3W Audio Power Amplifier with Shutdown Mode

❖ GENERAL DESCRIPTION

The AX4001 is a mono bridged audio power amplifier capable of delivering 3W of continuous average power into a 3Ω load with less than 10% THD when powered by a 5V power supply. It does not require output coupling capacitors or bootstrap capacitors, and is ideal for mobile phone and other low voltage applications where minimal power consumption is a primary requirement.

The AX4001 features a low-power consumption shutdown mode, and an internal thermal shutdown protection mechanism. Advanced pop & click circuitry is built in to eliminate noises that would otherwise occur during turn-on and turn-off transitions. The AX4001 is unity-gain stable and can be configured by external gain-setting resistors.

AXElite products are RoHS and Halogen free compliant.

❖ Key Specifications

- BTL mode PO at THD+N=1%, f=1kHz, VDD =5V
  - 2.45 W (typ) into 3Ω
  - 2.1 W (typ) into 4Ω
  - 1.2 W (typ) into 8Ω
- BTL mode PO at THD+N=10%, f=1kHz, VDD =5V
  - 3W (typ) into 3Ω
- Shutdown current 0.1μA (typ)

❖ Features

- No output coupling capacitors, bootstrap capacitors, or snubber circuits required
- Unity-gain stable
- TDFN-8
- External gain configuration capability

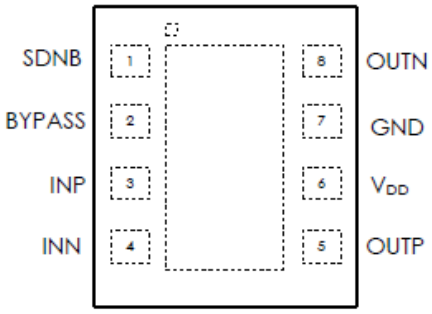
❖ Applications

- Portable Computers
- Desktop computers

Rev.1.1 Jun.29, 2017

❖ PIN ASSIGNMENT

The packages of AX4001 are TDFN-8L(3*3); the pin assignment is given by:



Pin #	Pin Name	Function
1	SNDB	Low Level Shutdown
2	BYPASS	Mid-supply Voltage biasing, Adding a Bypass Capacitor to Improves PSRR and Noise Immunity / Turn-on Time Define
3	INP	Biased by Mid-supply Voltage / One-side Audio Input for Differential Signal
4	INN	Negative Feedback for Audio Input
5	OUTP	Positive(Relative to INN) Audio Output to Load
6	VDD	Power Supply
7	GND	Ground
8	OUTN	Negative(Relative to INN) Audio Output to Load

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking (TDFN-8L)
AX4001 XX X Package Type J8:TDFN-8L(3*3) Packing Blank: Tube A : Taping	D W → AX4001 Y W X → ID Code: Internal Week: 01~26(A~Z) 27~52(a~z) Year : A = 2010 1 = 2011

❖ ABSOLUTE MAXIMUM RATINGS

Characteristics	Rating	Unit
Supply Voltage	6 V	V
Storage Temperature Range	-65°C to +150°C	°C
Input Voltage	-0.3 V to VDD +0.3 V	V
Power Dissipation	Internally Limited	W
ESD Susceptibility	HBM2KV	V
ESD Susceptibility	MM200V	V
Junction Temperature	150°C	°C
Thermal Resistance (θ_{JA})	180°C/W	°C/W
Operating Range (Temperature Range)	-40°C≦TA ≦85°C	°C
Operating Range(Supply Voltage)	2.6 V≦VDD≦5.5 V	V

