TPA3138D2 10-W, 3.5-V to 14.4-V, Inductor Free, Stereo Class-D Speaker Amplifier

1 Features

- Wide Supply Range 3.5-V to 14.4-V
  - 2 × 10 W into 6-Ω, 1% THD+N, 12-V Supply
  - 1 x 18.5 W into 4-Ω, 10% THD+N, 12-V Supply
  - THD+N : 0.04% at 1 W, 1 kHz input, 6-Ω
- Longer Battery Life for Portable Applications:
  - 20-mA (12-V) Idle Current in 1SPW Mode
  - >90% Class-D Efficiency
- Reduced Solution Size and Cost:
  - Inductor-Free Operation
  - EN55013 and EN55022 EMC Compliant When No Inductors are Used
  - No External Heatsink Required
- Flexible Audio Solution:
  - Single-ended or Differential Analog Inputs
  - Selectable Gain: 20 dB and 26 dB
  - Pop and Click-Free Startup
- Integrated Protections and Auto Recovery:
  - Pin-to-pin, Pin-to-Ground, and Pin-to-Power Short Circuit Protection
  - Thermal Protection, Undervoltage Protection, and Overvoltage Protection
  - Power Limiter and DC Speaker Protection
- Pin-to-Pin Compatible with TPA3110D2, TPA3136D2 and TPA3136AD2

2 Applications

- Televisions and Monitors
- Bluetooth® Speakers and Wireless Speakers
- Audio Amplifiers in Smart Appliance
- Audio Speakers in Internet of Things
- Consumer Audio Equipment

3 Description

The TPA3138D2 is a 10-W/ch, high-efficiency, low-idle-current Class-D stereo audio amplifier. It can drive stereo speakers with a load as low as 3.2-Ω. In the 1SPW mode, it consumes a low idle current of only 21-mA (12-V) and can operate down to 3.5-V, allowing for longer audio play and improved thermal performance in bluetooth speakers, battery-powered appliances and other power-sensitive applications.

Advanced EMI Suppression with Spread Spectrum Control enables the use of inexpensive ferrite bead filters while meeting EMC requirements for system cost reduction.

To further simplify the design, the TPA3138D2 integrates essential protection features including undervoltage, overvoltage, power limit, short circuit, overtemperature, as well as DC speaker protection. All of these protections come with automatic recovery.

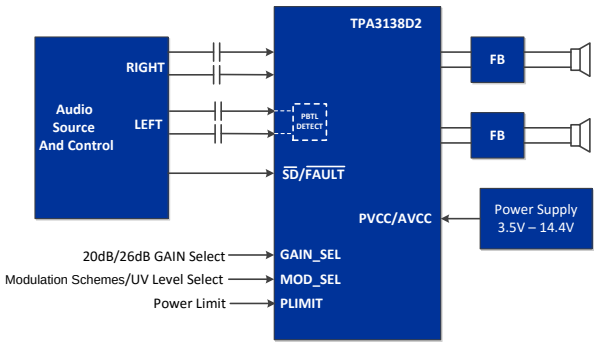
Customers can leverage every TPA3138D2 feature in existing designs as it is fully pin-to-pin compatible to TI's TPA3110D2, TPA3136D2 and TPA3136AD2.

Device Information(1)

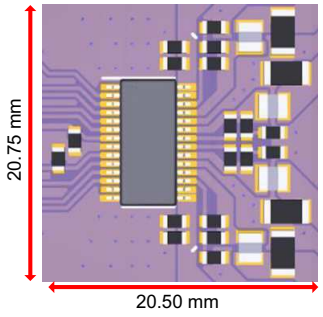
PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPA3138D2	HTSSOP (28)	9.70 mm × 4.40 mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.

Simplified Schematic



TPA3138 Layout with Ferrite Beads

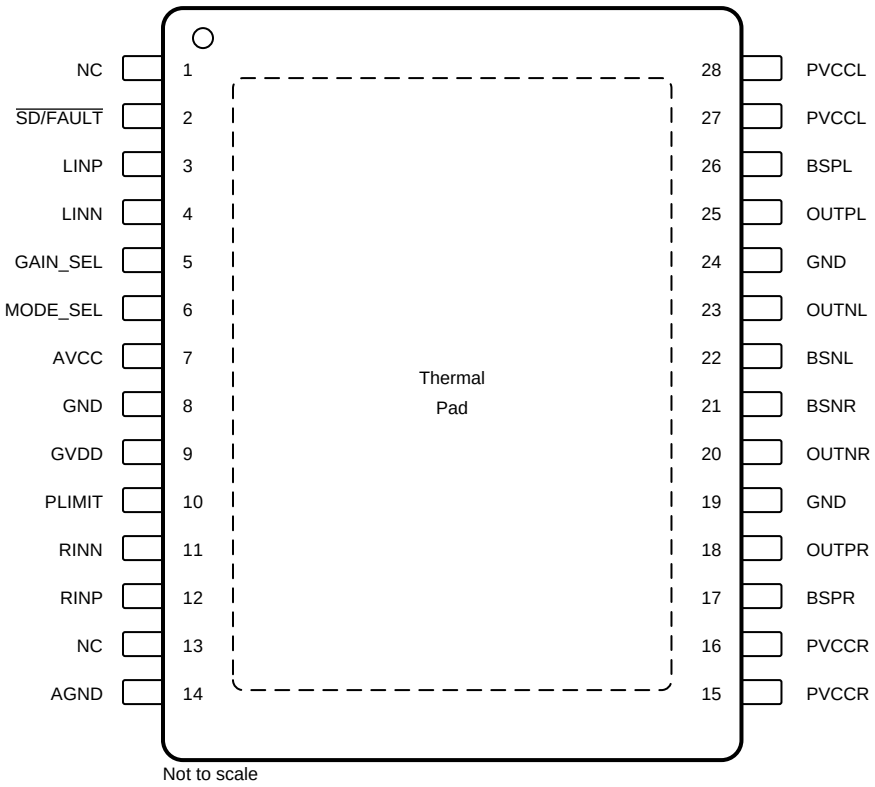


5 Device Comparison Table

Product	Supply Voltage	Modulation Scheme	Package	Rdson	Gain	Inductor Free
TPA3138D2	3.5-V to 14.4-V	BD, 1SPW	HTSSOP-28	180-mΩ	20-dB, 26-dB	YES
TPA3110D2	8-V to 26-V	BD	HTSSOP-28	240-mΩ	20-dB, 26-dB, 32-dB, 36-dB	NO
TPA3136D2	4.5-V to 14.4-V	BD	HTSSOP-28	240-mΩ	26-dB	YES
TPA3136AD2	8-V to 14.4-V	BD	HTSSOP-28	240-mΩ	26-dB	YES

6 Pin Configuration and Functions

PWP Package
28-Pin HTSSOP
(Top View)



Not to scale

Pin Functions

PIN		I/O/P(1)	DESCRIPTION
NAME	NO.		
NC	1	–	No Connect Pin. Can be shorted to PVCC or shorted to GND or left open.
$\overline{\text{SD/FAULT}}$	2	IO	TTL logic levels with compliance to AVCC. Shutdown logic input for audio amp (LOW , outputs Hi-Z; HIGH , outputs enabled). General fault reporting including Over-Temp, Over-Current, DC Detect. $\overline{\text{SD/FAULT}}$= High, normal operation, $\overline{\text{SD/FAULT}}$= Low, fault condition Device will auto-recover once the OT/OC/DC Fault has been removed.
LINP	3	I	Positive audio input for left channel. Biased at 2.5 V. Connect to GND for PBTL mode.
LINN	4	I	Negative audio input for left channel. Biased at 2.5 V. Connect to GND for PBTL mode.
GAIN_SEL	5	I	Gain select least significant bit. TTL logic levels with compliance to AVDD. Low = 20 dB Gain, High = 26 dB Gain, Floating = 26 dB Gain.

(1) I = Input, O = Output, IO = Input and Output, P = Power

Pin Functions (continued)

PIN		I/O/P[1]	DESCRIPTION
NAME	NO.		
MODE_SEL	6	I	Mode select least significant bit. TTL logic levels with compliance to AVDD. Low = BD Mode/UV Threshold = 7.5 V, High = Low-Idle-Current 1SPW Mode/UV Threshold = 3.4V, Floating = Low-Idle-Current 1SPW Mode/UV threshold = 3.4V
AVCC	7	P	Analog supply.
GND	8	–	Analog signal ground.
GVDD	9	O	FET gate drive supply. Nominal voltage is 5 V.
PLIMIT	10	I	Power limiter level control. Connect a resistor divider from GVDD to GND to set power limit. Connect directly to GVDD for no power limit.
RINN	11	I	Negative audio input for right channel. Biased at 2.5 V.
RINP	12	I	Positive audio input for right channel. Biased at 2.5 V.
NC	13	–	No Connect Pin. Can be shorted to PVCC or shorted to GND or left open.
AGND	14	–	Analog signal ground. Connect to the thermal pad.
PVCCR	15, 16	P	Power supply for right channel H-bridge. Right channel and left channel power supply inputs are connected internally.
BSPR	17	P	Bootstrap supply (BST) for right channel, positive high-side FET.
OUTPR	18	O	Class-D H-bridge positive output for right channel.
GND	19	–	Power ground for the H-bridges.
OUTNR	20	O	Class-D H-bridge negative output for right channel.
BSNR	21	P	Bootstrap supply (BST) for right channel, negative high-side FET.
BSNL	22	P	Bootstrap supply (BST) for left channel, negative high-side FET.
OUTNL	23	O	Class-D H-bridge negative output for left channel.
GND	24	–	Power ground for the H-bridges.
OUTPL	25	O	Class-D H-bridge positive output for left channel.
BSPL	26	P	Bootstrap supply (BST) for left channel, positive high-side FET.
PVCCL	27, 28	P	Power supply for left channel H-bridge. Right channel and left channel power supply inputs are connected internally.
Thermal Pad		–	Connect to GND for best thermal and electrical performance