

# FDS4435BZ

## P-Channel PowerTrench® MOSFET -30V, -8.8A, 20mΩ

### Features

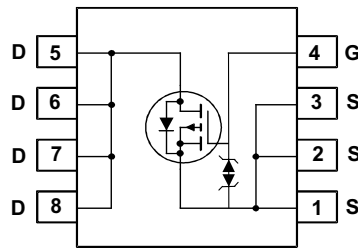
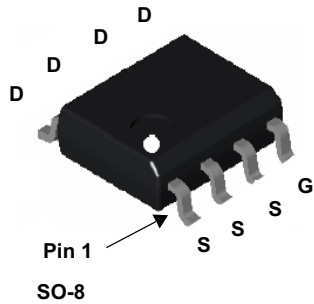
- Max  $r_{DS(on)}$  = 20mΩ at  $V_{GS} = -10V$ ,  $I_D = -8.8A$
- Max  $r_{DS(on)}$  = 35mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -6.7A$
- Extended  $V_{GSS}$  range (-25V) for battery applications
- HBM ESD protection level of ±3.8KV typical (note 3)
- High performance trench technology for extremely low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



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ 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                        | $T_A = 25^\circ\text{C}$ (Note 1a) | -8.8             |
|                | -Pulsed  |                                    | -50              |
| $P_D$          | Power Dissipation                                | $T_A = 25^\circ\text{C}$ (Note 1a) | 2.5              |
|                | Power Dissipation                                | $T_A = 25^\circ\text{C}$ (Note 1b) | 1.0              |
| $E_{AS}$       | Single Pulse Avalanche Energy                    | (Note 4)                           | 24               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150                        | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |   |    |                    |
|-----------------|---|----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 25 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | 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 $T_J = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

#### Off Characteristics

|                                      |   |  |     |     |          |                      |
|--------------------------------------|---|--|-----|-----|----------|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$                | -30 |     |          | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$ |     | -21 |          | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = -24\text{V}, V_{GS} = 0\text{V}$                 |     |     | 1        | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$              |     |     | $\pm 10$ | $\mu\text{A}$        |

#### On Characteristics

|  |  |   |    |      |    |                      |
|--|--|---|----|------|----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = -250\mu\text{A}$                            | -1 | -2.1 | -3 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$          |    | 6    |    | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = -10\text{V}, I_D = -8.8\text{A}$                          |    | 16   | 20 | m $\Omega$           |
|  |  | $V_{GS} = -4.5\text{V}, I_D = -6.7\text{A}$                         |    | 26   | 35 |                      |
|  |  | $V_{GS} = -10\text{V}, I_D = -8.8\text{A}, T_J = 125^\circ\text{C}$ |    | 22   | 28 |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = -5\text{V}, I_D = -8.8\text{A}$                           |    | 24   |    | S                    |

#### Dynamic Characteristics

|           |                              |   |  |      |      |          |
|-----------|------------------------------|---|--|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ |  | 1385 | 1845 | pF       |
| $C_{oss}$ | Output Capacitance           |   |  | 275  | 365  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |   |  | 230  | 345  | pF       |
| $R_g$     | Gate Resistance              | $f = 1\text{MHz}$   |  | 4.5  |      | $\Omega$ |

#### Switching Characteristics

|              |                               |   |                                      |     |    |    |
|--------------|-------------------------------|---|--------------------------------------|-----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = -15\text{V}, I_D = -8.8\text{A}, V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$ |                                      | 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             |   | $V_{GS} = 0\text{V to } -10\text{V}$ |     | 28 | 40 |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0\text{V to } -5\text{V}$   |                                      | 16  | 23 | nC |
| $Q_{gs}$     | Gate to Source Charge         | $V_{DD} = -15\text{V}, I_D = -8.8\text{A}$  |                                      | 5.2 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |   |                                      | 7.4 |    | nC |

#### Drain-Source Diode Characteristics

|          |                                       |   |  |      |      |    |
|----------|---------------------------------------|---|--|------|------|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{V}, I_S = -8.8\text{A}$ (Note 2)     |  | -0.9 | -1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = -8.8\text{A}, di/dt = 100\text{A}/\mu\text{s}$ |  | 29   | 44   | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |   |  | 23   | 35   | nC |

#### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{in.}$  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.  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper.



