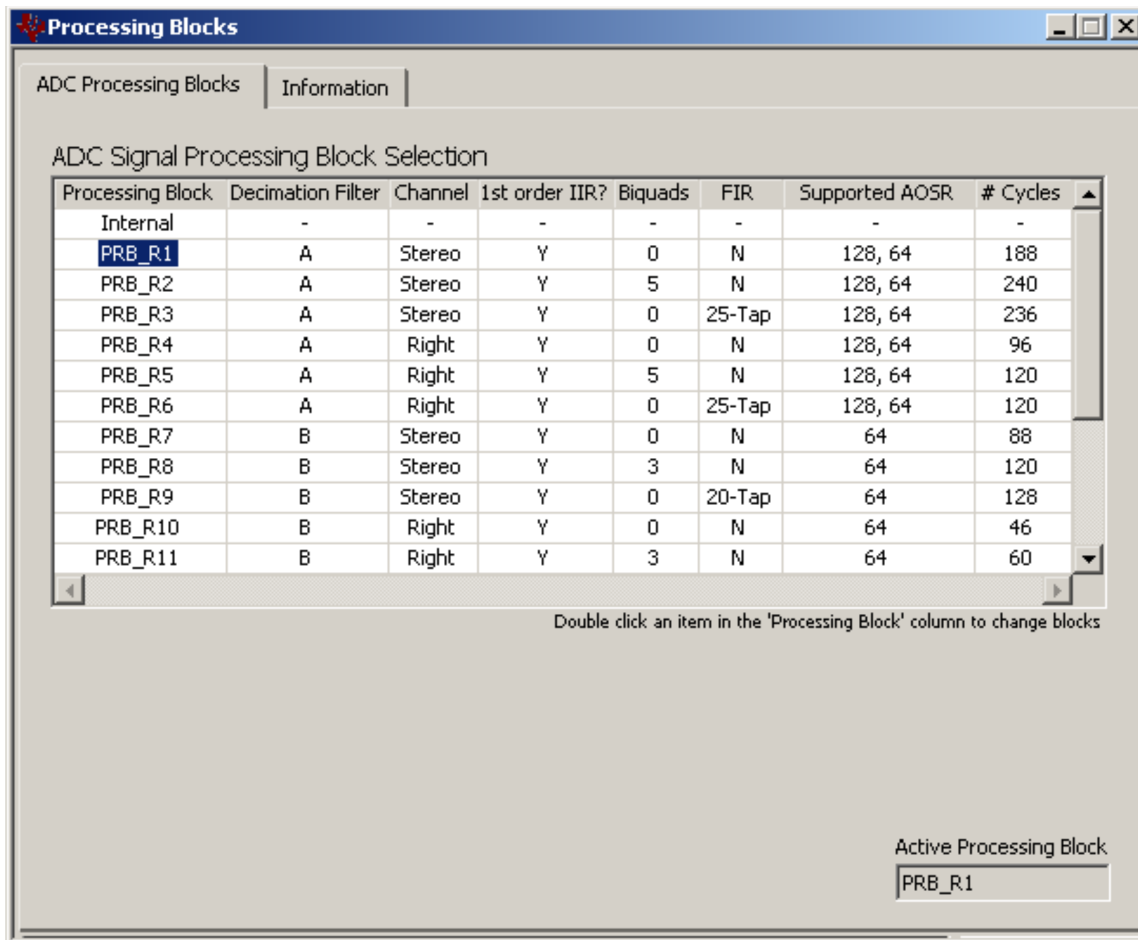
Figure 10. Automatic Gain Control (AGC) Panel

4.1.4 Signal Processing

The **Signal Processing** category provides control of selection of Processing Blocks and includes a Biquad Filter Tool that allow the user to program biquad filters such as high-pass, low-pass, EQ, notch, treble shelf, and bass shelf.

4.1.4.1 ADC Processing Blocks Panel

The [Figure 11](#) allows the user to view and select a particular processing block. The Information tab has an explanation of the ADC Decimation Filtering and Signal Processing Blocks. See the TLV320ADC3101 ([SLAS553](#)) data sheet for more detailed information.



C009

Figure 11. Processing Blocks Panel

4.1.4.2 Biquad Filter Tool

The Biquad Filter Tool allows the user to specify the following biquad filters downloadable to the TLV320ADC3101:

- All-pass
- High-pass (Butterworth first-order, Butterworth second-order, Bessel second-order, Linkwitz-Riley second-order, and variable-Q second-order)
- Low-pass (Butterworth first-order, Butterworth second-order, Bessel second-order, Linkwitz-Riley second-order, and variable-Q second-order)
- EQ (equalizer)
- Notch
- Treble shelf
- Bass shelf

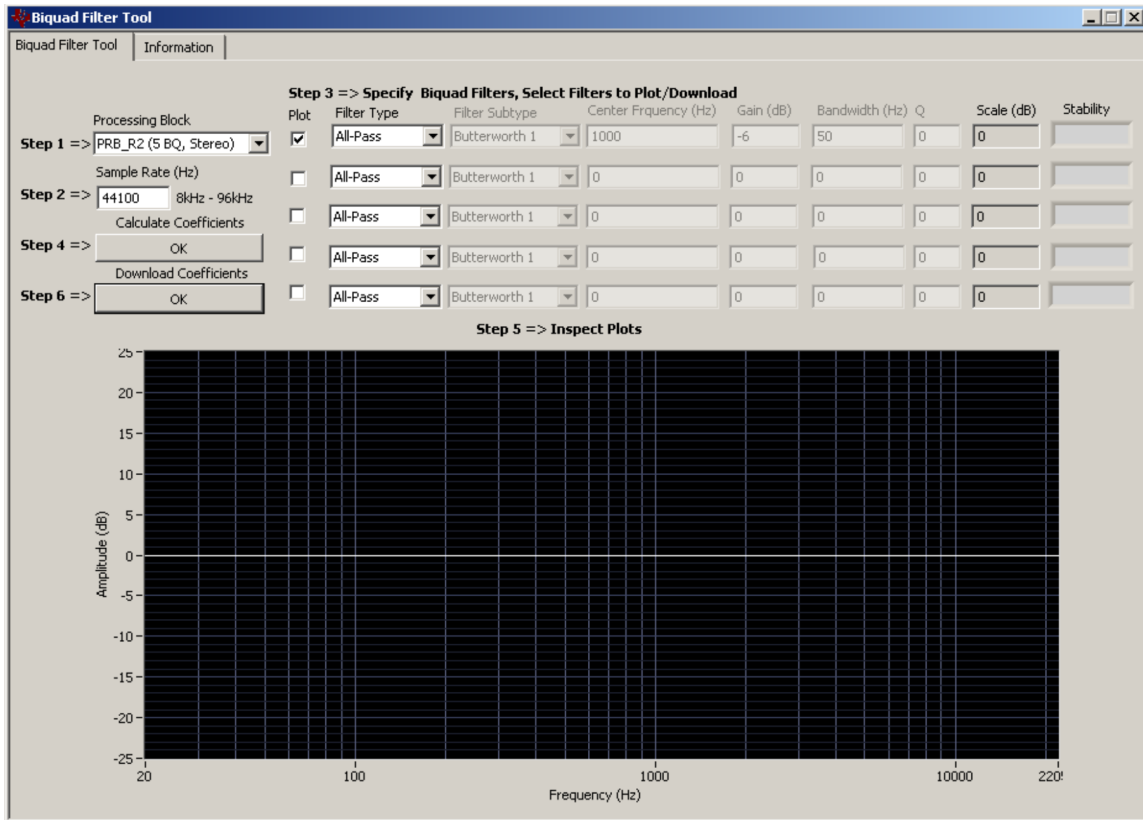
Using the Biquad Filter Tool:

The easiest way to play with the Biquad Filter Tool is first to use the default EVM settings ($f_s = 44.1$ kHz, etc.) with the Recording panel in the Quick-Start section of the software. For example, first run the Line-In (J9) Recording script. After inputting a sine-wave sweep into J9, design and download biquads into the TLV320ADC3101. The biquads can then be checked by running a frequency-response plot on the output.

Steps to use the Biquad Filter Tool:

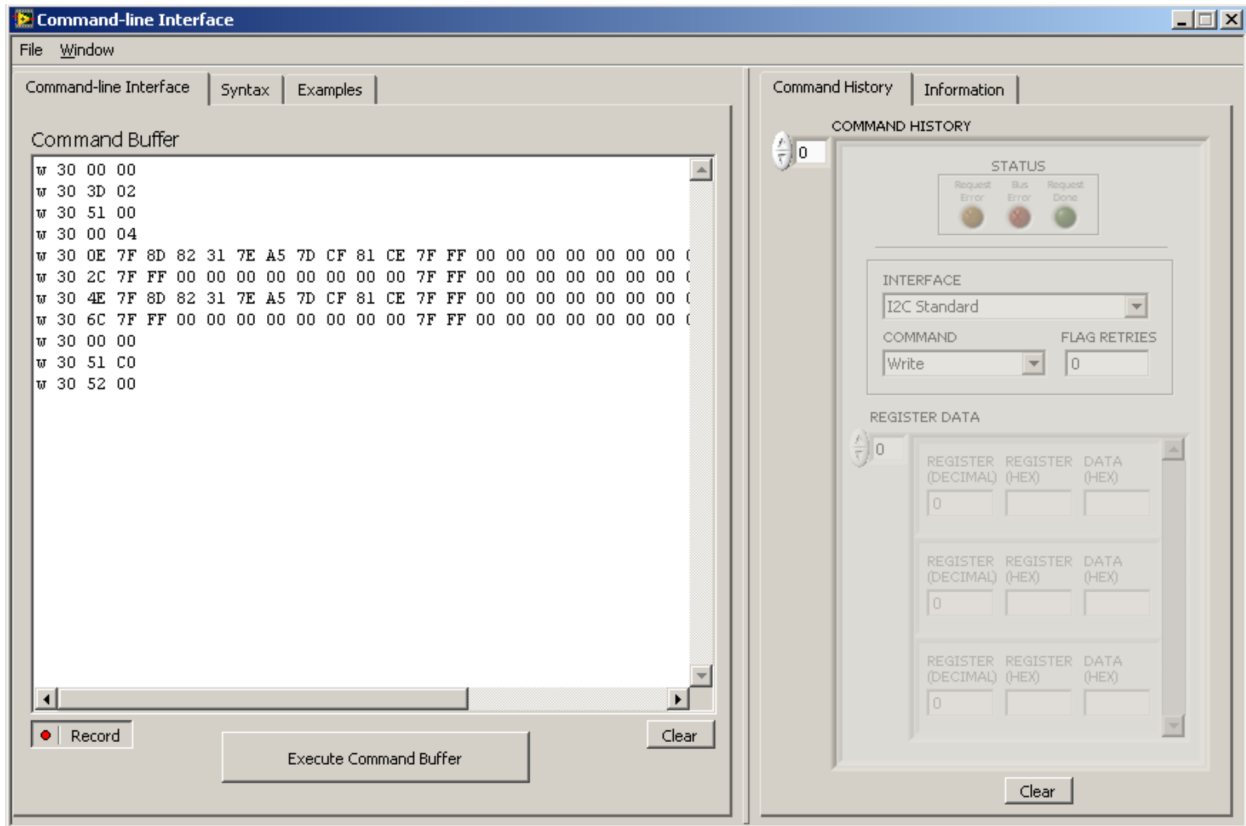
1. **Step 1: Select the Processing Block** – This specifies the number of biquads available (3 or 5) and stereo or mono (right). For best results use Processing Block PRB_R2 as this works well with the default EVM setup.
2. **Step 2: Specify the Sample Rate** – This is a key design parameter input to the Biquad Filter Tool. The default is 44.1 kHz which is the sample rate used on the USB interface for the EVM. The tool works with any sample rate from 8 kHz to 96 kHz; however, if a sample rate other than 44.1 kHz is selected, then the user must go to the clock panel and modify PLL and/or clock settings so that the desired sample rate is set correctly.
3. **Step 3: Specify the Biquad Filters** – Select the filter type and subtype and enter any required parameters. Note that the parameters not used will be grayed out. Using the Plot check-box, select the filters to plot and/or download.
4. **Step 4: Calculate the Coefficients** – Click on the Calculate Coefficients OK button. This calculates all the selected filters and plots the **combined response** of all the checked filters. If a filter is not checked, it is treated as an All-Pass filter.
5. **Step 5: Inspect the Plots** – Based on the selected filters determine if this is the total desired response. Also, inspect the Scale (dB) display. Some filters may create an overall negative gain error which is reflected in the Scale. For example, if the Scale displays 0.5 then there is a -0.5 -dB gain error which can be corrected in the analog PGA or the digital volume. In the last column, the stability of the filter is indicated. If the roots of the filter denominator are less than 1, then the filter is stable and this field will display the text "Stable". Otherwise, it will display the text "Unstable," meaning that the unstable filter should be re-specified until it is stable.
6. **Step 6: Download the Coefficients** – Click the Download Coefficients OK button. This action downloads the filter coefficients to the TLV320ADC3101 device. Note that the process of downloading coefficients is accomplished by the following register writes to the device:
 - Page 0 - Select processing block and power down both ADCs
 - Page 4 - Write filter coefficients to both left and right channels as required
 - Page 0 - Power up both ADCs

Note that the filter coefficients can be saved as an I²C script by using the Command-line Interface **Record** button. The I²C commands will be displayed in the Command Buffer ([Figure 13](#)), which can be selected and copied to a text command file.



C010

Figure 12. Biquad Filter Tool Panel



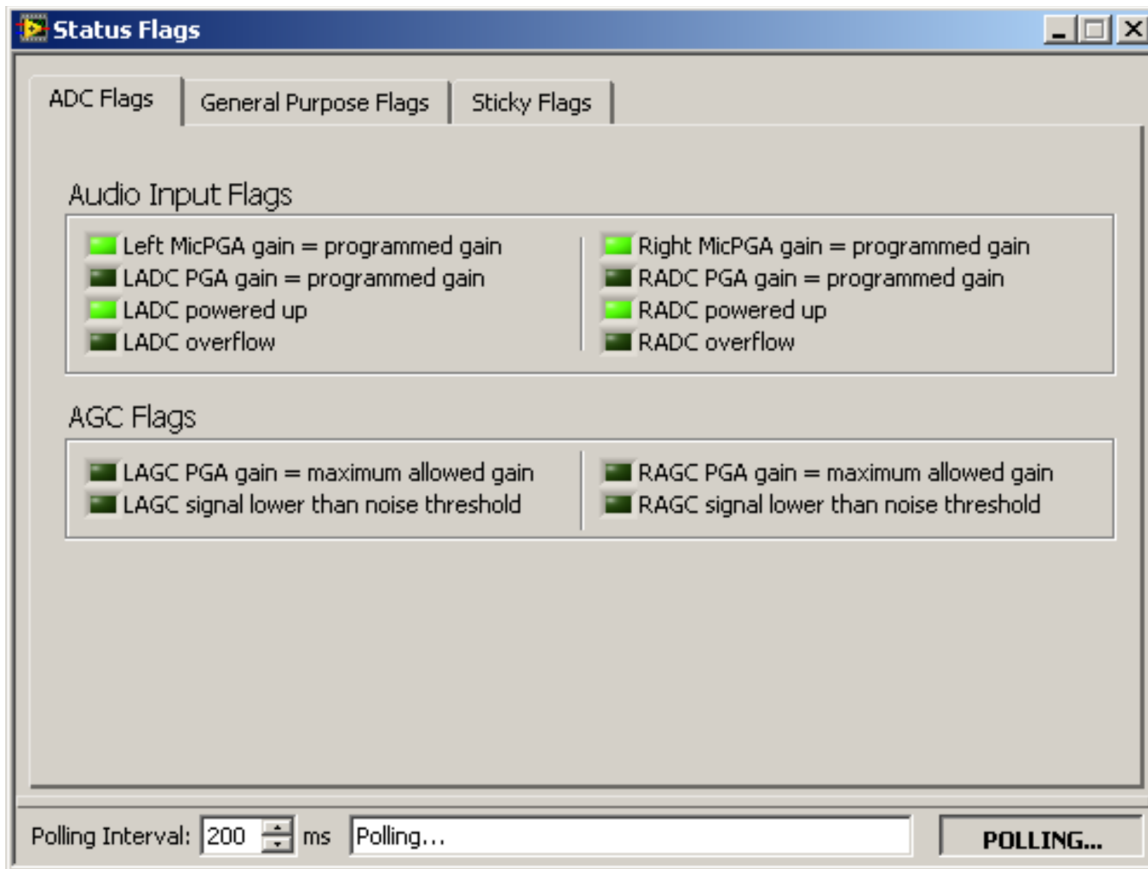
C016

Figure 13. Command-line Interface Panel Record Function

4.2 Status Flags Panel

The TLV320ADC3101 status flags can be monitored in the **Status Flags** panel (Figure 14) which is located below the **Panel Selection Tree**. Pressing the **POLLING** button continuously reads all the registers relevant to each flag and updates those flags accordingly. The rate at which the registers are read can be modified by changing the value in the **Polling Interval** numeric control. Note that a smaller interval reduces responsiveness of other controls, especially volume sliders, due to bandwidth limitations. By default, the polling interval is 200 ms and can be set to a minimum of 20 ms.

The **Sticky Flags** tab contains indicators whose corresponding register contents clear every time a read is performed to that register. To read all the sticky flags, click the **Read Sticky Flags** button.



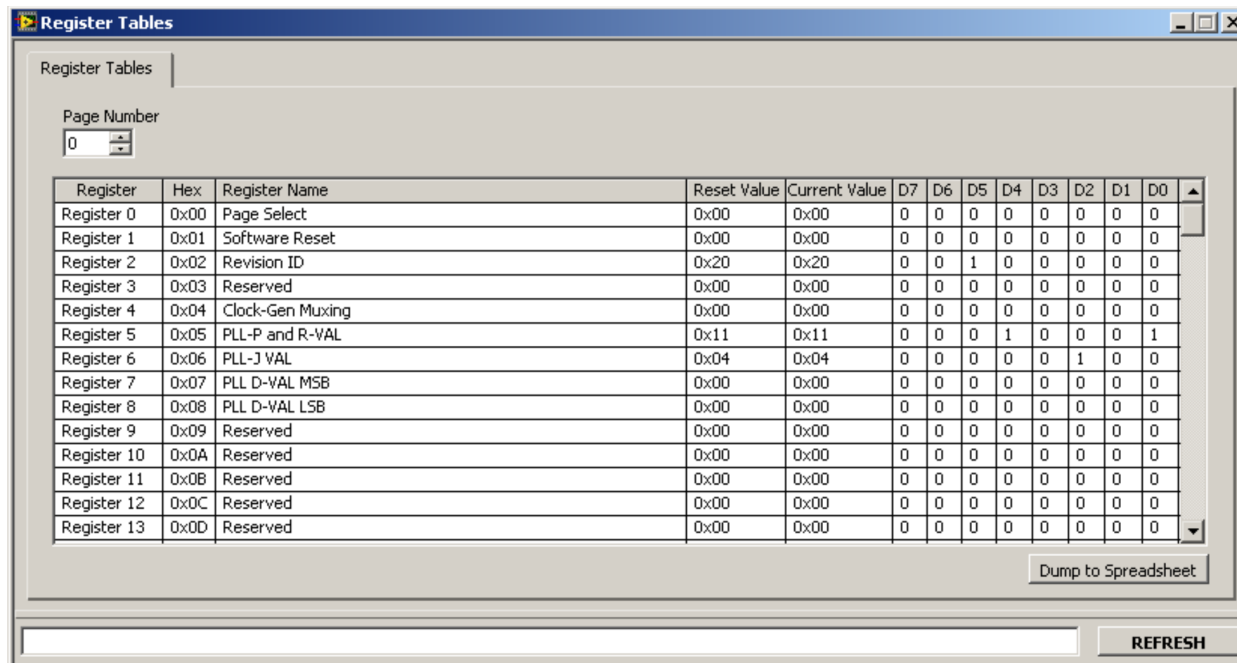
C012

Figure 14. Status Flags Panel

4.3 Register Tables Panel

The contents of configuration and coefficient pages of the TLV320ADC3101 can be accessed through the **Register Tables** panel (Figure 15).

