

LM4892 Boomer® Audio Power Amplifier Series

1 Watt Audio Power Amplifier with Headphone Sense

General Description

The LM4892 is an audio power amplifier primarily designed for demanding applications in mobile phones and other portable communication device applications. It is capable of delivering 1 watt of continuous average power to an 8 Ω BTL load with less than 1% distortion (THD+N) from a 5V_{DC} power supply. Switching between bridged speaker mode and headphone (single-ended) mode is accomplished using the headphone sense pin.

Boomer audio power amplifiers are designed specifically to provide high quality output power with a minimal amount of external components. The LM4892 does not require output coupling capacitors or bootstrap capacitors, and therefore is ideally suited for mobile phone and other low voltage applications where minimal power consumption is a primary requirement.

The LM4892 features a low-power consumption shutdown mode, which is achieved by driving the shutdown pin with logic low. Additionally, the LM4892 features an internal thermal shutdown protection mechanism.

The LM4892 contains advanced pop & click circuitry which eliminates noise which would otherwise occur during turn-on and turn-off transitions.

The LM4892 is unity-gain stable and can be configured by external gain-setting resistors.

Key Specifications

j PSRR at 217Hz, VDD = 5V, 8 Ω Load	62dB (typ)
j Power Output at 5.0V & 1% THD	1.0W (typ)
j Power Output at 3.3V & 1% THD	400mW (typ)
j Shutdown Current	0.1 μ A (typ)

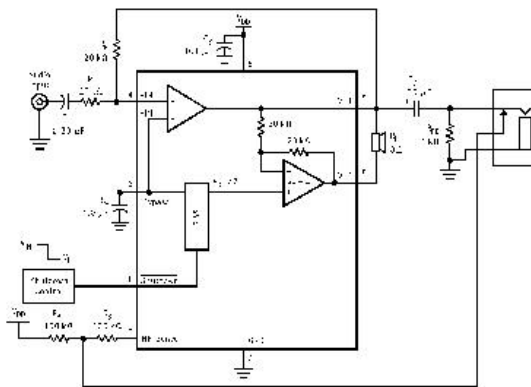
Features

- n Available in space-saving packages: LLP, micro SMD, MSOP, and SOIC
- n Ultra low current shutdown mode
- n BTL output can drive capacitive loads up to 500pF
- n Improved pop & click circuitry eliminates noise during turn-on and turn-off transitions
- n 2.2 - 5.5V operation
- n No output coupling capacitors, snubber networks or bootstrap capacitors required
- n Thermal shutdown protection
- n Unity-gain stable
- n External gain configuration capability
- n Headphone amplifier mode

Applications

- n Mobile Phones
- n PDAs
- n Portable electronic devices

Typical Application

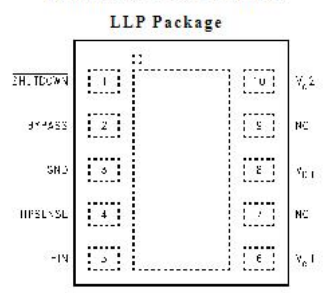
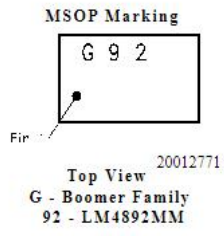
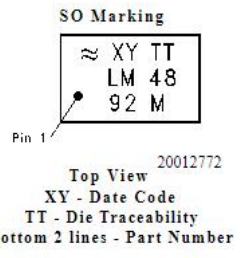
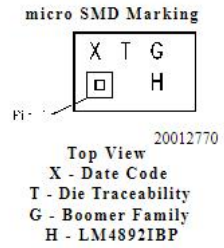
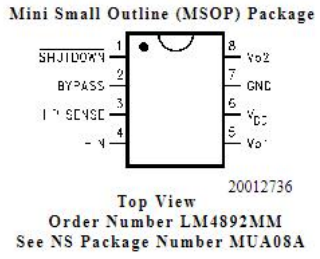
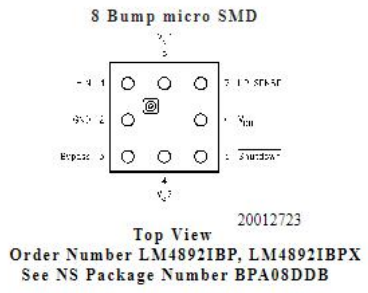


