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ON Semiconductor®

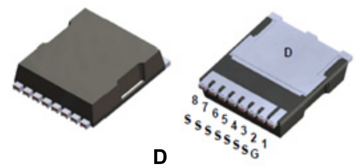
# FDBL9401-F085

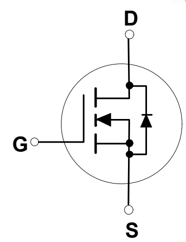
## N-Channel PowerTrench® MOSFET

### 40 V, 300 A, 0.65 mΩ

## Features

- Typical $R_{DS(on)}$ = 0.5 mΩ at $V_{GS}$ = 10V, $I_D$ = 80 A
- Typical $Q_{g(tot)}$ = 220 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 | 300 | A |
| | Pulsed Drain Current | $T_C$ = 25°C | See Figure 4 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | (Note 2) | 1064 | mJ |
| $P_D$ | Power Dissipation | | 429 | W |
| | Derate Above 25°C | | 2.86 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | | -55 to + 175 | °C |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | | 0.35 | °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 = 0.3mH, $I_{AS}$ = 84A, $V_{DD}$ = 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 | | | |
|---|---|---|---|---|---|
| FDBL9401 | FDBL9401-F085 | MO-299A | - | - | - |

## 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 |
| | | | $T_J$ = 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 | 3.0 | 4.0 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $I_D$ = 80A, $V_{GS}$= 10V | $T_J$ = 25°C | - | 0.50 | 0.65 | mΩ |
| | | | $T_J$ = 175°C (Note 4) | - | 0.86 | 1.10 | mΩ |
| **Dynamic Characteristics** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz | | - | 15900 | - | pF |
| $C_{oss}$ | Output Capacitance | | | - | 4025 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | - | 604 | - | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | - | 2.6 | - | Ω |
| $Q_{g(ToT)}$ | Total Gate Charge at 10V | $V_{GS}$ = 0 to 10V | $V_{DD}$ = 20V, $I_D$ = 80A | - | 220 | 296 | nC |
| $Q_{g(th)}$ | Threshold Gate Charge | $V_{GS}$ = 0 to 2V | | - | 29 | 39 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | - | 73 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller“ Charge | | | - | 41 | - | nC |
| **Switching Characteristics** | | | | | | | |
| $t_{on}$ | Turn-On Time | $V_{DD}$ = 20V, $I_D$ = 80A, $V_{GS}$ = 10V, $R_{GEN}$ = 6Ω | | - | - | 221 | ns |
| $t_{d(on)}$ | Turn-On Delay | | | - | 54 | - | ns |
| $t_r$ | Rise Time | | | - | 82 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay | | | - | 106 | - | ns |
| $t_f$ | Fall Time | | | - | 52 | - | ns |
| $t_{off}$ | Turn-Off Time | | | - | - | 215 | 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 | | - | 119 | 133 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | - | 228 | 274 | 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

