DATA SHEET

GPY0031A
GPY0032A

2.0W Audio Power Amplifier

May 06, 2009

Version 1.1

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AUDIO DRIVER

1. GENERAL DESCRIPTION

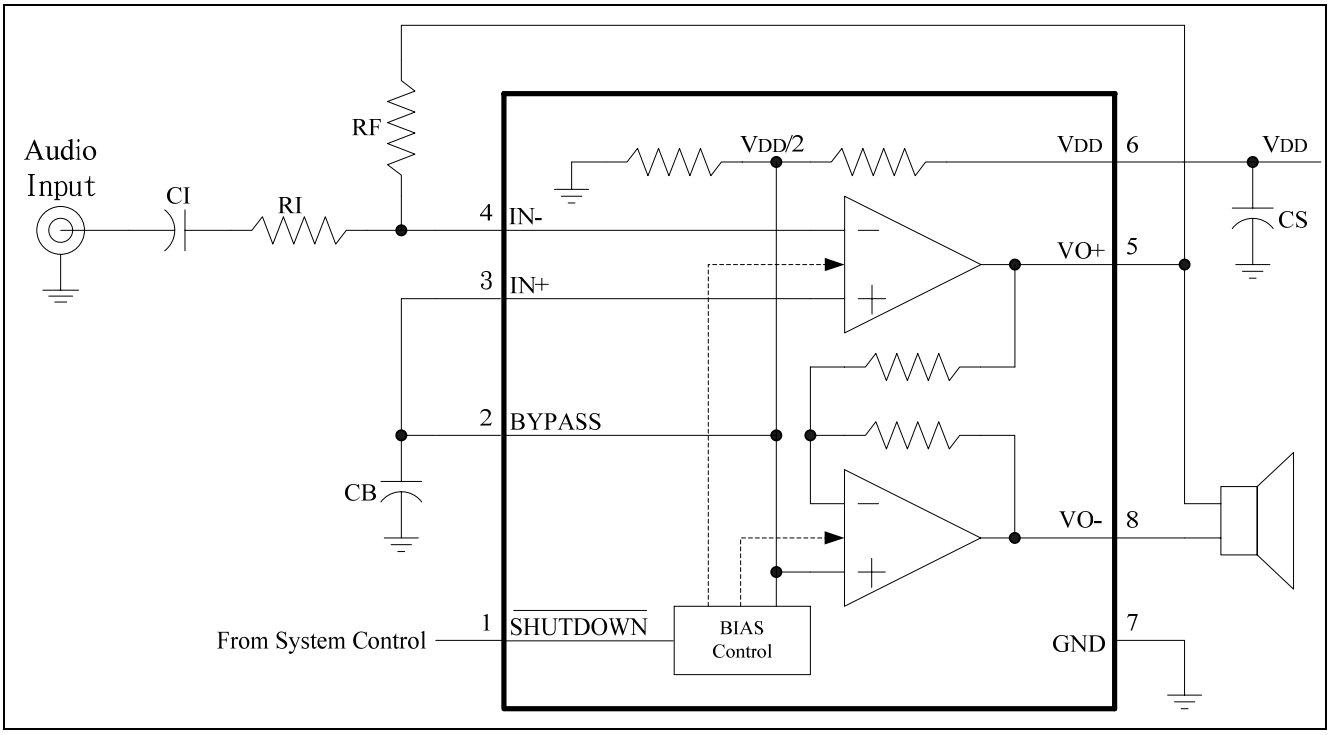
The GPY0031A (a bridge-tied load (BTL) and GPY0032A (a BTL or singled-ended (SE)), are audio amplifiers, designed especially for low-voltage applications which normally require internal speaker. Operating on 5V power supply, GPY0031A / 32A can deliver 2.0W of successive average power into 4Ω load at less than 10% THD+N throughout voice band frequencies and embedded the de-pop circuit to minimize the turn-on and turn-off pop noise. Normally, it is applied for GPC series, GPF series, GPL series and other GENERALPLUS products. The GPY0031A / 32A are easily to be used in various applications and products.

2. FEATURES

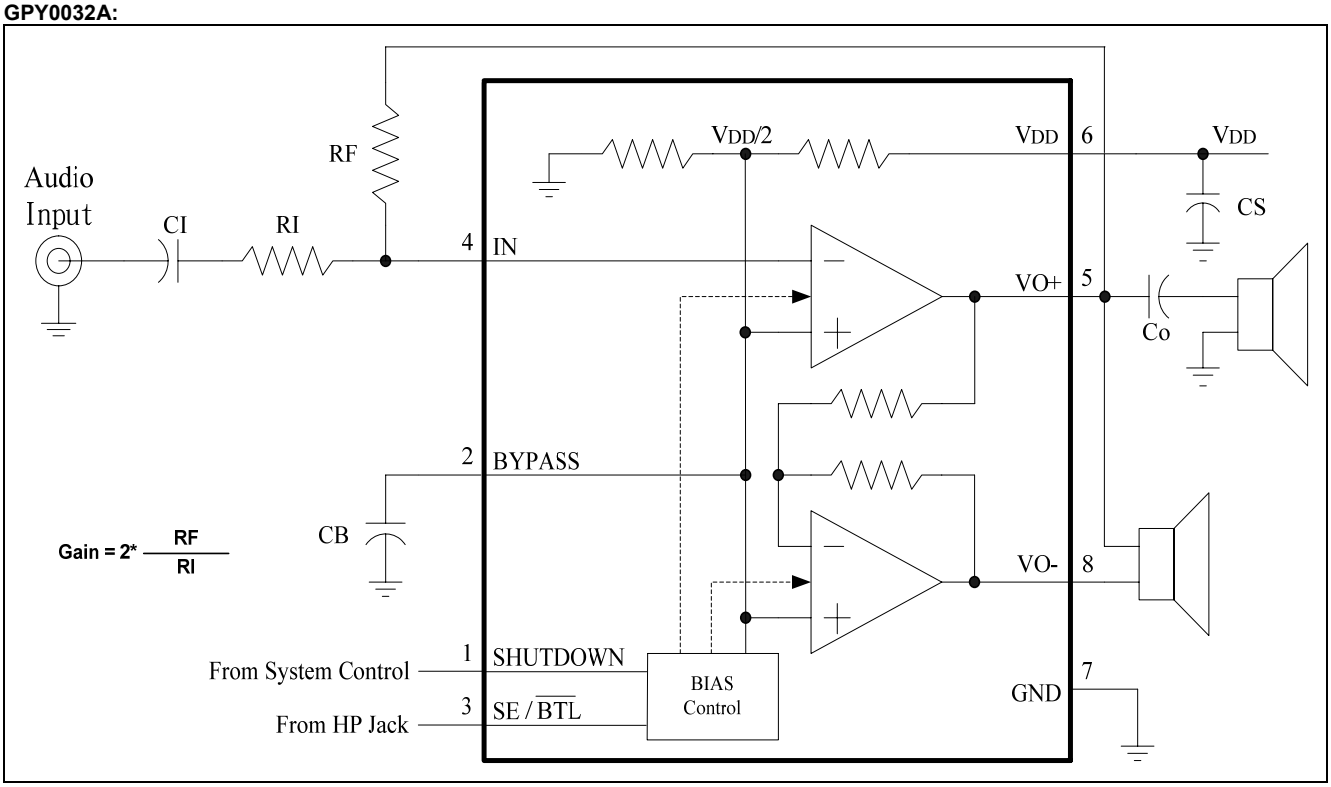
- Wide Operation Range: 2.0V – 6.8V
- Bridge-Tied Load (BTL) (For GPY0031A)
- Bridge-Tied Load (BTL) or Single-Ended (SE) Modes Operation (For GPY0032A)
- Low Distortion: THD+N = 0.15% (Typ.)
  (For VDD = 5.0V, R_L = 4.0Ω & P_{out} = 630mW)
- High Output Power: P_{OUT} = 1.6W
  (For VDD = 5.0V, THD+N =1.0%, f =1.0KHz & R_L = 4Ω)
- Low Shutdown Current: 1.0μA
- Minimize the turn-on and turn-off pop noise
- Thermal Shutdown Protection
- Over Current Protection

3. BLOCK DIAGRAM

GPY0031A:



GPY0032A:


Audio Input
CI
RI
RF
4
IN
VDD/2
VDD
6
VDD
CS
VO+
5
Co
2
BYPASS
CB
Gain = 2* RF/RI
VO-
8
1
SHUTDOWN
From System Control
3
SE / BTL
From HP Jack
BIAS Control
7
GND

4. SIGNAL DESCRIPTIONS

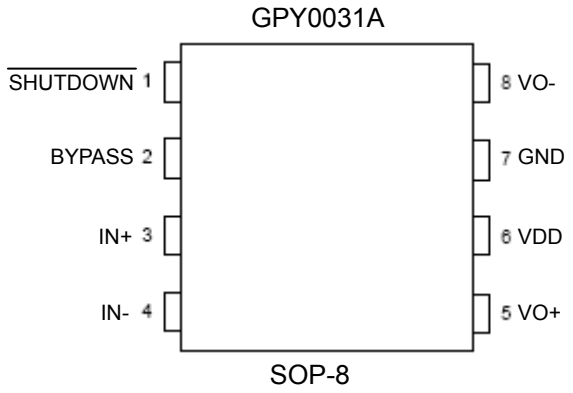
GPY0031A:

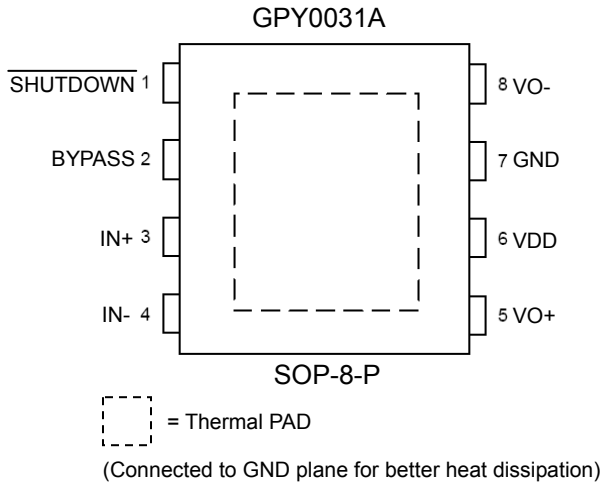
Mnemonic	PIN No.	Type	Description	Electrical Characteristics
$\overline{\text{SHUTDOWN}}$	1	I	Shutdown mode control signal input. Active Low.	-
BYPASS	2	I	BYPASS is internal mid-supply bias. This pin should be connected to a 0.1uF ~ 2.2uF capacitor.	VDD/2
IN+	3	I	IN+ is non-inverting input	-
IN-	4	I	IN- is inverting input	-
VO+	5	O	VO+ is positive BTL output	-
VDD	6	I	Power VDD	2.0V – 6.8V
VO-	7	O	VO- is negative BTL output	-
GND	8	I	Power Ground	-

GPY0032A:

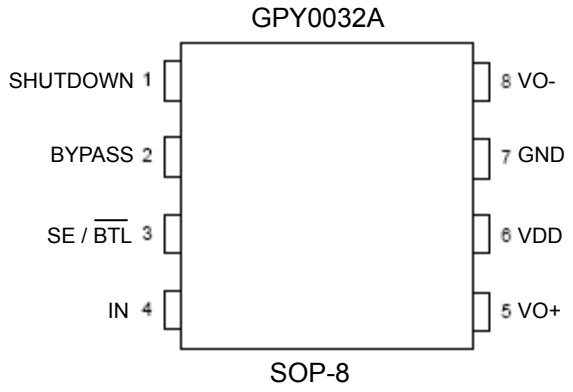
Mnemonic	PIN No.	Type	Description	Electrical Characteristics
SHUTDOWN	1	I	Shutdown mode control signal input. Active High.	-
BYPASS	2	I	BYPASS is internal mid-supply bias. This pin should be connected to a 0.1uF ~ 2.2uF capacitor.	VDD/2
SE / $\overline{\text{BTL}}$	3	I	When SE / $\overline{\text{BTL}}$ is held low, GPY0032A is in BTL mode. When SE/ $\overline{\text{BTL}}$ is held High, GPY0032A is in SE mode.	-
IN	4	I	Audio input	-
VO+	5	O	VO+ is positive output for BTL mode and SE mode	-
VDD	6	I	Power VDD	2.0V – 6.8V
VO-	7	O	VO- is negative BTL output	-
GND	8	I	Power Ground	-

4.1. Package Pin Assignment





(Connected to GND plane for better heat dissipation)



5. ELECTRICAL SPECIFICATIONS

5.1. Absolute Maximum Ratings

Characteristics	Symbol	Ratings
DC Supply Voltage	V_+	< 7.0V
Input Voltage Range	V_{IN}	-0.5V to V+ + 0.5V
Operating free-air Temperature Range	T_A	-40℃ to + 85℃
Operating junction Temperature Range	T_J	-40℃ to + 150℃
Storage Temperature	T_{STO}	-50℃ to + 150℃

Note: Stresses beyond those given in the Absolute Maximum Rating table may cause operational errors or damage to the device. For normal operational conditions see AC/DC Electrical Characteristics.

