

***TPA6110A2 MSOP  
Audio Power Amplifier  
Evaluation Module***

*User's Guide*

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# Read This First

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### *Related Documentation From Texas Instruments*

- **TI Plug-N-Play Audio Amplifier Evaluation Platform** (literature number SLOU011) provides detailed information on the evaluation platform and its use with TI audio evaluation modules.
- **TPA6110A2 150-mW Stereo Audio Power Amplifier** (literature number SLOS314) This is the data sheet for the TPA6110A2 audio amplifier integrated circuit.

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# Introduction

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This chapter provides an overview of the Texas Instruments (TI) TPA6110A2 MSOP audio amplifier evaluation module (SLOP338). It includes a list of EVM features, a brief description of the module illustrated with a pictorial diagram, and a list of EVM specifications.

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## 1.1 Features

The TI TPA6110A2 MSOP audio amplifier evaluation module and the TI plug-n-play audio amplifier evaluation platform include the following features:

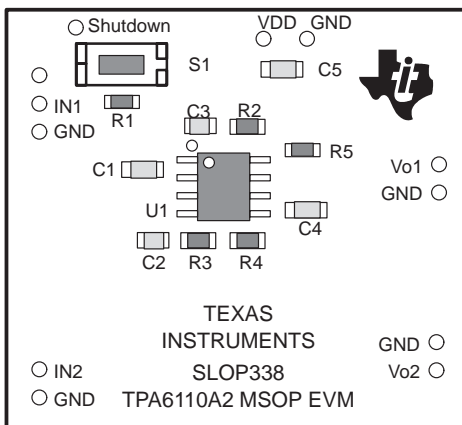
- TPA6110A2 MSOP Stereo Audio Power Amplifier Evaluation Module
  - Dual channel, single-ended operation
  - 150-mW output power into 8  $\Omega$  at 5 V
  - 2.5-V to 5.5-V operation
  - Very low distortion:
    - THD+N is less than 0.01% at 1 kHz and less than 0.03% from 20 Hz to 20 kHz into 10-k $\Omega$  loads
    - Less than 0.02% at 1 kHz and less than 0.4% from 20 Hz to 20 kHz into 32- $\Omega$  loads
    - Less than 0.05% at 1 kHz and less than 0.8% from 20 Hz to 20 kHz into 8- $\Omega$  loads
  - Extremely low current consumption in shutdown mode
  - Internal thermal and short-circuit protection
  - Internal pop reduction circuitry
- Quick and Easy Configuration With the TI Plug-N-Play Audio Amplifier Evaluation Platform
  - Evaluation module is designed to simply plug into the platform, automatically making all signal, control, and power connections
  - Platform provides flexible power options
  - Jumpers on the platform select power and module control options
  - Switches on the platform route signals
  - Platform provides quick and easy audio input and output connections
- Platform Power Options
  - Onboard 9-V battery
  - External 5-V–15-V ( $V_{CC}$ ) supply inputs
  - External regulated  $V_{DD}$  supply input
  - Socket for on-board 5-V  $V_{DD}$  voltage regulator EVM
  - Onboard overvoltage and reverse polarity power protection
- Platform Audio Input and Output Connections
  - Left and right RCA phono jack inputs
  - Miniature stereo phone jack input
  - Left and right RCA phono jack outputs
  - Left and right compression speaker terminal outputs
  - Miniature stereo headphone jack output



## 1.2 Description

The TPA6110A2 MSOP audio power amplifier evaluation module is a complete, low-power stereo audio power amplifier for high-fidelity line-level output, headphone, and small speaker applications. It consists of the TI TPA6110A2 150-mW stereo audio power amplifier IC in a very small MSOP package, along with a small number of other parts mounted on a circuit board that is approximately one and a quarter inches square (Figure 1–1).

Figure 1–1. The TI TPA6110A2 Audio Amplifier Evaluation Module



† Due to the very small size of the MSOP IC package, the standard part number TPA6110A2 is replaced with the code TIAIZ.

