FAIRCHILD SEMICONDUCTOR®

August 2007

# FDB8453LZ

## N-Channel PowerTrench® MOSFET

### 40V, 50A, 7.0mΩ

### Features

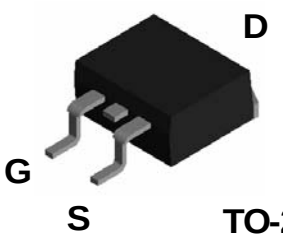
- Max $r_{DS(on)}$ = 7.0mΩ at $V_{GS}$ = 10V, $I_D$ = 17.6A
- Max $r_{DS(on)}$ = 9.0mΩ at $V_{GS}$ = 4.5V, $I_D$ = 14.9A
- HBM ESD protection level of 7.6kV typical (note 4)
- Fast Switching
- RoHS Compliant

### General Description

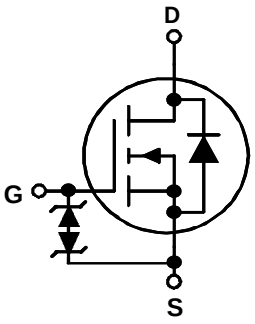
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance and switching loss. G-S zener has been added to enhance ESD voltage level.

### Applications

- Inverter
- Power Supplies




**TO-263AB**
**FDB Series**




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

| Symbol | Parameter | | | Ratings | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | | 40 | V |
| $V_{GS}$ | Gate to Source Voltage | | | ±20 | V |
| $I_D$ | Drain Current -Continuous (Package limited) | $T_C$ = 25°C | | 50 | A |
| | -Continuous (Silicon limited) | $T_C$ = 25°C | | 74 | |
| | -Continuous | $T_A$ = 25°C | (Note 1a) | 16.1 | |
| | -Pulsed | | | 100 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | | (Note 3) | 253 | mJ |
| $P_D$ | Power Dissipation | $T_C$ = 25°C | | 66 | W |
| | Power Dissipation | $T_A$ = 25°C | (Note 1a) | 3.1 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | | -55 to +150 | °C |

### Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 1.88 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 40 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDB8453LZ | FDB8453LZ | TO-263AB | 330mm | 24mm | 800 units |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 40 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | 36 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 32V, $V_{GS}$ = 0V | | | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | | | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 1.0 | 1.8 | 3.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | -6.0 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 17.6A | | 6.3 | 7.0 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 14.9A | | 7.3 | 9.0 | |
| | | $V_{GS}$ = 10V, $I_D$ = 17.6A, $T_J$ = 125°C | | 9.9 | 11 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5V, $I_D$ = 17.6A | | 84 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 20V, $V_{GS}$ = 0V, f = 1MHz | | 2665 | 3545 | pF |
| $C_{oss}$ | Output Capacitance | | | 325 | 430 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 200 | 295 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 2.2 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 20V, $I_D$ = 17.6A, $V_{GS}$ = 10V, $R_{GEN}$ = 6Ω | | 11 | 20 | ns |
| $t_r$ | Rise Time | | | 6 | 13 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 37 | 60 | ns |
| $t_f$ | Fall Time | | | 5 | 11 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to 10V, $V_{DD}$ = 20V, $I_D$ = 17.6A | | 47 | 66 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to 5V, $V_{DD}$ = 20V, $I_D$ = 17.6A | | 25 | 35 | nC |
| $Q_{gs}$ | Gate to Source Charge | $V_{DD}$ = 20V, $I_D$ = 17.6A | | 7 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DD}$ = 20V, $I_D$ = 17.6A | | 9 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = 2.6A (Note 2) | | 0.7 | 1.2 | V |
| | | $V_{GS}$ = 0V, $I_S$ = 17.6A (Note 2) | | 0.8 | 1.3 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 17.6A, di/dt = 100A/μs | | 24 | 38 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 15 | 27 | nC |

Notes:

**1:** $R_{\theta JA}$ 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.

a. 40°C/W when mounted on a 1 $in^2$ pad of 2 oz copper

b. 62.5°C/W when mounted on a minimum pad.

