

TPA0211 Mono Audio Power Amplifier Evaluation Module

User's Guide

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Preface

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.
- ***TPA0211 2-W MONO AUDIO POWER AMPLIFIER*** (literature number SLOS275) This is the data sheet for the TPA0211 audio amplifier integrated circuit.

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Introduction

This chapter provides an overview of the Texas Instruments (TI) TPA0211 mono audio amplifier evaluation module (SLOP265). 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

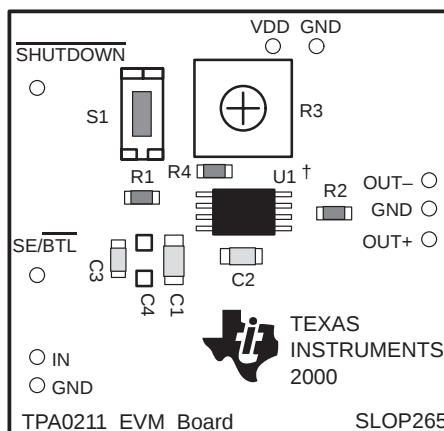
The TI TPA0211 mono audio amplifier evaluation module and the TI Plug-n-play audio amplifier evaluation platform include the following features:

- ❑ TPA0211 2-W Mono Audio Power Amplifier Evaluation Module
 - Single channel, bridge-tied load (BTL)
 - 3.3-V and 5-V operation
 - 2-W output power into 4 Ω at 5 V, BTL
 - Ultralow current consumption in shutdown mode
 - Internal thermal protection
 - Module gain is variable from -2 V/V to -10.4 V/V BTL (-1 V/V to -5.2 V/V SE)
- ❑ 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 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 TPA0211 mono audio power amplifier evaluation module is a complete single-channel audio power amplifier. It consists of the TI TPA0211 2-W mono 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 TPA0211 Mono Audio Power Amplifier Evaluation Module



† Due to the very small size of the MSOP IC package, the standard part number TPA0211 is replaced with the code TIAEG

Single in-line header pins are mounted to 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, with room for a pair of TPA0211 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, 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 TPA0211 EVM Specifications

Supply voltage range, V_{DD}	2.5 V to 5.5 V
Supply current, I_{DD}	900 mA max
Continuous output power per channel, P_O : 4- Ω , $V_{DD}=5$ V	2 W
Audio input voltage, V_I	5 V _{p-p} max
Minimum load impedance, R_L	4 Ω

Operation

The quick start lists in this chapter contain steps that can be followed to quickly prepare the TPA0211 mono audio amplifier EVM for use either with the TI plug-n-play audio amplifier evaluation platform or for stand-alone operation. Using the EVM with the TI evaluation platform is a quick and easy way to connect power, signal and control inputs, and signal outputs to the EVM, using standard connectors.

The platform switch and jumper settings shown in Table 2–1 are typical for the TPA0211 EVM. They will cause the TPA0211 IC to switch to single-ended output mode 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 TPA0211 EVM

EVM	JP6	JP7	JP8	S2	S3
TPA0211	Mode	X	Hi	Note 2	X

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.

The audio amplifier evaluation module can also be used stand-alone by making connections directly to the module pins, and it can be wired directly into existing circuits or equipment. Stand-alone connection diagrams appear below.

The chapter ends with a schematic and parts list for the EVM.

