

## Class AB Stereo Headphone Driver

### Features

- Operating Voltage
  - Single Supply 3V to 6V
  - Dual Supply  $\pm 1.5V$  to  $\pm 3.0V$
- High Signal-to-Noise Ratio 100dB
- Low Distortion -65dB
- 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 ,DIP or TSSOP Package

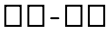
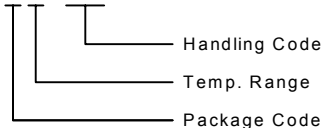



### Applications

- Portable Digital Audio

### General Description

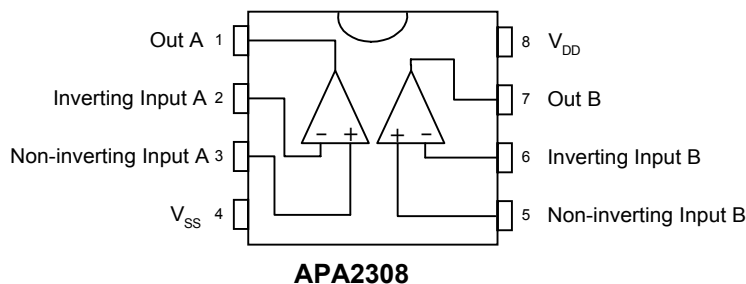
The APA2308 is an integrated class AB stereo headphone driver contained in an SO-8, a DIP-8 or a TSSOP-8 plastic package. The APA2308 is capable of delivering 280mW of max. Output power to an 8 $\Omega$  load or 110mW to a 32 $\Omega$  load with less than 10% (THD+N) from a 5V power supply. The device is fabricated in a CMOS process and has been primarily developed for portable digital audio applications .

### Ordering and Marking Information

<p>APA2308 </p> <p>                        Handling Code                      Temp. Range                      Package Code                 </p>	<p>Package Code                      J : PDIP - 8      K : SOP - 8                      O : TSSOP - 8                      Temp. Range                      I : - 40 to 85° C                      Handling Code                      TU : Tube      TR : Tape &amp; Reel</p>
<p>APA2308 J : </p>	<p>XXXXX - Date Code</p>
<p>APA2308 K : </p>	<p>XXXXX - Date Code</p>
<p>APA2308 O : </p>	<p>XXXXX - Date Code</p>

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

## Block Diagram



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
$V_{DD}$	Supply Voltage	7	V
$T_{SC(O)}$	Output Short-circuit Duration, at $T_A=25^{\circ}C$ , $P_{TOT}=1W$	20	S
$T_A$	Operating Ambient Temperature range	-40 to 85	$^{\circ}C$
$T_J$	Maximum Junction Temperature	150	$^{\circ}C$
$T_{STG}$	Storage Temperature Range	-65 to +150	$^{\circ}C$
$T_S$	Soldering Temperature , 10 seconds	260	$^{\circ}C$
$V_{ESD}$	Electrostatic Discharge	-3000 to 3000*1	V

Note : \*1. Human body model :  $C=100pF$  ,  $R=1500\Omega$  , 3 positive pulses plus 3 negative pulses

## Thermal Characteristics

Symbol	Parameter	Value	Unit	
$R_{THJA}$	Thermal Resistance from Junction to Ambient in Free Air			
		DIP-8	109	K/W
		SO-8	210	K/W

## Electrical Characteristics

$V_{DD}=5V$  ,  $V_{SS}=0V$  ,  $T_A=25^{\circ}C$  ,  $f_i=1kHz$  ,  $R_L=32\Omega$  ( unless otherwise noted)

Symbol	Parameter	Test Condition	APA2308			Unit
			Min.	Typ.	Max	
<b>Supply</b>						
$V_{DD}$	Supply Voltage					V
	Single		3.0	5.0	6.0	
	Dual		$\pm 1.5$	$\pm 2.5$	$\pm 3.0$	
$V_{SS}$	Negative Supply Voltage		-1.5	-2.5	-3.0	V
$I_{DD}$	Supply Current	No Load		2.5	5	MA
$P_{TOT}$	Total Power Dissipation	No Load		12.5	25	mW

