



**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                    | $\pm 12$                |                    |     |
| $I_D^*$           | Continuous Drain Current               | -4.5                    | A                  |     |
| $I_{DM}^*$        | 300 $\mu\text{s}$ Pulsed Drain Current |                         |                    | -18 |
| $I_S^*$           | Diode Continuous Forward Current       | -1                      | A                  |     |
| $T_J$             | Maximum Junction Temperature           | 150                     | $^\circ\text{C}$   |     |
| $T_{STG}$         | Storage Temperature Range              | -55 to 150              |                    |     |
| $P_D^*$           | Maximum Power Dissipation              | $T_A=25^\circ\text{C}$  | 0.83               | W   |
|                   |  | $T_A=100^\circ\text{C}$ | 0.3                |     |
| $R_{\theta JA}^*$ | Thermal Resistance-Junction to Ambient | 150                     | $^\circ\text{C/W}$ |     |

Note:

\*Surface Mounted on 1in<sup>2</sup> pad area,  $t \leq 10\text{sec}$ .

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

| Symbol   | Parameter                        | Test Condition                                     | APM2317A |      |           | Unit             |
|--|----------------------------------|--|----------|------|-----------|------------------|
|  |                                  |  | Min.     | Typ. | Max.      |                  |
| <b>Static Characteristics</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  | $V_{DS}=-16V, V_{GS}=0V$<br>$T_J=85^\circ\text{C}$ |          |      | -1        | $\mu\text{A}$    |
|  |                                  |  |          |      | -30       |                  |
| $V_{GS(th)}$                                   | Gate Threshold Voltage           | $V_{DS}=V_{GS}, I_{DS}=-250\mu\text{A}$            | -0.5     | -0.7 | -1        | 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 | $V_{GS}=-4.5V, I_{DS}=-4.5A$                       |          | 28   | 35        | $\text{m}\Omega$ |
|  |                                  | $V_{GS}=-2.5V, I_{DS}=-2.5A$                       |          | 38   | 50        |                  |
|  |                                  | $V_{GS}=-1.8V, I_{DS}=-2A$                         |          | 55   | 75        |                  |
| $V_{SD}^a$                                     | Diode Forward Voltage            | $I_{SD}=-1A, V_{GS}=0V$                            |          | -0.7 | -1.3      | V                |
| <b>Gate Charge Characteristics<sup>b</sup></b> |                                  |  |          |      |           |                  |
| $Q_g$  | Total Gate Charge                | $V_{DS}=-10V, V_{GS}=-4.5V,$<br>$I_{DS}=-4.5A$     |          | 14   | 20        | nC               |
| $Q_{gs}$                                       | Gate-Source Charge               |  |          | 2.1  |           |                  |
| $Q_{gd}$                                       | Gate-Drain Charge                |  |          | 4.7  |           |                  |

