TPA3251D2EVM

This user's guide describes the operation of the evaluation module (TPA3251D2EVM) for the TPA3251D2 175-W Stereo/350-W mono PurePath™ Ultra-HD Analog Input Power Stage. The user's guide also provides design information, which includes schematic, BOM, and PCB layout. For questions and support go to the E2E forums (e2e.ti.com).

The main contents of this document are:

- Hardware descriptions and implementation
- Design information

Related documents:

- TPA3251D2 Data Sheet (SLASE40)

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1 Hardware Overview

The TPA3251D2EVM PurePath™ Ultra-HD evaluation module demonstrates the TPA3251D2DDV integrated circuit from Texas Instruments. The TPA3251D2DDV is a high-performance, high-power, class-D amplifier that enables true premium sound quality with high efficiency class-D technology. It features an advance integrated feedback design and high-speed gate driver error correction (PurePath Ultra-HD), which enables ultra-low distortion across the audio band and superior audio quality. This EVM supports 2 BTL (stereo 2.0) output channels, 1 PBTL (mono 0.1) output channel, 1 BTL plus 2 SE (2.1) output channels, and 4 SE (4.0) output channel configurations. The NE5532 is a high-performance audio op amp designed to allow TPA3251D2DDV operation with differential or single-ended input signals to the EVM with differential inputs yielding the optimal performance. TPA3251D2EVM is a complete 2 V_{RMS} analog input 2 × 175-W stereo/1 × 350-W mono high-power amplifier ready for evaluation and excellent listening experience.

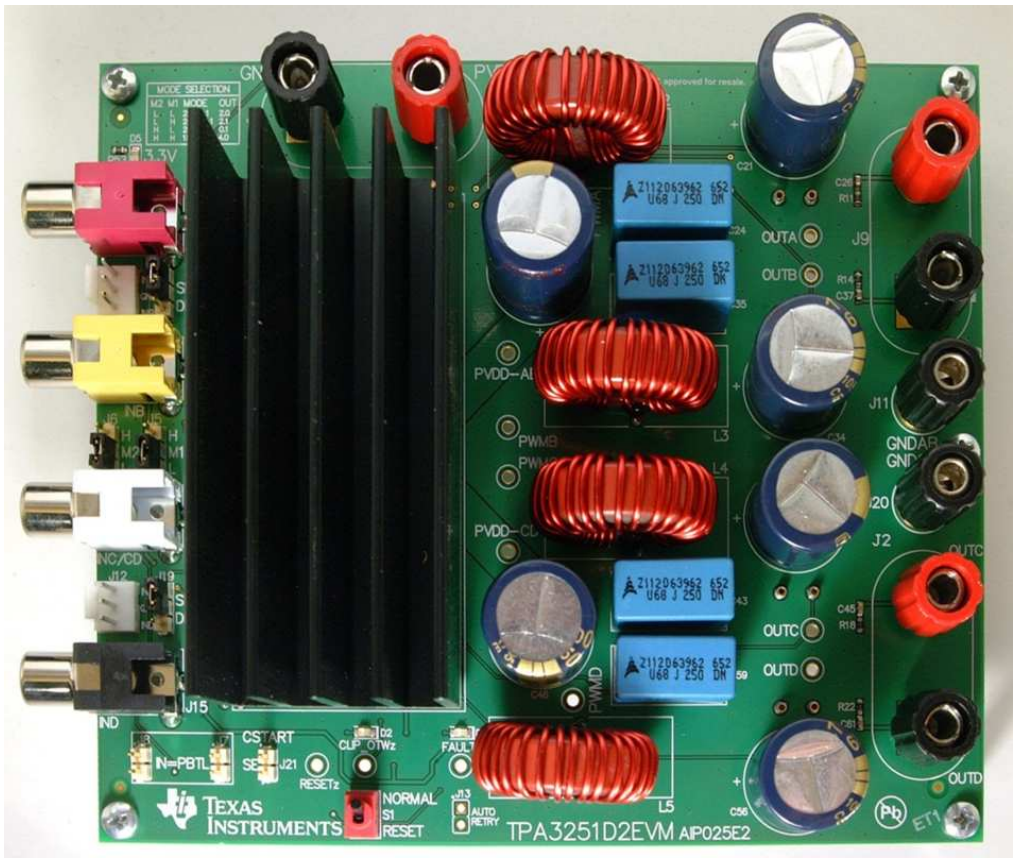

Figure 1. TPA3251D2EVM

1.1 TPA3251D2EVM Features

The TPA3251D2EVM has following features:

- Stereo PurePath Ultra-HD evaluation module
- Self-contained protection system (short circuit, clip, and thermal)
- Standard 2 V_{RMS} differential input or single-ended line input
- BTL, PBTL, and SE output configuration support
- Frequency adjust and oscillator sync interface
- Single supply voltage range 18–38 V
- Double-sided, plated-through, 2-oz Cu, 2-layer PCB layout

1.2 TPA3251D2EVM Frequency Adjust

The TPA3251D2EVM offers hardware trimmed oscillator frequency by external control 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, the switching frequency can be changed from nominal to lower values. 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 1.

