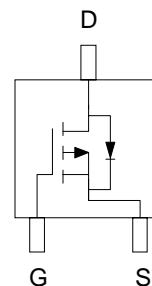


P-Channel Enhancement Mode MOSFET

Features

- -20V/-2.8A , $R_{DS(ON)}=72m\Omega(\text{typ.}) @ V_{GS}=-10V$
 $R_{DS(ON)}=100m\Omega(\text{typ.}) @ V_{GS}=-4.5V$
- Super High Dense Cell Design for Extremely Low $R_{DS(ON)}$
- Reliable and Rugged
- SOT-23 Package

Pin Description



Top View of SOT-23

Applications

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

Ordering and Marking Information

| | |
|---|---|
| <p>APM2301 □□-□□</p> <div style="margin-left: 20px;"> <p>└─── Handling Code</p> <p>└─── Temp. Range</p> <p>└─── Package Code</p> </div> | <p>Package Code A : SOT-23</p> <p>Operation Junction Temp. Range C : -55 to 150°C</p> <p>Handling Code TR : Tape & Reel</p> |
| <p>APM2301 A : M01X</p> | <p>X - Date Code</p> |

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

| Symbol | Parameter | Rating | Unit |
|-----------|------------------------------------|----------|------|
| V_{DSS} | Drain-Source Voltage | -20 | V |
| V_{GSS} | Gate-Source Voltage | ± 16 | |
| I_D^* | Maximum Drain Current – Continuous | -2.8 | A |
| I_{DM} | Maximum Drain Current – Pulsed | -10 | |

* Surface Mounted on FR4 Board, $t \leq 10$ sec.

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.

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

| Symbol | Parameter | Rating | Unit |
|------------------|--|-------------------------|--------------------|
| P_D | Maximum Power Dissipation | $T_A=25^\circ\text{C}$ | 1.25 |
| | | $T_A=100^\circ\text{C}$ | 0.5 |
| T_J | Maximum Junction Temperature | 150 | $^\circ\text{C}$ |
| T_{STG} | Storage Temperature Range | -55 to 150 | $^\circ\text{C}$ |
| $R_{\theta JA}$ | Thermal Resistance – Junction to Ambient | 100 | $^\circ\text{C/W}$ |

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

| Symbol | Parameter | Test Condition | APM2301 | | | Unit |
|----------------------------|----------------------------------|---|---------|------|-----------|---------------|
| | | | Min. | Typ. | Max. | |
| Static | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{\text{GS}}=0\text{V}, I_{\text{DS}}=-250\mu\text{A}$ | 20 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{\text{DS}}=-16\text{V}, V_{\text{GS}}=0\text{V}$ | | | 1 | μA |
| $V_{\text{GS(th)}}$ | Gate Threshold Voltage | $V_{\text{DS}}=V_{\text{GS}}, I_{\text{DS}}=-250\mu\text{A}$ | 0.6 | | 1.5 | V |
| I_{GSS} | Gate Leakage Current | $V_{\text{GS}}=\pm 16\text{V}, V_{\text{DS}}=0\text{V}$ | | | ± 100 | nA |
| $R_{\text{DS(ON)}}^a$ | Drain-Source On-state Resistance | $V_{\text{GS}}=-10\text{V}, I_{\text{DS}}=-2.8\text{A}$ | | 72 | 85 | m Ω |
| | | $V_{\text{GS}}=-4.5\text{V}, I_{\text{DS}}=-2.5\text{A}$ | | 98 | 110 | |
| V_{SD}^a | Diode Forward Voltage | $I_{\text{SD}}=-1.25\text{A}, V_{\text{GS}}=0\text{V}$ | 0.6 | | 1.3 | V |
| Dynamic^b | | | | | | |
| Q_g | Total Gate Charge | $V_{\text{DS}}=-10\text{V}, I_{\text{DS}}=-3\text{A}$ $V_{\text{GS}}=-4.5\text{V}$ | | 7.6 | 10 | nC |
| Q_{gs} | Gate-Source Charge | | | 3.2 | | |
| Q_{gd} | Gate-Drain Charge | | | 2 | | |
| $t_{\text{d(ON)}}$ | Turn-on Delay Time | $V_{\text{DD}}=-10\text{V}, I_{\text{DS}}=-1\text{A},$ $V_{\text{GEN}}=-4.5\text{V}, R_G=6\Omega$ $R_L=6\Omega$ | | 11 | 22 | ns |
| T_r | Turn-on Rise Time | | | 32 | 55 | |
| $t_{\text{d(OFF)}}$ | Turn-off Delay Time | | | 38 | 68 | |
| T_f | Turn-off Fall Time | | | 32 | 55 | |
| C_{iss} | Input Capacitance | $V_{\text{GS}}=0\text{V}$ | | 430 | | pF |
| C_{oss} | Output Capacitance | $V_{\text{DS}}=-15\text{V}$ | | 235 | | |
| C_{rss} | Reverse Transfer Capacitance | Frequency=1.0MHz | | 95 | | |