## Electrical Characteristics (Cont.) (T<sub>A</sub> = 25°C unless otherwise noted)

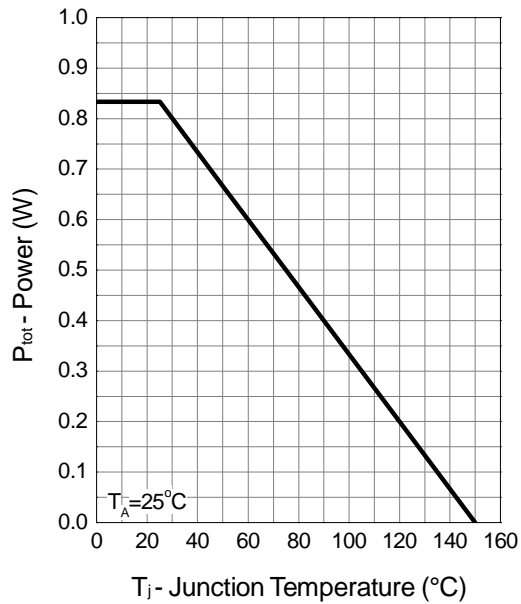
| Symbol                                     | Parameter                    | Test Condition  | APM2317A |      |      | Unit |
|--|------------------------------|---|----------|------|------|------|
|  |                              |   | Min.     | Typ. | Max. |      |
| <b>Dynamic Characteristics<sup>b</sup></b> |                              |   |          |      |      |      |
| R <sub>G</sub>                             | Gate Resistance              | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz  |          | 7    |      | Ω    |
| C <sub>iss</sub>                           | Input Capacitance            | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =-10V,<br>Frequency=1.0MHz  |          | 1520 |      | pF   |
| C <sub>oss</sub>                           | Output Capacitance           |   |          | 225  |      |      |
| C <sub>rss</sub>                           | Reverse Transfer Capacitance |   |          | 165  |      |      |
| t <sub>d(ON)</sub>                         | Turn-on Delay Time           | V <sub>DD</sub> =-10V, R <sub>L</sub> =10Ω,<br>I <sub>DS</sub> =-1A, V <sub>GEN</sub> =-4.5V,<br>R <sub>G</sub> =6Ω |          | 6    | 12   | ns   |
| t <sub>r</sub>                             | Turn-on Rise Time            |   |          | 13   | 24   |      |
| t <sub>d(OFF)</sub>                        | Turn-off Delay Time          |   |          | 86   | 156  |      |
| t <sub>f</sub>                             | Turn-off Fall Time           |   |          | 42   | 77   |      |
| t <sub>rr</sub>                            | Reverse Recovery Time        | I <sub>SD</sub> =-4.5A, dI <sub>SD</sub> /dt =100A/μs   |          | 21   |      | ns   |
| q <sub>rr</sub>                            | Reverse Recovery Charge      |   |          | 9    |      | nC   |

Notes:

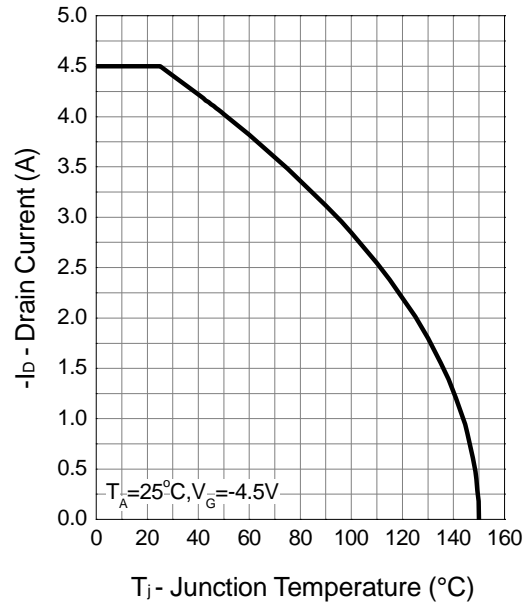
- a : Pulse test ; pulse width ≤ 300μs, duty cycle ≤ 2%.
- b : Guaranteed by design, not subject to production testing.

