Dual 2.1W Audio Amplifier Plus Stereo Headphone & 3D Enhancement

■ General Description

The LN4888 is a dual bridge-connected audio power amplifier which, when connected to a 5V supply, will deliver 2.1W to a 4Ω load or 2.4W to a 3Ω load with less than 1.0% THD+N.

A user selectable “3D Enhancement” mode provides enhanced stereo imaging.

The LN4888 also has two separate HP (headphone) enable inputs, each having different logic level thresholds. Either HP enable input activates the single ended headphone mode and disables the BTL output mode. The HP Sense input is for use with a normal stereo headphone jack. The remaining input, HP Logic, accepts standard logic level thresholds.

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 LN4888 combines dual bridge speaker amplifiers and stereo headphone amplifiers on one chip.

The LN4888 features a low-power consumption shutdown mode and thermal shutdown protection. It also utilizes circuitry to reduce “clicks and pops” during device turn-on.

■ Applications

- Cell phones
- Multimedia monitors
- Portable and desktop computers
- Portable audio systems

■ Key Specifications

- Power Output @1% THD+N & VDD=5V
  - R_L=3Ω 2.4W(TYP.)
  - R_L=4Ω 2.1W(TYP.)
  - R_L=8Ω 1.3W(TYP.)
- Single-ended mode THD+N@75mW into 32Ω (5V,1KHz) 0.01%(TYP)
- Shutdown current 0.04μA(TYP.)
- Supply voltage range 2.7V~5.5V
- PSRR at f_{IN}=217Hz 85dB(TYP.)

■ Features

- National 3D Enhancement
- Selectable headphone enable modes
- Stereo headphone amplifier mode
- Improved “click and pop” suppression circuitry
- Thermal shutdown protection circuitry
- PCB area-saving QFN package
- Micro power shutdown mode