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2.1 Precautions

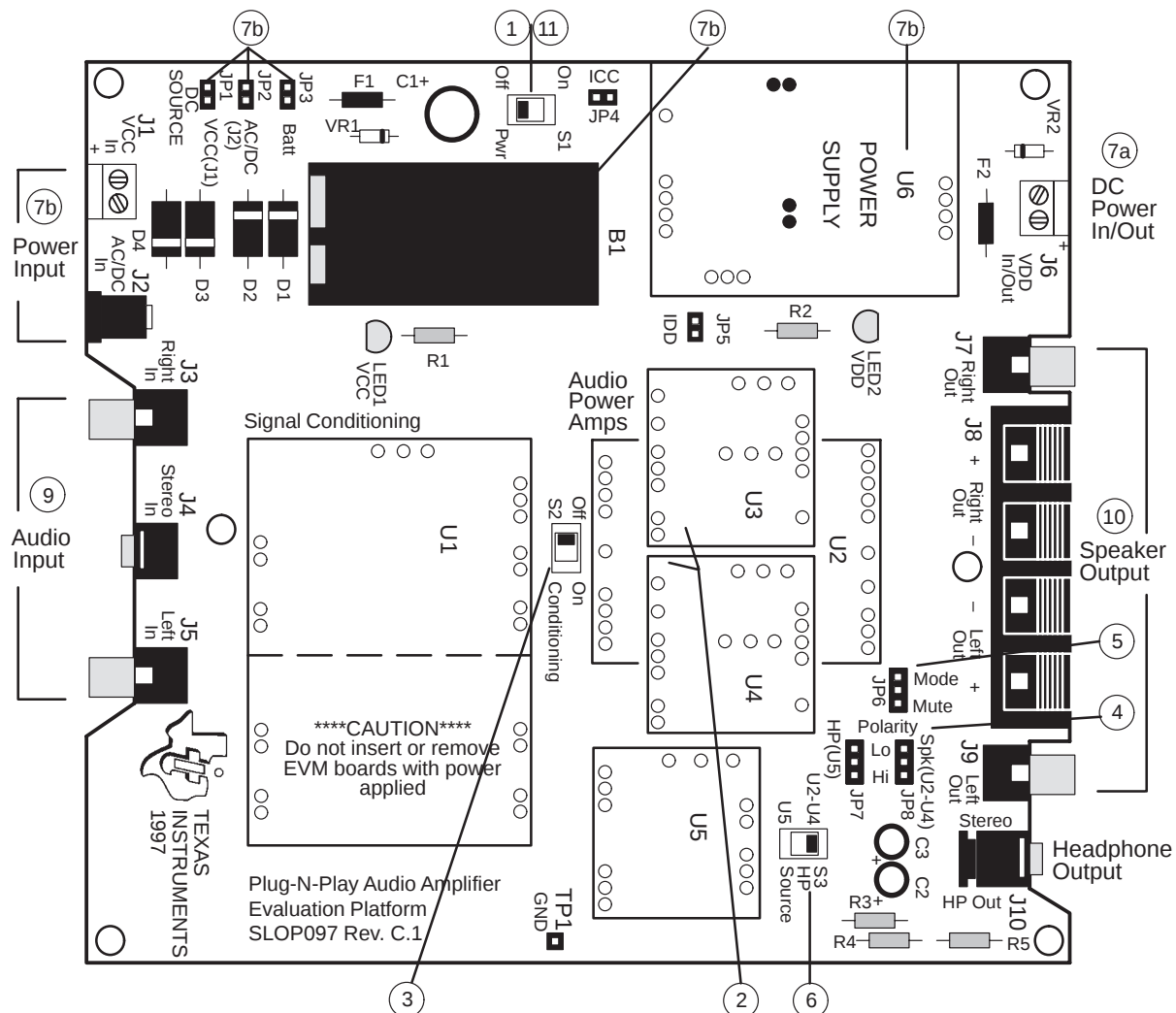
Power Supply Input Polarity and Maximum Voltage

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 TPA0211 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 TPA0211 EVM 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 **Hi**.
- 5) Set jumper **JP6** to select the **Mode** control input (causes the TPA0211 to shut down if a plug is inserted into platform headphone jack **J10**).
- 6) If the headphone jack (**J10**) output will be used, set HP source switch **S3** to **U2—U4**.

Table 2–2. Platform Jumper and Switch Settings for the TPA0211 EVM

EVM	JP6	JP7	JP8	S2	S3
TPA0211	Mode	X	Hi	Note 2	X

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

- 7) 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 a 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

- 8) Ensure that signal source level is set to minimum.
- 9) Connect the audio source to left and right RCA phono jacks **J3** and **J5** or stereo miniature phone jack **J4**.
- 10) Connect 4- Ω – 32- Ω speakers to left and right RCA jacks **J7** and **J9** or to stripped wire connectors **J8**.

□ Power Up

- 11) 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**.

