Stereo 330mW 8Ω Speak Driver With Mute

Features

- **Operating Voltage**
  - Single Supply 3V to 7V
  - Dual Supply ±1.5V to ± 3.5V
- **Depop Circuitry Integrated.**
- **High Signal-to-Noise Ratio, 100dB**
- **High Slew Rate, 5.5V/ms**
- **Low Distortion, -66dB**
- **Output Power at 10% THD+N**
  - into 8W, 330mW
  - into 16W, 200mW
- **Large Output Voltage Swing**
- **Excellent Power Supply Ripple Rejection**
- **Low Power Consumption**
- **Short-Circuit Elimination**
- **Wide Temperature Range**
- **No Switch ON/OFF Clicks**
- **Available in 8 Pin SOP, TSSOP, and MSOP Package**
- **Lead Free and Green Devices Available (RoHS Compliant)**

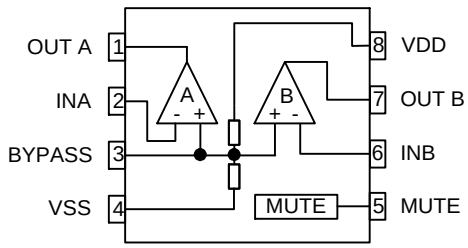
Gereral Description

The APA4880 is an integrated class AB stereo headphone amplifier contained in SOP-8, TSSOP-8, and MSOP-8 plastic package. The APA4880 is capable of delivering 330mW of max. Output power to an 8Ω load with less than 10% (THD+N) from a 5V power supply. The device has been primarily developed for portable digital audio applications. Both of the depop circuitry and mute circuitry are integrated in the APA4880, that reduces pops and clicks noise during power up and when using the mute mode (high active).

Applications

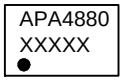
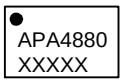
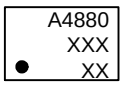
- **Portable Digital Audio**
- **Personal Computers**
- **Microphone Preamplifier**
- **CD ROM Player**
- **Headphone Amplifier**

Pin Configuration



APA4880

Ordering and Marking Information

APA4880 □□-□□□ Assembly Material Handling Code Temperature Range Package Code	Package Code K : SOP - 8 O : TSSOP-8 X : MSOP-8 Temperature Range I : - 40 to 85 °C Handling Code TR : Tape & Reel Assembly Material G : Halogen and Lead Free Device
APA4880 K : 	XXXXX - Date Code
APA4880 O : 	XXXXX - Date Code
APA4880 X : 	XXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020C for MSL classification at lead-free peak reflow temperature. ANPEC defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
V_{DD}	Supply Voltage	7	V
$T_{SC(O)}$	Output Short-Circuit Duration , at T_A=25°C , P_{TOT}=1W	20	S
T_A	Operating Ambient Temperature range	-40 to 85	°C
T_J	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-65 to+150	°C
T_S	Maximum Lead Soldering Temperature , 10 Seconds	260	°C

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Characteristics

Symbol	Parameter	Typical Value	Unit
θ_{JA}	Thermal Resistance from Junction to Ambient in Free Air (Note 2)		°C/W
	SOP-8	210	
	TSSOP-8	220	
	MSOP-8	210	

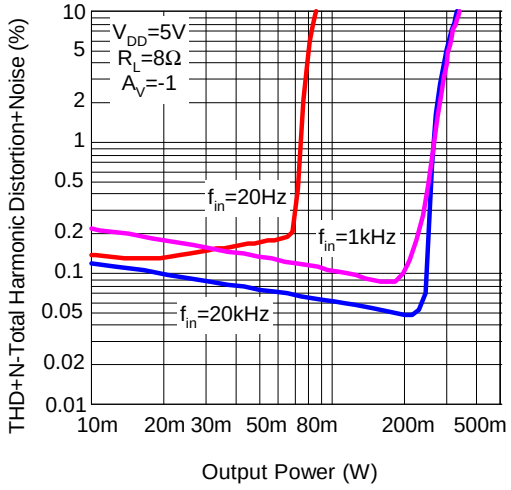
Note 2: θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air.

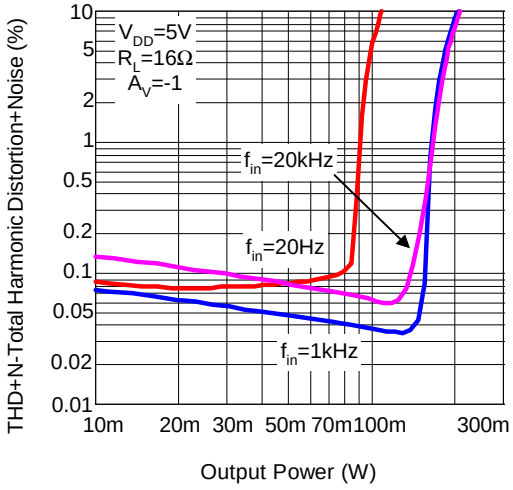
Electrical Characteristics

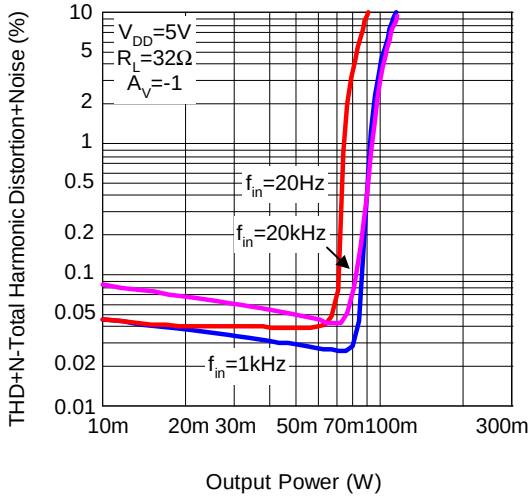
T_A=25°C, V_{DD}=5V, V_{SS}=0V, f_{in} =1kHz (unless otherwise noted)