b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width  $< 300\mu\text{s}$ , 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  $T_J = 25^\circ\text{C}$ ,  $L = 1\text{mH}$ ,  $I_{AS} = -7\text{A}$ ,  $V_{DD} = -30\text{V}$ ,  $V_{GS} = -10\text{V}$

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

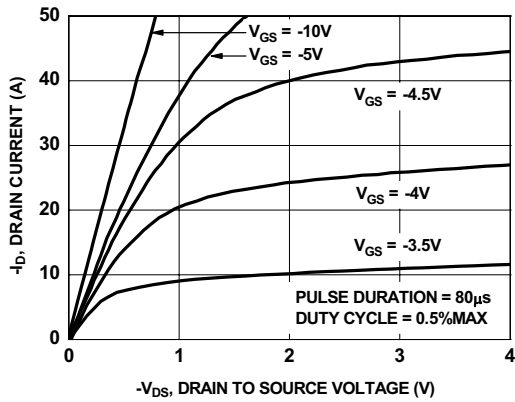


Figure 1. On-Region Characteristics

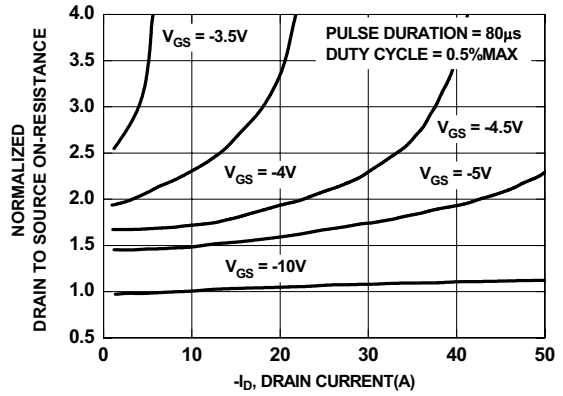


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

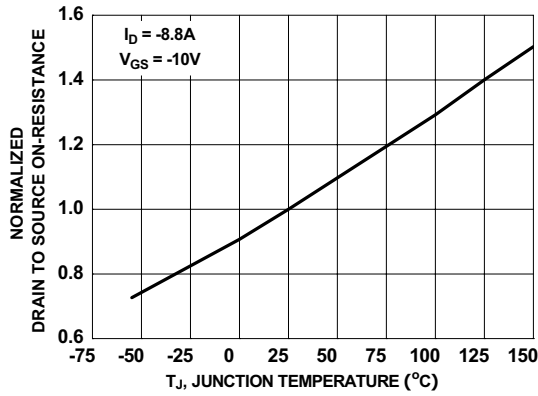


Figure 3. Normalized On-Resistance vs Junction Temperature

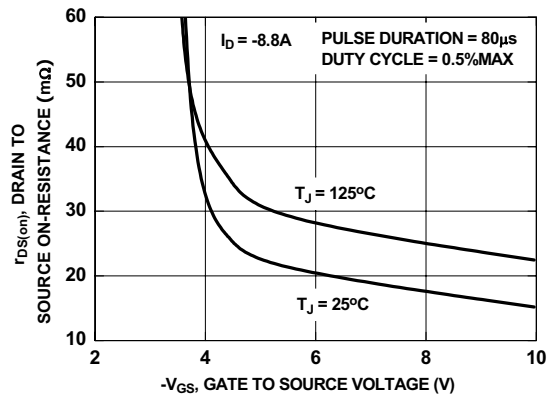


Figure 4. On-Resistance vs Gate to Source Voltage

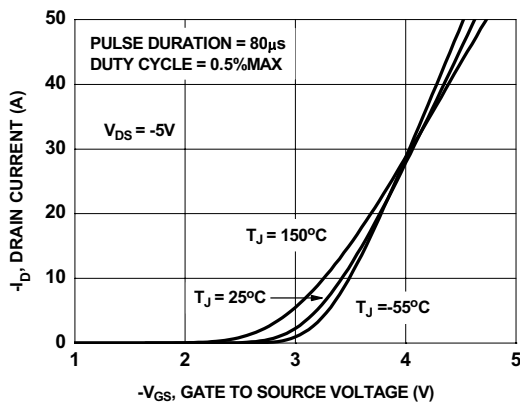


Figure 5. Transfer Characteristics

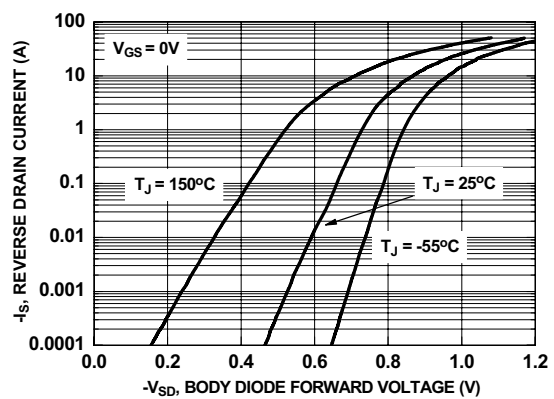
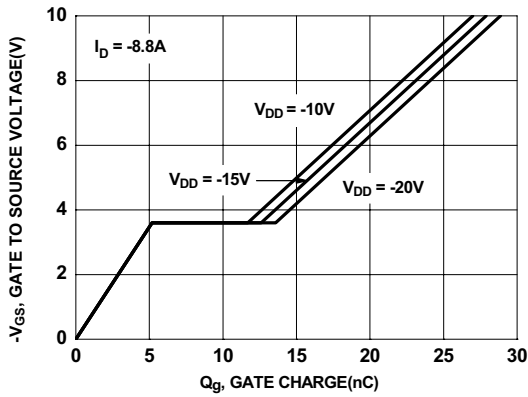
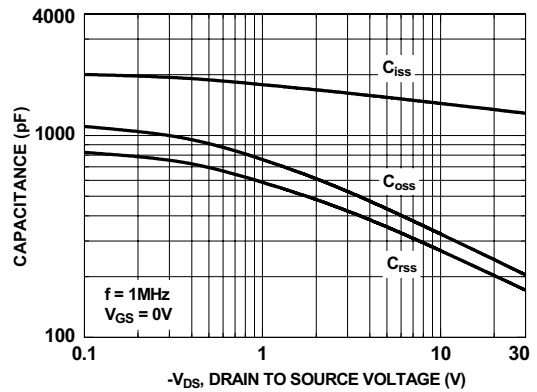


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

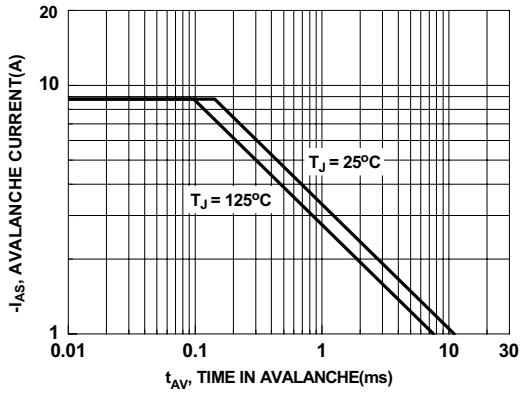
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



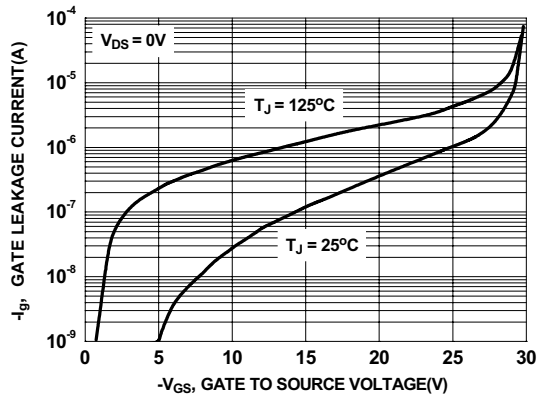
**Figure 7. Gate Charge Characteristics**



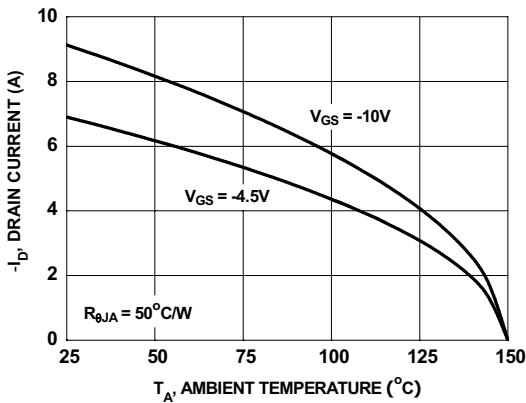
**Figure 8. Capacitance vs Drain to Source Voltage**



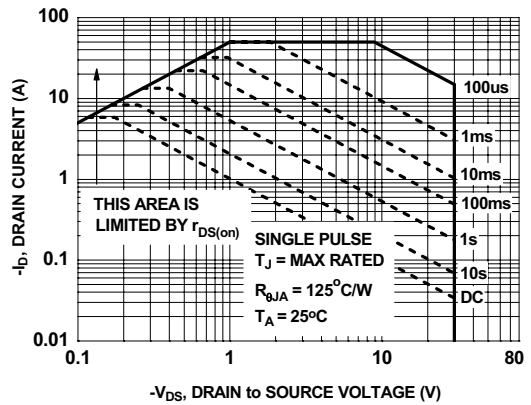
**Figure 9. Unclamped Inductive Switching Capability**



**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**  $T_J = 25^\circ\text{C}$  unless otherwise noted

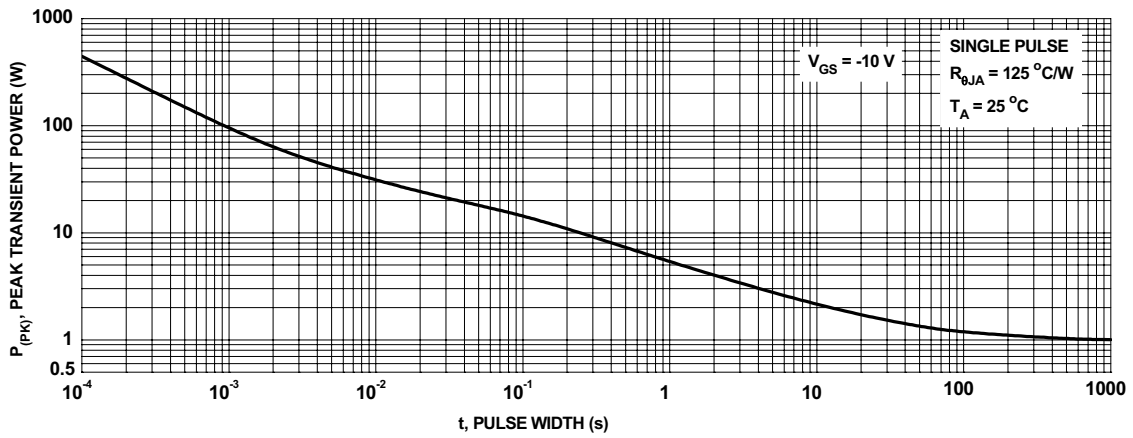


Figure 13. Single Pulse Maximum Power Dissipation

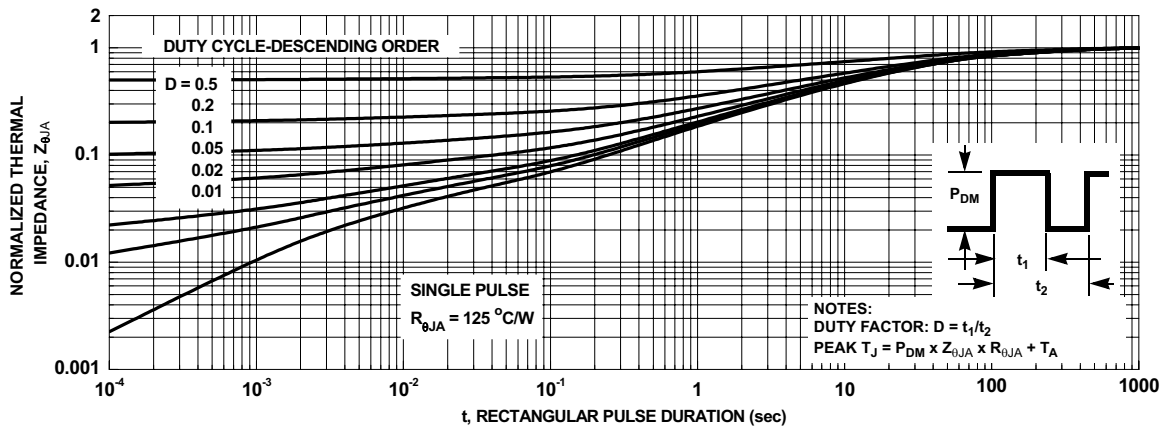








Figure 14. Transient Thermal Response Curve



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