

N-CHANNEL ENHANCEMENT MODE POWER MOSFET

| | |
|--------------|---------------|
| V_{DSS} | 60V |
| $R_{DS(ON)}$ | 6.5m Ω |
| I_D | 70A |

Description

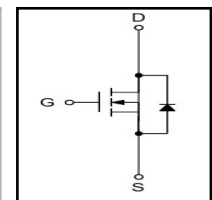
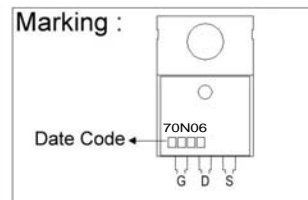
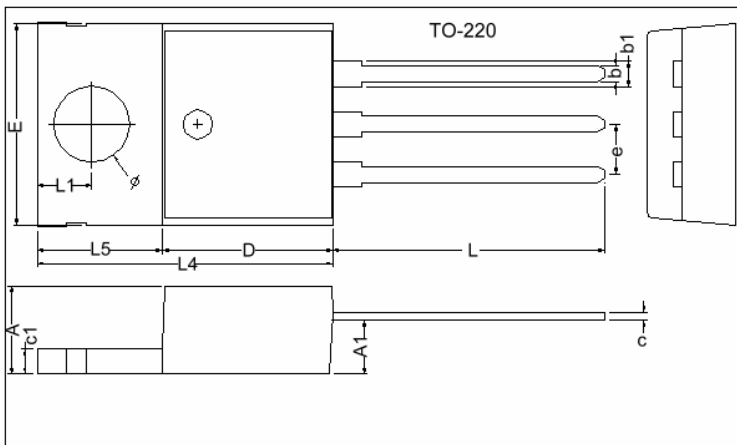
The BP70N06 uses advanced trench technology to provide excellent on-resistance extremely efficient and cost-effectiveness device.

The through-hole version (TO-220) is available for low-profile applications and suited for low voltage applications such as DC/DC converters.

Features

*High Density Cell Design for Ultra Low On-Resistance

*Avalanche rated and reliable and rugged

Package Dimensions


| REF. | Millimeter | | REF. | Millimeter | |
|------|------------|------|---------------|------------|-------|
| | Min. | Max. | | Min. | Max. |
| A | 4.40 | 4.80 | c1 | 1.25 | 1.45 |
| b | 0.76 | 1.00 | b1 | 1.17 | 1.47 |
| c | 0.36 | 0.50 | L | 13.25 | 14.25 |
| D | 8.60 | 9.00 | e | 2.54 REF. | |
| E | 9.80 | 10.4 | L1 | 2.60 | 2.89 |
| L4 | 14.7 | 15.3 | \varnothing | 3.71 | 3.96 |
| L5 | 6.20 | 6.60 | A1 | 2.60 | 2.80 |

Absolute Maximum Ratings

| Symbol | Parameter | Rating | Unit |
|------------------------------------------------------------------------|----------------------------------------------|-------------------------------|---------------------------|
| Common Ratings ($T_A=25^\circ\text{C}$ Unless Otherwise Noted) | | | |
| V_{DSS} | Drain-Source Voltage | 60 | V |
| V_{GSS} | Gate-Source Voltage | 25 | |
| T_J | Maximum Junction Temperature | 175 | $^\circ\text{C}$ |
| T_{STG} | Storage Temperature Range | -55 to 175 | $^\circ\text{C}$ |
| I_S | Diode Continuous Forward Current | $T_C=25^\circ\text{C}$ 70 | A |
| Mounted on Large Heat Sink | | | |
| I_{DP} | 300 μs Pulse Drain Current Tested | $T_C=25^\circ\text{C}$ 280 | A |
| I_D | Continuous Drain Current | $T_C=25^\circ\text{C}$ 70 | A |
| | | $T_C=100^\circ\text{C}$ 60 | |
| P_D | Maximum Power Dissipation | $T_C=25^\circ\text{C}$ 160 | W |
| | | $T_C=100^\circ\text{C}$ 85 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | 0.5 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | 62.5 | |
| Avalanche Ratings | | | |
| E_{AS} | Avalanche Energy, Single Pulsed | $L=0.3\text{mH}$ 510 | mJ |