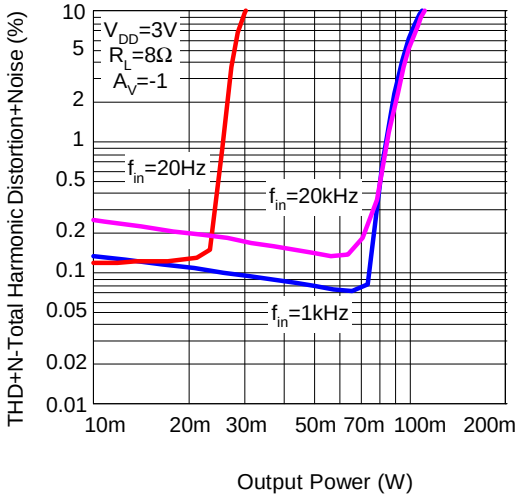
Symbol	Parameter	Test Conditions	APA4880			Unit
			Min.	Typ.	Max.	
I_{DD}	Supply Current	No Load	-	3.0	-	mA
I_{MUTE}	Mute Current	V_{PINS}	-	140	-	µA
$V_{I(OS)}$	Input Offset Voltage		-	5	-	mV
AC CHARACTERISTICS						
THD+N	Total Harmonic Distortion Plus Noise	P_O=200mW, R_L=8Ω, f_{in}=1kHz P_O=120mW, R_L=16Ω, f_{in}=1kHz P_O=75mW, R_L=32Ω, f_{in}=1kHz	-	0.05 0.04 0.03	-	%
Po	Output Power	THD+N=0.1%, f_{in}=1kHz R_L=8Ω R_L=16Ω R_L=32Ω THD+N=10%, f_{in}=1kHz R_L=8Ω R_L=16Ω R_L=32Ω	-	 240 150 85 330 200 110	-	mW
PSRR	Power Supply Rejection Ratio	C_B=2.2µF, V_{RIPPLE}=200mV_{rms}, f_{in}=120Hz	-	50	-	dB
$MUTE_{ATT}$	Mute attenuation	V_{in}=1V_{rms}, R_L=8Ω	-	85	-	dB
Crosstalk	Channel Separation	P_O=200mV, R_L=8Ω, C_B=2.2µF	-	85	-	dB
Av	Open Loop Gain		-	100	-	dB
Fg	Unity Gain Frequency		-	7	-	MHz
SR	Slew Rate		-	5.5	-	V/µs
S/N	Signal to Noise Ratio	V_{in}=1V_{rms} , R_L=8Ω	-	20	-	µV_{rms}

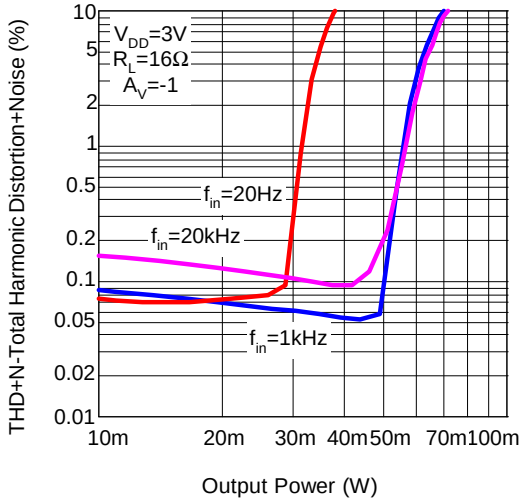
Typical Operating Characteristics

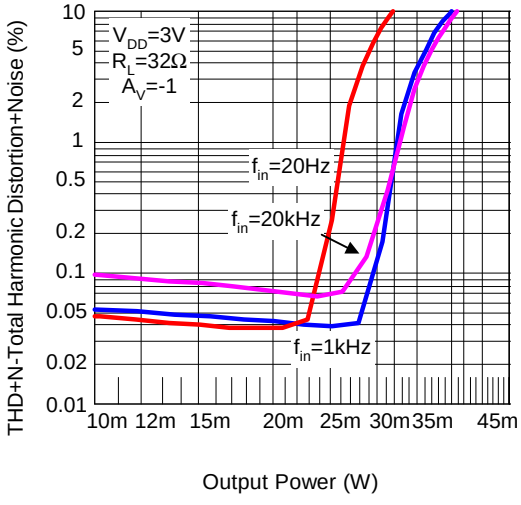












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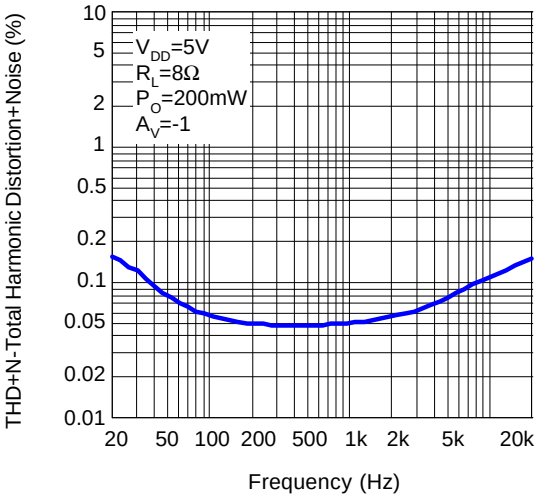