Single in-line header pins are mounted to the underside of the module circuit board; these pins allow the EVM to be plugged into the TI plug-n-play audio amplifier evaluation platform, or to be wired directly into existing circuits and equipment when used stand-alone.

The platform has room for a single TPA6110A2 evaluation module and is a convenient vehicle for demonstrating TI's audio power amplifier and related evaluation modules. The EVMs simply plug into the platform, which automatically provides power to the modules, interconnects them correctly, and connects them to a versatile array of standard audio input and output jacks and connectors. Easy-to-use configuration controls allow the platform and EVMs to quickly model many possible end-equipment configurations.

There is nothing to build, nothing to solder, and nothing but the speakers included with the platform to hook up.

## 1.3 TPA6110A2 MSOP EVM Specifications

Supply voltage range, $V_{DD}$	2.5 V to 5.5 V
Supply current, $I_{DD}$	160 mA, max
Continuous output power, $P_O$ : 8 $\Omega$ , $V_{DD}=5$ V	150 mW
Audio input voltage, $V_I$	$V_{DD} + 0.3$ V <sub>pp</sub> , max
Minimum load impedance, $R_L$	8 $\Omega$



## Operation

Follow the steps in this chapter to quickly prepare the TPA6110A2 MSOP audio amplifier EVM for use. The TPA6110A2 MSOP EVM and the TI plug-n-play audio amplifier evaluation platform provide a quick and easy way to connect power, signal and control inputs, and signal outputs to the EVM using standard connectors. However, the audio amplifier evaluation module can be used stand-alone by making connections directly to the module pins and can be wired directly into existing circuits or equipment.

The platform switch and jumper settings shown in Table 2–1 are typical for the TPA6110A2 MSOP EVM and will cause the TPA6110A2 IC to shutdown/mute when a plug is removed from platform headphone jack J10.

*Table 2–1. Typical TI Plug-N-Play Platform Jumper and Switch Settings for the TPA6110A2 MSOP EVM*

EVM	JP6	JP7	JP8	S2	S3
TPA6110A2	X	Lo	X	See Note 2	U5

- Notes:**
- 1) X = Don't care
  - 2) Set S2 to ON when signal conditioning board is installed in U1; set S2 to OFF when no signal conditioning board is installed.

