

P-Channel 20-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---------------------|-----------------------------------|---------------------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) ^d | Q _g (Typ.) |
| - 20 | 0.39 at V _{GS} = - 4.5 V | - 0.9 | 0.88 nC |
| | 0.53 at V _{GS} = - 2.5 V | - 0.6 | |

FEATURES

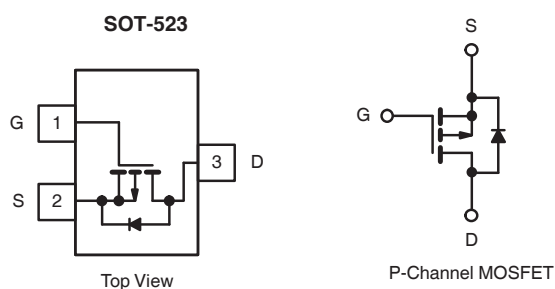
- DT-Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT

APPLICATIONS

- Load Switch for Portable Devices
- DC/DC Converter



| ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted | | | |
|---|-----------------------------------|------------------------|-------|
| Parameter | Symbol | Limit | Unit |
| Drain-Source Voltage | V _{DS} | - 20 | V |
| Gate-Source Voltage | V _{GS} | ± 12 | |
| Continuous Drain Current (T _J = 150 °C) | I _D | T _C = 25 °C | A |
| | | T _C = 70 °C | |
| | | T _A = 25 °C | |
| | | T _A = 70 °C | |
| Pulsed Drain Current (10 μs Pulse Width) | I _{DM} | - 3 | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | - 0.9 |
| | | T _A = 25 °C | |
| Maximum Power Dissipation | P _D | T _C = 25 °C | W |
| | | T _C = 70 °C | |
| | | T _A = 25 °C | |
| | | T _A = 70 °C | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | °C |

| THERMAL RESISTANCE RATINGS | | | | |
|---|-------------------|---------|---------|------|
| Parameter | Symbol | Typical | Maximum | Unit |
| Maximum Junction-to-Ambient ^{a, c} | R _{thJA} | 90 | 110 | °C/W |
| Maximum Junction-to-Foot (Drain) | R _{thJF} | 50 | 65 | |

Notes:

- Surface Mounted on 1" x 1" FR4 board.
- t = 5 s.
- Maximum under Steady State conditions is 175 °C/W.
- T_C = 25 °C.

| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | |
|---|-------------------------|--|------|------|-----------|---------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$ | -20 | | | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = -250\text{ }\mu\text{A}$ | | -20 | | mV/°C |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | -2.5 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$ | -0.5 | | -1.5 | V |
| Gate-Source Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$ | | | -1 | μA |
| | | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | | | -10 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$ | -3 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}, I_D = -0.4\text{ A}$ | | 0.39 | 0.48 | Ω |
| | | $V_{GS} = -2.5\text{ V}, I_D = -0.4\text{ A}$ | | 0.53 | 0.65 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = -10\text{ V}, I_D = -0.4\text{ A}$ | | 7.5 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 190 | | pF |
| Output Capacitance | C_{oss} | | | 22 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 9 | | |
| Total Gate Charge | Q_g | $V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -0.4\text{ A}$ | | 0.88 | | nC |
| Total Gate Charge | Q_g | $V_{DS} = -10\text{ V}, V_{GS} = -2.5\text{ V}, I_D = -0.4\text{ A}$ | | 0.75 | | |
| Gate-Source Charge | Q_{gs} | | | 0.62 | | |
| Gate-Drain Charge | Q_{gd} | | | 0.5 | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | 2 | 10 | 20 | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = -10\text{ V}, R_L = 5\text{ }\Omega$ $I_D \cong -0.04\text{ A}, V_{GEN} = -0.5\text{ V}, R_g = 1\text{ }\Omega$ | | 22 | 40 | ns |
| Rise Time | t_r | | | 20 | 40 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 35 | 72 | |
| Fall Time | t_f | | | 10 | 20 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = -10\text{ V}, R_L = 5\text{ }\Omega$ $I_D \cong -0.04\text{ A}, V_{GEN} = -2.0\text{ V}, R_g = 1\text{ }\Omega$ | | 8 | 16 | |
| Rise Time | t_r | | | 9 | 18 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 33 | 65 | |
| Fall Time | t_f | | | 9 | 18 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | -0.9 | A |
| Pulse Diode Forward Current | I_{SM} | | | | -3 | |
| Body Diode Voltage | V_{SD} | $I_S = -0.5\text{ A}, V_{GS} = 0\text{ V}$ | | -0.8 | -1.2 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = -0.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | | 22 | 35 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 13 | 25 | nC |
| Reverse Recovery Fall Time | t_a | | | 9 | | ns |
| Reverse Recovery Rise Time | t_b | | | 12 | | |

