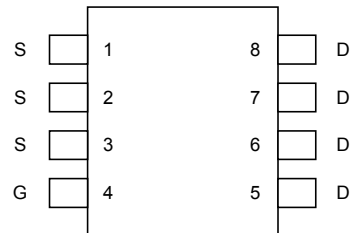


N-Channel Enhancement Mode MOSFET

Features

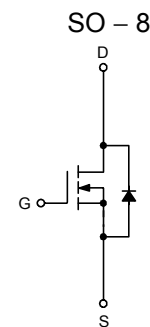
- 30V/11.5A, $R_{DS(ON)} = 9m\Omega(\text{typ.}) @ V_{GS} = 10V$
 $R_{DS(ON)} = 14.5m\Omega(\text{typ.}) @ V_{GS} = 4.5V$
- High Density Cell Design
- Reliable and Rugged
- SO-8 Package

Pin Description



Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems



N-Channel MOSFET

Ordering and Marking Information

| | |
|---|---|
| <p>APM4410 □□-□□</p> <p>□□□□ Handling Code</p> <p>□□□□ Temp. Range</p> <p>□□□□ Package Code</p> | <p>Package Code K : SO-8</p> <p>Operating Junction Temp. Range C : -55 to 125°C</p> <p>Handling Code TU : Tube TR : Tape & Reel</p> |
| <p>APM4410 K : APM4410 XXXXXX</p> | <p>XXXXXX - Date Code</p> |

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Rating | Unit | |
|-----------|------------------------------------|---------------------------|------|---|
| V_{DSS} | Drain-Source Voltage | 30 | V | |
| V_{GSS} | Gate-Source Voltage | ± 20 | | |
| I_D | Maximum Drain Current – Continuous | 11.5 | A | |
| I_{DM} | Maximum Drain Current – Pulsed | 50 | | |
| P_D | Maximum Power Dissipation | $T_A = 25^\circ\text{C}$ | 2.5 | W |
| | | $T_A = 100^\circ\text{C}$ | 1.0 | |

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.

Thermal Characteristics

| Symbol | Parameter | Rating | Unit |
|-----------------|--|------------|------|
| T_J | Maximum Junction Temperature | 150 | °C |
| T_{STG} | Storage Temperature Range | -55 to 150 | |
| $R_{\theta JA}$ | Thermal Resistance - Junction to Ambient | 50 | °C/W |

Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Condition | APM4410 | | | Unit |
|----------------------------|---|---|---------|--------------------|-----------|------------|
| | | | Min. | Typ ^a . | Max. | |
| Static | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 30 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=24V, V_{GS}=0V$ | | | 1 | μA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1 | | 3 | V |
| I_{GSS} | Gate Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | | | ± 100 | nA |
| $R_{DS(ON)}$ | Drain-Source On-state Resistance ^b | $V_{GS}=10V, I_D=11.5A$ | | 9 | 11 | m Ω |
| | | $V_{GS}=4.5V, I_D=5A$ | | 14.5 | 16 | |
| V_{SD} | Diode Forward Voltage ^b | $I_{SD}=2.3A, V_{GS}=0V$ | 0.6 | | 1.2 | V |
| Dynamic^a | | | | | | |
| Q_g | Total Gate Charge | $V_{DS}=15V, V_{GS}=10V,$ $I_D=10A$ | | 45 | 60 | nC |
| Q_{gs} | Gate-Source Charge | | | 10 | | |
| Q_{gd} | Gate-Drain Charge | | | 8 | | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}=15V, R_L=15\Omega,$ $I_D=1A, V_{GEN}=10V,$ $R_G=6\Omega,$ | | 16 | 25 | ns |
| t_r | Turn-on Rise Time | | | 24 | 35 | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | | 78 | 110 | |
| t_f | Turn-off Fall Time | | | 42 | 80 | |
| C_{iss} | Input Capacitance | $V_{GS}=0V, V_{DS}=25V$ Frequency = 1.0MHZ | | 2000 | | pF |
| C_{oss} | Output Capacitance | | | 400 | | |
| C_{rss} | Reverse Transfer Capacitance | | | 220 | | |

