

January 2007

# **FDFS6N548**

# Integrated N-Channel PowerTrench® MOSFET and Schottky Diode 30V, 7A, 23m $\Omega$

#### **Features**

- Max  $r_{DS(on)}$  = 23m $\Omega$  at  $V_{GS}$  = 10V,  $I_D$  = 7A
- Max  $r_{DS(on)}$  = 30m $\Omega$  at  $V_{GS}$  = 4.5V,  $I_D$  = 6A
- V<sub>F</sub> < 0.45V @ 2A

V<sub>F</sub> < 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



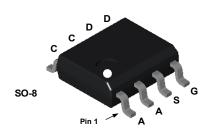
## **General Description**

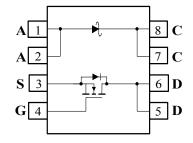
The FDFS6N548 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

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<sub>A</sub> = 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
	Drain Current -Continuous (Note 1a)		7	۸
ID	-Pulsed		30	— A
D	Power Dissipation for Dual Operation		2	w
$P_{D}$	Power Dissipation for Single Operation	(Note 1a)	1.6	VV
E <sub>AS</sub>	Drain-Source Avalanche Energy	(Note 3)	12	mJ
$V_{RRM}$	Schotty Repetitive Peak Reverse Voltage		20	V
I <sub>O</sub>	Schotty Average Forward Current	(Note 1a)	2	Α
T <sub>J</sub> , T <sub>STG</sub>	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	C/ <b>VV</b>	

### **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

Parameter	Test Conditions	Min	Тур	Max	Units
acteristics					
Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$	30			V
Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, referenced to 25°C		22		mV/°C
Zero Gate Voltage Drain Current	$V_{DS} = 24V$ , $V_{CS} = 0V$ $T_{L} = 125^{\circ}C$			1 250	μА
Gate to Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			±100	nA
	Drain to Source Breakdown Voltage Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current	acteristicsDrain to Source Breakdown Voltage $I_D = 250\mu A$ , $V_{GS} = 0V$ Breakdown Voltage Temperature Coefficient $I_D = 250\mu A$ , referenced to 25°CZero Gate Voltage Drain Current $V_{DS} = 24V$ , $V_{GS} = 0V$ $V_{DS} = 125°C$	acteristics         Drain to Source Breakdown Voltage $I_D = 250\mu A$ , $V_{GS} = 0V$ 30         Breakdown Voltage Temperature Coefficient $I_D = 250\mu A$ , referenced to 25°C         Zero Gate Voltage Drain Current $V_{DS} = 24V$ , $V_{GS} = 0V$ $V_{JS} = 125$ °C	Drain to Source Breakdown Voltage $I_D = 250\mu A$ , $V_{GS} = 0V$ 30       Breakdown Voltage Temperature Coefficient $I_D = 250\mu A$ , referenced to 25°C     22       Zero Gate Voltage Drain Current $V_{DS} = 24V$ , $V_{GS} = 0V$ $V_{JS} = 125$ °C	acteristicsDrain to Source Breakdown Voltage $I_D = 250\mu A$ , $V_{GS} = 0V$ 30Breakdown Voltage Temperature Coefficient $I_D = 250\mu A$ , referenced to 25°C22Zero Gate Voltage Drain Current $V_{DS} = 24V$ , $V_{GS} = 0V$ 1 $V_{DS} = 24V$ , $V_{GS} = 0V$ $V_{DS} = 125^{\circ}C$ 250

#### **On Characteristics**

V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, referenced to 25°C		-5		mV/°C
r <sub>DS(on)</sub> Drain to Source		V <sub>GS</sub> = 10V, I <sub>D</sub> = 7A		19	23	
	Drain to Source On-Resistance	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 6A		23	30	mΩ
		$V_{GS}$ = 10V, $I_D$ = 7A, $T_J$ = 125°C		26	31	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5V, I <sub>D</sub> = 7A		20		S

## **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	\\ -45\\\\\ -0\\		525	700	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V, f = 1MHz		100	133	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			65	100	pF
$R_g$	Gate Resistance	f = 1MHz		0.8		Ω

## **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time			6	12	ns
t <sub>r</sub>	Rise Time	$V_{DD}$ = 15V, $I_{D}$ = 7A $V_{GS}$ = 10V, $R_{GEN}$ = 6 $\Omega$		2	10	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 10V, R_{GEN} = 6\Omega$		14	25	ns
t <sub>f</sub>	Fall Time			2	10	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V <sub>DS</sub> = 15V, I <sub>D</sub> = 7A		9	13	nC
Q <sub>gs</sub>	Gate to Source Gate Charge	V <sub>GS</sub> = 10V		1.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2		nC

#### **Drain-Source Diode Characteristics**

$V_{SE}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0V, I_S = 7A$ (N	Note2)	0.90	1.25	V
t <sub>rr</sub>	Reverse Recovery Time	- I <sub>=</sub> = 7A. di/dt = 100A/μs		23	35	ns
$Q_{rr}$	Reverse Recovery Charge	IF - 7A, αι/αι - 100Α/μS		14	21	nC

## **Schottky Diode Characteristics**

$V_R$	Reverse Breakdown Voltage	I <sub>R</sub> = 1mA		30			V
	Reverse Leakage V <sub>R</sub> =	\/ - 10\/	$T_J = 25^{\circ}C$		39	250	μА
<sup>I</sup> R		V <sub>R</sub> = -10V	$T_J = 125^{\circ}C$		18		mA
V <sub>F</sub> Forward Voltag		I = 100mA	$T_J = 25^{\circ}C$		225	280	
	Forward Voltage	I <sub>F</sub> = -100mA	$T_J = 125^{\circ}C$		140		mV
	Forward Voltage	I <sub>F</sub> = -2A	T <sub>J</sub> = 25°C		364	450	- IIIV
			T <sub>J</sub> = 125°C		290		

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#### Notes:

 $R_{0IA}$  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.  $R_{0IC}$  is guaranteed by design while  $R_{0CA}$  is determined by the user's board design.



