

MOSFET – N-Channel, POWERTRENCH®

80 V, 50 A, 13.4 mΩ

FDMS86380-F085

Features

- Typ $R_{DS(on)}$ = 11.3 mΩ at V_{GS} = 10 V; I_D = 50 A
- Typ $Q_{g(tot)}$ = 20 nC at V_{GS} = 10 V; I_D = 50 A
- UIS Capability
- AEC-Q101 Qualified and PPAP Capable
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant

Applications

- Automotive Engine Control
- PowerTrain Management
- Solenoid and Motor Drivers
- Electronic Steering
- Integrated Starter/Alternator
- Distributed Power Architectures and VRM
- Primary Switch for 12 V Systems

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

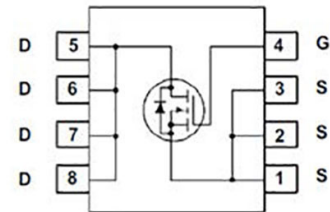
| Parameter | Symbol | Value | Unit |
|--------------------------------------------------------------|-----------------|--------------|------|
| Drain-to-Source Voltage | V_{DSS} | 80 | V |
| Gate-to-Source Voltage | V_{GS} | ±20 | V |
| Continuous Drain Current (V_{GS} = 10 V) (Note 1) | I_D | 50 | A |
| Pulsed Drain Current | | See Figure 4 | |
| Single Pulse Avalanche Energy (Note 2) | E_{AS} | 16 | mJ |
| Power Dissipation | P_D | 75 | W |
| Derate above 25°C | | 0.5 | W/°C |
| Operating and Storage Temperature | T_J, T_{STG} | -55 to +175 | °C |
| Thermal Resistance (Junction-to-Case) | $R_{\theta JC}$ | 2 | °C/W |
| Maximum Thermal Resistance (Junction-to-Ambient) (Note 3) | $R_{\theta JA}$ | 50 | °C/W |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

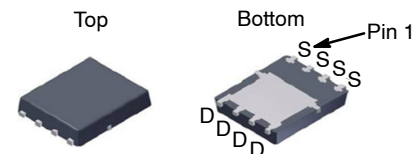
1. Current is limited by bondwire configuration.
2. Starting T_J = 25°C, L = 20 μH, I_{AS} = 40 A, V_{DD} = 80 V during inductor charging and V_{DD} = 0 V during time in avalanche.
3. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design. The maximum rating presented here is based on mounting on a 1 in² pad of 2 oz copper.

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 80 V | 13.4 mΩ @ 10 V | 50 A |

ELECTRICAL CONNECTION

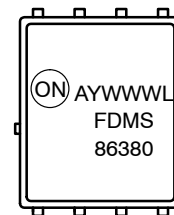


N-Channel MOSFET



PQFN8
CASE 483BJ

MARKING DIAGRAM



A = Assembly Location
 WL = Wafer Lot
 Y = Year
 WW = Work Week
 FDMS86380 = Specific Device Code

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------------------|-----------------------|
| FDMS86380-F085 | PQFN8 (Power 56) (Pb-Free) | 3000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