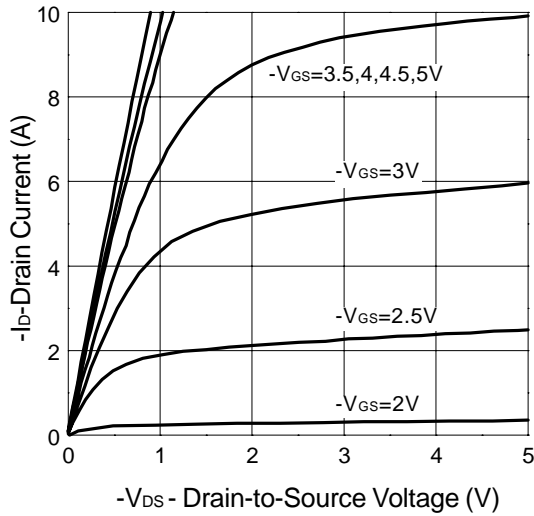
Notes

^a : Pulse test ; pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$

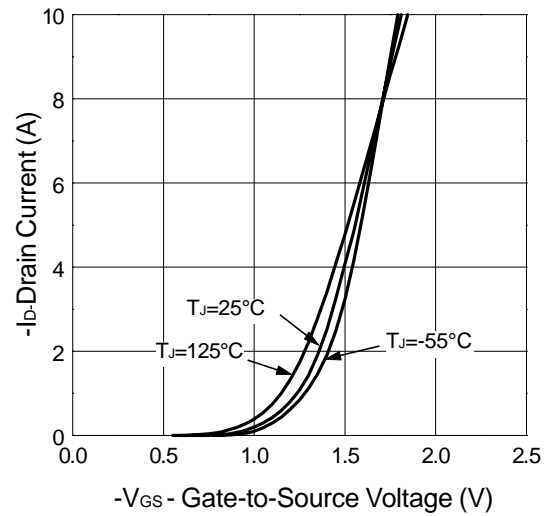
^b : Guaranteed by design, not subject to production testing

