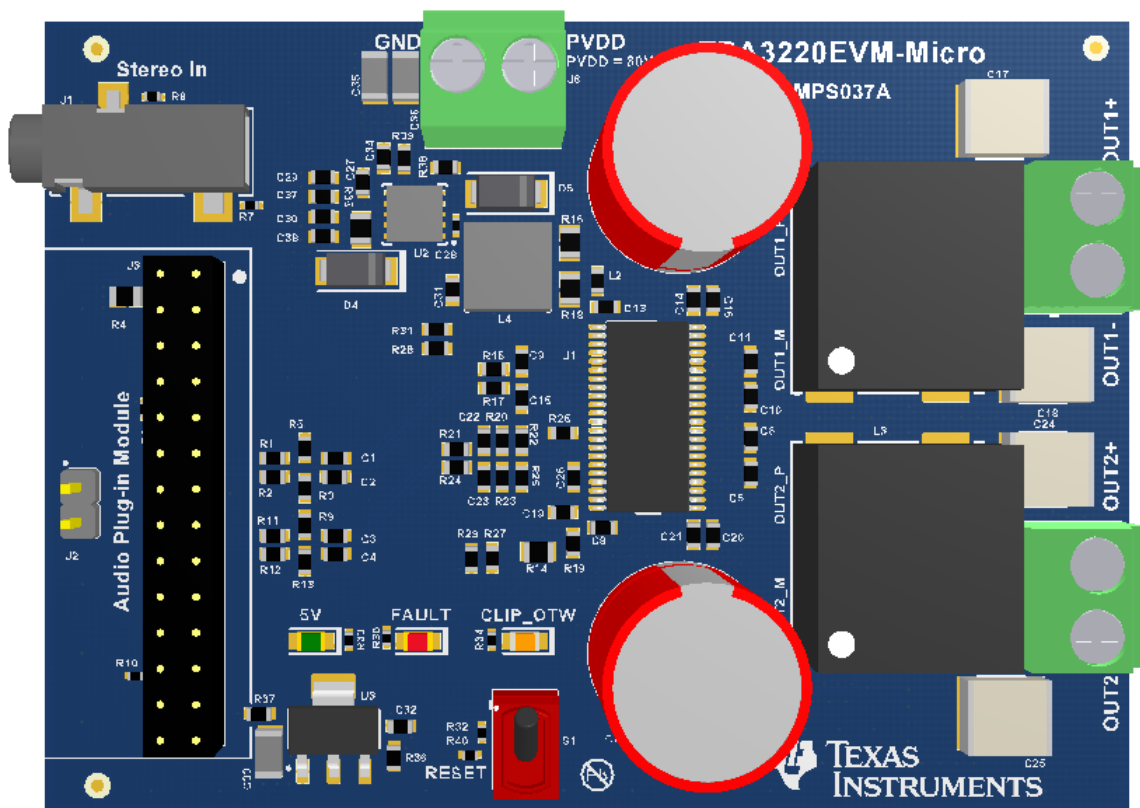![Texas Instruments logo]

TPA3220 Evaluation Module Micro

This user's guide describes the characteristics, operation, and use of the TPA3220 Evaluation Module Micro. A complete printed-circuit board (PCB) description, schematic diagram, and bill of materials (BOM) are also included.

Contents

List of Figures

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Trademarks

CoilCraft is a trademark of CoilCraft, Inc.
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1 Quick Start (BTL MODE)

The following section describes the necessary hardware, connections, configuration, and steps to quick start the EVM into BTL mode with stereo audio playing out of two speakers.

Figure 1 illustrates the BTL mode output configuration
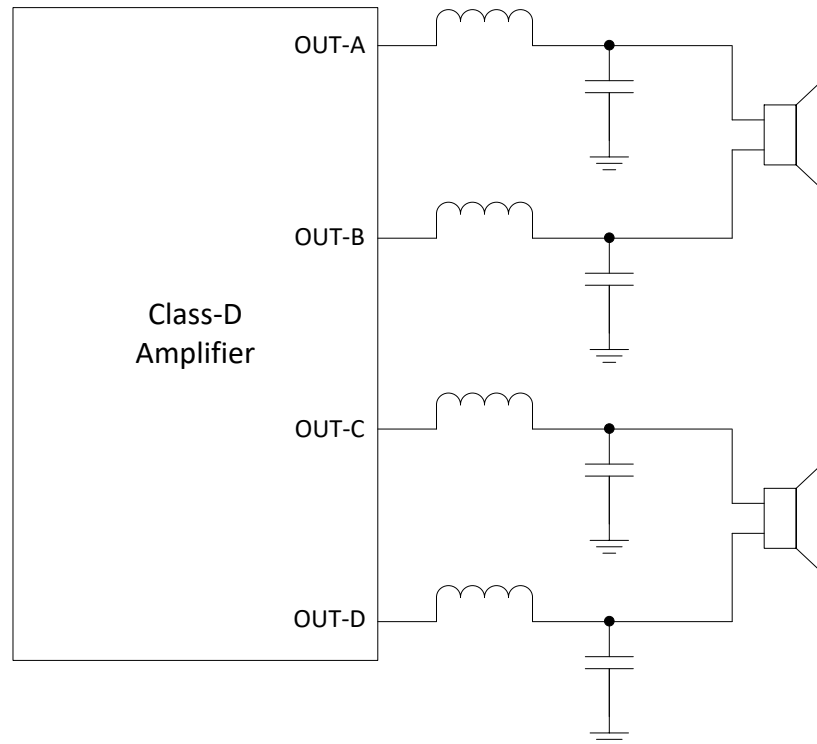

