



100mW STEREO HEADPHONE AMPLIFIER

- Operating from **V_{CC}=2V to 5.5V**
- 100mW into 16Ω at 5V
- 38mW into 16Ω at 3.3V
- 11.5mW into 16Ω at 2V
- Switch ON/OFF click reduction circuitry
- High Power Supply Rejection Ratio: 85dB at 5V
- High Signal-to-Noise ratio: 110dB(A) at 5V
- High Crosstalk immunity: 100dB (F=1kHz)
- Rail to Rail input and output
- Unity-Gain Stable
- Available in **SO8, MiniSO8 & DFN8**

DESCRIPTION

The TS482 is a dual audio power amplifier able to drive a 16 or 32Ω stereo headset down to low voltages.

It's delivering up to 100mW per channel (into 16Ω loads) of continuous average power with 0.1% THD+N from a 5V power supply.

The unity gain stable TS482 can be configured by external gain-setting resistors.

APPLICATIONS

- Stereo Headphone Amplifier
- Optical Storage
- Computer Motherboard
- PDA, organizers & Notebook computers
- High end TV, Set Top Box, DVD Players
- Sound Cards

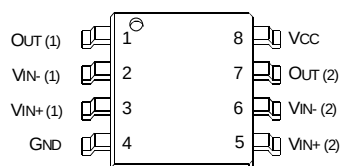
ORDER CODE

Part Number	Temperature Range	Package			Marking
		D	S	Q	
TS482ID/DT	-40, +85°C	•			482I
TS482IST			•		
TS482IQT				•	

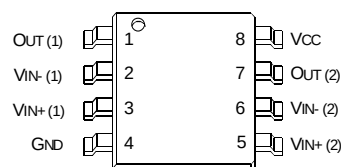
MiniSO & DFN only available in Tape & Reel with T suffix,
SO is available in Tube (D) and in Tape & Reel (DT)

PIN CONNECTIONS (top view)

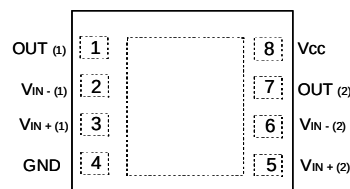
TS482ID, TS482IDT - SO8



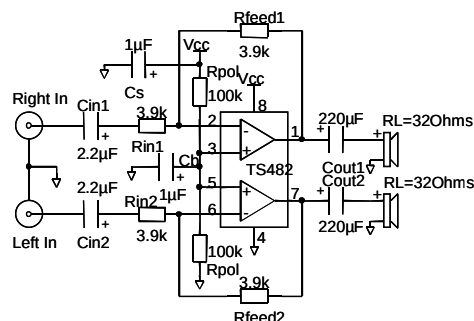
TS482IST - MiniSO8



TS482IQT - DFN8



TYPICAL APPLICATION SCHEMATIC



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage ¹⁾	6	V
V_i	Input Voltage	-0.3 to $V_{CC}+0.3$	V
T_{oper}	Operating Free Air Temperature Range	-40 to + 85	°C
T_{stg}	Storage Temperature	-65 to +150	°C
T_j	Maximum Junction Temperature	150	°C
R_{thja}	Thermal Resistance Junction to Ambient SO8 MiniSO8 DFN8	175 215 70	°C/W
P_d	Power Dissipation ²⁾ SO8 MiniSO8 DFN8	0.71 0.58 1.79	W
ESD	Human Body Model (pin to pin)	2	kV
ESD	Machine Model - 220pF - 240pF (pin to pin)	200	V
Latch-up	Latch-up Immunity (All pins)	200	mA
	Lead Temperature (soldering, 10sec)	250	°C
	Output Short-Circuit Duration	see note ³⁾	

1. All voltages values are measured with respect to the ground pin.

2. P_d has been calculated with $T_{amb} = 25^{\circ}\text{C}$, $T_{junction} = 150^{\circ}\text{C}$.

3. Attention must be paid to continuous power dissipation. Exposure of the IC to a short circuit on one or two amplifiers simultaneously can cause excessive heating and the destruction of the device.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 5.5	V
R_L	Load Resistor	≥ 16	Ω
C_L	Load Capacitor $R_L = 16$ to 100Ω $R_L > 100\Omega$	400 100	pF
V_{ICM}	Common Mode Input Voltage Range	G_{ND} to V_{CC}	V
R_{THJA}	Thermal Resistance Junction to Ambient SO8 MiniSO8 DFN8 ¹⁾	150 190 41	°C/W

1. When mounted on a 4-layer PCB.

Components	Functional Description
R_{in}	Inverting input resistor which sets the closed loop gain in conjunction with R_{feed} . This resistor also forms a high pass filter with C_{in} ($f_c = 1 / (2 \times \pi \times R_{in} \times C_{in})$)
C_{in}	Input coupling capacitor which blocks the DC voltage at the amplifier input terminal
R_{feed}	Feed back resistor which sets the closed loop gain in conjunction with R_{in}
C_s	Supply Bypass capacitor which provides power supply filtering
C_b	Bypass capacitor which provides half supply filtering
C_{out}	Output coupling capacitor which blocks the DC voltage at the load input terminal This capacitor also forms a high pass filter with R_L ($f_c = 1 / (2 \times \pi \times R_L \times C_{out})$)
R_{pol}	These 2 resistors form a voltage divider which provide a DC biasing voltage ($V_{cc}/2$) for the 2 amplifiers.
A_v	Closed loop gain = $-R_{feed} / R_{in}$

ELECTRICAL CHARACTERISTICS

$V_{CC} = +5V$, $GND = 0V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current No input signal, no load		5.5	7.2	mA
V_{IO}	Input Offset Voltage ($V_{ICM} = V_{CC}/2$)		1	5	mV
I_{IB}	Input Bias Current ($V_{ICM} = V_{CC}/2$)		200	500	nA
P_O	Output Power THD+N = 0.1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 0.1% Max, $F = 1kHz$, $R_L = 16\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 16\Omega$	60 95	65 67.5 100 107		mW
THD + N	Total Harmonic Distortion + Noise ($A_v = -1$) ¹ $R_L = 32\Omega$, $P_{out} = 60mW$, $20Hz \leq F \leq 20kHz$ $R_L = 16\Omega$, $P_{out} = 90mW$, $20Hz \leq F \leq 20kHz$		0.03 0.03		%
PSRR	Power Supply Rejection Ratio ($A_v = 1$), inputs floating $F = 100Hz$, $V_{ripple} = 100mV_{pp}$		85		dB
I_O	Max Output Current THD + N < 1%, $R_L = 16\Omega$ connected between out and $V_{CC}/2$	106	120		mA
V_O	Output Swing $V_{OL} : R_L = 32\Omega$ $V_{OH} : R_L = 32\Omega$ $V_{OL} : R_L = 16\Omega$ $V_{OH} : R_L = 16\Omega$	4.45 4.2	0.4 4.6 0.55 4.4	0.48 0.65	V
SNR	Signal-to-Noise Ratio (Filter Type A, $A_v = -1$) ($R_L = 32\Omega$, THD + N < 0.2%, $20Hz \leq F \leq 20kHz$)	95	110		dB
Crosstalk	Channel Separation, $R_L = 32\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$ Channel Separation, $R_L = 16\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$		100 80 100 80		dB
C_I	Input Capacitance		1		pF
GBP	Gain Bandwidth Product ($R_L = 32\Omega$)	1.35	2.2		MHz
SR	Slew Rate, Unity Gain Inverting ($R_L = 16\Omega$)	0.45	0.7		V/ μs

1. Fig. 68 to 79 show dispersion of these parameters.

ELECTRICAL CHARACTERISTICS

$V_{CC} = +3.3V$, GND = 0V, $T_{amb} = 25^{\circ}C$ (unless otherwise specified) ²⁾

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current No input signal, no load		5.3	7.2	mA
V_{IO}	Input Offset Voltage ($V_{ICM} = V_{CC}/2$)		1	5	mV
I_{IB}	Input Bias Current ($V_{ICM} = V_{CC}/2$)		200	500	nA
P_O	Output Power THD+N = 0.1% Max, F = 1kHz, $R_L = 32\Omega$ THD+N = 1% Max, F = 1kHz, $R_L = 32\Omega$ THD+N = 0.1% Max, F = 1kHz, $R_L = 16\Omega$ THD+N = 1% Max, F = 1kHz, $R_L = 16\Omega$	23 36	27 28 38 42		mW
THD + N	Total Harmonic Distortion + Noise ($A_v=-1$) ¹⁾ $R_L = 32\Omega$, $P_{out} = 16mW$, $20Hz \leq F \leq 20kHz$ $R_L = 16\Omega$, $P_{out} = 35mW$, $20Hz \leq F \leq 20kHz$		0.03 0.03		%
PSRR	Power Supply Rejection Ratio ($A_v=1$), inputs floating F = 100Hz, Vripple = 100mVpp		80		dB
I_O	Max Output Current THD + N < 1%, $R_L = 16\Omega$ connected between out and $V_{CC}/2$	64	75		mA
V_O	Output Swing $V_{OL} : R_L = 32\Omega$ $V_{OH} : R_L = 32\Omega$ $V_{OL} : R_L = 16\Omega$ $V_{OH} : R_L = 16\Omega$	2.85 2.68	0.3 3 0.45 2.85	0.38 0.52	V
SNR	Signal-to-Noise Ratio (Filter Type A, $A_v=-1$) ($R_L = 32\Omega$, THD + N < 0.2%, $20Hz \leq F \leq 20kHz$)	92	107		dB
Crosstalk	Channel Separation, $R_L = 32\Omega$ F = 1kHz F = 20Hz to 20kHz Channel Separation, $R_L = 16\Omega$ F = 1kHz F = 20Hz to 20kHz		100 80 100 80		dB
C_I	Input Capacitance		1		pF
GBP	Gain Bandwidth Product ($R_L = 32\Omega$)	1.2	2		MHz
SR	Slew Rate, Unity Gain Inverting ($R_L = 16\Omega$)	0.45	0.7		V/ μ s

1. Fig. 68 to 79 show dispersion of these parameters.

2. All electrical values are guaranteed with correlation measurements at 2V and 5V

ELECTRICAL CHARACTERISTICS

$V_{CC} = +2.5V$, $GND = 0V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified) ²⁾

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current No input signal, no load		5.1	7.2	mA
V_{IO}	Input Offset Voltage ($V_{ICM} = V_{CC}/2$)		1	5	mV
I_{IB}	Input Bias Current ($V_{ICM} = V_{CC}/2$)		200	500	nA
P_O	Output Power THD+N = 0.1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 0.1% Max, $F = 1kHz$, $R_L = 16\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 16\Omega$	12.5 17.5	13.5 14.5 20.5 22		mW
THD + N	Total Harmonic Distortion + Noise ($A_v=-1$) ¹⁾ $R_L = 32\Omega$, $P_{out} = 10mW$, $20Hz \leq F \leq 20kHz$ $R_L = 16\Omega$, $P_{out} = 16mW$, $20Hz \leq F \leq 20kHz$		0.03 0.03		%
PSRR	Power Supply Rejection Ratio ($A_v=1$), inputs floating $F = 100Hz$, $V_{ripple} = 100mV_{pp}$		75		dB
I_O	Max Output Current THD + N < 1%, $R_L = 16\Omega$ connected between out and $V_{CC}/2$	45	56		mA
V_O	Output Swing $V_{OL} : R_L = 32\Omega$ $V_{OH} : R_L = 32\Omega$ $V_{OL} : R_L = 16\Omega$ $V_{OH} : R_L = 16\Omega$	2.14 1.97	0.25 2.25 0.35 2.15	0.325 0.45	V
SNR	Signal-to-Noise Ratio (Filter Type A, $A_v=-1$) ($R_L = 32\Omega$, THD + N < 0.2%, $20Hz \leq F \leq 20kHz$)	89	102		dB
Crosstalk	Channel Separation, $R_L = 32\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$ Channel Separation, $R_L = 16\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$		100 80 100 80		dB
C_I	Input Capacitance		1		pF
GBP	Gain Bandwidth Product ($R_L = 32\Omega$)	1.2	2		MHz
SR	Slew Rate, Unity Gain Inverting ($R_L = 16\Omega$)	0.45	0.7		V/ μs