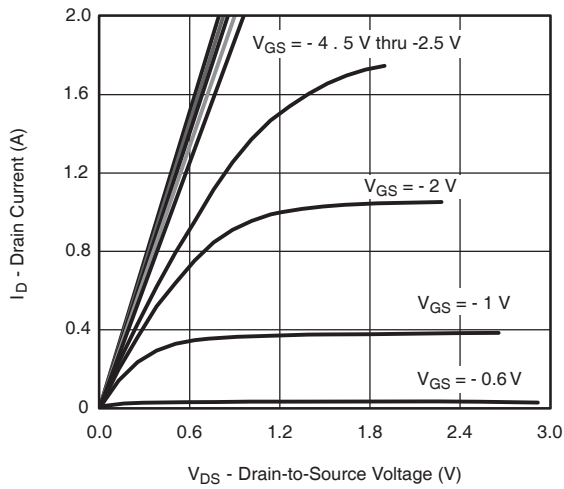
Notes:

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

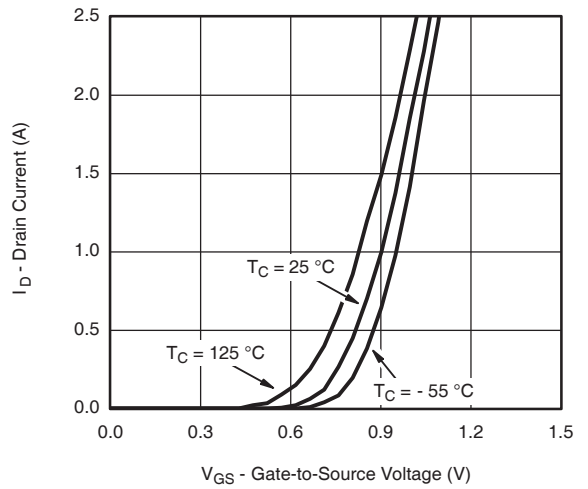
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

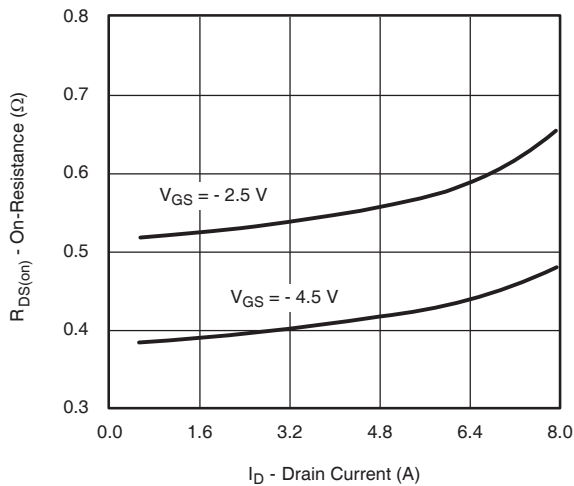
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



