

## **TPA6110A2-Q1 Evaluation Module**

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This user's guide describes the characteristics, operation, and use of the TPA6110A2-Q1 Evaluation Module (EVM). A complete schematic diagram, printed-circuit board layouts, and bill of materials (BOM) are included in this document.

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### **Trademarks**

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## 1 Introduction

This section provides an overview of the Texas Instruments (TI) TPA6110A2-Q1 MSOP audio amplifier evaluation module. It includes a list of EVM features, a brief description of the module illustrated with a pictorial diagram, and a list of EVM specifications.

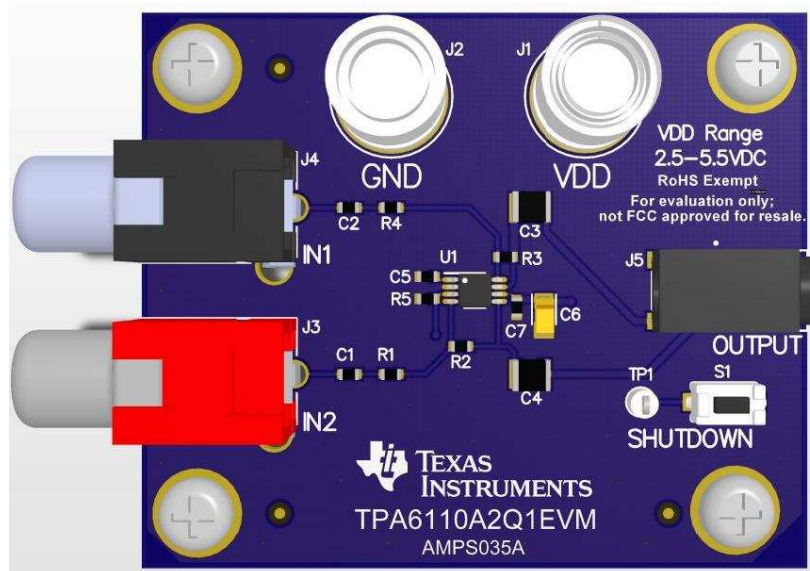
### 1.1 Features

The TI TPA6110A2-Q1 MSOP audio amplifier evaluation module includes the following features:

- TPA6110A2-Q1 MSOP stereo audio power amplifier evaluation module
  - Dual channel, single-ended operation
  - 150-mW output power into 8  $\Omega$  at 5 V
  - 2.5-V to 5.5-V operation
  - Very low distortion:
    - THD+N is less than 0.01% at 1 kHz and less than 0.03% from 20 Hz to 20 kHz into 10-k $\Omega$  loads
    - Less than 0.02% at 1 kHz and less than 0.4% from 20 Hz to 20 kHz into 32- $\Omega$  loads
    - Less than 0.05% at 1 kHz and less than 0.8% from 20 Hz to 20 kHz into 8- $\Omega$  loads
  - Extremely low current consumption in shutdown mode
  - Internal thermal and short-circuit protection
  - Internal pop reduction circuitry
- Platform audio input and output connections
  - Left and right RCA phono jack inputs
  - Miniature stereo headphone jack output

### 1.2 Description

The TPA6110A2-Q1 MSOP audio power amplifier evaluation module is a complete, low-power stereo audio power amplifier for high-fidelity line-level output, headphone, and small speaker applications. It consists of the TI TPA6110A2-Q1 150-mW stereo 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](#)).



Due to the very small size of the MSOP IC package, the standard part number TPA6110A2-Q1 is replaced with the code TIAIZ.

**Figure 1. TPA6110A2-Q1 Audio Amplifier Evaluation Module**

The EVM features RCA input jacks and 3.5-mm output jack that enables an easy connection to external equipment for evaluation and testing. Input and feedback resistors as well as input capacitors are placed in open areas so the user can easily modify them for different gain settings.

### 1.3 TPA6110A2-Q1 MSOP EVM Specifications

Table 1 lists the TPA6110A2-Q1 MSOP EVM specifications.

**Table 1. TPA6110A2-Q1 MSOP EVM Specifications**

Parameter		Specification
$V_{DD}$	Supply voltage range	2.5 V to 5.5 V
$I_{DD}$	Supply current	160 mA, max
	Continuous output power, PO: 8 W, $V_{DD} = 5$ V	150 mW
$V_I$	Audio input voltage	$V_{DD} + 0.3$ Vpp, max
$R_L$	Minimum load impedance	8 $\Omega$

## 2 Operation

Follow the steps in this section to quickly prepare the TPA6110A2-Q1 MSOP audio amplifier EVM for use.