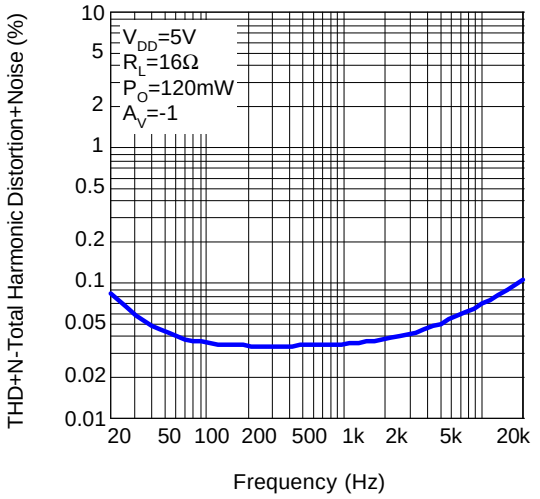

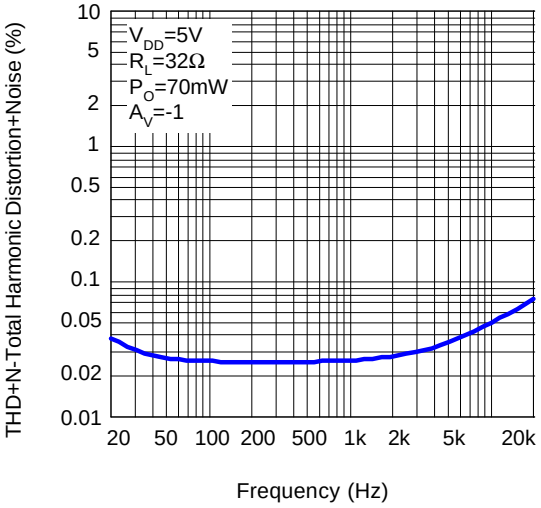

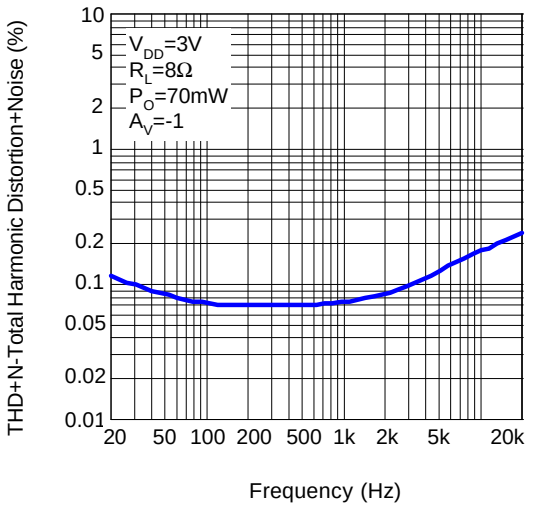

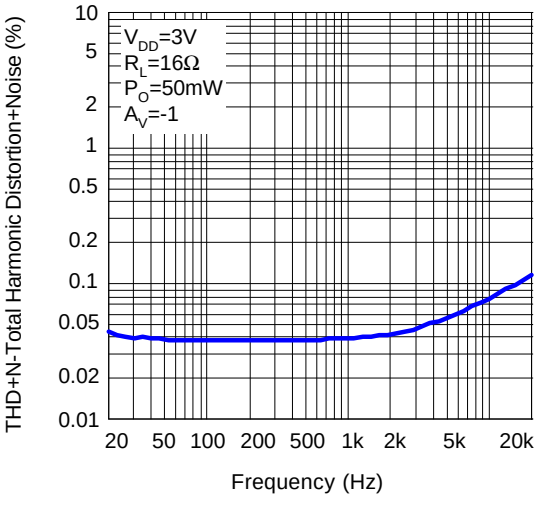

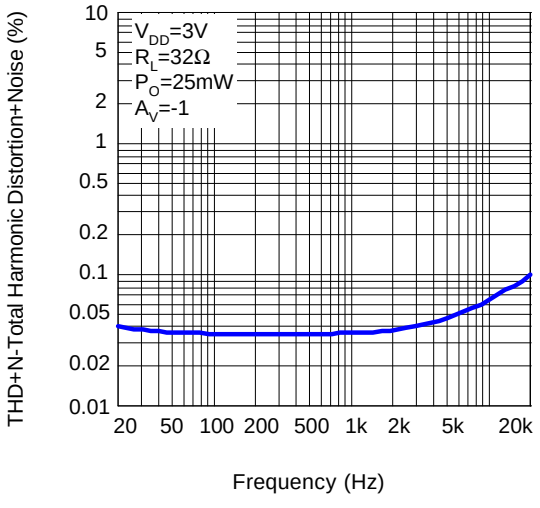

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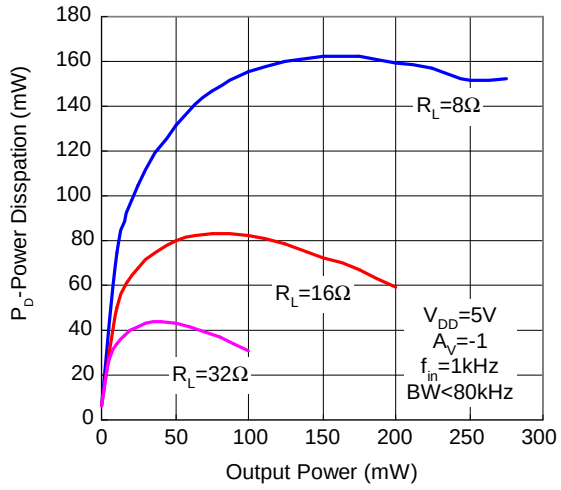

