

P-Channel 12 V (D-S) MOSFET

| MOSFET PRODUCT SUMMARY | | | |
|------------------------|------------------------------------|---------------------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) Max. | I _D (A) ^a | Q _g (Typ.) |
| - 12 | 0.028 at V _{GS} = - 4.5 V | - 6 ^e | 9 nC |
| | 0.032 at V _{GS} = - 3.7 V | - 6 ^e | |
| | 0.040 at V _{GS} = - 2.5 V | - 6 ^e | |
| | 0.063 at V _{GS} = - 1.8 V | - 4.5 | |
| | 0.150 at V _{GS} = - 1.5 V | - 3.6 | |

FEATURES

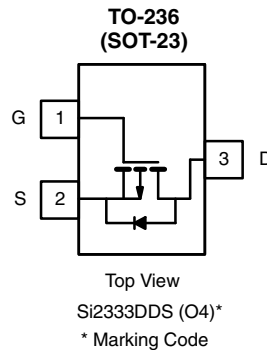
- TrenchFET[®] Power MOSFET
- 100 % R_g Tested
- Material categorization:
For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Smart Phones and Tablet PCs
 - Load Switch
 - Battery Switch



Ordering Information: Si2333DDS-T1-GE3 (Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted) | | | |
|---|-----------------------------------|------------------------|------------------------|
| Parameter | Symbol | Limit | Unit |
| Drain-Source Voltage | V _{DS} | - 12 | V |
| Gate-Source Voltage | V _{GS} | ± 8 | |
| Continuous Drain Current (T _J = 150 °C) | I _D | T _C = 25 °C | - 6 ^e |
| | | T _C = 70 °C | - 5.2 |
| | | T _A = 25 °C | - 5 ^{b, c} |
| | | T _A = 70 °C | - 4 ^{b, c} |
| Pulsed Drain Current (t = 300 μs) | I _{DM} | - 20 | A |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | |
| | | T _A = 25 °C | - 0.63 ^{b, c} |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 1.7 |
| | | T _C = 70 °C | 1.1 |
| | | T _A = 25 °C | 1.20 ^{b, c} |
| | | T _A = 70 °C | 0.6 ^{b, 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 ^{b, d} | R _{thJA} | 100 | 130 | °C/W | |
| Maximum Junction-to-Foot (Drain) | R _{thJF} | 60 | 75 | | |

Notes:

- Based on T_C = 25 °C.
- Surface mounted on 1" x 1" FR4 board.
- t = 5 s.
- Maximum under steady state conditions is 175 °C/W.
- Package limited.

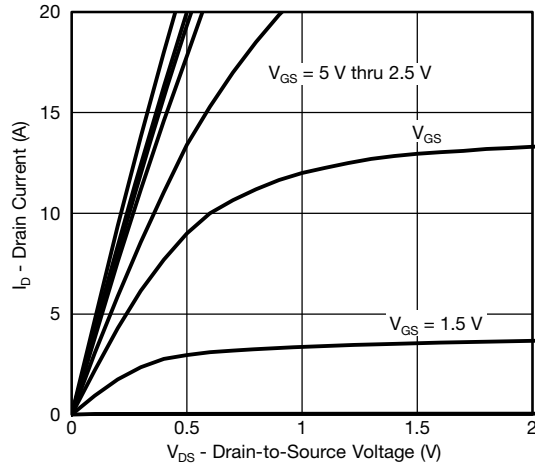
| MOSFET SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | |
|--|-------------------------|---|------|-------|-----------|----------------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{DS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$ | -12 | | | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = -250\text{ }\mu\text{A}$ | | -8 | | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | 2.4 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$ | -0.4 | | -1 | 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} | $V_{DS} = -12\text{ V}$, $V_{GS} = 0\text{ V}$ | | | -1 | μA |
| | | $V_{DS} = -12\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^\circ\text{C}$ | | | -10 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \leq -5\text{ V}$, $V_{GS} = -4.5\text{ V}$ | -20 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}$, $I_D = -5\text{ A}$ | | 0.023 | 0.028 | Ω |
| | | $V_{GS} = -3.7\text{ V}$, $I_D = -4.6\text{ A}$ | | 0.026 | 0.032 | |
| | | $V_{GS} = -2.5\text{ V}$, $I_D = -4.3\text{ A}$ | | 0.033 | 0.040 | |
| | | $V_{GS} = -1.8\text{ V}$, $I_D = -1\text{ A}$ | | 0.048 | 0.063 | |
| | | $V_{GS} = -1.5\text{ V}$, $I_D = -0.5\text{ A}$ | | 0.075 | 0.150 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = -5\text{ V}$, $I_D = -5\text{ A}$ | | 18 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -6\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | | 1275 | | pF |
| Output Capacitance | C_{oss} | | | 255 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 236 | | |
| Total Gate Charge | Q_g | $V_{DS} = -6\text{ V}$, $V_{GS} = -8\text{ V}$, $I_D = -5\text{ A}$ | | 23 | 35 | nC |
| | | $V_{DS} = -6\text{ V}$, $V_{GS} = -4.5\text{ V}$, $I_D = -5\text{ A}$ | | 14 | 21 | |
| Q_{gs} | | | 2.3 | | | |
| Q_{gd} | | | 3.6 | | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | 1.9 | 9.5 | 19 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = -6\text{ V}$, $R_L = 6\text{ }\Omega$ $I_D = -4\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_G = 1\text{ }\Omega$ | | 26 | 40 | ns |
| Rise Time | t_r | | | 24 | 40 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 45 | 70 | |
| Fall Time | t_f | | | 20 | 35 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | -1.4 | A |
| Pulse Diode Forward Current ^a | I_{SM} | | | | -20 | |
| Body Diode Voltage | V_{SD} | $I_S = -4\text{ A}$ | | -0.8 | -1.2 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = -4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^\circ\text{C}$ | | 24 | 48 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 8 | 16 | nC |
| Reverse Recovery Fall Time | t_a | | | 9 | | ns |
| Reverse Recovery Rise Time | t_b | | | 15 | | |

