

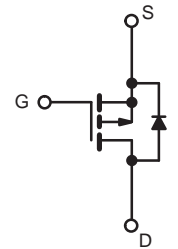
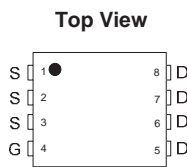
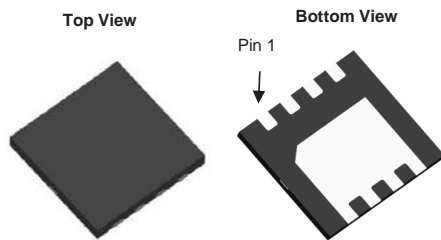
P-Channel 60 V (D-S) MOSFET



RoHS
COMPLIANT

| PRODUCT SUMMARY | | | |
|---------------------|------------------------------------|--------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) Max. | I _D (A) | Q _g (Typ.) |
| - 60 | 0.050 at V _{GS} = - 10 V | - 12 ^d | 20 nC |
| | 0.060 at V _{GS} = - 4.5 V | - 9 ^d | |

DFN 3x3 EP



P-Channel MOSFET

FEATURES

- DT-Trench Power MOSFET
- Low On-Resistance for Low Voltage Drop
- 100 % R_g and UIS Tested

APPLICATIONS

- Battery, Load and Adaptor Switches
 - Notebook Computers
 - Notebook Battery Packs

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|--|-----------------------------------|------------------------|-----------------------|
| Drain-Source Voltage | V _{DS} | - 60 | V |
| Gate-Source Voltage | V _{GS} | ± 20 | |
| Continuous Drain Current (T _J = 150 °C) | I _D | T _C = 25 °C | - 12 ^d |
| | | T _C = 70 °C | - 9 |
| | | T _A = 25 °C | - 4.1 ^{a, b} |
| | | T _A = 70 °C | - 2.5 ^{a, b} |
| Pulsed Drain Current (t = 100 μs) | I _{DM} | - 48 | A |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | - 12 ^d |
| | | T _A = 25 °C | - 1.1 ^{a, b} |
| Avalanche Current | I _{AS} | - 18 | |
| Single-Pulse Avalanche Energy | E _{AS} | 15 | mJ |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 42 |
| | | T _C = 70 °C | 13 |
| | | T _A = 25 °C | 3.2 ^{a, b} |
| | | T _A = 70 °C | 2.1 ^{a, b} |
| 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} | 21 | 30 | °C/W |
| Maximum Junction-to-Case | R _{thJC} | 2.1 | 2.7 | |

Notes:

- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- Maximum under steady state conditions is 70 °C/W.
- Package limited.
- The DFN3X3 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

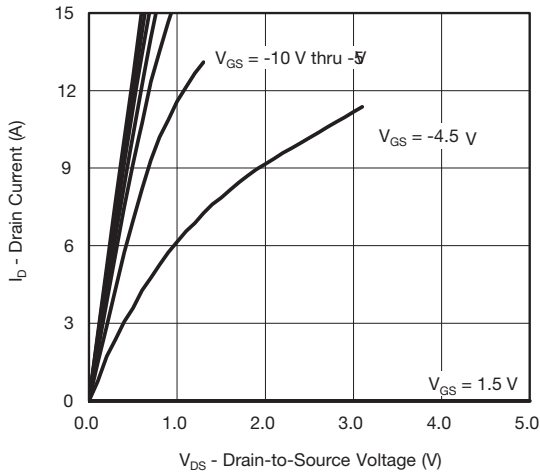
| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | |
|--|-------------------------|---|------|-------|-----------|---------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0, I_D = -250\text{ }\mu\text{A}$ | -60 | | | 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 | $\Delta V_{GS(th)}/T_J$ | | | 3.6 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$ | -1 | | -3 | V |
| Gate-Source Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}$ | | | -1 | μA |
| | | $V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | | | -5 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq -10\text{ V}, V_{GS} = -10\text{ V}$ | -48 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -5\text{ A}$ | | 0.050 | 0.056 | Ω |
| | | $V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$ | | 0.060 | 0.067 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = -10\text{ V}, I_D = -5\text{ A}$ | | 20 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 1750 | | pF |
| Output Capacitance | C_{oss} | | | 596 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 393 | | |
| Total Gate Charge | Q_g | $V_{DS} = -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$ | | 20 | | nC |
| | | | | 15.1 | | |
| Gate-Source Charge | Q_{gs} | $V_{DS} = -48\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$ | | 8.6 | | |
| Gate-Drain Charge | Q_{gd} | | | 28.8 | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | | 1.3 | | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DS} = -48\text{ V}, R_L = 3.5\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$ | | 12 | | ns |
| Rise Time | t_r | | | 10 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 29 | | |
| Fall Time | t_f | | | 7 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = -48\text{ V}, R_L = 3.5\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$ | | 29 | | |
| Rise Time | t_r | | | 30 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 22 | | |
| Fall Time | t_f | | | 17 | | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | -12 | A |
| Pulse Diode Forward Current (100 μs) | I_{SM} | | | | -48 | |
| Body Diode Voltage | V_{SD} | $I_S = -3\text{ A}, V_{GS} = 0$ | | -0.7 | -1 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = -5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | | 21 | | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 50 | | nC |
| Reverse Recovery Fall Time | t_a | | | 9 | | ns |
| Reverse Recovery Rise Time | t_b | | | 14 | | |