5.2. Thermal Characteristics

Characteristics	Symbol	Value	Unit
SOP-8 Package Thermal Resistance	R_{THJA}	150	℃/W
SOP-8-P Package Thermal Resistance	R_{THJA}	80	℃/W

5.3. DC Characteristics (V_{DD}=5.0V, T_A = 25°C unless otherwise specified)

GPY0031A:

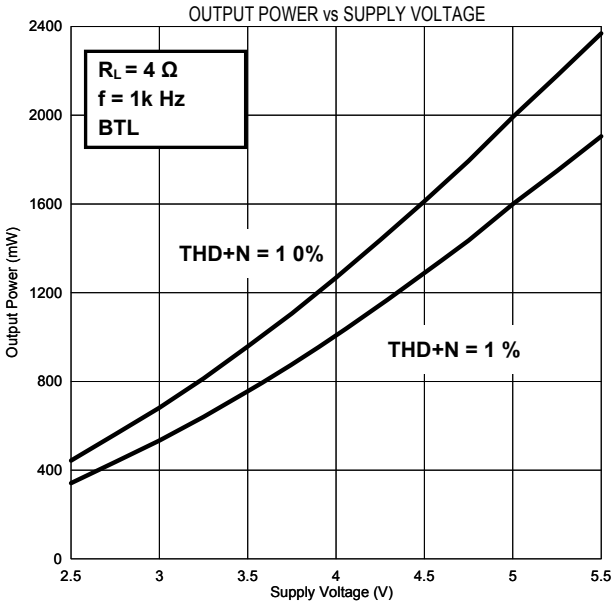
Item	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Operation Voltage	Temperature = 25°C	V_{DD}	2.00	-	6.8	V
	Temperature = -20°C	V_{DD}	2.15		6.8	V
	Temperature = -40°C	V_{DD}	2.25		6.8	V
Shutdown Current	$\overline{SHUTDOWN}$=GND	I_{STBY}	-	0.1	1.0	uA
Operating Current	V_{DD} = 5.0V, $\overline{SHUTDOWN}$ =V_{DD}, No Load	I_{DD}	-	4.0	-	mA
Reference Voltage	V_{DD}=5.0V, $\overline{SHUTDOWN}$ =V_{DD}	V_{REF}	-	V_{DD} /2	-	V
Total Harmonic Distortion + Noise	V_{DD} = 5.0V, R_L = 4.0Ω, P_{OUT} = 630mW	THD+N	-	0.15	-	%
	V_{DD} = 5.0V, R_L = 8.0Ω, P_{OUT} = 630mW	THD+N	-	0.15	-	%
Output Power	V_{DD} = 5.0V, THD+N = 1%, f = 1.0KHz & R_L = 4.0Ω	P_{OUT}	-	1600	-	mW
	V_{DD} = 5.0V, THD+N = 1%, f = 1.0KHz & R_L = 8.0Ω	P_{OUT}	-	1150	-	mW
	V_{DD} = 5.0V, THD+N = 10%, f = 1.0KHz & R_L = 4.0Ω	P_{OUT}	-	2000	-	mW
	V_{DD} = 5.0V, THD+N = 10%, f = 1.0KHz & R_L = 8.0Ω	P_{OUT}	-	1400	-	mW
Output Offset Voltage	V_{IN}=0V	V_{OS}	-	-	30	mV
Power Rejection Ratio	f = 1kHz	PSRR	-	70	-	dB
Enable Time	V_{DD} = 5.0V, CI=0.47μF, CB=1.0μF	T_{ON}	-	70	-	ms
Shutdown Time	V_{DD} = 5.0V, CI=0.47μF, CB=1.0μF	T_{OFF}	-	70	-	ms

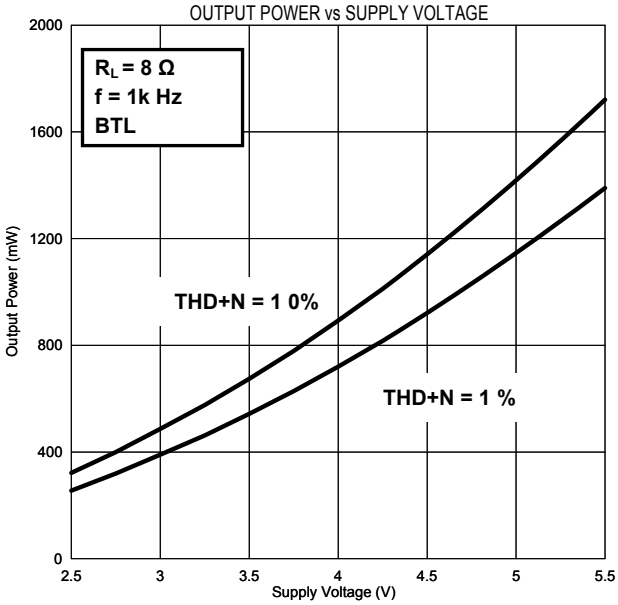
GPY0032A:

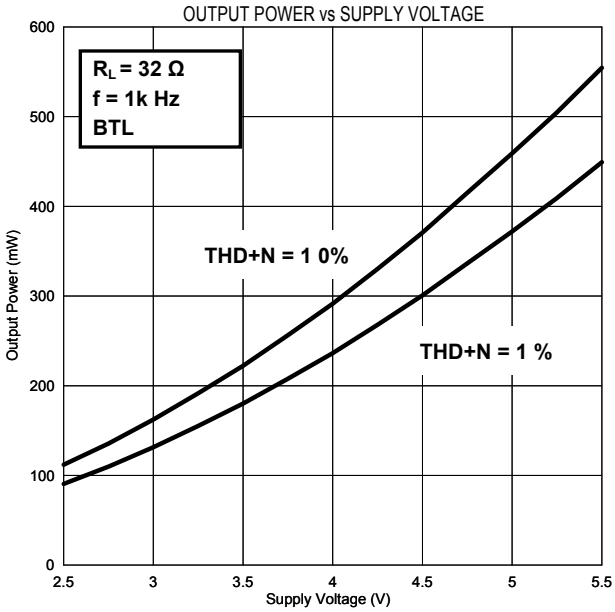
Item	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Operation Voltage	Temperature = 25°C	V_{DD}	2.00	-	6.8	V
	Temperature = -20°C	V_{DD}	2.15		6.8	V
	Temperature = -40°C	V_{DD}	2.25		6.8	V
Shutdown Current	SHUTDOWN=VDD	I_{STBY}	-	0.1	1.0	uA
Operating Current	V_{DD} = 5.0V, SHUTDOWN =GND, No Load	I_{DD}	-	4.0	-	mA
Reference Voltage	V_{DD}=5.0V, SHUTDOWN =GND	V_{REF}	-	V_{DD} /2	-	V
Total Harmonic Distortion + Noise	V_{DD} = 5.0V, R_L = 4.0Ω, P_{OUT} = 630mW	THD+N	-	0.15	-	%
	V_{DD} = 5.0V, R_L = 8.0Ω, P_{OUT} = 630mW	THD+N	-	0.15	-	%
Output Power	V_{DD} = 5.0V, THD+N = 1%, f = 1.0KHz & R_L = 4.0Ω	P_{OUT}	-	1600	-	mW
	V_{DD} = 5.0V, THD+N = 1%, f = 1.0KHz & R_L = 8.0Ω	P_{OUT}	-	1150	-	mW
	V_{DD} = 5.0V, THD+N = 10%, f = 1.0KHz & R_L = 4.0Ω	P_{OUT}	-	2000	-	mW
	V_{DD} = 5.0V, THD+N = 10%, f = 1.0KHz & R_L = 8.0Ω	P_{OUT}	-	1400	-	mW
Output Offset Voltage	V_{IN}=0V	V_{OS}	-	-	30	mV
Power Rejection Ratio	f = 1kHz	PSRR	-	70	-	dB
Enable Time	V_{DD} = 5.0V, SE / $\overline{BTL}$ = GND, CB=1.0μF	T_{ON}	-	70	-	ms
	V_{DD} = 5.0V, SE / $\overline{BTL}$ = V_{DD}, CB=1.0μF		-	200	-	ms
Shutdown Time	V_{DD} = 5.0V, SE / $\overline{BTL}$=GND, CB=1.0μF	T_{OFF}	-	70	-	ms
	V_{DD} = 5.0V, SE / $\overline{BTL}$ = V_{DD}, CB=1.0μF		-	200	-	ms

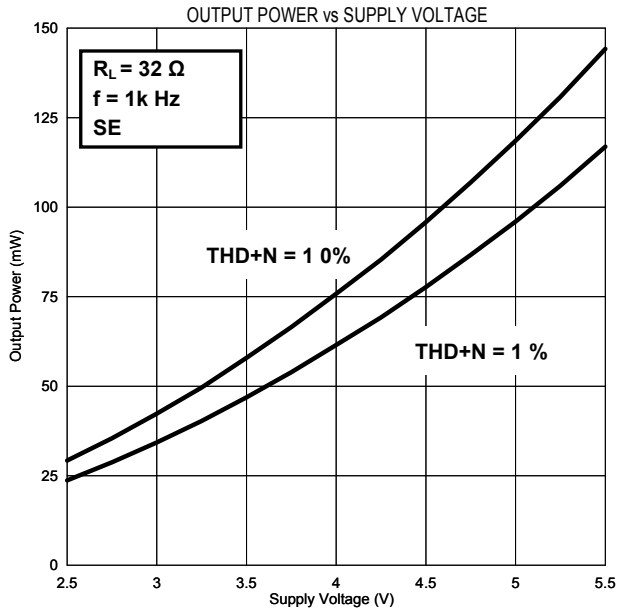
5.4. Typical Performance Characteristics