The **Page Number** control changes to the page to be displayed in the register table. The register table contains page information such as the register name, reset value, current value, and a bitmap of the current value. The contents of the selected page can be exported into a spreadsheet by clicking the **Dump to Spreadsheet** button.



Register Tables

Page Number: 0

Register	Hex	Register Name	Reset Value	Current Value	D7	D6	D5	D4	D3	D2	D1	D0
Register 0	0x00	Page Select	0x00	0x00	0	0	0	0	0	0	0	0
Register 1	0x01	Software Reset	0x00	0x00	0	0	0	0	0	0	0	0
Register 2	0x02	Revision ID	0x20	0x20	0	0	1	0	0	0	0	0
Register 3	0x03	Reserved	0x00	0x00	0	0	0	0	0	0	0	0
Register 4	0x04	Clock-Gen Muxing	0x00	0x00	0	0	0	0	0	0	0	0
Register 5	0x05	PLL-P and R-VAL	0x11	0x11	0	0	0	1	0	0	0	1
Register 6	0x06	PLL-J VAL	0x04	0x04	0	0	0	0	0	1	0	0
Register 7	0x07	PLL D-VAL MSB	0x00	0x00	0	0	0	0	0	0	0	0
Register 8	0x08	PLL D-VAL LSB	0x00	0x00	0	0	0	0	0	0	0	0
Register 9	0x09	Reserved	0x00	0x00	0	0	0	0	0	0	0	0
Register 10	0x0A	Reserved	0x00	0x00	0	0	0	0	0	0	0	0
Register 11	0x0B	Reserved	0x00	0x00	0	0	0	0	0	0	0	0
Register 12	0x0C	Reserved	0x00	0x00	0	0	0	0	0	0	0	0
Register 13	0x0D	Reserved	0x00	0x00	0	0	0	0	0	0	0	0

Dump to Spreadsheet

REFRESH

C013

Figure 15. Register Tables Panel

4.4 Command-Line Interface Panel

The **Command-Line Interface** panel provides a means to communicate with the TLV320ADC3101 using a simple scripting language (described in [Section G.3](#)). The TAS1020B USB Controller (located on the USB-MODEVM motherboard) handles all communication between the PC and the TLV320ADC3101.

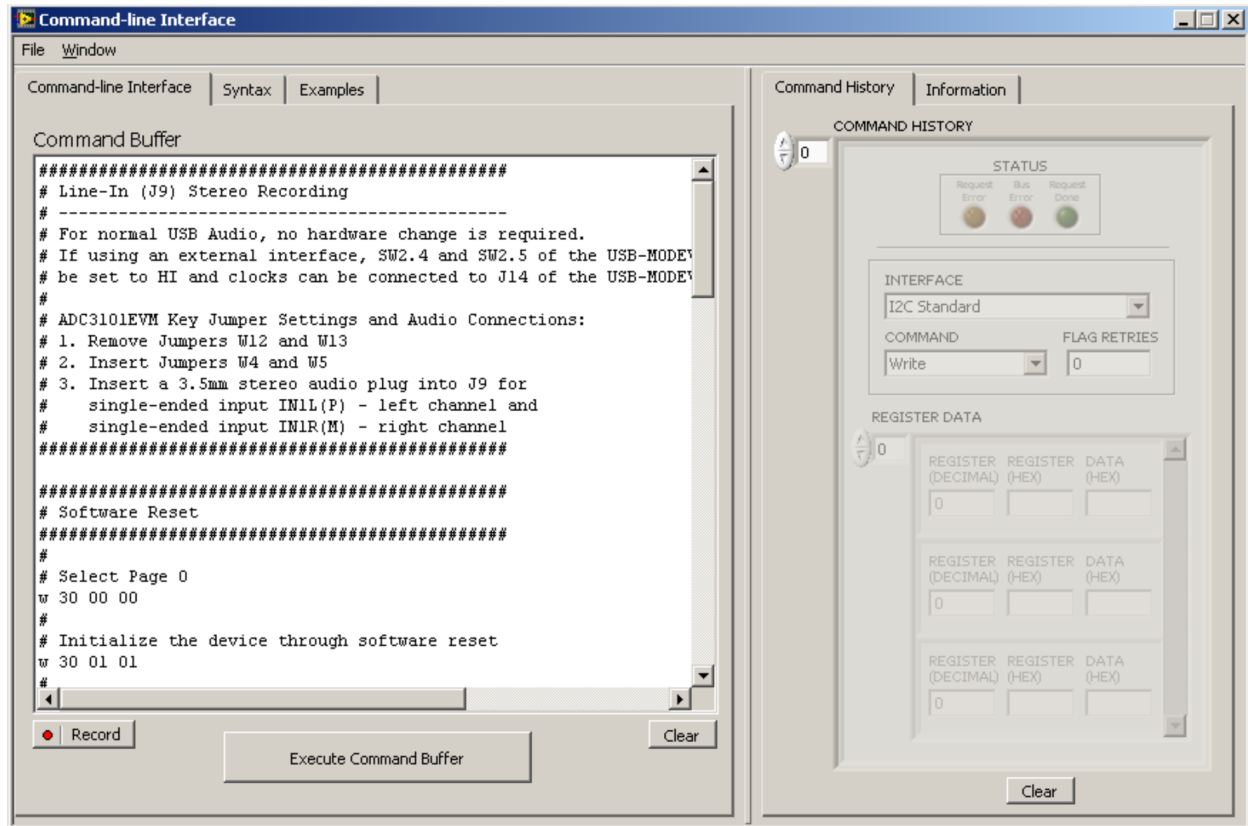
A script is loaded into the Command Buffer ([Figure 16](#)), either by loading a script file using the **File** menu or by pasting text from the clipboard using the Ctrl-V key combination.

When the command buffer is executed, the return data packets that result from each individual command are displayed in the **Command History** control. This control is an array (with a maximum size of 100 elements) that contains information about each command. The **INTERFACE** box displays the interface used for a particular command in the **Command History** array. The **COMMAND** box displays the type of command executed (i.e., write, read) for a particular interface. The **FLAG RETRIES** box displays the number of read iterations performed by a **Wait for Flag** command (see [Section G.3](#) for details). The **REGISTER DATA** array displays the register number and data bytes that correspond to a particular command.

The **Information** tab provides additional information related to the **Command History** as well as additional settings. The **Syntax** and **Examples** tabs provide useful information related to the scripting language.

The **File** menu provides some options for working with scripts. The first option, *Open Script File...*, loads a command file script into the command buffer. This script can then be executed by pressing the **Execute Command Buffer** button. The contents of the **Command Buffer** can be saved using the *Save Script File...* option.

Both the **Command Buffer** and **Command History** can be cleared by clicking their corresponding **Clear** buttons.



C015

Figure 16. Command-line Interface Panel Download Function

Appendix A EVM Connector Descriptions

This appendix contains the connection details for each of the main connectors on the EVM.

A.1 Analog Interface Connectors

A.1.1 Analog Dual-Row Socket Details, J1 and J2

The TLV320ADC3101EVM has two analog dual-row sockets located at the bottom of the board. These sockets provide support to the EVM and connect the analog ground plane of the EVM to the USB-MODEVM analog ground. Consult Samtec at www.samtec.com or call 1-800-SAMTEC-9 for a variety of mating connector options. [Table A-1](#) summarizes the analog interface pinout for the TLV320ADC3101EVM.

Table A-1. Analog Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
J1.1	NC	Not connected
J1.2	NC	Not connected
J1.3	NC	Not connected
J1.4	NC	Not connected
J1.5	NC	Not connected
J1.6	NC	Not connected
J1.7	NC	Not connected
J1.8	NC	Not connected
J1.9	AGND	Analog ground
J1.10	NC	Not connected
J1.11	AGND	Analog ground
J1.12	NC	Not connected
J1.13	AGND	Analog ground
J1.14	NC	Not connected
J1.15	NC	Not connected
J1.16	NC	Not connected
J1.17	AGND	Analog ground
J1.18	NC	Not connected
J1.19	AGND	Analog ground
J1.20	NC	Not connected
J2.1	NC	Not connected
J2.2	NC	Not connected
J2.3	NC	Not connected
J2.4	NC	Not connected
J2.5	NC	Not connected
J2.6	NC	Not connected
J2.7	NC	Not connected
J2.8	NC	Not connected
J2.9	AGND	Analog ground
J2.10	NC	Not connected
J2.11	AGND	Analog ground
J2.12	NC	Not connected
J2.13	AGND	Analog ground
J2.14	NC	Not connected
J2.15	NC	Not connected
J2.16	NC	Not connected

Table A-1. Analog Interface Pinout (continued)

PIN NUMBER	SIGNAL	DESCRIPTION
J2.17	AGND	Analog ground
J2.18	NC	Not connected
J2.19	AGND	Analog ground
J2.20	NC	Not connected

A.1.2 Analog Screw Terminal and Audio Jack Details

The analog inputs can be accessed through screw terminals or audio jacks.

