Specification

U4890 1 W Differential Audio Power Amplifiers

n Description

The U4890 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 8Ω BTL load with less than 1% distortion (THD+N) from a 5V DC power supply. Boomer audio power amplifiers were designed specifically to provide high
quality output power with a minimal amount of external components. The U4890 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 U4890 features a low-power consumption shutdown mode, which is achieved by driving the shutdown pin with logic low. Additionally, the U4890 features an internal thermal shutdown protection mechanism. The U4890 contains advanced pop & click circuitry which eliminates noises which would otherwise occur during turn-on and turn-off transitions. The U4890 is unity-gain stable and can be configured by external gain-setting resistors.

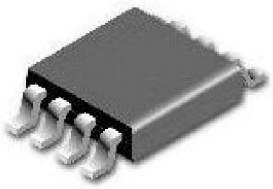
n Features

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

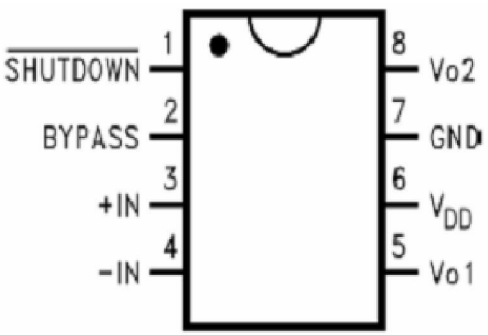
n Applications

- Mobile Phones
- PDAs
- Portable electronic devices

n Package Information



n Pin Configuration



n TYPICAL APPLICATION

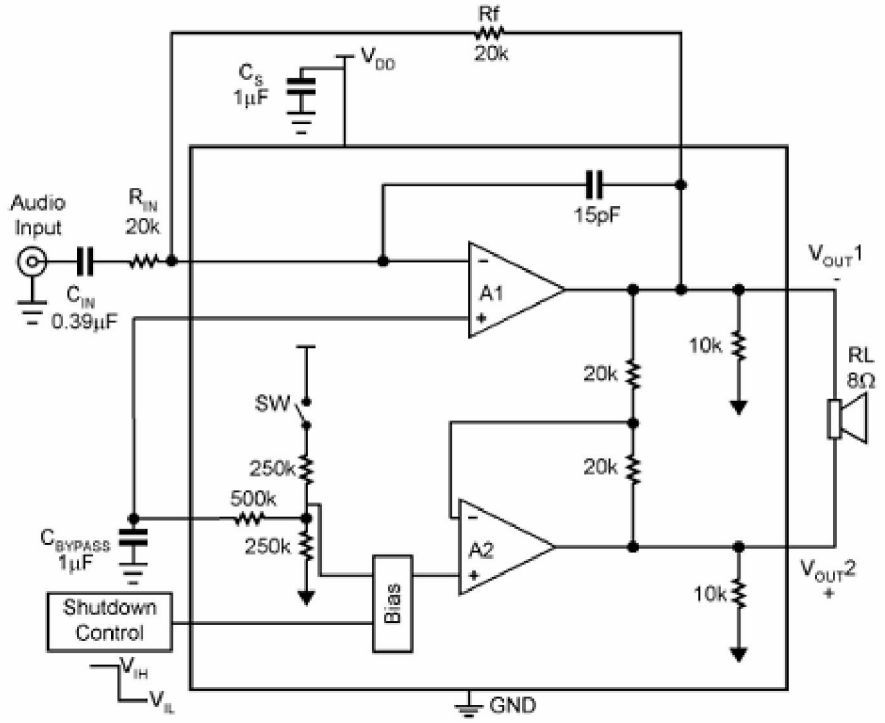


Figure 1

n Absolute Maximum Ratings (T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.3 – 6.0	V
Input Voltage	V_{IN}	-0.3 – V_{DD}+0.3	V
ESD Susceptibility	-	2000	V
Operating Temperature	T_{opr}	-40 to +85	°C
Storage Temperature	R_{stg}	-65 to +150	°C

n Electrical Characteristics

(V_{DD} = 5V Unless otherwise specified. Limits apply for T_A = 25°C.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Quiescent Power Supply Current	I_{DD}	VIN = 0V, Io = 0A, No Load	—	4	8	mA
		VIN = 0V, Io = 0A, 8Ω Load	—	5	10	mA
Shutdown Current	I_{SD}	VSHUTDOWN = 0V	—	0.1	2	µA
Shutdown Voltage Input High	V_{SDIH}		1.2	—	—	V
Shutdown Voltage Input Low	V_{SDIL}		—	—	0.4	V
Output Ofsett Voltage	V_{OS}		—	7	50	mV
Resistor Output to GND	$R_{OUT-GND}$		7.0	8.5	9.7	kΩ

Output Power (8Ω)	P_O	THD = 2% (max); f = 1 kHz8Ω Load	0.8	1.0	—	W
Wake-up time	T_{WU}		—	170	220	ms
Thermal Shutdown Temperature	T_{SD}		150	170	190	℃
Total Harmonic Distortion+Noise	THD+N	Po = 0.4 Wrms; f = 1kHz	—	0.1	—	%
Power Supply Rejection Ratio	PSRR	V_{ripple} = 200mV sine p-p f=217Hz	55	62	—	dB
		V_{ripple} = 200mV sine p-p f=1kHz		66		
Shut Down Time	T_{SDT}	8Ω Load	—	1.0	—	ms

(V_{DD} = 3V Unless otherwise specified. Limits apply for T_A = 25°C.)