Notes:

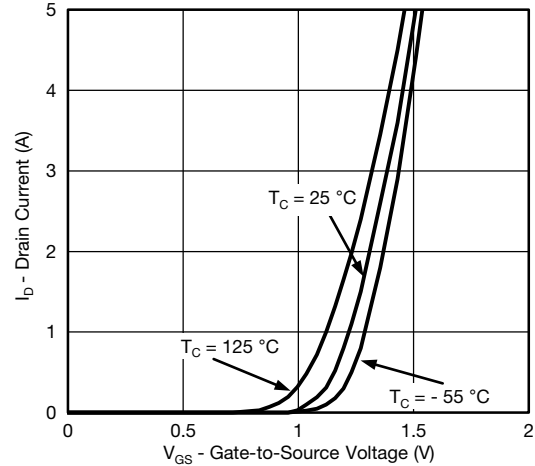
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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.

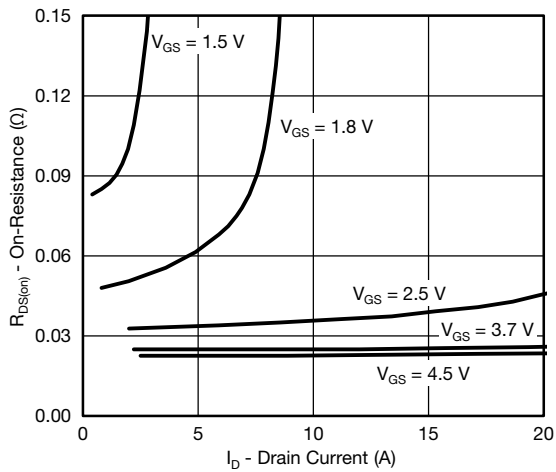
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