## Electrical Characteristics Cont.

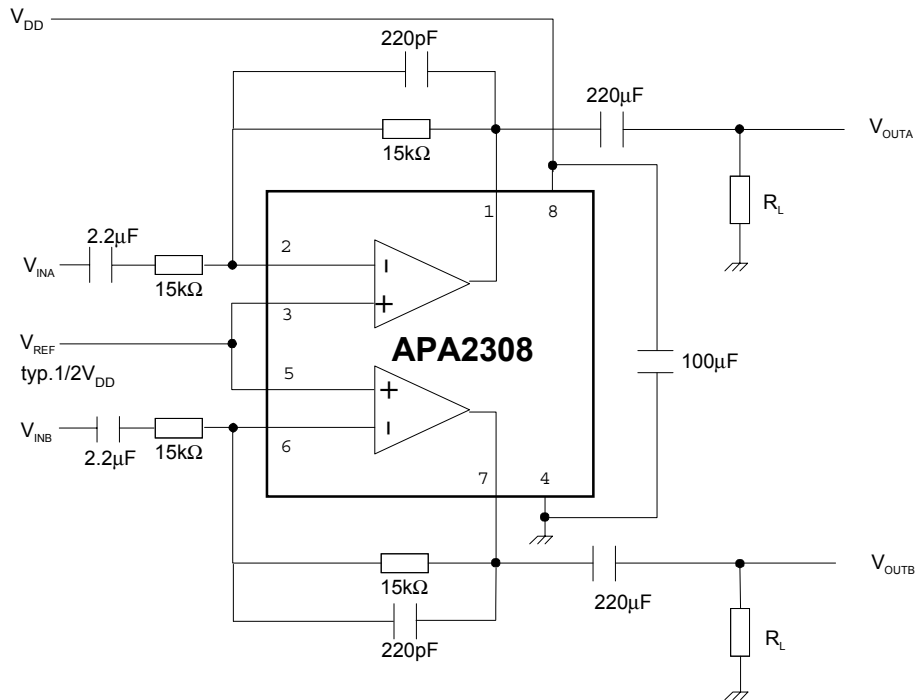
$V_{DD}=5V$ ,  $V_{SS}=0V$ ,  $T_A=25^{\circ}C$ ,  $f_i=1kHz$ ,  $R_L=32\Omega$  ( unless otherwise noted)

Symbol	Parameter	Test Condition	APA2308			Unit
			Min.	Typ.	Max	
<b>DC Characteristics</b>						
$V_{I(OS)}$	Input Offset Voltage			5		MV
$I_{BIAS}$	Input Bias Current			10		PA
$V_{CM}$	Common Mode Voltage		0		3.5	V
$G_V$	Open-loop Voltage Gain	$R_L=5k\Omega$		75		dB
$I_O$	Max. Output Current	$(THD+N)/S < 0.1\%$		140		MA
$R_O$	Output Resistance			0.25		$\Omega$
<b>AC Characteristics</b>						
$V_O$	Output Voltage Swing	$R_L=32\Omega^{*1}$	0.25		4.75	V
		$R_L=16\Omega^{*1}$	0.5		4.5	
PSRR	Power Supply Rejection Ratio	$F_i=100Hz$ $V_{RIPPLE(P-P)}=100mV$		65		dB
$\alpha_{CS}$	Channel Separation	$R_L=32\Omega$		95		dB
$C_L$	Load Capacitance				200	pF
(THD+N)/S	Total Harmonic Distortion Plus Noise to Signal Ratio	$R_L=32\Omega^{*2}$		-65	-60	dB
				0.05	0.1	%
S/N	Signal to Noise Ratio		90	100		dB
$F_G$	Unity Gain Frequency	$R_L=5k\Omega$		5		MHz
$P_O$	Max. Output Power	$(THD+N)/S < 0.1\%$		84		mW
$C_I$	Input Capacitance			3		pF
B	Power Bandwidth	Unity Gain Inverting		20		kHz

Notes \*1 : Values are proportional to  $V_{DD}$  ;  $(THD+N)/S < 0.1\%$

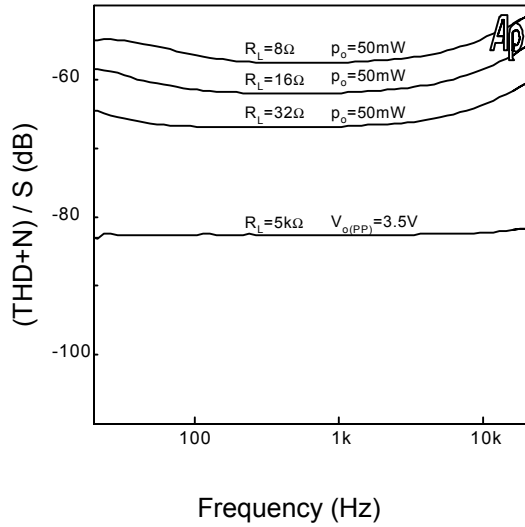
\*2 :  $V_{DD}=5.0V$  ;  $V_{O(P-P)}=3.5V$  (at 0 dB)

