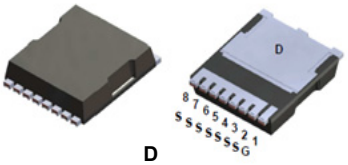
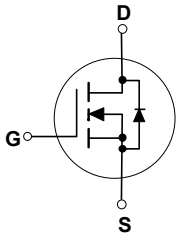
ON Semiconductor®

# FDBL9406-F085

## N-Channel PowerTrench® MOSFET

### 40 V, 240 A, 1.2 mΩ




### Features

- Typical $R_{DS(on)}$ = 0.9 mΩ at $V_{GS}$ = 10V, $I_D$ = 80 A
- Typical $Q_{g(tot)}$ = 90 nC at $V_{GS}$ = 10V, $I_D$ = 80 A
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

### Applications

- Automotive Engine Control
- PowerTrain Management
- Solenoid and Motor Drivers
- Integrated Starter/Alternator
- Primary Switch for 12V Systems

100% RoHS COMPLIANT

### MOSFET Maximum Ratings $T_J$ = 25°C unless otherwise noted.

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | | 40 | V |
| $V_{GS}$ | Gate-to-Source Voltage | | ±20 | V |
| $I_D$ | Drain Current - Continuous ($V_{GS}$=10) (Note 1) | $T_C$ = 25°C | 240 | A |
| | Pulsed Drain Current | $T_C$ = 25°C | See Figure 4 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | (Note 2) | 316 | mJ |
| $P_D$ | Power Dissipation | | 300 | W |
| | Derate Above 25°C | | 2.0 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | | -55 to + 175 | °C |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | | 0.5 | °C/W |
| $R_{\theta JA}$ | Maximum Thermal Resistance, Junction to Ambient | (Note 3) | 43 | °C/W |

**Notes:**
1: Current is limited by bondwire configuration.
2: Starting $T_J$ = 25°C, L = 0.1mH, $I_{AS}$ = 79.5A, $V_{DD}$ = 40V during inductor charging and $V_{DD}$ = 0V 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 board design. The maximum rating presented here is based on mounting on a 1 $in^2$ pad of 2oz copper.

### Package Marking and Ordering Information

| Device Marking | Device | Package | | | |
|---|---|---|---|---|---|
| FDBL9406 | FDBL9406-F085 | MO-299A | - | - | - |

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Publication Order Number:
FDBL9406-F085/D

## Electrical Characteristics $T_J$ = 25°C unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $B_{VDSS}$ | Drain-to-Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 40 | - | - | V |
| $I_{DSS}$ | Drain-to-Source Leakage Current | $V_{DS}$=40V, $V_{GS}$ = 0V, $T_J$ = 25°C | - | - | 1 | μA |
| | | $V_{GS}$ = 0V, $T_J$ = 175°C (Note 4) | - | - | 1 | mA |
| $I_{GSS}$ | Gate-to-Source Leakage Current | $V_{GS}$ = ±20V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 2.0 | 3.2 | 4.0 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $I_D$ = 80A, $V_{GS}$= 10V, $T_J$ = 25°C | - | 0.90 | 1.20 | mΩ |
| | | $I_D$ = 80A, $V_{GS}$= 10V, $T_J$ = 175°C (Note 4) | - | 1.64 | 1.86 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | - | 7735 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 2160 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 129 | - | pF |
| $R_g$ | Gate Resistance | f = 1MHz | - | 2.5 | - | Ω |
| $Q_{g(ToT)}$ | Total Gate Charge at 10V | $V_{GS}$ = 0 to 10V, $V_{DD}$ = 32V, $I_D$ = 80A | - | 90 | 107 | nC |
| $Q_{g(th)}$ | Threshold Gate Charge | $V_{GS}$ = 0 to 2V, $V_{DD}$ = 32V, $I_D$ = 80A | - | 13.5 | 15.5 | nC |
| $Q_{gs}$ | Gate-to-Source Gate Charge | $V_{DD}$ = 32V, $I_D$ = 80A | - | 43 | - | nC |
| $Q_{gd}$ | Gate-to-Drain “Miller“ Charge | $V_{DD}$ = 32V, $I_D$ = 80A | - | 10 | - | nC |
| **Switching Characteristics** | | | | | | |
| $t_{on}$ | Turn-On Time | $V_{DD}$ = 20V, $I_D$ = 80A, $V_{GS}$ = 10V, $R_{GEN}$ = 6Ω | - | - | 102 | ns |
| $t_{d(on)}$ | Turn-On Delay | | - | 33 | - | ns |
| $t_r$ | Rise Time | | - | 40 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay | | - | 47 | - | ns |
| $t_f$ | Fall Time | | - | 23 | - | ns |
| $t_{off}$ | Turn-Off Time | | - | - | 91 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source-to-Drain Diode Voltage | $I_{SD}$ =80A, $V_{GS}$ = 0V | - | - | 1.25 | V |
| | | $I_{SD}$ = 40A, $V_{GS}$ = 0V | - | - | 1.2 | V |
| $t_{rr}$ | Reverse-Recovery Time | $I_F$ = 80A, $dI_{SD}/dt$ = 100A/μs, $V_{DD}$=32V | - | 91 | 107 | ns |
| $Q_{rr}$ | Reverse-Recovery Charge | | - | 128 | 167 | nC |