5.4.1. Output power vs. supply voltage

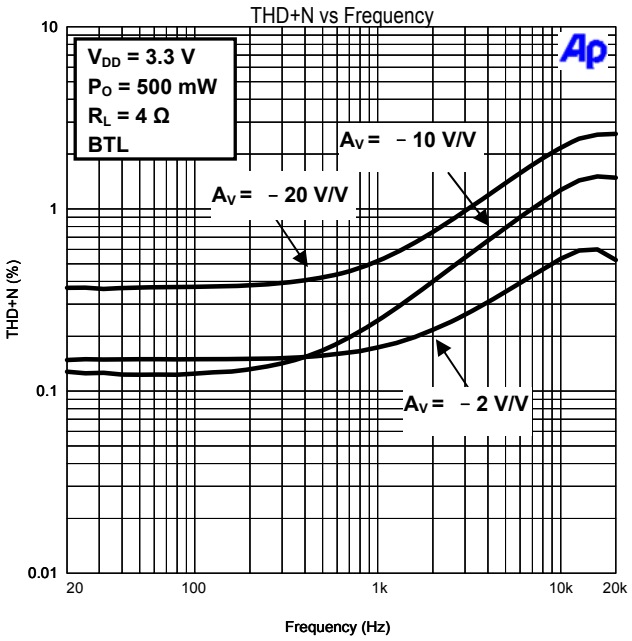


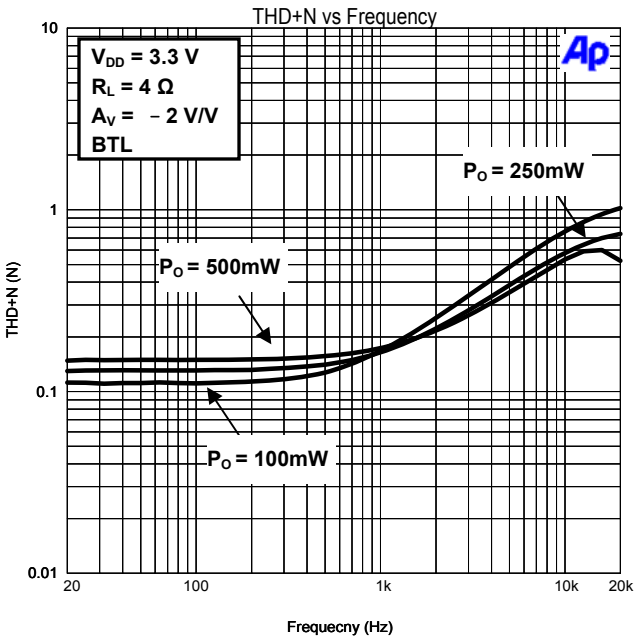


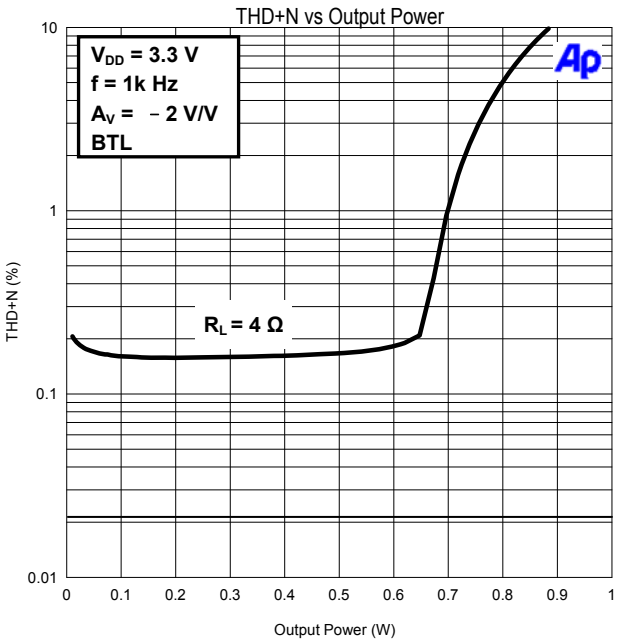


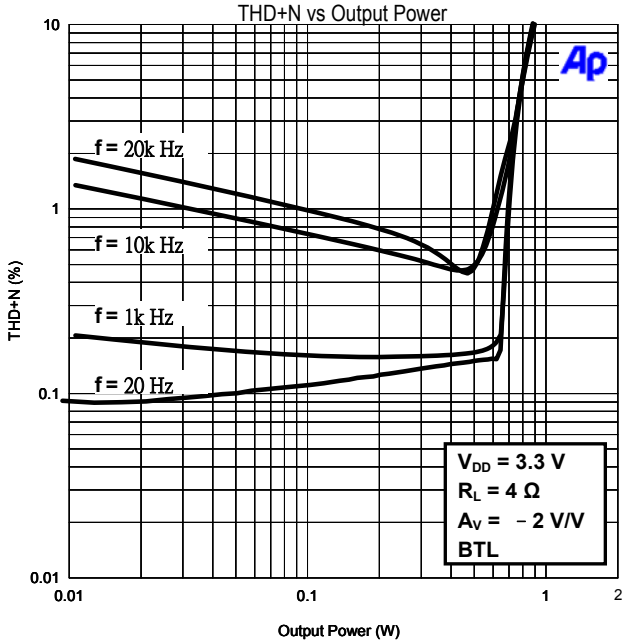


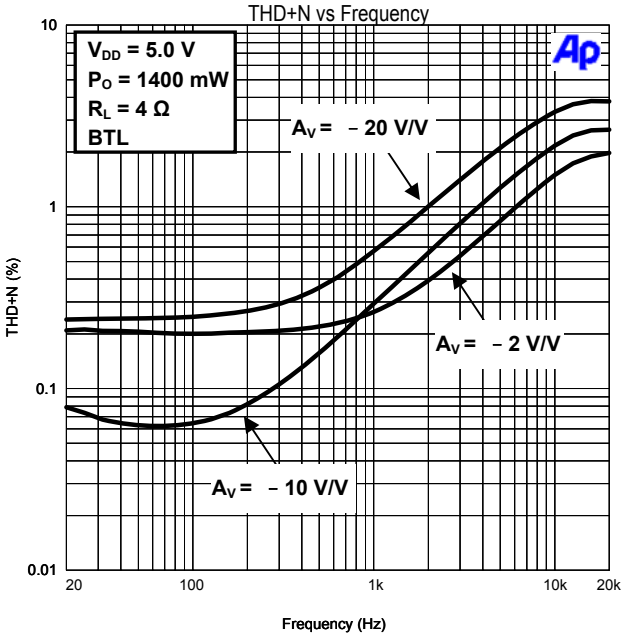
5.4.2. THD+N

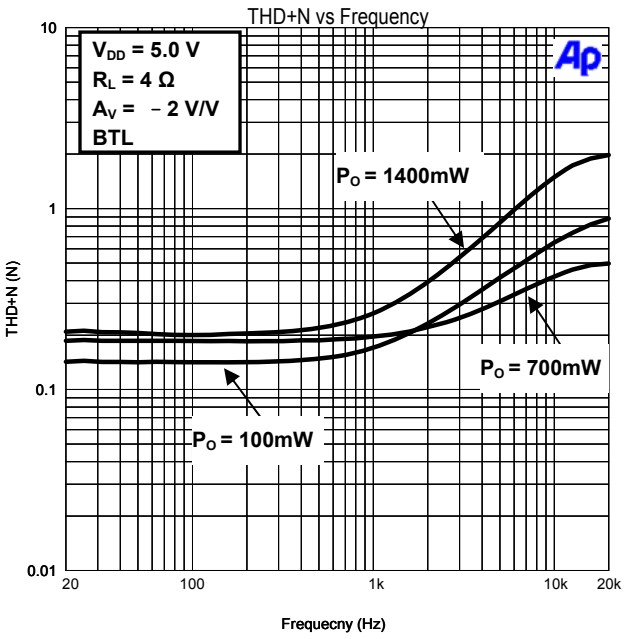

THD+N vs Frequency
V_{DD} = 3.3 V
P_O = 500 mW
R_L = 4 Ω
BTL
A_V = －10 V/V
A_V = －20 V/V
A_V = －2 V/V
THD+N (%)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequency (Hz)

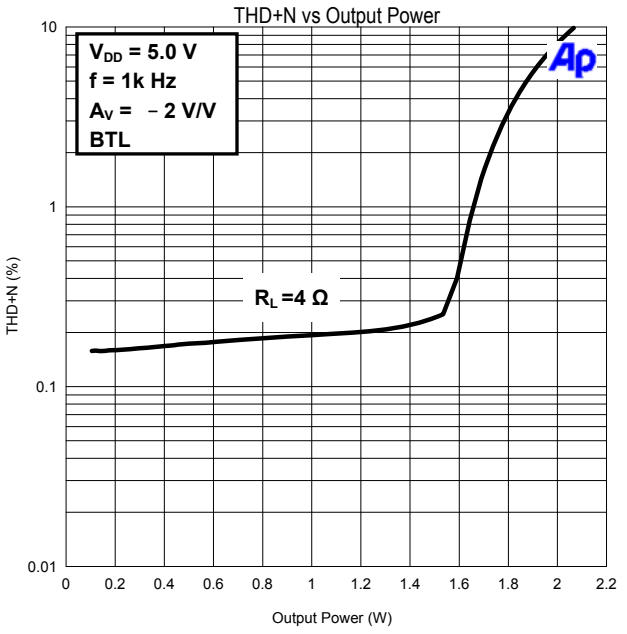

THD+N vs Frequency
V_{DD} = 3.3 V
R_L = 4 Ω
A_V = －2 V/V
BTL
P_O = 250mW
P_O = 500mW
P_O = 100mW
THD+N (N)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequecny (Hz)

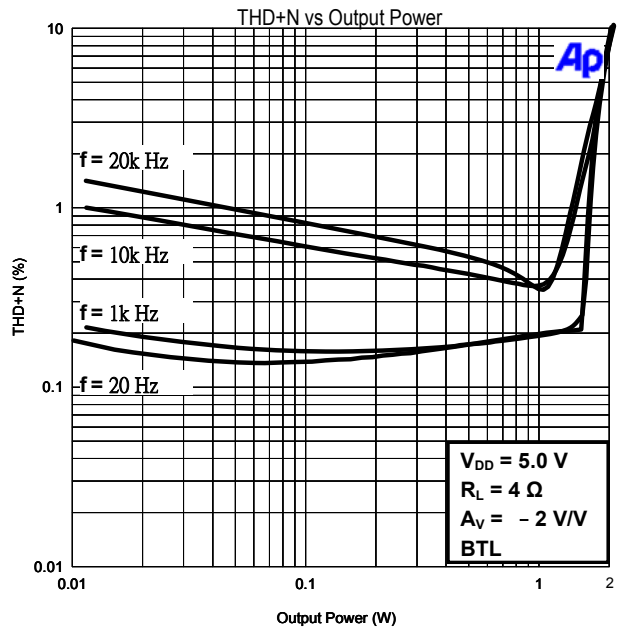

THD+N vs Output Power
V_{DD} = 3.3 V
f = 1k Hz
A_V = －2 V/V
BTL
R_L = 4 Ω
THD+N (%)
10
1
0.1
0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Output Power (W)

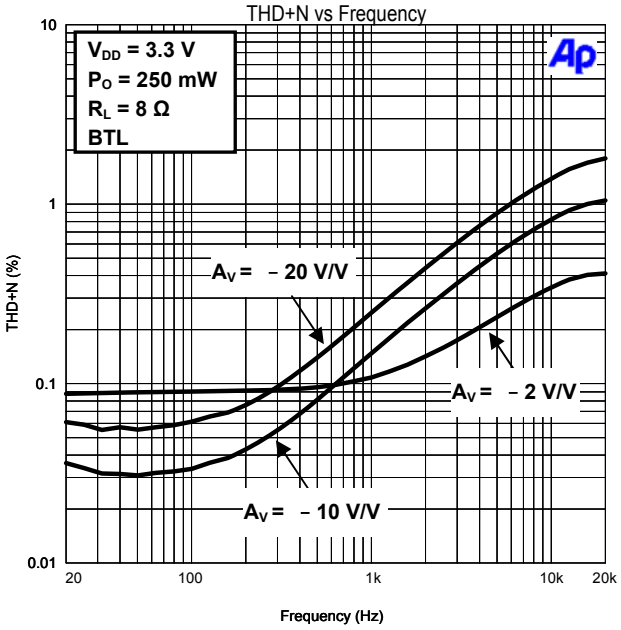

THD+N vs Output Power
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
V_{DD} = 3.3 V
R_L = 4 Ω
A_V = －2 V/V
BTL
THD+N (%)
10
1
0.1
0.01
0.01
0.1
1
2
Output Power (W)

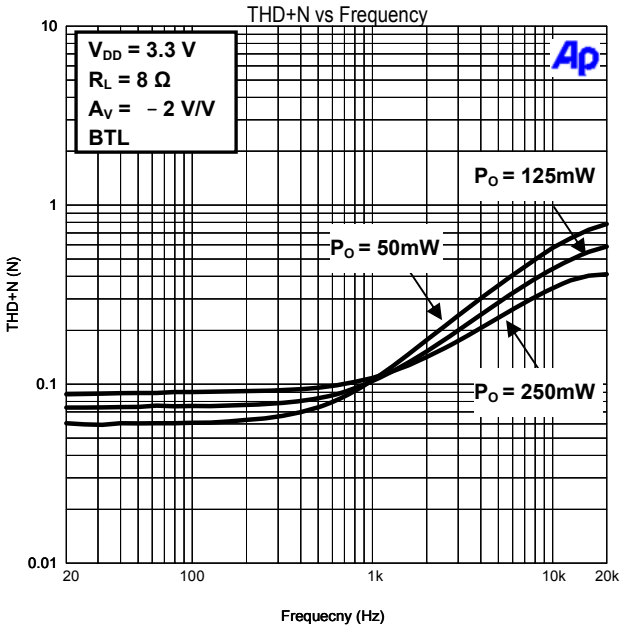

THD+N vs Frequency
V_{DD} = 5.0 V
P_O = 1400 mW
R_L = 4 Ω
BTL
A_V = －20 V/V
A_V = －2 V/V
A_V = －10 V/V
THD+N (%)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequency (Hz)