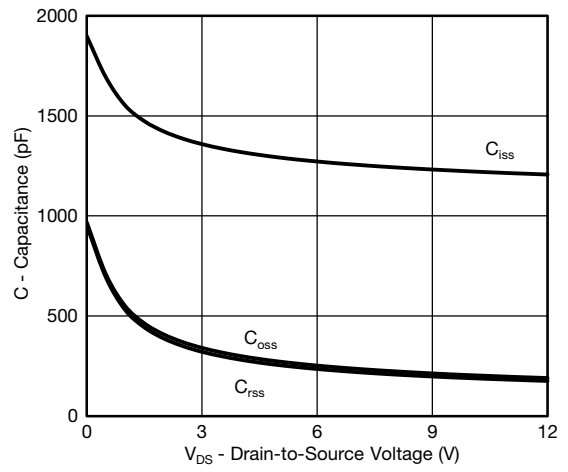
Output Characteristics



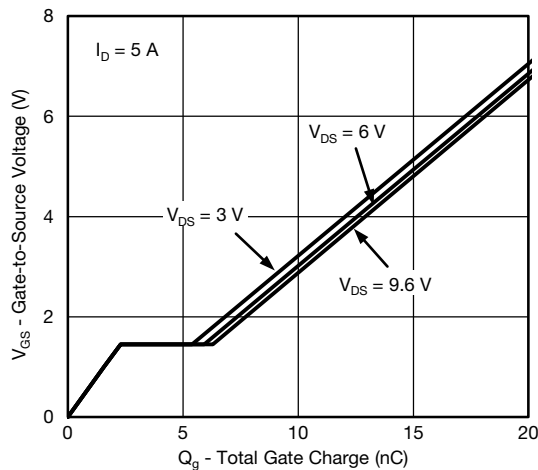
Transfer Characteristics



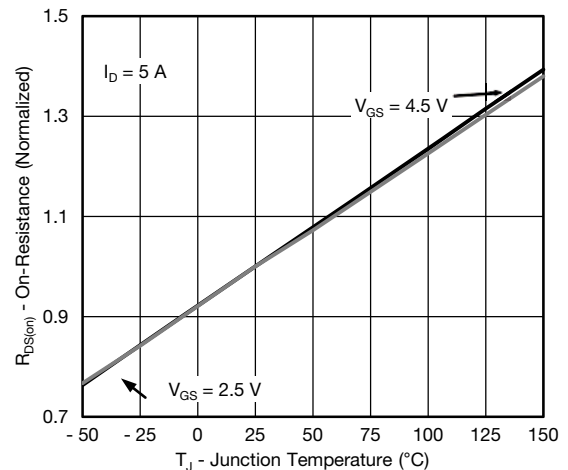
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

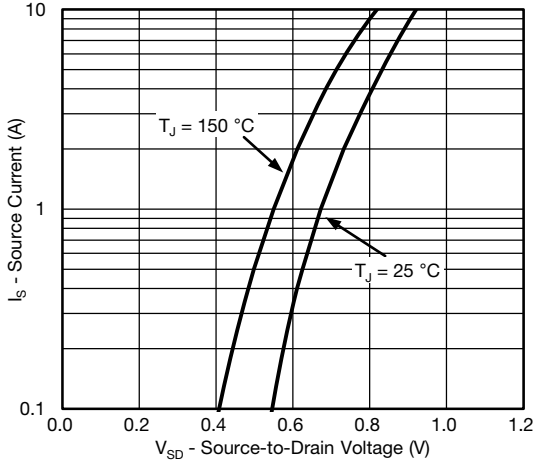


Gate Charge

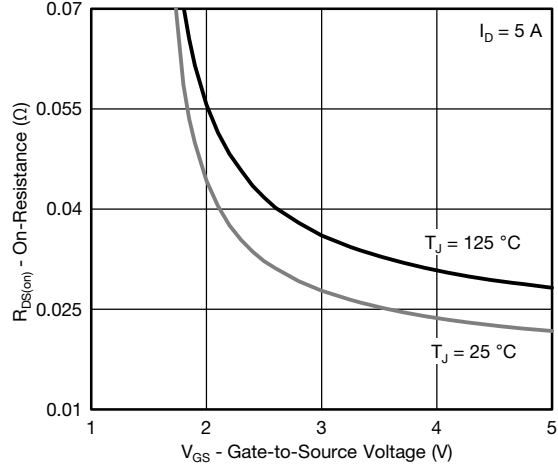


On-Resistance vs. Junction Temperature

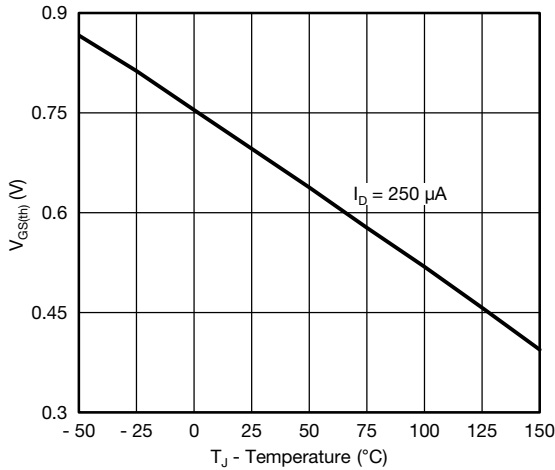
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



