National Semiconductor

August 2000

LM4861 Boomer® Audio Power Amplifier Series
1.1W Audio Power Amplifier with Shutdown Mode

General Description

The LM4861 is a bridge-connected audio power amplifier capable of delivering 1.1W of continuous average power to an 8Ω load with 1% THD+N using 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 LM4861 does not require output coupling capacitors, bootstrap capacitors, or snubber networks, it is optimally suited for low-power portable systems.

The LM4861 features an externally controlled, low-power consumption shutdown mode, as well as an internal thermal shutdown protection mechanism.

The unity-gain stable LM4861 can be configured by external gain-setting resistors for differential gains of up to 10 without the use of external compensation components. Higher gains may be achieved with suitable compensation.

Key Specifications

- THD+N for 1kHz at 1W continuous average output power into 8Ω — 1.0% (max)
- Output power at 10% THD+N at 1kHz into 8Ω — 1.5W (typ)
- Shutdown Current — 0.6µA (typ)

Features

- No output coupling capacitors, bootstrap capacitors, or snubber circuits are necessary
- Small Outline (SO) packaging
- Compatible with PC power supplies
- Thermal shutdown protection circuitry
- Unity-gain stable
- External gain configuration capability

Applications

- Personal computers
- Portable consumer products
- Self-powered speakers
- Toys and games

Typical Application

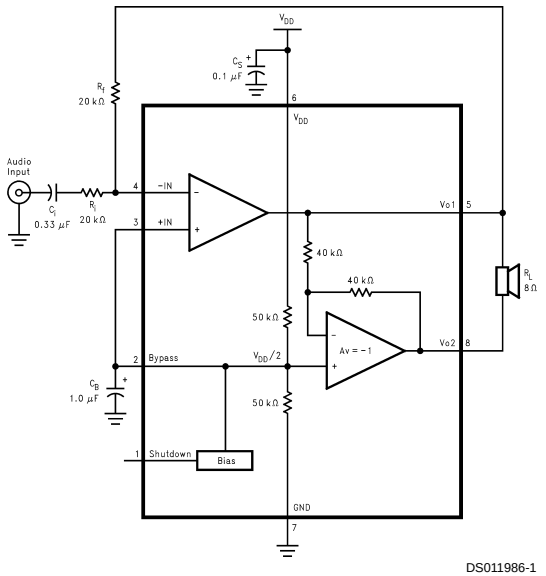

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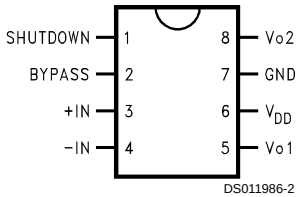
FIGURE 1. Typical Audio Amplifier Application Circuit

Connection Diagram

Small Outline Package



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Top View
Order Number LM4861M
See NS Package Number M08A

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Absolute Maximum Ratings (Note 2)

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 3)	Internally limited
ESD Susceptibility (Note 4)	3000V
ESD Susceptibility (Note 5)	250V
Junction Temperature	150˚C
Soldering Information	
Small Outline Package	
Vapor Phase (60 sec.)	215˚C
Infrared (15 sec.)	220˚C

See AN-450 *"Surface Mounting and their Effects on Product Reliability"* for other methods of soldering surface mount devices.

Operating Ratings

Temperature Range	
$T_{MIN} \le T_A \le T_{MAX}$	−40˚C ≤ T_A ≤ +85˚C
Supply Voltage	2.0V ≤ V_{DD} ≤ 5.5V
Thermal Resistance	
θ_{JC} (typ)—M08A	35˚C/W
θ_{JA} (typ)—M08A	140˚C/W
θ_{JC} (typ)—N08E	37˚C/W
θ_{JA} (typ)—N08E	107˚C/W

Electrical Characteristics (Note 1) (Note 2)

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

Symbol	Parameter	Conditions	LM4861		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
V_{DD}	Supply Voltage			2.0 5.5	V (min) V (max)
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_O = 0A (Note 8)	6.5	10.0	mA (max)
I_{SD}	Shutdown Current	$V_{pin1} = V_{DD}$	0.6	10.0	µA (max)
V_{OS}	Output Offset Voltage	V_{IN} = 0V	5.0	50.0	mV (max)
P_O	Output Power	THD = 1% (max); f = 1 kHz	1.1	1.0	W (min)
THD+N	Total Harmonic Distortion + Noise	P_O = 1Wrms; 20 Hz ≤ f ≤ 20 kHz	0.72		%
PSRR	Power Supply Rejection Ratio	V_{DD} = 4.9V to 5.1V	65		dB

Note 1: All voltages are measured with respect to the ground pin, unless otherwise specified.