1. Fig. 68 to 79 show dispersion of these parameters.

2. All electrical values are guaranteed with correlation measurements at 2V and 5V

ELECTRICAL CHARACTERISTICS $V_{CC} = +2V$, $GND = 0V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current No input signal, no load		5	7.2	mA
V_{IO}	Input Offset Voltage ($V_{ICM} = V_{CC}/2$)		1	5	mV
I_{IB}	Input Bias Current ($V_{ICM} = V_{CC}/2$)		200	500	nA
P_O	Output Power THD+N = 0.1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 32\Omega$ THD+N = 0.1% Max, $F = 1kHz$, $R_L = 16\Omega$ THD+N = 1% Max, $F = 1kHz$, $R_L = 16\Omega$	7 9.5	8 9 11.5 13		mW
THD + N	Total Harmonic Distortion + Noise ($A_v=-1$) ¹⁾ $R_L = 32\Omega$, $P_{out} = 6.5mW$, $20Hz \leq F \leq 20kHz$ $R_L = 16\Omega$, $P_{out} = 8mW$, $20Hz \leq F \leq 20kHz$		0.02 0.025		%
PSRR	Power Supply Rejection Ratio ($A_v=1$), inputs floating $F = 100Hz$, $V_{ripple} = 100mV_{pp}$		75		dB
I_O	Max Output Current THD + N < 1%, $R_L = 16\Omega$ connected between out and $V_{CC}/2$	33	41.5		mA
V_O	Output Swing $V_{OL} : R_L = 32\Omega$ $V_{OH} : R_L = 32\Omega$ $V_{OL} : R_L = 16\Omega$ $V_{OH} : R_L = 16\Omega$	1.67 1.53	0.24 1.73 0.33 1.63	0.295 0.41	V
SNR	Signal-to-Noise Ratio (Filter Type A, $A_v=-1$) ($R_L = 32\Omega$, THD + N < 0.2%, $20Hz \leq F \leq 20kHz$)	88	101		dB
Crosstalk	Channel Separation, $R_L = 32\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$ Channel Separation, $R_L = 16\Omega$ $F = 1kHz$ $F = 20Hz$ to $20kHz$		100 80 100 80		dB
C_I	Input Capacitance		1		pF
GBP	Gain Bandwidth Product ($R_L = 32\Omega$)	1.2	2		MHz
SR	Slew Rate, Unity Gain Inverting ($R_L = 16\Omega$)	0.42	0.65		V/ μs

1. Fig. 68 to 79 show dispersion of these parameters.

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Fig. 1 : Open Loop Gain and Phase vs Frequency