FDMS86380-F085

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------|------------|-----|-----|-----|------|
|--------|-----------|------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|------------|-----------------------------------|-----------------------------------------------------|------------------------------------|---|-----------|-----------------|
| B_{VDSS} | Drain-to-Source Breakdown Voltage | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$ | 80 | – | – | V |
| I_{DSS} | Drain-to-Source Leakage Current | $V_{DS} = 80\ \text{V}$, $V_{GS} = 0\ \text{V}$ | $T_J = 25^\circ\text{C}$ | – | – | 1 μA |
| | | | $T_J = 175^\circ\text{C}$ (Note 4) | – | – | 1 mA |
| I_{GSS} | Gate-to-Source Leakage Current | $V_{GS} = \pm 20\ \text{V}$ | – | – | ± 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|--------------|----------------------------------|---------------------------------------------------|------------------------------------|-----|------|-----------------------|
| $V_{GS(th)}$ | Gate-to-Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$ | 2.0 | 3.0 | 4.0 | V |
| $R_{DS(on)}$ | Drain-to-Source On-Resistance | $I_D = 50\ \text{A}$, $V_{GS} = 10\ \text{V}$ | $T_J = 25^\circ\text{C}$ | – | 11.3 | 13.4 $\text{m}\Omega$ |
| | | | $T_J = 175^\circ\text{C}$ (Note 4) | – | 25.3 | 30.0 |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|--------------|-------------------------------|------------------------------------------------------------------------|---------------------------------------------------|------|-----|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 40\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$ | – | 1440 | – | pF |
| C_{oss} | Output Capacitance | | – | 300 | – | |
| C_{rss} | Reverse Transfer Capacitance | | – | 14 | – | |
| R_g | Gate Resistance | $f = 1\ \text{MHz}$ | – | 2.0 | – | Ω |
| $Q_{g(tot)}$ | Total Gate Charge | $V_{GS} = 0$ to $10\ \text{V}$ | $V_{DD} = 64\ \text{V}$, $I_D = 50\ \text{A}$ | – | 20 | 30 nC |
| $Q_{g(th)}$ | Threshold Gate Charge | $V_{GS} = 0$ to $2\ \text{V}$ | | – | 2.7 | – |
| Q_{gs} | Gate-to-Source Gate Charge | | | – | 8.8 | – |
| Q_{gd} | Gate-to-Drain "Miller" Charge | | | – | 4.4 | – |
| | | | | | | |

SWITCHING CHARACTERISTICS

| | | | | | | |
|--------------|----------------|-----------------------------------------------------------------------------------------------------|---|----|----|----|
| t_{on} | Turn-On Time | $V_{DD} = 40\ \text{V}$, $I_D = 50\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$ | – | – | 31 | ns |
| $t_{d(on)}$ | Turn-On Delay | | – | 13 | – | |
| t_r | Rise Time | | – | 8 | – | |
| $t_{d(off)}$ | Turn-Off Delay | | – | 15 | – | |
| t_f | Fall Time | | – | 5 | – | |
| t_{off} | Turn-Off Time | | – | – | 30 | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|----------|-------------------------------|-------------------------------------------------------------------------------------------|---|----|------|----|
| V_{SD} | Source-to-Drain Diode Voltage | $I_{SD} = 50\ \text{A}$, $V_{GS} = 0\ \text{V}$ | – | – | 1.25 | V |
| | | $I_{SD} = 25\ \text{A}$, $V_{GS} = 0\ \text{V}$ | – | – | 1.2 | |
| t_{rr} | Reverse Recovery Time | $I_F = 50\ \text{A}$, $dI_{SD}/dt = 100\ \text{A}/\mu\text{s}$, $V_{DD} = 64\ \text{V}$ | – | 37 | 55 | ns |
| Q_{rr} | Reverse Recovery Charge | | – | 23 | 35 | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. The maximum value is specified by design at $T_J = 175^\circ\text{C}$. Product is not tested to this condition in production