Note : *VD=50V

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

| Symbol | Parameter | Test Conditions | BP70N06 | | | Unit |
|----------------------------------|----------------------------------|-------------------------------------------------------------------|---------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Static Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} =0V, I _{DS} =250μA | 60 | - | - | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =55V, V _{GS} =0V T _J =85°C | - | - | 1 | μA |
| | | | - | - | 10 | |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _{DS} =250μA | 2 | 3 | 4 | V |
| I _{GSS} | Gate Leakage Current | V _{GS} =±25V, V _{DS} =0V | - | - | ±100 | nA |
| R _{DS(ON)} ^a | Drain-Source On-state Resistance | V _{GS} =10V, I _{DS} =40A | - | 6.5 | 7 | mΩ |
| Diode Characteristics | | | | | | |
| V _{SD} ^a | Diode Forward Voltage | I _{SD} =40A, V _{GS} =0V | - | 0.8 | 1 | V |
| t _{rr} | Reverse Recovery Time | I _{SD} =40A, di _{SD} /dt=100A/μs | - | 33 | - | ns |
| Q _{rr} | Reverse Recovery Charge | | - | 61 | - | nC |

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

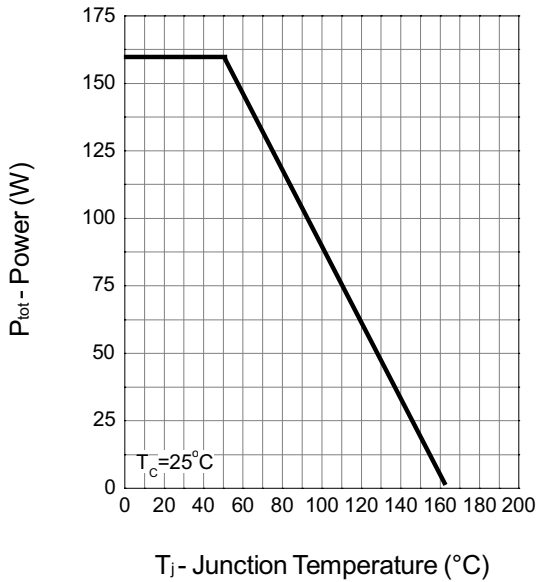
| Symbol | Parameter | Test Conditions | BP70N06 | | | Unit |
|------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------|---------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Dynamic Characteristics^b | | | | | | |
| R _G | Gate Resistance | V _{GS} =0V, V _{DS} =0V, F=1MHz | - | 1.5 | - | Ω |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =30V, Frequency=1.0MHz | - | 1480 | - | pF |
| C _{oss} | Output Capacitance | | - | 190 | - | |
| C _{rss} | Reverse Transfer Capacitance | | - | 135 | - | |
| t _{d(ON)} | Turn-on Delay Time | V _{DD} =30V, R _L =30Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω | - | 14 | - | ns |
| T _r | Turn-on Rise Time | | - | 13 | - | |
| t _{d(OFF)} | Turn-off Delay Time | | - | 40 | - | |
| T _f | Turn-off Fall Time | | - | 7.2 | - | |
| Gate Charge Characteristics^b | | | | | | |
| Q _g | Total Gate Charge | V _{DS} =30V, V _{GS} =10V, I _{DS} =40A | - | 45 | - | nC |
| Q _{gs} | Gate-Source Charge | | - | 4 | - | |
| Q _{gd} | Gate-Drain Charge | | - | 15 | - | |

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

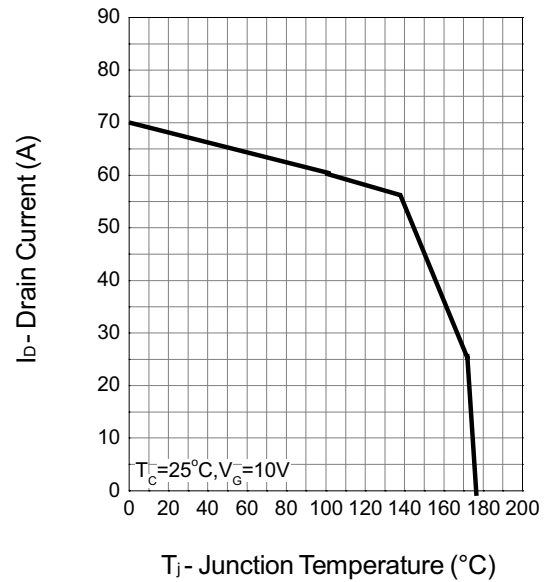
Note b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

