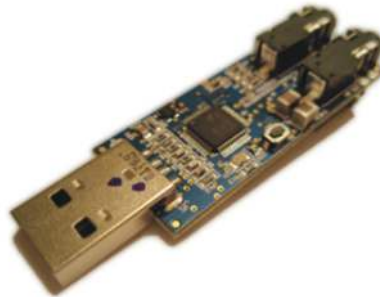


## **TLV320AIC3254EVM-U**

This User's Guide describes the operation, use, features and characteristics of the TLV320AIC3254EVM-U. This small form factor evaluation module (EVM) is a programmable USB audio device that features the TLV320AIC3254 Audio Codec with miniDSP.



**Figure 1. TLV320AIC3254EVM-U Angle View**

The following related documents are available through the Texas Instruments Web site at [www.ti.com](http://www.ti.com).

### EVM-Compatible Device Data Sheets

Device	Literature Number
TLV320AIC3254	<a href="#">SLAS549</a>
TAS1020B	<a href="#">SLES025</a>

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## 1 EVM Overview

### 1.1 Features

- Small USB Stick form factor EVM for the TLV320AIC3254 Audio Codec.
- USB connection to the PC provides power, control and streaming audio for easy evaluation.
- Pre-programmed EEPROM boots the TLV320AIC3254 as a fully functional USB Audio Device when connected to a PC.
- Easy to use AIC3254 Control Software (CS) configures and controls the TLV320AIC3254.

The TLV320AIC3254EVM-U is a universal serial bus (USB)-based audio device for use with a personal computer running the Microsoft Windows™ XP operating system

### 1.2 Introduction

The TLV320AIC3254EVM-U is a USB Audio Device with programmable inputs and outputs, effects and extensive routing capabilities. It is a simple platform to evaluate the TLV320AIC3254 miniDSP Audio Codec.

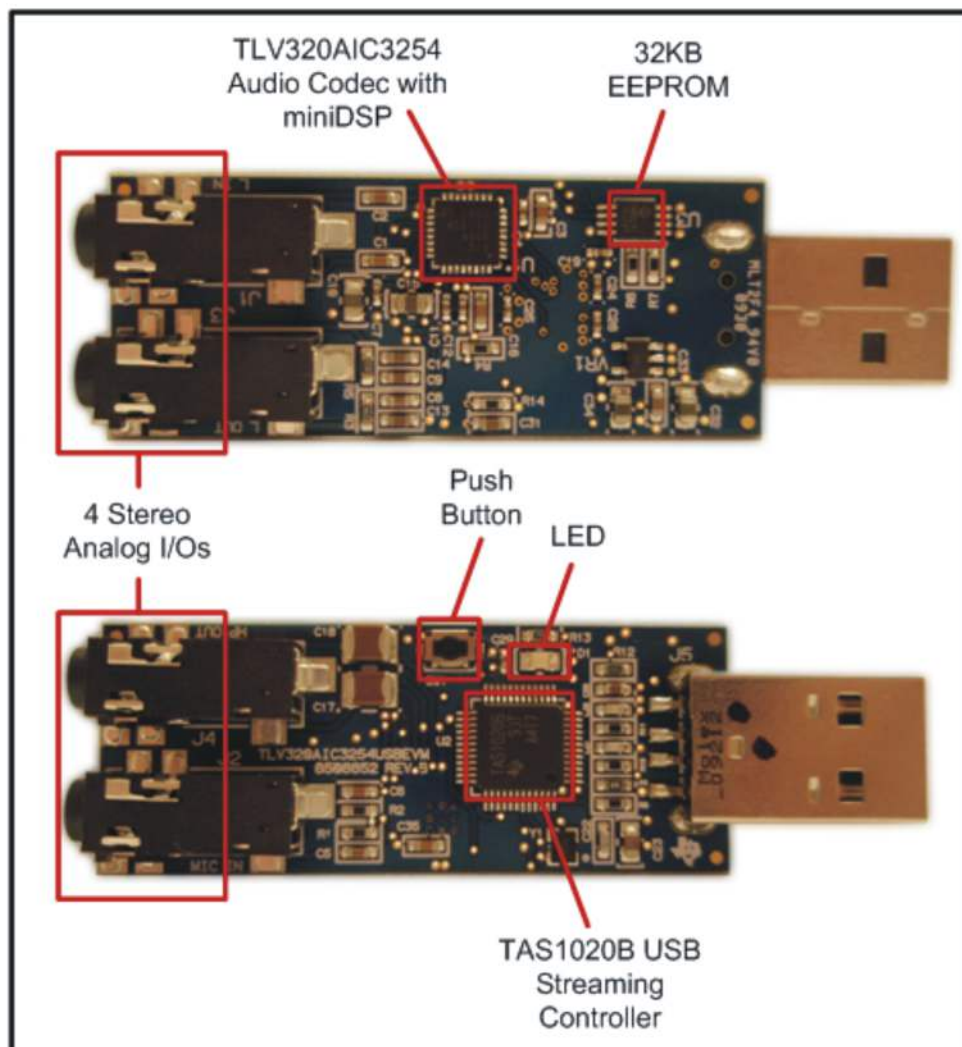
## 2 EVM Description and Basics

This section provides information on the analog input and output, digital control, power, and general connection of the TLV320AIC3254EVM-U.

### 2.1 TLV320AIC3254EVM-U Hardware Description

The TLV320AIC3254EVM-U has 2 stereo analog input connectors (Line-in and Mic-in) and 2 stereo analog output connectors (Line-Out and Headphone-Out) that are routed to the TLV320AIC3254. Digital audio as well as control data communicated between the PC and the EVM are interpreted by the TAS1020B USB Streaming Controller. Control data is communicated to the TLV320AIC3254 via the I2C protocol; audio data is communicated via the I2S protocol.

An on-board 32KB EEPROM is capable of storing TLV320AIC3254 commands (scripts) as well as the TAS1020B firmware. A push button is provided to cycle between scripts along with an LED that provides the user feedback regarding the script that is currently loaded. The EEPROM Manager in the AIC3254 CS is used to write new scripts into the EEPROM.



