

TLV320AIC12KEVMB-K and TLV320AIC14KEVMB-K User's Guide

This user's guide describes the characteristics, operation, and use of evaluation modules TLV320AIC12KEVMB and TLV320AIC14KEVMB, both as stand-alone and as kits (TLV320AIC12KEVMB-K and TLV320AIC14KEVMB-K). A complete circuit description, schematic diagram and bill of materials are also included.

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

EVM-Compatible Device Data Sheets

Device	Literature Number
TLV320AIC12K/14K	SLWS115E
TAS1020B	SLES025
REG1117-3.3	SBVS001
TPS767D318	SLVS209
SN74LVC125A	SCAS290
SN74LVC1G125	SCES223
SN74LVC1G07	SCES296

Contents

1	EVM Overview	3
2	Analog Interface.....	3
3	Digital Interface	4
4	Power Supplies	6
5	EVM Operation.....	6
6	Kit Operation	7
7	EVM Bill of Materials.....	29
Appendix A	TLV320AIC12KEVMB/14KEVMB Schematic	32
Appendix B	USB-MODEVM Schematic	33

List of Figures

1	TLV320AIC12KEVMB-K/14KEVMB-K Block Diagram	8
2	Default Software Screen	10
3	Information Tab.....	12
4	Sounds and Audio Devices Properties	13
5	Preset Configurations.....	14
6	Device Controls Tab	15
7	Control Register 1 Tab	16
8	Control Register 2 Tab	17
9	Control Register 3 Tab	17
10	Control Register 4 Tab	18
11	Control Register 5 Tab	18
12	Control Register 6 Tab	19

SMARTDM is a trademark of Texas Instruments.
 I²C is a trademark of Koninklijke Philips Electronics N.V.
 Windows is a registered trademark of Microsoft Corporation.
 LabView is a trademark of National Instruments.

13	Command Line Interface Tab	20
14	File Menu	21
15	Options Menu	21
16	Help	22

List of Tables

1	Analog Interface Pinout	3
2	Alternate Analog Connectors.....	4
3	Digital Interface Pinout	4
4	Power Supply Pinout	6
5	List of Jumpers	7
6	USB-MODEVM SW2 Settings	9
7	USB Control Endpoint HIDSETREPORT Request	22
8	Data Packet Configuration	23
9	GPIO Pin Assignments	25
10	TLV320AIC12KEVMB/14KEVMB Bill of Materials	29
11	USB-MODEVM Bill of Materials	30

1 EVM Overview

1.1 Features

- Full-featured evaluation board for the TLV320AIC12K/14K audio codec
- TLV320AIC12KEVMB-K/14KEVMB-K features USB connectivity for quick and easy setup.
- Intuitive evaluation software
- Easy interfacing to multiple analog sources
- Analog output signals from the TLV320AIC12K/14K are available on top and bottom connectors.
- On-board headphone jack, external microphone jack and electret microphone are included
- Digital control signals can be applied directly to top and bottom connectors.

1.2 Introduction

The TLV320AIC12KEVMB-K/14KEVMB-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 running Microsoft Windows® operating systems. Provisions are made for connecting all audio inputs and outputs either from the modular connectors or with on-board terminals, a headphone jack, and external microphone jack. An on-board electret microphone is also provided.

2 Analog Interface

For maximum flexibility, the TLV320AIC12KEVMB/14KEVMB is designed for easy interfacing to multiple analog sources. 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 J1 and J2. These headers/sockets provide access to the analog input and output pins of the device. Consult Samtec at www.samtec.com or call 1-800-SAMTEC-9 for a variety of mating connector options. [Table 1](#) summarizes the analog interface pinout for the TLV320AIC12KEVMB/14KEVMB.

Table 1. Analog Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
J1.1	OUTM1	Inverting output of the DAC
J1.2	OUTP1	Noninverting output of the DAC
J1.3	OUTMV	Programmable virtual ground for the output of OUTP2 and OUTP3
J1.4	OUTP2	Analog output number 2 from the 16-Ω driver
J1.5	OUTMV	Programmable virtual ground for the output of OUTP2 and OUTP3
J1.6	OUTMV	Programmable virtual ground for the output of OUTP2 and OUTP3
J1.7	OUTMV	Programmable virtual ground for the output of OUTP2 and OUTP3
J1.8	OUTP2	Analog output number 3 from the 16-Ω driver
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	INM2	Inverting analog input 2

Table 1. Analog Interface Pinout (continued)

PIN NUMBER	SIGNAL	DESCRIPTION
J2.2	INP2	Noninverting analog input 2
J2.3	NC	Not Connected
J2.4	NC	Not Connected
J2.5	NC	Not Connected
J2.6	NC	Not Connected
J2.7	INM1	Inverting analog input 1
J2.8	INP1	Noninverting analog input 1
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
J2.17	AGND	Analog Ground
J2.18	NC	Not Connected
J2.19	AGND	Analog Ground
J2.20	NC	Not Connected

In addition to the analog headers, the analog inputs and outputs may also be accessed through alternate connectors, either screw terminals or audio jacks. The microphone input is also tied to J8 and the headset output tied to J11. [Table 2](#) summarizes the screw terminals available on the TLV320AIC12KEVMB/14KEVMB.

Table 2. Alternate Analog Connectors

DESIGNATOR	PIN 1	PIN 2	PIN3
J6	OUTP1	OUTM1	
J7	OUTP2	OUTMV	OUTP3
J9	INP2	INM2	
J10	INM1	INP1	

3 Digital Interface

The TLV320AIC12KEVMB/14KEVMB is designed to easily 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 3](#) summarizes the digital interface pinout for the TLV320AIC12KEVMB/14KEVMB.

Table 3. Digital Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
J4.1	NC	Not Connected
J4.2	NC	Not Connected
J4.3	NC	Not Connected
J4.4	DGND	Digital Ground
J4.5	NC	Not Connected

Table 3. Digital Interface Pinout (continued)

PIN NUMBER	SIGNAL	DESCRIPTION
J4.6	NC	Not Connected
J4.7	NC	Not Connected
J4.8	AIC12K/14K $\overline{\text{RESET}}$	Reset signal input to AIC12K/14KEVMB
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	AIC12K/14K $\overline{\text{RESET}}$	Reset signal input to AIC12K/14KEVMB
J4.15	NC	Not Connected
J4.16	SCL	I ² C Serial Clock
J4.17	NC	Not Connected
J4.18	DGND	Digital Ground
J4.19	NC	Not Connected
J4.20	SDA	I ² C Serial Data Input/Output
J5.1	NC	Not Connected
J5.2	NC	Not Connected
J5.3	SCLK	Audio Serial Data Shift Clock (Input/Output)
J5.4	DGND	Digital Ground
J5.5	NC	Not Connected
J5.6	NC	Not Connected
J5A.7	FSD	Audio Serial Data Bus Frame Sync Delayed
J5B.7	FS	Audio Serial Data Bus Frame Sync (Input/Output)
J5.8	NC	Not Connected
J5.9	NC	Not Connected
J5.10	DGND	Digital Ground
J5.11	DIN	Audio Serial Data Bus Data Input (Input)
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 Serial Clock
J5.17	MCLK	Master Clock Input
J5.18	DGND	Digital Ground
J5.19	AIC12K/14K $\overline{\text{PWRDN}}$	Power down signal input to AIC12K/14KEVMB
J5.20	SDA	I ² C Serial Data Input/Output

Note that J5 comprises the signals needed for a SMARTDM™ serial digital audio interface and I²C™ signals. The reset and power down ($\overline{\text{RESET}}$ and $\overline{\text{PWRDN}}$) signals are routed to J4. I²C™ is actually routed from the USB-MODEVM to both connectors; however, the codec and EEPROM are only connected to J5.

4 Power Supplies

J3 provides connection to the common power bus for the TLV320AIC12KEVMB/14KEVMB. Power is supplied on the pins listed in [Table 4](#).

Table 4. Power Supply Pinout

SIGNAL	PIN NUMBER		SIGNAL
NC	J3.1	J3.2	NC
+5VA	J3.3	J3.4	NC
DGND	J3.5	J3.6	AGND
DVDD (1.8V)	J3.7	J3.8	NC
IOVDD (3.3V)	J3.9	J3.10	NC

The TLV320AIC12KEVMB-K/14KEVMB-K motherboard (the USB-MODEVM Interface board) supplies power to J3 of the TLV320AIC12KEVMB/14KEVMB. Power for the motherboard is supplied either through its USB connection or via terminal blocks on that board.

4.1 Stand-Alone Operation

When used as a stand-alone EVM, power can be applied to J3 directly. The user must be 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 [TLV320AIC12K/14K data sheet](#) before applying power to the EVM.

4.2 USB-MODEVM Interface Power

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

- USB
- 6VDC–10VDC AC/DC external wall supply (not included)
- Lab power supply

When powered from the USB connection, JMP6 should have a shunt from pins 1–2 (this is the default factory configuration). When powered from 6V-10VDC, either through the J8 terminal block or the J9 barrel jack, JMP6 should 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 lab supplies are used to provide the individual voltages required by the USB-MODEVM Interface, JMP6 should 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 need to 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.

5 EVM Operation

This section provides information on the analog input and output, digital control, and general operating conditions for the TLV320AIC12KEVMB/14KEVMB.

5.1 Analog Input

The analog input sources can be applied directly to J2 (top or bottom side). The analog inputs may also be accessed through J8 and screw terminals J9 and J10.

5.2 Analog Output

The analog outputs from the TLV320AIC12K/14K are available on J1 (top or bottom). They also may be accessed through J6 and J7 or J11. Note that the TLV320AIC14K only has one (differential) output which can be accessed from J1 or screw terminal J6.

5.3 Digital Control

The digital control signals can be applied directly to J4 and J5 (top or bottom side). The modular TLV320AIC12KEVMB/14KEVMB can also be connected directly to the USB-MODEVM Interface board included as part of the TLV320AIC12EVMB-K/14EVMB-K. See the product folder for this [EVM](#) or the [TLV320AIC12K/14K](#) for a current list of compatible interface and/or accessory boards.

5.4 Default Jumper Locations

[Table 5](#) lists the jumpers found on the EVM and their respective factory default conditions. **Please note that jumper W5 must be set to position 1-2 (IOVDD=3.3V) when using the USB-MODEVM for I²C communication.**

Table 5. List of Jumpers

JUMPER	DEFAULT POSITION	JUMPER DESCRIPTION
W1	1-2	Sets the codec as master or slave. When set as master (2-3), the codec provides the digital audio clock signals. When set as slave (1-2), the codec receives the digital audio clock signals.
W2	1-2	Used for correct polarity for FSD. In stand-alone master, FSD must be pulled high (2-3), In stand alone slave, FSD must be pulled low (1-2).
W3	Installed	Provides a means of measuring IOVDD current
W4	Installed	Provides a means of measuring DVDD current
W5	1-2	IOVDD select. Can be set to 3.3V (1-2) or 1.8V (2-3) although 3.3V is required when using the USB-MODEVM for I ² C communication.
W6	Installed	Selects on-board EEPROM as firmware source (required)
W7	Installed	When installed, allows the USB-MODEVM to hardware reset the device under user control
W8	Installed	Provides a means of measuring AVDD current
W9	Installed	Provides a means of measuring DRVDD current
W10	Installed	Coupling for OOTP1. Either directly or via capacitor
W11	1-2	Source for INM1. Set to 1-2 when using external common mode for MICIN
W12	Installed	Disconnects electret microphone (MK1)

6 Kit Operation

This section provides information on using the TLV320AIC12KEVMB-K/14KEVMB-K, including set up, program installation, and program usage.

6.1 TLV320AIC12KEVMB-K/14KEVMB-K Block Diagram

A block diagram of the TLV320AIC12KEVMB-K/14KEVMB-K is shown in [Figure 1](#). The evaluation kit consists of two circuit boards connected together. The motherboard is designated as the USB-MODEVM Interface board, while the daughtercard is the TLV320AIC12KEVMB/14KEVMB described previously in this manual.

