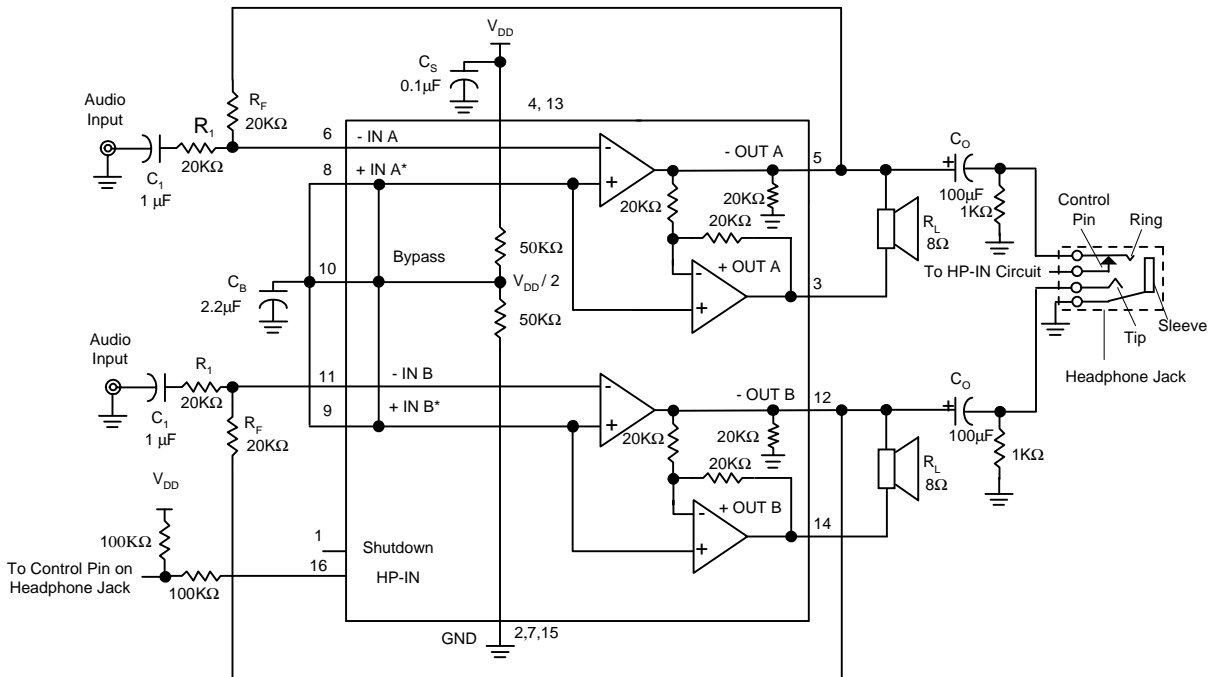




## Block Diagram



\* +INA and +INB pins are connected to Bypass pin inside the IC.

## Absolute Maximum Ratings

(Over operating free-air temperature range unless otherwise noted.)

Symbol	Parameter	Rating	Unit
$V_{DD}$	Supply Voltage	6	V
$T_A$	Operating Ambient Temperature Range	-40 to 85	°C
$T_J$	Maximum Junction Temperature	150	°C
$T_{STG}$	Storage Temperature Range	-65 to +150	°C
$T_S$	Soldering Temperature, 10 seconds	260	°C
$V_{ESD}$	Electrostatic Discharge	-2000 to 2000 <sup>*1</sup>	V

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

## Recommended Operating Conditions

		Min.	Typ.	Max.	Unit
Supply Voltage, $V_{DD}$		3	5	5.5	V
Operating free-air temperature, $T_A$	$V_{DD}=5V$ , 250mW/Ch average power 4- $\Omega$ stereo BTL drive, with proper PCB design	-20		85	$^{\circ}C$
	$V_{DD}=5V$ , 1.8 W/Ch average power 4- $\Omega$ stereo BTL drive, with proper PCB design and 300 CFM forced-air cooling	-20		85	
Common mode input voltage, $V_{ICM}$	$V_{DD}=5 V$	1.25		4.5	V
	$V_{DD}=3.3V$	1.25		2.7	

## Dissipation Rating Table

Package	Air Flow (CFM)	Thermal Resistance $\theta_{JA}(^{\circ}C/W)$	$T_A \leq 25^{\circ}C$	$T_A = 70^{\circ}C$
SO16 +	0	50	2.5W	1.6W
TSSOP ++	0	73.2	1.7W	1.1W
	200	66.6	1.8W	1.2W
TSSOP-P ++	0	37.6	3.3W	2.1W
	200	32.3	3.8W	2.4W

+ : The parameter is measured with the recommended copper heat sink pattern on an 2-layer PCB, 11.7 in<sup>2</sup> 3.0x2.4 in<sup>2</sup> in PCB, 1oz. copper, 3.0x1.5 in<sup>2</sup> in coverage at Top-layer and Bottom-layer at 100% coverage (7.2in<sup>2</sup>).  
 ++:The parameter is measured with the JEDEC standard test boards (multi-layer PCB).

## Electical Characteristics

### Electrical Characteristics for Entire IC

The following specifications apply for  $V_{DD}=5V$  unless otherwise noted. Limits apply for  $T_A=25^{\circ}C$

Symbol	Parameter	Test Conditions	APA4863			Unit
			Min.	Typ.	Max.	
$V_{DD}$	Supply Voltage		3		5.5	V
$I_{DD}$	Quiescent Power Supply Current	$V_{IN}=0V, I_O=0A, HP-IN=0V$		9	13.5	mA
		$V_{IN}=0V, I_O=0A, HP-IN=4V$		5	7.5	
$I_{SD}$	Shutdown Current	$V_{PIN1}=V_{DD}$	5	0.5		$\mu A$
$V_{IH}$	Headphone High Input Voltage		4			V
$V_{IL}$	Headphone Low Input Voltage				0.8	V

## Electical Characteristics Cont.

### Electrical Characteristics for BTL Mode Operation

The following specifications apply for  $V_{DD}=5V$  unless otherwise noted. Limits apply for  $T_A=25^\circ C$

