

# TPA6013A4 Audio Power Amplifier EVM

This user's guide describes the operation of TPA6013A4 evaluation module and presents the schematic, board layout, and bill of materials of the printed-circuit board.

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## 1 Introduction

This section provides an overview of the Texas Instruments (TI) TPA6013A4 evaluation module (EVM). The EVM user guide includes a brief description of the module and a list of EVM specifications.

### 1.1 Description

The TPA6013A4 is a stereo amplifier with 32-steps DC volume control. TPA6013A4 supports both speaker and headphone output. TPA6013A4 also has 2-to-1 stereo input MUX.

The TPA6013A4 EVM is a complete, stand-alone audio board. It contains the TPA6013A4 TSSOP (PWP) stereo amplifier. All components are Pb-free.

### 1.2 EVM Specifications

Supply voltage range, $V_{DD}$	4 V to 5.5 V
Supply current, $I_{DD}$	1.2 A, maximum
Speaker continuous output power, $P_O$ , $V_{DD} = 5.5$ V, $3 \Omega$ , THD+N = 10 %	3 W
Headphone continuous output power, $P_O$ , $V_{DD} = 5$ V, $16 \Omega$ , THD+N = 1 %	180 mW

## 2 Operation

This section describes how to operate the TPA6013A4EVM.

### 2.1 Quick-Start List for Stand-Alone Operation

Use the following steps when operating the TPA6013A4EVM stand-alone board or when connecting the EVM into an existing circuit.

#### 2.1.1 Power and Ground

1. Ensure that the external power sources are set to OFF.
2. Set the power supply voltage between 4 V and 5.5 V. When connecting the power supply to the EVM, first connect the ground connection to GND at the POWER terminal block, and then connect the positive supply to  $V_{DD}$  at the POWER terminal block. Verify that the connections are made to the correct terminals.

#### 2.1.2 Inputs and Outputs

##### 2.1.2.1 Audio Input

1. Connect audio source at the RCA jacks LLINEIN and RLINEIN. Shunt jumper RIN and LIN for single-ended input.
2. Short position 2 and 3 at 3-pin header RH JP. Audio source right channel will go into RLINEIN of the amplifier.
3. Short position 2 and 3 at 3-pin header LH JP. Audio source left channel will go into LLINEIN of the amplifier.
4. TPA6013A4 has 2-to-1 input MUX that can accept 2 single-ended stereo source. To use the MUX:
  - (a) Connect the first audio source at RCA jacks LLINEIN and RLINEIN. Shunt jumper RIN and LIN for single-ended input.
  - (b) Connect the second audio source at test points RHPIN and LHPIN.
  - (c) Remove shunts at 3-pin headers RH JP and LH JP.
  - (d) To select LLINEIN and RLINEIN, remove shunt at HP/LINE.
  - (e) To select LHPIN and RHPIN, shunt at HP/LINE.

##### 2.1.2.2 Audio Output

1. Connect speakers at terminal blocks ROUT and LOUT.
2. TPA6013A4 supports both speaker and headphone output. To select speaker output, remove headphone in the headphone jack. To select headphone output, insert headphone into the headphone jack; speaker amplifiers will be turned off automatically.

