

**TPA2000D2**  
**Filterless Class-D**  
**Audio Power Amplifier**  
**Evaluation Module**

*User's Guide*

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# Preface

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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.
- ***TPA2000D2 2-W STEREO CLASS-D AUDIO POWER AMPLIFIER*** (literature number SLOS291) This is the data sheet for the TPA2000D2 audio amplifier integrated circuit.

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# Introduction

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This chapter provides an overview of the Texas Instruments (TI) TPA2000D2 filterless class-D audio amplifier evaluation module (SLOP312A). 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 Feature Highlights

The TI TPA2000D2 audio amplifier evaluation module and the TI plug-n-play audio amplifier evaluation platform include the following features:

- TPA2000D2 Stereo 2-W Filterless Class-D Audio Power Amplifier Evaluation Module
  - Class-D without output filter
  - Internal depop circuitry to minimize transients in outputs
  - High efficiency
  - Low distortion
  - Low supply current (8 mA)
  - 2 W per channel output power into 3  $\Omega$  at 5 V
  - Low current consumption in shutdown mode
  - Four selectable gain settings: 8, 12, 17.5, and 23.5 dB
  - Differential stereo inputs
  - 24-pin TSSOP PWP package
- 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
  - External 5-V – 15-V dc  $V_{CC}$  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



## 1.2 Description

The TPA2000D2 filterless class-D stereo audio power amplifier evaluation module is a complete, 2-watt per channel class-D stereo audio power amplifier that can operate without an output filter. It consists of the TI TPA2000D2 class-D stereo 2-W audio power amplifier IC along with a small number of other parts mounted on a circuit board that measures approximately 2-1/4 inches by 1-1/2 inches (Figure 1–1 and Figure 1–2).

Figure 1–1. The TI TPA2000D2 Audio Amplifier EVM Without Output Filter—Top View

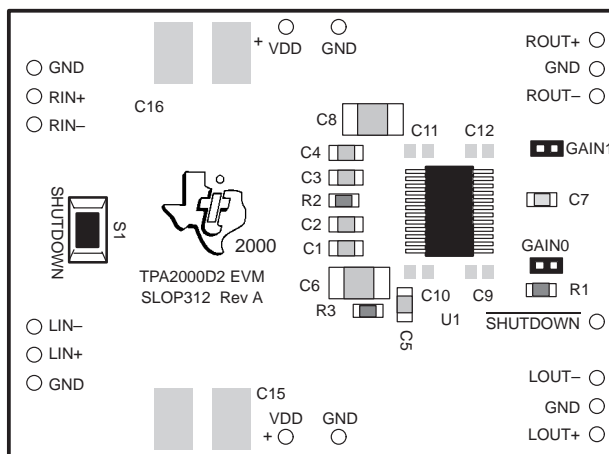
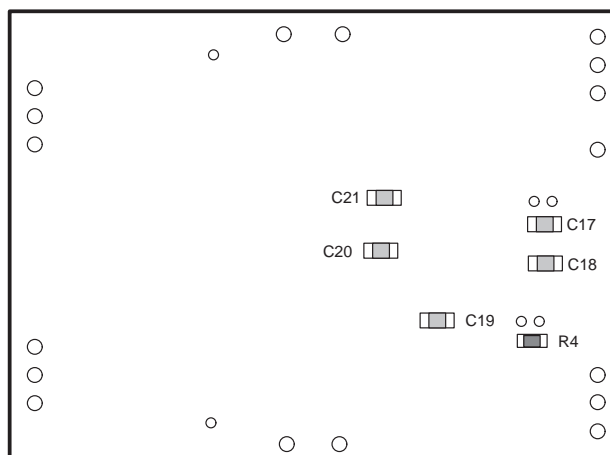


Figure 1–2. The TI TPA2000D2 Audio Amplifier EVM Without Output Filter—Bottom View



Single in-line header pins extend from the underside of the module circuit board to 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 TPA2000D2 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 TPA2000D2 EVM Specifications

Supply voltage range, $V_{DD}$ .....	4.5 V to 5.5 V
Supply current, $I_{DD}$ .....	2 A max
Continuous output power per channel, $P_O$ : 3 $\Omega$ , $V_{DD} = 5$ V .....	2 W
Minimum load impedance, $R_L$ .....	3 $\Omega$

## Quick Start

The steps in this chapter can be followed to quickly prepare the TPA2000D2 filterless class-D audio amplifier EVM for use. Using the TPA2000D2 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 can be wired directly into existing circuits or equipment.

The platform switch and jumper settings shown in Table 2–1 are typical for the TPA2000D2 EVM and will cause the TPA2000D2 to shut down when a plug is inserted into platform headphone jack J10.

*Table 2–1. Typical TI Plug-N-Play Platform Jumper and Switch Settings for the TPA2000D2*

EVM	JP4	JP5	JP6	JP7	JP8	S2	S3
P-N-P Platform	X	ON	Mute	X	Lo	Note 2	U5

- Notes:**
- 1) ON = Jumper installed, OFF = Jumper **NOT** Installed, 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.

*Table 2–2. Typical TPA2000D2 EVM Jumper Settings*

EVM	GAIN0	GAIN1
TPA2000D2	OFF	OFF

**Note:** ON = Jumper installed, OFF = Jumper **NOT** Installed, X = Don't care

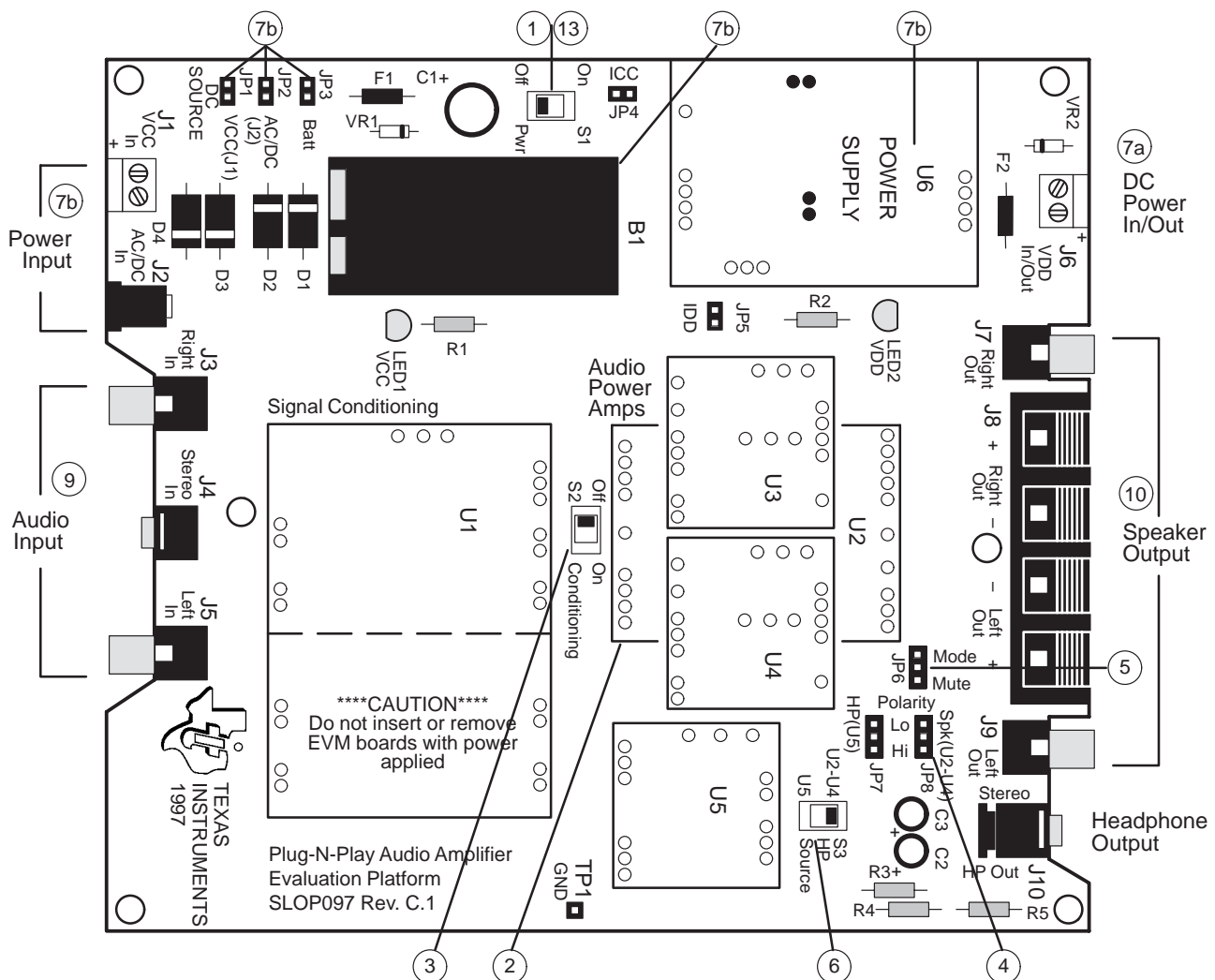
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## 2.1 Precautions

