

# FDR838P

## P-Channel 2.5V Specified PowerTrench™ MOSFET

### General Description

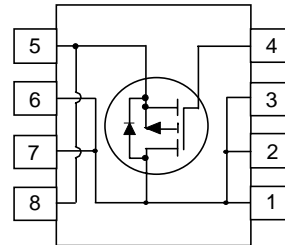
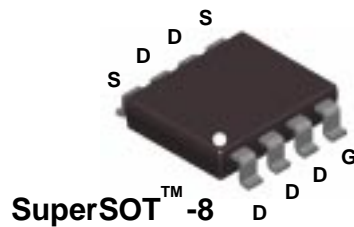
These P-Channel 2.5V specified MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

### Applications

- Load switch
- Motor driving
- Power Management

### Features

- -8 A, -20 V.  $R_{DS(ON)} = 0.017 \Omega @ V_{GS} = -4.5 V$   
 $R_{DS(ON)} = 0.024 \Omega @ V_{GS} = -2.5 V$
- Low gate charge (30nC typical).
- Fast switching speed.
- High performance trench technology for extremely low  $R_{DS(ON)}$ .
- Small footprint (38% smaller than a standard SO-8); low profile package (1 mm thick); power handling capability similar to SO-8.



### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	Drain-Source Voltage	-20	V
V <sub>GSS</sub>	Gate-Source Voltage	±8	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a) - Pulsed	-8	A
		-50	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	1.8	W
		1.0	
		0.9	
T <sub>J</sub> , T <sub>stg</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	70	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	20	°C/W

### Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.838P	FDR838P	13"	12mm	3000 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-18		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

## On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.85	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = -2.5\text{ V}, I_D = -7.0\text{ A}$		0.014 0.020 0.020	0.017 0.026 0.024	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-50			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -8\text{ A}$		28		S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		3300		pF
$C_{oss}$	Output Capacitance			730		pF
$C_{rss}$	Reverse Transfer Capacitance			350		pF

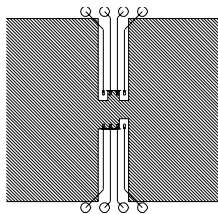
## Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		14	25	ns
$t_r$	Turn-On Rise Time			20	32	ns
$t_{d(off)}$	Turn-Off Delay Time			110	150	ns
$t_f$	Turn-Off Fall Time			60	90	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -8\text{ A},$ $V_{GS} = -4.5\text{ V}$		30	45	nC
$Q_{gs}$	Gate-Source Charge			5		nC
$Q_{gd}$	Gate-Drain Charge			9		nC

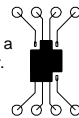
## Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.5	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -1.5\text{ A}$ (Note 2)		-0.7	-1.2	V

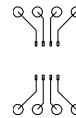
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $70^\circ\text{ C/W}$  when mounted on a  $1.0\text{ in}^2$  pad of 2 oz. copper.



b)  $125^\circ\text{ C/W}$  when mounted on a  $0.026\text{ in}^2$  pad of 2oz. copper.



c)  $135^\circ\text{ C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

Typical Characteristics

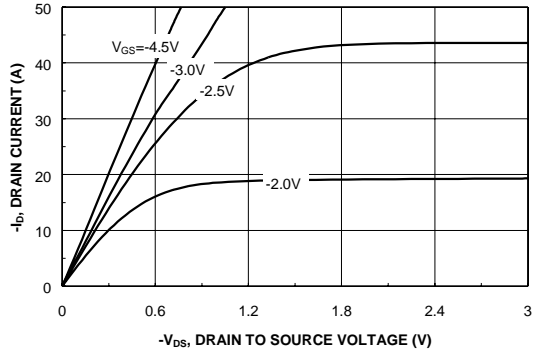


Figure 1. On-Region Characteristics.

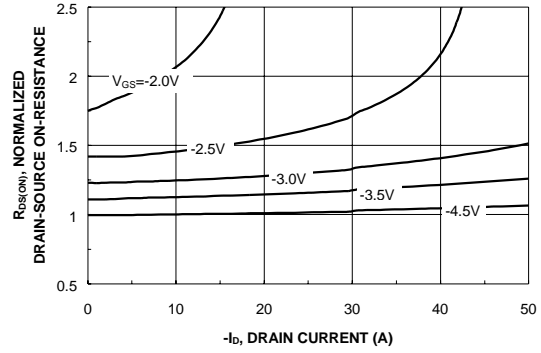


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

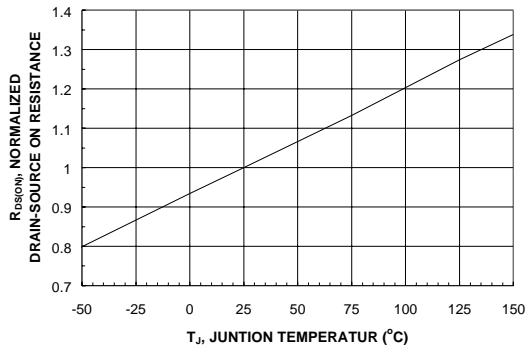


Figure 3. On-Resistance Variation with Temperature.

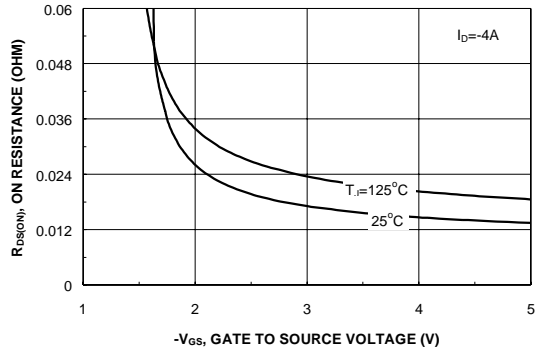


Figure 4: On-Resistance Variation with Gate-to-Source Voltage.