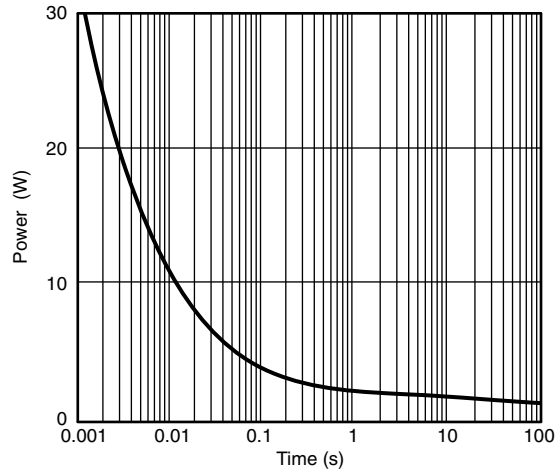
Source-Drain Diode Forward Voltage



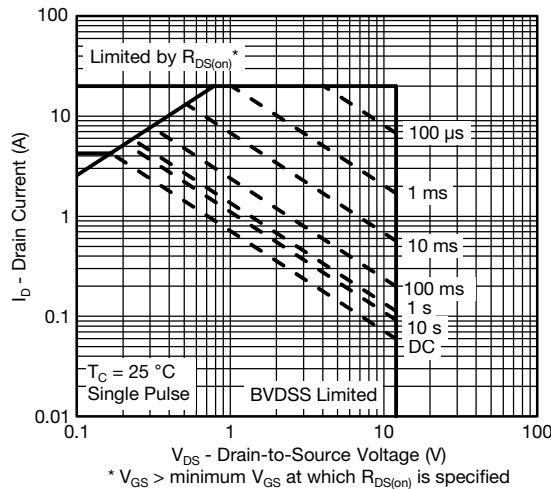
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

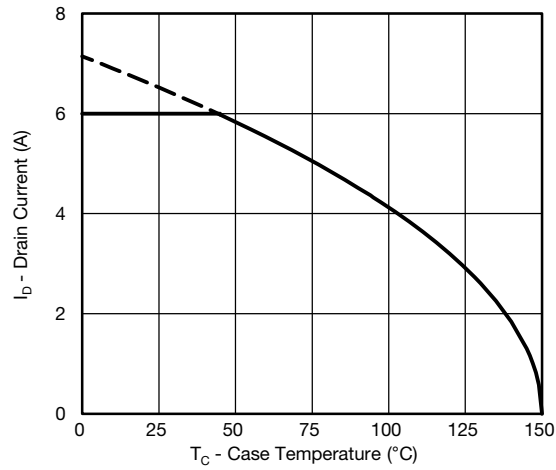


Single Pulse Power

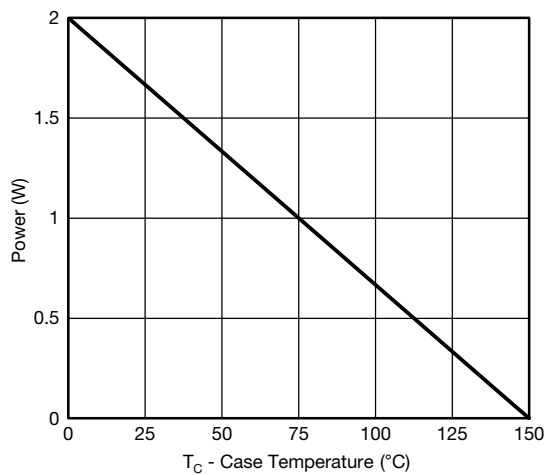


Safe Operating Area

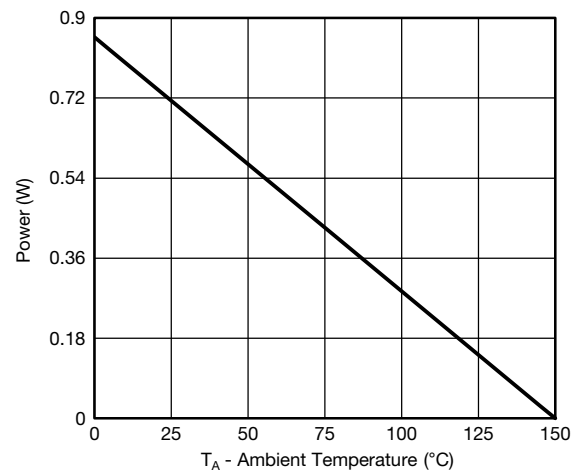
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