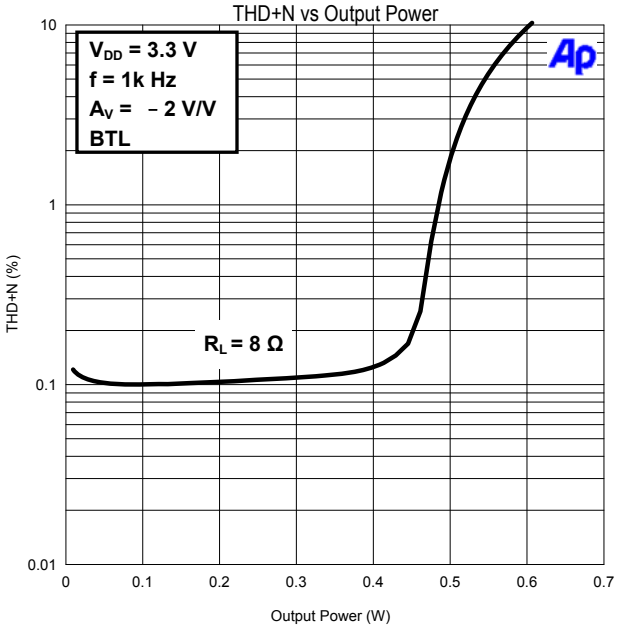

THD+N vs Frequency
V_{DD} = 5.0 V
R_L = 4 Ω
A_V = －2 V/V
BTL
P_O = 1400mW
P_O = 700mW
P_O = 100mW
THD+N (N)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequecny (Hz)

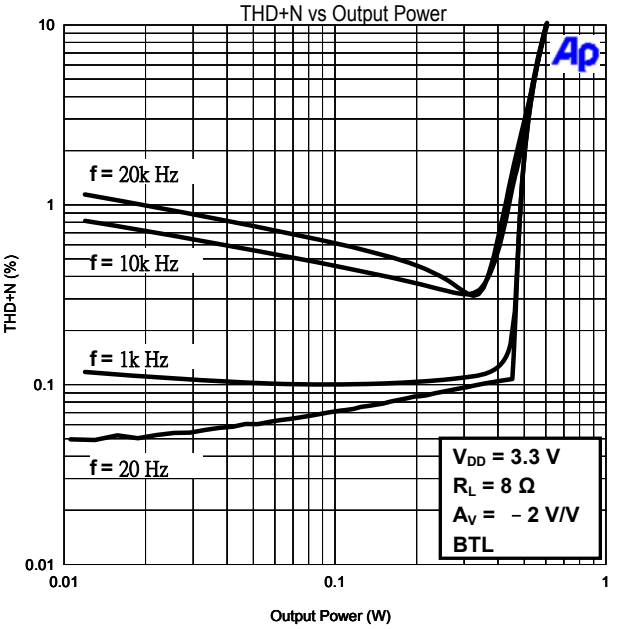

THD+N vs Output Power
V_{DD} = 5.0 V
f = 1k Hz
A_V = －2 V/V
BTL
R_L =4 Ω
THD+N (%)
10
1
0.1
0.01
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
Output Power (W)

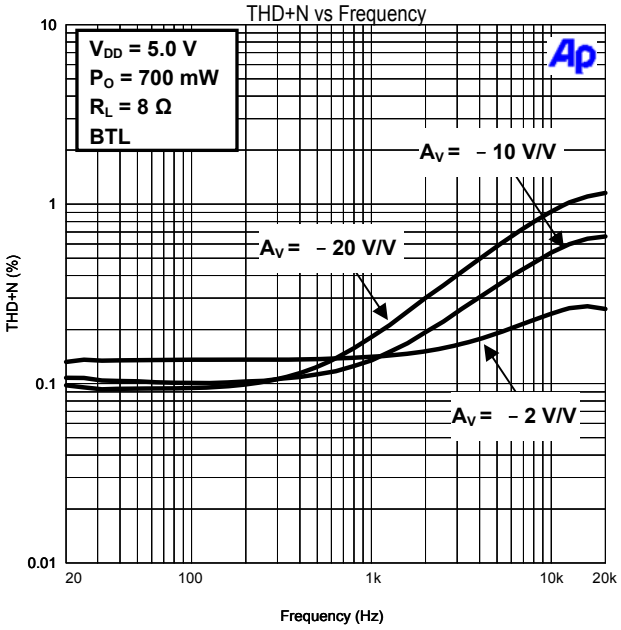

THD+N vs Output Power
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
V_{DD} = 5.0 V
R_L = 4 Ω
A_V = －2 V/V
BTL
THD+N (%)
10
1
0.1
0.01
0.01
0.1
1
2
Output Power (W)

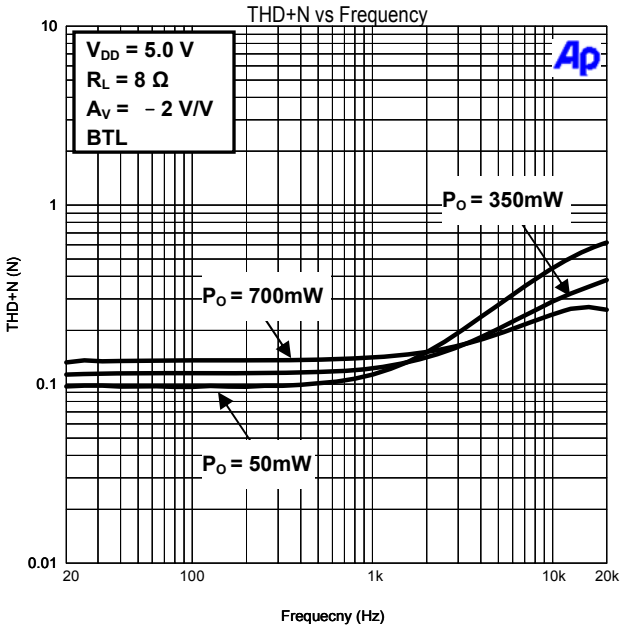

THD+N vs Frequency
V_{DD} = 3.3 V
P_O = 250 mW
R_L = 8 Ω
BTL
A_V = – 20 V/V
A_V = – 2 V/V
A_V = – 10 V/V
THD+N (%)
Frequency (Hz)
10
1
0.1
0.01
20
100
1k
10k
20k

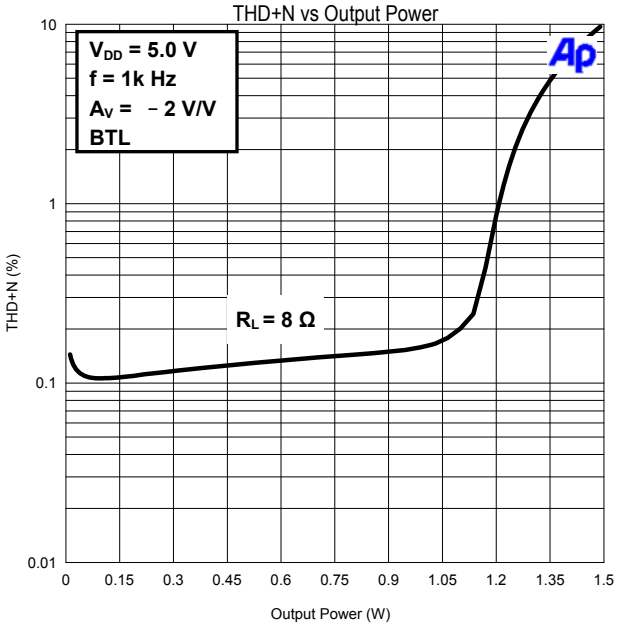

THD+N vs Frequency
V_{DD} = 3.3 V
R_L = 8 Ω
A_V = – 2 V/V
BTL
P_O = 125mW
P_O = 50mW
P_O = 250mW
THD+N (N)
Frequecny (Hz)
10
1
0.1
0.01
20
100
1k
10k
20k

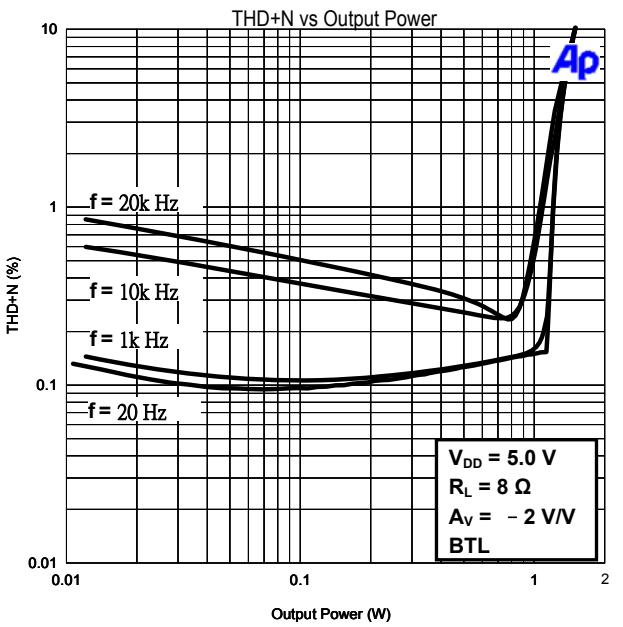

THD+N vs Output Power
V_{DD} = 3.3 V
f = 1k Hz
A_V = – 2 V/V
BTL
R_L = 8 Ω
THD+N (%)
Output Power (W)
10
1
0.1
0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

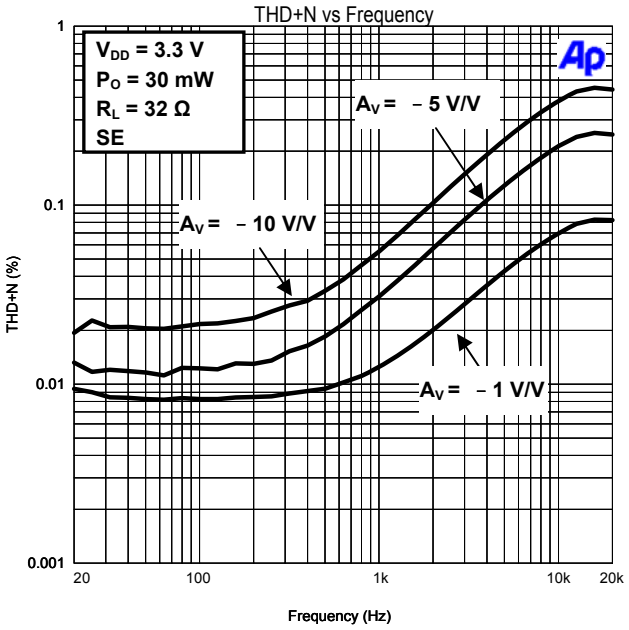

THD+N vs Output Power
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
V_{DD} = 3.3 V
R_L = 8 Ω
A_V = – 2 V/V
BTL
THD+N (%)
Output Power (W)
10
1
0.1
0.01
0.01
0.1
1

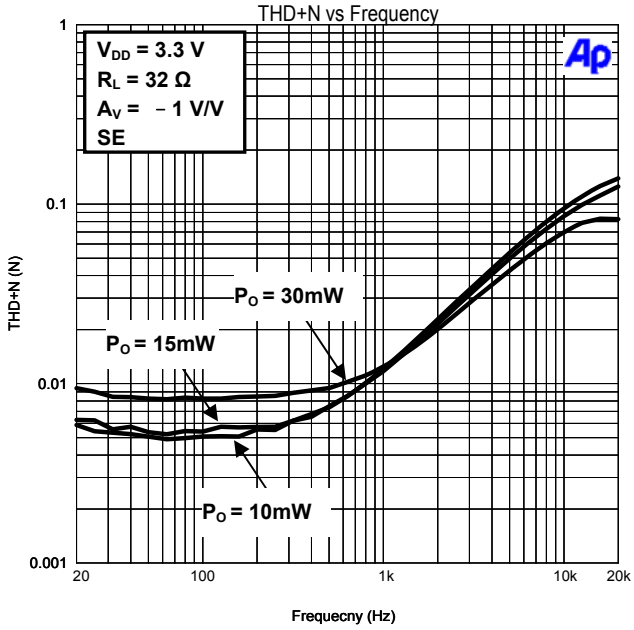

THD+N vs Frequency
V_{DD} = 5.0 V
P_O = 700 mW
R_L = 8 Ω
BTL
A_V = －10 V/V
A_V = －20 V/V
A_V = －2 V/V
THD+N (%)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequency (Hz)