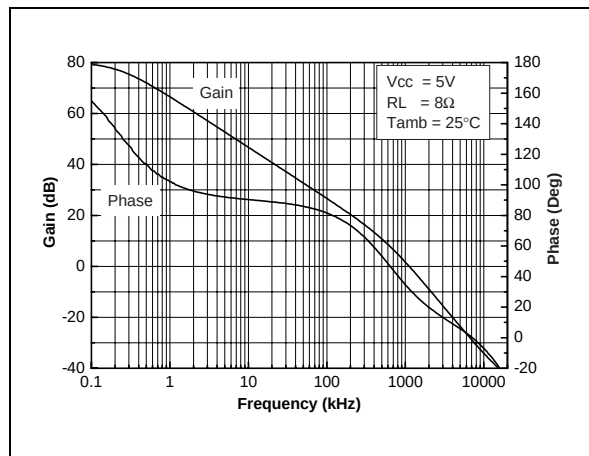


Fig. 2 : Open Loop Gain and Phase vs Frequency

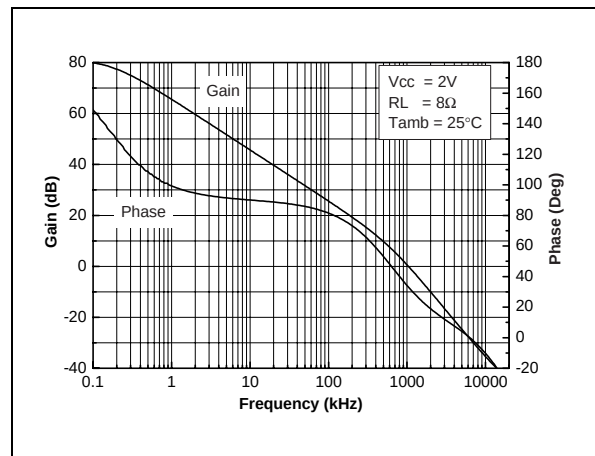


Fig. 3 : Open Loop Gain and Phase vs Frequency

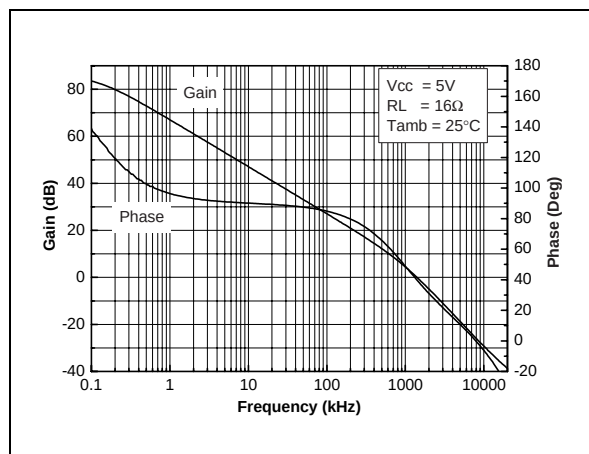


Fig. 4 : Open Loop Gain and Phase vs Frequency

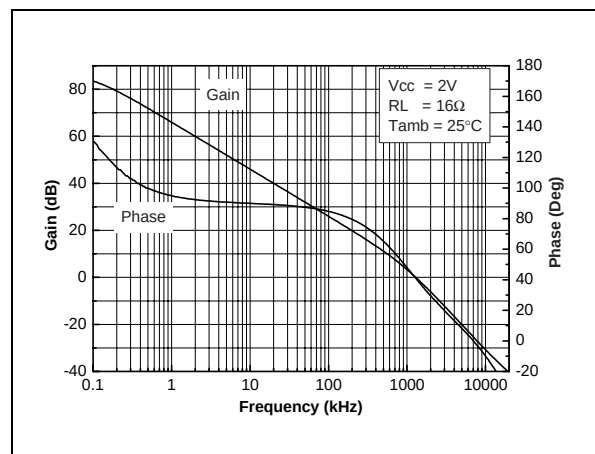


Fig. 5 : Open Loop Gain and Phase vs Frequency

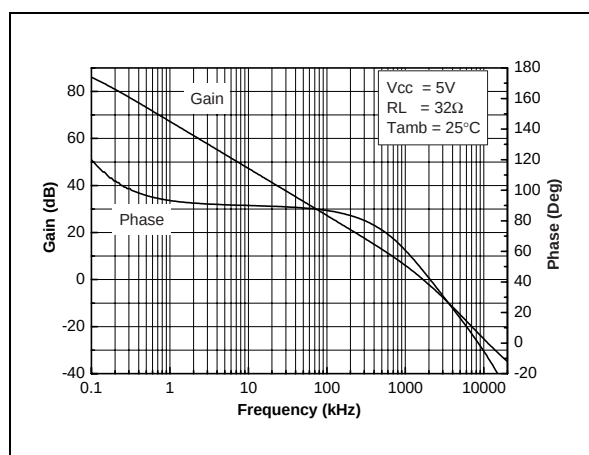


Fig. 6 : Open Loop Gain and Phase vs Frequency

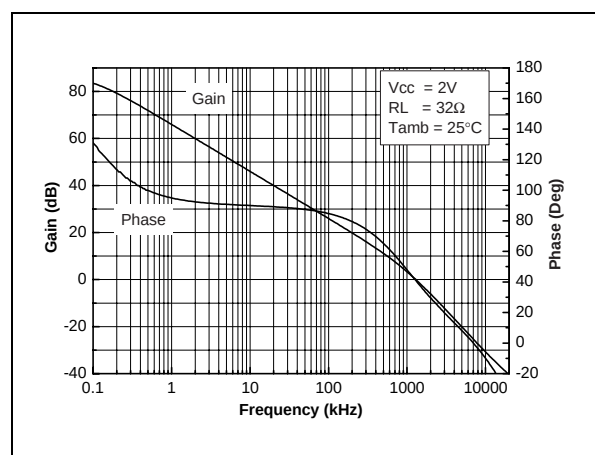


Fig. 7 : Open Loop Gain and Phase vs Frequency

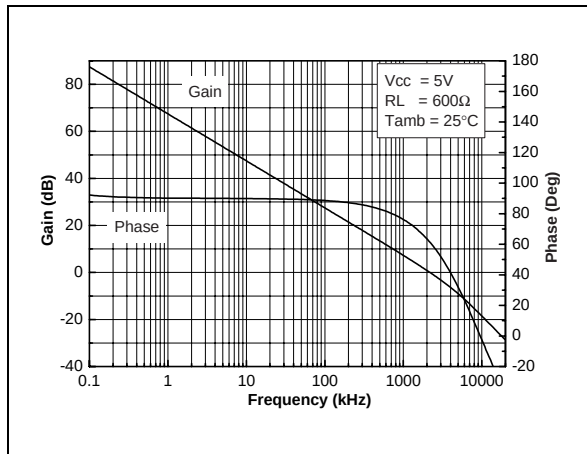


Fig. 8 : Open Loop Gain and Phase vs Frequency

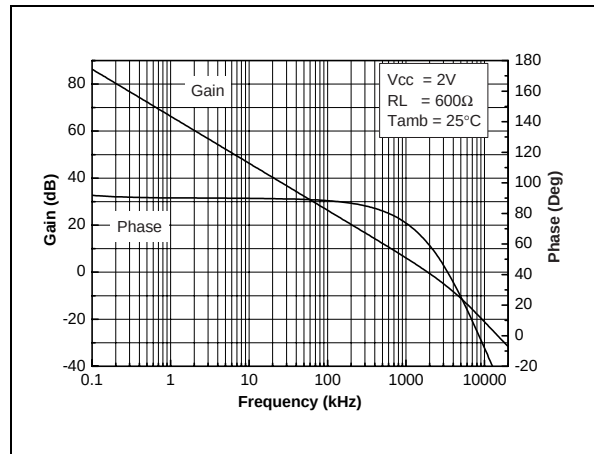


Fig. 9 : Open Loop Gain and Phase vs Frequency

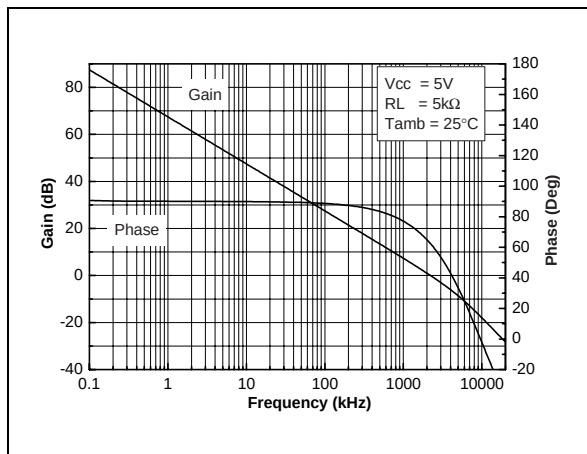


Fig. 10 : Open Loop Gain and Phase vs Frequency

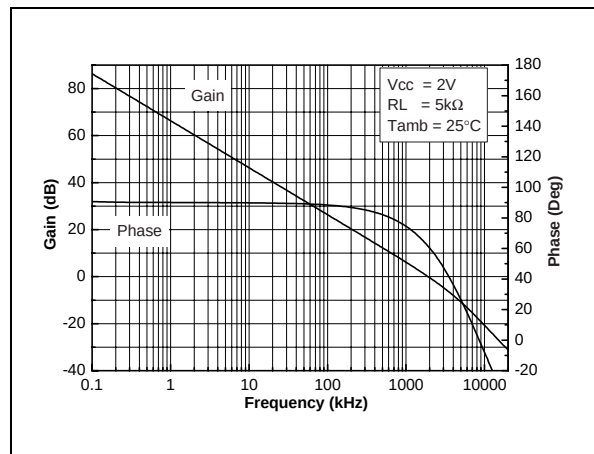


Fig. 11 : Phase Margin vs Power Supply Voltage

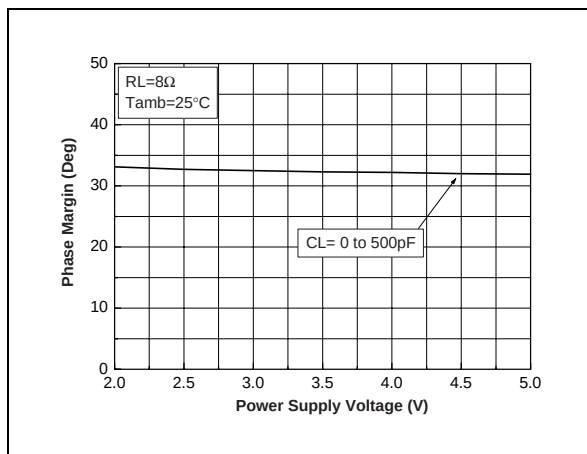


Fig. 12 : Gain Margin vs Power Supply Voltage

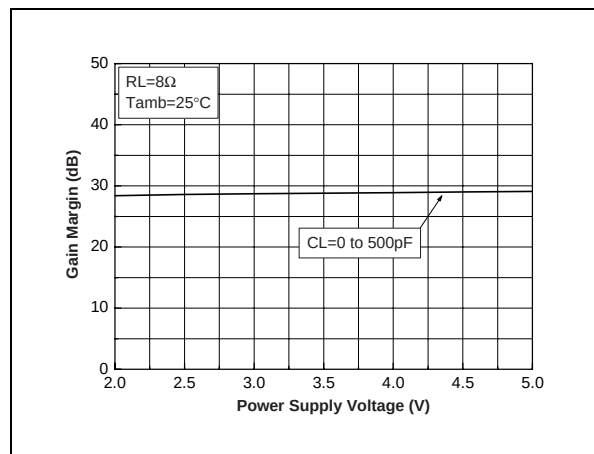