TYPICAL CHARACTERISTICS

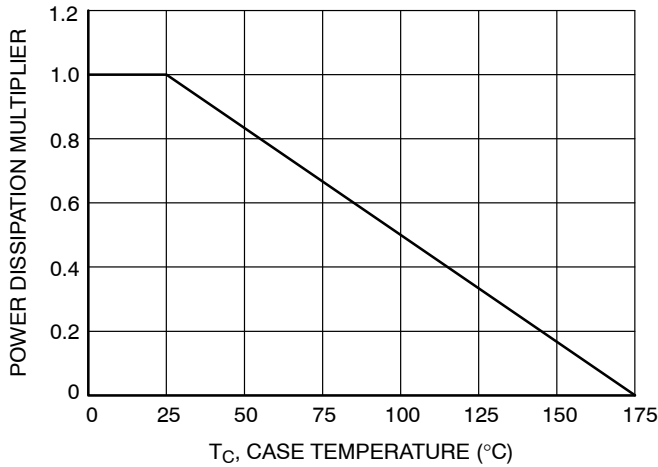


Figure 1. Normalized Power Dissipation vs. Case Temperature

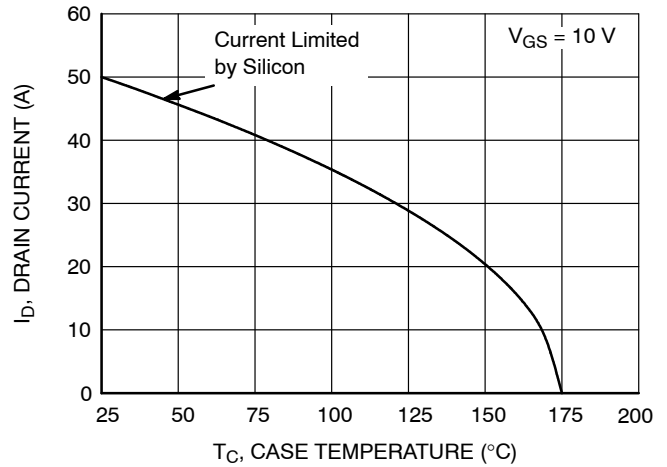


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

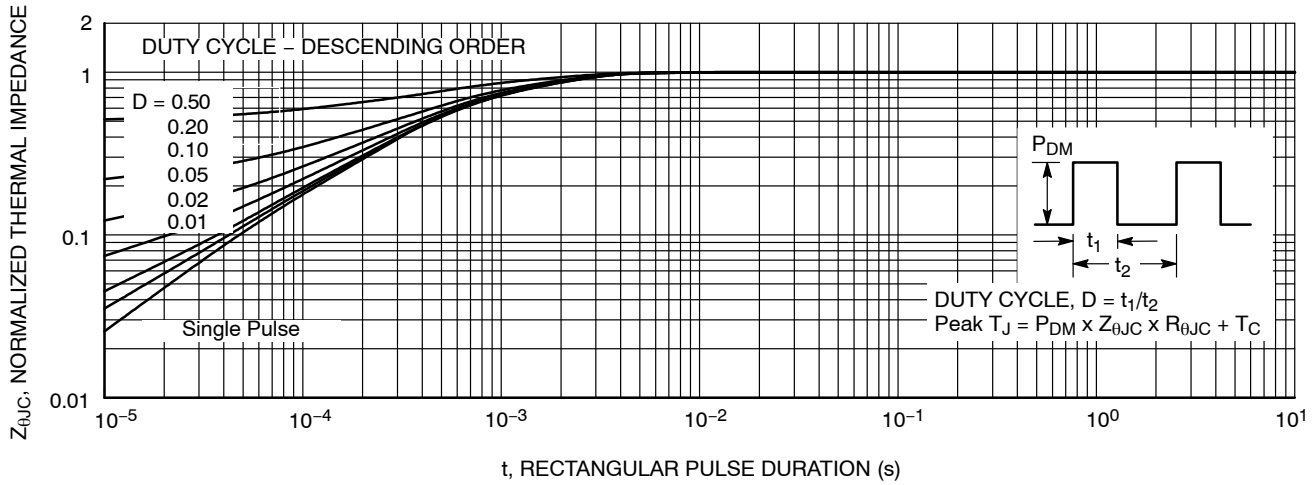


Figure 3. Normalized Maximum Transient Thermal Impedance

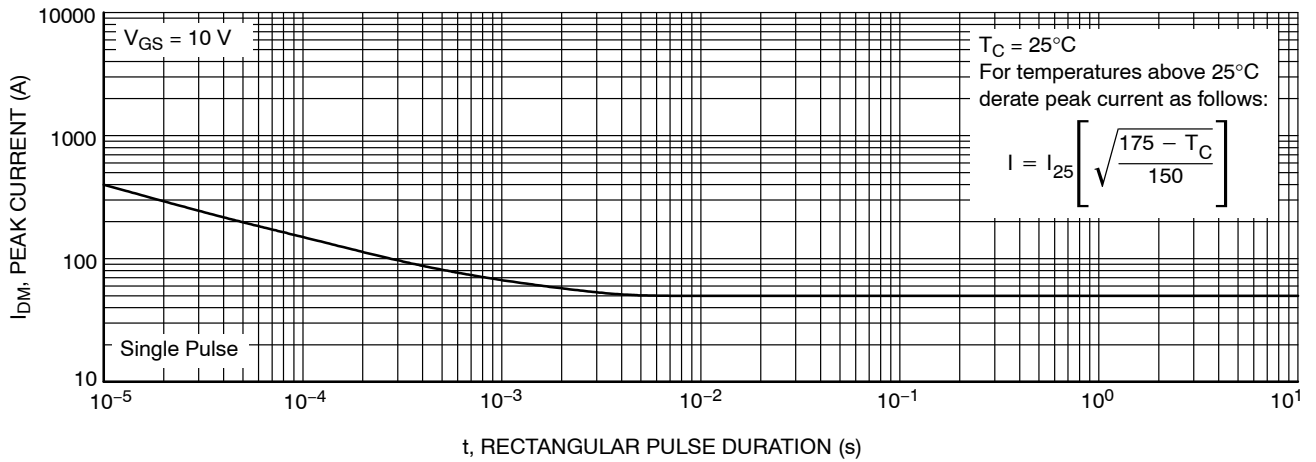


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS (continued)