❖ Typical Application

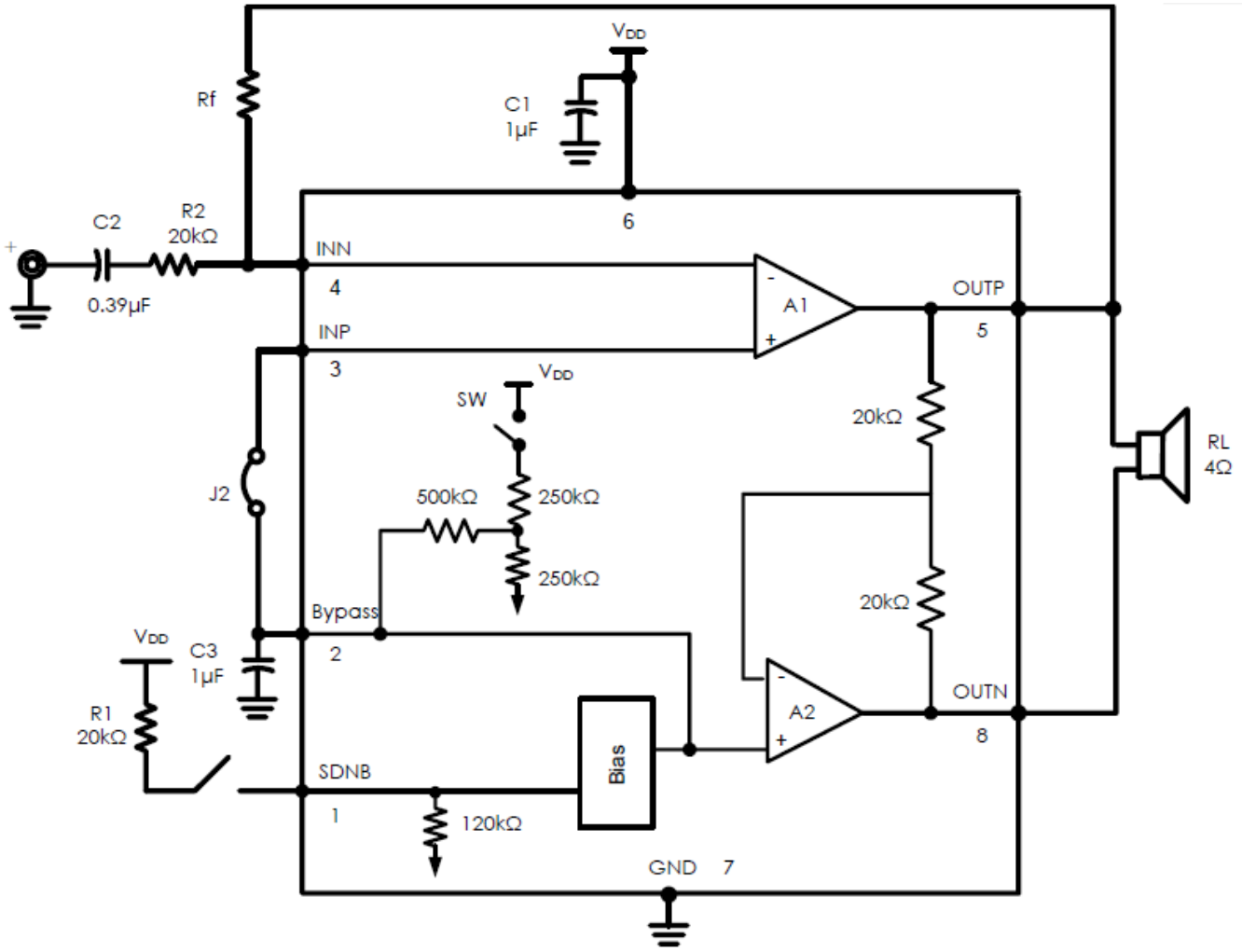


FIGURE 1. Typical Audio Amplifier Application Circuit with single-ended input

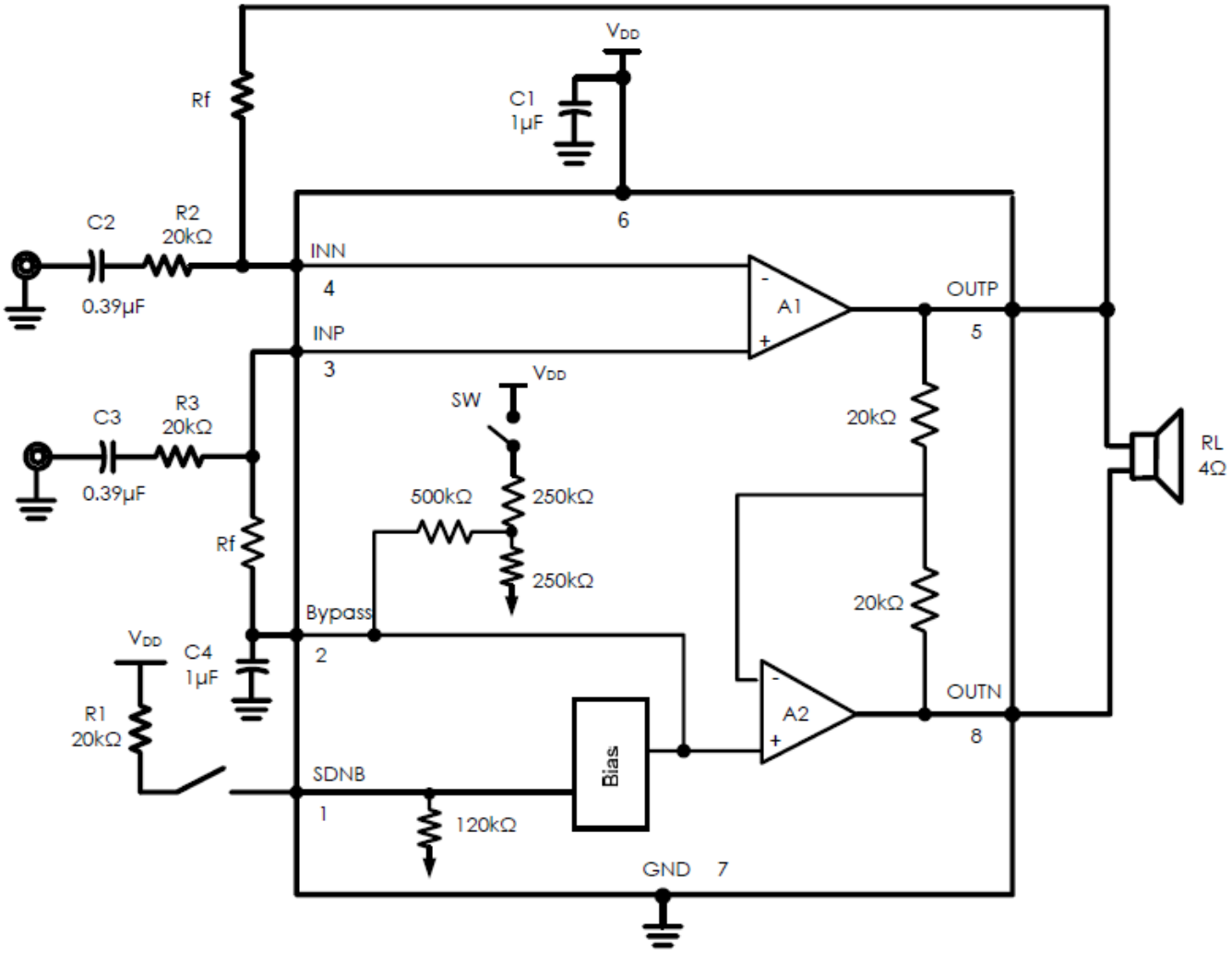


FIGURE 2. Typical Audio Amplifier Application Circuit with differential input

❖ Electrical Characteristics

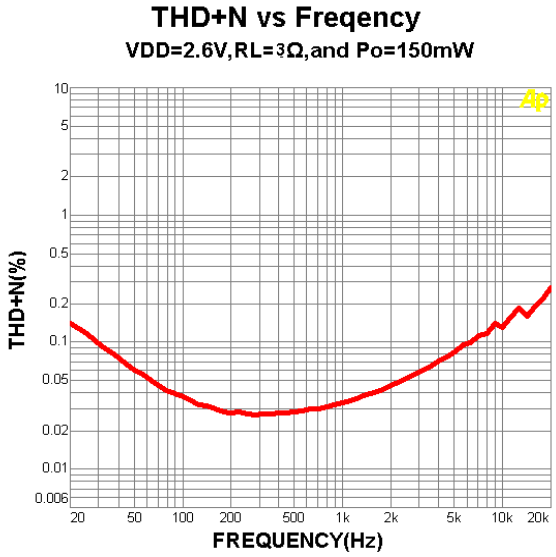
The following specifications apply for V_{DD} = 5V and R_L = 4Ω unless otherwise specified. Limits apply for T_A = 25°C.

