

N-Channel 60 V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---------------------|-----------------------------------|------------------------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) ^{a, e} | Q _g (Typ.) |
| 60 | 0.0066 at V _{GS} = 10 V | 56 | 53 nC |
| | 0.0097 at V _{GS} = 4.5 V | 33 | |

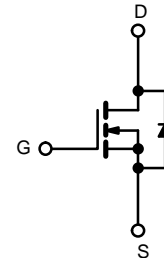
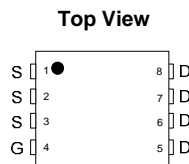
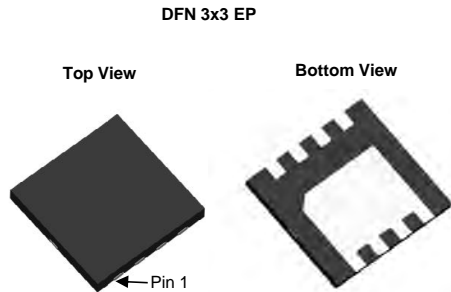
FEATURES

- DT-Trench Power MOSFET
- 100 % R_g and UIS Tested



APPLICATIONS

- Notebook PC Core
- VRM/POL



N-Channel MOSFET

| 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 = 175 °C) | I _D | T _C = 25 °C | 56 ^{a, e} | A |
| | | T _C = 70 °C | 48 ^e | |
| | | T _A = 25 °C | 24 ^{b, c} | |
| | | T _A = 70 °C | 15 ^{b, c} | |
| Pulsed Drain Current | I _{DM} | 224 | | |
| Avalanche Current Pulse | L = 0.1 mH | I _{AS} | 50 | mJ |
| Single Pulse Avalanche Energy | | E _{AS} | 55 | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | 50 ^{a, e} | A |
| | | T _A = 25 °C | 33 ^{b, c} | |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 39 | W |
| | | T _C = 70 °C | 20 | |
| | | T _A = 25 °C | 3.9 ^{b, c} | |
| | | T _A = 70 °C | 2.13 ^{b, c} | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 175 | °C | |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|-------------------|---------|---------|------|--|
| Parameter | Symbol | Typical | Maximum | Unit | |
| Maximum Junction-to-Ambient ^{b, d} | R _{thJA} | 30 | 40 | °C/W | |
| Maximum Junction-to-Case | | | | | |

Notes:

- a. Based on T_C = 25 °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 10 s.
- d. Maximum under steady state conditions is 90 °C/W.
- e. Calculated based on maximum junction temperature. Package limitation current is 80 A.

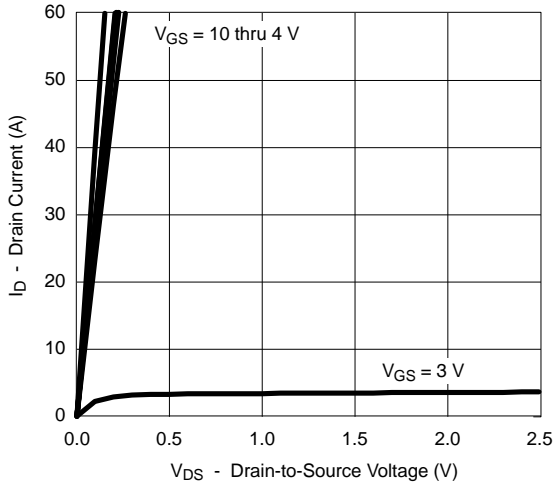
| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | |
|--|-------------------------|--|-------|--------|-----------|----------------------|
| Parameter | Symbol | Test Conditions | Min . | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 60 | | | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ | | 35 | | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | - 5.5 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 1.0 | | 3.0 | 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 |
| | | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | | | 10 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$ | 56 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 12\text{ A}$ | | 0.0066 | 0.0079 | Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 9\text{ A}$ | | 0.0097 | 0.0128 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 48\text{ V}, I_D = 12\text{ A}$ | | 90 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 3100 | | pF |
| Output Capacitance | C_{oss} | | | 998 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 508 | | |
| Total Gate Charge | Q_g | $V_{DS} = 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 12\text{ A}$ | | 71 | | nC |
| | | $V_{DS} = 48\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 9\text{ A}$ | | 61.5 | | |
| Gate-Source Charge | Q_{gs} | | | 34 | | |
| Gate-Drain Charge | Q_{gd} | | 29 | | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | | 1.4 | 2.1 | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 48\text{ V}, R_L = 0.555\text{ }\Omega$ $I_D \cong 7\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$ | | 18 | 27 | ns |
| Rise Time | t_r | | | 11 | 17 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 70 | 105 | |
| Fall Time | t_f | | | 10 | 15 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 48\text{ V}, R_L = 0.625\text{ }\Omega$ $I_D \cong 4\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ | | 55 | 83 | |
| Rise Time | t_r | | | 180 | 270 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 55 | 83 | |
| Fall Time | t_f | | | 12 | 18 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | 38 | A |
| Pulse Diode Forward Current ^a | I_{SM} | | | | 114 | |
| Body Diode Voltage | V_{SD} | $I_S = 12\text{ A}$ | | 0.8 | 1.2 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | | 52 | 78 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 70.2 | 105 | nC |
| Reverse Recovery Fall Time | t_a | | | 27 | | ns |
| Reverse Recovery Rise Time | t_b | | | 25 | | |