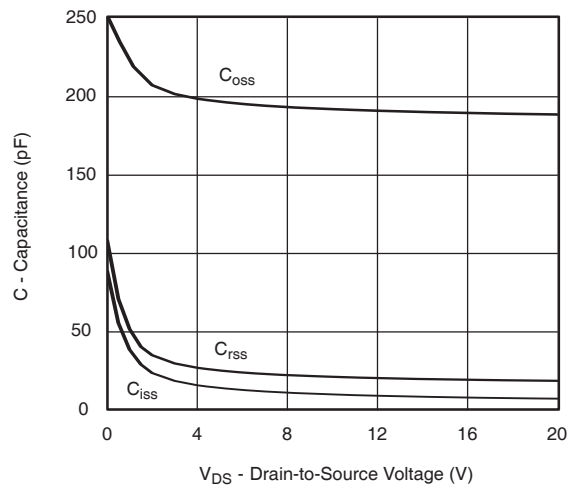
Output Characteristics



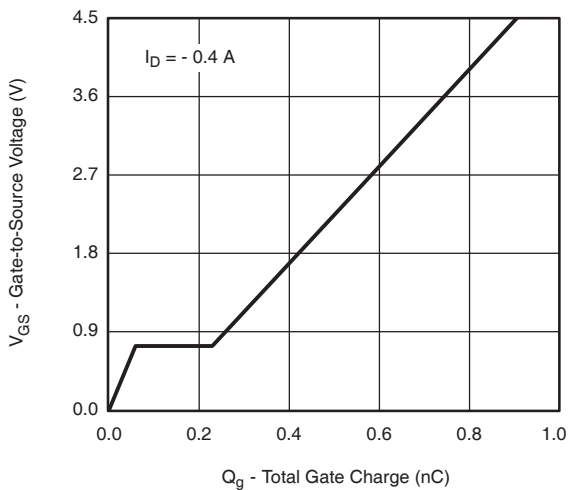
Transfer Characteristics



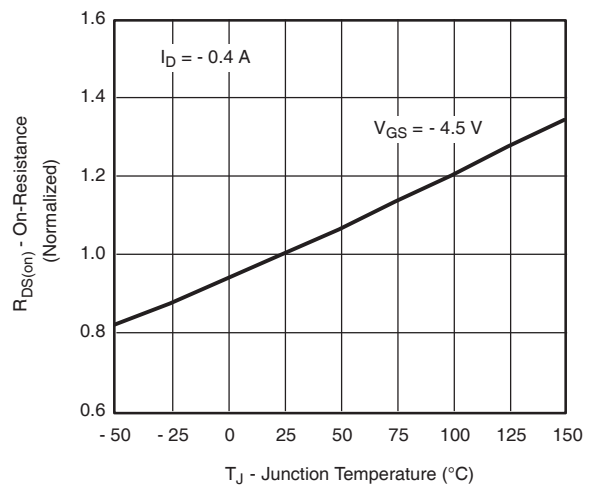
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

