

## 低成本 单声道 1W 音频功率放大器

### 产品概述

LN4890 是差分输入音频功率放大电路，适用于移动电话和其他内置扬声器的便携式音频设备。它能够为  $8\Omega$  负载提供 1W 功率的稳定输出，5V 电源供电的条件下其总谐波失真和噪声不超过 1%。LN4890 采用桥接负载结构在提供高品质音频功率放大的同时，大大减少了外部元件数，无需外接输出耦合电容和自举电容。

LN4890 内置待机电路，当 SHUTDOWN 管脚接低电平时，整个电路工作在待机模式，待机电流不超过 100nA。LN4890 内置了杂音消除电路，可以消除芯片启动和关断过程中的咔嚓声或噼啪声。还可以通过外接电阻来调节增益。

### 关键指标

- PSRR @ $f_{in}=217\text{Hz}$ , VDD=5V                      62dB(typ.)
- 功率输出@VDD=5V & 1% THD                      1W(typ.)
- 功率输出@VDD=3V & 1% THD                      400mW(typ.)
- 关断电流    0.1uA(typ.)

### 订购信息

#### LN4890XY

项目	符号	描述
X		封装类型
	MM	MSOP-8
	M	SOP-8
Y	A	输入大于 5.2V 时自动关闭
	C	没有高压自动关闭功能
	D	没有高压自动关闭功能，且高压情况下增益自动降低至 1 倍

### 额定工

工作温度范围	-----	$T_{MIN} \leq T_A \leq T_{MAX}$ -40°C $\leq$ TA $\leq$ 85°C
工作电压范围	-----	2.2V $\leq$ VDD $\leq$ 5.0V

### 作参数

### 用途

- 移动电话
- PDA
- 便携电子设备

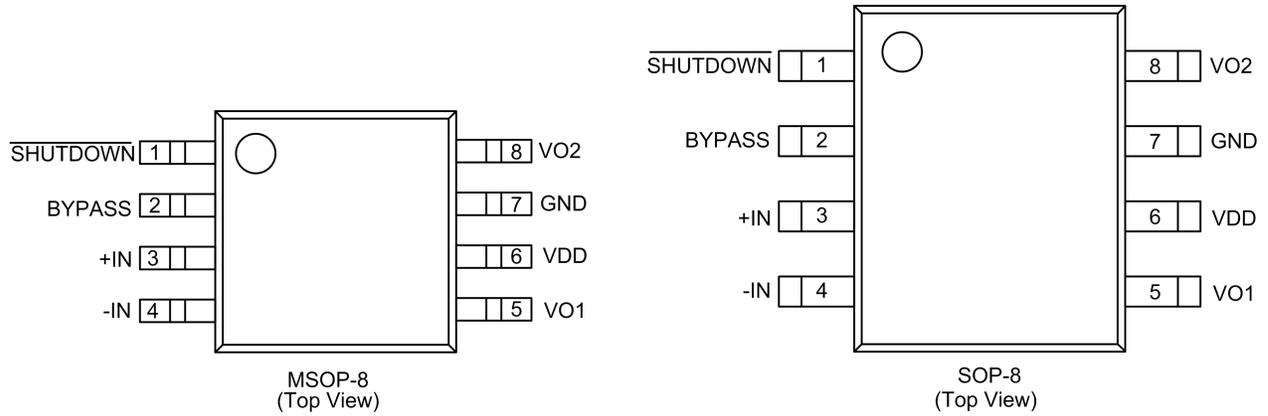
### 产品特点

- 工作电压范围宽：2.2—5.0V
- 无需输出耦合电容、缓冲网络或自举电容
- 热保护功能
- 内部增益固定，外部增益可调
- 超小型封装
- 100nA 的低功耗关断模式
- BTL 输出可以驱动容性负载
- 上电/断电时无咔嚓声或噼啪声

### 封装

- MSOP-8
- SOP-8

## 引脚配置

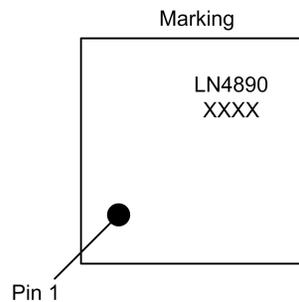


## 引脚功能描述

引脚号	引脚名称	功能描述
1	SHUTDOWN	芯片使能端（低有效）
2	BYPASS	旁路电容输入端
3	+IN	正输入端（差分+）
4	-IN	负输入端（差分-）
5	VO1	负输出端（差分-）
6	VDD	电源输入端
7	GND	接地端
8	VO2	正输出端（差分+）

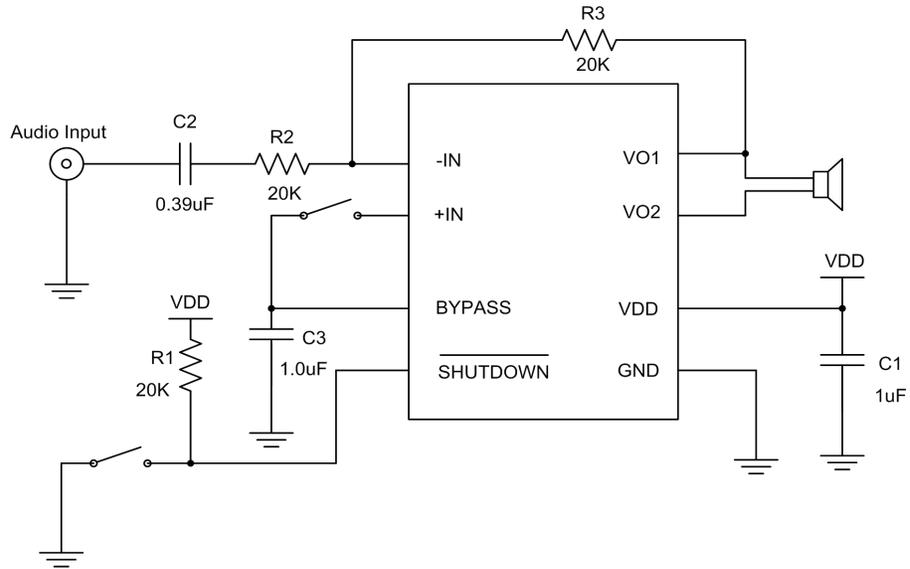
## 打印信息

- MSOP-8、SOP-8



XXXX: 封装批号

■ 典型应用电路图



■ 绝对最大额定值

项目	符号	值	单位
工作电压	VDD	-0.3—5.0	V
输入电压	VIN	-0.3—VDD+0.3	V
工作温度	Topr	-40—85	°C
贮存温度	Tstg	-65—150	°C
ESD 参数	-	2000	V



