

LM4863 Boomer® Audio Power Amplifier Series

Dual 2.2W Audio Amplifier Plus Stereo Headphone Function

General Description

The LM4863 is a dual bridge-connected audio power amplifier which, when connected to a 5V supply, will deliver 2.2W to a 4Ω load (Note 1) or 2.5W to a 3Ω load (Note 2) with less than 1.0% THD+N. In addition, the headphone input pin allows the amplifiers to operate in single-ended mode when driving stereo headphones.

Boomer audio power amplifiers were designed specifically to provide high quality output power from a surface mount package while requiring few external components. To simplify audio system design, the LM4863 combines dual bridge speaker amplifiers and stereo headphone amplifiers on one chip.

The LM4863 features an externally controlled, low-power consumption shutdown mode, a stereo headphone amplifier mode, and thermal shutdown protection. It also utilizes circuitry to reduce "clicks and pops" during device turn-on.

Note 1: An LM4863MTE or LM4863LQ that has been properly mounted to a circuit board will deliver 2.2W into 4Ω. The other package options for the LM4863 will deliver 1.1W into 8Ω. See the Application Information sections for further information concerning the LM4863MTE and LM4863LQ.

Note 2: An LM4863MTE or LM4863LQ that has been properly mounted to a circuit board and forced-air cooled will deliver 2.5W into 3Ω.

Key Specifications

- P_O at 1% THD+N
- LM4863LQ, 3Ω, 4Ω loads 2.5W(typ), 2.2W(typ)
- LM4863MTE, 3Ω, 4Ω loads 2.5W(typ), 2.2W(typ)
- LM4863MTE, 8Ω load 1.1W(typ)
- LM4863, 8Ω 1.1W(typ)
- Single-ended mode THD+N at 75mW into 32Ω 0.5%(max)
- Shutdown current 0.7μA(typ)
- Supply voltage range 2.0V to 5.5V

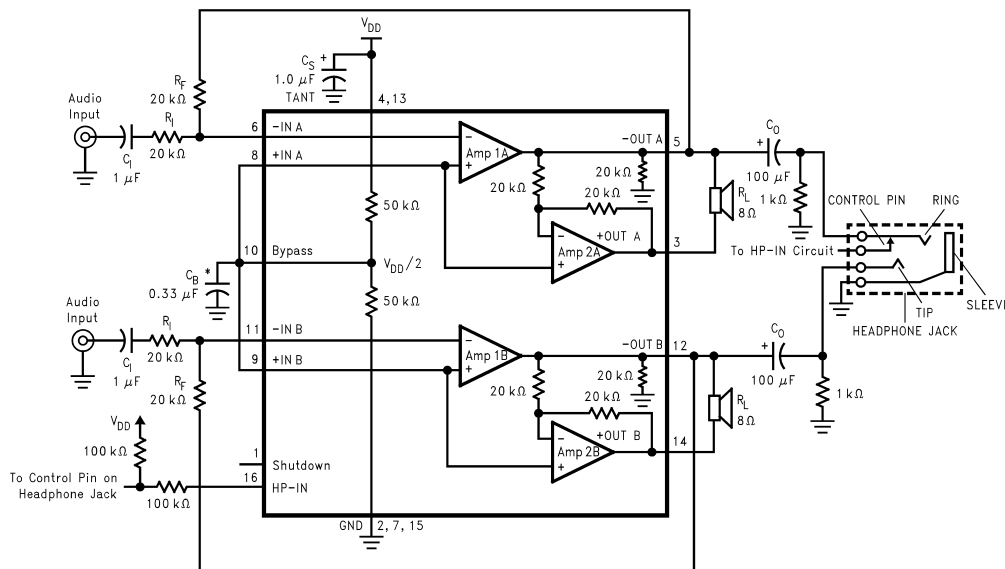
Features

- Stereo headphone amplifier mode
- "Click and pop" suppression circuitry
- Unity-gain stable
- Thermal shutdown protection circuitry
- SOIC, DIP, TSSOP and exposed-DAP TSSOP and LLP packages

Applications

- Multimedia monitors
- Portable and desktop computers
- Portable televisions

Typical Application

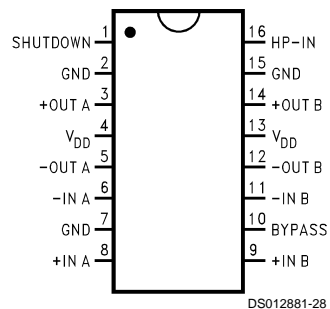


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Note: Pin out shown for DIP and SO packages. Refer to the Connection Diagrams for the pinout of the TSSOP, Exposed-DAP TSSOP, and Exposed-DAP LLP packages.

