

# 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



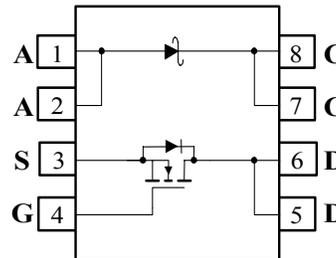
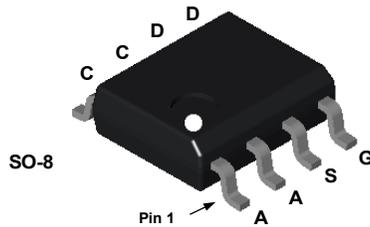
### General Description

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 $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	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
$V_{RRM}$	Schottky Repetitive Peak Reverse Voltage	20	V
$I_O$	Schottky Average Forward Current (Note 1a)	2	A
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ C$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	78	$^\circ C/W$
$R_{\theta JC}$	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 $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		22		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}, T_J = 125^\circ\text{C}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On-Resistance	$V_{GS} = 10\text{V}, I_D = 7\text{A}$		19	23	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 6\text{A}$		23	30	
		$V_{GS} = 10\text{V}, I_D = 7\text{A}, T_J = 125^\circ\text{C}$		26	31	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{V}, I_D = 7\text{A}$		20		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		525	700	pF
$C_{oss}$	Output Capacitance			100	133	pF
$C_{rss}$	Reverse Transfer Capacitance			65	100	pF
$R_g$	Gate Resistance		$f = 1\text{MHz}$		0.8	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{V}, I_D = 7\text{A}, V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$		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	$V_{DS} = 15\text{V}, I_D = 7\text{A}$		9	13	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{GS} = 10\text{V}$		1.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 7\text{A}$ (Note2)		0.90	1.25	V
$t_{rr}$	Reverse Recovery Time	$I_F = 7\text{A}, di/dt = 100\text{A}/\mu\text{s}$		23	35	ns
$Q_{rr}$	Reverse Recovery Charge			14	21	nC

### Schottky Diode Characteristics

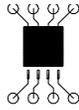
$V_R$	Reverse Breakdown Voltage	$I_R = 1\text{mA}$	30			V
$I_R$	Reverse Leakage	$V_R = -10\text{V}$	$T_J = 25^\circ\text{C}$	39	250	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$	18		mA
$V_F$	Forward Voltage	$I_F = -100\text{mA}$	$T_J = 25^\circ\text{C}$	225	280	mV
			$T_J = 125^\circ\text{C}$	140		
		$I_F = -2\text{A}$	$T_J = 25^\circ\text{C}$	364	450	
			$T_J = 125^\circ\text{C}$	290		

**Notes:**

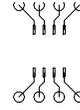
**1:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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



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 minimum pad

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

**3:** Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1\text{mH}$ ,  $I_{AS} = 5.0\text{A}$ ,  $V_{DD} = 27\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