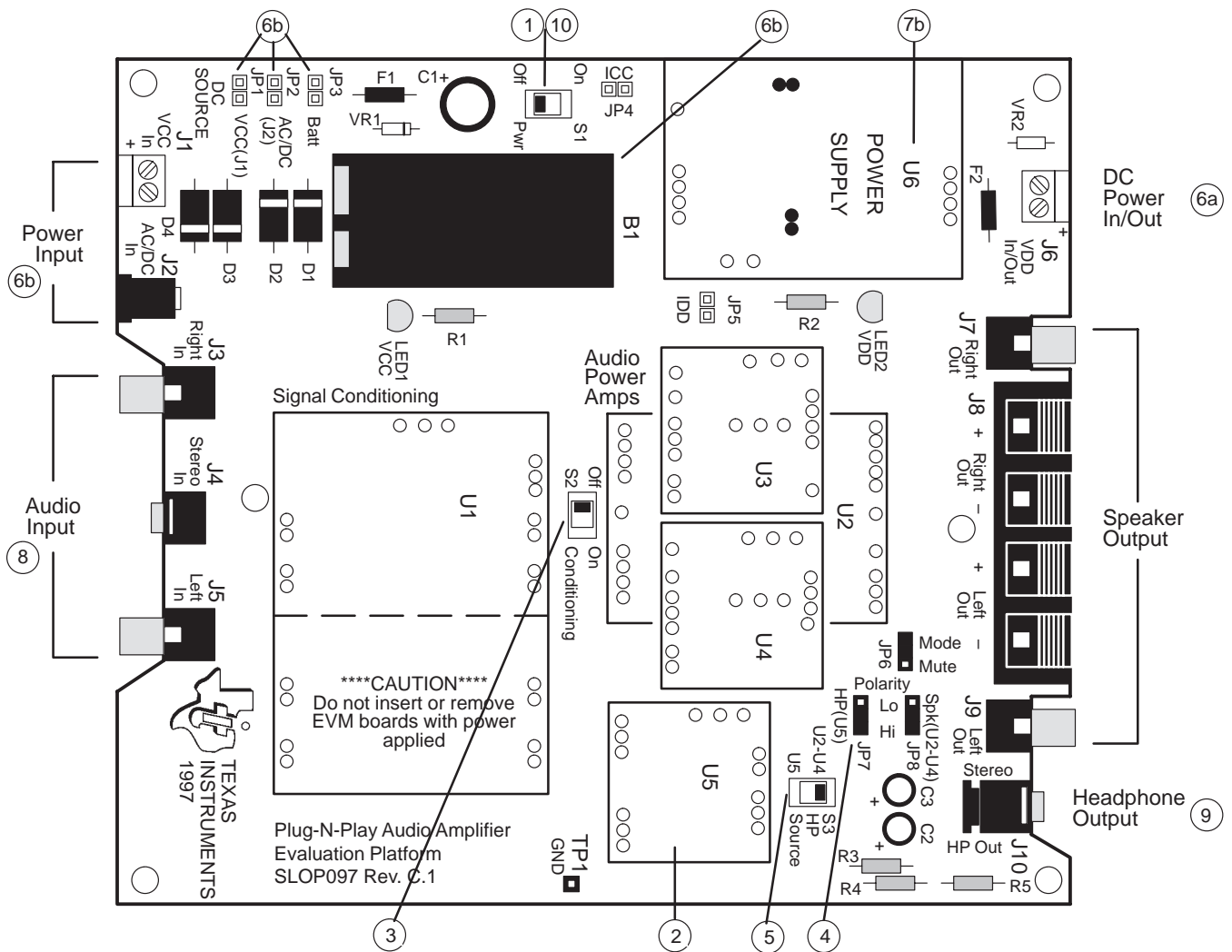
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## 2.1 Precautions

**Power Supply Input Polarity and Maximum Voltage**  
 Always ensure that the polarity and voltage of the external power connected to  $V_{CC}$  power input connector J1, J2, and/or  $V_{DD}$  power input connector J6 are correct. Overtoltage or reverse-polarity power applied to these terminals can open onboard soldered-in fuses and cause other damage to the platform, installed evaluation modules, and/or the power source.

**Inserting or Removing EVM Boards**  
 Do not insert or remove EVM boards with power applied—damage to the EVM board, the platform, or both may result.

Figure 2–1. Quick Start Platform Map



## 2.2 Quick Start List for Platform

Follow these steps when using the TPA6110A2 MSOP EVM with the TI plug-n-play audio amplifier evaluation platform (see the platform user's guide, SLOU011, for additional details). Numbered callouts for selected steps are shown in Figure 2–1.

### □ Platform preparations

- 1) Ensure that all external power sources are set to off and that the platform power switch S1 is set to off.
- 2) Install a TPA6110A2 MSOP module in platform socket U5, taking care to align the module pins correctly.
- 3) Use switch S2 to select or bypass the signal conditioning EVM (U1)
- 4) Set control signal polarity jumper JP7 to Lo.
- 5) Set HP source switch S3 to U5 to route the output signal to the headphone jack (J10).

Table 2–2. Platform Jumper and Switch Settings for the TPA6110A2 MSOP EVM

EVM	JP6	JP7	JP8	S2	S3
TPA6110A2	X	Lo	X	See Note 2	U5

**Notes:**

- 1) X = Don't care
- 2) Set S2 to ON when signal conditioning board is installed in U1; set S2 to OFF when no signal conditioning board is installed.

### □ Power supply

- 6) Select and connect the power supply:
  - a) Connect an external regulated power supply set to a voltage between 2.5 V and 5.5 V to platform  $V_{DD}$  power input connector J6, taking care to observe marked polarity, or
  - b) Install 3-V to 5-V voltage regulator EVM (SLVP097 or equiv.) in platform socket U6. Install a 9-V battery in B1 or connect a 7 V – 12 V power source to a platform  $V_{CC}$  power input J1 or J2 and jumper the appropriate power input (see platform user's guide).

