

TPA6047A4 Audio Power Amplifier Evaluation Module

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1 Introduction

1.1 Description

The TPA6047A4 evaluation module (EVM) consists of a single 2-W stereo speaker amplifier and 100-mW DirectPath™ headphone amplifier complete with a small number of external components mounted on a circuit board that can be used to drive speakers and headphones directly with external analog audio sources as inputs. The TPA6047A4 also contains an LDO capable of outputting 4.75 V with a load of 120 mA.

1.2 TPA6047A4EVM Specifications

Supply voltage range, VDD	4.5 V to 5.5 V
Supply current, IDD	1 A, maximum
Speaker amplifier output power per channel, P _O : 4Ω, VDD = 5 V, THD+N=1%	2 W
Headphone output power per channel, P _O : 16 Ω, VDD = 5 V, THD+N=10%	100 mW

2 Operation

2.1 Quick-Start List for Stand-Alone Operation

2.1.1 Speaker Amplifier

Follow these steps to use the TPA6047A4EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM can be made by inserting stripped wire or using banana plugs for the power supply and output connections. The inputs accept standard RCA plugs.

2.1.2 Power Supply

1. Ensure that all external power sources are set to OFF.
2. Connect an external regulated power supply adjusted to 5 V to the module VDD and GND banana jacks, taking care to observe marked polarity.

2.1.3 Evaluation Module Preparations

Inputs and Outputs

1. If connecting to a fully differential input or a grounded input (the shield of the RCA is GND), remove jumpers JP1 and JP2 from the EVM. If connecting to a floating source like a portable CD, install jumpers JP1 and JP2. After setting the JP1 and JP2 jumpers appropriately, connect the input source to either the speaker inputs (SPKR_LIN, SPKR_RIN) or the headphone inputs (HP_INL, HP_INR) or both.
2. Connect a speaker across LOUT+ and LOUT-. Connect another speaker across ROUT+ and ROUT-.
3. Install both gain jumpers GAIN0 and GAIN1 at position 0. This sets the gain of the amplifier to the lowest level, 10 dB.
4. Connect a set of headphones to the headphone output jack (HP_OUT).

Control Inputs

1. **Speaker Enable:** Set jumper SPKR_EN at position 1 to enable the speaker amplifier. Set at 0 to disable the amplifier.
2. **Headphone Enable:** Set jumper HP_EN at position 1 to enable the headphone amplifier. Set at 0 to disable the amplifier.
3. **GAIN0/GAIN1:** Together, these terminals determine the gain of the amplifier. See [Table 1](#).
4. **Regulator Enable:** Set jumper REG_EN at position 1 to enable the regulator. Set at 0 to disable the regulator.

Table 1. Gain Settings

GAIN1 ⁽¹⁾	GAIN0 ⁽¹⁾	Amplifier Gain (dB)
0	0	10
0	1	12
1	0	15.6
1	1	21.6

⁽¹⁾ OFF = Jumper REMOVED; ON = Jumper INSTALLED

2.1.4 Power Up

1. Verify correct voltage and input polarity, and turn on the external power supplies.
The EVM should begin operation.
2. Adjust the input signal.
3. Adjust the control inputs to the desired settings.
4. Adjust the amplifier gain by installing/removing the gain jumpers, GAIN0 and GAIN1.