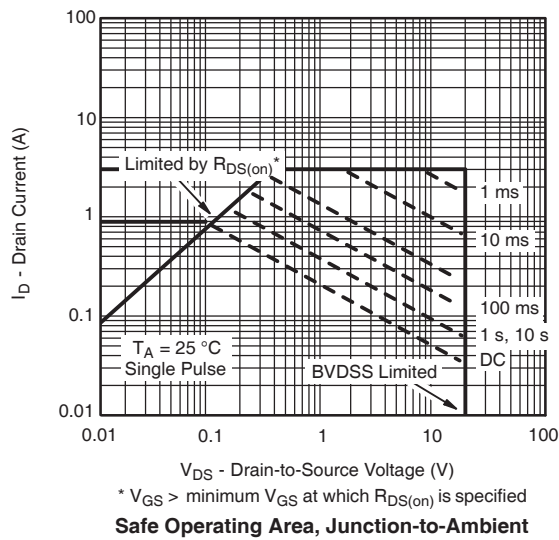
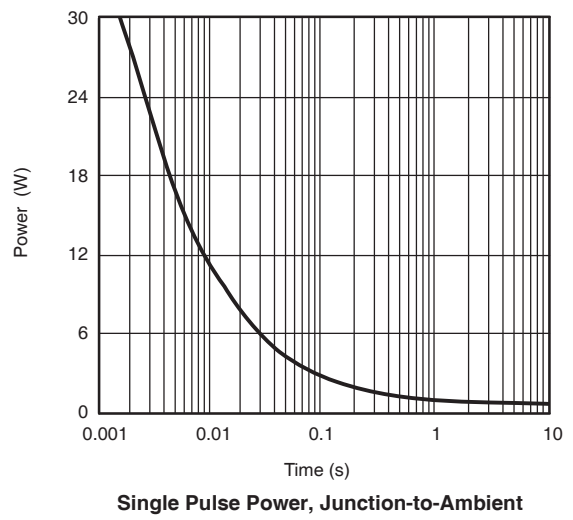
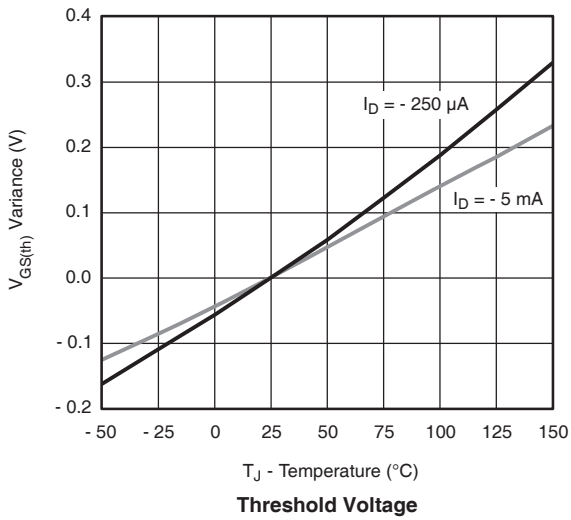
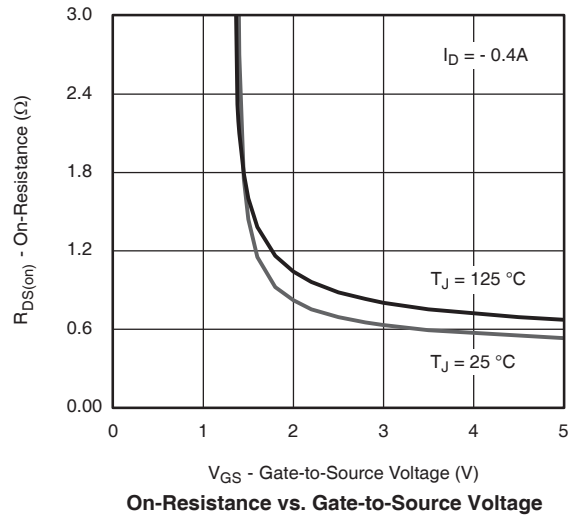
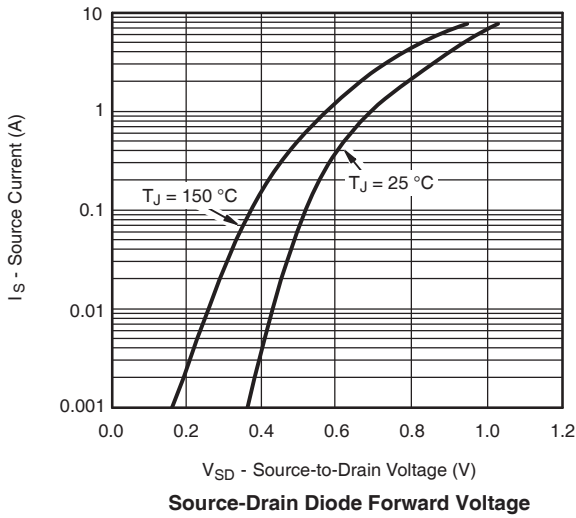