Symbol	Parameter	Conditions	Conditions			Units (Limits)
			Min	Typical	Limit	
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, Io = 0A		5.0	10.0	mA
I_{SD}	Shutdown Current	V_{SDNB} = GND		0.1	1.0	μA
V_{OS}	Output Offset Voltage	V_{IN} = 0V		5.0	50	mV
P_O	Output Power	THD + N = 1 %, f = 1kHz R_L = 3Ω R_L = 4Ω R_L = 8Ω		2.45 2.1 1.2		W
		THD + N = 10 %, f = 1kHz R_L = 3Ω R_L = 4Ω R_L = 8Ω		3 2.5 1.5		W
THD+N	Total Harmonic Distortion + Noise	f = 1kHz, AV=2, P_O=1W R_L = 3Ω R_L = 4Ω R_L = 8Ω		0.05 0.02 0.013		%
PSRR	Power Supply Rejection Ratio	V_{RIPPLE}=200mV, sine p-p at 217Hz, input 10Ω to GND		60	55	dB

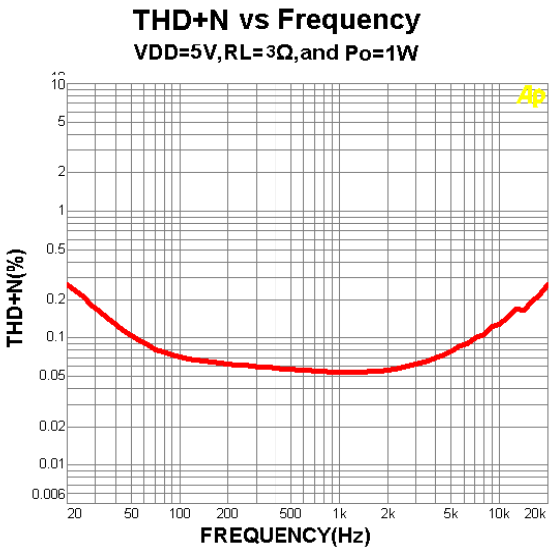
The following specifications apply for VDD = 2.6V and RL = 4Ω unless otherwise specified. Limits apply for TA = 25°C.

Symbol	Parameter	Conditions	Conditions			Units (Limits)
			Min	Typical	Limit	
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, Io = 0A		4.0	10.0	mA
I_{SD}	Shutdown Current	V_{SDNB} = GND		0.1	1.0	μA
V_{OS}	Output Offset Voltage	V_{IN} = 0V		5.0	50	mV
P_O	Output Power	THD + N = 1 %, f = 1kHz R_L = 3Ω R_L = 4Ω R_L = 8Ω		0.7 0.5 0.32		W
		THD + N = 10 %, f = 1kHz R_L = 3Ω R_L = 4Ω R_L = 8Ω		0.85 0.62 0.52		W
THD+N	Total Harmonic Distortion + Noise	f = 1kHz, AV=2, P_O=150mW R_L = 3Ω R_L = 4Ω R_L = 8Ω		0.03 0.035 0.02		%
PSRR	Power Supply Rejection Ratio	V_{RIPPLE}=200mV, sine p-p at 217Hz, input 10Ω to GND		60	55	dB