**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. 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.

**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 TPA2000D2 EVM with the TI plug-n-play audio amplifier evaluation platform (see the platform user's guide, literature number SLOU011, for additional details). Numbered callouts for selected steps are shown in Figure 2–1 and Figure 2–2, and details appear in Chapter 3.

### 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 TPA2000D2 module in platform socket **U2**, 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 (causes the TPA2000D2 to shut down if a plug is inserted into platform headphone jack **J10**).
- 6) If a headphone amplifier will be installed in **U5**, set headphone source switch **S3** to **U5**.

Table 2–3. Platform Jumper and Switch Settings for the TPA2000D2

EVM	JP4	JP5	JP6	JP7	JP8	S2	S3
P-N-P Platform	X	ON	Mute	X	Lo	Note 2	U5

**Notes:** 1) ON = Jumper installed, OFF = Jumper **NOT** Installed, 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

- 1) Select and connect the power supply (ensure power supply is set to **OFF**):
  - a) Connect an external regulated power supply set to 5 V to platform  $V_{DD}$  power input connector **J6** taking care to observe marked polarity, or
  - b) Install a voltage regulator EVM (SLVP097 or equiv.) in platform socket **U6**. 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). If using **J1**, **J2**, or **B1**, set **S1** to **ON** to supply power to the EVM.

### Inputs and outputs

- 1) Ensure that the audio signal source level is set to minimum.
- 2) Connect the audio source to left and right RCA phono jacks **J3** and **J5** or stereo miniature phone jack **J4**.
- 3) Connect speakers to left and right RCA jacks **J7** and **J9** or to stripped wire speaker connectors **J8**.

**Evaluation Module Preparations**

- 1) Use jumpers **GAIN0** and **GAIN1** to set the gain (Figure 2–2 and Table 2–4).

Figure 2–2. Module Preparation

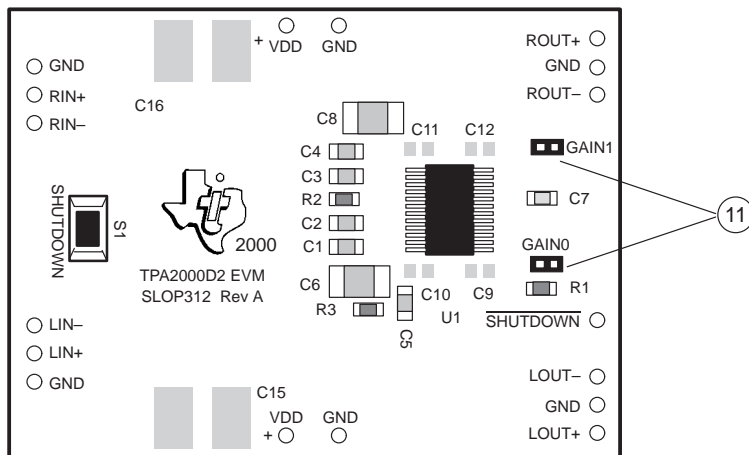


Table 2–4. Typical TPA2000D2 EVM Jumper Settings

GAIN1	GAIN0	GAIN (dB)
OFF	OFF	8
OFF	ON	12
ON	OFF	17.5
ON	ON	23.5

**Note:** ON = Jumper installed, OFF = Open, X = Don't care

**Power Up**

- 1) 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**.

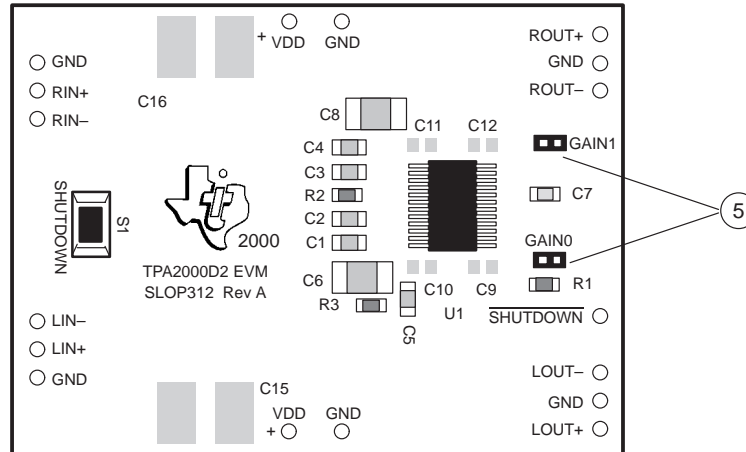
Platform LED2 should light indicating the presence of  $V_{DD}$ , and the evaluation modules installed on the platform should begin operation.

- 2) Adjust the signal source level as needed.

## 2.3 Quick Start List for Stand-Alone

Follow these steps to use the TPA2000D2 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the TPA2000D2 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 2–3 and details appear in Chapter 3.

Figure 2–3. Quick Start Module Map



### 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 **VDD** and **GND** pins taking care to observe marked polarity.

### Inputs and outputs

- 1) Ensure that audio signal source level adjustments are set to minimum.
- 2) Connect the right (left) positive lead of the audio source to the module **RIN+** (**LIN+**) pins and the negative lead to the **RIN-** (**LIN-**) pins.

**Evaluation module preparations**

- 1) Use jumpers **GAIN0** and **GAIN1** to set the gain as shown in Table 2–5.