■ Package

- QFN-24

■ Ordering Information

Ordering Number	Package Type
LN4888	QFN-24

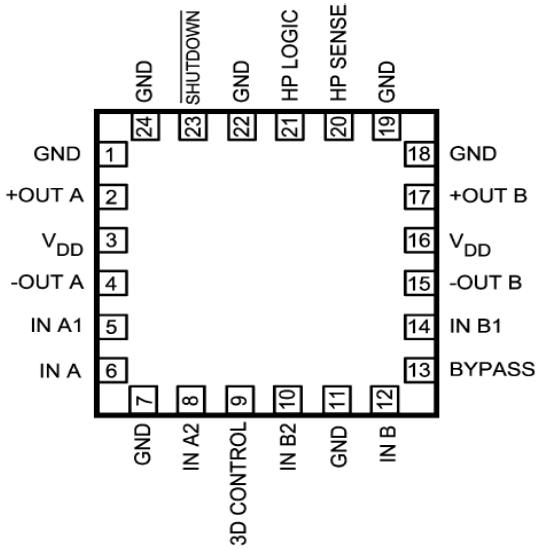
■ Operating Ratings

Temperature Range

TMIN ≤ TA ≤ TMAX---------- −40°C ≤ TA ≤ 85°C

Supply Voltage ---------- 2.7V ≤ VDD ≤ 5.5V

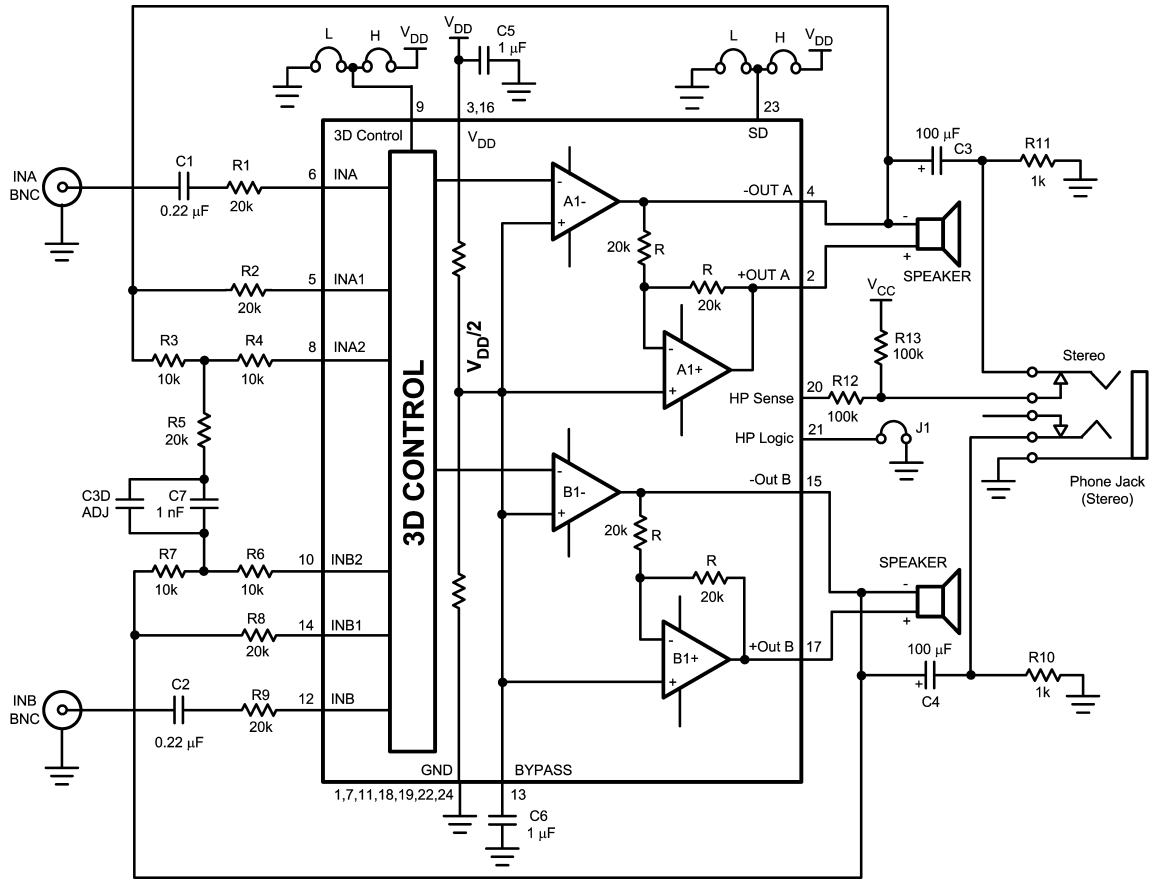
■ Pin Configuration



QFN-24(Top View)

XXYY ： Lot number for the chip package

■ Function Block Diagram



■ Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.3—6.0	V
Input Voltage	V_{IN}	-0.3—V_{DD}+0.3	V
Power Output	—	Internal limit	
Junction Temperature	—	-150	℃
Storage Temperature	Tstg	-65—150	℃
ESD Susceptibility	-	2000	V

■ Electrical Characteristics

(VDD = 5V Unless otherwise specified. Limits apply for TA = 25°C.)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage	—	2.7	—	5.5	V
I_{DD}	Quiescent Power Supply Current	VIN = 0V, Io = 0A, BTL Mode	—	6	10	mA
		VIN = 0V, Io = 0A, SE Mode	—	3	6	mA
I_{SD}	Shutdown Current	$V_{SHUTDOWN}$ = 0V	—	0.04	2	μA
V_{IH}	Headphone Sense High Input Voltage	—	-	3.7	4.0	V
V_{IL}	Headphone Sense Low Input Voltage	—	0.8	2.6	-	V
V_{SDIH}	Shutdown, Headphone micro, 3D control High Input voltage	—	-	1.2	1.4	V
V_{SDIL}	Shutdown, Headphone micro, 3D control Low Input voltage	—	0.4	1	-	V
T_{WU}	Turn On Time	Bypass Cap CBP=1μF	—	140	—	ms

■ Electrical Characteristics For Bridged-Mode Operation

(VDD = 5V Unless otherwise specified. Limits apply for TA = 25°C.)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
V_{OS}	Output Offset Voltage	VIN = 0V	—	5	25	mV
P_O	Output Power	THD+N = 1%; f = 1 kHz RL=3Ω RL=4Ω RL=8Ω	1.0	2.4 2.1 1.3	—	W
		THD+N = 10%; f = 1 kHz RL=3Ω RL=4Ω RL=8Ω	—	3.0 2.5 1.7	—	W
THD+N	Total Harmonic Distortion+Noise	AVD=2; f = 1kHz RL=4Ω,PO=1W RL=8Ω,PO=0.4W	—	0.1 0.06	—	%
PSRR	Power Supply Rejection Ratio	Input Unterminated， V_{ripple} = 200mV_{p-p}, 217Hz CBP=1μF, RL=8Ω	—	85	—	dB
		Input Unterminated，V_{ripple} = 200mV_{p-p}, 1kHz ,CBP=1μF, RL=8Ω		80		
		Input grounded，V_{ripple} = 200mV_{p-p}, 217Hz, CBP=1μF, RL=8Ω		65		
		Input grounded，V_{ripple} = 200mV_{p-p}, 1kHz, CBP=1μF, RL=8Ω		70		
XTALK	Channel Separation	f=1kHz,CBP=1μF,3D Control = Low	—	82	—	dB
V_{NO}	Output Noise Voltage	1 kHz, A-weighted	—	21	—	μV

■ Electrical Characteristics For Single-Ended Operation

(VDD = 5V Unless otherwise specified. Limits apply for TA = 25°C.)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
P_O	Output Power	THD+N = 0.5%; f = 1 kHz RL=32Ω	75	90	—	mW
THD+N	Total Harmonic Distortion+Noise	f = 1kHz,RL=32Ω,PO=20mW	—	0.015	—	%
PSRR	Power Supply Rejection Ratio	Input Unterminated，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=32Ω	—	70	—	dB
		Input Unterminated，V_{ripple} = 200mV_{p-p}, 1kHz, CBP=1μF, RL=32Ω		72		
		Input grounded，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=32Ω		65		
		Input grounded，V_{ripple} = 200mV_{p-p}, 1kHz,CBP=1μF, RL=32Ω		70		
XTALK	Channel Separation	f=1kHz,CBP=1μF,3D Input grounded	—	80	—	dB
V_{NO}	Output Noise Voltage	1 kHz, A-weighted	—	11	—	μV

■ Electrical Characteristics

(VDD = 3V Unless otherwise specified. Limits apply for TA = 25°C.)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
I_{DD}	Quiescent Power Supply Current	VIN = 0V, Io = 0A, BTL Mode	—	4.5	—	mA
		VIN = 0V, Io = 0A, SE Mode	—	2.5	—	mA
I_{SD}	Shutdown Current	$V_{SHUTDOWN}$ = 0V	—	0.01	—	μA
V_{IH}	Headphone Sense High Input Voltage	—	—	2.2	—	V
V_{IL}	Headphone Sense Low Input Voltage	—	—	1.5	—	V
V_{SDIH}	Shutdown, Headphone micro,3D control High Input voltage	—	-	1	1.4	V
V_{SDIL}	Shutdown, Headphone micro,3D control Low Input voltage		0.4	0.8	-	V
T_{WU}	Turn On Time	Bypass Cap CBP=1μF	—	140	—	ms