Symbol	Parameter	Test Conditions	APA4863	Unit
			Typ.	
$V_{OS}$	Output Offset Voltage	$V_{IN}=0V$	5	mV
$P_O$	Output Power	THD=1%, f=1kHz	2.2	W
		$R_L=3\Omega$	1.8	
		$R_L=4\Omega$	1.2	
		$R_L=8\Omega$		
THD+N	Total Harmonic Distortion + Noise	THD=10%, f=1kHz	2.7	
		$R_L=3\Omega$	2.3	
		$R_L=4\Omega$	1.5	
		$R_L=8\Omega$		
THD+N	Total Harmonic Distortion + Noise	$A_{VD}=2$ , f=1kHz	0.3	%
		$R_L=4\Omega$ , $P_O=1.8W$	0.15	
		$R_L=8\Omega$ , $P_O=1W$		
RSRR	Power Supply Rejection Ratio	$V_{DD}=5V$ , $V_{RIPPLE}=200mV_{RMS}$ , $R_L=8\Omega$ $C_B=2.2\mu F$	64	dB
$X_{TALK}$	Channel Separation	f=1kHz, $C_B=2.2\mu F$ , $P_O=1W$ , $R_L=8\Omega$	90	dB
SNR	Signal-to-Noise Ratio	$V_{DD}=5V$ , $P_O=1.1W$ , $R_L=8\Omega$	95	dB

### Electrical Characteristics for SE Mode Operation

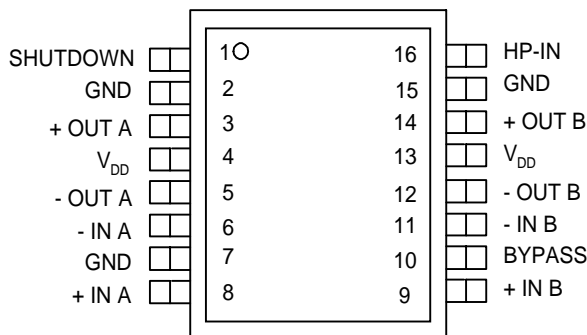
The following specifications apply for  $V_{DD}=5V$  unless otherwise noted. Limits apply for  $T_A=25^\circ C$

Symbol	Parameter	Test Conditions	APA4863	Unit
			Typ.	
$V_{OS}$	Output Offset Voltage	$V_{IN}=0V$	5	mV
$P_O$	Output Power	THD=0.5%, f=1kHz, $R_L=32\Omega$	90	mW
		THD=1%, f=1kHz, $R_L=8\Omega$	320	
		THD=10%, f=1kHz, $R_L=8\Omega$	400	
THD+N	Total Harmonic Distortion plus Noise	$A_V=-1$ , $P_O=75mW$ , f=1kHz, $R_L=32\Omega$	0.02	%
RSRR	Power Supply Rejection Ratio	$V_{RIPPLE}=200mV_{RMS}$ , f=1kHz, $C_B=2.2\mu F$ , $R_L=8\Omega$	49	dB
$X_{TALK}$	Channel Separation	f=1kHz, $C_B=2.2\mu F$ , $P_O=32mW$ , $R_L=32\Omega$	85	dB
SNR	Signal-to-Noise Ratio	$V_{DD}=5V$ , $P_O=340mW$ , $R_L=8\Omega$	95	dB

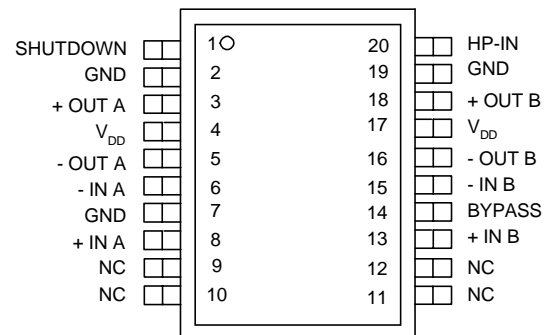
### Truth Table for Logic Inputs

Shutdown	HP-IN	APA4863 Mode
Low	Low	Bridge -Tied
Low	High	Single-Ended
High	Low	APA4863 Shutdown
High	High	APA4863 Shutdown

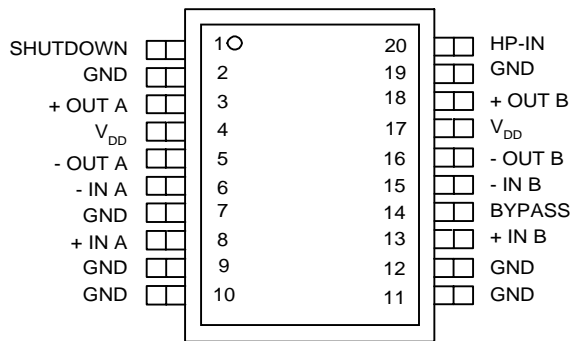
### Pin Description



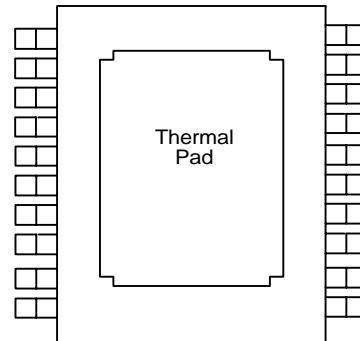
Top View  
for SOP



Top View  
for TSSOP



Top View  
for TSSOP-P



Bottom View  
for TSSOP -P

### Pin Description

Name	I/O	Description
GND		Ground connection of circuitry
V <sub>DD</sub>	I	Supply voltage input
+ INA	I	Non-inverting input of channel A, connected to bypass pin inside the IC
- INA	I	Input pin of channel A
+ OUT A	O	A channel + output in BTL mode, high impedance in SE mode
- OUT A	O	A channel - output in BTL mode, + output in SE mode
+ IN B	I	Non-inverting input of channel B, connected to bypass pin inside the IC
- IN B	I	Input pin of channel B
+ OUT B	O	B channel + output in BTL mode, high impedance in SE mode
- OUT B	O	B channel - output in BTL mode, + output in SE mode
BYPASS		Connect to voltage divider for internal mid-supply bias
HP-IN	I	Headphone control pin input, hold high for single-ended mode operation
SHUTDOWN	I	Shutdown mode control pin input, places entire IC in shutdown mode when held high, I <sub>DD</sub> = 0.5μA

