TPA2006D1 Audio Power Amplifier EVM

This document provides an overview of the Texas Instruments (TI) TPA2006D1 audio amplifier evaluation module. It includes a list of EVM features, a brief illustrated description of the module, and a list of EVM specifications.

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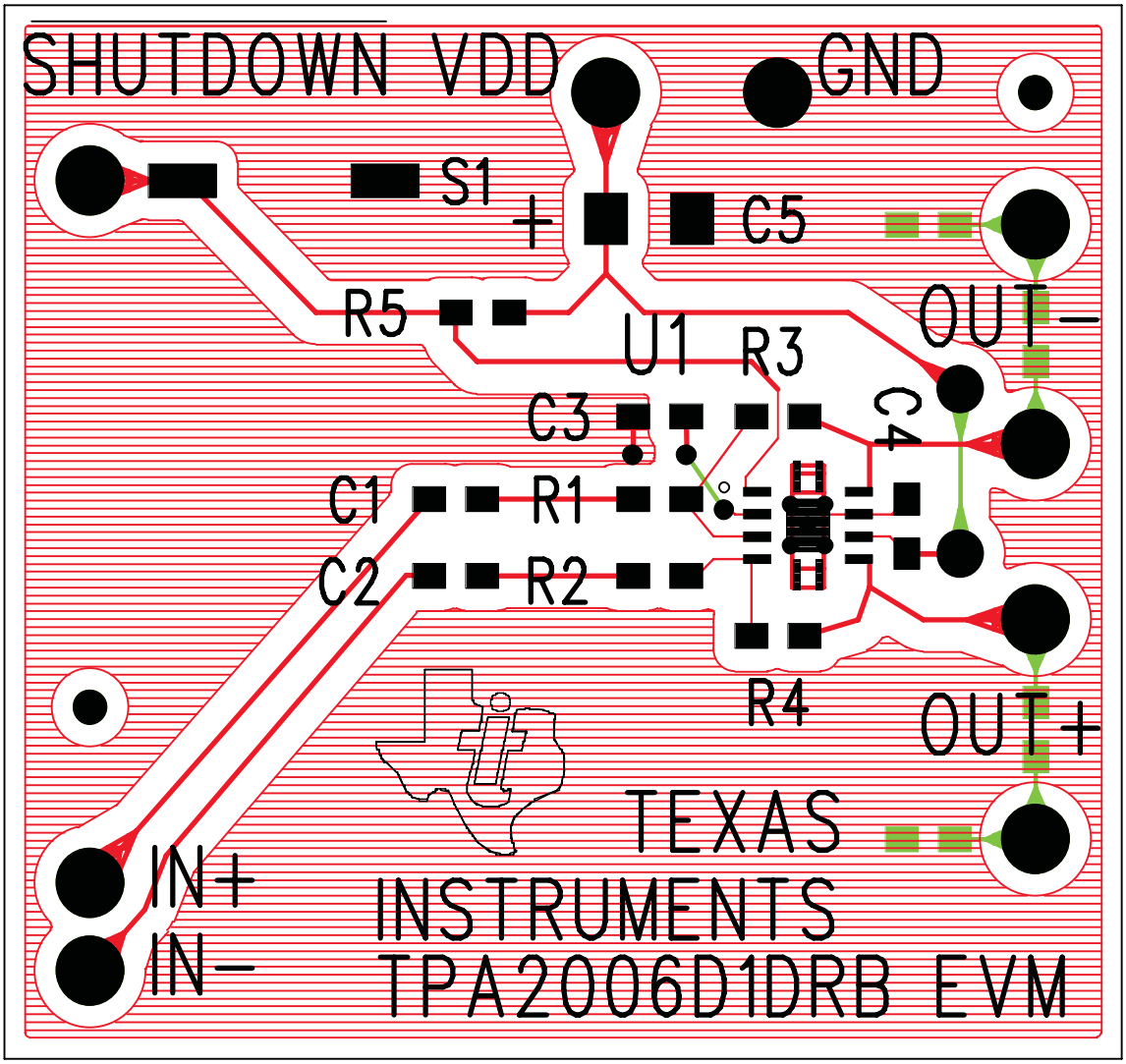
1 Feature Highlights

The TI TPA2006D1 audio amplifier evaluation module and the TI plug-n-play audio amplifier evaluation platform include the following features:

- TPA2006D1 Low-Voltage Audio Power Amplifier Evaluation Module
  - 3 mm × 3 mm DRB package
  - Fully differential filter-free Class-D amplifier
  - Single channel, bridge-tied load (BTL)
  - 2.5-V to 5.5-V operation
  - 1.45-W output power into 8 Ω at 5 V, BTL
  - Internal depop and quick start-up circuitry
  - Internal thermal and short-circuit protection
  - Module gain is set at 2 V/V
  - 1.8-V logic level on Shutdown pin; 5-V tolerant
- 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 to 15-V (V_{CC}) supply inputs
  - External regulated V_{DD} supply input
  - Socket for onboard 5-V/3.3-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

1.1 Description

The TPA2006D1 audio power amplifier evaluation module is a complete, low-power single-channel audio power amplifier. It consists of the TI TPA2006D1 1.45-W low-voltage audio power amplifier IC in a very small DRB package, along with a small number of other parts mounted on a circuit board that is approximately 1.25 in. by 1.125 in (32 mm x 29 mm) (see Figure 1).



NOTE: Due to the small size of the DRB IC package, the standard part number TPA6002D1DRB is replaced with the code AAOI.

Figure 1. The TI TPA2006D1 Audio Amplifier Evaluation Module

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, which has room for a pair of TPA2006D1 evaluation modules, 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 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.

1.2 TPA2006D1 EVM Specifications

		VALUE	UNIT
V_{DD}	Supply voltage range	2.5 to 5.5	V
	Power supply current rating required	500	mA
P_O	Continuous output power, 8 Ω BTL, V_{DD} = 5 V	1.45	W
V_I	Audio input voltage	0 to V_{DD}, max	V
Z_L	Minimum load impedance	8	Ω

2 Operation

Follow the steps in this section to prepare the TPA2006D1 audio amplifier EVM for use. Using the TPA2006D1 EVM with the TI plug-n-play audio amplifier evaluation platform is 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 it can be wired directly into existing circuits or equipment.

The platform switch and jumper settings shown in Table 1 are typical for the TPA2006D1 EVM. They cause the TPA2006D1 amplifier IC on the EVM to shut down when a plug is inserted into platform headphone jack J10.

Table 1. Typical TI Plug-N-Play Platform Jumper and Switch Settings for the TPA2006D1 EVM

EVM	JP6	JP7	JP8	S2	S3
TPA2006D1	Mute	X(1)	Lo	See (2)	X(1)

(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.

2.1 Precautions

CAUTION

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. Overvoltage 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.

CAUTION

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.