$V_{SDIH}$	关断电压 输入高电平		1.2	—	—	V
$V_{SDIL}$	关断电压 输入低电平		—	—	0.4	V
$V_{OS}$	输出失调电压		—	7	50	mV
$R_{OUT-GND}$	输出电阻		7.0	8.5	9.7	k $\Omega$
$P_O$	输出功率	THD = 2% (max); f = 1 kHz 8 $\Omega$ Load	0.8	1.0	—	W
$T_{WU}$	启动时间		—	170	220	ms
$T_{SD}$	热关断温度		150	170	190	$^{\circ}$ C
THD+N	总谐波失真 +噪声	$P_O = 0.4$ Wrms; f = 1kHz	—	0.1	—	%
PSRR	电源抑制比	$V_{ripple} = 200mV_{sine\ p-p}$ f=217Hz	55	62	—	dB
		$V_{ripple} = 200mV_{sine\ p-p}$ f=1kHz		66		
$T_{SDT}$	关断时间	8 $\Omega$ Load	—	1.0	—	ms

VDD=3V

(除非特别说明,  $T_a=25^{\circ}$ C)

符号	参数	测试条件	最小	典型	最大	单位
$I_{DD}$	静态电流	$V_{IN} = 0V, I_o = 0A, No\ Load$	—	3.5	7	mA
		$V_{IN} = 0V, I_o = 0A, 8\Omega\ Load$	—	4.5	9	mA
$I_{SD}$	关断电流	$V_{SHUTDOWN} = 0V$	—	0.1	2	$\mu$ A

$V_{SDIH}$	关断电压 输入高电平		1.2	—	—	V
$V_{SDIL}$	关断电压 输入低电平		—	—	0.4	V
$V_{OS}$	输出失调电压		—	7	50	mV
$R_{OUT-GND}$	输出电阻		7.0	8.5	9.7	k $\Omega$
$P_O$	输出功率	THD = 2% (max); f = 1 kHz 8 $\Omega$ Load	0.28	0.31	—	W
$T_{WU}$	启动时间		—	170	220	ms
$T_{SD}$	热关断温度		150	170	190	$^{\circ}C$
THD+N	总谐波失真 +噪声	$P_O = 0.4 W_{rms}$ ; f = 1kHz	—	0.1	—	%
PSRR	电源抑制比	$V_{ripple} = 200mV_{sine\ p-p}$ f=217Hz	45	56	—	dB
		$V_{ripple} = 200mV_{sine\ p-p}$ f=1kHz		62		

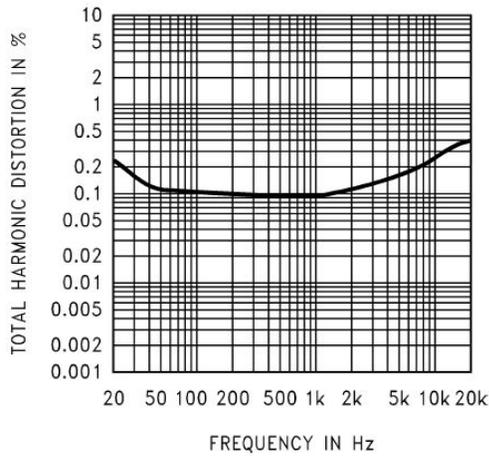
**VDD=2.6V**

 (除非特别说明,  $T_a=25^{\circ}C$ )

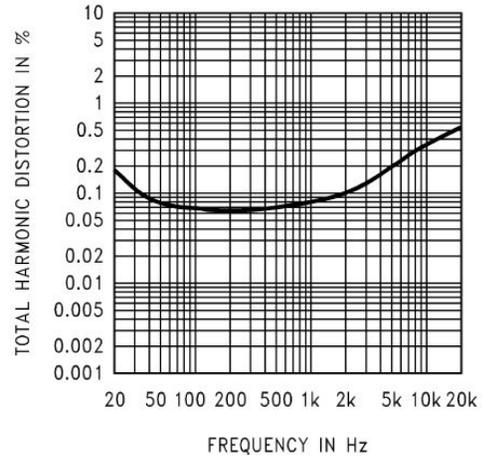
符号	参数	测试条件	最小	典型	最大	单位	
$I_{DD}$	静态电流	$V_{IN} = 0V, I_o = 0A, No\ Load$	—	2.6	5.5	mA	
$I_{SD}$	关断电流	$V_{SHUTDOWN} = 0V$	—	0.1	2	$\mu A$	
$P_O$	输出功率	THD = 1% (max); f = 1 kHz	8 $\Omega$ Load	—	0.2	—	W
			4 $\Omega$ Load		0.22		
THD+N	总谐波失真 +噪声	$P_O = 0.1 W_{rms}$ ; f = 1kHz	—	0.08	—	%	
PSRR	电源抑制比	$V_{ripple} = 200mV_{sine\ p-p}$ f=217Hz	—	44	—	dB	
		$V_{ripple} = 200mV_{sine\ p-p}$ f=1kHz		44			