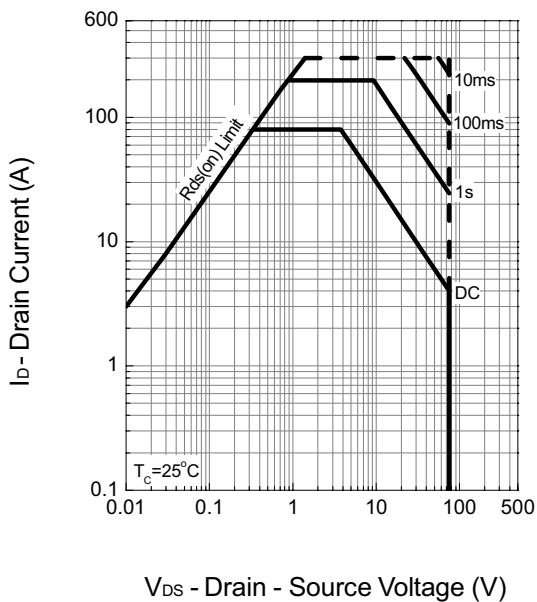
Power Dissipation



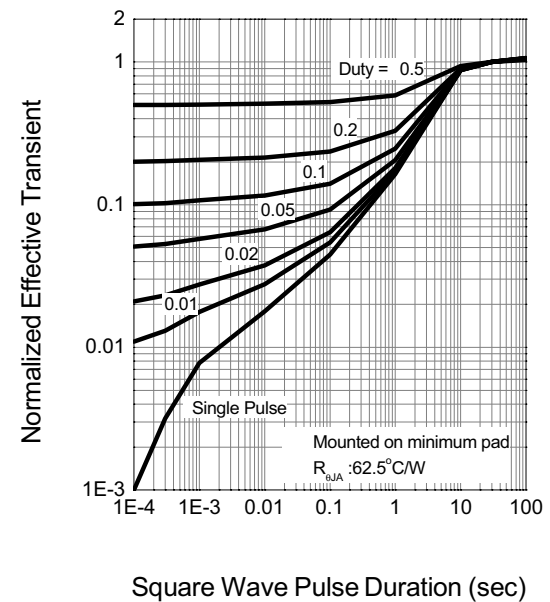
Drain Current



Safe Operation Area

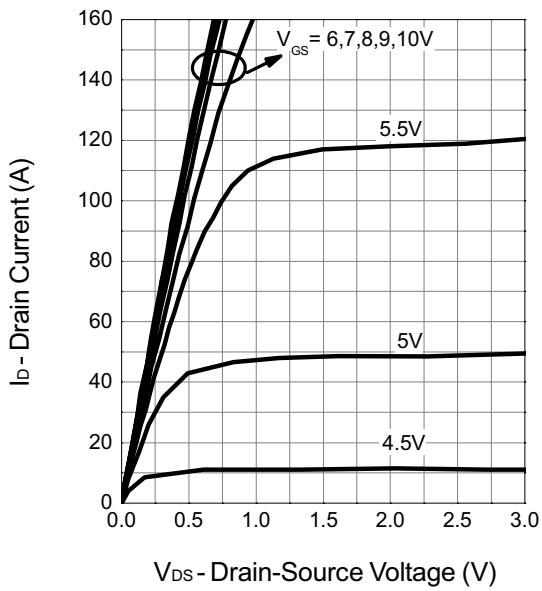


Thermal Transient Impedance

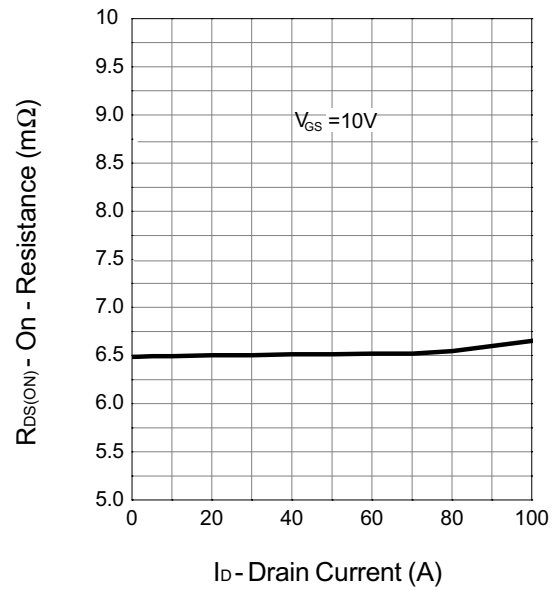


Typical Operating Characteristics (Cont.)