[Table A-2](#) summarizes the analog input screw terminals available on the TLV320ADC3101EVM.

[Table A-3](#) summarizes the J9 input audio jack available on the TLV320ADC3101EVM.

Table A-2. Three-Terminal Analog Input Connectors

Reference	Pin1	Pin2	Pin3
J6	IN1L(P)	AGND	IN1R(M)
J7	IN2L(P)	AGND	IN3L(M)
J8	IN2R(P)	AGND	IN3R(M)

Table A-3. Audio Input Connector J9

Reference	Pin 1	Pin2 / Pin4	Pin3 / Pin 5
J9	AGND	Internal Microphone MK1 or external input to IN1L(P)	Internal Microphone MK2 or external input to IN1L(M)

A.2 Digital Interface Connectors, J4 and J5

The TLV320ADC3101EVM is designed to interface with multiple control platforms. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin, dual-row header/socket combination at J4 and J5. These headers/sockets provide access to the digital control and serial data pins of the device. Consult Samtec at www.samtec.com or call 1-800-SAMTEC-9 for a variety of mating connector options. Table A-4 summarizes the digital interface pinout for the TLV320ADC3101EVM.

Table A-4. Digital Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
J4.1	NC	Not connected
J4.2	GPIO1	GPIO1
J4.3	NC	Not connected
J4.4	DGND	Digital ground
J4.5	NC	Not connected
J4.6	GPIO1	Jumper W9 provides GPIO1
J4.7	NC	Not connected
J4.8	$\overline{\text{RESET}}$	Jumper W10 provides $\overline{\text{RESET}}$ (same as pin 14)
J4.9	NC	Not connected
J4.10	DGND	Digital ground
J4.11	NC	Not connected
J4.12	NC	Not connected
J4.13	NC	Not connected
J4.14	$\overline{\text{RESET}}$	TAS1020B reset
J4.15	NC	Not connected
J4.16	NC	Not connected
J4.17	NC	Not connected
J4.18	DGND	Digital ground
J4.19	NC	Not connected
J4.20	NC	Not connected
J5.1	NC	Not connected
J5.2	NC	Not connected
J5.3	BCLK	Audio serial data bus bit clock (input/output)
J5.4	DGND	Digital ground
J5.5	NC	Not connected
J5.6	NC	Not connected
J5.7	WCLK	Audio serial data bus word clock (input/output)
J5.8	NC	Not connected
J5.9	NC	Not connected
J5.10	DGND	Digital ground
J5.11	NC	Not connected
J5.12	NC	Not connected
J5.13	DOUT	Audio serial data bus data output (output)
J5.14	NC	Not connected
J5.15	NC	Not connected
J5.16	SCL	I ² C™ clock
J5.17	MCLK	Master clock input
J5.18	DGND	Digital ground (I ² C ground)
J5.19	NC	Not connected
J5.20	SDA	I ² C™ Data

The signals needed for an I²S serial digital audio interface and the control interface I²C are available at J5. Reset control (RESET) is routed to J4.

A.3 Power-Supply Connector Pin Header, J3

J3 provides connection to the common power bus for the TLV320ADC3101EVM. Power is supplied on the pins listed in [Table A-5](#).

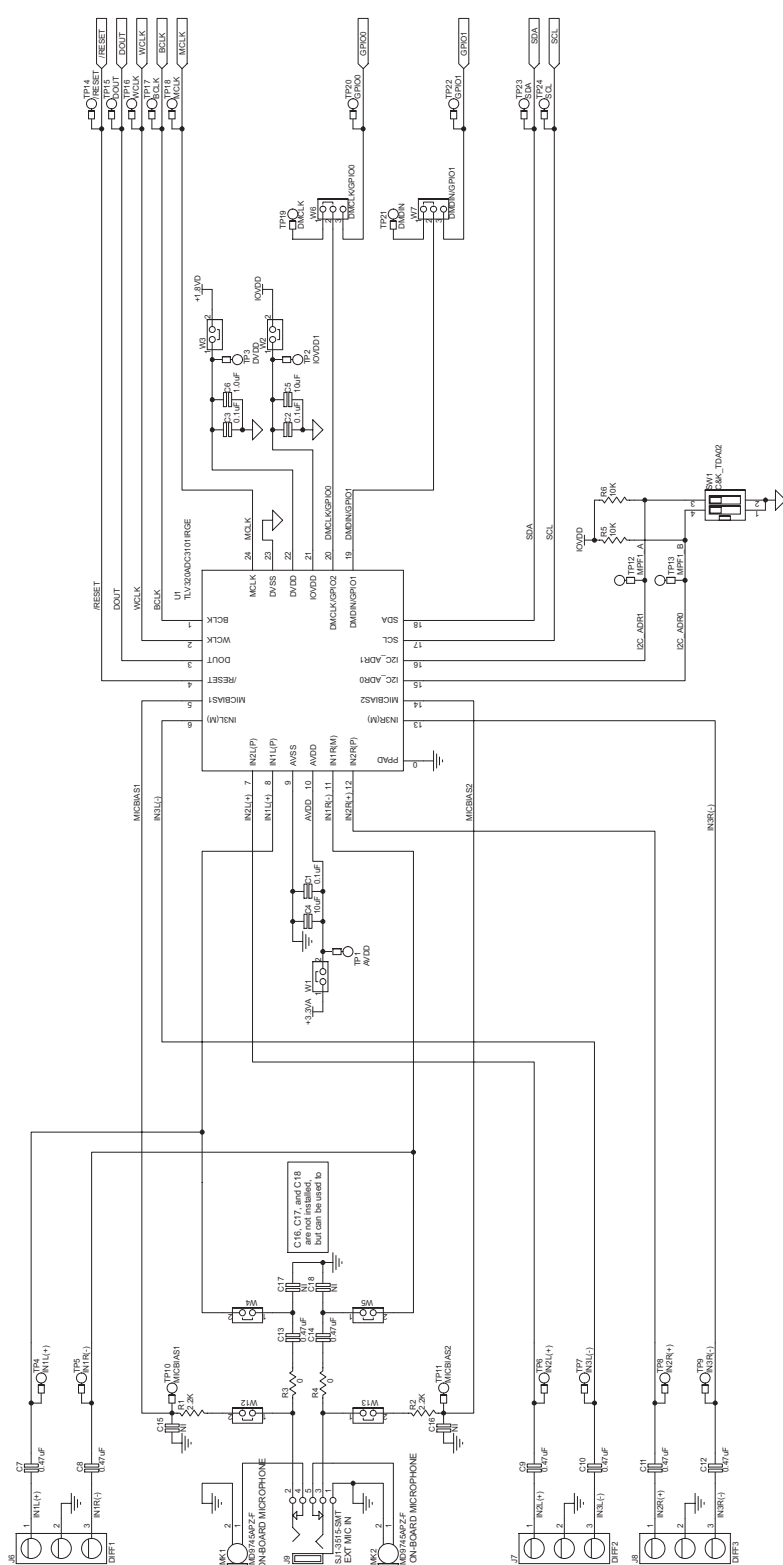
Table A-5. J3 Power Supply Pin Out

SIGNAL	PIN NUMBER
NC	1
NC	2
+5VA	3
NC	4
DGND	5
AGND	6
+1.8VD	7
NC	8
+3.3VD	9
NC	10

The TLV320ADC3101-K motherboard (the USB-MODEVM interface board) supplies power to J3 of the TLV320ADC3101EVM. Power for the motherboard is supplied either through its USB connection or via terminal blocks on that board.

Appendix B TLV320ADC3101EVM Schematic

The schematic diagram for the TLV320ADC3101EVM is provided as a reference.



S001

Figure B-1. Schematic (Sheet 1 of 2)

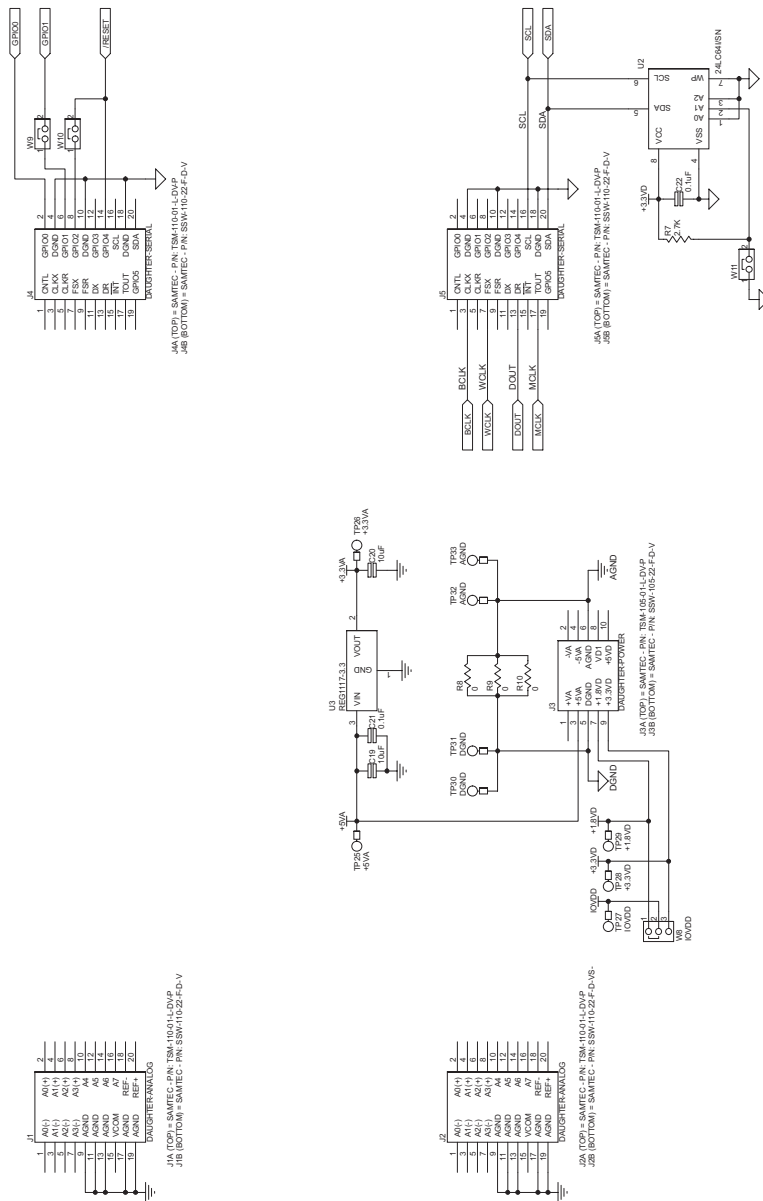


Figure B-2. Schematic (Sheet 2 of 2)