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FIGURE 1. Typical Audio Amplifier Application Circuit (Pin #'s apply toM&MM packages)

LM4892

Connection Diagrams



Absolute Maximum Ratings (Note 2)		θ_{JC} (MSOP)	56°C/W
If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.		θ_{JA} (MSOP)	190°C/W
		θ_{JA} (LLP)	220°C/W (Note 9)
		Soldering Information	
Supply Voltage	6.0V	See AN-1112 'microSMD Wafers Level Chip Scale Package'.	
Storage Temperature	-65°C to +150°C	See AN-1187 'Leadless Leadframe Package (LLP)'.	
Input Voltage	-0.3V to $V_{DD} + 0.3V$		
Power Dissipation (Note 3)	Internally Limited		
ESD Susceptibility (Note 4)	2500V		
ESD Susceptibility (Note 5)	250V		
Junction Temperature	150°C		
Thermal Resistance			
θ_{JC} (SOP)	35°C/W		
θ_{JA} (SOP)	150°C/W		
θ_{JA} (micro SMD)	220°C/W		

Operating Ratings

Temperature Range	$T_{MIN} \leq T_A \leq T_{MAX}$	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$
Supply Voltage		$2.2V \leq V_{DD} \leq 5.5V$

Electrical Characteristics V $V_{DD} = 5V$ (Notes 1, 2)

The following specifications apply for $V_{DD} = 5V, AV = 2$, and Ω load unless otherwise specified. Limits apply for $T_A = 25^\circ\text{C}$.

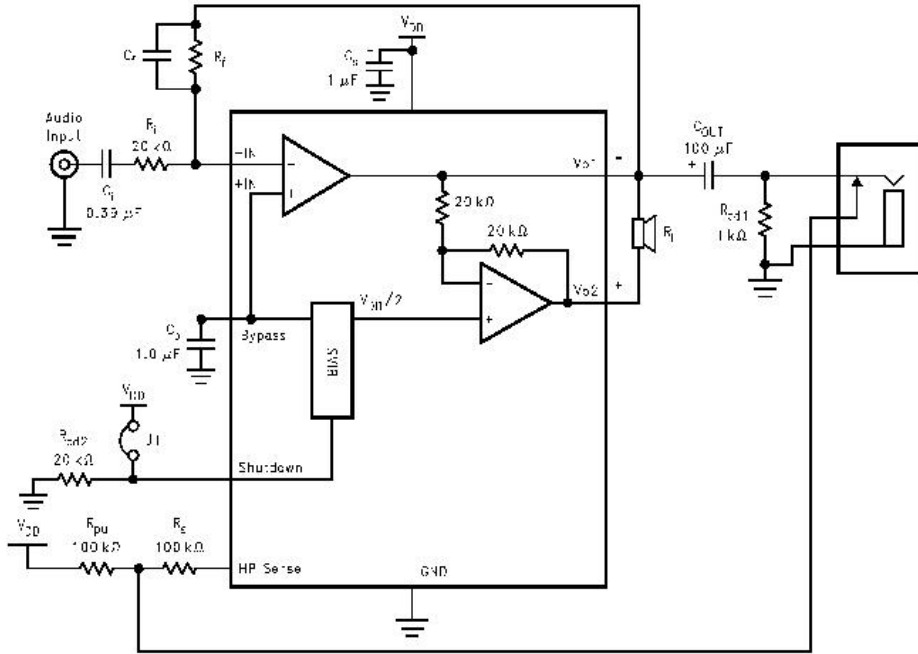
Symbol	Parameter	Conditions	LM4892		Units (Limits)
			Typical	Limit	
			(Note 6)	(Note 7)	
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V, I_o = 0A, HP\ sense = 0V$	4	10	mA (max)
		$V_{IN} = 0V, I_o = 0A, HP\ sense = 5V$	2.5		mA (max)
I_{SD}	Shutdown Current	$V_{shutdown} = GND$ (Note 8)	0.1		μA (max)
P_o	Output Power	THD = 2% (max), $f = 1\text{kHz}$, $R_L = 8\Omega$, HP Sense < 0.8V	1		W
		THD = 1% (max), $f = 1\text{kHz}$, $R_L = 32\Omega$, HP Sense > 4V	90		mW
V_{IH}	HP Sense high input voltage			4	V (min)
V_{IL}	HP Sense low input voltage			0.8	V (max)
THD+N	Total Harmonic Distortion+Noise	$P_o = 0.4\text{ W}_{rms}$; $f = 1\text{kHz}$ 10Hz \leq $BW \leq 80\text{kHz}$	0.1		%
PSSR	Power Supply Rejection Ratio	$V_{ripple} = 200\text{mV}$ sine p-p	62 ($f = 217\text{Hz}$) 66 ($f = 1\text{kHz}$)		dB