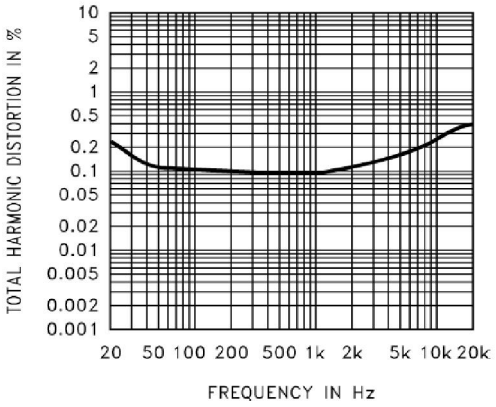
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Quiescent Power Supply Current	I_{DD}	VIN = 0V, Io = 0A, No Load	—	3.5	7	mA
		VIN = 0V, Io = 0A, 8Ω Load	—	4.5	9	mA
Shutdown Current	I_{SD}	VSHUTDOWN = 0V	—	0.1	2	μA
Shutdown Voltage Input High	V_{SDIH}		1.2	—	—	V
Shutdown Voltage Input Low	V_{SDIL}		—	—	0.4	V
Output Ofsett Voltage	V_{OS}		—	7	50	mV
Resistor Output to GND	$R_{OUT-GND}$		7.0	8.5	9.7	kΩ
Output Power (8Ω)	P_O	THD = 2% (max); f = 1 kHz 8Ω Load	0.28	0.31	—	W
Wake-up time	T_{WU}		—	170	220	ms
Thermal Shutdown Temperature	T_{SD}		150	170	190	℃
Total Harmonic Distortion+Noise	THD+N	Po = 0.4 Wrms; f = 1kHz	—	0.1	—	%
Power Supply Rejection Ratio	PSRR	V_{ripple} = 200mV sine p-p f=217Hz	45	56	—	dB
		V_{ripple} = 200mV sine p-p f=1kHz		62		

(V_{DD} = 3V Unless otherwise specified. Limits apply for T_A = 25°C.)

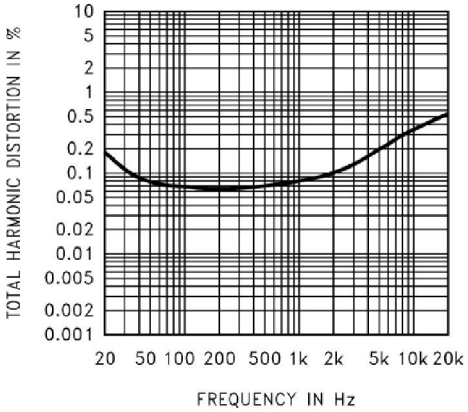
Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Quiescent Power Supply Current	I_{DD}	VIN = 0V, Io = 0A, No Load		—	2.6	5.5	mA
	I_{SD}	VSHUTDOWN = 0V		—	0.1	2	μA
Output Power (8Ω)	PO	THD = 1% (max); f = 1 kHz	8Ω Load		0.2	—	W
			4Ω Load		0.22		
Total Harmonic Distortion+Noise	THD+N	Po = 0.1 Wrms; f = 1kHz		—	0.08	—	%
Power Supply Rejection Ratio	PSRR	V_{ripple} = 200mV sine p-p f=217Hz		—	44	—	dB
		V_{ripple} = 200mV sine p-p f=1kHz			44		

n Typical Performance Characteristics

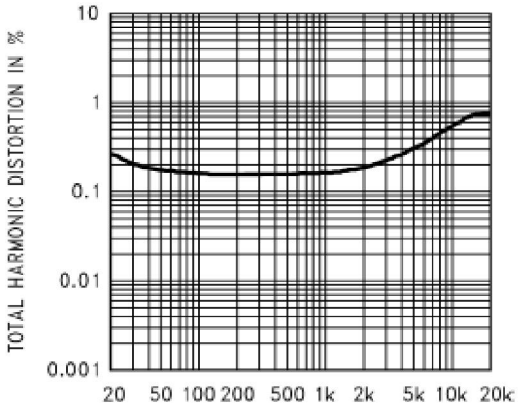
THD+N vs Frequency
at V_{DD} = 5V, 8Ω R_L, and PWR = 250mW, A_V = 2