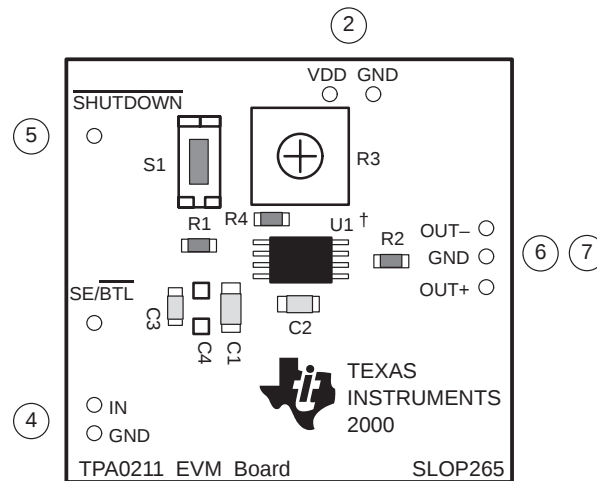
Platform LED2 should light indicating the presence of V_{DD} , and the evaluation modules installed on the platform should begin operation.

- 12) Adjust the signal source level and module gain (via R3) as needed.

2.3 Quick Start List for Stand-Alone

Follow these steps to use the TPA0211 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the TPA0211 EVM 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.

Figure 2–2. Quick Start Module Map



† Due to the very small size of the MSOP IC package, the standard part number TPA0211 is replaced with the code TIAEG

□ 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

- 3) Ensure that the signal source level is set to minimum.
- 4) Connect the audio source to the module **IN** and **GND** pins, taking care to observe marked polarity.
- 5) Connect the **SHUTDOWN** pin to V_{DD} through a normally closed switch.
- 6) For BTL output, connect a 4- Ω – 32- Ω speaker to the module **OUT+** and **OUT-** pins, or
- 7) For single-ended output, connect a headphone or a 4- Ω – 32- Ω speaker to the module **OUT+** and **GND** pins through a 33 μ F to 1000 μ F output-coupling capacitor (Figure 2–4).

□ 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 and module gain (via R3) as needed.

