TLV320DAC3202EVM

This user's guide describes the characteristics, operation, and use of the TLV320DAC3202EVM. The TLV320DAC3202EVM provides a simplified platform to evaluate the performance and functionality of the TLV320DAC3202 low-power headset IC. A complete circuit description, schematic diagram, and bill of materials are included.

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

Device	Literature Number
TPS62044	SLVS463
TAS1020B	SLES025
TLV320DAC3202	SLAS726

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1 TLV320DAC3202EVM Overview

1.1 Features

TLV320DAC3202EVM:

- A USB stick version of the TLV320DAC3202EVM for easy operation
- USB connection to PC provides ability to stream audio data for evaluation
- Power to TLV320DAC3202 can be supplied from a PC USB connection, or an external battery by changing the jumper connection
- A 3.5-mm jack can be connected to a headphone for listening tests or to a cable connected to an instrument for performance verifications
- Pre-programmed EEPROM boots TLV320DAC3202 as a USB audio device when connected to a PC
- Use generated wave files (.wav) to evaluate total harmonic distortion (THD), crosstalk between channels, ICN, dynamic range, or amplitude

1.2 Introduction

The TLV320DAC3202 is a high-fidelity, low-power headphone amplifier with an integrated digital-to-analog converter (DAC) and power rails. The digital audio interface supports industry-standard formats such as I^{2}S™ and PCM. Volume setting, data width, and sampling rate are configurable for optimum flexibility and efficiency. The headset power control automatically adjusts the rail voltage based on the input signal to maximize efficiency and performance. An industry-standard I^{2}C™ controller enables ease of operation and reduces overall device pin count.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the TLV320DAC3202EVM.

2 Description

This section describes the input and output connections, the power connection, and the dc ampere meter connection to the TLV320DAC3202EVM.

2.1 Top Side Components

The top side of the EVM consists of a TLV320DAC3202 device and its supporting components inside the white square bracket and a switched mode power supply (SMPS) that powers the DVDD pin, as Figure 1 shows. A USB-type A connector connects the EVM to a PC for streaming audio data.

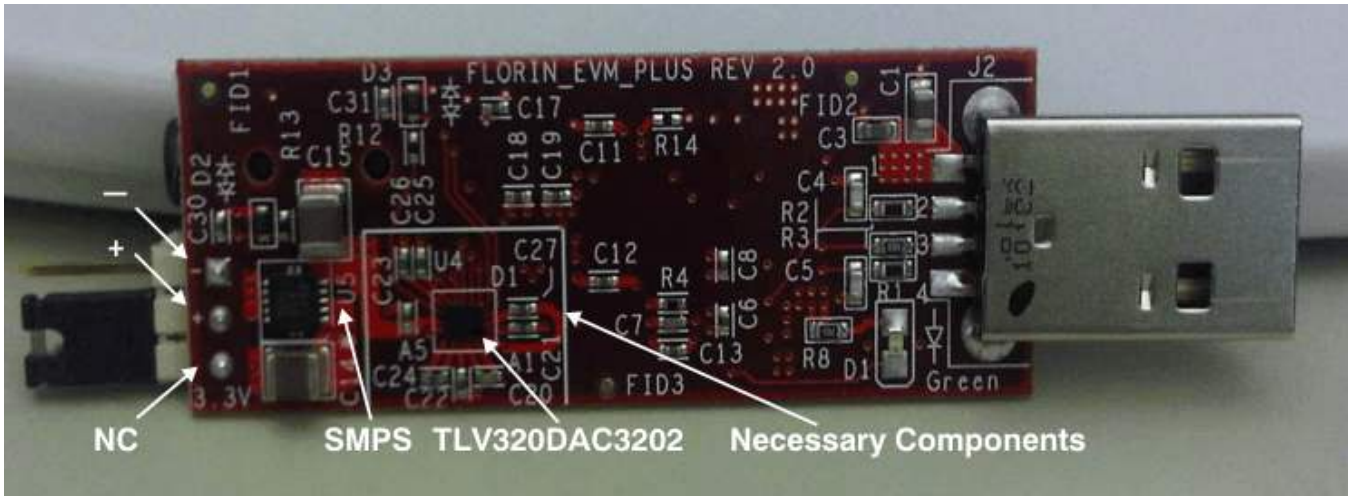

Figure 1. TLV320DAC3202EVM: Top Side

The SMPS is a 1.2-A/1.25-MHz step-down converter that provides approximately 90% efficiency with a 3.6-V input voltage. Refer to the TLV320DAC3202 product data sheet for different input voltage options.