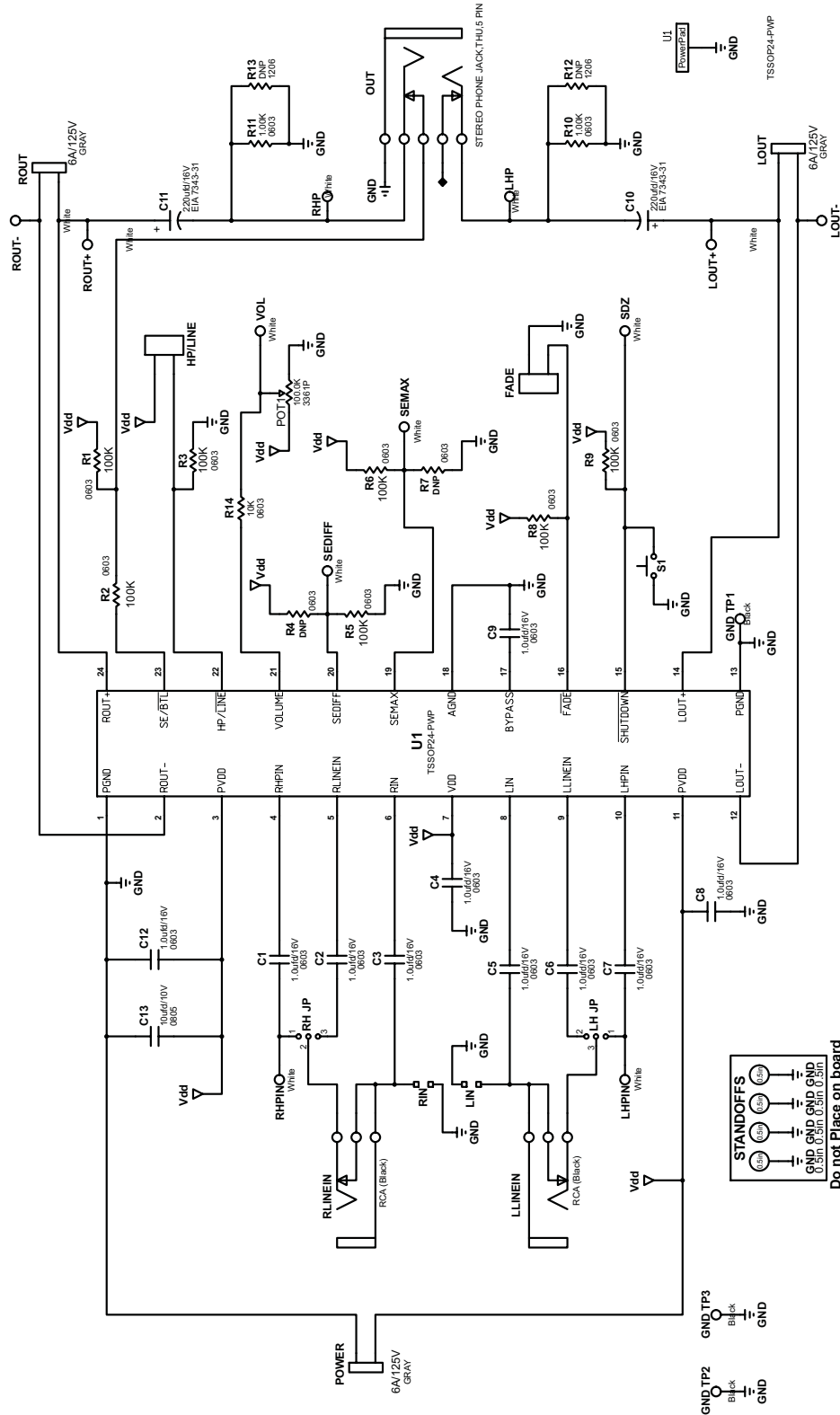
##### 2.1.2.3 Other Controls

1. Shutdown is controlled by pushbutton S1. Press and hold S1 to place the TPA6013A4 in shutdown mode. Release S1 to reactivate the TPA6013A4.
2. Volume is controlled by potentiometer.
3. Shunt FADE to enable fade function. Remove shunt to disable fade function.
4. To use SEDIFF and SEMAX function, apply voltage at test points SEDIFF and SEMAX. SEDIFF and SEMAX can also be controlled by placing resistors of different values at R4 and R7.

### 3 Reference

This section includes the EVM schematic, board layout reference, and parts list.

