National Semiconductor

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LM4834 Boomer® Audio Power Amplifier Series
1.75W Audio Power Amplifier with DC Volume Control and Microphone Preamp

General Description

The LM4834 is a monolithic integrated circuit that provides DC volume control, and a bridged audio power amplifier capable of producing 1.75W into 4Ω with less than 1.0% (THD). In addition, the headphone/lineout amplifier is capable of driving 70 mW into 32Ω with less than 0.1%(THD). The LM4834 incorporates a volume control and an input microphone preamp stage capable of driving a 1 kΩ load impedance.

Boomer® audio integrated circuits were designed specifically to provide high quality audio while requiring a minimum amount of external components in surface mount packaging. The LM4834 incorporates a DC volume control, a bridged audio power amplifier and a microphone preamp stage, making it optimally suited for multimedia monitors and desktop computer applications.

The LM4834 features an externally controlled, low-power consumption shutdown mode, and both a power amplifier and headphone mute for maximum system flexibility and performance.

Key Specifications

- THD at 1.1W continuous average output power into 8Ω at 1kHz 0.5% (max)
- Output Power into 4Ω at 1.0% THD+N 1.75W (typ)
- THD at 70mW continuous average output power into 32Ω at 1kHz 0.1% (typ)
- Shutdown Current 1.0µA (max)
- Supply Current 17.5mA (typ)

Features

- PC98 Compliant
- "Click and Pop" suppression circuitry
- Stereo line level outputs with mono input capability for system beeps
- Microphone preamp with buffered power supply
- DC Volume Control Interface
- Thermal shutdown protection circuitry

Applications

- Multimedia Monitors
- Desktop and Portable Computers

Block Diagram

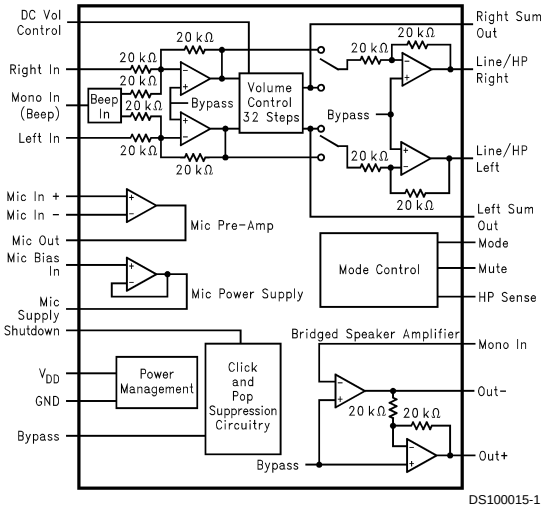
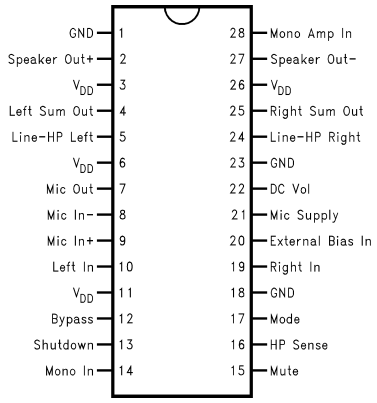


FIGURE 1. LM4834 Block Diagram

Connection Diagram

SSOP Package



Top View
Order Number LM4834MS
See NS Package Number MSA028CB for SSOP

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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	Internally limited
ESD Susceptibility (Note 4)	2000V
Pin 5	1500V
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.

θ_{JC} (typ)—MSA028CB	29˚C/W
θ_{JA} (typ)—MSA028CB	95˚C/W

Operating Ratings

Temperature Range	
$T_{MIN} \le T_A \le T_{MAX}$	−40˚C ≤TA ≤ 85˚C
Supply Voltage	$4.5 \le V_{DD} \le 5.5V$

Electrical Characteristics for Entire IC

(Notes 1, 2)
The following specifications apply for V_{DD} = 5V unless otherwise noted. Limits apply for T_A= 25˚C.

Symbol	Parameter	Conditions	LM4834		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
V_{DD}	Supply Voltage			4.5	V (min)
				5.5	V (max)
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_O= 0A	17.5	26	mA (max)
I_{SD}	Shutdown Current	$V_{pin13} = V_{DD}$	0.6	2.0	µA (max)

Electrical Characteristics for Volume Attenuators

(Notes 1, 2)
The following specifications apply for V_{DD} = 5V. Limits apply for T_A = 25˚C.

