

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 | ± 12 | | |
| I_D^* | Continuous Drain Current | -3 | A | |
| I_{DM}^* | 300 μs Pulsed Drain Current | | | |
| I_S^* | Diode Continuous Forward Current | -1.3 | 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 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | 75 | $^\circ\text{C}/\text{W}$ | |
| $R_{\theta JA}^*$ | Thermal Resistance-Junction to Ambient | 150 | $^\circ\text{C}/\text{W}$ | |

Note : *Surface Mounted on 1in² pad area, t ≤ 10sec.

Electrical Characteristics ($T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

| Symbol | Parameter | Test Conditions | APM2301C | | | Unit |
|--|----------------------------------|---|----------|-------|----------|---------------|
| | | | Min. | Typ. | Max. | |
| Static Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$ | -20 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=-16\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$ | - | - | -1 | μA |
| | | | - | - | -30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_{DS}=-250\mu\text{A}$ | -0.5 | -0.75 | -1 | V |
| I_{GSS} | Gate Leakage Current | $V_{GS}=\pm 12\text{V}, V_{DS}=0\text{V}$ | - | - | ± 10 | μA |
| $R_{DS(ON)}^a$ | Drain-Source On-State Resistance | $V_{GS}=-4.5\text{V}, I_{DS}=-3\text{A}$ | - | 56 | 70 | m Ω |
| | | $V_{GS}=-2.5\text{V}, I_{DS}=-2\text{A}$ | - | 85 | 115 | |
| | | $V_{GS}=-1.8\text{V}, I_{DS}=-1\text{A}$ | - | 135 | 250 | |
| V_{SD}^a | Diode Forward Voltage | $I_{SD}=-1.3\text{A}, V_{GS}=0\text{V}$ | - | -0.75 | -1.3 | V |
| Gate Charge Characteristics^b | | | | | | |
| Q_g | Total Gate Charge | $V_{DS}=-10\text{V}, V_{GS}=-4.5\text{V},$ $I_{DS}=-3\text{A}$ | - | 7 | 10 | nC |
| Q_{gs} | Gate-Source Charge | | - | 1.9 | - | |
| Q_{gd} | Gate-Drain Charge | | - | 1.9 | - | |

Electrical Characteristics (Cont.) (T_A = 25°C Unless Otherwise Noted)

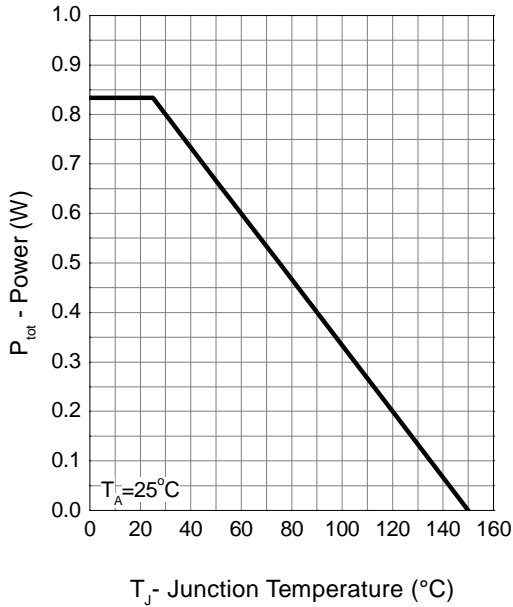
| Symbol | Parameter | Test Conditions | APM2301C | | | Unit |
|--|------------------------------|--|----------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Dynamic Characteristics^b | | | | | | |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =-10V, Frequency=1.0MHz | - | 580 | - | pF |
| C _{oss} | Output Capacitance | | - | 100 | - | |
| C _{rss} | Reverse Transfer Capacitance | | - | 75 | - | |
| t _{d(ON)} | Turn-on Delay Time | V _{DD} =-10V, R _L =10Ω, I _{DS} =1A, V _{GEN} =-4.5V, R _G =6Ω | - | 4 | 7 | ns |
| t _r | Turn-on Rise Time | | - | 13 | 23 | |
| t _{d(OFF)} | Turn-off Delay Time | | - | 35 | 63 | |
| t _f | Turn-off Fall Time | | - | 20 | 36 | |
| t _{rr} | Reverse Recovery Time | I _{SD} =-3A, dI _{SD} /dt =100A/μs | - | 20 | - | ns |
| Q _{rr} | Reverse Recovery Charge | | - | 7 | - | nC |

Note a : Pulse test ; pulse width≤300μs, duty cycle≤2%.