### □ Inputs and outputs

- 7) Ensure that signal source level is set to minimum.
- 8) Connect the audio source to left and right RCA phono jacks J3 and J5 or stereo miniature phone jack J4.
- 9) Connect 32- $\Omega$  headphones to headphone jack J10.

### □ Power-up

- 10) Verify correct voltage and input polarity and set the external power supply to ON. If  $V_{CC}$  and an onboard regulator EVM are used to provide  $V_{DD}$ , set platform power switch S1 to ON.

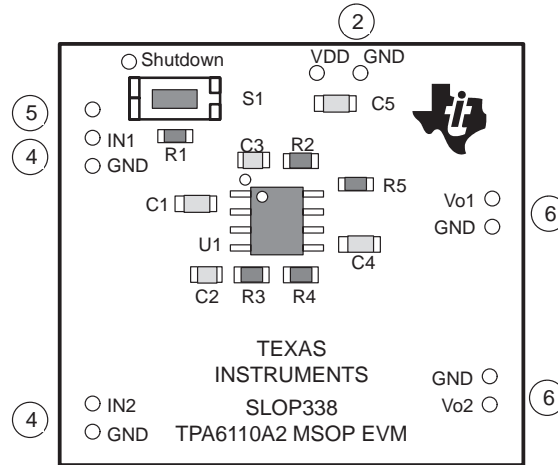
Platform LED2 lights indicating the presence of  $V_{DD}$ , and the evaluation modules installed on the platform begin operation.

- 11) Adjust the signal source level as needed.

## 2.3 Quick Start List for Stand-Alone

Follow these steps to use the TPA6110A2 MSOP EVM stand-alone or when connecting it to existing circuits or equipment. Connections to the TPA6110A2 MSOP module header pins can be made via individual sockets, wire-wrapping, or soldering to the pins, either on the top or the bottom of the module circuit board. Numbered callouts for selected steps are shown in Figure 2–2 and details appear in Chapter 3.

Figure 2–2. Quick Start Module Map



† Due to the very small size of the MSOP IC package, the standard part number TPA6110A2 is replaced with the code T1A1Z.

### ❑ Power supply

- 1) Ensure that all external power sources are set to off.
- 2) Connect an external regulated power supply set to 5 V to the module  $V_{DD}$  and GND pins, taking care to observe marked polarity.

### ❑ Inputs and outputs

- 3) Ensure that the signal source level is set to minimum.
- 4) Connect the audio source to the module IN1, IN2, and GND pins, taking care to observe marked polarity.
- 5) Connect the shutdown (S1) pin to  $V_{DD}$  through a normally open switch.
- 6) Connect 32- $\Omega$  headphones to the module  $V_{O1}$ , and  $V_{O2}$  pins through 33  $\mu$ F to 1000  $\mu$ F output-coupling capacitors (see Figure 2–3) and return to the GND pin, or
- 7) For line output, connections to the  $V_{O1}$  and  $V_{O2}$  pins must be made through 33  $\mu$ F to 1000  $\mu$ F output-coupling capacitors and returned to GND.

### ❑ Power-up

- 8) Verify correct voltage and input polarity and set the external power supply to *ON*.