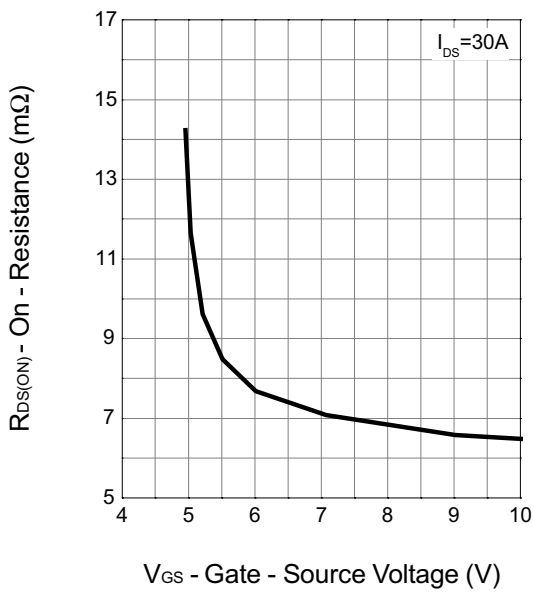
Output Characteristics



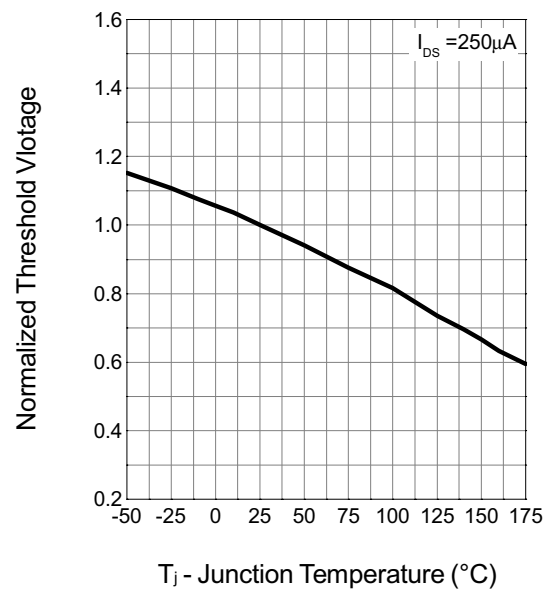
Drain-Source On Resistance



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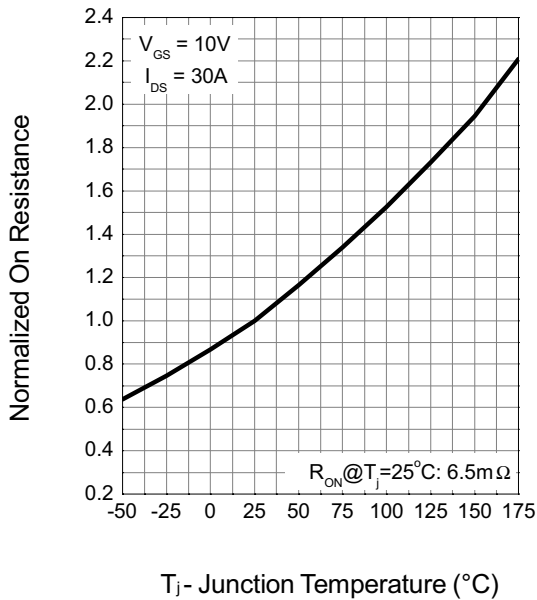


Gate Threshold Voltage

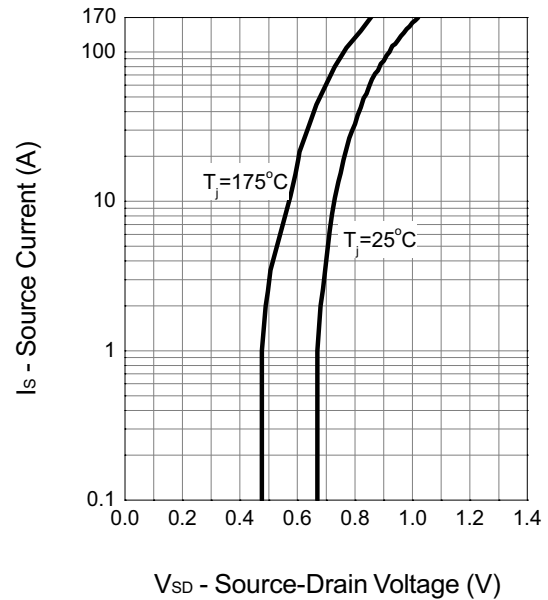


Typical Operating Characteristics (Cont.)

