National Semiconductor

December 2001

LM4902 Boomer® Audio Power Amplifier Series

265mW at 3.3V Supply Audio Power Amplifier with Shutdown Mode

General Description

The LM4902 is a bridged audio power amplifier capable of delivering 265mW of continuous average power into an 8Ω load with 1% THD+N from a 3.3V 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 LM4902 does not require output coupling capacitors, bootstrap capacitors or snubber networks, it is optimally suited for low-power portable applications.

The LM4902 features an externally controlled, low power consumption shutdown mode, and thermal shutdown protection.

The closed loop response of the unity-gain stable LM4902 can be configured by external gain-setting resistors.

Key Specifications

- THD+N at 1kHz for 265mW continuous average output power into 8Ω, V_{DD} = 3.3V 1.0% (max)
- THD+N at 1kHz for 675mW continuous average output power into 8Ω, V_{DD} = 5V 1.0% (max)
- Shutdown current 0.1µA (typ)

Features

- MSOP packaging
- No output coupling capacitors, bootstrap capacitors, or snubber circuits are necessary
- Thermal shutdown protection circuitry
- Unity-gain stable
- External gain configuration capability
- Latest generation 'click and pop' suppression circuitry

Applications

- Cellular phones
- PDA's
- Any portable audio application

Typical Application

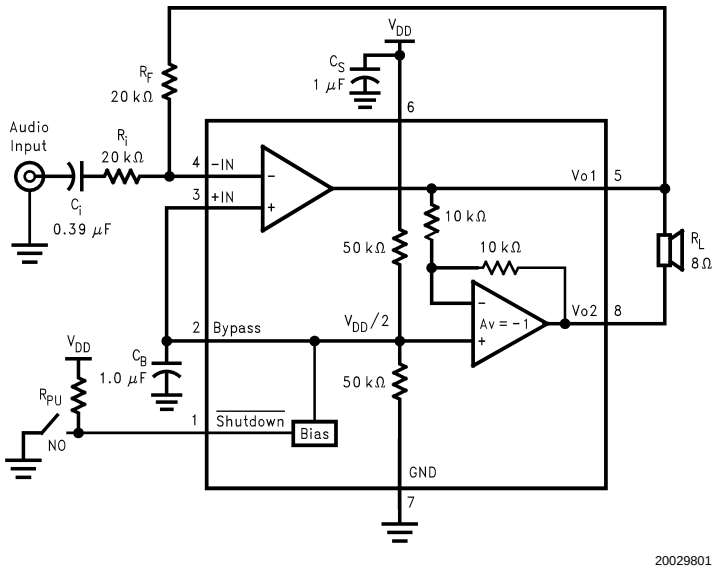

FIGURE 1. Typical Audio Amplifier Application Circuit

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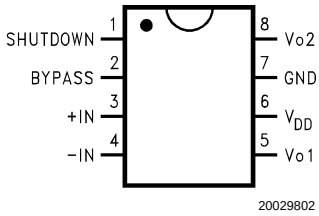
Connection Diagram

MSOP



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Top View
Order Number LM4902MM
See NS Package Number MUA08A

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)	2000V
ESD Susceptibility (Note 5)	200V
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)	190˚C/W

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

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˚C

Symbol	Parameter	Conditions	LM4902		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 9)	
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_O = 0A (Note 8)	4	6.0	mA (max)
I_{SD}	Shutdown Current	V_{PIN1} =GND	0.1	5	µA (max)
V_{OS}	Output Offset Voltage	V_{IN} = 0V	5	50	mV (max)
P_O	Output Power	THD = 1% (max); f = 1kHz; R_L = 8Ω;	675	300	mW (min)
THD+N	Total Harmonic Distortion+Noise	P_O = 400 mWrms; A_{VD} = 2; R_L = 8Ω; 20Hz ≤ f ≤ 20kHz, BW < 80kHz	0.4		%
PSRR	Power Supply Rejection Ratio	V_{RIPPLE} = 200mV sine p-p			dB
		f = 217Hz (Note 10)	70		
		f = 1KHz (Note 10)	67		
		f = 217Hz (Note 11)	55		
		f = 1KHz (Note 11)	55		

Electrical Characteristics (Notes 1, 2)

The following specifications apply for V_{DD} = 3.3V, for all available packages, unless otherwise specified. Limits apply for T_A = 25˚C