Gate Charge

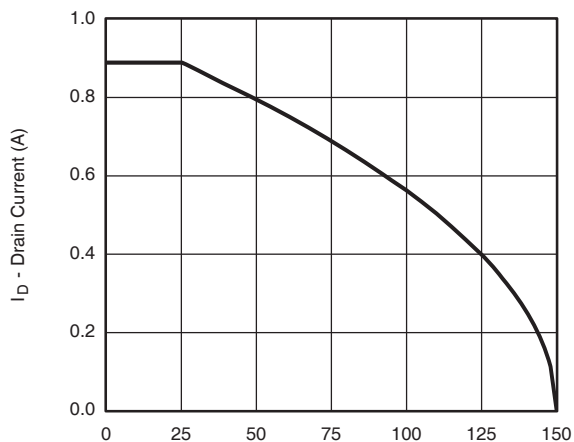


On-Resistance vs. Junction Temperature

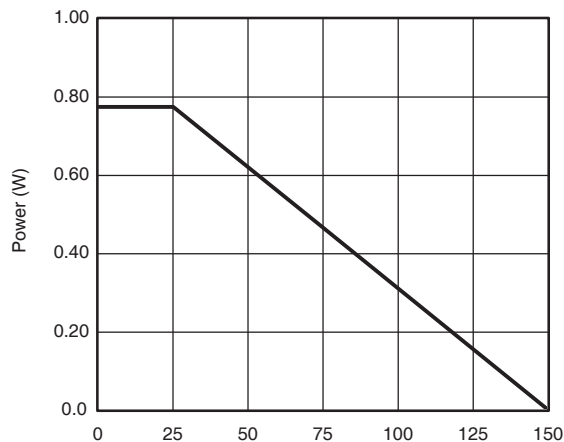
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



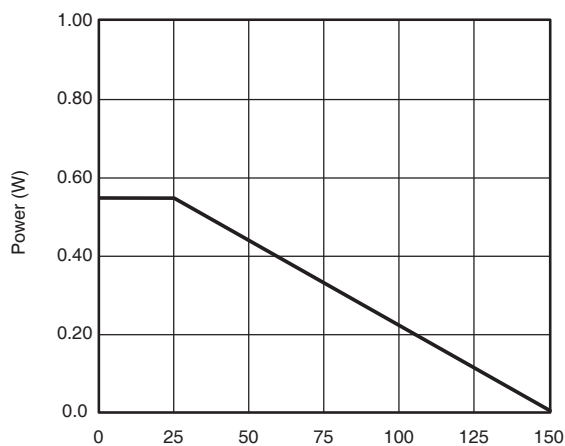
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



T_C - Case Temperature (°C)
Current Derating*



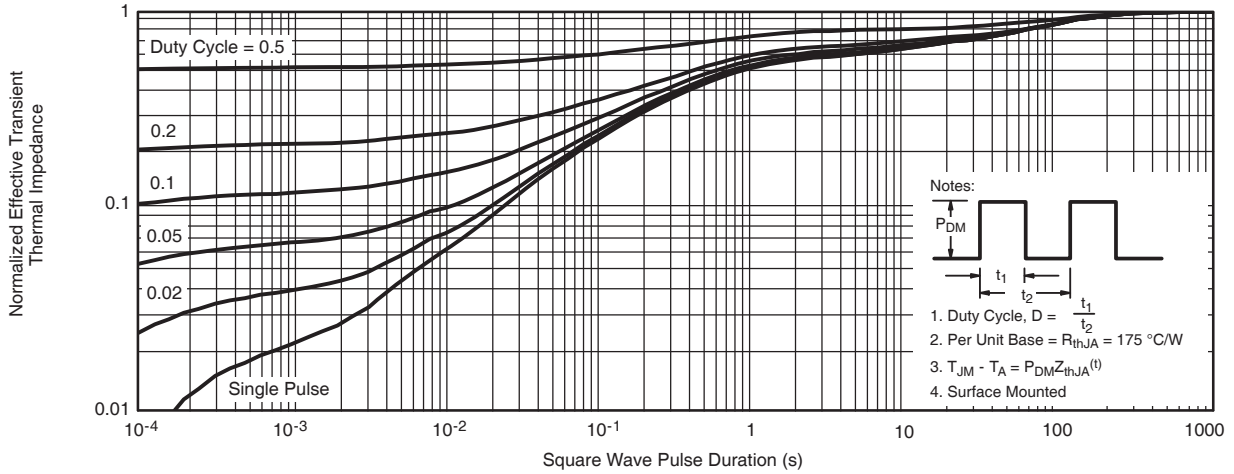
T_C - Case Temperature (°C)
Power Derating, Junction-to-Foot