Typical Characteristics

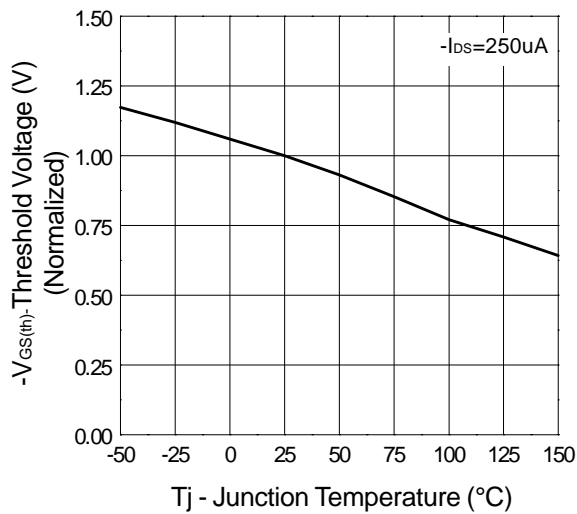
Output Characteristics



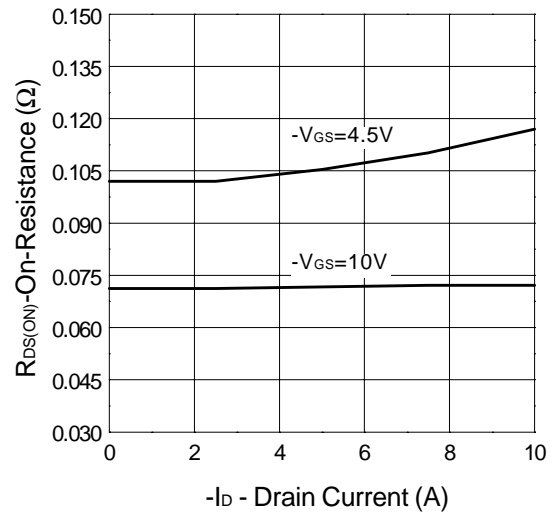
Transfer Characteristics



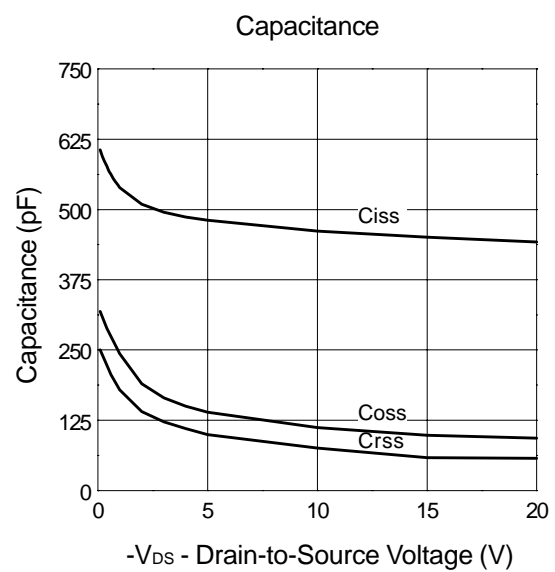
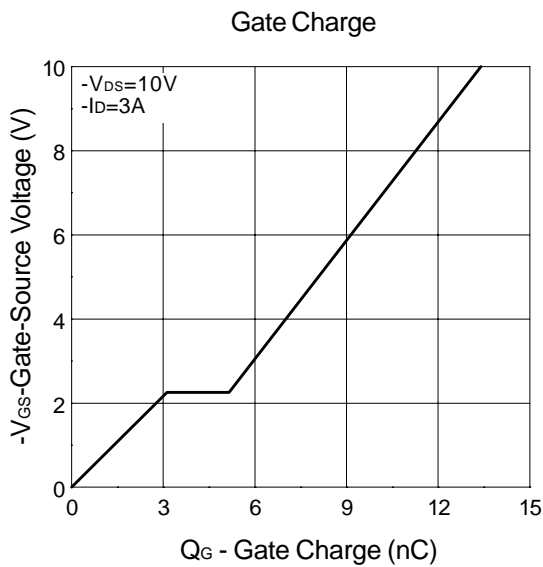
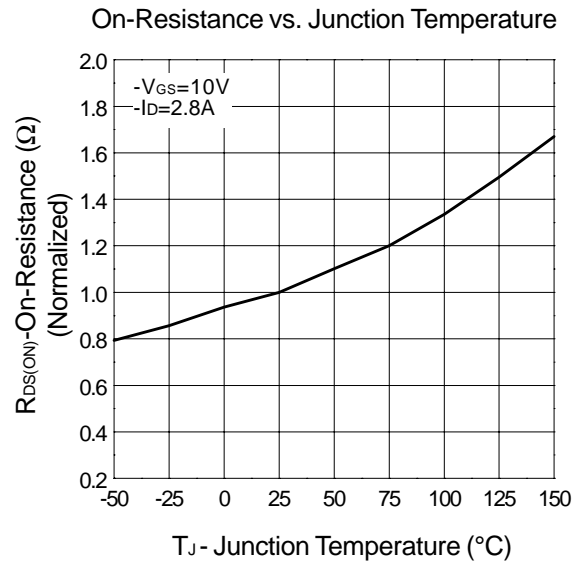
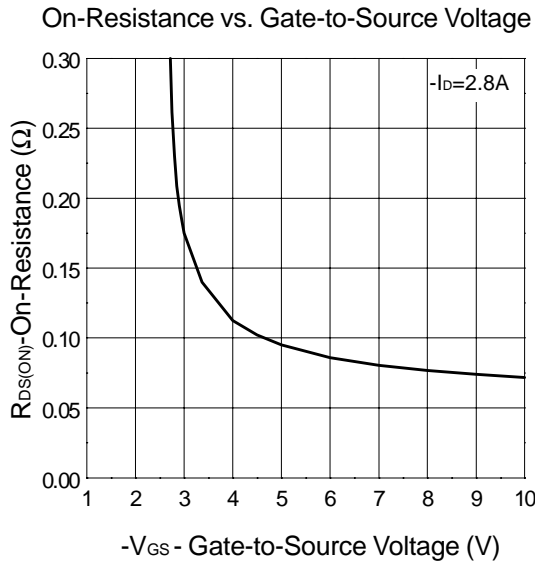
Threshold Voltage vs. Junction Temperature