## Typical Characteristics

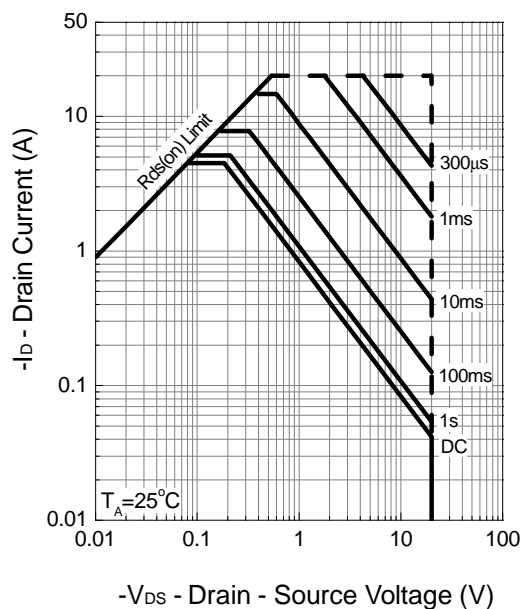
Power Dissipation



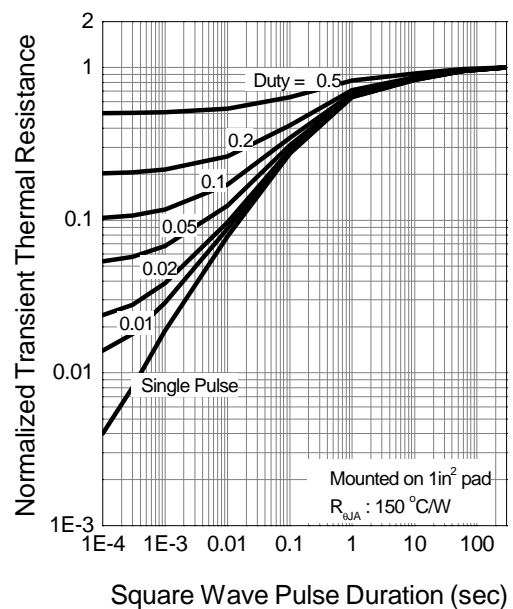
Drain Current



Safe Operation Area

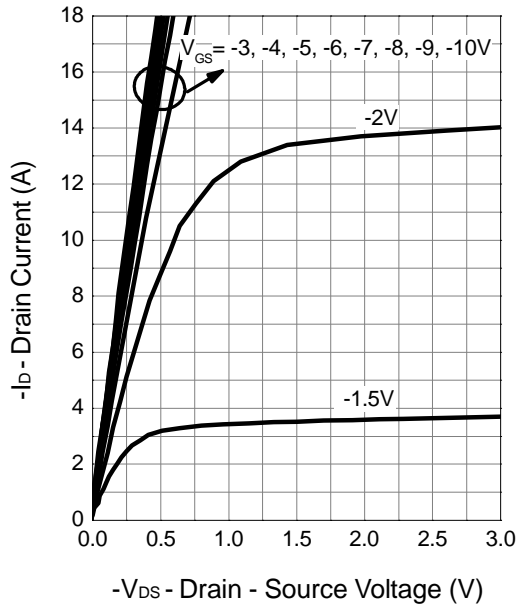


Thermal Transient Impedance

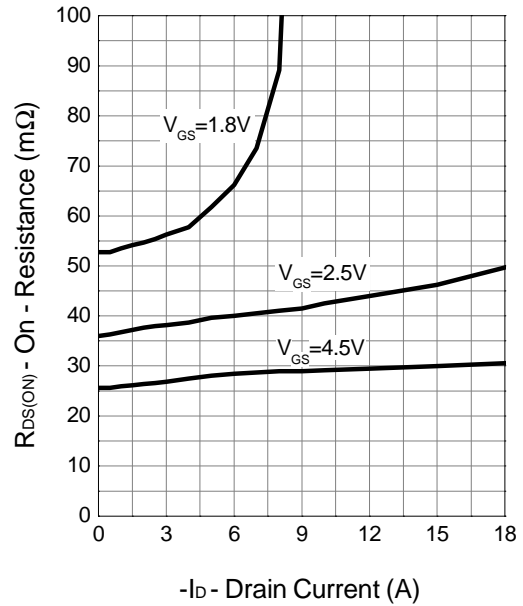