Appendix C TLV320ADC3101EVM Layout Views

C.1 Layout Views

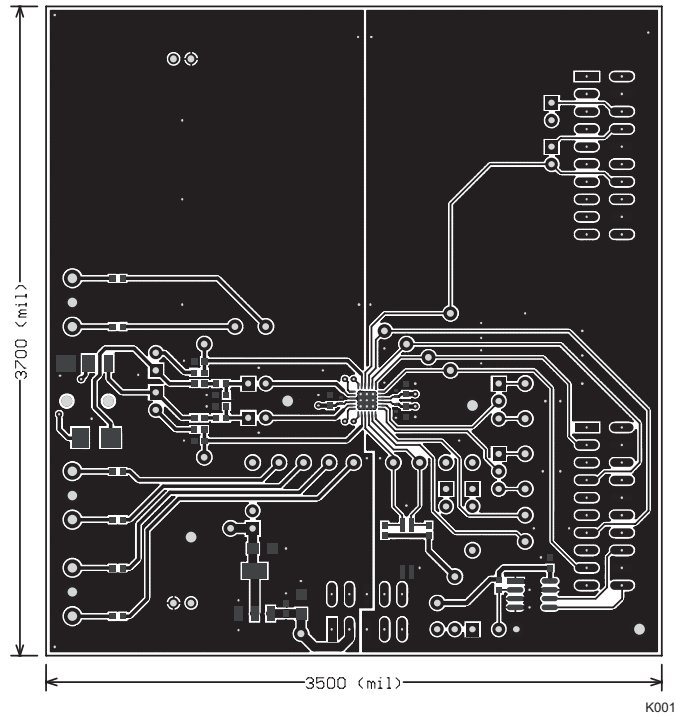


Figure C-1. Top Layer

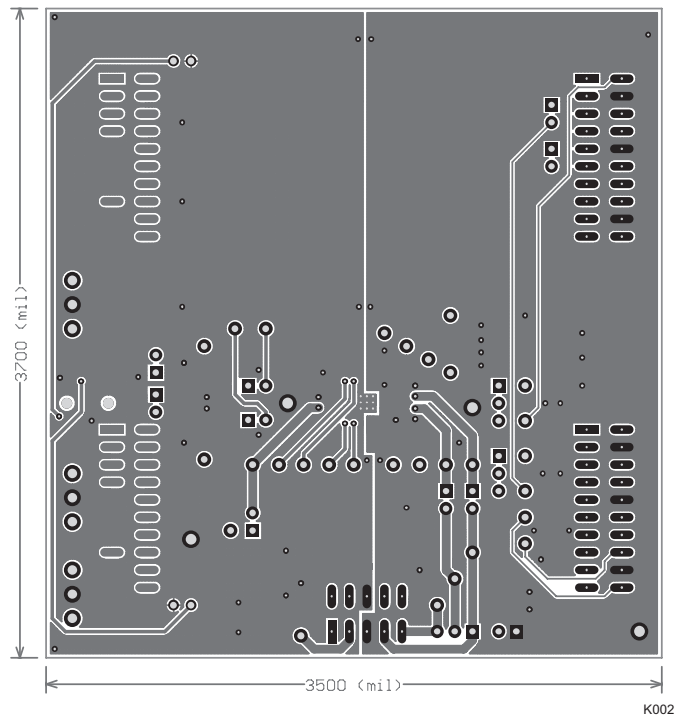


Figure C-2. Bottom Layer

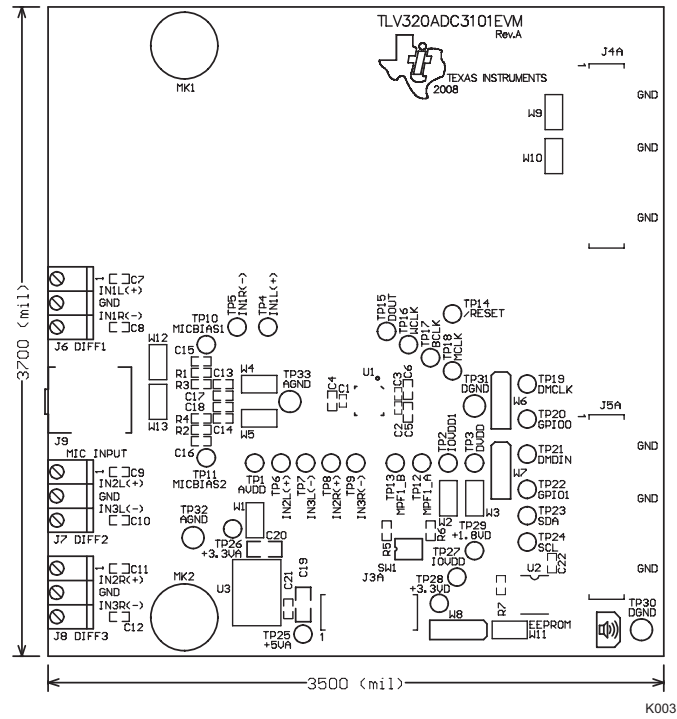


Figure C-3. Top Overlay

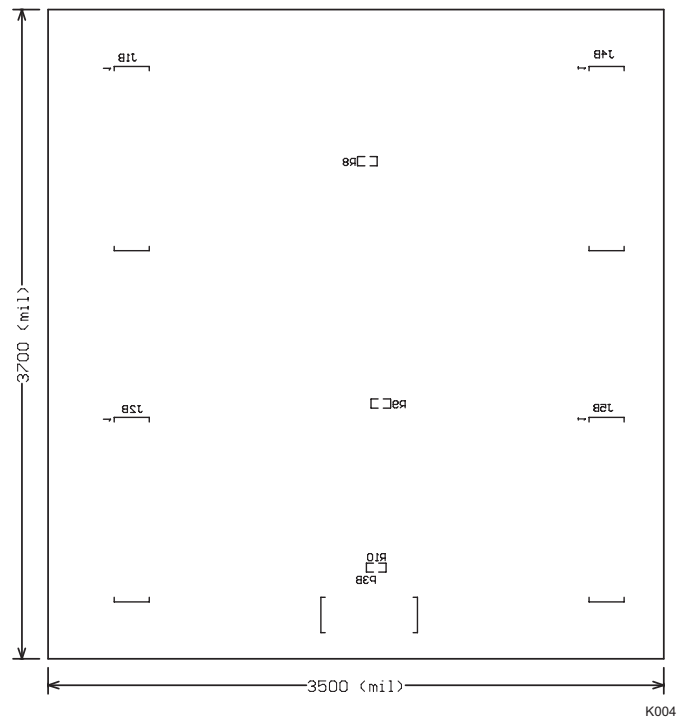


Figure C-4. Bottom Overlay

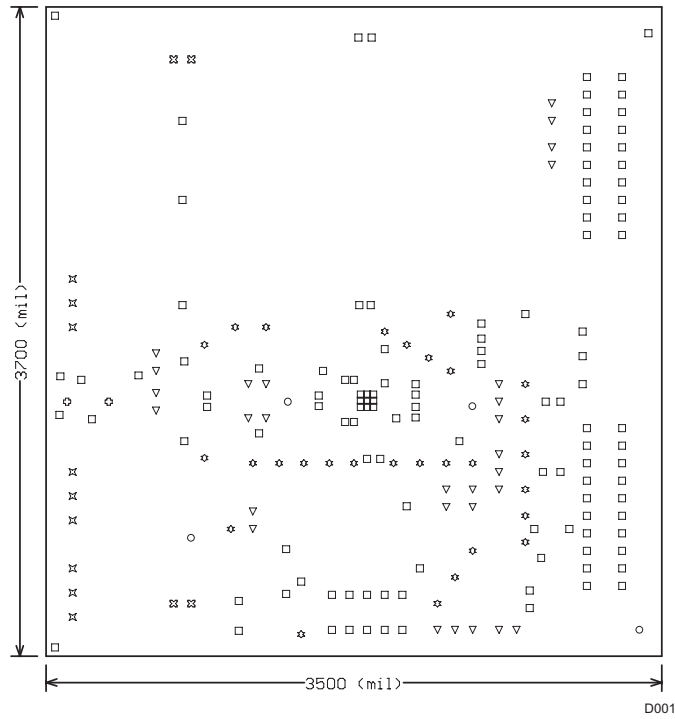


Figure C-5. Drill Drawing

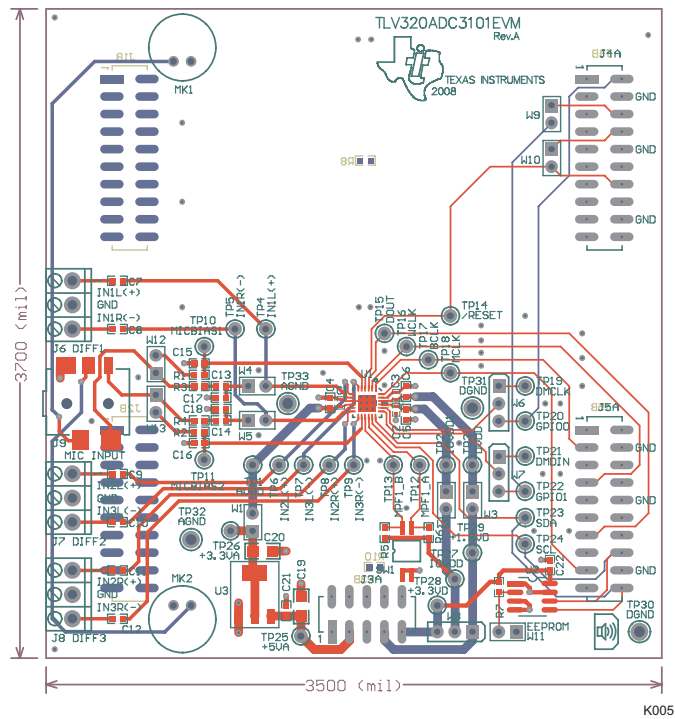


Figure C-6. Composite

Appendix D TLV320ADC3101EVM Bill of Materials

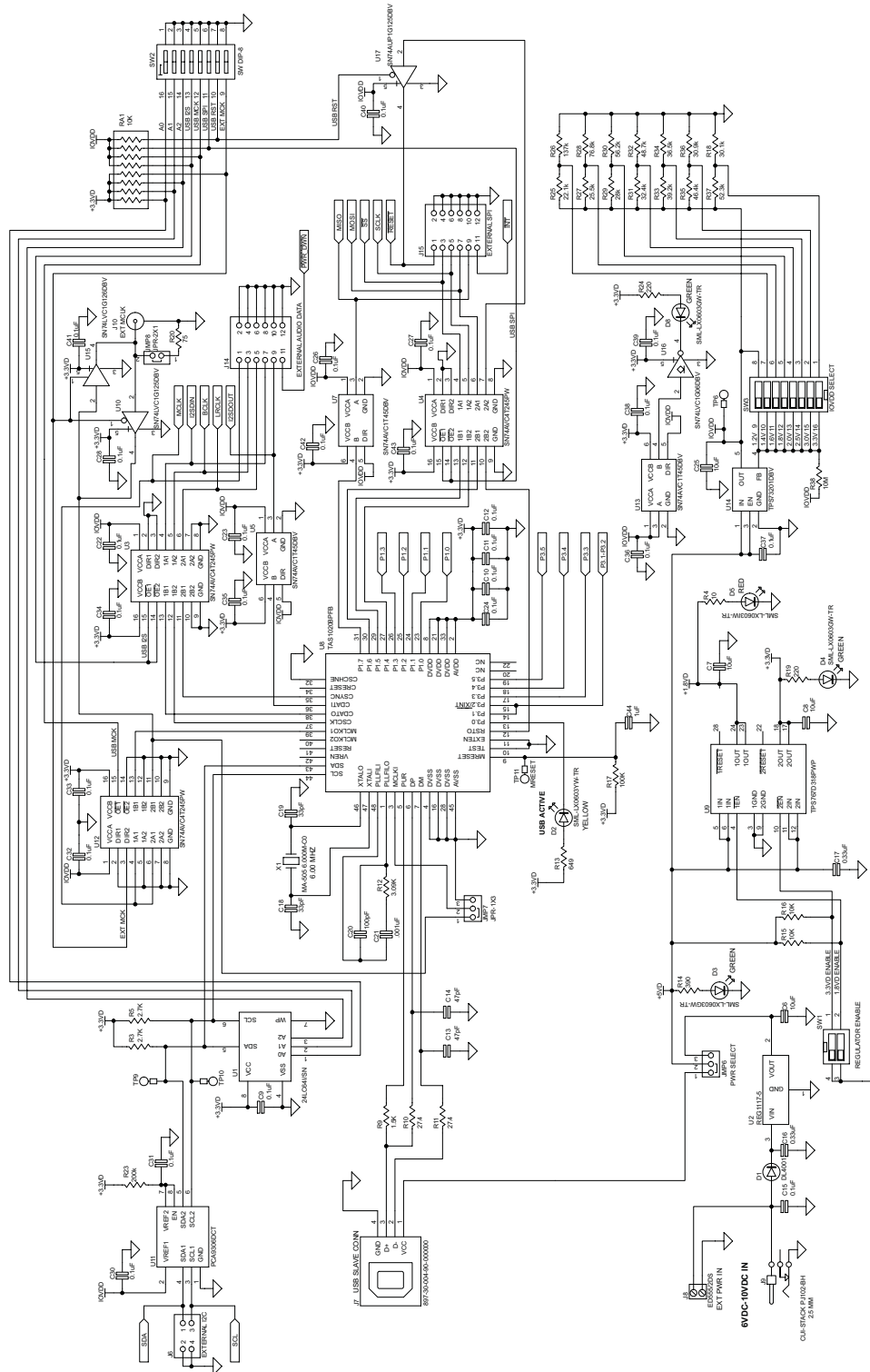
The complete bill of materials for the TLV320ADC3101EVM is provided as a reference.

Table D-1. TLV320ADC3101EVM Bill of Materials

Item No.	Qty	Value	Ref Des	Description	Vendor	Part Number
PCB						
1	1		N/A	TLV320AIC3101_RGE_EVM_RevA (PCB)	Texas Instruments	
RESISTORS						
2	5	0	R3, R4, R8, R9, R10	RES 0-Ω, 1/10-W, 5%, 0603, SMD	Panasonic	ERJ-3GEY0R00V
3	2	2.2 kΩ	R1, R2	RES 2.2-kΩ, 1/10-W, 5%, 0603, SMD	Panasonic	ERJ-3GEYJ222V
4	1	2.7 kΩ	R7	RES 2.7-kΩ, 1/10-W, 5%, 0603, SMD	Panasonic	ERJ-3GEYJ272V
5	2	10 kΩ	R5, R6	RES 10-kΩ, 1/10-W, 5%, 0603, SMD	Panasonic	ERJ-3GEYJ103V
CAPACITORS						
6	3	0.1 μF	C1, C2, C3	CAP CER, 0.10-μF, 6.3-V, X5R, 10%, 0402	TDK Corporation	C1005X5R0J104K
7	2	0.1 μF	C21, C22	CAP CER, 0.1-μF, 25-V X7R, 0603	TDK Corporation	C1608X7R1E104K
8	8	0.47 μF	C7, C8, C9, C10, C11, C12, C13, C14	CAP CER, 0.47-μF, 10-V, X5R, 10%, 0603	Panasonic	C1608X5R1A474K
9	1	1 μF	C6	CAP CER, 1-μF, 10-V, X5R, 0603	Panasonic	ECJ-BVB1A105K
10	2	10 μF	C4, C5	CAP CER, 10-μF, 6.3-V, X5R, 0603	Panasonic	ECJ-1VB0J106M