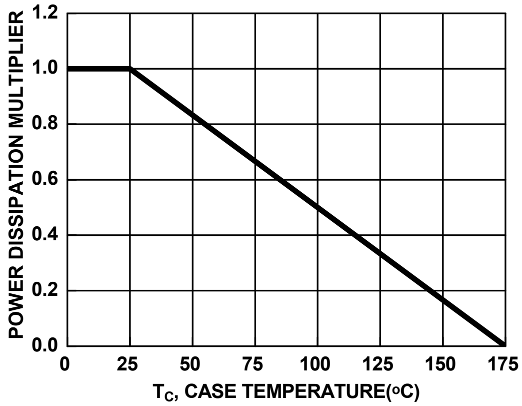



**Figure 1. Normalized Power Dissipation vs. Case Temperature**

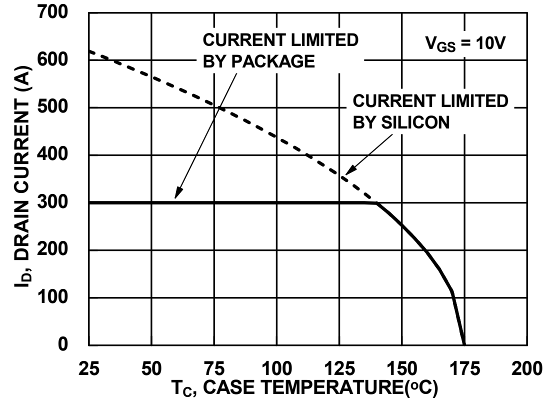



**Figure 2. Maximum Continuous Drain Current vs. Case Temperature**

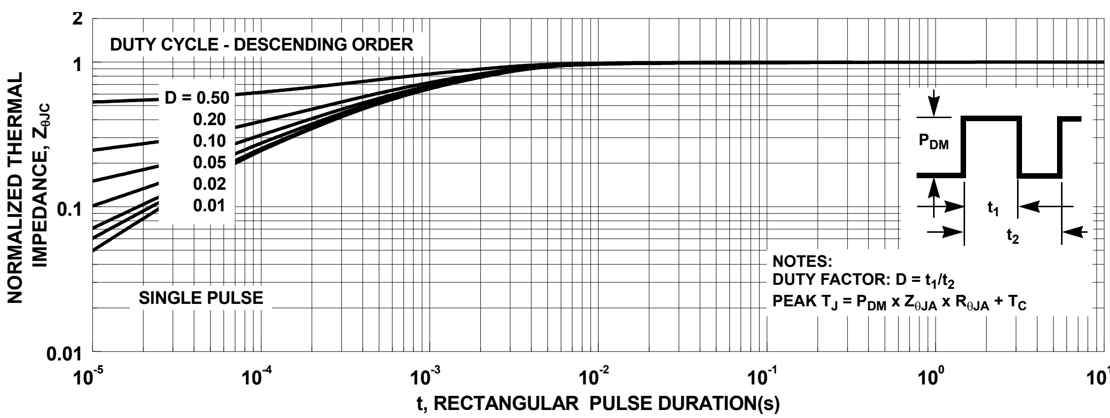



**Figure 3. Normalized Maximum Transient Thermal Impedance**

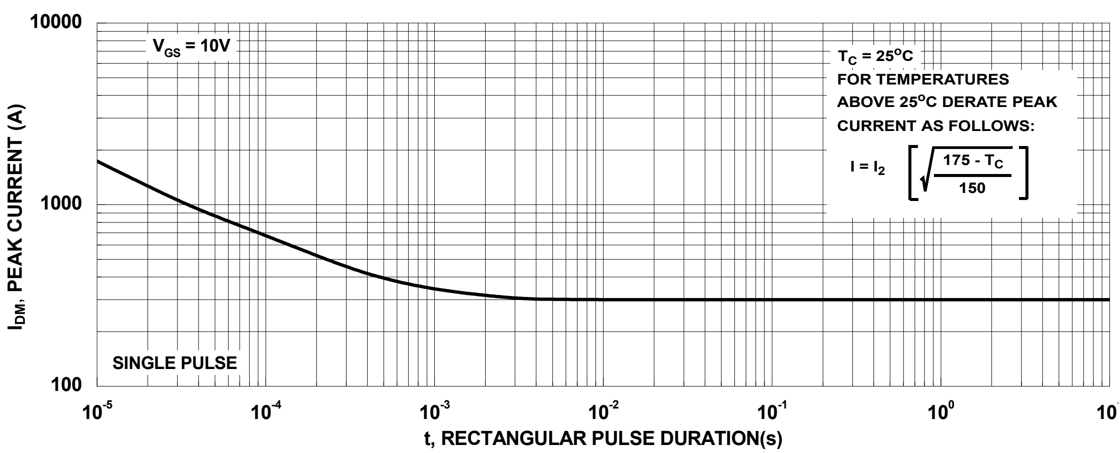



**Figure 4. Peak Current Capability**

## Typical Characteristics

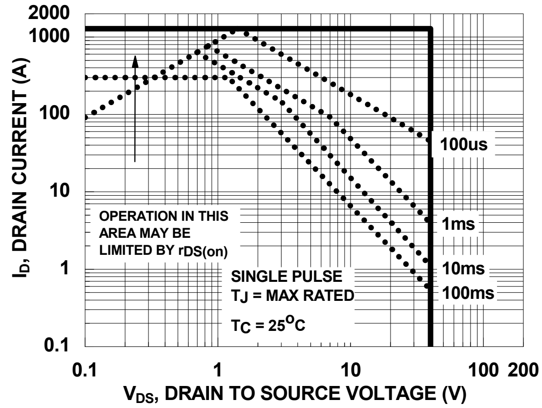
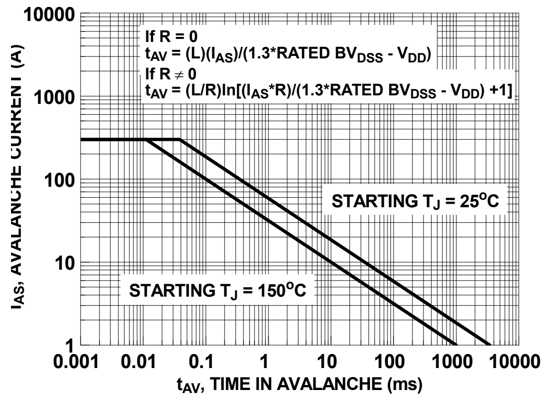