The three-pin jumper provides users the option to power the TLV320DAC3202 AVDD pin. The default setting is connecting the jumper to the **+** and ***NC*** terminals, as illustrated in Figure 1. When the jumper is set on the **+**and **–** terminals, the SMPS input is supplied from an external power source such as a battery.

2.2 Bottom Side Components

The bottom side of the EVM contains a pair of low-dropout regulators (LDOs) to power a TAS1020B USB streaming controller. The bottom side also features a 6-MHz oscillator, a 256k EEPROM, a 3.5-mm audio jack, and two level shifters, one each for the I^2C and I^2S interfaces. Figure 2 shows the bottom side of the EVM.

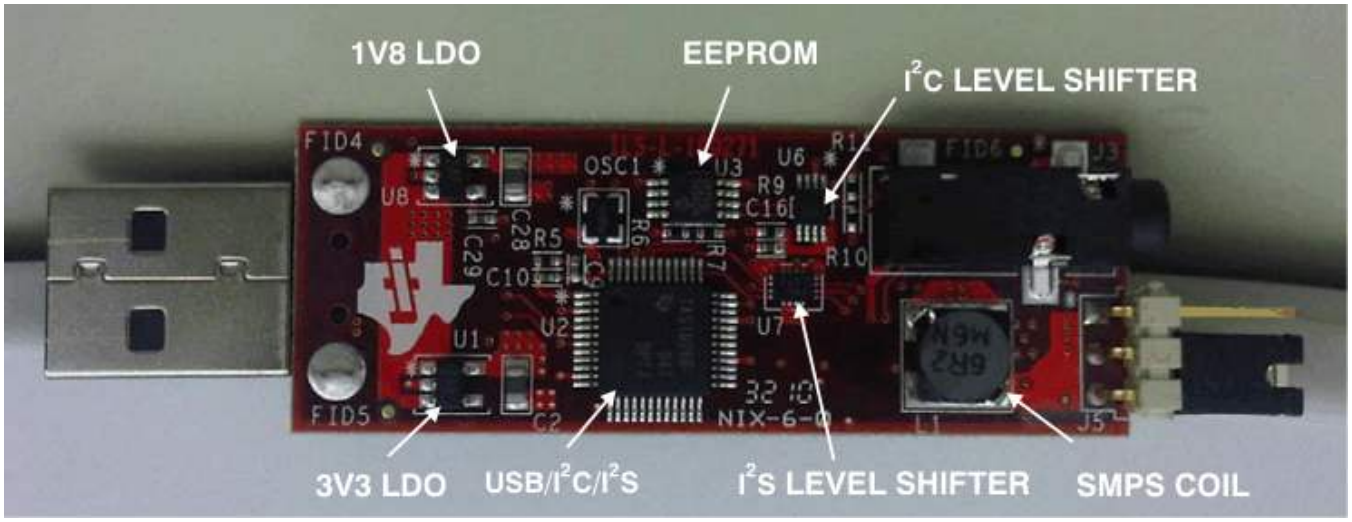

Figure 2. TLV320DAC3202EVM: Bottom Side

The EEPROM stores the firmware needed to boot up the USB controller when the EVM is connected to a PC. The 3.5-mm audio jack allows a headphone connection for listening tests, or for performance testing by connecting a cable to an audio instrument such as an Audio Precision® analyzer.

2.3 DC Ampere Meter Connection

Using the dc ampere meter connection, one can measure the current drawn from the SMPS by connecting the 3-pin header to the terminal as shown in Figure 3. This ampere meter is limited to less than 10 mA; consequently, playing music at a high volume could cause unpleasant sounds.