## ■ 特性曲线

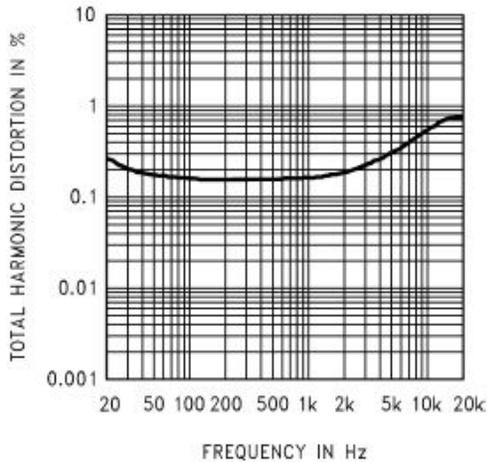
**THD+N vs Frequency**  
at  $V_{DD} = 5V$ ,  $8\Omega R_L$ , and  $PWR = 250mW$ ,  $A_V = 2$



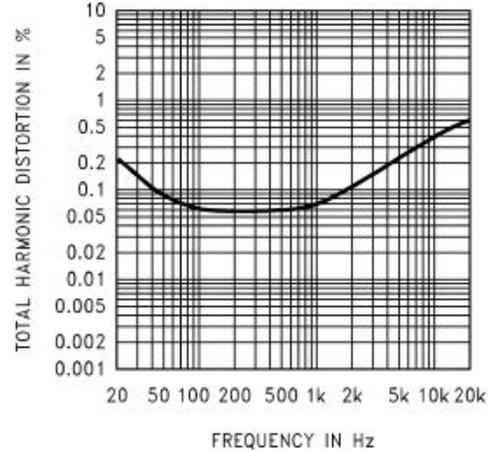
**THD+N vs Frequency**  
at  $V_{DD} = 3.3V$ ,  $8\Omega R_L$ , and  $PWR = 150mW$ ,  $A_V = 2$



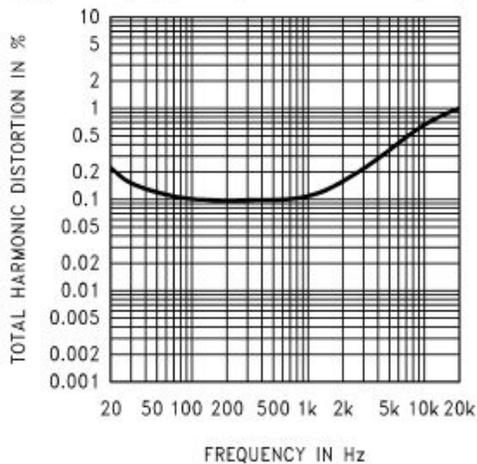
**THD+N vs Frequency**  
at  $V_{DD} = 3V$ ,  $R_L = 8\Omega$ ,  $PWR = 250mW$ ,  $A_V = 2$



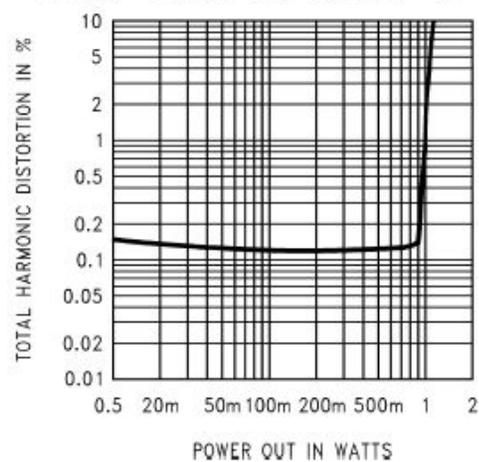
**THD+N vs Frequency**  
@  $V_{DD} = 2.6V$ ,  $R_L = 8\Omega$ ,  $PWR = 100mW$ ,  $A_V = 2$