**Note:**

4: The maximum value is specified by design at $T_J$ = 175°C. Product is not tested to this condition in production.

## Typical Characteristics

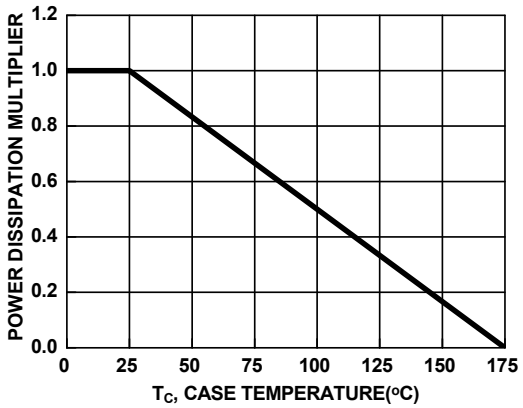



Figure 1. Normalized Power Dissipation vs. Case Temperature

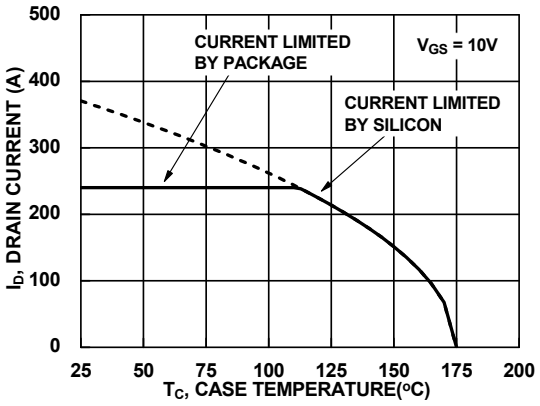