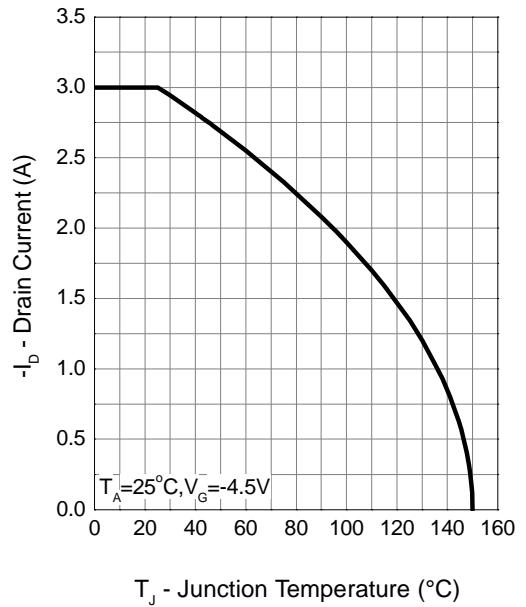
Note b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

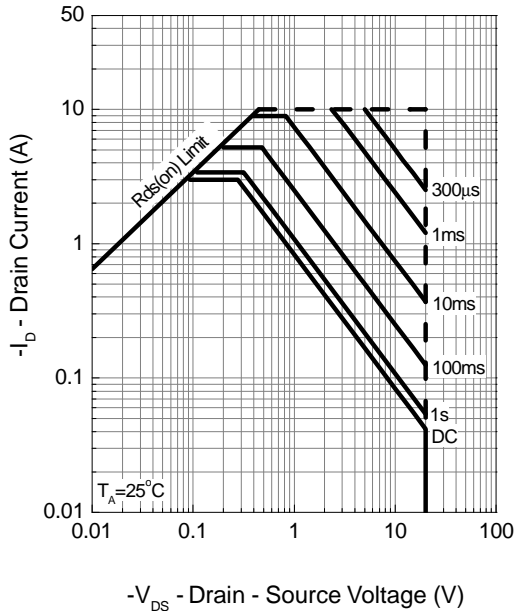
Power Dissipation



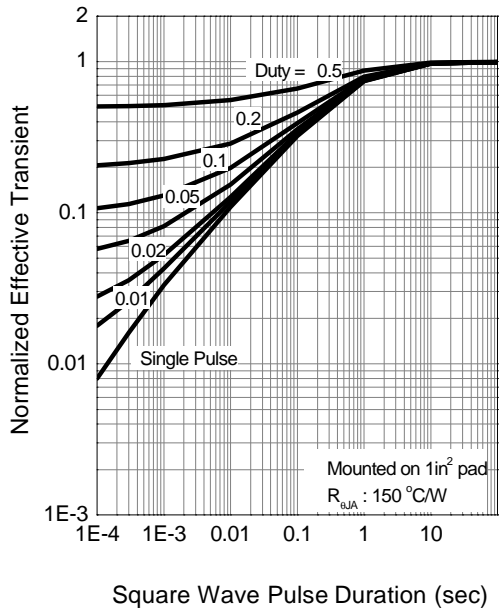
Drain Current



Safe Operation Area

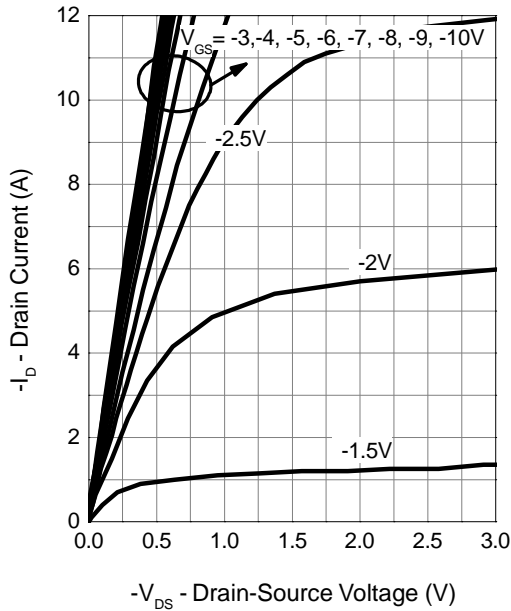


Thermal Transient Impedance

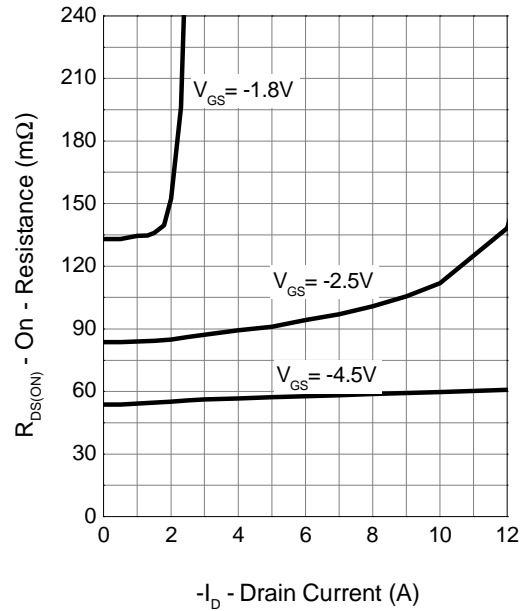


Typical Operating Characteristics (Cont.)