■ Electrical Characteristics For Bridged-Mode Operation

(VDD =3V Unless otherwise specified. Limits apply for TA = 25°C.)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
V_{OS}	Output Offset Voltage	VIN = 0V	—	5	—	mV
P_O	Output Power	THD+N = 1%; f = 1 kHz RL=3Ω RL=4Ω RL=8Ω	—	 0.82 0.70 0.43	—	W
		THD+N = 10%; f = 1 kHz RL=3Ω RL=4Ω RL=8Ω	—	 1.0 0.85 0.53	—	W
THD+N	Total Harmonic Distortion+Noise	AVD=2; f = 1kHz RL=4Ω,PO=1W RL=8Ω,PO=0.4W	—	 0.1 0.05	—	%
PSRR	Power Supply Rejection Ratio	Input Unterminated，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=8Ω	—	90	—	dB
		Input Unterminated，V_{ripple} = 200mV_{p-p}, 1kHz,CBP=1μF, RL=8Ω		80		
		Input grounded，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=8Ω		65		
		Input grounded，V_{ripple} = 200mV_{p-p}, 1kHz,CBP=1μF, RL=8Ω		73		
XTALK	Channel Separation	f=1kHz,CBP=1μF,3D Control = Low	—	85	—	dB
V_{NO}	Output Noise Voltage	1 kHz, A-weighted	—	21	—	μV

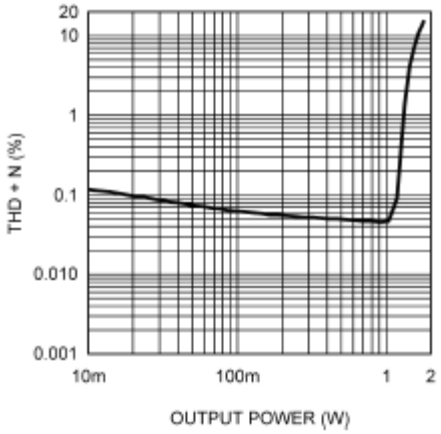
■ Electrical Characteristics For Single-Ended Operation

(VDD = 3V, Unless otherwise specified. Limits apply for TA = 25°C.)

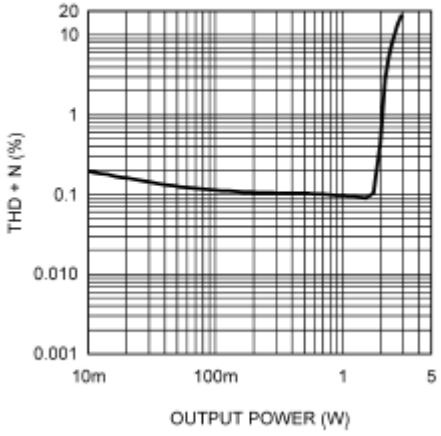
Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
P_O	Output Power	THD+N = 0.5%; f = 1 kHz RL=32Ω	—	35	—	mW
THD+N	Total Harmonic Distortion+Noise	f = 1kHz,RL=32Ω,PO=20mW	—	0.015	—	%
PSRR	Power Supply Rejection Ratio	Input Unterminated，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=32Ω	—	71	—	dB
		Input Unterminated，V_{ripple} = 200mV_{p-p}, 1kHz,CBP=1μF, RL=32Ω		79		
		Input grounded，V_{ripple} = 200mV_{p-p}, 217Hz,CBP=1μF, RL=32Ω		65		
		Input grounded，V_{ripple} = 200mV_{p-p}, 1kHz,CBP=1μF, RL=32Ω		72		
XTALK	Channel Separation	f=1kHz,CBP=1μF,3D Control = Low	—	80	—	dB
V_{NO}	Output Noise Voltage	1 kHz, A-weighted	—	11	—	μV

■ Typical Performance Characteristics

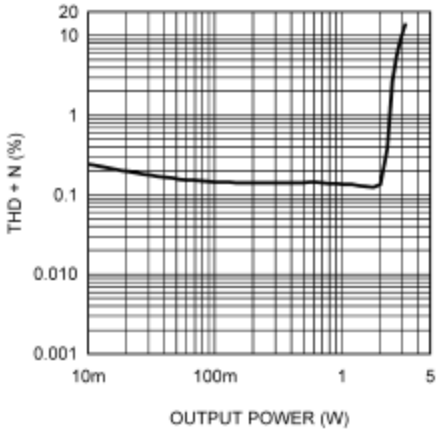
THD+N vs Output Power
5V, 8Ω, BTL at 1kHz



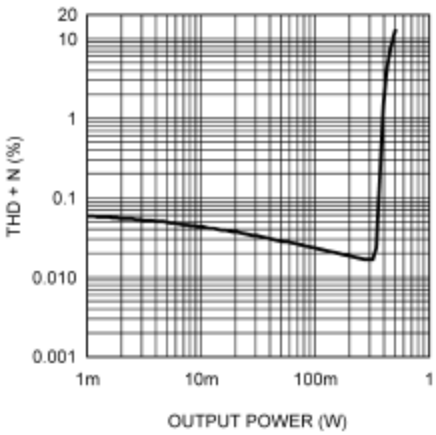
THD+N vs Output Power
5V, 4Ω, BTL at 1kHz