Figure 2. Maximum Continuous Drain Current vs. Case Temperature

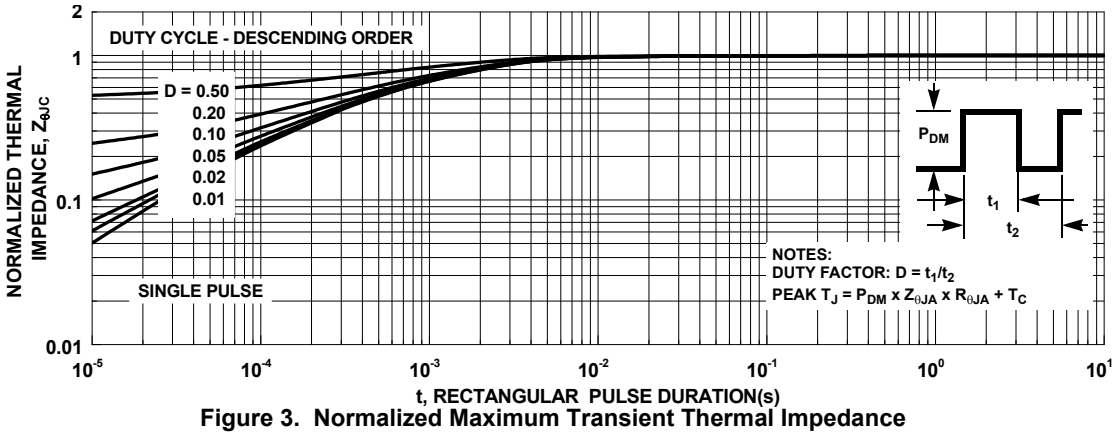



Figure 3. Normalized Maximum Transient Thermal Impedance

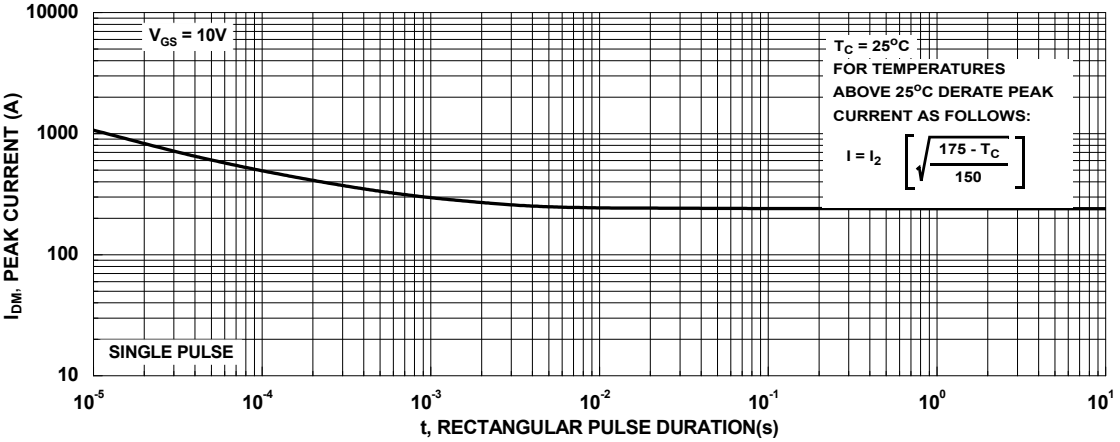



Figure 4. Peak Current Capability

## Typical Characteristics

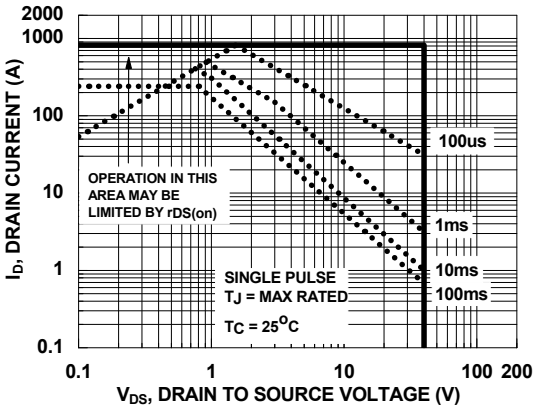
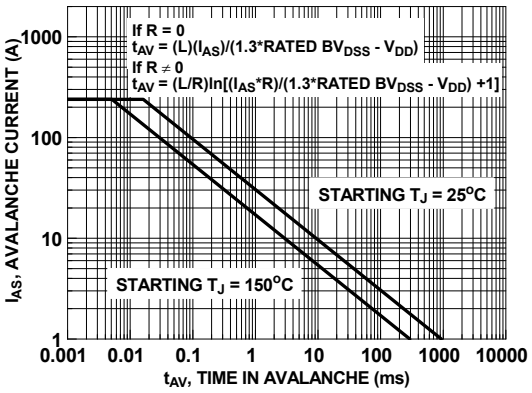



