

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

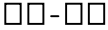
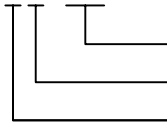



Applications

- Portable Digital Audio

General Description

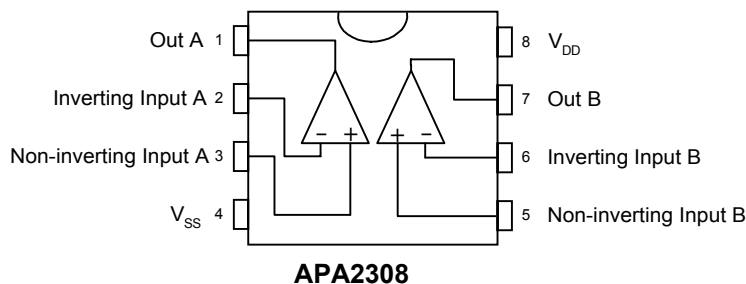
The APA2308 is an integrated class AB stereo headphone driver contained in an SO-8, a DIP-8 or a TSSOP-8 plastic package. The APA2308 is capable of delivering 280mW of max. Output power to an 8 Ω load or 110mW to a 32 Ω load with less than 10% (THD+N) from a 5V power supply. The device is fabricated 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 & 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 | |
| Supply | | | | | | |
| V_{DD} | Supply Voltage | | | | | V |
| | Single | | 3.0 | 5.0 | 6.0 | |
| | Dual | | ± 1.5 | ± 2.5 | ± 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.

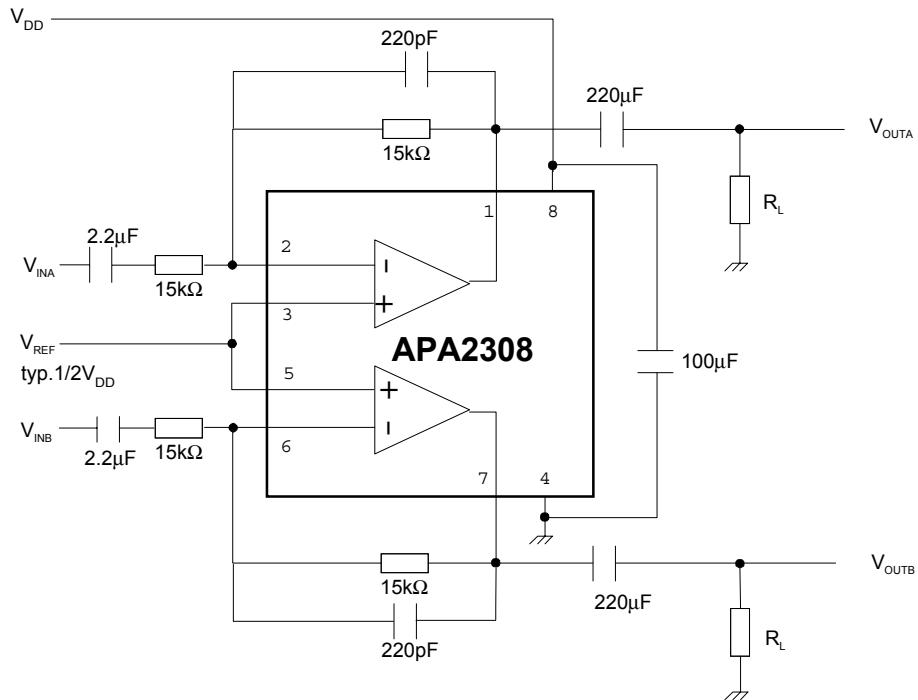
$V_{DD}=5V$, $V_{SS}=0V$, $T_A=25^{\circ}C$, $f_i=1kHz$, $R_L=32\Omega$ (unless otherwise noted)

| Symbol | Parameter | Test Condition | APA2308 | | | Unit |
|---------------------------|--|--|---------|------|------|----------|
| | | | Min. | Typ. | Max | |
| DC Characteristics | | | | | | |
| $V_{I(OS)}$ | 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 | | Ω |
| AC Characteristics | | | | | | |
| 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 |
| α_{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} ; $(THD+N)/S < 0.1\%$