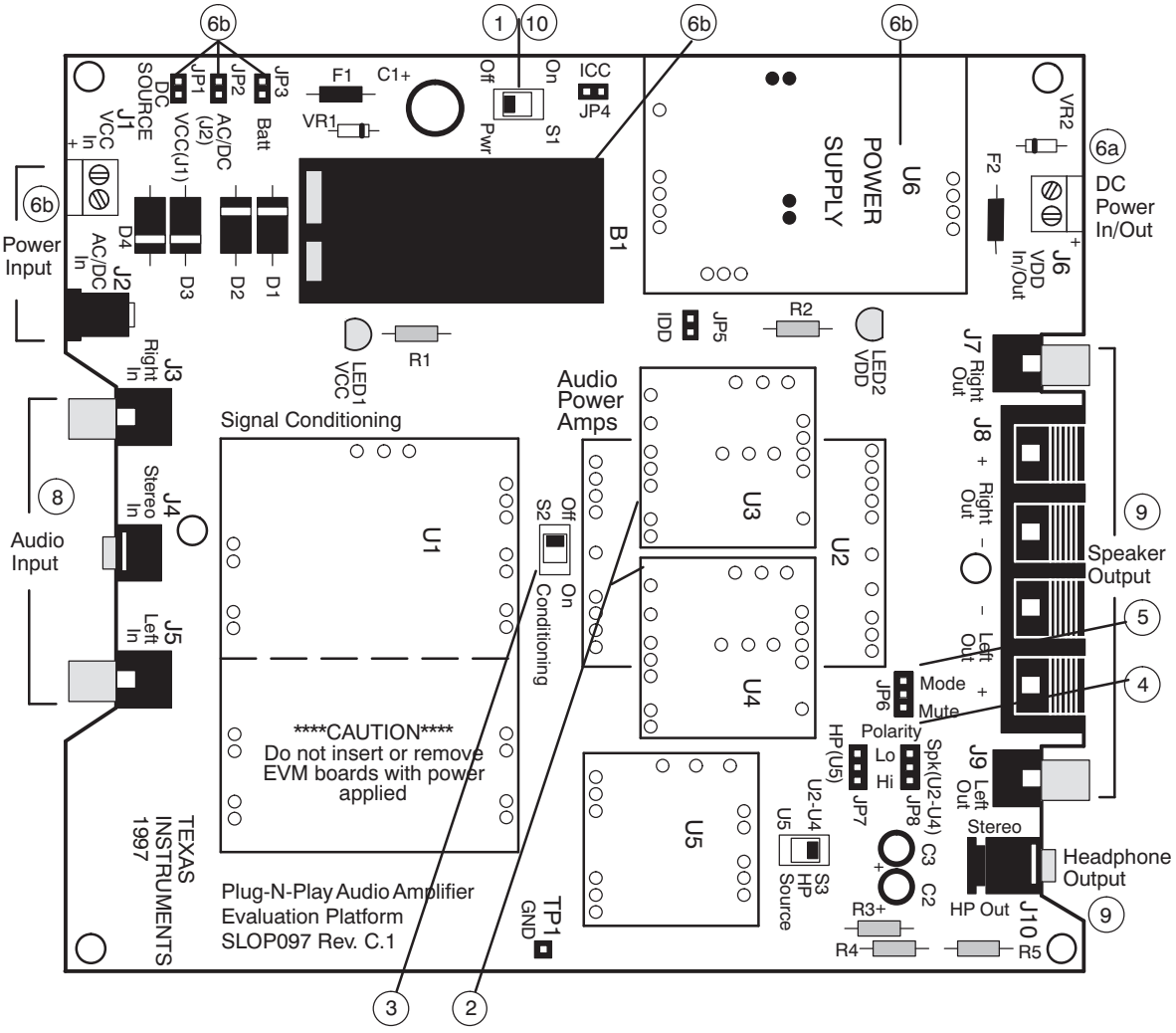


Figure 2. Quick Start Platform Map

2.2 Quick Start List for Platform

Follow these steps when using the TPA2006D1 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.

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 TPA2006D1 module in platform sockets U3 and U4 for stereo operation (or a module in either U3 or U4 for single channel operation), 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 JP8 to Lo.
5. Set jumper JP6 to select the mute control input (which causes the TPA2006D1 to shut down if a plug is inserted into platform headphone jack J10).

Table 2. Platform Jumper and Switch Settings for the TPA2006D1 EVM

EVM	JP6	JP7	JP8	S2	S3
TPA2006D1	Mute	X(1)	Lo	See (2)	X(1)

(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.

Selecting and connecting the power supply:

6a. 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

6b. Install a voltage regulator EVM (SLVP097 or equivalent.) 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 Setup:

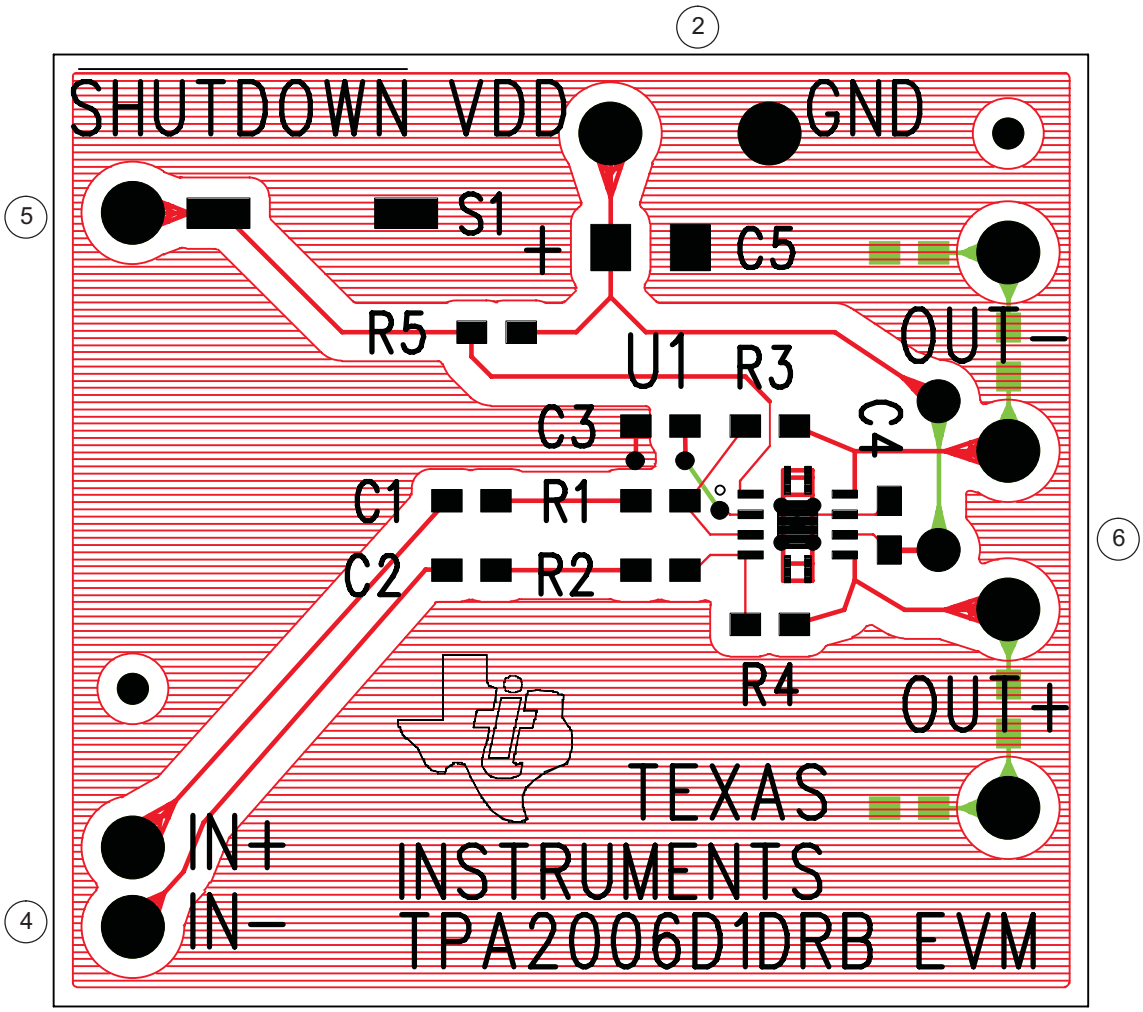
7. Ensure that signal source level is set to minimum.
8. Connect the audio source to left and right RCA phono jacks J3 and J5 or to stereo miniature phone jack J4.
9. Connect 8Ω–32Ω speakers to left and right RCA jacks J7 and J9 or to stripped wire connector J8.

Power-Up Procedure:

10. Verify correct voltage and input polarity and set the external power supply to on. If V_{CC} and an on-board 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 TPA2006D1 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the TPA2006D1 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 3.



NOTE: Due to the small size of the DRB IC package, the standard part number TPA6002D1DRB is replaced with the code AAOI.

Figure 3. Quick Start Module Map

Power Supply Setup

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.

