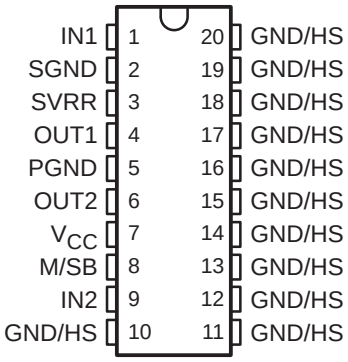
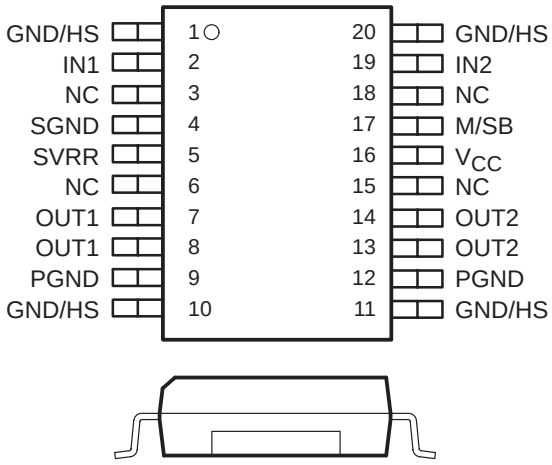
- **TDA1517P Compatible**
- **High Power Outputs (6 W/Channel)**
- **Surface Mount Availability**
  20-Pin Thermal SOIC PowerPAD™
- **Thermal Protection**
- **Fixed Gain . . . 20 dB**
- **Mute and Standby Operation**
- **Supply Range . . . 9.5 V – 18 V**

NE PACKAGE
(TOP VIEW)



DWP PACKAGE
(TOP VIEW)



Cross Section View Showing PowerPAD

NC – No internal connection

description

The TPA1517 is a stereo audio power amplifier that contains two identical amplifiers capable of delivering 6 W per channel of continuous average power into a 4-Ω load at 10% THD+N or 5 W per channel at 1% THD+N. The gain of each channel is fixed at 20 dB. The amplifier features a mute/standby function for power-sensitive applications. The amplifier is available in Texas Instruments patented PowerPAD 20-pin surface-mount thermally-enhanced package (DWP) that reduces board space and facilitates automated assembly while maintaining exceptional thermal characteristics. It is also available in the 20-pin thermally enhanced DIP package (NE).

AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	
	THERMALLY ENHANCED PLASTIC DIP	THERMALLY† ENHANCED SURFACE MOUNT (DWP)
–40°C to 85°C	TPA1517NE	TPA1517DWP

† The DWP package is available taped and reeled. To order a taped and reeled part, add the suffix R (e.g., TPA1517DWPR).

Terminal Functions

TERMINAL NAME	TERMINAL DWP NO.	TERMINAL NE NO.	I/O	DESCRIPTION
IN1	2	1	I	IN1 is the audio input for channel 1.
SGND	4	2	I	SGND is the input signal ground reference.
SVRR	5	3		SVRR is the midrail bypass mode enable.
OUT1	7, 8	4	O	OUT1 is the audio output for channel 1.
PGND	9, 12	5		PGND is the power ground reference.
OUT2	13, 14	6	O	OUT2 is the audio output for channel 2.
V_{CC}	16	7	I	V_{CC} is the supply voltage input.
M/SB	17	8	I	M/SB is the mute/standby mode enable. When held at less than 2 V, this signal enables the TPA1517 for standby operation. When held between 3.4 V and 8.8 V, this signal enables the TPA1517 for mute operation. When held above 9.2 V, the TPA1517 operates normally.
IN2	19	9	I	IN2 in the audio input for channel 2.
GND/HS	1, 10, 11, 20	10– 20		GND/HS are the ground and heatsink connections. All GND/HS terminals are connected directly to the mount pad for thermal-enhanced operation.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} . . . . . 22 V
Input voltage, V_I (IN1, IN2) . . . . . 22 V
Continuous total power dissipation . . . . . Internally limited (See Dissipation Rating Table)
Operating free-air temperature range, T_A . . . . . –40°C to 85°C
Operating junction temperature range, T_J . . . . . –40°C to 150°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: DWP or NE package . . . . . 260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: These devices have been classified as Class 1 ESD sensitive products per MIL-PRF-38535 Method 3015.7. Appropriate precautions should be taken to prevent serious damage to the device.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$	DERATING FACTOR	$T_A = 70°C$	$T_A = 85°C$
DWP‡	2.94 W	23.5 mW/°C	1.88 W	1.53 W
NE‡	2.85 W	22.8 mW/°C	1.82 W	1.48 W

‡ See the Texas Instruments document, *PowerPAD Thermally Enhanced Package Application Report* (literature number SLMA002), for more information on the PowerPAD package. The thermal data was measured on a PCB layout based on the information in the section entitled *Texas Instruments Recommended Board for PowerPAD* on page 33 of the before mentioned document.

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	9.5		18	V
Operating free-air temperature, T_A	–40		85	°C

electrical characteristics, V_{CC} = 12 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{CC}	Supply current			45	70	mA
$V_{O(DC)}$	DC output voltage	See Note 2		4		V
$V_{(M/SB)}$	M/SB on voltage			9.5		V
$V_{O(M)}$	Mute output voltage	V_I = 1 V (max)		2		mV
$I_{CC(SB)}$	Supply current in standby mode			7	100	μA

NOTE 2: At 6 V < V_{CC} < 18 V the DC output voltage is approximately $V_{CC}/2$.

electrical characteristics, V_{CC} = 14.5 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{CC}	Supply current			50	80	mA
$V_{O(DC)}$	DC output voltage	See Note 2		5		V
$V_{(M/SB)}$	Voltage on M/SB terminal for normal operation			9.5		V
$V_{O(M)}$	Mute output voltage	V_I = 1 V (max)		2		mV
$I_{CC(SB)}$	Supply current in standby mode			7	100	μA

NOTE 2: At 6 V < V_{CC} < 18 V the DC output voltage is approximately $V_{CC}/2$.

operating characteristic, V_{CC} = 12 V, R_L = 4 Ω, f = 1 kHz, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O	Output power (see Note 3)	THD = 0.2%		3		W
		THD = 10%		6		
SNR	Signal-to-noise ratio			84		dB
THD	Total harmonic distortion	P_O = 1 W, R_L = 8 Ω, f = 1 kHz		0.1%		
$I_{O(SM)}$	Non-repetitive peak output current			4		A
$I_{O(RM)}$	Repetitive peak output current			2.5		A
	Low-frequency roll-off	–3 dB		45		Hz
	High-frequency roll-off	–1 dB	20			kHz
	Supply ripple rejection ratio	M/SB = On, f = 1 kHz		65		dB
Z_I	Input impedance			60		kΩ
V_n	Noise output voltage (see Note 4)	R_S = 0, M/SB = On		50		μV(rms)
		R_S = 10 kΩ, M/SB = On		70		μV(rms)
		M/SB = Mute		50		μV(rms)
	Channel separation	R_S = 10 kΩ		58		dB
	Gain		18.5	20	21	
	Channel balance			0.1	1	dB

NOTES: 3. Output power is measured at the output terminals of the IC.
4. Noise voltage is measured in a bandwidth of 20 Hz to 20 kHz.

operating characteristic, V_{CC} = 14.5 V, R_L = 4 Ω, f = 1 kHz, T_A = 25°C

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
P_O	Output power (see Note 3)	THD = 0.2%			4.5		W
		THD < 10%			6		W
SNR	Signal-to-noise ratio				84		dB
THD	Total harmonic distortion	P_O = 1 W			0.1%		
$I_{O(SM)}$	Non-repetitive peak output current				4		A
$I_{O(RM)}$	Repetitive peak output current				2.5		A
	Low-frequency roll-off	–3 dB			45		Hz
	High-frequency roll-off	–1 dB		20			kHz
	Supply ripple rejection ratio	M/SB = On			65		dB
Z_I	Input impedance				60		kΩ
V_n	Noise output voltage (see Note 4)	R_S = 0,	M/SB = On		50		μV(rms)
		R_S = 10 kΩ,	M/SB = On		70		μV(rms)
		M/SB = Mute			50		μV(rms)
	Channel separation	R_S = 10 kΩ			58		dB
	Gain			18.5	20	21	dB
	Channel balance				0.1	1	dB

NOTES: 3. Output power is measured at the output terminals of the IC.
4. Noise voltage is measured in a bandwidth of 22 Hz to 22 kHz.

TYPICAL CHARACTERISTICS

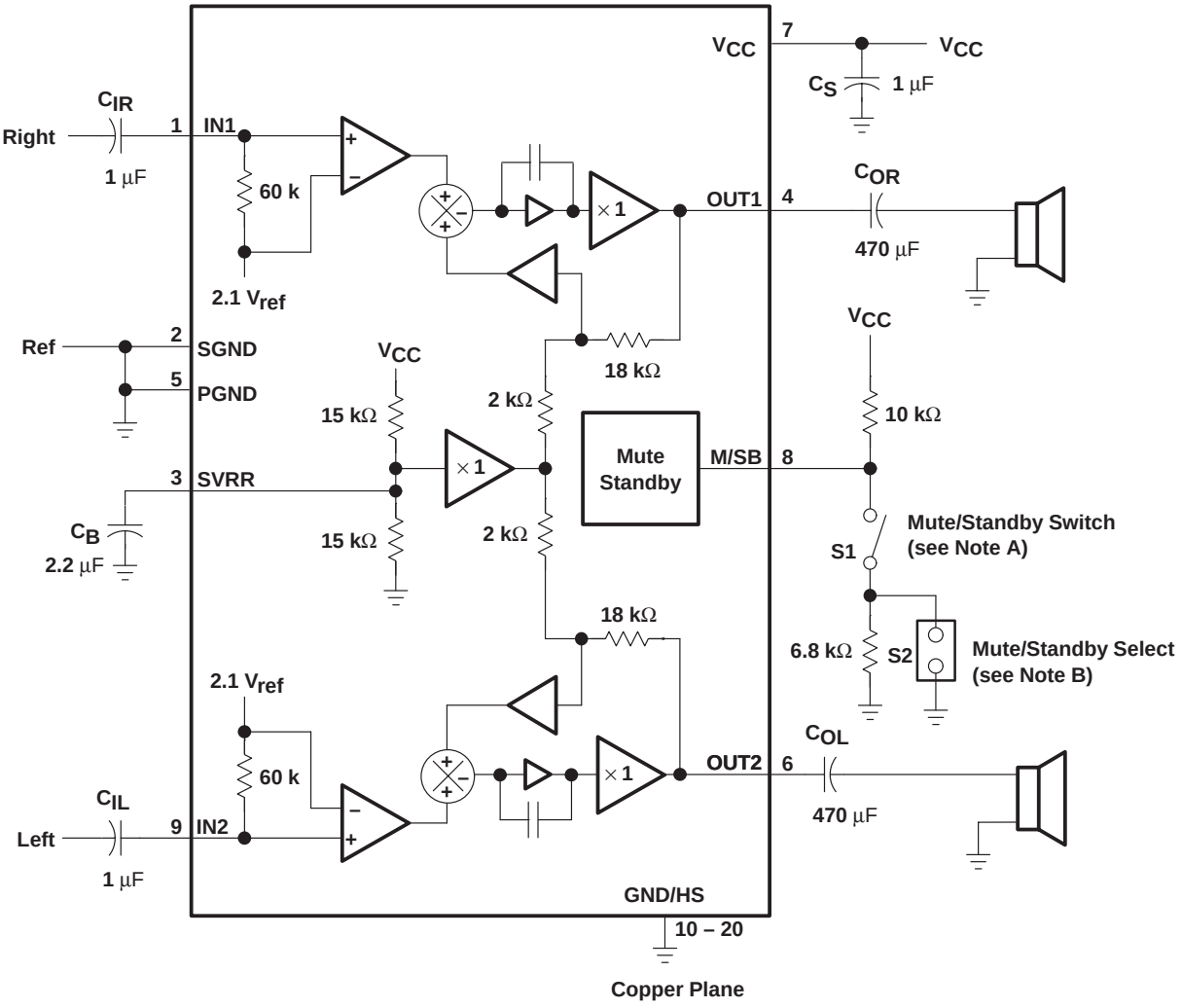
Table of Graphs

				FIGURE
I_{CC}	Supply current		vs Supply voltage	1
	Power supply rejection ratio		vs Frequency	2, 3
THD + N	Total harmonic distortion plus noise	V_{CC} = 12 V	vs Frequency vs Power output	4, 5, 6 10, 11
		V_{CC} = 14.5 V	vs Frequency vs Power output	7, 8, 9 12, 13
	Crosstalk		vs Frequency	14, 15
	Gain		vs Frequency	16
	Phase		vs Frequency	16
V_n	Noise voltage		vs Frequency	17, 18
P_O	Output power		vs Supply voltage vs Load resistance	19 20
P_D	Power dissipation		vs Output power	21, 22

APPLICATION INFORMATION

amplifier operation

The TPA1517 is a stereo audio power amplifier designed to drive 4-Ω speakers at up to 6 W per channel. Figure 23 is a schematic diagram of the minimum recommended configuration of the amplifier. Gain is internally fixed at 20 dB (gain of 10 V/V).



NOTES: A. When S1 is open, the TPA1517 operates normally. When this switch is closed, the device is in mute/standby mode.
B. When S2 is open, activating S1 places the TPA1517 in mute mode. When S2 is closed, activating S1 places the TPA1517 in standby mode.
C. The terminal numbers are for the 20-pin NE package.

Figure 23. TPA1517 Minimum Configuration

The following equation is used to relate gain in V/V to dB:

$$G_{dB} = 20 \text{ LOG}\left(G_{V/V}\right)$$

APPLICATION INFORMATION

The audio outputs are biased to a midrail voltage which is shown by the following equation:

$$V_{MID} = \frac{V_{CC}}{2}$$

The audio inputs are always biased to 2.1 V when in mute or normal mode. Any dc offset between the input signal source and the input terminal is amplified and can seriously degrade the performance of the amplifier. For this reason, it is recommended that the inputs always be connected through a series capacitor (ac coupled). The power outputs, also having a dc bias, must be connected to the speakers via series capacitors.

mute/standby operation

The TPA1517 has three modes of operation; normal, mute, and standby. They are controlled by the voltage on the M/SB terminal as described in Figure 24. In normal mode, the TPA1517 amplifies the signal applied to the two input terminals providing low impedance drive to speakers connected to the output terminals. In mute mode, the amplifier retains all bias voltages and quiescent supply current levels but does not pass the input signal to the output. In standby mode, the internal bias generators and power-drive stages are turned off, thereby reducing the supply current levels.

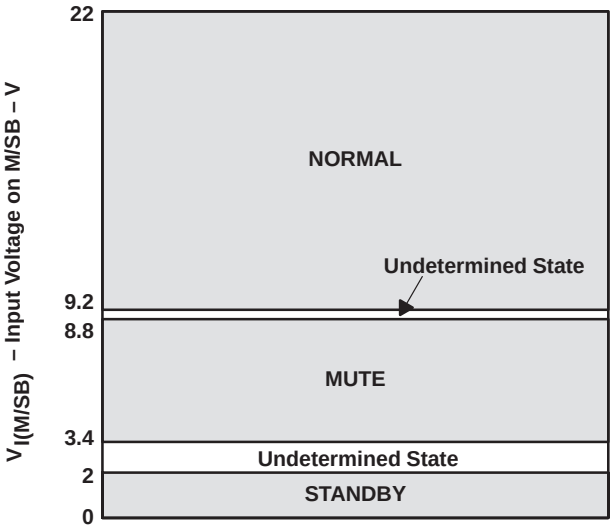
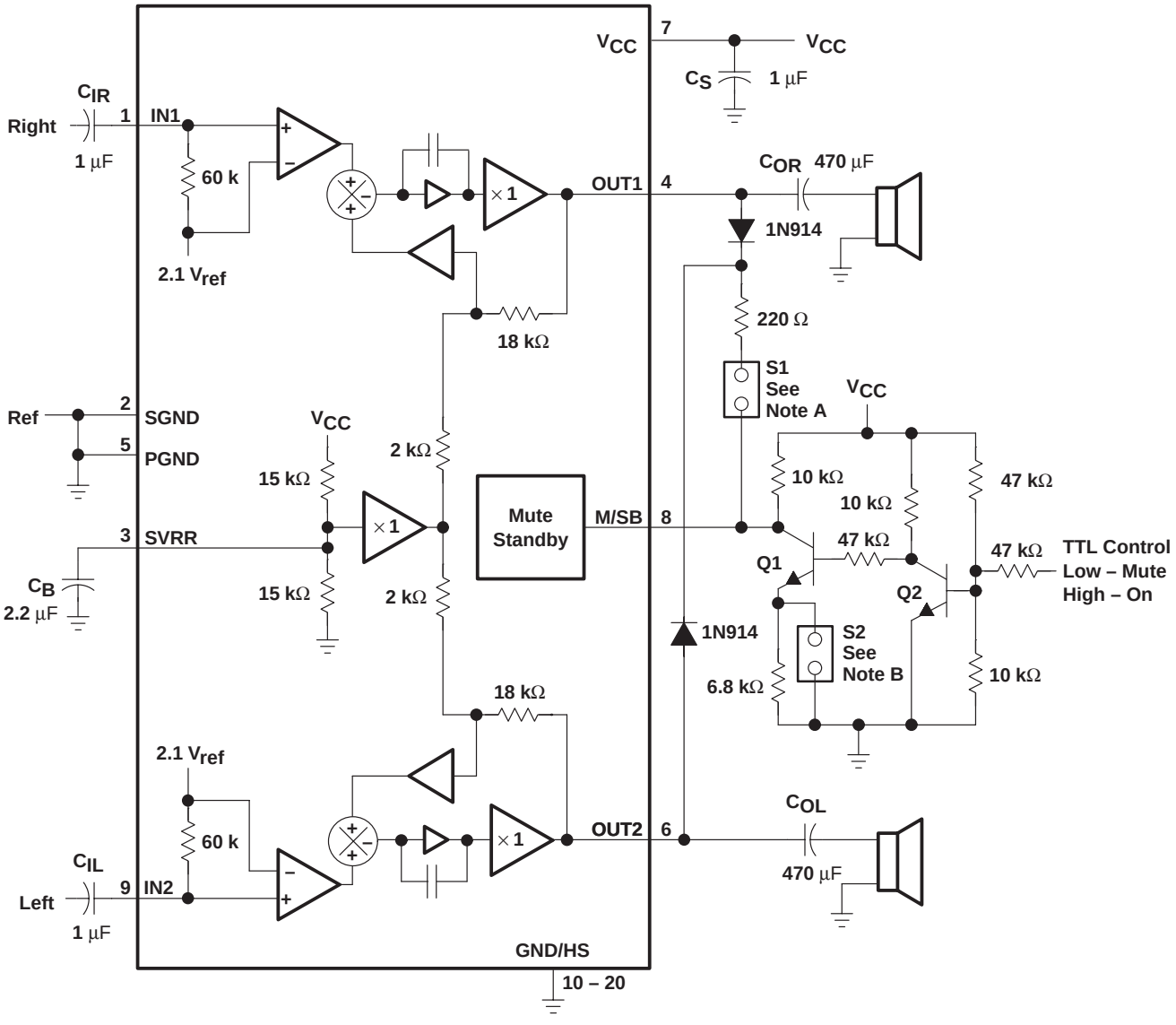


Figure 24. Standby, Mute, and Normal (On) Operating Conditions

The designer must take care to place the control voltages within the defined ranges for each desired mode, whenever an external circuit is used to control the input voltage at the M/SB terminal. The undefined area can cause unpredictable performance and should be avoided. As the control voltage moves through the undefined areas pop or click sounds may be heard in the speaker. Moving from mute to normal causes a very small click sound. Whereas moving from standby to mute can cause a much larger pop sound. Figure 25 shows external circuitry designed to help reduce transition pops when moving from standby mode to normal mode.

APPLICATION INFORMATION

Figure 25 is a reference schematic that provides TTL-level control of the M/SB terminal. A diode network is also included which helps reduce turn-on pop noises. The diodes serve to drain the charge out of the output coupling capacitors while the amplifier is in shutdown mode. When the M/SB voltage is in the normal operating range, the diodes have no effect on the ac performance of the system.



NOTES: A. When S1 is closed, the depop circuitry is active during standby mode.
B. When S2 is open, activating S1 places the TPA1517 in mute mode. When S2 is closed, activating S1 places the TPA1517 in standby mode.
C. The terminal numbers are for the 20-pin NE package.

Figure 25. TTL Control with POP Reduction