Electrical Characteristics V $V_{DD} = 3.3V$ (Notes 1, 2)

The following specifications apply for $V_{DD} = 3.3V, AV = 2$, and Ω load unless otherwise specified. Limits apply for $T_A = 25^\circ\text{C}$.

Symbol	Parameter	Conditions	LM4892		Units (Limits)
			Typical	Limit	
			(Note 6)	(Note 7)	
I_{DD}	Quiescent Power Supply Current	$V_{IN} = 0V, I_o = 0A, HP\ sense = 0V$	3.5		mA (max)
		$V_{IN} = 0V, I_o = 0A, HP\ sense = 3.3V$	2.0		mA (max)
I_{SD}	Shutdown Current	$V_{shutdown} = GND$ (Note 8)	0.1		μA (max)
P_o	Output Power	THD = 1% (max), $f = 1\text{kHz}$, $R_L = 8\Omega$, HP Sense < 0.8V	0.4		W
		THD = 1% (max), $f = 1\text{kHz}$, $R_L = 32\Omega$, HP Sense > 3V	35		mW
V_{IH}	HP Sense high input voltage			2.6	V (min)
V_{IL}	HP Sense low input voltage			0.8	V (max)
THD+N	Total Harmonic Distortion+Noise	$P_o = 0.15\text{ W}_{rms}$; $f = 1\text{kHz}$ 10Hz \leq $BW \leq 80\text{kHz}$	0.1		%

Application Information (Continued)



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FIGURE 3. Higher Gain Audio Amplifier

The LM4892 is unity-gain stable and requires no external components besides gain-setting resistors, an input coupling capacitor, and proper supply bypassing in the typical application. However, if a closed-loop differential gain of greater than 10 is required, a feedback capacitor (C_f) may be needed as shown in Figure 3 to bandwidth limit the amplifier. This feedback capacitor creates a low pass filter that elimi-

nates possible high frequency oscillations. Care should be taken when calculating the -3dB frequency in that an incorrect combination of R_f and C_f will cause rolloff before 20kHz. A typical combination of feedback resistor and capacitor that will not produce audio band high frequency rolloff is $R_f = 20k\Omega$ and $C_f = 25pF$. These components result in a -3dB point of approximately 320 kHz.

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LM4892

Application Information (Continued)

Mono LM4892 Reference Design Boards Bill of Material for all Demo Boards

Part Description	Qty	Ref Designator
LM4892 Audio Amplifier	1	U1
Tantalum Capacitor, 1 μ F	2	Cs, Cb
Ceramic Capacitor, 0.39 μ F	1	Ci
Capacitor, 100 μ F	1	Cout
Resistor, 1 $k\Omega$, 1/10W	1	Rpd
Resistor, 20 $k\Omega$, 1/10W	3	Ri, Rf, Rpu2
Resistor, 100 $k\Omega$, 1/10W	2	Rpu1, Rs
Jumper Header Vertical Mount 2X1, 0.100" spacing	1 J 1	
3.5mm Audio Jack (PC mount, w/o nut), PN# SJS-0357-B Shogyo International Corp. (www.shogyo.com)	1 J 2	

PCB LAYOUT GUIDELINES

This section provides practical guidelines for mixed signal PCB layout that involves various digital/analog power and ground traces. Designers should note that these are only 'rule-of-thumb' recommendations and the actual results will depend heavily on the final layout.

General Mixed Signal Layout Recommendation

Power and Ground Circuits

For 2 layer mixed signal design, it is important to isolate the digital power and ground trace paths from the analog power and ground trace paths. Star trace routing techniques (bringing individual traces back to a central point rather than daisy chaining traces together in a serial manner) can have a major impact on low level signal performance. Star trace routing refers to using individual traces to feed power and ground to each circuit or even device. This technique will require a greater amount of design time but will not increase the final price of the board. The only extra parts required will be some jumpers.