Table 2–5. TPA2000D2 EVM Gain Settings

GAIN1	GAIN0	GAIN (dB)
OFF	OFF	8
OFF	ON	12
ON	OFF	17.5
ON	ON	23.5

**Note:** ON = Jumper installed, OFF = Open, X = Don't care

**Control inputs**

- 1) **SHUTDOWN**: A low shuts down the amplifier IC on the module; a high or float allows normal operation.

**Power up**

- 1) Connect external power supply set to 5 V across EVM VDD and GND pins.
- 2) Verify correct voltage and input polarity and set the external power supply to **ON**.

The EVM should begin operation.

- 3) Adjust the signal source level as needed.



# Details

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This chapter provides details on the TPA2000D2 IC, the evaluation module, and the steps in the Quick-Start List, additional application information, and a parts list for the TPA2000D2 evaluation module.

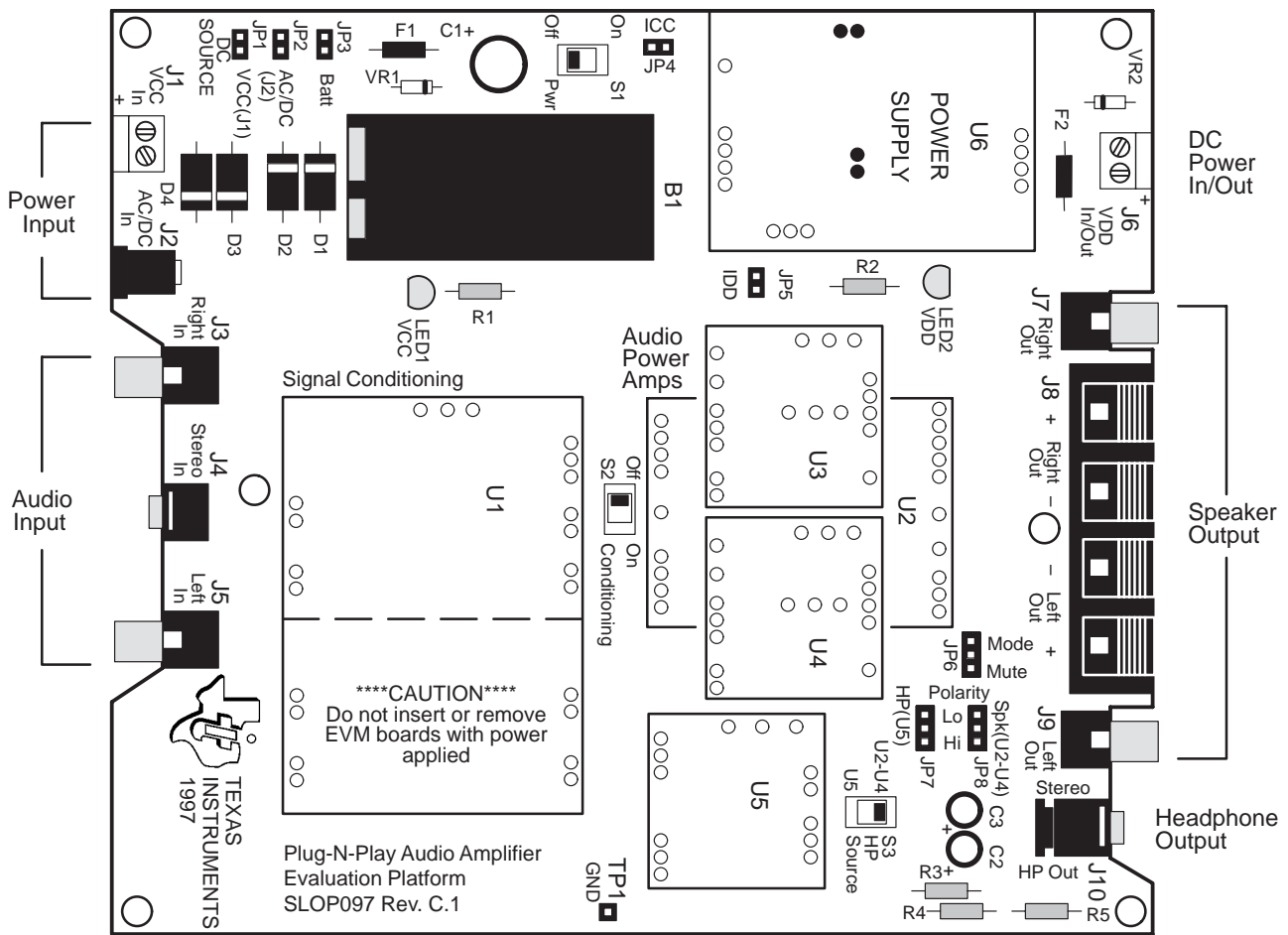
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### 3.1 Precautions

**Power Supply Input Polarity and Maximum Voltage**  
 Always ensure that the polarity and voltage of the external power connected to V<sub>CC</sub> power input connector J1, J2, and/or V<sub>DD</sub> 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.

**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 3–1. The TI Plug-N-Play Audio Amplifier Evaluation Platform



### 3.2 The TPA2000D2 Audio Power Amplifier Evaluation Module

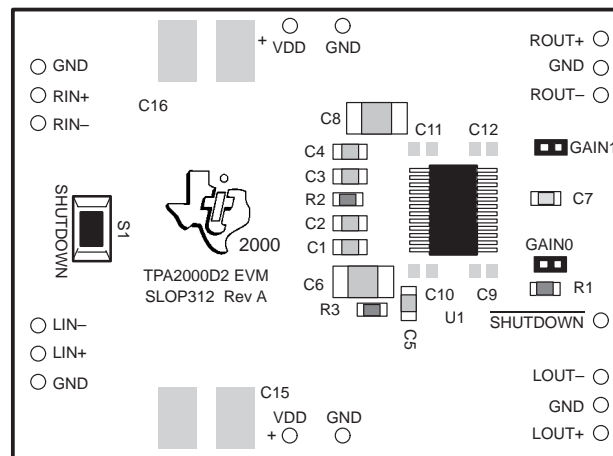
The TPA2000D2 audio power amplifier evaluation module is powered by a TPA2000D2 stereo power amplifier capable of delivering greater than 2 W of continuous power per channel into 3-Ω loads. The evaluation module includes a control input for shutdown.

The module can be used with the TI plug-n-play audio amplifier evaluation platform (Figure 3–1) or wired directly into circuits or equipment. The module has single in-line header connector pins mounted to the under side of the board. These pins allow the module to be plugged into the TI platform, which automatically makes all the signal input and output, power, and control connections to the module.

The module connection pins are on 0.1-inch centers to allow easy use with standard perf board and plug board-based prototyping systems. Or, the EVM can be wired directly into existing circuits and equipment when used stand-alone.

The module appears in Figure 3–2 and Figure 3–3, and its schematic is shown in Figure 3–4.

Figure 3–2. The TI TPA2000D2 Audio Amplifier EVM Without Output Filter—Top View



**Note:** Capacitors C9 – C12, C15, and C16 are optional (not assembled) and pad locations for them on the EVM PCB have been provided to increase design flexibility.