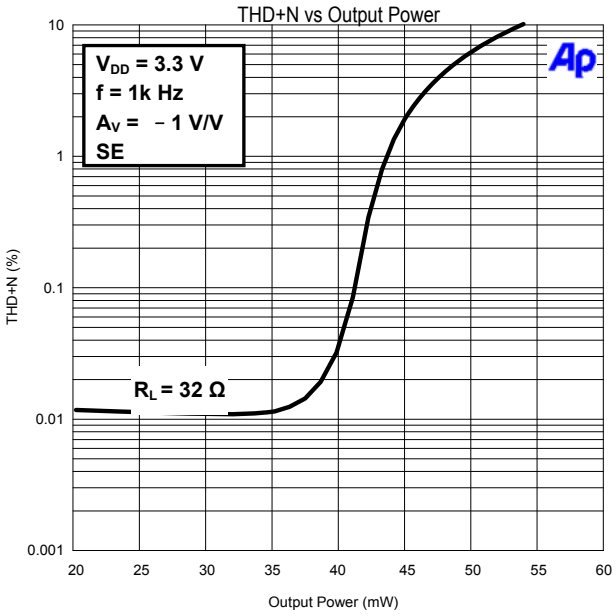

THD+N vs Frequency
V_{DD} = 5.0 V
R_L = 8 Ω
A_V = －2 V/V
BTL
P_O = 350mW
P_O = 700mW
P_O = 50mW
THD+N (N)
10
1
0.1
0.01
20
100
1k
10k
20k
Frequecny (Hz)

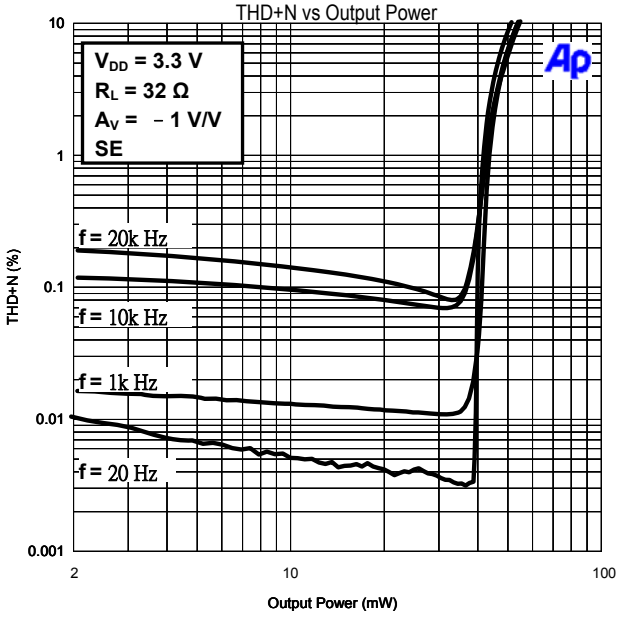

THD+N vs Output Power
V_{DD} = 5.0 V
f = 1k Hz
A_V = －2 V/V
BTL
R_L = 8 Ω
THD+N (%)
10
1
0.1
0.01
0
0.15
0.3
0.45
0.6
0.75
0.9
1.05
1.2
1.35
1.5
Output Power (W)

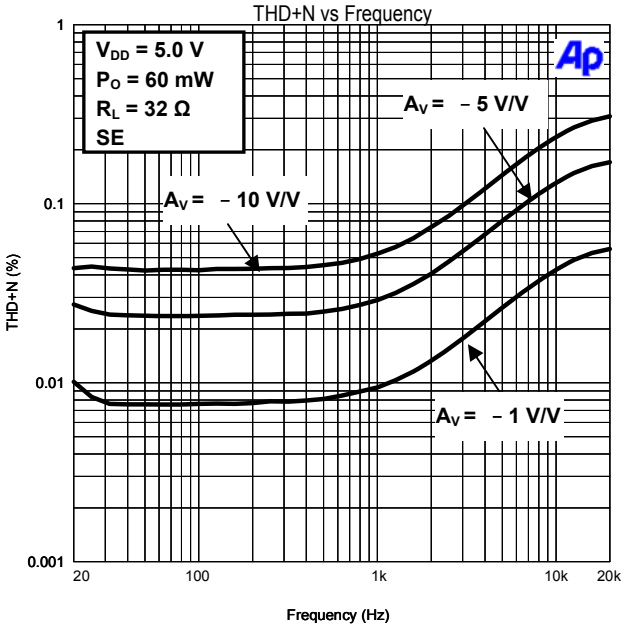

THD+N vs Output Power
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
V_{DD} = 5.0 V
R_L = 8 Ω
A_V = －2 V/V
BTL
THD+N (%)
10
1
0.1
0.01
0.01
0.1
1
2
Output Power (W)

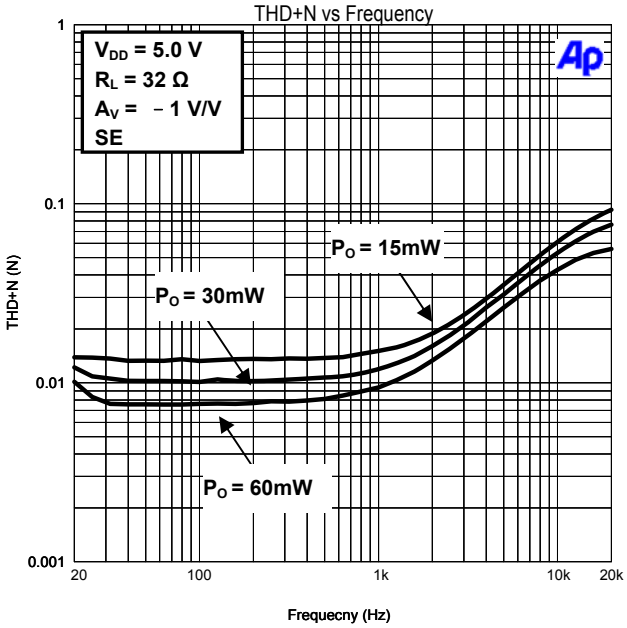

THD+N vs Frequency
V_{DD} = 3.3 V
P_O = 30 mW
R_L = 32 Ω
SE
A_V = －5 V/V
A_V = －10 V/V
A_V = －1 V/V
THD+N (%)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequency (Hz)

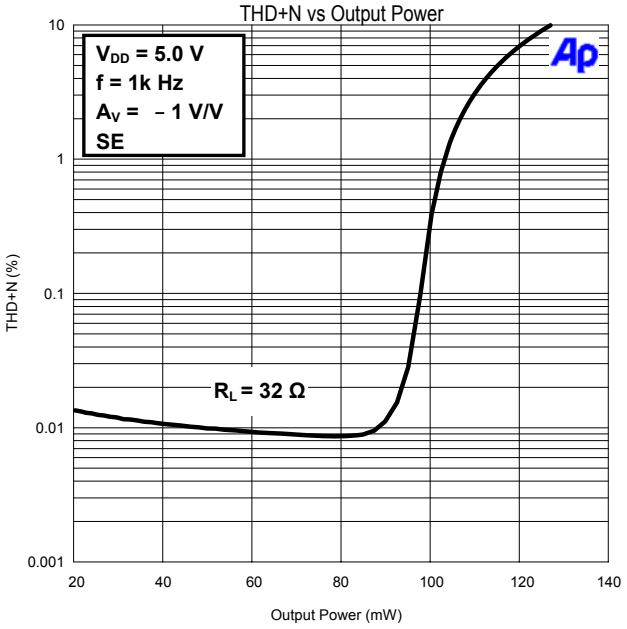

THD+N vs Frequency
V_{DD} = 3.3 V
R_L = 32 Ω
A_V = －1 V/V
SE
P_O = 30mW
P_O = 15mW
P_O = 10mW
THD+N (N)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequecny (Hz)

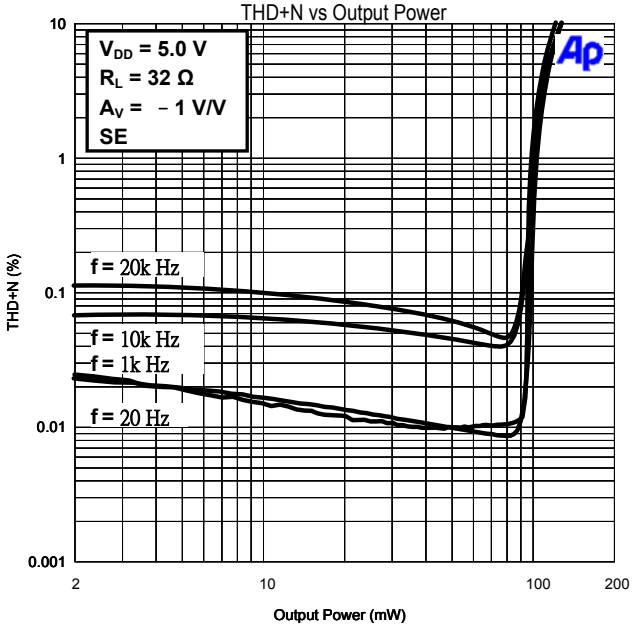

THD+N vs Output Power
V_{DD} = 3.3 V
f = 1k Hz
A_V = －1 V/V
SE
R_L = 32 Ω
THD+N (%)
10
1
0.1
0.01
0.001
20
25
30
35
40
45
50
55
60
Output Power (mW)

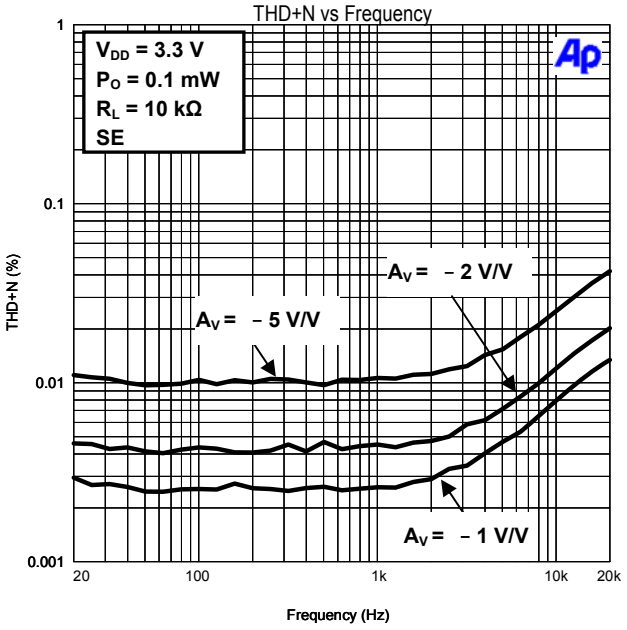

THD+N vs Output Power
V_{DD} = 3.3 V
R_L = 32 Ω
A_V = －1 V/V
SE
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
THD+N (%)
10
1
0.1
0.01
0.001
2
10
100
Output Power (mW)

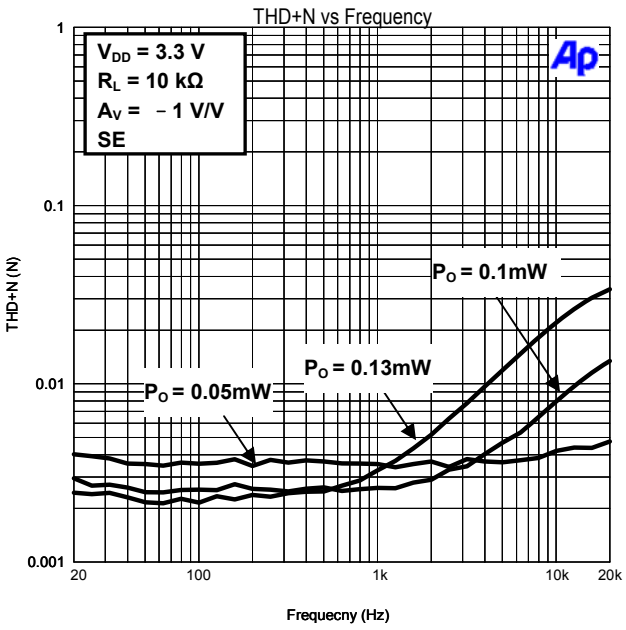

THD+N vs Frequency
V_{DD} = 5.0 V
P_O = 60 mW
R_L = 32 Ω
SE
A_V = – 5 V/V
A_V = – 10 V/V
A_V = – 1 V/V
THD+N (%)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequency (Hz)

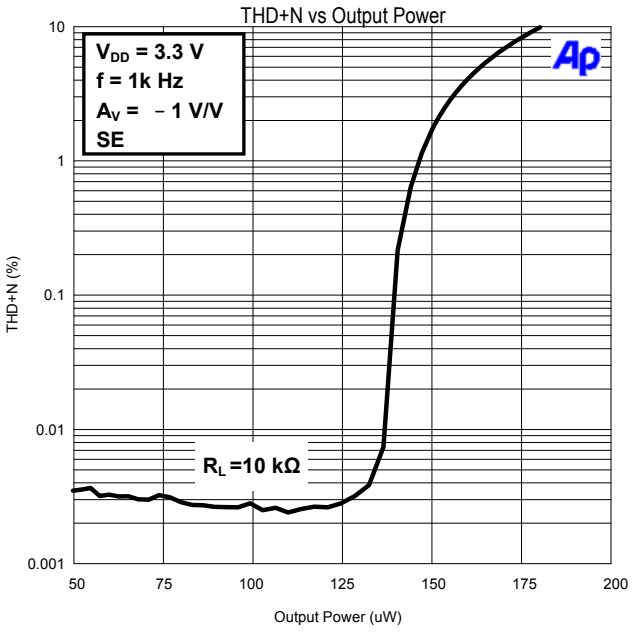

THD+N vs Frequency
V_{DD} = 5.0 V
R_L = 32 Ω
A_V = – 1 V/V
SE
P_O = 15mW
P_O = 30mW
P_O = 60mW
THD+N (N)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequecny (Hz)