**Figure 5. Forward Bias Safe Operating Area**




NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

**Figure 6. Unclamped Inductive Switching Capability**

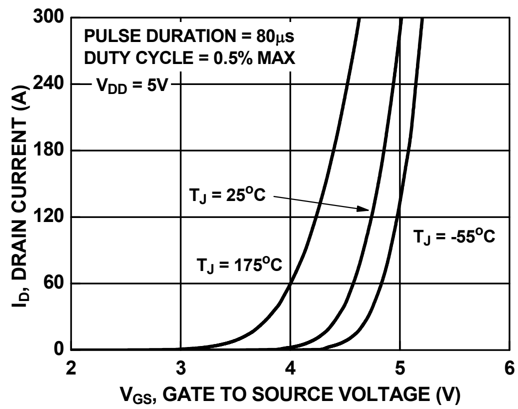



**Figure 7. Transfer Characteristics**

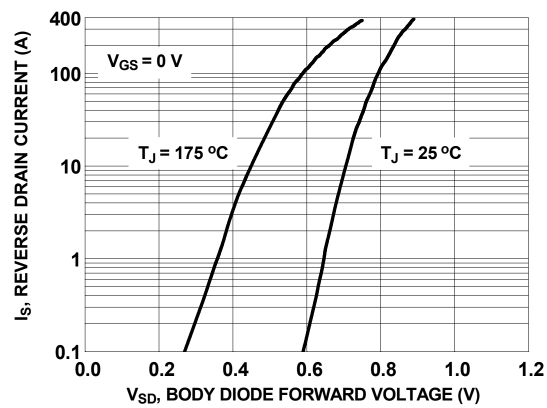



**Figure 8. Forward Diode Characteristics**

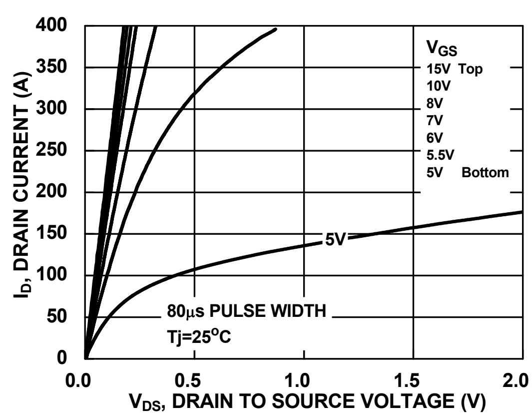



**Figure 9. Saturation Characteristics**

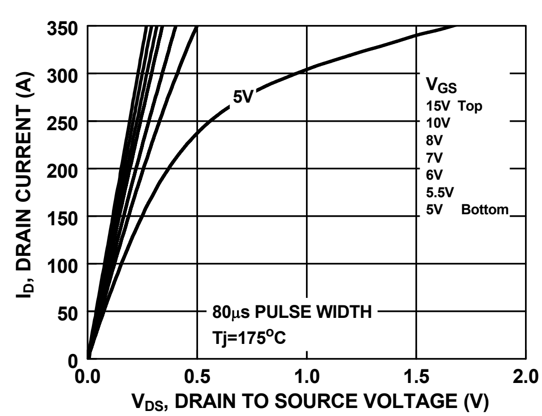



**Figure 10. Saturation Characteristics**

## Typical Characteristics

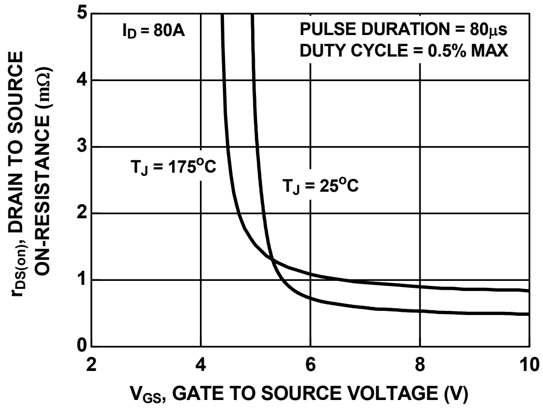



