

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 |

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Windows is a registered trademark of Microsoft Corporation.
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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 OUTP1. 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.

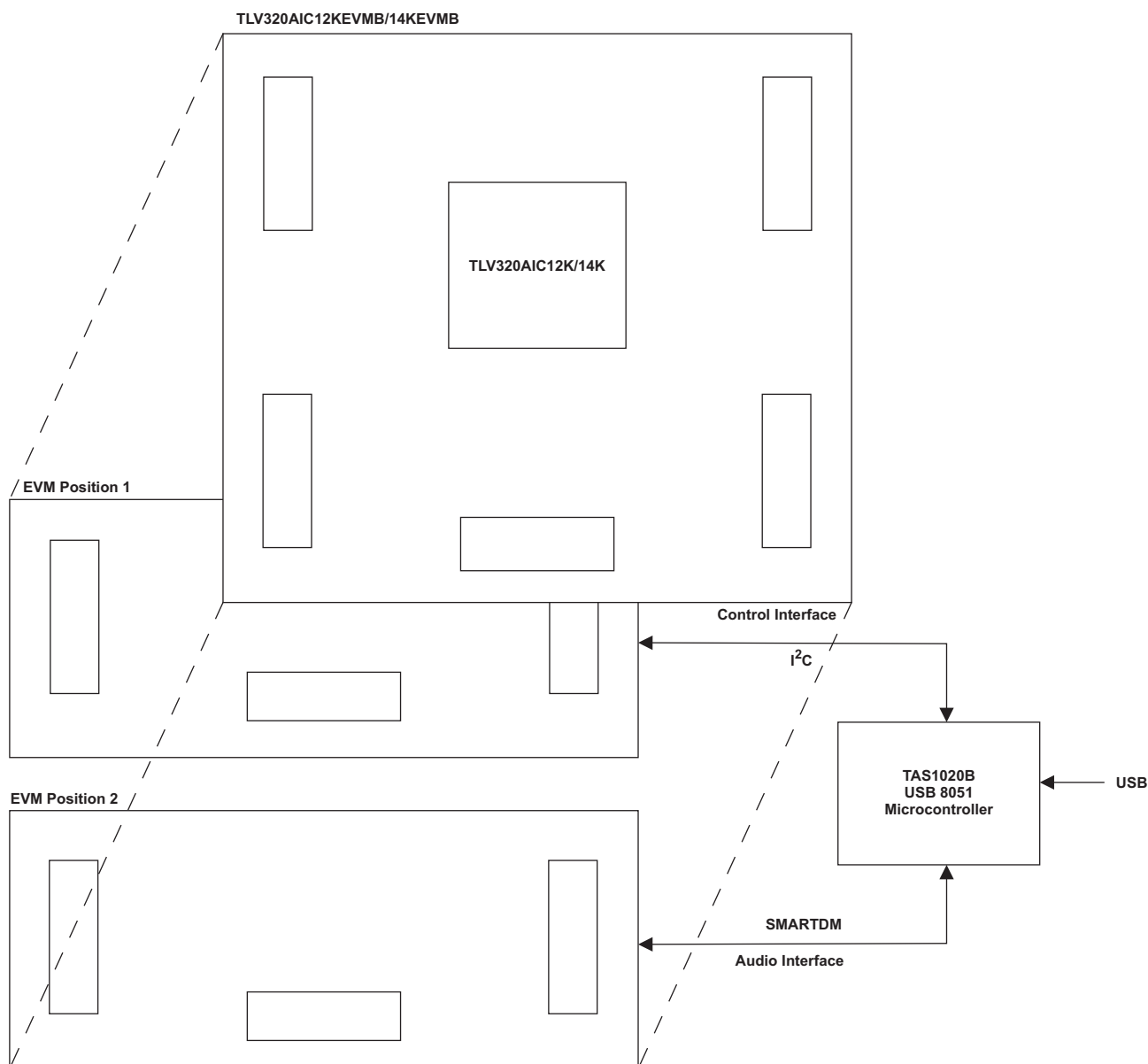


Figure 1. TLV320AIC12KEVMB-K/14KEVMB-K Block Diagram

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.

