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# FDS4435BZ

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

### Features

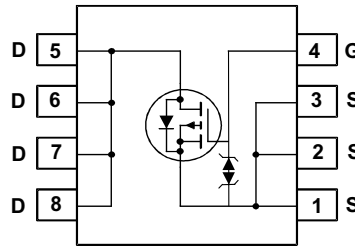
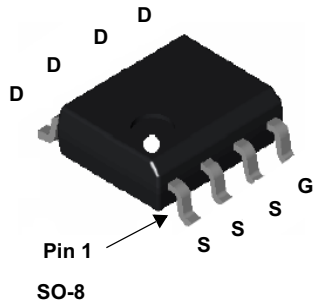
- Max  $r_{DS(on)}$  = 20mΩ at  $V_{GS} = -10V$ ,  $I_D = -8.8A$
- Max  $r_{DS(on)}$  = 35mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -6.7A$
- Extended  $V_{GSS}$  range (-25V) for battery applications
- HBM ESD protection level of ±3.8KV typical (note 3)
- High performance trench technology for extremely low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

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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#### 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

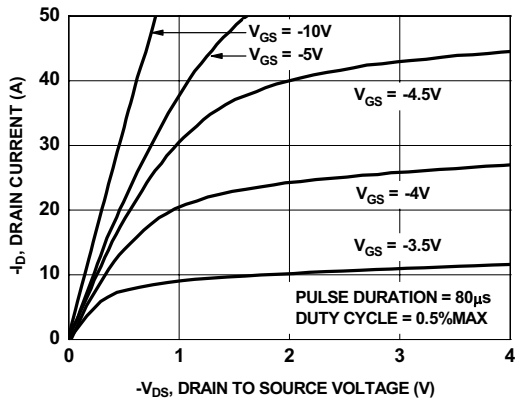


Figure 1. On-Region Characteristics