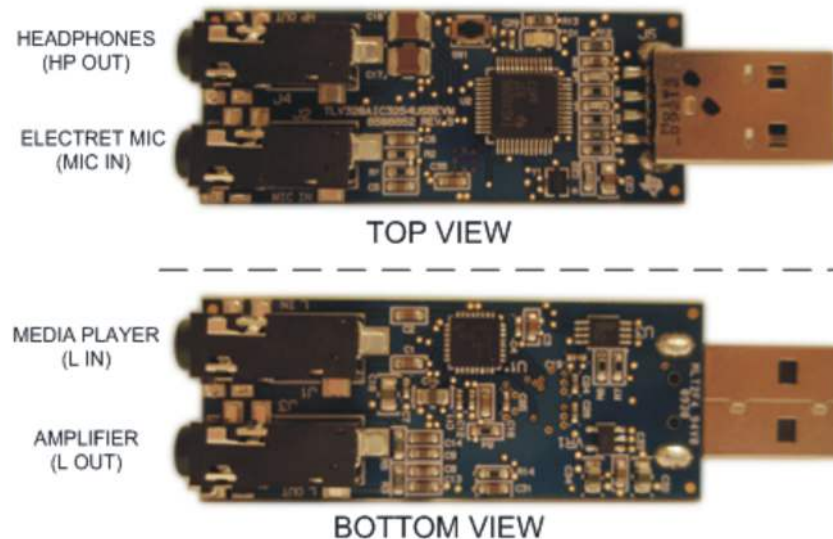
**Figure 2. Bottom and Top Views**

The table below summarizes the audio jacks available to connect analog inputs and outputs to the TLV320AIC3254, as well as a switch.

Designator	Label	Associated Pin	Description
J1	L IN (LINE IN)	IN2_L / IN2_R	Line Input.
J2	MIC IN (MIC IN)	IN3_L / IN3_R	External electric microphone input. MICBIAS is connected to both tip and ring through resistors.
J3	L OUT (LINE OUT)	LOL / LOR	Line output. Only high impedance loads should be connected to this output (e.g. external Class-D amplifier).
J4	HP OUT (HEADPHONE)	HPL / HPR	Headphone output.
SW1	SW1	N/A	Cycles through scripts loaded in the on-board EEPROM.

## 2.2 Getting Started

Evaluation can start right out of the box. Simply connect the TLV320AIC3254EVM-U to an available USB port, connect stereo headphones to HP OUT and start playing audio with any media player. By default, when the TLV320AIC3254EVM-U is connected, the TLV320AIC3254 is automatically configured to play and record stereo audio through all four jacks, as shown below.



**Figure 3. Default Input and Output Signals**

To adjust playback volume, open “Sounds and Audio Devices” in the “Control Panel” and click the “Volume” button of the “Sound playback” section of the “Audio” tab. Ensure USB-miniEVM is selected as the default playback and recording device.



**Figure 4. Sounds and Audio Devices Properties**

Pressing SW1 on the EVM once will set a flat response at the outputs (LED D1 blinks once). Pressing SW1 again will switch to bass and treble boost (LED D1 blinks twice).

The following section explains the software installation procedure which allows programming of the audio device.

### 3 AIC3254EVM-U Control Software

The AIC3254 Control Software (CS) is an intuitive, easy-to-use, powerful tool to learn, evaluate, and control the TLV320AIC3254. This tool was specifically designed to make learning the TLV320AIC3254 software easy. The following sections describe the operation and installation of this software

---

**NOTE:** For configuration of the codec, the TLV320AIC3254 block diagram located in [SLAS549](#) is a good reference to help determine the signal routing.

---

#### 3.1 AIC3254EVM-U CS Setup

This section provides setup instructions for the AIC3254EVM-U CS.

To install the AIC3254EVM-U software:

1. Download the latest version of the AIC3254EVM-U Control Software (CS) located in the [TLV320AIC3254EVM-U Product Folder](#).
2. Open the self-extracting installation file.
3. Extract the software to a known folder.
4. Install the EVM software by double-clicking the **Setup** executable, and follow the directions. The user may be prompted to restart their computer.

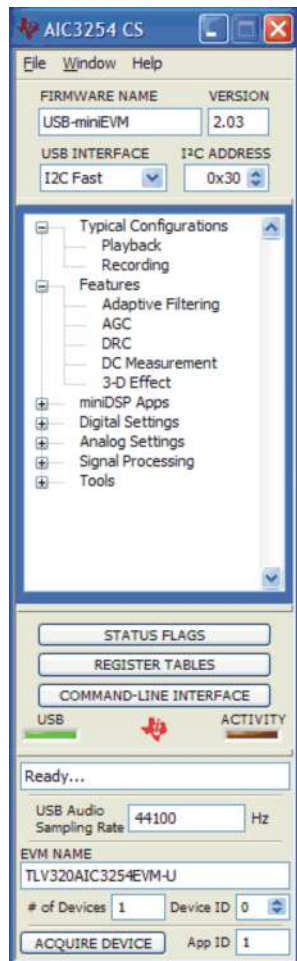
This installs all the AIC3254EVM-U software and required drivers onto the PC.

## 3.2 AIC3254EVM-U CS Usage

The following sections describe the AIC3254EVM-U CS usage.

### 3.2.1 Main Panel Window

The Main Panel window, shown in the figure below, provides easy access to all the features of the AIC3254 CS.



**Figure 5. Main Panel Window**

The Firmware Name and Version boxes provide information about the firmware loaded into the EVM's EEPROM.

The USB-MODEVM Interface drop-down menu allows the user to select which communication protocol the TAS1020B USB Controller uses to communicate with the TLV320AIC3254.

The TLV320AIC3254 supports I2C Standard, I2C Fast, and 8-bit register SPI. However, this EVM only supports I2C. The USB Interface selection is global to all panels, including the Command-Line Interface.

The Panel Selection Tree provides access to typical configurations, features, and other panels that allow the user to control the TLV320AIC3254.

The tree is divided into several categories which contain items that pop up panels. A panel can be opened by double-clicking any item inside a category in the Panel Selection Tree.