Figure 3–3. The TI TPA2000D2 Audio Amplifier EVM Without Output Filter—Bottom View

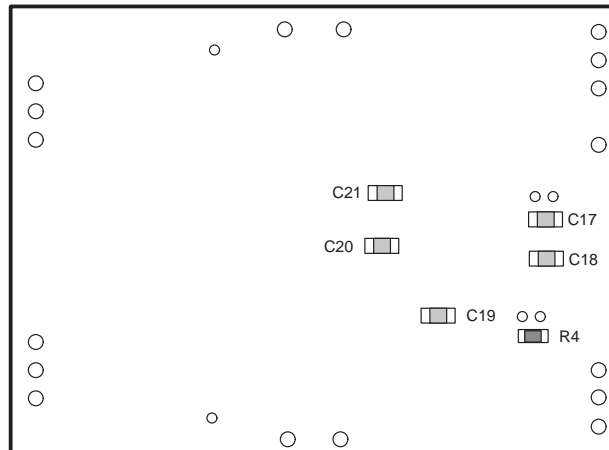
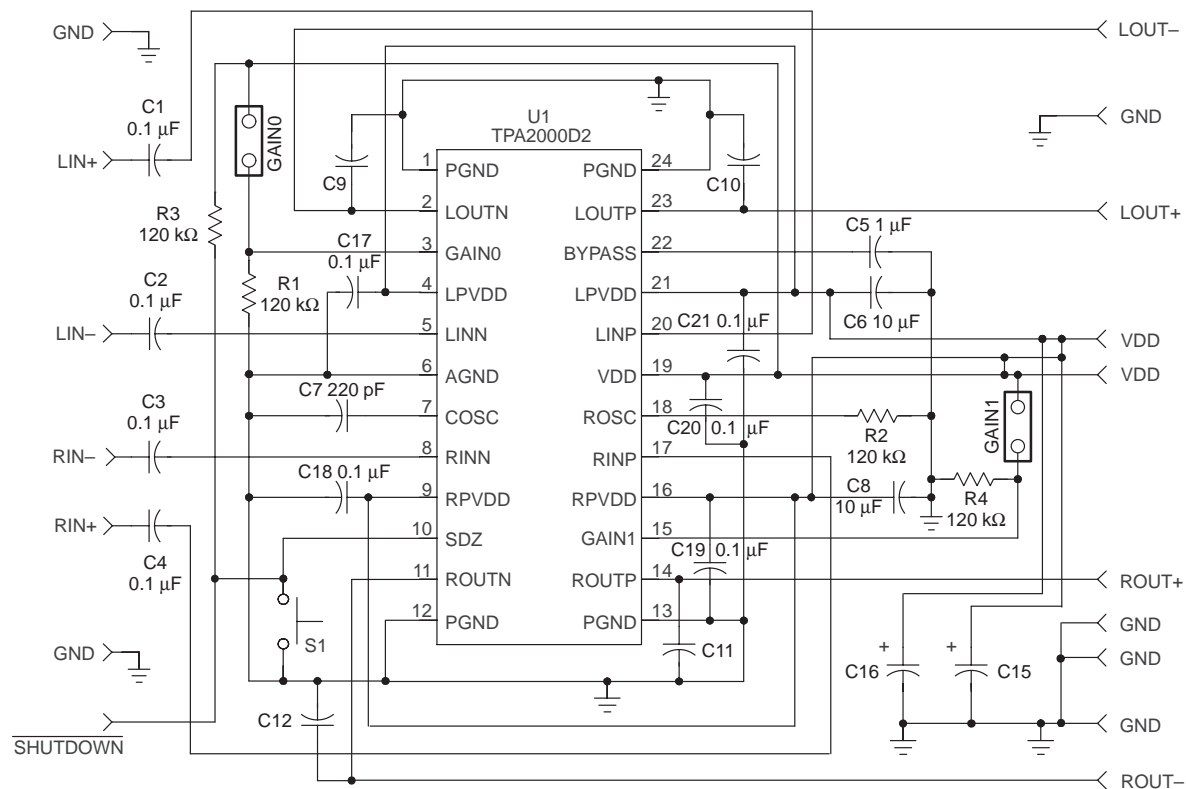


Figure 3–4. TPA2000D2 EVM Schematic Diagram



### 3.2.1 TPA2000D2 Audio Amplifier IC

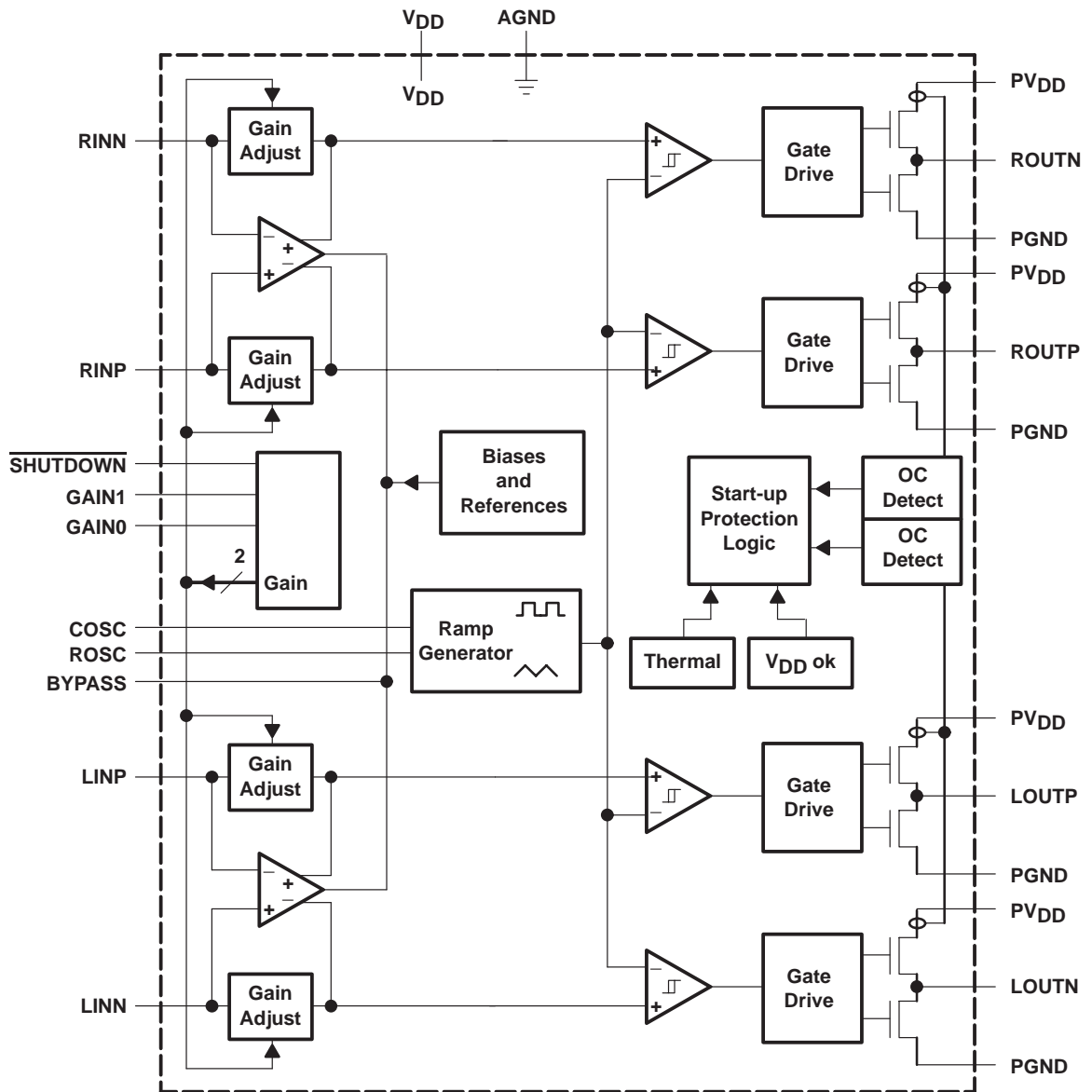
The TPA2000D2 class-D stereo audio power amplifier integrated circuit converts low-level audio into pulse-width-modulated (PWM) signals. The IC features high-current output transistors and internal feedback that provides excellent performance without the need for external components. The modulation scheme allows the amplifier to be used without an output filter. Typical applications include multimedia systems and portable computers.

