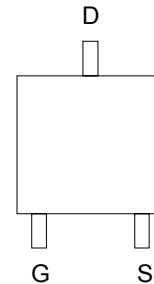


## N-Channel Enhancement Mode MOSFET

### Features

- 20V/6A ,  $R_{DS(ON)}=25m\Omega(\text{typ.}) @ V_{GS}=10V$   
 $R_{DS(ON)}=32m\Omega(\text{typ.}) @ V_{GS}=4.5V$   
 $R_{DS(ON)}=40m\Omega(\text{typ.}) @ V_{GS}=2.5V$
- Super High Dense Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- SOT-23 Package

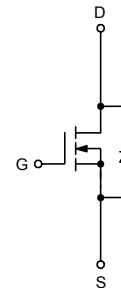
### Pin Description



Top View of SOT-23

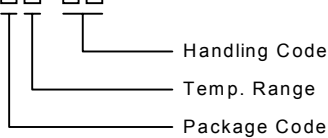
### Applications

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



N-Channel MOSFET

### Ordering and Marking Information

|  |   |
|--|---|
| <p>APM2300A□□-□□</p>  <p>Handling Code<br/>Temp. Range<br/>Package Code</p> | <p>Package Code<br/>A : SOT-23<br/>Operating Junction Temp. Range<br/>C : -55 to 150°C<br/>Handling Code<br/>TR : Tape &amp; Reel</p> |
| <p>APM2300A A : <span style="border: 1px solid black; padding: 2px;">A00X</span></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                | $\pm 12$ |      |
| $I_D^*$   | Maximum Drain Current – Continuous | 6        | A    |
| $I_{DM}$  | Maximum Drain Current – Pulsed     | 20       |      |

\* 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                     | $^\circ\text{C}$   |
| $T_{\text{STG}}$ | 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                                       | APM2300A |      |           | Unit          |
|----------------------------|----------------------------------|--|----------|------|-----------|---------------|
|                            |                                  |  | Min.     | Typ. | Max.      |               |
| <b>Static</b>              |                                  |  |          |      |           |               |
| $BV_{DSS}$                 | Drain-Source Breakdown Voltage   | $V_{GS}=0V, I_{DS}=250\mu\text{A}$                   | 20       |      |           | V             |
| $I_{DSS}$                  | Zero Gate Voltage Drain Current  | $V_{DS}=16V, V_{GS}=0V$                              |          |      | 1         | $\mu\text{A}$ |
| $V_{GS(th)}$               | Gate Threshold Voltage           | $V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$               | 0.5      | 0.7  | 1.0       | V             |
| $I_{GSS}$                  | Gate Leakage Current             | $V_{GS}=\pm 12V, V_{DS}=0V$                          |          |      | $\pm 100$ | nA            |
| $R_{DS(ON)}^a$             | Drain-Source On-state Resistance | $V_{GS}=10V, I_{DS}=6A$                              |          | 25   | 30        | m $\Omega$    |
|                            |                                  | $V_{GS}=4.5V, I_{DS}=3A$                             |          | 32   | 40        |               |
|                            |                                  | $V_{GS}=2.5V, I_{DS}=2A$                             |          | 40   | 55        |               |
| $V_{SD}^a$                 | Diode Forward Voltage            | $I_{SD}=1.25A, V_{GS}=0V$                            |          | 0.7  | 1.3       | V             |
| <b>Dynamic<sup>b</sup></b> |                                  |  |          |      |           |               |
| $Q_g$                      | Total Gate Charge                | $V_{DS}=10V, I_{DS}=6A$                              |          | 10   | 12        | nC            |
| $Q_{gs}$                   | Gate-Source Charge               | $V_{GS}=4.5V$  |          | 3.6  |           |               |
| $Q_{gd}$                   | Gate-Drain Charge                |  |          | 2    |           |               |
| $t_{d(ON)}$                | Turn-on Delay Time               | $V_{DD}=10V, I_{DS}=1A, V_{GEN}=4.5V, R_G=0.2\Omega$ |          | 8    | 14        | ns            |
| $T_r$                      | Turn-on Rise Time                |  |          | 6    | 12        |               |
| $t_{d(OFF)}$               | Turn-off Delay Time              |  |          | 19   | 45        |               |
| $T_f$                      | Turn-off Fall Time               |  |          | 7    | 23        |               |
| $C_{iss}$                  | Input Capacitance                | $V_{GS}=0V$  |          | 550  |           | pF            |
| $C_{oss}$                  | Output Capacitance               | $V_{DS}=15V$   |          | 120  |           |               |
| $C_{rss}$                  | Reverse Transfer Capacitance     | Frequency=1.0MHz                                     |          | 80   |           |               |