**2:** Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

**3:** Starting $T_J$ = 25°C, L = 3mH, $I_{AS}$ = 13A, $V_{DD}$ = 40V, $V_{GS}$ = 10V.

**4:** The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

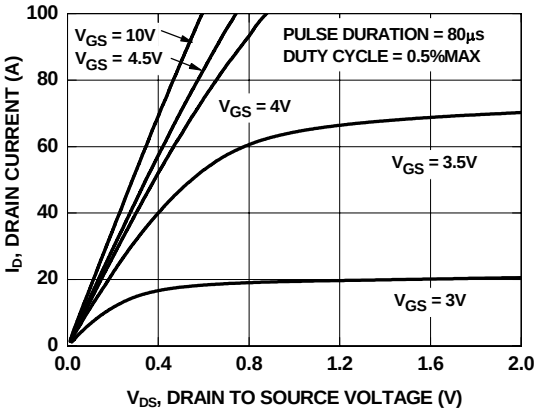



Figure 1. On-Region Characteristics

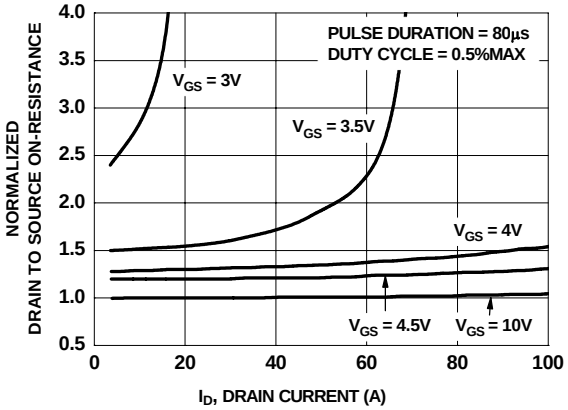



Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

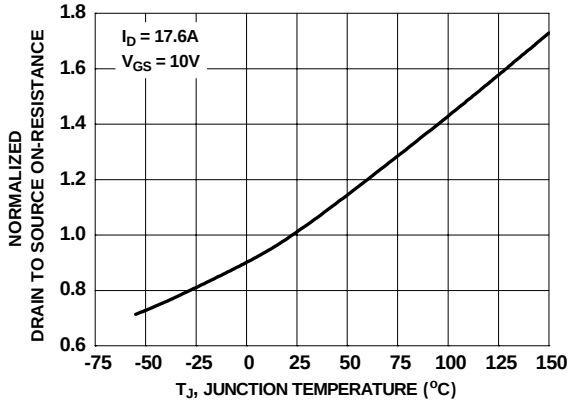



Figure 3. Normalized On-Resistance vs Junction Temperature

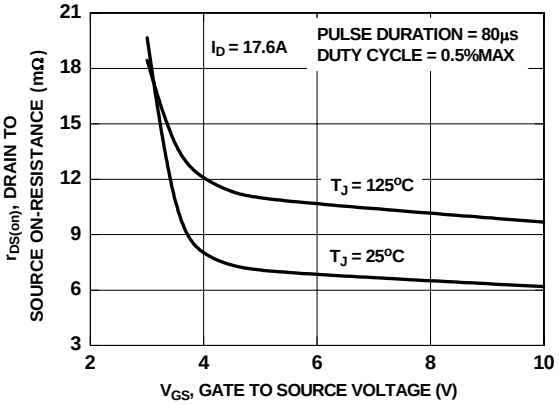