A full range of protection features are built into the TPA2000D2 amplifier IC to increase device reliability including thermal, overcurrent, and undervoltage shutdown.

The device is provided in a very small 24-pin thermally-enhanced PowerPAD TSSOP surface-mount package and consumes only 1  $\mu$ A in the shutdown mode, making the TPA2000D2 an excellent choice for portable battery-powered applications. Although the TPA2000D2 IC amplifier comes in a PowerPAD package, the PowerPAD is not needed and is not used in this EVM due to the high efficiency of this part.

A block diagram of the TPA2000D2 amplifier IC appears in Figure 3–5. For more information, see the TPA2000D2 amplifier IC data sheet, TI literature number SLOS291.

Figure 3–5. TPA2000D2 Amplifier IC



### 3.2.2 Gain

The gain of the amplifier is pin-selectable with GAIN0 and GAIN1 input terminals. The gain for each GAIN0/GAIN1 combination is shown in Table 3–1.

Table 3–1. TPA2000D2 EVM Gain Settings

GAIN1	GAIN0	GAIN (dB)
OFF	OFF	8
OFF	ON	12
ON	OFF	17.5
ON	ON	23.5

**Note:** ON = Jumper installed, OFF = Open, X = Don't care

Since the overall gain of the amplifier is set by the internal preamplifier stage and not by the power amplifier stage, the TPA2000D2 maintains the same total harmonic distortion (THD) at even the highest gain settings.

### 3.2.3 Differential Input

The differential input stage of the amplifier cancels any noise that appears on both input lines of a channel. To use the TPA2000D2 EVM with a differential source, connect the positive lead of the audio source to the RIN+ (LIN+) input and the negative lead from the audio source to the RIN– (LIN–) input. To use the TPA2000D2 with a single-ended source, ac-ground the RIN– and LIN– inputs through a capacitor and apply the audio signal to the RIN+ and LIN+ inputs. In a single-ended input application, the RIN+ and LIN+ inputs should be ac-grounded at the audio source instead of at the device inputs for best noise performance.

### 3.2.4 Depop Circuitry

The TPA2000D2 amplifier IC contains internal circuitry to minimize the various transients that might appear at the output during the transition from power on/off or entering and leaving shutdown.

### 3.3 Using the TPA2000D2 EVM With the Plug-N-Play Evaluation Platform

The TPA2000D2 audio amplifier evaluation module was designed to be used with the TI plug-n-play audio amplifier evaluation platform. It simply plugs into socket U2.

The following paragraphs provide additional details for using the TPA2000D2 EVM with the platform.

#### 3.3.1 Installing and Removing EVM Boards

TI plug-n-play evaluation modules use single-in-line header pins installed on the underside of the module circuit board to plug into sockets on the platform. The EVM pins and the platform sockets are keyed such that only the correct type of EVM can be installed in a particular socket, and then only with the proper orientation.

Evaluation modules are easily removed from the platform by simply prying them up and lifting them out of their sockets. Care must be taken, however, to prevent bending the pins.

##### 3.3.1.1 EVM Insertion

- 1) Remove all power from the evaluation platform.
- 2) Locate socket U2 on the platform.
- 3) Orient the module correctly.
- 4) Carefully align the pins of the module with the socket pin receptacles.
- 5) Gently press the module into place.
- 6) Check to be sure that all pins are seated properly and that none are bent over.

##### 3.3.1.2 EVM Removal

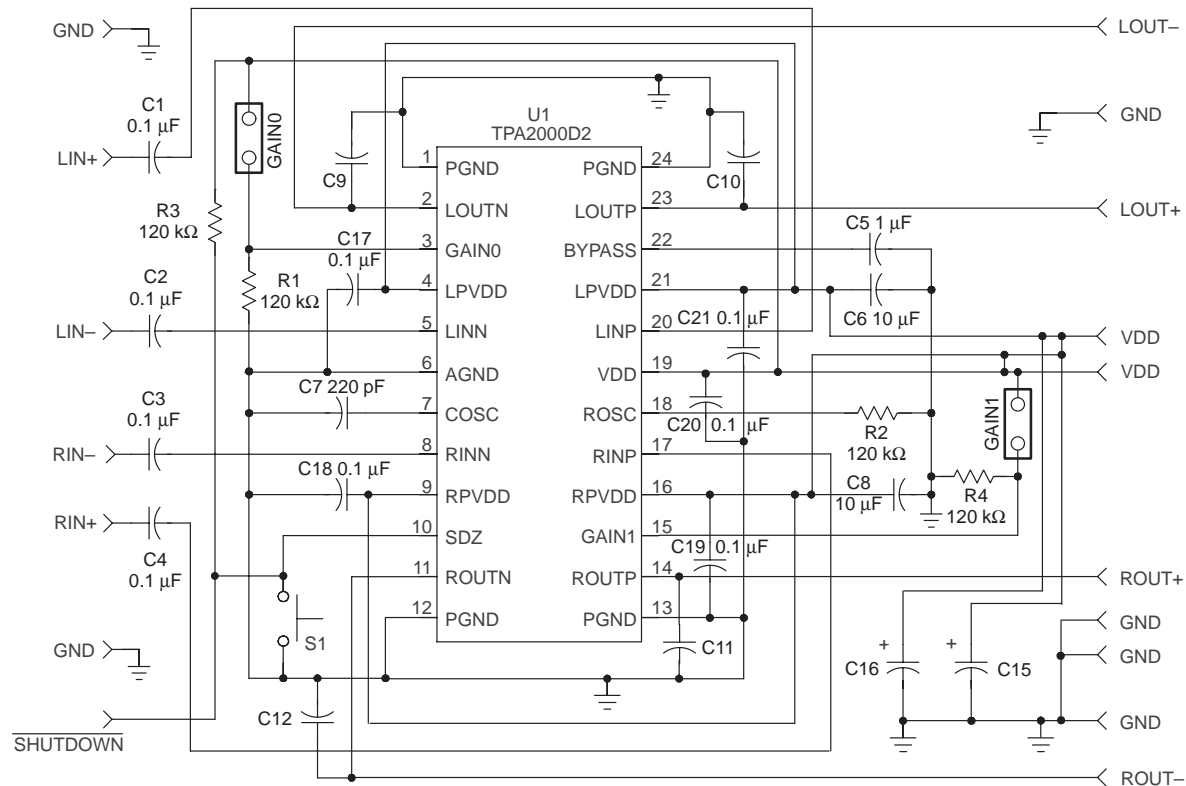
- 1) Remove all power from the evaluation platform.
- 2) Using an appropriate tool as a lever, gently pry up one side of the module a small amount.
- 3) Change to the opposite side of the module and use the tool to pry that side up a small amount.
- 4) Alternate between sides, prying the module up a little more each time to avoid bending the pins, until it comes loose from the socket.
- 5) Lift the EVM off the platform.