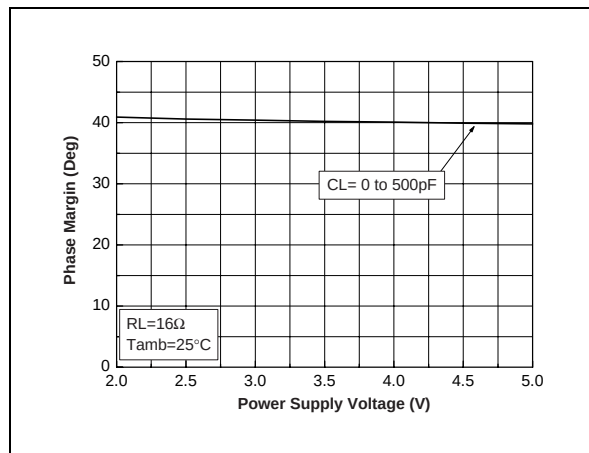
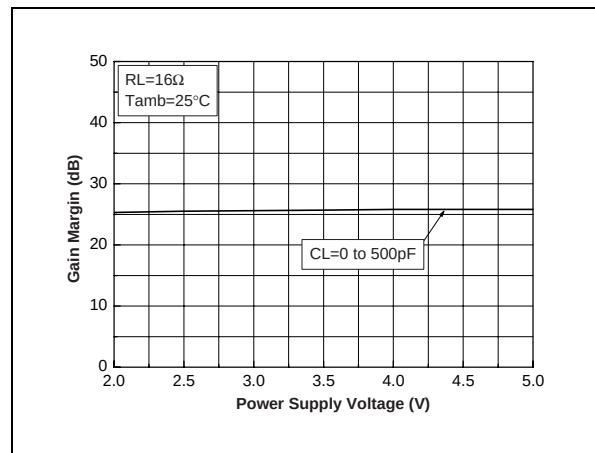
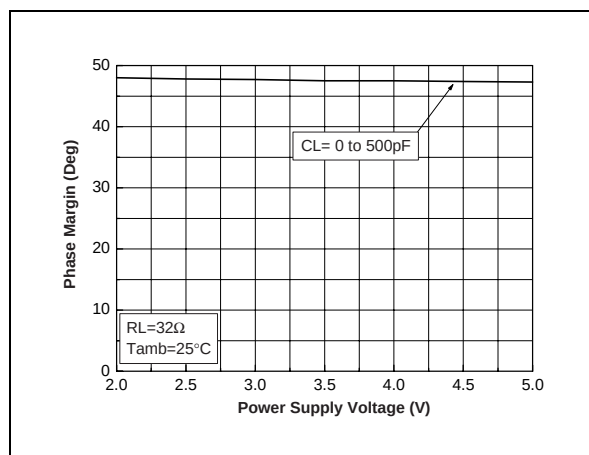
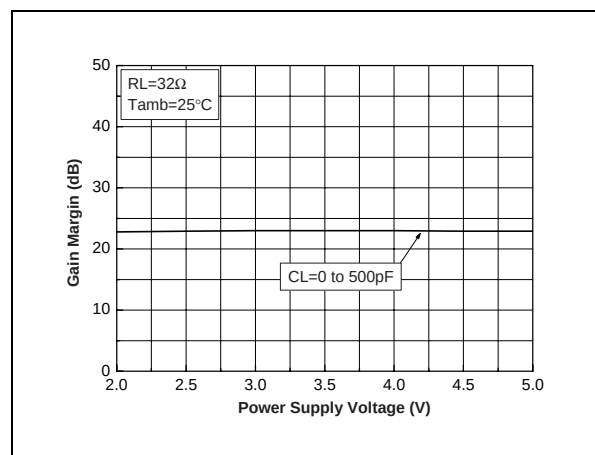
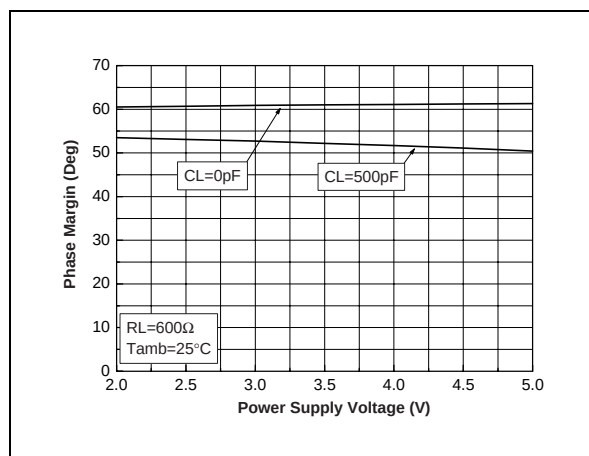
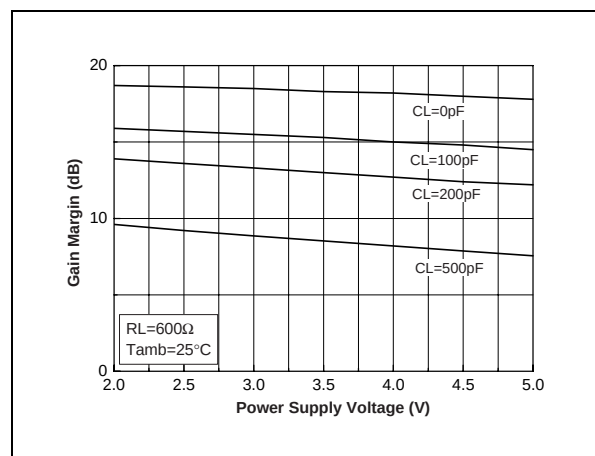
Fig. 13 : Phase Margin vs Power Supply Voltage**Fig. 14 : Gain Margin vs Power Supply Voltage****Fig. 15 : Phase Margin vs Power Supply Voltage****Fig. 16 : Gain Margin vs Power Supply Voltage****Fig. 17 : Phase Margin vs Power Supply Voltage****Fig. 18 : Gain Margin vs Power Supply Voltage**

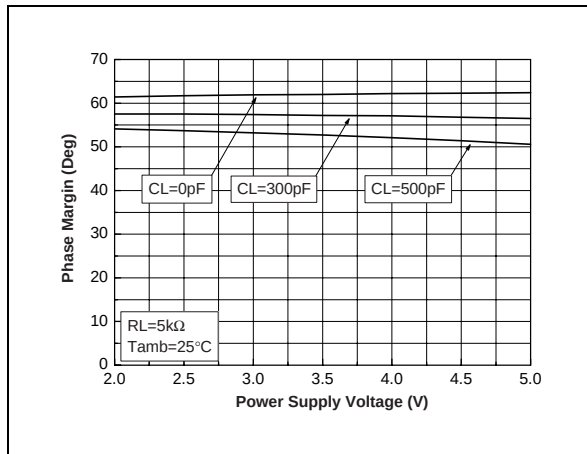
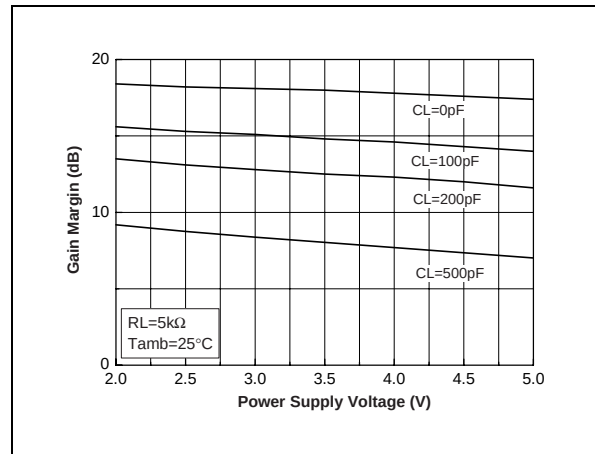
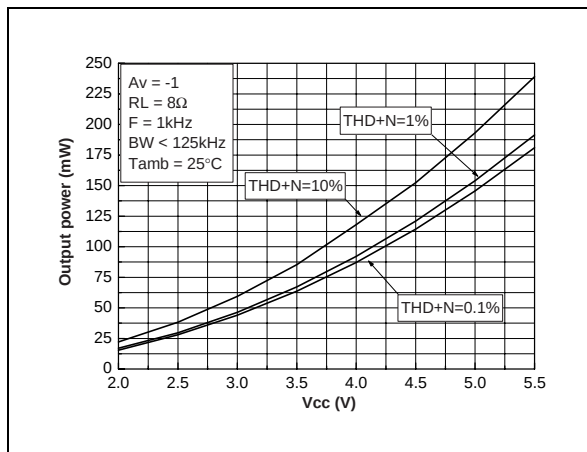
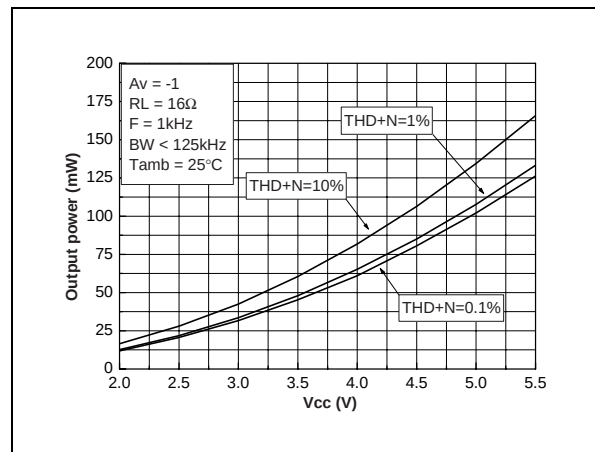
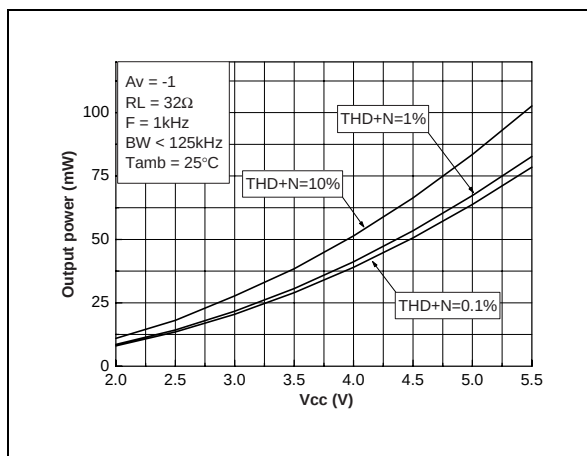
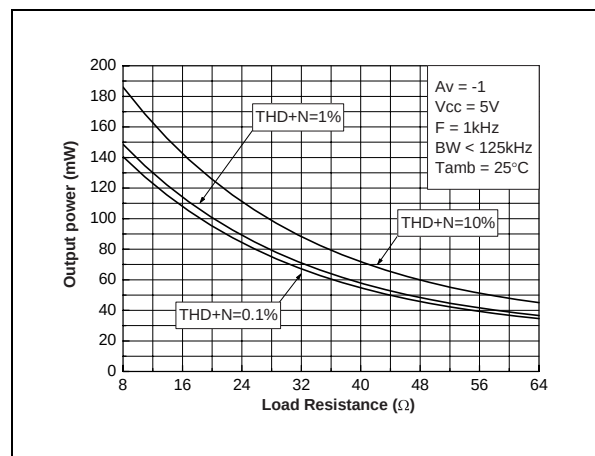
Fig. 19 : Phase Margin vs Power Supply Voltage**Fig. 20 : Gain Margin vs Power Supply Voltage****Fig. 21 : Output Power vs Power Supply Voltage****Fig. 22 : Output Power vs Power Supply Voltage****Fig. 23 : Output Power vs Power Supply Voltage****Fig. 24 : Output Power vs Load Resistance**