Figure 1. Output Configuration BTL

1.1 Required Hardware

The following hardware is required for this EVM:

- TPA3220EVM-Micro
- Power supply 5–14 A, 12–30 VDC
- Two 2–8 Ω speaker or resistor loads (ensure speaker or load is appropriately sized for required wattage output)
- Four 12–20 AWG wires
- One XLR to 3.5-mm audio jack
- Analog output audio source

1.2 Connections and Board Configuration

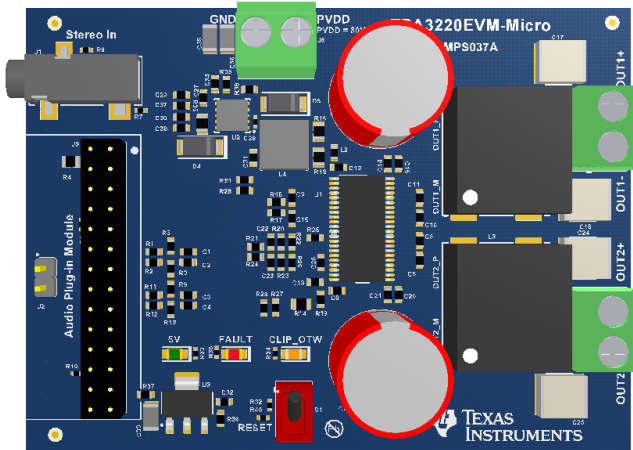Figure 2 and Figure 3 illustrate the top and bottom of the EVM.

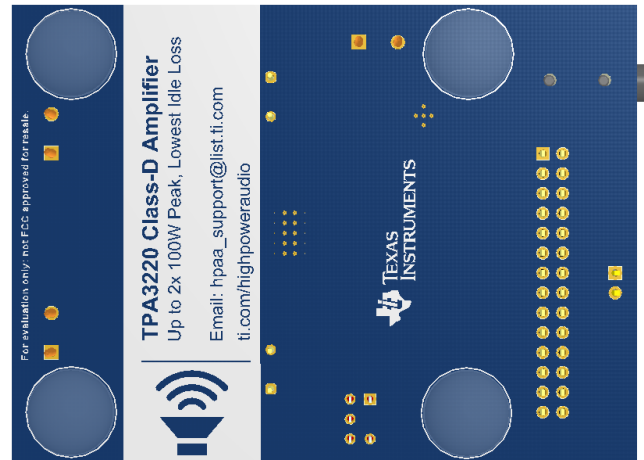**Figure 2. EVM Board (Top Side)**

Figure 3. EVM Board (Bottom Side)

Use the following steps when connecting and configuring the board in BTL MODE:

1. Ensure the power supply is OFF. Connect the power supply positive terminal to J6 PVDD and negative terminal to J6 GND.

2. Connect the left channel speaker, power resistor load (3–8 Ω) to the TPA3220EVM-Micro positive output terminal (J4 OUT1+) and other side of the speaker, power resistor to the TPA3220EVM-Micro negative output terminal (J4 OUT1–).

3. Connect the right channel speaker, power resistor load (3–8 Ω) to the TPA3220EVM-Micro positive output terminal (J5 OUT2+) and other side of the speaker, power resistor to the TPA3220EVM-Micro negative output terminal (J5 OUT2–).

4. Check to make sure that the power supply is only connected to J6 and speakers are connected to J4 or J5 only, as their colors are the same.

5. Input Configuration:
   a. **Differential Inputs:** Depopulate R3 and R13
   b. **Single-Ended Inputs:** Populate R3 and R13
   c. **Audio Interface Board Input:** Populate R1, R2, R11, and R12

6. Ensure that RESET S1 is in the lower position of RESET.

7. Check Table 1 for all necessary jumper and switch configurations.

Table 1. Jumper and Switch Configurations (BTL Mode)

Component	Component Description	Configuration for BTL
R28, R31	Gain/SLV Select	MSTR-34dB
R3, R13	Input DIFF or SE Select	SE = Populate
		DIFF = Remove
R1, R2, R11, R12	AIB Input Select	Populated
R27, R29	HEAD or AD Mode Select	HEAD = Populate R27, Remove R29
		AD = Remove R27, Populate R29
R22, R26	PBTL or BTL Select	Remove
S1	RESET Control	RESET
R25	FREQ_ADJ	MASTER MODE = 480kHz

1.3 Power-Up

Ensure that required connections and configurations have been checked. The TPA3220EVM-Micro board can now be powered on.

1. Enable the power supply at 12 V to 30 V and ensure that LED D2 illuminates. LEDs D1 and D3 should not be illuminated.
2. Switch S1 out of RESET. The FAULT LED (D1) should blink once quickly, then remain unilluminated.
3. Note that the EVM does not have volume control, configure your analog input for a reasonable audio level before beginning audio playback.
4. Enable audio input playback and the EVM should begin driving audio out of the left and right speakers. If resistor loads are used for testing instead of speakers, they will now be energized.