### Typical Characteristics

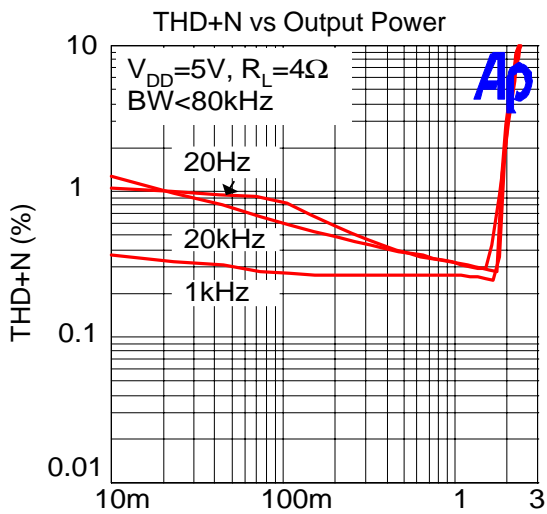


Figure 1 : Output Power (W)

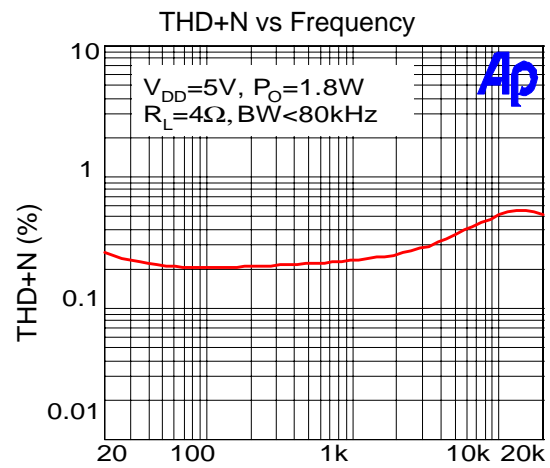


Figure 2 : Frequency (Hz)

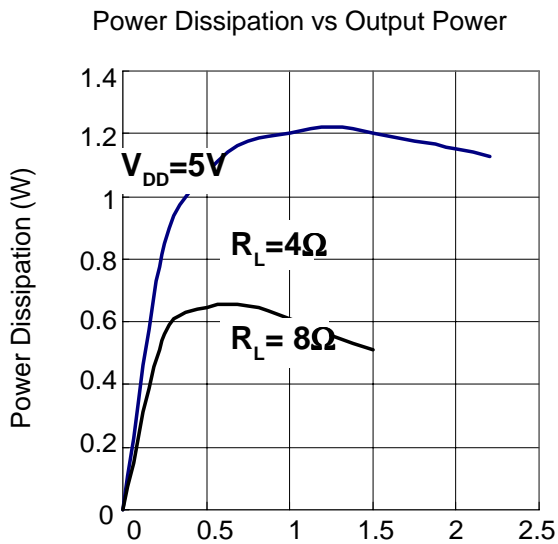


Figure 3 : Output Power (W)

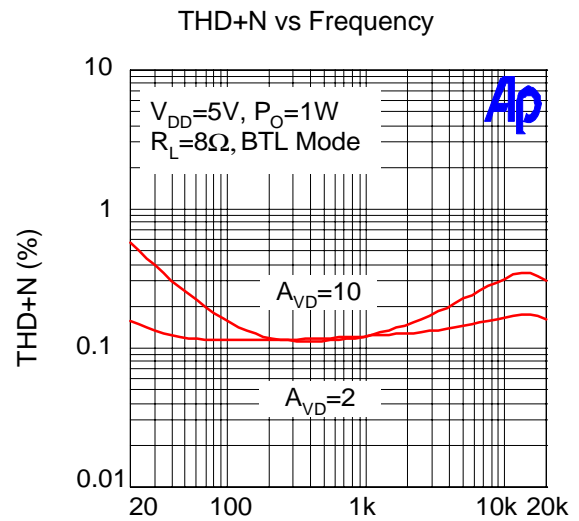


Figure 4 : Frequency (Hz)

Typical Characteristics Cont.

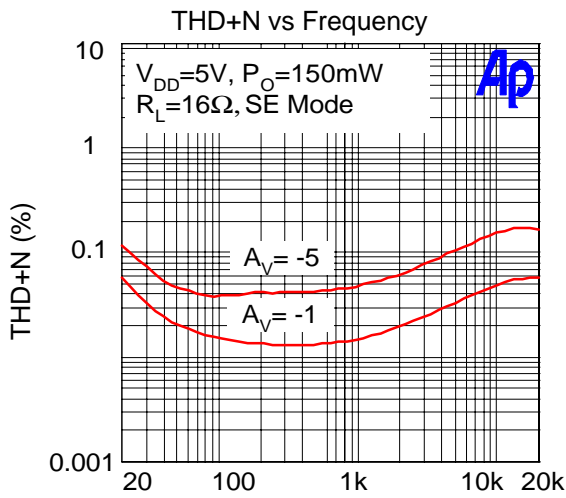


Figure 5 : Frequency (Hz)

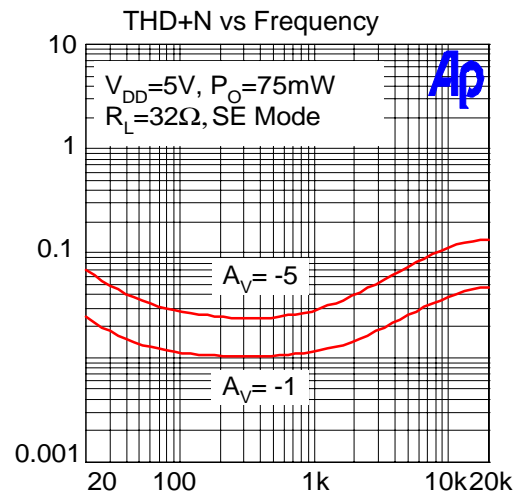


Figure 6 : Frequency (Hz)