**THD+N vs Frequency**  
@  $V_{DD} = 2.6V$ ,  $R_L = 4\Omega$ ,  $PWR = 100mW$ ,  $A_V = 2$

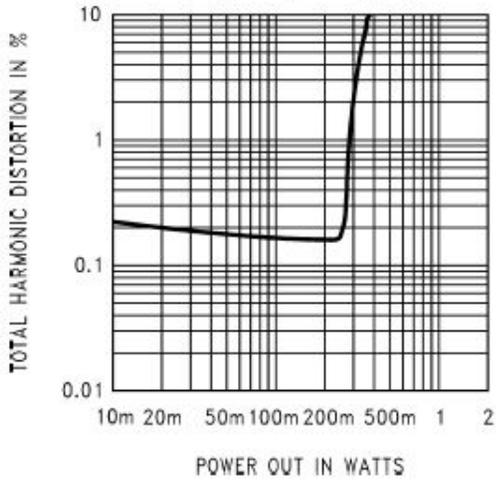


**THD+N vs Power Out**  
@  $V_{DD} = 5V$ ,  $R_L = 8\Omega$ ,  $1kHz$ ,  $A_V = 2$



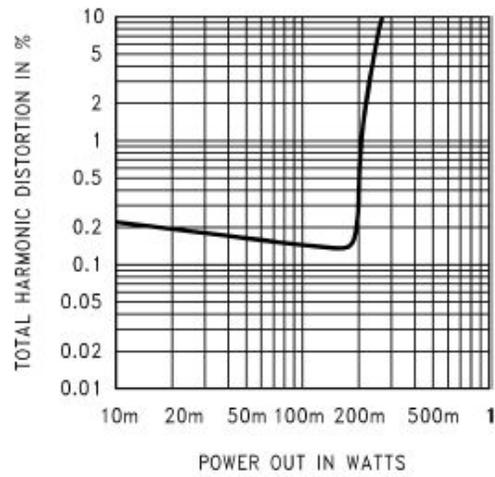
THD+N vs Power Out

@  $V_{DD} = 3V, R_L = 8\Omega, 1kHz, A_V = 2$



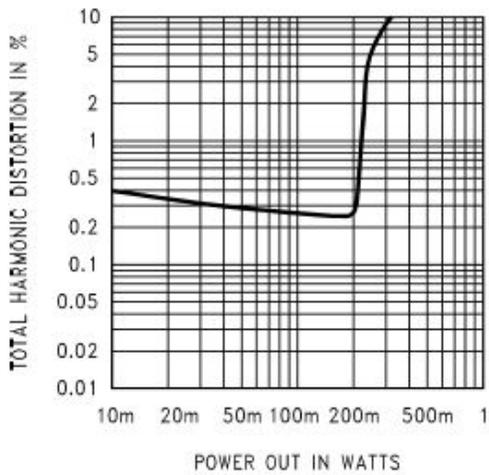
THD+N vs Power Out

@  $V_{DD} = 2.6V, R_L = 8\Omega, 1kHz, A_V = 2$



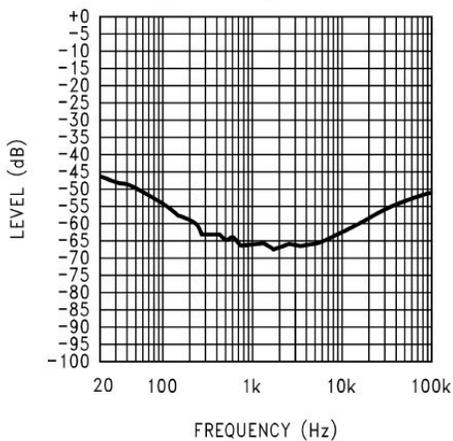
THD+N vs Power Out

@  $V_{DD} = 2.6V, R_L = 4\Omega, 1kHz, A_V = 2$



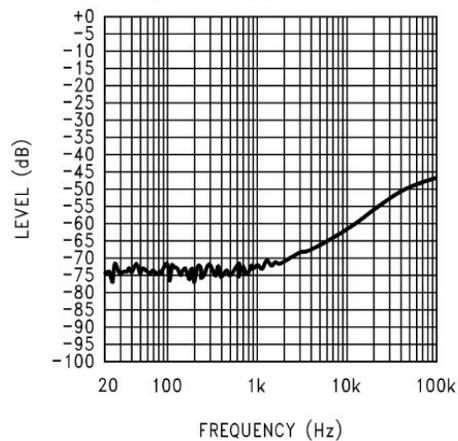
Power Supply Rejection Ratio (PSRR) @  $A_V = 2$

$V_{DD} = 5V, V_{ripple} = 200mvp-p$   
 $R_L = 8\Omega, R_{IN} = 10\Omega$



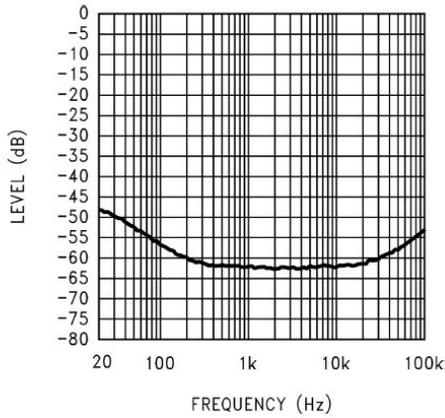
Power Supply Rejection Ratio (PSRR) @  $A_V = 2$

$V_{DD} = 5V, V_{ripple} = 200mvp-p$   
 $R_L = 8\Omega, R_{IN} = Float$



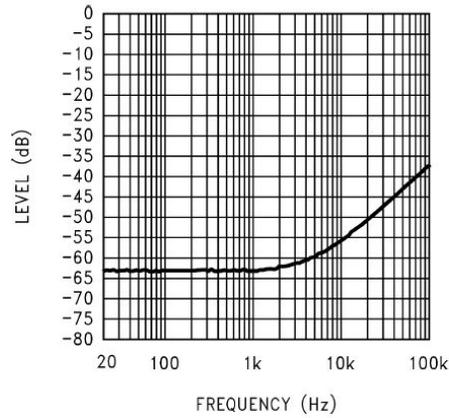
Power Supply Rejection Ratio (PSRR) @  $A_V = 4$

$V_{DD} = 5V$ ,  $V_{ripple} = 200mvp-p$   
 $R_L = 8\Omega$ ,  $R_{IN} = 10\Omega$



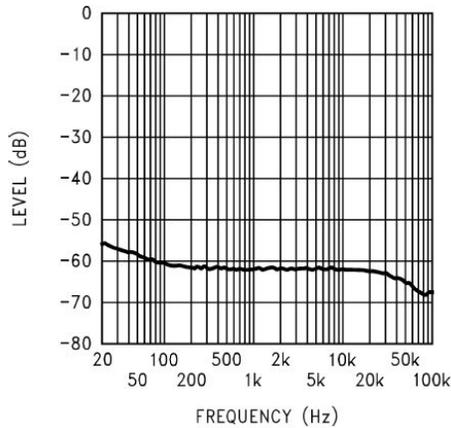
Power Supply Rejection Ratio (PSRR) @  $A_V = 4$

$V_{DD} = 5V$ ,  $V_{ripple} = 200mvp-p$   
 $R_L = 8\Omega$ ,  $R_{IN} = \text{Float}$



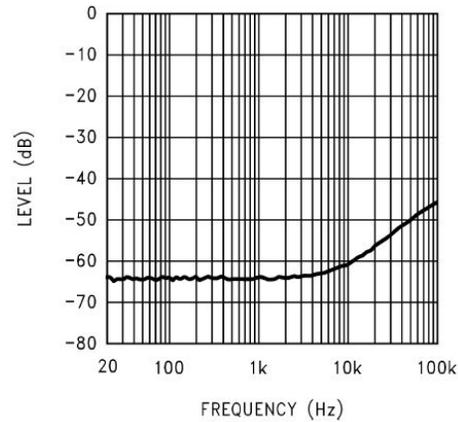
Power Supply Rejection Ratio (PSRR) @  $A_V = 2$

$V_{DD} = 3V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = 10\Omega$



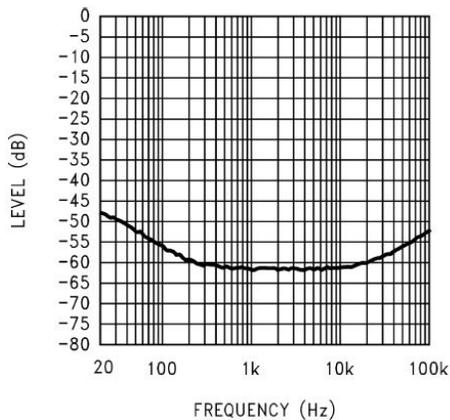
Power Supply Rejection Ratio (PSRR) @  $A_V = 2$