2 Setup By Mode

The following sections describe the setup and configuration for each output mode. The TPA3220DDV EVM-Micro allows for two output modes: Stereo BTL and Mono PBTL.

2.1 BTL MODE (Stereo - 2 Speaker Outputs)

This mode is the same as described in *Quick Start (BTL MODE)* .

2.2 PBTL MODE (Mono – 1 Speaker Output)

This mode provides one speaker output that is more powerful than each BTL output and is useful when mono audio is to be played or when more power is needed.

Figure 4 illustrates the PBTL mode output configuration with 4 inductors.

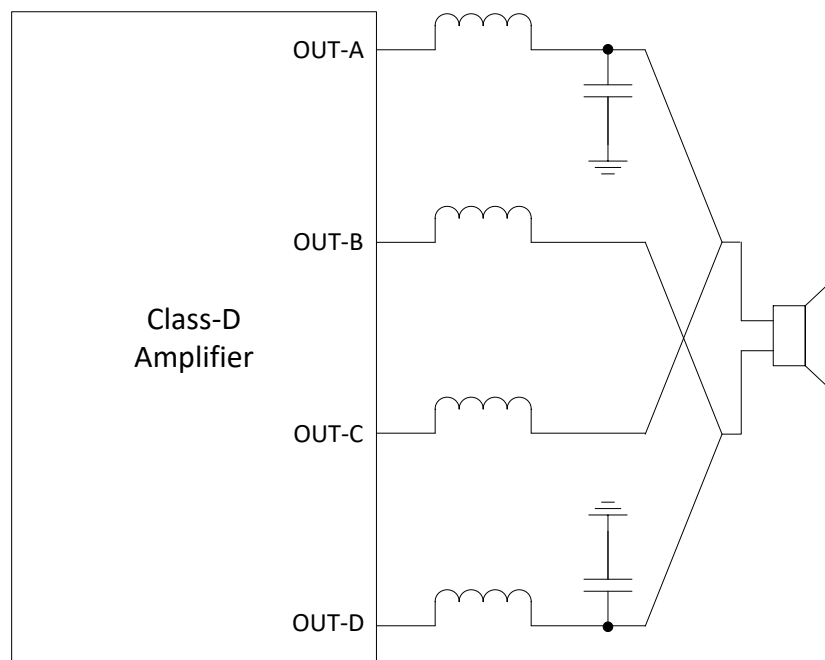**Figure 4. Output Configuration PBTL - 4 Inductors**

2.2.1 Connections and Board Configuration

Use the following steps when connecting and configuring the board in BTL MODE:

1. Ensure the power supply is OFF. Connect the positive terminal of the power supply to J6 PVDD and negative terminal to J6 GND.
2. Connect one channel speaker, power resistor load (2–8 Ω) to the TPA3220EVM-Micro positive output

terminal (J4 OUT1+) and other side of the speaker, power resistor to the TPA3220EVM-Micro negative output terminal (J4 OUT1–).

3. Use a wire to connect J5 OUT2+ to J4 OUT1+, then use another wire to connect J5 OUT2– to J4 OUT1–. This forms a parallel connection of both OUTx+ to one side of the speaker and a parallel connection of both OUTx– to the other side of the speaker.

4. Check to make sure that the power supply is connected to J6 only and speakers are connected to J4 or J5 only, as their colors are the same.

5. Input Configuration:
   a. **Differential Inputs:** Depopulate R3 and R13
   b. **Single-Ended Inputs:** Populate R3 and R13
   c. **Audio Interface Board Input:** Populate R1, R2, R11, and R12

6. Ensure that RESET S1 is in the lower position of RESET.

7. Check Table 2 for all jumper and switch configurations necessary.

Table 2. Jumper and Switch Configurations (PBTL Mode)

Component	Component Description	Configuration for PBTL
R28, R31	Gain/SLV Select	MSTR-34dB
R3, R13	Input DIFF or SE Select	SE = Populate
		DIFF = Remove
R1, R2, R11, R12	AIB Input Select	Populated
R27, R29	HEAD or AD Mode Select	HEAD = Populate R27, Remove R29
		AD = Remove R27, Populate R29
R22, R26	PBTL or BTL Select	Populate
S1	RESET Control	RESET
R25	FREQ_ADJ	MASTER MODE = 480 kHz

2.2.2 Power-Up

Ensure that required connections and configurations have been checked. The TPA3220EVM-Micro board can now be powered on.

1. Enable the power supply at 12 V to 30 V and ensure that LED D2 illuminates. LEDs D1 and D3 should not be illuminated.

2. Switch S1 out of RESET. The FAULT LED (D1) should blink once quickly, then remain unilluminated.

3. Note that the EVM does not have volume control, configure your analog input for a reasonable audio level before beginning audio playback.

4. Enable audio input playback and the EVM should begin driving audio out of the left and right speakers. If resistor loads are used for testing instead of speakers, they will now be energized.

3   Hardware Configuration

3.1   Indicator Overview (CLIP_OTW and FAULT)

The TPA3220EVM-Micro is equipped with LED indicators that illuminate when the FAULT or CLIP_OTW pin goes low. See Table 3 and *TPA3220 100-W Peak HD-Audio, Analog-Input, Class-D* for more details.