Fig. 25 : Output Power vs Load Resistance

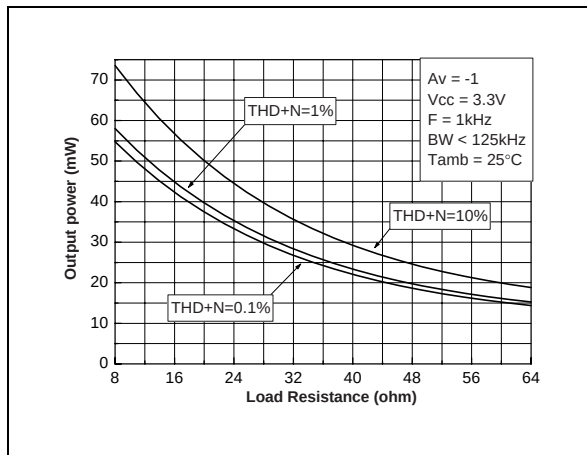


Fig. 26 : Output Power vs Load Resistance

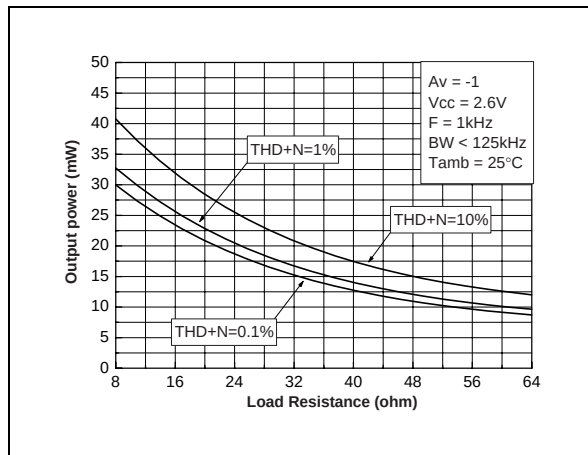


Fig. 27 : Output Power vs Load Resistance

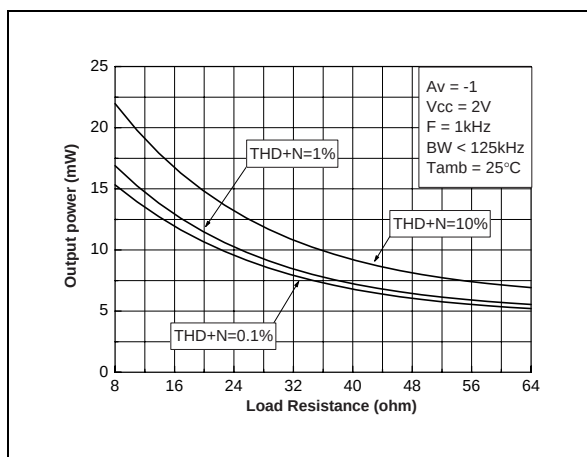


Fig. 28 : Power Dissipation vs Output Power

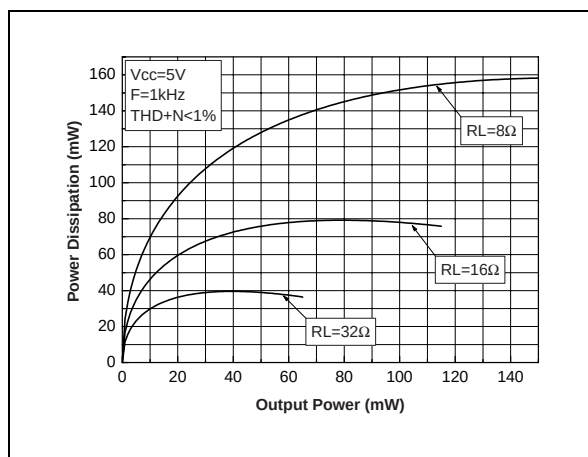


Fig. 29 : Power Dissipation vs Output Power

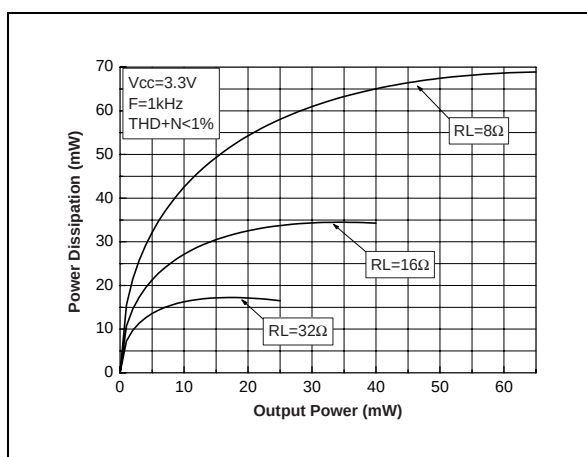


Fig. 30 : Power Dissipation vs Output Power

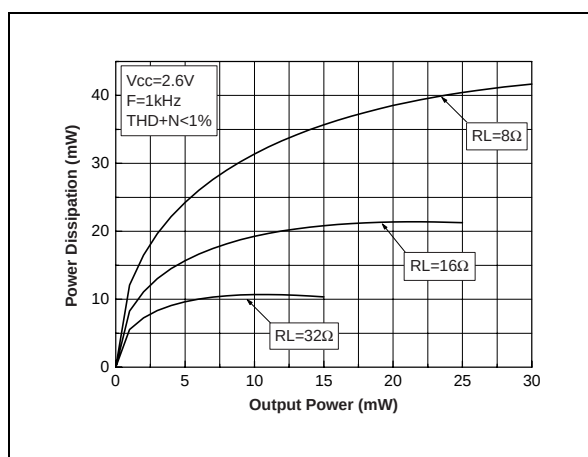


Fig. 31 : Power Dissipation vs Output Power

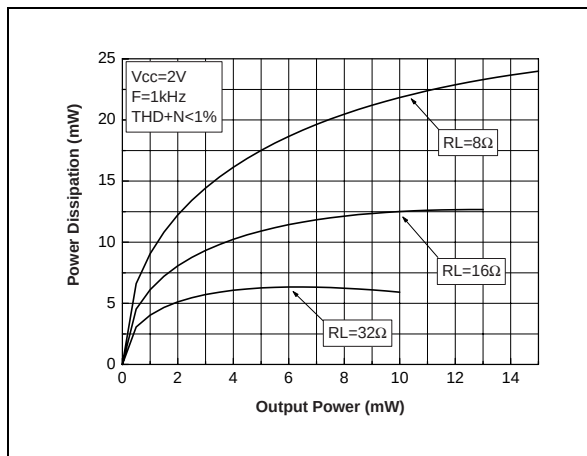


Fig. 32 : Power Derating vs Ambient Temperature

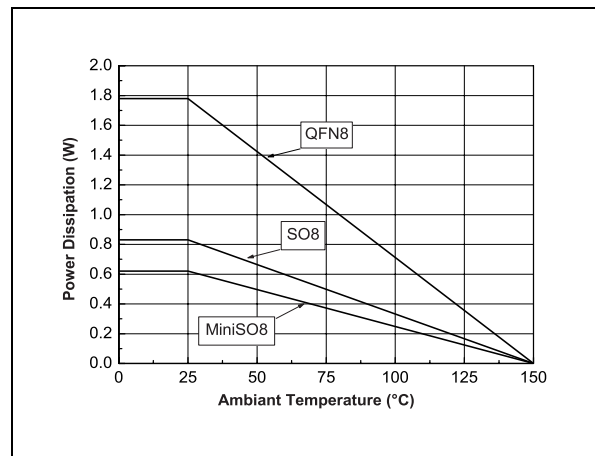


Fig. 33 : Current Consumption vs Power Supply Voltage

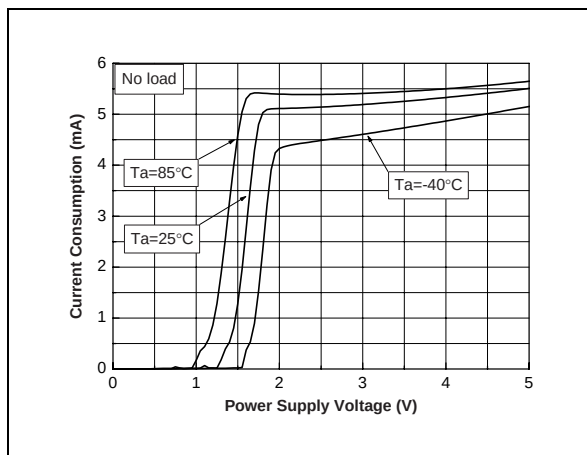


Fig. 34 : Power Supply Rejection Ration vs Frequency

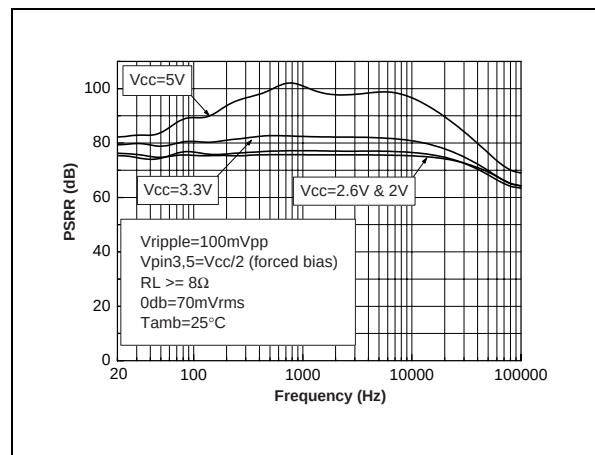


Fig. 35 : THD + N vs Output Power

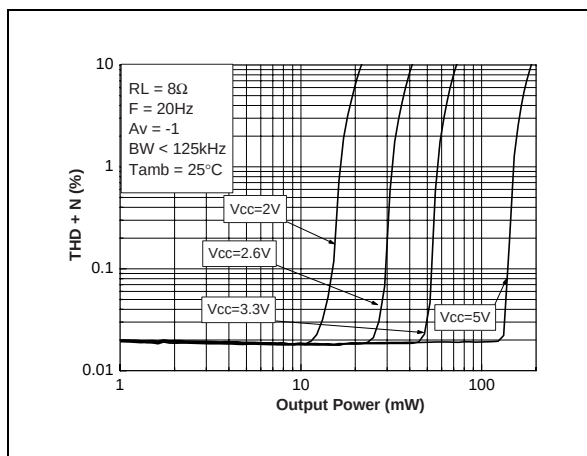


Fig. 36 : THD + N vs Output Power

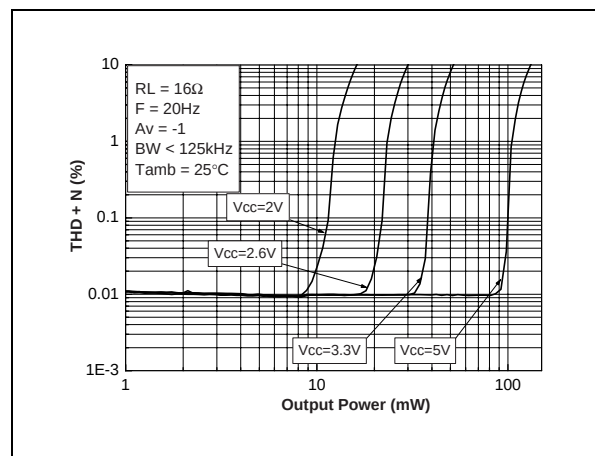


Fig. 37 : THD + N vs Output Power

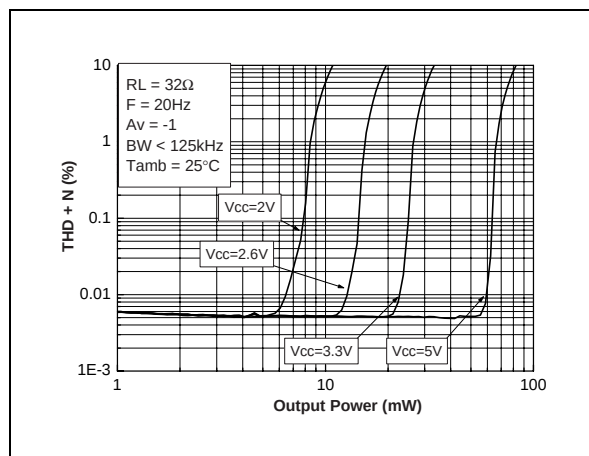


Fig. 38 : THD + N vs Output Power

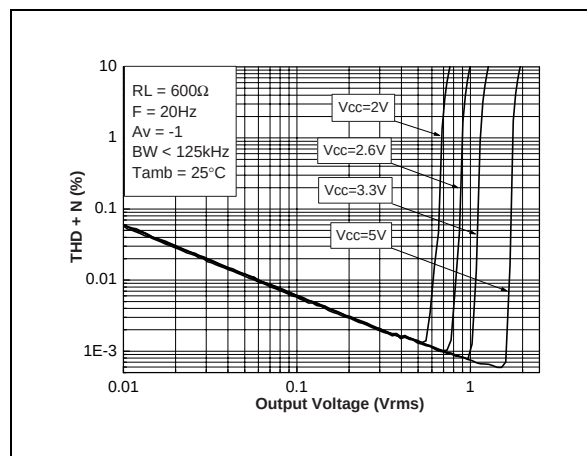


Fig. 39 : THD + N vs Output Power

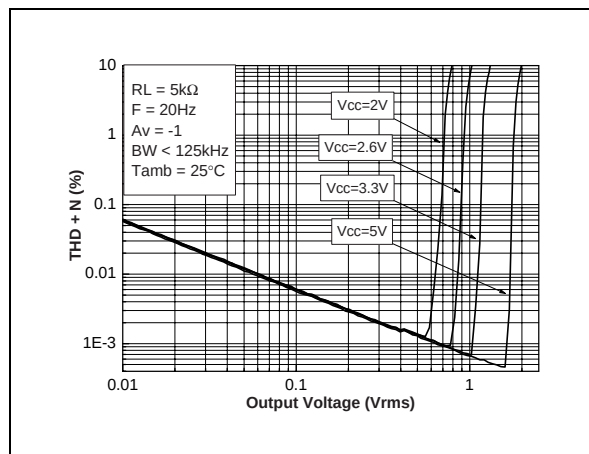


Fig. 40 : THD + N vs Output Power

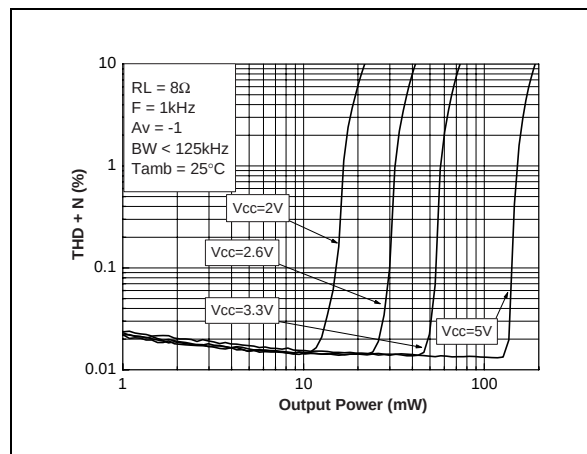


Fig. 41 : THD + N vs Output Power

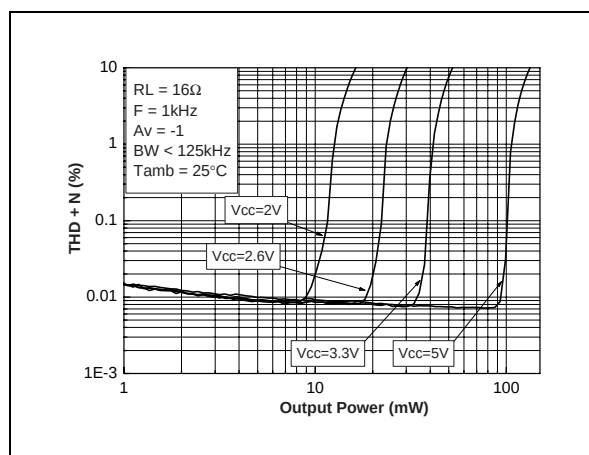


Fig. 42 : THD + N vs Output Power