Notes:

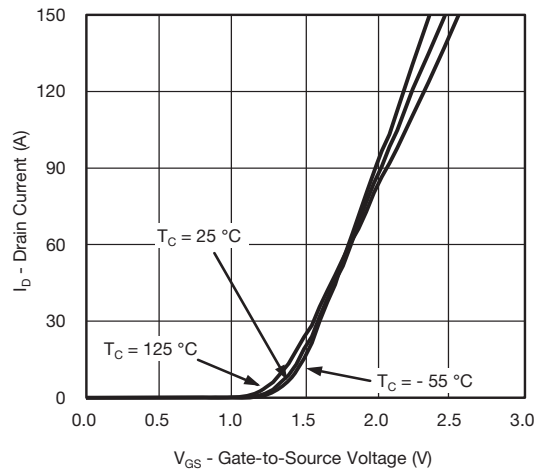
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.

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.

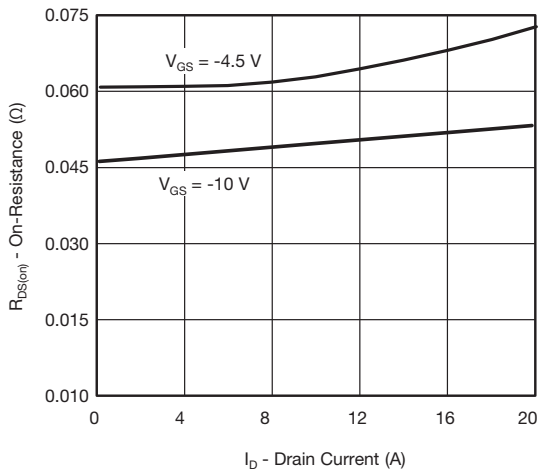
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