Table 3. Fault and Clip Overtemperature Status

FAULT LED Status	CLIP_OTW LED Status	Description
ON	ON	Overtemperature (OTE) or overload (OLP) or undervoltage (UVP). Junction temperature higher than 125°C (OTE warning)
ON	OFF	Overload (OLP) or undervoltage (UVP). Junction temperature lower than 125°C
OFF	ON	Junction temperature higher than 125°C (OTE warning)
OFF	OFF	Junction temperature lower than 125°C and no OLP or UVP faults (normal operation)

3.2   PWM Frequency Adjust

The TPA3220EVM-Micro allows for three oscillator frequency options by external configuration of the FREQ_ADJ pin. The frequency adjust can be used to reduce interference problems while using a radio receiver tuned within the AM band. These values should be chosen such that the nominal and the lower value switching frequencies together results in the fewest cases of interference throughout the AM band. The oscillator frequency can be selected by the value of the FREQ_ADJ resistor connected to GND in master mode according to Table 4.

Table 4. Frequency Adjust Master Mode Selection

FREQ_ADJ (R25, R)	Resistor Value	PWM Frequency
Master MODE	49.9 kΩ	600 kHz
Master MODE	30 kΩ	533 kHz
Master MODE	10 kΩ	480 kHz
Slave MODE	Pull up to 5 V	N/A

Selecting *Slave Mode* configures the OSC_I/O pins as inputs to be slaved from an external differential clock. In a master or slave system, interchannel delay is automatically set up between the switching phases of the audio channels, which can be illustrated by no idle channels switching at the same time. This will not influence the audio output, but only the switch timing to minimize noise coupling between audio channels through the power supply. This will optimize audio performance and result in better operating conditions for the power supply. The inter-channel delay will be set up for a slave device depending on the polarity of the OSC_I/O connection such that slave mode 1 is selected by connecting the OSC_I/O of the master device with the OSC_I/O of the slave device with the same polarity (+ to + and – to –), while slave mode 2 is selected by connecting the OSC_I/Os with the inverse polarity (+ to – and – to +).

3.3   Modulation Modes (AD Mode and HEAD Mode)

The TPA3220EVM-Micro supports both AD modulation as well as HEAD modulation. In AD mode, each of the two half-bridge outputs are continuously switching. AD mode is the default mode for the TPA3220EVM-Micro. The EVM also supports HEAD mode modulation. HEAD mode also switches both half-bridge outputs but also optimizes the switching for lower power loss at idle as well as increased EMI performance at cost of some performance. The device accomplishes this by reducing its duty cycle at idle and while playing small signals. At higher output levels HEAD mode will also reduce the switching on one of the half bridges. The modulation mode can be controlled through jumper J6 on the EVM as follows:

Table 5. HEAD and AD Mode Selection

Resistors State (R27, R29)	Modulation Mode
R27 = Populate, R29 = Remove	HEAD Mode
R27 = Remove, R29 = Populate	AD Mode

More information on the differences between HEAD mode and AD mode as well as performance data is found in *TPA3220 100-W Peak HD-Audio, Analog-Input, Class-D* .

3.4 Output Mode Selection

The TPA3220 does not use discrete mode pins and therefore relies solely on the states of the IN2_M and IN2_P pins. Connecting the IN2_M and IN2_P pins to regular high output impedance audio outputs by removing J7 and J8 puts the TPA3220 into BTL mode (2 × stereo outputs). Tying the IN2_M and IN2_P pins to GND by populating R22 and R26 puts the TPA3220 into PBTL mode (1 × mono output). This is summarized in Table 6:

Table 6. Output Mode and Modulation Mode Selection

Input Resistors R22 and R26		Input Mode	Output Configuration	Description
IN2_M	IN2_P			
OUT	OUT	1N / 2N + 1	2 × BTL	Stereo BTL output configuration
IN	IN		1 × PBTL	Mono paralleled BTL configuration. Connect OUT1+ to OUT2+ and OUT1– to OUT2–.

3.5 EVM Power Tree

The TPA3220EVM-Micro includes a few options for power configuration so that various input types can be evaluated.

3.5.1 TPA3220 Supplies

The TPA3220 device has a few power supplies which each have their own voltage range and rules. Details for each supply are as shown:

- **PVDD** – This is the main device supply which accepts from 7 V to 30 V. Power output of the device is derived solely from PVDD and therefore it is important to configure this supply according to the chosen output configuration and load. Complete details are included in *TPA3220 100-W Peak HD-Audio, Analog-Input, Class-D* .

- **VDD** – This supply is used for the non-PVDD power of the device for blocks such as the front-end and control circuitry. The TPA3220 internal 5-V LDO is also powered by this pin. VDD can be powered by 5 V directly if using the TPA3220 with the internal regulator OFF. In this case, tie the GVDD and AVDD pins directly to VDD through R18 and remove R16. When the internal regulator is used, VDD must be between 7 V and PVDD through R16. GVDD and AVDD are only 5-V tolerant, so R18 must be removed.

- **GVDD** and **AVDD** – These pins are used for the gate drive and analog supply of the device. These pins accept only 5 V. When the internal regulator is used, these pins are fed internal to the device, no external connection is necessary. When the internal regulator is OFF.