## Typical Characteristics (Cont.)

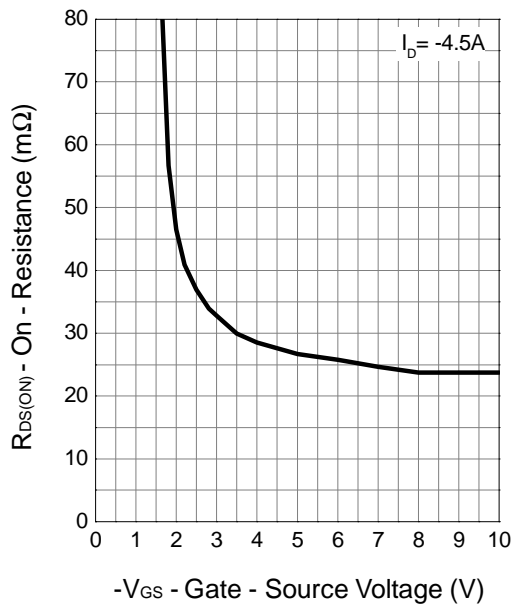
Output Characteristics



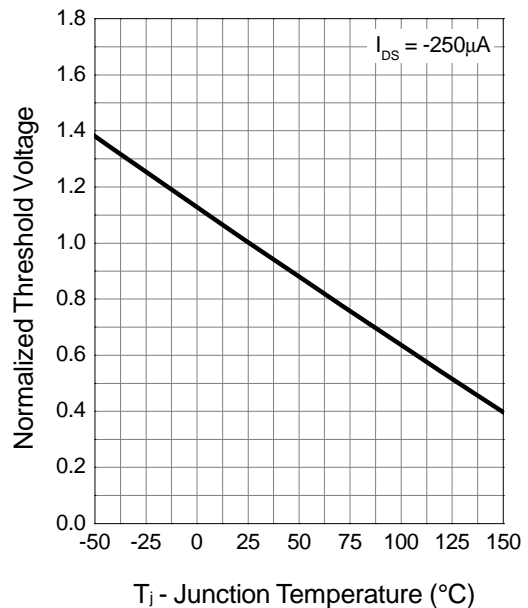
Drain-Source On Resistance



Drain-Source On Resistance

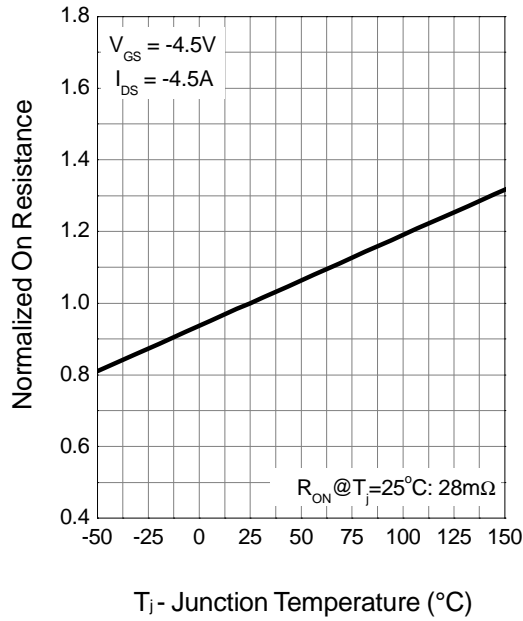


Gate Threshold Voltage

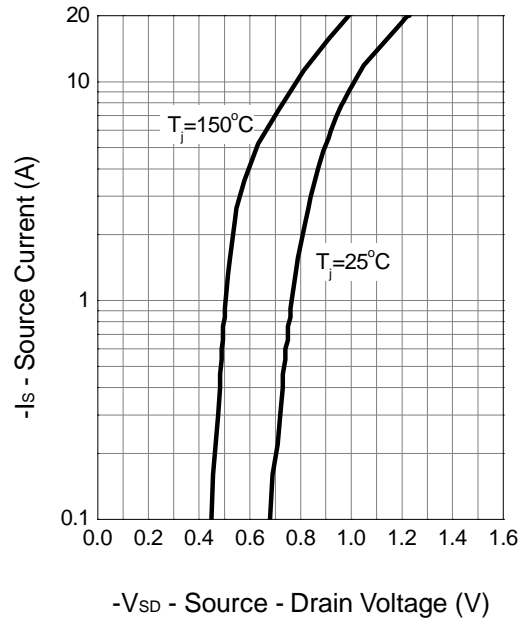


Typical Characteristics (Cont.)