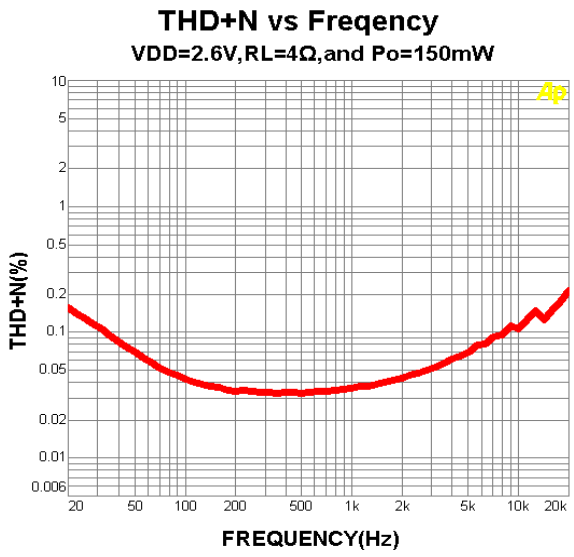
❖ Typical Performance Characteristics



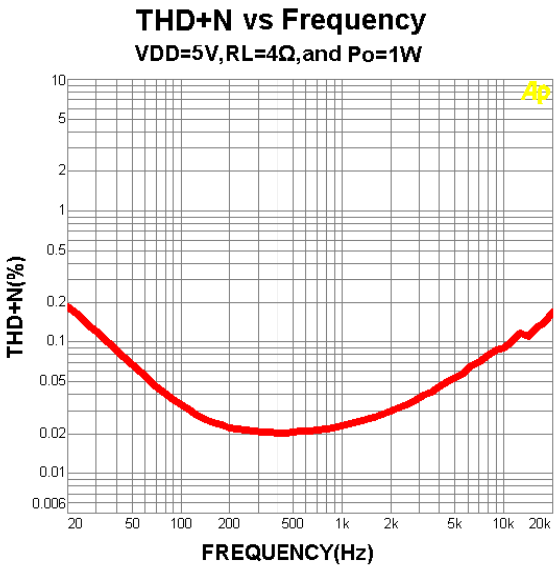
THD + Noise vs Frequency
V_{DD} = 2.6V, R_L = 3Ω, Po = 150mW, A_V = 2



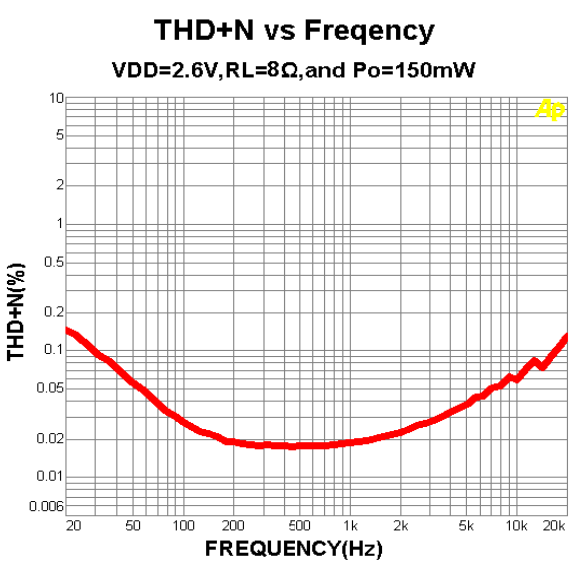
THD + Noise vs Frequency
@ V_{DD} =5V, R_L = 3Ω, Po =1W, A_V = 2



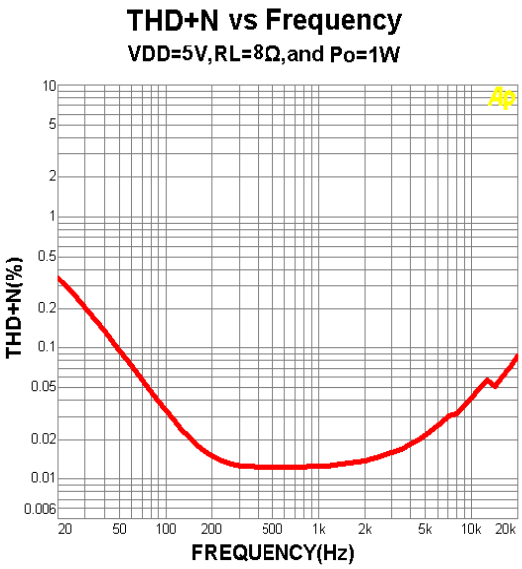
THD + Noise vs Frequency
@ V_{DD} = 2.6V, R_L = 4Ω, Po = 150mW, A_V = 2