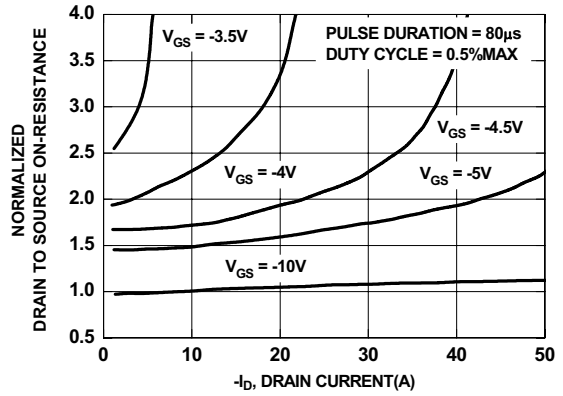


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

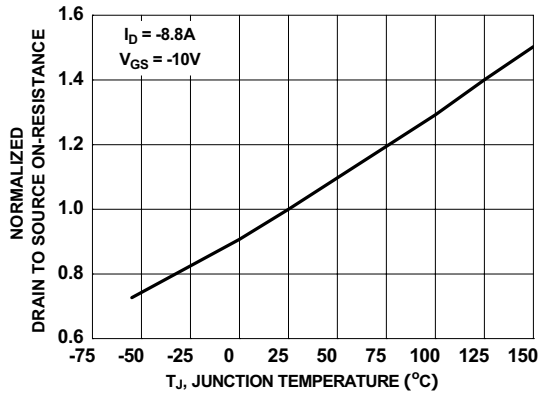


Figure 3. Normalized On-Resistance vs Junction Temperature

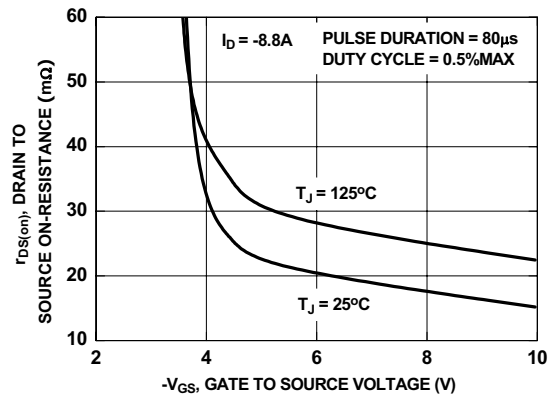


Figure 4. On-Resistance vs Gate to Source Voltage

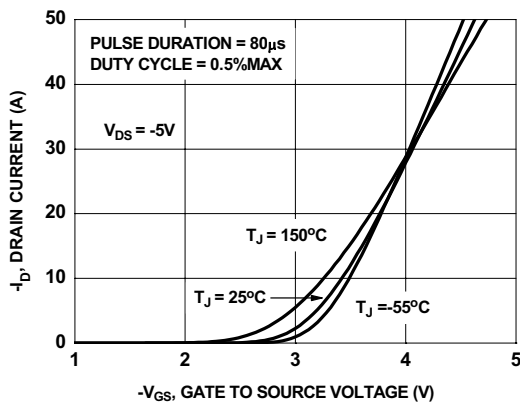


Figure 5. Transfer Characteristics

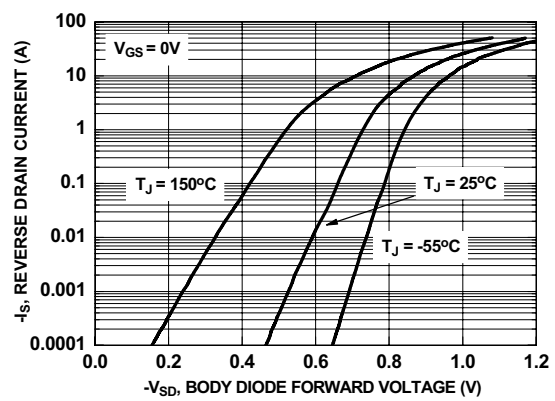
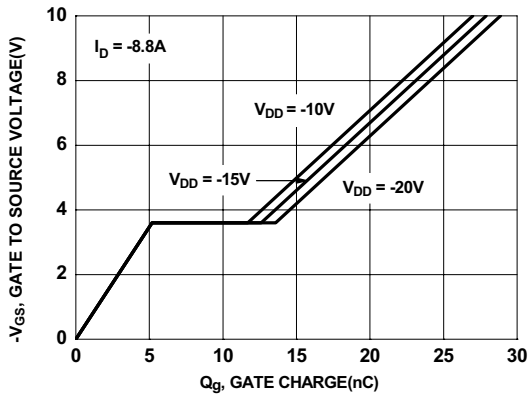
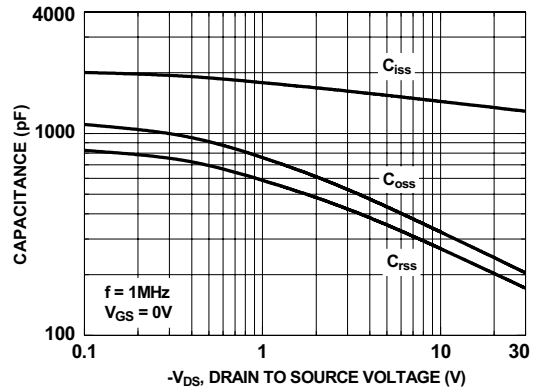


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

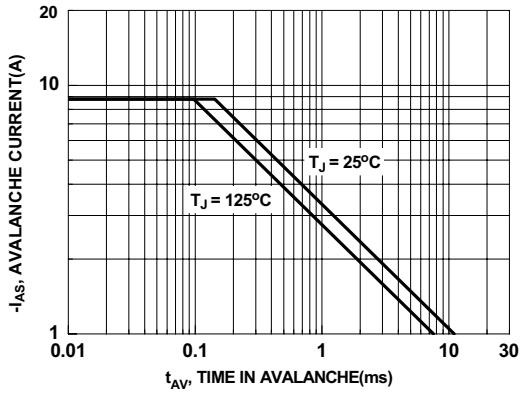
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



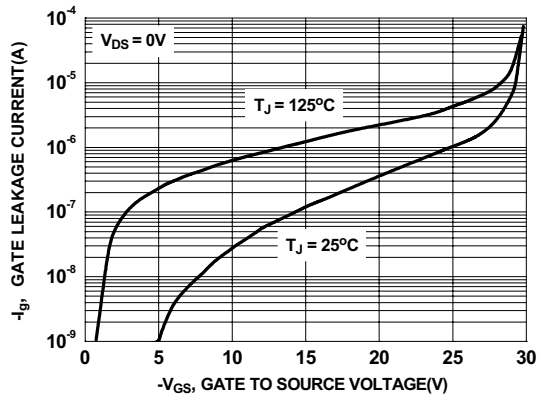
**Figure 7. Gate Charge Characteristics**



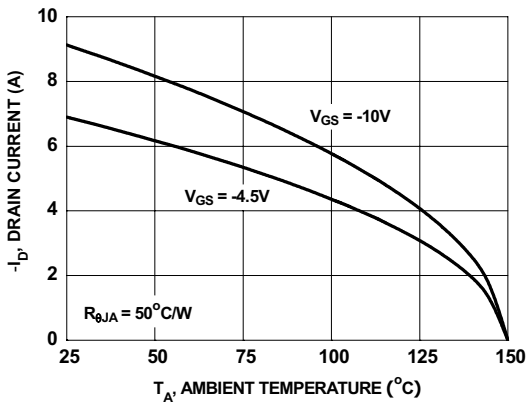
**Figure 8. Capacitance vs Drain to Source Voltage**