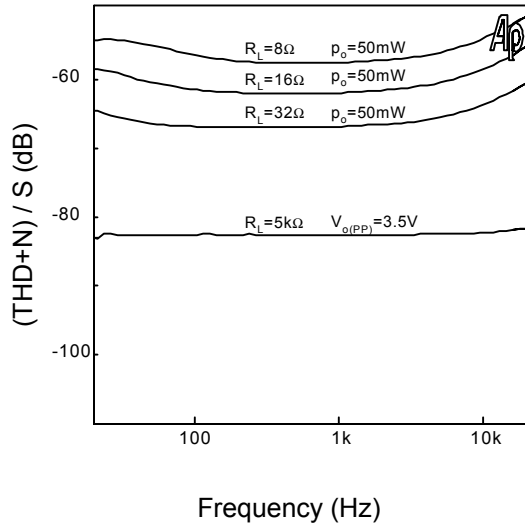
*2 : $V_{DD}=5.0V$; $V_{O(P-P)}=3.5V$ (at 0 dB)

Test And Application Circuits

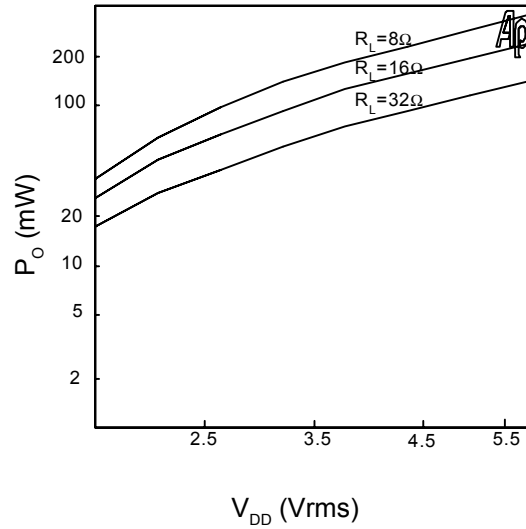


Typical Characteristics

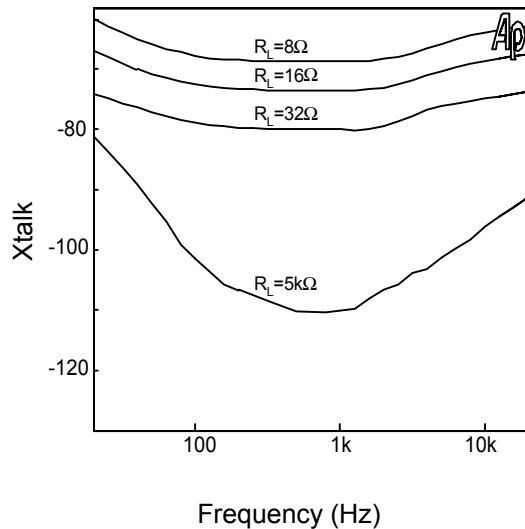
Total Harmonic Distortion Plus Noise-to-Signal Ratio as a Function of Input Frequency



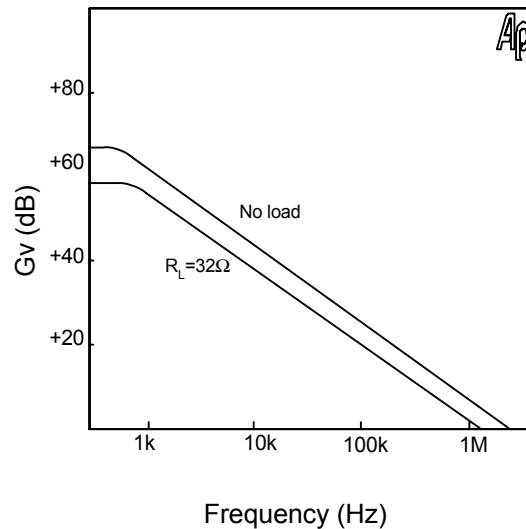
Output Power as a Function of Supply Voltage