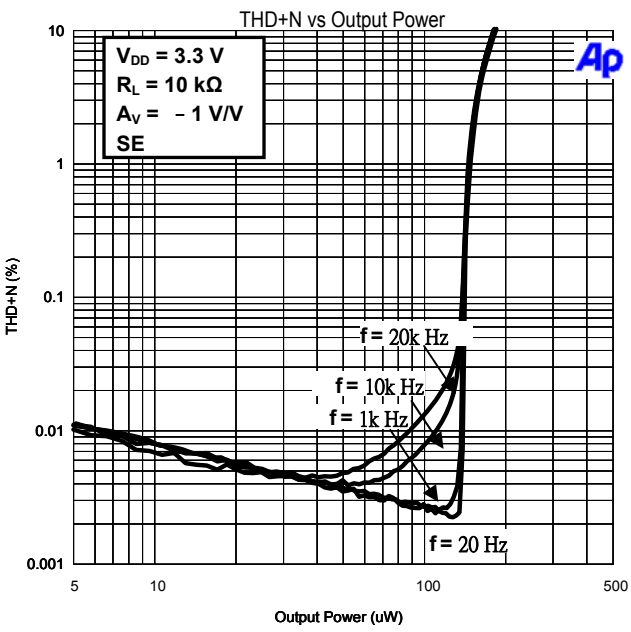

THD+N vs Output Power
V_{DD} = 5.0 V
f = 1k Hz
A_V = – 1 V/V
SE
R_L = 32 Ω
THD+N (%)
10
1
0.1
0.01
0.001
20
40
60
80
100
120
140
Output Power (mW)

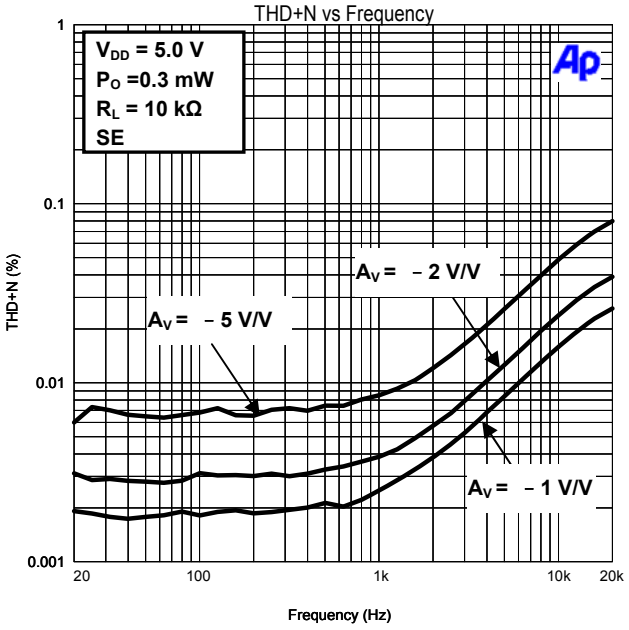

THD+N vs Output Power
V_{DD} = 5.0 V
R_L = 32 Ω
A_V = – 1 V/V
SE
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
THD+N (%)
10
1
0.1
0.01
0.001
2
10
100
200
Output Power (mW)

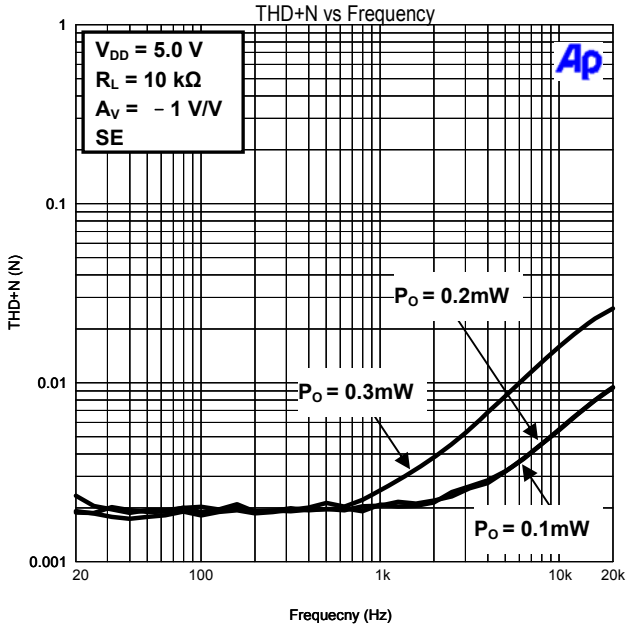

THD+N vs Frequency
V_{DD} = 3.3 V
P_O = 0.1 mW
R_L = 10 kΩ
SE
A_V = – 2 V/V
A_V = – 5 V/V
A_V = – 1 V/V
THD+N (%)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequency (Hz)

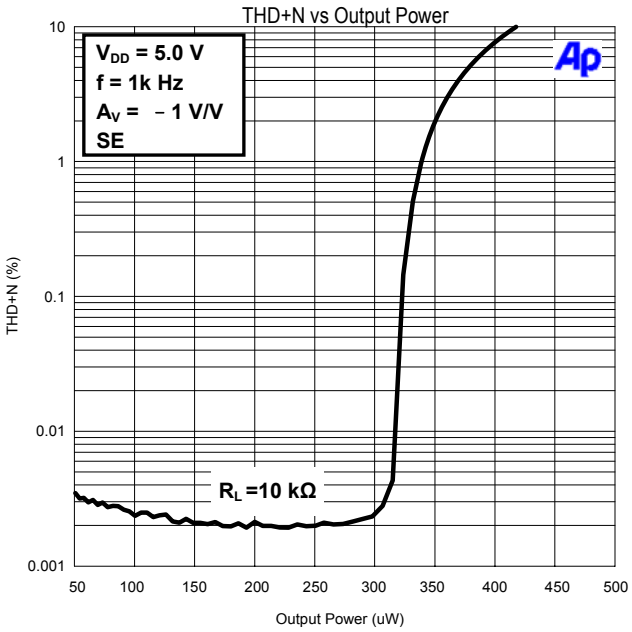

THD+N vs Frequency
V_{DD} = 3.3 V
R_L = 10 kΩ
A_V = – 1 V/V
SE
P_O = 0.1mW
P_O = 0.13mW
P_O = 0.05mW
THD+N (N)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequecny (Hz)

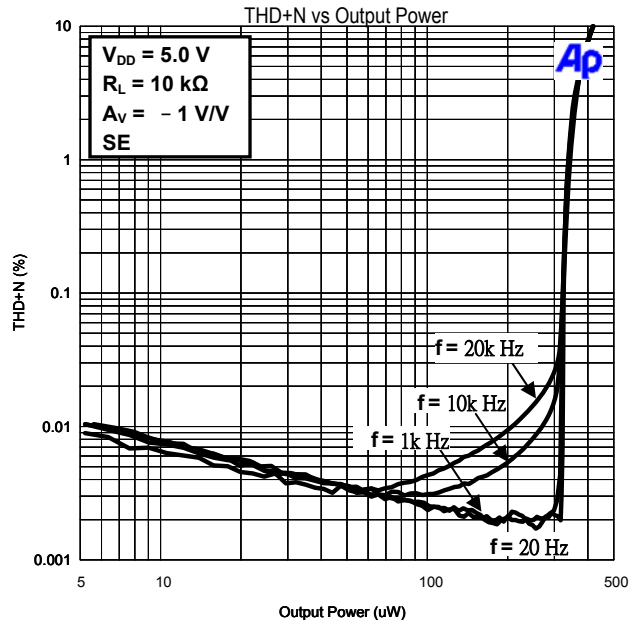

THD+N vs Output Power
V_{DD} = 3.3 V
f = 1k Hz
A_V = – 1 V/V
SE
R_L =10 kΩ
THD+N (%)
10
1
0.1
0.01
0.001
50
75
100
125
150
175
200
Output Power (uW)


THD+N vs Output Power
V_{DD} = 3.3 V
R_L = 10 kΩ
A_V = – 1 V/V
SE
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
THD+N (%)
10
1
0.1
0.01
0.001
5
10
100
500
Output Power (uW)

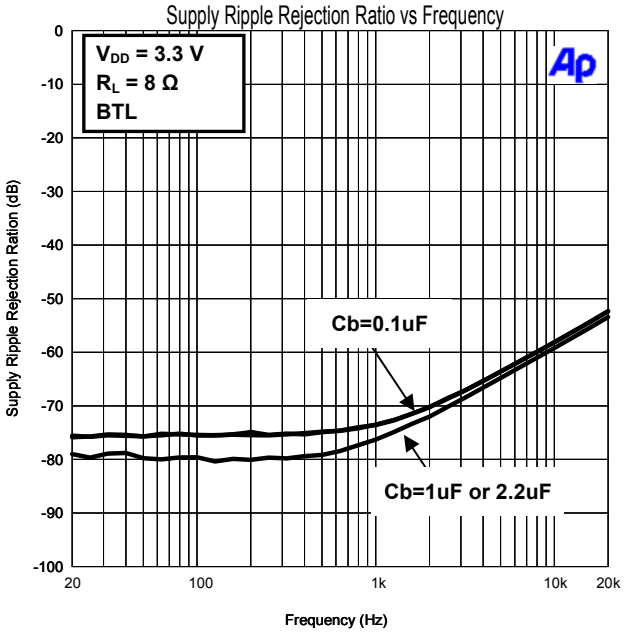

THD+N vs Frequency
V_{DD} = 5.0 V
P_O =0.3 mW
R_L = 10 kΩ
SE
A_V = – 2 V/V
A_V = – 5 V/V
A_V = – 1 V/V
THD+N (%)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequency (Hz)

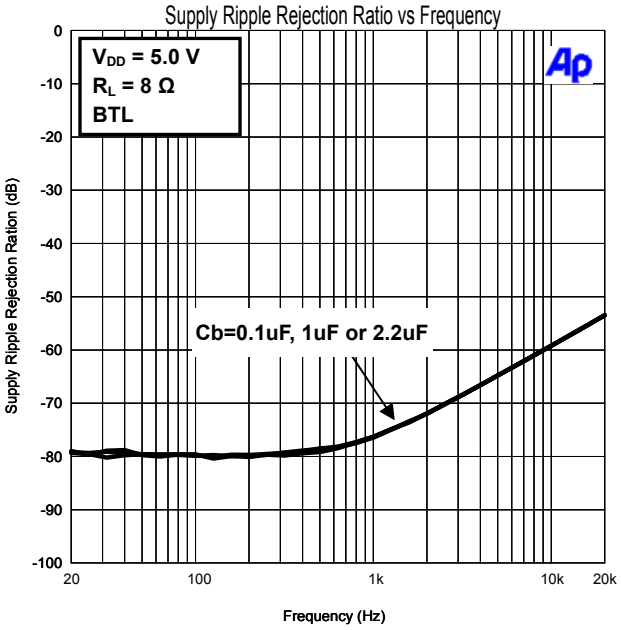

THD+N vs Frequency
V_{DD} = 5.0 V
R_L = 10 kΩ
A_V = – 1 V/V
SE
P_O = 0.2mW
P_O = 0.3mW
P_O = 0.1mW
THD+N (N)
1
0.1
0.01
0.001
20
100
1k
10k
20k
Frequecny (Hz)