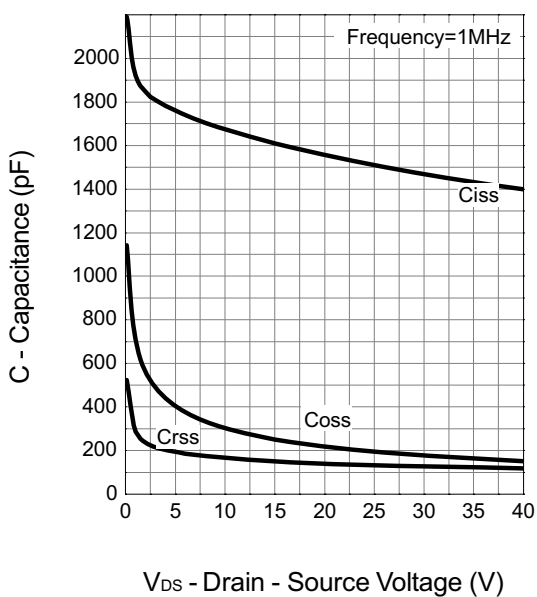
Drain-Source On Resistance



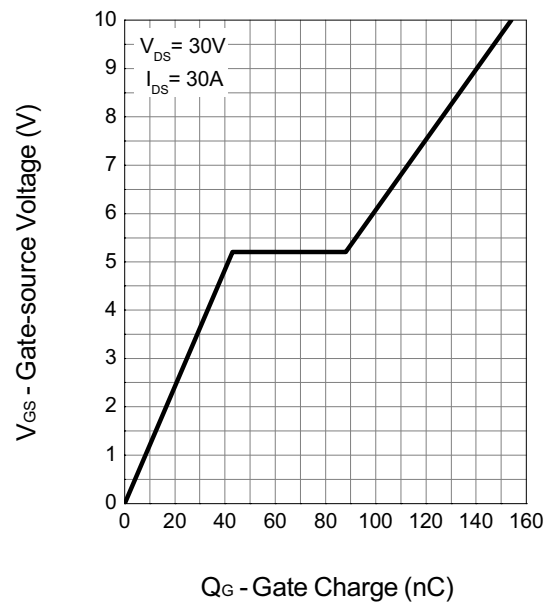
Source-Drain Diode Forward



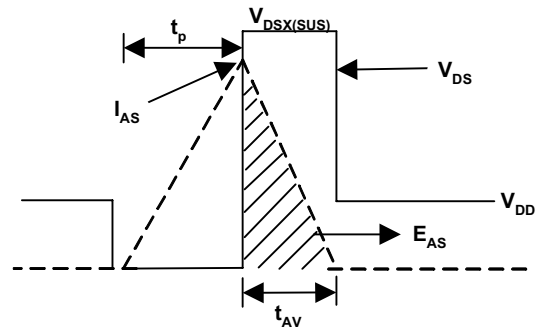
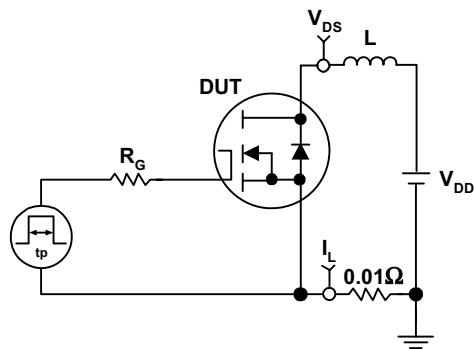
Capacitance