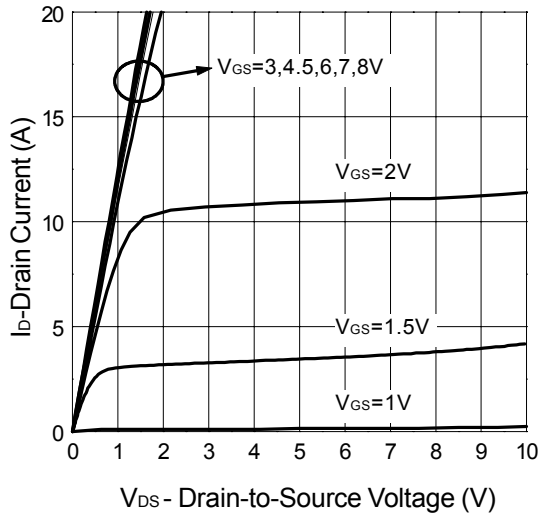
### Notes

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

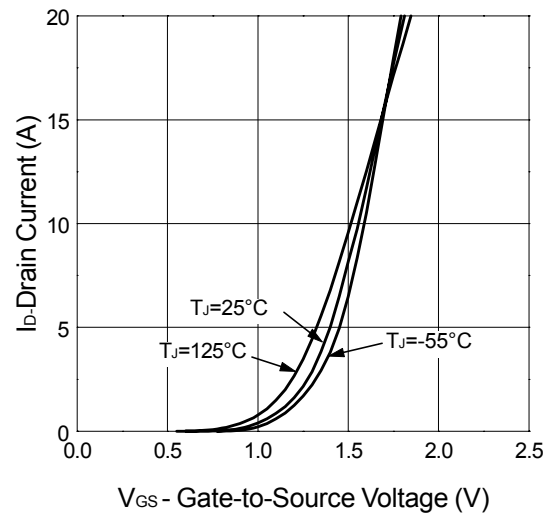
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