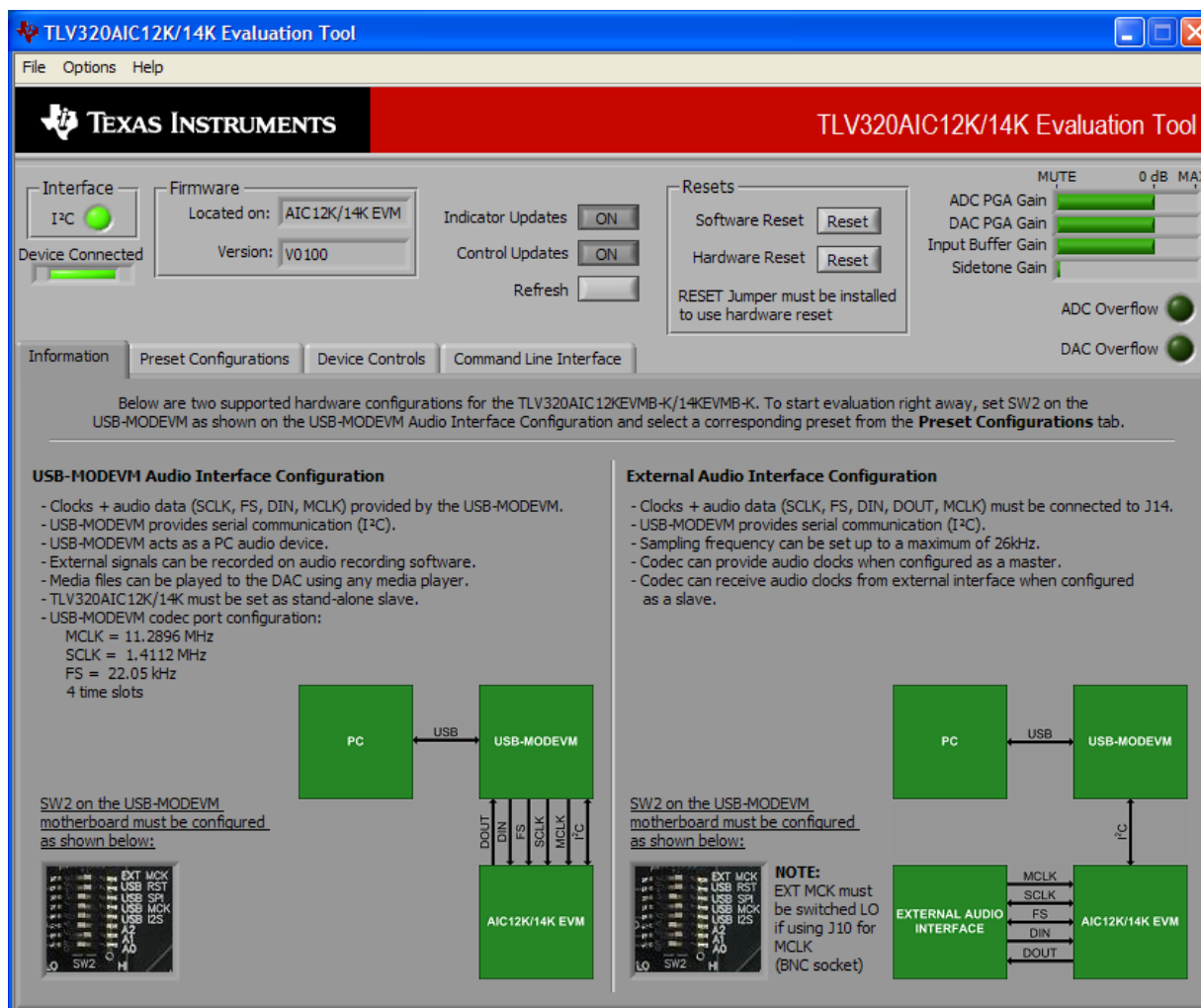


Figure 2. Default Software Screen

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](#).

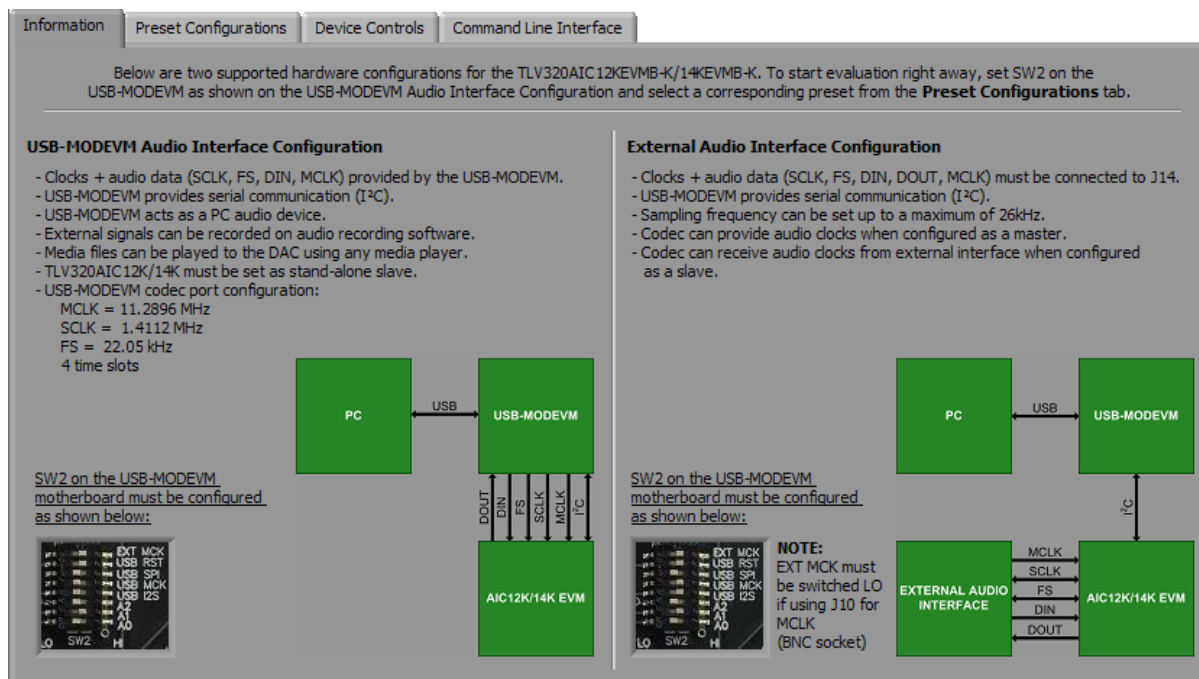


Figure 3. Information Tab

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](#).