The TPA6110A2-Q1 EVM provides a quick and easy way to connect power, signal, and control inputs. Inputs and outputs use standard connectors making external equipment connections easy.

### 2.1 Precautions

#### CAUTION

##### Power Supply Input Polarity and Maximum Voltage

Always ensure that the polarity and voltage of the external power connected to VDD power input connector J1 are correct. Overvoltage or reverse-polarity power applied to these terminals can cause other damage to the evaluation modules, or the power source.

### 2.2 Quick Start List

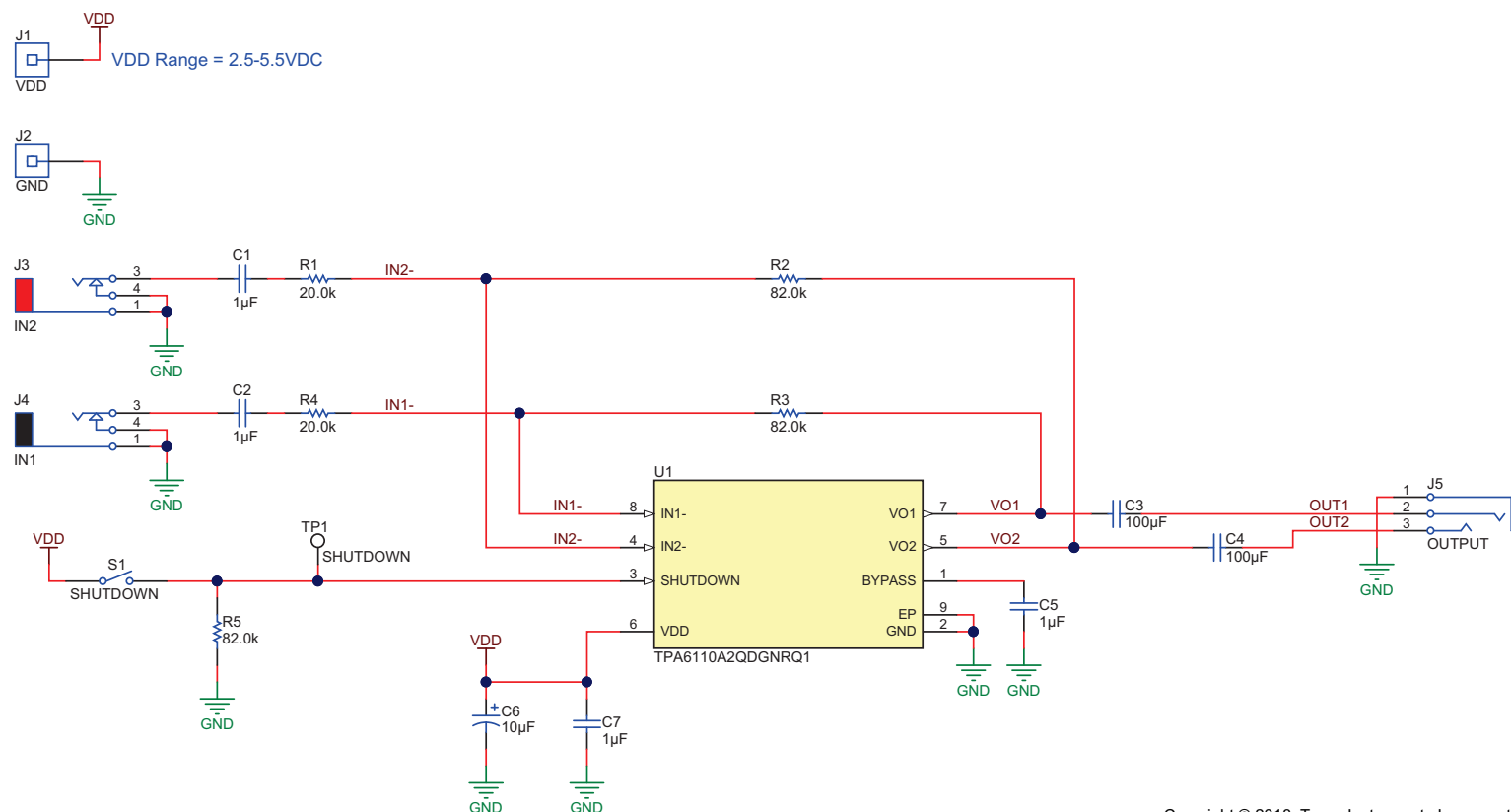
Follow these steps to use the TPA6110A2-Q1 MSOP EVM stand-alone or when connecting it to existing circuits or equipment. Connections to the TPA6110A2-Q1 module are made via RCA input jack and 3.5-mm output jack.