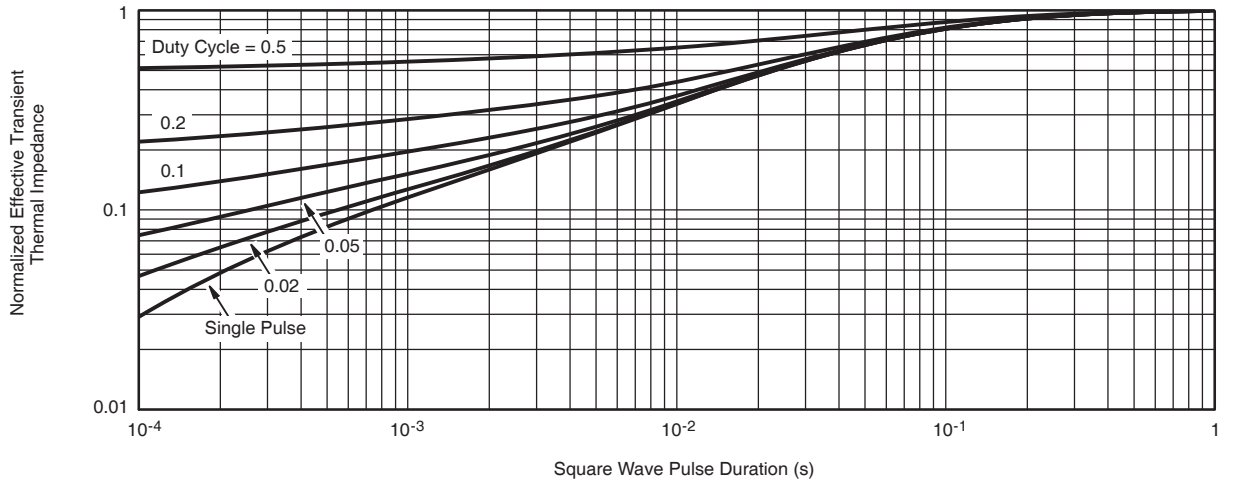
T_A - Ambient Temperature (°C)
Power, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

