FAIRCHILD SEMICONDUCTOR®

June 2007

# FDS4435BZ

## P-Channel PowerTrench® MOSFET

### -30V, -8.8A, 20mΩ

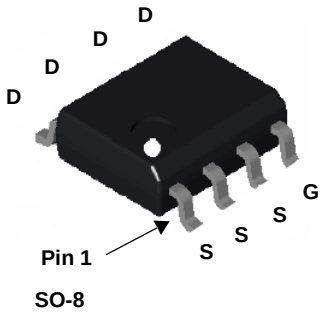
### Features

- Max $r_{DS(on)}$ = 20mΩ at $V_{GS}$ = -10V, $I_D$ = -8.8A
- Max $r_{DS(on)}$ = 35mΩ at $V_{GS}$ = -4.5V, $I_D$ = -6.7A
- Extended $V_{GSS}$ range (-25V) for battery applications
- HBM ESD protection level of ±3.8KV typical (note 3)
- High performance trench technology for extremely low $r_{DS(on)}$
- High power and current handling capability
- Termination is Lead-free and RoHS compliant

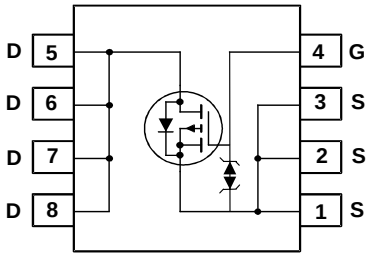
### General Description

This P-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance.

This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.




SO-8




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

| Symbol | Parameter | | | Ratings | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | | -30 | V |
| $V_{GS}$ | Gate to Source Voltage | | | ±25 | V |
| $I_D$ | Drain Current -Continuous | $T_A$ = 25°C | (Note 1a) | -8.8 | A |
| | -Pulsed | | | -50 | |
| $P_D$ | Power Dissipation | $T_A$ = 25°C | (Note 1a) | 2.5 | W |
| | Power Dissipation | $T_A$ = 25°C | (Note 1b) | 1.0 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | | (Note 4) | 24 | mJ |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | | -55 to +150 | °C |

### Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 25 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDS4435BZ | FDS4435BZ | SO-8 | 13" | 12mm | 2500units |

## 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 | -30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | -21 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -24V, $V_{GS}$ = 0V | | | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±25V, $V_{DS}$ = 0V | | | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = -250μA | -1 | -2.1 | -3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | 6 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = -10V, $I_D$ = -8.8A | | 16 | 20 | mΩ |
| | | $V_{GS}$ = -4.5V, $I_D$ = -6.7A | | 26 | 35 | |
| | | $V_{GS}$ = -10V, $I_D$ = -8.8A, $T_J$ = 125°C | | 22 | 28 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = -5V, $I_D$ = -8.8A | | 24 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -15V, $V_{GS}$ = 0V, f = 1MHz | | 1385 | 1845 | pF |
| $C_{oss}$ | Output Capacitance | | | 275 | 365 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 230 | 345 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | | 4.5 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = -15V, $I_D$ = -8.8A, $V_{GS}$ = -10V, $R_{GEN}$ = 6Ω | | 10 | 20 | ns |
| $t_r$ | Rise Time | | | 6 | 12 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 30 | 48 | ns |
| $t_f$ | Fall Time | | | 12 | 22 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to -10V; $V_{DD}$ = -15V, $I_D$ = -8.8A | | 28 | 40 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0V to -5V; $V_{DD}$ = -15V, $I_D$ = -8.8A | | 16 | 23 | nC |
| $Q_{gs}$ | Gate to Source Charge | $V_{DD}$ = -15V, $I_D$ = -8.8A | | 5.2 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | $V_{DD}$ = -15V, $I_D$ = -8.8A | | 7.4 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = -8.8A (Note 2) | | -0.9 | -1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = -8.8A, di/dt = 100A/μs | | 29 | 44 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | $I_F$ = -8.8A, di/dt = 100A/μs | | 23 | 35 | nC |

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in$^2$ pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

a. 50°C/W when mounted on a 1 in$^2$ pad of 2 oz copper.

b. 125°C/W when mounted on a minimum pad of 2 oz copper.