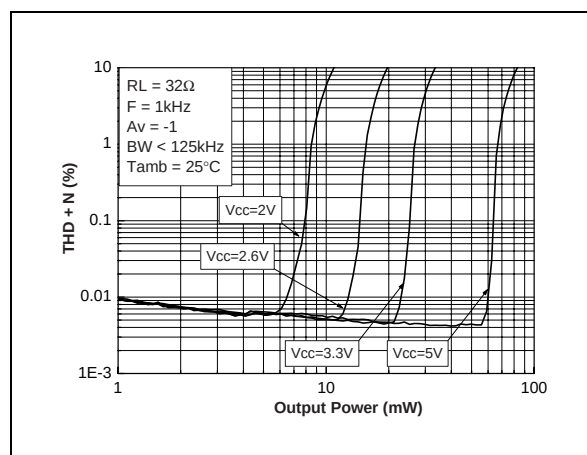


Fig. 43 : THD + N vs Output Power

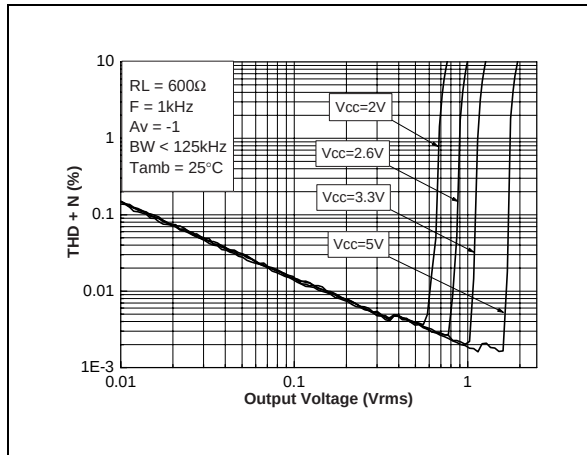


Fig. 44 : THD + N vs Output Power

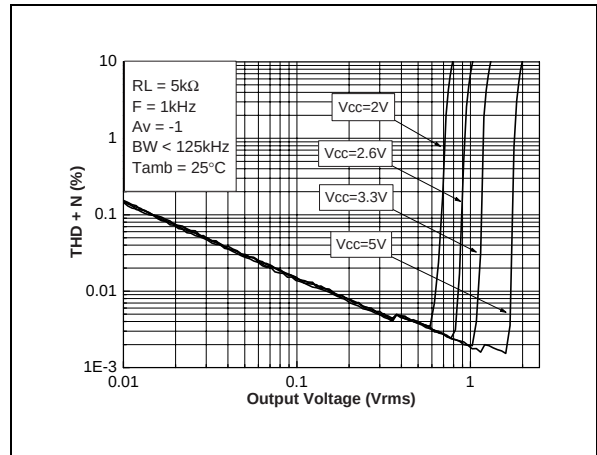


Fig. 45 : THD + N vs Output Power

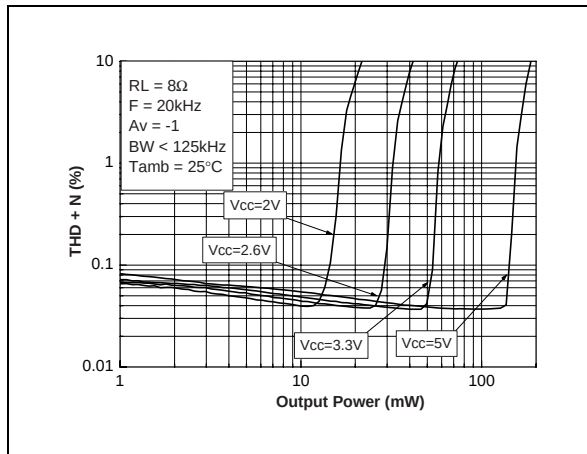


Fig. 46 : THD + N vs Output Power

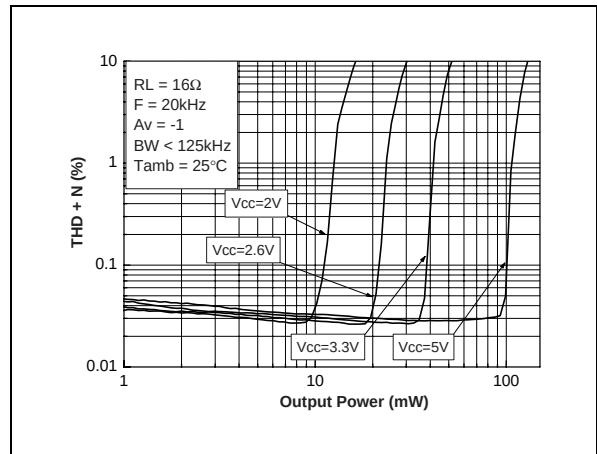


Fig. 47 : THD + N vs Output Power

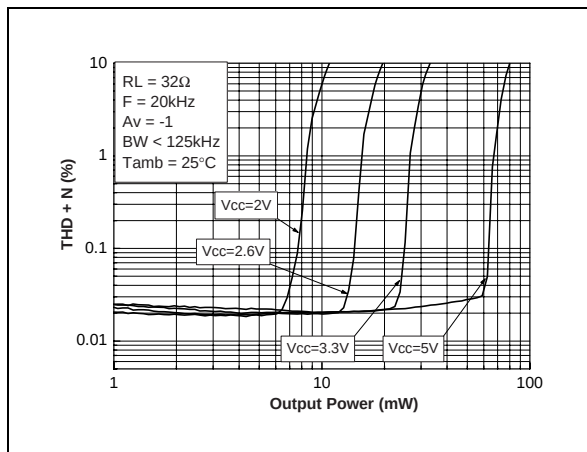


Fig. 48 : THD + N vs Output Power

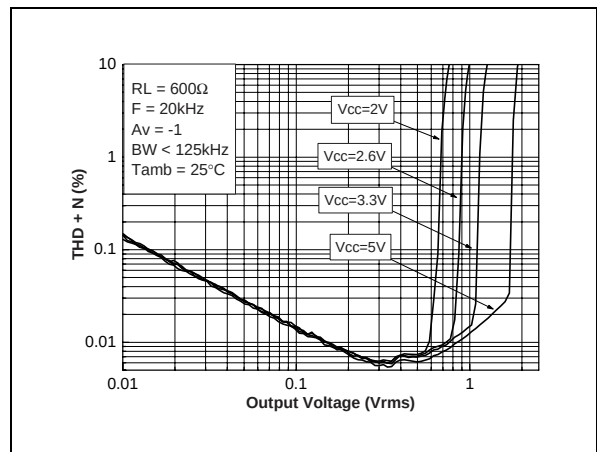


Fig. 49 : THD + N vs Output Power

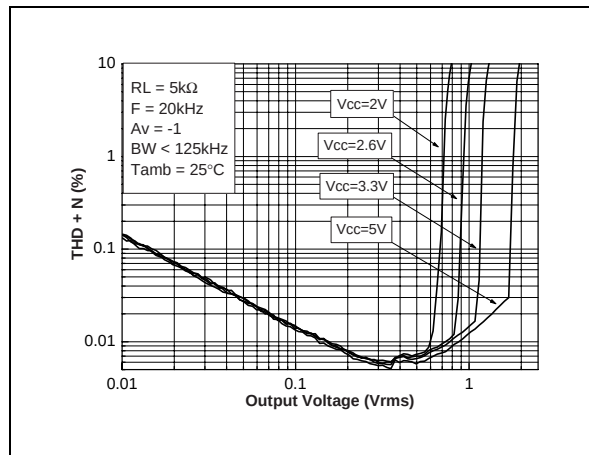


Fig. 50 : THD + N vs Frequency

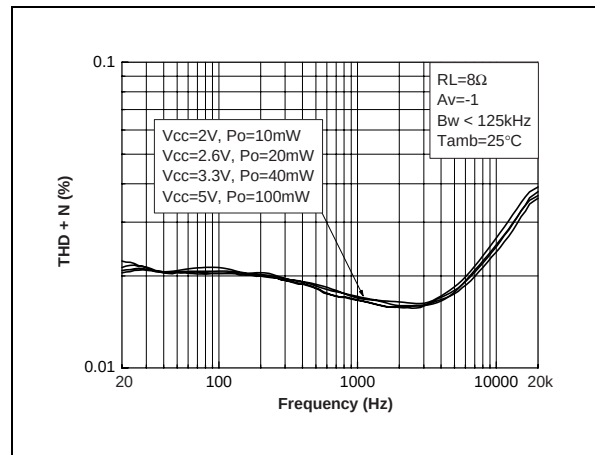


Fig. 51 : THD + N vs Frequency

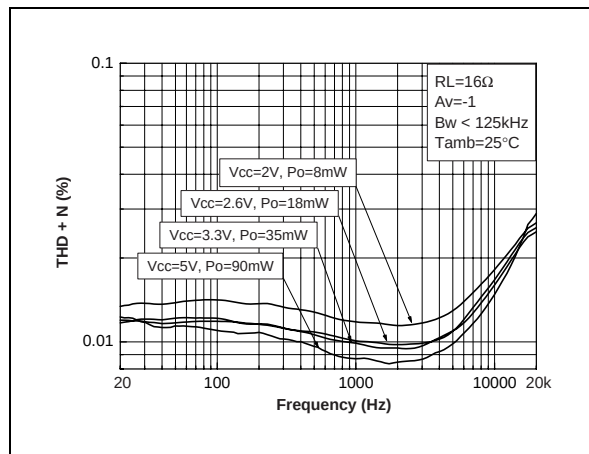


Fig. 52 : THD + N vs Frequency

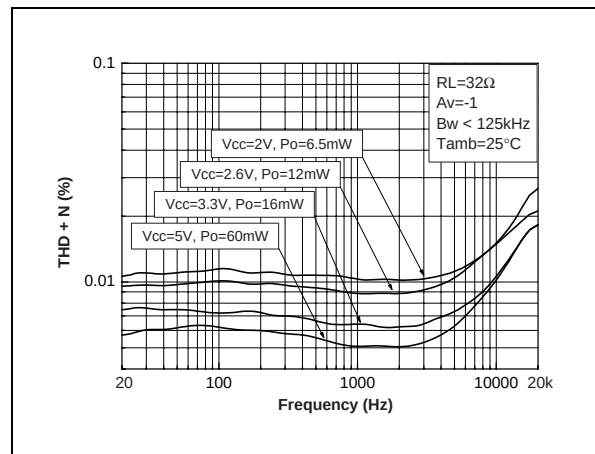


Fig. 53 : THD + N vs Frequency

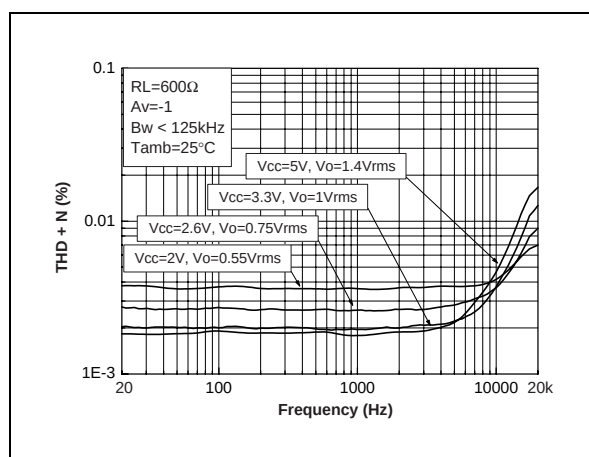


Fig. 54 : THD + N vs Frequency

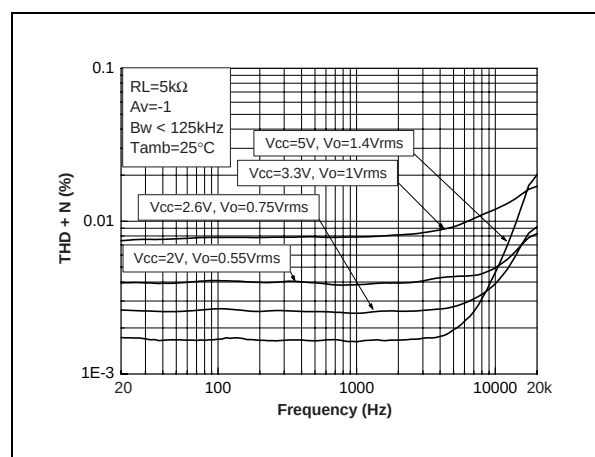


Fig. 55 : Signal to Noise Ratio vs Power Supply Voltage with Unweighted Filter (20Hz to 20kHz)

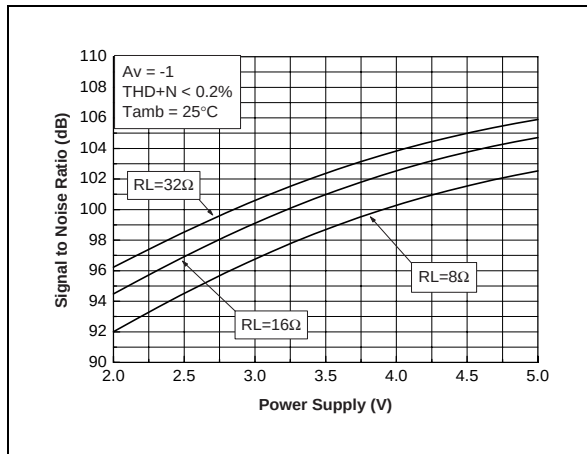


Fig. 56 : Signal to Noise Ratio vs Power Supply Voltage with Unweighted Filter (20Hz to 20kHz)

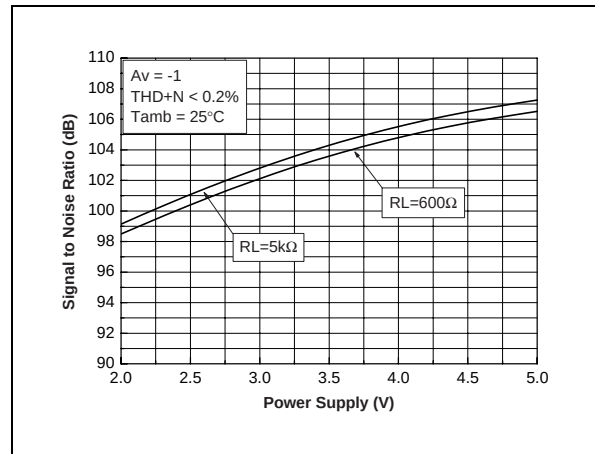


Fig. 57 : Signal to Noise Ratio vs Power Supply Voltage with Weighted Filter Type A

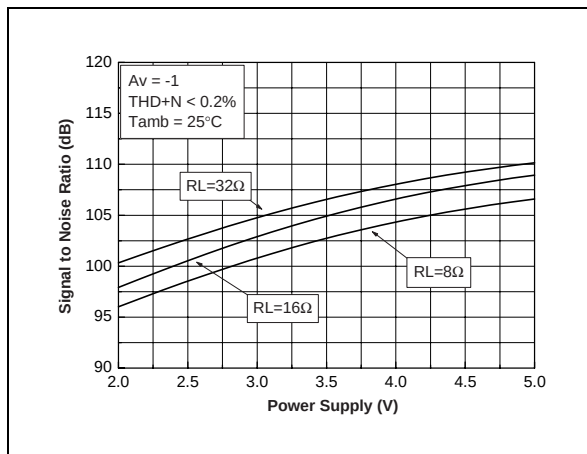


Fig. 58 : Signal to Noise Ratio vs Power Supply Voltage with Weighted Filter Type A