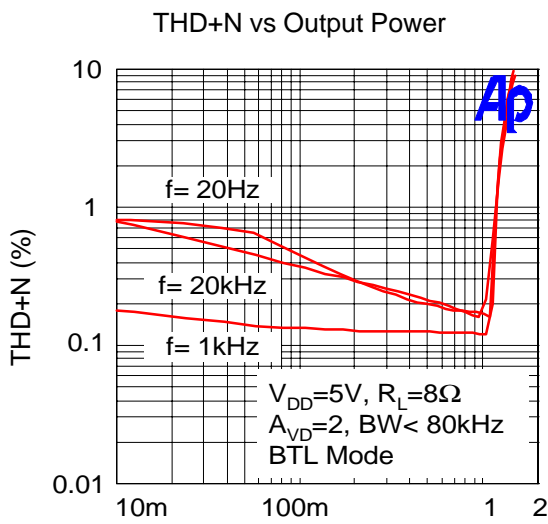


Figure 7 : Output Power (W)

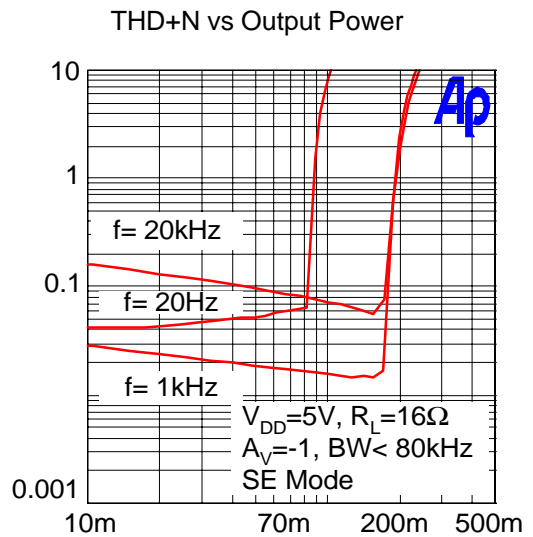


Figure 8 : Output Power (W)

Typical Characteristics Cont.

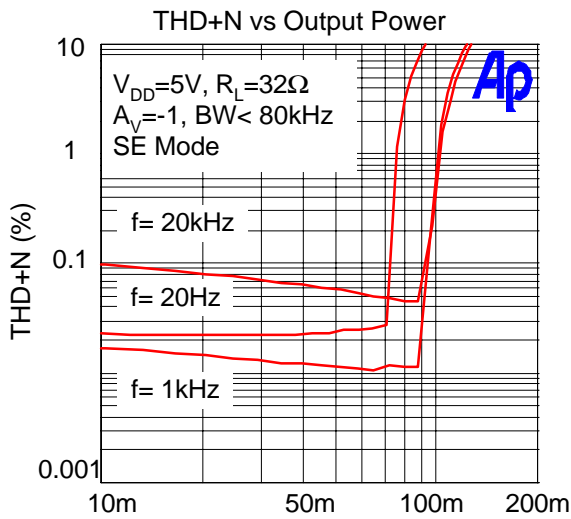


Figure 9 : Output Power (W)

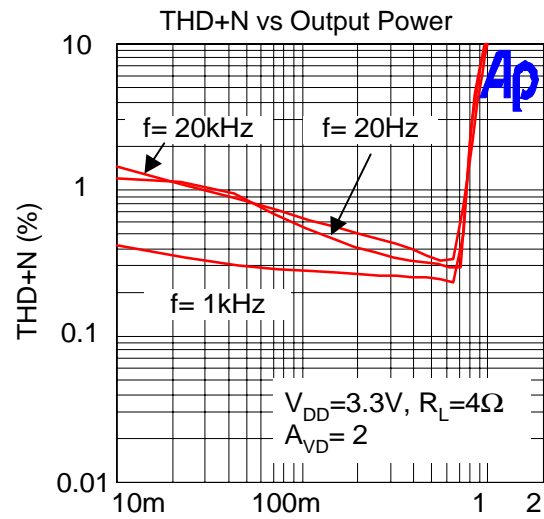


Figure 10 : Output Power (W)

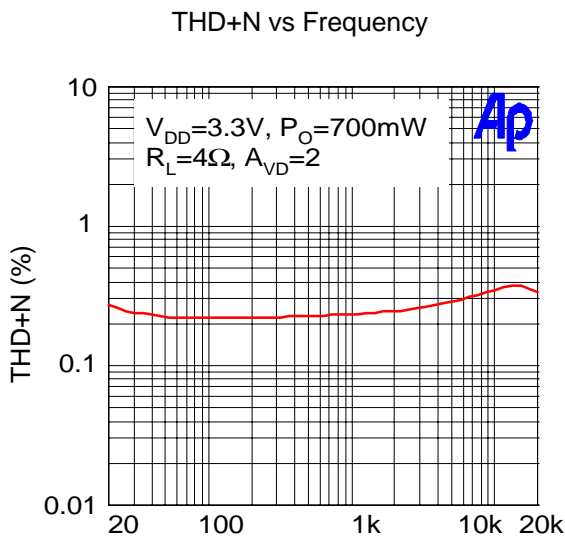


Figure 11 : Frequency (Hz)

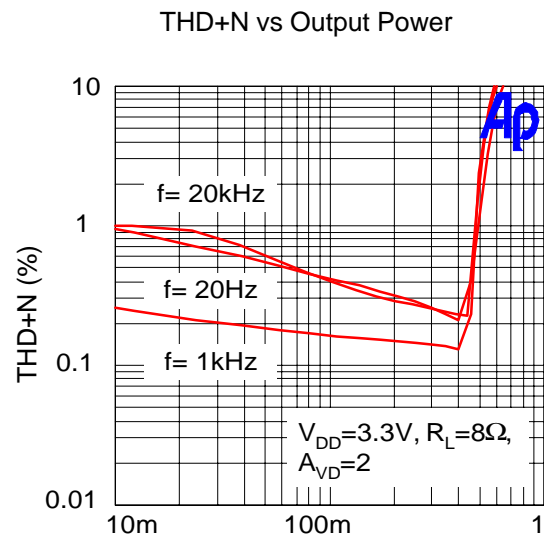


Figure 12 : Output Power (W)



Typical Characteristics Cont.