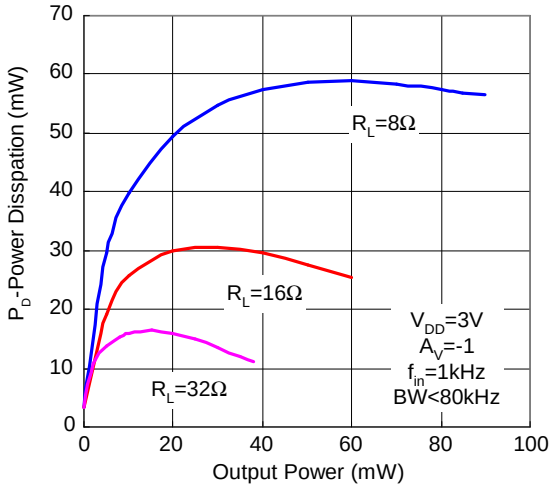

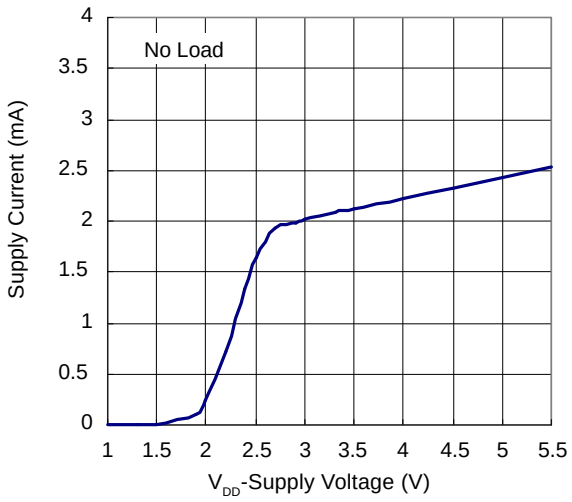

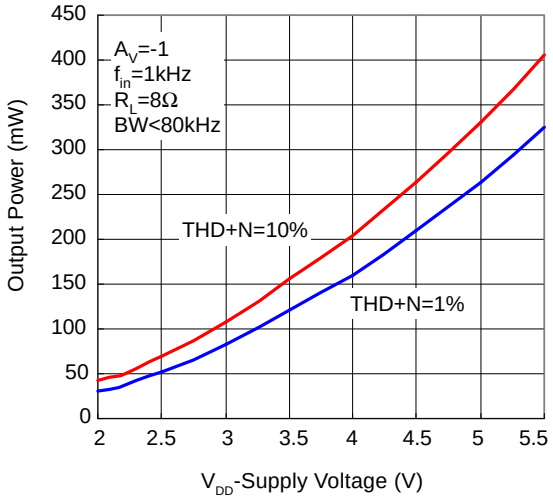

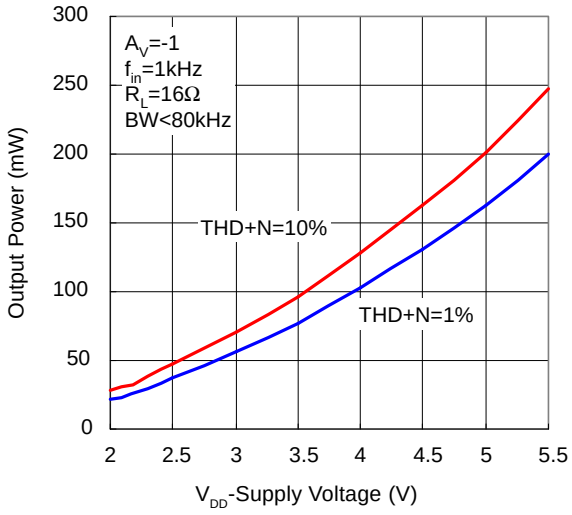

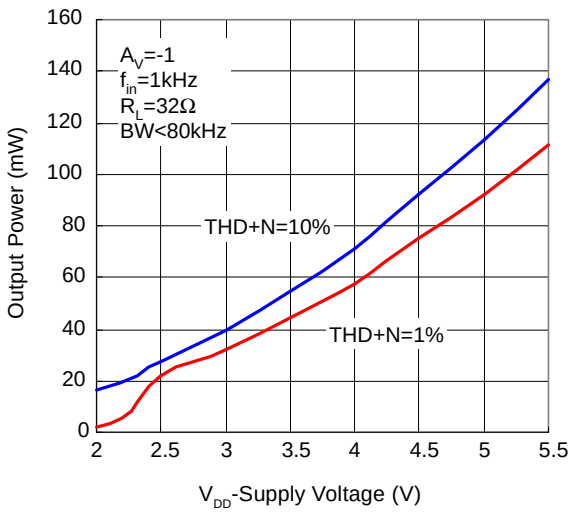

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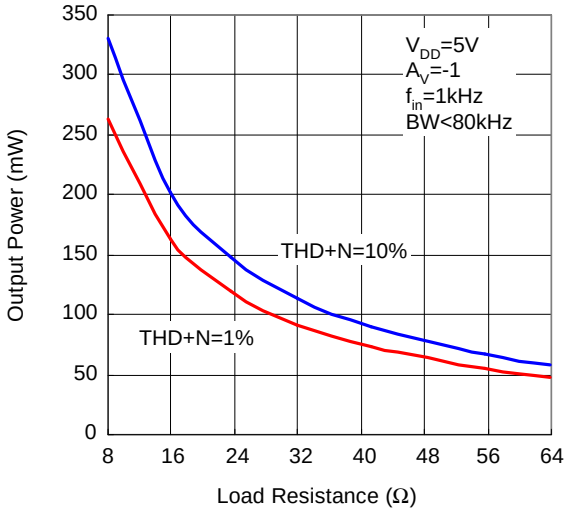
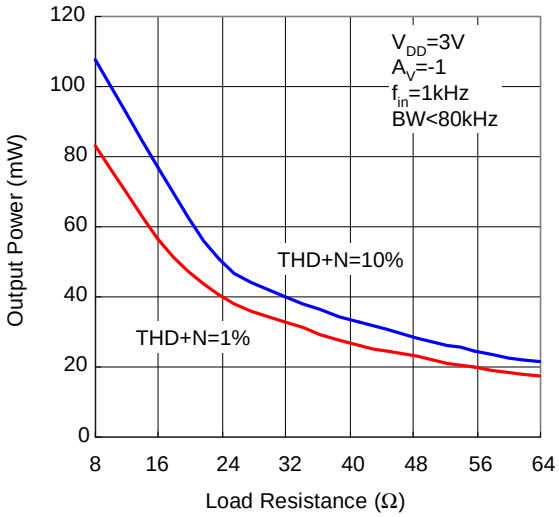
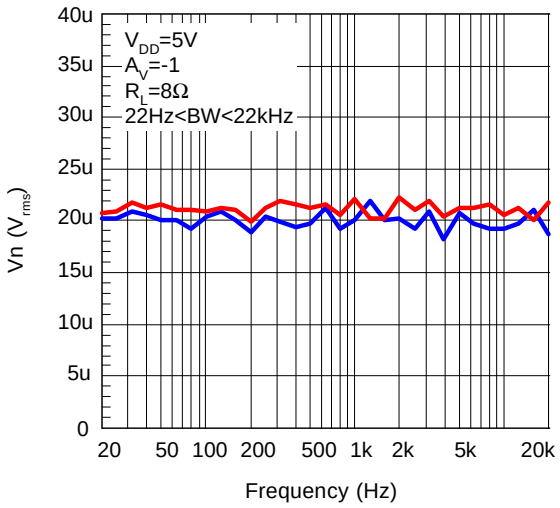
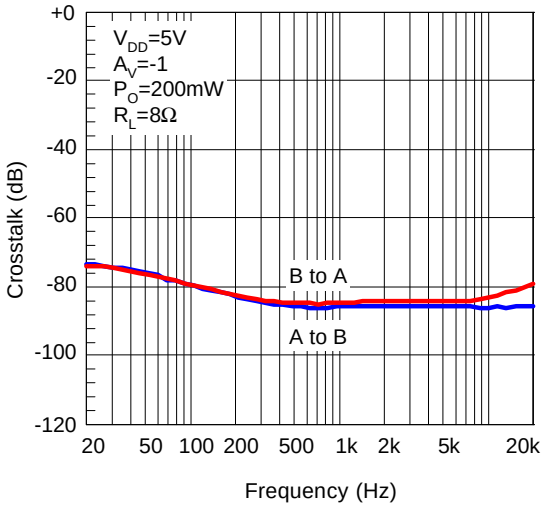
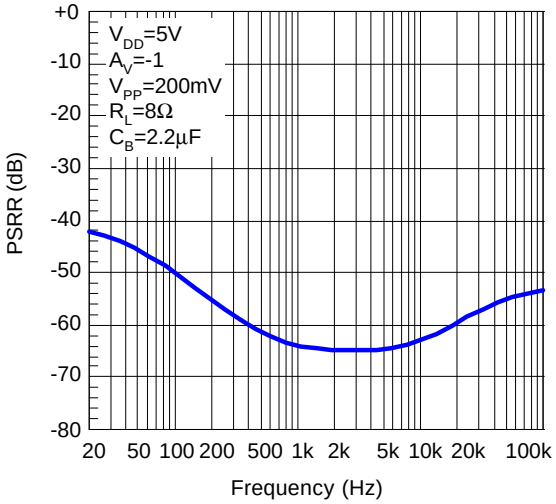
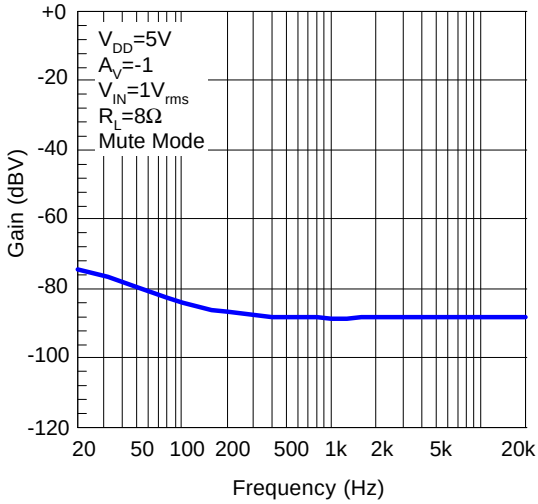