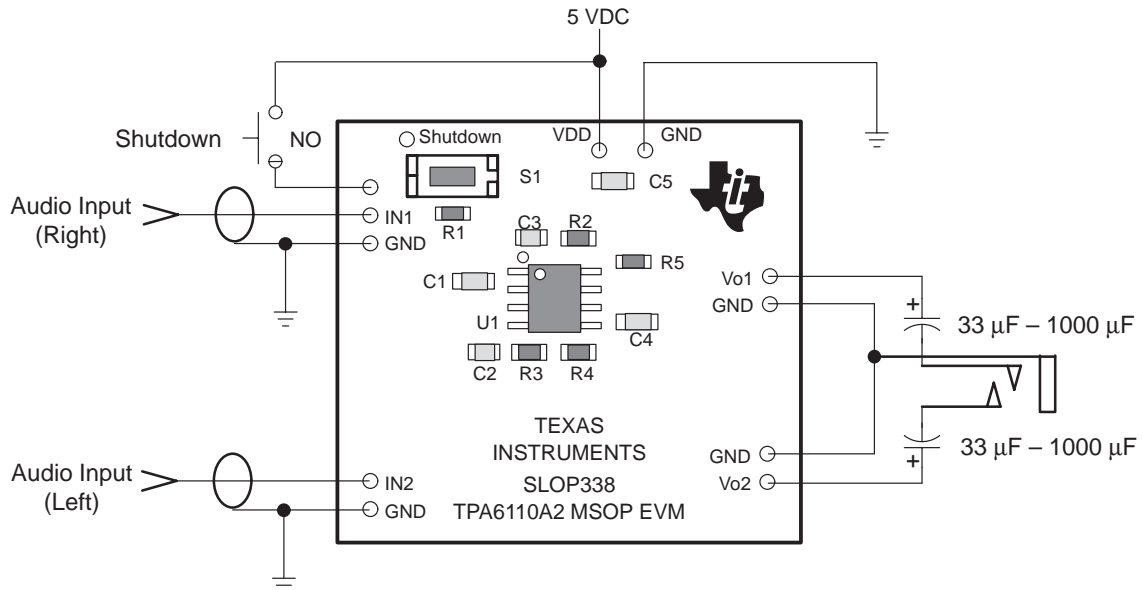
The EVM should begin operation.

- 9) Adjust the signal source level as needed.

## 2.4 References

### 2.4.1 TPA6110A2 MSOP EVM Connected as a Stereo Headphone Amplifier

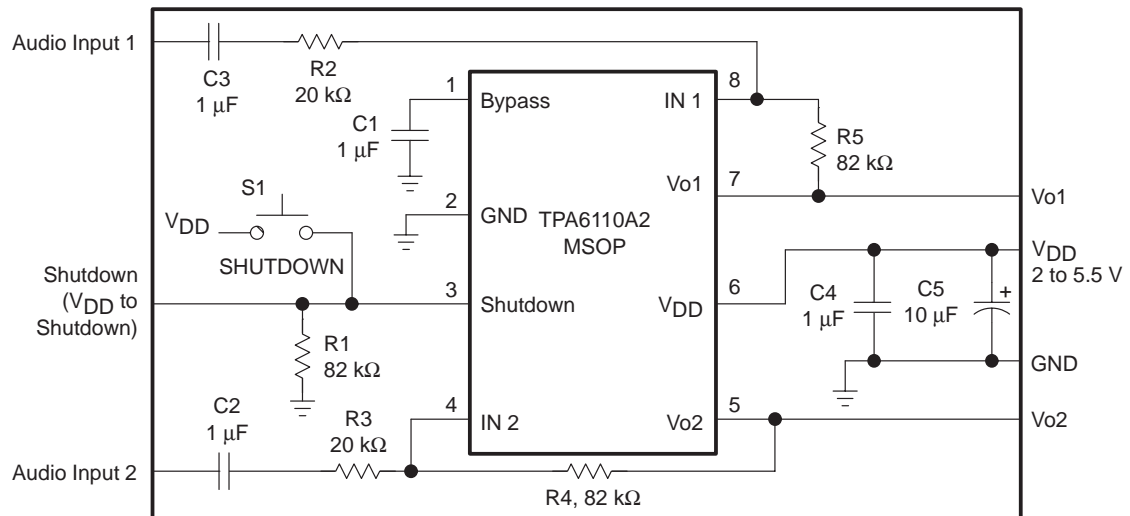
Figure 2–3. TPA6110A2 MSOP EVM Connected as a Stereo Headphone Amplifier



† Due to the very small size of the MSOP IC package, the standard part number TPA6110A2 is replaced with the code TIAIZ.