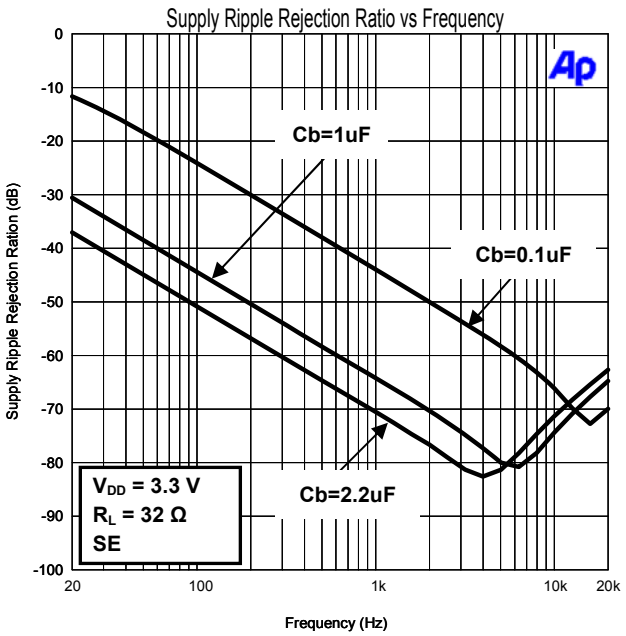

THD+N vs Output Power
V_{DD} = 5.0 V
f = 1k Hz
A_V = – 1 V/V
SE
R_L =10 kΩ
THD+N (%)
10
1
0.1
0.01
0.001
50
100
150
200
250
300
350
400
450
500
Output Power (uW)

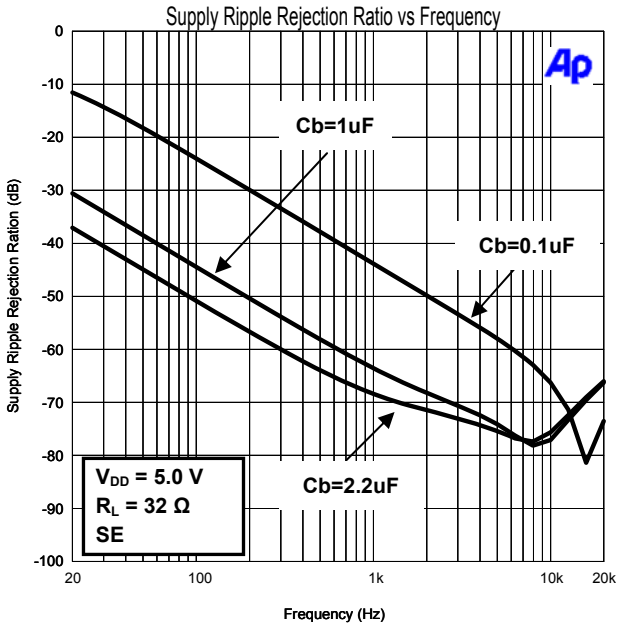

THD+N vs Output Power
V_{DD} = 5.0 V
R_L = 10 kΩ
A_V = – 1 V/V
SE
f = 20k Hz
f = 10k Hz
f = 1k Hz
f = 20 Hz
THD+N (%)
10
1
0.1
0.01
0.001
5
10
100
500
Output Power (uW)

5.4.3. Supply ripple rejection ratio vs. frequency

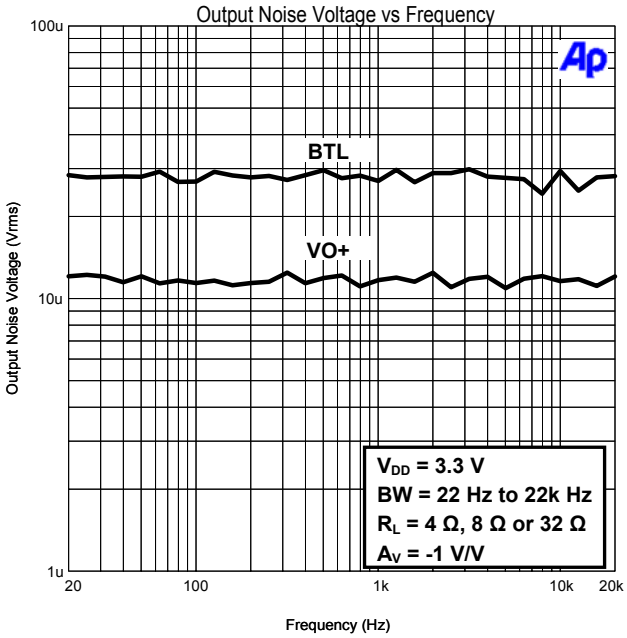


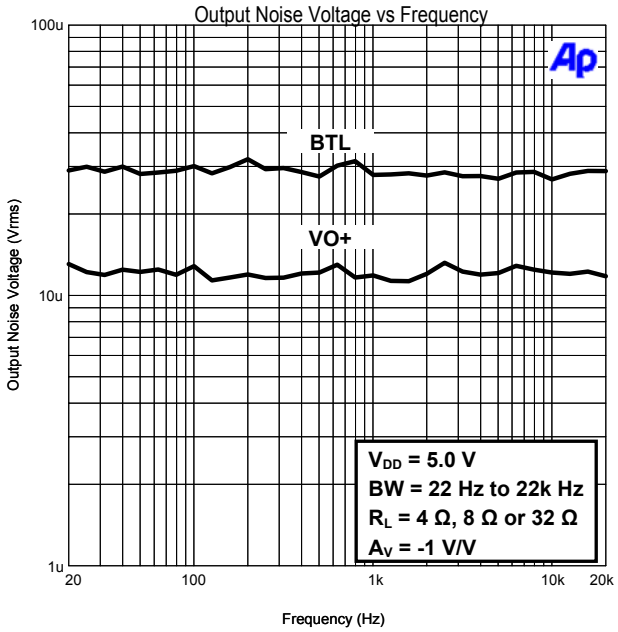






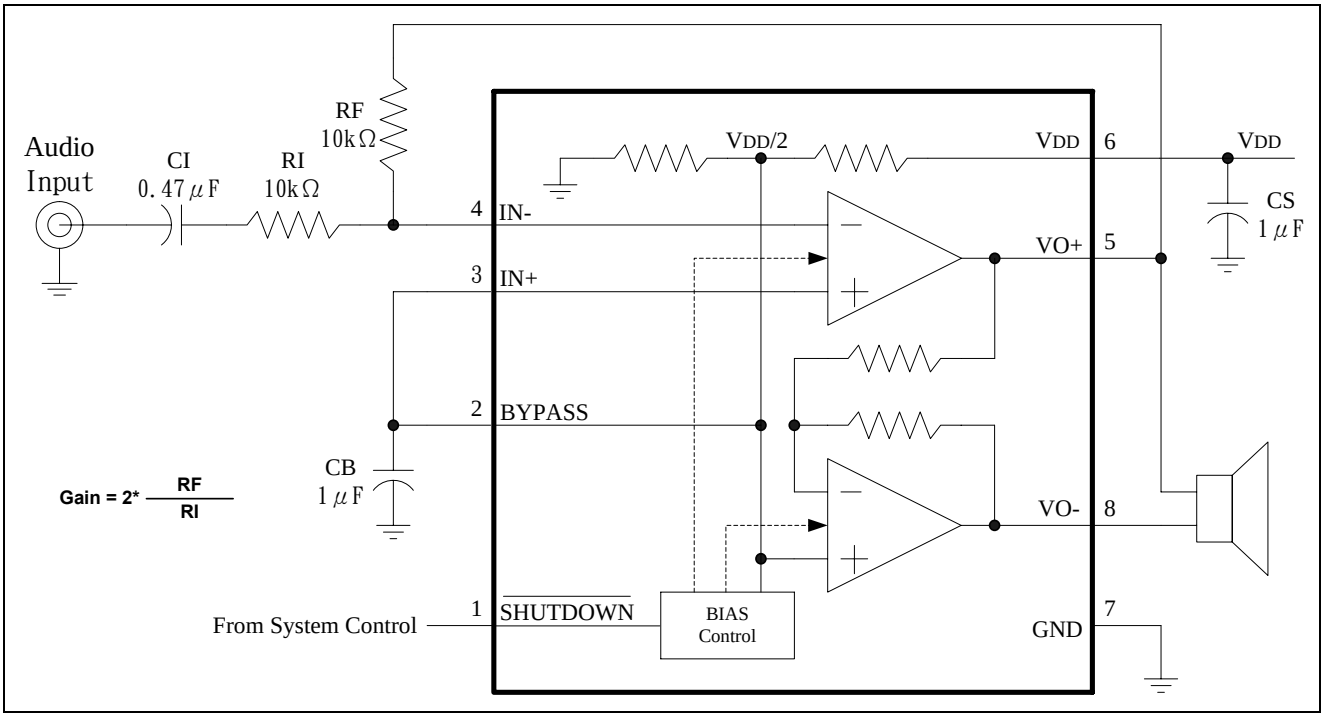
5.4.4. Noise


Output Noise Voltage vs Frequency
100u
10u
1u
Output Noise Voltage (Vrms)
BTL
VO+
VDD = 3.3 V
BW = 22 Hz to 22k Hz
RL = 4 Ω, 8 Ω or 32 Ω
AV = -1 V/V
20
100
1k
10k
20k
Frequency (Hz)

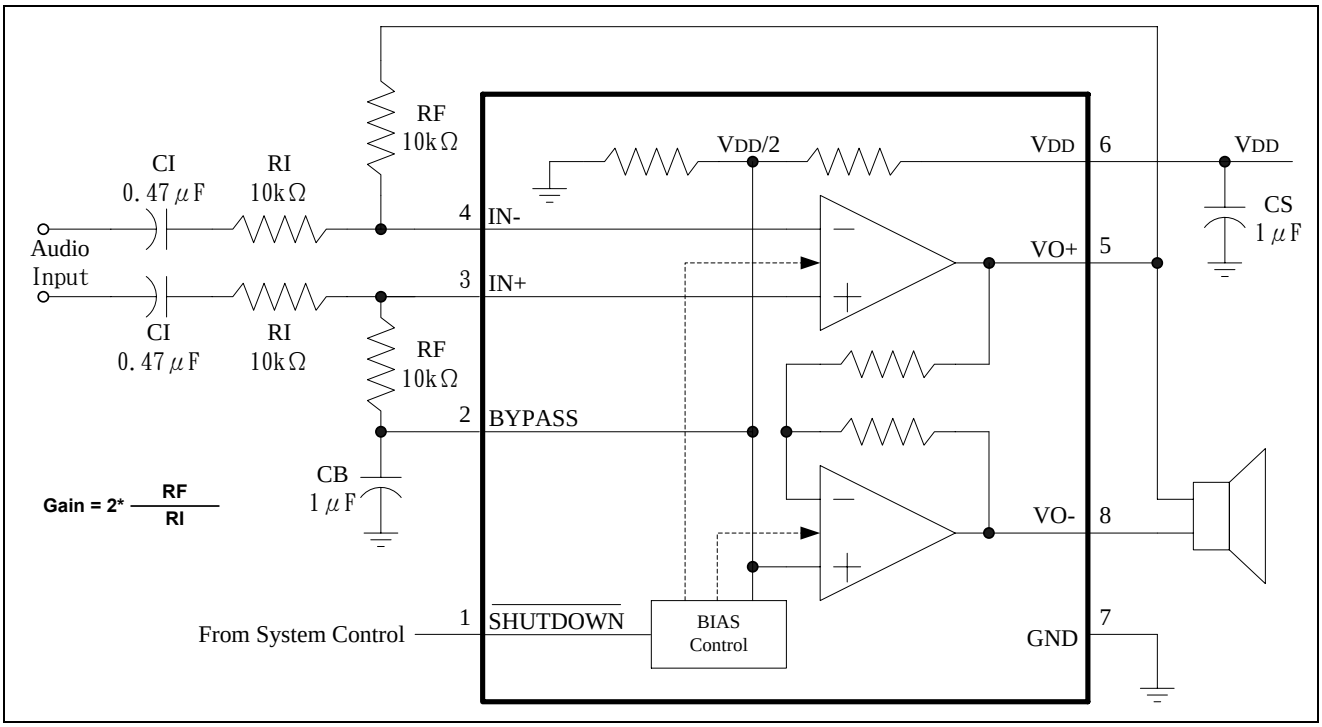

Output Noise Voltage vs Frequency
100u
10u
1u
Output Noise Voltage (Vrms)
BTL
VO+
VDD = 5.0 V
BW = 22 Hz to 22k Hz
RL = 4 Ω, 8 Ω or 32 Ω
AV = -1 V/V
20
100
1k
10k
20k
Frequency (Hz)