Table 1. Frequency Adjust Master Mode Selection

Master Mode	Resistor to GND
Nominal	10 kΩ
AM1	20 kΩ
AM2	30 kΩ

For slave-mode operation, turn off the oscillator by pulling the FREQ_ADJ pin to DVDD. This configures the OSC_I/O pins as inputs to be slaved from an external differential clock. In a master/slave system inter-channel delay is automatically setup 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 setup for a slave device depending on the polarity of the OSC_I/O connection such that slave mode 1 is selected by connecting OSC_I/O of the master device in phase with OSC_I/O of the slave device (+ to + and – to –), while slave mode 2 is selected by connecting the OSC_I/O's out of phase (+ to – and – to +).

1.3 TPA3251D2EVM Single-Ended and Differential Input

The TPA3251D2EVM supports both differential and single-ended inputs. For single-ended inputs, J4 and/or J19 jumpers are set to the SE position, so that the TPA3251D2EVM uses the NE5532 to convert the single-ended input signal to differential to properly drive the differential inputs of the TPA3251D2. The input RCA jack, J3, is used to provide INA and INB inputs and RCA jack J18 is used to provide INC and IND inputs with single-ended inputs.

For differential input operation, J4 and/or J19 jumpers are set to the DIFF position, and the TPA3251D2EVM uses the NE5532 to buffer the differential input signal to the differential inputs of the TPA3251D2. The input RCA jack, J3, is used to provide INA, RCA jack J14 provides INB, RCA jack J18 provides INC, and RCA jack J15 provides IND with differential inputs.

NOTE: Single-ended input settings on the TPA3251D2EVM should only be used for channels with output configuration BTL or PBTL, not SE. For SE output configuration J4 and/or J19 jumpers for that channel must be set to the DIFF position, so the input signal INx is mapped directly to OUTx.

1.4 TPA3251D2EVM Clip Overtemperature and Fault Indicators

The TPA3251D2EVM is equipped with LED indicators that illuminate when the $\overline{\text{FAULT}}$ and/or $\overline{\text{CLIP\_OTW}}$ pin goes low. See Table 2 and the TPA3251D2 data sheet (SLASE40) for more details.

Table 2. Fault and Clip Overtemperature Status

$\overline{\text{FAULT}}$	$\overline{\text{CLIP\_OTW}}$	Description
0	0	Overtemperature (OTE) or overload (OLP) or undervoltage (UVP). Junction temperature higher than 125°C (overtemperature warning).
0	0	Overload (OLP) or undervoltage (UVP). Junction temperature higher than 125°C (overtemperature warning).
0	1	Overload (OLP) or undervoltage (UVP). Junction temperature lower than 125°C.
1	0	Junction temperature higher than 125°C (overtemperature warning)
1	1	Junction temperature lower than 125°C and no OLP or UVP faults (normal operation)

2 TPA3251D2EVM Setup

This section describes the TPA3251D2EVM hardware setup and connection.

2.1 TPA3251D2EVM Setup

Figure 2 illustrates the TPA3251D2EVM connection.