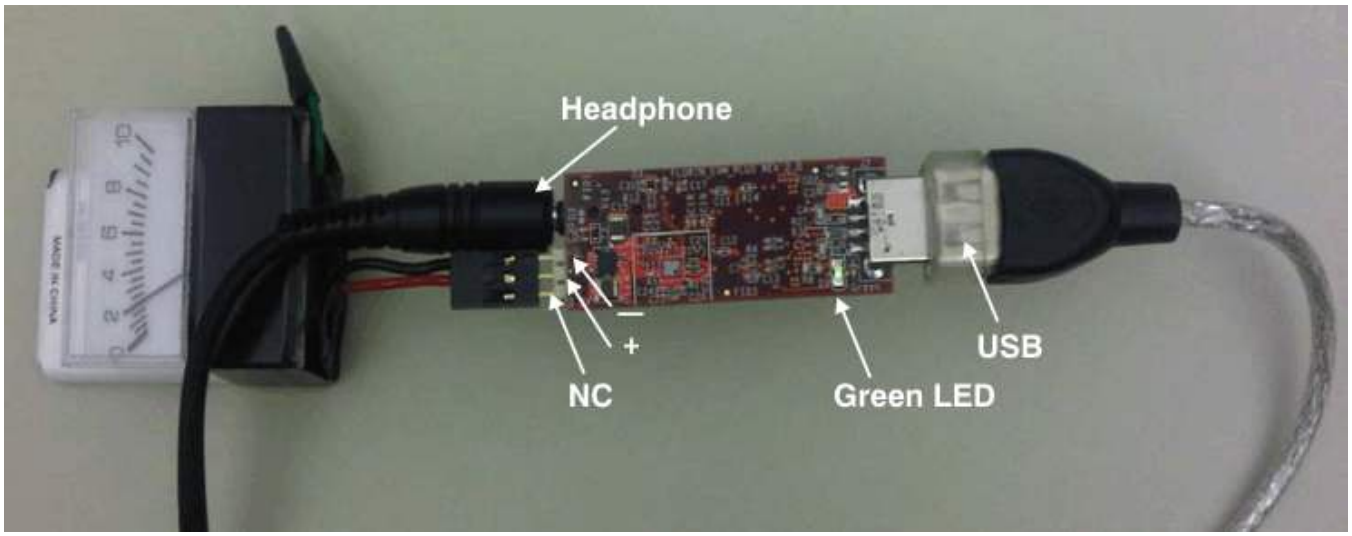

Figure 3. DC Ampere Meter Connection

3 Getting Started

Users can quickly evaluate the TLV320DAC3202EVM performance by simply connecting the EVM to a laptop or PC with an available USB port. USB enumeration begins; under the *Sounds and Audio Devices Properties* menu in the Microsoft® Windows® Control Panel (as Figure 4 shows), an **MIS-iSOLUTION-USBEVM** device is listed when the EVM is detected. Connect a set of headphones to the 3.5-mm audio jack and then start playing audio with the media player. (The type of media player used is described in more detail in Section 4.)

Figure 4. Sounds and Audio Devices Panel

You can adjust the volume either through the media player volume control or the system volume button on the laptop or PC, as illustrated in Figure 5.

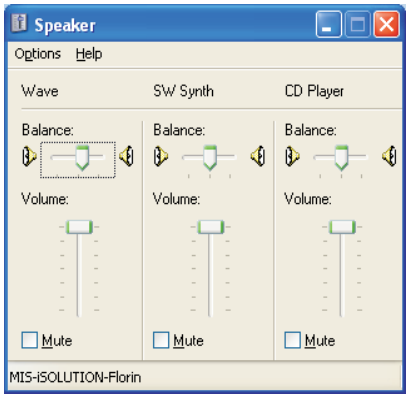

Figure 5. System Volume Controls

4 Recommended Media Player

The Apple® QuickTime® media player is recommended to perform listening tests because it does not initiate or terminate USB communications abruptly as does the Windows Media Player®. Abrupt signal processing could result in a clicking sound on the headphone side. This type of click has been confirmed to not be related to the TLV320DAC3202 device because no writing or reading of registers occurs during this period of time to the device under test (DUT).

It is also suggested to not stop or pause the player in the middle of a large audio signal.

Users can download the QuickTime Player from the Apple website at http://www.apple.com/quicktime/download/.

5 Performance Testing

In order to evaluate the performance of the TLV320DAC3202, several uncompressed wave files (.wav) have been developed; each plays for approximately 2 minutes. Table 1 gives a description of these files.

Table 1. .WAV Test File Summary

Parameter	48kS/s Files	44.1kS/s Files
Idle Channel Noise	ICN_48kS.wav	ICN_44kS.wav
Dynamic Range	DR_48kS.wav	DR_44kS.wav
Crosstalk	CT_48kS.wav	CT_44kS.wav
0 dBFS THD	FS_48kS.wav	FS_44kS.wav
–3 dBFS THD	M3dBFS_48kS.wav	M3dBFS_44kS.wav
–20 dBFS THD	M20dBFS_48kS.wav	M20dBFS_44kS.wav

These wave files are generated with 24-bit data length and a tone setting of approximately 1-kHz. Simply double-click on the .wav file and an active system media player opens to play the tone.