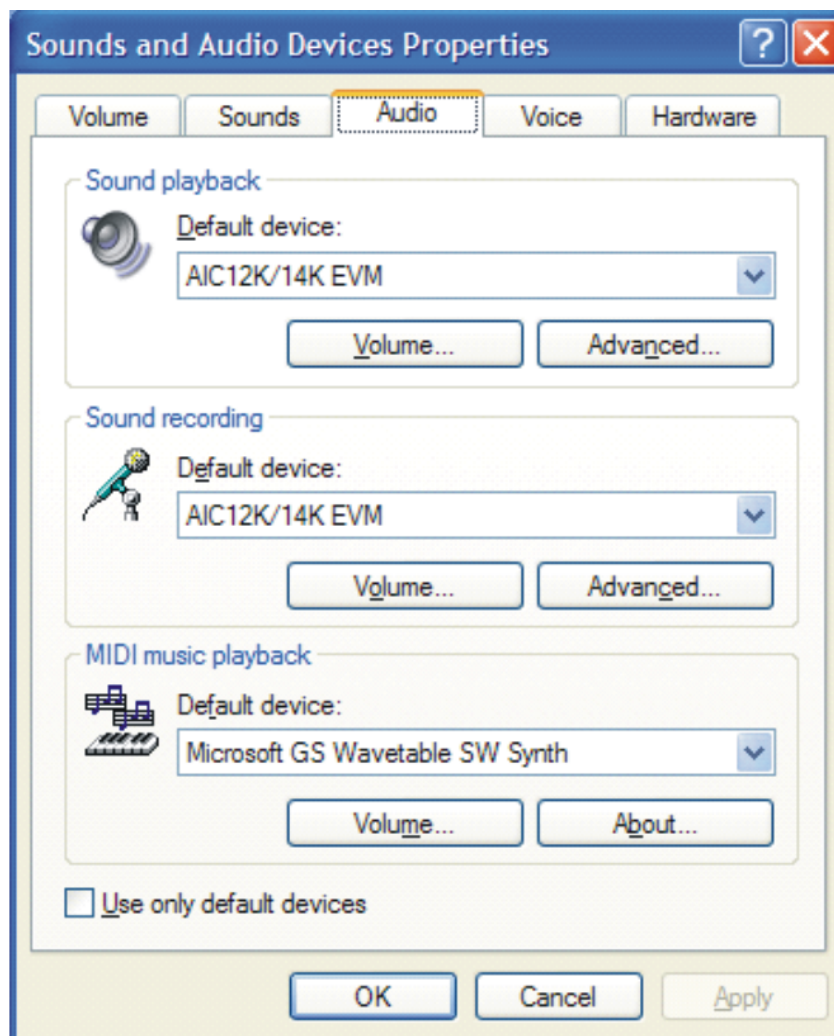


Figure 4. Sounds and Audio Devices Properties

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).

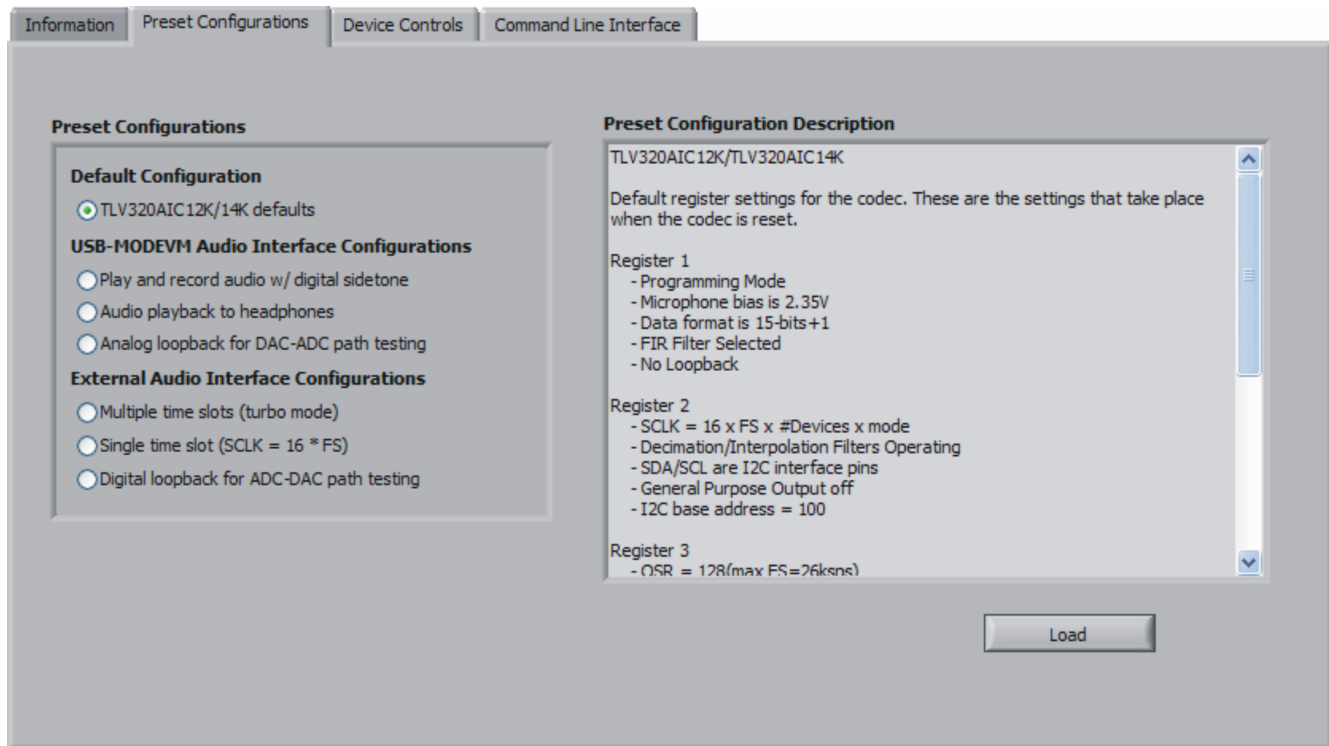


Figure 5. Preset Configurations

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.