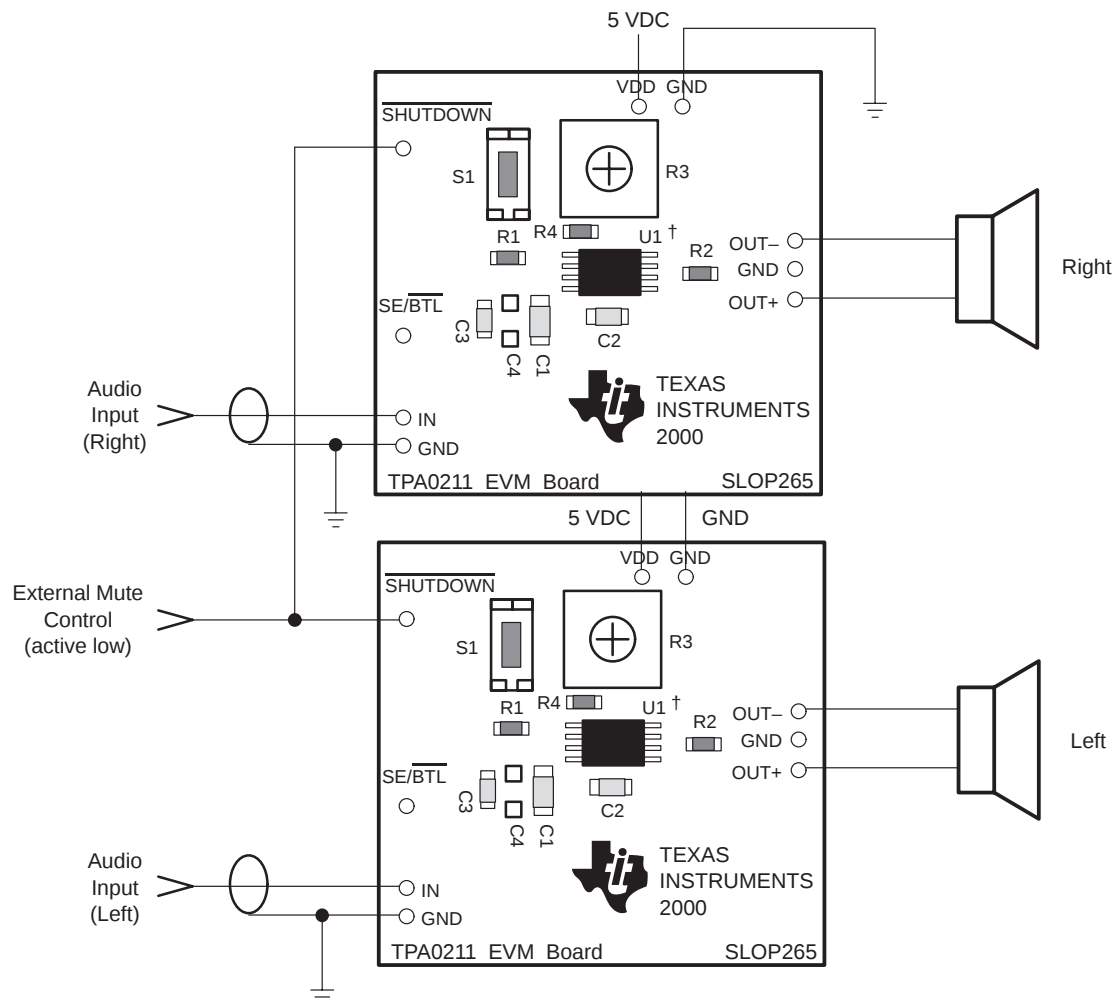
2.4 Stand-Alone Connection Diagrams

The power supply range is 4.5 V to 5.5 V.

2.4.1 TPA0211 Mono EVMs Connected for Stereo BTL Output

Figure 2–3 shows two TPA0211 EVMs connected for stereo BTL operation.