These wave files are available for download from the device product folder.

Some performance results captured on an Audio Precision system (AP 2722) with 48-kHz sampling wave files are shown in Figure 6. This type of measurement is done by connecting the 3.5-mm audio jack to the Audio Precision unbalanced BNC inputs.

(a) –3 dBFS Input (b) –60 dBFS Input (c) Crosstalk

Figure 6. AP Performance Testing

Figure 7 illustrates typical crosstalk performance.

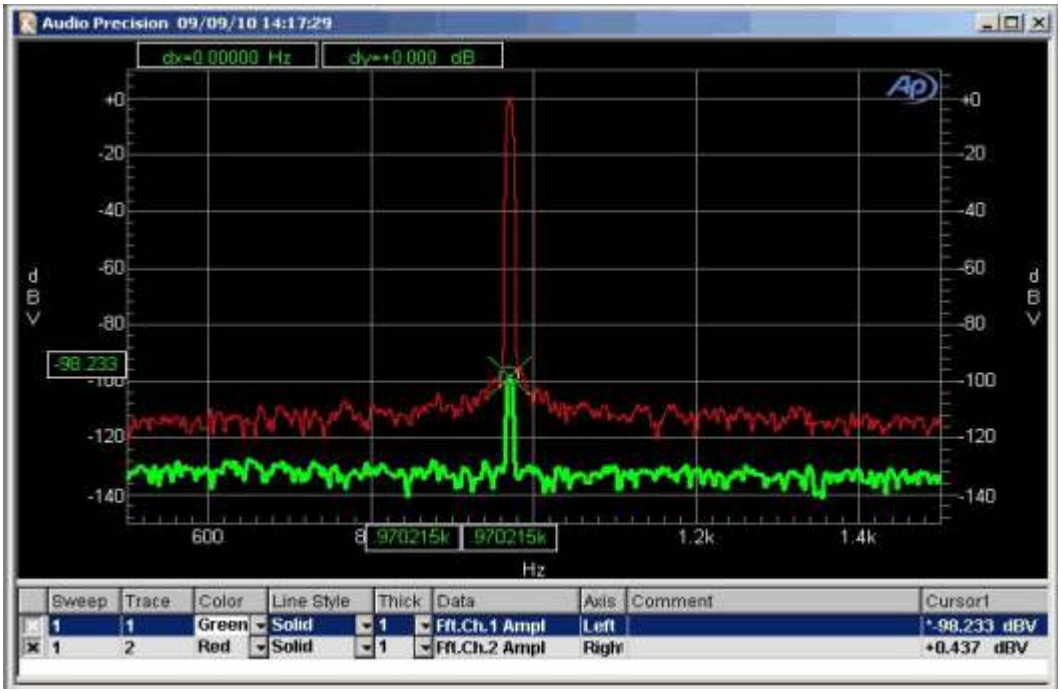

Figure 7. Crosstalk FFT

6 Generating Wave Files

In order to generate the wave files for the performance testing, extract all the files from the *Wave_files.zip* to a designated folder on your local PC or laptop. The compressed file contains three batch files that have been created; double-click the compressed file to automatically generate the wave files (refer to Table 1). The three batch files perform these respective functions:

- **gen41kS.bat**: generates the 44.1-kS/s sampling files
- **gen48kS.bat**: generates the 48-kS/s sampling files
- **clean.bat**: removes all the wave files from the system

7 Schematic and BOM

This section contains the schematic diagram for the TLV320DAC3202EVM. The bill of materials is listed in Table 2.

7.1 Schematic

The TLV320DAC3202 EVM schematic is shown in Figure 8.

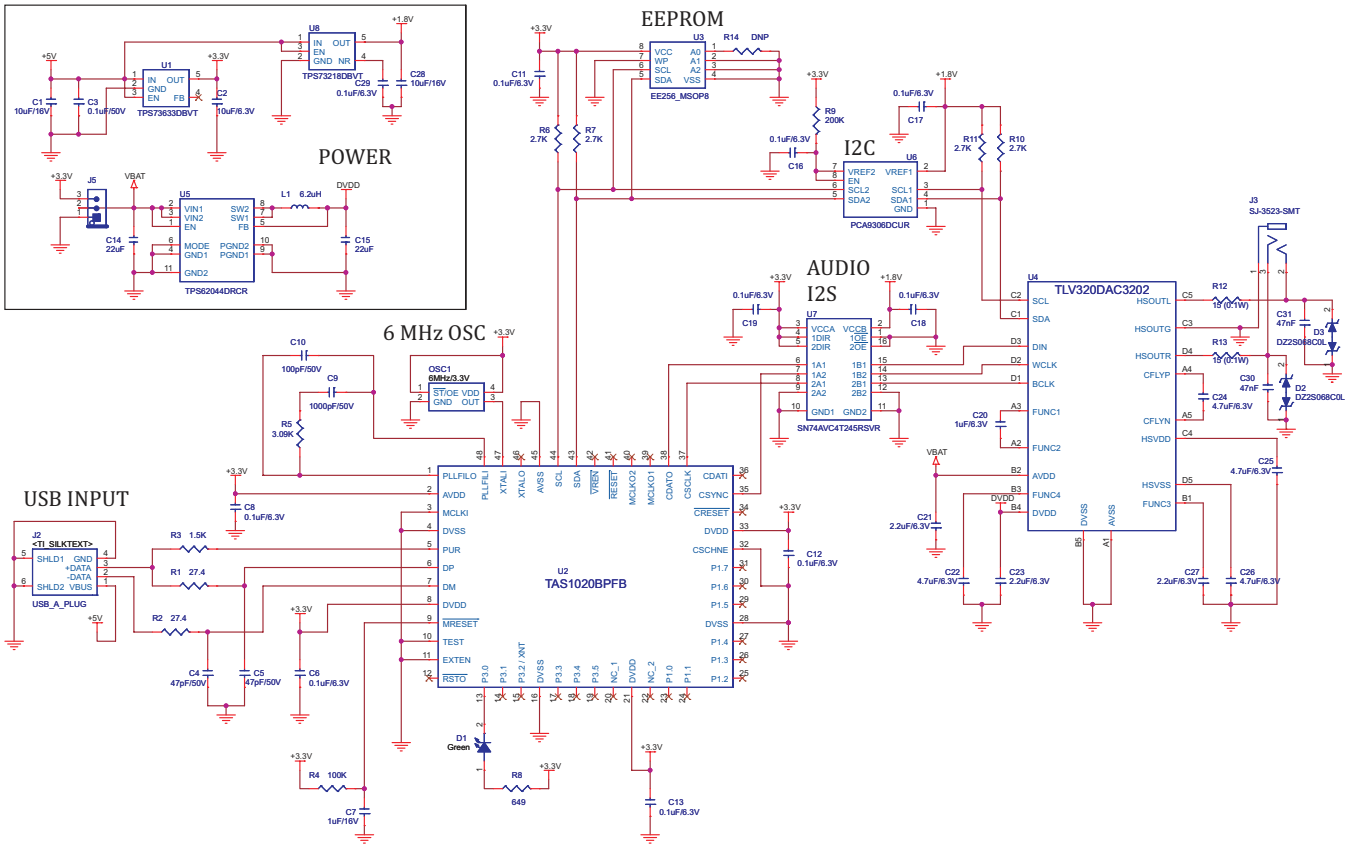

Figure 8. TLV320DAC3202EVM Schematic

7.2 Bill of Materials

Table 2. TLV320DAC3202EVM Bill of Materials

Item No	Count	RefDes	Value	Description	Size	Part Number	MFR
1	10	C6, C8, C11, C12, C13,C16, C17, C18, C19, C29	0.1 μF	X7R, ±10%, 16 V Capacitor	0402	C0402X7R160-104KNE	Venkel
2	1	C7	1.0 μF	X5R, ±10%, 10 V Capacitor	0402	GRM155R61A105KE15D	Murata Electronics
3	1	C20	1.0 μF	X5R, ±10%, 10 V Capacitor	0402	GRM155R61A105KE15D	Murata Electronics
4	1	C9	1000 pF	X7R, ±10%, 50 V Capacitor	0402	C0402X7R500-102KNE	Venkel
5	1	C10	100 pF	C0G, ±5%, 50 V Capacitor	0402	C0402COG500-101JNE	Venkel
6	3	C21, C23, C27	2.2 μF	X5R, ±20%, 6.3 V Capacitor	0402	GRM155R60J225ME15D	Murata Electronics
7	4	C22, C24, C25, C26	4.7 μF	X5R, ±20%, 4 V Capacitor	0402	AMK105BJ475MV-F	Taiyo Yuden
8	2	C30, C31	47000 pF	X7R, ±10%, 25 V Capacitor	0402	GRM155R71E473KA88D	Murata Electronics
9	1	C3	0.1 μF	X7R, ±10%, 50 V Capacitor	0603	C0603X7R500-104KNE	Venkel
10	2	C4, C5	47 pF	C0G, ±5%, 50 V Capacitor	0603	C0603COG500-470JNE	Venkel
11	3	C1, C2, C28	10 μF	X5R, ±10%, 16 V Capacitor	0805	EMK212BJ106KG-T	Taiyo Yuden
12	2	C14, C15	22 μF	X5R, ±20%, 6.3 V Capacitor	1210	JMK325BJ226MM-T	Taiyo Yuden
13	1	R4	100 kΩ	1/16W, ±1%, Resistor	0402	RC0402FR-07100KL	Yageo America
14	2	R12, R13	15 Ω	0.063W, ±1%, 50 V Resistor	0402	CR0402-16W-15R0FT	Venkel
15	4	R6, R7, R10, R11	2.74 kΩ	1/16W, ±1%, 75 V Resistor	0402	CRCW04022K74FKED	Vishay/Dale
16	1	R9	200 kΩ	1/16W, ±1%, 75 V Resistor	0402	ERJ-2RKF2003X	Panasonic - Ecg
17	1	R5	3.09 kΩ	1/16W, ±1%, Resistor	0402	ERJ-2RKF3091X	Panasonic - Ecg
18	1	R3	1.50 kΩ	1/10W, ±1%, 150 V Resistor	0603	CR0603-10W-1501FT	Venkel