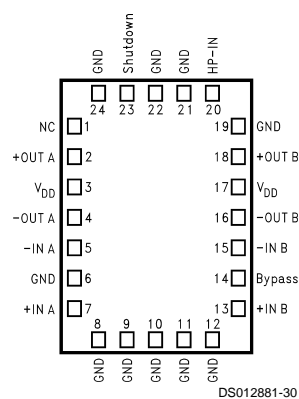
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Connection Diagrams



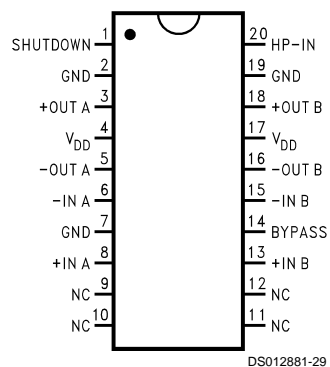
Top View

Order Number LM4863M, LM4863N
See NS Package Number M16B for SO
See NS Package Number N16E for DIP



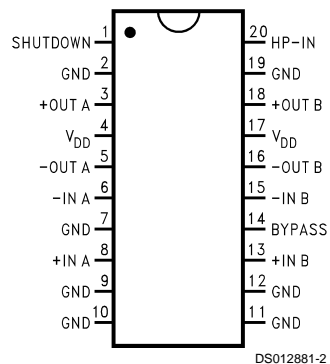
Top View

Order Number LM4863LQ
See NS Package Number LQA24A for Exposed-DAP
LLP



Top View

Order Number LM4863MT
See NS Package Number MTC20 for TSSOP



Top View

Order Number LM4863MTE
See NS Package Number MXA20A for Exposed-DAP
TSSOP

Absolute Maximum Ratings (Note 3)

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 4)	Internally limited
ESD Susceptibility (Note 5)	2000V
ESD Susceptibility (Note 6)	200V
Junction Temperature	150°C
Solder 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} (typ) — M16B	20°C/W
θ_{JA} (typ) — M16B	80°C/W
θ_{JC} (typ) — N16A	20°C/W
θ_{JA} (typ) — N16A	63°C/W
θ_{JC} (typ) — MTC20	20°C/W
θ_{JA} (typ) — MTC20	80°C/W
θ_{JC} (typ) — MXA20A	2°C/W
θ_{JA} (typ) — MXA20A	41°C/W (Note 7)
θ_{JA} (typ) — MXA20A	51°C/W (Note 8)
θ_{JA} (typ) — MXA20A	90°C/W (Note 9)
θ_{JA} (typ) — LQ24A	TBD °C/W (Note 10)
θ_{JA} (typ) — LQ24A	TBD °C/W (Note 11)
θ_{JA} (typ) — LQ24A	TBD °C/W (Note 12)

Operating Ratings

Temperature Range

$$T_{MIN} \leq T_A \leq T_{MAX}$$

Supply Voltage

$$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$$

$$2.0V \leq V_{DD} \leq 5.5V$$

Electrical Characteristics for Entire IC (Notes 3, 13)

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

Symbol	Parameter	Conditions	LM4863		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
V_{DD}	Supply Voltage			2	V (min)
				5.5	V (max)
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V$, $I_O = 0A$ (Note 16), HP-IN = 0V	11.5	20	mA (max)
		$V_{IN} = 0V$, $I_O = 0A$ (Note 16), HP-IN = 4V	5.8	6	mA (min)
I_{SD}	Shutdown Current	V_{DD} applied to the SHUTDOWN pin	0.7	2	μA (min)
V_{IH}	Headphone High Input Voltage			4	V (min)
V_{IL}	Headphone Low Input Voltage			0.8	V (max)

Electrical Characteristics for Bridged-Mode Operation (Notes 3, 13)

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

Symbol	Parameter	Conditions	LM4863		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
V_{OS}	Output Offset Voltage	$V_{IN} = 0V$	5	50	mV (max)
P_O	Output Power (Note 17)	THD+N = 1%, $f = 1\text{kHz}$			
		LM4863MTE, $R_L = 3\Omega$ (Note 18)	2.5		W
		LM4863LQ, $R_L = 3\Omega$ (Note 18)	2.5		W
		LM4863MTE, $R_L = 4\Omega$ (Note 19)	2.2		W
		LM4863LQ, $R_L = 4\Omega$ (Note 19)	2.2		W
		LM4863, $R_L = 8\Omega$	1.1	1.0	W (min)
		THD+N = 10%, $f = 1\text{kHz}$			
		LM4863MTE, $R_L = 3\Omega$ (Note 18)	3.2		W
		LM4863LQ, $R_L = 3\Omega$ (Note 18)	3.2		W
		LM4863MTE, $R_L = 4\Omega$ (Note 19)	2.7		W
		LM4863LQ, $R_L = 4\Omega$ (Note 19)	2.7		W
		LM4863, $R_L = 8\Omega$	1.5		W
		THD+N = 1%, $f = 1\text{kHz}$, $R_L = 32\Omega$	0.34		W

