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# F DN338P

## P-Channel 2.5V Specified PowerTrench<sup>®</sup> MOSFET

### General Description

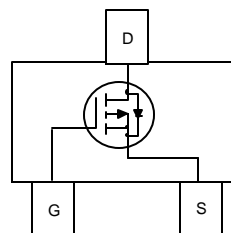
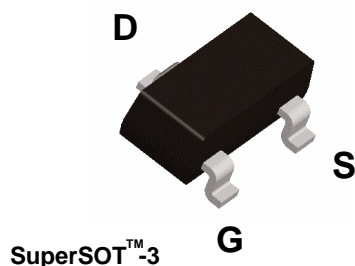
This P-Channel 2.5V specified MOSFET uses Fairchild's advanced low voltage PowerTrench process. It has been optimized for battery power management applications.

### Applications

- Battery management
- Load switch
- Battery protection

### Features

- 1.6 A, –20 V.  $R_{DS(ON)} = 115\text{ m}\Omega$  @  $V_{GS} = -4.5\text{ V}$   
 $R_{DS(ON)} = 155\text{ m}\Omega$  @  $V_{GS} = -2.5\text{ V}$
- Fast switching speed
- High performance trench technology for extremely low  $R_{DS(ON)}$
- SuperSOT<sup>™</sup>-3 provides low  $R_{DS(ON)}$  and 30% higher power handling capability than SOT23 in the same footprint



### Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	–20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 8$	V
$I_D$	Drain Current – Continuous	–1.6	A
	– Pulsed	–5	
$P_D$	Maximum Power Dissipation (Note 1a)	0.5	W
	(Note 1b)	0.46	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	–55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	250	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	75	$^\circ\text{C/W}$

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
338	F DN338P	7"	8mm	3000 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	–20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to 25°C		–16		mV/°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, Forward	$V_{GS} = 8\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -8\text{ V}$ , $V_{DS} = 0\text{ V}$			–100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	–0.4	–0.8	–1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to 25°C		2.7		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -4.5\text{ V}$ , $I_D = -1.6\text{ A}$ $V_{GS} = -2.5\text{ V}$ , $I_D = -1.3\text{ A}$ $V_{GS} = -4.5\text{ V}$ , $I_D = -1.6\text{ A}$ , $T_J=125^\circ\text{C}$		88 117 116	115 155 165	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -4.5\text{ V}$ , $V_{DS} = -5\text{ V}$	–5			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}$ , $I_D = -1.6\text{ A}$		6		S
Dynamic Characteristics						
$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		451		pF
$C_{oss}$	Output Capacitance			75		pF
$C_{rss}$	Reverse Transfer Capacitance			33		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -10\text{ V}$ , $I_D = -1\text{ A}$ , $V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		10	20	ns
$t_r$	Turn–On Rise Time			11	20	ns
$t_{d(off)}$	Turn–Off Delay Time			16	29	ns
$t_f$	Turn–Off Fall Time			6.5	13	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}$ , $I_D = -1.6\text{ A}$ , $V_{GS} = -4.5\text{ V}$		4.4	6.2	nC
$Q_{gs}$	Gate–Source Charge			1.1		nC
$Q_{gd}$	Gate–Drain Charge			0.7		nC
Drain–Source Diode Characteristics and Maximum Ratings						
$I_S$	Maximum Continuous Drain–Source Diode Forward Current				–0.42	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -0.42$ (Note 2)		–0.7	–1.2	V

### Notes:

- $R_{\theta JA}$  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)  $250^\circ\text{C/W}$  when mounted on a  $0.02\text{ in}^2$  pad of 2 oz. copper.



b)  $270^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

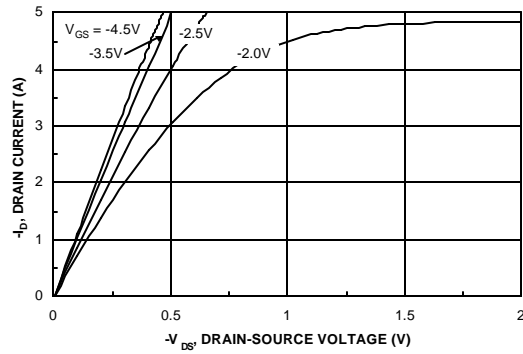


Figure 1. On-Region Characteristics.