Figure 4. On-Resistance vs Gate to Source Voltage

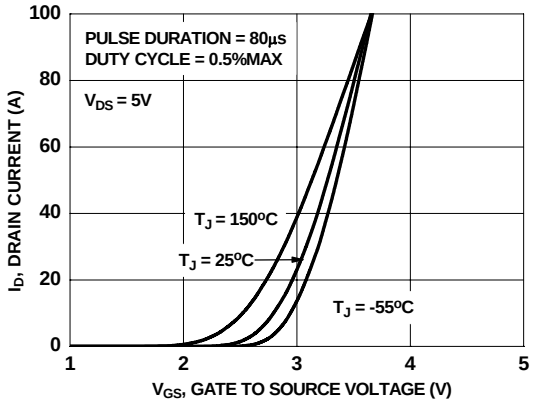



Figure 5. Transfer Characteristics

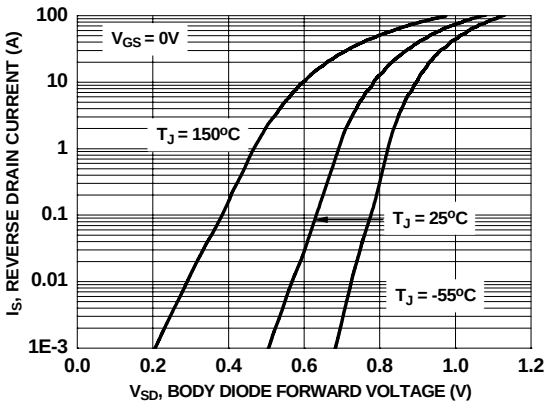



Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

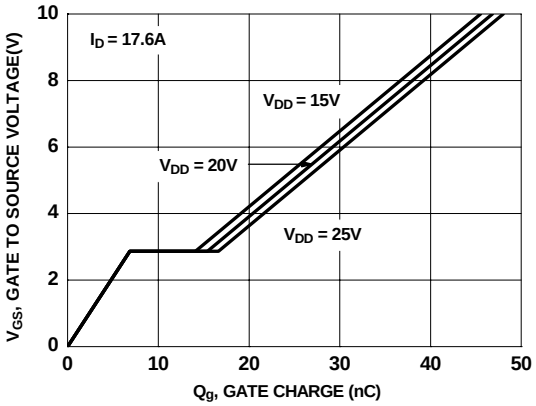



**Figure 7. Gate Charge Characteristics**

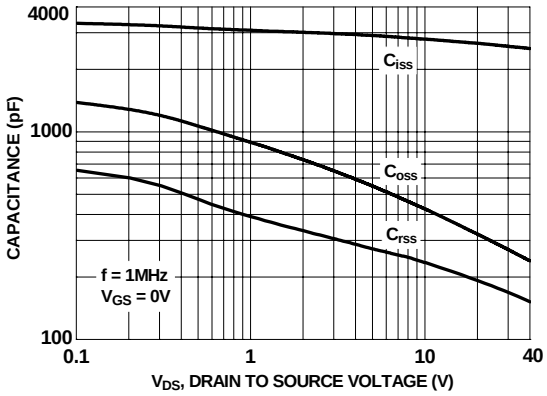



**Figure 8. Capacitance vs Drain to Source Voltage**

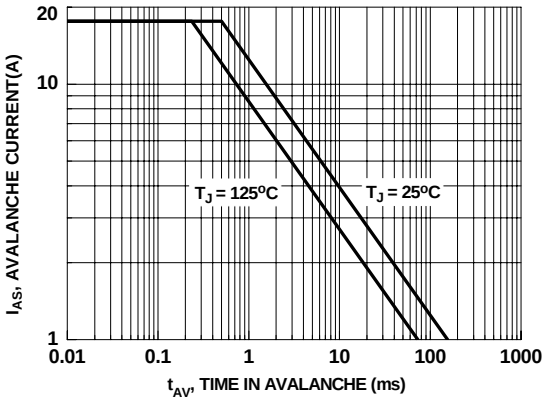



**Figure 9. Unclamped Inductive Switching Capability**

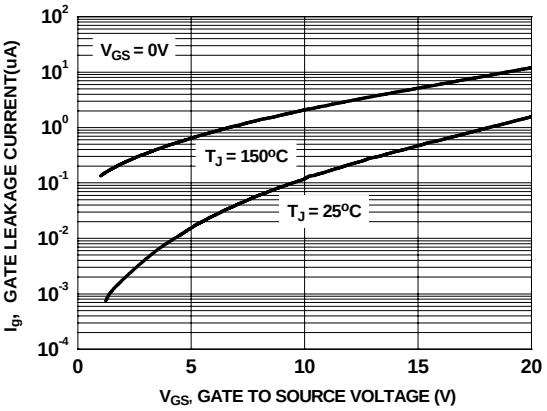