$V_{DD} = 3V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = \text{Float}$



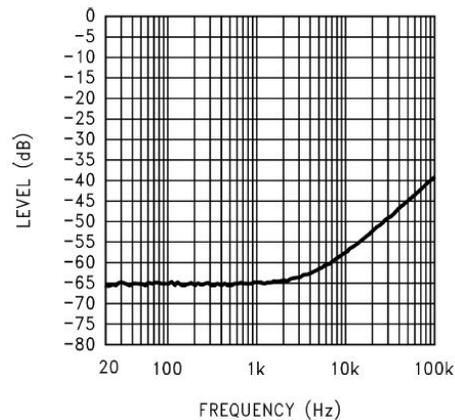
Power Supply Rejection Ratio (PSRR) @  $A_V = 4$

$V_{DD} = 3V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = 10\Omega$



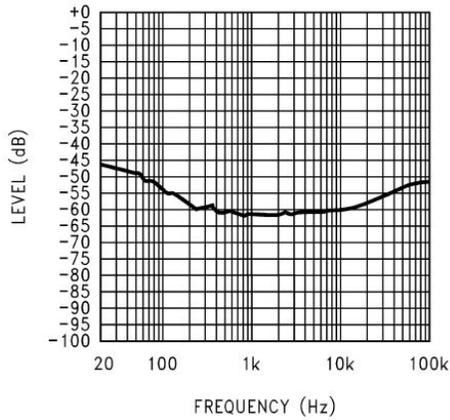
Power Supply Rejection Ratio (PSRR) @  $A_V = 4$

$V_{DD} = 3V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = \text{Float}$



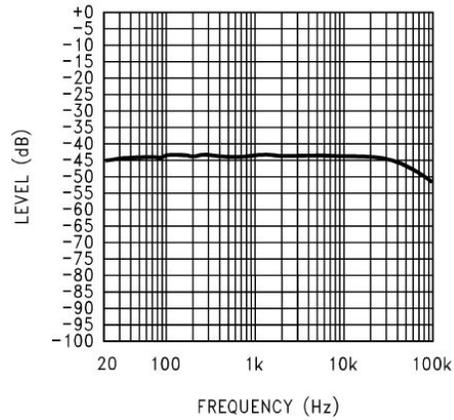
**Power Supply Rejection Ratio (PSRR) @  $A_V = 2$**

$V_{DD} = 3.3V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = 10\Omega$



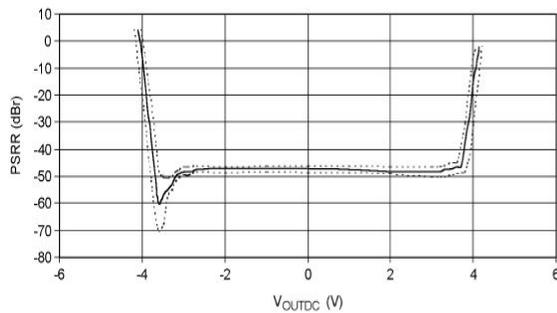
**Power Supply Rejection Ratio (PSRR) @  $A_V = 2$**

$V_{DD} = 2.6V$ ,  $V_{ripple} = 200mvp-p$ ,  
 $R_L = 8\Omega$ ,  $R_{IN} = 10\Omega$