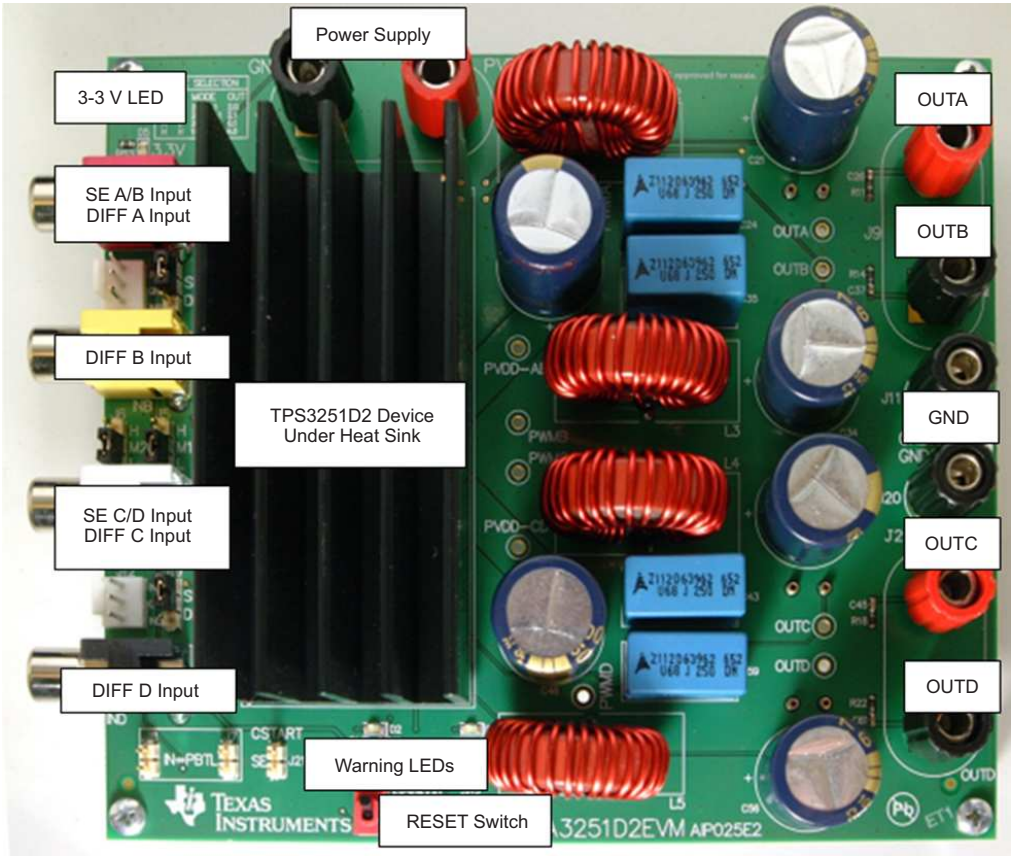

Figure 2. TPA3251D2EVM Connections

2.2 Hardware Requirements

The following hardware is required for this EVM:

- TPA3251D2EVM (AIP025-001)
- Power supply 5–14 A/18–38 V_{DC}
- Two 3–8 Ω (≈100 W) speakers/resistor loads
- Four speaker/banana cables
- RCA input cables
- Analog output audio source

2.3 Hardware Default Setup BTL (2.0)

BTL (2.0) default hardware setup is as follows:

- Remove the EVM from the ESD bag.
- Check that jumpers are in their default state as shown in Figure 1 for stereo **BTL** operation:
  - J4 and J19 **pin 1-pin 2 position** (SE Input)
  - J5 and J6 **pin 2-pin 3 position** (2 BTL Output)
  - J7, J8, J17, and J21 **out**
  - J16 **pin 3-pin 4 position** (Master Mode)
  - J22, J23, J24 and J25 **in** (BTL Outputs)
- Set **S1** to the **RESET** position.
- Set power supply to 36 V (18- to 38-V range) and current to 10 A (5- to 14-A range). Do not power up until all connections are completed.
- Connect power supply to TPA3251D2 EVM positive terminal to PVDD (**RED**) and negative terminal to GND (**BLACK**).
- Connect **left** channel speaker/power resistor load (3–8 Ω) to TPA3251D2 EVM positive output terminal to OUTA (**RED**) and AP analog input channel A positive terminal.
- Connect **left** channel speaker/power resistor load (3–8 Ω) to TPA3251D2 EVM negative output terminal to OUTB (**BLACK**) and AP analog input channel A negative terminal.
- Connect **right** channel speaker/power resistor load (3–8 Ω) to TPA3251D2 EVM positive output terminal to OUTC (**RED**) and AP analog input channel B positive terminal.
- Connect **right** channel speaker/power resistor load (3–8 Ω) to TPA3251D2 EVM negative output terminal to OUTD (**BLACK**) and AP analog input channel B negative terminal.
- Be careful not to mix up PVDD and OUTA and OUTB terminals, since the colors are the same (**RED**).
- For **single-ended stereo inputs**, connect AP channel A XLR to RCA male jacks to female RCA jacks input A/AB (**RED**) and AP channel B XLR to RCA male jacks to female RCA jacks input C/CD (**WHITE**) and set **J4** and **J19** jumper positions to SE.
- For **differential stereo inputs,** connect positive RCA male jacks to female RCA jacks input A/AB (**RED**) and input C/CD (**WHITE**) and connect negative RCA male jacks to female RCA jacks input B (**YELLOW**) and input D (**BLACK**) and set **J4** and **J19** jumper positions to DIFF.
- Power up power supply once all the connections are made correctly and the 3.3-V LED (**GREEN**) will illuminate.
- Set **S1** to the **NORMAL** position.
- CLIP_OTWz (**ORANGE**) and FAULTz (**RED**) LEDs should be off, if the audio source is off.

NOTE: **J3/J10** and **J18/J15** can be used for differential inputs to INA/INB and INC/IND, respectively.

Using a smart phone/tablet/PC with headphone to RCA cable, audio streaming via headphone jack can begin once the EVM is powered up correctly with jumpers in their default state. Start the media player of your choice and enjoy the enhanced audio performance TPA3251D2 provides as a quick check of the setup.

3 Using TPA3251D2EVM in Different Output Configurations

The TPA3251D2EVM can be configured for four different output operations. The 2.0 BTL configuration is the default set up of the TPA3251D2EVM described in Section 2.3. The remaining three configurations are 2.1 BTL plus two single-ended (SE) outputs, 0.1 PBTL output, and 4.0 single-ended (SE) outputs.

