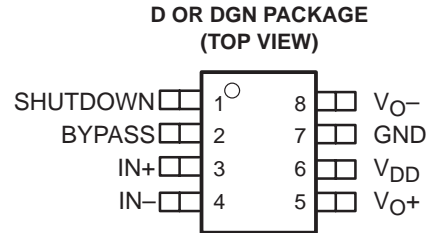


TPA321

350-mW MONO AUDIO POWER AMPLIFIER WITH DIFFERENTIAL INPUTS

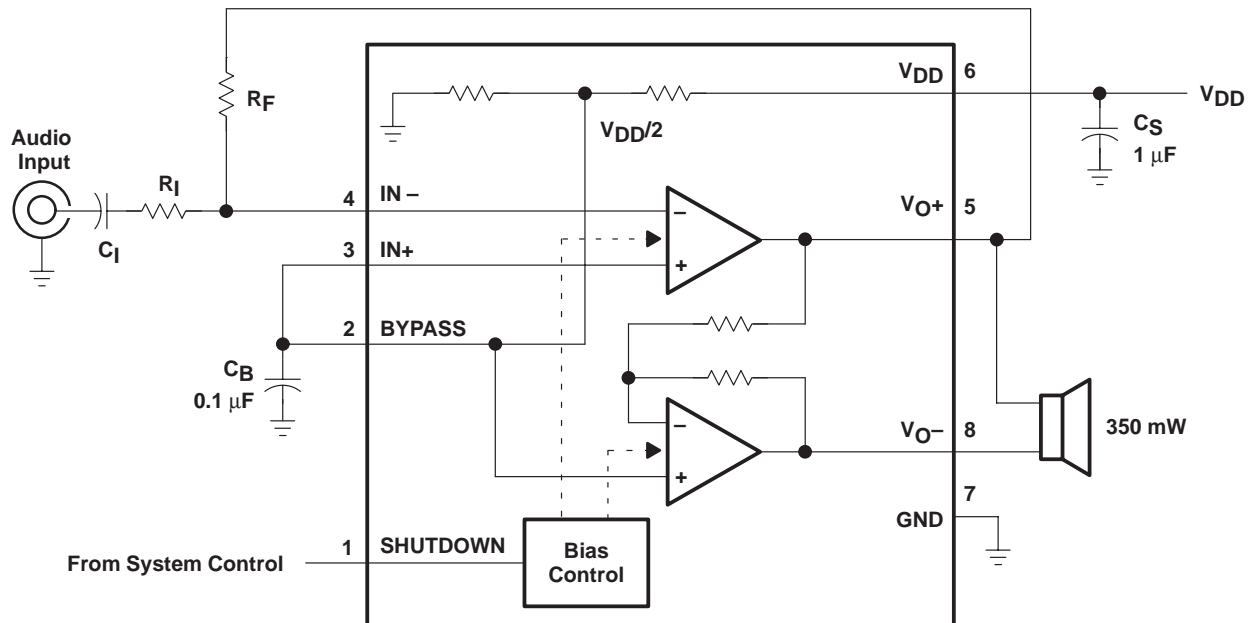
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- Fully Specified for 3.3-V and 5-V Operation
- Wide Power Supply Compatibility
2.5 V – 5.5 V
- Output Power for $R_L = 8\ \Omega$
 - 350 mW at $V_{DD} = 5\text{ V}$
 - 250 mW at $V_{DD} = 3.3\text{ V}$
- Ultralow Supply Current in Shutdown
Mode . . . 0.15 μA
- Thermal and Short-Circuit Protection
- Surface-Mount Packaging
 - SOIC
 - PowerPAD™ MSOP



description

The TPA321 is a bridge-tied load (BTL) audio power amplifier developed especially for low-voltage applications where internal speakers are required. Operating with a 3.3-V supply, the TPA321 can deliver 250-mW of continuous power into a BTL 8- Ω load at less than 1% THD+N throughout voice band frequencies. Although this device is characterized out to 20 kHz, its operation was optimized for narrower band applications such as cellular communications. The BTL configuration eliminates the need for external coupling capacitors on the output in most applications, which is particularly important for small battery-powered equipment. This device features a shutdown mode for power-sensitive applications with a quiescent current of 0.15 μA during shutdown. The TPA321 is available in an 8-pin SOIC surface-mount package and the surface-mount PowerPAD™ MSOP, which reduces board space by 50% and height by 40%.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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AVAILABLE OPTIONS

T _A	PACKAGED DEVICES		MSOP SYMBOLIZATION
	SMALL OUTLINE† (D)	MSOP† (DGN)	
–40°C to 85°C	TPA321D	TPA321DGN	AJB

† The D and DGN packages are available taped and reeled. To order a taped and reeled part, add the suffix R to the part number (e.g., TPA321DR).

Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
BYPASS	2	I	BYPASS is the tap to the voltage divider for internal mid-supply bias. This terminal should be connected to a 0.1-μF to 1-μF capacitor when used as an audio amplifier.
GND	7		GND is the ground connection.
IN–	4	I	IN– is the inverting input. IN– is typically used as the audio input terminal.
IN+	3	I	IN+ is the noninverting input. IN+ is typically tied to the BYPASS terminal for SE operations.
SHUTDOWN	1	I	SHUTDOWN places the entire device in shutdown mode when held high (I _{DD} < 1 μA).
V _{DD}	6		V _{DD} is the supply voltage terminal.
V _{O+}	5	O	V _{O+} is the positive BTL output.
V _{O–}	8	O	V _{O–} is the negative BTL output.

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

Supply voltage, V _{DD}	6 V
Input voltage, V _I	–0.3 V to V _{DD} + 0.3 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	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.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C	DERATING FACTOR	T _A = 70°C	T _A = 85°C
D	725 mW	5.8 mW/°C	464 mW	377 mW
DGN	2.14 W§	17.1 mW/°C	1.37 W	1.11 W

§ Please 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	MAX	UNIT
Supply voltage, V _{DD}	2.5	5.5	V
Operating free-air temperature, T _A	–40	85	°C



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electrical characteristics at specified free-air temperature, $V_{DD} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$ V_{OS} $	Output offset voltage (measured differentially)			5	20	mV
PSRR	Power supply rejection ratio	$V_{DD} = 3.2\text{ V to }3.4\text{ V}$		85		dB
I_{DD}	Supply current (see Figure 3)			0.7	1.5	mA
$I_{DD(SD)}$	Supply current, shutdown mode (see Figure 4)			0.15	5	μA

operating characteristics, $V_{DD} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 8\ \Omega$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O	Output power, see Note 1	THD = 0.5%, See Figure 9		250		mW
THD + N	Total harmonic distortion plus noise	$P_O = 250\text{ mW}$, $f = 20\text{ Hz to }4\text{ kHz}$, Gain = 2, See Figure 7		1.3%		
	Maximum output power bandwidth	$A_V = -2\text{ V/V}$, THD = 3%, See Figure 7		10		kHz
B_1	Unity-gain bandwidth	Open Loop, See Figure 15		1.4		MHz
	Supply ripple rejection ratio	$f = 1\text{ kHz}$, $C_B = 1\ \mu\text{F}$, See Figure 2		71		dB
V_n	Noise output voltage	$A_V = -1\text{ V/V}$, $C_B = 0.1\ \mu\text{F}$, $R_L = 32\ \Omega$, See Figure 19		15		$\mu\text{V(rms)}$

NOTE 1: Output power is measured at the output terminals of the device at $f = 1\text{ kHz}$.

electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$ V_{OS} $	Output offset voltage (measured differentially)			5	20	mV
PSRR	Power supply rejection ratio	$V_{DD} = 4.9\text{ V to }5.1\text{ V}$		78		dB
I_{DD}	Supply current (see Figure 3)			0.7	1.5	mA
$I_{DD(SD)}$	Supply current, shutdown mode (see Figure 4)			0.15	5	μA

operating characteristics, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $R_L = 8\ \Omega$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O	Output power	THD = 0.5%, See Figure 13		700		mW
THD + N	Total harmonic distortion plus noise	$P_O = 250\text{ mW}$, $f = 20\text{ Hz to }4\text{ kHz}$, Gain = 2, See Figure 11		1%		
	Maximum output power bandwidth	$A_V = -2\text{ V/V}$, THD = 2%, See Figure 11		10		kHz
B_1	Unity-gain bandwidth	Open Loop, See Figure 16		1.4		MHz
	Supply ripple rejection ratio	$f = 1\text{ kHz}$, $C_B = 1\ \mu\text{F}$, See Figure 2		65		dB
V_n	Noise output voltage	$A_V = -1\text{ V/V}$, $C_B = 0.1\ \mu\text{F}$, $R_L = 32\ \Omega$, See Figure 20		15		$\mu\text{V(rms)}$

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PARAMETER MEASUREMENT INFORMATION

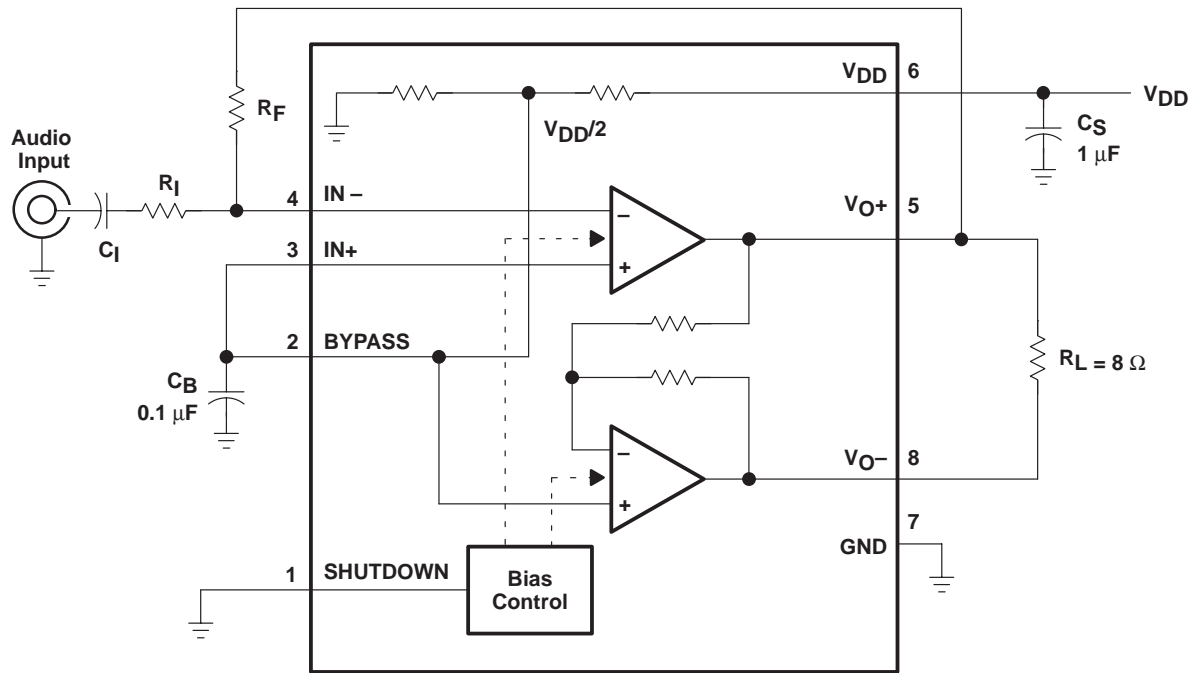


Figure 1. Test Circuit

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
kSVR	Supply voltage rejection ratio	vs Frequency	2
IDD	Supply current	vs Supply voltage	3, 4
PO	Output power	vs Supply voltage	5
		vs Load resistance	6
THD + N	Total harmonic distortion plus noise	vs Frequency	7, 8, 11, 12
		vs Output power	9, 10, 13, 14
	Open loop gain and phase	vs Frequency	15, 16
	Closed loop gain and phase	vs Frequency	17, 18
Vn	Output noise voltage	vs Frequency	19, 20
PD	Power dissipation	vs Output power	21, 22

APPLICATION INFORMATION

application schematics

Figure 26 is a schematic diagram of a typical handheld audio application circuit, configured for a gain of -10 V/V.

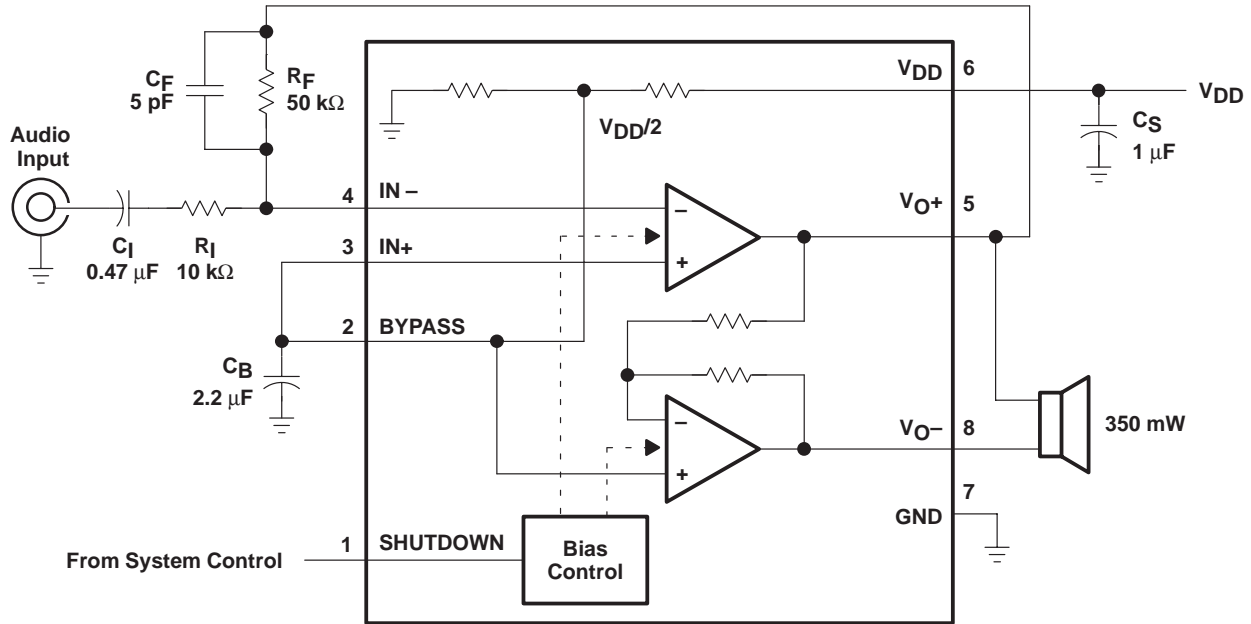


Figure 26. TPA321 Application Circuit

Figure 27 is a schematic diagram of a typical handheld audio application circuit, configured for a gain of -10 V/V with a differential input.

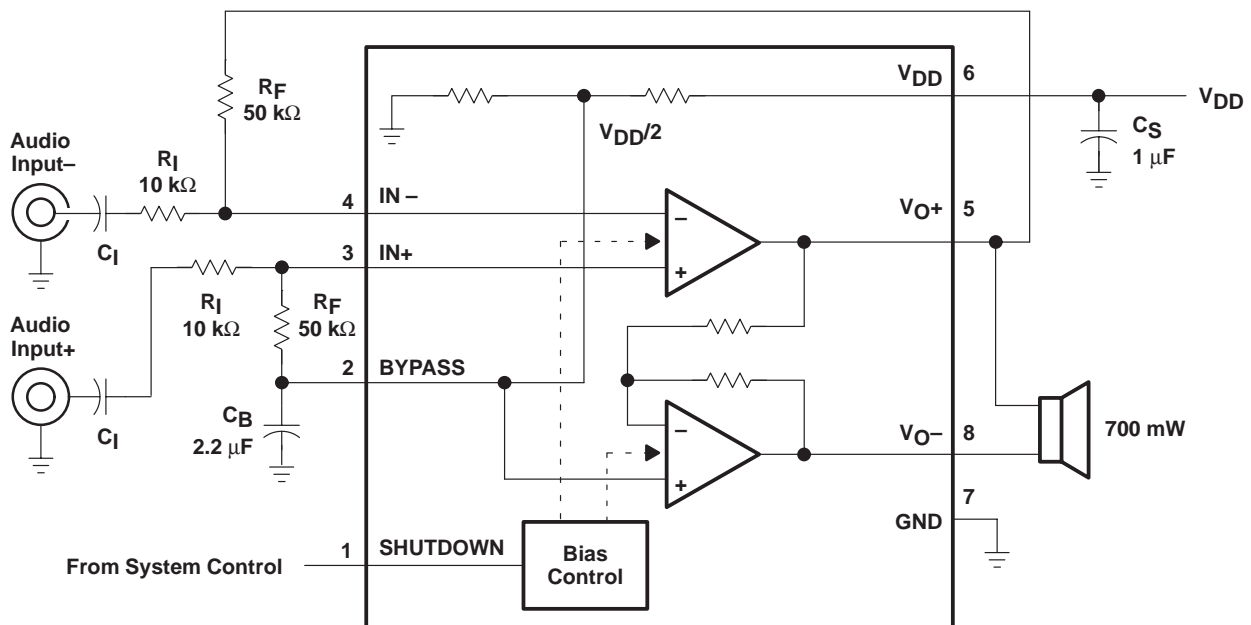


Figure 27. TPA321 Application Circuit With Differential Input