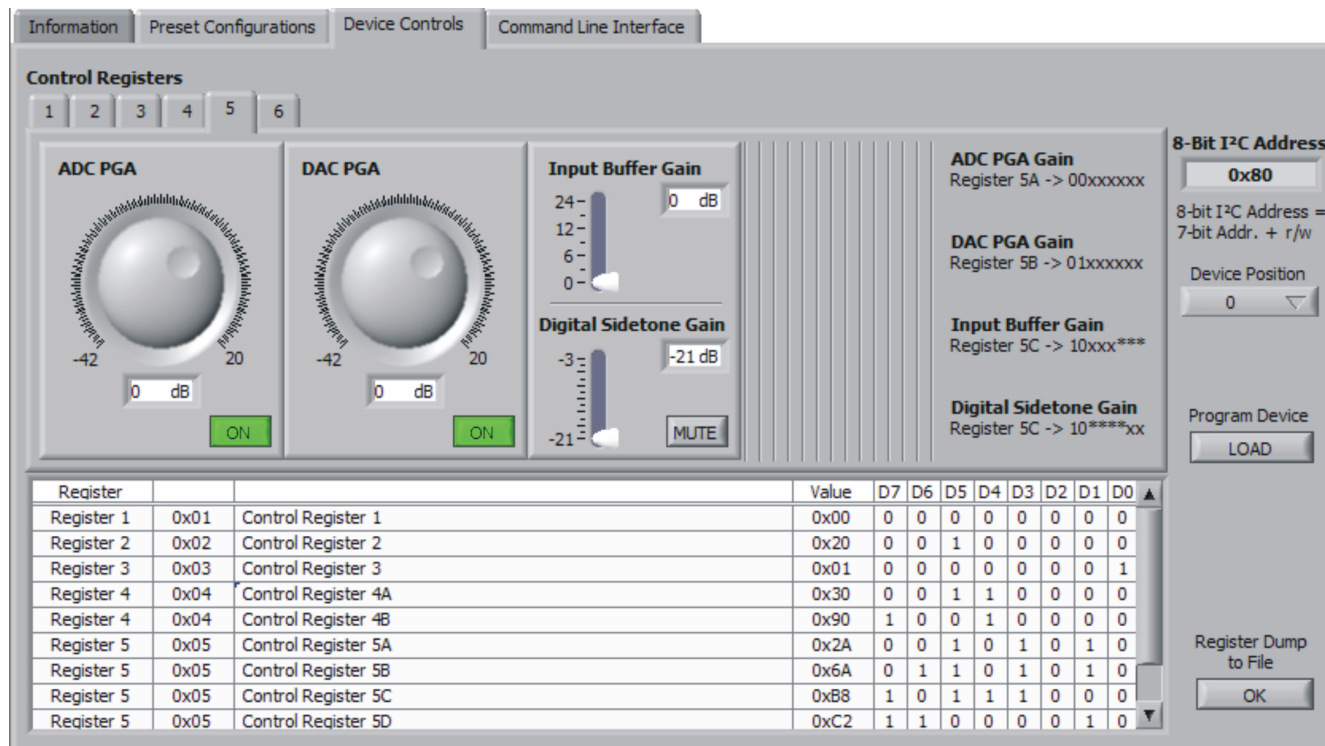


Figure 6. Device Controls Tab

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.

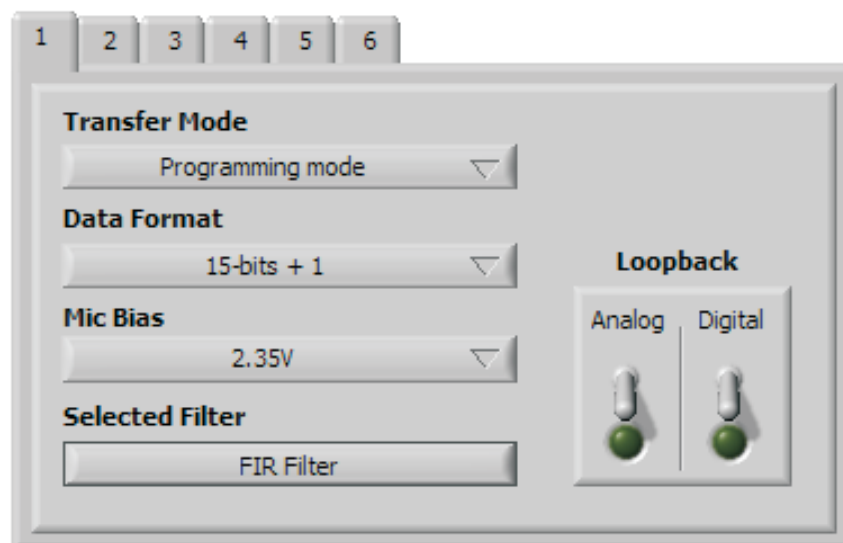


Figure 7. Control Register 1 Tab

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.

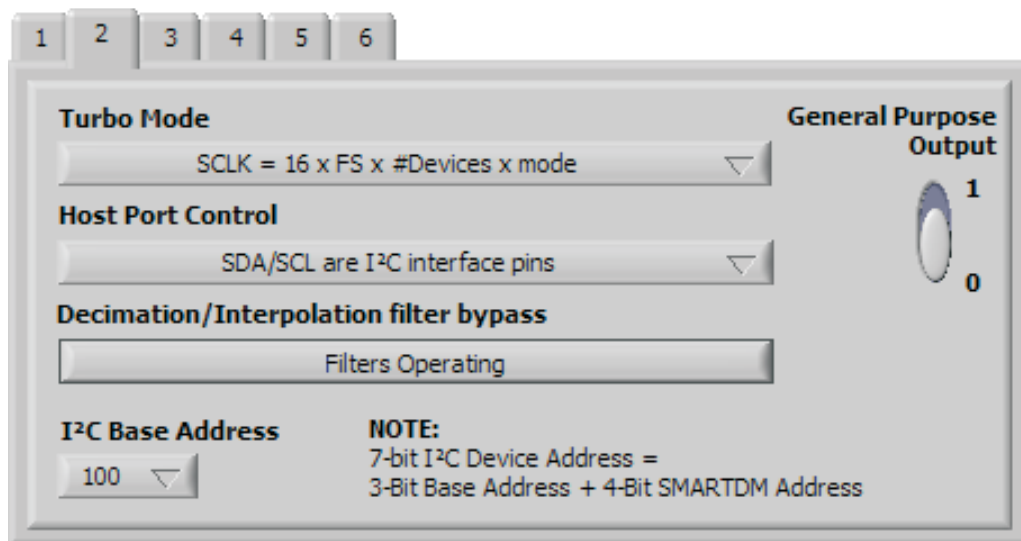


Figure 8. Control Register 2 Tab

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.

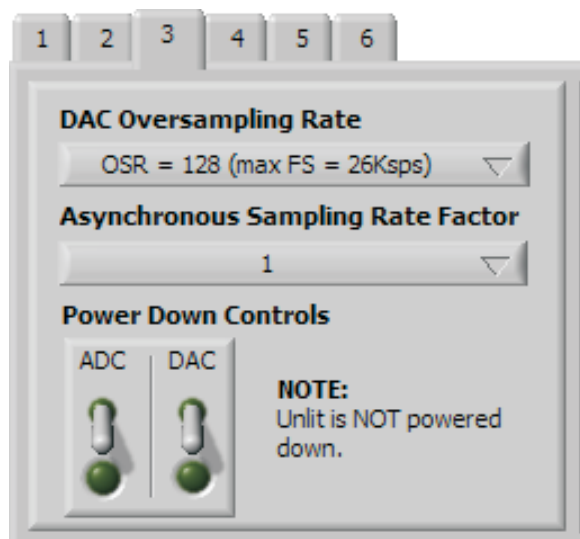


Figure 9. Control Register 3 Tab

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.