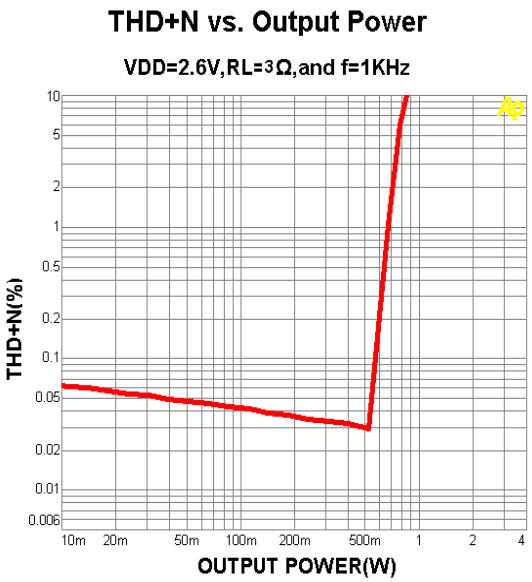
THD + Noise vs Frequency
@ V_{DD} =5V, R_L = 4Ω, Po =1W, A_V = 2



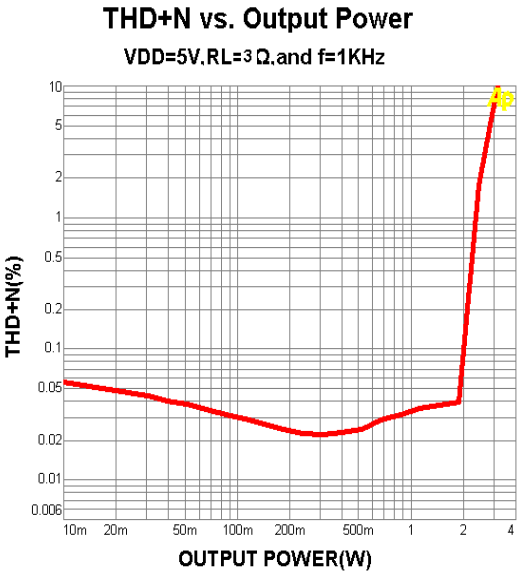
THD + Noise vs Frequency
@ V_{DD} = 2.6V, R_L = 8Ω, Po = 150mW, A_V = 2



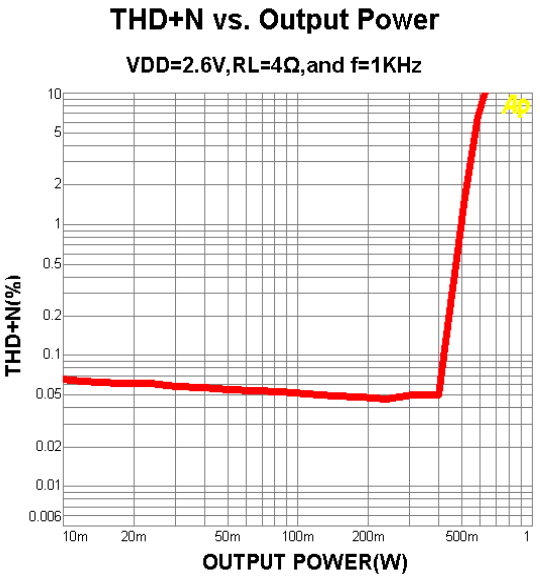
THD + Noise vs Frequency
@ V_{DD} =5V, R_L = 8Ω, Po =1W, A_V = 2