3.5.2 TPA3220EVM-Micro Power Options

3.5.2.1 Default Mode

This is the default configuration of TPA3220EVM-Micro. In this configuration, the TPA3220 utilizes the onboard buck converter to bring down PVDD to 5 V.

Table 7 shows how to configure TPA3220EVM-Micro into this mode.

Table 7. Default Mode Configuration

Component	Component Description	Configuration for LDO Mode
R16	PVDD to VDD Connector	Populate
R18	5 V to VDD Connector	Remove
R14	5 V to GVDD Connector	Populate
D4	Buck Input Component	Populate
L4, C31, R38	Buck Output Components	Populate
R40	Voltage Divider for RESET	Remove

3.5.2.2 PVDD Only (12 V to 30 V) LDO Mode

This power mode is the default setup when the board is tested and shipped. The user can connect any valid supply voltage to J1 and the onboard LDOs will generate the required non-PVDD voltages. PVDD itself always connects directly to the TPA3220 PVDD pins. Setup for this mode is the same as described in *Quick Start (BTL MODE)* .

Table 8 shows how to configure the TPA3220EVM-Micro into this mode.

Table 8. LDO Mode Configuration

Component	Component Description	Configuration for LDO Mode
R16	PVDD to VDD Connector	Populate
R18	5 V to VDD Connector	Remove
R14	5 V to GVDD Connector	Populate
D4	Buck Input Component	Remove
L4, C31, R38	Buck Output Components	Remove
R40	Voltage Divider for RESET	Remove

3.5.2.3 PVDD (12 V to 30 V) and One Non-5-V Supply

This power mode is useful for certain applications where a system has one higher voltage used for PVDD and a second lower voltage that may be used for device pullups and other supplies (VDD, GVDD, and AVDD).

Special consideration must be taken for the RESET pin. The RESET pin needs to have a 5-V input. In order to do this R40 must be installed to create a voltage divider network that will drop the voltage down to 5 V.

Table 9 shows how to configure TPA3220EVM-Micro into this mode.

Table 9. Non-5-V Supply Configuration

Component	Component Description	Configuration for External Non-5-V Mode
R16	PVDD to VDD Connector	Populate
R18	5 V to VDD Connector	Remove
R14	5 V to GVDD Connector	Remove
D4	Buck Input Component	Remove
L4, C31, R38	Buck Output Components	Remove
R40	Voltage Divider for RESET	Populate

3.5.2.4 PVDD (12 V to 30 V) and External 5-V Supply

This power mode is most useful for systems in which a 5-V supply is already available due to additional circuitry like an MCU or wireless module. On the EVM, this is also the preferred way to measure efficiency of the TPA3220 device.

Table 10 shows how to configure TPA3220EVM-Micro into this mode.

Table 10. External 5-V Supply Mode Configuration

Component	Component Description	Configuration for External 5-V Mode
R16	PVDD to VDD Connector	Remove
R18	5 V to VDD Connector	Populate
R14	5 V to GVDD Connector	Populate
D4	Buck Input Component	Remove
L4, C31, R38	Buck Output Components	Remove
R40	Voltage Divider for RESET	Remove

ADVANCE INFORMATION

3.6 LC Response and Overview

Included near the output of the TPA3220 device are four output LC filters. These output filters filter the pulse-width modulation (PWM) output, leaving only the audio content at high power, which is fed to the speakers. The board uses a CoilCraft™ 7-µH inductor and a 0.68-µF film capacitor to form this LC filter. Using the equations listed in LC Filter Design , the low-pass filter cutoff is calculated as follows in Equation 1:

$$F_{cut-off} = \frac{1}{2\pi\sqrt{L \times C}} = \frac{1}{2\pi\sqrt{7\ \mu H \times .68\ \mu F}} = 72.9\ kHz$$

(1)

Figure 5. Filter Frequency Response

3.7 Reset Circuit and POR

The TPA3220EVM-Micro includes RESET supervision so that the TPA3220 device will remain in reset until all power rails are up and stable. The RESET supervisor also ensures that the device will be put into reset if one of the power rails experiences a brown out. This circuit, combined with the RESET switch (S1) help ensure that the TPA3220 can be placed in reset easily, as needed, or automatically if there is a power supply issue.

3.8   Analog-Input-Board Connector (J3)

The Analog-Input-Board (AIB) connector allows for cross compatibility with several Analog Plug-in Modules (APMs) offered by TI. This generic connector provides access to common board connections such as analog input, analog output, Fault and overtemperature warning (OTW) error reporting, common board voltages (12 V, 3.3 V, and so forth), and EVM reset. These plug-in modules allow for an application-specific front end to be plugged into the TPA3220EVM-Micro with ease. Examples of plug-in modules include front ends for guitar amplifier, karaoke, wireless sub-woofer, and front-end audio crossover. Table 11 provides the details for the AIB connector pinouts.