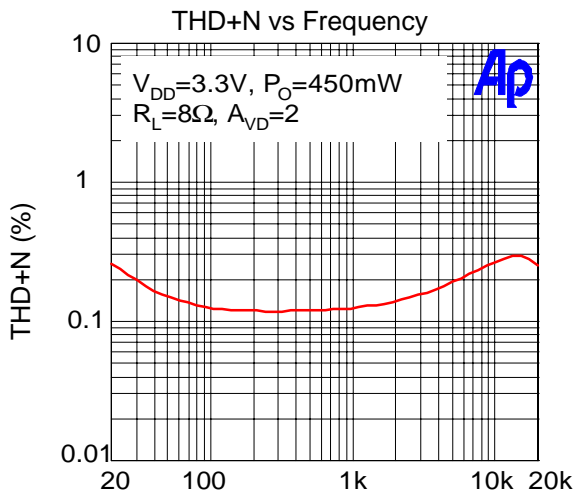


Figure 13 : Frequency (Hz)

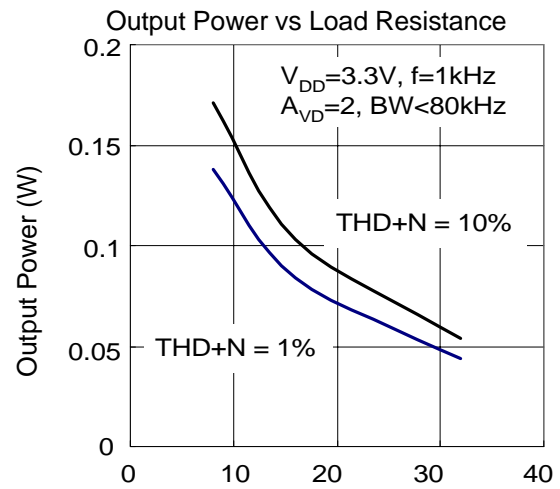


Figure 14 : Load Resistance ( $\Omega$ )

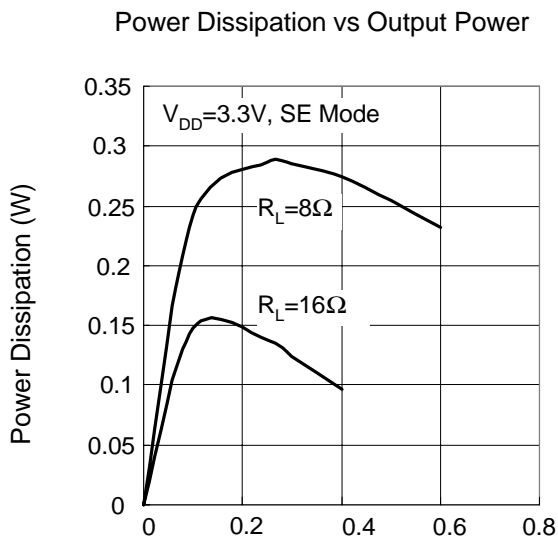


Figure 15 : Output Power (W)

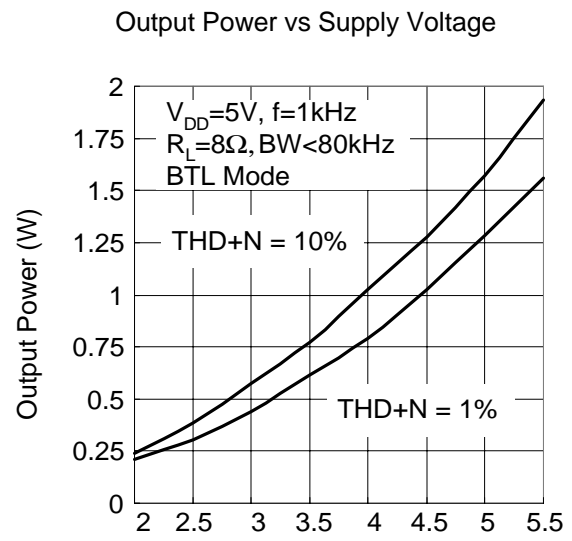


Figure 16 : Supply Voltage (V)

Typical Characteristics Cont.

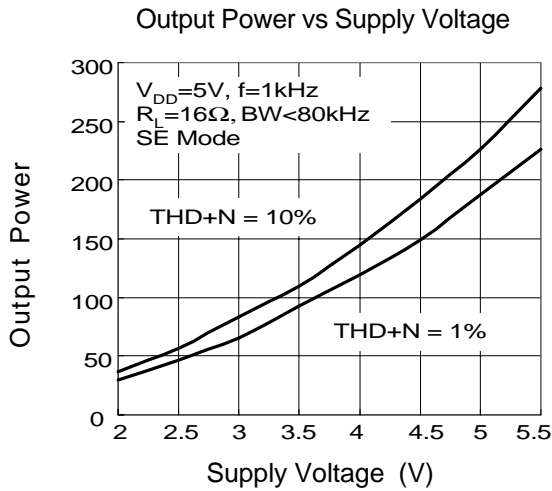


Figure 17

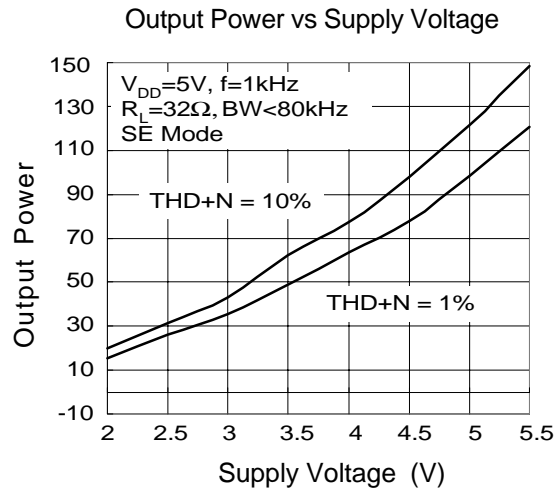


Figure 18

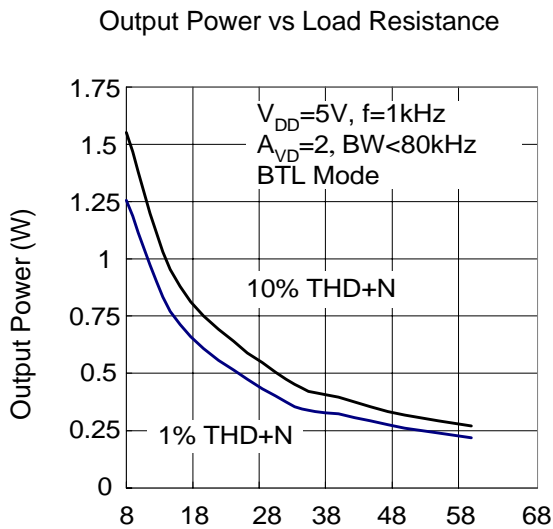


Figure 19 : Load Resistance ( $\Omega$ )