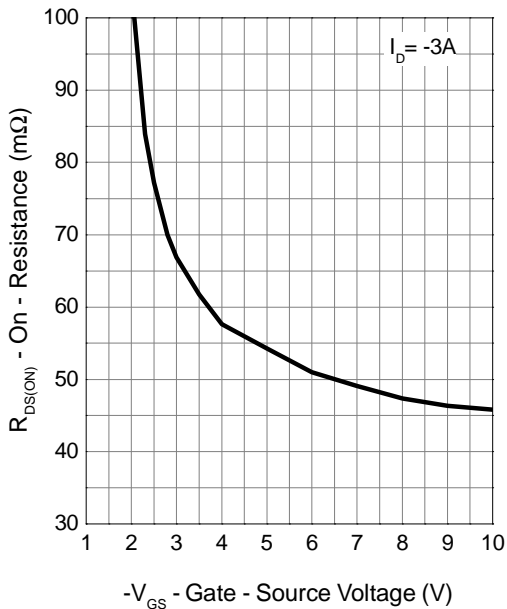
Output Characteristics



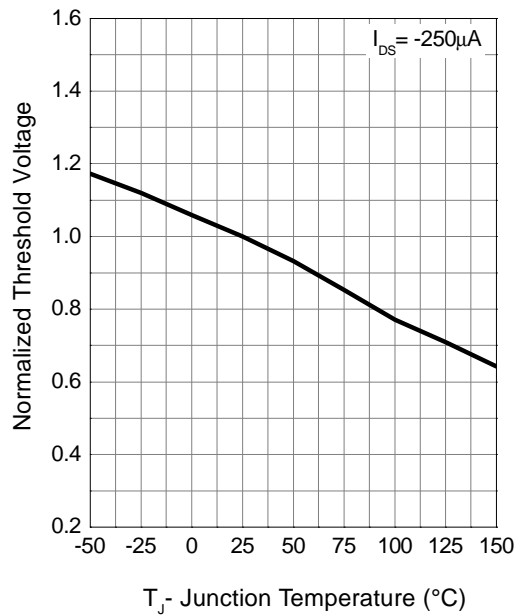
Drain-Source On Resistance



Drain-Source On Resistance

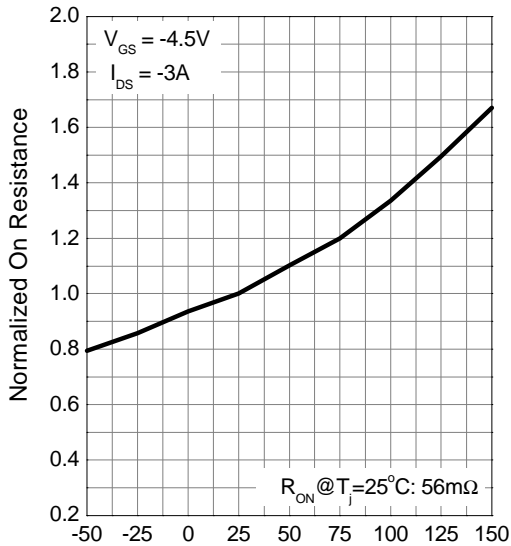


Gate Threshold Voltage



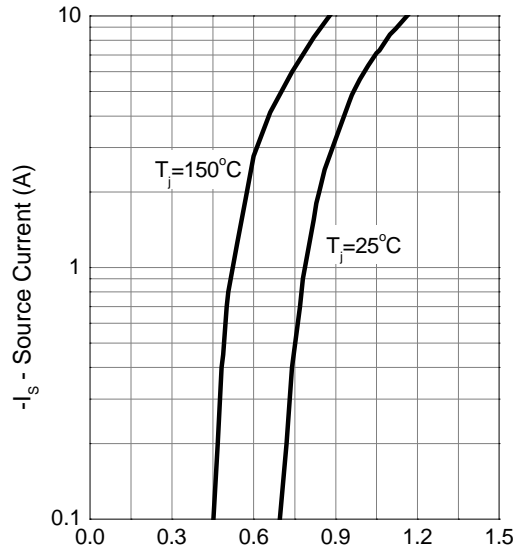
