

FDS9933

Dual P-Channel 2.5V Specified PowerTrench $^{\circ}$ MOSFET

General Description

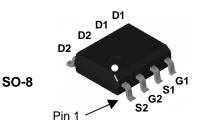
This P-Channel MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It has been optimized for power management applications with a wide range of gate drive voltage (2.5V – 12V).

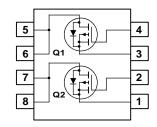
Applications

- Load switch
- Motor drive
- DC/DC conversion
- Power management

Features

- -5 A, -20 V, $R_{DS(ON)} = 55 \text{ m}\Omega$ @ $V_{GS} = -4.5 \text{ V}$ $R_{DS(ON)} = 90 \text{ m}\Omega$ @ $V_{GS} = -2.5 \text{ V}$
- Extended V_{GSS} range (±12V) for battery applications
- · Low gate charge
- High performance trench technology for extremely low $R_{\mbox{\scriptsize DS(ON)}}$
- High power and current handling capability





Absolute Maximum Ratings TA=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V _{DSS}	Drain-Source Voltage		-20	V
V _{GSS}	Gate-Source Voltage		±12	V
I _D	Drain Current - Continuous	(Note 1a)	-5	Α
	- Pulsed		-30	
P _D	Power Dissipation for Dual Operation		2	W
	Power Dissipation for Single Operation	(Note 1a)	1.6	
		(Note 1b)	1	
		(Note 1c)	0.9	
T _J , T _{STG}	Operating and Storage Junction Temperature Range		-55 to +175	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	78	°C/W
R _{BJC}	Thermal Resistance, Junction-to-Case	(Note 1)	40	°C/W

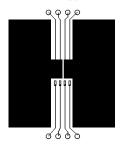
Package Marking and Ordering Information

	<u> </u>			
Device Marking	Device	Reel Size	Tape width	Quantity
9933 FDS9933		13"	12mm	2500 units

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Char	racteristics			I.		I.
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_{D} = -250 \mu\text{A}$	-20			V
$\Delta BV_{DSS} \over \Delta T_{J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250 \mu A$, Referenced to 25°C		-12		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$			-1	μΑ
I _{GSS}	Gate-Body Leakage	$V_{GS} = \pm 12 \text{ V}, \qquad V_{DS} = 0 \text{ V}$			±100	nA
On Char	acteristics (Note 2)					
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = -250 \mu A$	-0.6	-0.8	-1.2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250 \mu A$, Referenced to 25°C		3		mV/°C
R _{DS(on)}	Static Drain–Source On–Resistance	$V_{GS} = -4.5 \text{ V}, \qquad I_D = -3.2 \text{ A}$ $V_{GS} = -2.5 \text{ V}, \qquad I_D = -1.0 \text{ A}$		44 72	55 90	mΩ
I _{D(on)}	On-State Drain Current	$V_{GS} = -2.5 \text{ V}, \qquad I_{D} = -1.0 \text{ A}$ $V_{GS} = -4.5 \text{ V}, \qquad V_{DS} = -5 \text{ V}$	-16			Α
g FS	Forward Transconductance	$V_{DS} = -9 \text{ V}, \qquad I_{D} = -3.4 \text{ A}$		8		S
Dvnami	c Characteristics					
C _{iss}	Input Capacitance	$V_{DS} = -10 \text{ V}, \qquad V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$		825		pF
Coss	Output Capacitance			420		pF
C _{rss}	Reverse Transfer Capacitance			150		pF
Switchir	ng Characteristics (Note 2)					
t _{d(on)}	Turn-On Delay Time	$V_{DD} = -10 \text{ V}, \qquad I_{D} = -1 \text{ A}, \\ V_{GS} = -4.5 \text{ V}, \qquad R_{GEN} = 6 \Omega$		16	40	ns
t _r	Turn-On Rise Time			46	80	ns
t _{d(off)}	Turn-Off Delay Time	7		40	70	ns
t _f	Turn-Off Fall Time			25	40	ns
Qg	Total Gate Charge	$V_{DS} = -6 \text{ V}, \qquad I_{D} = -3.2 \text{A},$		10	20	nC
Q _{gs}	Gate-Source Charge	$V_{GS} = -4.5 \text{ V}$		2.1		nC
Q_{gd}	Gate-Drain Charge			3.3		nC
Drain-S	ource Diode Characteristics	and Maximum Ratings				
					-2.0	Α
Is	Maximum Continuous Drain-Source	e Diode Forward Current			2.0	A