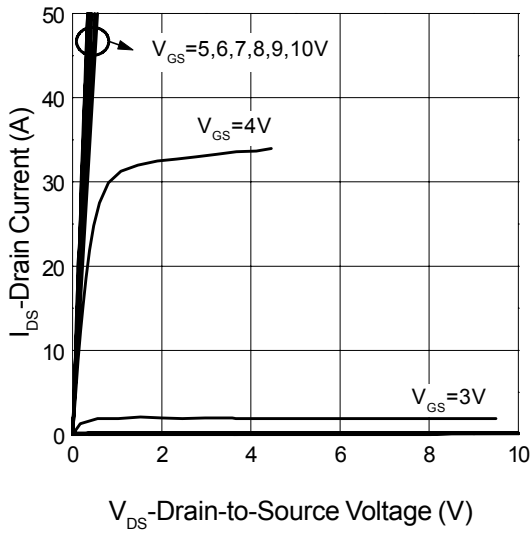
Notes

^a : Guaranteed by design, not subject to production testing

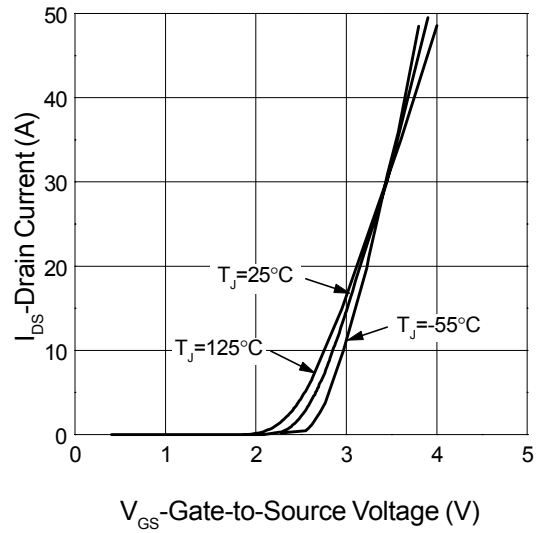
^b : Pulse test ; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$

Typical Characteristics

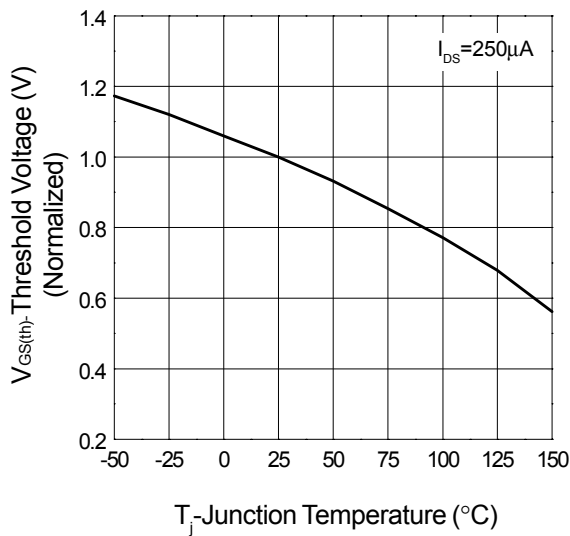
Output Characteristics



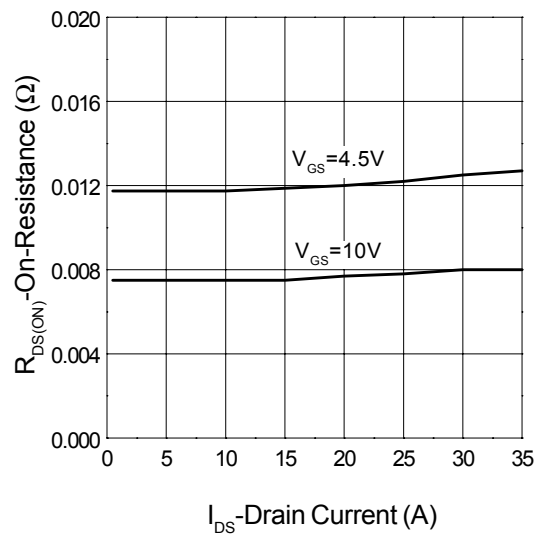
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