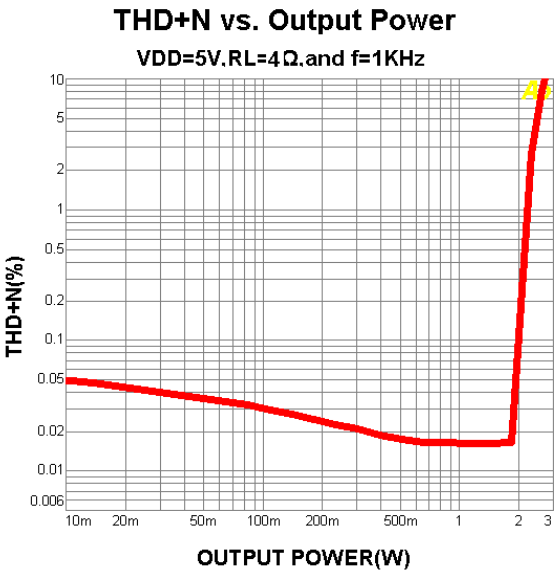
THD + Noise vs Output Power
@ V_{DD} =2.6V, R_L = 3Ω, 1kHz, BW=60kHz, A_V = 2



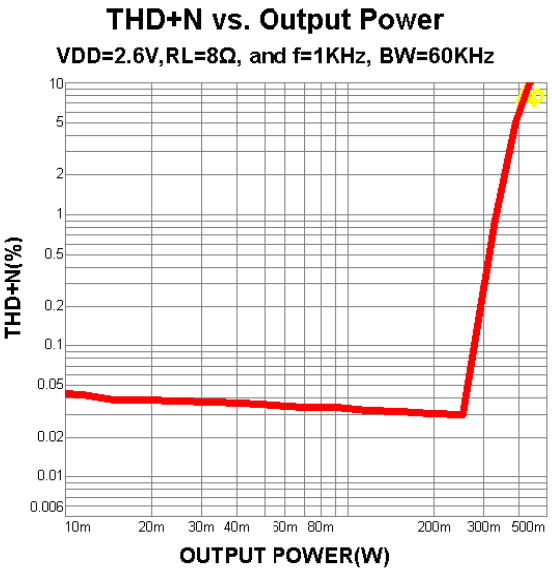
THD + Noise vs Output Power
@ V_{DD} =5V, R_L = 3Ω, 1kHz, BW=60kHz, A_V = 2



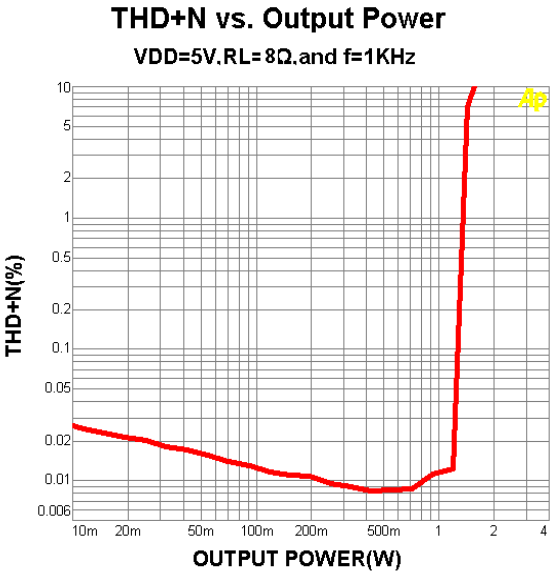
THD + Noise vs Output Power
@ V_{DD} =2.6V, R_L = 4Ω, 1kHz, BW=60kHz, A_V = 2



THD + Noise vs Output Power
@ V_{DD} =5V, R_L = 4Ω, 1kHz, BW=60kHz, A_V = 2



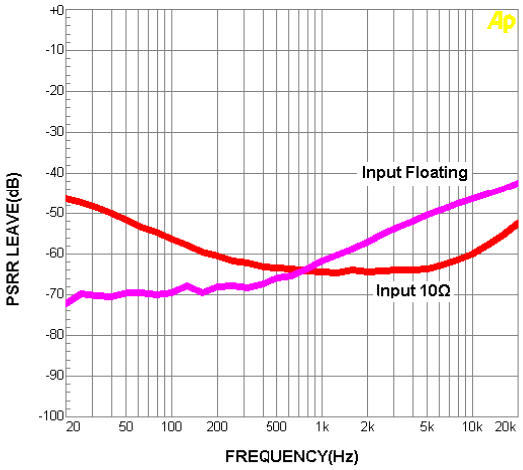
THD + Noise vs Output Power
@ V_{DD} =2.6V, R_L = 8Ω, 1kHz, BW=60kHz, A_V = 2