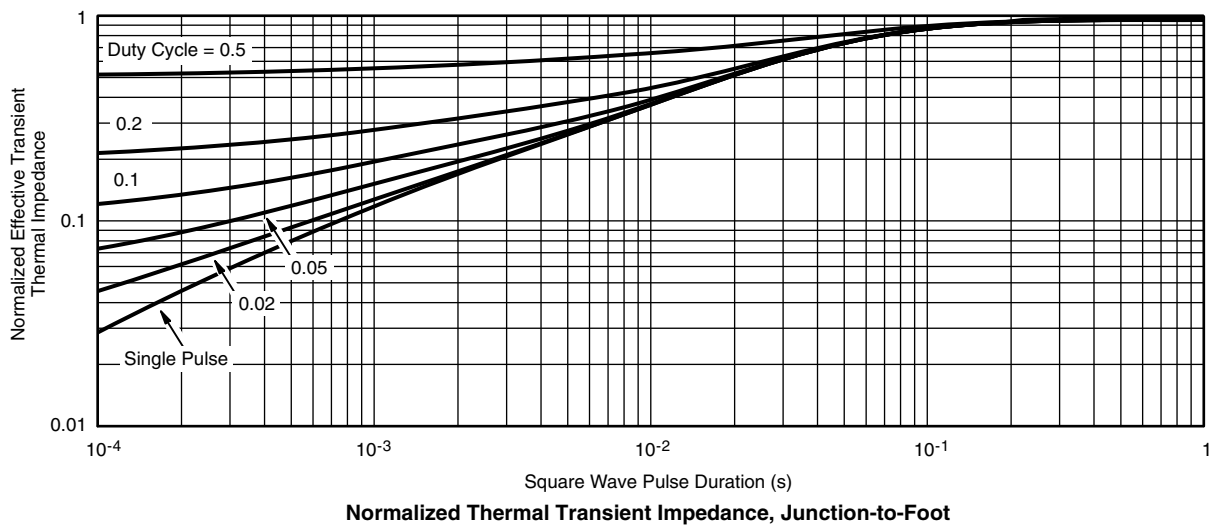
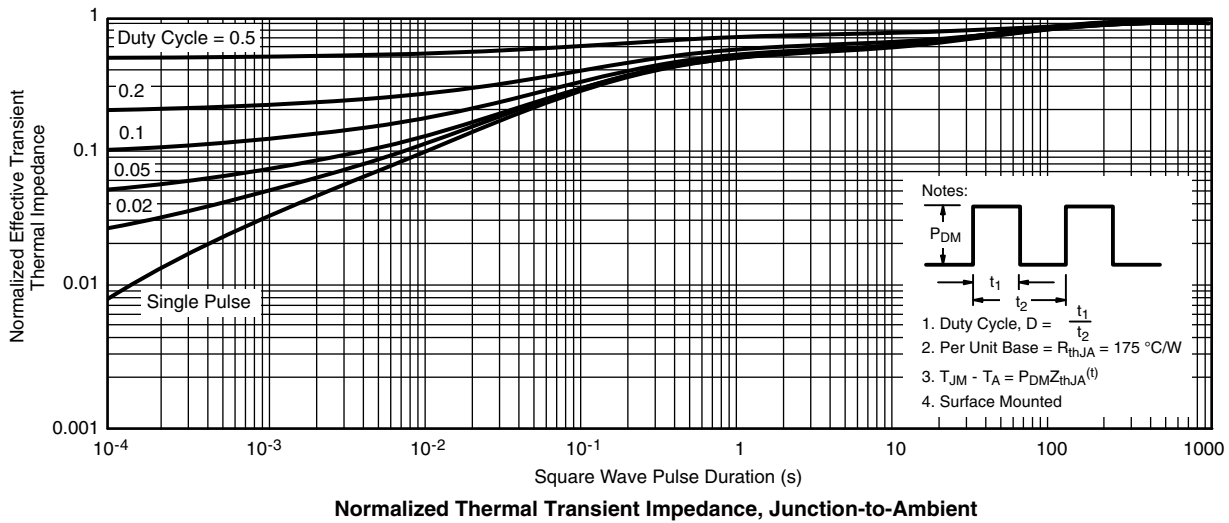
Power, Junction-to-Case



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)



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SOT-23 (TO-236): 3-LEAD



| Dim | MILLIMETERS | | INCHES | |
|----------------|-------------|------|------------|-------|
| | Min | Max | Min | Max |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| A ₁ | 0.01 | 0.10 | 0.0004 | 0.004 |
| A ₂ | 0.88 | 1.02 | 0.0346 | 0.040 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.085 | 0.18 | 0.003 | 0.007 |
| D | 2.80 | 3.04 | 0.110 | 0.120 |
| E | 2.10 | 2.64 | 0.083 | 0.104 |
| E ₁ | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 0.95 BSC | | 0.0374 Ref | |
| e ₁ | 1.90 BSC | | 0.0748 Ref | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| L ₁ | 0.64 Ref | | 0.025 Ref | |
| S | 0.50 Ref | | 0.020 Ref | |
| q | 3° | 8° | 3° | 8° |

ECN: S-03946-Rev. K, 09-Jul-01
 DWG: 5479

RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads
Dimensions in Inches/(mm)

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