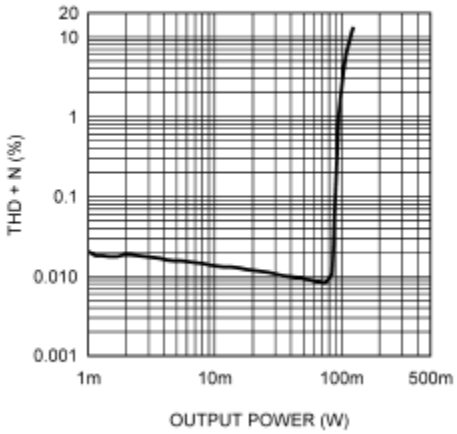
THD+N vs Output Power
5V, 3Ω, BTL at 1kHz



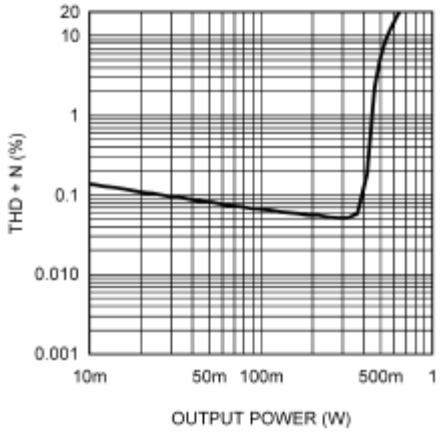
THD+N vs Output Power
5V, 32Ω, BTL at 1kHz



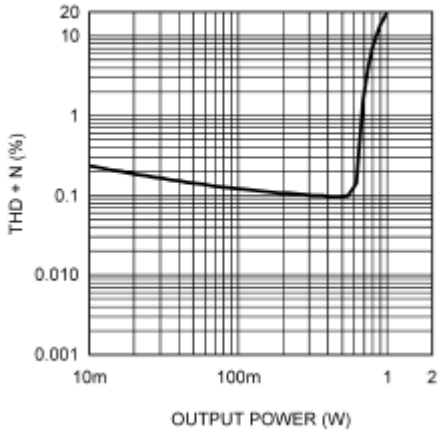
THD+N vs Output Power
5V, 32Ω, SE at 1kHz



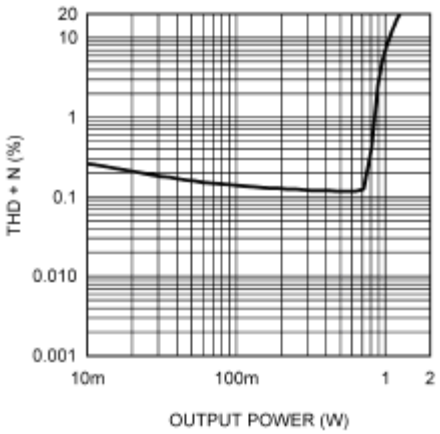
THD+N vs Output Power
3V, 8Ω, BTL at 1kHz



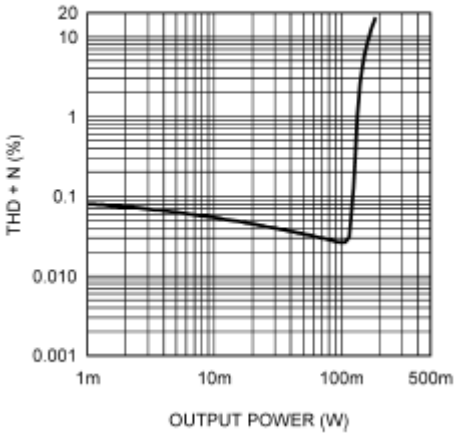
THD+N vs Output Power
3V, 4Ω, BTL at 1kHz



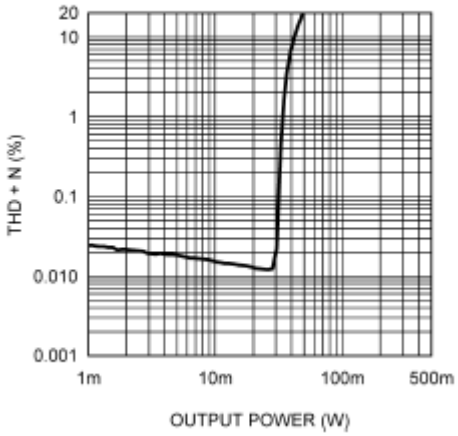
THD+N vs Output Power
3V, 3Ω, BTL at 1kHz



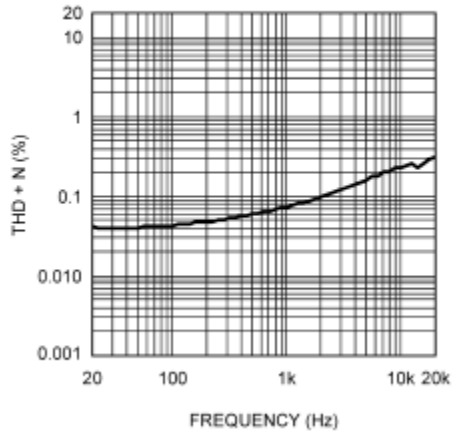
THD+N vs Output Power
3V, 32Ω, BTL at 1kHz