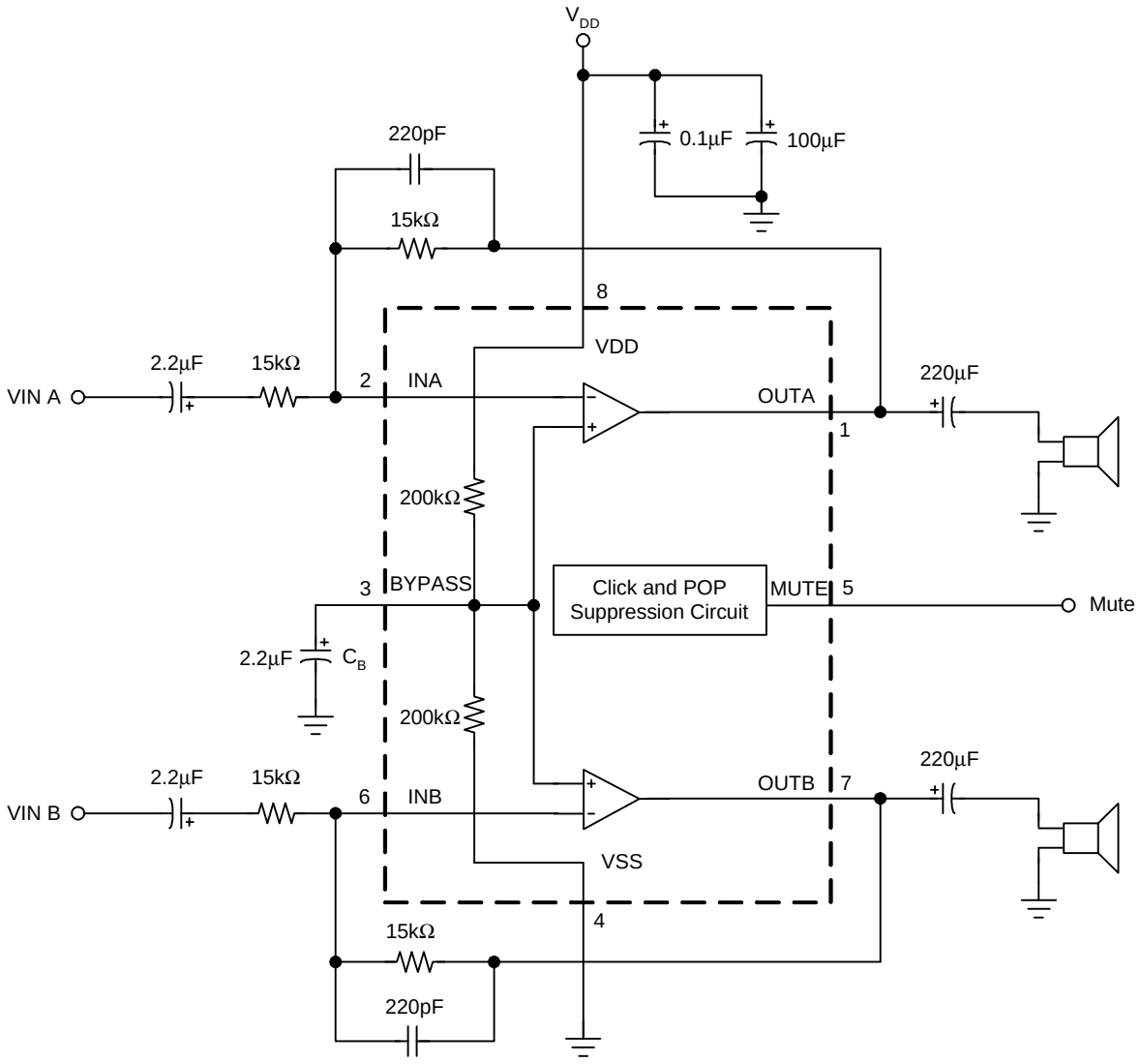




Pin Description

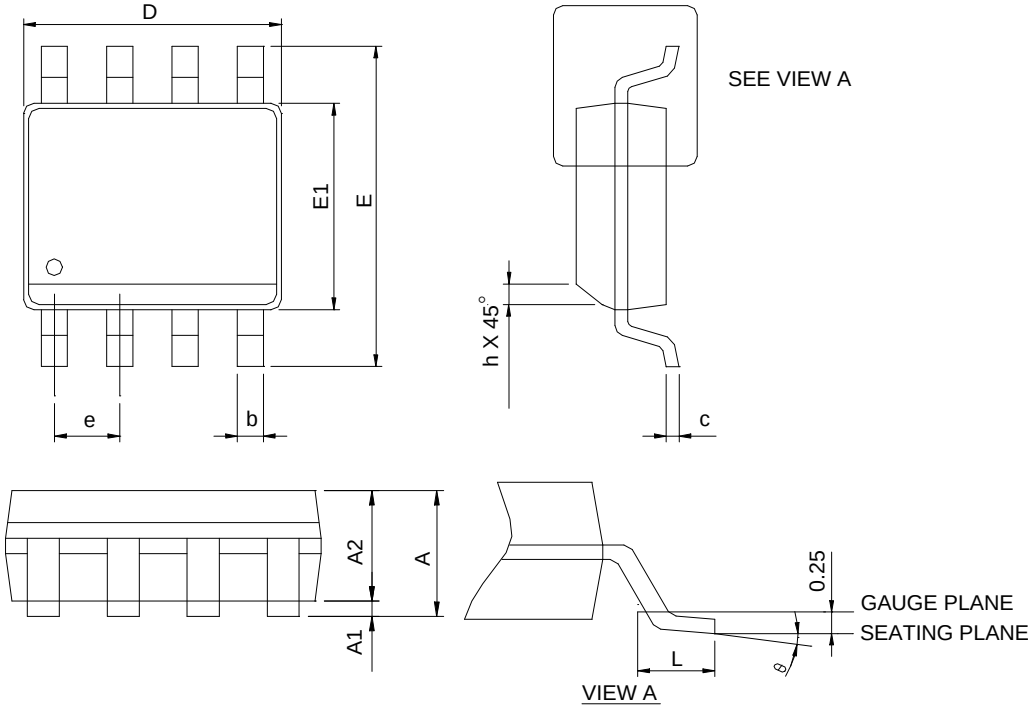
PIN		I/O	FUNCTION
NO.	NAME		
1	OUTA	O	Channel A output pin
2	INA	I	Audio input channel A
3	BYPASS	I	Connect to voltage divider for internal mid_supply bias
4	VSS		Ground or negative supply voltage connection for circuitry.
5	MUTE	I	mute mode control signal input, place entire IC in mute mode when held high, Imute=140μA
6	INB	I	Audio input channel B
7	OUTB	O	Channel B output pin
8	VDD		Supply voltage input pin

Typical Application Circuit



Package Information

SOP-8

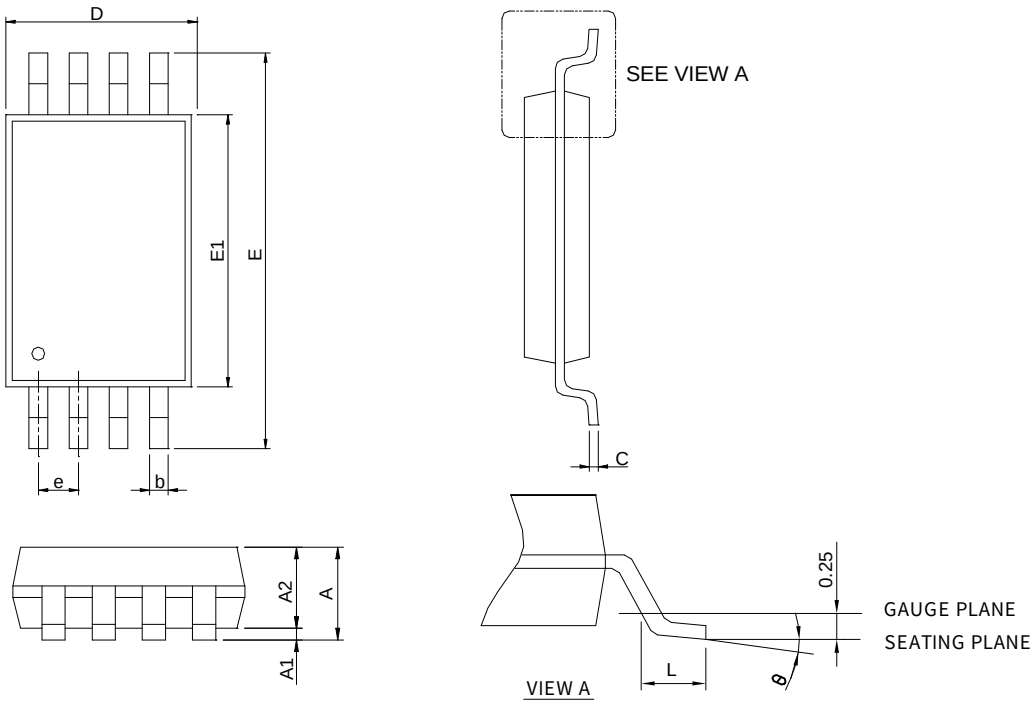