Below the Panel Selection Tree are three buttons that pop up the following:

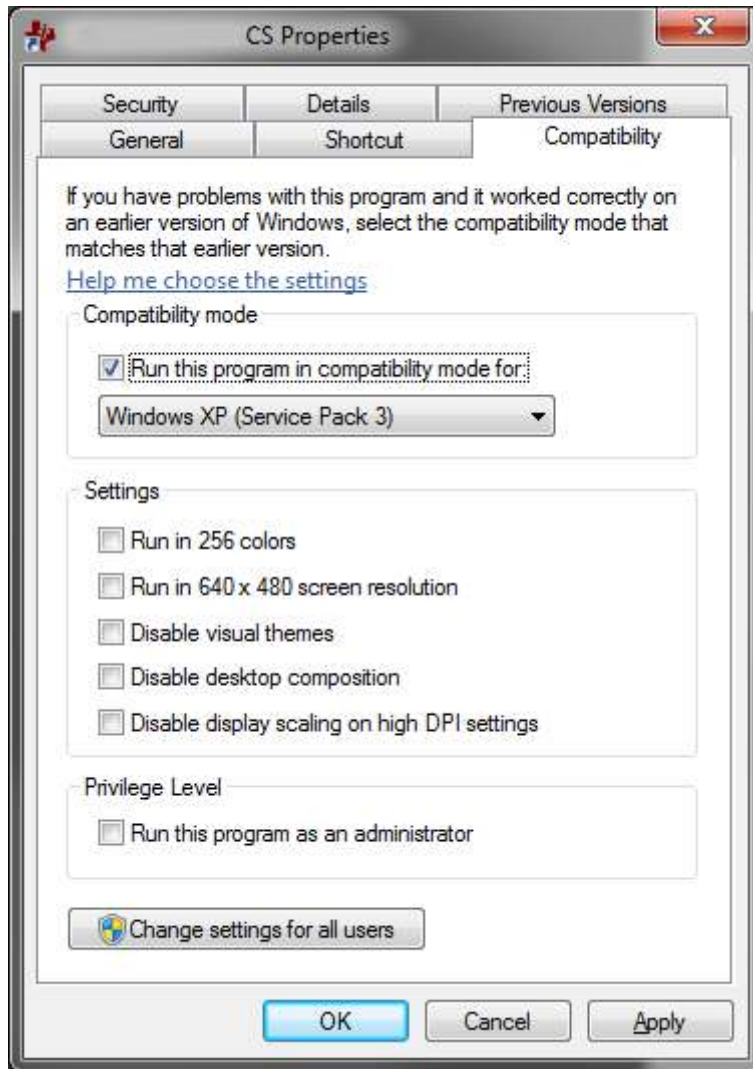
- Status Flags - Allows the user to monitor the TLV320AIC3254 status flags.
- Register Tables - A tool to monitor register pages.
- Command-Line Interface - A tool to execute/generate scripts and monitor register activity.

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

The dialog box at the bottom of the Main Panel provides feedback of the current status of the software.



If running the software in Windows Vista or Windows 7, right-click the AIC3254EVM-U CS shortcut and select *Properties*. Configure the *Compatibility* tab as shown in [Figure 6](#)



**Figure 6. Compatibility Tab**

### 3.2.2 Typical Configurations

This category can help users to quickly become familiar with the TLV320AIC3254. Each of the panels that can be accessed through this menu have controls relevant to the selected configuration; a tab shows the script that will be loaded for that particular configuration. Each script includes a brief description of the selected configuration.