Table 11. AIB Connector (J3) Pinout

Pin #	Function	Description	Audio EVM Input/Output
1	Amp Out A	Speaker-level output from audio class-D EVM (SE or one side of BTL)	O
2	Amp Out B	Speaker-level output from audio class-D EVM (SE or one side of BTL)	O
3	PVDD	PVDD voltage supply from audio Class-D EVM (variable voltage depending on Class-D EVM use)	O
4	GND	Ground reference between audio plug-in module and audio class-D EVM	-
5	NC	-	-
6	NC	-	-
7	3.3 V	3.3-V supply from EVM; used for powering Audio Plug-in Module	O
8	3.3 V	3.3-V supply from EVM; used for powering Audio Plug-in Module	O
9	12 V	12-V supply from EVM; used for powering Audio Plug-in Module	O
10	EN and RESET	Assert enable and reset control for audio class-D EVM (active low)	I
11	Analog IN_A	Analog audio Input A (analog in EVM), Data In I2S Bus (digital in EVM)	I
12	NC	-	-
13	Analog IN_B	Analog audio Input B (analog in EVM), Data In I2S Bus (digital in EVM)	I
14	CLIP_OTW	Clipping detection, overtemperature warning, or both from audio class-D EVM (active low)	O
15	Analog IN_C	Analog audio Input C (analog in EVM), Data In I2S Bus (digital in EVM)	I
16	FAULT	Fault detection from audio Class-D EVM (Active Low)	O
17	Analog IN_D	Analog audio Input D (analog in EVM), Data In I2S Bus (digital in EVM)	I
18	NC	-	-
19	NC	-	-
20	NC	-	-
21	GND	Ground reference between audio plug-in module and audio class-D EVM	-
22	GND	Ground reference between audio plug-in module and audio class-D EVM	-
23	NC	-	-
24	NC	-	-
25	NC	-	-
26	NC	-	-
27	Amp Out C	Speaker-level output from audio class-D EVM (SE or one side of BTL)	O
28	Amp Out D	Speaker-level output from audio class-D EVM (SE or one side of BTL)	O

4   EVM Design Documents

This section contains the EVM board layouts, schematics, and bill of materials (BOM).

4.1   *TPA3220EVM-Micro Board Layouts*

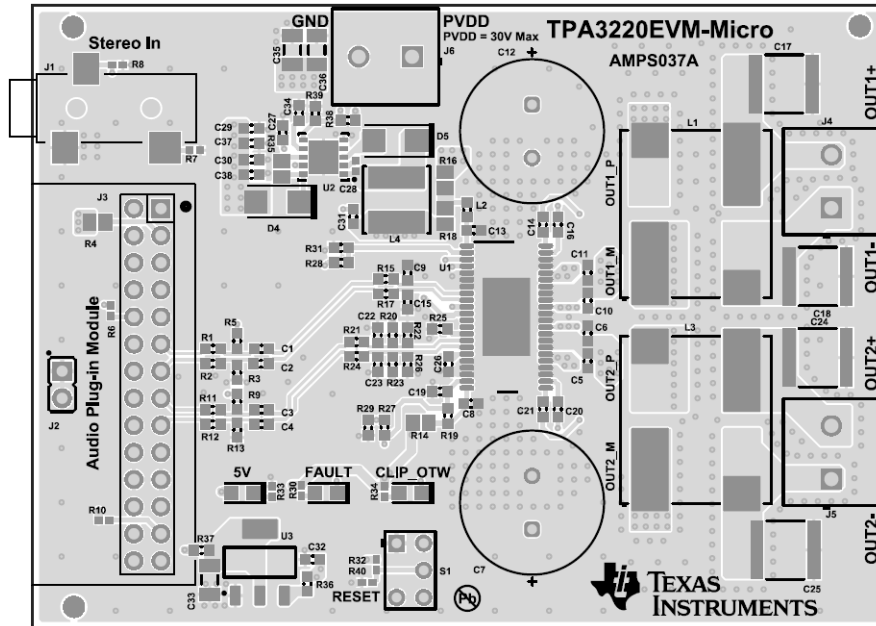Figure 6 and Figure 7 illustrate the EVM board layouts.
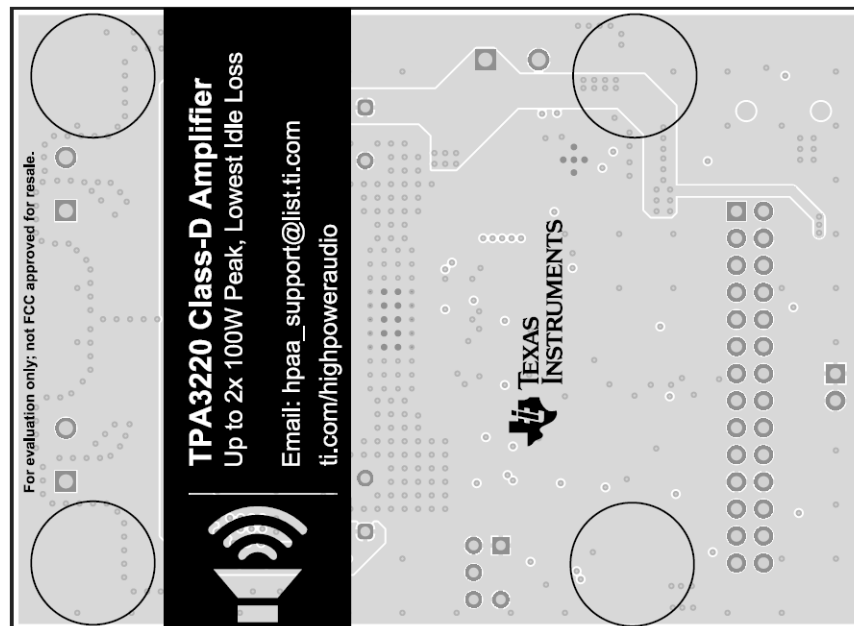