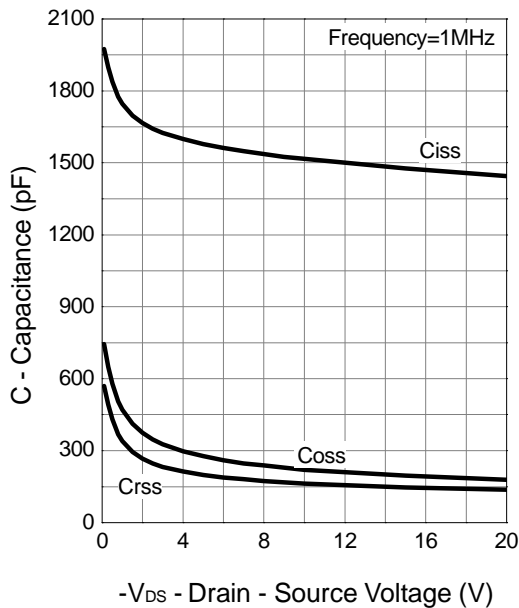
Drain-Source On Resistance



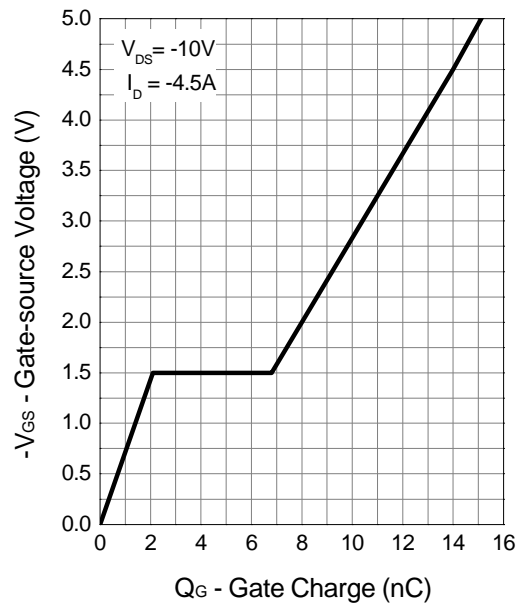
Source-Drain Diode Forward



Capacitance

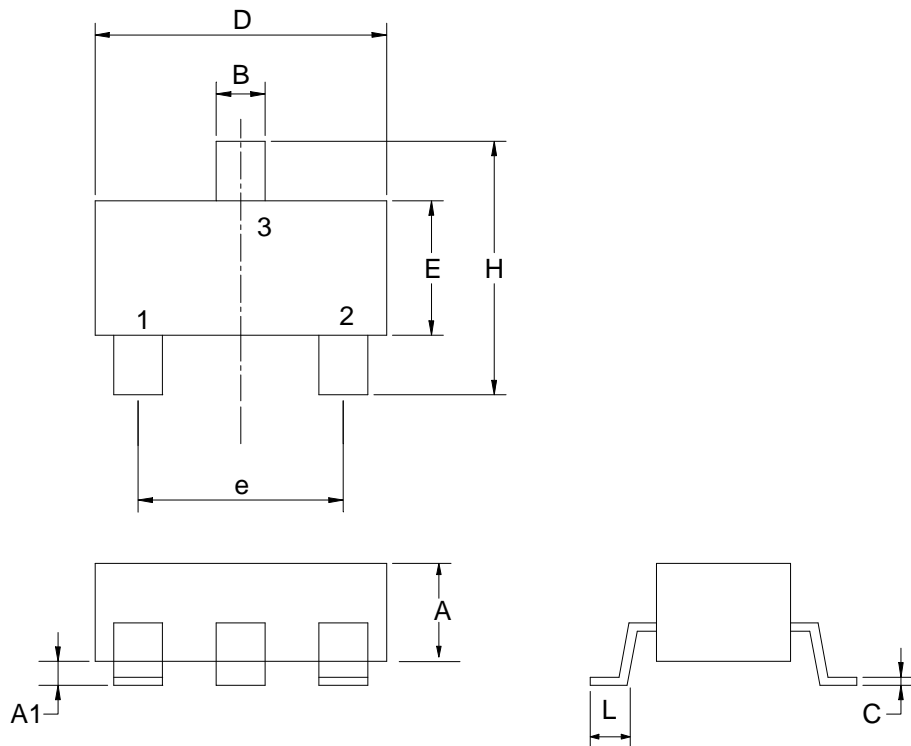


Gate Charge



## Packaging Information

SOT-23

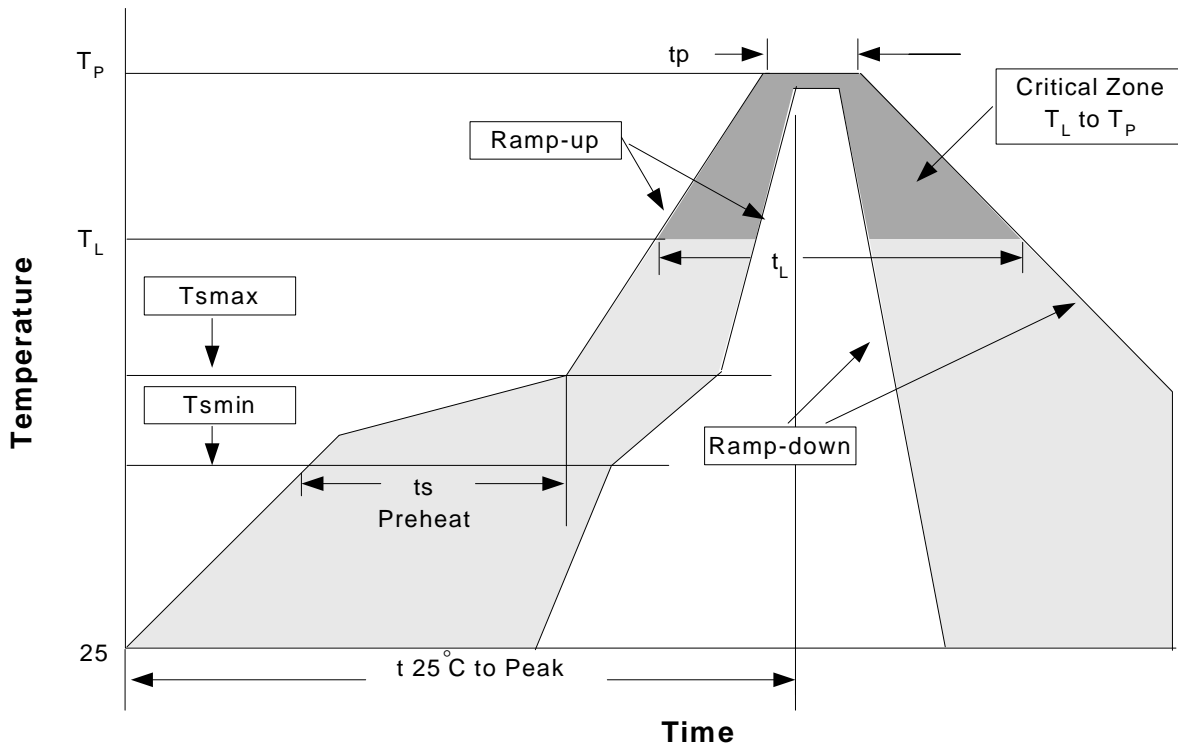


| Dim | Millimeters   |      | Inches           |       |
|-----|---------------|------|------------------|-------|
|     | Min.          | Max. | Min.             | Max.  |
| A   | 1.00          | 1.30 | 0.039            | 0.051 |
| A1  | 0.00          | 0.10 | 0.000            | 0.004 |
| B   | 0.35          | 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   | 1.90/2.1 BSC. |      | 0.075/0.083 BSC. |       |
| H   | 2.40          | 3.00 | 0.094            | 0.118 |
| L   | 0.37          |      | 0.015            |       |

## Physical Specifications

|                    |  |
|--------------------|--|
| Terminal Material  | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.         |