Crosstalk as a Function of Input Frequency

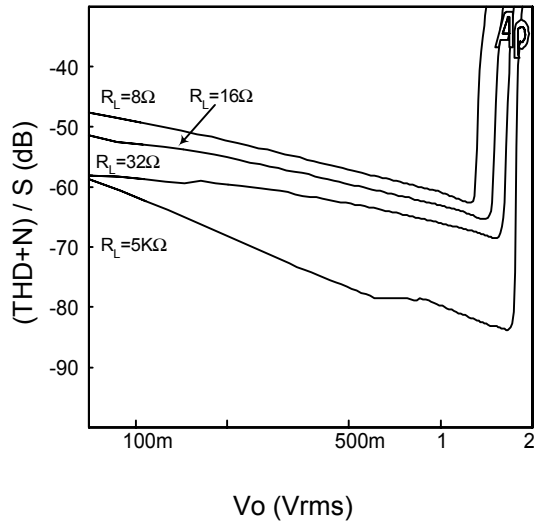


Open Loop Gain as a Function of Input Frequency



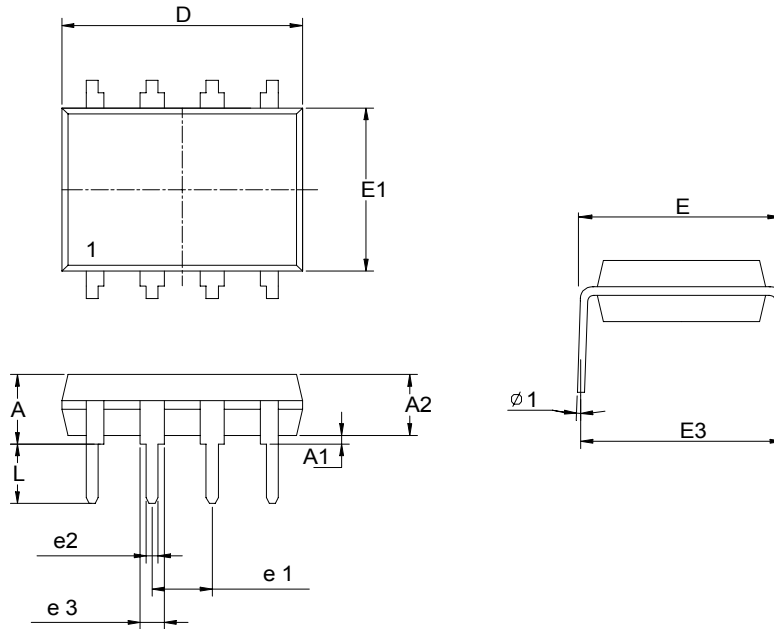
Typical Characteristics Cont.