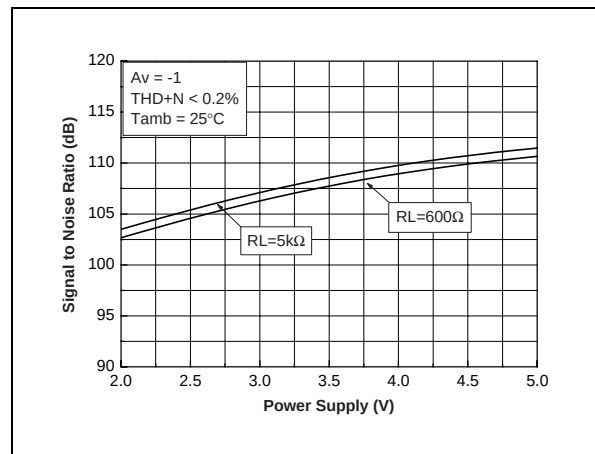


Fig. 59 : Equivalent Input Noise Voltage vs Frequency

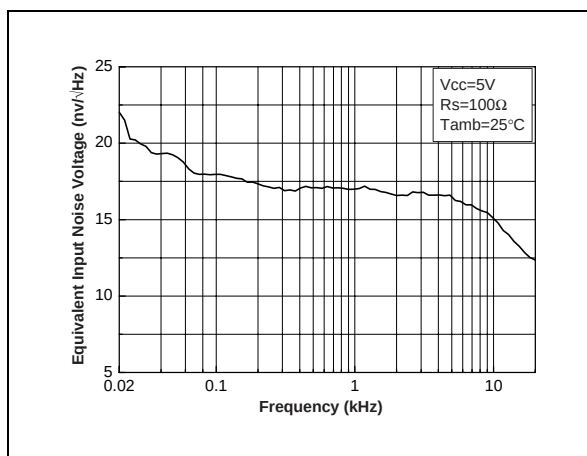


Fig. 60 : Output Voltage Swing vs Power Supply Voltage

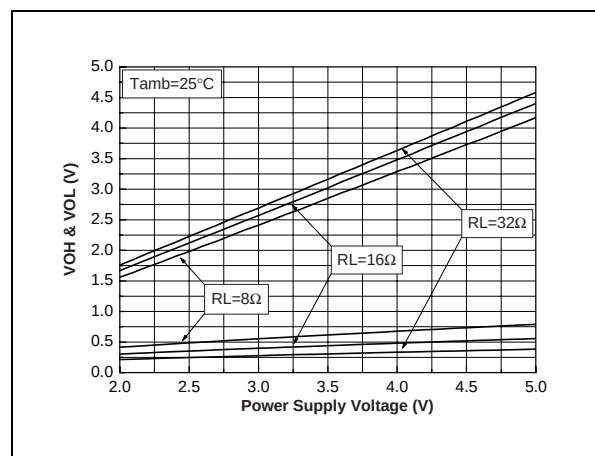


Fig. 61 : Crosstalk vs Frequency

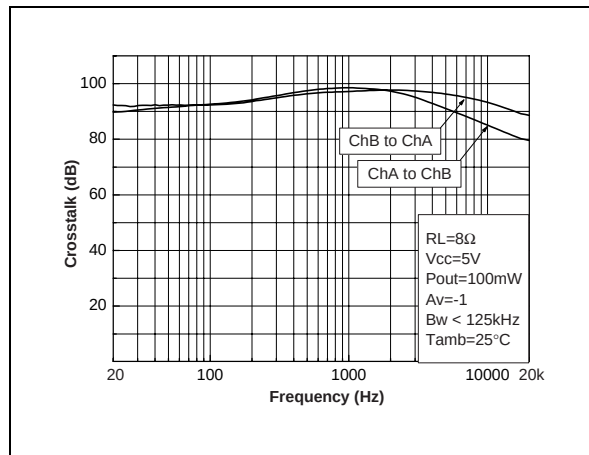


Fig. 62 : Crosstalk vs Frequency

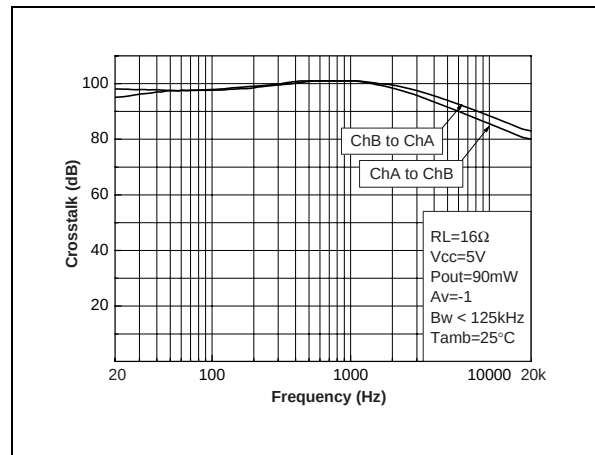


Fig. 63 : Crosstalk vs Frequency

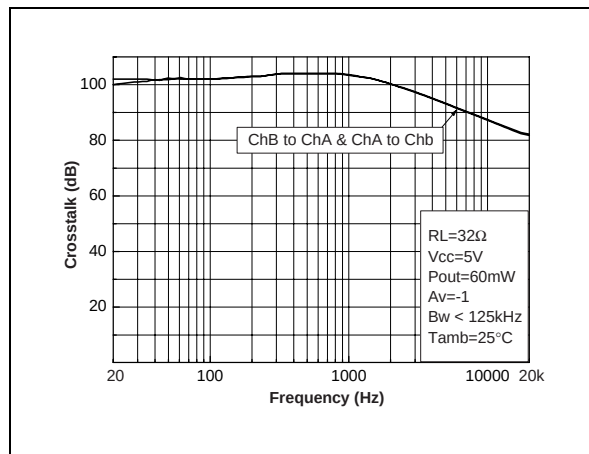


Fig. 64 : Crosstalk vs Frequency

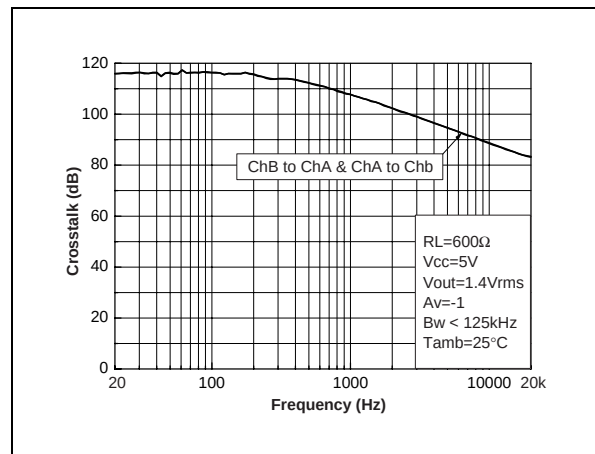


Fig. 65 : Crosstalk vs Frequency

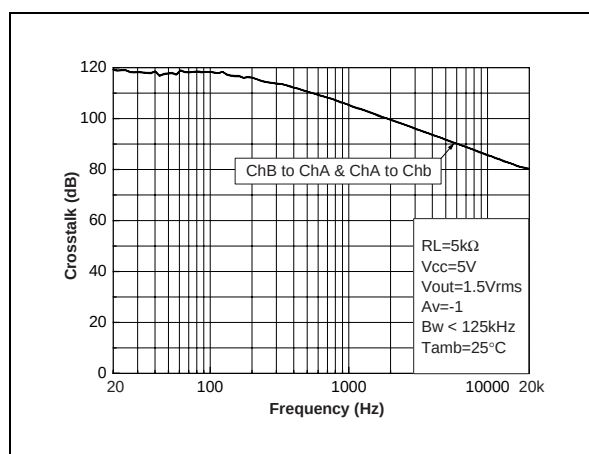


Fig. 66 : Lower Cut Off Frequency vs Output Capacitor

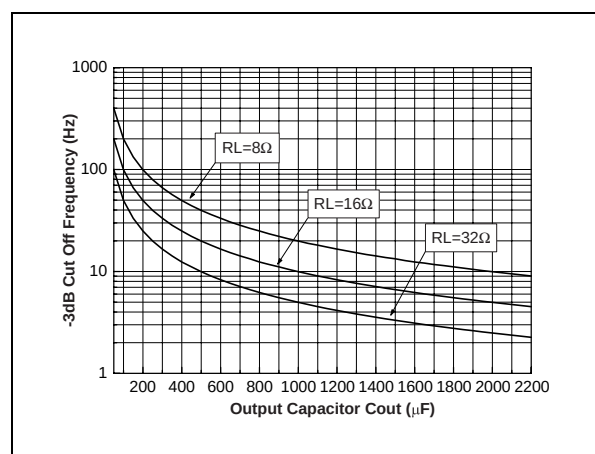


Fig. 67 : Lower Cut Off Frequency vs Input Capacitor

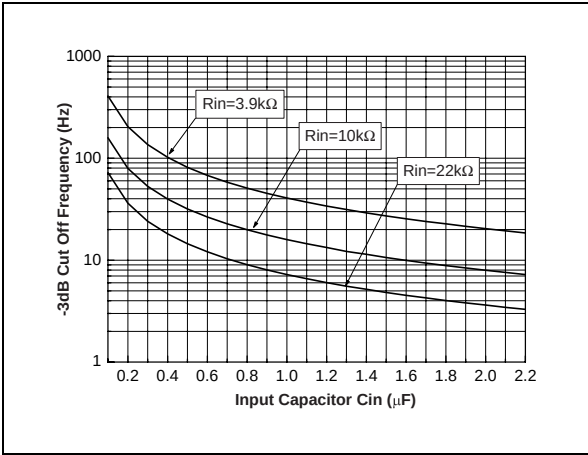


Fig. 68 : Typical Distribution of THD+N

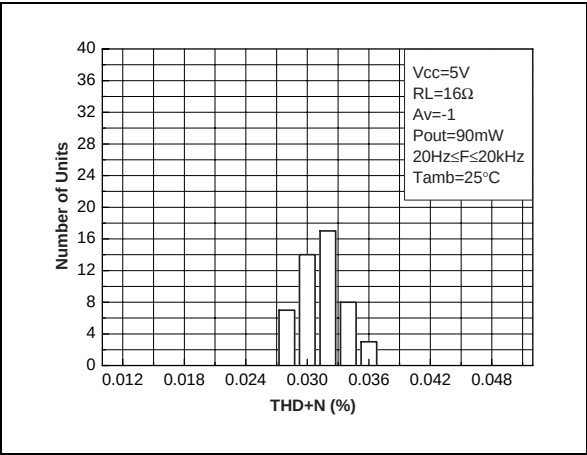


Fig. 69 : Best Case Distribution of THD+N

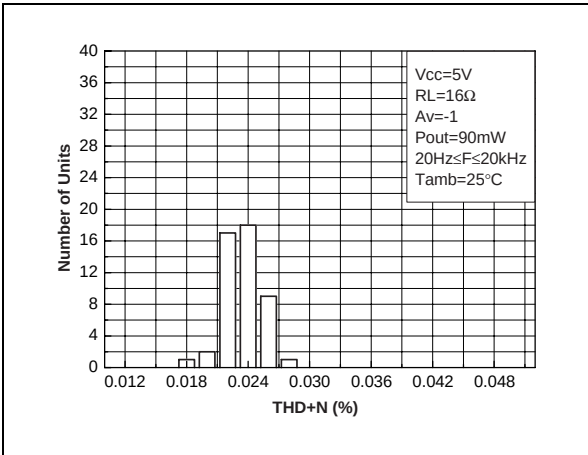


Fig. 70 : Worst Case Distribution of THD+N

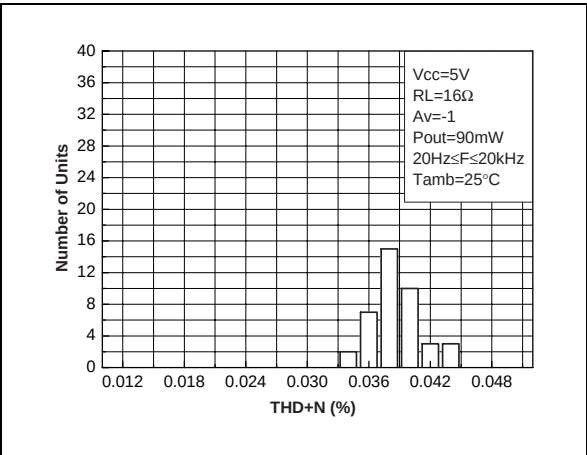


Fig. 71 : Typical Distribution of THD+N

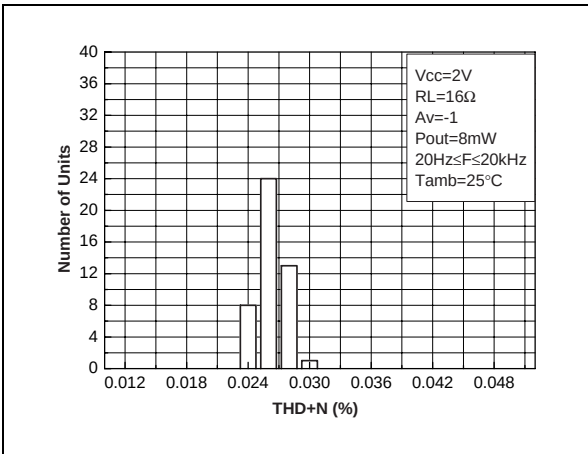


Fig. 72 : Best Case Distribution of THD+N

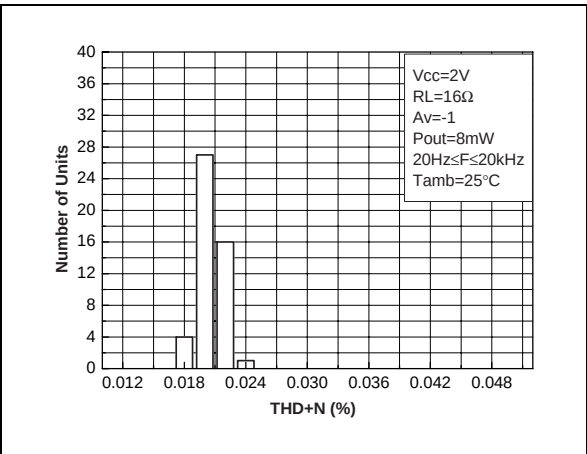


Fig. 73 : Worst Case Distribution of THD+N

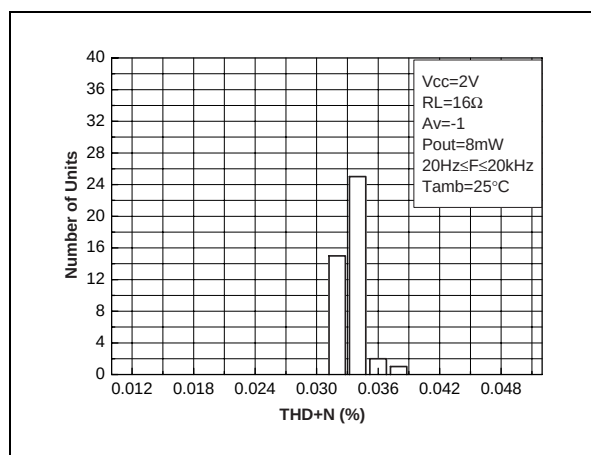


Fig. 74 : Typical Distribution of THD+N

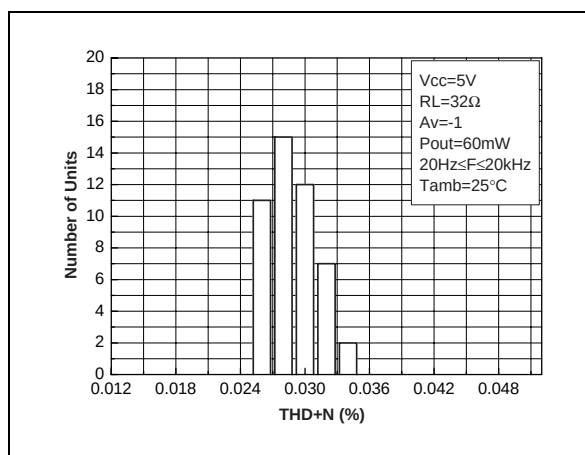


Fig. 75 : Best Case Distribution of THD+N

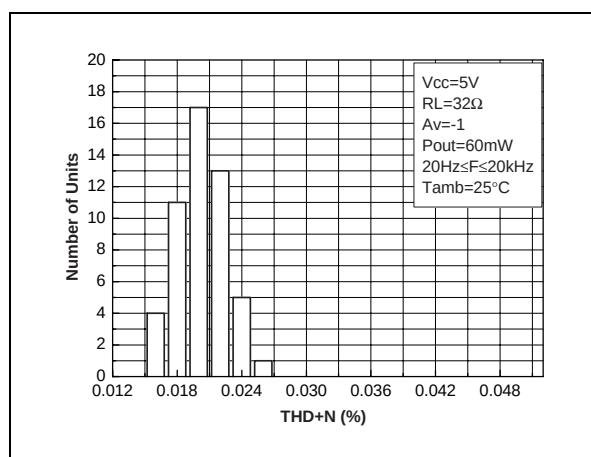