Electrical Characteristics for Bridged-Mode Operation (Notes 3, 13) (Continued)

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

Symbol	Parameter	Conditions	LM4863		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
THD+N	Total Harmonic Distortion+Noise	$20Hz \leq f \leq 20kHz$, $A_{VD} = 2$ LM4863MTE, $R_L = 4\Omega$, $P_O = 2W$ LM4863LQ, $R_L = 4\Omega$, $P_O = 2W$ LM4863, $R_L = 8\Omega$, $P_O = 1W$	0.3 0.3 0.3		%
PSRR	Power Supply Rejection Ratio	$V_{DD} = 5V$, $V_{RIPPLE} = 200mV_{RMS}$, $R_L = 8\Omega$, $C_B = 1.0\mu F$	67		dB
X_{TALK}	Channel Separation	$f = 1kHz$, $C_B = 1.0\mu F$	90		dB
SNR	Signal To Noise Ratio	$V_{DD} = 5V$, $P_O = 1.1W$, $R_L = 8\Omega$	98		dB

Electrical Characteristics for Single-Ended Operation (Notes 3, 4)

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

Symbol	Parameter	Conditions	LM4863		Units (Limits)
			Typical (Note 14)	Limit (Note 15)	
V_{OS}	Output Offset Voltage	$V_{IN} = 0V$	5	50	mV (max)
P_O	Output Power	$THD+N = 0.5\%$, $f = 1kHz$, $R_L = 32\Omega$ $THD+N = 1\%$, $f = 1kHz$, $R_L = 8\Omega$ $THD+N = 10\%$, $f = 1kHz$, $R_L = 8\Omega$	85 340 440	75	mW (min) mW mW
THD+N	Total Harmonic Distortion+Noise	$A_V = -1$, $P_O = 75mW$, $20Hz \leq f \leq 20kHz$, $R_L = 32\Omega$	0.2		%
PSRR	Power Supply Rejection Ratio	$C_B = 1.0\mu F$, $V_{RIPPLE} = 200mV_{RMS}$, $f = 1kHz$	52		dB
X_{TALK}	Channel Separation	$f = 1kHz$, $C_B = 1.0\mu F$	60		dB
SNR	Signal To Noise Ratio	$V_{DD} = 5V$, $P_O = 340mW$, $R_L = 8\Omega$	95		dB

Note 3: 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 4: The maximum power dissipation is dictated by T_{JMAX} , θ_{JA} , and the ambient temperature T_A and must be derated at elevated temperatures. The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$. For the LM4863, $T_{JMAX} = 150^\circ C$. For the θ_{JA} s for different packages, please see the Application Information section or the Absolute Maximum Ratings section.

Note 5: Human body model, 100 pF discharged through a 1.5 k Ω resistor.

Note 6: Machine model, 220 pF–240 pF discharged through all pins.

Note 7: The given θ_{JA} is for an LM4863 packaged in an MXA20A with the exposed–DAP soldered to an exposed 2in² area of 1oz printed circuit board copper.

Note 8: The given θ_{JA} is for an LM4863 packaged in an MXA20A with the exposed–DAP soldered to an exposed 1in² area of 1oz printed circuit board copper.

Note 9: The given θ_{JA} is for an LM4863 packaged in an MXA20A with the exposed–DAP not soldered to printed circuit board copper.

Note 10: The given θ_{JA} is for an LM4863 packaged in an LQA24A with the exposed–DAP soldered to an exposed 2in² area of 1oz printed circuit board copper.

Note 11: The given θ_{JA} is for an LM4863 packaged in an LQA24A with the exposed–DAP soldered to an exposed 1in² area of 1oz printed circuit board copper.

Note 12: The given θ_{JA} is for an LM4863 packaged in an LQA24A with the exposed–DAP not soldered to printed circuit board copper.

Note 13: All voltages are measured with respect to the ground (GND) pins unless otherwise specified.

Note 14: Typical values are measured at 25°C and represent the parametric norm.

Note 15: Limits are guaranteed to National's AOQL (Average Outgoing Quality Level).

Note 16: The quiescent power supply current depends on the offset voltage when a practical load is connected to the amplifier.

Note 17: Output power is measured at the device terminals.

Note 18: When driving 3 Ω loads from a 5V supply, the LM4863LQ and LM4863MTE must be mounted to the circuit board and forced-air cooled (450 linear-feet per minute).

Note 19: When driving 4 Ω loads from a 5V supply, the LM4863LQ and LM4863MTE must be mounted to the circuit board.