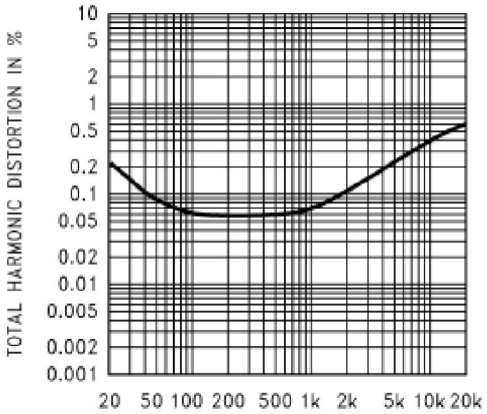
THD+N vs Frequency
at V_{DD} = 3.3V, 8Ω R_L, and PWR = 150mW, A_V = 2



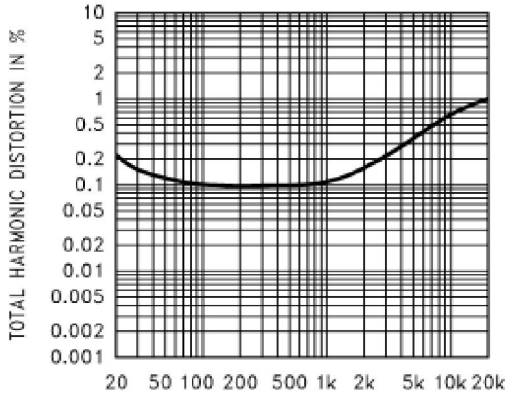
THD+N vs Frequency
at V_{DD} = 3V, R_L = 8Ω, PWR = 250mW, A_V = 2



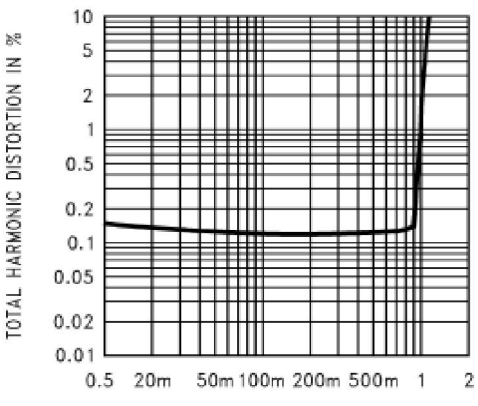
THD+N vs Frequency
@ V_{DD} = 2.6V, R_L = 8Ω, PWR = 100mW, A_V = 2



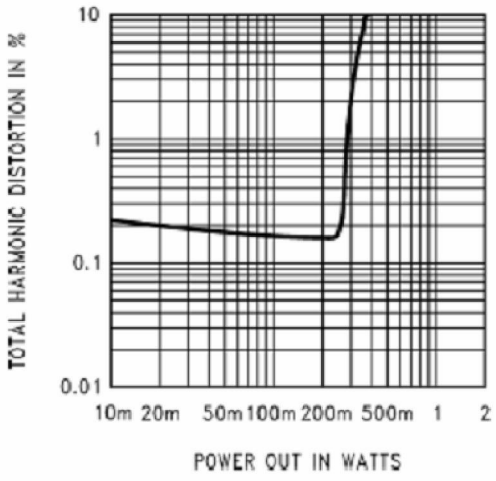
THD+N vs Frequency
@ V_{DD} = 2.6V, R_L = 4Ω, PWR = 100mW, A_V = 2



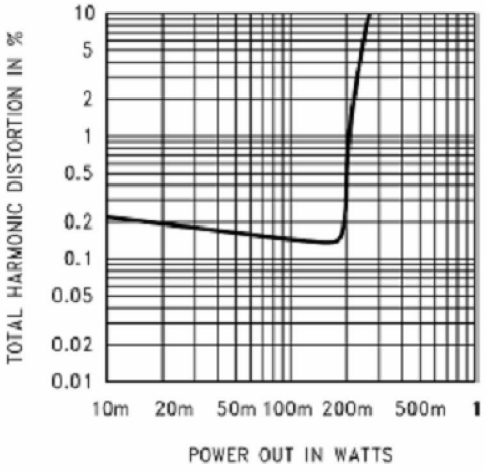
THD+N vs Power Out
@ V_{DD} = 5V, R_L = 8Ω, 1kHz, A_V = 2