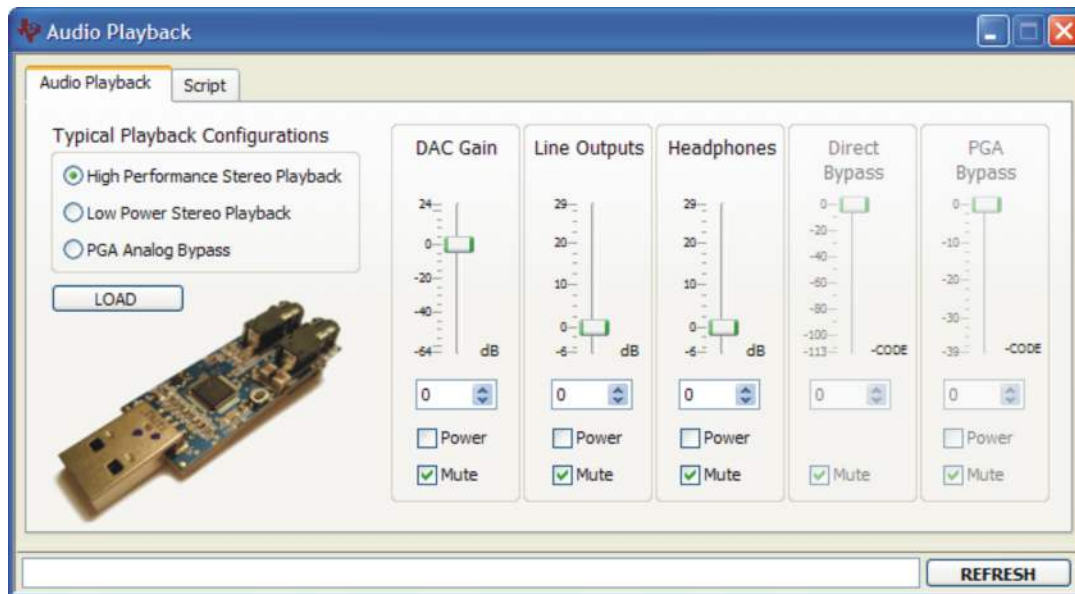


Figure 7. Playback Configurations and Controls

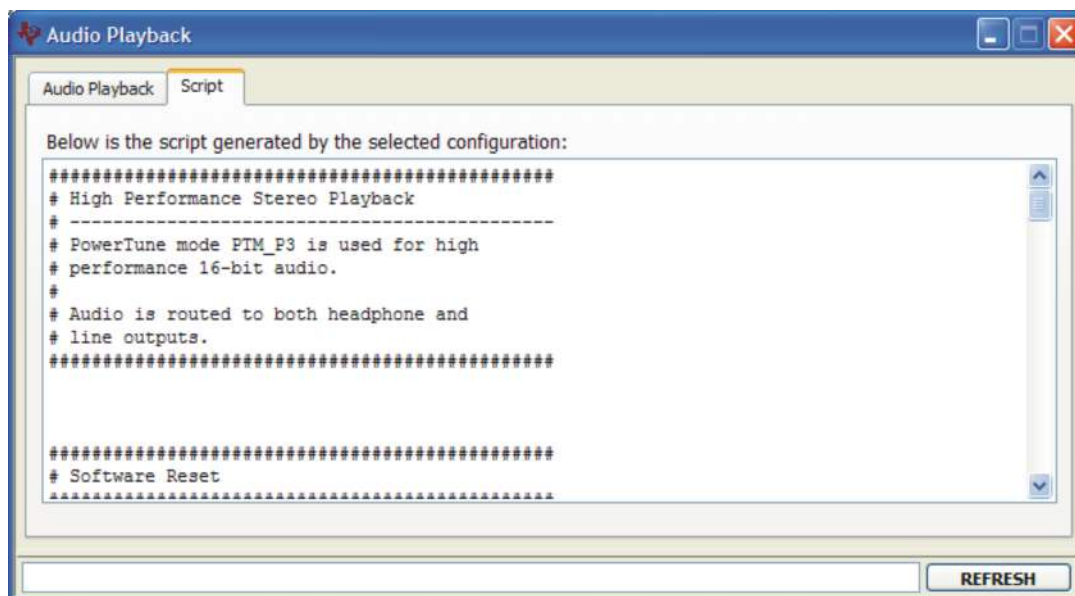
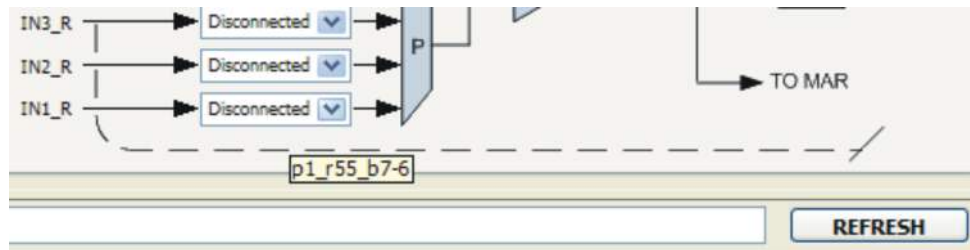


Figure 8. Associated Script and Description

### 3.2.3 Control Categories

The Digital Settings, Analog Settings, and Signal Processing categories provide control of many registers and other features of the TLV320AIC3254 . These categories are intended for the advanced user. Hovering the mouse cursor on top of a control displays a tip strip that contains page, register, and bit information. As an example, hovering on top of IN1\_R of the Audio Inputs panel, as shown in [Figure 9](#) displays p1\_r55\_b7-6 which means that this control writes to Page 1/Register 55/Bits D7 to D6.



**Figure 9. Tip Strip Example**

Before changing a control, see the data sheet to ensure that a particular control is compatible with the current state of the codec. As an example, some controls in the Analog Setup panel must be modified in a particular order as described in the data sheet. Other controls must only be modified with a specific hardware setup, such as powering up the AVDD LDO.

All controls update their status with respect to the register contents in the following conditions:

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

### 3.2.4 Status Flags Panel

The TLV320AIC3254 status flags can be monitored in the Status Flags panel (Figure 10) which is located below in the Panel Selection Tree. Pressing the POLL button continuously reads all the registers relevant to each flag and updates those flags accordingly. The rate at which the registers are read can be modified by changing the value in the Polling Interval numeric control. Note that a smaller interval reduces responsiveness of other controls, especially volume sliders, due to bandwidth limitations. By default, the polling interval is 200 ms and can be set to a minimum of 20 ms. The Sticky Flags tab contains indicators whose corresponding register contents clear every time a read is performed to that register. To read all the sticky flags, click the Read Sticky Flags button.

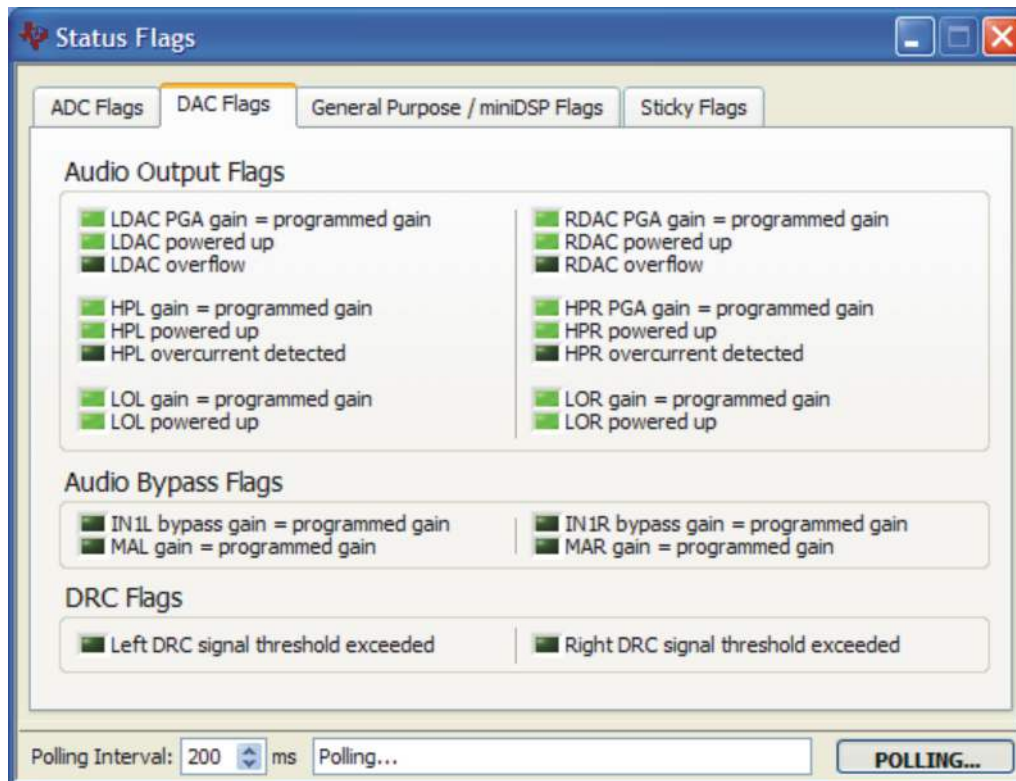


Figure 10. Status Flags Panel

### 3.2.5 Register Tables Panel

The contents of configuration and coefficient pages of the TLV320AIC3254 can be accessed through the Register Tables panel (Figure 11). The Page Number control changes to the page to be displayed in the register table. The register table contains page information such as the register name, reset value, current value, and a bitmap of the current value. The contents of the selected page can be exported into a spreadsheet by clicking the Dump to Spreadsheet button.