Figure 6. TPA3220EVM-Micro Top Composite Assembly

Figure 7. TPA3220EVM-Micro Bottom Composite Assembly

4.2   *TPA3220EVM-Micro Board Layouts*

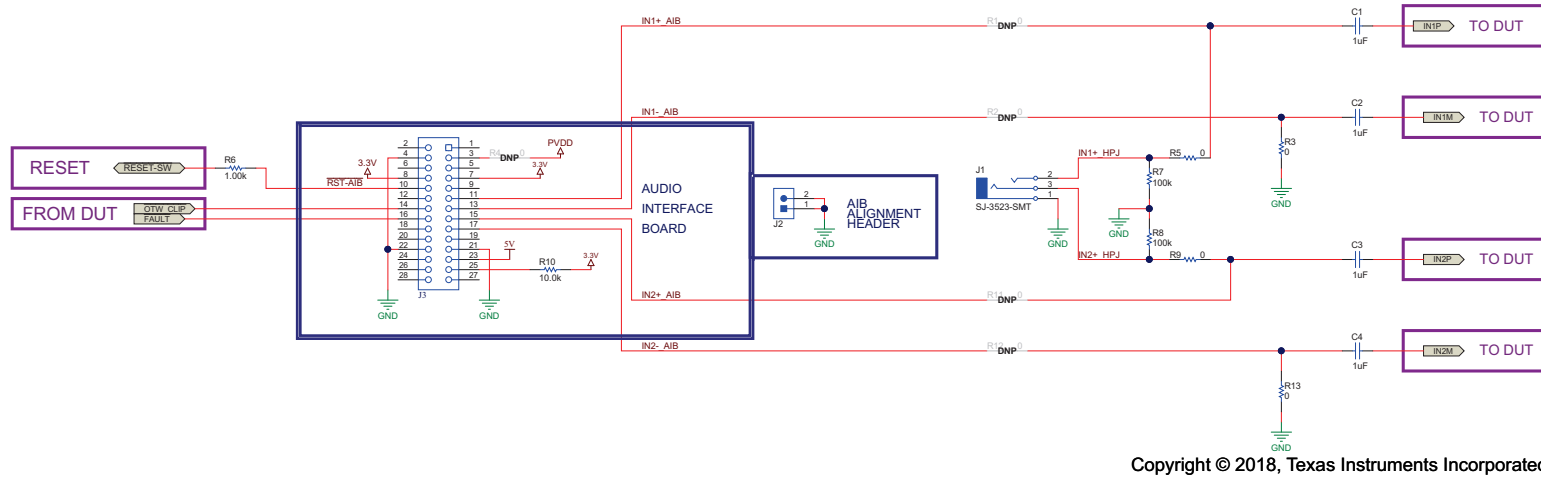Figure 8 shows the EVM board dimensions.

Image shown is **not** actual scale.

Figure 8. TPA3220EVM-Micro Board Dimensions

5 Schematic and Bill of Materials

This section contains the EVM schematic images and the BOM.

5.1 Schematic

Figure 9 and Figure 10 illustrate the EVM schematics.

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Figure 9. TPA3220EVM-MICRO Schematic 1

Figure 10. TPA3220EVM-MICRO Schematic 2

ADVANCE INFORMATION

5.2 Bill of Materials

Table 12 displays the EVM BOM.