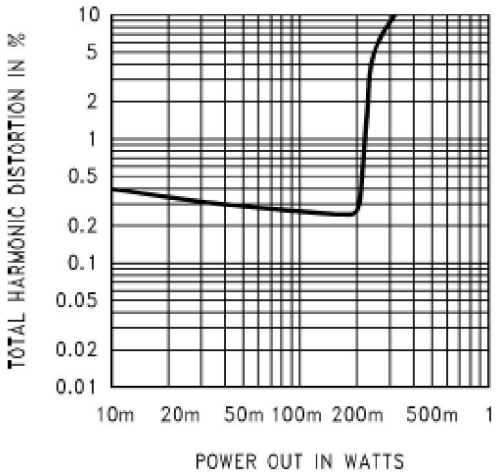
THD+N vs Power Out
@ V_{DD} = 3V, R_L = 8Ω, 1kHz, A_V = 2



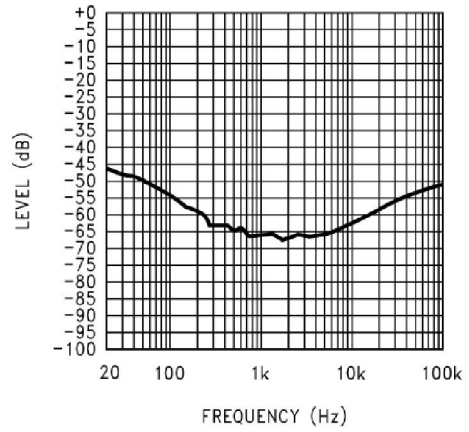
THD+N vs Power Out
@ V_{DD} = 2.6V, R_L = 8Ω, 1kHz, A_V = 2



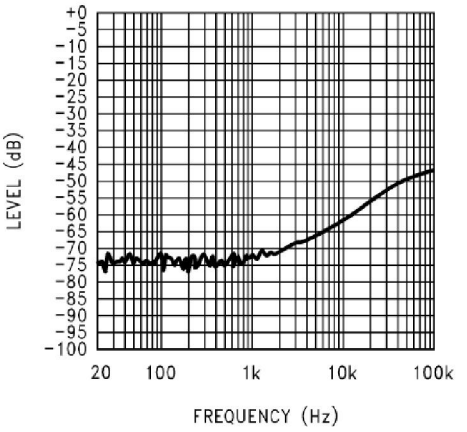
THD+N vs Power Out
@ V_{DD} = 2.6V, R_L = 4Ω, 1kHz, A_V = 2



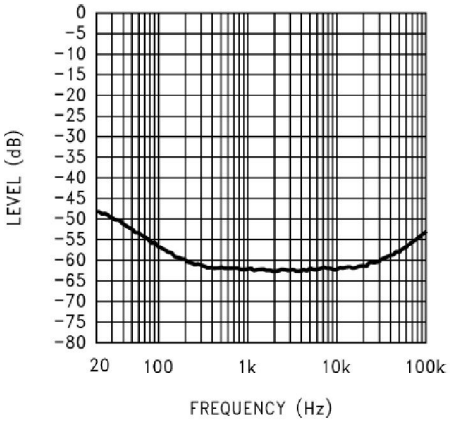
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 5V, V_{ripple} = 200mvp-p
R_L = 8Ω, R_{IN} = 10Ω



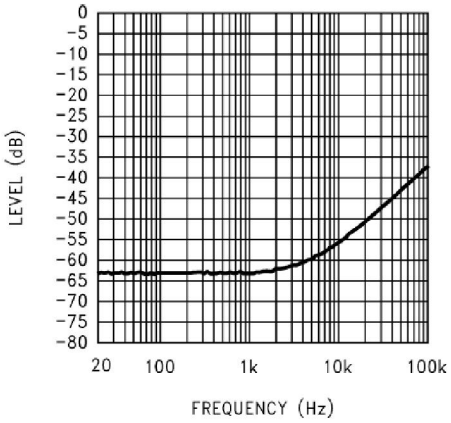
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 5V, V_{ripple} = 200mvp-p
R_L = 8Ω, R_{IN} = Float



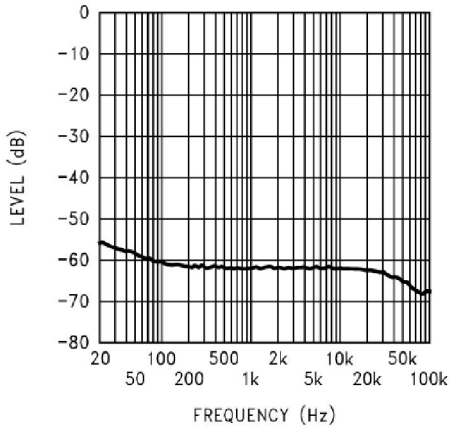
Power Supply Rejection Ratio (PSRR) @ A_V = 4
V_{DD} = 5V, V_{ripple} = 200mvp-p
R_L = 8Ω, R_{IN} = 10Ω