Notes:

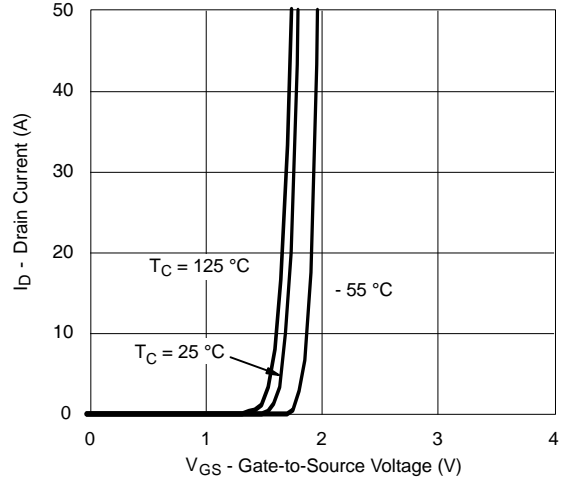
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.

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.

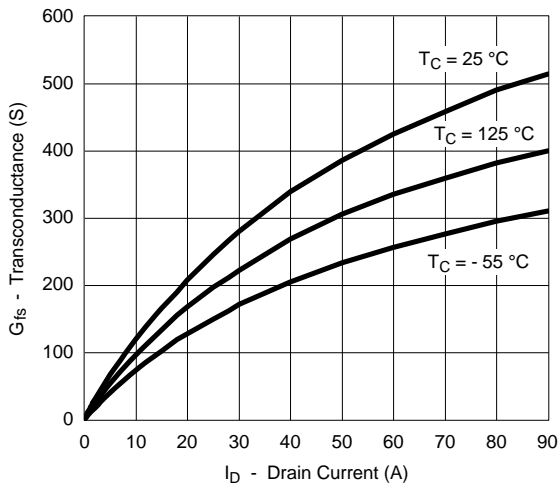
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