### Reflow Condition (IR/Convection or VPR Reflow)



### Classification Reflow Profiles

| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | 3°C/second max.         | 3°C/second max.  |
| Preheat  |                         |                  |
| - Temperature Min ( $T_{smin}$ )                     | 100°C                   | 150°C            |
| - Temperature Max ( $T_{smax}$ )                     | 150°C                   | 200°C            |
| - Time (min to max) ( $t_s$ )                        | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                               |                         |                  |
| - Temperature ( $T_L$ )                              | 183°C                   | 217°C            |
| - Time ( $t_L$ )                                     | 60-150 seconds          | 60-150 seconds   |
| Peak/Classification Temperature ( $T_p$ )            | See table 1             | See table 2      |
| Time within 5°C of actual Peak Temperature ( $t_p$ ) | 10-30 seconds           | 20-40 seconds    |
| Ramp-down Rate                                       | 6°C/second max.         | 6°C/second max.  |
| Time 25°C to Peak Temperature                        | 6 minutes max.          | 8 minutes max.   |

Notes: All temperatures refer to topside of the package .Measured on the body surface.



## Classification Reflow Profiles (Cont.)

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 240 +0/-5°C                    | 225 +0/-5°C                    |
| ≥2.5 mm           | 225 +0/-5°C                    | 225 +0/-5°C                    |

Table 2. Pb-free Process – Package Classification Reflow Temperatures

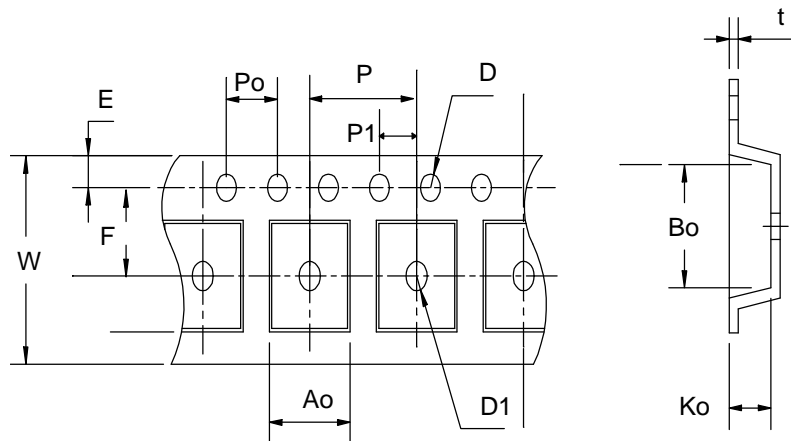
| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>>2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 +0°C*                      | 260 +0°C*                          | 260 +0°C*                       |
| 1.6 mm – 2.5 mm   | 260 +0°C*                      | 250 +0°C*                          | 245 +0°C*                       |
| ≥2.5 mm           | 250 +0°C*                      | 245 +0°C*                          | 245 +0°C*                       |

\*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

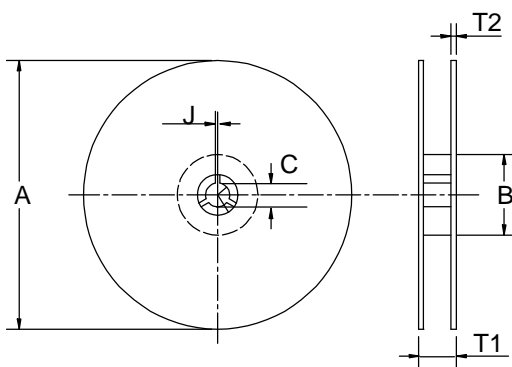
## Reliability Test Program

| 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



## Carrier Tape & Reel Dimensions



| Application | A          | B        | C      | J          | T1         | T2  | W                 | P   | E        |
|-------------|------------|----------|--------|------------|------------|-----|-------------------|-----|----------|
| SOT-23      | 178±1      | 60 ± 1.0 | 12.0   | 2.5 ± 0.15 | 9.0 ± 0.5  | 1.4 | 8.0+ 0.3<br>- 0.3 | 4.0 | 1.75     |
|             | F          | D        | D1     | Po         | P1         | Ao  | Bo                | Ko  | t        |
|             | 3.5 ± 0.05 | 1.5 +0.1 | 0.1MIN | 4.0        | 2.0 ± 0.05 | 3.1 | 3.0               | 1.3 | 0.2±0.03 |

(mm)

## Cover Tape Dimensions

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

## Customer Service

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