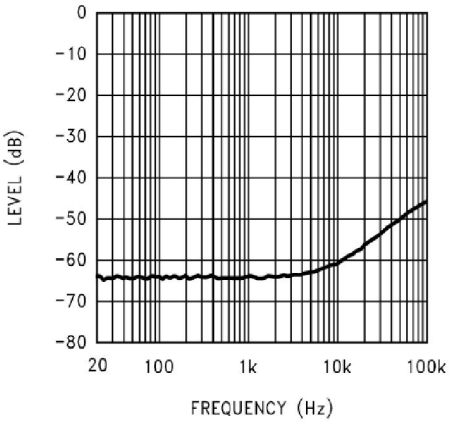
Power Supply Rejection Ratio (PSRR) @ A_V = 4
V_{DD} = 5V, V_{ripple} = 200mvp-p
R_L = 8Ω, R_{IN} = Float



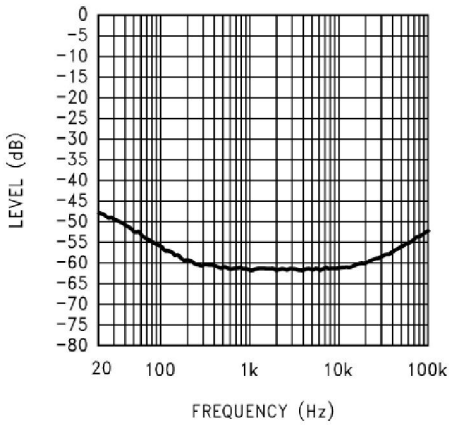
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 3V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = 10Ω



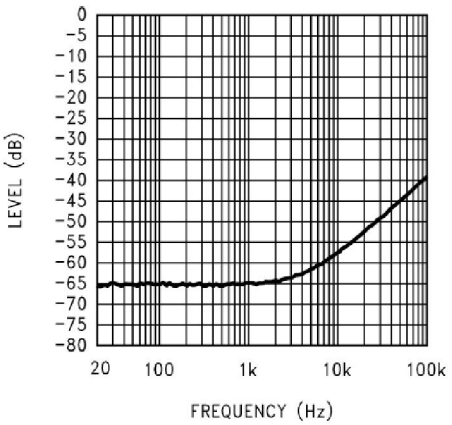
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 3V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = Float



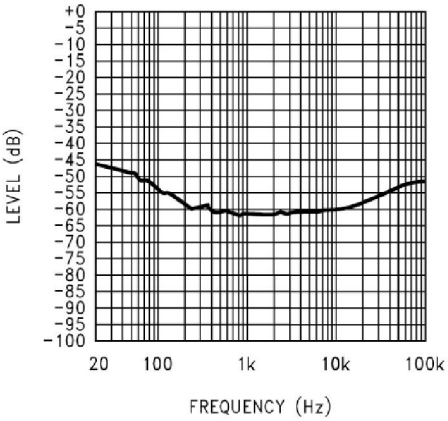
Power Supply Rejection Ratio (PSRR) @ A_V = 4
V_{DD} = 3V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = 10Ω



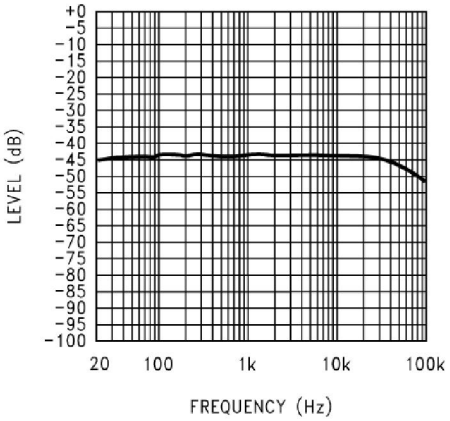
Power Supply Rejection Ratio (PSRR) @ A_V = 4
V_{DD} = 3V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = Float



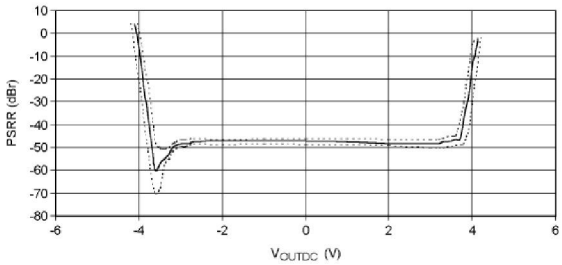
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 3.3V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = 10Ω



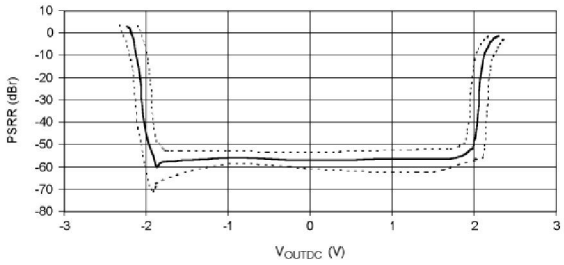
Power Supply Rejection Ratio (PSRR) @ A_V = 2
V_{DD} = 2.6V, V_{ripple} = 200mvp-p,
R_L = 8Ω, R_{IN} = 10Ω



