

LM4864 Boomer® Audio Power Amplifier Series 725mW Audio Power Amplifier with Shutdown Mode

General Description

The LM4864 is a bridged audio power amplifier capable of delivering 725mW of continuous average power into an 8Ω load with 1% THD+N from a 5V power supply.

Boomer® audio power amplifiers were designed specifically to provide high quality output power from a low supply voltage while requiring a minimal amount of external components. Since the LM4864 does not require output coupling capacitors, bootstrap capacitors or snubber networks, it is optimally suited for low-power portable applications.

The LM4864 features an externally controlled, low power consumption shutdown mode, and thermal shutdown protection.

The closed loop response of the unity-gain stable LM4864 can be configured by external gain-setting resistors. The device is available in multiple package types to suit various applications.

Key Specifications

- P_O at 1% THD+N with $V_{DD} = 5V$, 1kHz

LM4864LD, 4Ω load	625mW (typ)
LM4864LD, 8Ω load	725mW (typ)
LM4864M & LM4864N, 8Ω load	675mW (typ)
LM4864MM, 8Ω load (Note 10)	300mW (typ)
LM4864, 16Ω load	550mW (typ)
- Shutdown current

	0.7μA (typ)
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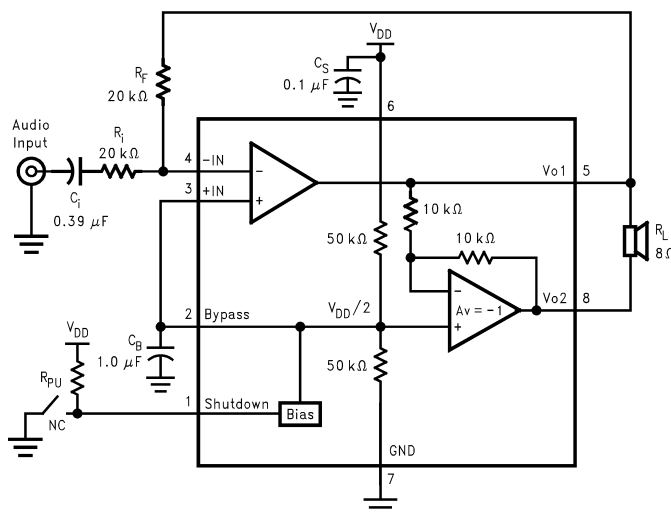
Features

- MSOP, SOP, DIP, and LD packaging
- No output coupling capacitors, bootstrap capacitors, or snubber circuits are necessary
- Thermal shutdown protection circuitry
- Unity-gain stable
- External gain configuration capability

Applications

- Cellular phones
- Personal computers
- General purpose audio

Typical Application

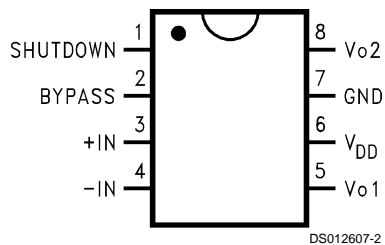


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FIGURE 1. Typical Audio Amplifier Application Circuit

Connection Diagrams

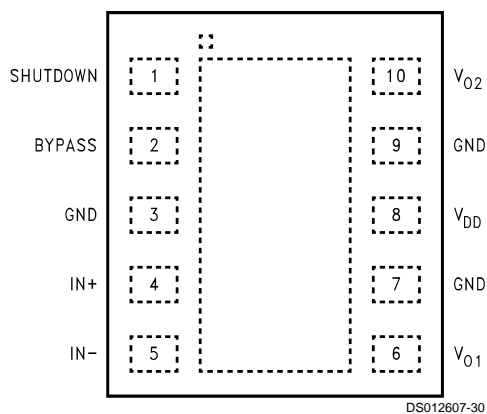
MSOP, SOP, and DIP Package



Top View

Order Number LM4864MM,
LM4864M or LM4864N
See NS Package Number MUA08A,
M08A or N08E

LD Package



Top View

Order Number LM4864LD,
See NS Package Number LDA10A

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)	3500V
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.

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
θ_{JA} (LD) (Note 11)	63° C/W
θ_{JC} (LD) (Note 11)	12° C/W

Operating Ratings

Temperature Range

$$T_{MIN} \leq T_A \leq T_{MAX} \quad -40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$$

Supply Voltage

$$2.7V \leq V_{DD} \leq 5.5V$$

Electrical Characteristics (Note 1) (Note 2)

The following specifications apply for $V_{DD} = 5V$, for all available packages, unless otherwise specified. Limits apply for $T_A = 25^\circ\text{C}$