Typical Operating Characteristics (Cont.)

Drain-Source On Resistance



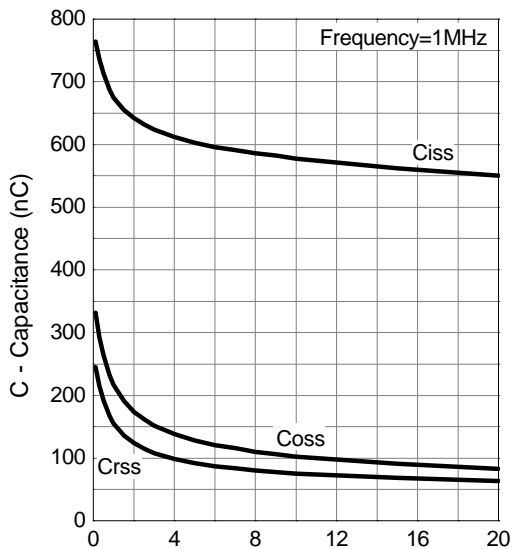
T_j - Junction Temperature (°C)

Source-Drain Diode Forward



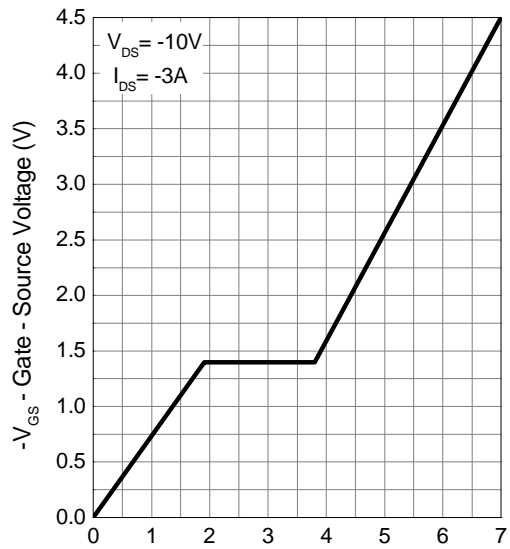
$-V_{SD}$ - Source - Drain Voltage (V)

Capacitance



$-V_{DS}$ - Drain - Source Voltage (V)