SYMBOL	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

Note: 1. Follow JEDEC MS-012 AA.
2. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
3. Dimension “E” does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

Package Information

TSSOP-8

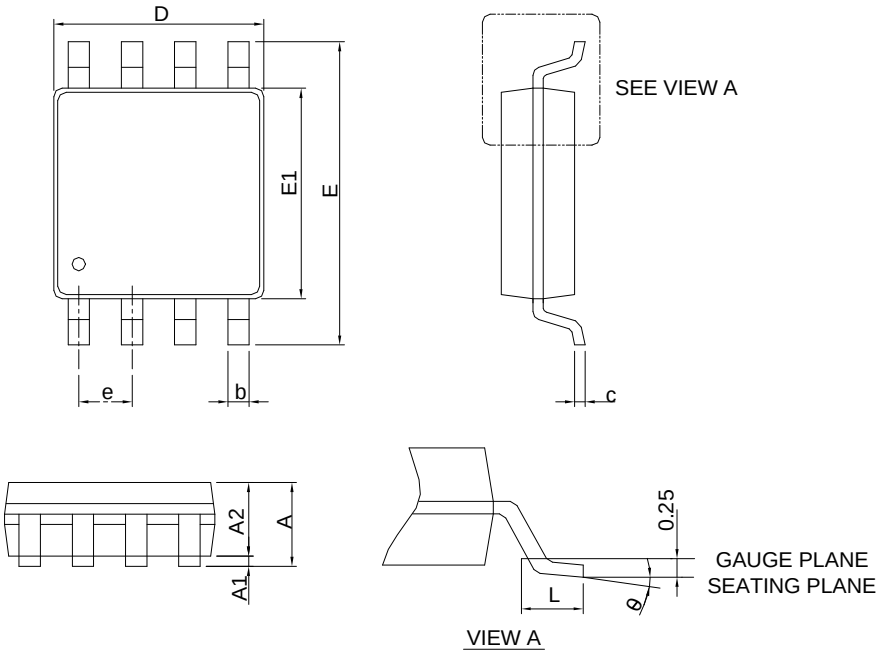


SYMBOL	TSSOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.20		0.047
A1	0.05	0.15	0.002	0.006
A2	0.80	1.05	0.031	0.041
b	0.19	0.30	0.007	0.012
c	0.09	0.20	0.004	0.008
D	2.90	3.10	0.114	0.122
E	6.20	6.60	0.244	0.260
E1	4.30	4.50	0.169	0.177
e	0.65 BSC		0.026 BSC	
L	0.45	0.75	0.018	0.030
θ	0 °	8 °	0 °	8°