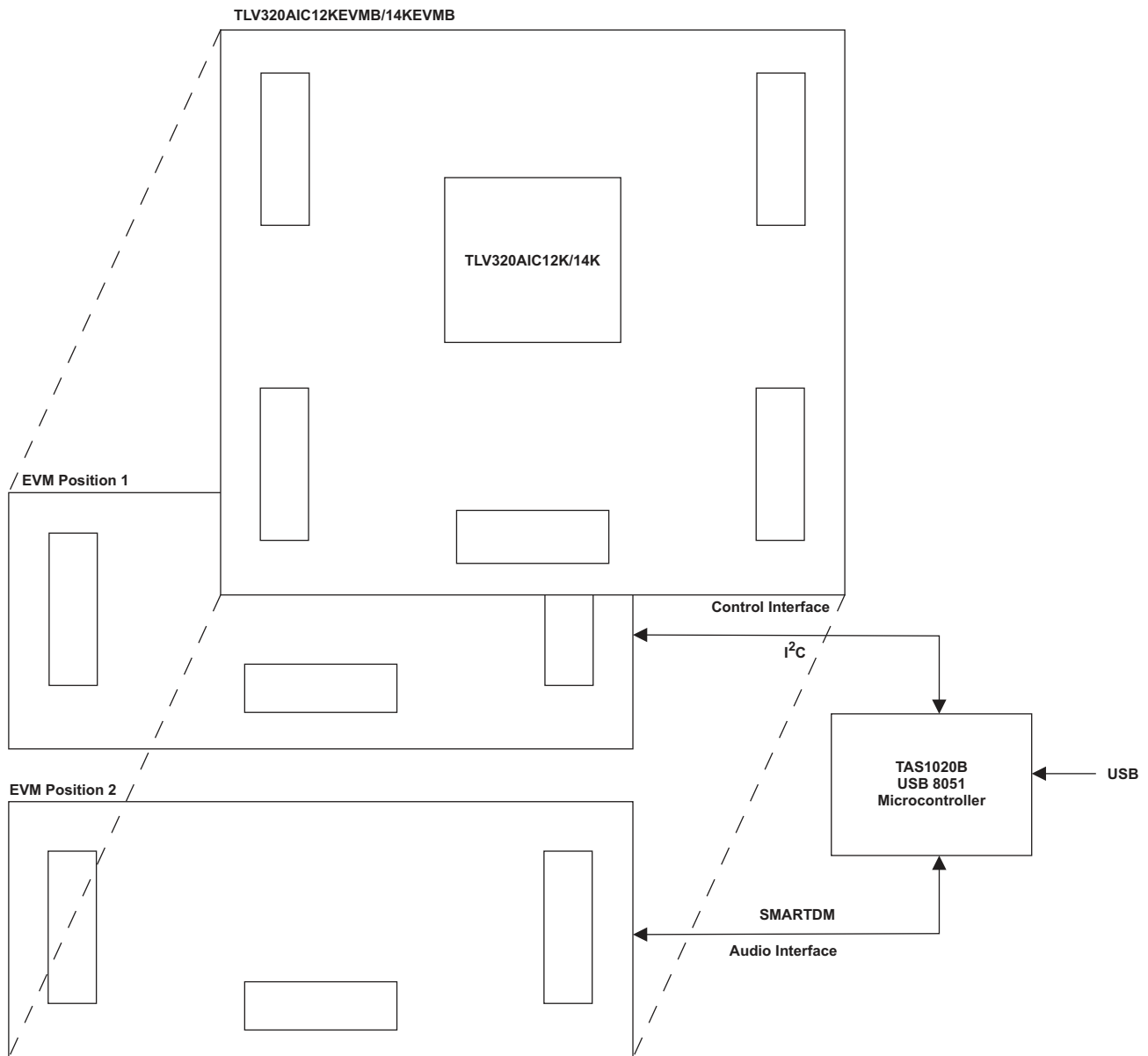


Figure 1. TLV320AIC12KEVMB-K/14KEVMB-K Block Diagram

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, PCM/SMARTDM™) externally. The source of these signals is controlled by SW2 on the USB-MODEVM. Refer to [Table 6](#) for details on the switch settings.

Additionally, SW3 on the USB-MODEVM (IOVDD SELECT) must be set up to 3.3V (SW3 position 1 on, SW3 positions 2-8 off).

Table 6. 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	Digital Audio Bus Source Selection ON: Digital Audio Bus connects to TAS1020 OFF: Digital Audio Bus connects to USB-MODEVM J14
5	USB MCK	Digital Audio 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

For use with the TLV320AIC12KEVMB/14KEVMB, SW-2 positions 1, 3, 4, 5 and 6 should be set to ON, while SW-2 positions 2, 7 and 8 should be set to OFF.

6.2 Installation

Ensure that the TLV320AIC12KEVMB/14KEVMB is installed on the USB-MODEVM Interface board, aligning J1, J2, J3, J4, J5 with the corresponding connectors on the USB-MODEVM.

Place the CD-ROM into your PC CD-ROM drive. Locate the **Setup** program on the disk, and start it. The Setup program will install the TLV320AIC12K/14K Evaluation Tool software on your PC.

The NI-VISA Runtime installer is embedded to the TLV320AIC12K/14K Evaluation Tool installer. This software allows the program to communicate with the USB-MODEVM.

When the installation completes, click *Finish* on the TLV320AIC12K/14K Evaluation Tool installer window. You may be prompted to restart your computer.

When installation is complete, attach a USB cable from your PC to the USB-MODEVM Interface board. As configured at the factory, the board will be powered from the USB interface, so the power indicator LEDs and the 'USB ACTIVE' LED on the USB-MODEVM should light.

The **Found New Hardware Wizard** will show up on the screen. Select the '**No, not this time**' radio button and click '**Next >**'. Select '**Install the software automatically (Recommended)**' and click '**Next >**'. If the driver installs correctly the message: '**The wizard has finished installing the software for: AIC12K/14K EVM**' should appear. Click '**Finish**'. The AIC12K/14K EVM driver should now be installed. The device should now appear on the Device Manager as '**NI-VISA USB Devices>AIC12K/14K EVM**' and as '**Sound, video and game controllers>USB Audio Device**'.

Once the device drivers are installed launch the TLV320AIC12K/14K Evaluation Tool software on your PC, located on the computer's desktop or in 'Start>Programs>Texas Instruments'.

The software should automatically find the TLV320AIC12K/14K, and a screen similar to the one in [Figure 2](#) should appear.

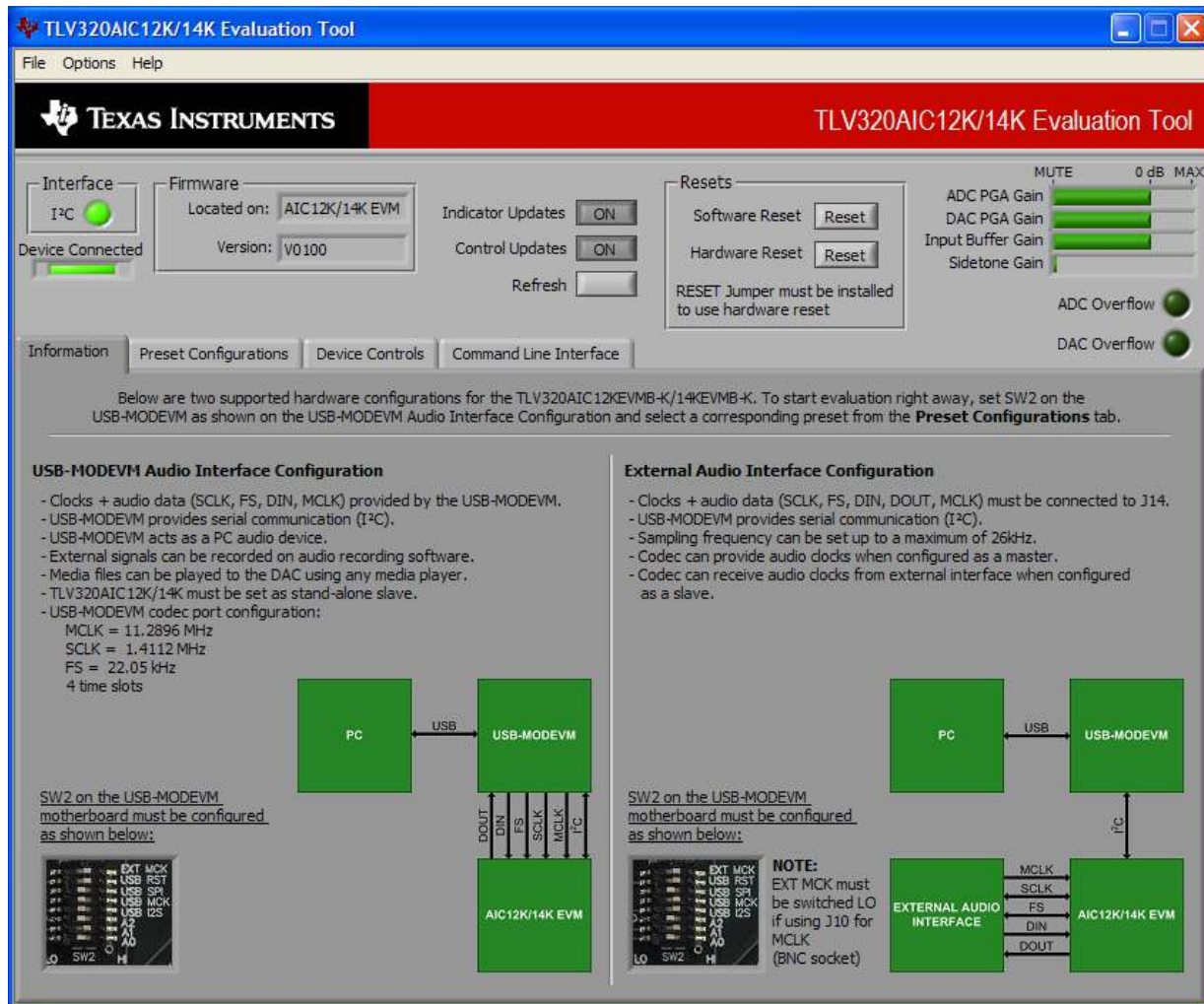


Figure 2. Default Software Screen

6.3 USB-MODEVM Interface Board

The simple diagram shown in [Figure 1](#) shows only the basic features of the USB-MODEVM Interface board. The board is built around a TAS1020B streaming audio USB controller with an 8051-based core. The board features two positions for modular EVMs, or one double-wide serial modular EVM may be installed.

Since the TLV320AIC12KEVMB/14KEVMB is a double-wide modular EVM, it is installed with connections to both EVM positions, which connects the TLV320AIC12K/14K 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 use with the TLV320AIC12KEVMB/14KEVMB. To view all the functions and configuration options available on the USB-MODEVM board, see the USB-MODEVM Interface Board schematic in [Appendix B](#).

6.4 Program Description

After the TLV320AIC12KEVMBK/14KEVMB-K software installation (described in [Section 6.2](#)) is complete, evaluation and development with the TLV320AIC12K/14K can begin.

6.5 Indicators and Main Screen Controls

Figure 2 illustrates the indicators and the main screen controls near the top of the software screen display, and a large tabbed interface below. This section discusses the controls above this tabbed section.

At the top left of the screen is an **Interface** indicator. The TLV320AIC12K/14K has an I²C interface. The indicator is lit after the program begins. Below the Interface indicator is the **Device Connected** indicator. The TLV320AIC12K/14K Evaluation Tool detects whether or not the TLV320AIC12KEVMB-K/14KEVMB-K is present. If the device is unplugged from the USB port or if the device driver is not installed properly, the **Device Connected** indicator will turn red. Otherwise, it will turn green.

To the right of the **Interface** indicator is a group box called **Firmware**. This box indicates the product identification of the USB device, so *AIC12K/14K EVM* should be displayed in the box labeled **Located On:**. The version of the firmware appears in the **Version** box below this.