Setting the Inputs and Outputs

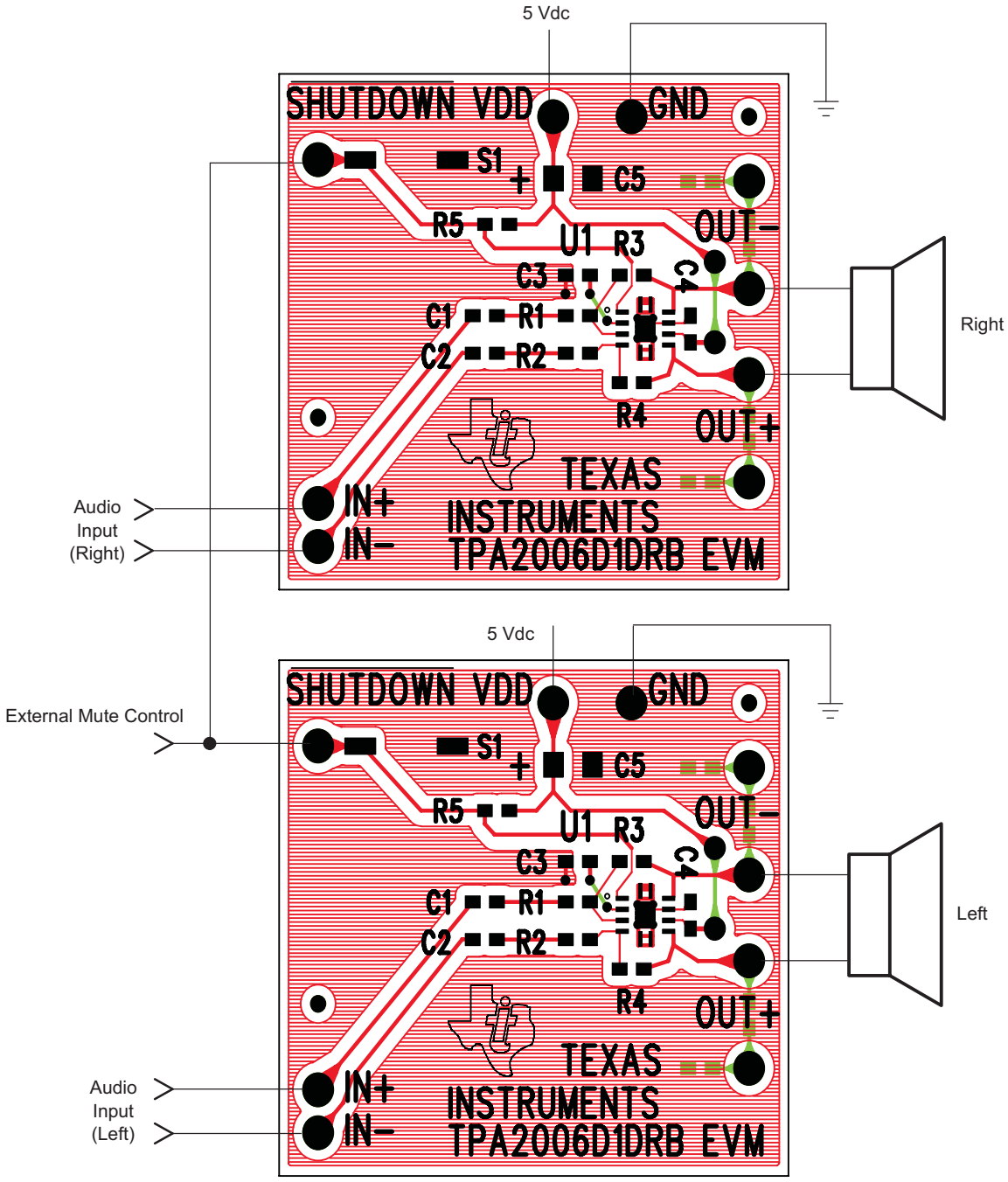
3. Ensure that the signal source level is set to minimum.
4. Connect the positive lead from the audio source to module IN+ pin, negative lead to the IN– pin.
5. Connect the $\overline{\text{SHUTDOWN}}$ pin through a normally open switch to GND.
6. Connect an 8Ω–32Ω speaker to the module OUT+ and OUT– pins.

Power-Up Procedure

7. Verify correct voltage, input polarity; set external power supply to on. The EVM begins operation.
8. Adjust the signal source level as needed.

2.4 References

2.4.1 TPA2006D1 EVM Connected for Stereo BTL Output



NOTE: Due to the small size of the DRB IC package, the standard part number TPA6002D1DRB is replaced with the code AAOI.