## Test And Application Circuits

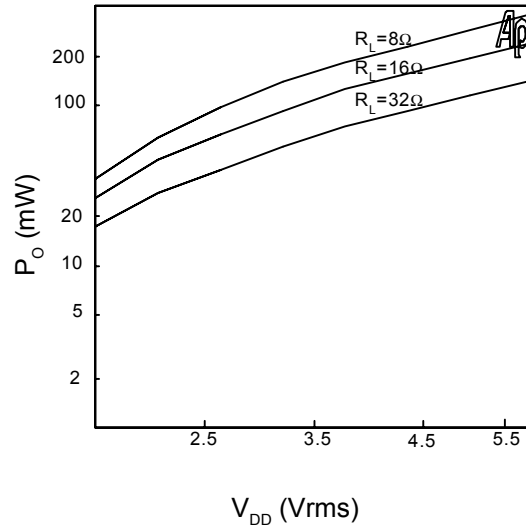


## Typical Characteristics

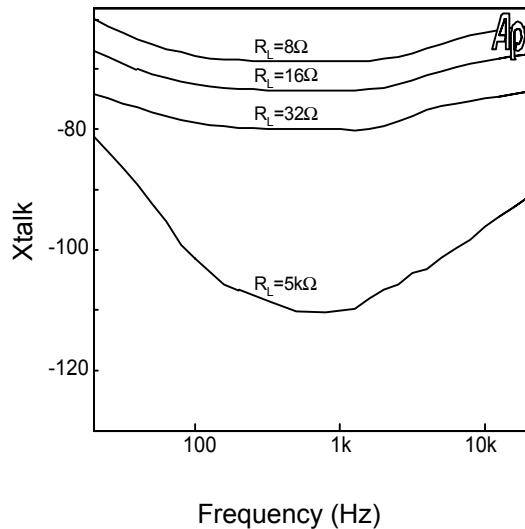
Total Harmonic Distortion Plus Noise-to-Signal Ratio as a Function of Input Frequency



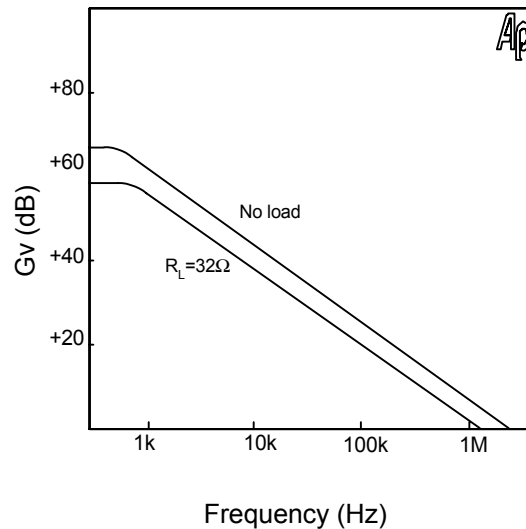
Output Power as a Function of Supply Voltage