Symbol	Parameter	Conditions	LM4902		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 9)	
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_O = 0A (Note 8)	3	5	mA (max)
I_{SD}	Shutdown Current	V_{PIN1} = GND	0.1	3	µA (max)
V_{OS}	Output Offset Voltage	V_{IN} = 0V	5	50	mV (max)
P_O	Output Power	THD = 1% (max); f = 1kHz; R_L = 8Ω;	265		mW
THD+N	Total Harmonic Distortion+Noise	P_O = 250 mWrms; A_{VD} = 2; R_L = 8Ω; 20Hz ≤ f ≤ 20kHz, BW < 80kHz	0.4		%

Electrical Characteristics (Notes 1, 2) (Continued)

The following specifications apply for V_{DD} = 3.3V, for all available packages, unless otherwise specified. Limits apply for T_A = 25˚C

Symbol	Parameter	Conditions	LM4902		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 9)	
PSRR	Power Supply Rejection Ratio	V_{RIPPLE} = 200mV sine p-p			dB
		f = 217Hz (Note 10)	73		
		f = 1KHz (Note 10)	70		
		f = 217Hz (Note 11)	60		
		f = 1KHz (Note 11)	68		

Electrical Characteristics (Notes 1, 2)

The following specifications apply for V_{DD} = 2.6V, for all available packages, unless otherwise specified. Limits apply for T_A = 25˚C

Symbol	Parameter	Conditions	LM4902		Units (Limits)
			Typical (Note 6)	Limit (Notes 7, 9)	
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_O = 0A (Note 8)	2.6	4	mA (max)
I_{SD}	Shutdown Current	$V_{PIN1} = V_{DD}$	0.1	2.0	µA (max)
V_{OS}	Output Offset Voltage	V_{IN} = 0V	5		mV
P_O	Output Power	THD = 1% (max); f = 1kHz; R_L = 8Ω	130		mW
THD+N	Total Harmonic Distortion+Noise	P_O = 100 mWrms; A_{VD} = 2; R_L = 8Ω; 20Hz ≤ f ≤ 20kHz, BW < 80kHz	0.4		%
PSRR	Power Supply Rejection Ratio	V_{RIPPLE} = 200mV sine p-p			dB
		f = 217Hz (Note 11)	58		
		f = 1KHz (Note 11)	63		

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 LM4902, T_{JMAX} = 150˚C. The typical junction-to-ambient thermal resistance, when board mounted, is 190˚C/W for package number MUA08A.

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

Note 5: Machine Model, 220pF–240pF 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).

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

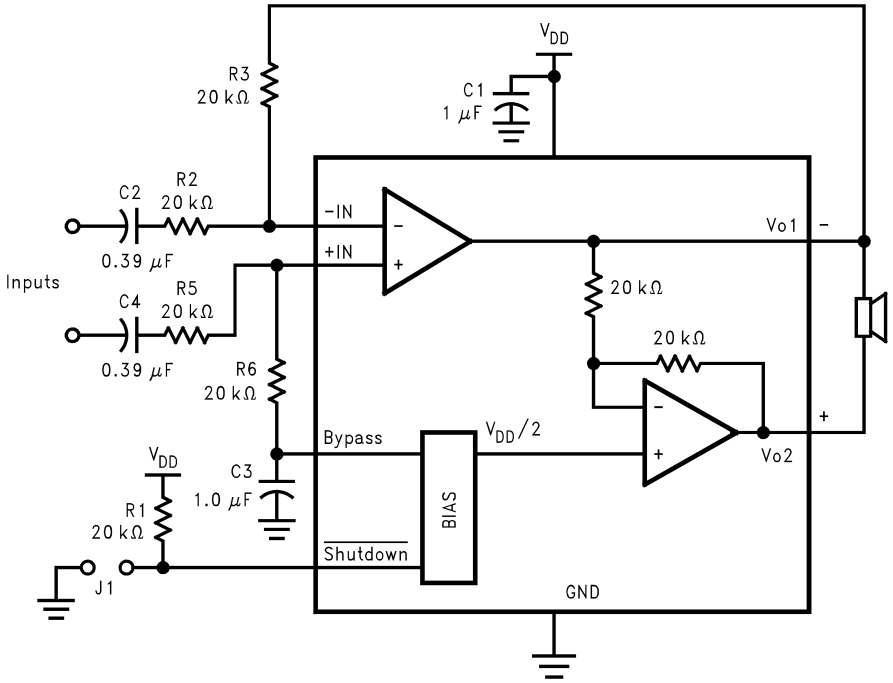
Note 9: Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.

Note 10: Unterminated input.

Note 11: 10Ω terminated input.

Application Information (Continued)

DIFFERENTIAL AMPLIFIER CONFIGURATION FOR LM4902



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