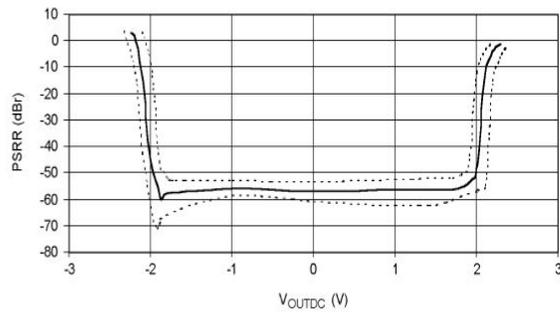
**PSRR vs DC Output Voltage**

$V_{DD} = 5V$ ,  $A_V = 10$



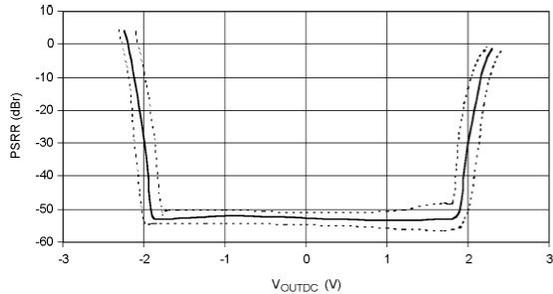
**PSRR vs DC Output Voltage**

$V_{DD} = 3V$ ,  $A_V = 2$



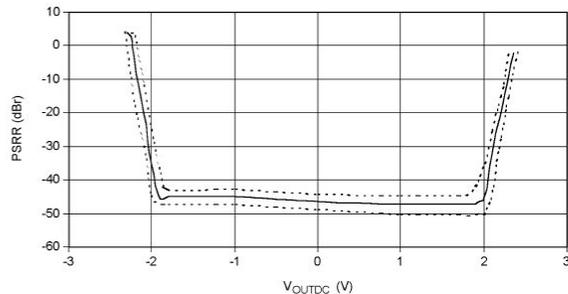
**PSRR vs DC Output Voltage**

$V_{DD} = 3V$ ,  $A_V = 4$



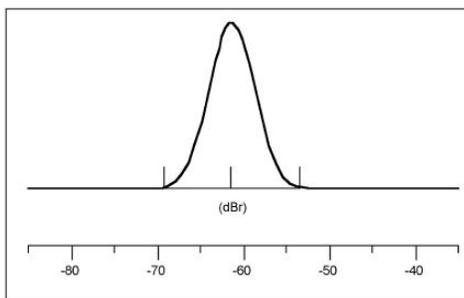
**PSRR vs DC Output Voltage**

$V_{DD} = 3V$ ,  $A_V = 10$



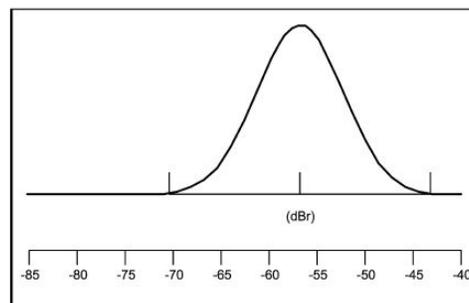
**PSRR Distribution  $V_{DD} = 5V$**

217Hz, 200mvp-p,  
-30, +25, and +80°C



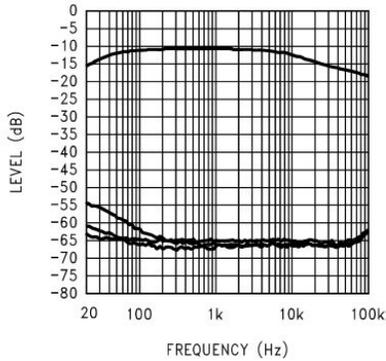
**PSRR Distribution  $V_{DD} = 3V$**

217Hz, 200mvp-p,  
-30, +25, and +80°C



Power Supply Rejection Ratio vs Bypass Capacitor Size

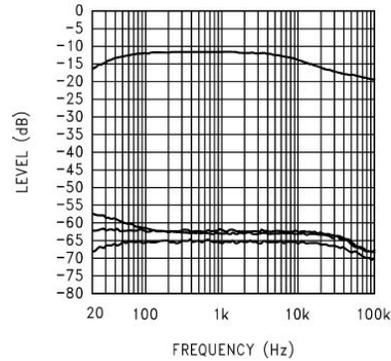
$V_{DD} = 5V$ , Input Grounded =  $10\Omega$ , Output Load =  $8\Omega$



Top Trace = No Cap, Next Trace Down =  $1\mu f$   
Next Trace Down =  $2\mu f$ , Bottom Trace =  $4.7\mu f$

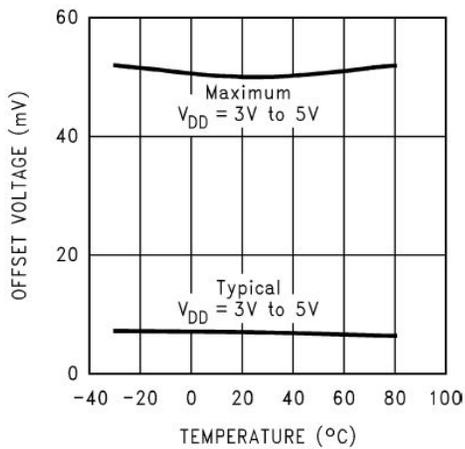
Power Supply Rejection Ratio vs Bypass Capacitor Size

$V_{DD} = 3V$ , Input Grounded =  $10\Omega$ , Output Load =  $8\Omega$

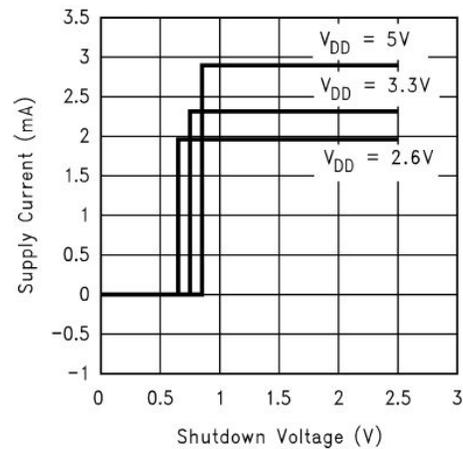


Top Trace = No Cap, Next Trace Down =  $1\mu f$   
Next Trace Down =  $2\mu f$ , Bottom Trace =  $4.7\mu f$

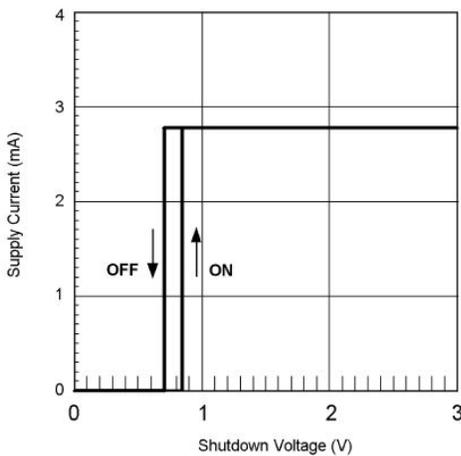
Output Offset Voltage



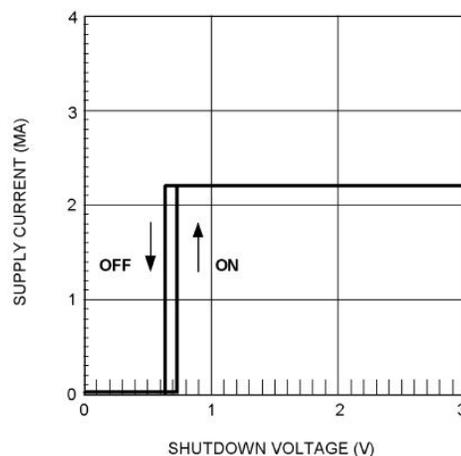
Supply Current vs Shutdown Voltage



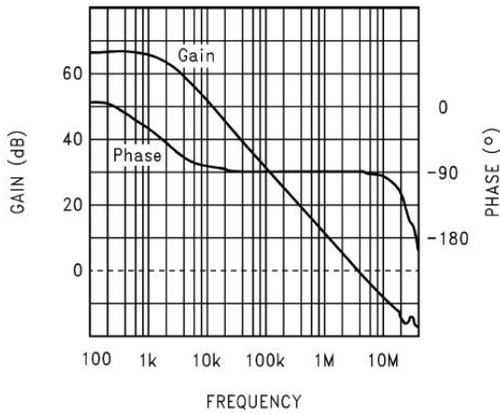
Shutdown Hysteresis Voltage  
 $V_{DD} = 5V$