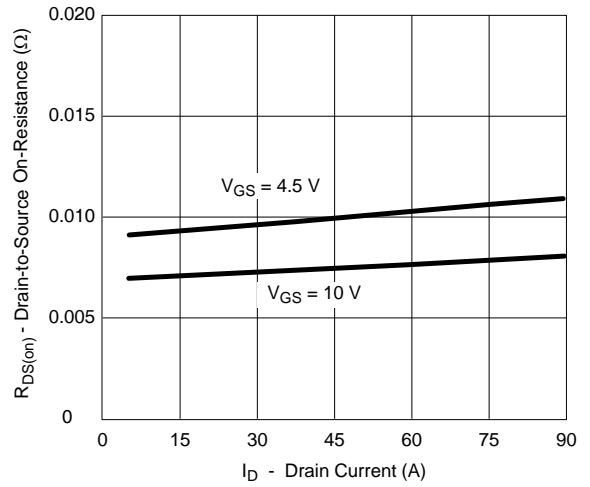
Output Characteristics



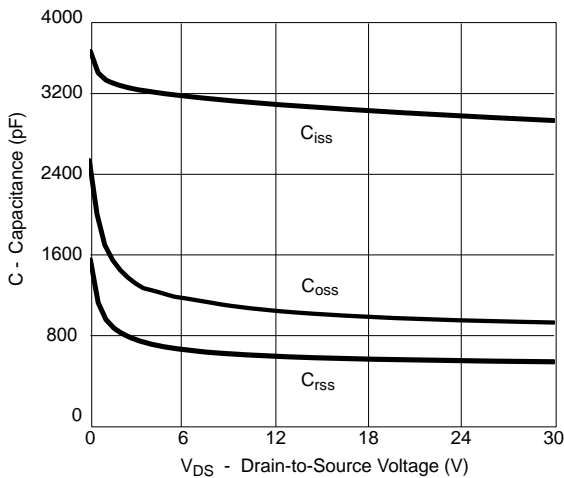
Transfer Characteristics



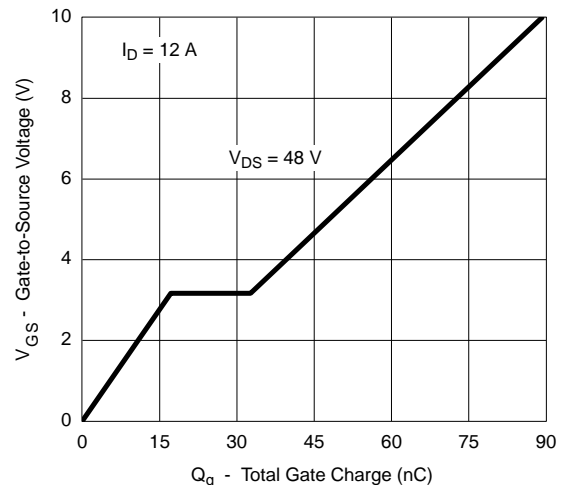
Transconductance



$R_{DS(on)}$ vs. Drain Current

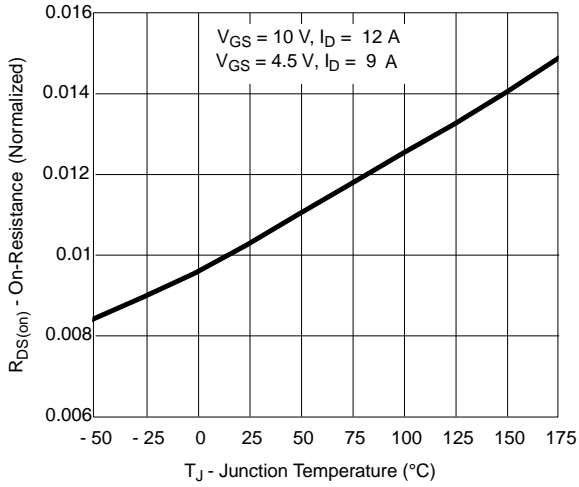


Capacitance



Gate Charge

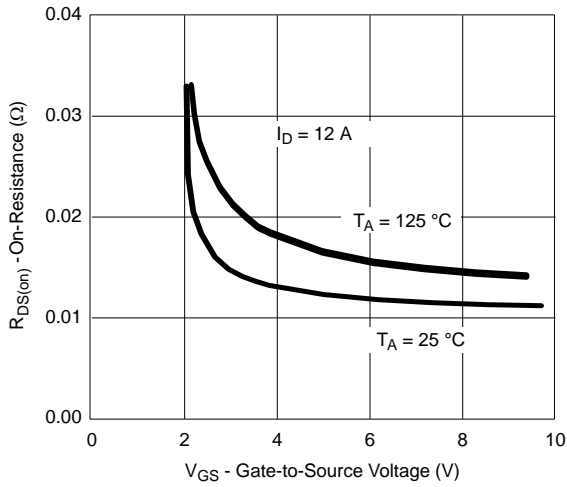
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