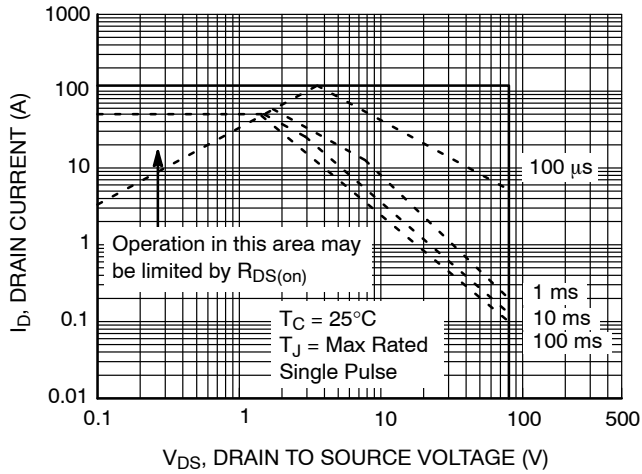
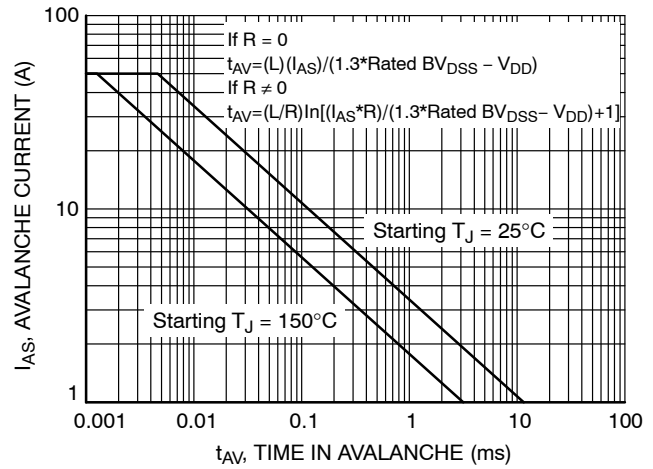


Figure 5. Forward Bias Safe Operating Area



(Note: Refer to onsemi Applications Notes [AN7514](#) and [AN7515](#))