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



Packaging Information

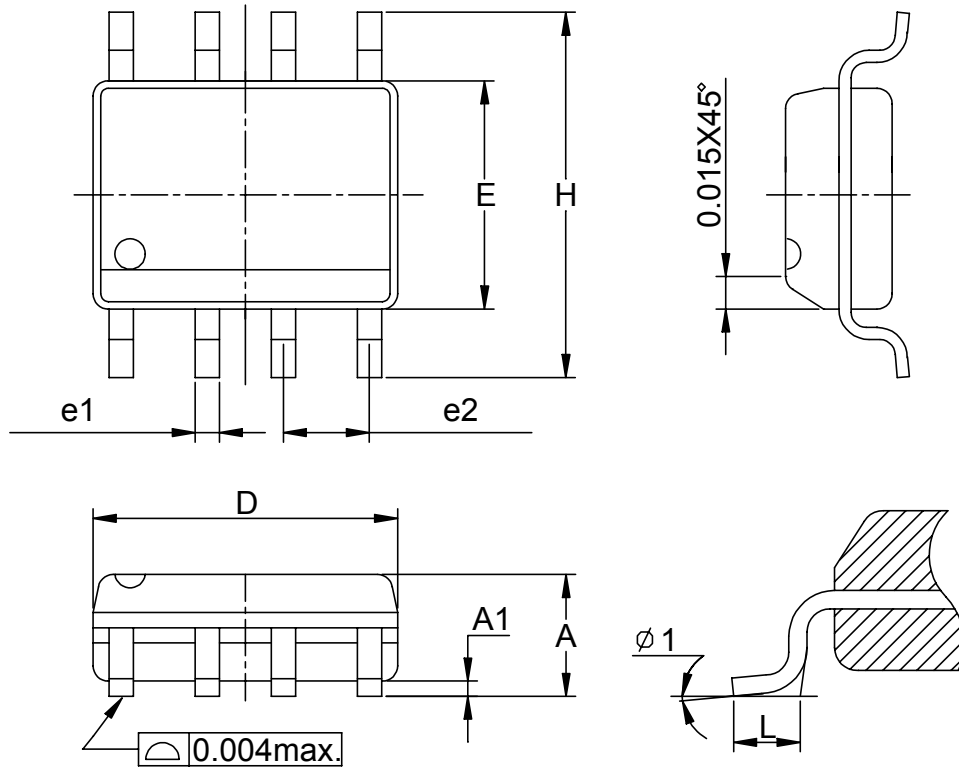
PDIP-8 pin (Reference JEDEC Registration MS-001)



| 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

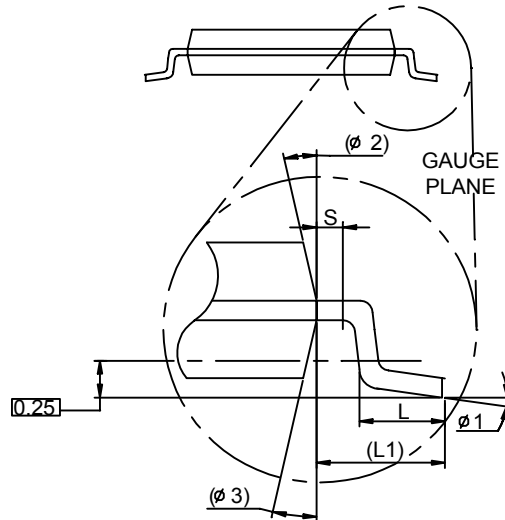
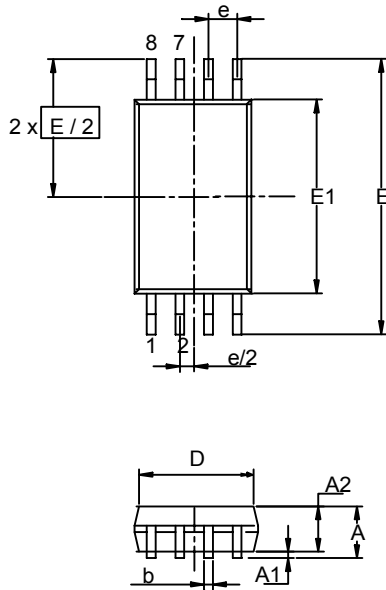
SOP-8 pin (Reference JEDEC Registration MS-012)