11	2	10 μF	C19, C20	CAP CER, 10-μF, 16-V, X5R, 20%, 1206	TDK Corporation	C3216X5R0J106M
12	4	Not installed	C15, C16, C17, C18	Ceramic chip capacitor		
INTEGRATED CIRCUITS						
13	1		U1	Audio ADC	Texas Instruments	TLV320ADC3101IRGE
14	1		U2	64K I ² C EEPROM	MicroChip	24LC64-I/SN
15	1		U3	3.3-V LDO voltage regulator	Texas Instruments	REG1117-3.3
16	3		J6, J7, J8	Screw terminal block, 3-position	On Shore Technology	ED555/3DS
17	1		J9	3.5-mm audio jack, T-R-S, SMD or alternate	CUI Inc. KobiConn	SJ1-3515-SMT 161-3335-E
18	2		J4A, J5A	20-pin SMT plug	Samtec	TSM-110-01-L-DV-P
19	4		J1B, J2B, J4B, J5B	20-pin SMT socket	Samtec	SSW-110-22-F-D-VS-K
20	1		J3A	10-pin SMT plug	Samtec	TSM-105-01-L-DV-P
21	1		J3B	10-pin SMT socket	Samtec	SSW-105-22-F-D-VS-K
MISCELLANEOUS ITEMS						
22	7		W4, W5, W9, W10, W11, W12, W13	2-position jumper, 0.1-inch (2.54-mm) spacing	Samtec	TSW-102-07-L-S
23	3		W1, W2, W3	Bus wire (18–22 gauge)		
24	3		W6, W7, W8	3-position jumper, 0.1-inch (2.54-mm) spacing	Samtec	TSW-103-07-L-S
25	2		MK1, MK2	Omnidirectional microphone cartridge or alternate	Knowles Acoustics	MD9745APZ-F MD9745APA-1
26	1		SW1	2-position half-pitch DIP switch	C&K	TDA02H0SB1
27	8	Not installed	TP1, TP2, TP3, TP25, TP26, TP27, TP28, TP29	Test point, PC mini, 0.040-inch (1.016-mm) diameter, red	Keystone Electronics	5000
28	21	Not installed	TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24	Test point, PC mini, 0.040-inch (1.016-mm) diameter, white	Keystone Electronics	5002
29	4		TP30, TP31, TP32, TP33	Test point, PC, multipurpose black	Keystone Electronics	5011
30		Installed per test procedure	N/A	Header shorting block	Samtec	SNT-100-BK-T