Figure 6. Unclamped Inductive Switching Capability

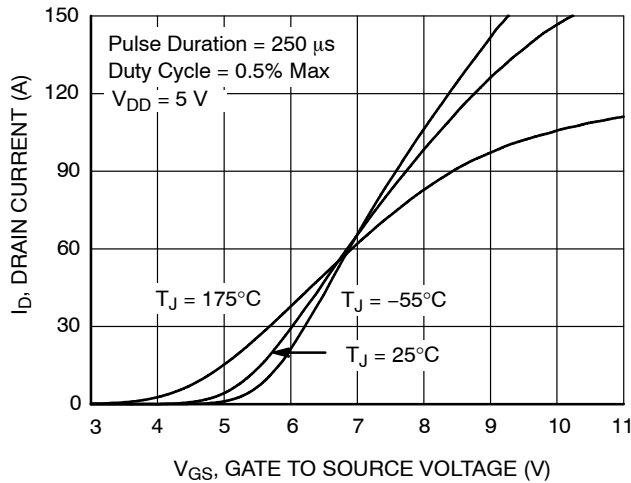


Figure 7. Transfer Characteristics

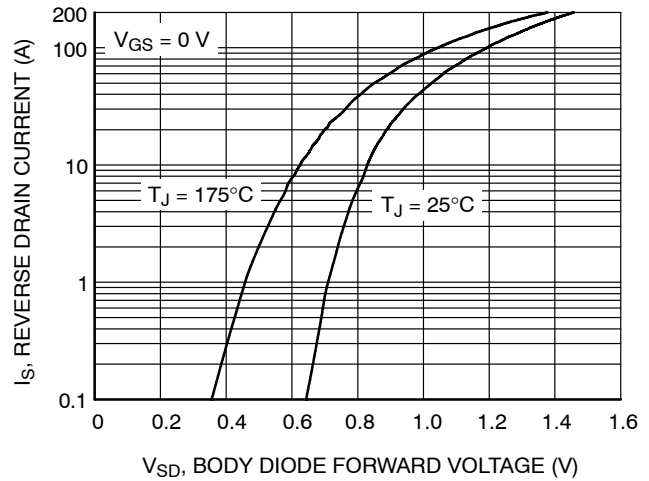


Figure 8. Forward Diode Characteristics

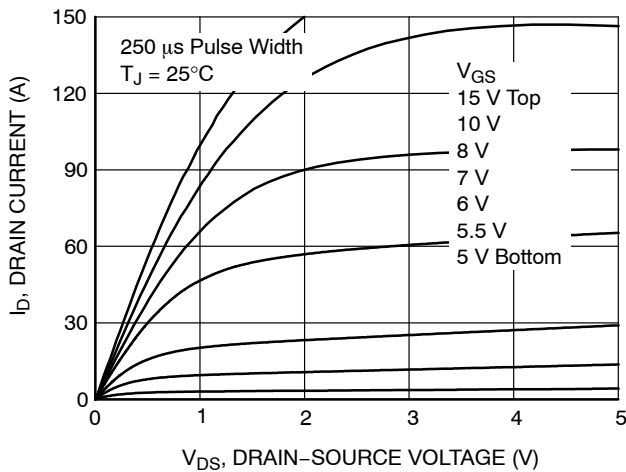


Figure 9. Saturation Characteristics