To the right, the next group box contains controls for resetting the TLV320AIC12K/14K. A software reset can be done by writing to a register in the TLV320AIC12K/14K; the writing is accomplished by pushing the button labeled **Software Reset**. This button also resets to the default I²C address and refreshes the GUI's register table and controls/indicators by reading all registers. The TLV320AIC12K/14K also may be reset by toggling a GPIO pin on the USB-MODEVM, which is done by pushing the **Hardware Reset** button.

CAUTION

In order to perform a hardware reset, the RESET jumper (W7) must be installed and SW2-7 on the USB-MODEVM must be turned OFF. Failure to do either of these steps results in not generating a hardware reset or causing unstable operation of the EVM, which may require cycling power to the USB-MODEVM.

The **ADC Overflow** and **DAC Overflow** indicators light when the overflow flags are set in register 1 of the TLV320AIC12K/14K. These indicators, as well as the other indicators on this panel, update only when writing or reading registers, on resets or by pushing the **Refresh** button. The **Indicator Updates** and **Control Updates** buttons enable/disable updates of indicators and controls, respectively.

6.6 Information Tab

The information tab (Figure 3) shows information for two TLV320AIC12KEVMB-K/14KEVMB-K hardware configurations.

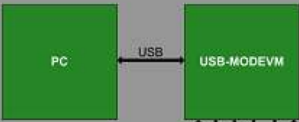
The **USB-MODEVM Audio Interface Configuration** allows audio data and I²C communication between the host computer and the TLV320AIC12K/14K. SW2 on the USB-MODEVM must be configured as shown in the left section of Figure 3.

Information Preset Configurations Device Controls Command Line Interface


Below are two supported hardware configurations for the TLV320AIC12KEVMB-K/14KEVMB-K. To start evaluation right away, set SW2 on the USB-MODEVM as shown on the USB-MODEVM Audio Interface Configuration and select a corresponding preset from the **Preset Configurations** tab.

USB-MODEVM Audio Interface Configuration

- Clocks + audio data (SCLK, FS, DIN, MCLK) provided by the USB-MODEVM.
- USB-MODEVM provides serial communication (I²C).
- USB-MODEVM acts as a PC audio device.
- External signals can be recorded on audio recording software.
- Media files can be played to the DAC using any media player.
- TLV320AIC12K/14K must be set as stand-alone slave.
- USB-MODEVM codec port configuration:
MCLK = 11.2896 MHz
SCLK = 1.4112 MHz
FS = 22.05 kHz
4 time slots

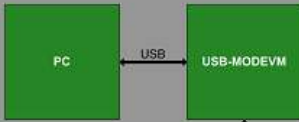


SW2 on the USB-MODEVM motherboard must be configured as shown below:




External Audio Interface Configuration

- Clocks + audio data (SCLK, FS, DIN, DOUT, MCLK) must be connected to J14.
- USB-MODEVM provides serial communication (I²C).
- Sampling frequency can be set up to a maximum of 26kHz.
- Codec can provide audio clocks when configured as a master.
- Codec can receive audio clocks from external interface when configured as a slave.



SW2 on the USB-MODEVM motherboard must be configured as shown below:



NOTE:
EXT MCK must be switched LO if using J10 for MCLK (BNC socket)

Figure 3. Information Tab

Additionally, the operating system's audio device must be configured as AIC12K/14K EVM (see [Figure 4](#)).

The **External Audio Interface Configuration** only allows I²C communication between the host computer and the TLV320AIC12K/14K. In this configuration, the TLV320AIC12K/14K can transmit and receive audio data to/from an external PCM device or DSP. SW2 on the USB-MODEVM must be configured as shown in the right section of [Figure 3](#).

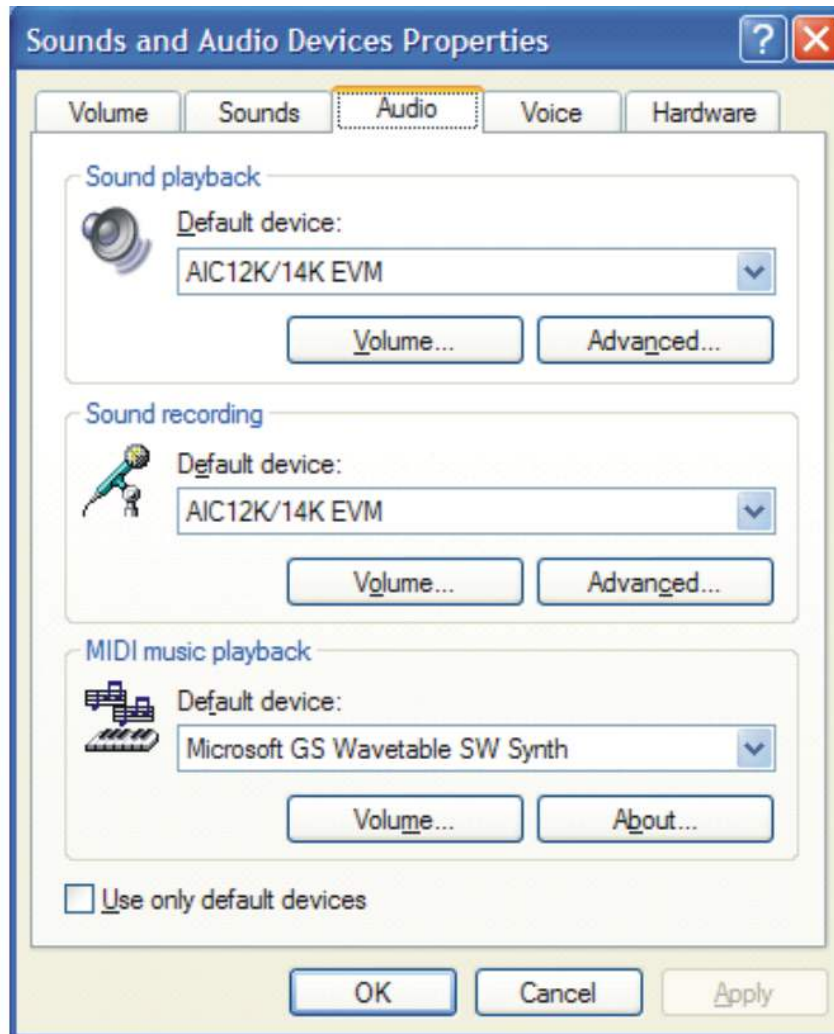


Figure 4. Sounds and Audio Devices Properties

6.7 Preset Configurations Tab

The **Preset Configurations** tab (Figure 5) provides several presets for both the **USB-MODEVM Audio Interface Configuration** and the **External Audio Interface Configuration**. Also, there is a **TLV320AIC12K/14K Defaults** preset which programs the codec's default register settings. When a radio button is selected, a detailed description of the preset will appear on the **Preset Configuration Description** box. To load a preset to the codec, select the desired preset by selecting the corresponding radio button and pushing the **Load** button. At the same time, this will show the preset's executed commands on the **Command Buffer** of the **Command Line Interface** tab (see Figure 13).

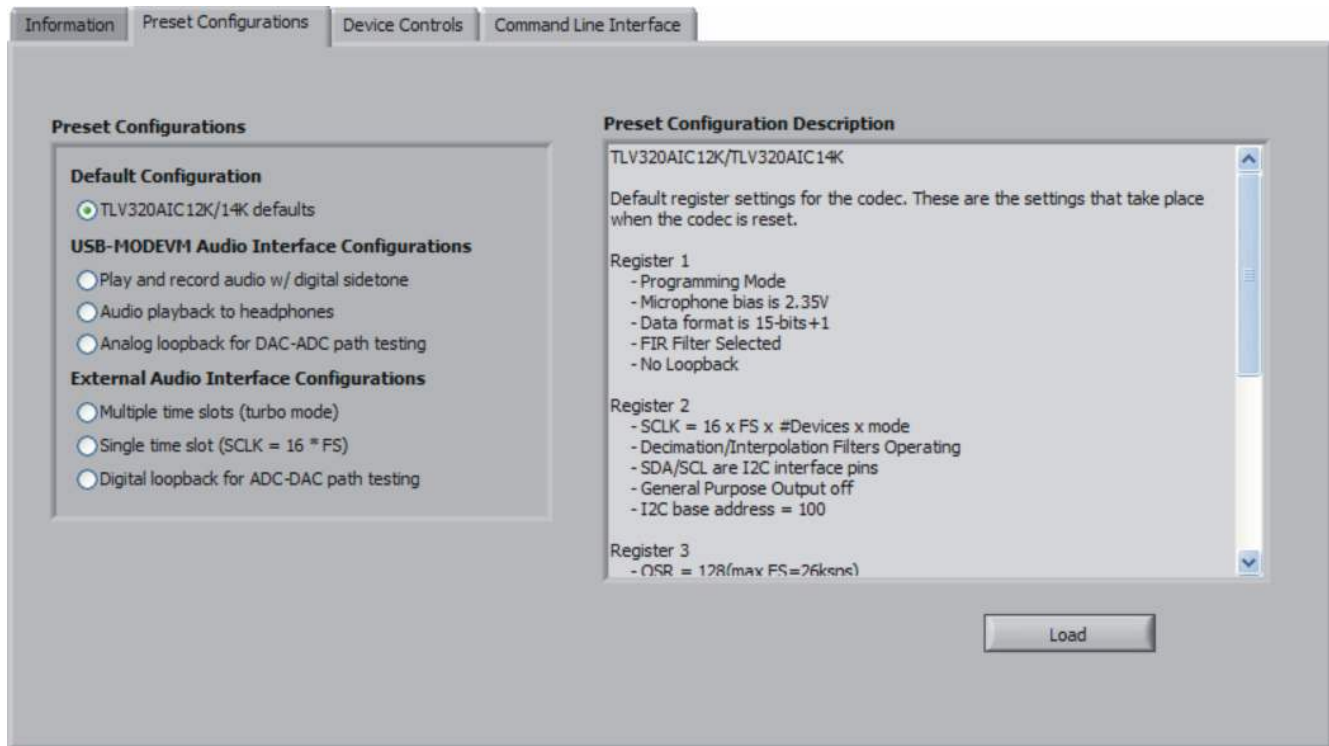


Figure 5. Preset Configurations

6.8 Device Controls Tab

The **Device Controls Tab** (Figure 6) contains six enumerated **Control Registers** sub tabs with controls for all six registers of the TLV320AIC12K/14K, a register table at the bottom of the tab, several controls and an indicator at the right of the tab. The **8-bit I²C Address** indicator shows the current I²C address. The **Device Position** control lets the user select a specific codec on a master-slave chain to write to or read from. The TLV320AIC12KEVMB-K/14KEVMB-K is configured as a stand-alone slave, so the device position must be set to zero. The **Program Device** button, when pushed, programs the register corresponding *only* to the selected **Control Registers** sub tab. The register table holds the current register values in hexadecimal and binary format. The **Register Dump to File** button dumps the current register values to a spreadsheet. Please refer to the [TLV320AIC12K/14K](#) datasheet for further details on control register content.

The screenshot shows a software interface for device control. At the top, there are tabs for 'Information', 'Preset Configurations', 'Device Controls', and 'Command Line Interface'. The 'Device Controls' tab is active, showing a 'Control Registers' section with six numbered buttons (1-6). Below this are four gain controls: ADC PGA, DAC PGA, Input Buffer Gain, and Digital Sidetone Gain. Each has a circular slider and a numerical display. The ADC and DAC PGA sliders are set to 0 dB and have 'ON' buttons below them. The Input Buffer Gain slider is set to 0 dB. The Digital Sidetone Gain slider is set to -21 dB and has a 'MUTE' button. To the right of these sliders are four gain settings: ADC PGA Gain (Register 5A), DAC PGA Gain (Register 5B), Input Buffer Gain (Register 5C), and Digital Sidetone Gain (Register 5C). On the far right, there is an '8-Bit I²C Address' field set to 0x80, a 'Device Position' dropdown set to 0, and a 'Program Device' button labeled 'LOAD'. Below the sliders is a table of control registers.