Crosstalk as a Function of Input Frequency

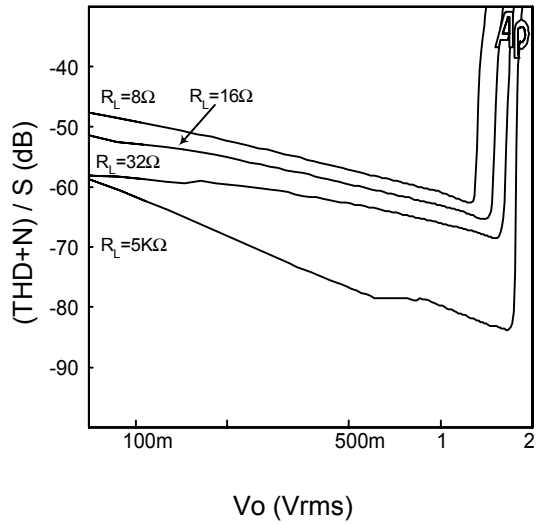


Open Loop Gain as a Function of Input Frequency



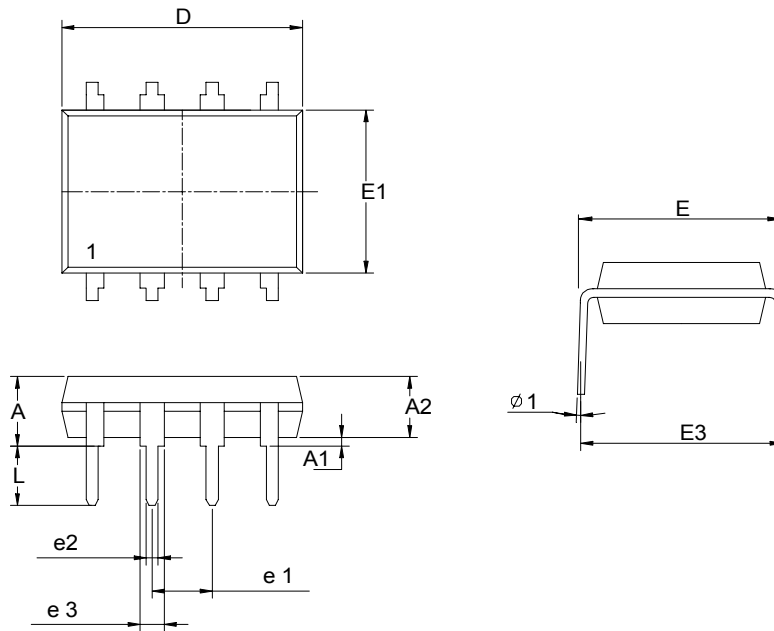
Typical Characteristics Cont.

Total Harmonic Distortion Plus Noise-to-Signal Ratio as a Function of output Voltage



## Packaging Information

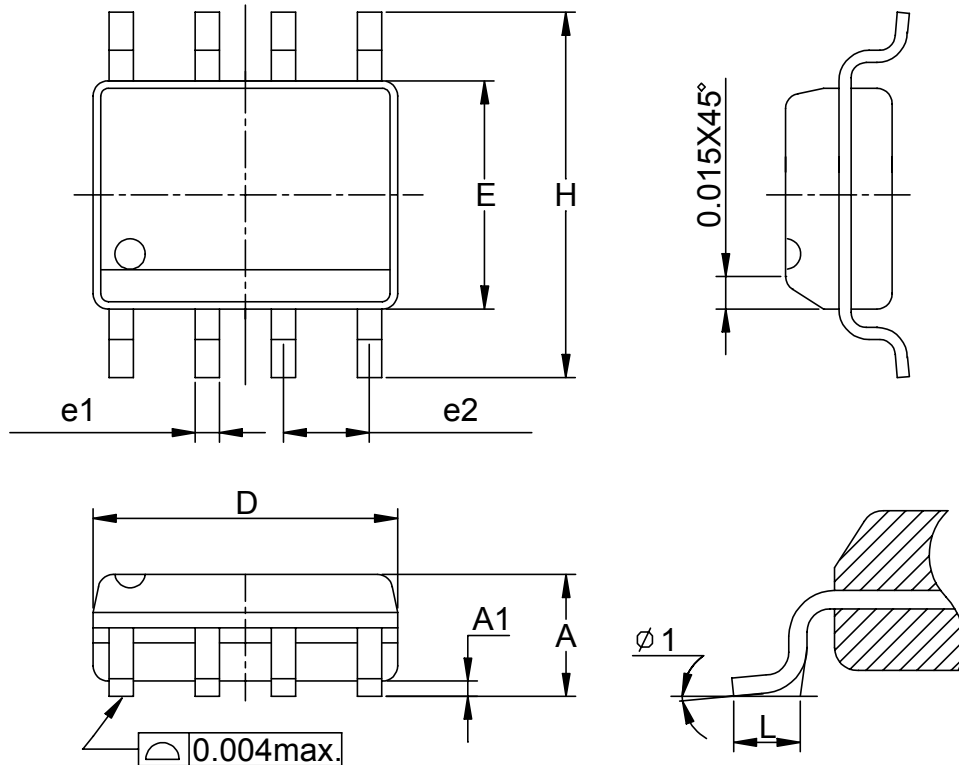
PDIP-8 pin ( Reference JEDEC Registration MS-001)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A		5.33		0.210
A1	0.38		0.015	
A2	2.92	3.68	0.115	0.145
D	9.02	10.16	0.355	0.400
e1	2.54BSC		0.100BSC	
e2	0.36	0.56	0.014	0.022
e3	1.14	1.78	0.045	0.070
E	7.62 BSC		0.300 BSC	
E1	6.10	7.11	0.240	0.280
E3		10.92		0.430
L	2.92	3.81	0.115	0.150
φ 1	15°		15°	