Notes:

 R_{8JA} 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_{8JC} is guaranteed by design while R_{8CA} is determined by the user's board design.



a) 78°C/W when mounted on a 0.5in² pad of 2 oz copper



125°C/W when mounted on a 0.02 in² pad of 2 oz copper



c) 135°0 mour minin

135°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300μ s, Duty Cycle < 2.0%

Typical Characteristics:

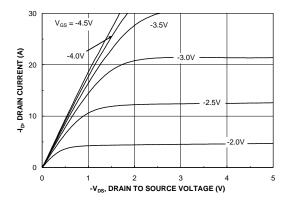


Figure 1. On-Region Characteristics.

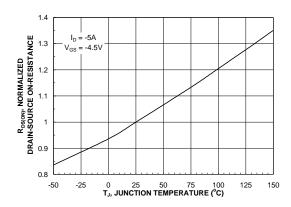


Figure 3. On-Resistance Variation with Temperature.

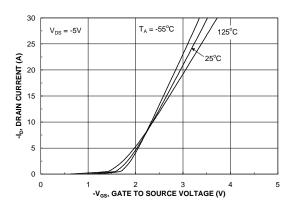


Figure 5. Transfer Characteristics.

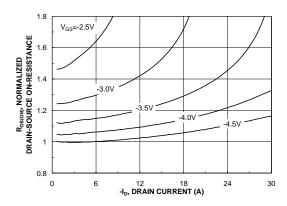


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

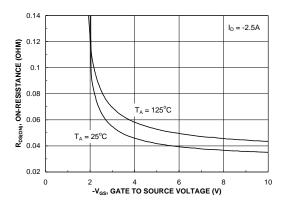


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

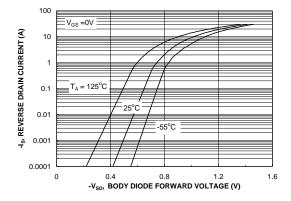
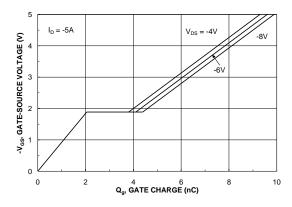


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics:



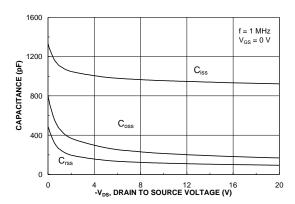


Figure 7. Gate Charge Characteristics.

100

10

0.01

-I_D, DRAIN CURRENT (A)

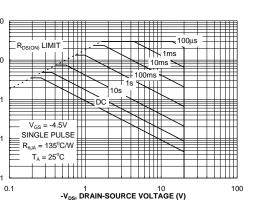


Figure 8. Capacitance Characteristics.

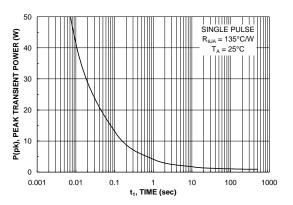


Figure 9. Maximum Safe Operating Area.



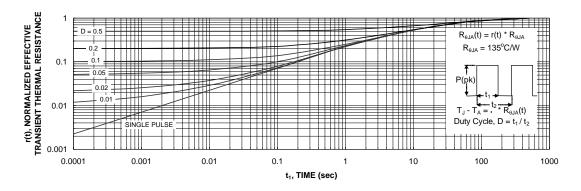


Figure 11. Transient Thermal Response Curve.

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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