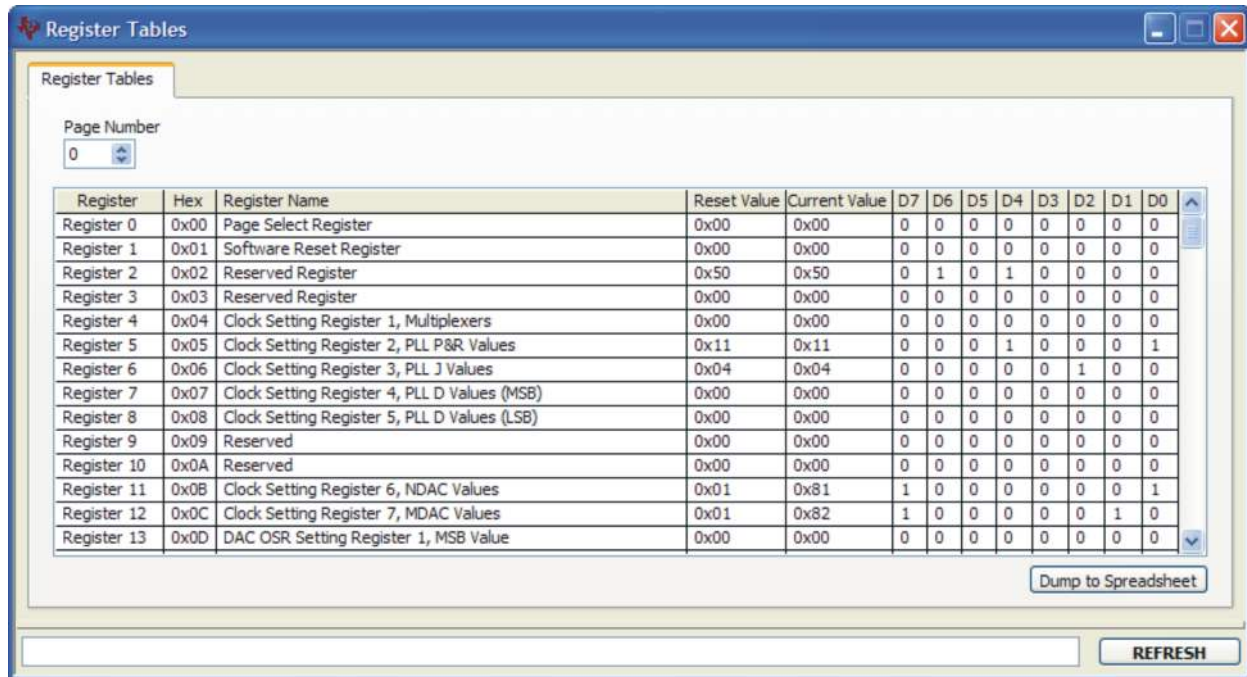


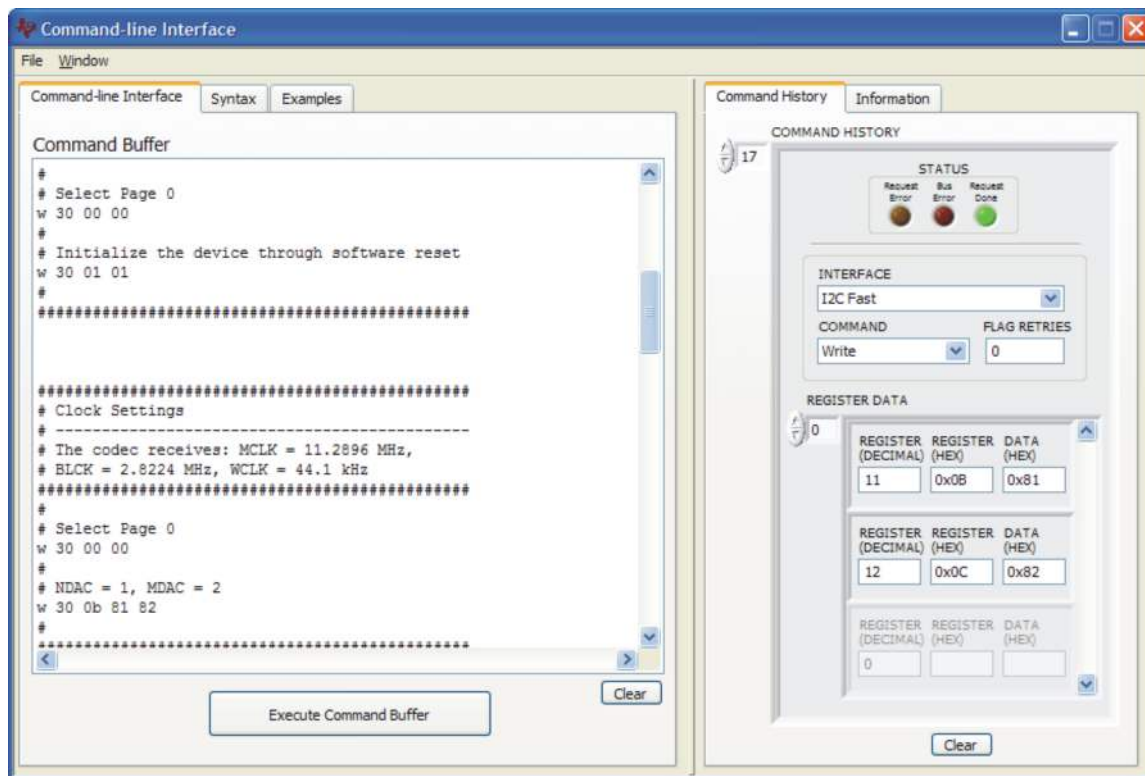
Figure 11. Register Tables Panel

### 3.2.6 Command-line Interface Panel

The Command-Line Interface panel provides a means to communicate with the TLV320AIC3254 using a simple scripting language (described in [Appendix C](#)). The TAS1020B USB Controller handles all communication between the PC and the TLV320AIC3254. A script is loaded into the command buffer, either by loading a script file using the File menu or by pasting text from the clipboard using the Ctrl-V key combination ([Figure 12](#)). When the command buffer is executed, the return data packets which result from each individual command are displayed in the Command History control. This control is an array (with a maximum size of 100 elements) that contains information about each command as well as status. The Interface box displays the interface used for