**Figure 10. Gate Leakage Current vs Gate to Source Voltage**

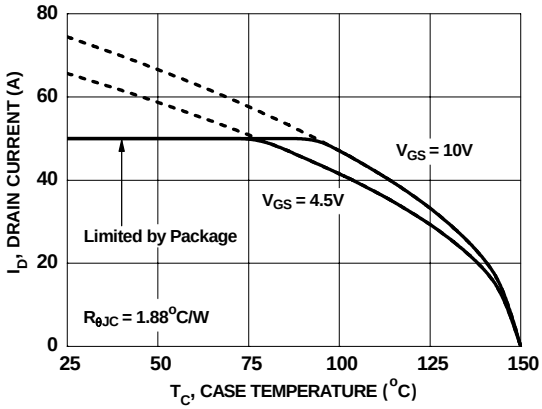



**Figure 11. Maximum Continuous Drain Current vs Ambient Temperature**

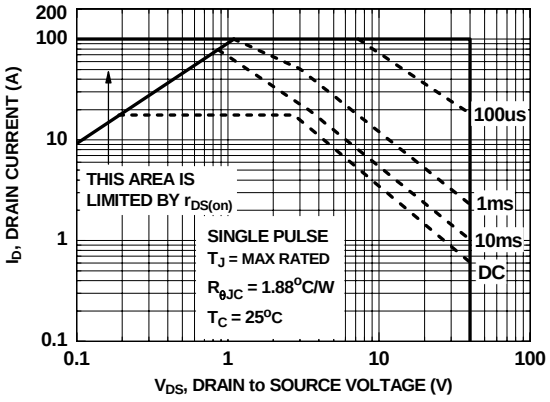



**Figure 12. Forward Bias Safe Operating Area**

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

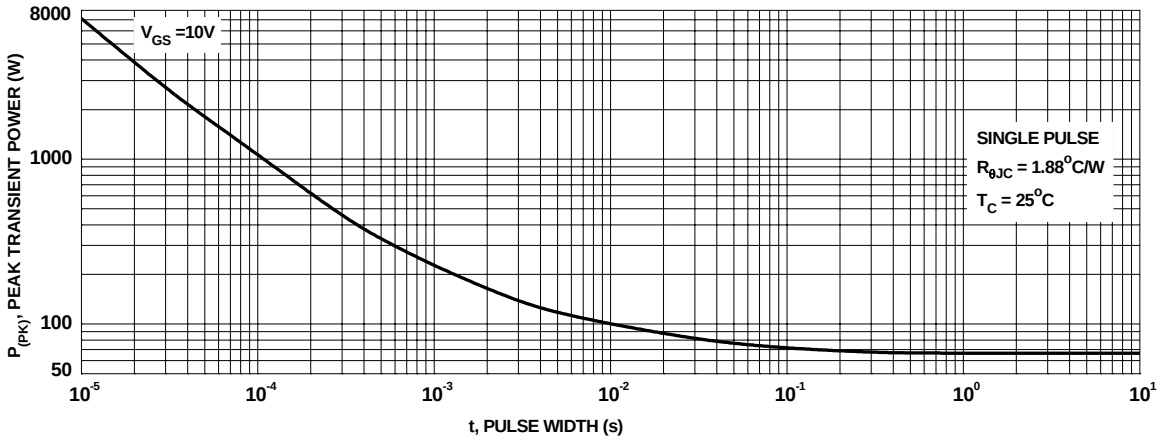



**Figure 13. Single Pulse Maximum Power Dissipation**

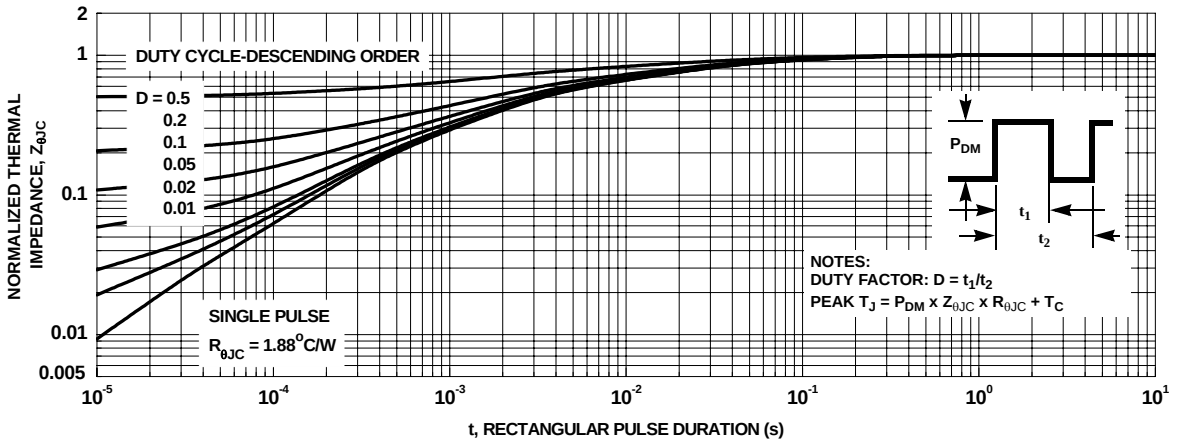



**Figure 14. Transient Thermal Response Curve**

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