Symbol	Parameter	Conditions	LM4834		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
C_{RANGE}	Attenuator Range	Gain with $V_{pin\ 22}$ = 5V	2.6	3.65	dB (max)
		Attenuation with $V_{pin\ 22}$ = 0V	-75	-88	dB (min)
A_M	Mute Attenuation	$V_{pin\ 15}$ = 5V, Sum Out	-92	-105	dB (max)
		$V_{pin\ 15}$ = 5V, Line Out/Headphone Amp	-92	-105	dB (max)

Electrical Characteristics for Microphone Preamp and Power Supply

(Notes 1, 2)
The following specifications apply forV_{DD} = 5V unless otherwise noted. Limits apply for T_A= 25˚C.

Symbol	Parameter	Conditions	LM4834		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
V_{OS}	Offset Voltage	V_{IN} = 0V	0.9		mV
SNR	Signal to Noise Ratio	V_{DD} = 5V, R_L = 1k, f = 1 kHz, V_{OUT} = 4.7V, A-Wtd Filter	123		dB
V_{SWING}	Output Voltage Swing	f = 1 kHz, THD < 1.0%, R_L = 1 kΩ	4.72		V
E_{NO}	Input Referred Noise	A-Weighted Filter	1.2		µV
PSRR	Power Supply Rejection Ratio	f = 120 Hz, V_{RIPPLE}= 200 mVrms, C_B=1µF	28		dB
V_S	Mic Power Supply	R_L = 1 kΩ, Bias In = 2.5V	2.5	2.5	V (min)

Electrical Characteristics for Line/Headphone Amplifier

(Notes 1, 2)
The following specifications apply for V_{DD} = 5V. Limits apply for T_A = 25˚C.

Symbol	Parameter	Conditions	LM4834		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
P_O	Output Power	THD = 0.1%; f = 1kHz; R_L = 32Ω	70		mW
		THD = 10%; f = 1 kHz; R_L = 32Ω	95		mW
THD+N	Total Harmonic Distortion+Noise	V_{OUT} = 4V_{P-P}, 20 Hz < f < 20 kHz, R_L = 10kΩ, A_{VD} = −1	0.05		%
PSRR	Power Supply Rejection Ratio	C_B = 1.0 µF, f =120 Hz, V_{RIPPLE} = 200 mVrms	30		dB
SNR	Signal to Noise Ratio	V_{DD}=5V, P_{OUT}=75mW, R_L = 32Ω, A-Wtd Filter	102		dB

Electrical Characteristics for Bridged Speaker Amplifer

(Notes 1, 2)
The following specifications apply for V_{DD} = 5V, unless otherwise noted. Limits apply for T_A= 25˚C.

Symbol	Parameter	Conditions	LM4834		Units (Limits)
			Typical (Note 6)	Limit (Note 7)	
V_{OS}	Output Offset Voltage	V_{IN} = 0V	5	30	mV (max)
P_O	Output Power	THD = 0.5% (max);f = 1 kHz; R_L = 8Ω	1.1	1.0	W (min)
		THD+N = 10%;f = 1 kHz; R_L = 8Ω	1.5		W
THD+N	Total Harmonic Distortion+Noise	P_O = 1W, 20 Hz< f < 20 kHz, R_L = 8Ω, A_{VD} = 2	0.3		%
		P_O = 340 mW, R_L = 32Ω	1.0		%
PSRR	Power Supply Rejection Ratio	C_B = 1.0 µF, f = 120 Hz,V_{RIPPLE} = 200 mVmrs	58		dB
SNR	Signal to Noise Ratio	V_{DD} = 5V, P_{OUT} = 1.1W, R_L= 8Ω, A-Wtd Filter	93		dB

Note 1: All voltages are measured with respect to the ground pins, unlessotherwise specified. All specifications are tested using the typical application as shown in *Figure 1*.

Note 2: *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur. *Operating Ratings* indicate conditionsfor 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 deviceis 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 $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$.For the LM4834MS, T_{JMAX} = 150˚C, and the typical junction-to-ambient thermal resistance, when board mounted, is 95˚C/W assuming the MSA028CB package.

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).