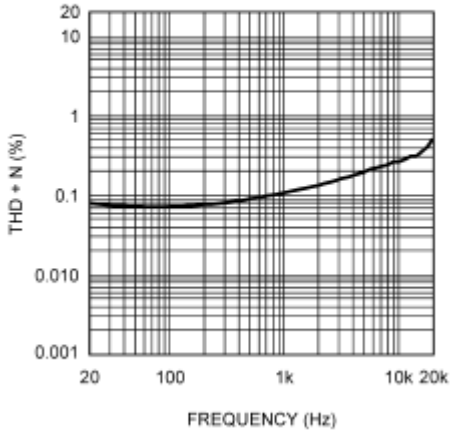
THD+N vs Output Power
3V, 32Ω, SE at 1kHz



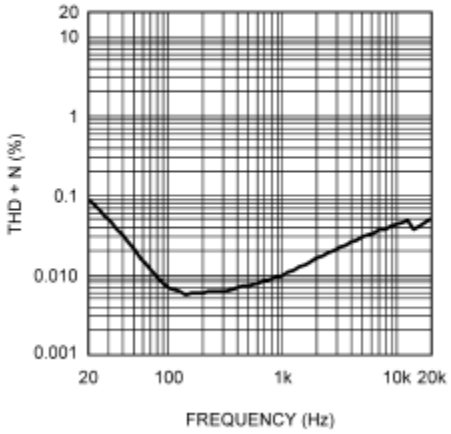
THD+N vs Frequency
5V, 8Ω, BTL at 400mW



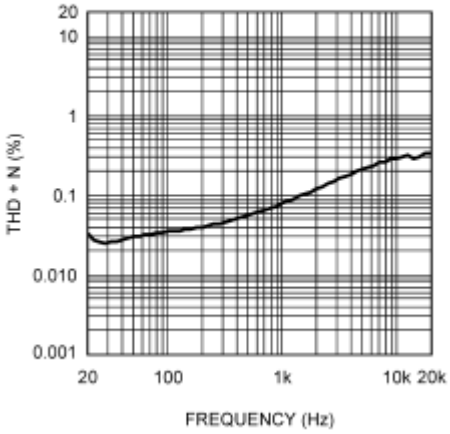
THD+N vs Frequency
5V, 4Ω, BTL at 1W



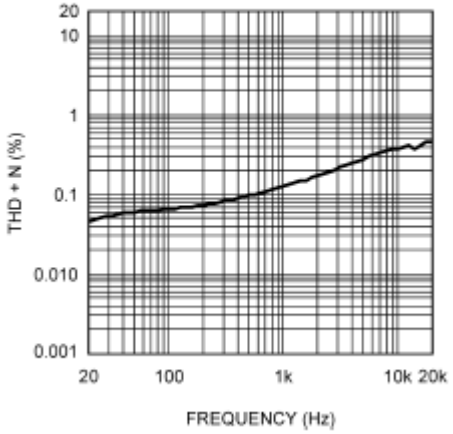
THD+N vs Frequency
5V, 32Ω, SE at 75mW



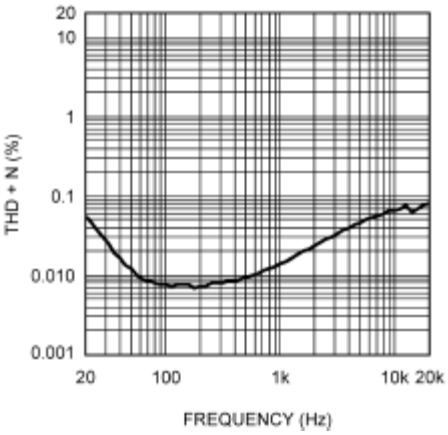
THD+N vs Frequency
3V, 8Ω, BTL at 150mW



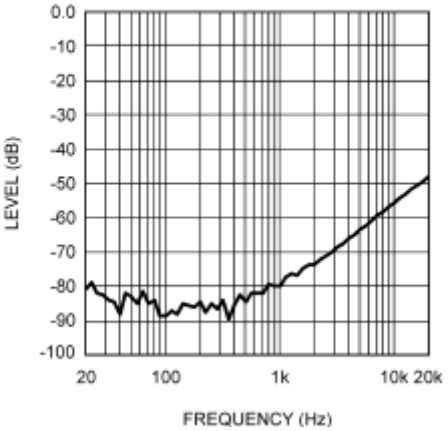
THD+N vs Frequency
3V, 4Ω, BTL at 250mW



THD+N vs Frequency
3V, 32Ω, SE at 25mW



PSRR
5V, 8Ω, BTL, Input Unterminated



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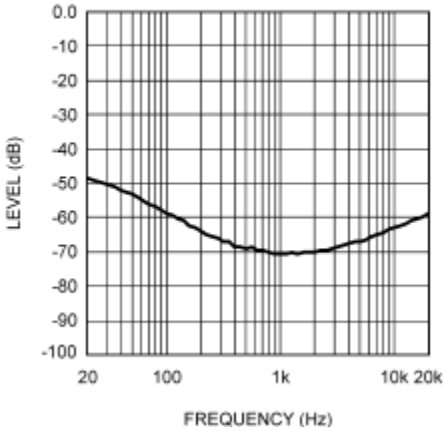