THD + Noise vs Output Power
@ V_{DD} =5V, R_L = 8Ω, 1kHz, BW=60kHz, A_V = 2

Power Supply Rejection Ration(PSRR) vs Frequency

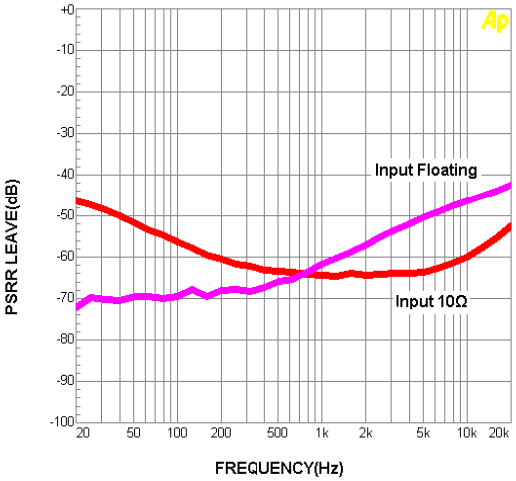
Vdd=2.6V,RL=8Ω



PSRR @ V_{DD} =2.6V, R_L = 8Ω, A_V = 2

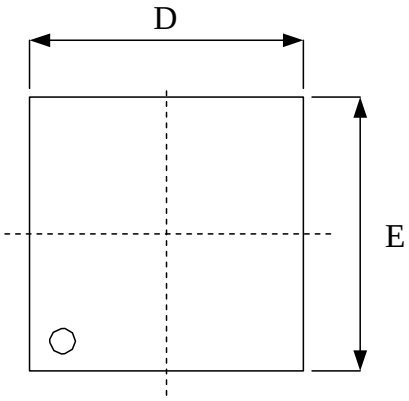
Power Supply Rejection Ration(PSRR) vs Frequency

Vdd=5v,RL=8Ω

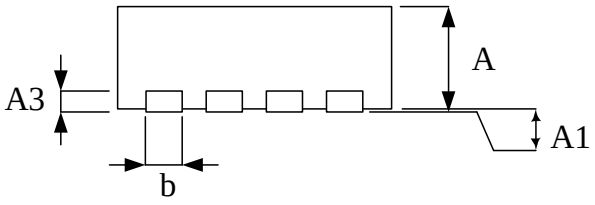


PSRR @ V_{DD} =2.6V, R_L = 8Ω, A_V = 2

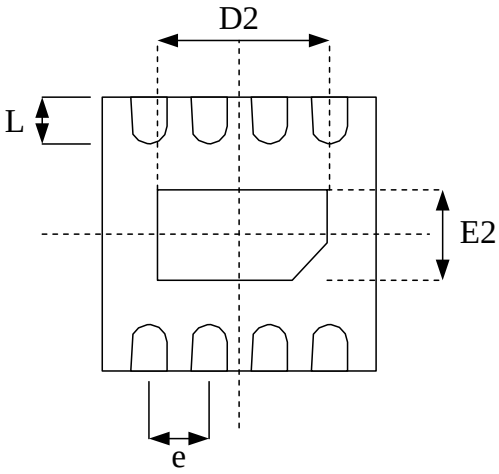
(1)TDFN-8L(3*3mm)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Symbol	Dimension in mm	
	Min	Max
A	0.70	0.80
A1	0.00	0.05
A3	0.2 REF.	
b	0.18	0.30
D	3.0 BSC	
E	3.0 BSC	
e	0.65 BSC	
L	0.30	0.5

Exposed pad

	Dimension in mm	
	Min	Max
D2	1.95	2.05
E2	1.6	1.75