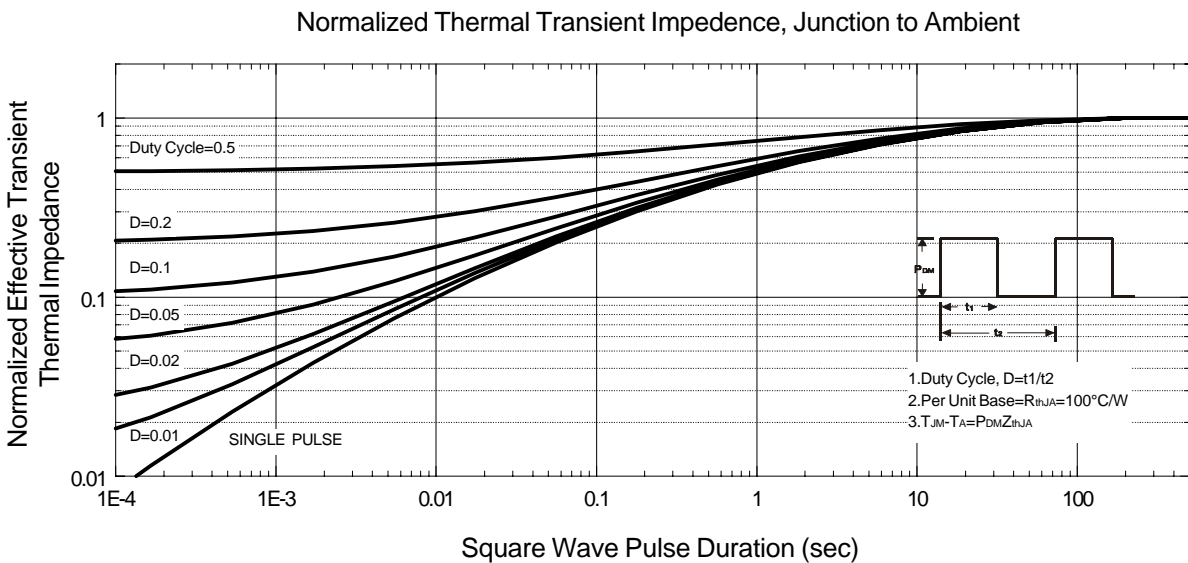
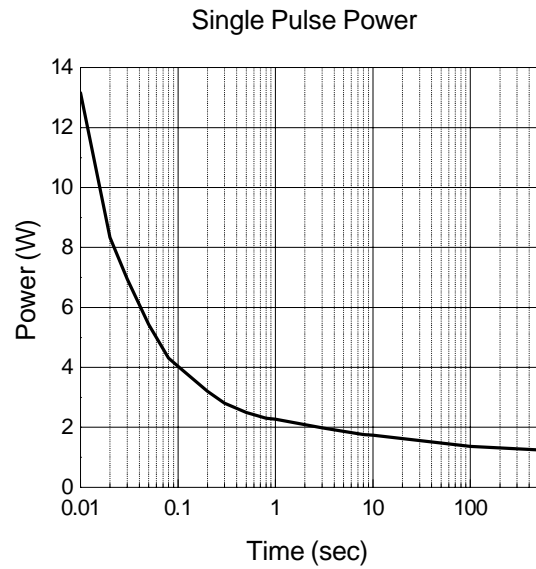
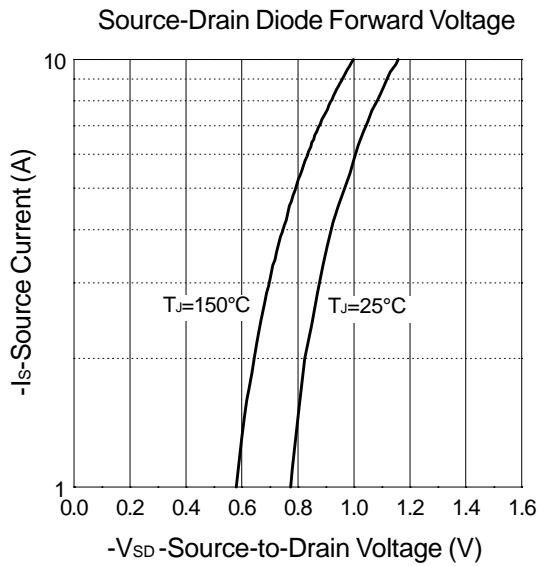
On-Resistance vs. Drain Current