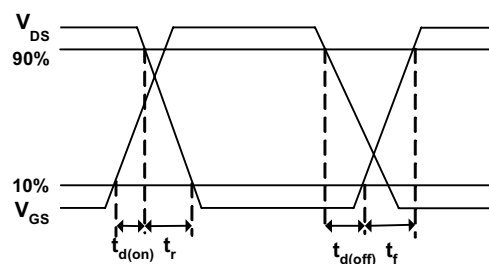
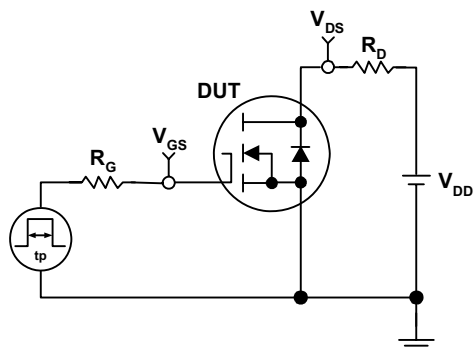
Gate Charge



Avalanche Test Circuit and Waveforms



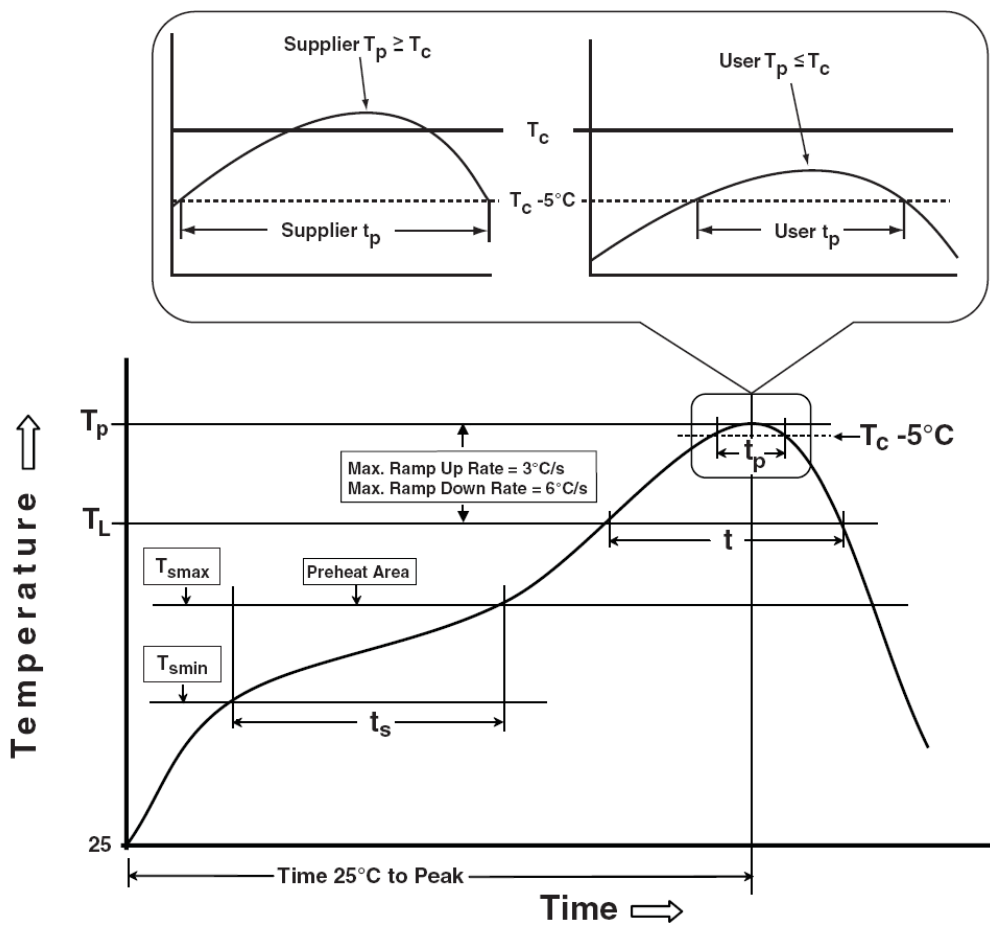
Avalanche Test Circuit and Waveforms



Devices Per Unit

| Package Type | Unit | Quantity |
|--------------|------|----------|
| TO-220 | Tube | 50 |

Classification Profile



Classification Reflow Profiles

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (T_{smin} to T_{smax}) (t_s) | 100 °C 150 °C 60-120 seconds | 150 °C 200 °C 60-120 seconds |
| Average ramp-up rate (T_{smax} to T_p) | 3 °C/second max. | 3°C/second max. |
| Liquidous temperature (T_L) Time at liquidous (t_L) | 183 °C 60-150 seconds | 217 °C 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. | | |

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

| 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 (T_c)

| 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 |