Register	Value	D7	D6	D5	D4	D3	D2	D1	D0
Register 1	0x01	Control Register 1	0	0	0	0	0	0	0
Register 2	0x02	Control Register 2	0	0	1	0	0	0	0
Register 3	0x03	Control Register 3	0	0	0	0	0	0	1
Register 4	0x04	Control Register 4A	0	0	1	1	0	0	0
Register 4	0x04	Control Register 4B	0x90	1	0	0	1	0	0
Register 5	0x05	Control Register 5A	0x2A	0	0	1	0	1	0
Register 5	0x05	Control Register 5B	0x6A	0	1	1	0	1	0
Register 5	0x05	Control Register 5C	0xB8	1	0	1	1	1	0
Register 5	0x05	Control Register 5D	0xC2	1	1	0	0	0	1

Figure 6. Device Controls Tab

6.8.1 Control Register 1 Tab

The **Transfer Mode** control lets the user select between continuous data transfer mode or programming mode. In the continuous data transfer mode, only audio data is sent and received through the serial audio bus. In the programming mode, control data is sent and received through the serial audio bus. The **Data Format Mode**, if set to 15 bits + 1, allows the codec to run in continuous mode and switch to programming mode by setting the LSB of DIN to 1 to send control data. The USB-MODEVM Audio Interface Configuration currently supports continuous and 16-bits audio data transfers. The **Mic Bias** sets the voltage of the BIAS pin to 2.35V or 1.35V. The **Selected Filter** button allows the user to select between an FIR filter or an IIR filter for the decimation/interpolation low-pass filter. The **Loopback** switches toggle the analog or digital loopback on and off. The indicator below each switch will light when on only if the register data sent by pressing the **Program Device** button is acknowledged.

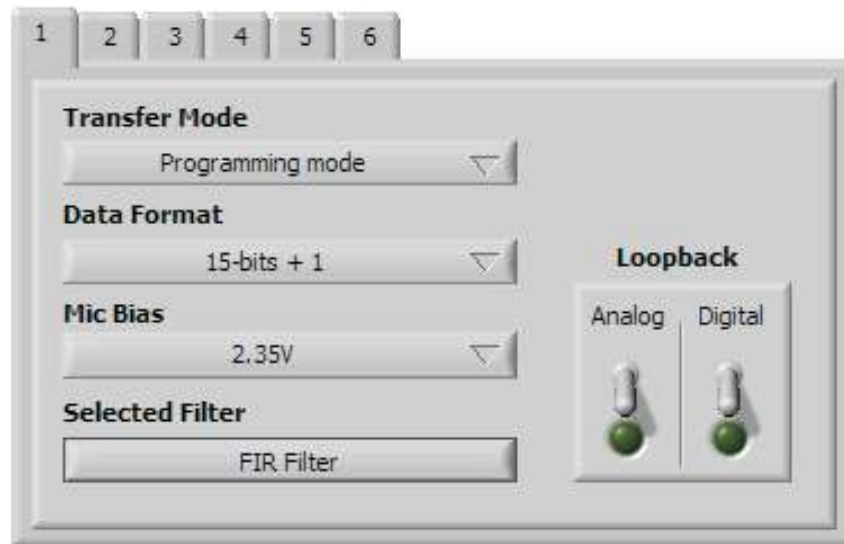


Figure 7. Control Register 1 Tab

6.8.2 Control Register 2 Tab

The **Turbo Mode** control (Figure 8) sets the SCLK frequency to $16 \times FS \times (\text{number of devices}) \times \text{mode}$ or $MCLK \div P$, where number of devices is the number of codecs in cascade (default=1) and the mode is 1 for continuous data transfer mode and 2 for programming mode. The **Host Port Control** can be used to assign different functions to the SDA pin or to set SCL and SDA for I2C or S2C. When using the **USB-MODEVM Audio Interface Configuration** the **Host Port Control** must be set to *SDA/SCL are I2C interface pins*.

If the host interface is not needed, the two pins of SCL and SDA can be programmed to become general-purpose I/Os. If selected to be used as I/O pins, the SDA and SCL pins become output and input pins respectively, determined by D1 and D0. SDA can then be set to 1 or 0 by toggling the **General Purpose Output** control.

The **Decimation/Interpolation filter bypass** button bypasses the filters selected in register 1. This can be useful when using a DSP to apply such filters. The **I²C Base Address** control allows the user to select the first three bits (MSB first) of the device's 7-bit I²C address. The last 4 bits of the address will depend on the automatic cascade detection (ACD) feature of SMARTDM™, which sets the device position.

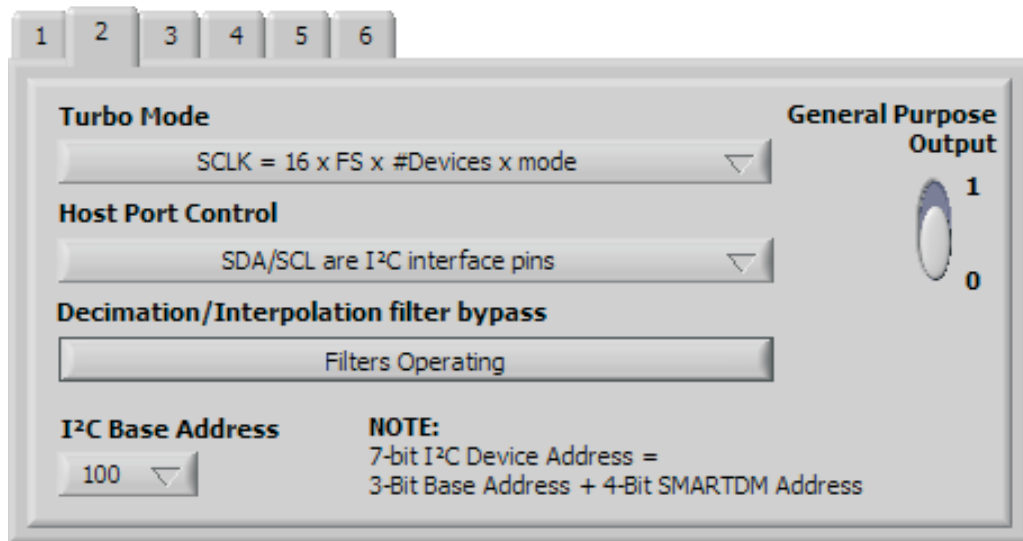


Figure 8. Control Register 2 Tab

6.8.3 Control Register 3 Tab

The **Control Register 3 Tab** (Figure 9) allows the user to set the **DAC Oversampling Rate (OSR)**, set the **Asynchronous Sampling Rate Factor** and power down the ADC or DAC with the **Power Down Controls**. The indicator below each power down switch will light when on only if the register data sent by pressing the **Program Device** button is acknowledged. The **USB-MODEVM Audio Interface Configuration** currently allows a fixed sampling rate and a single codec. For an OSR=256 the value of M, set in register 4, must be a multiple of 2. Similarly, for an OSR=512 the value of M must be a multiple of 4.

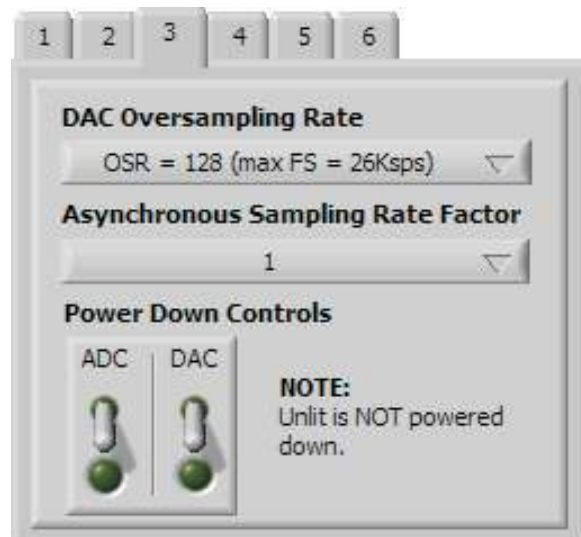


Figure 9. Control Register 3 Tab

6.8.4 Control Register 4 Tab

The **Control Register 4 Tab** (Figure 10) provides controls for **P**, **N** and **M**. Furthermore, an **FS** calculator is provided for convenience. The calculator derives **FS** from the **MCLK** frequency entered by the user or loaded by a preset by using the equation: $FS = MCLK / (16 \times P \times M \times N)$. The **PLL Method** switch illustrates that for coarse sampling, **P** must be equal to 8. Please note that the **FS** calculator and the **PLL Method**

are merely for illustration; what is actually written to registers 4A and 4B are the values of **P**, **M** and **N** only. The **USB-MODEVM Audio Interface Configuration** is set up for an $MCLK=11.2896\text{ MHz}$, so **P**, **M** and **N** must satisfy the **FS** equation and the **SCLK** equation in Turbo Mode for that configuration. If using the **External Audio Interface Configuration**, the divider values can be set to anything specified in the [TLV320AIC12K/14K](#) datasheet.

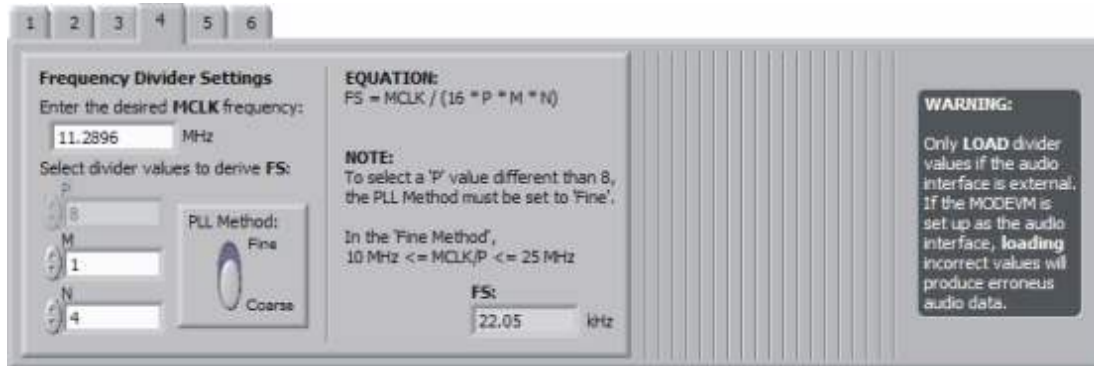


Figure 10. Control Register 4 Tab

6.8.5 Control Register 5 Tab

The **Control Register 5 Tab** (Figure 11) has several gain controls. The **ADC PGA** and **DAC PGA** gain knobs range from -42dB to 20dB and each have a **MUTE** button. The gain knobs and the respective **MUTE** buttons write to register 5A for the ADC PGA and to register 5B for the DAC PGA. Sliders are provided for the **Input Buffer Gain** (0dB to 24dB) and the **Digital Sidetone Gain** (-21dB to -3dB w/**MUTE**) and they both share register 5C. For convenience, the corresponding register for each control is provided to the right of the tab. An 'x' denotes the bits modified by the corresponding control.



Figure 11. Control Register 5 Tab

6.8.6 Control Register 6 Tab

The **Control Register 6 Tab** (Figure 12) provides controls to select the analog input and to configure the analog outputs. Note that OUTP2/P3 are only available on the TLV320AIC12/12K. The TLV320AIC12KEVMB/14KEVMB provides a 1/8" audio jack (J8) to connect a microphone, an on-board electret microphone (MK1) and another 1/8" audio jack (J11) to connect a stereo headset. There are four options for the **Analog Input Select** control:

- INP/M1 - selects input 1 as the input source (connected to screw terminal J10). To use this mode, jumper W11 must be installed on pins 2-3.
- MICIN self-biased to 1.35V (single-ended) - In this mode, the device internally self-biases the input to 1.35V. To use this mode, jumper W11 must be installed on pins 2-3. Jumper W12 must be installed if using the on-board electret microphone (MK1), otherwise a microphone can be connected to J8.

Please refer to [Appendix A](#) for details. Note that the ring contact in J8 is not connected.