- 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  $V_{DD}$  and GND connectors, taking care to observe marked polarity.
- Inputs and outputs
  1. Ensure that signal source level is set to minimum.
  2. Connect the audio source to the module IN1 and IN2 RCA input connectors.
  3. Connect 32- $\Omega$  headphones to the module output 3.5-mm connector J5. The output is already coupled through capacitors C3 and C4 so there is no need to add external coupling capacitors.
- Power-up
  1. Verify correct voltage and input polarity and set the external power supply to ON.  
The EVM should begin operation.
  2. Adjust the signal source level as needed.

## 2.3 References

### 2.3.1 TPA6110A2-Q1 MSOP EVM Schematic Diagram

Figure 2 illustrates the EVM schematic.



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Figure 2. TPA6110A2-Q1 MSOP EVM Schematic Diagram

## 2.3.2 TPA6110A2-Q1 MSOP Audio Power Amplifier Evaluation Module Bill of Materials

Table 2 displays the EVM bill of materials.

**Table 2. TPA6110A2-Q1 MSOP EVM Bill of Materials**

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
!PCB	1		Printed Circuit Board		AMPS035	Any
C1, C2, C5, C7	4	1uF	CAP, CERM, 1 $\mu$ F, 25 V, $\pm$ 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71E105KA64D	Murata
C3, C4	2	100uF	CAP, CERM, 100 $\mu$ F, 16 V, $\pm$ 20%, X5R, 1210	1210	C1210C107M4PAC7800	Kemet
C6	1	10uF	CAP, TA, 10 $\mu$ F, 6.3 V, $\pm$ 10%, 3.4 ohm, SMD	3216-18	293D106X96R3A2TE3	Vishay-Sprague
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2	2		Binding Post, Nickel, TH	Receptacle, 1x1 Position, Dia 9.8mm, TH	111-2223-001	Cinch Connectivity
J3	1		RCA Jack, Red, R/A, TH	PC Mount Phono Jack-Red, TH	971	Keystone
J4	1		RCA Jack, Black, R/A, TH	RCA Jack, Black, R/A, TH	972	Keystone
J5	1		Audio Jack, 3.5 mm, Stereo, R/A, TH	Connector, 3-Leads, 3.5mm Stereo Jack R/A, TH	STX-3000	Kycon Inc
R1, R4	2	20.0k	RES, 20.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3EKF2002V	Panasonic
R2, R3, R5	3	82.0k	RES, 82.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0782KL	Yageo America
S1	1		Switch, SPST-NO, Off-Mom, 0.05 A, 12 VDC, SMD	6x3.5mm	EVQ-5PN04K	Panasonic
TP1	1		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
U1	1		Automotive Grade 150-mW Stereo Audio Power Amplifier, DGN0008D (VSSOP-8)	DGN0008D	TPA6110A2QDGNRQ1	Texas Instruments
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A

### 2.3.3 TPA6110A2-Q1 EVM PCB Layers

Figure 3 through Figure 5 illustrate the EVM PBC layers. The following illustrations depict the TPA6110A2-Q1 EVM PCB layers and silkscreen. These drawings are not to scale. Gerber plots can be obtained from any TI sales office.

