National Semiconductor

August 2000

LM4881 Boomer® Audio Power Amplifier Series
Dual 200 mW Headphone Amplifier with Shutdown Mode

General Description

The LM4881 is a dual audio power amplifier capable of delivering 200mW of continuous average power into an 8Ω load with 0.1% THD+N from a 5V power supply.

Boomer audio power amplifiers were designed specifically to provide high quality output power with a minimal amount of external components using surface mount packaging. Since the LM4881 does not require bootstrap capacitors or snubber networks, it is optimally suited for low-power portable systems.

The LM4881 features an externally controlled, low power consumption shutdown mode which is virtually clickless and popless, as well as an internal thermal shutdown protection mechanism.

The unity-gain stable LM4881 can be configured by external gain-setting resistors.

Key Specifications

- THD+N at 1kHz at 125mW continuous average output power into 8Ω — 0.1% (max)
- THD+N at 1kHz at 75mW continuous average output power into 32Ω — 0.02% (typ)
- Output power at 10% THD+N at 1kHz into 8Ω — 300mW (typ)
- Shutdown Current — 0.7µA (typ)
- Supply voltage range — 2.7V to 5.5V

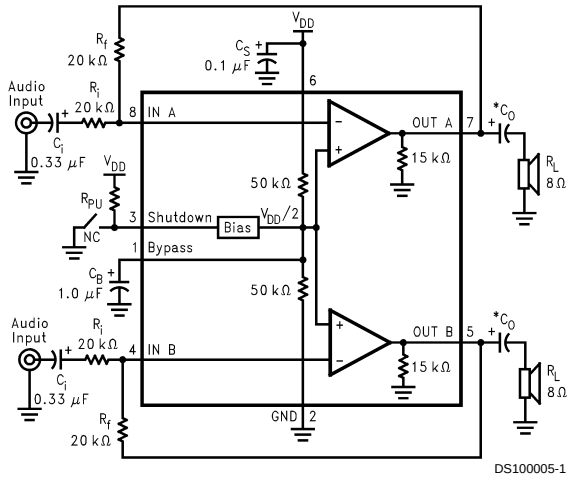
Features

- MSOP surface mount packaging
- Unity-gain stable
- External gain configuration capability
- Thermal shutdown protection circuitry
- No bootstrap capacitors, or snubber circuits are necessary

Applications

- Headphone Amplifier
- Personal Computers
- Microphone Preamplifier

Typical Application

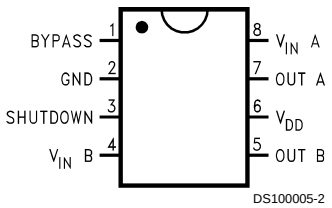


*Refer to the **Application Information** Section for information concerning proper selection of the input and output coupling capacitors.

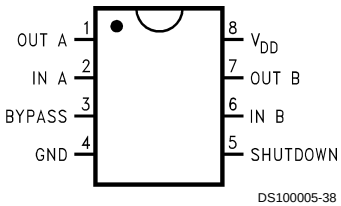
FIGURE 1. Typical Audio Amplifier Application Circuit

Connection Diagrams

MSOP Package



SOP and DIP Package



Top View
Order Number LM4881MM, LM4881M, or LM4881N
See NS Package Number MUA08A, M08A, or N08E

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Absolute Maximum Ratings (Note 3)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage	6.0V
Storage Temperature	−65˚C to +150˚C
Input Voltage	−0.3V to V_{DD} + 0.3V
Power Dissipation (Note 4)	Internally limited
ESD Susceptibility (Note 5)	3500V
ESD Susceptibility (Note 6)	250V
Junction Temperature	150˚C
Soldering Information (Note 1)	
Small Outline Package	
Vapor Phase (60 seconds)	215˚C
Infrared (15 seconds)	220˚C

Thermal Resistance

θ_{JC} (MSOP)	56˚C/W
θ_{JA} (MSOP)	210˚C/W
θ_{JC} (SOP)	35˚C/W
θ_{JA} (SOP)	170˚C/W
θ_{JC} (DIP)	37˚C/W
θ_{JA} (DIP)	107˚C/W

Operating Ratings

Temperature Range	
$T_{MIN} \le T_A \le T_{MAX}$	−40˚C ≤ T_A ≤ 85˚C
Supply Voltage	2.7V ≤ V_{DD} ≤ 5.5V

Note 1: See AN-450 “Surface Mounting and their Effects on Product Reliability” for other methods of soldering surface mount devices.