3 Schematic and Bill of Materials

3.1 TPA6047A4EVM Schematic

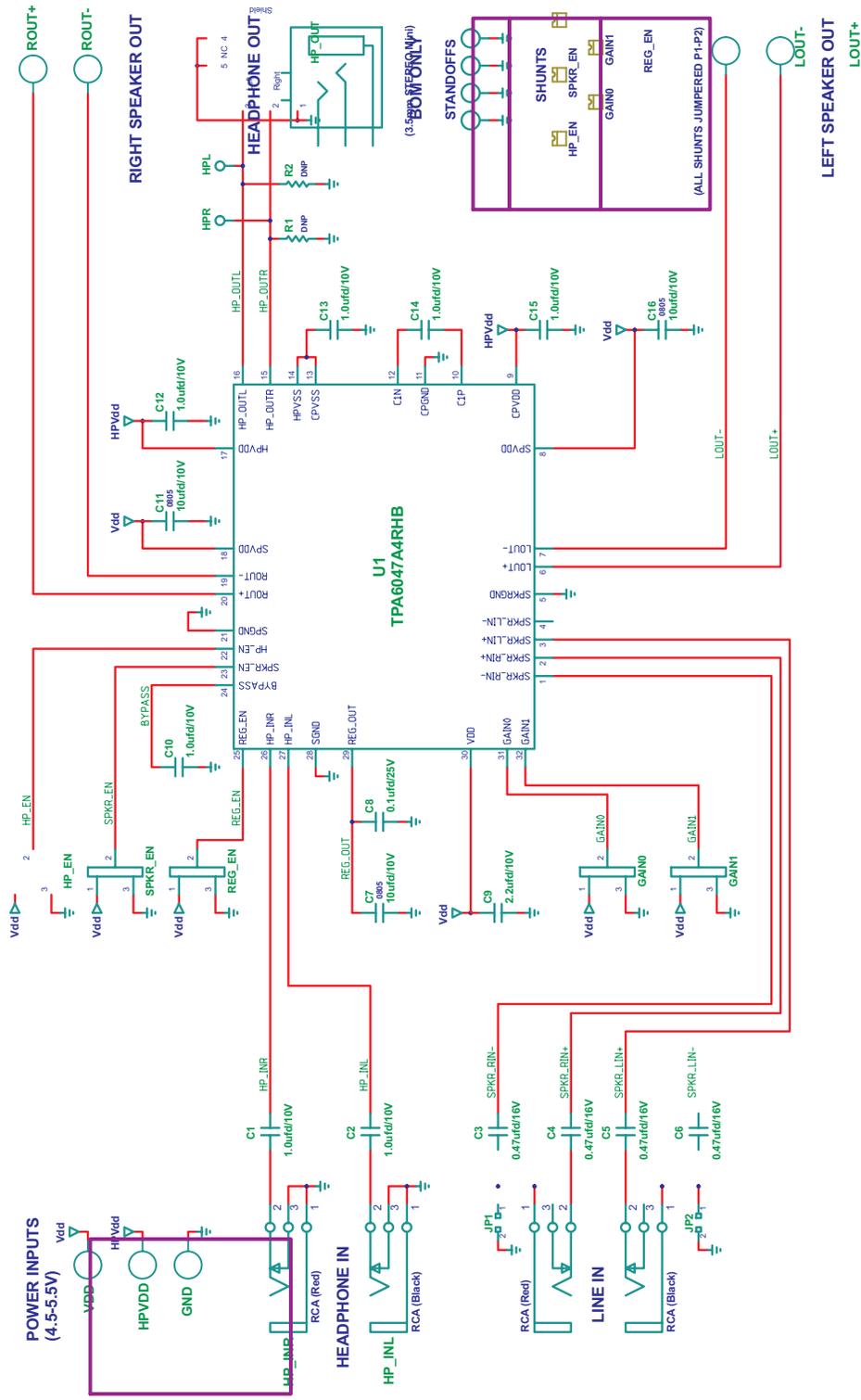


Figure 1. EVM Schematic

3.2 TPA6047A4EVM PCB Layers

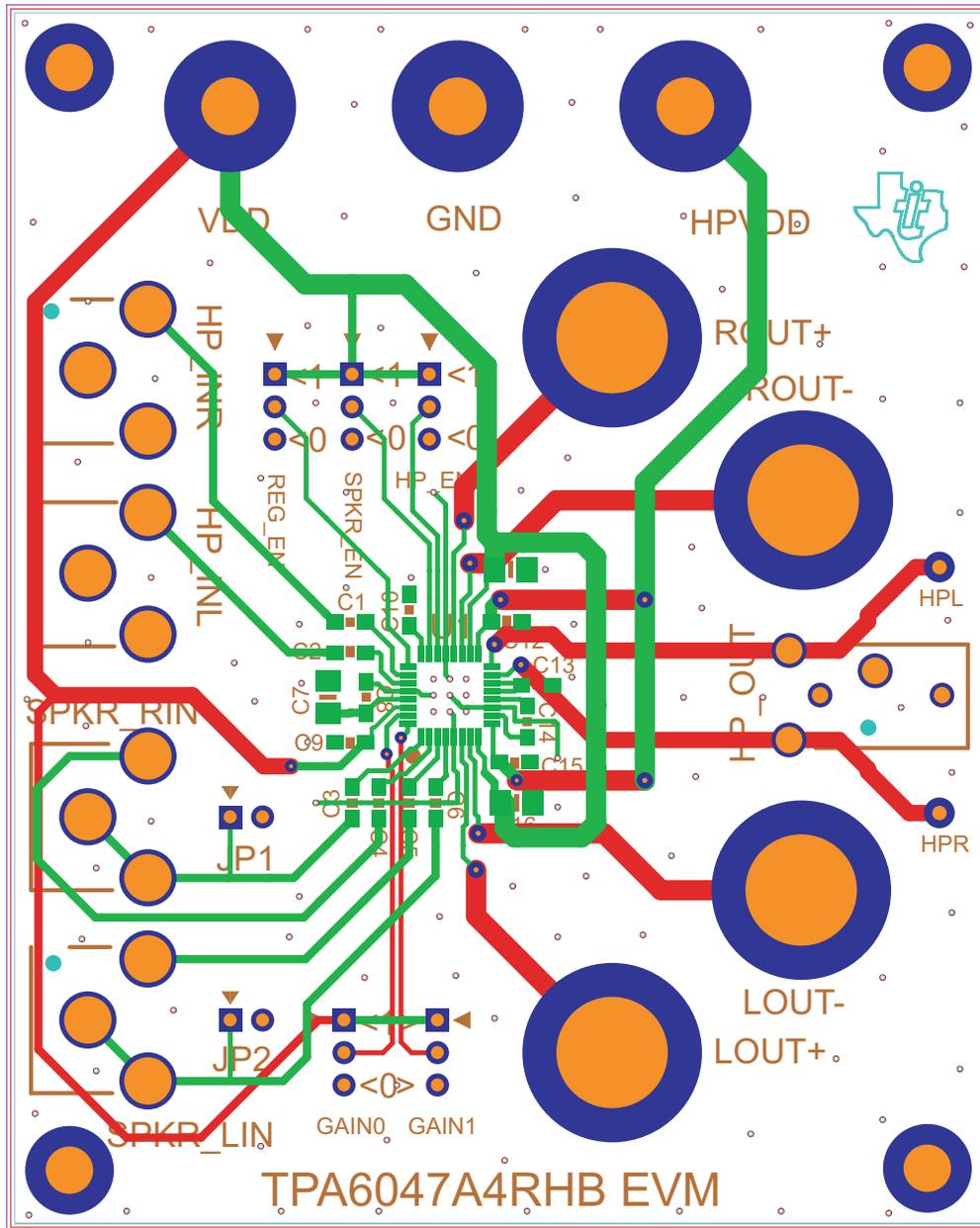


Figure 2. Top Side Layout

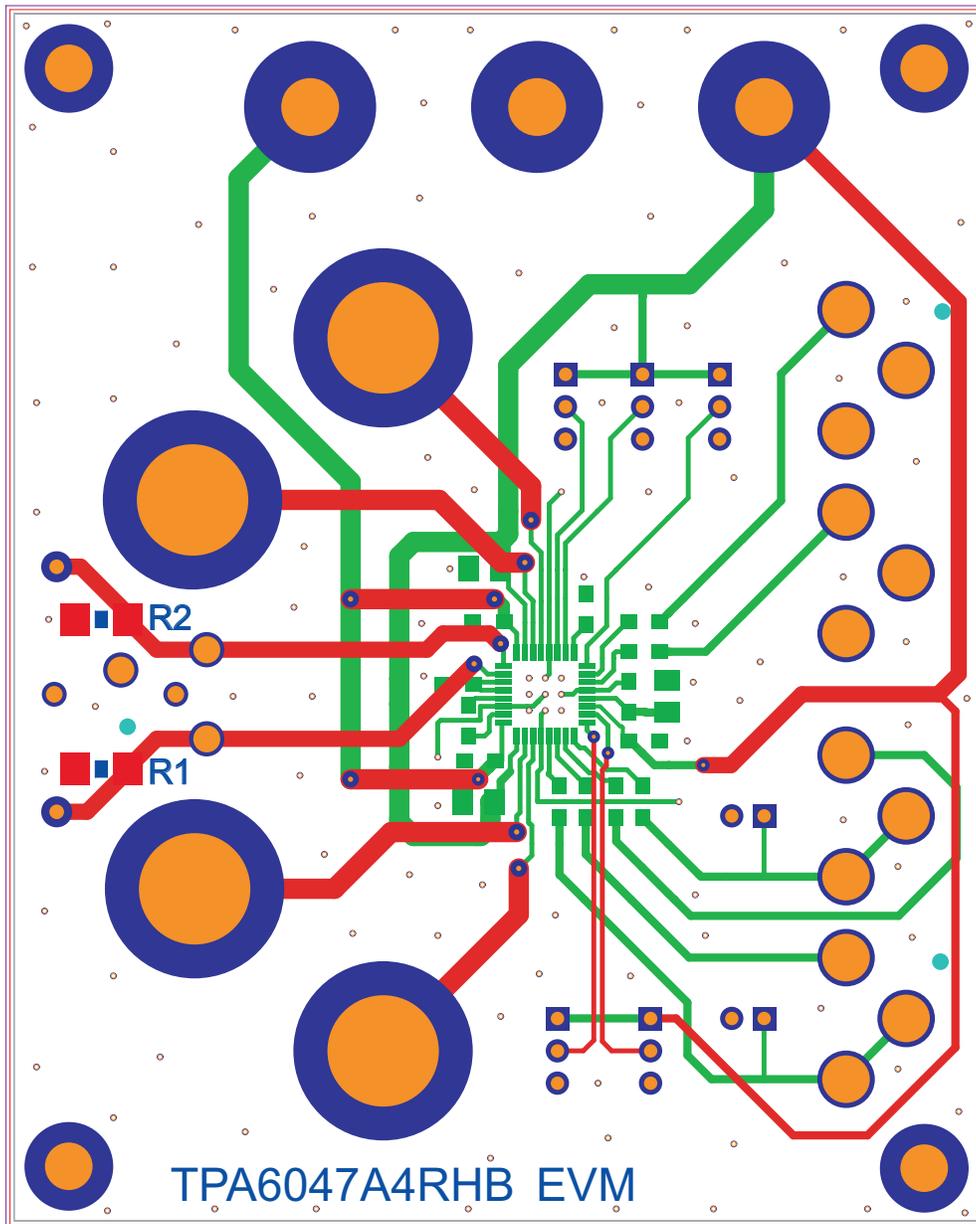


Figure 3. Bottom Side Layout

3.3 TPA6047A4EVM Bill of Materials

REF.	DESCRIPTION	SIZE	QTY	MFG	PART NO.	VENDOR NO.
C3-C6	Capacitor, ceramic, 0.47- μ F, X7R, 16-V	0603	1	AVX	06033D104KAT2A	Digi-Key/478-1244-1
C1, C2, C10, C12-C15	Capacitor, ceramic, 1- μ F, \pm 10%, X5R, 10-V	0603	7	AVX	ECJ-1VB1A105K	Digi-Key/PCC2174TR
C8	Capacitor, ceramic, 0.1- μ F, X7R, 25-V	0603	1	AVX	06033D104KAT2A	Digi-Key/478-1244-1
C9	Capacitor, ceramic, 2.2- μ F, 10-V, X7R	0603	1	Murata Electronics	GRM188R71A225K E15D	Digi-Key/490-4520-2