**Figure 5. Forward Bias Safe Operating Area**




NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

**Figure 6. Unclamped Inductive Switching Capability**

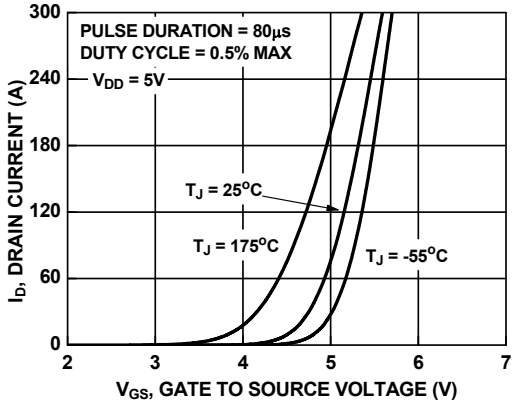



**Figure 7. Transfer Characteristics**

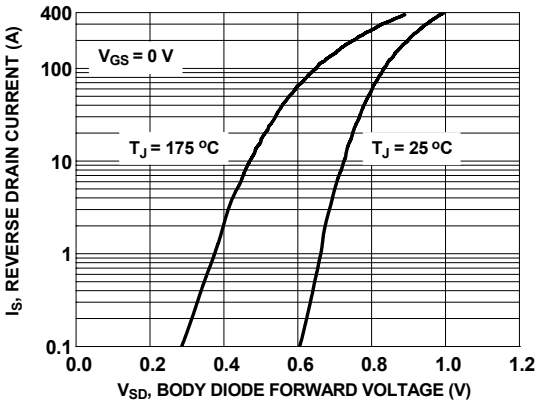



**Figure 8. Forward Diode Characteristics**

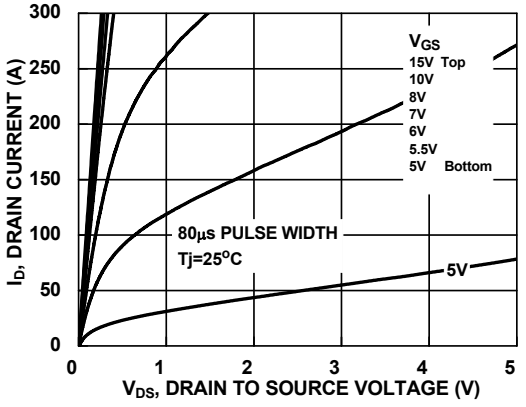



**Figure 9. Saturation Characteristics**

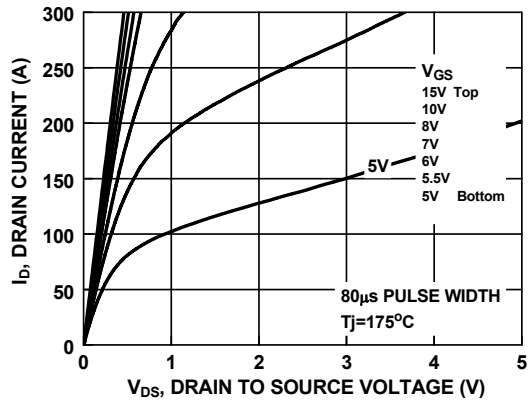



**Figure 10. Saturation Characteristics**

## Typical Characteristics

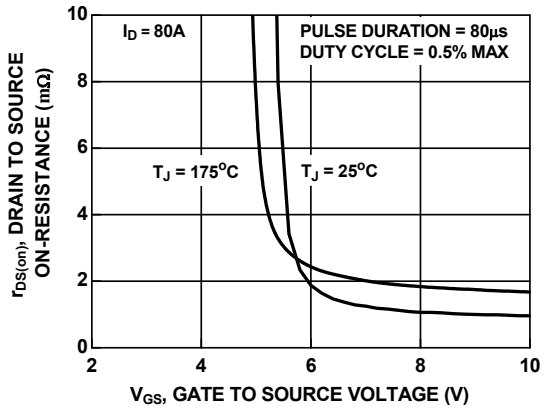