| 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



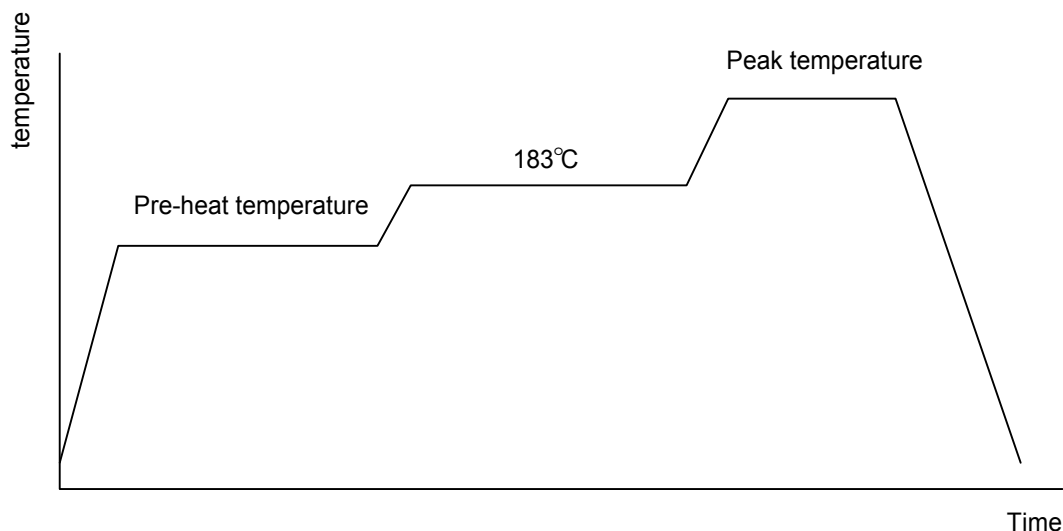
| Dim | Millimeters | | Inches | |
|-----|-------------|------|-----------|-------|
| | Min. | Max. | Min. | Max. |
| A | | 1.2 | | 0.047 |
| A1 | 0.00 | 0.15 | 0.000 | 0.006 |
| A2 | 0.80 | 1.05 | 0.031 | 0.041 |
| b | 0.19 | 0.30 | 0.007 | 0.012 |
| D | 2.9 | 3.1 | 0.114 | 0.122 |
| e | 0.65 BSC | | 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 | |
| φ1 | 0° | 8° | 0° | 8° |
| φ2 | 12° REF | | 12° REF | |
| φ3 | 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. | |

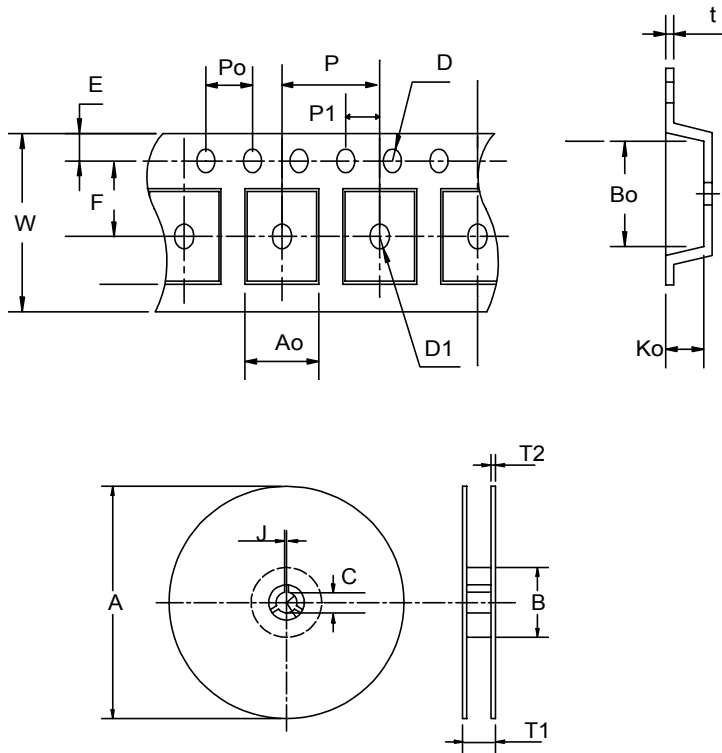
Package Reflow Conditions

| pkg. thickness ≥ 2.5mm and all bgas | pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm ³ | pkg. thickness < 2.5mm and pkg. volume < 350mm ³ |
|--|---|--|
| 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 _{tr} > 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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