a particular command in the Command History array. The Command box displays the type of command executed (i.e., write, read) for a particular interface. The Flag Retries box displays the number of read iterations performed by a Wait for Flag command (see [Appendix C](#) for details). The Register Data array displays the register number and data bytes that correspond to a particular command. The Information tab provides additional information related to the Command History as well as additional settings. The Syntax and Examples tabs provide useful information related to the scripting language.

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

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



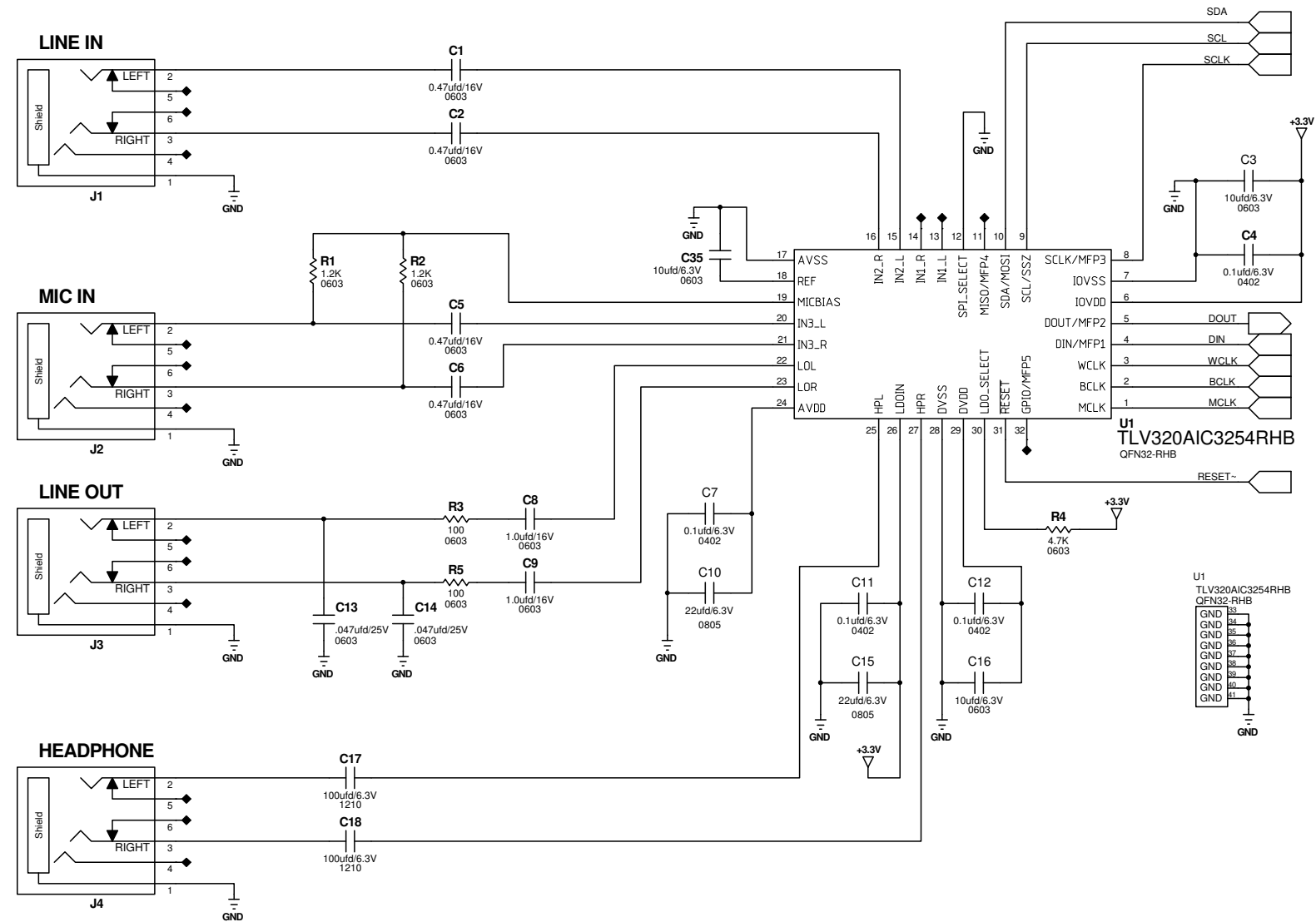
**Figure 12. Command Line interface Panel**

## Appendix A TLV320AIC3254EVM Schematic

The schematic diagram for the TLV320AIC3254EVM is provided as a reference.