- c. MICIN with external common mode (pseudo-differential) - In this mode, the single ended input is connected through ac-coupling to MICIN and the bias voltage used to generate the signal is also ac coupled to INM1. To use this mode, jumper W11 must be installed on pins 1-2. Jumper W12 must be installed if using the on-board electret microphone (MK1), otherwise a microphone can be connected to J8. Please refer to [Appendix A](#) for details. Note that the ring contact in J8 is not connected.
- d. INP/M2 - selects input 2 as the input source (connected to screw terminal J9).

The **Output Configuration** control (TLV320AIC12K only) sets outputs OUTP2/P3 to differential or single-ended mode. If set to differential, OUTP2 and OUTP3 share pin OUTMV as the common inverting output. If set to single-ended, OUTMV becomes a virtual ground for OUTP2/P3 at the common mode voltage of 1.35V. Switch SW2 on the TLV320AIC12KEVMB/14KEVMB can be used to try multiple output configurations on J7 and J11. Please see the Functional Description section on the [TLV320AIC12K/14K](#) datasheet for details.

The **Output Drivers Controls** (TLV320AIC12K only) mutes and powers down OUTP2 and/or OUTP3.

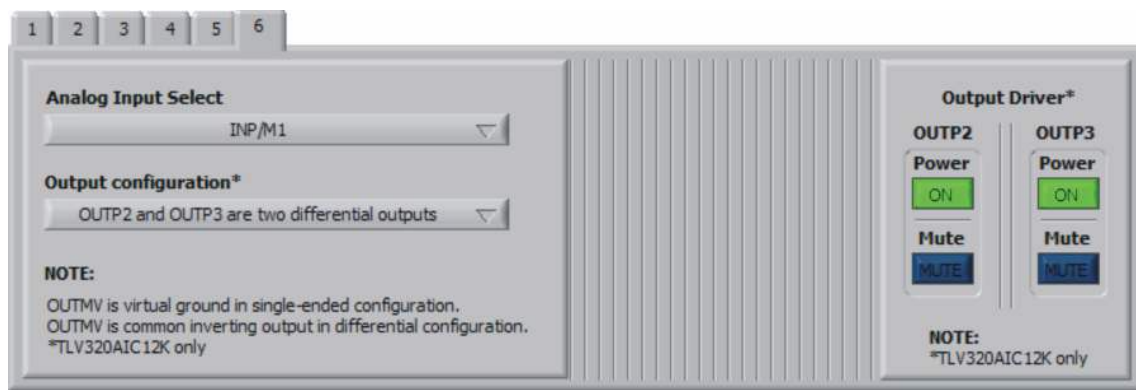


Figure 12. Control Register 6 Tab

6.9 Command Line Interface Tab

A simple scripting language controls the TAS1020 on the USB-MODEVM from the LabView™-based PC software. The main program controls, described previously, do nothing more than write a script which is then handed off to an interpreter that sends the appropriate data to the correct USB endpoint. Because this system is script-based, provision is made in this tab for the user to view the scripting commands that are created as the controls are manipulated, as well as load and execute other scripts that have been written and saved (see [Figure 13](#)). This design allows the software to be used as a quick test tool or to help provide troubleshooting information in the rare event that the user encounters a problem with this EVM.

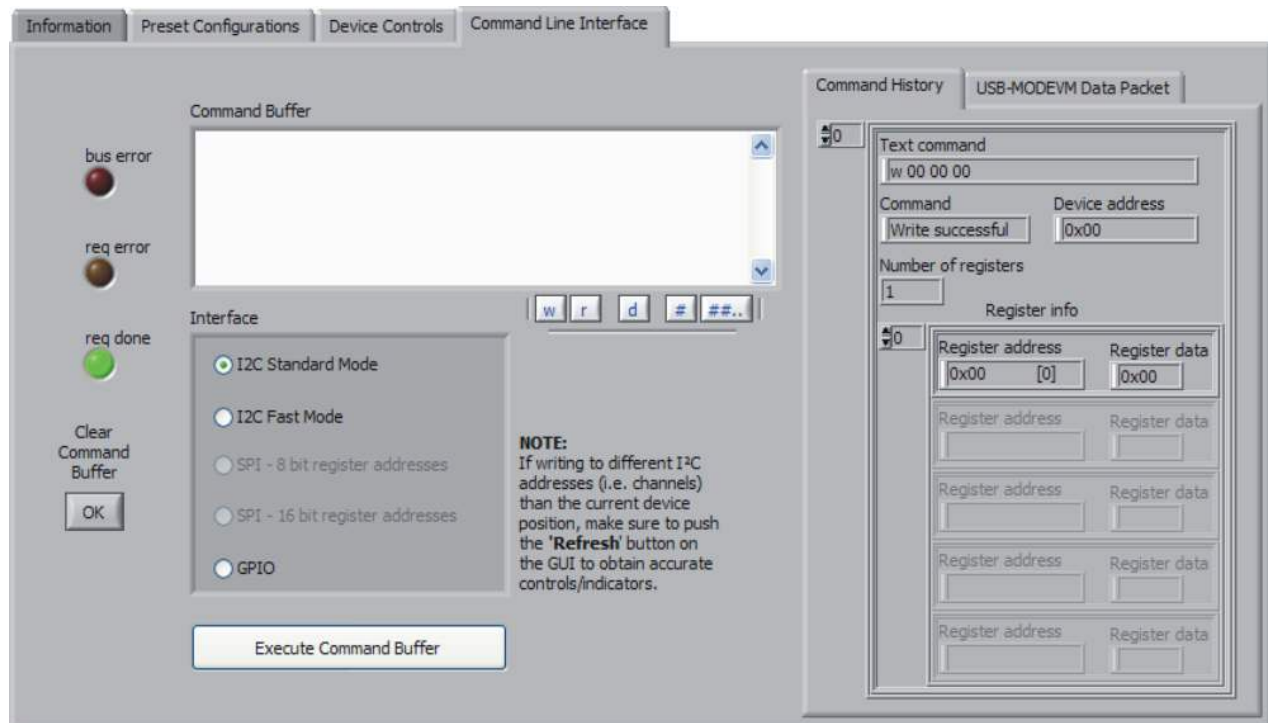


Figure 13. Command Line Interface Tab

A script is loaded into the command buffer, either by operating the controls on the other tabs or by loading a script file or preset.

When executed, either by loading commands from other tabs, loading a preset or pushing the Execute Command Buffer button, an array containing executed commands will be displayed on the **Command History** tab. Additionally, the return packet of data which results from the last command executed will be displayed in the **USB-MODEVM Data Packet** tab. The logging function, described below, can be used to see the results after every executed command.

The File menu (Figure 14) provides some options for working with scripts. The first option, *Open Command File...*, loads a command file script into the command buffer. This script can then be executed by pressing the **Execute Command Buffer** button.

The second option, *Save Command File...*, saves the contents of the command buffer into a file.

The third option is *Log Script and Results...*, which opens a file save dialog box. The user can choose a location for a log file to be written using the file save dialog. When the Execute Command Buffer button is pressed, the script will run and the script, along with resulting data read back during the script, will be saved to the file specified. The log file is a standard text file which can be opened with any text editor, and looks much like the source script file, but with the additional information of the result of each script command executed.

The third menu item is a submenu of *Recently Opened Files*. This list is simply a list of script files that have previously been opened, allowing fast access to commonly-used script files. The final menu item is *Exit*, which terminates the TLV320AIC12K/14K Evaluation Tool software.

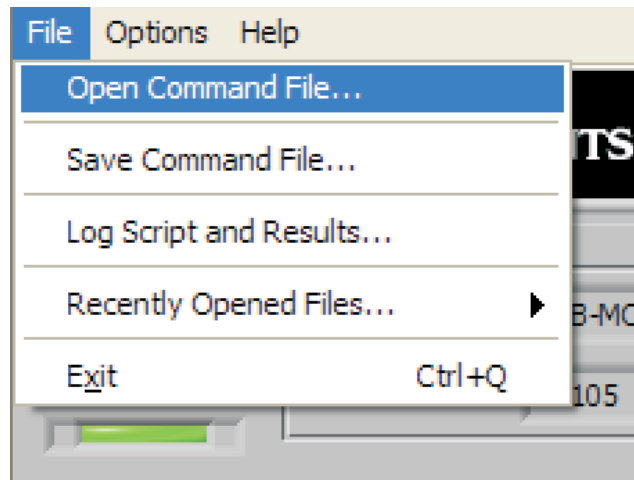


Figure 14. File Menu

The Options menu (Figure 15) provides two settings suitable for command line interface users and for troubleshooting. These settings allows the user to evaluate the device in its most basic form.

The first option, *Hardware Reset on Startup*, enables (checked) and disables (unchecked) the hardware reset commands every time the GUI starts. If checked, a series of commands will be sent to the TAS1020 to hardware reset the TLV320AIC12K/14K at startup. If unchecked, nothing will be written to the TLV320AIC12K/14K when the GUI starts. This option is useful if the user wants to keep the registers intact when closing and re-opening the GUI. Keep in mind that, every time the EVM-K is connected or reconnected, a hardware reset must be done in order to write to the codec either by pushing the Hardware Reset button on the GUI, pressing the push-button on the EVM or by using the command line interface.

The second option, *Hardware Reset on USB reconnection*, enables (checked) and disables (unchecked) the hardware reset commands every time the EVM-K is reconnected while using the GUI. If unchecked, a manual hardware reset must be done if writing to the codec as stated on the paragraph above.

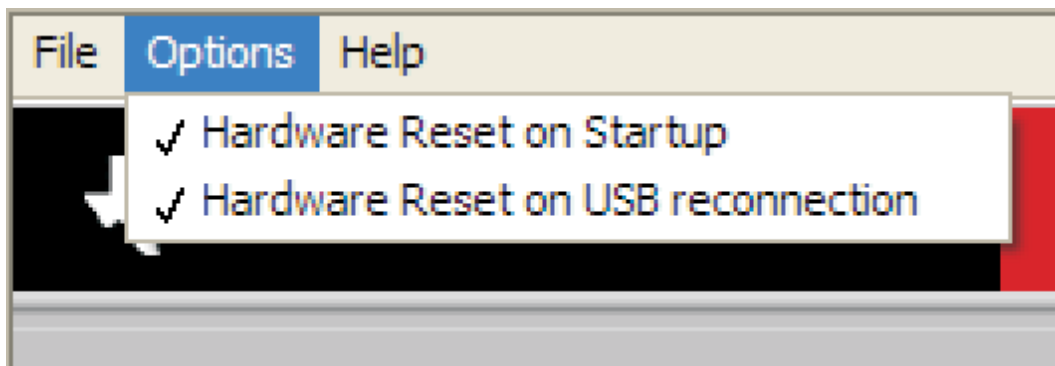


Figure 15. Options Menu

Under the Help menu is an *About...* menu item (Figure 16) which displays information about the TLV320AIC12KEVMB/14KEVMB software.

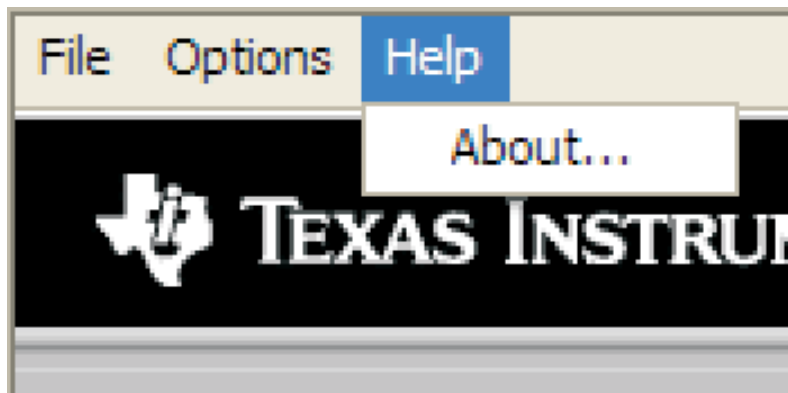


Figure 16. Help

The actual USB protocol used as well as instructions on writing scripts are detailed in the following subsections. While it is not necessary to understand or use either the protocol or the scripts directly, understanding them may be helpful to some users.