Electrical Characteristics (Notes 2, 3)

The following specifications apply for V_{DD} = 5V unless otherwise specified. Limits apply for T_A = 25C.

Symbol	Parameter	Conditions	LM4881		Units (Limits)
			Typ (Note 7)	**Limit** (Note 8)	
V_{DD}	Power Supply Voltage			2.7	V (min)
				5.5	V (max)
I_{DD}	Quiescent Current	V_{IN} = 0V, I_O = 0A	3.6	6.0	mA (max)
I_{SD}	Shutdown Current	V_{PIN1} = V_{DD}	0.7	5	µA (max)
V_{OS}	Offset Voltage	V_{IN} = 0V	5	50	mV (max)
P_O	Output Power	THD = 0.1% (max); f = 1 kHz;			
		R_L = 8Ω	200	125	mW (min)
		R_L = 16Ω	150		mW
		R_L = 32Ω	85		mW
		THD + N = 10%; f = 1 kHz;			
		R_L = 8Ω	300		mW
		R_L = 16Ω	200		mW
		R_L = 32Ω	110		mW
THD+N	Total Harmonic Distortion + Noise	R_L = 16Ω, P_O = 120 mWrms;	0.025		%
		R_L = 32Ω, P_O = 75 mWrms; f = 1 kHz	0.02		%
PSRR		C_B = 1.0 µF, V_{RIPPLE} = 200 mVrms, f = 120Hz	50		dB

Electrical Characteristics (Notes 2, 3)

The following specifications apply for V_{DD} = 3V unless otherwise specified. Limits apply for T_A = 25C.

Symbol	Parameter	Conditions	LM4881		Units (Limits)
			Typ (Note 7)	**Limit** (Note 8)	
I_{DD}	Quiescent Current	V_{IN} = 0V, I_O = 0A	1.1		mA
I_{SD}	Shutdown Current	$V_{PIN1} = V_{DD}$	0.7		µA
V_{OS}	Offset Voltage	V_{IN} = 0V	5		mV
P_O	Output Power	THD = 1% (max); f = 1 kHz;			
		R_L = 8Ω	70		mW
		R_L = 16Ω	65		mW
		R_L = 32Ω	30		mW
		THD + N = 10%; f = 1 kHz;			
		R_L = 8Ω	95		mW
		R_L = 16Ω	65		mW
		R_L = 32Ω	35		mW
THD+N	Total Harmonic Distortion + Noise	R_L = 16Ω, P_O = 60 mWrms;	0.2		%
		R_L = 32Ω, P_O = 25 mWrms; f = 1 kHz	0.03		%
PSRR	Power Supply Rejection Ratio	C_B = 1.0 µF, V_{RIPPLE} = 200 mVrms, f = 100 Hz	50		dB

Note 2: All voltages are measured with respect to the ground pin, unless otherwise specified.

Note 3: *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur. *Operating Ratings* indicate conditions for which the device is functional, but do not guarantee specific performance limits. *Electrical Characteristics* state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 4: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX}, θ_{JA}, and the ambient temperature T_A. The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX} - T_A) / \theta_{JA}$. For the LM4881, T_{JMAX} = 150˚C, and the typical junction-to-ambient thermal resistance, when board mounted, is 210˚C/W for the MSOP Package and 107˚C/W for package N08E.

Note 5: Human body model, 100 pF discharged through a 1.5 kΩ resistor.

Note 6: Machine Model, 220 pF–240 pF discharged through all pins.

Note 7: Typicals are measured at 25˚C and represent the parametric norm.

Note 8: Limits are guaranteed to National's AOQL (Average Outgoing Quality Level).