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National Semiconductor

LM4880 Boomer® Audio Power Amplifier Series
Dual 250 mW Audio Power Amplifier with Shutdown Mode

General Description

The LM4880 is a dual audio power amplifier capable of delivering typically 250mW per channel of continuous average power to an 8Ω load with 0.1% 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 LM4880 does not require bootstrap capacitors or snubber networks, it is optimally suited for low-power portable systems.

The LM4880 features an externally controlled, low-power consumption shutdown mode, as well as an internal thermal shutdown protection mechanism.

The unity-gain stable LM4880 can be configured by external gain-setting resistors.

Key Specifications

- THD+N at 1kHz at 200mW continuous average output power into 8Ω: 0.1% (max)
- THD+N at 1kHz at 85mW continuous average output power into 32Ω: 0.1% (typ)
- Output power at 10% THD+N at 1kHz into 8Ω: 325mW (typ)
- Shutdown current: 0.7µA (typ)
- 2.7V to 5.5V supply voltage range

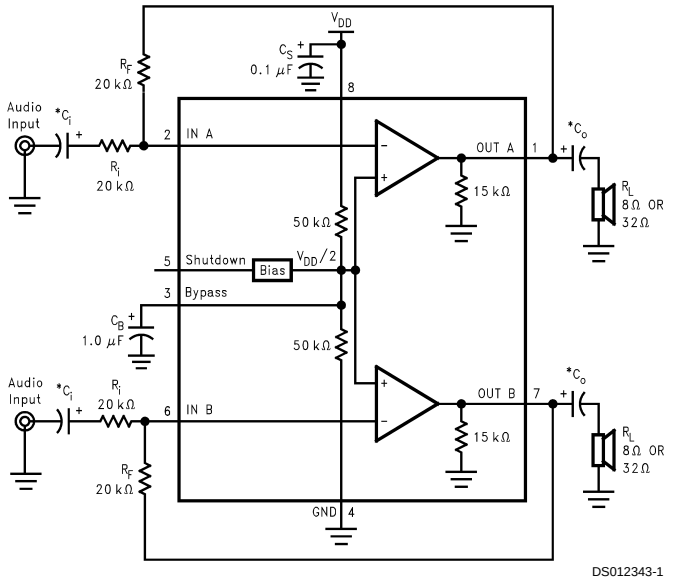
Features

- No bootstrap capacitors or snubber circuits are necessary
- Small Outline (SO) and DIP packaging
- Unity-gain stable
- External gain configuration capability

Applications

- Headphone Amplifier
- Personal Computers
- CD-ROM Players

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

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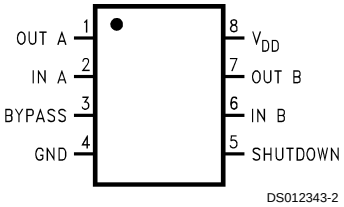
Connection Diagram

Small Outline and DIP Packages



Top View
Order Number LM4880M or LM4880N
See NS Package Number M08A for SO
or NS Package Number N08E for DIP

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} (DIP)	37˚C/W
θ_{JA} (DIP)	107˚C/W
θ_{JC} (SO)	35˚C/W
θ_{JA} (SO)	170˚C/W

Operating Ratings

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

Electrical Characteristics (Notes 1, 2)

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

Symbol	Parameter	Conditions	LM4880		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
V_{DD}	Supply Voltage			2.7	V (min)
				5.5	V (max)
I_{DD}	Quiescent Power Supply Current	V_{IN}=0V, I_O=0A	3.6	6.0	mA (max)
I_{SD}	Shutdown Current	V_{PIN5}=V_{DD}	0.7	5	µA (max)
V_{OS}	Output Offset Voltage	V_{IN}=0V	5	50	mV (max)
P_O	Output Power	THD=0.1% (max); f=1 kHz;			
		R_L=8Ω	250	200	mW (min)
		R_L=32Ω	85		mW
		THD+N=10%; f=1 kHz			
		R_L=8Ω	325		mW
		R_L=32Ω	110		mW
THD+N	Total Harmonic Distortion+Noise	R_L=8Ω, P_O=200 mW;	0.03		%
		R_L=32Ω, P_O=75 mW;	0.02		%
		f=1 kHz			
PSRR	Power Supply Rejection Ratio	C_B = 1.0 µF,	50		dB
		V_{RIPPLE}=200 mVrms, f = 100 Hz			

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 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 LM4880, T_{JMAX} = 150˚C, and the typical junction-to-ambient thermal resistance is 170˚C/W for package M08A and 107˚C/W for package N08E.

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 National's AOQL (Average Outgoing Quality Level).