Figure 2–3. TPA0211 Mono EVMs Connected for Stereo BTL Output

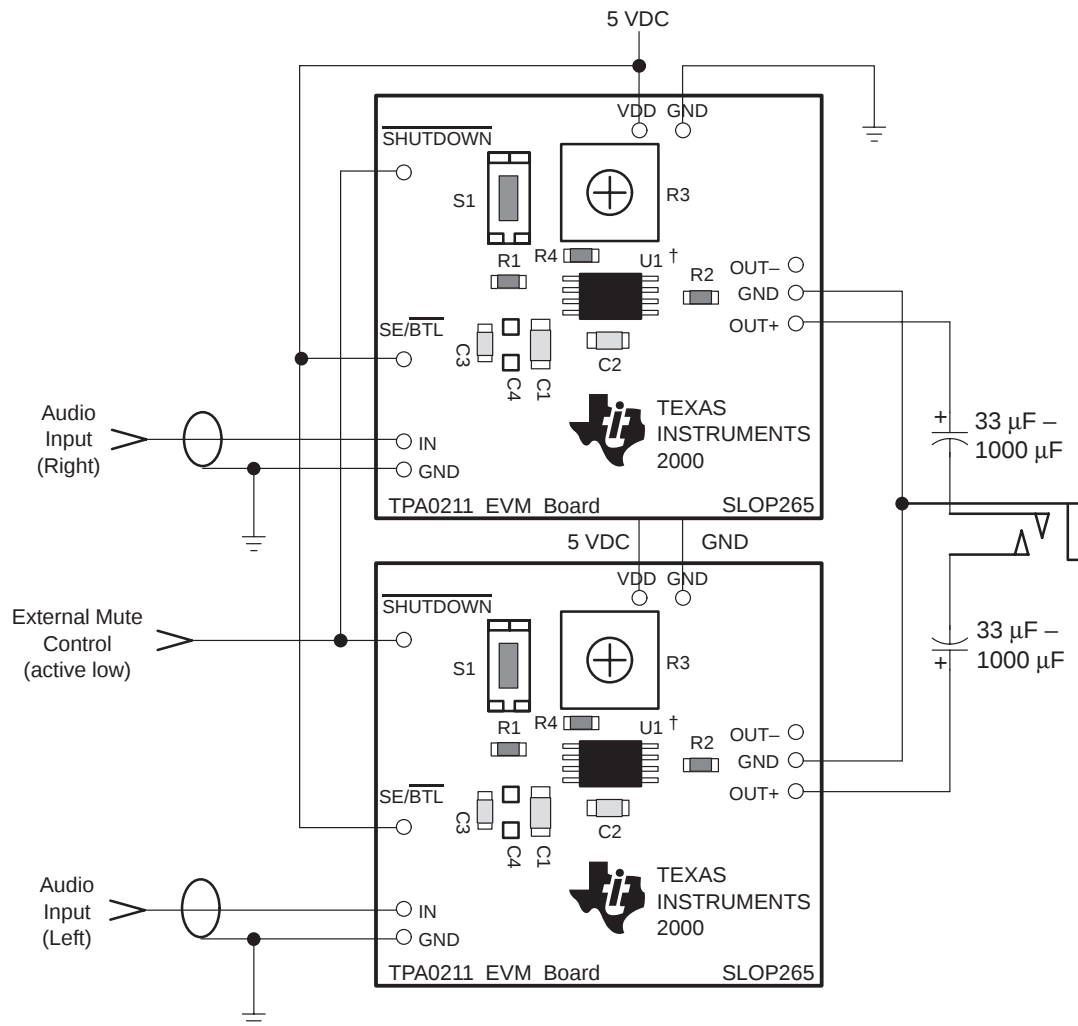


† Due to the very small size of the MSOP IC package, the standard part number TPA0211 is replaced with the code TIAEG

2.4.2 TPA0211 Mono EVMs Connected for Single-Ended Stereo Headphone Output

Figure 2–4 shows two TPA0211 EVMs connected for single-ended stereo operation.

Figure 2–4. TPA0211 Mono EVMs Connected for Stereo Single-Ended Output



† Due to the very small size of the MSOP IC package, the standard part number TPA0211 is replaced with the code TIAEG

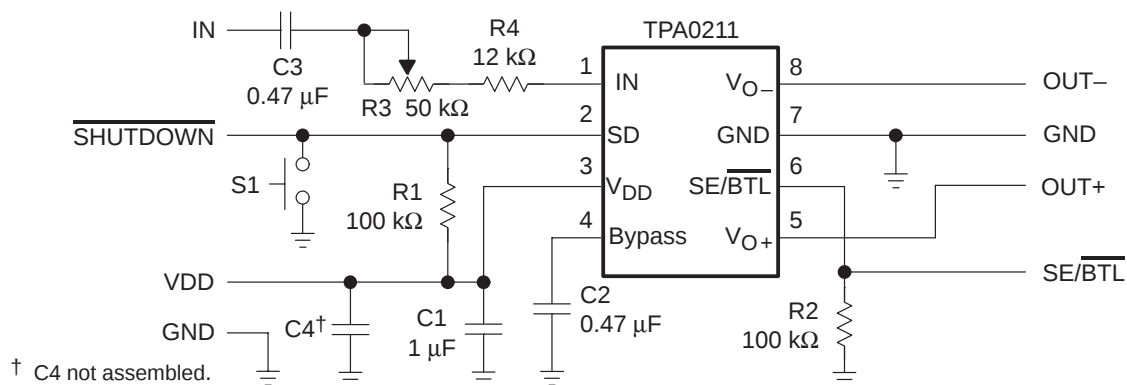
2.5 Reference

This section includes the TPA0211 EVM schematic, the EVM parts list, and the module PCB layers.

2.5.1 EVM Schematic

Figure 2–5 shows the TPA0211 EVM schematic.

Figure 2–5. TPA0211 EVM Schematic Diagram



2.5.2 EVM Parts List

Table 2–3 is the TPA0211 EVM parts list.

Table 2–3. TPA0211 EVM Parts List

Ref.	Description	Size	EVM Qty.	Manufacturer/ Part Number	Vendor Number
C1	Capacitor, 1 μ F @ 16 V, +80%/–20%, nonpolarized	1206	1	Murata GRM42-6Y5V105Z16BL	Newark 93F2254
C2, C3	Capacitor, 0.47 μ F @ 16 V +80%/–20%, nonpolarized	0805	2	Murata GRM40-Y5V474Z16	
C4 [†]	Capacitor	1206	1		
R1, R2	Resistor, 100 k Ω , 1/10 W, 5%	0805	2	Panasonic ERJ-6GEYJ104V	Digi-Key P100KACT-ND
R3	Potentiometer, 50 k Ω , 1/2 W, through-hole		1	Bourns 3323P–50K	Digi-Key 3323P–503–ND
R4	Resistor, 12 k Ω , 1/10 W, 5%	0805	1	Panasonic ERJ-6GEYJ123V	Digi-Key P12KACT-ND
S1	Switch, momentary		1	Panasonic P8048SCT-ND or EVQ–PJS04K	Digi-Key P8048SCT-ND
	Terminal Post Headers		9	Sullins PTC36SABN	Digi-Key S1022-36-ND
U1 [‡]	IC, TPA0211 2-W mono audio amplifier	MSOP-8	1	TI TPA0211DGN	
PCB1	PCB, TPA0211 EVM		1		

[†] C4 is not assembled. Pads are provided on the EVM PCB to allow installation of an additional decoupling capacitor if required.