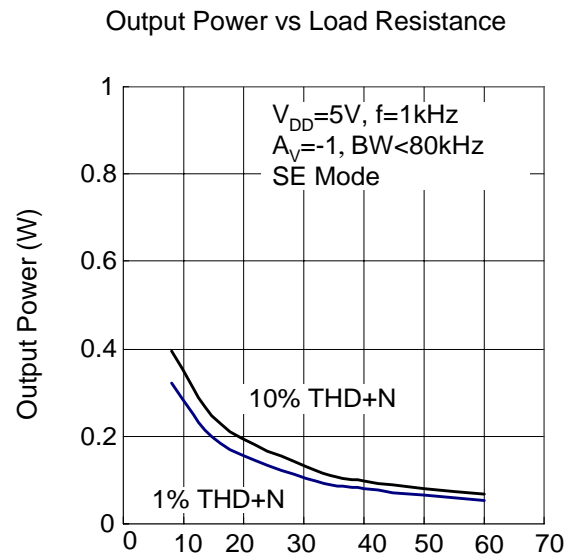


Figure 20 : Load Resistance ( $\Omega$ )

Typical Characteristics Cont.

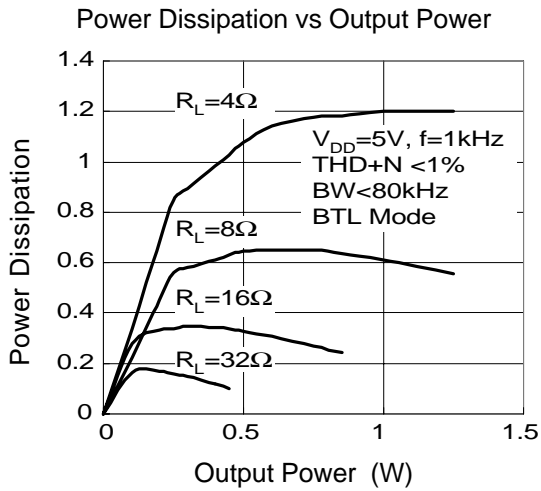


Figure 21

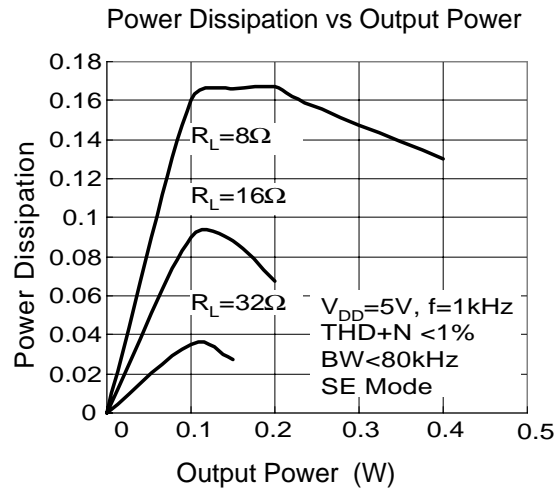


Figure 22

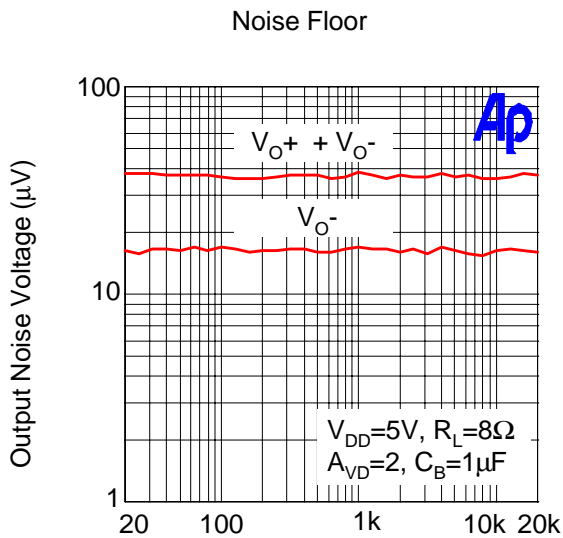


Figure 23 : Frequency (Hz)

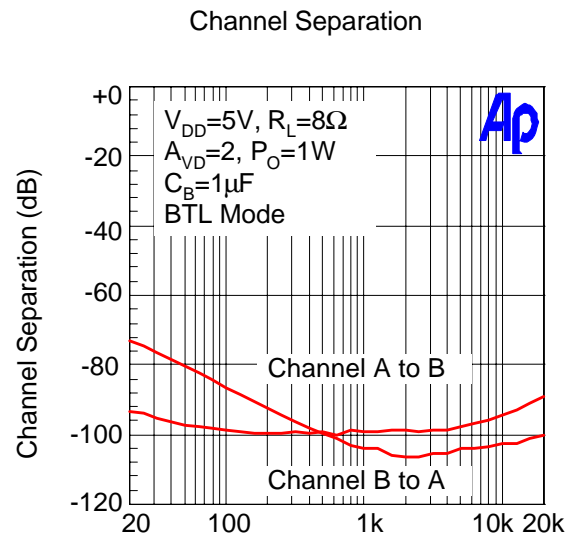


Figure 24 : Frequency (Hz)

Typical Characteristics Cont.