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

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

4. Starting $T_J$ = 25°C, L = 1mH, $I_{AS}$ = -7A, $V_{DD}$ = -30V, $V_{GS}$ = -10V

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

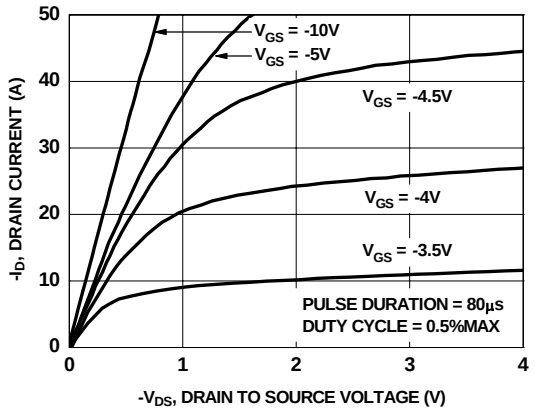



**Figure 1. On-Region Characteristics**

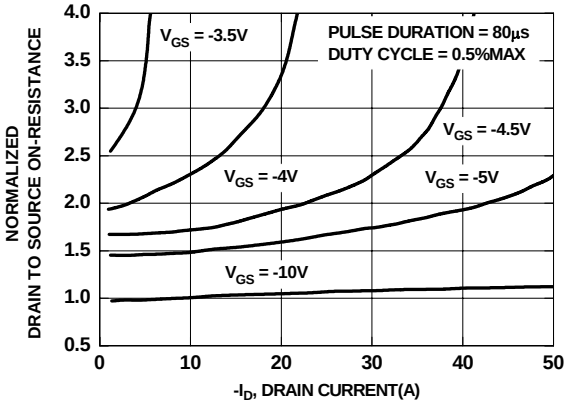



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

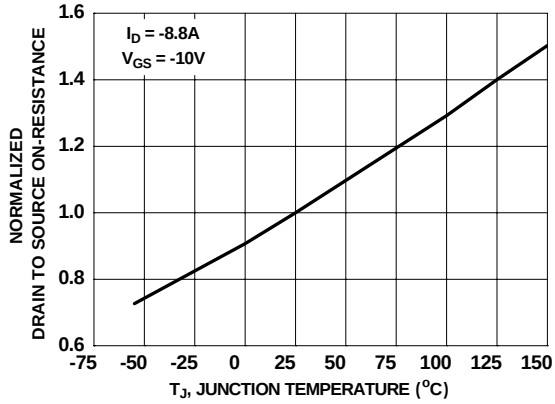



**Figure 3. Normalized On-Resistance vs Junction Temperature**

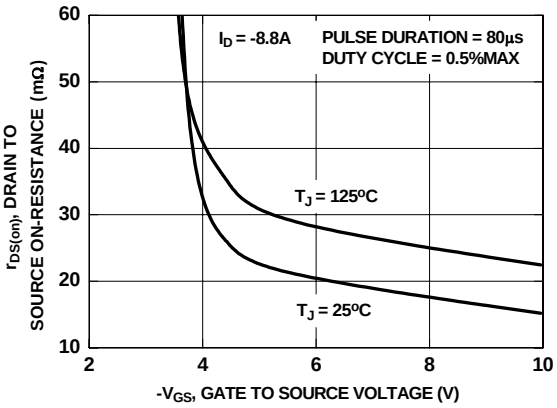