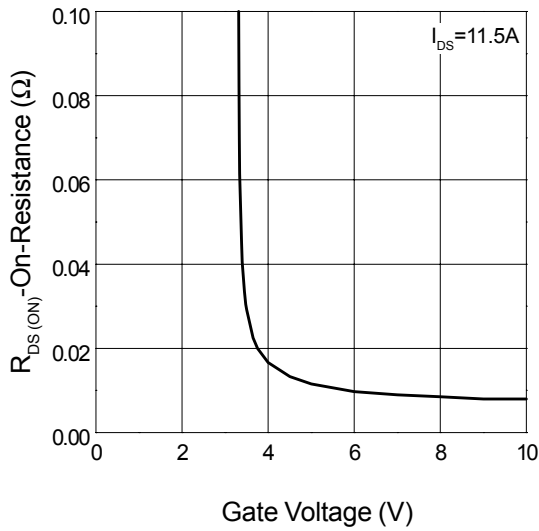


On-Resistance vs. Drain Current

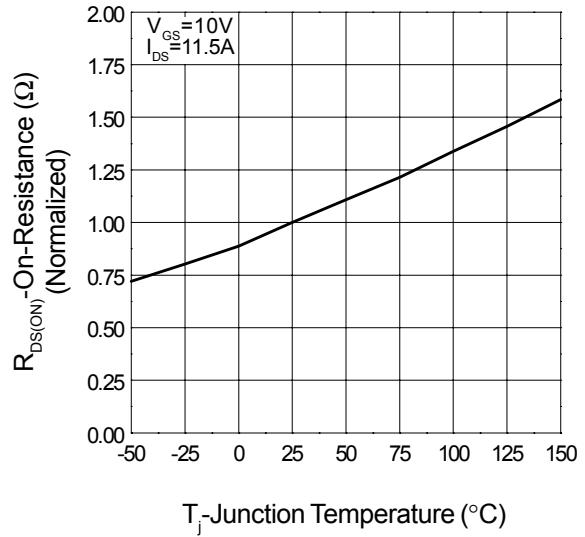


Typical Characteristics Cont.

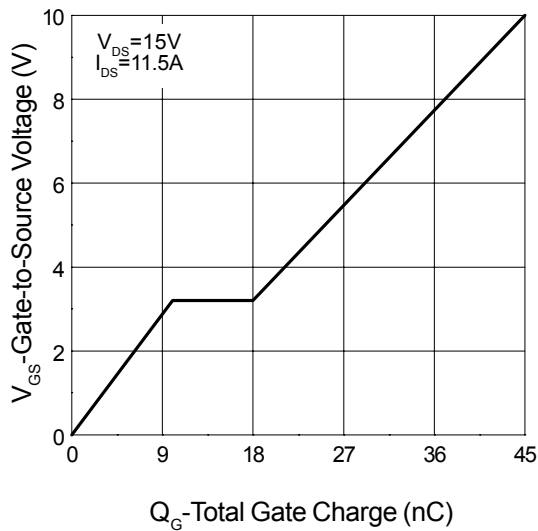
On-Resistance vs. Gate-to-Source Voltage