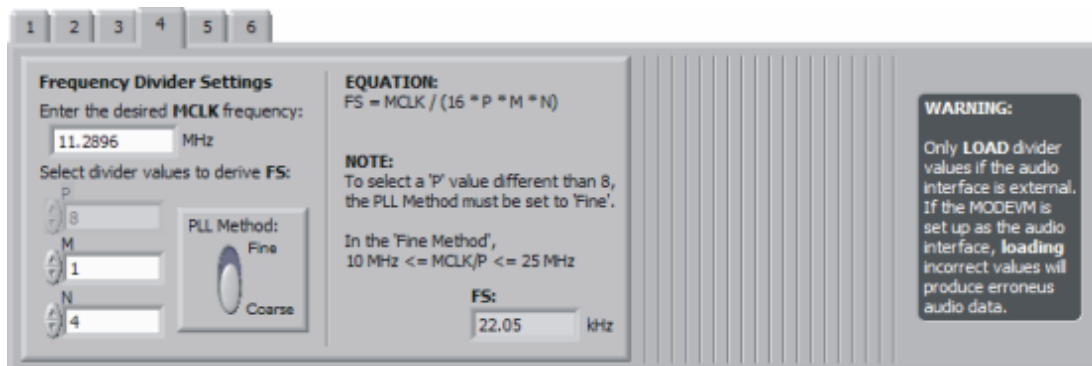


Figure 10. Control Register 4 Tab

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.

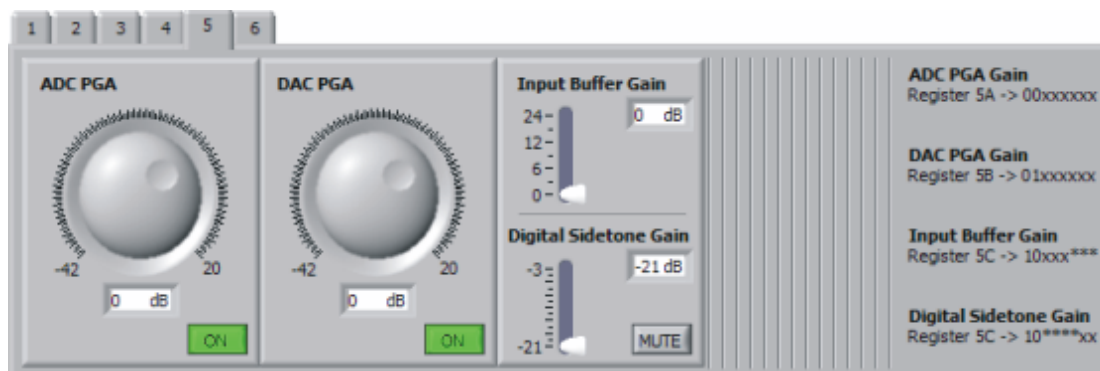


Figure 11. Control Register 5 Tab

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.

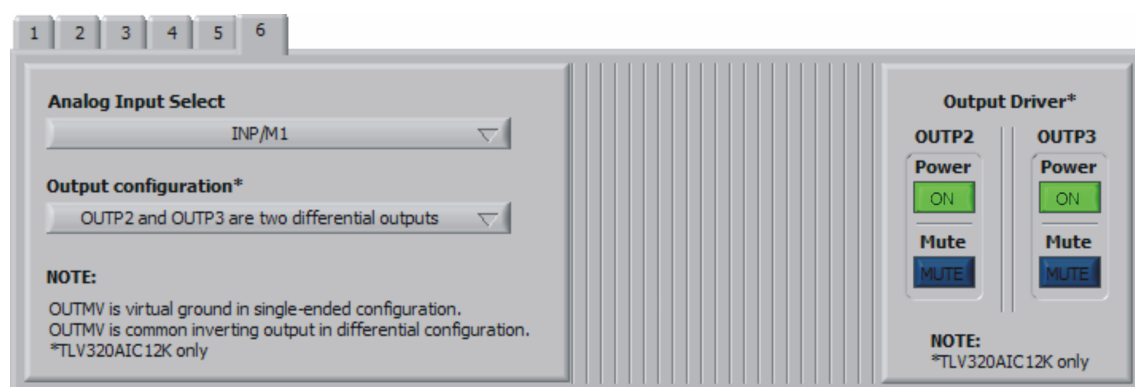


Figure 12. Control Register 6 Tab

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.