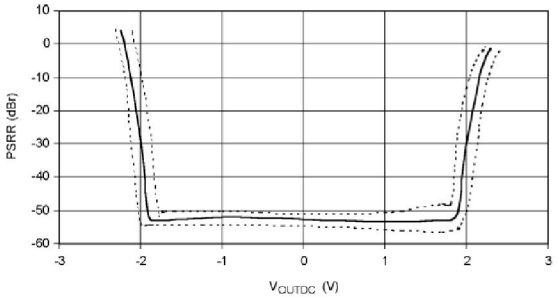
PSRR vs DC Output Voltage
V_{DD} = 5V, A_V = 10



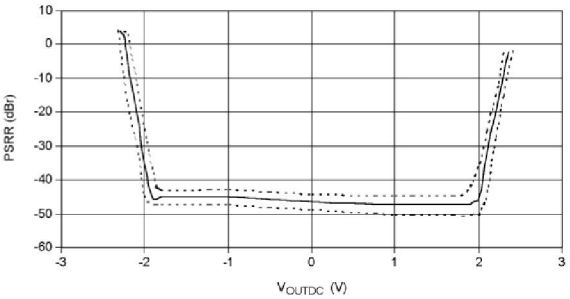
PSRR vs DC Output Voltage
V_{DD} = 3V, A_V = 2



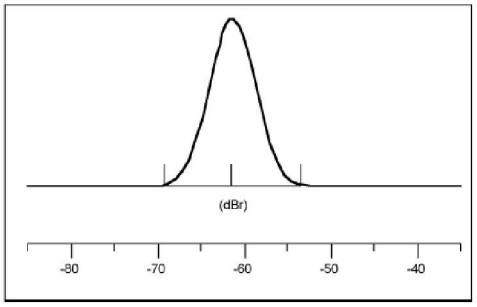
PSRR vs DC Output Voltage
V_{DD} = 3V, A_V = 4



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,
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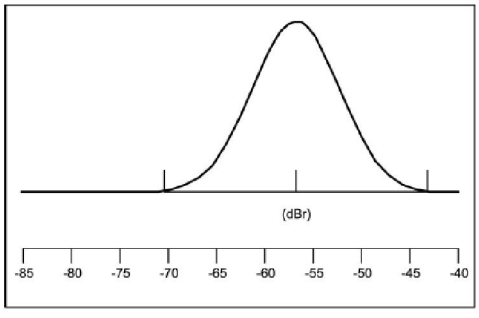
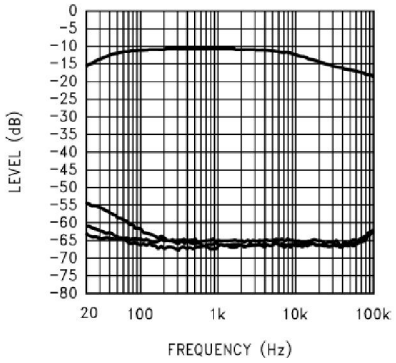
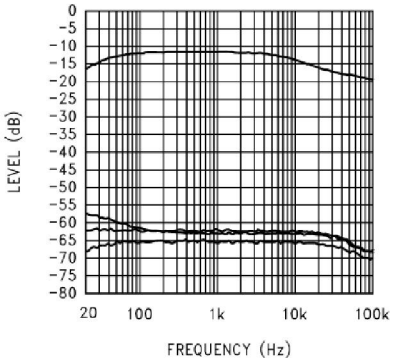


Power Supply Rejection Ration vs Bypass Capacitor Size
V_{DD} = 5V, Input Grounded = 10Ω, Output Load = 8Ω



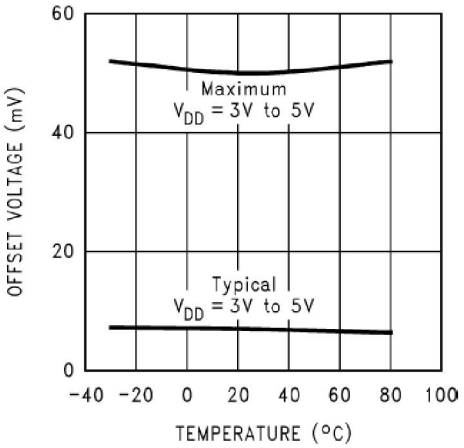
Top Trace = No Cap, Next Trace Down = 1µf
Next Trace Down = 2µf, Bottom Trace = 4.7µf

Power Supply Rejection Ration vs Bypass Capacitor Size
V_{DD} = 3V, Input Grounded = 10Ω, Output Load = 8Ω