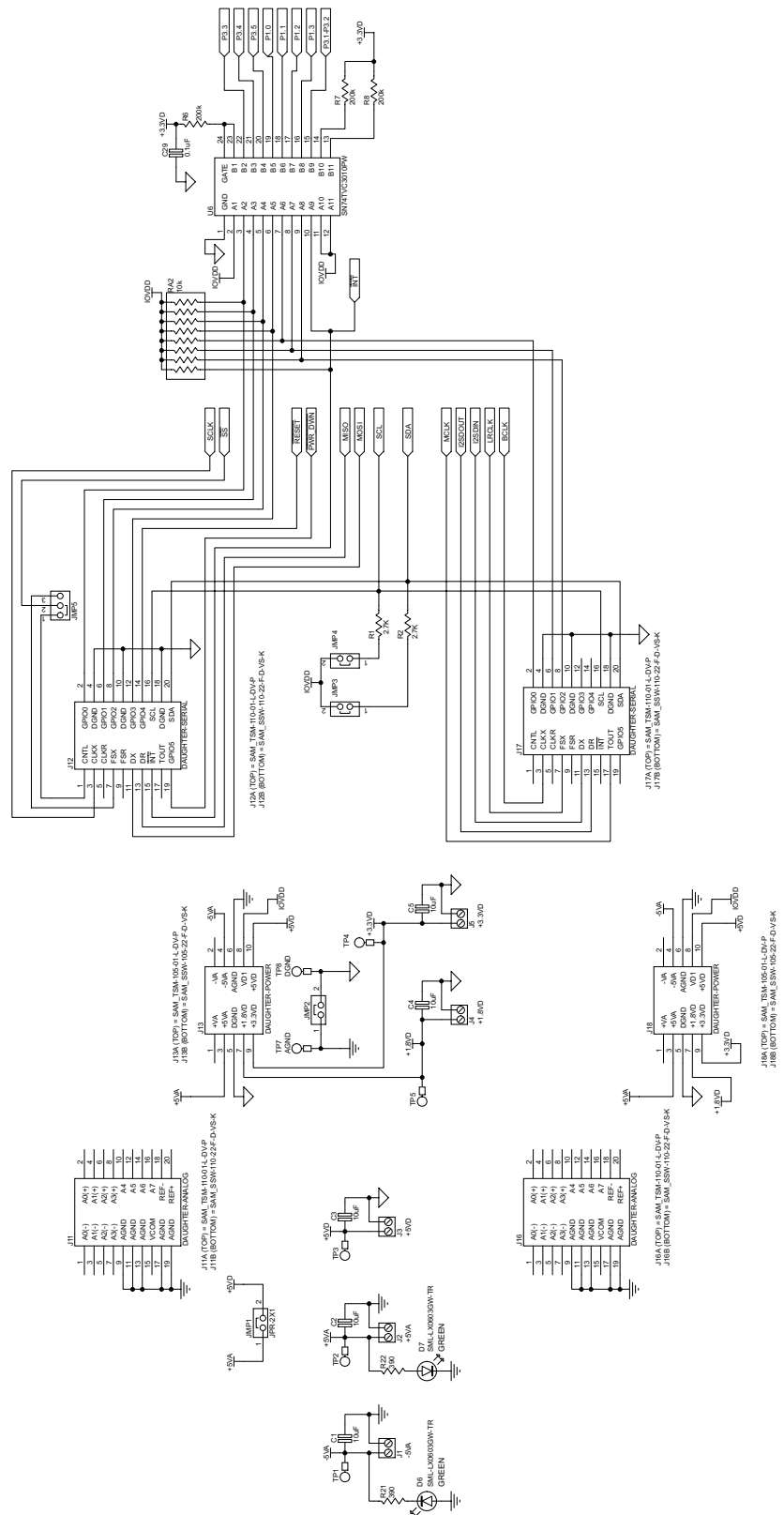
Appendix E USB-MODEVM Schematic

The schematic diagram for USB-MODEVM interface board is provided as a reference.



9003

Figure E-1. USB-MODEVM Schematic (Sheet 1 of 2)



S1004

Figure E-2. USB-MODEVM Schematic (Sheet 2 of 2)

Appendix F USB-MODEVM Bill of Materials

The complete bill of materials for USB-MODEVM interface board is provided as a reference.

Table F-1. USB-MODEVM Bill of Materials

Designator	Description	Manufacturer	Mfg. Part Number
R4	10Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1300V
R10, R11	27.4Ω 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF27R4V
R20	75Ω 1/4W 1% Chip Resistor	Panasonic	ERJ-14NF75R0U
R19	220Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ221V
R14, R21, R22	390Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ391V
R13	649Ω 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF6490V
R9	1.5KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1352V
R1–R3, R5–R8	2.7KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ272V
R12	3.09KΩ 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3091V
R15, R16	10KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1303V
R17, R18	100kΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1304V
RA1	10KΩ 1/8W Octal Isolated Resistor Array	CTS Corporation	742C163103JTR
C18, C19	33pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H330J
C13, C14	47pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H470J
C20	100pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H101J
C21	1000pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H102J
C15	0.1μF 16V Ceramic Chip Capacitor, ±10%, X7R	TDK	C1608X7R1C104K
C16, C17	0.33μF 16V Ceramic Chip Capacitor, ±20%, Y5V	TDK	C1608X5R1C334K
C9–C12, C22–C28	1μF 6.3V Ceramic Chip Capacitor, ±10%, X5R	TDK	C1608X5R0J1305K
C1–C8	10μF 6.3V Ceramic Chip Capacitor, ±10%, X5R	TDK	C3216X5R0J1306K
D1	50V, 1A, Diode MELF SMD	Micro Commercial Components	DL4001
D2	Yellow Light Emitting Diode	Lumex	SML-LX0603YW-TR
D3– D7	Green Light Emitting Diode	Lumex	SML-LX0603GW-TR
D5	Red Light Emitting Diode	Lumex	SML-LX0603IW-TR
Q1, Q2	N-Channel MOSFET	Zetex	ZXMN6A07F
X1	6MHz Crystal SMD	Epson	MA-505 6.000M-C0
U8	USB Streaming Controller	Texas Instruments	TAS1020BPFB
U2	5V LDO Regulator	Texas Instruments	REG1117-5
U9	3.3V/1.8V Dual Output LDO Regulator	Texas Instruments	TPS767D318PWP
U3, U4	Quad, 3-State Buffers	Texas Instruments	SN74LVC125APW
U5–U7	Single IC Buffer Driver with Open Drain o/p	Texas Instruments	SN74LVC1G07DBVR
U10	Single 3-State Buffer	Texas Instruments	SN74LVC1G125DBVR
U1	64K 2-Wire Serial EEPROM I ² C	Microchip	24LC64/SN
	USB-MODEVM PCB	Texas Instruments	6463995
TP1–TP6, TP9–TP11	Miniature test point terminal	Keystone Electronics	5000
TP7, TP8	Multipurpose test point terminal	Keystone Electronics	5011
J7	USB Type B Slave Connector Thru-Hole	Mill-Max	897-30-004-90-000000
J13, J2–J5, J8	2-position terminal block	On Shore Technology	ED555/2DS
J9	2.5mm power connector	CUI Stack	PJ-102B
J130	BNC connector, female, PC mount	AMP/Tyco	414305-1
J131A, J132A, J21A, J22A	20-pin SMT plug	Samtec	TSM-110-01-L-DV-P
J131B, J132B, J21B, J22B	20-pin SMT socket	Samtec	SSW-110-22-F-D-VS-K
J133A, J23A	10-pin SMT plug	Samtec	TSM-105-01-L-DV-P
J133B, J23B	10-pin SMT socket	Samtec	SSW-105-22-F-D-VS-K
J6	4-pin double row header (2x2) 0.1"	Samtec	TSW-102-07-L-D
J134, J135	12-pin double row header (2x6) 0.1"	Samtec	TSW-106-07-L-D
JMP1–JMP4	2-position jumper, 0.1" spacing	Samtec	TSW-102-07-L-S

Table F-1. USB-MODEVM Bill of Materials (continued)

Designator	Description	Manufacturer	Mfg. Part Number
JMP8–JMP14	2-position jumper, 0.1" spacing	Samtec	TSW-102-07-L-S
JMP5, JMP6	3-position jumper, 0.1" spacing	Samtec	TSW-103-07-L-S
JMP7	3-position dual row jumper, 0.1" spacing	Samtec	TSW-103-07-L-D
SW1	SMT, half-pitch 2-position switch	C&K Division, ITT	TDA02H0SK1
SW2	SMT, half-pitch 8-position switch	C&K Division, ITT	TDA08H0SK1
	Jumper plug	Samtec	SNT-100-BK-T

Appendix G USB-MODEVM Protocol

G.1 USB-MODEVM Protocol

The USB-MODEVM is defined to be a Vendor-Specific class and is identified on the PC system as an NI-VISA device. Because the TAS1020B has several routines in its ROM which are designed for use with HID-class devices, HID-like structures are used, even though the USB-MODEVM is not an HID-class device. Data is passed from the PC to the TAS1020B using the control endpoint.

Data is sent in a HIDSETREPORT (see [Table G-1](#)).

Table G-1. USB Control Endpoint HIDSETREPORT Request

Variable	Value	Description
bmRequestType	0x21	00100001
bRequest	0x09	SET_REPORT
wValue	0x00	Don't care
wIndex	0x03	HID interface is index 3
wLength	calculated by host	
Data		Data packet as described in Table G-2 .