**Figure 11. $R_{DSON}$ vs. Gate Voltage**

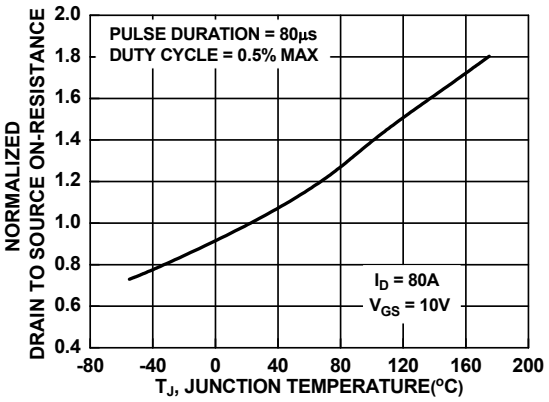



**Figure 12. Normalized $R_{DSON}$ vs. Junction Temperature**

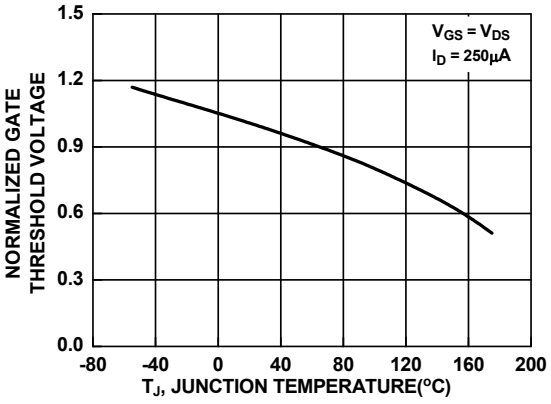



**Figure 13. Normalized Gate Threshold Voltage vs. Temperature**

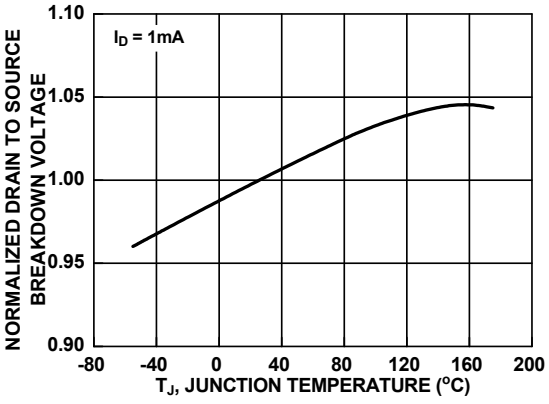



**Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature**

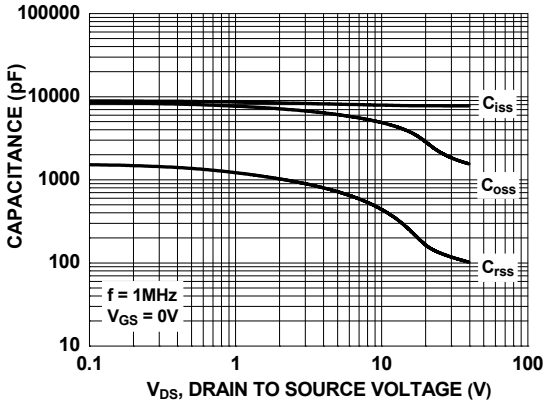



**Figure 15. Capacitance vs. Drain to Source Voltage**

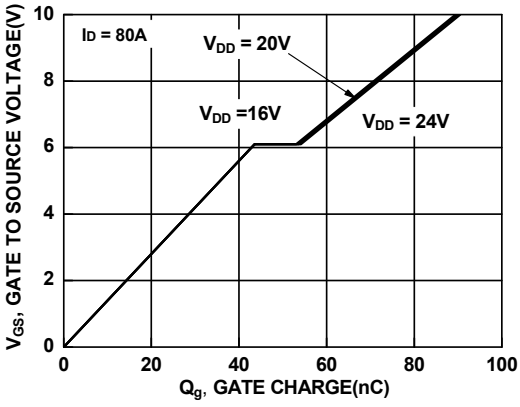



**Figure 16. Gate Charge vs. Gate to Source Voltage**

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