Table 3. Mode Selection Pins

Mode Pins		Input Mode	Output Configuration	Description
M2	M1			
0	0	2N + 1	2 × BTL	Stereo BTL output configuration
0	1	2N/1N + 1	1 × BTL + 2 × SE	2.1 BTL + SE mode
1	0	2N + 1	1 × PBTL	Paralleled BTL configuration. Connect INPUT_C and INPUT_D to GND.
1	1	1N + 1	4 × SE	Single-ended output configuration

3.1 BTL Plus Two SE (2.1) Operation

Configure the EVM as follows for 2 SE + 1 BTL operation:

- Set **J6** to L and **J5** to H.
- Connect left (stereo) speaker/power resistor load (2–4 Ω) positive terminal to OUTC and remove jumper **J24**.
- Connect right (stereo) speaker/power resistor load (2–4 Ω) positive terminal to OUTD and remove jumper **J25**.
- Connect subwoofer (mono) speaker/power resistor load (3–8 Ω) positive terminal to OUTA and negative terminal to OUTB.
- Set **J19** jumper position to DIFF.
- Connect **left** (stereo) channel input to female RCA jack input C/CD (**WHITE**) for OUTC speaker.
- Connect **right** (stereo) channel input to female RCA jack input D (**BLACK**) for OUTD speaker.
- For **single-ended subwoofer (mono) input**, connect RCA male jack to female RCA jack input A/AB (**RED**) and set **J4** jumper positions to SE.
- For **differential subwoofer (mono) inputs**, connect positive RCA male jack to female RCA jack input A/AB (**RED**) and connect negative RCA male jack to female RCA jack input B (**YELLOW**) and set **J4** jumper positions to DIFF.

NOTE: **OUTC** and **OUTD** are the single-ended output channels and **OUTA** and **OUTB** are the BTL channel for 2.1 operations.

3.2 PBTL (0.1) Output Operation

Configure the EVM as follows for PBTL operations:

- Set **J6** to H and **J5** to L.
- Connect speaker/power resistor (2–4 Ω) positive terminal to OUTA and OUTC (OUT A and C shorted).
- Connect speaker/power resistor (2–4 Ω) negative terminal to OUTB and OUTD (OUT B and D shorted).
- Install PBTL jumpers **J7** and **J8** (pulls input C and input D to GND).
- For **single-ended mono input**, connect RCA male jack to female RCA jack input A/AB (**RED**) and set **J4** jumper positions to SE.
- For **differential mono inputs**, connect positive RCA male jack to female RCA jack input A/AB (**RED**) and connect negative RCA male jack to female RCA jack input B (**YELLOW**) and set **J4** jumper position to DIFF.

NOTE: **INA** and **INB** are the inputs for PBTL and **INC** and **IND** are grounded for PBTL operation.

3.3 Single-Ended (SE) Output (4.0) Operation

Configure the EVM as follows for 4 single-ended operations:

- Set **J6** to H and **J5** to H.
- Connect speaker/power resistor (2–4 Ω) positive terminal to OUTA and remove jumper **J22**.
- Connect speaker/power resistor (2–4 Ω) positive terminal to OUTB and remove jumper **J23**.
- Connect speaker/power resistor (2–4 Ω) positive terminal to OUTC and remove jumper **J24**.
- Connect speaker/power resistor (2–4 Ω) positive terminal to OUTD and remove jumper **J25**.
- Set both **J4** and **J19** jumpers position to DIFF.
- Connect input to female RCA jack input A/AB (**RED**) for OUTA speaker.
- Connect input to female RCA jack input B (**YELLOW**) for OUTB speaker.
- Connect input to female RCA jack input C/CD (**WHITE**) for OUTC speaker.
- Connect input to female RCA jack input D (**BLACK**) for OUTD speaker.

NOTE: The performance of the TPA3251D2EVM/TPA3251D2DDV is dependent on the power supply. Design the power supply with margins that can deliver the needed power. In low-frequency applications additional bulk capacitance may be needed. Replacing the bulk capacitors on the TPA3251D2EVM with 3300 µF or more capacitance may be necessary, depending on the power supply used.

4 Board Layouts, Bill of Materials, and Schematic

4.1 TPA3251D2EVM Board Layouts

Figure 3 and Figure 4 illustrate the board layouts for the EVM.

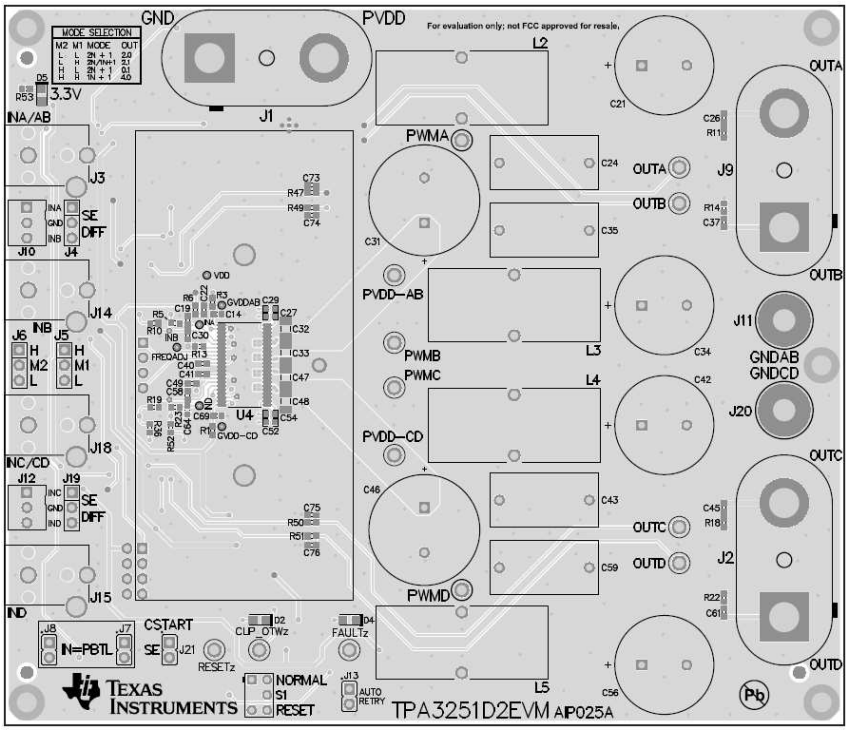

Figure 3. TPA3251D2EVM Top Composite Assembly

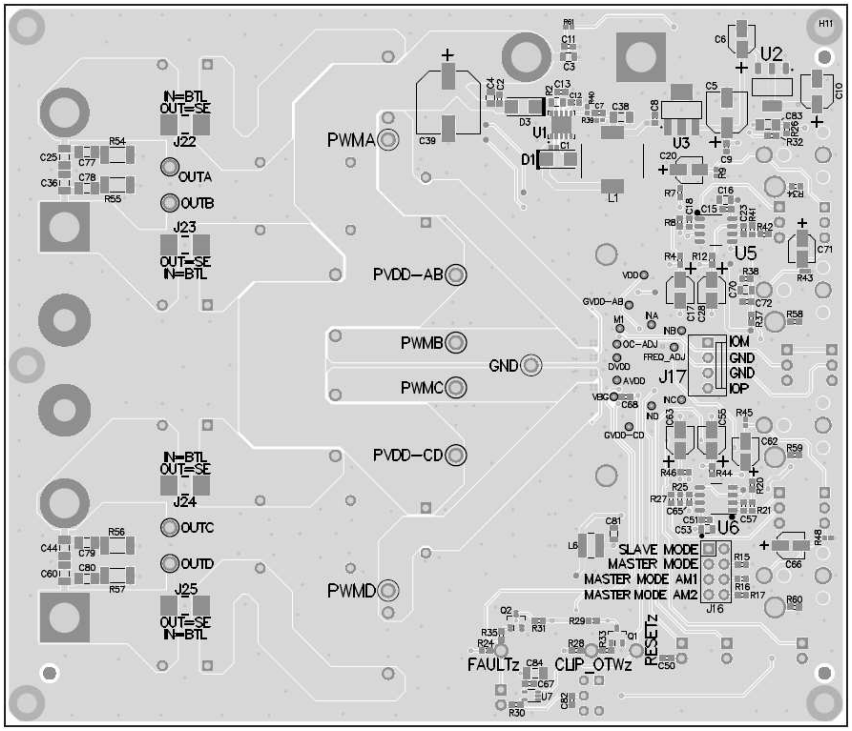

Figure 4. TPA3251D2EVM Bottom Composite Assembly

4.2 TPA3251D2EVM Board Dimension

Figure 5 illustrates the TPA3251D2EVM board dimensions 140 mm × 120 mm.

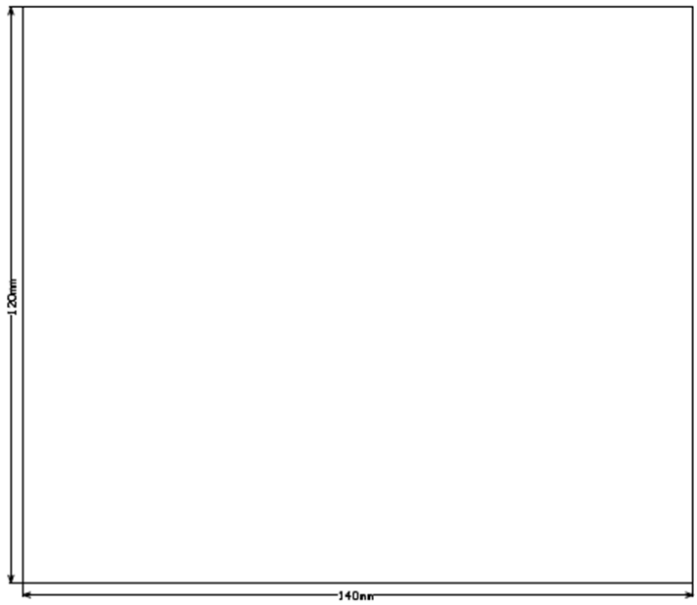

Figure 5. TPA3251D2EVM Board Dimension

4.3 Bill of Materials

Table 4 displays the BOM for this EVM.

Table 4. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		AIP025	Any
C1	1	0.047uF	CAP, CERM, 0.047 µF, 25 V, +/- 10%, X7R, 0402	0402	GRM155R71E473KA88D	Murata
C2, C9, C13, C14, C15, C22, C51, C67, C69, C72, C82	11	0.1uF	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	0603	C0603C104K5RACTU	Kemet
C3	1	1uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, 0805	0805	GRM21BR71H105KA12L	Murata
C4	1	2.2uF	CAP, CERM, 2.2 µF, 50 V, +/- 10%, X5R, 0805	0805	C2012X5R1H225K125AB	TDK
C5	1	47uF	CAP, AL, 47 µF, 16 V, +/- 20%, 0.36 ohm, SMD	SMT Radial D	EEE-FK1C470P	Panasonic
C6, C17, C20, C28, C55, C62, C63, C66, C71	9	10uF	CAP, AL, 10 µF, 16 V, +/- 20%, 1.35 ohm, SMD	SMT Radial B	EEE-FK1C100R	Panasonic
C7	1	5600pF	CAP, CERM, 5600 pF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H562KA01D	Murata
C8, C50	2	0.47uF	CAP, CERM, 0.47 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E474KA12D	Murata
C10	1	100uF	CAP, AL, 100 µF, 6.3 V, +/- 20%, 0.7 ohm, SMD	SMT Radial C	EEE-FK0J101UR	Panasonic
C11, C26, C37, C45, C49, C61	6	0.01uF	CAP, CERM, 0.01 µF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H103KA01D	Murata
C12	1	4700pF	CAP, CERM, 4700 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603X472K5RACTU	Kemet
C16, C53, C70, C81	4	10uF	CAP, CERM, 10 µF, 16 V, +/- 10%, X5R, 0805	0805	EMK212BJ106KG-T	Taiyo Yuden
C18, C23, C57, C65	4	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H220JA01D	Murata
C19, C30, C58, C64	4	100pF	CAP, CERM, 100 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H101JA01D	Murata
C21, C34, C42, C56	4	470uF	CAP, AL, 470 µF, 63 V, +/- 20%, 0.059 ohm, TH	D16xL20mm	EEU-FC1J471	Panasonic
C24, C35, C43, C59	4	0.68uF	CAP, Film, 0.68 µF, 250 V, +/- 5%, TH	18x9x17.5mm	B32652A3684J	EPCOS Inc
C25, C36, C44, C60	4	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, C0G/NP0, 1206	1206	GRM3195C1H102JA01D	Murata
C27, C29, C52, C54	4	0.033uF	CAP, CERM, 0.033 µF, 50 V, +/- 10%, X7R, 0603	0603	GRM188R71H333KA61D	Murata
C31, C46	2	2200uF	CAP, AL, 2200 µF, 50 V, +/- 20%, 0.023 ohm, TH	Dia 18mm	EEU-FC1H222	Panasonic
C32, C33, C47, C48, C83, C84	6	1uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, 1206	1206	GRM31MR71H105KA88L	Murata
C38	1	4.7uF	CAP, CERM, 4.7 µF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E475KA88L	Murata
C39	1	47uF	CAP, AL, 47 µF, 50 V, +/- 20%, 0.3 ohm, SMD	SMT Radial G	EEE-FC1H470P	Panasonic
C40, C41	2	1uF	CAP, CERM, 1 µF, 16 V, +/- 10%, X7R, 0603	0603	GRM188R71C105KA12D	Murata
C68	1	0.1uF	CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0603	0603	C0603C104K5RACTU	Kemet
D1	1	100V	Diode, Schottky, 100 V, 1 A, SMA	SMA	B1100-13-F	Diodes Inc.
D2	1	Orange	LED, Orange, SMD	LED_0805	LTST-C170KFKT	Lite-On
D3	1	100V	Diode, Schottky, 100 V, 3 A, SMA	SMA	SK310A-TP	Micro Commercial Components
D4	1	Red	LED, Red, SMD	LED_0805	LTST-C170KRKT	Lite-On
D5	1	Green	LED, Green, SMD	LED_0805	LTST-C170KGKT	Lite-On
H1, H2, H3, H4, H5	5	M3x5mm	MACHINE SCREW PAN PHILLIPS M3 5mm	Screw M3 Phillips head	MPMS 003 0005 PH	B&F Fastener Supply
H6, H7	2	M3x8mm	MACHINE SCREW PAN PHILLIPS M3 8mm	Screw M3 Phillips head	MPMS 003 0005 PH	B&F Fastener Supply
H8, H9, H10, H11, H12	5	M3	Standoff, Hex,25mm Length, M3, Aluminum	Standoff M3	24438	Keystone
HEATSINK	1		Heat Sink, Vertical	Heatsink	ATS-TI1OP-519-C1-R3	Advanced Thermal Solutions
J1, J2, J9	3		Dual Binding Posts with Base, 2x1, TH	Dual Binding Posts with Base, 2x1, TH	6883	Pomona Electronics
J3	1		RCA Jack, Red, R/A, TH	PC Mount Phono Jack-Red, TH	971	Keystone
J4, J5, J6, J19	4	1x3	Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions

Table 4. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
J7, J8, J21	3		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions
J10, J12	2		Header, 2.54 mm, 3x1, TH	Header, 2.54mm, 3x1, TH	22-11-2032	Molex
J11, J20	2		Binding Post, BLACK, TH	11.4x27.2mm	7007	Keystone
J14	1		RCA Jack, Yellow, R/A, TH	RCA Jack, Yellow, R/A, TH	973	Keystone
J15	1		RCA Jack, Black, R/A, TH	RCA Jack, Black, R/A, TH	972	Keystone
J16	1		Header, 100mil, 4x2, Tin, TH	Header, 4x2, 100mil, Tin	PEC04DAAN	Sullins Connector Solutions
J17	1		Header (friction lock), 100mil, 4x1, Gold, TH	Header 4x1 keyed	0022112042	Molex
J18	1		RCA Jack, White, R/A, TH	PC Mount Phono Jack-White, TH	970	Keystone
J22, J23, J24, J25	4		JUMPER TIN SMD	6.85x0.97x2.51 mm	S1911-46R	Harwin
L1	1	100uH	Inductor, Shielded Drum Core, Ferrite, 100 µH, 1.5 A, 0.165 ohm, SMD	10x5x10mm	7447714101	Wurth Elektronik eiSos
L2, L3, L4, L5	4	7uH	Inductor, Toroid, Powdered Iron, 7 µH, 6.5 A, 0.0215 ohm, TH	28.6x12.3mm	MA5173-AE	Coilcraft
L6	1	10uH	Inductor, Wirewound, 10 µH, 0.8 A, 0.204 ohm, SMD	2-Pin SMD, Body 4 x 4 mm, Height 1.2 mm	NRS4012T100MDGJV	Taiyo Yuden
Q1, Q2	2	60V	MOSFET, N-CH, 60 V, 0.17 A, SOT-23	SOT-23	2N7002-7-F	Diodes Inc.
R1, R3, R4, R12, R30, R44, R46	7	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R2	1	182k	RES, 182 k, 1%, 0.125 W, 0805	0805	ERJ-6ENF1823V	Panasonic
R5, R10, R19, R23, R33, R35	6	100	RES, 100, 1%, 0.1 W, 0603	0603	CRCW0603100RFKEA	Vishay-Dale
R6, R11, R14, R18, R22	5	3.3	RES, 3.3, 5%, 0.1 W, 0603	0603	CRCW06033R30JNEA	Vishay-Dale
R7, R8, R20, R21, R25, R27, R37, R38, R41, R42	10	10.0k	RES, 10.0 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD0710KL	Yageo America
R9, R43, R45, R48, R61	5	100k	RES, 100 k, 1%, 0.063 W, 0402	0402	CRCW0402100KFKED	Vishay-Dale
R13	1	22.0k	RES, 22.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0722KL	Yageo America
R15, R36, R52	3	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R16	1	20.0k	RES, 20.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0720KL	Yageo America
R17	1	30.0k	RES, 30.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0730KL	Yageo America
R24, R28	2	47k	RES, 47 k, 5%, 0.1 W, 0603	0603	RC0603JR-0747KL	Yageo America
R26	1	3.30k	RES, 3.30 k, 1%, 0.1 W, 0603	0603	RC0603FR-073K3L	Yageo America
R29, R31	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	CRCW06031K00FKEA	Vishay-Dale
R32	1	12.0k	RES, 12.0 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1202V	Panasonic
R39	1	4.99k	RES, 4.99 k, 1%, 0.063 W, 0402	0402	CRCW04024K99FKED	Vishay-Dale
R40	1	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	0402	CRCW04021K00FKED	Vishay-Dale
R53	1	499	RES, 499, 1%, 0.1 W, 0603	0603	CRCW0603499RFKEA	Vishay-Dale
S1	1		Switch, SPDT, On-On, 2 Pos, TH	Switch, 7x4.5mm	200USP1T1A1M2RE	E-Switch
SH1, SH2, SH3, SH4, SH5	5	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14	14	Grey	Test Point, Multipurpose, Grey, TH	Grey Multipurpose Testpoint	5128	Keystone
U1	1		High Voltage 1A Step Down Switching Regulator, 10-pin LLP, Pb-Free	SDC10A	LM5010ASD/NOPB	Texas Instruments
U2	1		FIXED LOW-DROPOUT VOLTAGE REGULATOR, DCY0003A	DCY0003A	TLV1117-33IDCY	Texas Instruments
U3	1		1A Low Dropout Regulator, 4-pin SOT-223, Pb-Free	MP04A	LM2940IMP-12/NOPB	Texas Instruments
U4	1		150W Stereo/300W MONO PurePath HD Analog-input Power Stage, DDV0044D	DDV0044D	TPA3251D2DDVR	Texas Instruments
U5, U6	2		Dual Low-Noise Operational Amplifier, 10 to 30 V, 0 to 70 degC, 8-pin SOIC (D0008A), Green (RoHS & no Sb/Br)	D0008A	NE5532ADR	Texas Instruments

Table 4. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
U7	1		ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS, DCK0005A	DCK0005A	TPS3802K33DCKR	Texas Instruments
C73, C74, C75, C76	0	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H220JA01D	Murata
C77, C78, C79, C80	0	1uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, 1206	1206	GRM31MR71H105KA88L	Murata
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A
J13	0		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions
R34, R58, R59, R60	0	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R47, R49, R50, R51	0	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R54, R55, R56, R57	0	3.3	RES, 3.3, 5%, 0.75 W, 2010	2010	CRCW20103R30JNEF	Vishay-Dale

4.4 TPA3251D2EVM Schematic

The schematic for TPA3251D2EVM is illustrated in Figure 6.

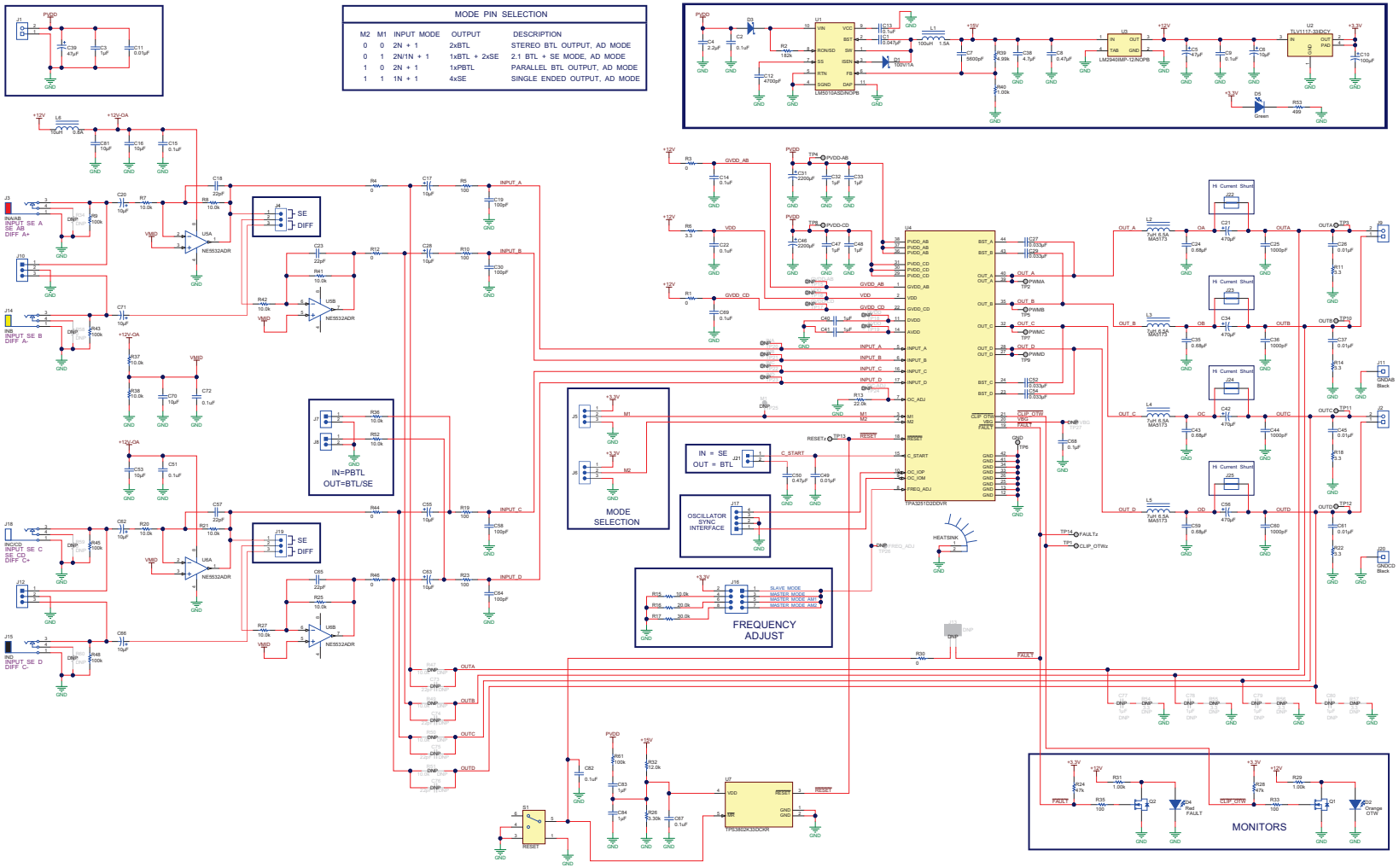

Figure 6. TPA3251D2EVM Schematic

Revision History

Changes from Original (September 2015) to A Revision **Page**

- Changed *Nominal* value to 10 kΩ in *Frequency Adjust Master Mode Selection* table. 3
- Text of second paragraph of *TPA3251D2EVM Frequency Adjust* section improved. 3
- Text of *TPA3251D2EVM Single-Ended and Differential Input* section improved. 3
- Typos corrected in *TPA3251D2EVM Connections* image. 5
- Added instruction to not power up EVM until all connections are complete. 6
- Added note regarding power supply usage to the end of the *Single-Ended (SE) Output (4.0) Operation* section. 8
- Changed part number in the *HEATSINK* row of the BOM. 11

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      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.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      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.

FCC Interference Statement for Class B EVM devices

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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.*

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

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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.

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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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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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