### 3.3.2 TPA2000D2 Module Jumper Settings and Switches

The TPA2000D2 EVM is equipped with a pushbutton SPST switch and two jumpers that act as SPST switches to allow module operation to be modified to suit various requirements. In the following discussion, setting a jumper to **ON** means that a shunt is installed across the two pins of the jumper. Setting a jumper to **OFF** means that no shunt is installed on the jumper. See Figure 3.6.

In typical applications, some or all of the jumper functions are controlled by the system microcontroller or external logic.

Figure 3–6. TPA2000D2 EVM Jumpers and Switches



#### 3.3.2.1 S1 — Shutdown Switch

Pushbutton switch S1 on the EVM allows the manual shutdown of the TPA2000D2 amplifier IC.

#### 3.3.2.2 GAIN0 and GAIN1 — Gain Select Jumpers

Jumpers GAIN0 and GAIN1 select the gain of the TPA2000D2 amplifier IC line as shown in Table 3–2.

Table 3–2. TPA2000D2 EVM Gain Settings

GAIN1	GAIN0	GAIN (dB)
OFF	OFF	8
OFF	ON	12
ON	OFF	17.5
ON	ON	23.5

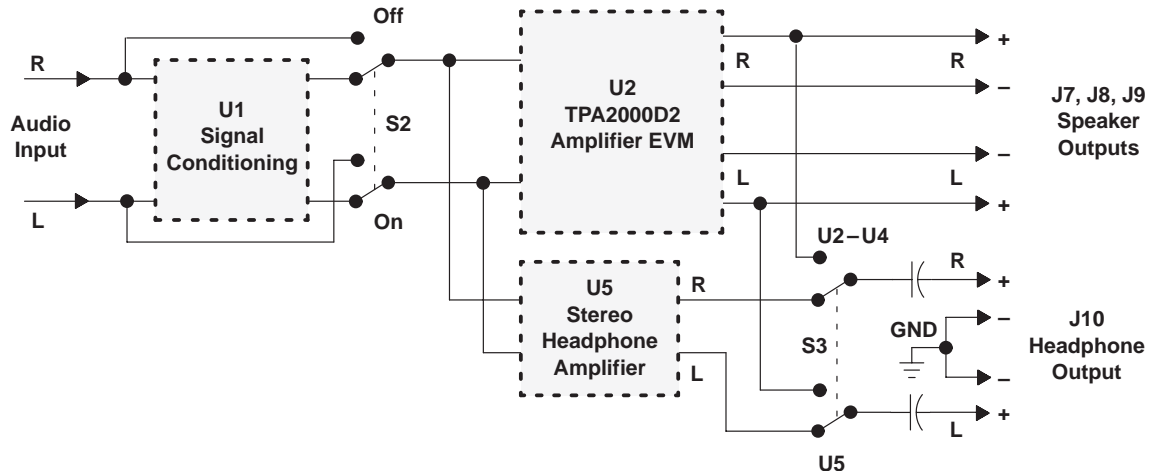
**Note:** ON = Jumper installed, OFF = Open, X = Don't care



### 3.3.3 Signal Routing

Signal flow on the platform is controlled by two signal routing switches, as shown in Figure 3–7.

Figure 3–7. Platform Signal Routing and Outputs



#### 3.3.3.1 Signal Conditioning

The audio signal from the input jacks can be applied to the signal conditioning socket (U1) if an EVM is installed there, or socket U1 can be bypassed and the audio input signal applied directly to the inputs of the TPA2000D2.

- Switch **S2** selects signal conditioning or bypasses it.

#### 3.3.3.2 Headphone Output Jack

Switch S3 is the source select for the stereo headphone output jack, J10. The headphone jack is capacitively coupled (via 470  $\mu$ F electrolytics) and can output either the signal from the headphone amplifier in socket U5, or the signal from the power amplifier installed in socket U2, as determined by the setting of headphone source select switch S3.

- The platform headphone output jack (J10) is not used in conjunction with the TPA2000D2 class-D EVM. Switch **S3** should be set to the **U5** position when the TPA2000D2 class-D EVM is installed on the platform.

### 3.3.4 Mute (Shutdown)/Mode

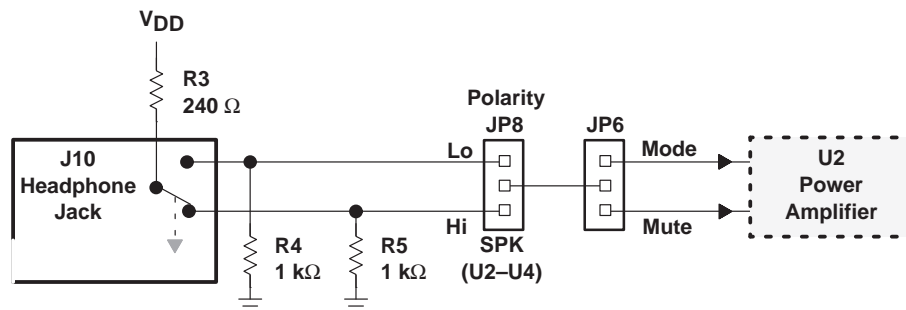
The TPA2000D2 EVM is equipped with a shutdown control input pin. When this input is pulled to ground, the TPA2000D2 amplifier IC on the module enters the shutdown mode and dissipates very little power. When the EVM control input is tied to GND or allowed to float, normal amplifier operation resumes.

In typical applications, as often found in notebook computers, portable audio products, and such, the internal speakers mute when headphones are plugged into the headphone jack, or internal speakers mute when external speakers are connected. In applications using separate speaker and headphone amplifiers, the one not being used can be shut down to conserve power.

#### 3.3.4.1 Headphone Jack Control Signals

The platform headphone output jack (J10) contains an internal switch that changes the state of a pair of control lines when a plug is inserted (Figure 3–8). Each control line is pulled down by a 1-k $\Omega$  resistor to ground (R4 and R5). The switch in the headphone jack pulls one line or the other up to V<sub>DD</sub> through a 240- $\Omega$  resistor (R3) depending on whether a plug is inserted in J10 or not.

Figure 3–8. Mute/Mode and Polarity Control



#### 3.3.4.2 Mute/Mode Select (JP6)

A 3-pin jumper header (JP6) on the platform, functioning as an SPDT switch, routes the control signal from the headphone jack to either the mute control input pin or the mode control input pin of the evaluation module.

- Set jumper **JP6** to **MUTE** when a separate headphone amplifier **IS** installed in **U5**. This will cause the TPA2000D2 class-D EVM to shut down when a plug is inserted into platform headphone jack **J10**.

#### 3.3.4.3 Mute/Mode Polarity Select (JP8)

A second 3-pin jumper header (JP8) on the platform selects the control signal polarity by connecting either the active-high or the active-low line from the headphone jack to jumper JP6.

- Set jumper **JP8** to **Lo** for normal class-D operation when a separate headphone amplifier **IS** installed in **U5**.