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



ωψψω b) 125°C/W when mounted on a 0.02 in<sup>2</sup> pad of 2 oz copper



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

- 2: Pulse Test: Pulse Width <  $300\mu\text{s}$  , Duty cycle < 2.0%.
- 3: Starting  $T_J = 25$ °C, L = 1mH,  $I_{AS} = 5.0$ A,  $V_{DD} = 27$ V,  $V_{GS} = 10$ V.

## Typical Characteristics T<sub>J</sub> = 25°C unless otherwise noted

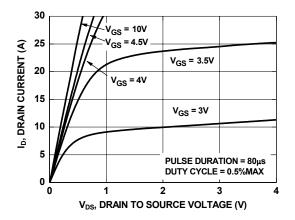


Figure 1. On Region Characteristics

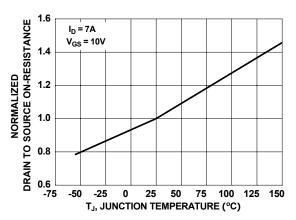


Figure 3. Normalized On-Resistance vs Junction Temperature

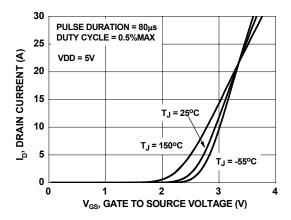


Figure 5. Transfer Characteristics

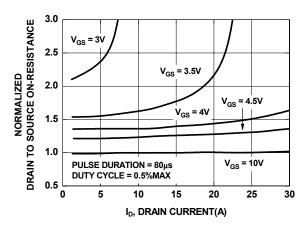


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

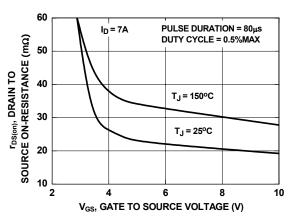


Figure 4. On-Resistance vs Gate to Source Voltage

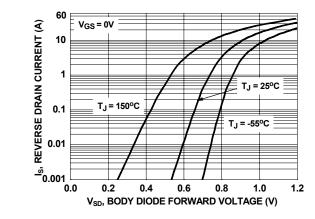


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

# **Typical Characteristics** $T_J = 25^{\circ}C$ unless otherwise noted

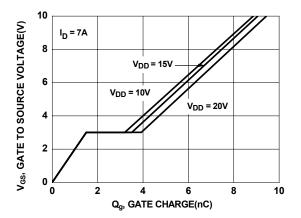


Figure 7. Gate Charge Characteristics

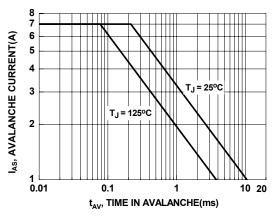


Figure 9. Unclamped Inductive Switching Capability

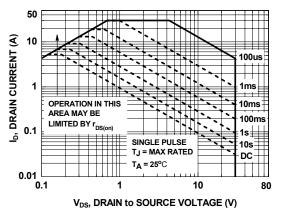


Figure 11. Forward Bias Safe Operating Area

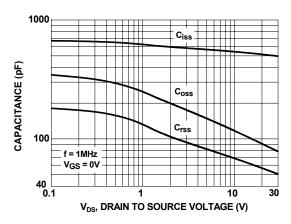


Figure 8. Capacitance vs Drain to Source Voltage

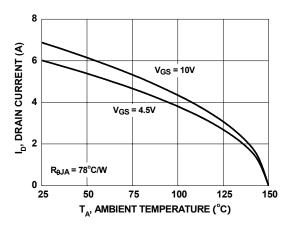


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

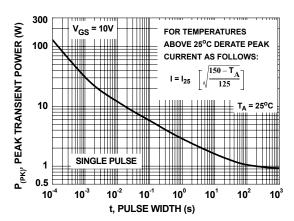
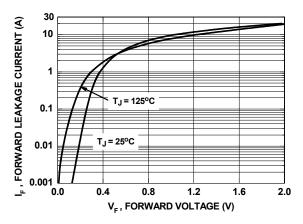


Figure 12. Single Pulse Maximum Power Dissipation

## Typical Characteristics T<sub>J</sub> = 25°C unless otherwise noted



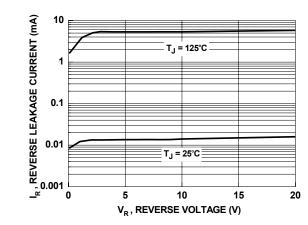


Figure 13. Schottky Diode Forward Characteristics

Figure 14. Schottky Diode Reverse Characteristics

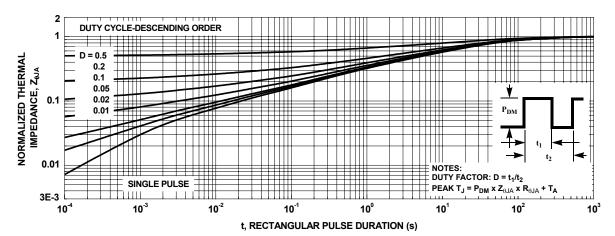


Figure 15. Transient Thermal Response Curve

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