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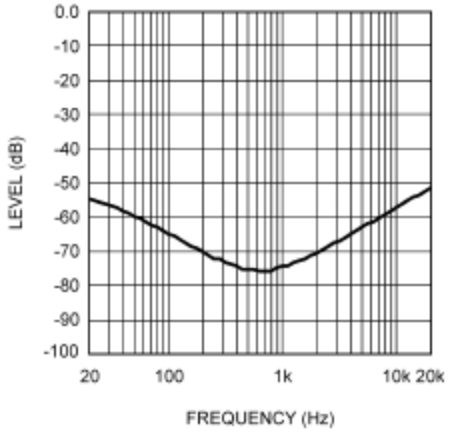
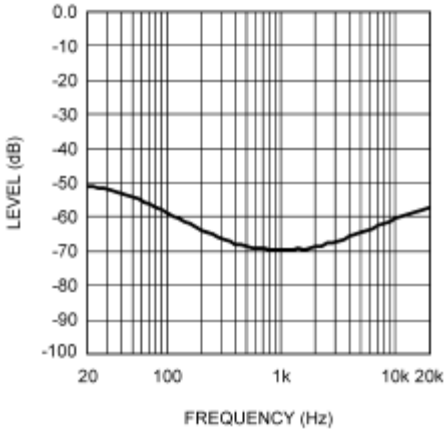
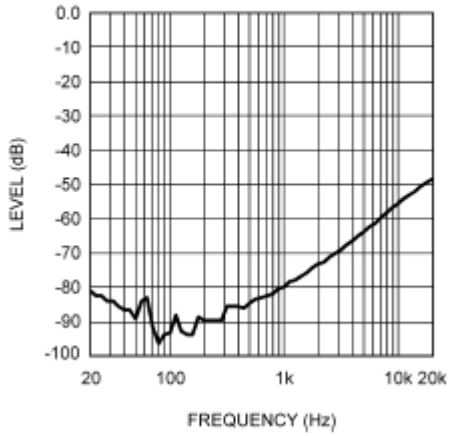