Note : 1. Follow JEDEC MO-153 AA
2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
3. Dimension "E1" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

Package Information

MSOP-8

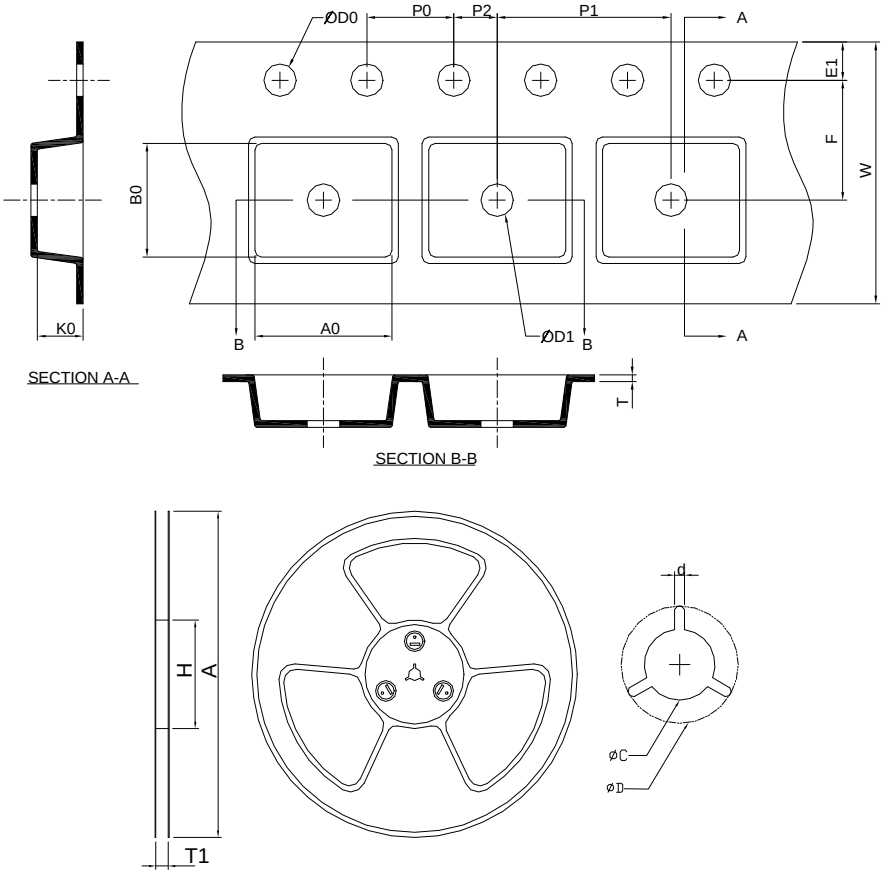


SYMBOL	MSOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.10		0.043
A1	0.00	0.15	0.000	0.006
A2	0.75	0.95	0.030	0.037
b	0.22	0.38	0.009	0.015
c	0.08	0.23	0.003	0.009
D	2.90	3.10	0.114	0.122
E	4.70	5.10	0.185	0.201
E1	2.90	3.10	0.114	0.122
e	0.65 BSC		0.026 BSC	
L	0.40	0.80	0.016	0.031
θ	0°	8°	0°	8°

Note: 1. Follow JEDEC MO-187 AA.

2. Dimension " D " does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
3. Dimension " E1 " does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 5 mil per side.

Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
SOP-8	330.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	**P1**	**P2**	**D0**	**D1**	**T**	**A0**	**B0**	**K0**
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.40±0.20	5.20±0.20	2.10±0.20
Application	**A**	**H**	**T1**	**C**	**d**	**D**	**W**	**E1**	**F**
TSSOP-8	330.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.10
	P0	**P1**	**P2**	**D0**	**D1**	**T**	**A0**	**B0**	**K0**
	4.00±0.10	8.00±0.10	2.00±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.90±0.20	3.40±0.20	1.60±0.20
Application	**A**	**H**	**T1**	**C**	**d**	**D**	**W**	**E1**	**F**
MSOP-8	330.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	**P1**	**P2**	**D0**	**D1**	**T**	**A0**	**B0**	**K0**
	4.00±0.10	8.00±0.10	2.00±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	5.30±0.20	3.30±0.20	1.40±0.20

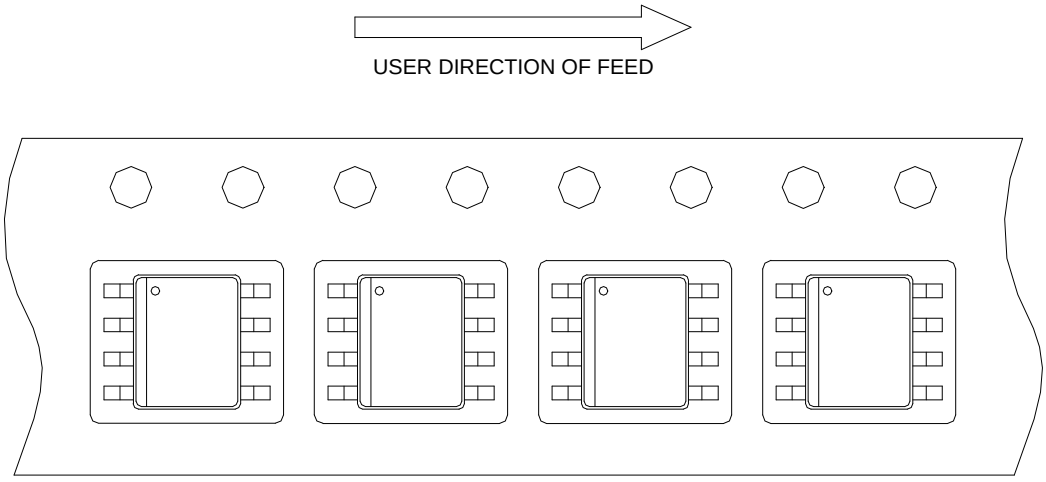
(mm)