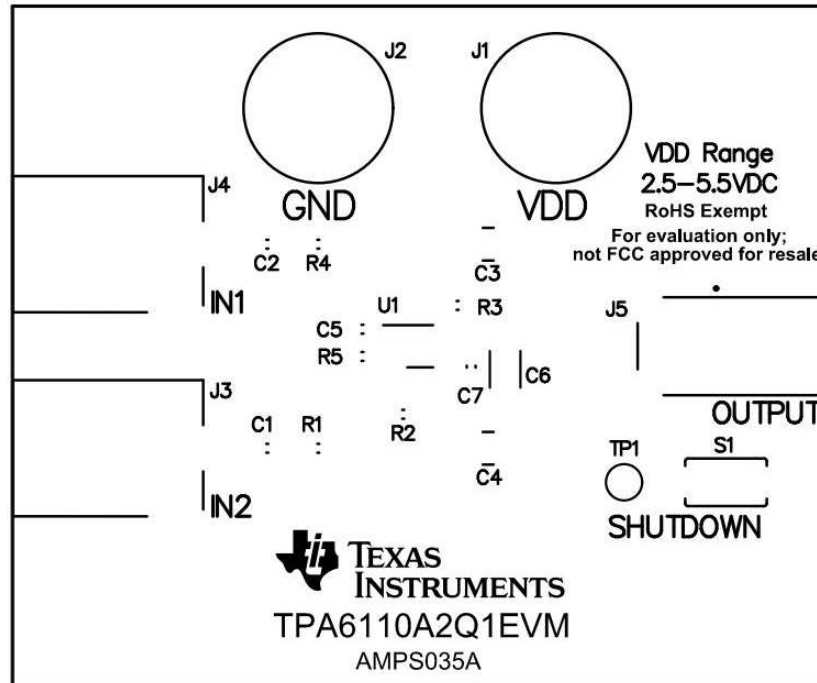


Figure 3. TPA6110A2 EVM Silk Screen

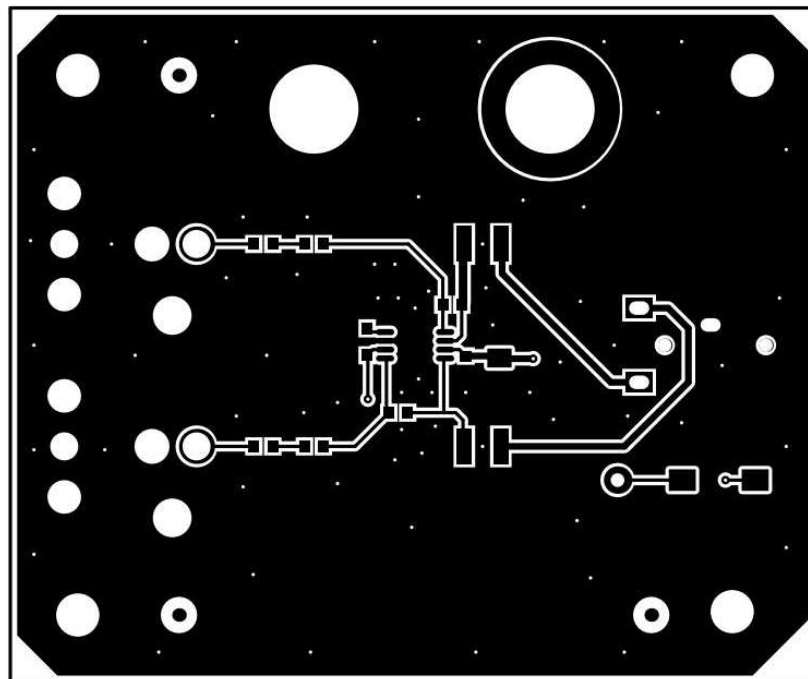


Figure 4. TPA6110A2 EVM PCB Top Layer

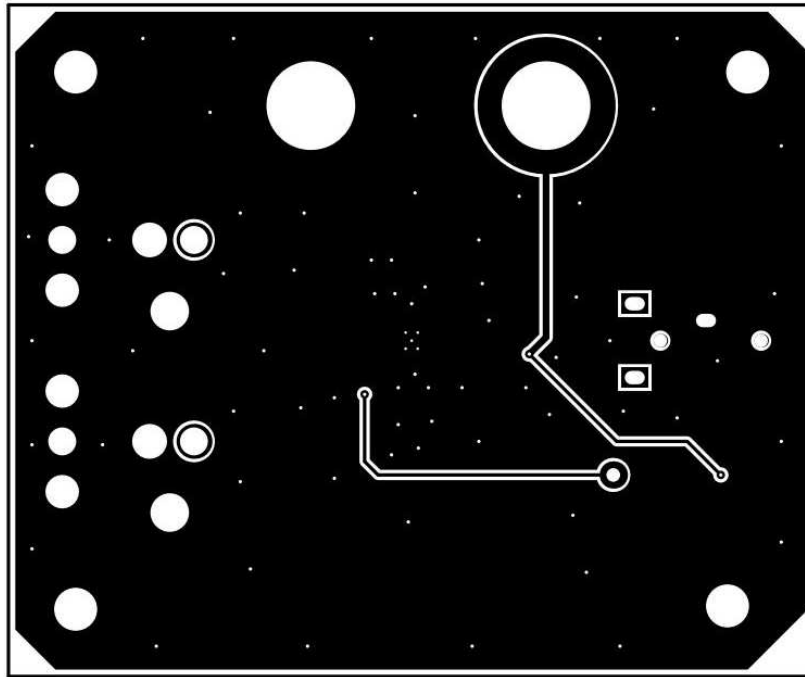


Figure 5. TPA6110A2 EVM PCB Bottom Layer

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### CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*



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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### 3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

#### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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