### 2.4.2 TPA6110A2 MSOP EVM Schematic Diagram

Figure 2–4. TPA6110A2 MSOP EVM Schematic Diagram



### 2.4.3 TPA6110A2 MSOP Audio Power Amplifier Evaluation Module Parts List

Table 2–3. TPA6110A2 MSOP EVM Parts List

Ref.	Description	Size	Qty.	Manufacturer/ Part Number	Vendor/Number
R2, R3	Resistor, 20 k $\Omega$ , 1/16 W, 5%, SMD	0603	3	Panasonic ERJ-3GSYJ203	Digi-Key P20PGCT-ND
R1, R4, R5	Resistor, 82 k $\Omega$ , 1/16 W, 5%, SMD	0603	2	Panasonic ERJ-3GSYJ823	Digi-Key P82KGCT-ND
C1–C4	Capacitor, 1 $\mu$ F, +20/–80%, Non-polarized, SMD	0603	4	Murata GRM39-Y5V105Z10	Newark
C5	Capacitor, 10 $\mu$ F, 6.3 V, SMD	A	1	Panasonic ECS-TOJY106R	Digi-Key PCS1106CT-ND
S1 (SHUTDOWN)	Switch, momentary SMD		1	Panasonic P8048SCT-ND	Digi-Key P8048SCT-ND
U1	IC, TPA6110A2, APA, 150 mW, 2 channel	MSOP-8	1	TI TPA6110A2DGN	
PNP Pins	Terminal post headers		11	Sullins	Digi-Key S1022-36-ND

The following illustrations depict the TPA6110A2 EVM PCB layers and silkscreen. These drawings are not to scale. Gerber plots can be obtained from any TI sales office.

### 2.4.4 TPA6110A2 EVM PCB Layers

Figure 2–5. TPA6110A2 EVM PCB Layers

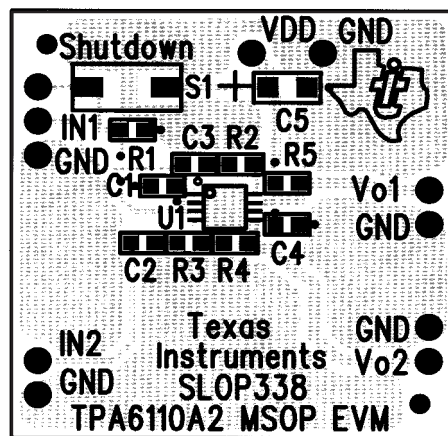




Figure 2–6. TPA6110A2 EVM Silkscreen

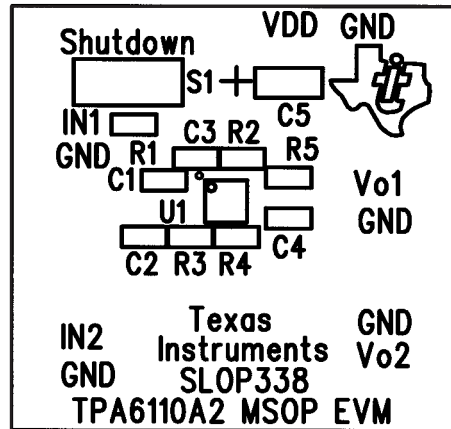


Figure 2–7. TPA6110A2 EVM PCB Top Layer

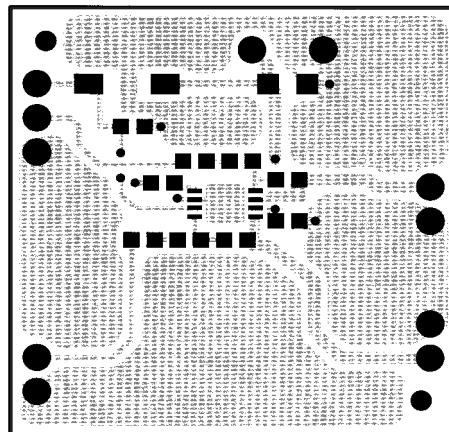


Figure 2–8. TPA6110A2 EVM PCB Bottom Layer

