FAIRCHILD SEMICONDUCTOR®

January 2007

FDFS6N548

Integrated N-Channel PowerTrench® MOSFET and Schottky Diode

30V, 7A, 23mΩ

Features

- Max $r_{DS(on)}$ = 23mΩ at V_{GS} = 10V, I_D = 7A
- Max $r_{DS(on)}$ = 30mΩ at V_{GS} = 4.5V, I_D = 6A
- V_F < 0.45V @ 2A

  V_F < 0.28V @ 100mA
- Schottky and MOSFET incorporated into single power surface mount SO-8 package
- Electrically independent Schottky and MOSFET pinout for design flexibility
- Low Miller Charge

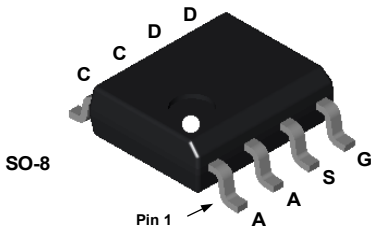
General Description

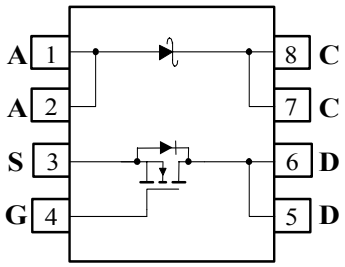
The FDFS6N548 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

This device is designed specifically as a single package solution for DC to DC converters. It features a fast switching, low gate charge MOSFET with very low on-state resistance. The independently connected Schottky diode allows its use in a variety of DC/DC converter topologies.

Application

- DC/DC Conversion





MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		30	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current -Continuous	(Note 1a)	7	A
	-Pulsed		30	
P_D	Power Dissipation for Dual Operation		2	W
	Power Dissipation for Single Operation	(Note 1a)	1.6	
E_{AS}	Drain-Source Avalanche Energy	(Note 3)	12	mJ
V_{RRM}	Schotty Repetitive Peak Reverse Voltage		20	V
I_O	Schotty Average Forward Current	(Note 1a)	2	A
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to +150	°C

Thermal Characteristics

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

Package Marking and Ordering Information

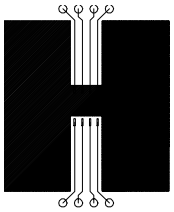
Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDFS6N548	FDFS6N548	SO-8	330mm	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

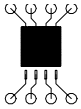
Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Off Characteristics							
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V		30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C			22		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24V, V_{GS} = 0V				1	μA
			T_J = 125°C			250	
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V, V_{DS} = 0V				±100	nA
On Characteristics							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA		1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C			-5		mV/°C
$r_{DS(on)}$	Drain to Source On-Resistance	V_{GS} = 10V, I_D = 7A			19	23	mΩ
		V_{GS} = 4.5V, I_D = 6A			23	30	
		V_{GS} = 10V, I_D = 7A, T_J = 125°C			26	31	
g_{FS}	Forward Transconductance	V_{DS} = 5V, I_D = 7A			20		S
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1MHz			525	700	pF
C_{oss}	Output Capacitance				100	133	pF
C_{rss}	Reverse Transfer Capacitance				65	100	pF
R_g	Gate Resistance	f = 1MHz			0.8		Ω
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15V, I_D = 7A, V_{GS} = 10V, R_{GEN} = 6Ω			6	12	ns
t_r	Rise Time				2	10	ns
$t_{d(off)}$	Turn-Off Delay Time				14	25	ns
t_f	Fall Time				2	10	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{DS} = 15V, I_D = 7A V_{GS} = 10V			9	13	nC
Q_{gs}	Gate to Source Gate Charge				1.5		nC
Q_{gd}	Gate to Drain “Miller” Charge				2		nC
Drain-Source Diode Characteristics							
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 7A (Note2)			0.90	1.25	V
t_{rr}	Reverse Recovery Time	I_F = 7A, di/dt = 100A/μs			23	35	ns
Q_{rr}	Reverse Recovery Charge				14	21	nC
Schottky Diode Characteristics							
V_R	Reverse Breakdown Voltage	I_R = -1mA		-30			V
I_R	Reverse Leakage	V_R = -10V	T_J = 25°C		-39	-250	μA
			T_J = 125°C		-18		mA
V_F	Forward Voltage	I_F = 100mA	T_J = 25°C		225	280	mV
			T_J = 125°C		140		
		I_F = 2A	T_J = 25°C		364	450	
			T_J = 125°C		290		

Notes:

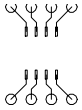
1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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



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



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

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

3: Starting T_J = 25°C, L = 1mH, I_{AS} = 5.0A, V_{DD} = 27V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

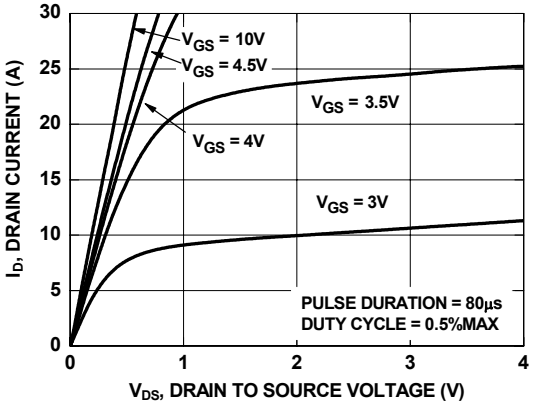


Figure 1. On Region Characteristics

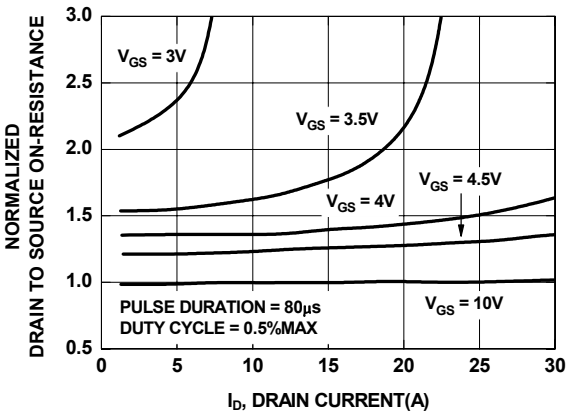


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

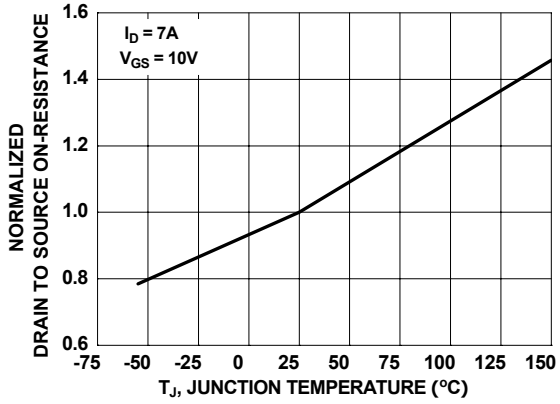


Figure 3. Normalized On-Resistance vs Junction Temperature

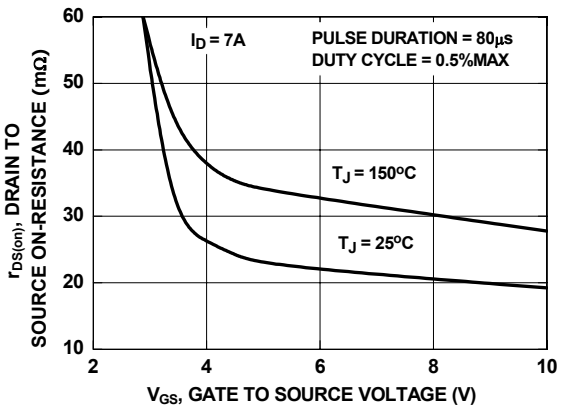


Figure 4. On-Resistance vs Gate to Source Voltage

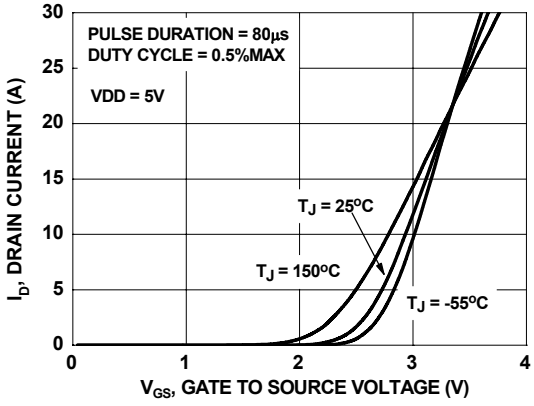


Figure 5. Transfer Characteristics

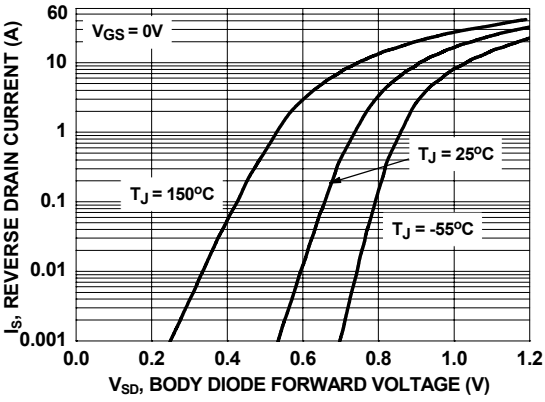


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

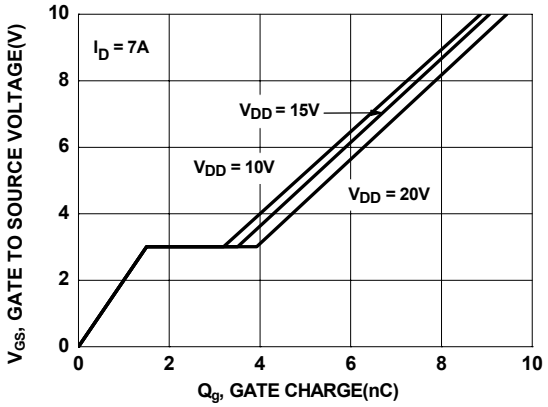


Figure 7. Gate Charge Characteristics

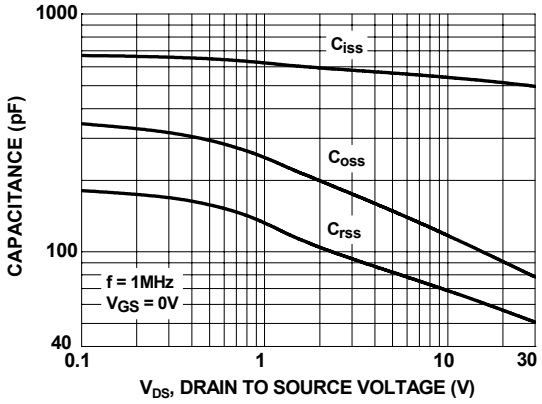


Figure 8. Capacitance vs Drain to Source Voltage

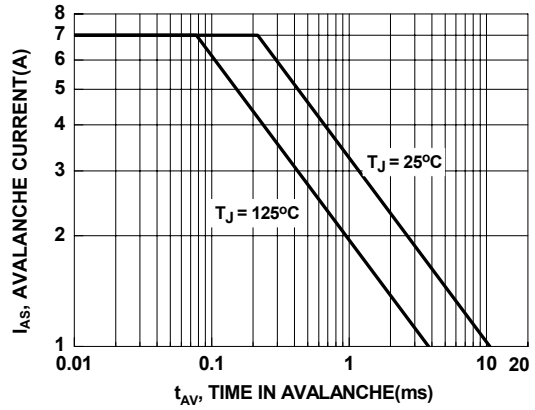


Figure 9. Unclamped Inductive Switching Capability

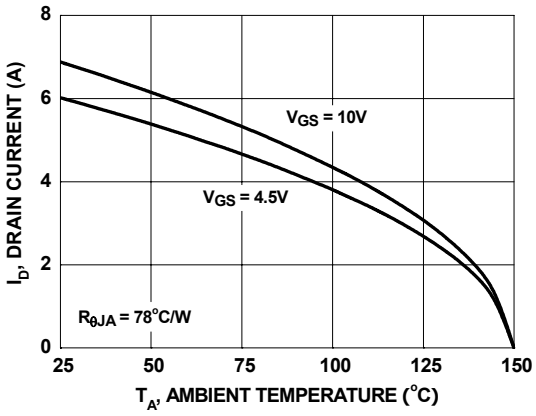


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

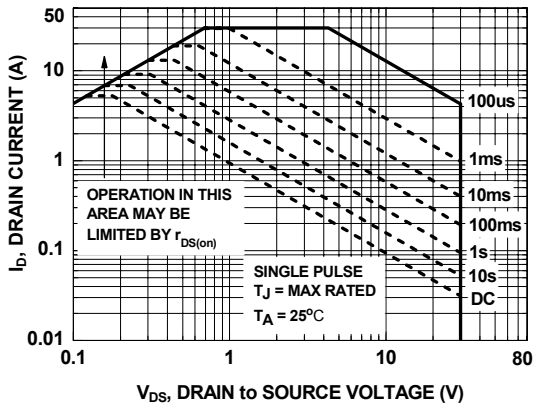


Figure 11. Forward Bias Safe Operating Area

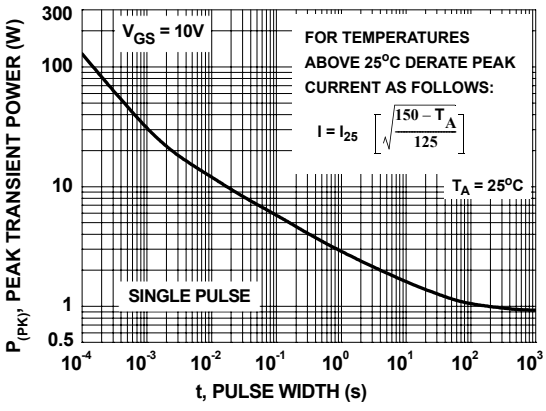


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

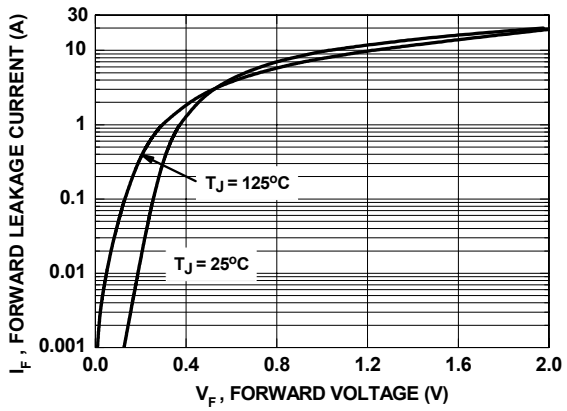


Figure 13. Schottky Diode Forward Characteristics

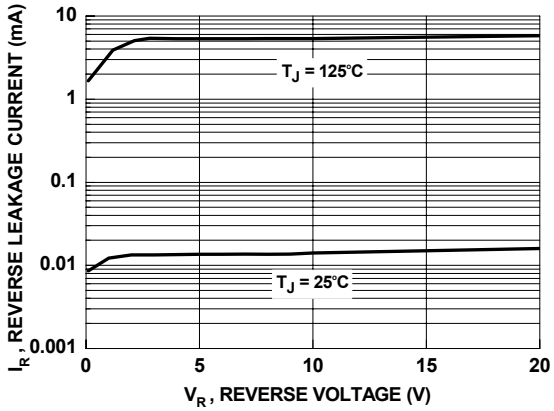


Figure 14. Schottky Diode Reverse Characteristics

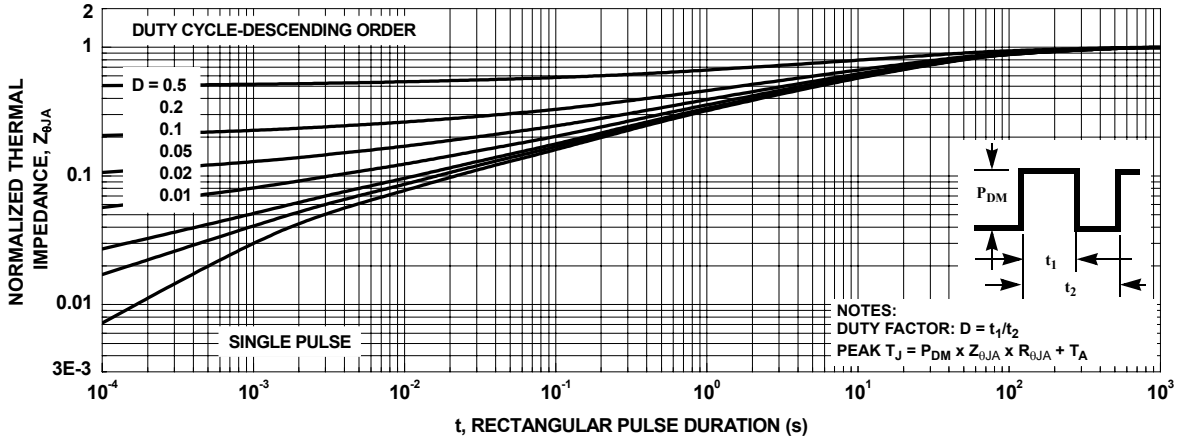


Figure 15. Transient Thermal Response Curve

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