19	2	R1, R2	27.4 kΩ	1/16W, ±1%, Resistor	0603	ERJ-3EKF27R4V	Panasonic - Ecg
20	1	R8	649 Ω	1/10W, ±1%, Resistor	0603	RC0603FR-07649RL	Yageo America
21	1	L1	6.2 μH	1.8 A, ±30% Inductor Coil	6.00 mm x 6.00 mm x 3.00 mm	CDRH5D28NP-6R2NC	Sumida Corporation
22	1	D1	LED-Green	2.1 V Optoelectronics	0805	PG1112H-TR	Stanley Electric
23	2	D2, D3	5.6 V-Bidirectional	5.6 V Discrete	SSMini2-F5-B	DZ2S068C0L	Panasonic - SSG
24	1	U5	TPS62044DRCR	Integrated Circuit	10-SON	TPS62044DRCR	Texas Instruments
25	1	U7	SN74AVC4T245RSV	1.2 V to 3.6 V Integrated Circuit	16-UQFN	SN74AVC4T245RSVR	Texas Instruments
26	1	U4	TLV320DAC3202	Integrated Circuit	20-BGA	TLV320DAC3202	Texas Instruments
27	1	U2	TAS1020BPFB	3 V to 3.6 V Integrated Circuit	48-TQFP	TAS1020BPFB	Texas Instruments
28	1	U3	24AA256-I/MS	1.7 V Integrated Circuit	8-MSOP	24AA256-I/MS	Microchip
29	1	U6	PCA9306DCUR	1.2 V to 5.5 V Integrated Circuit	8-VSSOP	PCA9306DCUR	Texas Instruments
30	1	U8	TPS73218DBVR	1.8 V, 250 mA Integrated Circuit	SOT-23-5	TPS73218DBVR	Texas Instruments
31	1	U1	TPS73633DBVT	3.3 V, 400 mA Integrated Circuit	SOT-23-5	TPS73633DBVT	Texas Instruments
32	1	OSC1	6.000 MHz	3.3 V, 15 pF 50 Crystals	2.5 mm x 2 mm	SIT8002AI-13-33E-6.00000T	SiTime
33	1	J5	1 X 3	High-temp connector	0.1 in	HTSW-150-25-G-S-RA	Samtec
34	1	J2	USB - A Type	Connector	EDG-SMT, R/A Horizontal	48037-1000	Molex Connector
35	1	J3	Mini Jack - 3.5 mm_R/A	Connector	SMT	SJ-3523-SMT	CUI Inc
36	1	R14	Do not install	—	—	—	—

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 0 V to 5 V and the output voltage range of 0 V to 1.5 V; refer to the TLV320DAC3202 data sheet (SLAS726).

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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