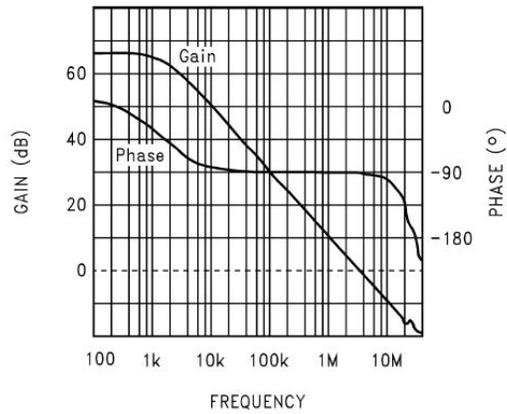
Shutdown Hysteresis Voltage  
 $V_{DD} = 3V$



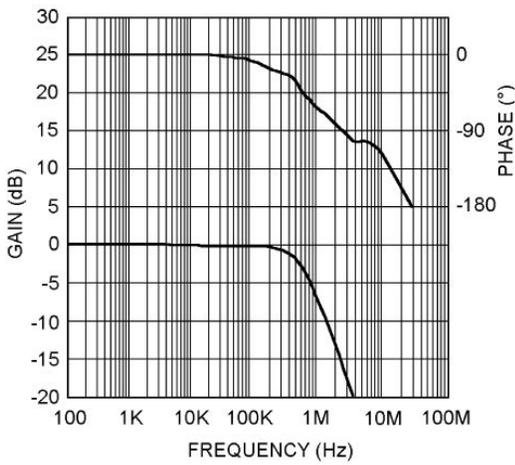
Open Loop Frequency Response  
 $V_{DD} = 5V$ , No Load



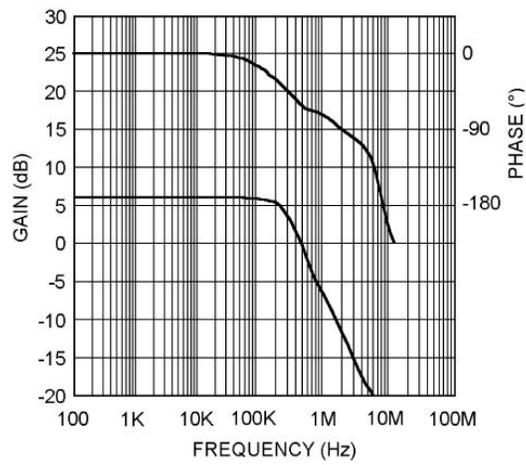
Open Loop Frequency Response  
 $V_{DD} = 3V$ , No Load



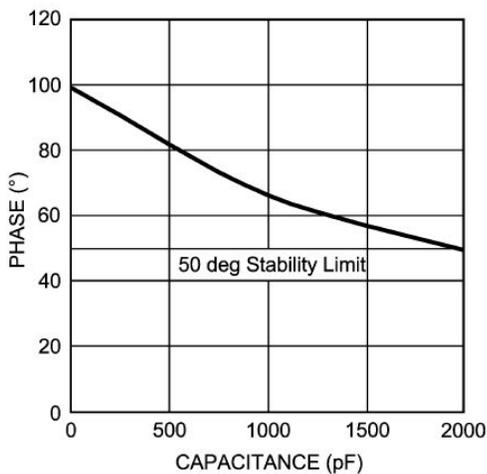
Gain / Phase Response,  $A_V = 2$   
 $V_{DD} = 5V$ ,  $8\Omega$  Load,  $C_{LOAD} = 500pF$



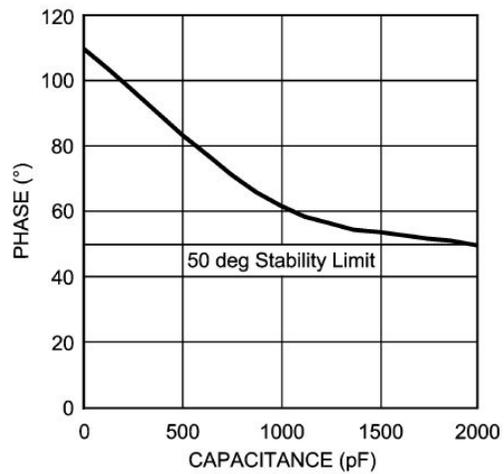
Gain / Phase Response,  $A_V = 4$   
 $V_{DD} = 5V$ ,  $8\Omega$  Load,  $C_{LOAD} = 500pF$



Phase Margin vs  $C_{LOAD}$ ,  $A_V = 2$   
 $V_{DD} = 5V$ ,  $8\Omega$  Load  
Capacitance to gnd on each output