Channel Separation

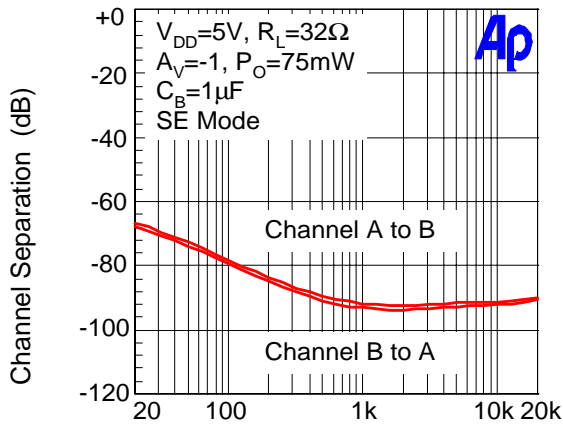


Figure 25 : Frequency (Hz)

Open Loop Frequency Response

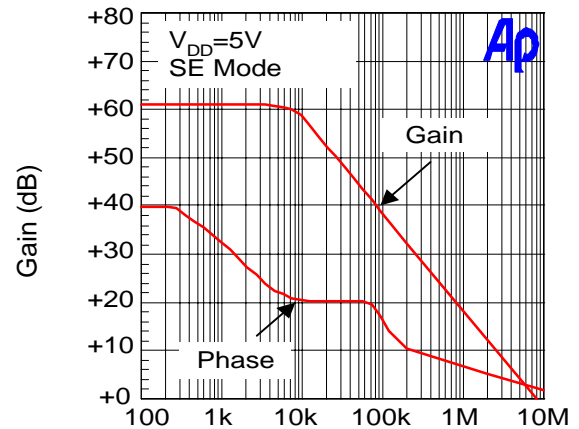


Figure 26 : Frequency (Hz)

Supply Current vs Supply Voltage

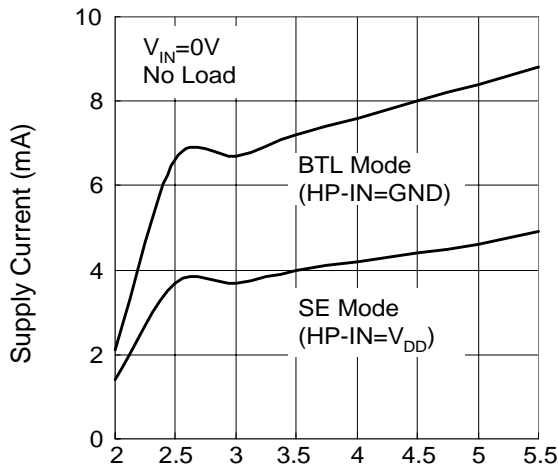
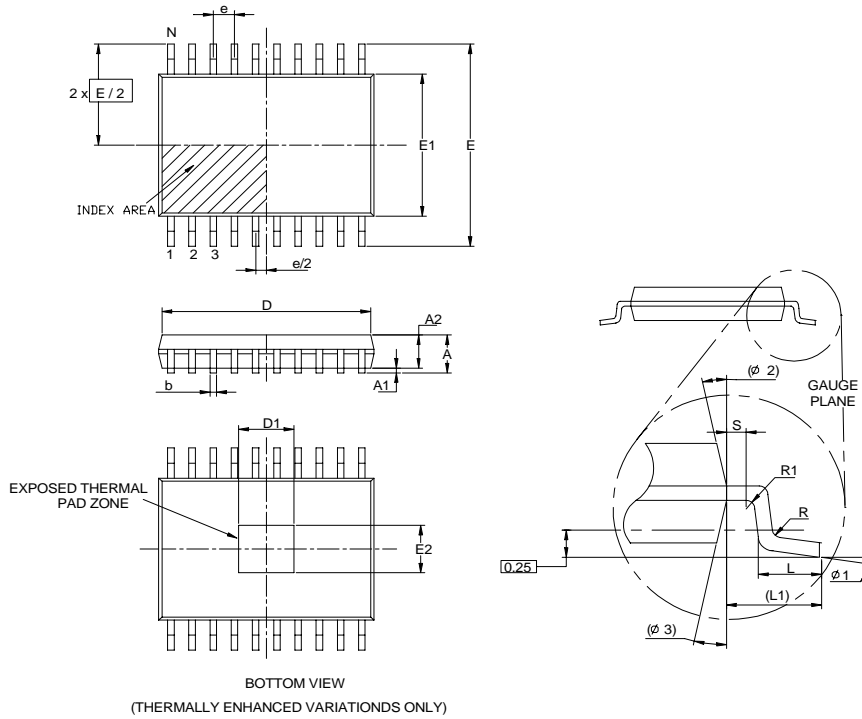


Figure 27 : Supply Voltage(V)

# Packaging Information

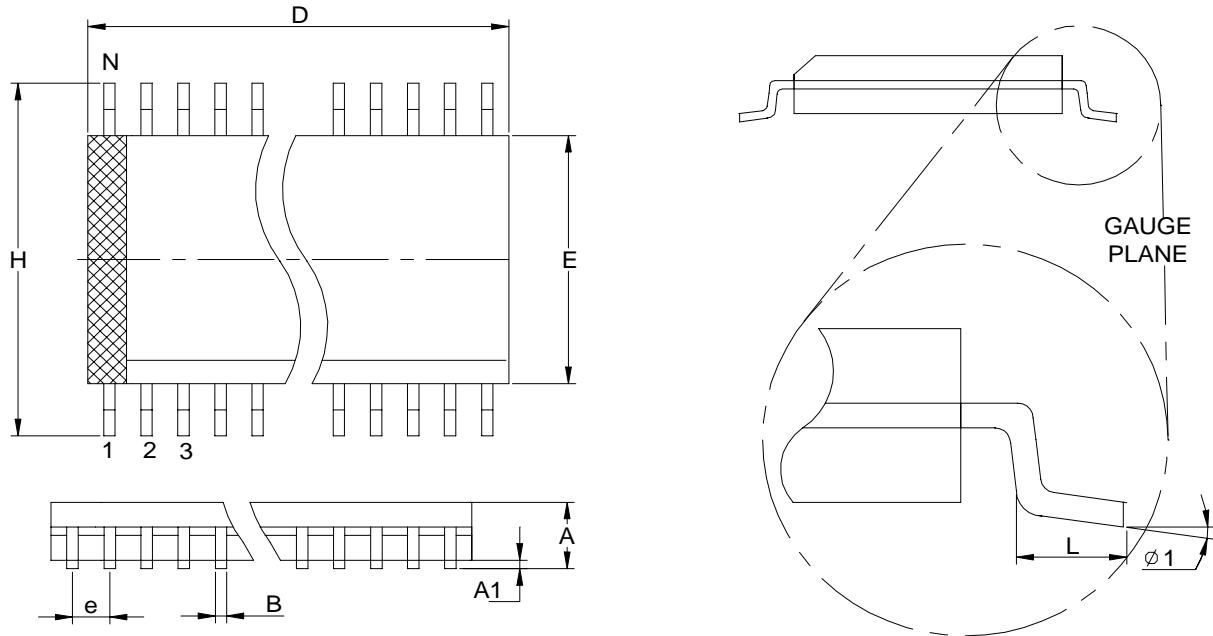
TSSOP/ TSSOP-P ( Reference JEDEC Registration MO-153)