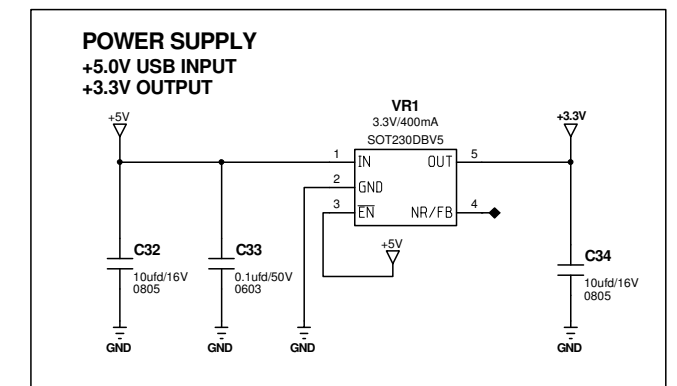
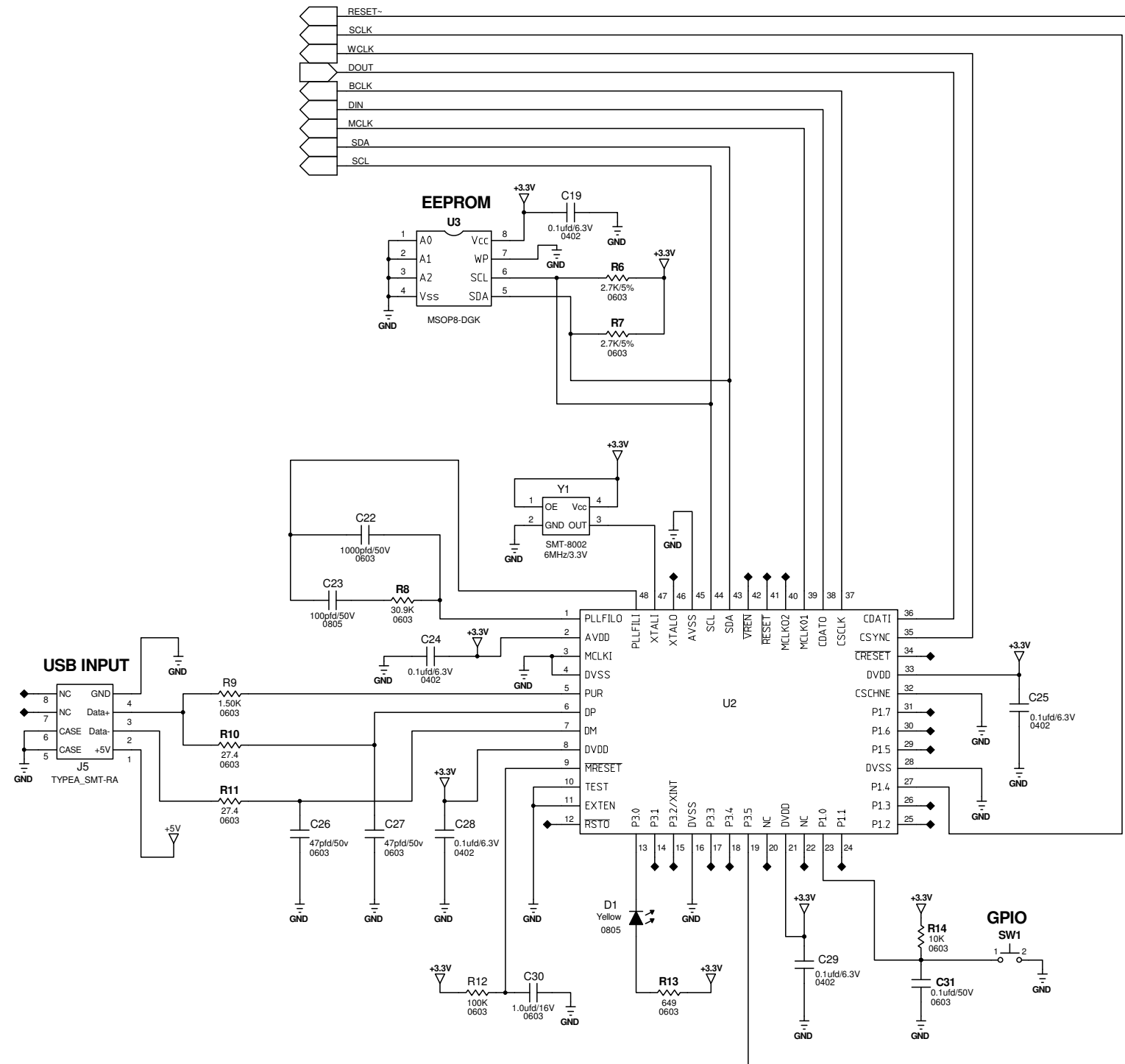


# TLV320AIC3254\_RHB\_USB\_EVM





# TLV320AIC3254\_RHB\_USB\_EVM



## Appendix B TLV320AIC3254EVM Bill of Materials

The complete bill of materials for the TLV320AIC3254EVM is provided as a reference.

**Table 1. TLV320AIC3254EVM Bill of Materials**

PCB					
Qty	Value	Ref Des	Description	Vendor	Part number
1		U1	ULTRA LO PWR ST AUDIO CODEC W/EMBEDDED MINI DSP QFN32-RHB ROHS	Texas Instruments	TLV320AIC3254 RHB
RESISTORS					
Qty	Value	Ref Des	Description	Vendor	Part number
1	1.5k	R9	RESISTOR SMD0603 1.50K OHM 1% THICK FILM 1/10W ROHS	DIGI-KEY	P1.50KHCT
3	100k	R3,R5,R12	RESISTOR SMD0603 100K OHM 1% THICK FILM 1/10W ROHS	DIGI-KEY	P100KHCT
1	1.7k	R4	RESISTOR SMD0603 4.7K OHMS 1% 1/10W ROHS	DIGI-KEY	P4.7KGCT
1	10k	R14	RESISTOR SMD0603 10K 5% 1/10W ROHS	DIGI-KEY	P10KGCT
2	1.2k	R1,R2	RESISTOR SMD0603 1.2K OHMS 5% 1/10W ROHS	DIGI-KEY	P1.2KGCT
1	649	R13	RESISTOR SMD0603 THICK FILM 649 OHMS 1% 1/10W ROHS	DIGI-KEY	311-649HRCT
1	30.9k	R8	RESISTOR SMD0603 30.9K OHMS 1% 1/10W ROHS		541-30.9KHCT
2	27.4k	R10,R11	RESISTOR SMD0603 27.4 OHMS 1% 1/10W ROHS	DIGI-KEY	P27.4HCT
2	2.7k	R6,R7	RESISTOR SMD0603 2.7K OHMS 5% 1/10W ROHS	DIGI-KEY	P2.7KGCT
2	100	R3,R5	RESISTOR SMD0603 100 OHM 1/10W 1% ROHS	DIGI-KEY	541-100HCT
CAPACITORS					
Qty	Value	Ref Des	Description	Vendor	Part number
9	0.1 $\mu$ F	C4,C7,C11,C12,C19,C24,C25,C28,C29	CAP SMD0402 CERM 0.1UFD 6.3V 10% X5R ROHS	DIGI-KEY	445-1266-1
3	10 $\mu$ F	C3,C16, C35	CAP SMD0603 CERM 10UFD 6.3V 20% X5R ROHS	DIGI-KEY	PCC2395CT
2	22 $\mu$ F	C10,C15	CAP SMD0805 CERM 22UFD 6.3V 20% X5R ROHS	DIGI-KEY	445-1422-1
2	47pF	C26,C27	CAP SMD0603 CERM 47PFD 50V 5% NPO ROHS	DIGI-KEY	PCC470ACVCT
1	1000pF	C22	CAP SMD0603 CERM 1000PFD 50V 5% COG ROHS	DIGI-KEY	445-1293-1
1	1 $\mu$ F	C30	CAP SMD0603 CERM 1.0UFD 16V 5% X7R ROHS	DIGI-KEY	445-1604-1
4	0.47 $\mu$ F	C1,C2,C5,C6	CAP SMD0603 CERM 0.47UFD 16V 10% X5R ROHS	DIGI-KEY	478-1248-1
2	0.47 $\mu$ F	C13,C14	CAP SMD0603 CERM 0.47UFD 25V 10% X7R ROHS	DIGI-KEY	PCC1771CT
2	1 $\mu$ F	C8,C9	CAP SMD0603 CERM 1.0UFD 16V 10% X5R ROHS	DIGI-KEY	PCC2224CT
1	100pF	C23	CAP SMD0805 CERM 100PFD 50V 5% C0G ROHS	DIGI-KEY	490-1615-1
2	0.1 $\mu$ F	C31,C33	CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS	DIGI-KEY	445-1314-1