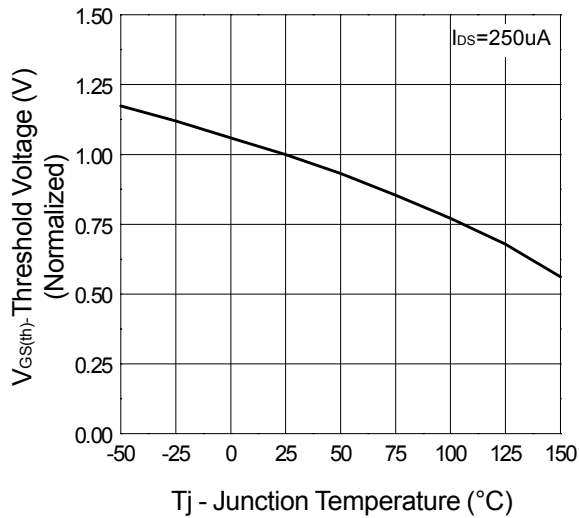
Output Characteristics



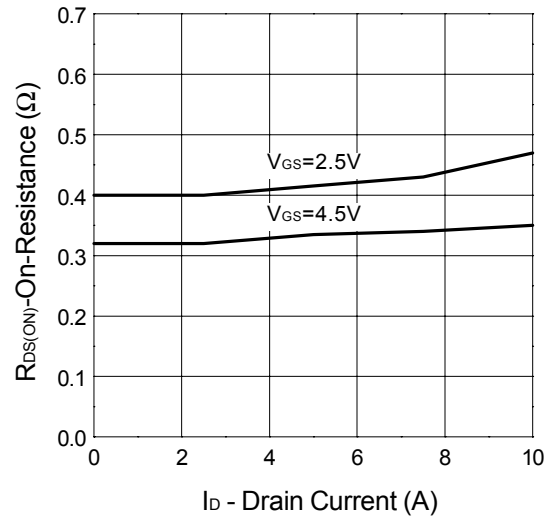
Transfer Characteristics



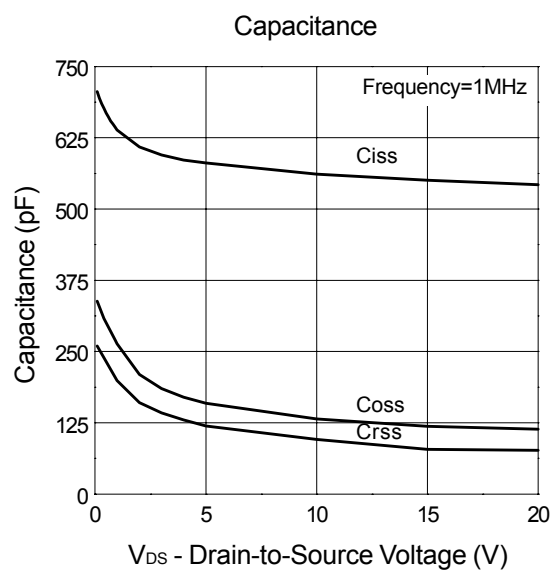
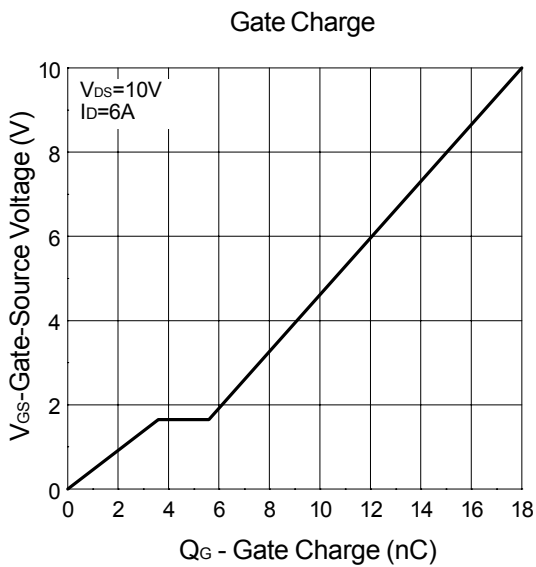
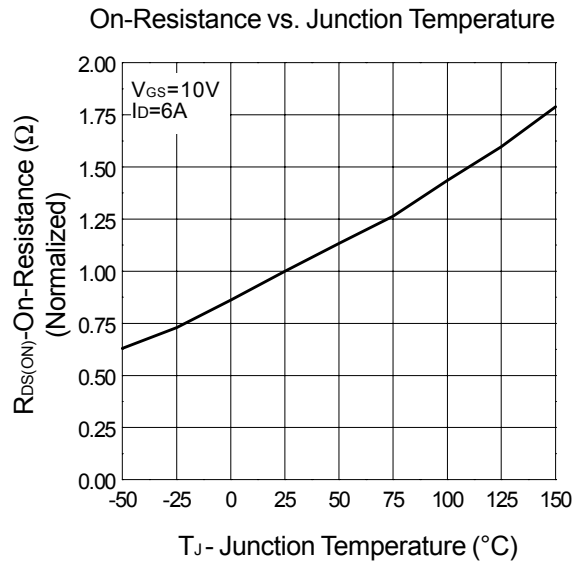
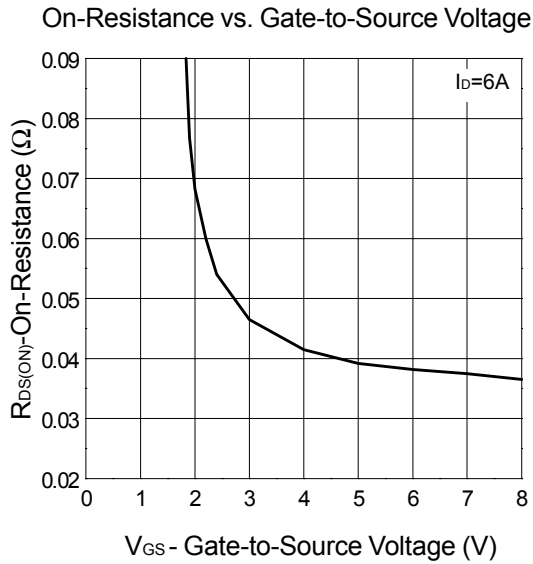
Threshold Voltage vs. Junction Temperature