Table 12. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		AMPS037	Any
C1, C2, C3, C4	4	1uF	CAP, CERM, 1 uF, 16 V, ±10%, X7R, 0603	0603	EMK107B7105KA-T	Taiyo Yuden
C5, C6, C10, C11, C37	5	1uF	CAP, CERM, 1 uF, 50 V, ± 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
C7, C12	2	1000uF	CAP, AL, 1000 µF, 50 V, ±20%, TH	D13xL25mm	860010678024	Wurth Elektronik
C8, C13, C19, C30, C38	5	0.1uF	CAP, CERM, 0.1 uF, 50 V, ±10%, X7R, 0603	0603	C0603C104K5RACTU	Kemet
C9, C15, C22, C23	4	100pF	CAP, CERM, 100 pF, 50 V, ±5%, C0G/NP0, 0603	0603	GRM1885C1H101JA01D	Murata
C14, C16, C20, C21, C26	5	0.033uF	CAP, CERM, 0.033 uF, 25 V, ±10%, X7R, 0603	0603	GRM188R71E333KA01D	Murata
C17, C18, C24, C25	4	0.68uF	CAP, Film, 0.68 µF, 40 VAC/63 VDC,±10%, AEC-Q200 Grade 1, 2220 SMD	2220	LDEDD3680KA5N00	Kemet
C27	1	0.47uF	CAP, CERM, 0.47 uF, 25 V, ±10%, X5R, 0603	0603	GRM188R61E474KA12D	Murata
C28	1	0.047uF	CAP, CERM, 0.047 uF, 25 V, ±10%, X7R, 0402	0402	GRM155R71E473KA88D	Murata
C29	1	2.2uF	CAP, CERM, 2.2 uF, 50 V, ±10%, X5R, 0603	0603	GRM188R61H225KE11D	Murata
C31	1	5600pF	CAP, CERM, 5600 pF, 50 V, ±10%, X7R, 0603	0603	GRM188R71H562KA01D	Murata
C32	1	10uF	CAP, CERM, 10 uF, 16 V, ±20%, X5R, 0603	0603	GRM188R61C106MAALD	Murata
C33	1	100uF	CAP, CERM, 100 uF, 6.3 V, ±20%, X5R, 1206	1206	GRM31CR60J107ME39L	Murata
C34	1	0.022uF	CAP, CERM, 0.022 uF, 50 V, ±10%, X7R, 0603	0603	C0603C223K5RACTU	Kemet
C35, C36	2	10uF	CAP, CERM, 10 uF, 50 V, ±10%, X5R, 1206	1206	GRM31CR61H106KA12L	Murata
D1	1	Red	LED, Red, SMD	Red 0805 LED	LTST-C170KRKT	Lite-On
D2	1	Green	LED, Green, SMD	LED_0805	LTST-C171GKT	Lite-On
D3	1	Orange	LED, Orange, SMD	LED_0805	LTST-C170KFKT	Lite-On
D4	1	100V	Diode, Schottky, 100 V, 3 A, SMA	SMA	SK310A-TP	Micro Commercial Components
D5	1	100V	Diode, Schottky, 100 V, 1 A, SMA	SMA	B1100-13-F	Diodes Inc.
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1	1		Audio Jack, 3.5mm, Stereo, R/A, SMT	Audio Jack SMD	SJ-3523-SMT	CUI Inc.
J2	1		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions
J3	1		Receptacle, 100mil, 14x2, Gold, TH	14x2 Receptacle	SSW-114-01-G-D	Samtec
J4, J5, J6	3		Terminal Block, 2x1, 5mm, Green, TH	Terminal Block, 2x1, 5mm, TH	1935776	Phoenix Contact
L1, L3	2	7uH	Inductor, Shielded, Ferrite, 7 µH, 6.5 A, .0066 ohm, AEC-Q200 Grade 1, SMD	15.5x14mm	UA8013-ALD	Coilcraft
L2	1	10uH	Inductor, Wirewound, 10 uH, 0.08 A, 0.36 ohm, SMD	0603	GLFR1608T100M-LR	TDK
L4	1	100uH	Inductor, Shielded, Ferrite, 100 µH, 0.9 A, 0.611 ohm, SMD	6x6m	VLS6045EX-101M	TDK
R3, R5, R9, R13	4	0	RES, 0, 5%, 0.1 W, 0603	0603	ERJ-3GEY0R00V	Panasonic
R6	1	1.00k	RES, 1.00 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1001X	Panasonic

Table 12. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
R7, R8	2	100k	RES, 100 k, 1%, 0.0625 W, 0402	0402	RC0402FR-07100KL	Yageo America
R10	1	10.0k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic
R14, R18	2	0	RES, 0, 5%, 0.125 W, 0805	0805	ERJ-6GEY0R00V	Panasonic
R15, R17, R21, R24	4	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo America
R19	1	3.32	RES, 3.32, 1%, 0.1 W, 0603	0603	RC0603FR-073R32L	Yageo America
R25	1	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1002V	Panasonic
R27,	1	47.0k	RES, 47.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0747KL	Yageo America
R28	1	100k	RES, 100 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE07100KL	Yageo America
R30, R34	2	820	RES, 820, 1%, 0.063 W, 0402	0402	RC0402FR-07820RL	Yageo America
R31	1	39.0k	RES, 39.0 k, 1%, 0.1 W, 0603	603	RC0603FR-0739KL	Yageo America
R32	1	47.0k	RES, 47.0 k, 1%, 0.0625 W, 0402	0402	RC0402FR-0747KL	Yageo America
R33	1	499	RES, 499, 0.1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	ERA-2AEB4990X	Panasonic
R35	1	121k	RES, 121 k, 1%, 0.125 W, 0805	0805	ERJ-6ENF1213V	Panasonic
R38, R39	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	RC0603FR-071KL	Yageo America
S1	1		Switch, SPDT, On-On, 2 Pos, TH	Switch, 7x4.5mm	200USP1T1A1M2RE	E-Switch
U1	1		35-W Stereo, 100-W Peak HD-Audio, Analog-Input, Class-D Amplifier, DDW0044D (TSSOP-44)	DDW0044D	TPA3220DDWR	Texas Instruments
U2	1		High Voltage 1A Step Down Switching Regulator, 10-pin LLP, Pb-Free	SDC10A	LM5010ASD/NOPB	Texas Instruments
U3	1		FIXED LOW-DROPOUT VOLTAGE REGULATOR, DCY0004A	DCY0004A	TLV1117-33IDCY	Texas Instruments
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
R1, R2, R11, R12, R36, R37	0	0	RES, 0, 5%, 0.1 W, 0603	0603	RC0603JR-070RL	Yageo America
R4, R16	0	0	RES, 0, 5%, 0.125 W, 0805	0805	ERJ-6GEY0R00V	Panasonic
R20, R22, R23, R26, R29	0	0	RES, 0, 5%, 0.1 W, 0603	0603	ERJ-3GEY0R00V	Panasonic
R40	0	0	RES, 0, 5%, 0.063 W, 0402	0402	RC0402JR-070RL	Yageo America