**Table 1. TLV320AIC3254EVM Bill of Materials (continued)**

2	10µF	C32,C34	CAP SMD0805 CERM 10UFD 16V 10% X5R ROHS	DIGI-KEY	490-3886-1
2	100µF	C17,C18	CAP SMD1210 CERM 100UFD 6.3V 20% X5R ROHS	DIGI-KEY	490-3390-1
<b>INTEGRATED CIRCUITS</b>					
<b>Qty</b>	<b>Value</b>	<b>Ref Des</b>	<b>Description</b>	<b>Vendor</b>	<b>Part number</b>
1		U2	USB STREAMING CONTROLLER TQFP48-PFB ROHS	DIGI-KEY	296-13041-5
1		VR1	VOLT REG 3.3V 400MA LDO CAP- FREE NMOS SOT23-DBV5 ROHS	DIGI-KEY	296-15819-1
1		U3	256K I2C SERIAL EEPROM,MSOP-8	DIGI-KEY	24AA256-I/MS- ND
1		D1	LED, YELLOW 2.0V SMD0805 ROHS	DIGI-KEY	67-1554-1
1		Y1	OSCILLATOR SMT 6MHz 3.3V OUT- ENABLE ROHS	DIGI-KEY	788- 8002AI133E- 6.0T
<b>MISCELLANEOUS ITEMS</b>					
<b>Qty</b>	<b>Value</b>	<b>Ref Des</b>	<b>Description</b>	<b>Vendor</b>	<b>Part number</b>
1		J5	JACK-USB MALE TYPEA SMT-RA 4PIN ROHS J	DIGI-KEY	WM17118
4		J1,J2,J3,J4	ACK AUDIO MINI(3.5MM ,4-COND PCB-RA ROHS	DIGI-KEY	CP-43516SJCT
1		SW1	SWITCH, MOM, 160G SMT 4X3MM ROHS	DIGI-KEY	EG4344CT
<b>ATTENTION: All components must be Rhos compliant. Some part numbers may be either leaded or Rhos. Verify that purchased components are Rhos compliant.</b>					

## Appendix C Writing Scripts

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

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

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

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

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

<b>i2cstd</b>	Standard mode I <sup>2</sup> C bus
<b>i2cfast</b>	Fast mode I <sup>2</sup> C bus
<b>spi8</b>	SPI bus with 8-bit register addressing
<b>spi16</b>	SPI bus with 16-bit register addressing

For example, if a fast mode I<sup>2</sup>C bus is to be used, the script begins with:

### **l i2cfast**

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

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

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

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

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

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

A series of byte values follows either a read or write command. Each byte value is expressed in hexadecimal, and each byte must be separated by a space. Commands are interpreted and sent to the TAS1020B by the program.

The first byte following an **r** (read) or **w** (write) command is the I<sup>2</sup>C slave address of the device (if I<sup>2</sup>C is used) or the first data byte to write (if SPI is used; note that SPI interfaces are not standardized on protocols, so the meaning of this byte varies with the device being addressed on the SPI bus). The second byte is the starting register address that data will be written to (again, with I<sup>2</sup>C; SPI varies). Following these two bytes are data, if writing; if reading, the third byte value is the number of bytes to read, (expressed in hexadecimal).

For example, to write the values 0xAA 0x55 to an I<sup>2</sup>C device with a slave address of 0x30, starting at a register address of 0x03, the user writes:

```
#example script

I i2cfast

w 30 03 AA 55

r 30 03 02
```

This script begins with a comment, specifies that a fast I<sup>2</sup>C bus will be used, then writes 0xAA 0x55 to the I<sup>2</sup>C slave device at address 0x30, writing the values into registers 0x03 and 0x04. The script then reads back two bytes from the same device starting at register address 0x03. Note that the slave device value does not change. It is unnecessary to set the R/W bit for I<sup>2</sup>C devices in the script; the read or write commands does that.

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

```
#example script for '>' command

I i2cfast

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

w 30 03 AA BB

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

> CC DD EE FF

# Place a commented breakpoint

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

# Read back all six registers, starting at register 3

r 30 03 06
```

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

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

I i2cfast

# Switch to Page 44

w 30 00 2C

# Switch buffers

w 30 01 05

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

f 30 01 xxxxxxx0
```

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

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

---

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

## EVALUATION BOARD/KIT IMPORTANT NOTICE

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

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### EVM WARNINGS AND RESTRICTIONS

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

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 85°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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