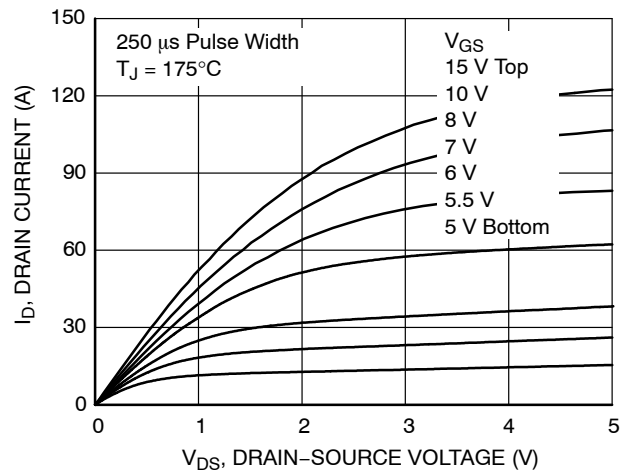
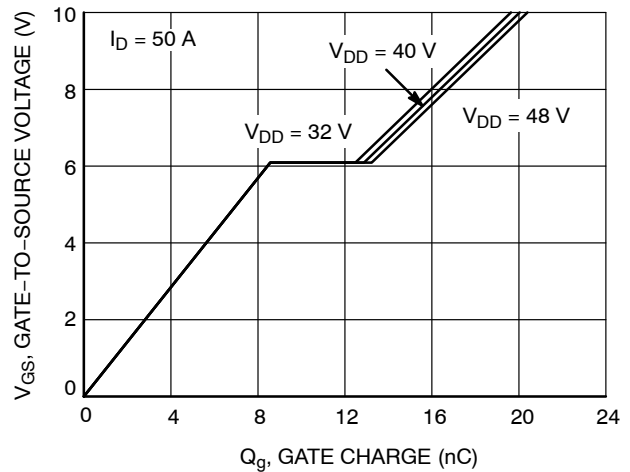
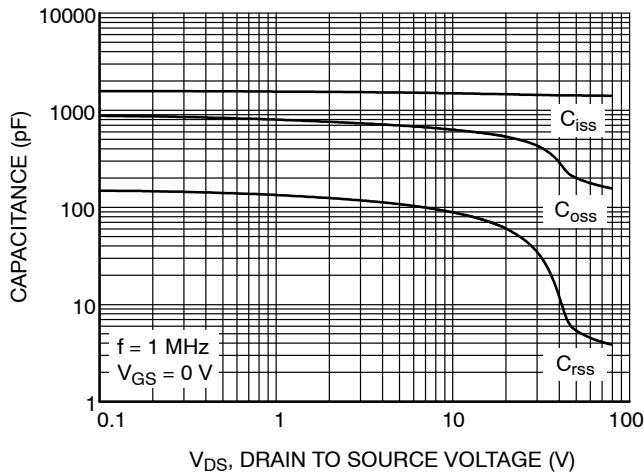
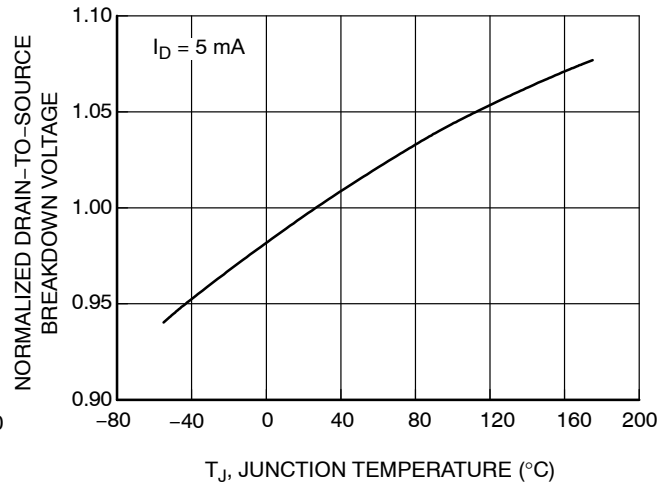
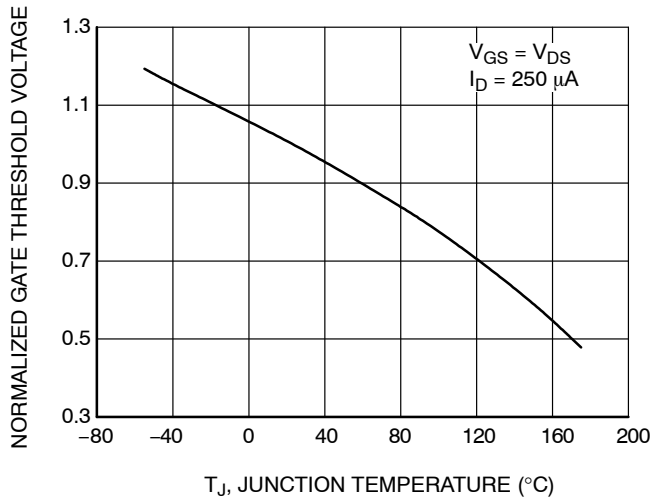
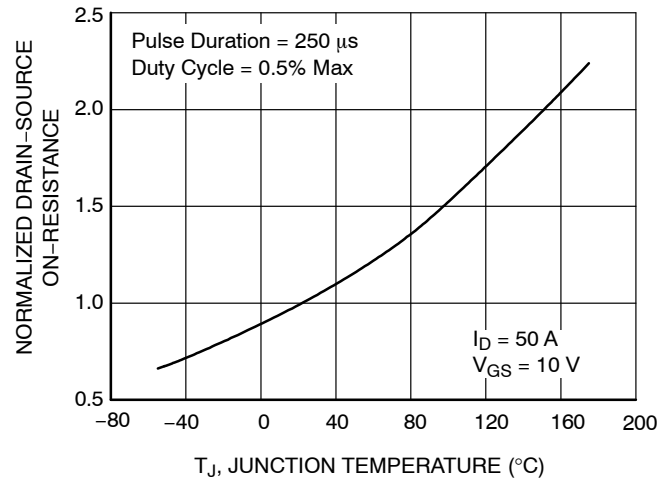
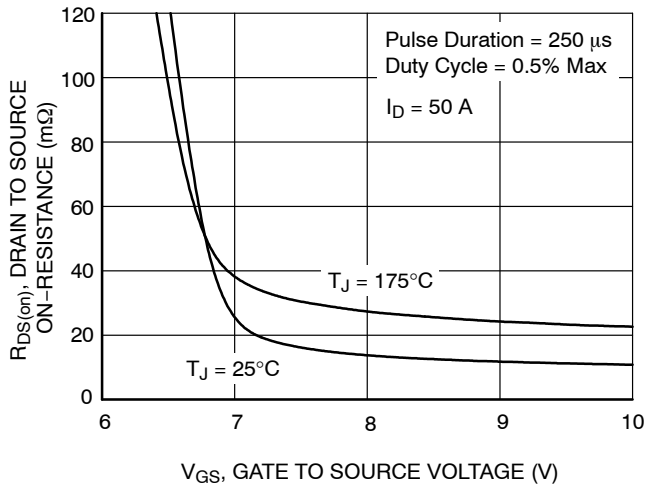