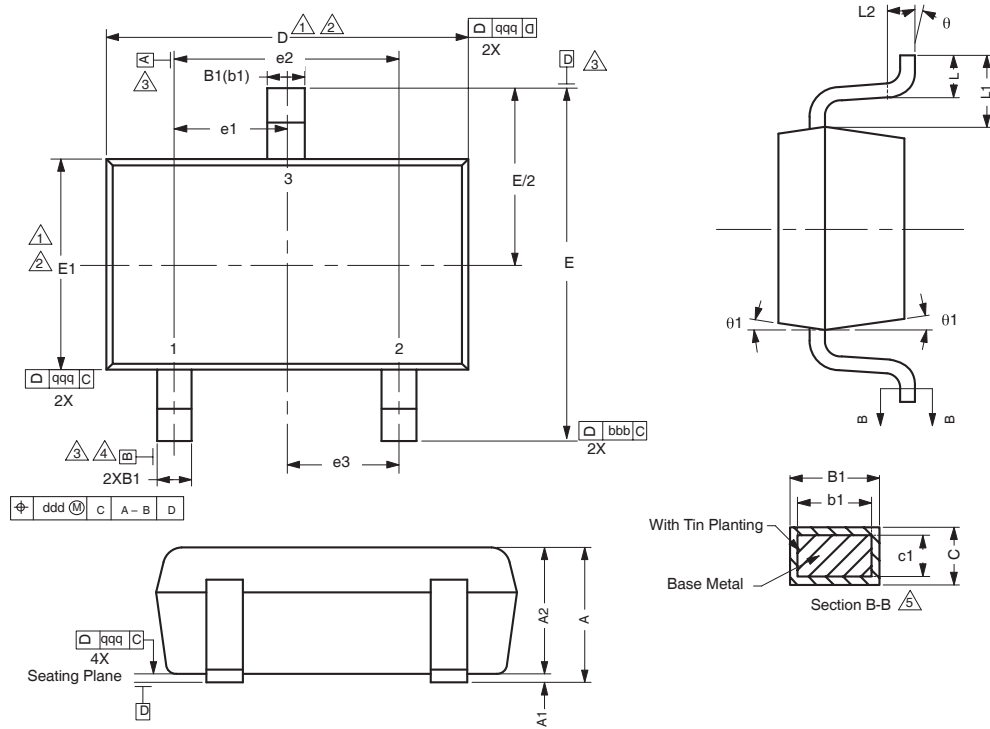


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

SOT-523: 3 Leads



Notes

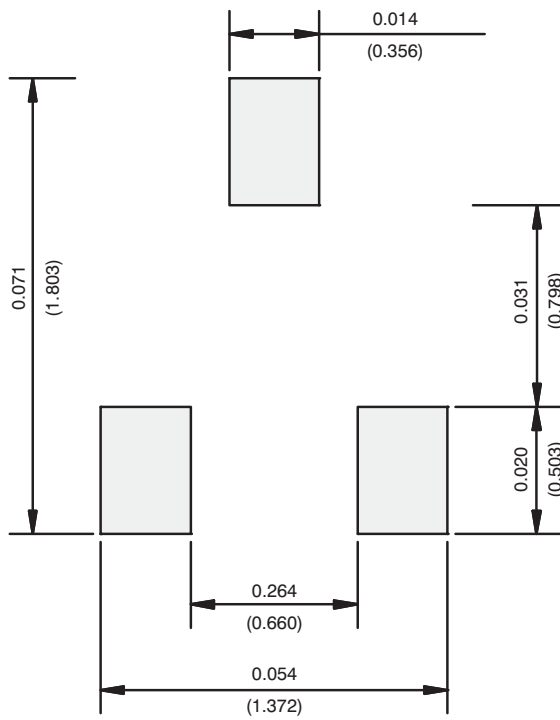
Dimensions in millimeters will govern.

1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E1 does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
2. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. Datums A, B and D to be determined 0.10 mm from the lead tip.
4. Terminal positions are shown for reference only.
5. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

| DIMENSIONS | TOLERANCES |
|------------|------------|
| aaa | 0.10 |
| bbb | 0.10 |
| ccc | 0.10 |
| ddd | 0.10 |

| DIM. | MILLIMETERS | | | NOTE |
|----------------|-------------|-------|------|------|
| | MIN. | NOM. | MAX. | |
| A | - | - | 0.80 | |
| A ₁ | 0.00 | - | 0.10 | |
| A ₂ | 0.65 | 0.70 | 0.80 | |
| B ₁ | 0.19 | - | 0.24 | 5 |
| b ₁ | 0.17 | - | 0.21 | |
| c | 0.13 | - | 0.15 | 5 |
| c ₁ | 0.10 | - | 0.12 | 5 |
| D | 1.48 | 1.575 | 1.68 | 1, 2 |
| E | 1.50 | 1.60 | 1.70 | |
| E ₁ | 0.66 | 0.76 | 0.86 | 1, 2 |
| e ₁ | 0.50 BSC | | | |
| e ₂ | 1.00 BSC | | | |
| e ₃ | 0.50 BSC | | | |
| L | 0.15 | 0.205 | 0.30 | |
| L ₁ | 0.40 ref. | | | |
| L ₂ | 0.15 BSC | | | |
| θ | 0° | - | 8° | |
| θ_1 | 4° | - | 10° | |

RECOMMENDED MINIMUM PADS FOR SOT523: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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