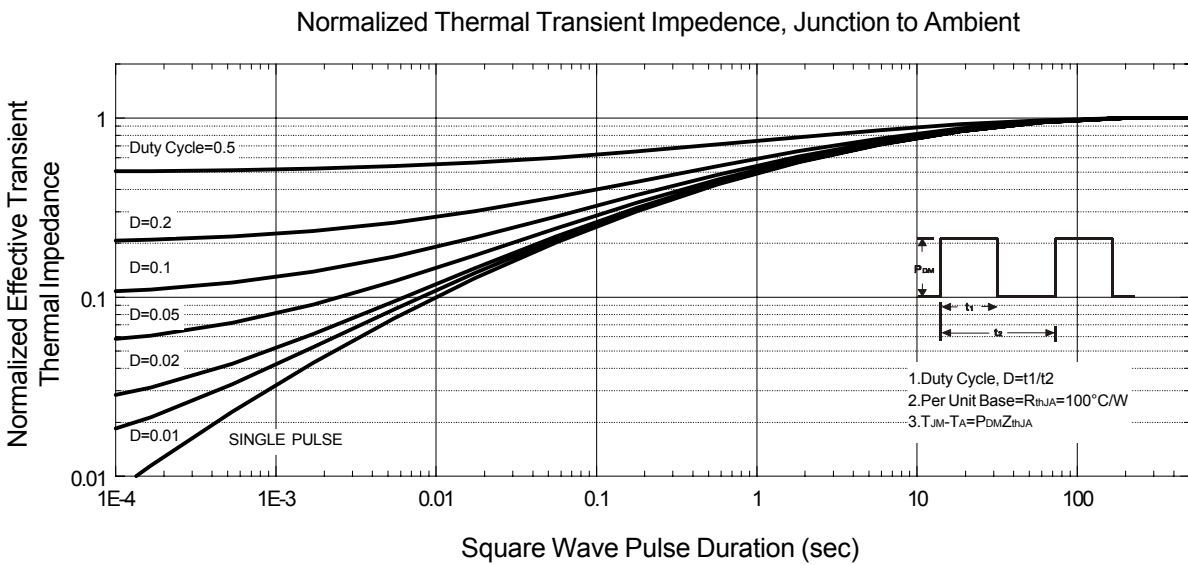
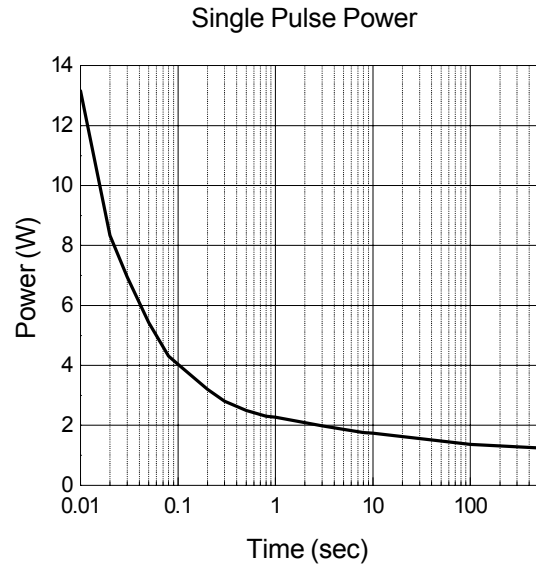
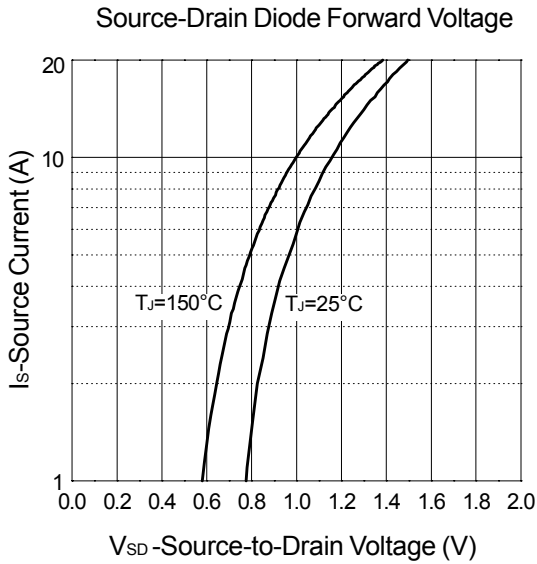
On-Resistance vs. Drain Current