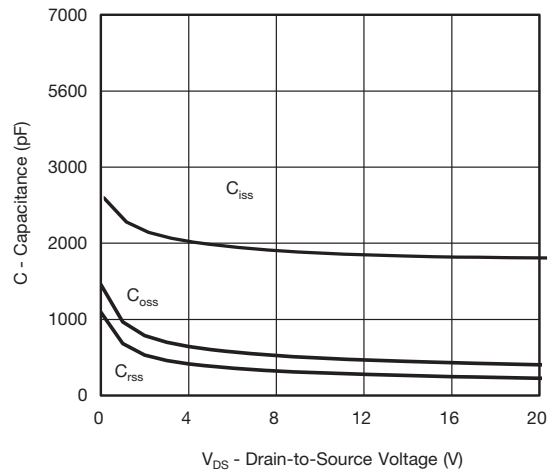
Output Characteristics



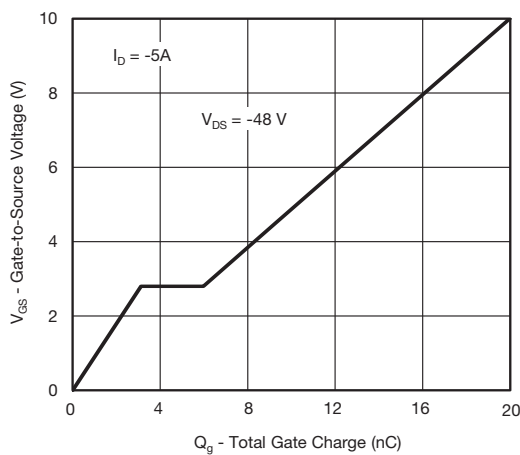
Transfer Characteristics



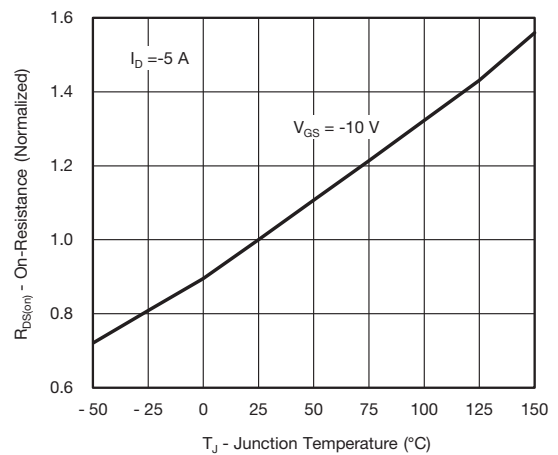
On-Resistance vs. Drain Current



Capacitance

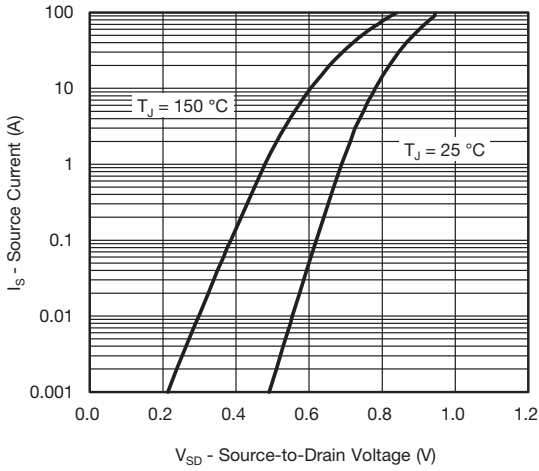


Gate Charge

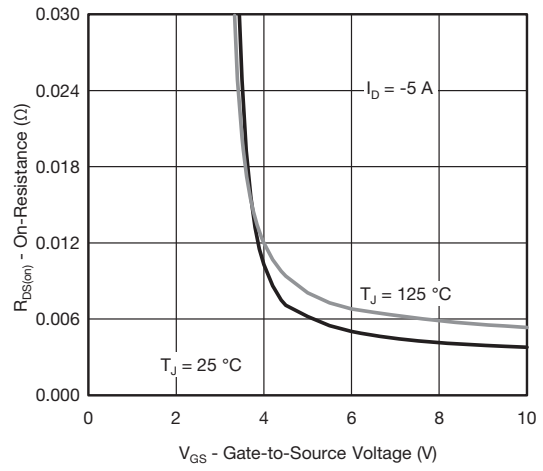


On-Resistance vs. Junction Temperature

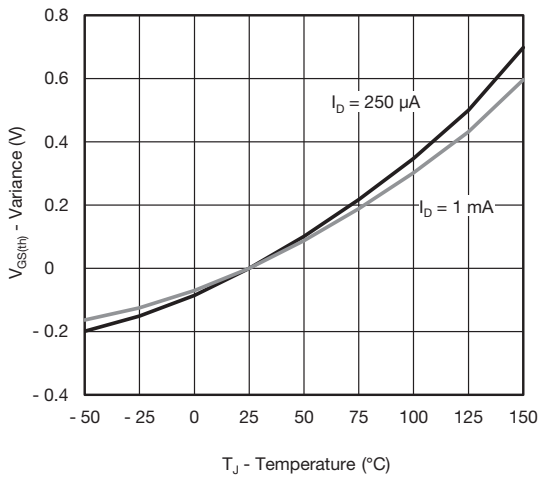
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