**Figure 11. $R_{DSON}$ vs. Gate Voltage**

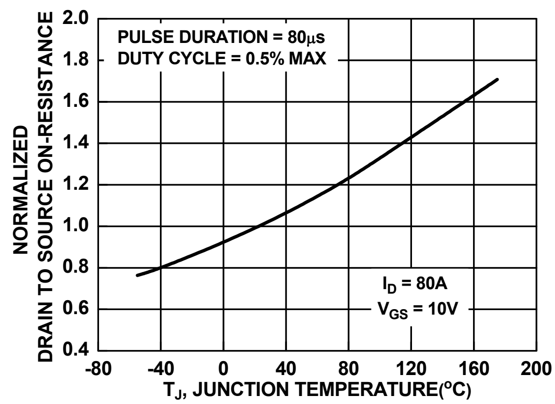



**Figure 12. Normalized $R_{DSON}$ vs. Junction Temperature**

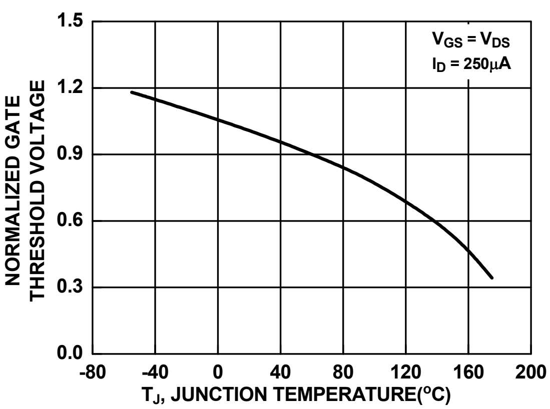



**Figure 13. Normalized Gate Threshold Voltage vs. Temperature**

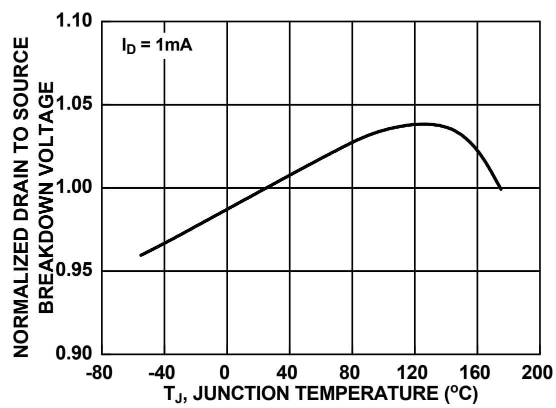



**Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature**

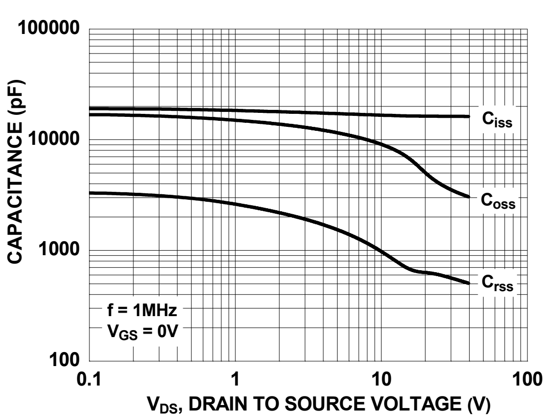



**Figure 15. Capacitance vs. Drain to Source Voltage**

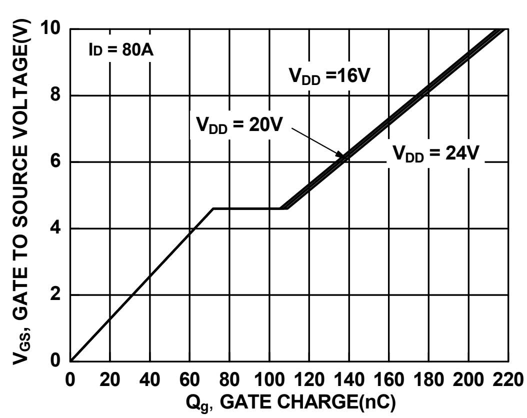



**Figure 16. Gate Charge vs. Gate to Source Voltage**

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