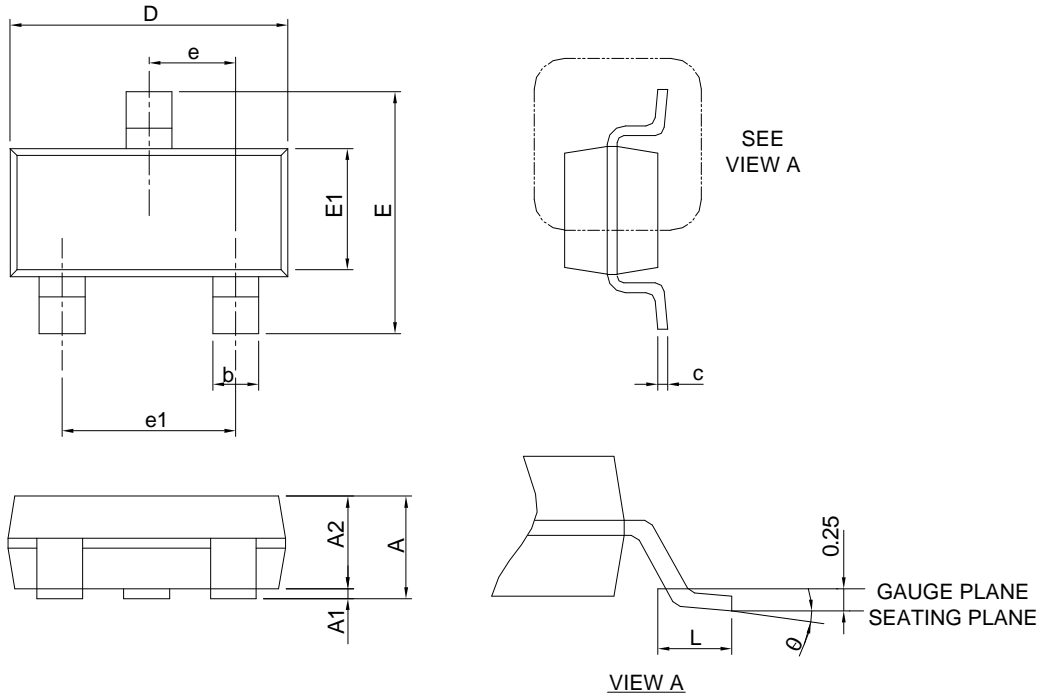
Gate Charge



Q_g - Gate Charge (nC)

Package Information

SOT-23-3

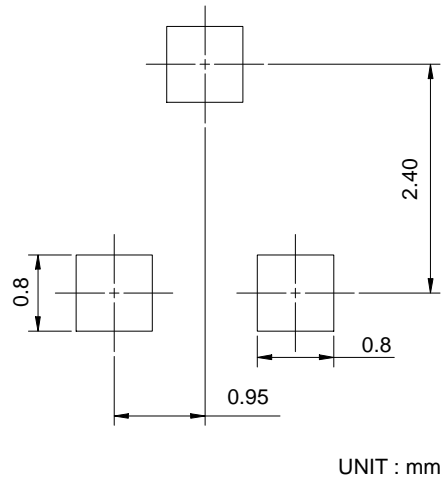


| DIMENSIONS | SOT-23-3 | | | |
|------------|-------------|------|-----------|-------|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | | 1.45 | | 0.057 |
| A1 | 0.00 | 0.15 | 0.000 | 0.006 |
| A2 | 0.90 | 1.30 | 0.035 | 0.051 |
| b | 0.30 | 0.50 | 0.012 | 0.020 |
| c | 0.08 | 0.22 | 0.003 | 0.009 |
| D | 2.70 | 3.10 | 0.106 | 0.122 |
| E | 2.60 | 3.00 | 0.102 | 0.118 |
| E1 | 1.40 | 1.80 | 0.055 | 0.071 |
| e | 0.95 BSC | | 0.037 BSC | |
| e1 | 1.90 BSC | | 0.075 BSC | |
| L | 0.30 | 0.60 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

Note : Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.

