



November 1998

FDN336P

Single P-Channel 2.5V Specified PowerTrench™ MOSFET

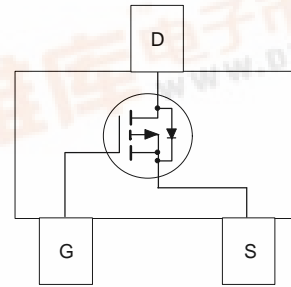
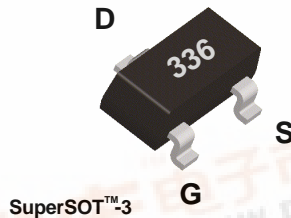
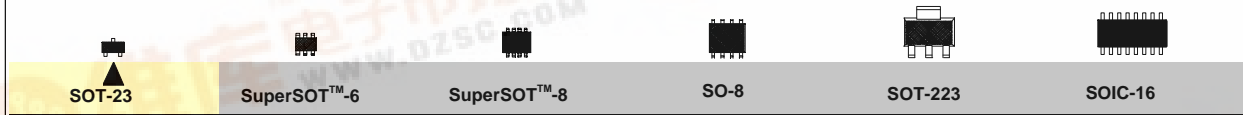
General Description

This P-Channel 2.5V specified MOSFET is 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.

These devices are well suited for portable electronics applications: load switching and power management, battery charging circuits, and DC/DC conversion.

Features

- 1.3 A, -20 V. $R_{DS(ON)} = 0.20 \Omega @ V_{GS} = -4.5 V$
 $R_{DS(ON)} = 0.27 \Omega @ V_{GS} = -2.5 V.$
- Low gate charge (3.6 nC typical).
- High performance trench technology for extremely low $R_{DS(ON)}$.
- High power version of industry standard SOT-23 package. Identical pin out to SOT-23 with 30% higher power handling capability.

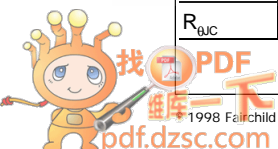


Absolute Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	FDN336P	Units
V_{DSS}	Drain-Source Voltage	-20	V
V_{GSS}	Gate-Source Voltage	± 8	V
I_D	Drain Current	- Continuous	-1.3
		- Pulsed	-10
P_D	Maximum Power Dissipation	(Note 1a)	0.5
		(Note 1b)	0.46
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$

THERMAL CHARACTERISTICS

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



Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V	
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = -250\ \mu\text{A}$, Referenced to 25°C		-16		mV/ $^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	μA	
						-10	μA
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	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.9	-1.5	V	
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = -250\ \mu\text{A}$, Referenced to 25°C		3		mV/ $^\circ\text{C}$	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -1.3\text{ A}$		0.122	0.2	Ω	
					0.18		0.32
					0.19		0.27
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-5			A	
g_{FS}	Forward Transconductance	$V_{DS} = -4.5\text{ V}, I_D = -2\text{ A}$		4		S	
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		330		pF	
C_{oss}	Output Capacitance			80		pF	
C_{rss}	Reverse Transfer Capacitance			35		pF	
SWITCHING CHARACTERISTICS (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = -5\text{ V}, I_D = -0.5\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		7	15	ns	
t_r	Turn - On Rise Time			12	22	ns	
$t_{D(off)}$	Turn - Off Delay Time			16	26	ns	
t_f	Turn - Off Fall Time			5	12	ns	
Q_g	Total Gate Charge		$V_{DS} = -10\text{ V}, I_D = -2\text{ A},$ $V_{GS} = -4.5\text{ V}$		3.6	5	nC
Q_{gs}	Gate-Source Charge			0.8		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	$V_{GS} = 0\text{ V}, I_S = -0.42\text{ A}$ (Note)		-0.7	-1.2	V	

Note:

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. 250°C/W when mounted on
a 0.02 in^2 pad of 2oz Cu.



b. 270°C/W when mounted on
a 0.001 in^2 pad of 2oz Cu.

Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

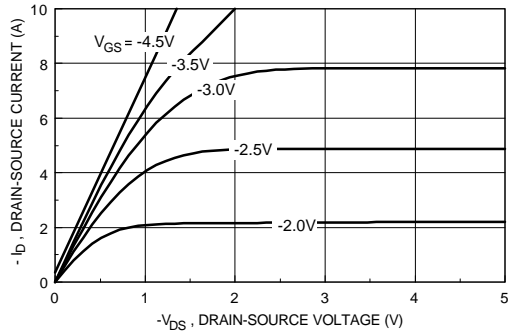


Figure 1. On-Region Characteristics.

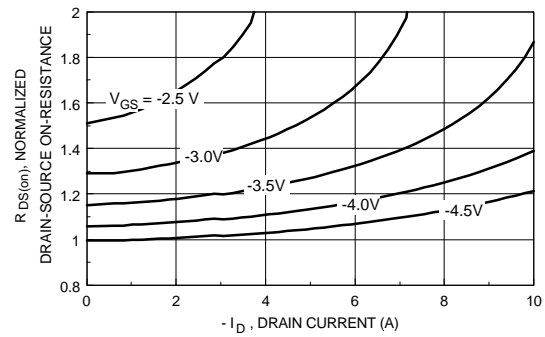


Figure 2. On-Resistance Variation with Drain Current and Gate

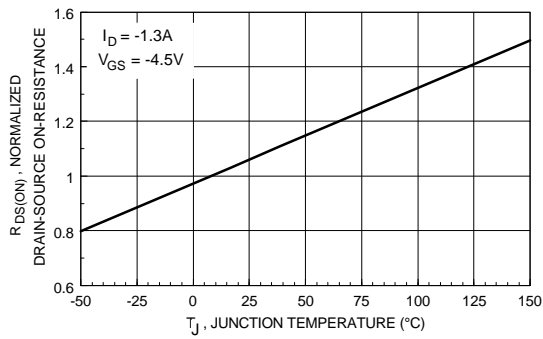


Figure 3. On-Resistance Variation with Temperature.

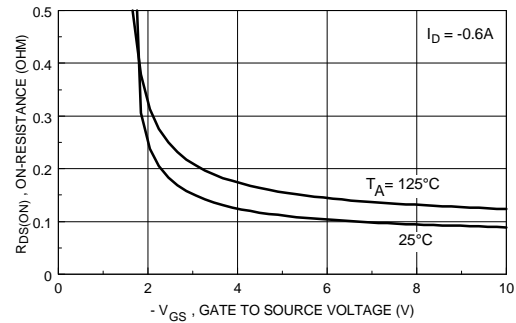


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

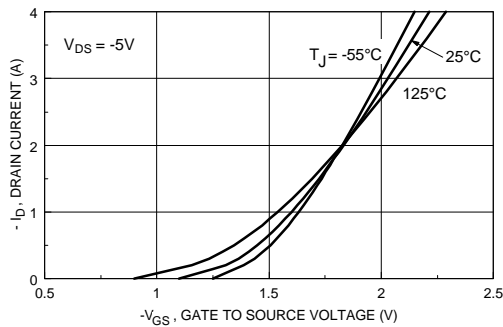


Figure 5. Transfer Characteristics.

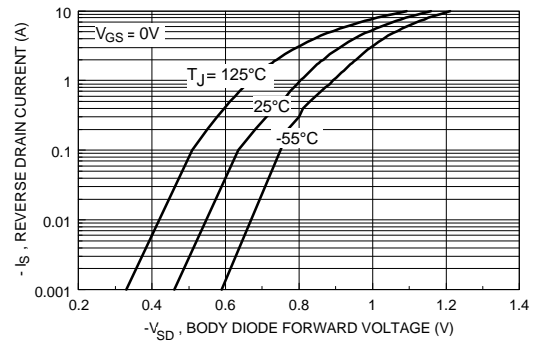


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics (continued)

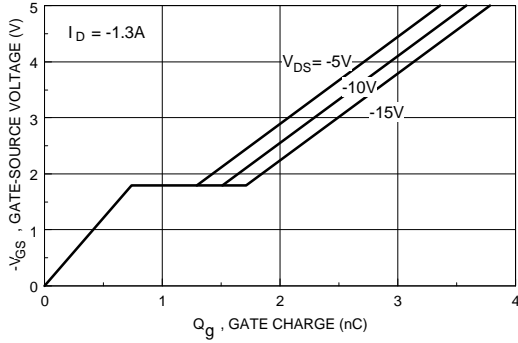


Figure 7. Gate Charge Characteristics.