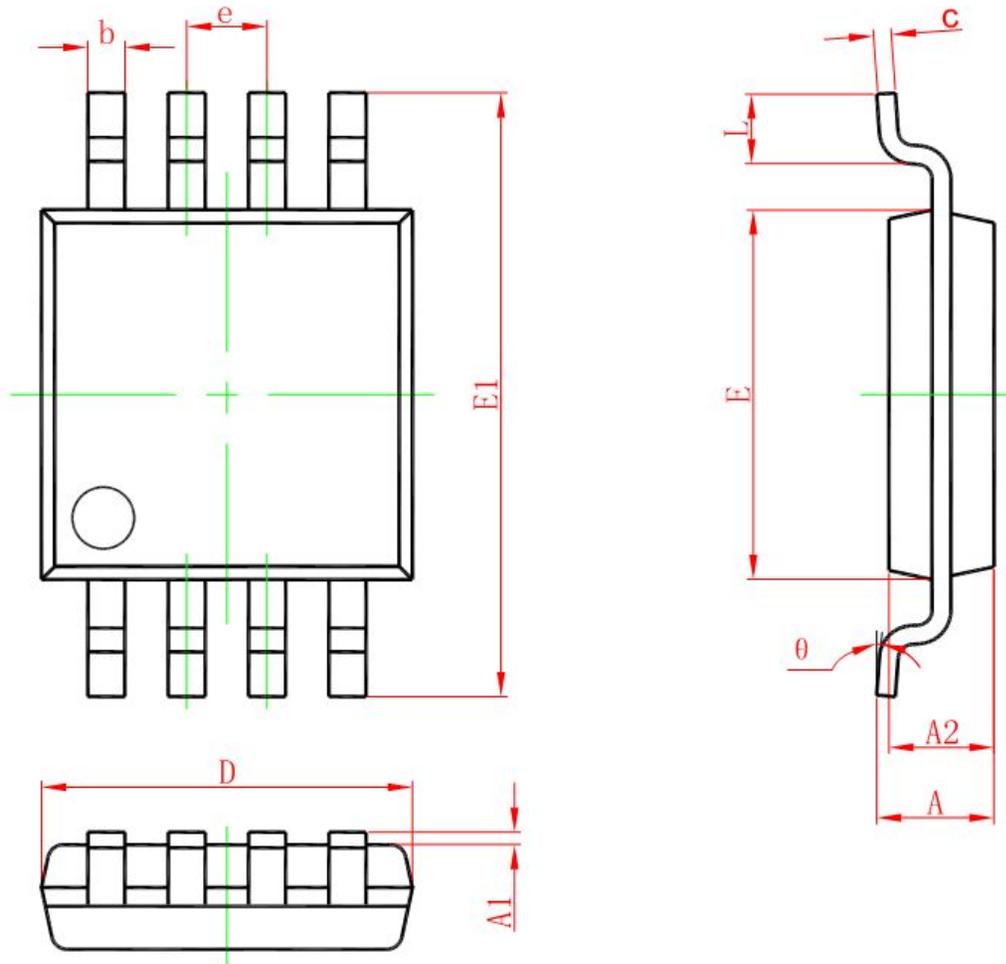


Phase Margin vs  $C_{LOAD}$ ,  $A_V = 4$   
 $V_{DD} = 5V$ ,  $8\Omega$  Load  
Capacitance to gnd on each output



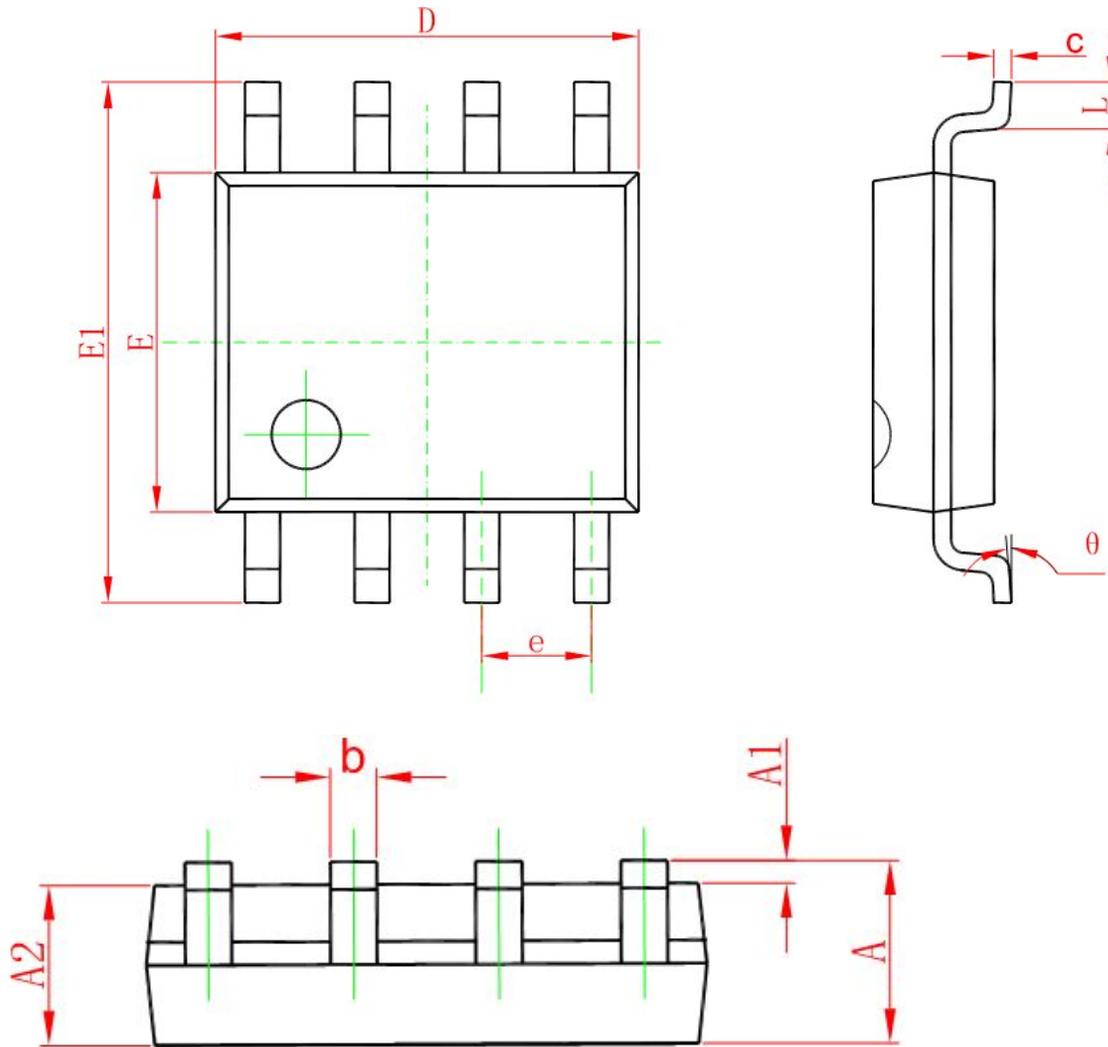
■ 封装信息

● MSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

● SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
theta	0° to 8°		0° to 8°	