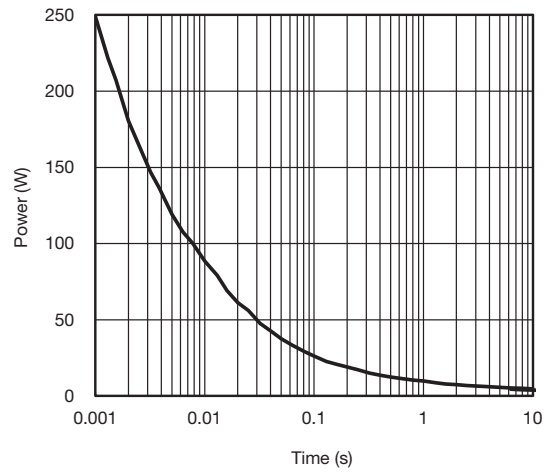
Source-Drain Diode Forward Voltage



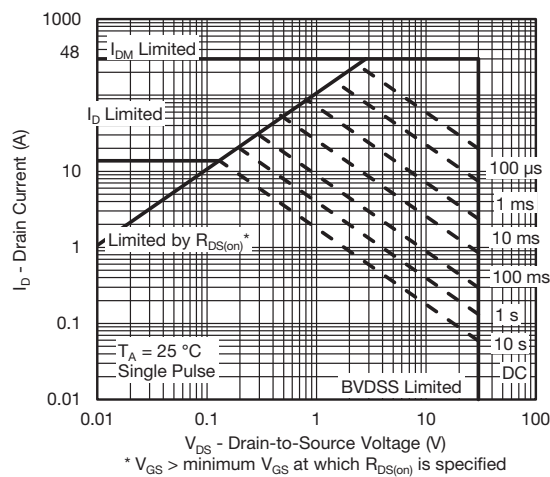
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



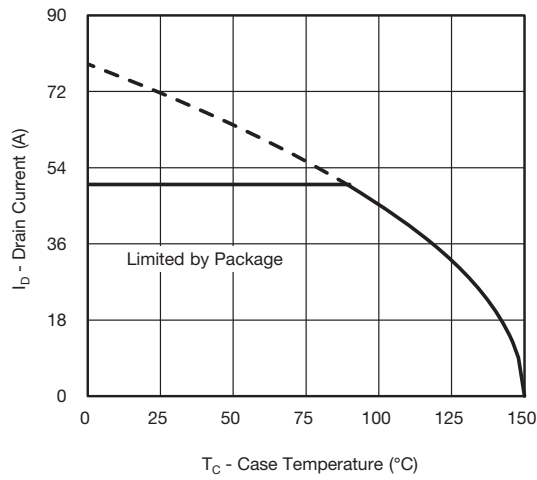
Single Pulse Power, Junction-to-Ambient



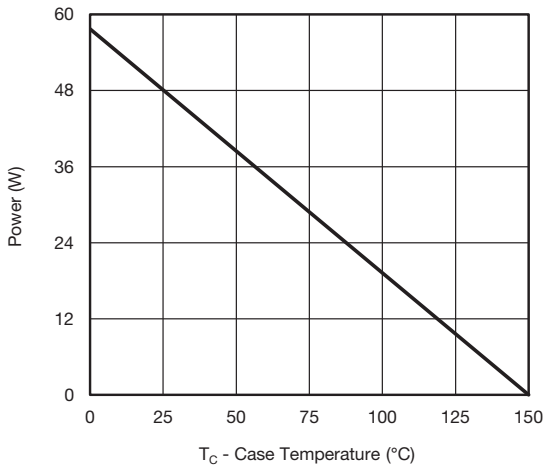
Safe Operating Area

* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

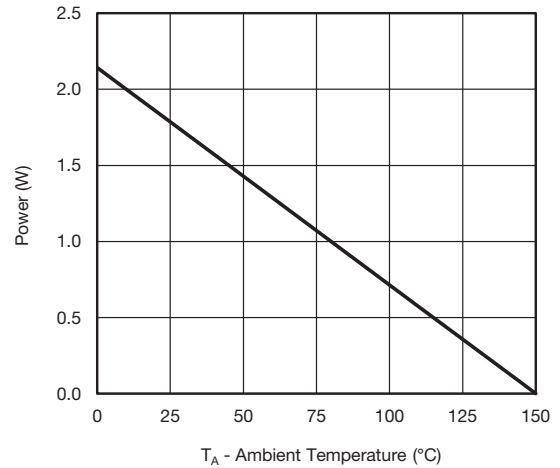
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