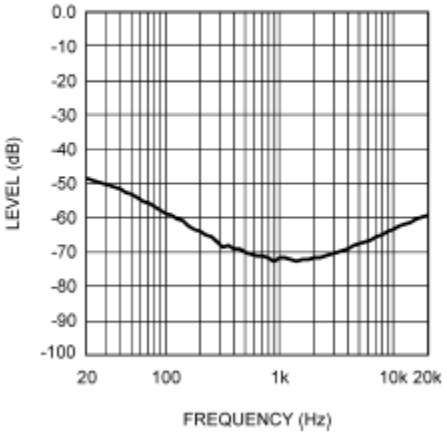
PSRR
5V, 32Ω, SE, Input Terminated



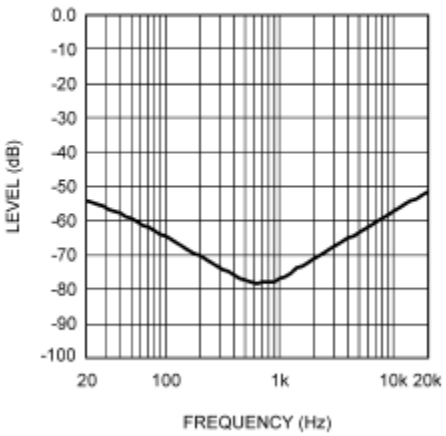
PSRR
3V, 8Ω, BTL, Input Unterminated



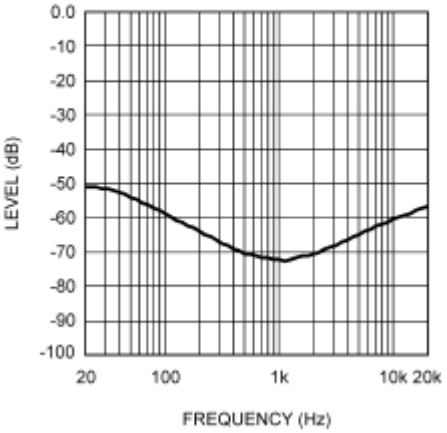
PSRR
3V, 8Ω, BTL, Input Terminated



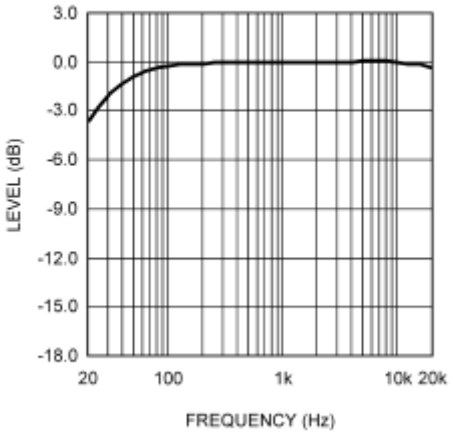
PSRR
3V, 32Ω, SE, Input Unterminated



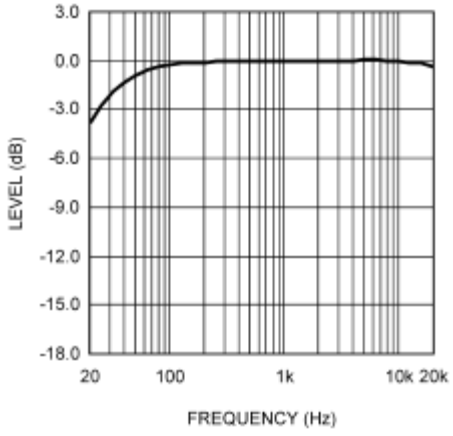
PSRR
3V, 32Ω, SE, Input Terminated



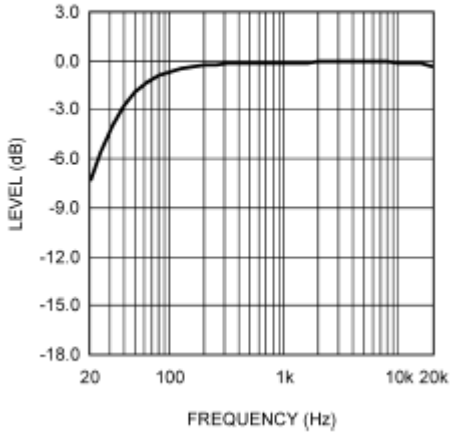
Frequency Response
5V, 8Ω, BTL



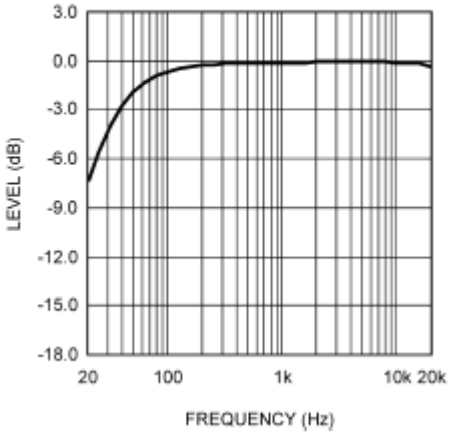
Frequency Response
3V, 8Ω, BTL



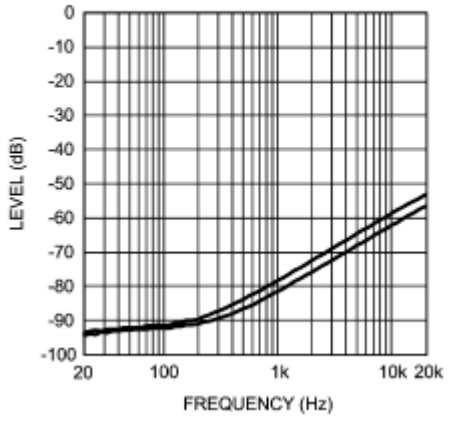
Frequency Response
5V, 32Ω, SE



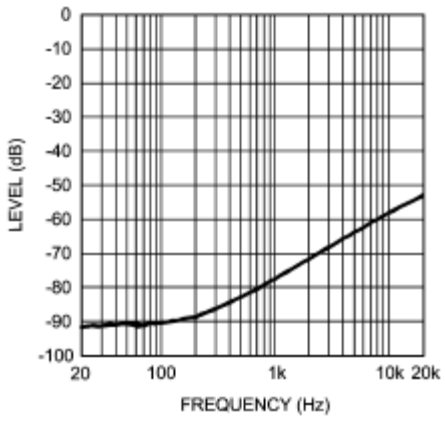
Frequency Response
3V, 32Ω, SE



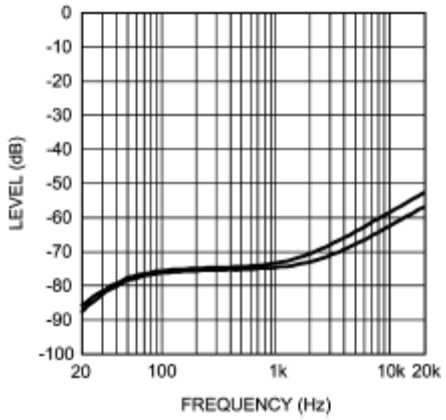
Crosstalk
5V, 8Ω, BTL



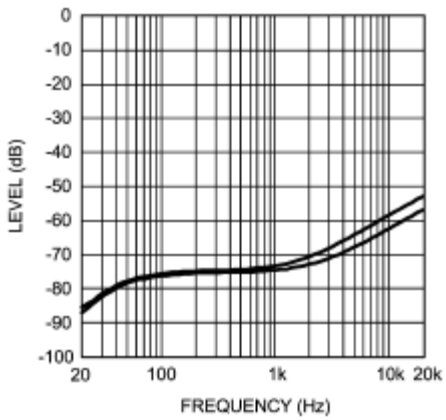
Crosstalk
3V, 8Ω, BTL



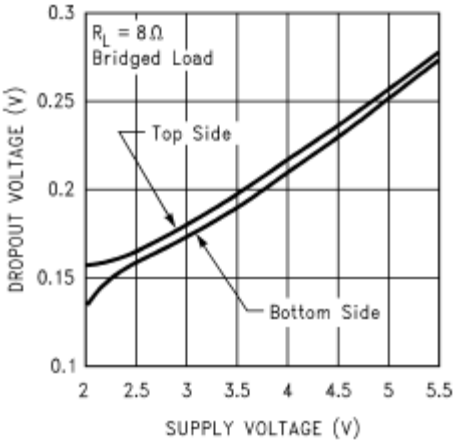
Crosstalk
3V, 32Ω, SE



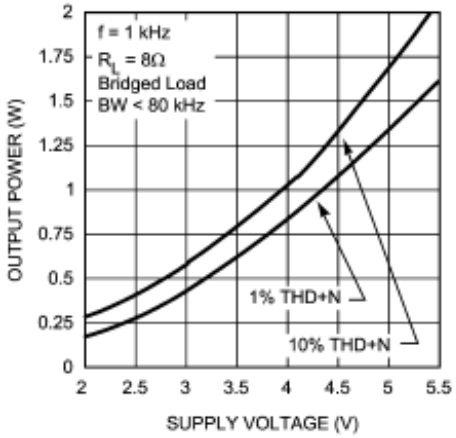