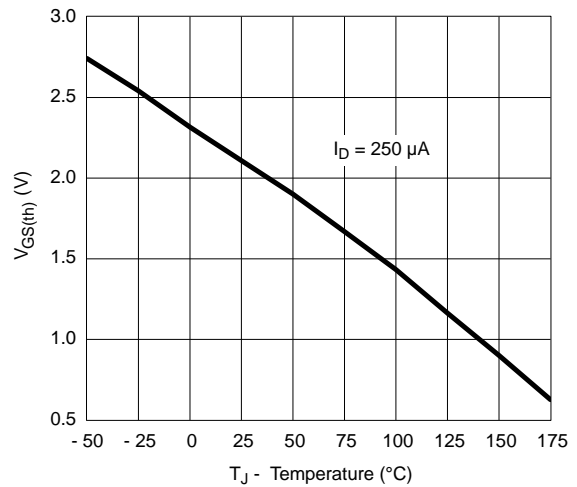
On-Resistance vs. Junction Temperature



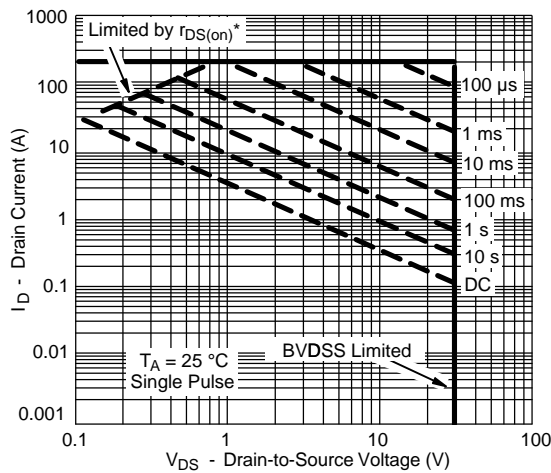
Forward Diode Voltage vs. Temperature



R_{DS(on)} vs. V_{GS} vs. Temperature

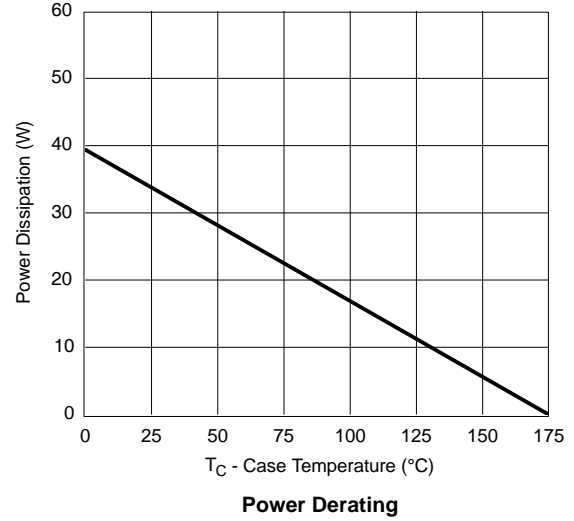
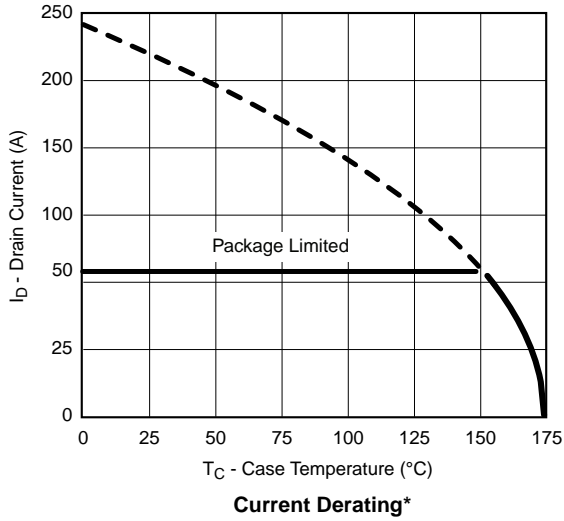