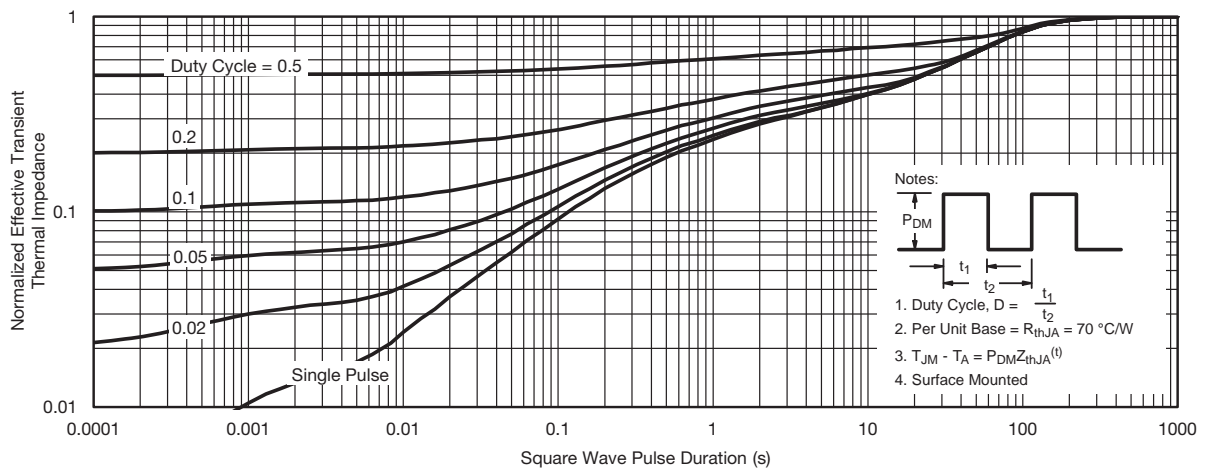
Power, Junction-to-Case



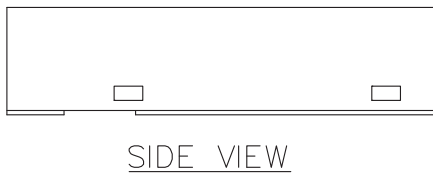
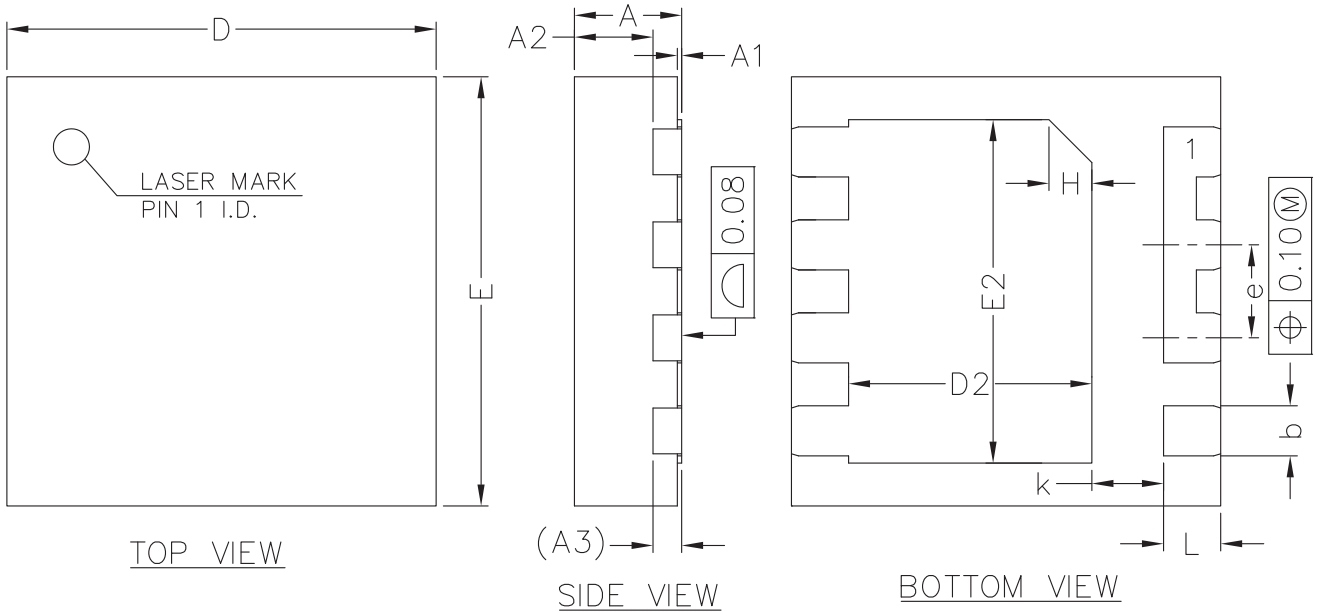
Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, 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



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|--------|---------|------|------|
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | 0.50 | 0.55 | 0.60 |
| A3 | 0.20REF | | |
| b | 0.30 | 0.35 | 0.40 |
| D | 2.90 | 3.00 | 3.10 |
| E | 2.90 | 3.00 | 3.10 |
| D2 | 1.60 | 1.70 | 1.80 |
| E2 | 2.30 | 2.40 | 2.50 |
| e | 0.55 | 0.65 | 0.75 |
| K | 0.40 | 0.50 | 0.60 |
| L | 0.35 | 0.40 | 0.45 |

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