Single-Point Power / Ground Connections

The analog power traces should be connected to the digital traces through a single point (link). A 'Pi-filter' can be helpful in minimizing High Frequency noise coupling between the analog and digital sections. It is further recommended to put digital and analog power traces over the corresponding digital and analog ground traces to minimize noise coupling.

Placement of Digital and Analog Components

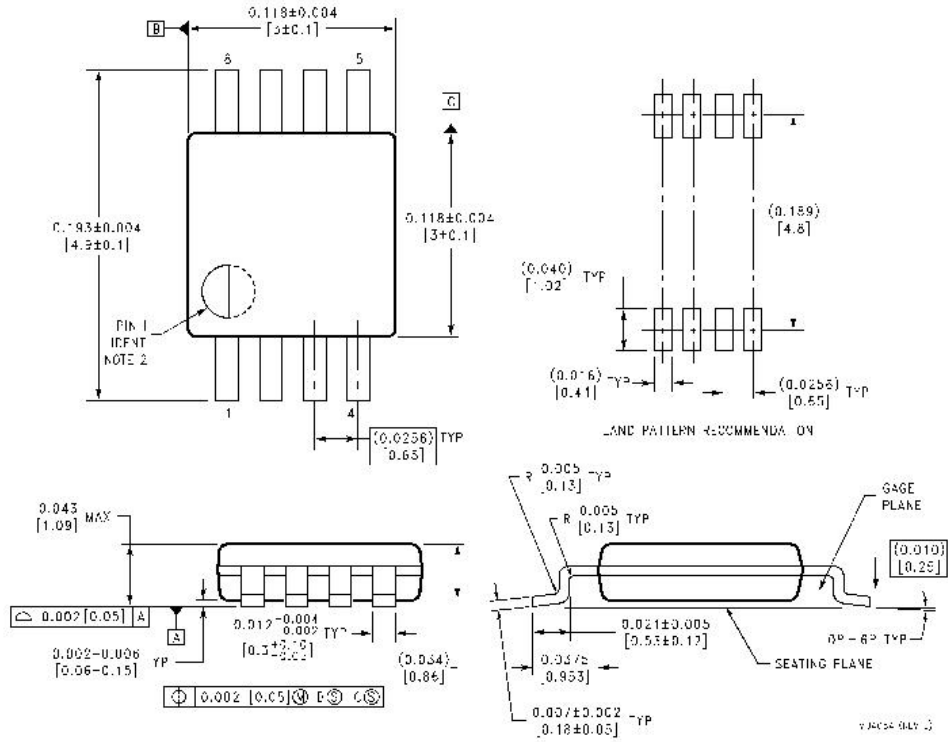
All digital components and high-speed digital signal traces should be located as far away as possible from analog components and circuit traces.

Avoiding Typical Design / Layout Problems

Avoid ground loops or running digital and analog traces parallel to each other (side-by-side) on the same PCB layer. When traces must cross over each other do it at 90 degrees. Running digital and analog traces at 90 degrees to each other from the top to the bottom side as much as possible will minimize capacitive noise coupling and cross talk.

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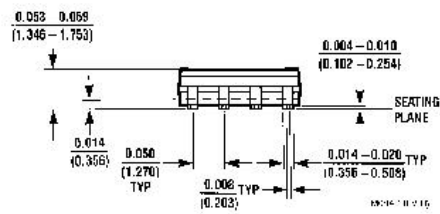
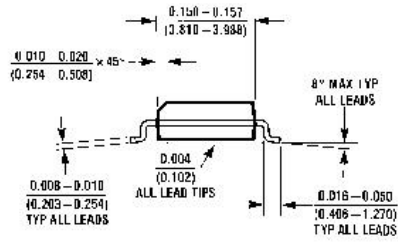
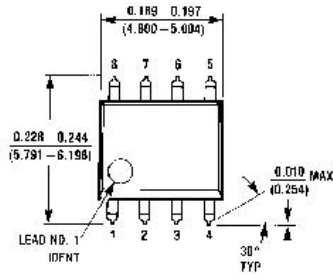
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



MSOP
Order Number LM4892MM
NS Package Number MUA08A

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Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



SO
 Order Number LM4892M
 NS Package Number M08A