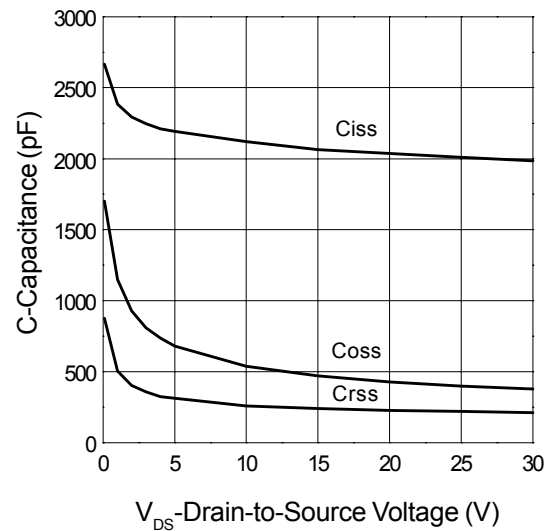
On-Resistance vs. Junction Temperature



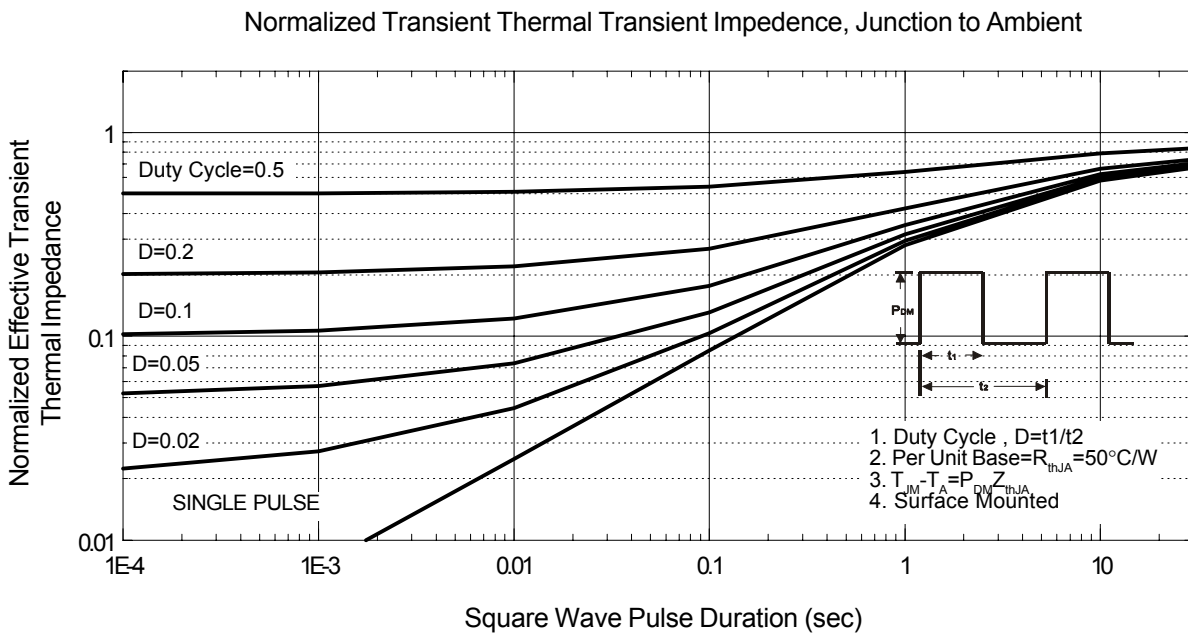
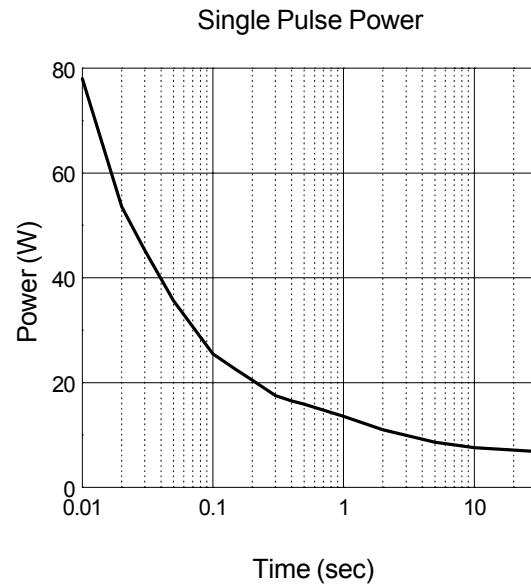
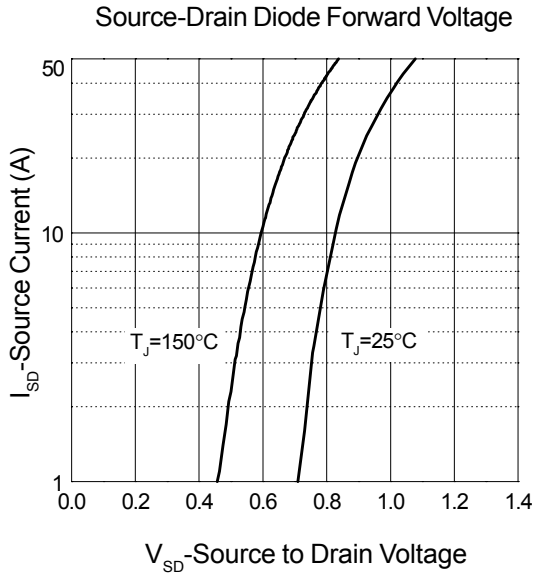
Gate Charge