6.9.1 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 TAS1020 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 passes from the PC to the TAS1020 using the control endpoint.

Data is sent in an HIDSETREPORT (see [Table 7](#)):

**Table 7. USB Control Endpoint
HIDSETREPORT Request**

PART	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 below

The data packet consists of the following bytes, shown in [Table 8](#):

Table 8. Data Packet Configuration

BYTE NUMBER	TYPE	DESCRIPTION														
0	Interface	<p>Specifies serial interface and operation. The two values are logically OR'd.</p> <p>Operation:</p> <table style="margin-left: 40px;"> <tr> <td>READ</td> <td>0x00</td> </tr> <tr> <td>WRITE</td> <td>0x10</td> </tr> </table> <p>Interface:</p> <table style="margin-left: 40px;"> <tr> <td>GPIO</td> <td>0x08</td> </tr> <tr> <td>SPI_16</td> <td>0x04</td> </tr> <tr> <td>I2C_FAST</td> <td>0x02</td> </tr> <tr> <td>I2C_STD</td> <td>0x01</td> </tr> <tr> <td>SPI_8</td> <td>0x00</td> </tr> </table>	READ	0x00	WRITE	0x10	GPIO	0x08	SPI_16	0x04	I2C_FAST	0x02	I2C_STD	0x01	SPI_8	0x00
READ	0x00															
WRITE	0x10															
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 reg addr 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 (45, A0) to device starting at register 1 of an I²C device with address 80:

```
[0] 0x11
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

Do the same with a fast mode I²C device:

```
[0] 0x12
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

In each case, the TAS1020 will return, 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 reg 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] should be the same as the sent one logically or'd with 0x20 - in the second example above (fast mode), the returning packet should be:

```
[0] 0x32
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

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

```
[0] 0x52 --> interface | INTF_ERROR
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

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

```
[0] 0x93 --> 0x13 was sent, which is not valid, so 0x93 is returned
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

Examples above used writes. Reading is similar:

Read two bytes from device starting at register 1 of an I²C device with address A0:

```
[0] 0x01
[1] 0x80
[2] 0x02
[3] 0x01
```

The return packet should be

```
[0] 0x21
[1] 0x80
[2] 0x02
[3] 0x01
[4] 0x45
[5] 0xA0
```

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

6.9.1.1 GPIO Capability

The USB-MODEVM has seven GPIO lines. The user can 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 9](#)):

Table 9. GPIO Pin Assignments

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 0, all others to 1:

```
[0] 0x18 --> write, GPIO
[1] 0x00 --> this value is ignored
[2] 0x01 --> length - ALWAYS a 1
[3] 0x00 --> this value is ignored
[4] 0x3F --> 00111111
```

The user may also read back from the GPIO to see the state of the pins. Suppose the port pins were written as in the previous example.

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 should be:

```
[0] 0x28
[1] 0x00
[2] 0x01
[3] 0x00
[4] 0x3F
```

6.9.2 Writing Scripts

A script is simply a text file that contains data to send to the serial control buses. The scripting language is quite simple, as is the parser for the language. Therefore, the program is not very forgiving about mistakes made in the source script file, but the formatting of the file is simple. Consequently, mistakes should be rare.

Each line in a script file is one command. There is no provision for extending lines beyond one line. A line is terminated by a carriage return.

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

```

i = = = = = =   Set interface bus to use
r = = = = = =   Read from the serial control bus
w = = = = = =   Write to the serial control bus
# = = = = = =   Comment
b = = = = = =   Break
d = = = = = =   Delay

```

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 I2C Bus
i2cfast        Fast mode I2C 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 would begin with:

```
i i2cfast
```

No data follows the break command. Anything following a comment command is ignored by the parser, provided that it is on the same line. The delay command allows the user to specify a time, in milliseconds, that the script will pause before proceeding.

Note: UNLIKE ALL OTHER NUMBERS USED IN THE SCRIPT COMMANDS, THE DELAY TIME IS ENTERED IN A DECIMAL FORMAT. Also, note that because of latency in the USB bus as well as the time it takes the processor on the USB-MODEVM to handle requests, the delay time may not be precise.

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 TAS1020 by the program using the protocol described in [Section 6.9.1](#).

The first byte following a read or 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 will vary 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 6.9.1](#) 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 0x45 0xA0 to an I²C device with a slave address of 0x80, starting at a register address of 0x01, one would write:

```
#example script
i i2cfast
w 80 01 45 A0
r 80 01 02
```

This script begins with a comment, specifies that a fast I²C bus will be used, then writes 0x45 0xA0 to the I²C slave device at address 0x80, writing the values into registers 0x01 and 0x02. The script then reads back two bytes from the same device starting at register address 0x01. Note that the slave device value does not change. **It is not necessary to set the R/W bit for I²C devices in the script**; the read or write commands will do that for the user.

Any text editor may 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 Command File...* from the File menu. Locate the script and open it. The script will then be displayed in the command buffer. The user may also edit the script once it is in the buffer and save it as specified in [Section 6.9](#).

Once the script is in the command buffer, it may be executed by pressing the *Execute Command Buffer* button. If the user has placed breakpoints in the script, it will execute to that point, and a dialog box will show up with a continue button to continue executing the script.

Please refer to sections 3.1 (Power Down and Reset) and section 3.2 (AIC12 Control Register Programming Procedures) on the [TLV320AIC12/13/14/15 Codec Operating In Stand-Alone Slave Mode](#) application note for important details on programming the codec.

Special care must be taken when writing subregisters (4A-4B and 5A-5D).

Example: w 80 01 45 A0 01 20 B8 00

The previous command writes registers 1, 2, 3, 4A, 5C and 6. **It will not increment from 3 to 4A and then to 4B.** The subregister to be written will depend on the data.

Here is an example of a script:

```
# TLV320AIC12K/14K
# This configuration allows playing audio to the DAC from any media player on
# a computer and recording from the ADC on audio recording software. Pin
# MICIN is configured as the input. The input can be heard via OUTP1/M1 and
# OUTP2/P3 due to the digital sidetone. Audio files played on the computer
# can also be heard via those outputs.
#
# Hardware reset codec using TAS1020B's GPIO pin P3.5
i gpio
w 00 00 3F
# Delay has to be at least 6 MCLK cycles ~ 540ns
d 1
w 00 00 7F
#
# I2C interface
i i2cstd
#
# reg 03 - Software reset
w 80 03 21
#
# reg 01 - Clear ADC and DAC overflow flags.
r 80 01 01
#
# reg 02 - Turbo Mode
w 80 01 A0
#
# reg 04 - Set clock divider values (4A and 4B). P=8, M=1, N=4.
w 80 04 20
w 80 04 81
#
# reg 05 - 5B -> DAC PGA=-32dB, 5C -> Input Buffer Gain=24dB,
# Digital Sidetone Gain=-3dB. Defaults used for 5A and 5D.
w 80 05 4A
w 80 05 83
#
# reg 06 - MICIN with external common mode, OUTP2/P3 drivers on.
w 80 06 1C
#
# reg 01 - Continuous data transfer mode, 16 bits.
w 80 01 41
```

7 EVM Bill of Materials

Table 10 and Table 11 contain a complete bill of materials for the modular TLV320AIC12KEVMB/14KEVMB and the USB-MODEVM Interface Board.

Table 10. TLV320AIC12KEVMB/14KEVMB Bill of Materials

REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER	MFG PART NUMBER
R7, R8	0Ω 1/10W 5% chip resistor	Panasonic (or equivalent)	ERJ-3GEY0R00V
R5	2.7kΩ 1/10W 5% chip resistor	Panasonic (or equivalent)	ERJ-3GEYJ272V
R1-R4, R6	10kΩ 1/10W 5% chip resistor	Panasonic (or equivalent)	ERJ-3GEYJ103V
C8-C10, C19	0.1μF 6.3V ceramic chip capacitor, ±10%, X5R	TDK (or equivalent)	C1005X5R0J104K
C1–C6, C11, C12, C20, C21	0.1μF 25V ceramic chip capacitor, ±5%, X7R	TDK (or equivalent)	C1608X7R1E104K
C13-C15, C18	10μF 6.3V ceramic chip capacitor, ±10%, X5R	Panasonic (or equivalent)	ECJ-1VB0J106M
C16, C17	10μF 16V ceramic chip capacitor, ±20%, X5R	TDK (or equivalent)	C3216X5R0J106M
C22, C23	47μF 10V ceramic chip capacitor, ±10%, X5R	Murata (or equivalent)	GRM32ER61A476KE20L
U1	Audio codec	Texas Instruments	TLV320AIC12KIDBT TLV320AIC14KIDBT
U2	3.3V LDO voltage regulator	Texas Instruments	REG1117-3.3
U3	64K I ² C EEPROM	MicroChip	24LC64-I/SN
U4	Pos edge triggered D Flip-flop	Texas Instruments	SN74AUP1G74
J6, J9, J10	Screw terminal block, 2-position	On Shore Technology	ED555/2DS
J7	Screw terminal block, 3-position	On Shore Technology	ED555/3DS
J8, J11	3.5mm audio jack, T-R-S, SMD	CUI Inc.	SJ1-3515-SMT
J1A, J2A, J4A, J5A	20-pin SMT plug	Samtec	TSM-110-01-L-DV-P
J1B, J2B, J4B, J5B	20-pin SMT socket	Samtec	SSW-110-22-F-D-VS-K
J3A	10-pin SMT plug	Samtec	TSM-105-01-L-DV-P
J3B	10-pin SMT socket	Samtec	SSW-105-22-F-D-VS-K
N/A	TLV320AIC12KEVMB/14KEVMB PWB	Texas Instruments	6488702
W3, W4, W6-W10, W12	2-position jumper, 0.1" spacing	Samtec	TSW-102-07-L-S
W1, W2, W5, W11	3-position jumper, 0.1" spacing	Samtec	TSW-103-07-L-S
MK1	Omnidirectional microphone cartridge	Knowles Acoustics	MD9745APZ-F
SW1	Switch LT TOUCH 6X3.5 240GF SMD	Panasonic - ECG	EVQ-PJU04K
SW2	4PDT right angle switch	E-Switch	EG4208
TP13–TP16, TP27	PC Test Point - Miniature (red)	Keystone Electronics	5000
TP11, TP12	PC Test Point - Miniature (black)	Keystone Electronics	5001
TP1-TP10, TP17-TP26	PC Test Point - Miniature (white)	Keystone Electronics	5002
N/A	Header shorting block	Samtec	SNT-100-BK-T

Table 11. USB-MODEVM Bill of Materials

Designators	Description	Manufacturer	Mfg. Part Number
R4	10Ω 1/10W 5% chip resistor	Panasonic	ERJ-3GEYJ100V
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-3GEYJ152V
R1, R2, R3, R5, R6, R7, 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-3GEYJ103V
R17, R18	100kΩ 1/10W 5% chip resistor	Panasonic	ERJ-3GEYJ104V
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, C10, C11, C12, C22, C23, C24, C25, C26, C27, C28	1μF 6.3V ceramic chip capacitor, ±10%, X5R	TDK	C1608X5R0J105K
C1, C2, C3, C4, C5, C6, C7, C8	10μF 6.3V ceramic chip capacitor, ±10%, X5R	TDK	C3216X5R0J106K
D1	50V, 1A, Diode MELF SMD	Micro Commercial Components	DL4001
D2	Yellow Light Emitting Diode	Lumex	SML-LX0603YW-TR
D3, D4, D6, 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, U6, 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	24LC64I/SN
	USB-MODEVM PCB	Texas Instruments	6463995

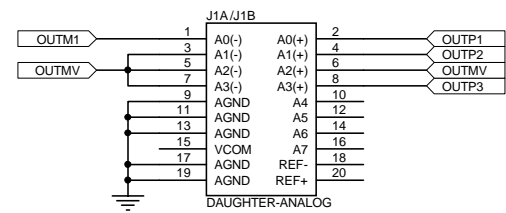