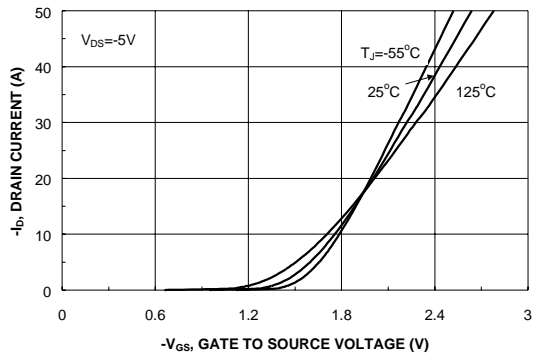


Figure 5. Transfer Characteristics.

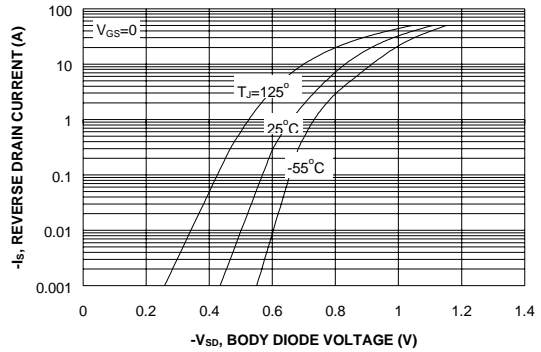
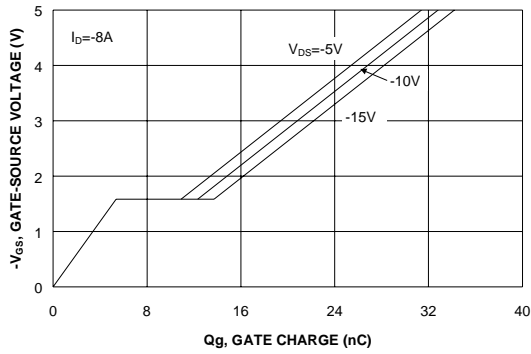
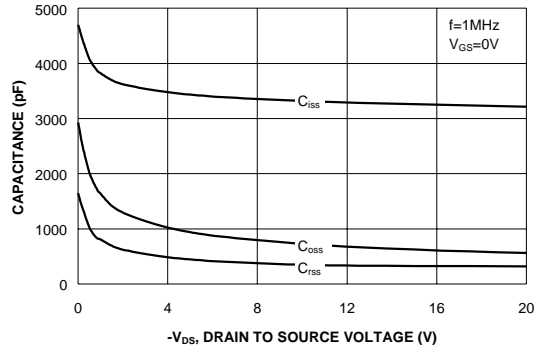


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

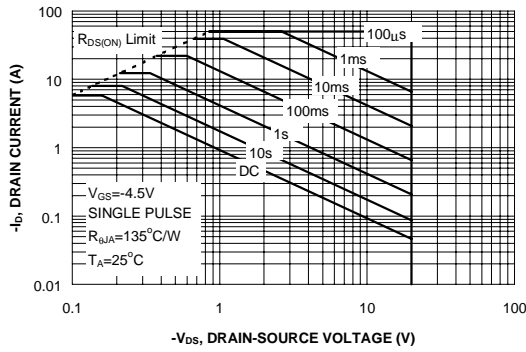
**Typical Characteristics** (continued)



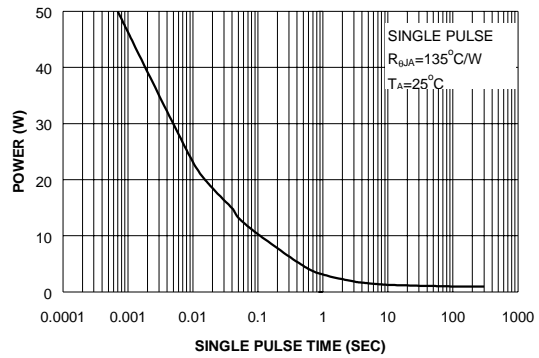
**Figure 7. Gate-Charge Characteristics.**



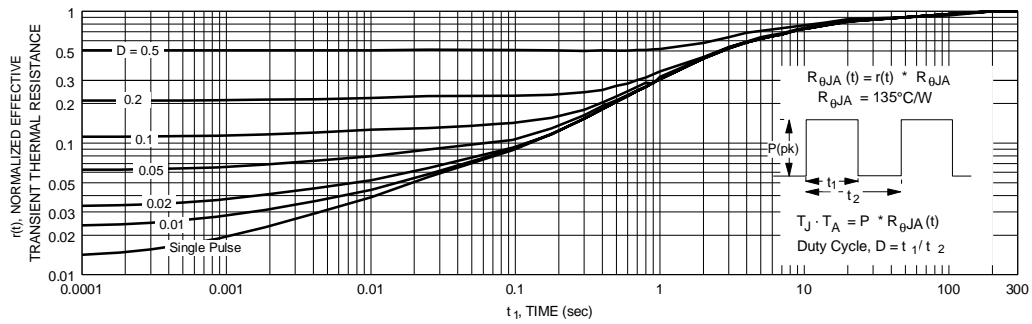
**Figure 8. Capacitance Characteristics.**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Single Pulse Maximum Power Dissipation.**



**Figure 11. Transient Thermal Response Curve.**

Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.

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