Symbol	Parameter	Conditions	LM4864		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 8)	
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V$, $I_O = 0A$ (Note 9)	3.6	6.0	mA (max)
I_{SD}	Shutdown Current	$V_{PIN1} = V_{DD}$	0.7	5	μA (max)
V_{OS}	Output Offset Voltage	$V_{IN} = 0V$	5	50	mV (max)
P_O	Output Power	THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 4\Omega$; LM4864LD (Note 11)	625		mW (min)
		THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 8\Omega$; LM4864LD (Note 11)	725		mW (min)
		THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 8\Omega$; LM4864MM (Note 10)		300	mW (min)
		THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 8\Omega$; LM4864M and LM4864N	675	300	mW (min)
		THD+N = 1%; $f = 1\text{ kHz}$; $R_L = 16\Omega$;	550		mW
THD+N	Total Harmonic Distortion+Noise	$P_O = 300\text{ mWrms}$; $A_{VD} = 2$; $R_L = 8\Omega$; $20\text{ Hz} \leq f \leq 20\text{ kHz}$, BW < 80kHz	0.7		%
PSRR	Power Supply Rejection Ratio	$V_{DD} = 4.9V-5.1V$	50		dB

Electrical Characteristics (Note 1) (Note 2)

The following specifications apply for $V_{DD} = 3V$, for all available packages, unless otherwise specified. Limits apply for $T_A = 25^\circ\text{C}$

Symbol	Parameter	Conditions	LM4864		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 8)	
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V$, $I_O = 0A$ (Note 9)	1.0	3.0	mA (max)
I_{SD}	Shutdown Current	$V_{PIN1} = V_{DD}$	0.3	2.0	μA (max)
V_{OS}	Output Offset Voltage	$V_{IN} = 0V$	5		mV
P_O	Output Power	THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 8\Omega$	200		mW
		THD = 1% (max); $f = 1\text{ kHz}$; $R_L = 16\Omega$	175		mW

Electrical Characteristics (Note 1) (Note 2) (Continued)

The following specifications apply for $V_{DD} = 3V$, for all available packages, unless otherwise specified. Limits apply for $T_A = 25^\circ C$

Symbol	Parameter	Conditions	LM4864		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 8)	
THD+N	Total Harmonic Distortion+Noise	$P_O = 100 \text{ mWrms}$; $A_{VD} = 2$; $R_L = 8\Omega$; $20 \text{ Hz} \leq f \leq 20 \text{ kHz}$, $BW < 80 \text{ kHz}$	1.5		%
PSRR	Power Supply Rejection Ratio	$V_{DD} = 2.9V-3.1V$	50		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 LM4864, $T_{JMAX} = 150^\circ C$. The typical junction-to-ambient thermal resistance, when board mounted, is $230^\circ C/W$ for package number MUA08A, $170^\circ C/W$ for package number M08A and is $107^\circ C/W$ for package number N08E.

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

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

Note 6: Typicals are measured at $25^\circ C$ and represent the parametric norm.

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

Note 8: Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.

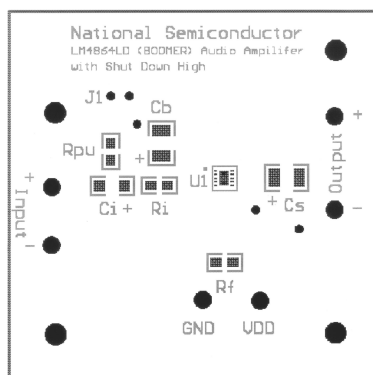
Note 9: The quiescent power supply current depends on the offset voltage when a practical load is connected to the amplifier.

Note 10: The MUA08BA package is thermally limited to 595 mW of power dissipation at room temperature. Referring to the Power Dissipation vs Output Power graph in the **Typical Performance Characteristics** section, the power dissipation limitation for the package occurs at 300 mW of output power. This package limitation is based on $25^\circ C$ ambient temperature and $\theta_{JA} = 210^\circ C$. For higher output power possibilities refer to the **Power Dissipation** Section.

Note 11: The LDA10A package has its exposed-DAP soldered to an exposed 1.2in² area of 1oz printed circuit board copper.

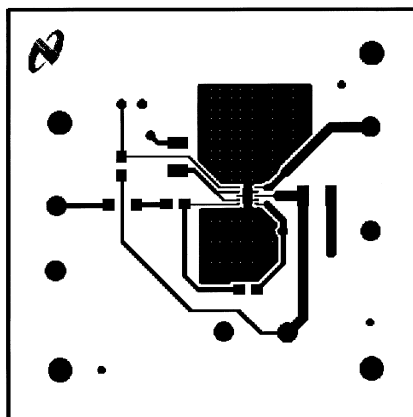
Application Information (Continued)

LM4864LD DEMO BOARD ARTWORK



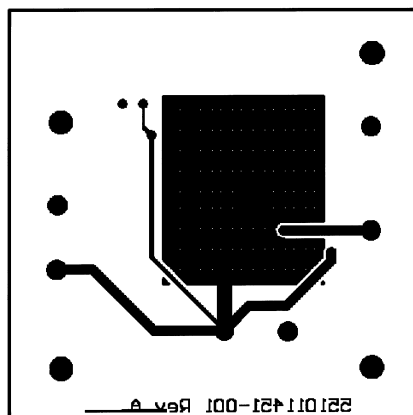
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Silk Screen View of LM4864LD



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Top Layer of LM4864LD



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Bottom Layer of LM4864LD