#### 3.1 TPA6013A4EVM Schematic





## 4 TPA6013A4EVM Bill of Materials

**Table 1. Bill of Materials for TPA6013A4PWPEVM**

Manufacturer/ Part Number	RefDes	Vendor/ Part Number	Description	MFR
TPA6013A4PWP	U1	Texas Instruments TPA6013A4PWP	3-W STEREO AUDIO POWER AMP W/DC VOLUME TSSOP24-PWP ROHS	TEXAS INSTRUMENTS
<b>CAPACITORS</b>				
EMK107B7105KA-T	C1, C2, C3, C4, C5, C6, C7, C8, C9, C12	DIGI-KEY 587-1241-1	CAP SMD0603 CERM 1.0µF 16V 10% X7R ROHS	TAIYO YUDEN
GRM21BR71A106KE51L	C13	DIGI-KEY 490-3905-1	CAP SMD0805 CERM 10µF 10V 10% X7R ROHS	MURATA
B45197A3227K509	C10, C11	DIGI-KEY 495-1552-1	CAP TANT EIA7343-31 220µF 16V 10% LOW ESR ROHS	EPCOS
<b>RESISTORS</b>				
ERJ-3GEYJ104V	R1, R2, R3, R5, R6, R8, R9	DIGI-KEY P100KGCT	RESISTOR SMD0603 100KΩ 5% THICK FILM 1/10W ROHS	PANASONIC
RC0603FR-071KL	R10, R11	DIGI-KEY 311-1.00KHRCT	RESISTOR SMD0603 THICK FILM 1.00KΩ 1% 1/10W ROHS	YAGEO
ERJ-3GEYJ103V	R14	DIGI-KEY P10KGCT	RESISTOR SMD0603 10KΩ 5% 1/10W ROHS	PANASONIC
3361P-1-104GLF	VOL	DIGI-KEY 3361P-104GLFCT	POTENTIOMETER, SMD CERMET 100.0KΩ, 10% SINGLE-TURN, TOP ADJUST 1/2W ROHS	BOURNS
<b>JACKS AND HEADERS AND TERMINAL BLOCKS</b>				
26630201RP2	LIN, RIN, FADE, HP/LINE	DIGI-KEY 2663S-02	HEADER 2-PIN, PCB 2.0MM ROHS	NORCOMP
PBC03SAAN	LH JP, RH JP	DIGI-KEY S1011E-03-ND	HEADER THRU MALE 3 PIN 100LS GOLD ROHS	SULLINS
PJRRAN1X1U01X	LLINEIN, RLINEIN	NEWARK 65K7770	JACK, RCA 3-PIN PCB-RA BLACK ROHS	SWITCHCRAFT
ED555/2DS	LOUT, ROUT, POWER	DIGI-KEY ED1514	TERMINAL BLOCK 2PIN 6A/125V GRAY 3.5mm PITCH 16-28AWG ROHS	ON SHORE TECHNOLOGY
35RAPC4BV4	OUT	DIGI-KEY 35RAPC4BV4-ND	STEREO PHONE JACK, THU, 5-PIN, 3.5mm	SWITCHCRAFT
<b>TESTPOINTS AND SWITCHES</b>				
5002	LHP, RHP, SDZ, VOL, LHPIN, LOUT+, LOUT-, RHPIN, ROUT+, ROUT-, SEMAX, SEDIFF	DIGI-KEY 5002K	PC TESTPOINT, WHITE, ROHS	KEYSTONE ELECTRONICS
5001	GND TP1, GND TP2, GND TP3	DIGI-KEY 5001K	PC TESTPOINT, BLACK, ROHS	KEYSTONE ELECTRONICS
TL1015AF160QG	S1	DIGI-KEY EG4344CT	SWITCH, MOM, 160G SMT 4x3MM ROHS	E-SWITCH
<b>COMPONENTS NOT ASSEMBLED</b>				
HW1, HW2, HW3, HW4, R4, R7, R12, R13				

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### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of  $HPVSS - 0.3\text{ V}$  to  $HPVDD + 0.3\text{ V}$  and the output voltage range of  $HPVSS$  to  $HPVDD$ .

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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