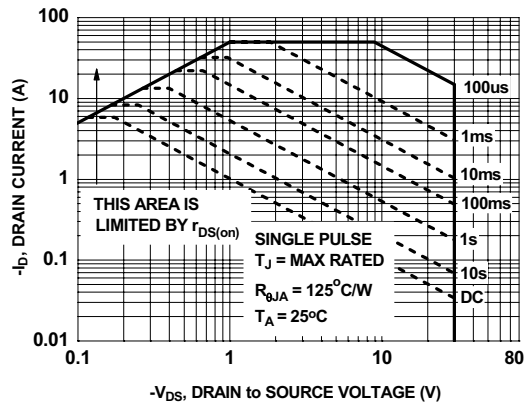
**Figure 9. Unclamped Inductive Switching Capability**



**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

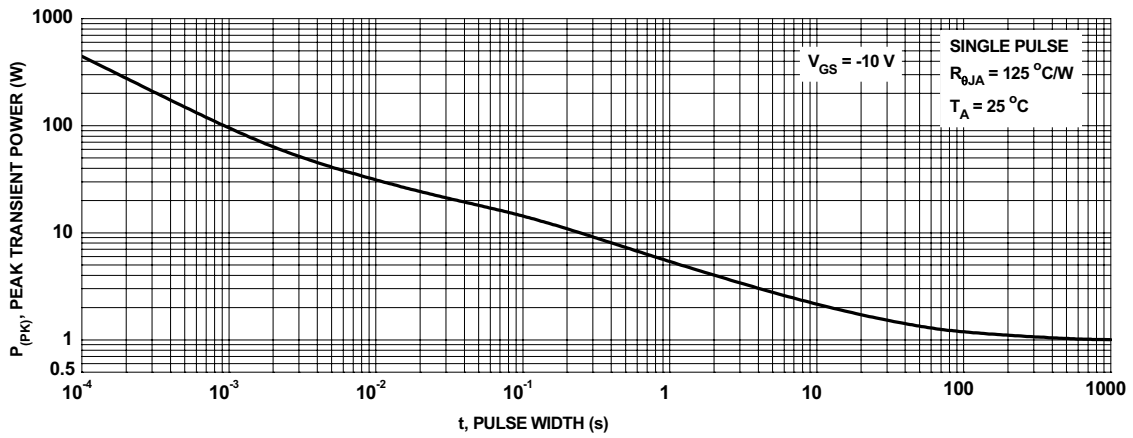


Figure 13. Single Pulse Maximum Power Dissipation

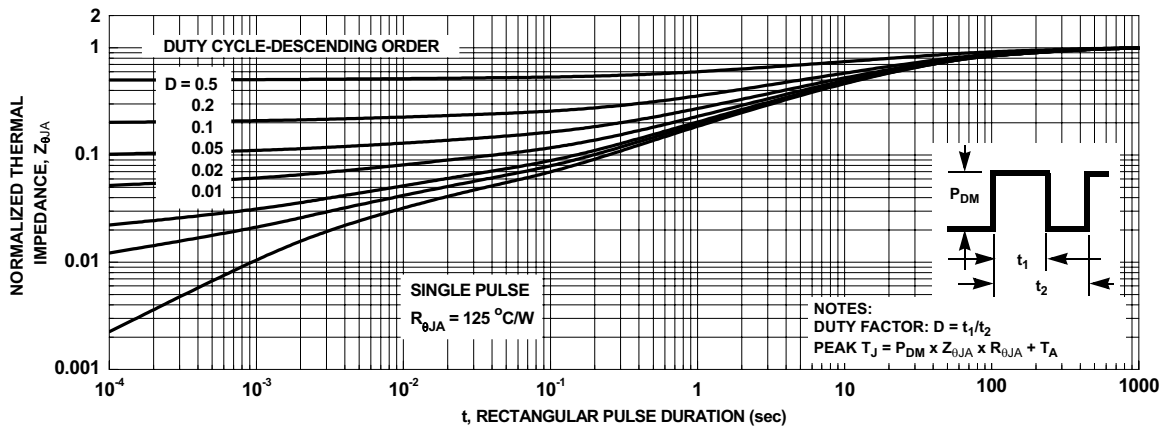








Figure 14. Transient Thermal Response Curve



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