## Packaging Information

SOP-8 pin ( Reference JEDEC Registration MS-012)

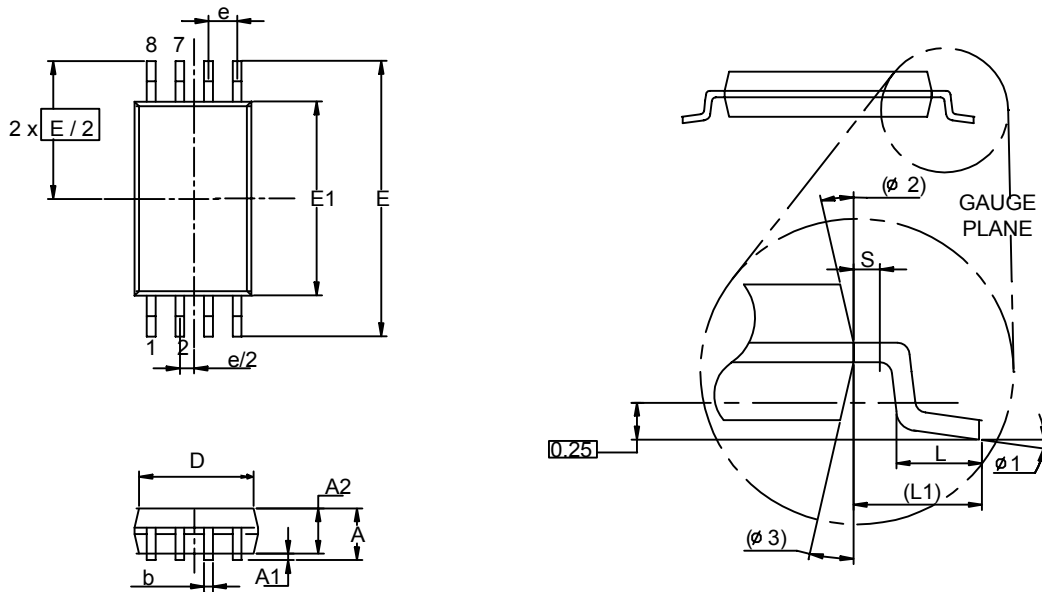


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	8°		8°	



## Packaging Information

TSSOP-8



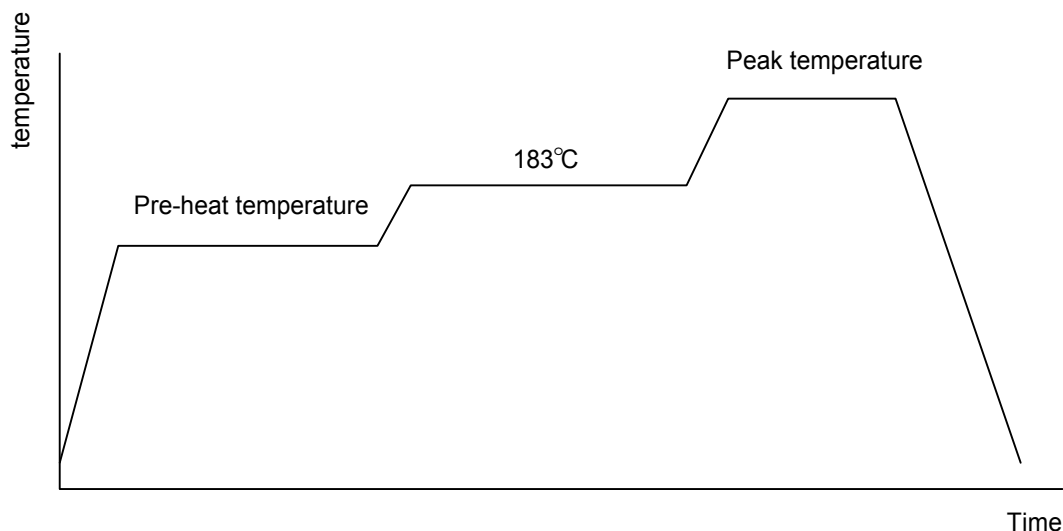
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A		1.2		0.047
A1	0.00	0.15	0.000	0.006
A2	0.80	1.05	0.031	0.041
b	0.19	0.30	0.007	0.012
D	2.9	3.1	0.114	0.122
e	0.65 BSC		0.026 BSC	
E	6.40 BSC		0.252 BSC	
E1	4.30	4.50	0.169	0.177
L	0.45	0.75	0.018	0.030
L1	1.0 REF		0.039 REF	
R	0.09		0.004	
R1	0.09		0.004	
S	0.2		0.008	
phi 1	0°	8°	0°	8°
phi 2	12° REF		12° REF	
phi 3	12° REF		12° REF	