Capacitance Characteristics

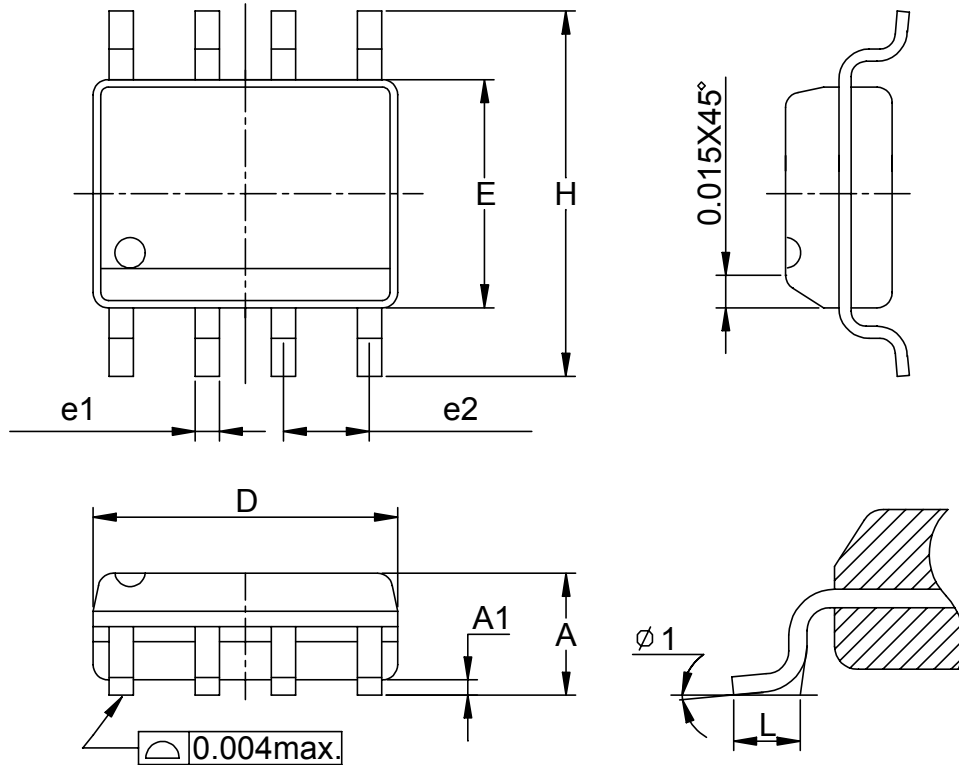


Typical Characteristics Cont.