Table 11. USB-MODEVM Bill of Materials (continued)

Designators	Description	Manufacturer	Mfg. Part Number
TP1, TP2, TP3, TP4, TP5, TP6, TP9, TP10, 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
J1, J2, J3, J4, J5, J8	2-position terminal block	On Shore Technology	ED555/2DS
J9	2.5mm power connector	CUI Stack	PJ-102B
J10	BNC connector, female, PC mount	AMP/Tyco	414305-1
J11A, J12A, J21A, J22A	20-pin SMT plug	Samtec	TSM-110-01-L-DV-P
J11B, J12B, J21B, J22B	20-pin SMT socket	Samtec	SSW-110-22-F-D-VS-K
J13A, J23A	10-pin SMT plug	Samtec	TSM-105-01-L-DV-P
J13B, 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
J14, J15	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
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

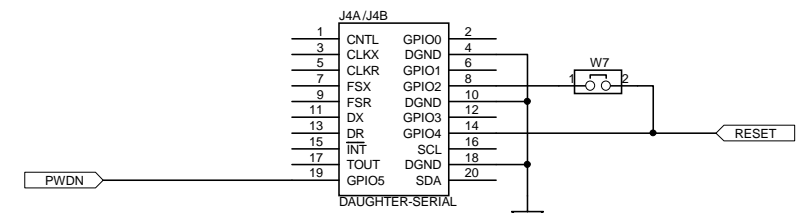
Appendix A TLV320AIC12KEVMB/14KEVMB Schematic

The schematic diagram is provided as a reference.

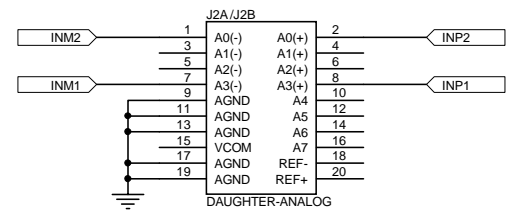
REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



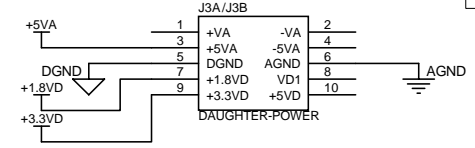
J1A (TOP) = SAMTEC - P/N: TSM-110-01-L-DV-P
 J1B (BOTTOM) = SAMTEC - P/N: SSW-110-22-F-D-V



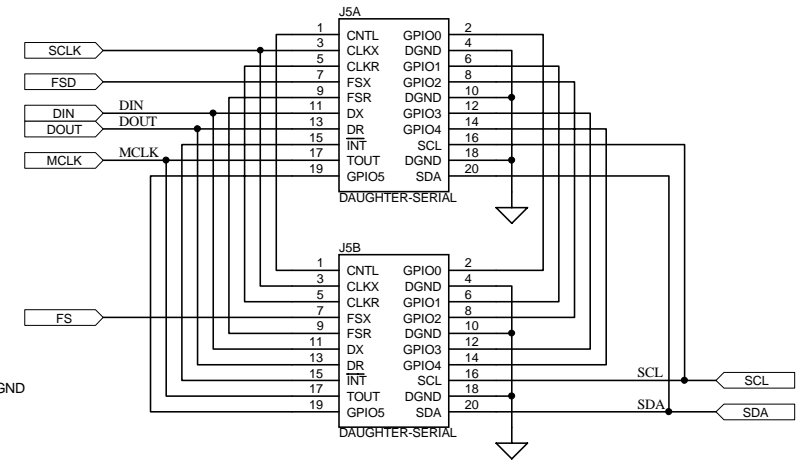
J4A (TOP) = SAMTEC - P/N: TSM-110-01-L-DV-P
 J4B (BOTTOM) = SAMTEC - P/N: SSW-110-22-F-D-V



J2A (TOP) = SAMTEC - P/N: TSM-110-01-L-DV-P
 J2B (BOTTOM) = SAMTEC - P/N: SSW-110-22-F-D-VS-I



J3A (TOP) = SAMTEC - P/N: TSM-105-01-L-DV-P
 J3B (BOTTOM) = SAMTEC - P/N: SSW-105-22-F-D-V

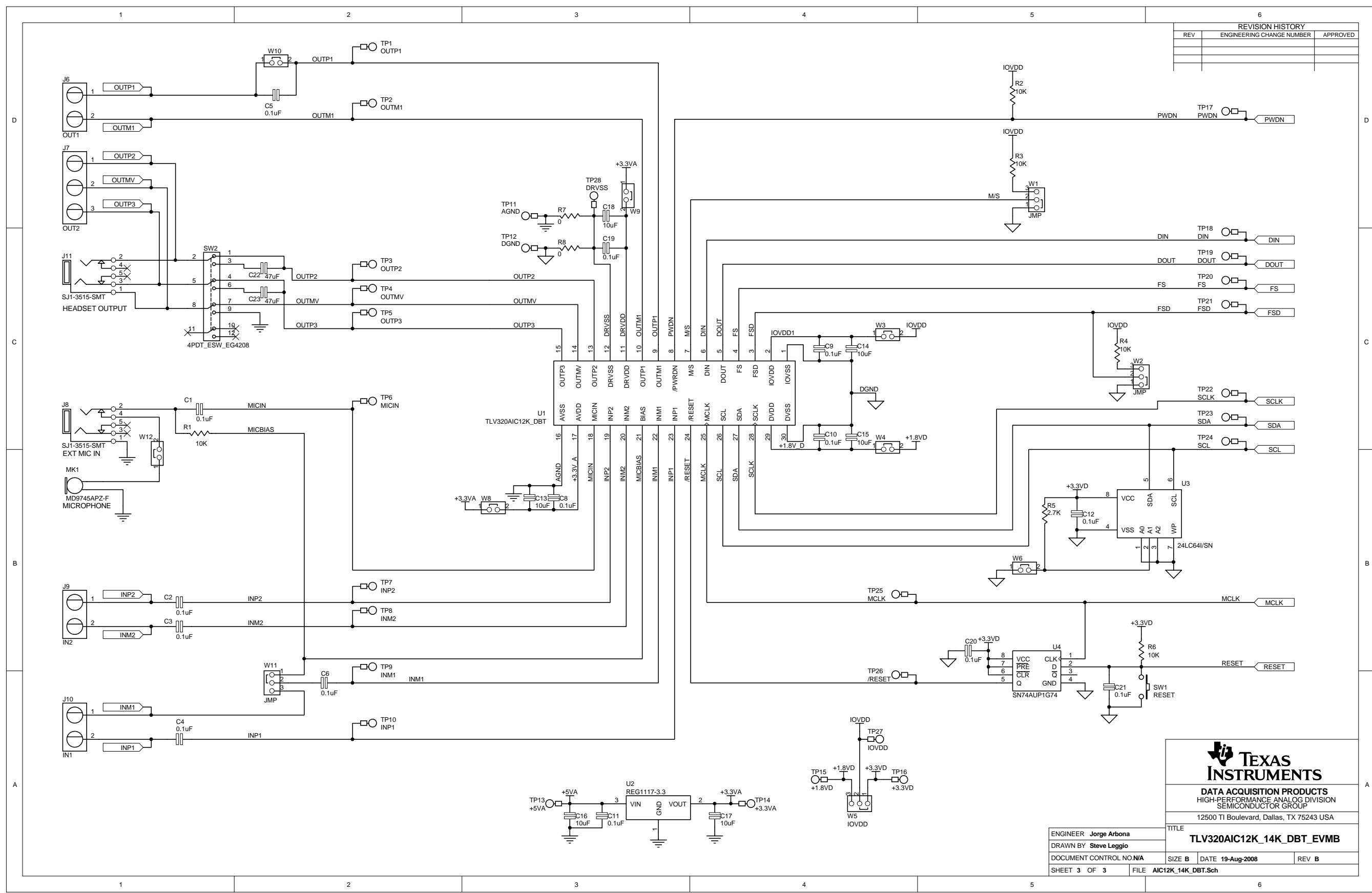


J5A (TOP) = SAMTEC - P/N: TSM-110-01-L-DV-P
 J5B (BOTTOM) = SAMTEC - P/N: SSW-110-22-F-D-V

TEXAS INSTRUMENTS
 DATA ACQUISITION PRODUCTS
 HIGH-PERFORMANCE ANALOG DIVISION
 SEMICONDUCTOR GROUP
 12500 TI Boulevard, Dallas, TX 75243 USA

ENGINEER	Jorge Arbona	TITLE	TLV320AIC12K_14K_DBT_EVMB
DRAWN BY	Steve Leggio	SIZE	B
DOCUMENT CONTROL NO./NA		DATE	19-Aug-2008
SHEET 2 OF 3	FILE	Daughtercard_Interface.Sch	REV B

REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



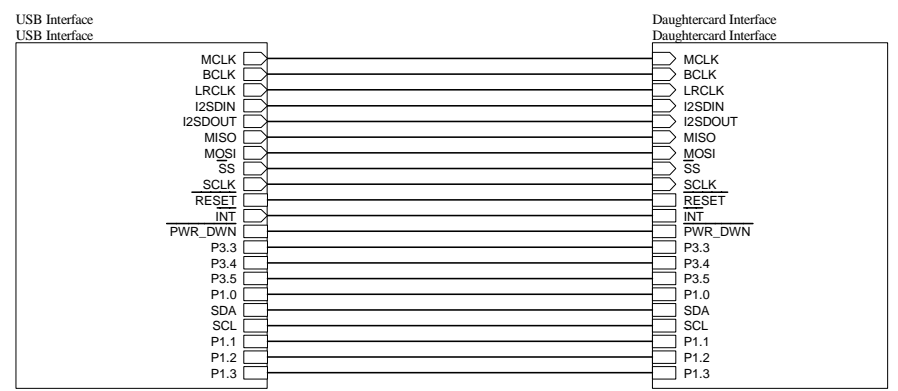
TEXAS INSTRUMENTS
 DATA ACQUISITION PRODUCTS
 HIGH-PERFORMANCE ANALOG DIVISION
 SEMICONDUCTOR GROUP
 12500 TI Boulevard, Dallas, TX 75243 USA

TITLE			
TLV320AIC12K_14K_DBT_EVMB			
ENGINEER	Jorge Arbona	DATE	19-Aug-2008
DRAWN BY	Steve Leggio	SIZE	B
DOCUMENT CONTROL NO./NA		REV	B
SHEET 3 OF 3	FILE	AIC12K_14K_DBT.Sch	

Appendix B USB-MODEVM Schematic

The schematic diagram is provided as a reference.

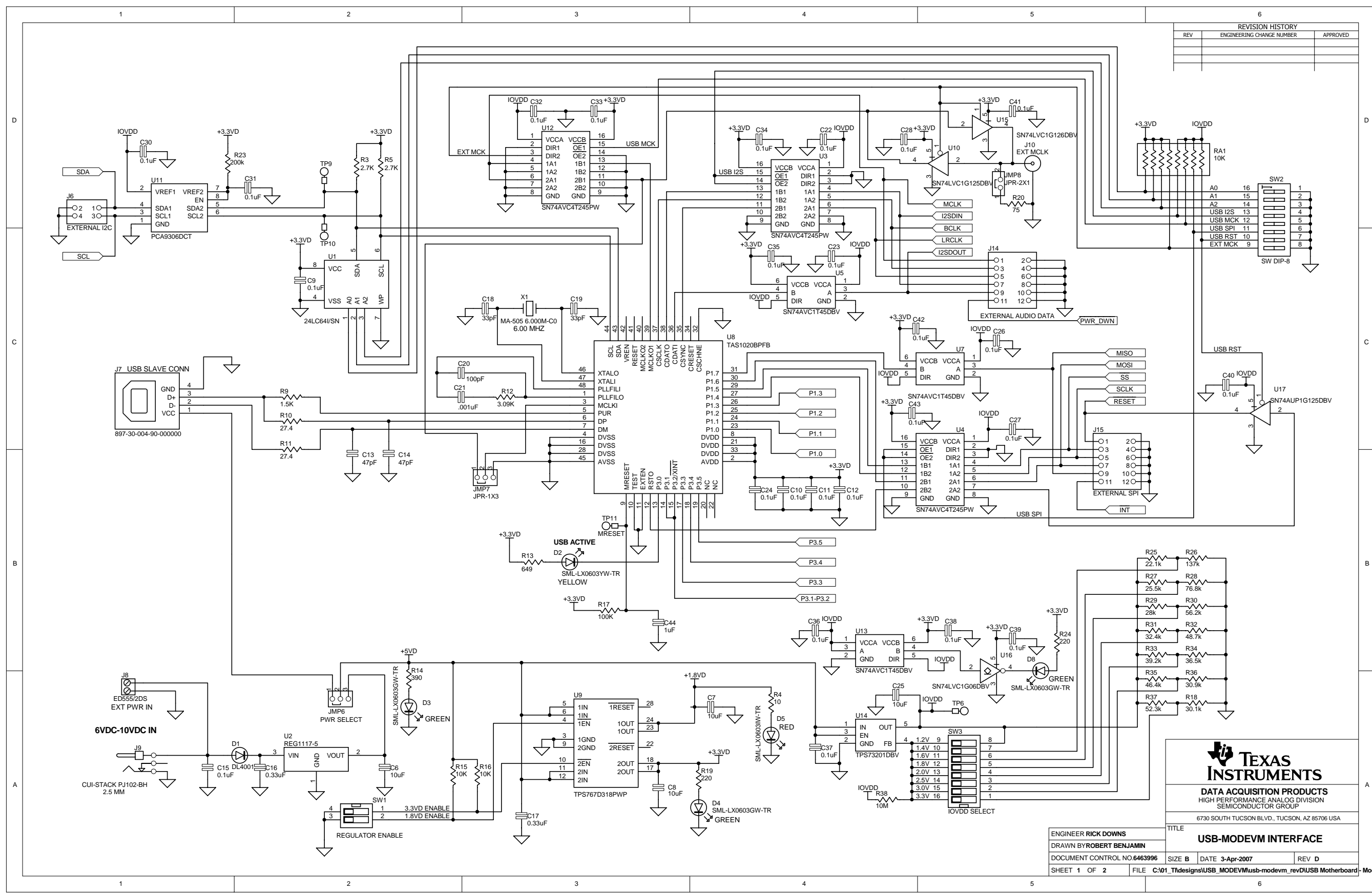
REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



TEXAS INSTRUMENTS
 DATA ACQUISITION PRODUCTS
 HIGH-PERFORMANCE ANALOG DIVISION
 SEMICONDUCTOR GROUP
 6730 SOUTH TUCSON BLVD., TUCSON, AZ 85706 USA

ENGINEER FRYE D. ZERKETTIS	TITLE	
DRAWN BY I. C. SPOTTS	untitled	
DOCUMENT CONTROL NO.1234567	SIZE B	DATE dd MMM yyyy
SHEET 1 OF 1	FILE ???	REV A

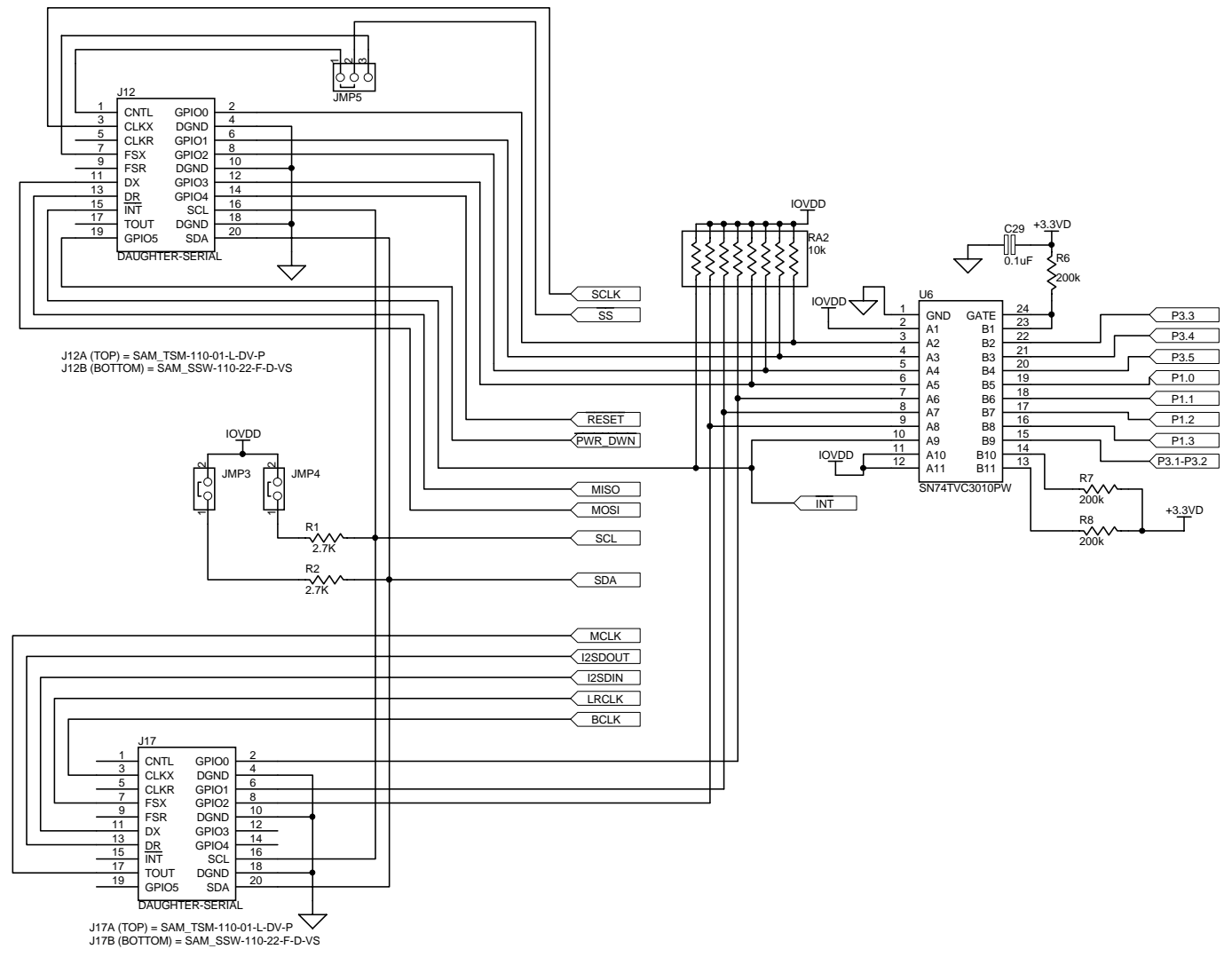
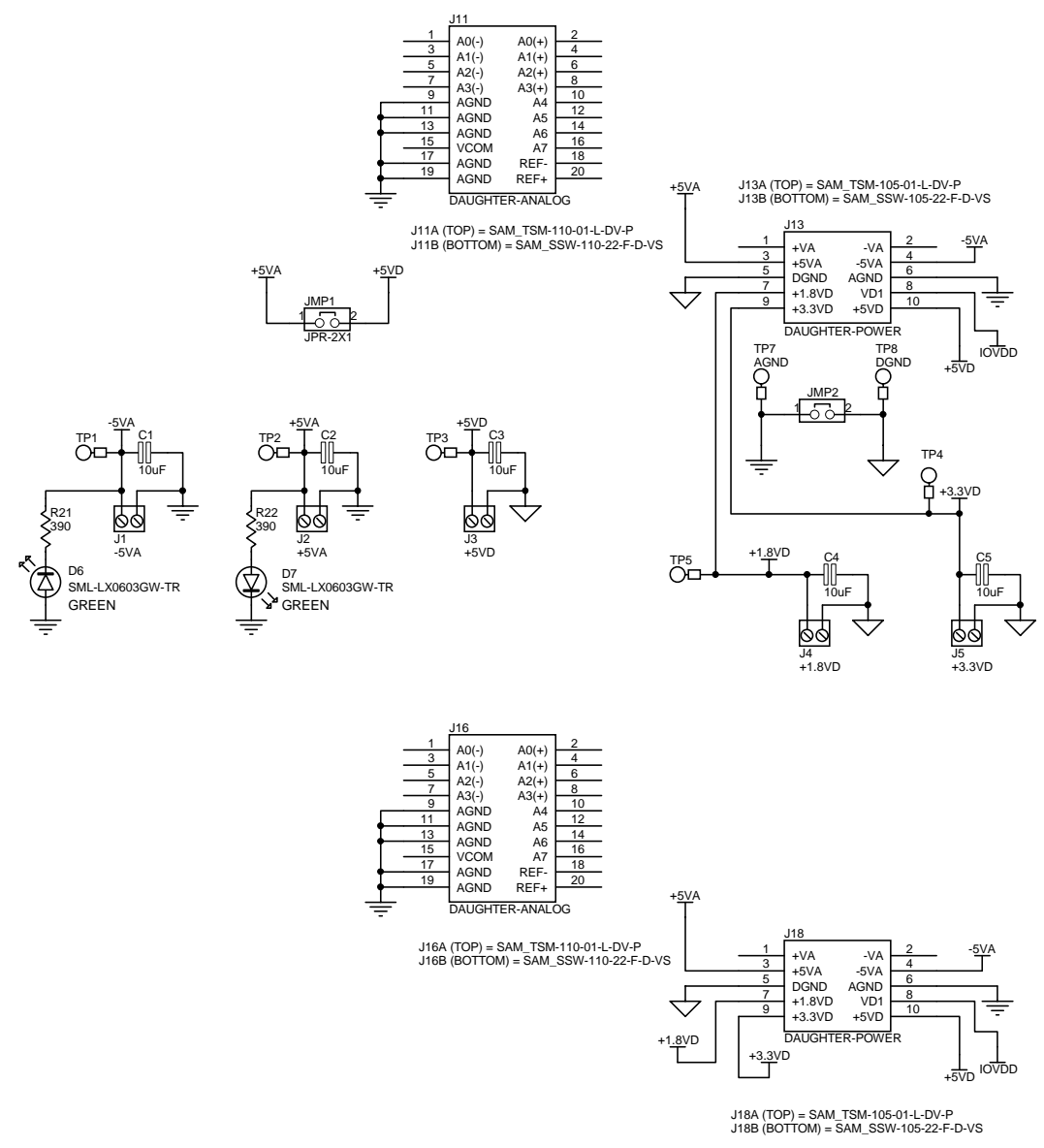
REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



TEXAS INSTRUMENTS
 DATA ACQUISITION PRODUCTS
 HIGH PERFORMANCE ANALOG DIVISION
 SEMICONDUCTOR GROUP
 6730 SOUTH TUCSON BLVD., TUCSON, AZ 85706 USA

ENGINEER RICK DOWNS		TITLE	
DRAWN BY ROBERT BENJAMIN		USB-MODEM INTERFACE	
DOCUMENT CONTROL NO. 6463996	SIZE B	DATE 3-Apr-2007	REV D
SHEET 1 OF 2	FILE C:\01_Ttdesigns\USB_MODEM\usb-modevm_revD\USB Motherboard-ModEvm.ddb - Documents\SCHUSB Interface		

REVISION HISTORY		
REV	ENGINEERING CHANGE NUMBER	APPROVED



ENGINEER RICK DOWNS	TITLE		
DRAWN BY ROBERT BENJAMIN	USB-MODEVM INTERFACE		
DOCUMENT CONTROL NO. 6463996	SIZE B	DATE 3-Apr-2007	REV D
SHEET 2 OF 2	FILE C:\01_Tfdesigns\USB_MODEVM\usb-modevm_revD\USB Motherboard - ModEvm.ddb - Documents\SCH\Daughtercard Interface		

FCC Warnings

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

EVM WARNINGS AND RESTRICTIONS

It is important to operate the EVM daughterboard within the input voltage range of 3.3 V to 5 V and the output voltage range of 0 V to 5 V and the EVM motherboard within the input voltage range of 6 VDC to 10 VDC when using an external AC/DC power supply. Refer to the USB-MODEVM Interface Power section of this manual when using lab power supplies.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 30°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright 2008, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated