



May 2001

FDS9953A

Dual 30V P-Channel PowerTrench[®] MOSFET

General Description

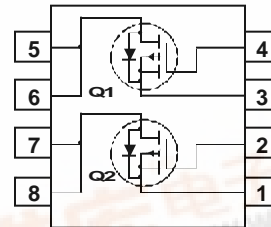
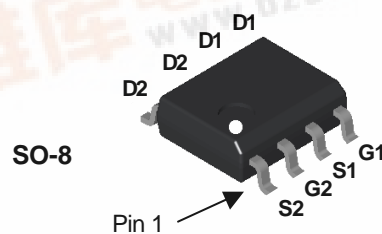
This P-Channel MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It has been optimized for power management applications requiring a wide range of gate drive voltage ratings (4.5V – 25V).

Applications

- Power management
- Load switch
- Battery protection

Features

- –2.9 A, –30 V $R_{DS(ON)} = 130\text{ m}\Omega$ @ $V_{GS} = -10\text{ V}$
 $R_{DS(ON)} = 200\text{ m}\Omega$ @ $V_{GS} = -4.5\text{ V}$
- Low gate charge (2.5nC typical)
- Fast switching speed
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability



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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	–30	V
V_{GSS}	Gate-Source Voltage	± 25	V
I_D	Drain Current – Continuous (Note 1a)	± 2.9	A
	– Pulsed	± 10	
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 +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	40	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS9953A	FDS9953A	13"	12mm	2500 units



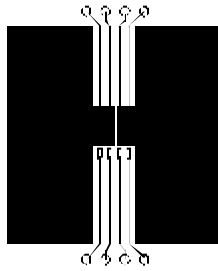
Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain–Source Breakdown Voltage	V _{GS} = 0 V, I _b = –250 μA	–30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _b = –250 μA, Referenced to 25°C		–23		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = –24 V, V _{GS} = 0 V			–2	μA
I _{GSSF}	Gate–Body Leakage, Forward	V _{GS} = –25 V, V _{DS} = 0 V			–100	nA
I _{GSSR}	Gate–Body Leakage, Reverse	V _{GS} = 25 V, V _{DS} = 0 V			100	nA
On Characteristics (Note 2)						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _b = –250 μA	–1	–1.8	–3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I _b = –250 μA, Referenced to 25°C		4		mV/°C
R _{DS(on)}	Static Drain–Source On–Resistance	V _{GS} = –10 V, I _b = –1 A V _{GS} = –10 V, I _b = –1 A, T _J =125°C V _{GS} = –4.5 V, I _b = –0.5 A V _{GS} = –4.5 V, I _b = –0.5 A, T _J =125°C		95 137 142 202	130 200 200 310	mΩ
I _{D(on)}	On–State Drain Current	V _{GS} = –10 V, V _{DS} = –5 V V _{GS} = –4.5 V, V _{DS} = –5 V	–5 –1.5			A
g _{FS}	Forward Transconductance	V _{DS} = –15 V, I _b = –1 A		4		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = –15 V, V _{GS} = 0 V, f = 1.0 MHz		185		pF
C _{oss}	Output Capacitance			56		pF
C _{rss}	Reverse Transfer Capacitance			26		pF
Switching Characteristics (Note 2)						
t _{d(on)}	Turn–On Delay Time	V _{DD} = –15 V, I _b = –1 A, V _{GS} = –10 V, R _{GEN} = 6 Ω		4.5	9	ns
t _r	Turn–On Rise Time			13	23	ns
t _{d(off)}	Turn–Off Delay Time			11	20	ns
t _f	Turn–Off Fall Time			2	4	ns
Q _g	Total Gate Charge	V _{DS} = –5 V, I _b = –1 A, V _{GS} = –10 V		2.5	3.5	nC
Q _{gs}	Gate–Source Charge			0.8		nC
Q _{gd}	Gate–Drain Charge			0.9		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain–Source Diode Forward Current				–1.2	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = –1.3 A (Note 2)		–0.8	1.3	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _F = –1.25A, dI _F /dt = 100A/μs		17	100	nS

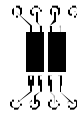
Typical Characteristics

Notes:

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



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



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

Scale 1 : 1 on letter size paper

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

Typical Characteristics

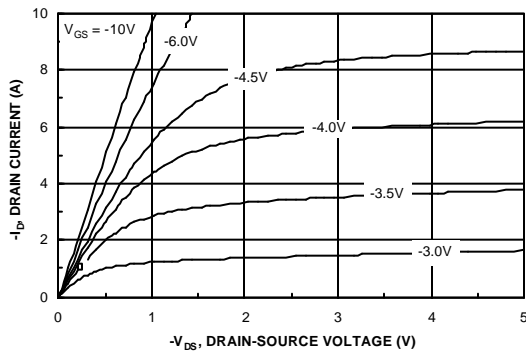


Figure 1. On-Region Characteristics.

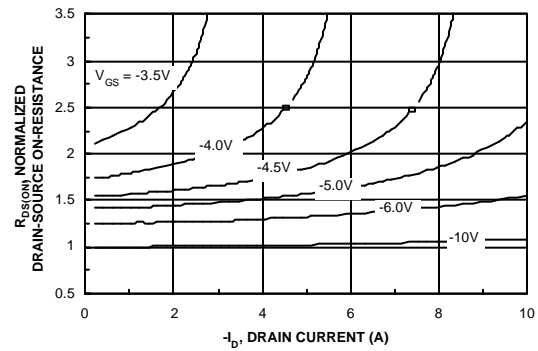


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

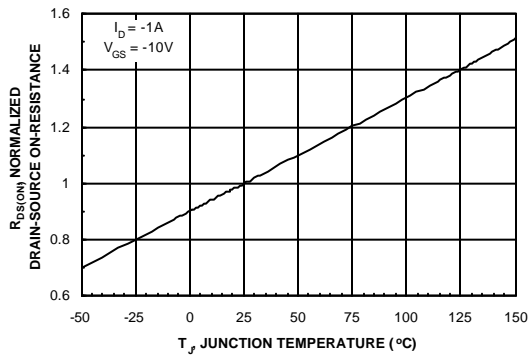


Figure 3. On-Resistance Variation with Temperature.

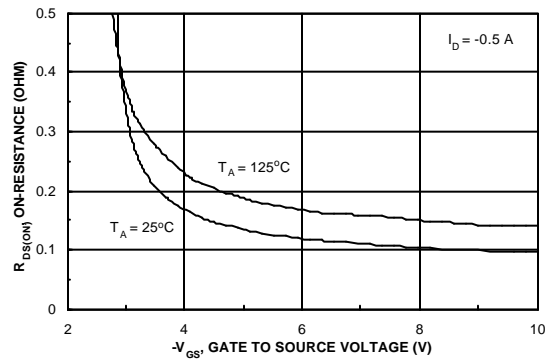


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

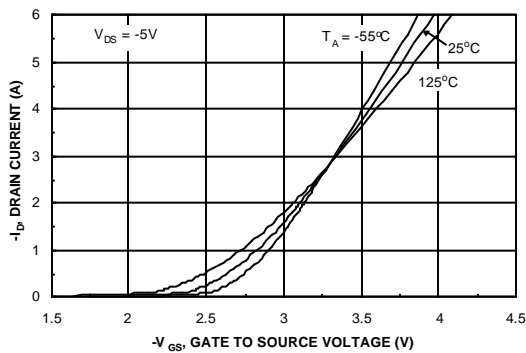


Figure 5. Transfer Characteristics.

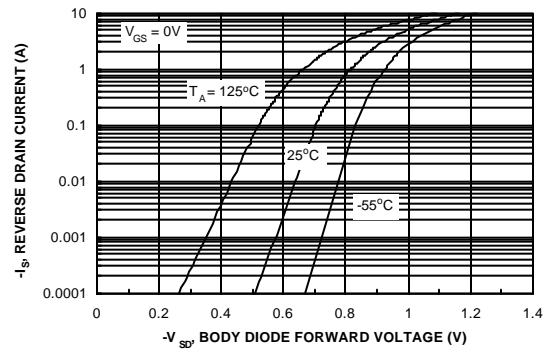


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

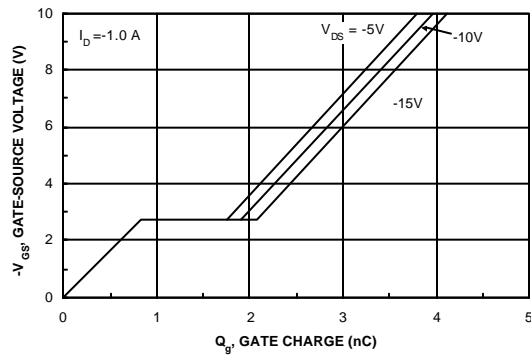


Figure 7. Gate Charge Characteristics.

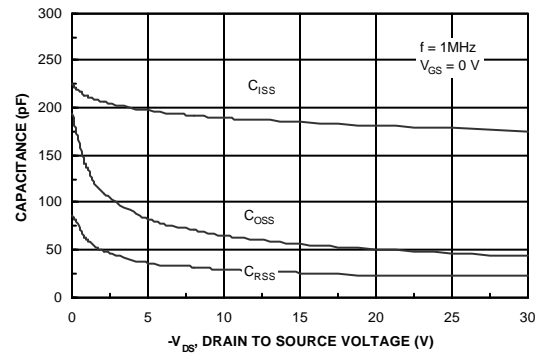


Figure 8. Capacitance Characteristics.

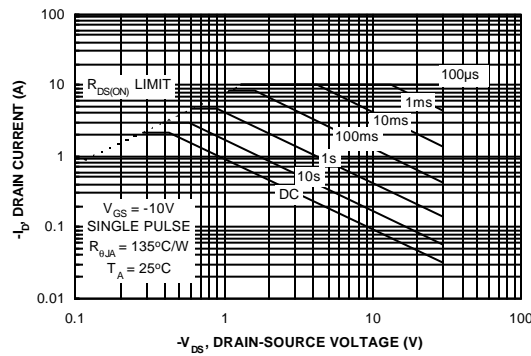


Figure 9. Maximum Safe Operating Area.

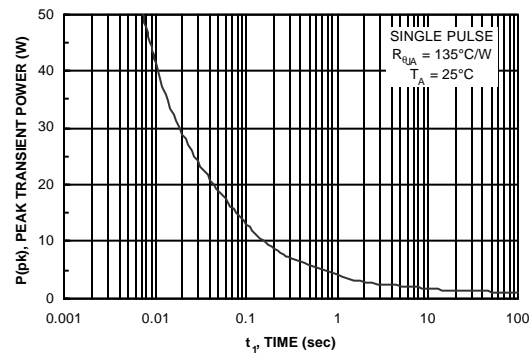


Figure 10. Single Pulse Maximum Power Dissipation.

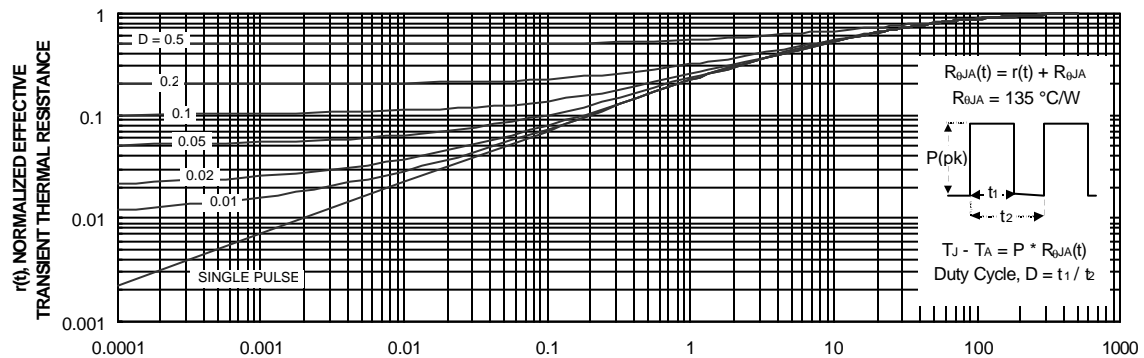


Figure 11. Transient Thermal Response Curve.

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

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