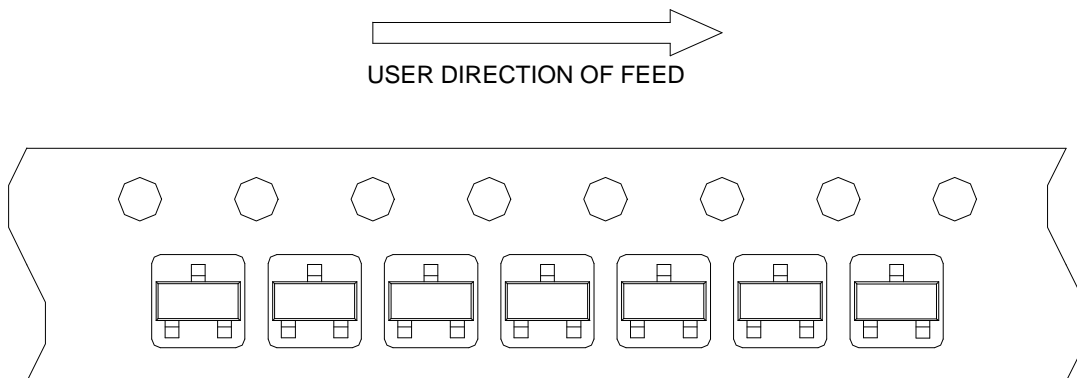
Recommended Land Pattern

SOT-23-3

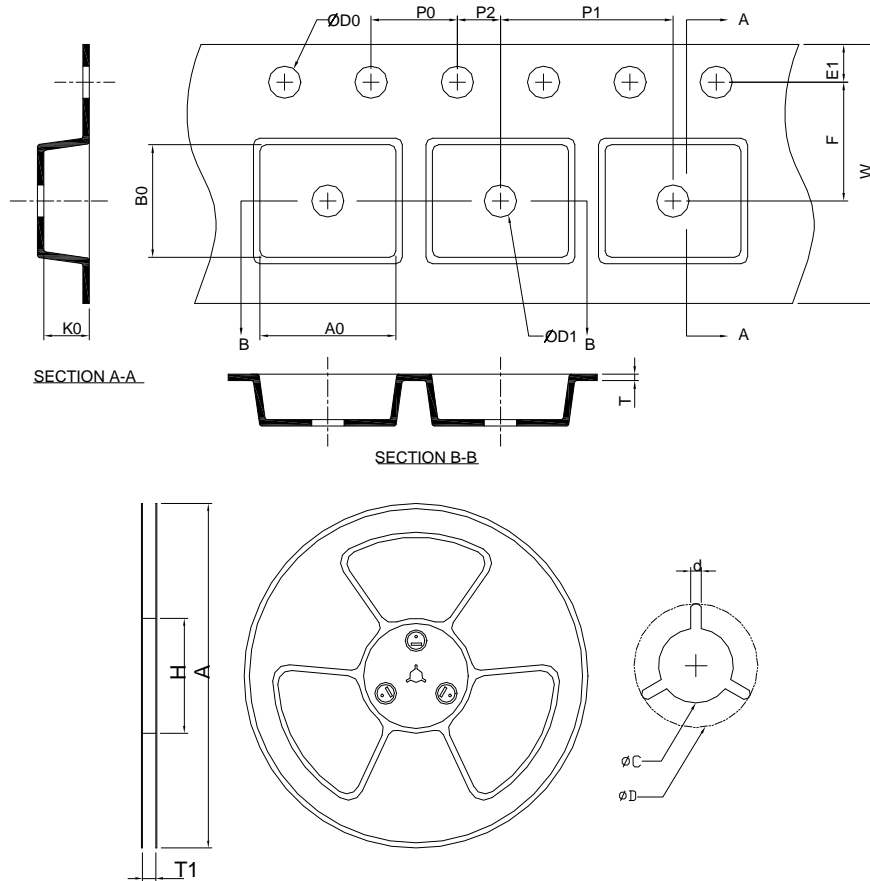


Taping Direction Information

SOT-23-3



Carrier Tape & Reel Dimensions



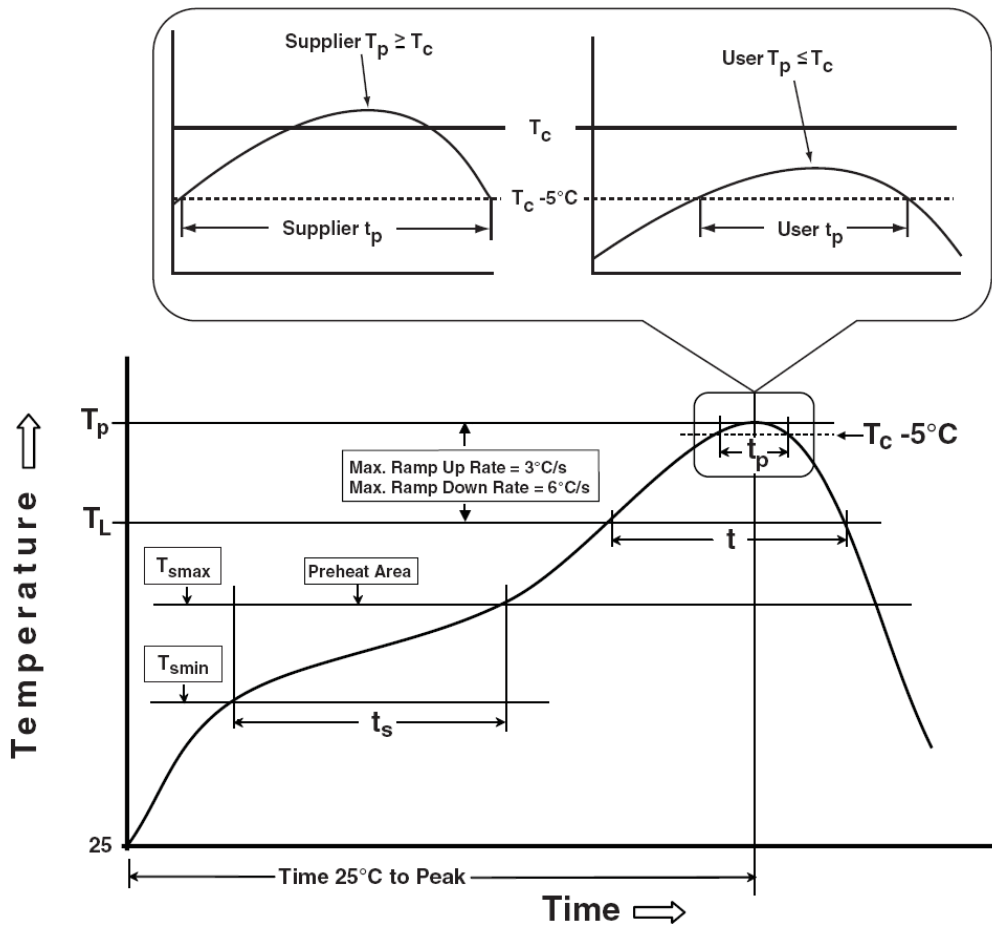
| Application | A | H | T1 | C | d | D | W | E1 | F |
|-------------|--------------|------------|-------------------|--------------------|----------|-------------------|-------------|-------------|-------------|
| SOT-23-3 | 178.0 ± 2.00 | 50 MIN. | 8.4+2.00 -0.00 | 13.0+0.50 -0.20 | 1.5 MIN. | 20.2 MIN. | 8.0 ± 0.30 | 1.75 ± 0.10 | 3.5 ± 0.05 |
| | P0 | P1 | P2 | D0 | D1 | T | A0 | B0 | K0 |
| | 4.0 ± 0.10 | 4.0 ± 0.10 | 2.0 ± 0.05 | 1.5+0.10 -0.00 | 1.0 MIN. | 0.6+0.00 -0.40 | 3.20 ± 0.20 | 3.10 ± 0.20 | 1.50 ± 0.20 |

(mm)

Devices Per Unit

| Package Type | Unit | Quantity |
|--------------|-------------|----------|
| SOT-23-3 | Tape & Reel | 3000 |

Classification Profile



Classification Reflow Profiles

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|------------------------------------|------------------------------------|
| Preheat & Soak | | |
| Temperature min (T_{smin}) | 100 °C | 150 °C |
| Temperature max (T_{smax}) | 150 °C | 200 °C |
| Time (T_{smin} to T_{smax}) (t_s) | 60-120 seconds | 60-120 seconds |
| Average ramp-up rate (T_{smax} to T_p) | 3 °C/second max. | 3°C/second max. |
| Liquidous temperature (T_L) | 183 °C | 217 °C |
| Time at liquidous (t_l) | 60-150 seconds | 60-150 seconds |