C7, C11, C16	Capacitor, ceramic, 10- μ F, 10-V, X7R	0805	3	Murata Electronics	GRM21BR71A106K E51L	Digi-Key/490-3905-2
R1, R2	Not Assembled					
JP1, JP2	Header 2 pin, PCB	2 mm	2	Norcomp	26630201RP2	Digi-key/2663S-02
Gain0, Gain1, HP_EN, REG_EN, SPKR_EN	Header 3 pin, PCB	2 mm	5	Norcomp	26630301RP2	Digi-Key/2663S-03
HP_OUT	Jack, mini-stereo, PCB-RA	3.5 mm	1	KYCON	STX-3000	Mouser/806-STX-3000
HP_INL, SPKR_LIN	Jack, RCA 3 pin PCB-RA black		2	Switchcraft	PJРАН1X1U01X	Newark/65K7770
HP_INR, SPKR_RIN	Jack, RCA 3 pin PCB-RA red		2	Switchcraft	PJРАН1X1U03X	Newark/89K7617
HPL, HPR	PC testpoint, white		2	Keystone Electronics	5002	Digi-Key/5002K
LOUT+, LOUTM, ROUT+, ROUTM	Binding post, 15-A uninsulated		4	Emerson NPCCS	111-2223-001	Digi-Key/J587
GND	Binding post, black 15-A econo		1	Keystone Electronics	7007	Digi-Key/7007K
HPVDD, VDD	Binding post, red, 15-A econo		2	Keystone Electronics	7006	Digi-Key/7006K
Gain0(1-2), Gain1(1-2), HP_EN(1-2), REG_EN(1-2), SPKR_EN(1-2)	Shunt, black AU flash	2 mm	5	Norcomp Inc.	810-002-SP2L001	Digi-Key/SP2-001E
U1	2W stereo amp with stereo HP QFN32-RHB		1	Texas Instruments	TPA6047A4RHB	Texas Instruments/TPA6047A4RHB
HW1, HW2, HW3, HW4	Hex Nut, 4-40, Zinc/Steel		4	Building Fasteners	HNZ440	Digi-Key/H216
HW1, HW2, HW3, HW4	Standoff 4-40 Threaded M/F 0.50 in. Alum-Hex		4	Keystone Electronics	8401	Digi-Key/8401K

32-pin QFN 5-mm sq. and 0,5-mm spacing and exposed thermal pad

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 4.5 V to 5.5 V and the output voltage range of 0 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.

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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