### 3.3.5 Power Requirements

The TPA2000D2 audio power amplifier evaluation module can operate from any voltage between approximately 4.5 V and 5.5 V; however, the TPA2000D2 amplifier IC on the module is characterized for operation at 5 V. For best performance (highest output power with lowest distortion), the module should be operated at approximately 5 V unless there is a specific reason for operating it from a different voltage.

The TI plug-n-play audio amplifier evaluation platform with a voltage regulator EVM installed on it can provide a regulated  $V_{DD}$  supply from a wide variety of unregulated  $V_{CC}$  voltage inputs between approximately 5.5 V and 12 V, including an onboard 9-V battery. Or, an external regulated power source can be used to supply  $V_{DD}$  voltage to the platform and the TPA2000D2 evaluation module installed on it.

Although the TPA2000D2 amplifier IC draws approximately 0.65 A from the power supply during continuous full power output, peak current draw can be as high as 1 A. Any power supply connected to the platform should be capable of providing 1 A of current to avoid clipping of the output signal during peaks. Current consumption driving speakers at normal listening levels is typically 0.1 A or less.

The platform is equipped with overvoltage and reverse-polarity supply voltage input protection in the form of fused crowbar circuits.

- $V_{DD}$  voltage applied to platform screw terminals J6 *MUST NOT* exceed the absolute maximum rating for the TPA2000D2 amplifier IC installed on the evaluation module (6 V) or damage to the IC may result. In no case should  $V_{DD}$  voltage of the incorrect polarity or in excess of 6.1 V be applied to screw terminals J6 of the platform, or the power protection circuit on the  $V_{DD}$  line will trip.
- $V_{CC}$  voltage applied to the platform *MUST NOT* exceed the maximum voltage input specified for the voltage regulator module installed in socket U6 (12 V for the SLVP097), or damage to the voltage regulator module may result. In no case should  $V_{CC}$  voltage applied to the platform exceed 15 V, or the overvoltage protection circuit on the  $V_{CC}$  bus will trip.

### 3.3.6 Inputs and Outputs

The TI plug-n-play audio amplifier evaluation platform is equipped with several standard connectors for audio inputs and outputs.

#### 3.3.6.1 Inputs

In most cases, audio signals enter the platform through either a pair of RCA phono jacks (J3 and J5) or a miniature (1/8") stereo phone jack (J4). Certain signal conditioning and amplifier EVMs, however, may have additional signal input connectors mounted on the module circuit board.

The platform audio signal input jacks (J3, J4, and J5) are of the closed-circuit type, grounding the signal input lines when no plugs are inserted.

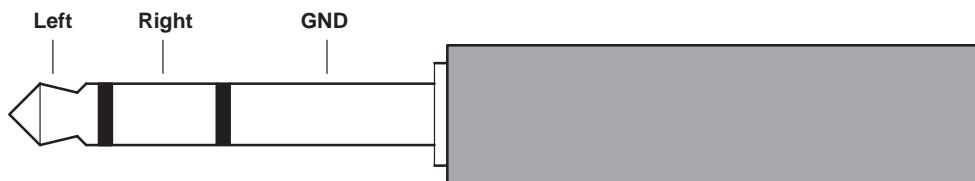
#### 3.3.6.2 Outputs

Amplified audio output signals leave the platform through left and right RCA phono jacks (J7 and J9), left and right pairs of compression connectors for stripped speaker wires (J8).

The audio output lines from the power amplifiers are separate all the way to the edge of the platform (output jacks J7, J8, and J9) — the OUT– lines from the power amplifier sockets are not tied to each other or to platform ground. This allows the TPA2000D2 power amplifier EVM to operate in the highly-efficient bridge-tied load configuration when driving speakers.

The platform headphone jack (J10) outputs the signal from a headphone amplifier installed in platform U5 and also contains a switch to signal when a headphone plug (Figure 3–9) has been inserted into the jack. When the platform is configured as shown in Table 2–3, the TPA2000D2 power amplifier EVM installed in U2 shuts down when the headphone plug is inserted (see 3.3.4).

Figure 3–9. Typical Headphone Plug



### 3.4 Using the TPA2000D2 EVM Stand-Alone

Using the TPA2000D2 audio power amplifier evaluation module stand-alone is much the same as using it with the platform. The same 4.5-V to 5.5-V power supply range and the isolated OUT+ and OUT- line requirement exists (Figure 3–10).

Note that the shutdown signal applied to the EVM  $\overline{\text{SHUTDOWN}}$  pin must be able to supply enough current to overcome the pullup resistor on the module (120 k $\Omega$ ).