| Peak package body Temperature (T_p)* | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time (t_p)** within 5°C of the specified classification temperature (T_c) | 20** seconds | 30** seconds |
| Average ramp-down rate (T_p to T_{smax}) | 6 °C/second max. | 6 °C/second max. |
| Time 25°C to peak temperature | 6 minutes max. | 8 minutes max. |

* Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum.
 ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

Classification Reflow Profiles

Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm ³ <350 | Volume mm ³ ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm | 235 °C | 220 °C |
| ≥2.5 mm | 220 °C | 220 °C |

Table 2. Pb-free Process – Classification Temperatures (Tc)

| Package Thickness | Volume mm ³ <350 | Volume mm ³ 350-2000 | Volume mm ³ >2000 |
|-------------------|-----------------------------|---------------------------------|------------------------------|
| <1.6 mm | 260 °C | 260 °C | 260 °C |
| 1.6 mm – 2.5 mm | 260 °C | 250 °C | 245 °C |
| ≥2.5 mm | 250 °C | 245 °C | 245 °C |

Reliability Test Program

| Test item | Method | Description |
|---------------|---------------|------------------------------|
| SOLDERABILITY | JESD-22, B102 | 5 Sec, 245°C |
| HOLT | JESD-22, A108 | 1000 Hrs, Bias @ 125°C |
| PCT | JESD-22, A102 | 168 Hrs, 100%RH, 2atm, 121°C |
| TCT | JESD-22, A104 | 500 Cycles, -65°C~150°C |

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