Threshold Voltage

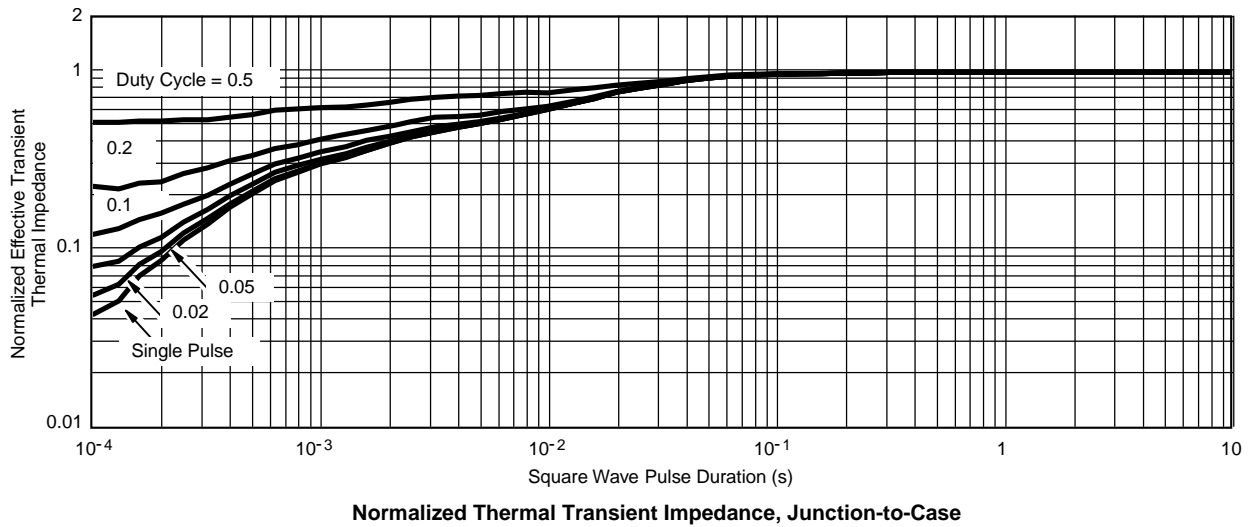


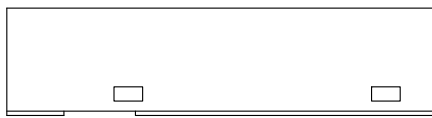
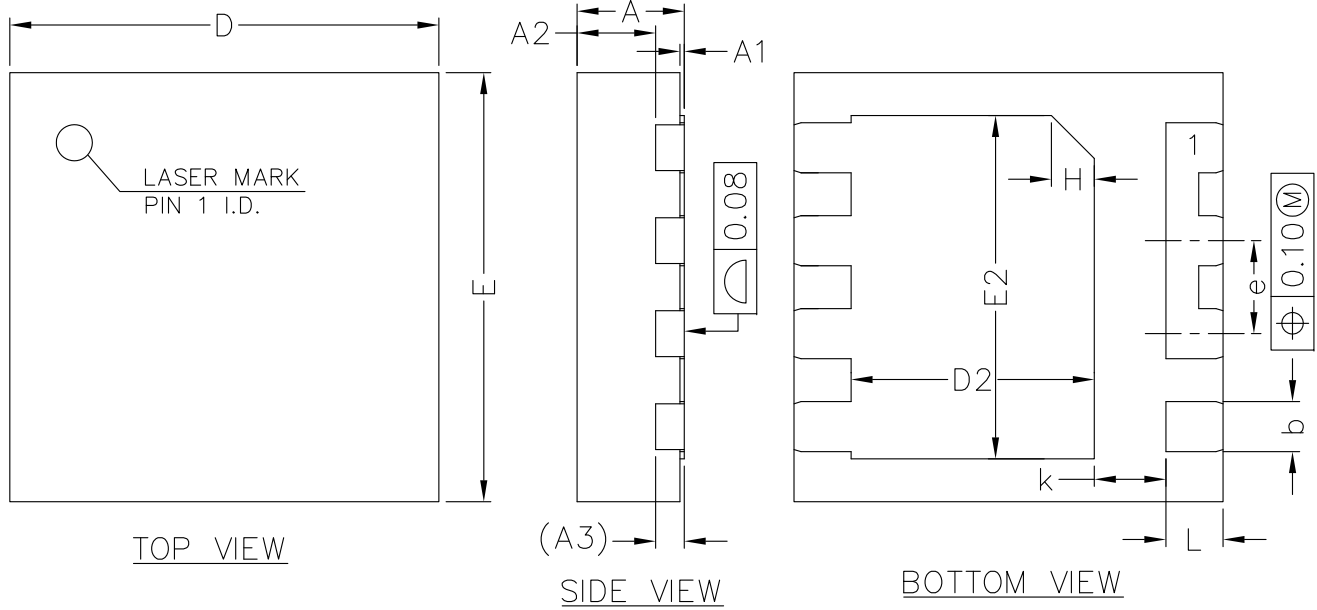
*V_{GS} > minimum V_{GS} at which r_{DS(on)} is specified
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



* The power dissipation P_D is based on $T_{J(max)} = 175$ °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.





SIDE VIEW

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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