Figure 3–10. TPA2000D2 EVM Connected for Stereo Output

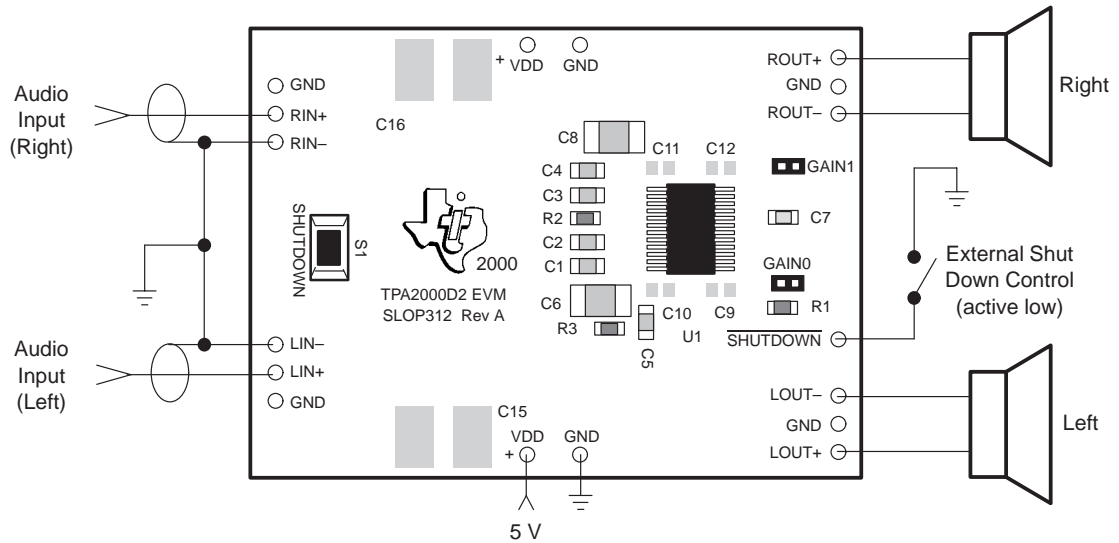


Table 3–3. Typical TPA2000D2 EVM Jumper Settings for Stand-Alone

EVM	GAIN0	GAIN1
TPA2000D2	OFF	OFF

**Note:** ON = Jumper installed, OFF = Jumper **NOT** Installed, X = Don't care

### 3.5 TPA2000D2 Audio Power Amplifier Evaluation Module Parts List

Table 3–4. TPA2000D2 EVM Parts List

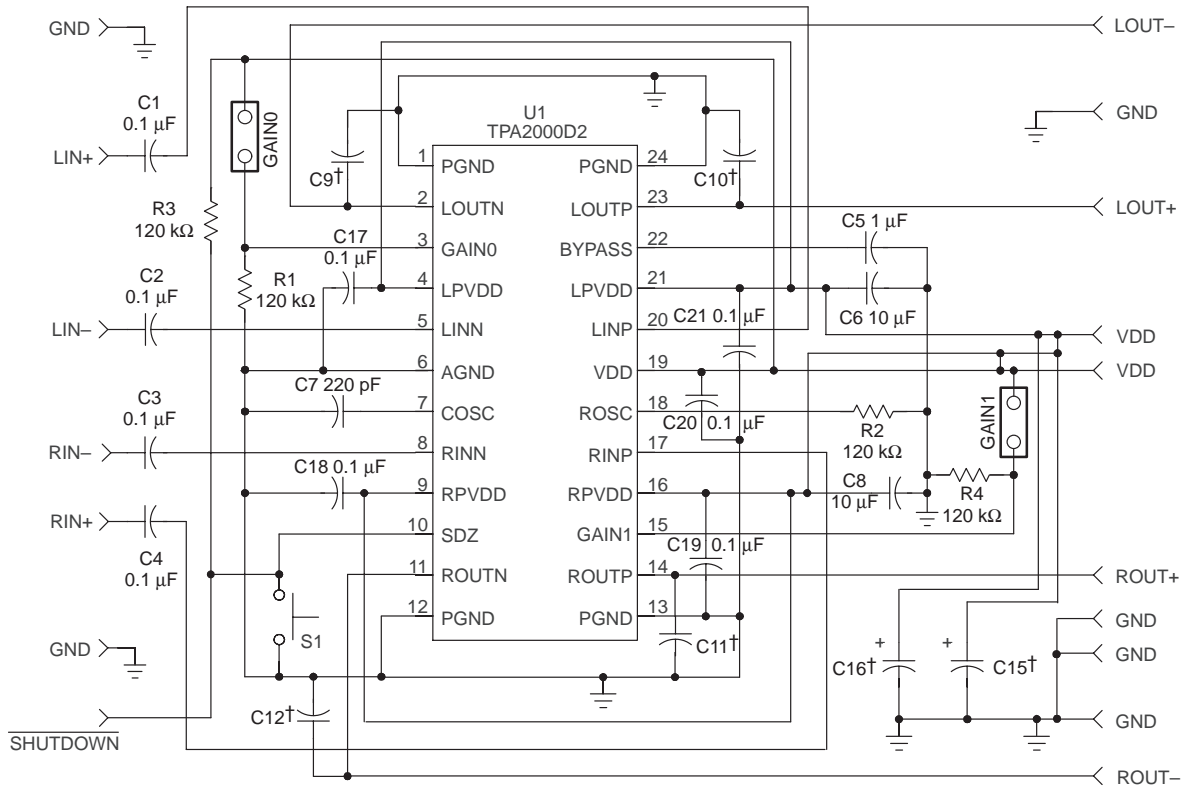
Reference	Description	Size	EVM Qty.	Manufacturer/ Part Number
C1–4, C17–21	Capacitor, ceramic chip, 0.1 $\mu$ F, $\pm$ 10%, X7R, 50 V	0805	9	Kemet C0805C104K5RAC
C5	Capacitor, ceramic, 1.0 $\mu$ F, 80%/–20%, Y5V, 16 V	0805	1	Murata GRM40-Y5V105Z16
C6, C8	Capacitor, ceramic, 10 $\mu$ F, 80%/–20%, Y5V, 16 V	1210	2	Murata GRM235-Y5V106Z16
C7	Capacitor, ceramic, 220 pF, $\pm$ 10%, XICON, 50 V	0805	2	Mouser 140-CC501B221K
C9 – C12†	Not assembled	0805		
C15, C16†	Not assembled	1210		
C13, C14	Reference designators not used			
R1 – R4	Resistor, chip, 120 k $\Omega$ , 1/10 W, 5%, XICON	0805	4	Mouser 260-120K
S1	Switch, momentary pushbutton, 12 V, 50 mA	0.291 X 0.138 X 0.134"	1	Panasonic EVQ-PJS04K
GAIN0, GAIN1	Header, 2 position	2 mm	2	Norcomp DigiKey # 2163-02-ND
	Shunts	2 mm	2	3M
	Headers, 0.1 in centers, 1/2 in long	0.5 X 0.25 X 0.1"	17	Samtec T SW-19-8-G-S
U1	IC, TPA2000D2, audio power amplifier, 2-W, 2-channel, class-D	24 pin TSSOP	1	TI TPA2000D2PWP
PCB	PCB, TPA2000D2 EVM	2.25 X 1.5"	1	TI SLOP312A

† Capacitors C9 – C12, C15, and C16 are optional (not assembled) and pad locations for them on the EVM PCB have been provided to increase design flexibility.

### 3.6 TPA2000D2 Filterless Class-D EVM Schematic

The TPA2000D2 filterless class-D EVM schematic is shown in Figure 3–11.

Figure 3–11. TPA2000D2 Class-D EVM Schematic Diagram



† Capacitors C9 – C12, C15, and C16 are optional (not assembled) and pad locations for them on the EVM PCB have been provided to increase design flexibility.





Figure 3–14. TPA2000D2 Filterless Class-D EVM Top Layer

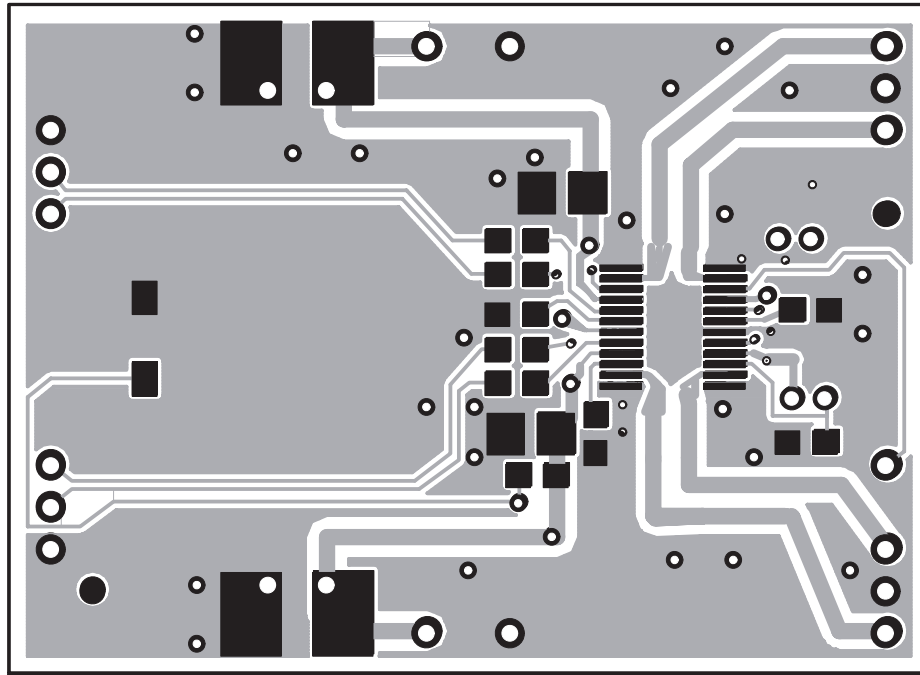


Figure 3–15. TPA2000D2 Filterless Class-D EVM Bottom Layer