**Figure 4. On-Resistance vs Gate to Source Voltage**

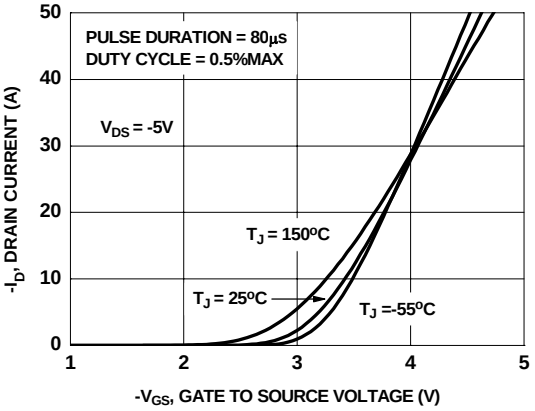



**Figure 5. Transfer Characteristics**

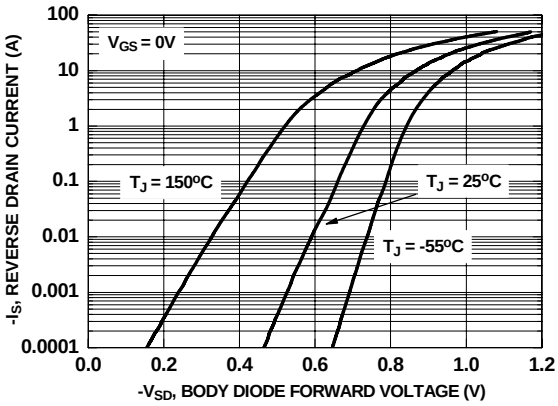



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

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

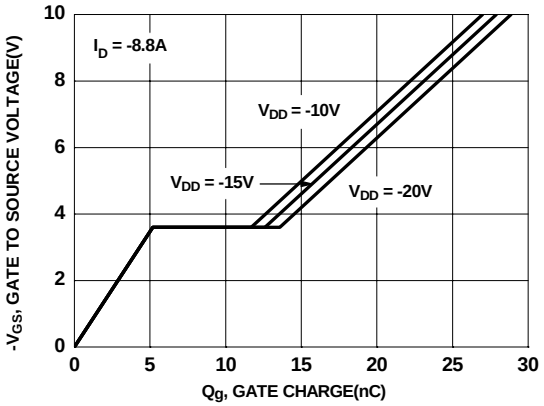



**Figure 7. Gate Charge Characteristics**

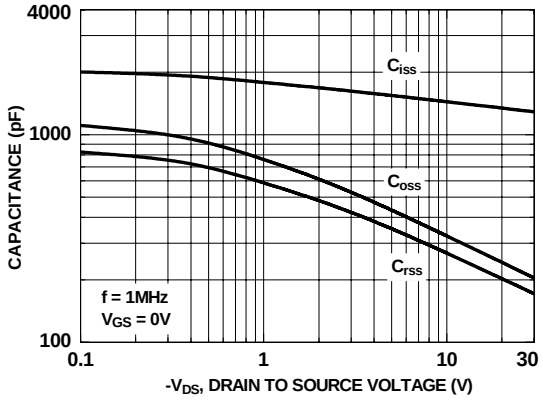



**Figure 8. Capacitance vs Drain to Source Voltage**

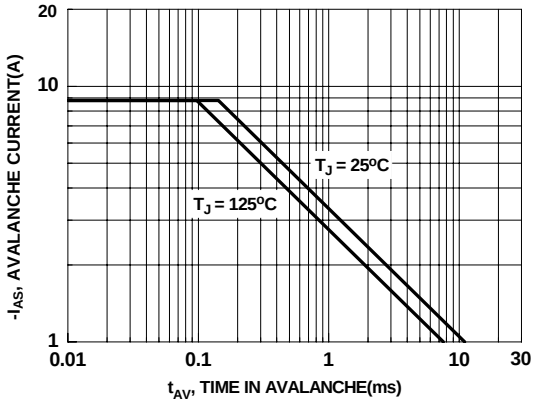



**Figure 9. Unclamped Inductive Switching Capability**

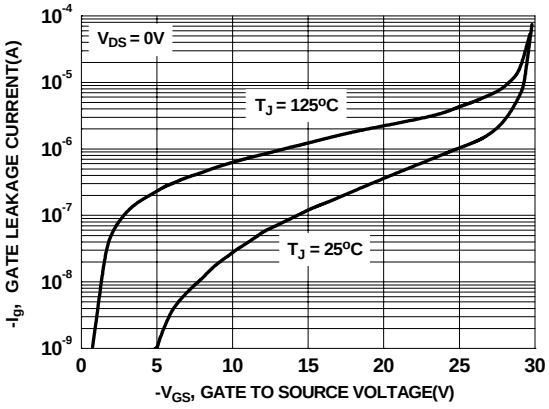