Fig. 76 : Worst Case Distribution of THD+N

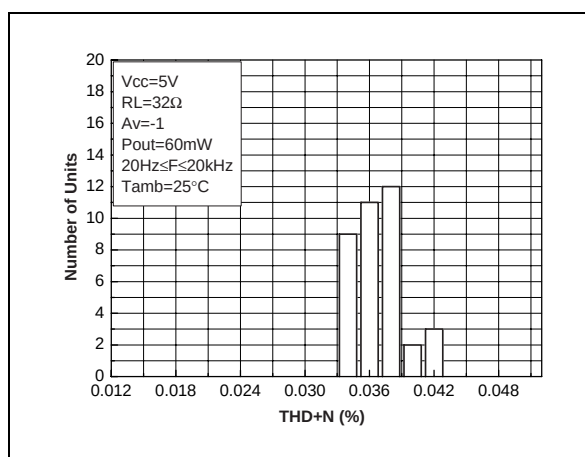


Fig. 77 : Typical Distribution of THD+N

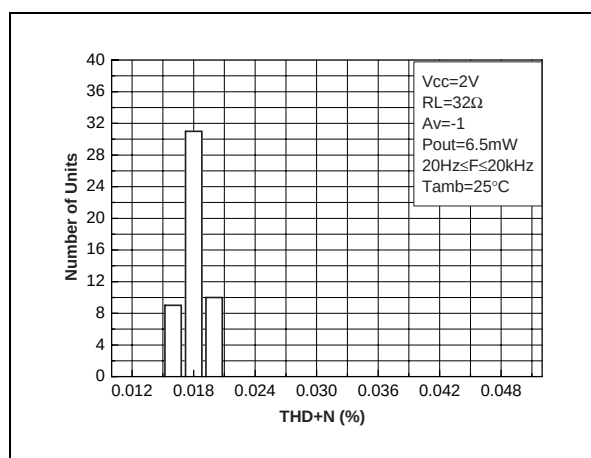


Fig. 78 : Best Case Distribution of THD+N

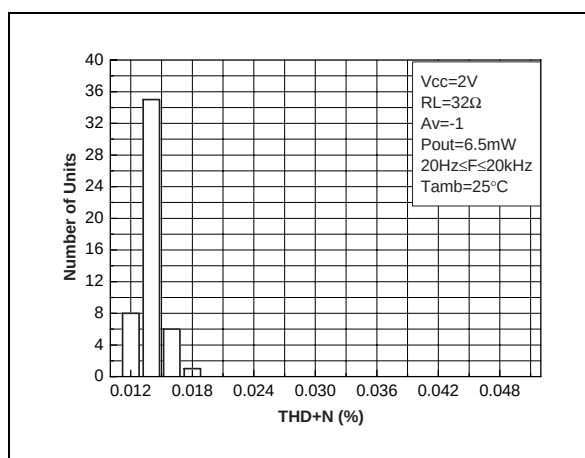
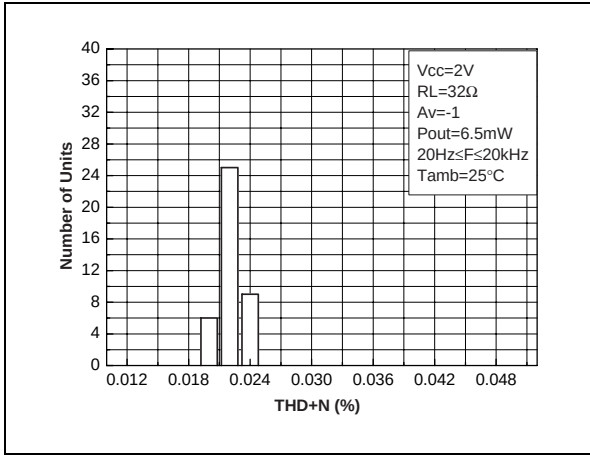


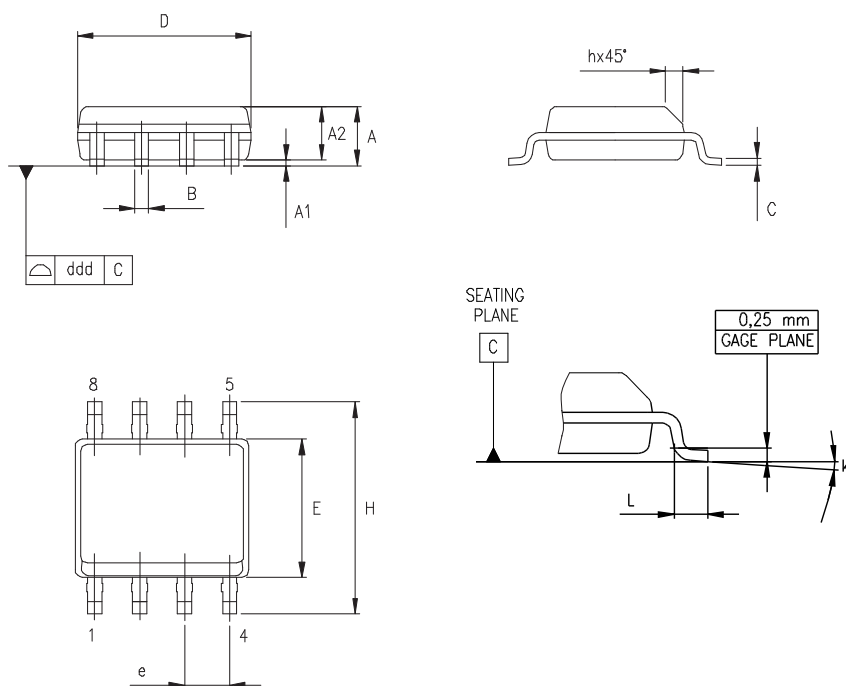
Fig. 79 : Worst Case Distribution of THD+N



PACKAGE MECHANICAL DATA

SO-8 MECHANICAL DATA

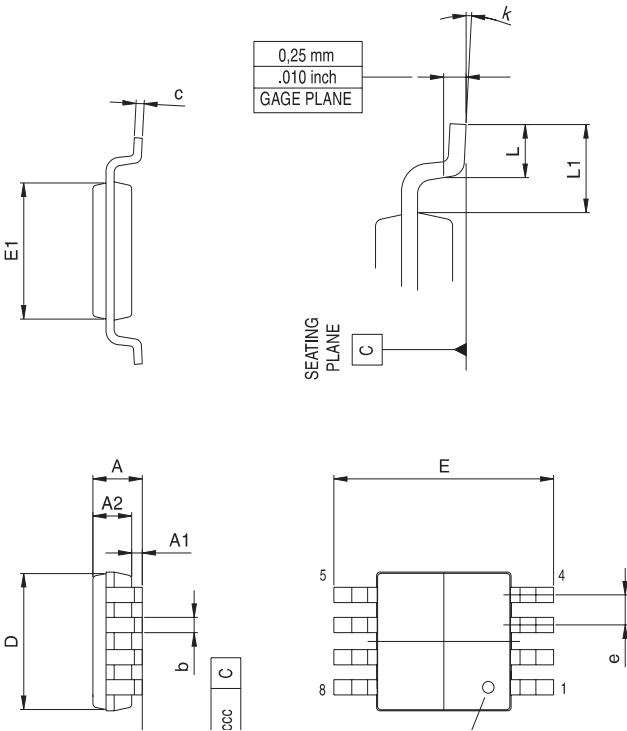
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	g° (max.)					
ddd			0.1			0.04



0016023/C

PACKAGE MECHANICAL DATA

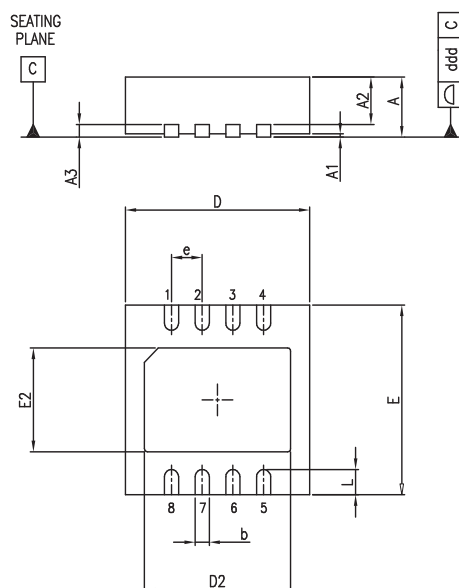
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.1			0.043
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.78	0.86	0.94	0.031	0.031	0.037
b	0.25	0.33	0.40	0.010	0.13	0.013
c	0.13	0.18	0.23	0.005	0.007	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.75	4.90	5.05	0.187	0.193	0.199
E1	2.90	3.00	3.10	.0114	0.118	0.122
e		0.65			0.026	
K	0°		6°	0°		6°
L	0.40	0.55	0.70	0.016	0.022	0.028
L1			0.10			0.004



PACKAGE MECHANICAL DATA

DFN8 (3x3) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	0.80	0.90	1.00	31,5	35,4	39,4
A1		0.02	0.05		0.8	2.0
A2		0.70			27,6	
A3		0.20			7.9	
b	0.18	0.23	0.30	7.1	9.1	11.8
D		3.00			118.1	
D2	2.23	2.38	2.48	87.8	93.7	97.7
E		3.00			118.1	
E2	1.49	1.64	1.74	58.7	64.6	68.5
e		0.50			19.7	
L	0.30	0.40	0.50	11.8	15.7	19.7



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