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
D	6.4 (N=20PIN) 7.7 (N=24PIN)	6.6 (N=20PIN) 7.9 (N=24PIN)	0.252 (N=20PIN) 0.303 (N=24PIN)	0.260 (N=20PIN) 0.311 (N=24PIN)
D1	2.20 (N=20PIN) 2.70 (N=24PIN) Thermally Enhanced		0.087 (N=20PIN) 0.106 (N=24PIN) Thermally Enhanced	
e	0.65 BSC		0.026 BSC	
E	6.40 BSC		0.252 BSC	
E1	4.30	4.50	0.169	0.177
E2	1.50		0.059	
L	0.45	0.75	0.018	0.030
L1	1.0 REF		0.039REF	
R	0.09		0.004	
R1	0.09		0.004	
S	0.2		0.008	
φ1	0°	8°	0°	8°
φ2	12° REF		12° REF	
φ3	12° REF		12° REF	

## Packaging Information

SO – 300mil ( Reference JEDEC Registration MS-013)



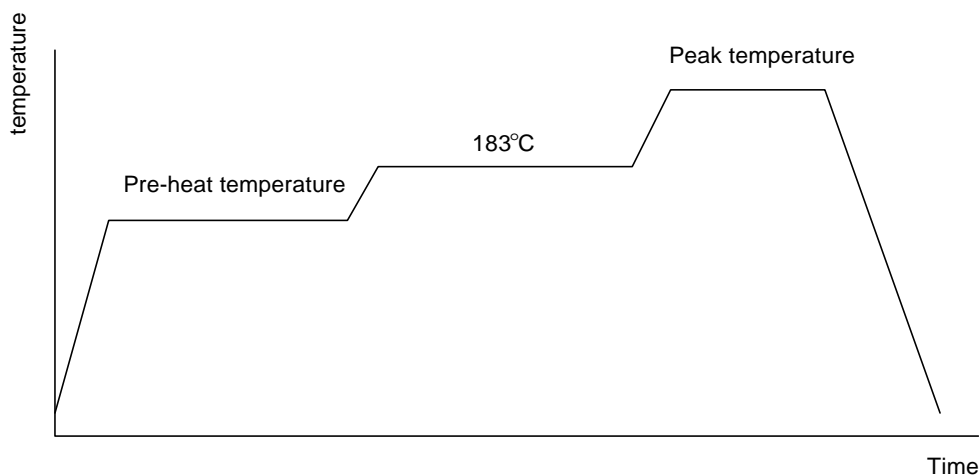
Dim	Millimeters		Variations- D			Dim	Inches		Variations- D		
	Min.	Max.	Variations	Min.	Max.		Min.	Max.	Variations	Min.	Max.
A	2.35	2.65	SO-16	10.10	10.50	A	0.093	0.1043	SO-16	0.398	0.413
A1	0.10	0.30	SO-18	11.35	11.76	A1	0.004	0.0120	SO-18	0.447	0.463
B	0.33	0.51	SO-20	12.60	13	B	0.013	0.020	SO-20	0.496	0.512
D	See variations		SO-24	15.20	15.60	D	See variations		SO-24	0.599	0.614
E	7.40	7.60	SO-28	17.70	18.11	E	0.2914	0.2992	SO-28	0.697	0.713
e	1.27BSC		SO-14	8.80	9.20	e	0.050BSC		SO-14	0.347	0.362
H	10	10.65				H	0.394	0.419			
L	0.40	1.27				L	0.016	0.050			
N	See variations					N	See variations				
$\phi 1$	0°	8°				$\phi 1$	0°	8°			

## 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.
Packaging	2000 devices per reel

## 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.	

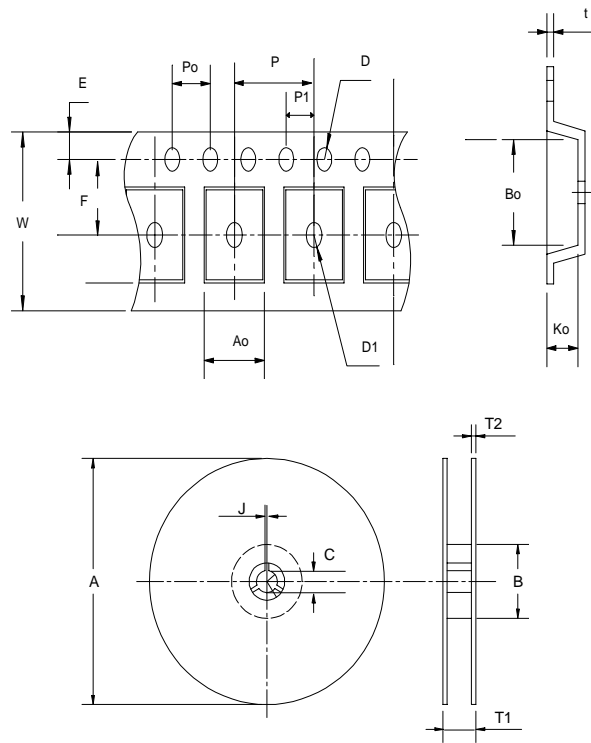
## Package Reflow Conditions

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



<b>Application</b>	A	B	C	J	T1	T2	W	P	E
<b>SOP-16W</b>	330±3	100 ± 2	13 + 0.5	2 ± 0.5	16.4 +0.3 -0.2	2.5± 0.5	16 ± 0.2	12± 0.1	1.75± 0.1
<b>Application</b>	F	D	D1	Po	P1	Ao	Bo	Ko	t
<b>SOP-16W</b>	7.5 ± 0.1	1.5 +0.1	1.5 +0.25	4.0 ± 0.1	2.0 ± 0.1	10.9 ± 0.1	10.8± 0.1	3.0± 0.1	0.3±0.013

(mm)

## Cover Tape Dimensions

<b>Carrier Width</b>	16
<b>Cover Tape Width</b>	13.3

(mm)



## Customer Service

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