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb)
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

## Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999



## Classification Reflow Profiles

	Convection or IR/ Convection	VPR
Average ramp-up rate(183°C to Peak)	3°C/second max.	10 °C /second max.
Preheat temperature 125 ± 25°C)	120 seconds max	
Temperature maintained above 183°C	60 – 150 seconds	
Time within 5°C of actual peak temperature	10 –20 seconds	60 seconds
Peak temperature range	220 +5/-0°C or 235 +5/-0°C	215-219°C or 235 +5/-0°C
Ramp-down rate	6 °C /second max.	10 °C /second max.
Time 25°C to peak temperature	6 minutes max.	

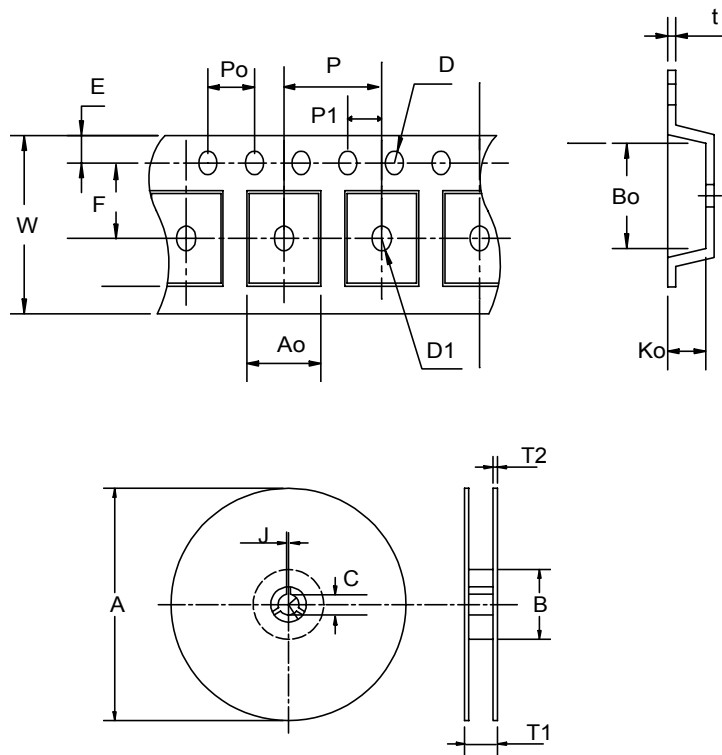
## Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm <sup>3</sup>	pkg. thickness < 2.5mm and pkg. volume < 350mm <sup>3</sup>
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C

## 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 , I <sub>tr</sub> > 100mA

## Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
SOP-8	330 ± 1	62 +1.5	12.75+ 0.15	2 ± 0.5	12.4 ± 0.2	2 ± 0.2	12± 0.3	8± 0.1	1.75±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5± 1	1.55 +0.1	1.55+ 0.25	4.0 ± 0.1	2.0 ± 0.1	6.4 ± 0.1	5.2± 0.1	2.1± 0.1	0.3±0.013
Application	A	B	C	J	T1	T2	W	P	E
TSSOP-8	330 ± 1	62 +1.5	12.75+ 0.15	2 + 0.5	12.4 ± 0.2	2 ± 0.2	12± 0.3	8± 0.1	1.75±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.1	1.5 + 0.1	1.5 + 0.1	4.0 ± 0.1	2.0 ± 0.1	7.0 ± 0.1	3.6 ± 0.3	1.6 ± 0.1	0.3±0.013

(mm)

## Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOP- 8	12	9.3	2500
TSSOP- 8	12	9.3	2500

## Customer Service

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