Crosstalk
5V, 32Ω, SE



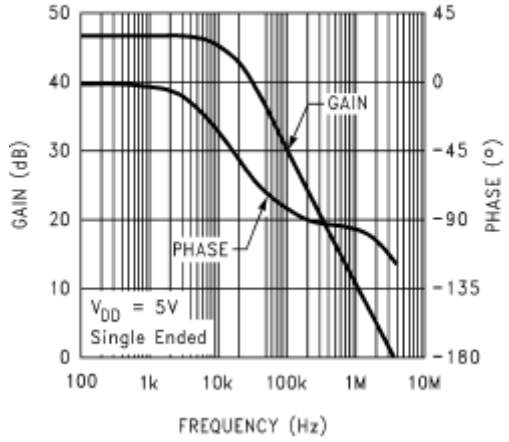
Dropout Voltage vs
Supply Voltage



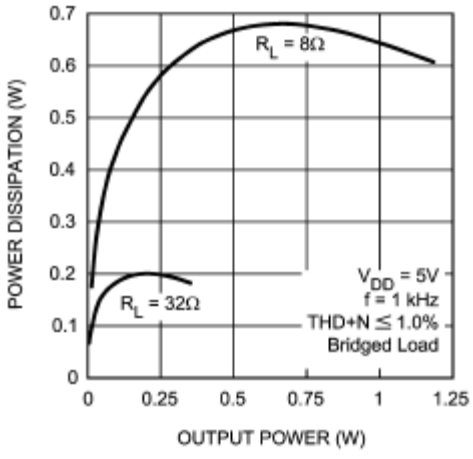
Output Power vs
Supply Voltage



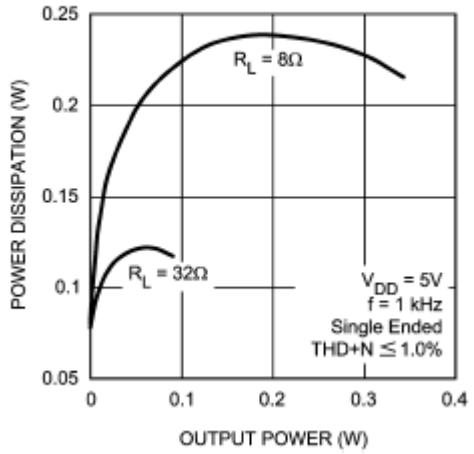
Open Loop
Frequency Response



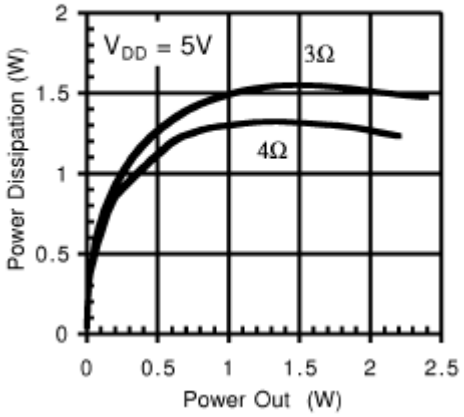
Power Dissipation vs
Output Power



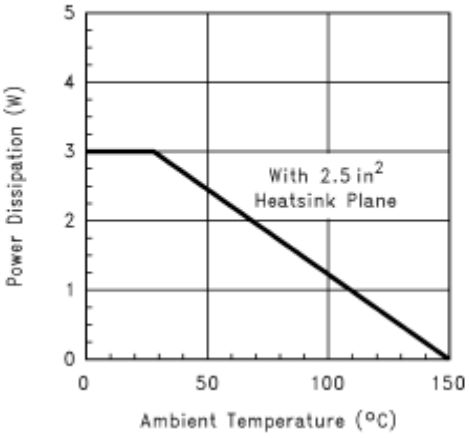
Power Dissipation vs Output Power



Power Dissipation vs Output Power Single Channel, f = 1kHz, THD+N ≤ 1.0%, BW < 80kHz

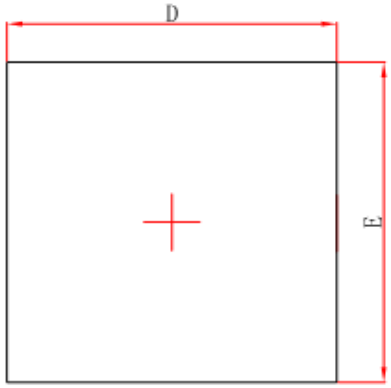


Power Derating Curve

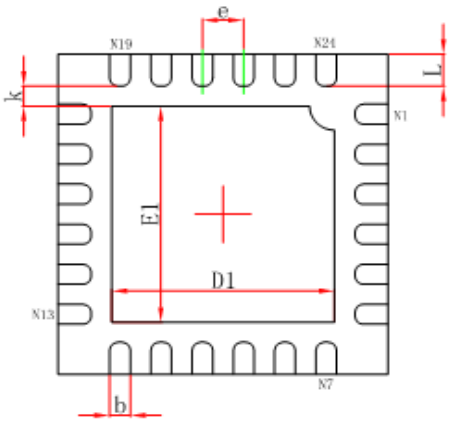


■ Package Information

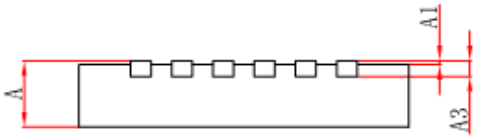
- **QFN-24**



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	3.900	4.100	0.154	0.161
E	3.900	4.100	0.154	0.161
D1	2.600	2.800	0.102	0.110
E1	2.600	2.800	0.102	0.110
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.300	0.500	0.012	0.020