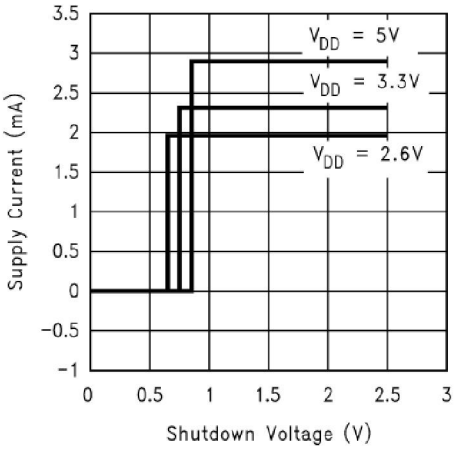


Top Trace = No Cap, Next Trace Down = 1µf
Next Trace Down = 2µf, Bottom Trace = 4.7µf

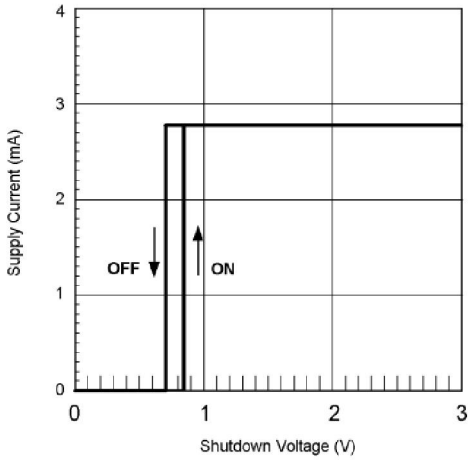
Output Offset Voltage



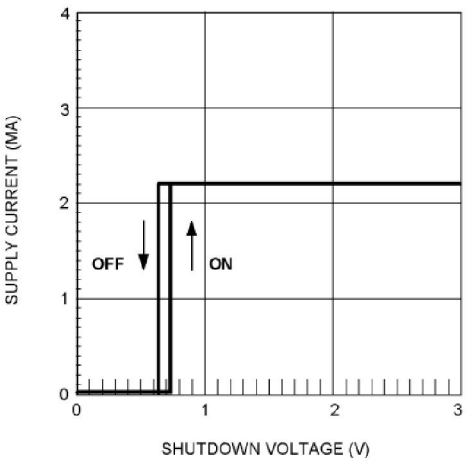
Supply Current vs Shutdown Voltage



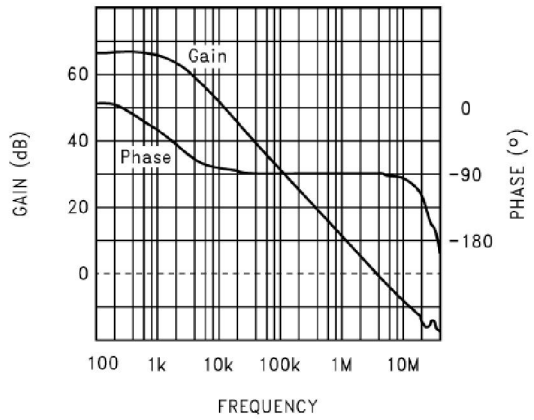
Shutdown Hysterisis Voltage
V_{DD} = 5V



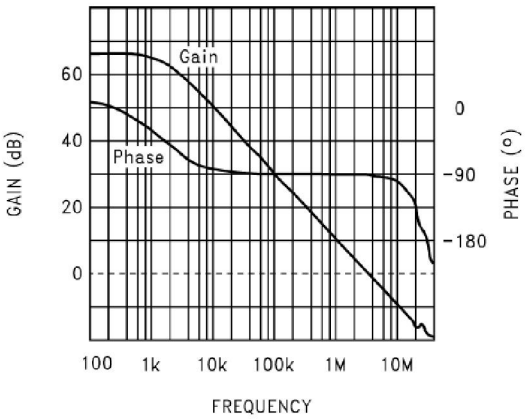
Shutdown Hysterisis Voltage
V_{DD} = 3V



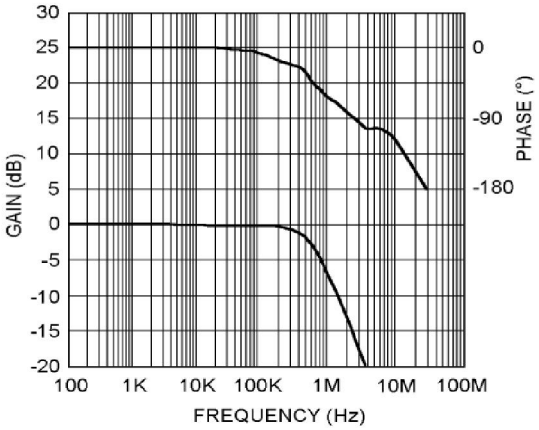
Open Loop Frequency Response
V_{DD} = 5V, No Load