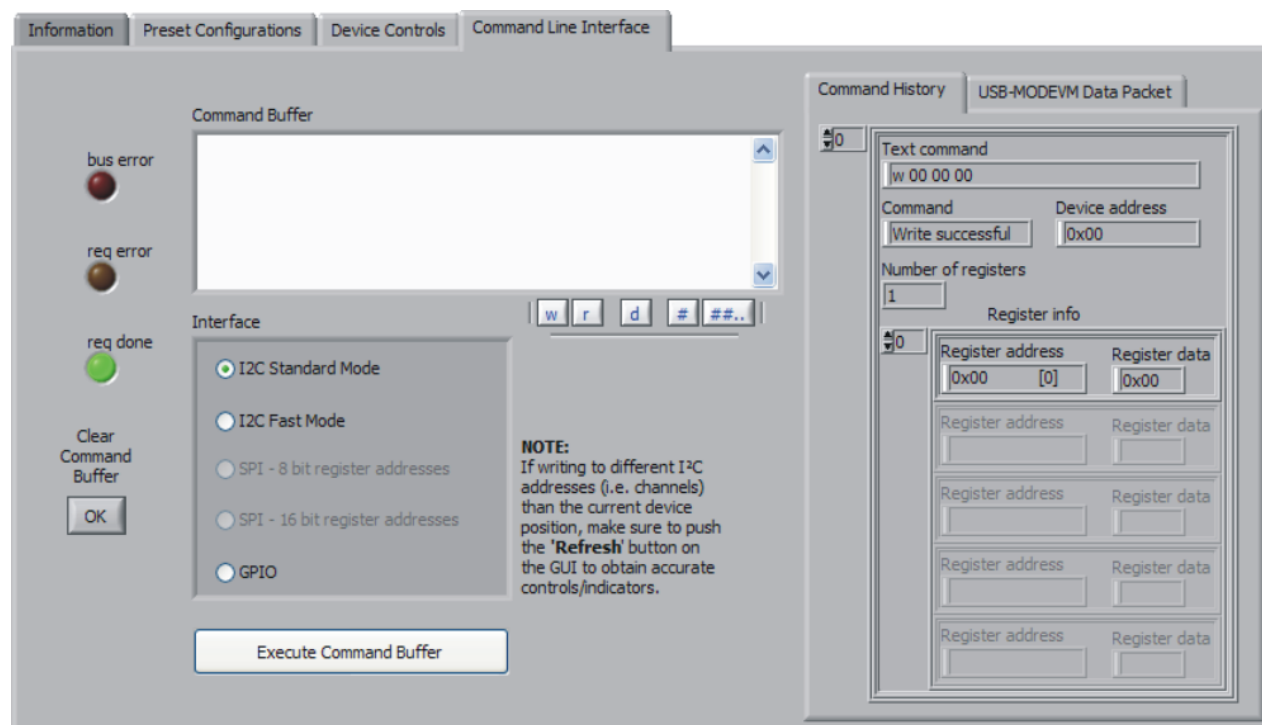


Figure 13. Command Line Interface Tab

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.

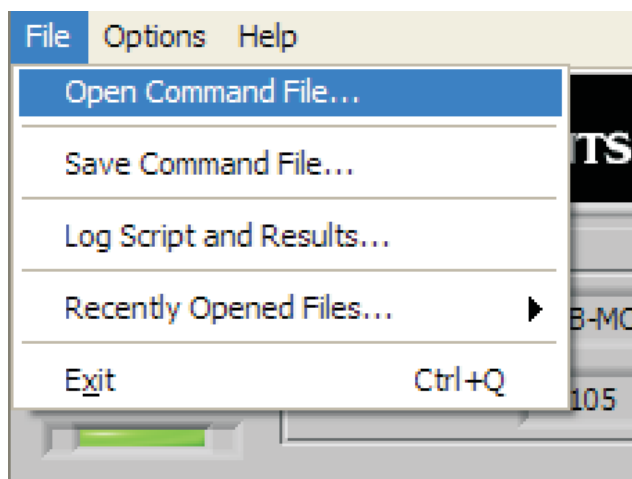


Figure 14. File Menu

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.

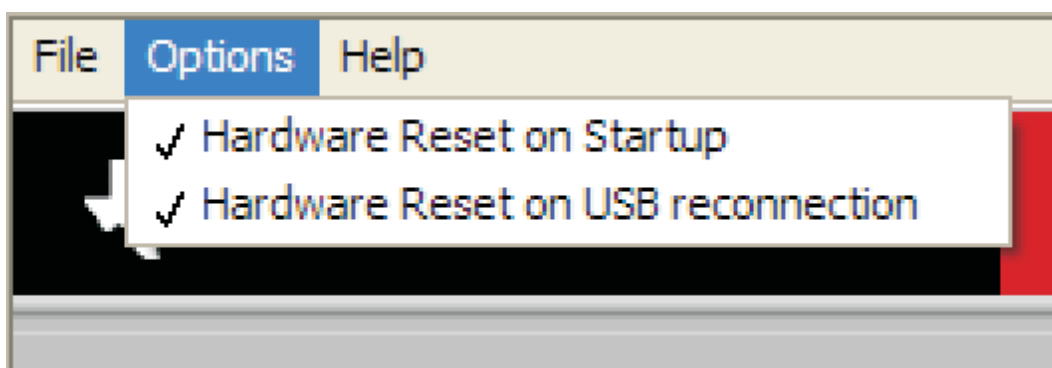


Figure 15. Options Menu

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

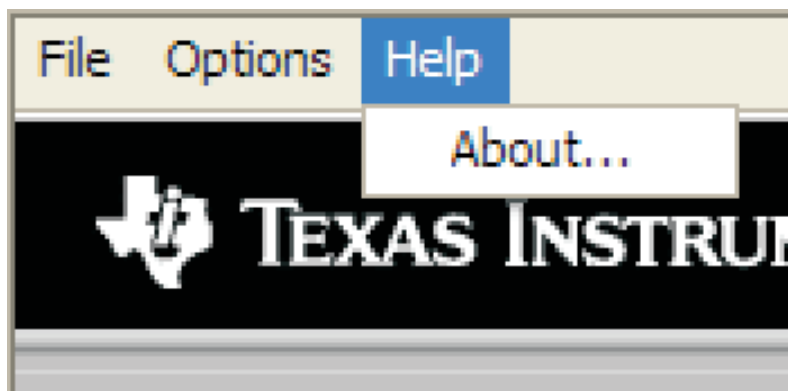


Figure 16. Help

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><tr><td>READ</td><td>0x00</td></tr><tr><td>WRITE</td><td>0x10</td></tr></table> <p>Interface:</p> <table><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

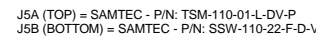
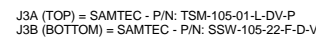
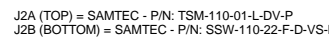
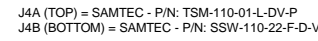
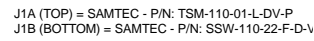
| Designators | Description | Manufacturer | Mfg. Part Number |
|--|--|-----------------------------|------------------|
| R4 | 10Ω 1/10W 5% chip resistor | Panasonic | ERJ-3GEYJ100V |
| R10, R11 | 27.4Ω 1/16W 1% chip resistor | Panasonic | ERJ-3EKF27R4V |
| R20 | 75Ω 1/4W 1% chip resistor | Panasonic | 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.