Typical Characteristics (Cont.)

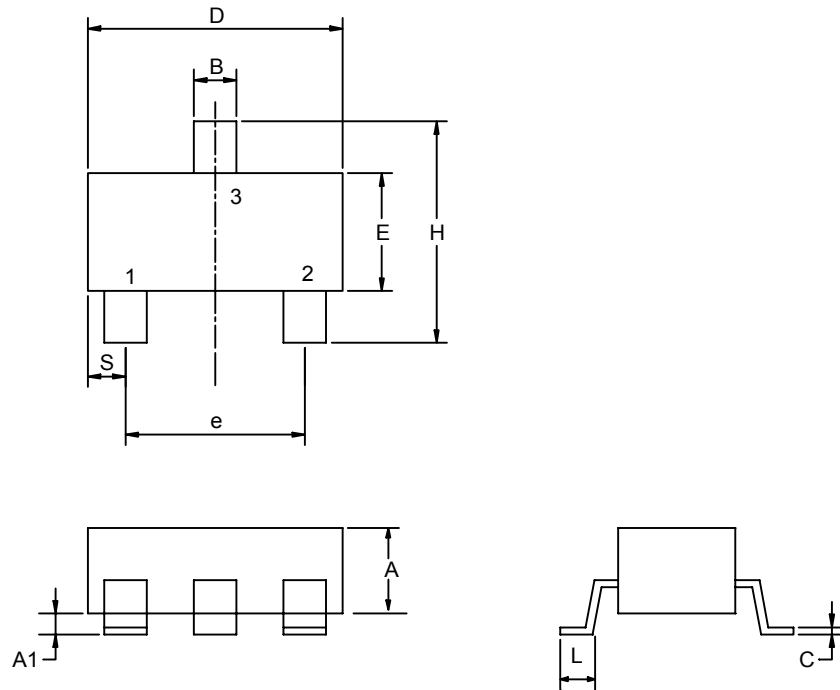


Typical Characteristics (Cont.)