Figure 4. TPA2006D1 EVM Connected for Stereo BTL Output

2.4.2 TPA2006D1 EVM Schematic Diagram

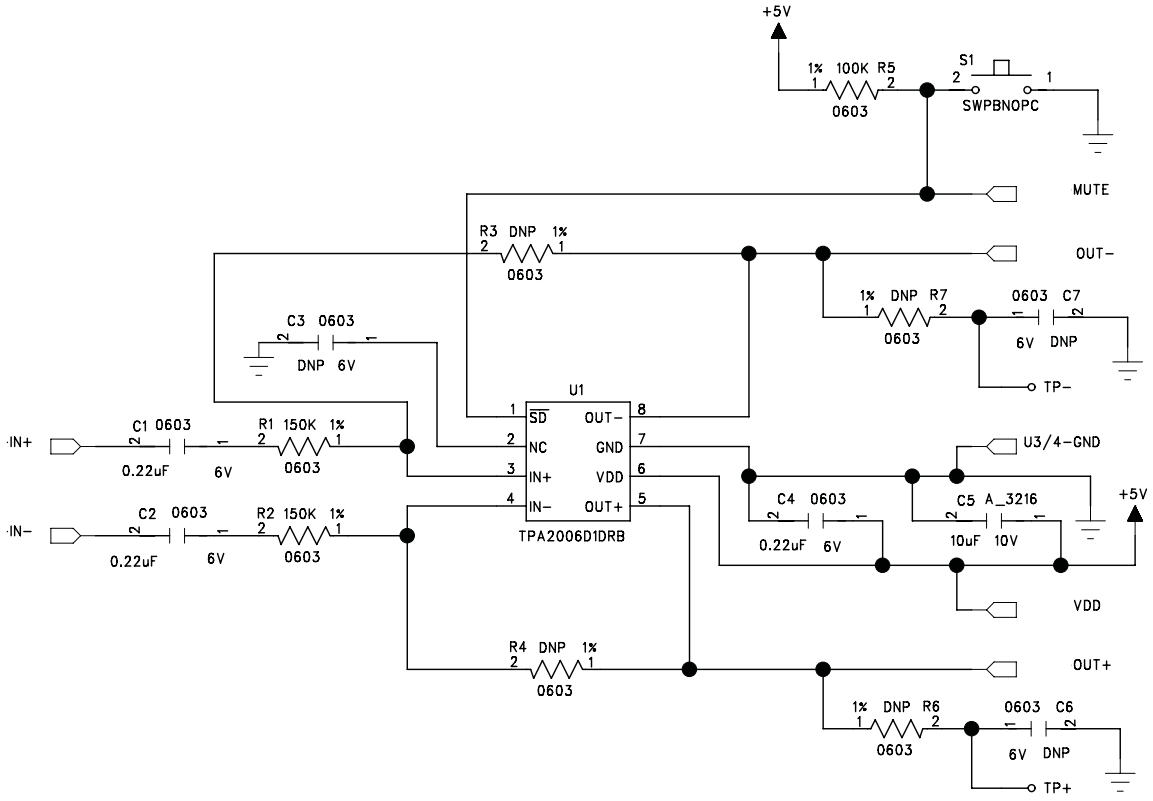


Figure 5. TPA2006D1 EVM Schematic Diagram

2.4.3 TPA2006D1 Audio Power Amplifier Evaluation Module Parts List

Table 3. TPA2006D1 EVM Parts List(1)

Reference(2)	Description	Size	Qty	Manufacturer/ Part Number	Digi-Key Number
C1, C2, C4	Capacitor, 0.22µF, ±10%, 10V, X7R, nonpolarized SMD(3)	0603	3	AVX 0603ZC224KAT2A	Digi-Key 478-1243-1-ND
C5	Capacitor, 10µF, 10V, SMD	A	1	Kemet T491A106K010AT	Digi-Key 399-3684-1-ND
R1, R2	Resistor, 150kΩ, 1/10 W, 1%, SMD	0603	2	Panasonic ERJ-3EKF1503V	Digi-Key P150KHTR-ND
R5	Resistor, 100kΩ, 1/16 W, 1%, SMD	0603	1	Panasonic ERJ-3EKF1003V	Digi-Key P100KHTR-ND
S1	Momentary switch, SMD (low profile)		1	Panasonic EVQ-PJS04K	Digi-Key P8048SCT-ND
U1	Integrated Circuit, TPA2006D1, mono Class-D audio amplifier		1	TI TPA2006DRB(4)	
	Terminal post headers		7	Sullins PTC36SABN	Digi-Key S1022-36-ND
PCB1	Printed Circuit Board, TPA2006D1DRB EVM		1		

(1) All items are SMD except terminal posts.
(2) R3, R4, and C3 pads are available so that TPA6205 can evaluated using this board.
(3) Substitute only with 10% capacitors.
(4) Due to the small size of the SON DRB package, the standard part number TPA2006D1DRB is replaced with the code AAOI.