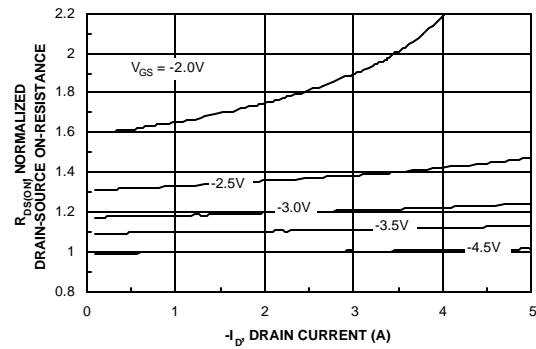


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

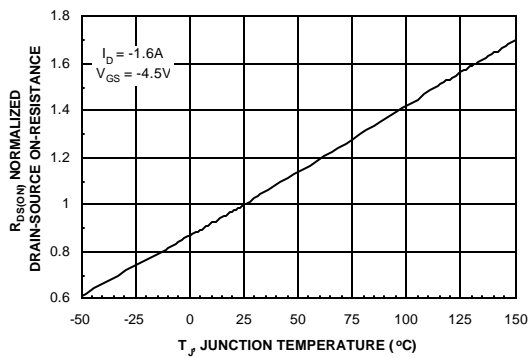


Figure 3. On-Resistance Variation with Temperature.

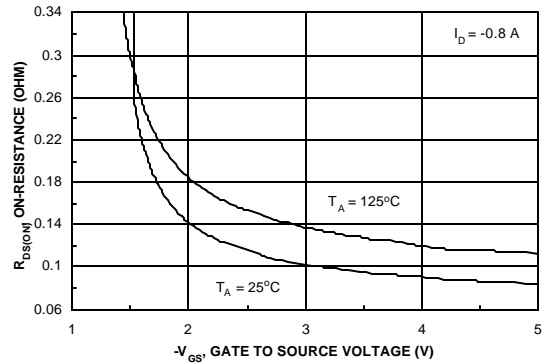


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

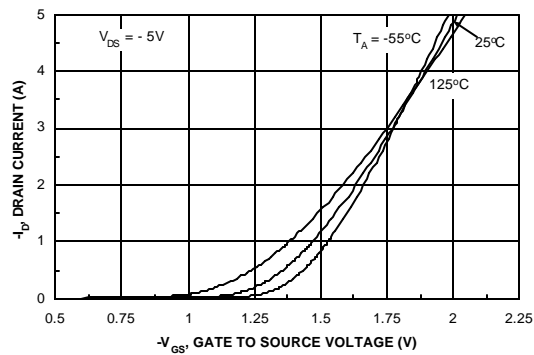


Figure 5. Transfer Characteristics.

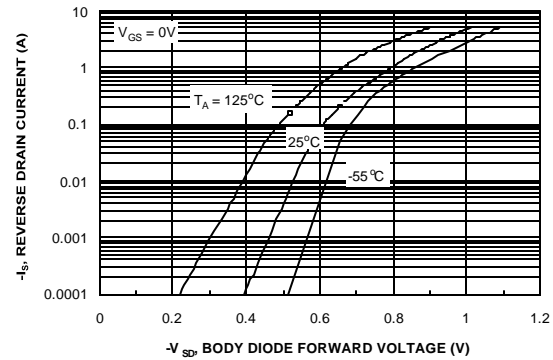


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

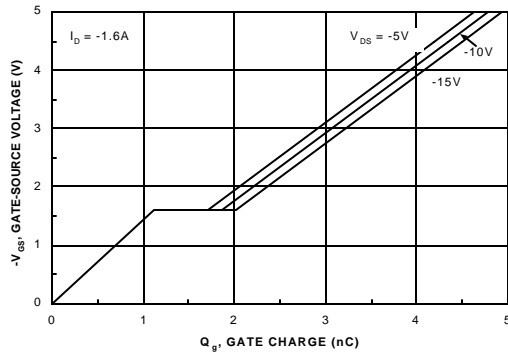


Figure 7. Gate Charge Characteristics.