Typical Characteristics

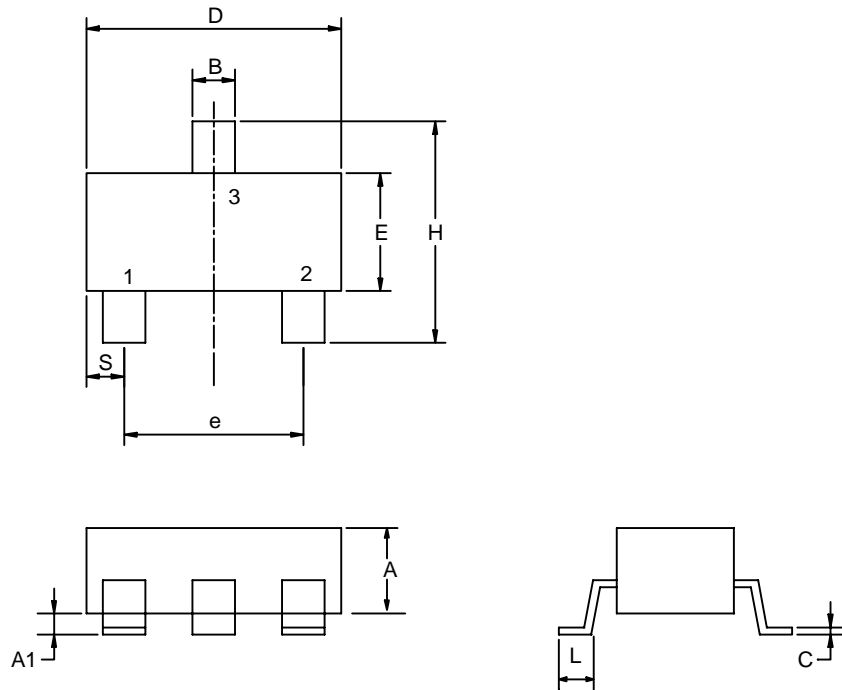


Typical Characteristics



Packaging Information

SOT-23



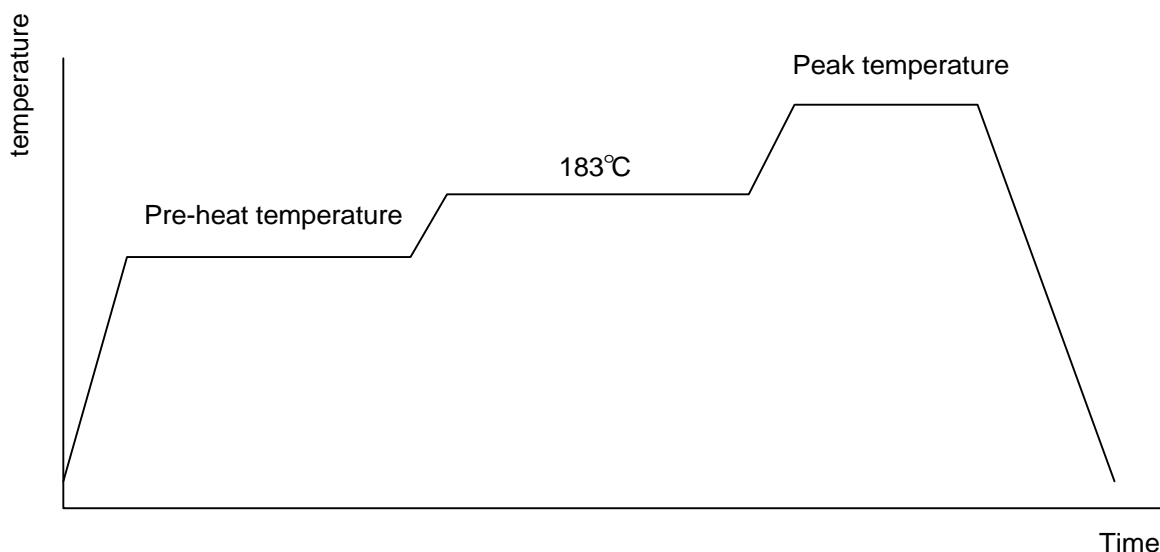
| Dim | Millimeters | | Inches | |
|-----|-------------|------|-----------|-------|
| | Min. | Max. | Min. | Max. |
| A | 1.00 | 1.30 | 0.039 | 0.051 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| B | 0.35 | 0.51 | 0.014 | 0.020 |
| C | 0.10 | 0.25 | 0.004 | 0.010 |
| D | 2.70 | 3.10 | 0.106 | 0.122 |
| E | 1.40 | 1.80 | 0.055 | 0.071 |
| e | 1.90 BSC | | 0.075 BSC | |
| H | 2.40 | 3.00 | 0.094 | 0.118 |
| L | 0.37 | | 0.0015 | |