Devices Per Unit

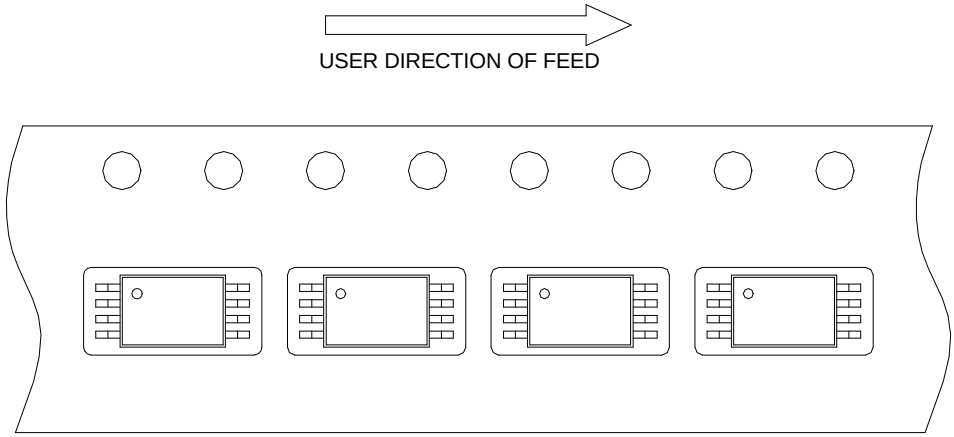
Package Type	Unit	Quantity
SOP-8	Tape & Reel	2500
TSSOP-8	Tape & Reel	2500
MSOP-8	Tape & Reel	3000

Taping Direction Information

SOP-8

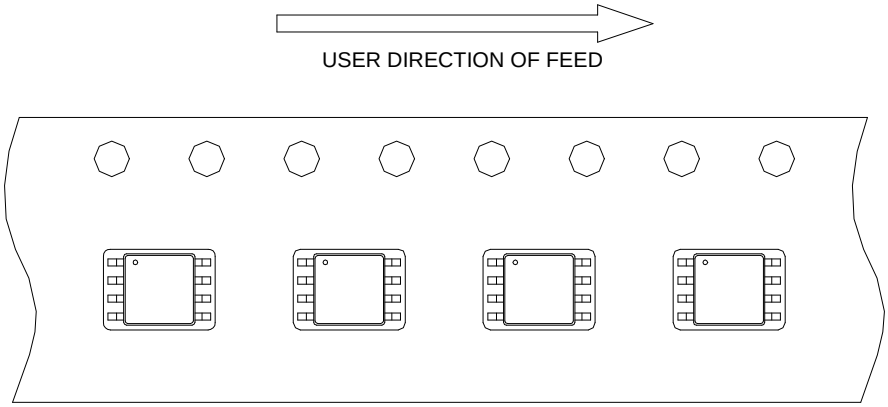


TSSOP-8

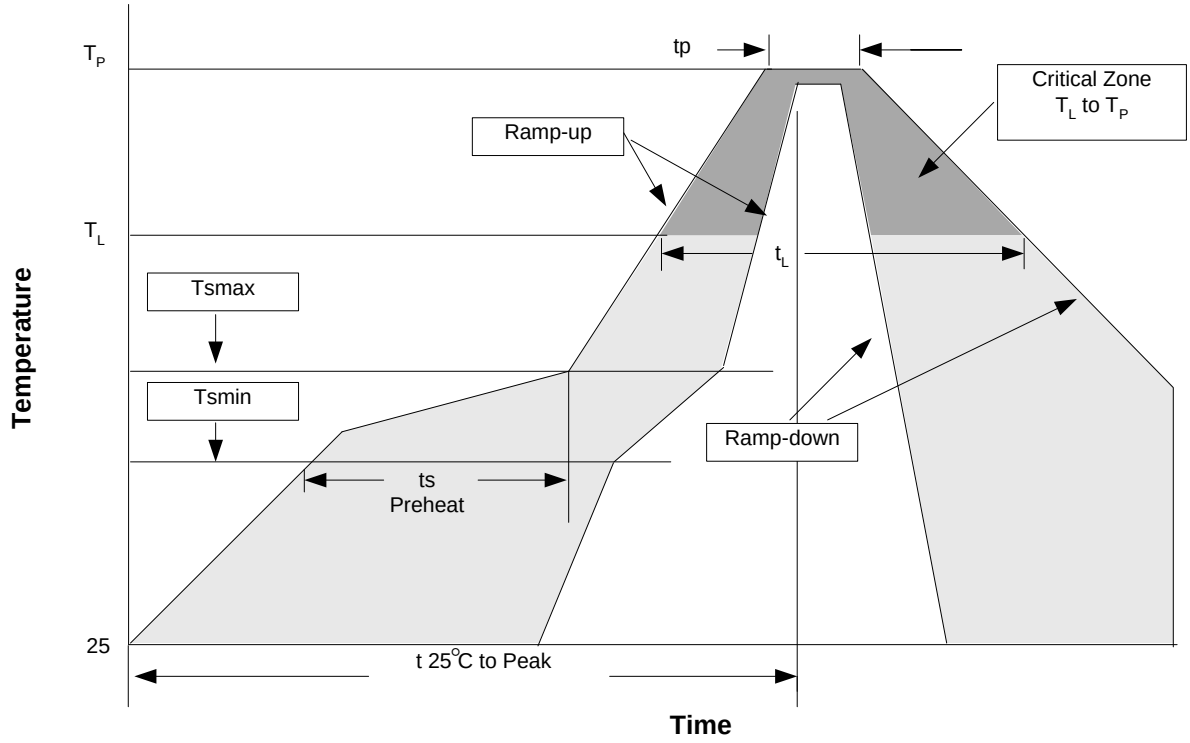


Taping Direction Information

MSOP-8



Reflow Condition (IR/Convection or VPR Reflow)



Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 sec
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @125°C
PCT	JESD-22-B,A102	168 Hrs, 100%RH, 121°C
TST	MIL-STD-883D-1011.9	-65°C~150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms, 1_{tr} > 100mA

Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max.	3°C/second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (min to max) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature (Tp)	See table 1	See table 2
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Notes: All temperatures refer to topside of the package. Measured on the body surface.

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 ³350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

* Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

Customer Service

Anpec Electronics Corp.
Head Office :
No.6, Dusing 1st Road, SBIP,
Hsin-Chu, Taiwan, R.O.C.
Tel : 886-3-5642000
Fax : 886-3-5642050

Taipei Branch :
2F, No. 11, Lane 218, Sec 2 Jhongsing Rd.,
Sindian City, Taipei County 23146, Taiwan
Tel : 886-2-2910-3838
Fax : 886-2-2917-3838