2.4.4 TPA2006D1 EVM PCB Layers

The following illustrations depict the TPA2006D1 EVM PCB layers and silkscreen. These drawings are not to scale. Gerber plots can be obtained from www.ti.com.

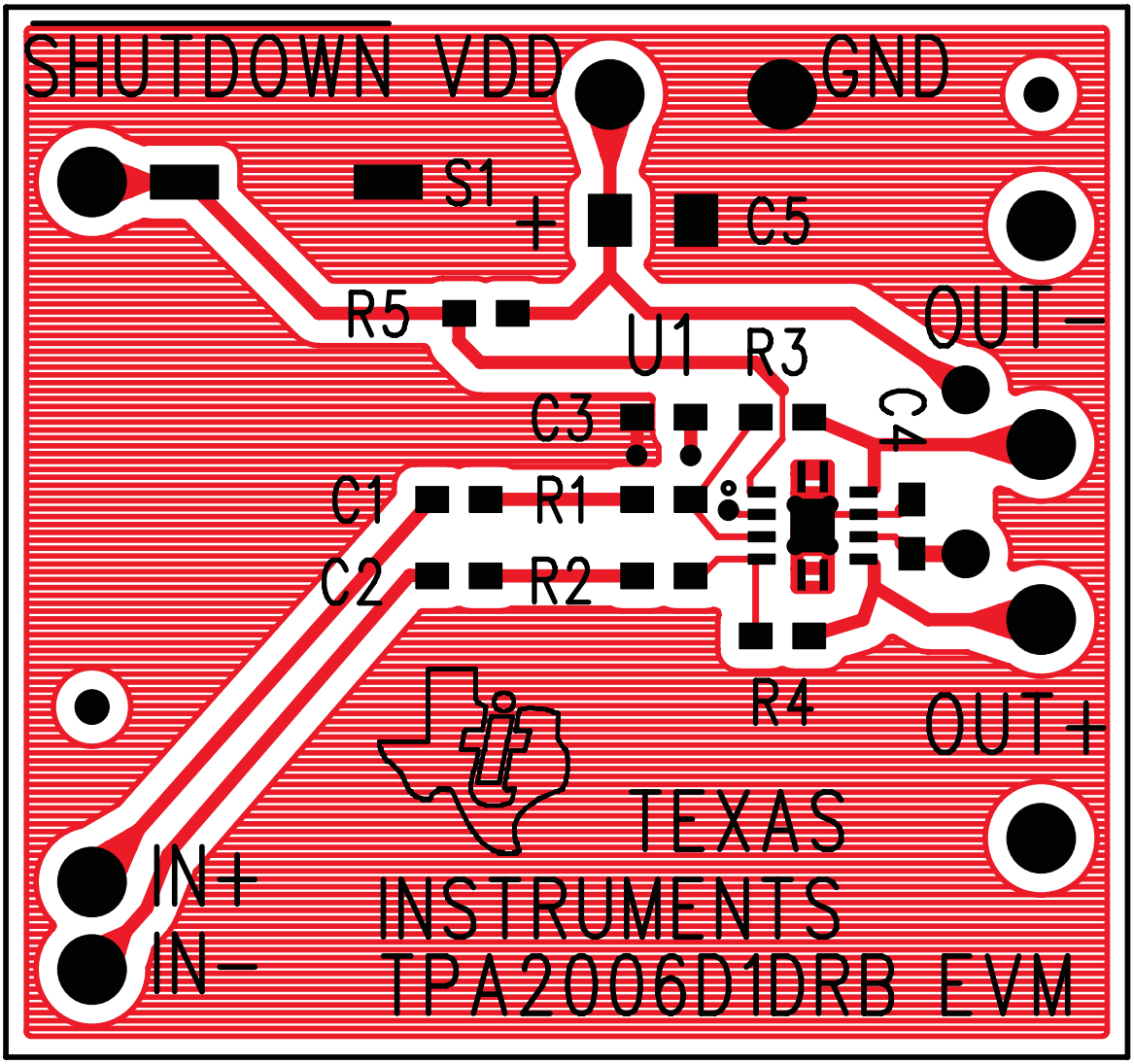


Figure 6. TPA2006D1 EVM Top Layer

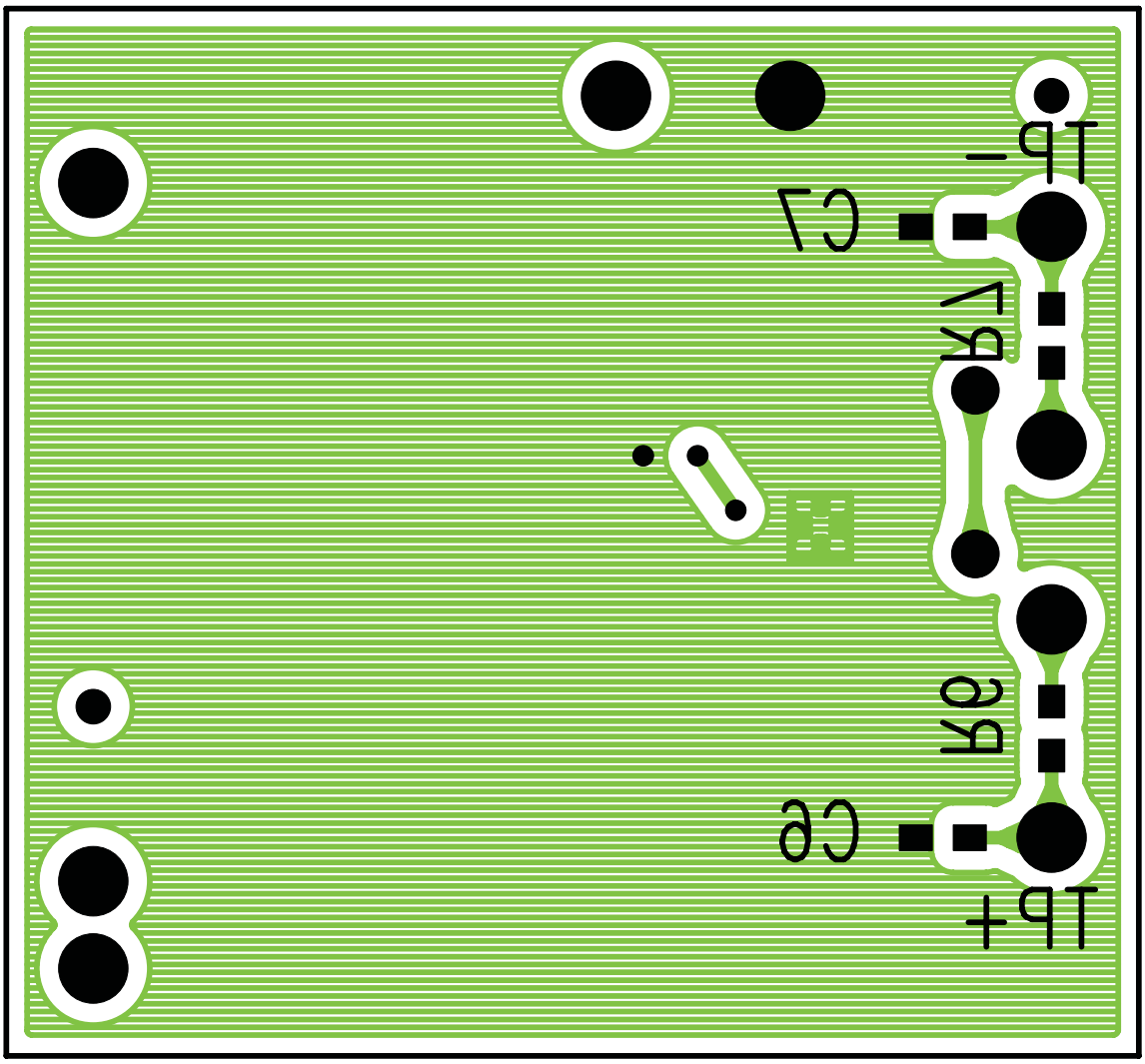


Figure 7. TPA2006D1 EVM Bottom Layer

3 Related Documentation From Texas Instruments

- ***TI Plug-N-Play Audio Amplifier Evaluation Platform*** (SLOU011) provides detailed information on the evaluation platform and its use with TI audio evaluation modules.
- ***TPA2006D1 1.8-V Control Mono Filter-Free Class-D Audio Power Amplifier*** (SLOS498) This is the data sheet for the TPA2006D1 audio amplifier integrated circuit.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.5 V to 5.5 V.

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.

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