Typical Application

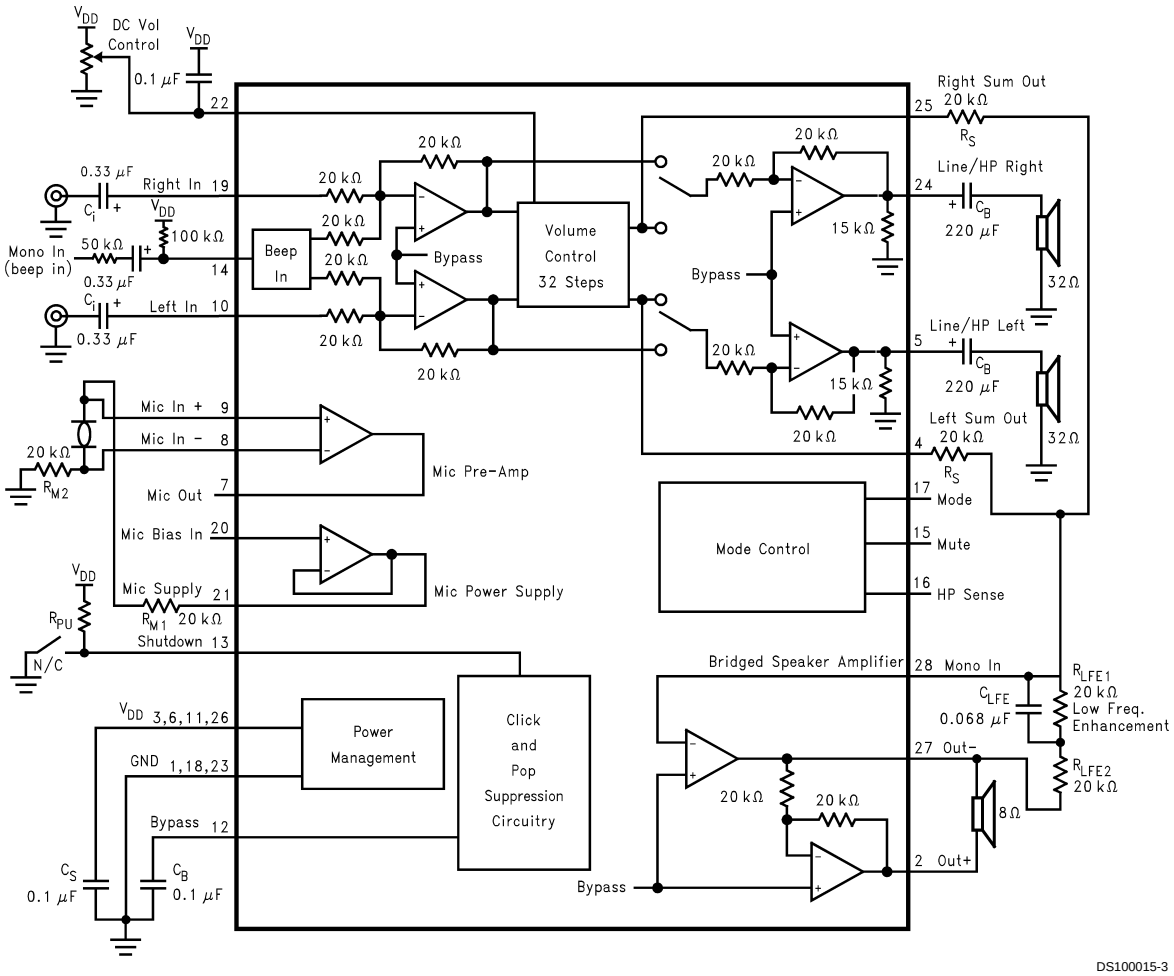

FIGURE 2. Typical Application Circuit

Truth Table for Logic Inputs

Mode	Mute	HP Sense	DC Vol. Control	Line/HP Left	Line/HP Right	Speaker Out
0	0	0	Adjustable	Fixed Level	Fixed Level	Vol. Changes
0	0	1	Adjustable	Fixed Level	Fixed Level	Muted
0	1	X	_	Fixed Level	Fixed Level	Muted
1	0	0	Adjustable	Vol. Changes	Vol. Changes	Vol. Changes
1	0	1	Adjustable	Vol. Changes	Vol. Changes	Muted
1	1	X	_	Muted	Muted	Muted

External Components Description *Figure 2*

Components.		Functional Description
1.	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.
2.	C_S	Supply bypass capacitor which provides power supply filtering. Refer to the **Power Supply Bypassing** section for information concerning proper placement and selection of the supply bypass capacitor.
3.	C_B	Bypass pin capacitor which provides half-supply filtering. Refer to the section, **Proper Selection of External Components**, for information concerning proper placement and selection of C_B.
4.	C_O	Output coupling capacitor which blocks the DC voltage at the amplifiers output. Forms a high pass filter with R_L at $f_o = 1/(2\pi R_L C_O)$.