**Figure 10. Gate Leakage Current vs Gate to Source Voltage**

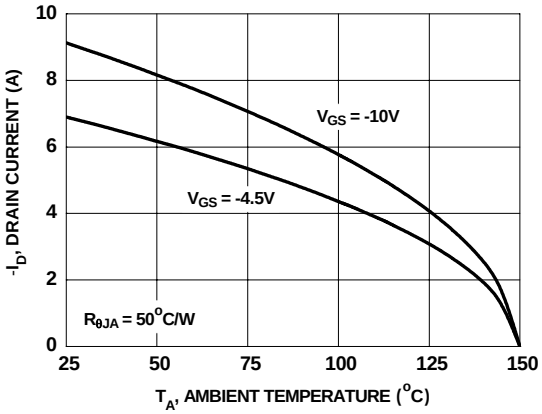



**Figure 11. Maximum Continuous Drain Current vs Ambient Temperature**

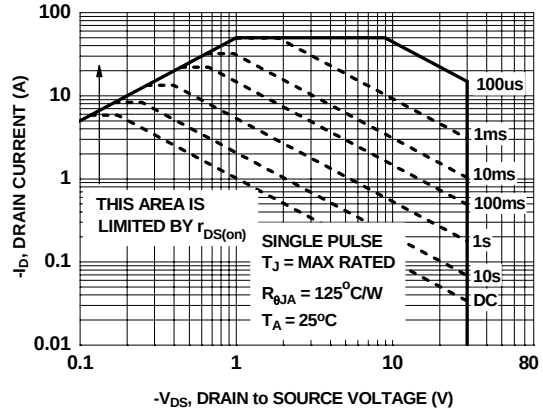



**Figure 12. Forward Bias Safe Operating Area**

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

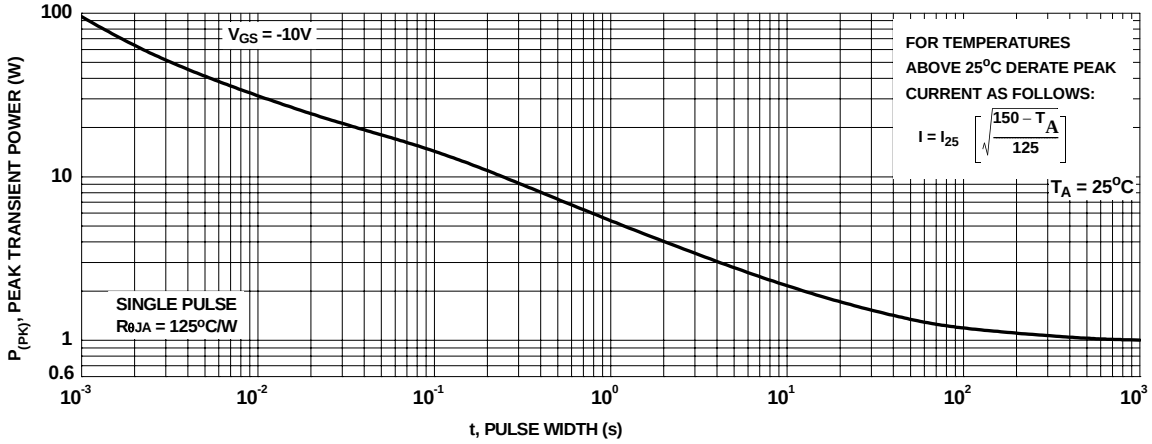



**Figure 13. Single Pulse Maximum Power Dissipation**

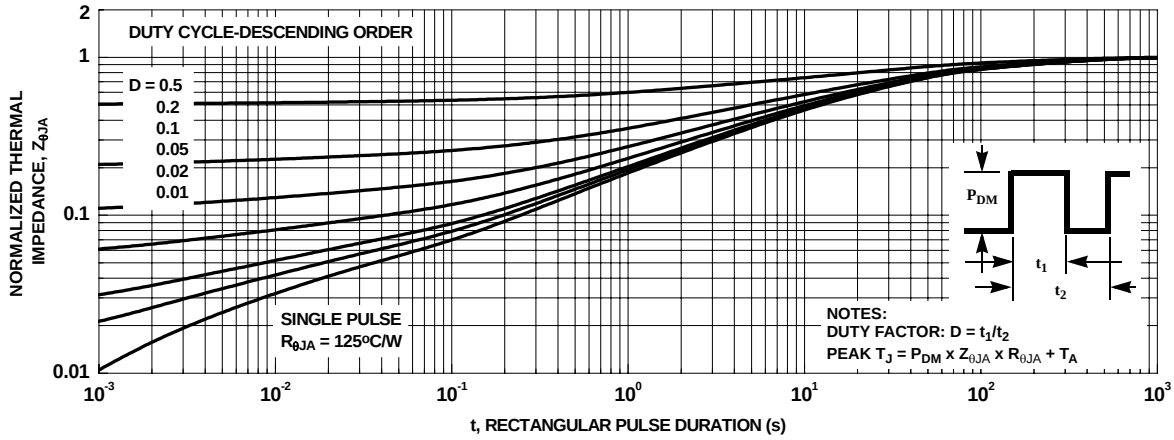



**Figure 14. Transient Thermal Response Curve**

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