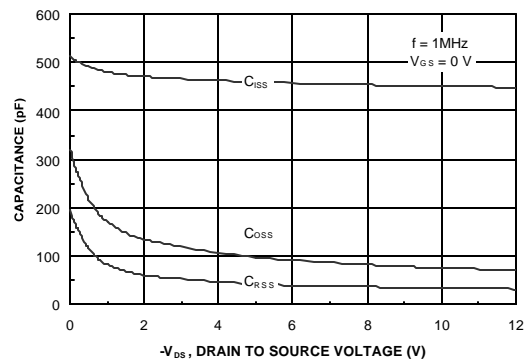


Figure 8. Capacitance Characteristics.

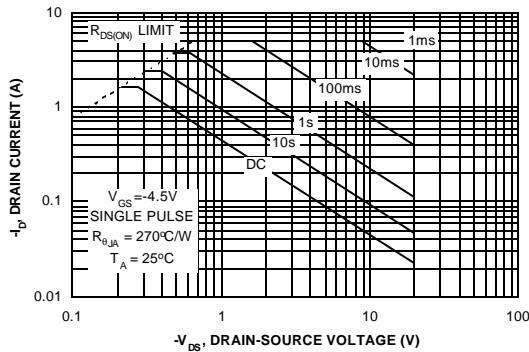


Figure 9. Maximum Safe Operating Area.

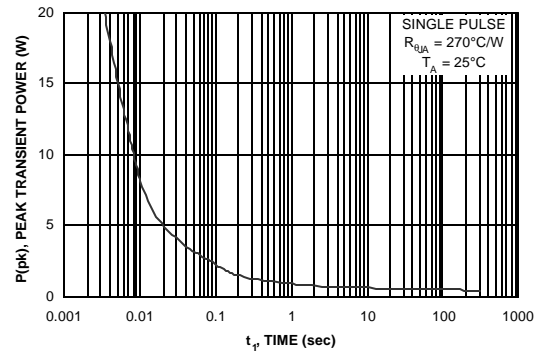


Figure 10. Single Pulse Maximum Power Dissipation.

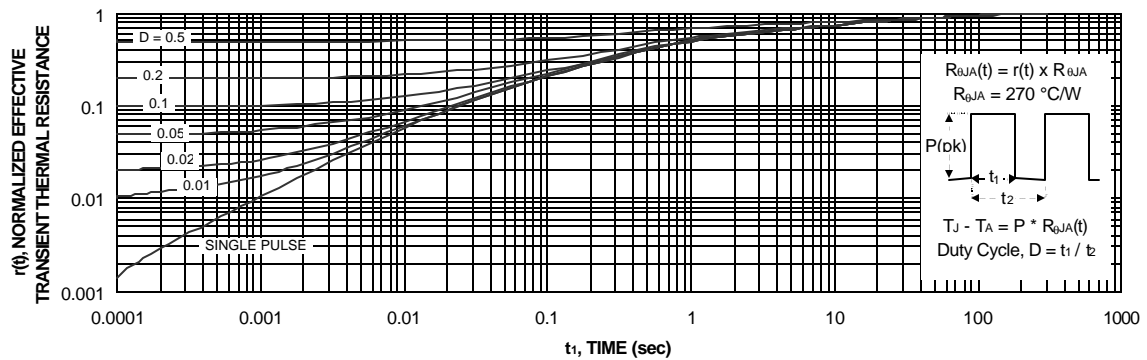




Figure 11. Transient Thermal Response Curve.

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



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