The data packet consists of the following bytes, shown in [Table G-2](#):

Table G-2. Data Packet Configuration

BYTE NUMBER	TYPE	DESCRIPTION
0	Interface	Specifies serial interface and operation. The two values are logically ORed. Operation: READ 0x00 WRITE 0x10 Interface: GPIO 0x08 SPI_16 0x04 I2C_FAST 0x02 I2C_STD 0x01 SPI_8 0x00
1	I ² C slave address	Slave address of I ² C device or MSB of 16-bit register address for SPI
2	Length	Length of data to write/read (number of bytes)
3	Register address	Address of register for I ² C or 8-bit SPI; LSB of 16-bit address for SPI
4..64	Data	Up to 60 data bytes could be written at a time. EP0 maximum length is 64. The return packet is limited to 42 bytes, so advise only sending 32 bytes at any one time.

Example usage:

Write two bytes (AA, 55) to device starting at register 5 of an I²C device with address A0:

```
[ 0 ] 0x11
[ 1 ] 0xA0
[ 2 ] 0x02
[ 3 ] 0x05
[ 4 ] 0xAA
[ 5 ] 0x55
```

Do the same with a fast mode I²C device:

```
[ 0 ] 0x12
[ 1 ] 0xA0
[ 2 ] 0x02
[ 3 ] 0x05
[ 4 ] 0xAA
[ 5 ] 0x55
```

Now with an SPI device which uses an 8-bit register address:

```
[ 0 ] 0x10
[ 1 ] 0xA0
[ 2 ] 0x02
[ 3 ] 0x05
[ 4 ] 0xAA
[ 5 ] 0x55
```

Now, do a 16-bit register address, as found on parts like the TSC2101. Assume the register address (command word) is **0x10E0**:

```
[ 0 ] 0x14
[ 1 ] 0x10 → Note: the I2C address now serves as the MSB of the register address.
[ 2 ] 0x02
[ 3 ] 0xE0
[ 4 ] 0xAA
[ 5 ] 0x55
```

In each case, the TAS1020 returns, in an HID interrupt packet, the following:

[0] interface byte | status

status:

REQ_ERROR 0x80

INTF_ERROR 0x40

REQ_DONE 0x20

[1] for I²C interfaces, the I²C address as sent

for SPI interfaces, the read back-data from SPI line for transmission of the corresponding byte

[2] length as sent

[3] for I²C interfaces, the register address as sent

for SPI interfaces, the read-back data from SPI line for transmission of the corresponding byte

[4..60] echo of data packet sent

If the command is sent with no problem, the returning byte [0] is the same as the sent one logically ORed with 0x20 - in the preceding first example, the returning packet is:

```
[ 0 ] 0x31  
[ 1 ] 0xA0  
[ 2 ] 0x02  
[ 3 ] 0x05  
[ 4 ] 0xAA  
[ 5 ] 0x55
```

If for some reason the interface fails (for example, the I²C device does not acknowledge), it comes back as:

```
[ 0 ] 0x51 → interface | INTF_ERROR  
[ 1 ] 0xA0  
[ 2 ] 0x02  
[ 3 ] 0x05  
[ 4 ] 0xAA  
[ 5 ] 0x55
```

If the request is malformed, that is, the interface byte (byte [0]) takes on a value which is not as previously described, the return packet is:

```
[ 0 ] 0x93 → the user sent 0x13, which is not valid, so 0x93 returned  
[ 1 ] 0xA0  
[ 2 ] 0x02  
[ 3 ] 0x05  
[ 4 ] 0xAA  
[ 5 ] 0x55
```

The preceding examples used writes. Reading is similar:

Read two bytes from device starting at register 5 of an I²C device with address A0:

```
[ 0 ] 0x01  
[ 1 ] 0xA0  
[ 2 ] 0x02  
[ 3 ] 0x05
```


The return packet is:

```
[ 0 ] 0x21
[ 1 ] 0xA0
[ 2 ] 0x02
[ 3 ] 0x05
[ 4 ] 0xAA
[ 5 ] 0x55
```

assuming that the values written starting at Register 5 were actually written to the device.

G.2 GPIO Capability

The USB-MODEVM has seven GPIO lines. Access them by specifying the interface to be 0x08, and then using the standard format for packets—but addresses are unnecessary. The GPIO lines are mapped into one byte (see [Table G-3](#)):

Table G-3. GPIO Pin Assignments

Bit 7	6	5	4	3	2	1	0
x	P3.5	P3.4	P3.3	P1.3	P1.2	P1.1	P1.0

Example: write P3.5 to a 1, set all others to 0:

```
[ 0 ] 0x18 → write, GPIO
[ 1 ] 0x00 → this value is ignored
[ 2 ] 0x01 → length - ALWAYS a 1
[ 3 ] 0x00 → this value is ignored
[ 4 ] 0x40 → 01000000
```

The user can also read back from the GPIO to see the state of the pins. Assume the previous example was just written to the port pins.

Example: read the GPIO

```
[ 0 ] 0x08 → read, GPIO
[ 1 ] 0x00 → this value is ignored
[ 2 ] 0x01 → length - ALWAYS a 1
[ 3 ] 0x00 → this value is ignored
```

The return packet is:

```
[ 0 ] 0x28
[ 1 ] 0x00
[ 2 ] 0x01
[ 3 ] 0x00
[ 4 ] 0x40
```

G.3 Writing Scripts

A script is simply a text file that contains data to send to the serial control buses.

Each line in a script file is one command. No provision is made for extending lines beyond one line, except for the > command. A line is terminated by a carriage return.

The first character of a line is the command. Commands are:

- l** Set interface bus to use
- r** Read from the serial control bus
- w** Write to the serial control bus
- >** Extend repeated write commands to lines below a **w**
- #** Comment
- b** Break
- d** Delay
- f** Wait for Flag

The first command, **I**, sets the interface to use for the commands to follow. This command must be followed by one of the following parameters:

i2cstd	Standard mode I ² C bus
i2cfast	Fast mode I ² C bus
spi8	SPI bus with 8-bit register addressing
spi16	SPI bus with 16-bit register addressing
gpio	Use the USB-MODEVM GPIO capability

For example, if a fast mode I²C bus is to be used, the script begins with:

I i2cfast

A double quoted string of characters following the **b** command can be added to provide information to the user about each breakpoint. When the script is executed, the software's command handler halts as soon as a breakpoint is detected and displays the string of characters within the double quotes.

The Wait for Flag command, **f**, reads a specified register and verifies if the bitmap provided with the command matches the data being read. If the data does not match, the command handler retries for up to 200 times. This feature is useful when switching buffers in parts that support the adaptive filtering mode. The command **f** syntax follows:

```
f [i2c address] [register] [D7][D6][D5][D4][D3][D2][D1][D0]
```

where 'i2c address' and 'register' are in hexadecimal format and 'D7' through 'D0' are in binary format with values of 0, 1 or X for don't care.

Anything following a comment command **#** is ignored by the parser, provided that it is on the same line.

The delay command **d** allows the user to specify a time, in milliseconds, that the script pauses before proceeding. **The delay time is entered in decimal format.**

A series of byte values follows either a read or write command. Each byte value is expressed in hexadecimal, and each byte must be separated by a space. Commands are interpreted and sent to the TAS1020B by the program using the protocol described in [Section G.1](#).

The first byte following an **r** (read) or **w** (write) command is the I²C slave address of the device (if I²C is used) or the first data byte to write (if SPI is used—note that SPI interfaces are not standardized on protocols, so the meaning of this byte varies with the device being addressed on the SPI bus). The second byte is the starting register address that data will be written to (again, with I²C; SPI varies—see [Section G.1](#) for additional information about what variations may be necessary for a particular SPI mode). Following these two bytes are data, if writing; if reading, the third byte value is the number of bytes to read, (expressed in hexadecimal).

For example, to write the values 0xAA 0x55 to an I²C device with a slave address of 0x30, starting at a register address of 0x03, the user writes:

```
#example script

I i2cfast

w 30 03 AA 55

r 30 03 02
```

This script begins with a comment, specifies that a fast I²C bus will be used, then writes 0xAA 0x55 to the I²C slave device at address 0x30, writing the values into registers 0x03 and 0x04. The script then reads back two bytes from the same device starting at register address 0x03. Note that the slave device value does not change. It is unnecessary to set the R/W bit for I²C devices in the script; the read or write commands does that.

If extensive repeated write commands are sent and commenting is desired for a group of bytes, the `>` command can be used to extend the bytes to other lines that follow. A usage example for the `>` command follows:

```
#example script for '>' command

I i2cfast

# Write AA and BB to registers 3 and 4, respectively

w 30 03 AA BB

# Write CC, DD, EE and FF to registers 5, 6, 7 and 8, respectively

> CC DD EE FF

# Place a commented breakpoint

b "AA BB CC DD EE FF was written, starting at register 3"

# Read back all six registers, starting at register 3

r 30 03 06
```

The following example demonstrates usage of the Wait for Flag command, `f`:

```
#example script for 'wait for flag' command

I i2cfast

# Switch to Page 44

w 30 00 2C

# Switch buffers

w 30 01 05

# Wait for bit D0 to clear. 'x' denotes a don't care.

f 30 01 xxxxxxxx0
```

Any text editor can be used to write these scripts; Jedit is an editor that is highly recommended for general usage. For more information, go to: <http://www.jedit.org>.

Once the script is written, it can be used in the command window by running the program, and then selecting *Open Script File...* from the File menu. Locate the script and open it. The script is then displayed in the command buffer. The user can also edit the script once it is in the buffer and save it by selecting *Save Script File...* from the File menu.

Once the script is in the command buffer, it can be executed by pressing the *Execute Command Buffer* button. If there are breakpoints in the script, the script executes to that point, and the user is presented with a dialog box with a button to press to continue executing the script. When ready to proceed, push that button and the script continues.

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It is important to operate the EVM daughterboard within the input voltage range specified in Table A-4 and the EVM motherboard within the input voltage range of 6 Vdc to 10 Vdc when using an external ac/dc power source. See the USB-MODEVM Interface Power section of this manual when using laboratory power supplies.

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