Automatic Shutdown Circuit

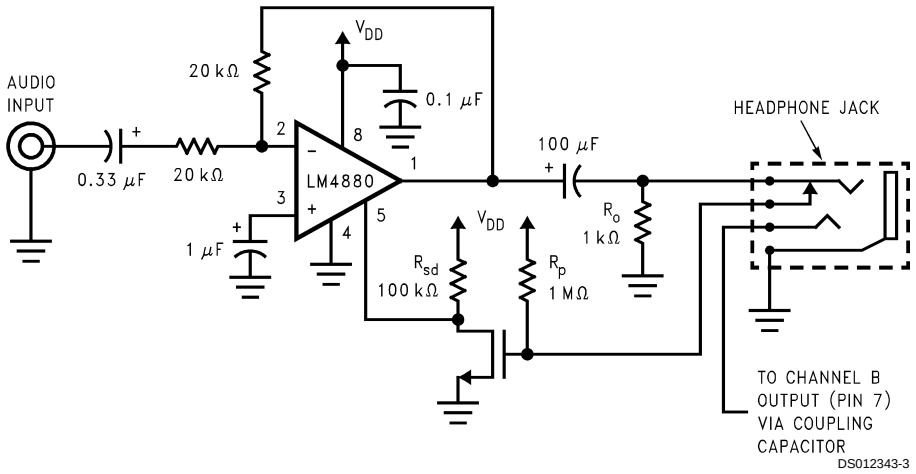


FIGURE 2. Automatic Shutdown Circuit

Automatic Switching Circuit

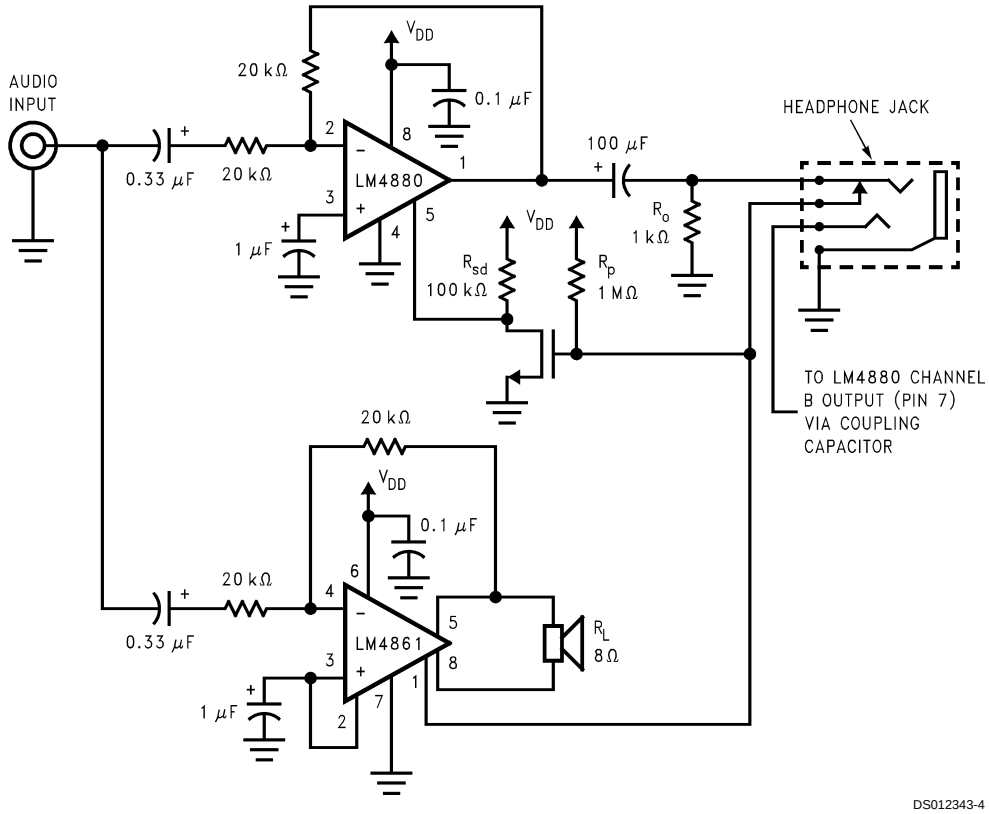


FIGURE 3. Automatic Switching Circuit

External Components Description (*Figure 1*)

Components		Functional Description
1.	R_i	Inverting input resistance which sets the closed-loop gain in conjunction with R_F. This resistor also forms a high pass filter with C_i at $f_c = 1/(2\pi R_i C_i)$.
2.	C_i	Input coupling capacitor which blocks the DC voltage at the amplifier's input terminals. Also creates a high pass filter with R_i at $f_c = 1/(2\pi R_i C_i)$. Refer to the section, **Proper Selection of External Components,** for an explanation of how to determine the value of C_i.
3.	R_F	Feedback resistance which sets closed-loop gain in conjunction with R_i.