6. APPLICATION CIRCUIT

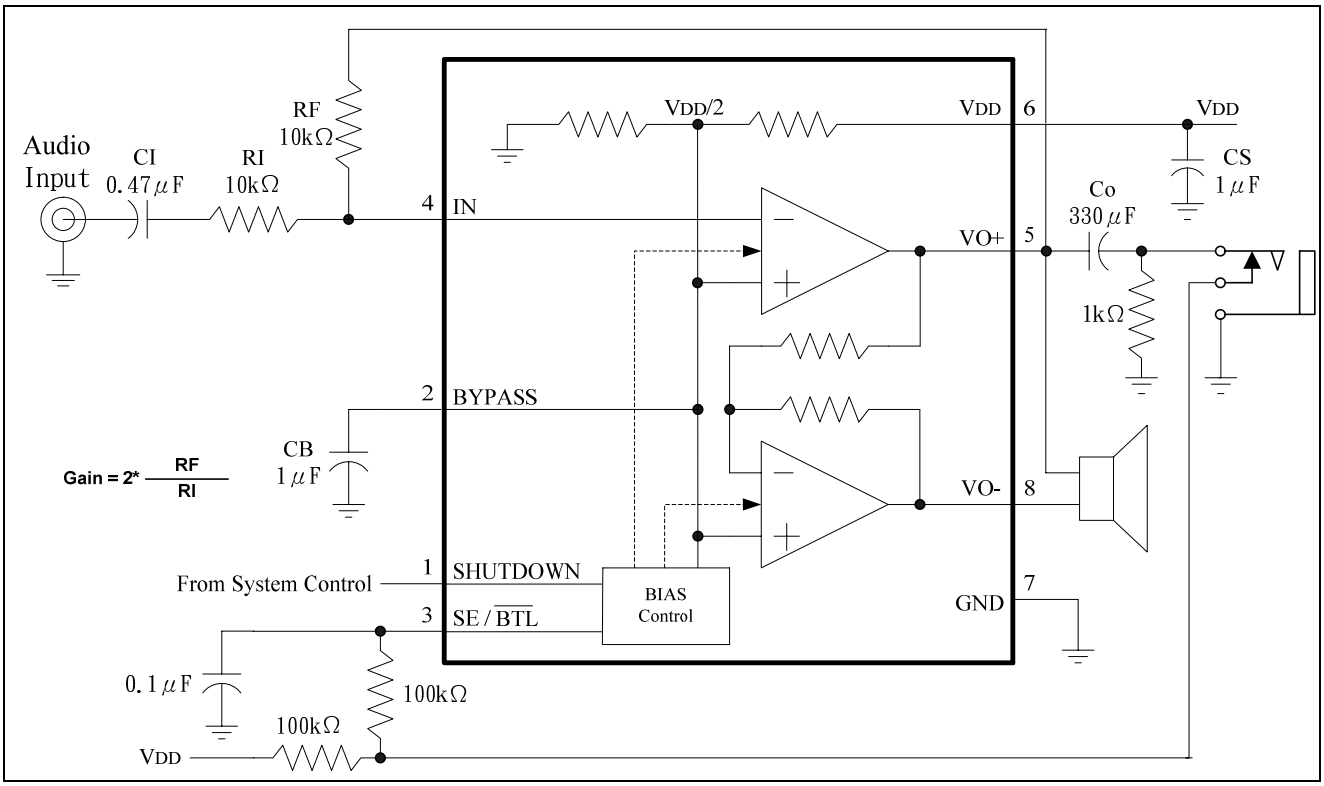
6.1. GPY0031A Typical Application Circuit



6.2. GPY0031A Differential Input Application Circuit



6.3. GPY0032A Typical Application Circuit



7. PACKAGE/PAD LOCATIONS

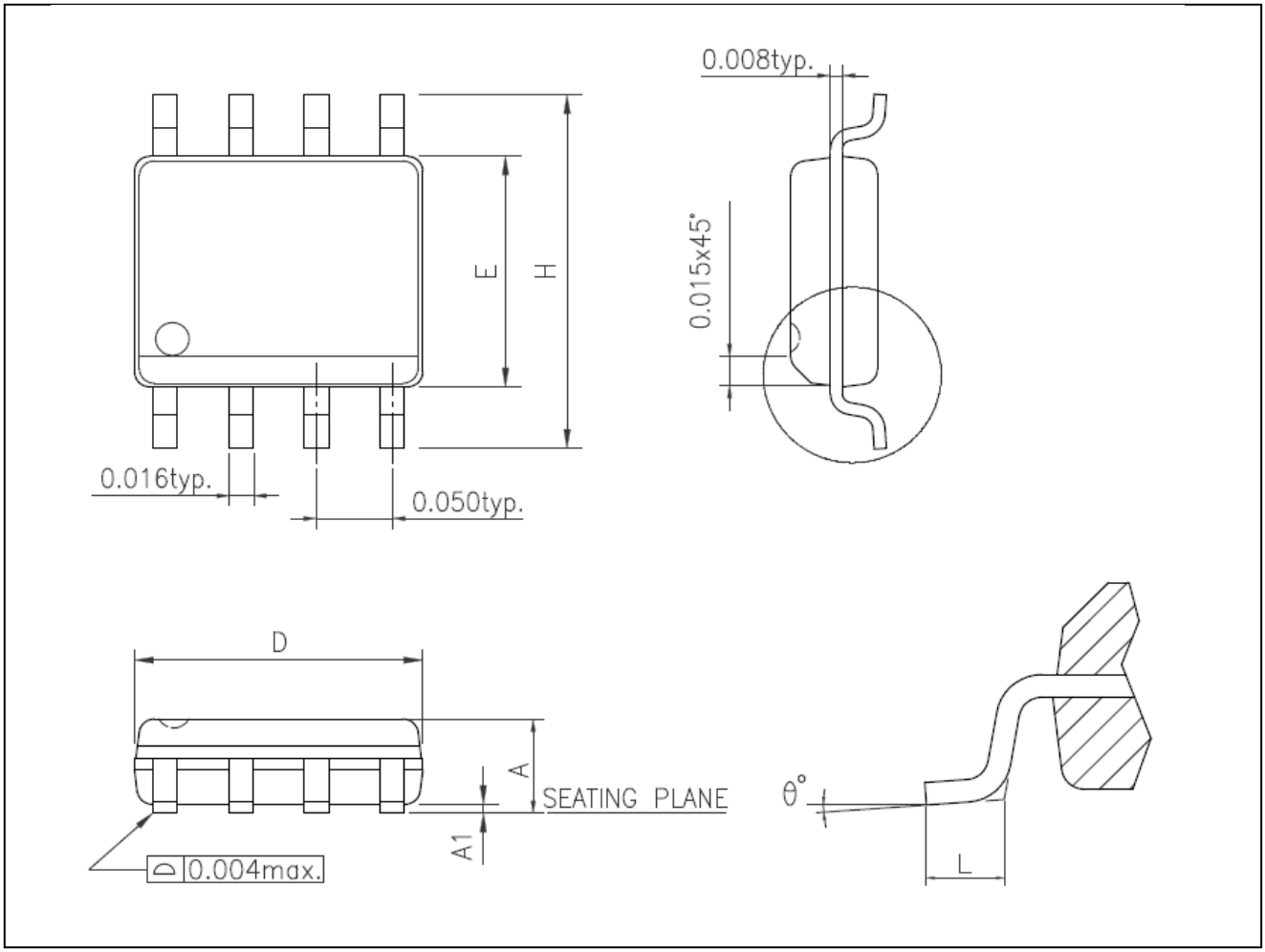
7.1. Ordering Information

Product Number	Package Type
GPY0031A - HS011	Green Package – SOP-8 (150mil)
GPY0031A - HS012	Green Package – SOP-8-P With Thermal PAD (150mil)
GPY0032A - HS01x	Green Package – SOP-8 (150mil)

Note: Package form number (x = 1 - 9, serial number).

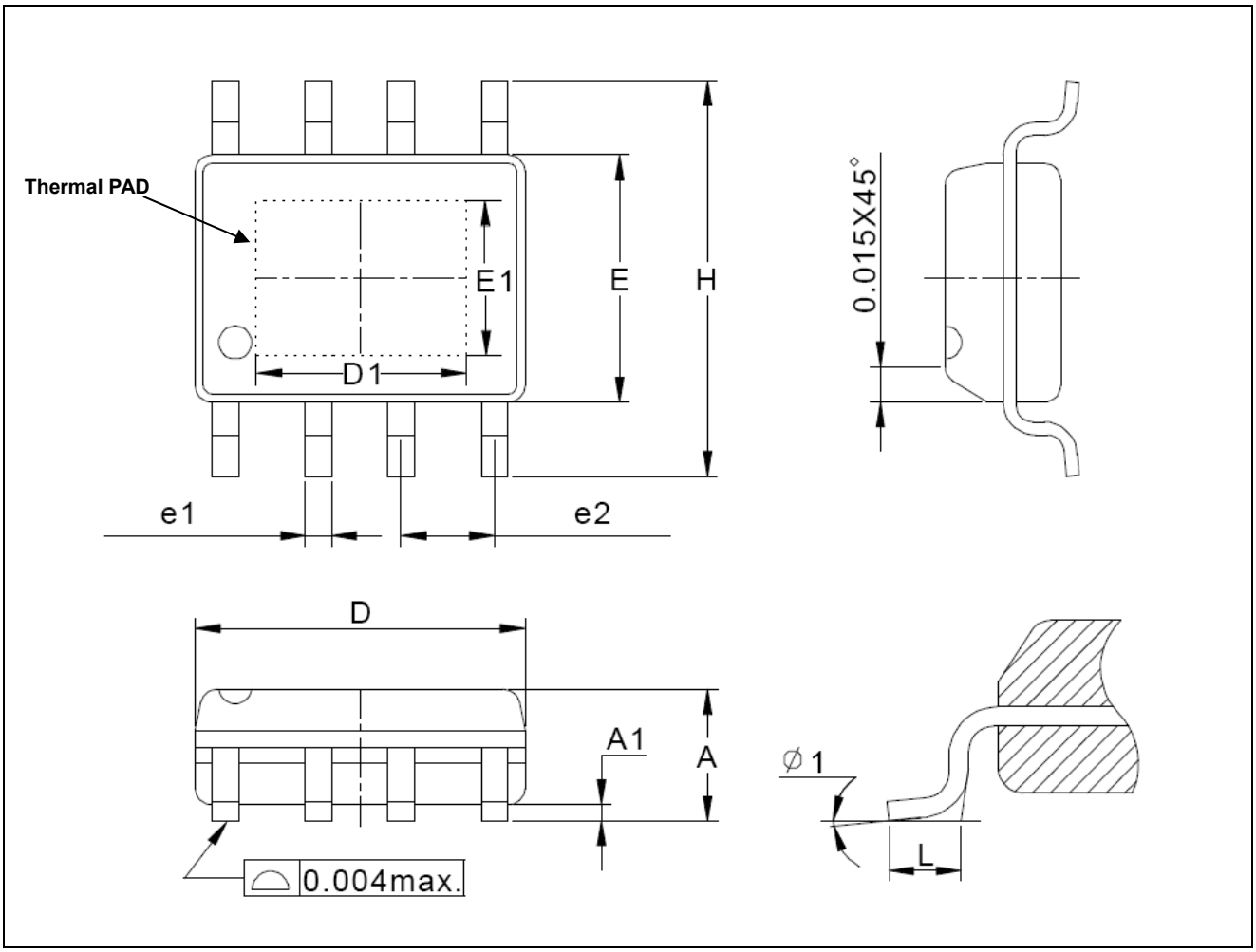
7.2. Package Information

7.2.1. SOP-8



Symbol	Dimension in inch		
	Min.	Typ.	Max.
A	0.053	-	0.069
A1	0.004	-	0.010
D	0.189	-	0.196
E	0.150	-	0.157
H	0.228	-	0.244
L	0.016	-	0.050
θº	0	-	8

7.2.2. SOP-8-P



Symbol	Dimension in inch		
	Min.	Typ.	Max.
A	0.053	-	0.067
A1	0.000	-	0.006
D	0.189		0.196
D1	0.077	-	0.090
E	0.150	-	0.157
E1	0.077	-	0.090
H	0.228	-	0.244
L	0.016	-	0.050
e1	-	0.016	-
e2	-	0.050	-
Φ1	8°		

8. DISCLAIMER

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9. REVISION HISTORY

Date	Revision #	Description	Page
MAY 06, 2009	1.1	1. Modify Feature in section 2. 2. Modify DC Characteristics in section 5.3.	3 7, 8
DEC. 19, 2008	1.0	1. Modify the title page for 2.0W Audio Power Amplifier. 2. Modify Package Pin Assignment in section 4.1. 3. Modify DC Characteristics in section 5.3. 4. Modify Typical Performance Characteristics in section 5.4. 5. Modify Ordering Information section 7.1. 6. Modify Package Information in section 7.2.	1 6 7 9 22 22
AUG. 20, 2008	0.1	Original	16