[‡] Due to the very small size of the MSOP IC package, the standard part number TPA0211 is replaced with the code TIAEG.

NOTE: All items are SMD except as noted.

2.5.3 Module PCB Layers

The following illustrations depict the TPA0211 EVM PCB layers and silkscreen. These drawings are not to scale. Gerber plots can be obtained from any TI sales office.

Figure 2–6. TPA0211 EVM PCB

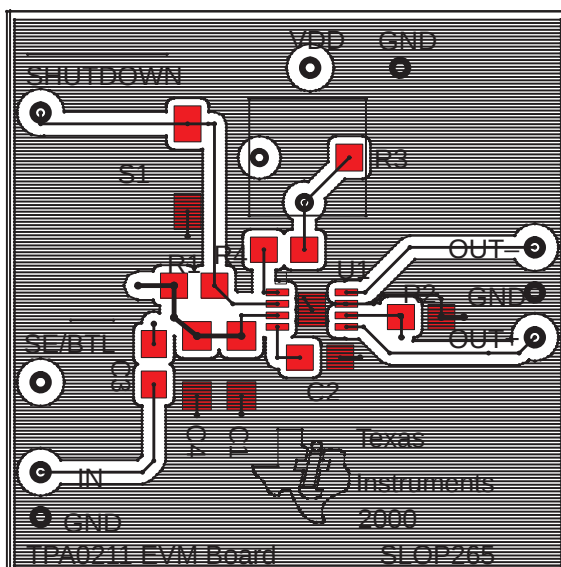


Figure 2–7. TPA0211 EVM Top Layer and Silkscreen

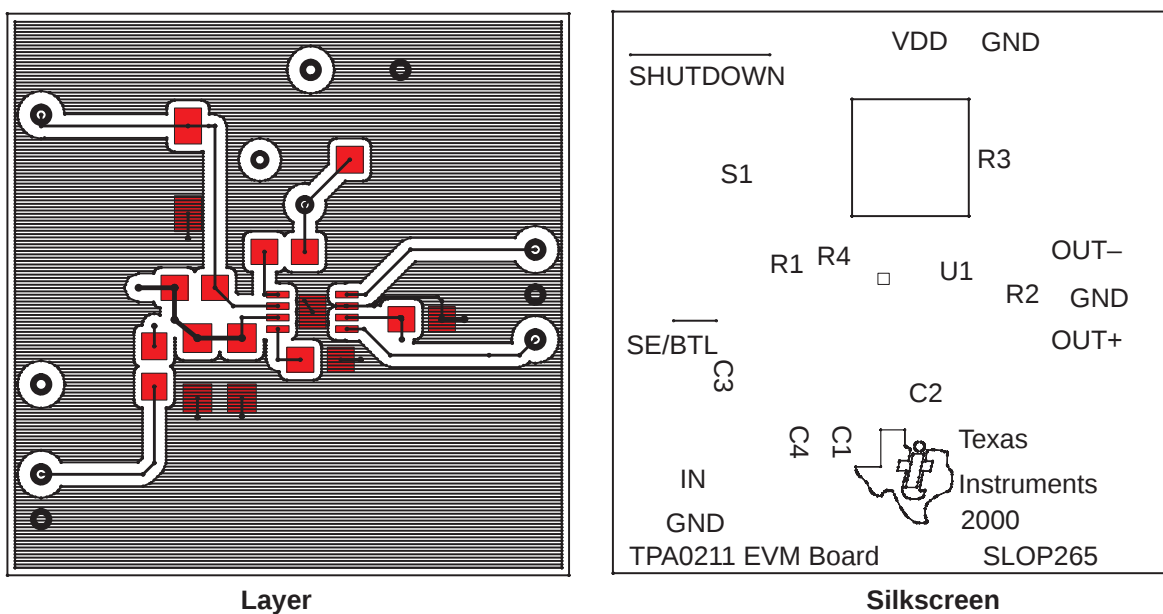


Figure 2–8. TPA0211 EVM Bottom Layer