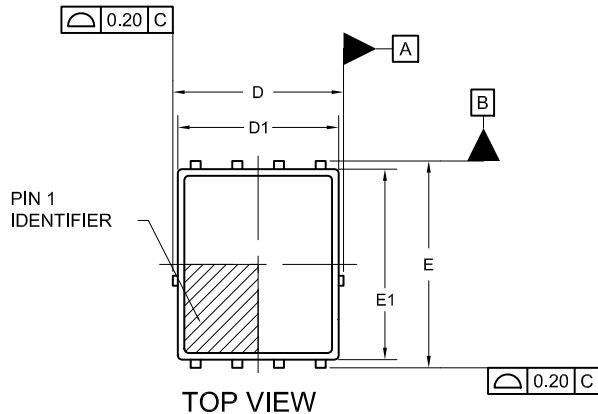
Figure 10. Saturation Characteristics

TYPICAL CHARACTERISTICS (continued)



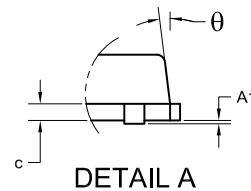
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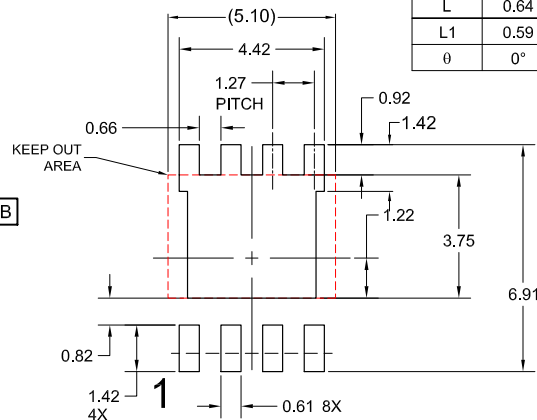
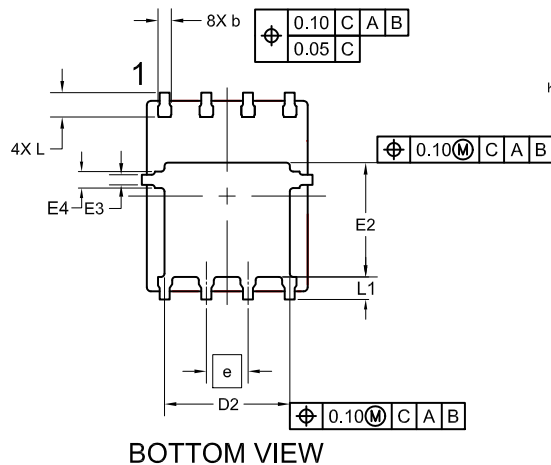
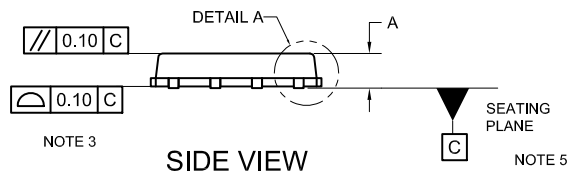


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



| DIM | MILLIMETERS | | |
|-------|-------------|-------|------|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | 0.025 | 0.05 |
| b | 0.31 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 4.90 | 5.00 | 5.10 |
| D1 | 4.80 | 4.90 | 5.00 |
| D2 | 3.72 | 3.82 | 3.92 |
| E | 6.20 | 6.30 | 6.40 |
| E1 | 5.70 | 5.80 | 5.90 |
| E2 | 3.38 | 3.48 | 3.58 |
| E3 | 0.30 | | |
| E4 | 0.50 | | |
| e | 1.27 BSC | | |
| L | 0.64 | 0.74 | 0.84 |
| L1 | 0.59 | 0.69 | 0.79 |
| theta | 0° | — | 12° |



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