Packaging Information

SOT-23



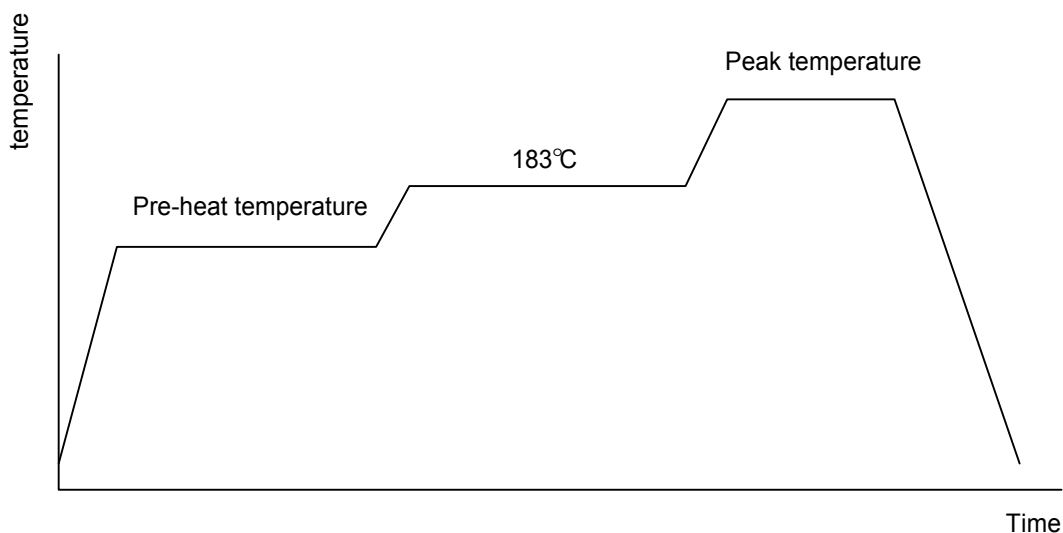
| Dim | Millimeters |      | Inches    |       |
|-----|-------------|------|-----------|-------|
|     | Min.        | Max. | Min.      | Max.  |
| A   | 1.00        | 1.30 | 0.039     | 0.051 |
| A1  | 0.00        | 0.10 | 0.000     | 0.004 |
| B   | 0.35        | 0.51 | 0.014     | 0.020 |
| C   | 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/<br>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.                  |                          |

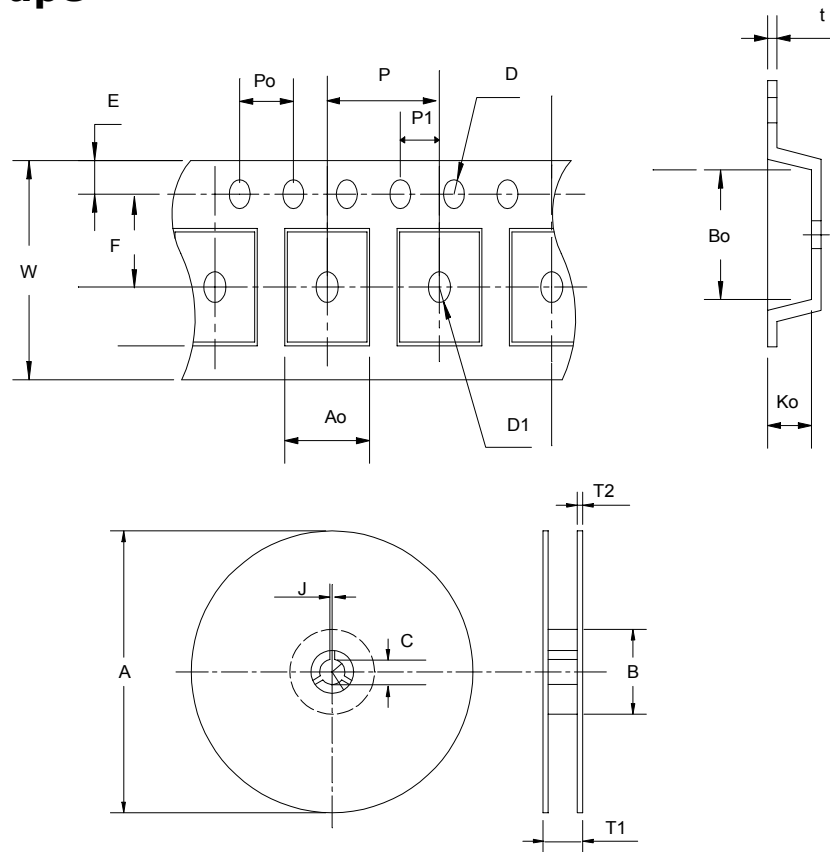
## Package Reflow Conditions

| pkg. thickness ≥ 2.5mm<br>and all bgas | pkg. thickness < 2.5mm and<br>pkg. volume ≥ 350 mm <sup>3</sup> | pkg. thickness < 2.5mm and pkg.<br>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 |

## Carrier Tape



| 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 <sup>+0.3</sup> <sub>-0.3</sub> | 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             |

## Customer Service

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