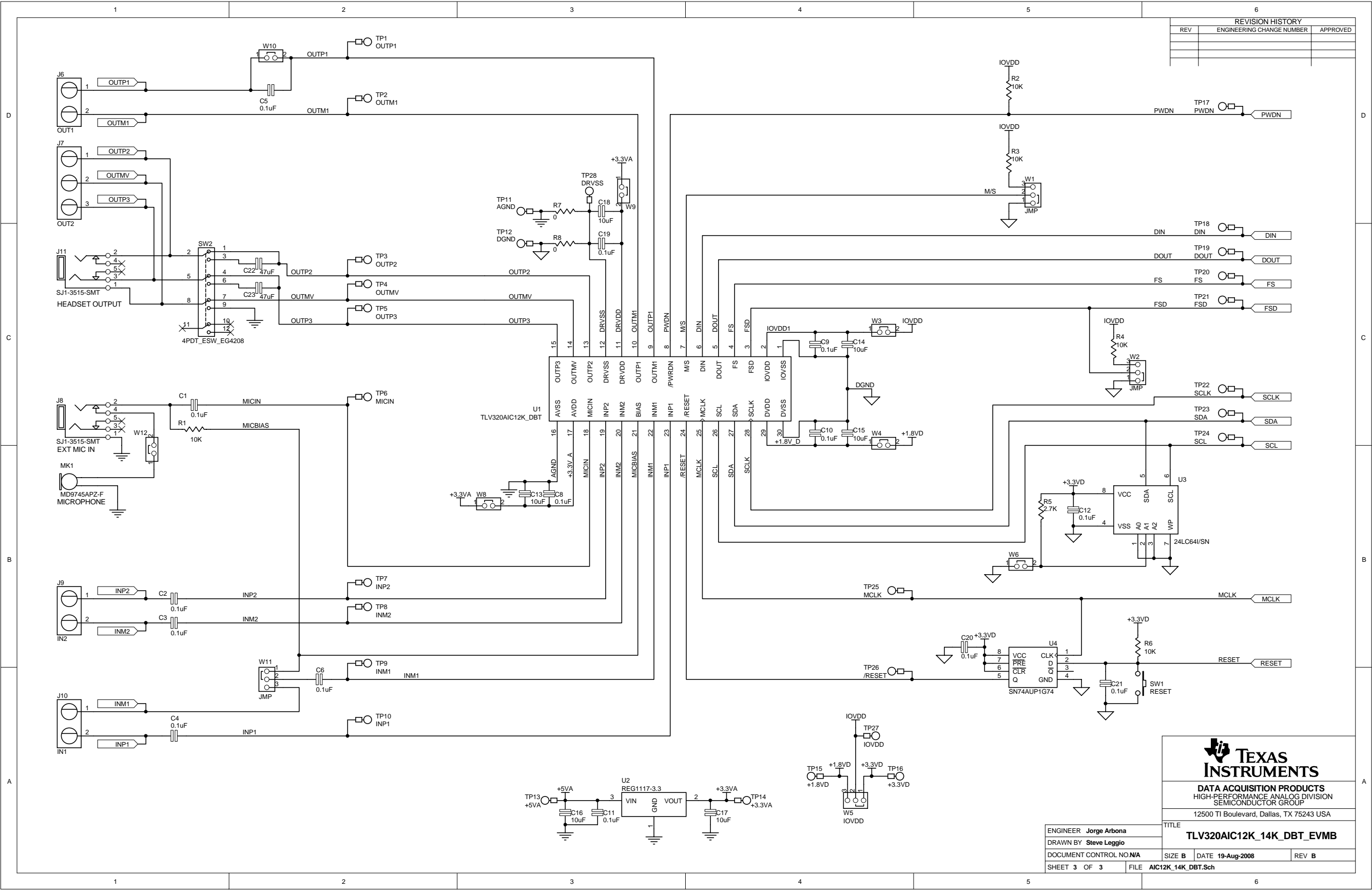


**TEXAS
INSTRUMENTS**

DATA ACQUISITION PRODUCTS
HIGH-PERFORMANCE ANALOG DIVISION
SEMICONDUCTOR GROUP

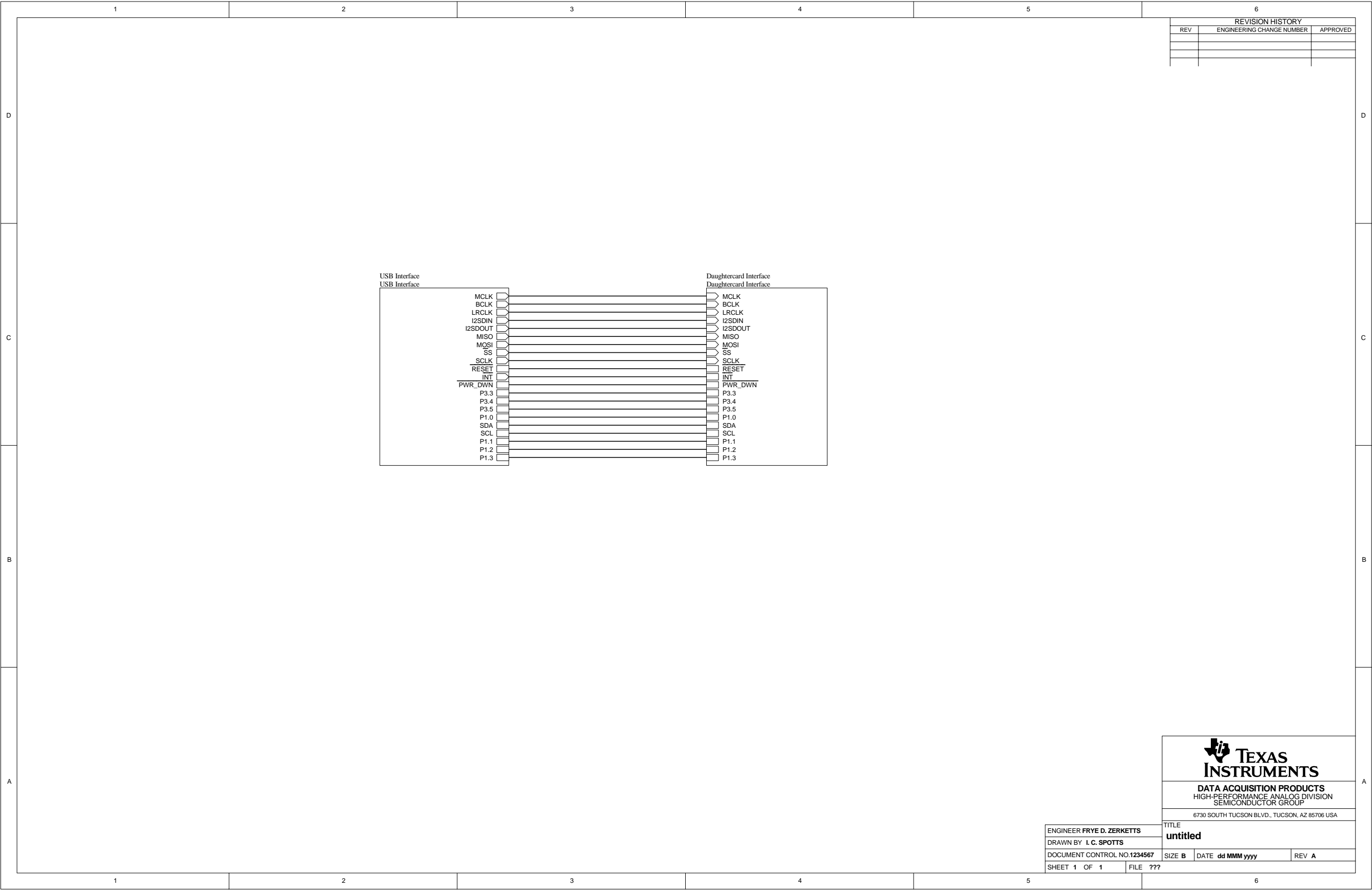
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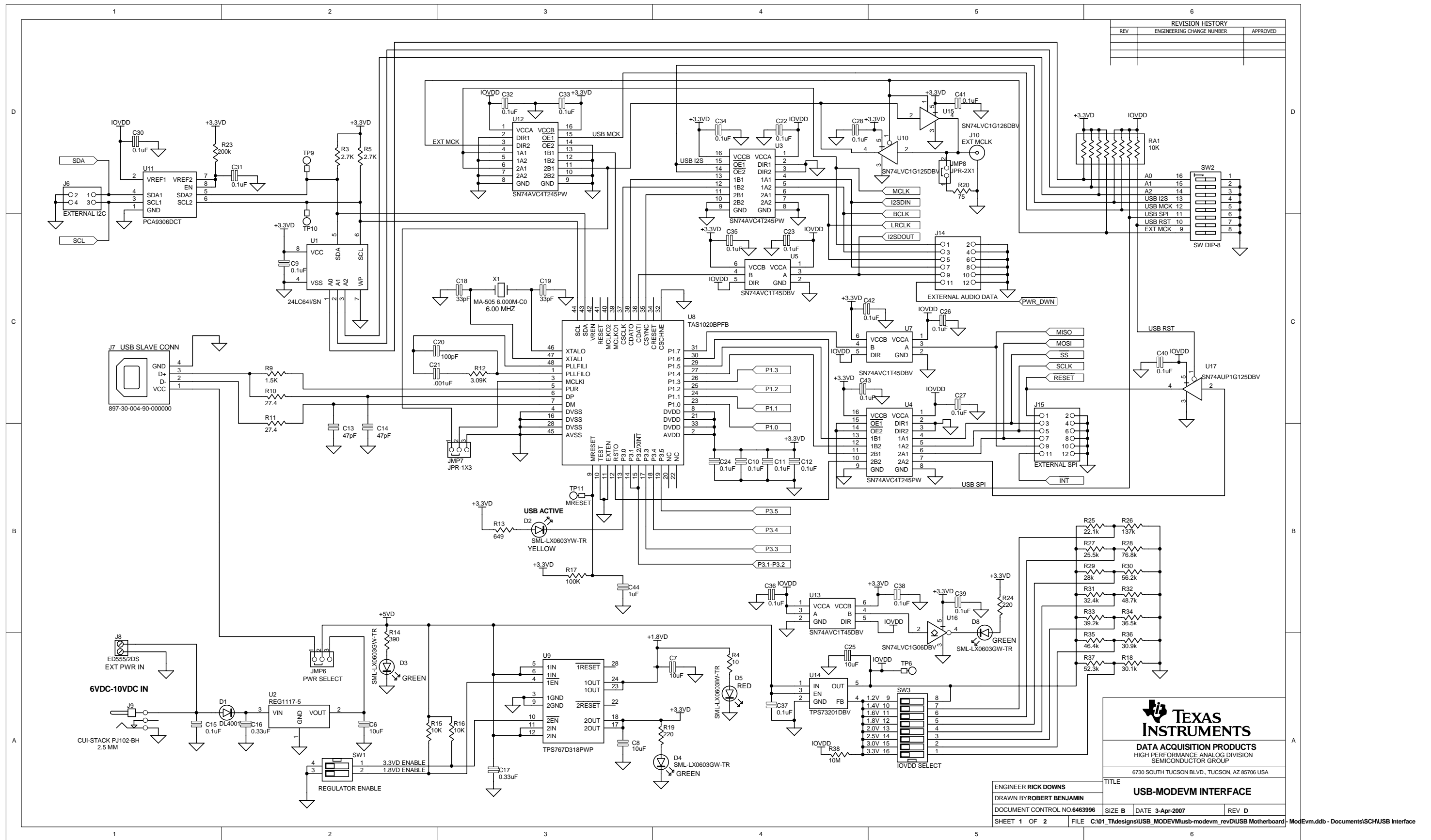
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| DRAWN BY Steve Leggio | | | |
| DOCUMENT CONTROL NO. N/A | SIZE B | DATE 19-Aug-2008 | REV B |
| SHEET 2 OF 3 | FILE Daughtercard_Interface.Sch | | |



Appendix B USB-MODEVM Schematic

The schematic diagram is provided as a reference.





FCC Warnings

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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.

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