Note 2: 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 3: 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 $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower. For the LM4861, T_{JMAX} = 150˚C, and the typical junction-to-ambient thermal resistance, when board mounted, is 140˚C/W.

Note 4: Human body model, 100 pF discharged through a 1.5 kΩ resistor.

Note 5: Machine Model, 220 pF–240 pF discharged through all pins.

Note 6: Typicals are measured at 25˚C and represent the parametric norm.

Note 7: Limits are guaranteed to Nationai's AOQL (Average Outgoing Quality Level).

Note 8: The quiescent power supply current depends on the offset voltage when a practical load is connected to the amplifier.

High Gain Application Circuit

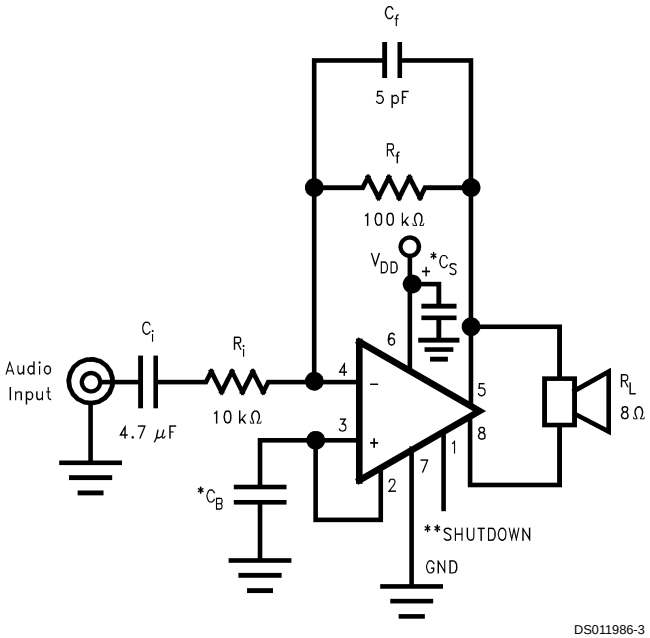
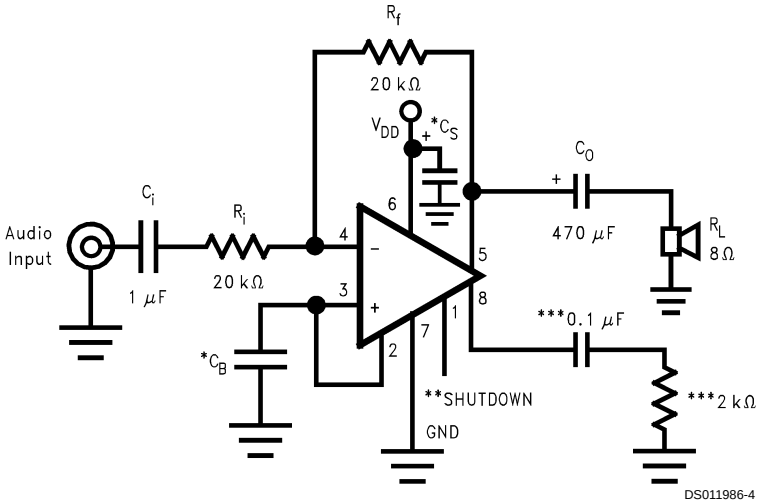


FIGURE 2. Audio Ampiifier with A_{VD} = 20

Single Ended Application Circuit



*C_S and C_B size depend on specific application requirements and constraints. Typical vaiues of C_S and C_B are 0.1 μF.
**Pin 1 should be connected to V_{DD} to disable the amplifier or to GND to enable the amplifier. This pin should not be left floating.
***These components create a “dummy” load for pin 8 for stability purposes.

FIGURE 3. Single-Ended Amplifier with A_V = −1