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. | |

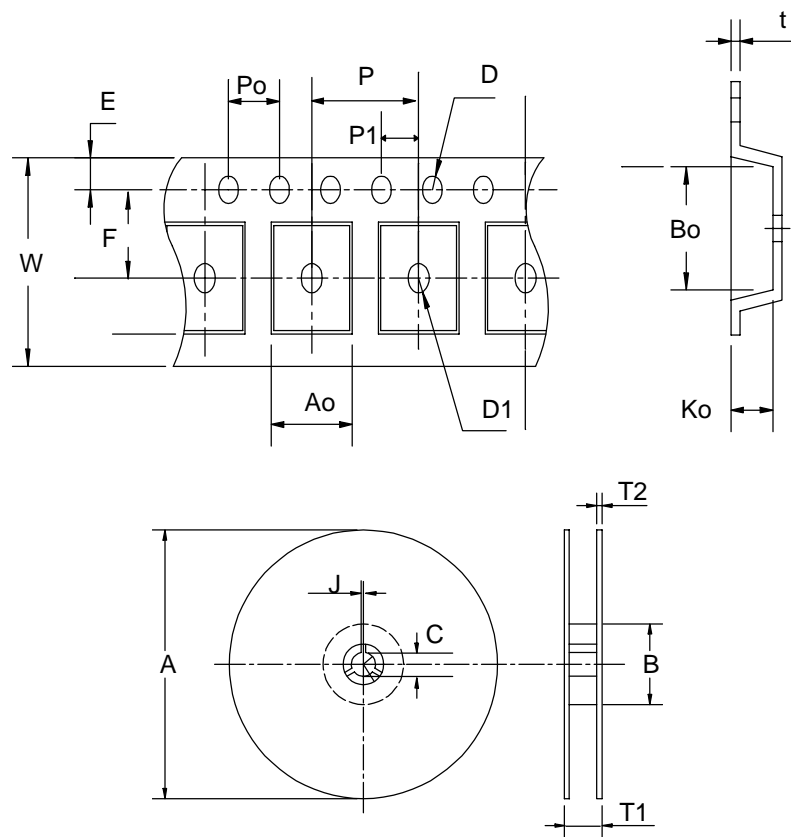
Package Reflow Conditions

| pkg. thickness ≥ 2.5mm and all bags | 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 |
|-------------|------------|-----------|------------|------------|-----------|------------|-------------------------------------|-----------|------------|
| SOT-23 | 178±1 | 72 ± 1.0 | 13.0 + 0.2 | 2.5 ± 0.15 | 8.4 ± 2 | 1.5 ± 0.3 | 8.0 ^{+0.3} _{-0.3} | 4 ± 0.1 | 1.75 ± 0.1 |
| | F | D | D1 | Po | P1 | Ao | Bo | Ko | t |
| | 3.5 ± 0.05 | 1.5 + 0.1 | 1.5 + 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 3.15 ± 0.1 | 3.2 ± 0.1 | 1.4 ± 0.1 | 0.2 ± 0.03 |

Cover Tape Dimensions

| Application | Carrier Width | Cover Tape Width | Devices Per Reel |
|-------------|---------------|------------------|------------------|
| SOT- 23 | 8 | 5.3 | 3000 |

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