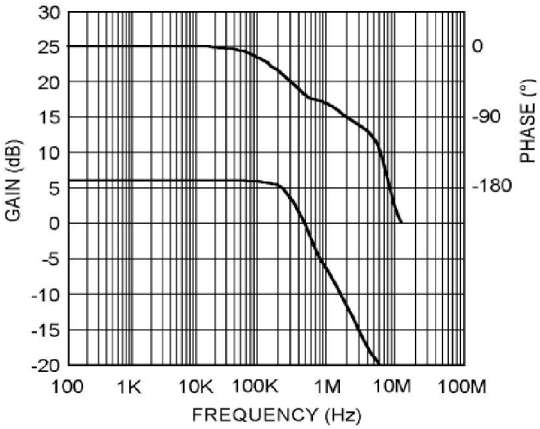
Open Loop Frequency Response
V_{DD} = 3V, No Load



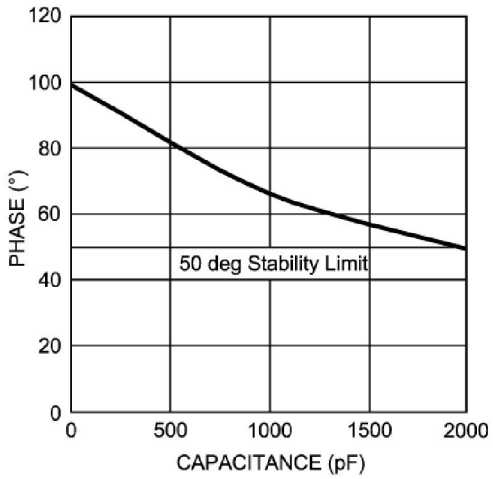
Gain / Phase Response, A_V = 2
V_{DD} = 5V, 8Ω Load, C_{LOAD} = 500pF



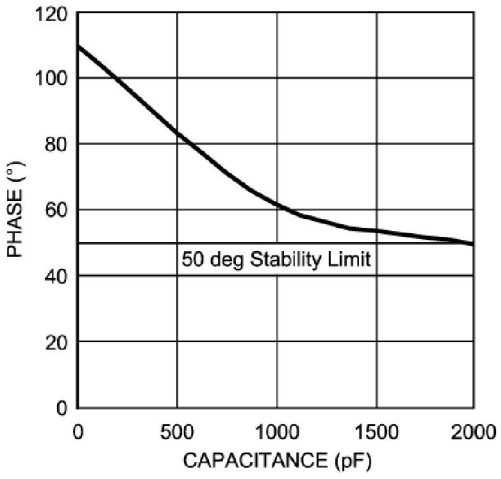
Gain / Phase Response, A_V = 4
V_{DD} = 5V, 8Ω Load, C_{LOAD} = 500pF



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



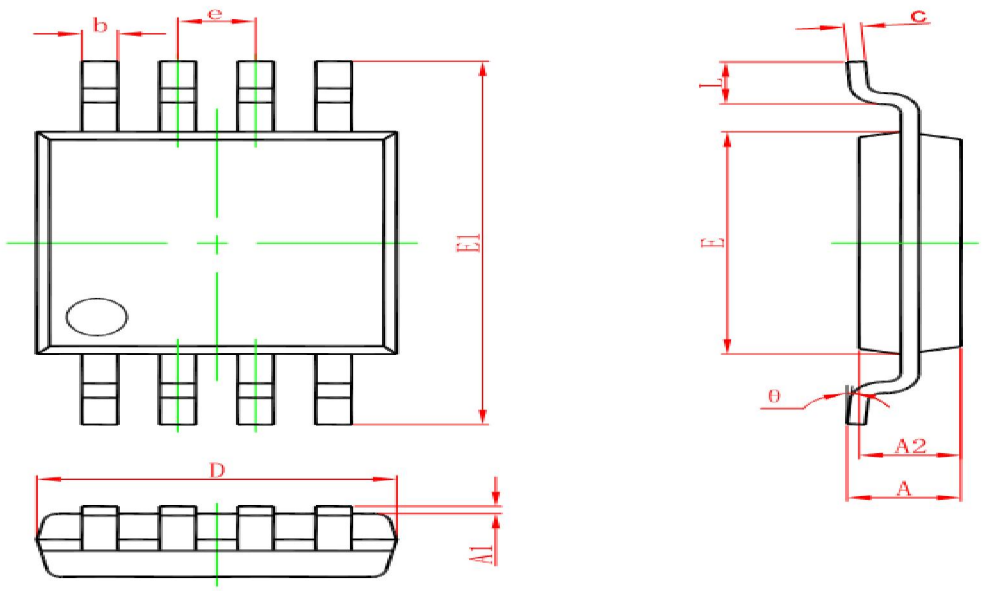
Phase Margin vs C_{LOAD}, A_V = 4
V_{DD} = 5V, 8Ω Load
Capacitance to gnd on each output



n Test Circuit

n Package Dimensions

MSOP-8 **Unit : mm**



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°