Packaging Information

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

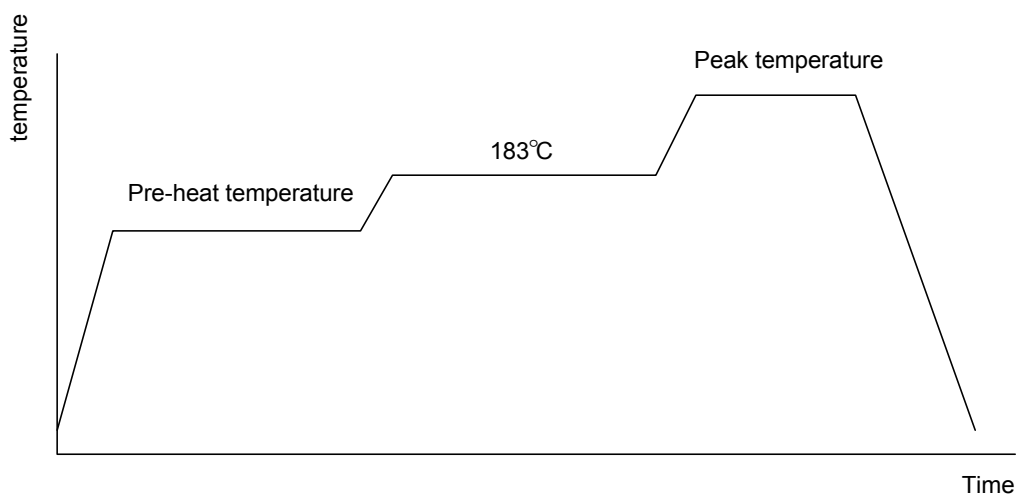


| Dim | Millimeters | | Inches | |
|-----|-------------|------|---------|-------|
| | Min. | Max. | Min. | Max. |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| D | 4.80 | 5.00 | 0.189 | 0.197 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| L | 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° | |

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)



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. | |

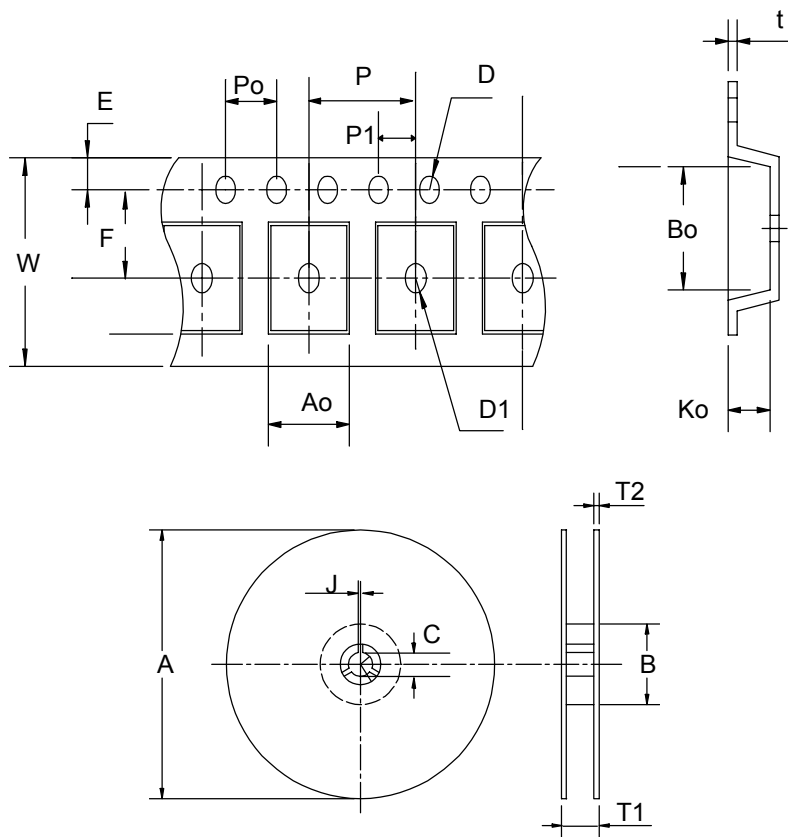
Package Reflow Conditions

| 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 |

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 - 0.1 | 8± 0.1 | 1.75± 0.1 |
| Application | F | D | D1 | Po | P1 | Ao | Bo | Ko | t |
| SOP-8 | 5.5 ± 0.1 | 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 |

(mm)

Cover Tape Dimensions

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

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