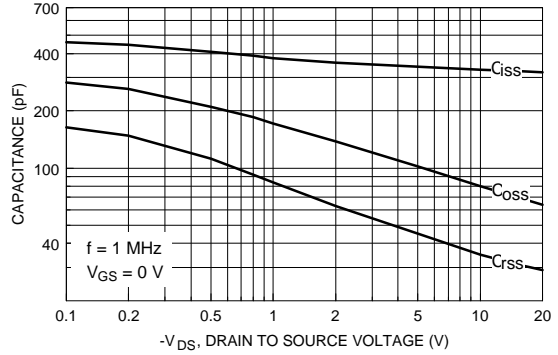


Figure 8. Capacitance Characteristics.

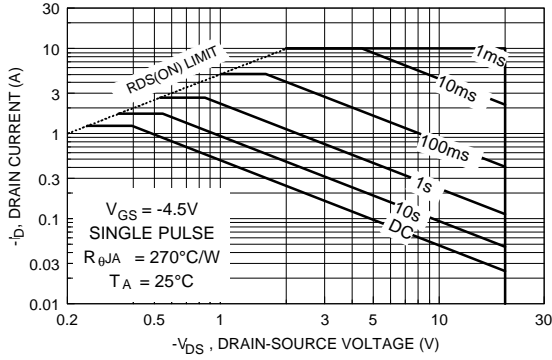


Figure 9. Maximum Safe Operating Area.

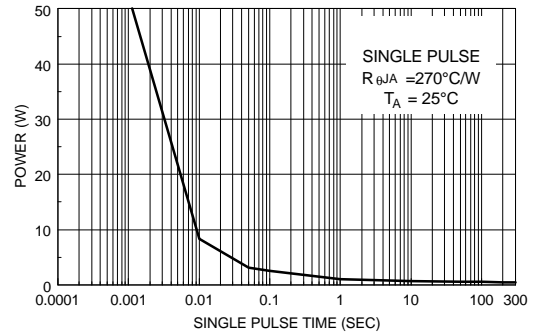


Figure 10. Single Pulse Maximum Power Dissipation.

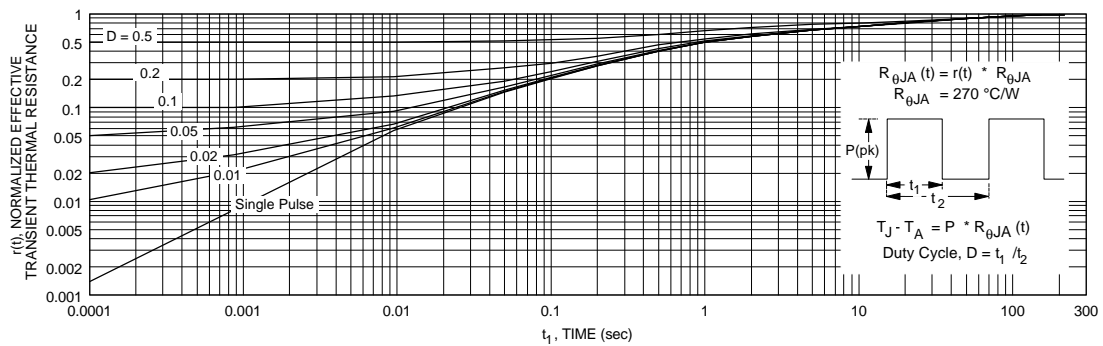


Figure 11. Transient Thermal Response Curve.

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

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