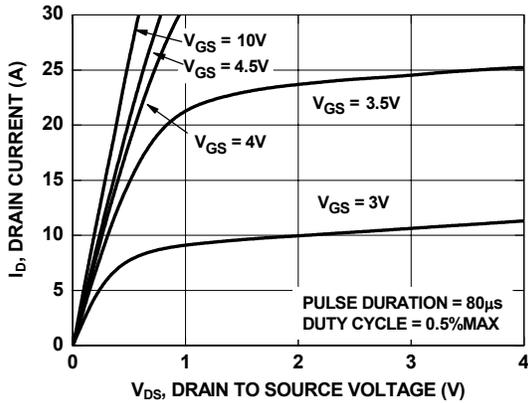


Figure 1. On Region Characteristics

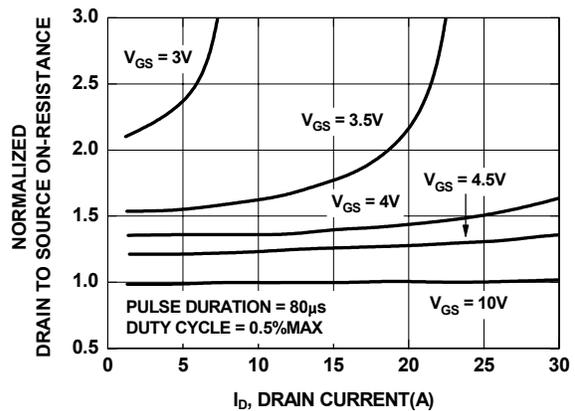


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

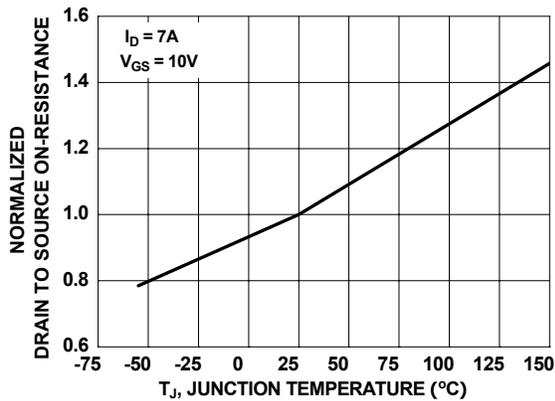


Figure 3. Normalized On-Resistance vs Junction Temperature

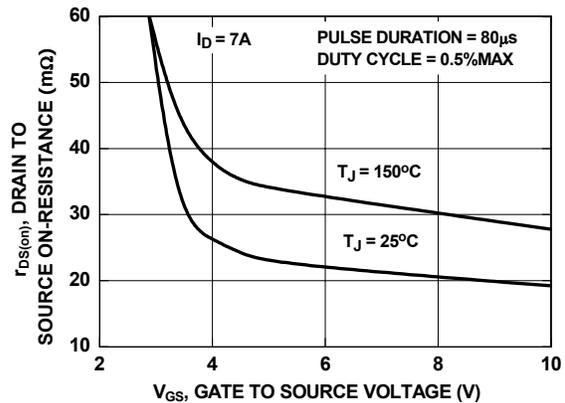


Figure 4. On-Resistance vs Gate to Source Voltage

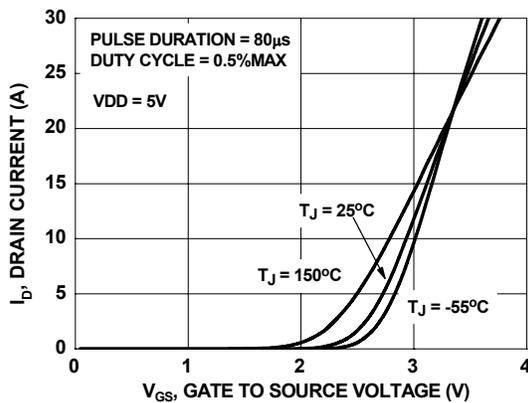


Figure 5. Transfer Characteristics

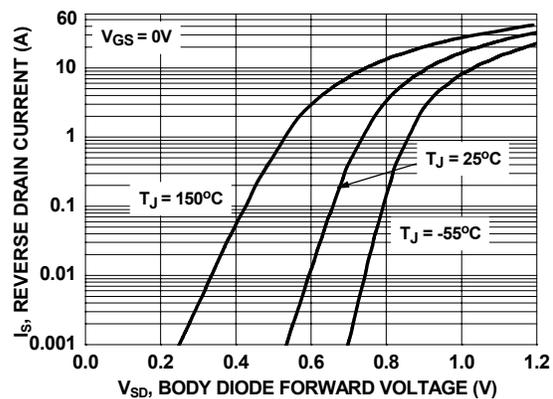
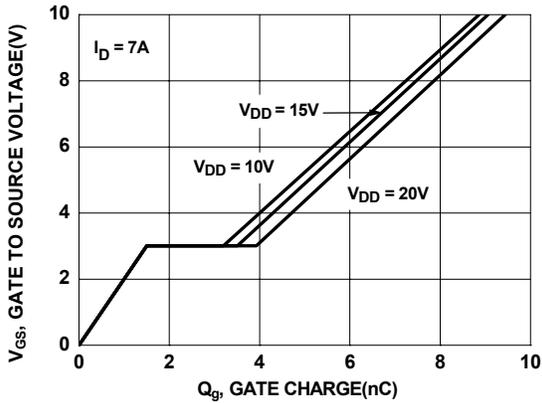
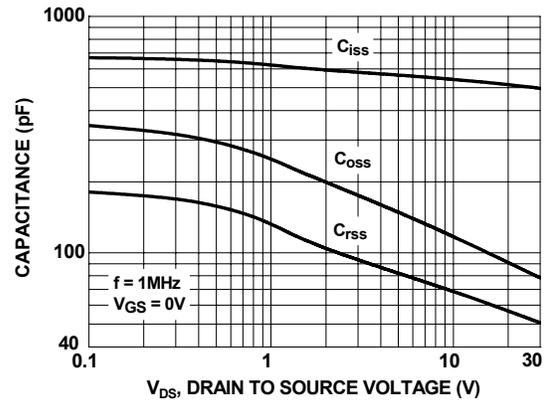


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

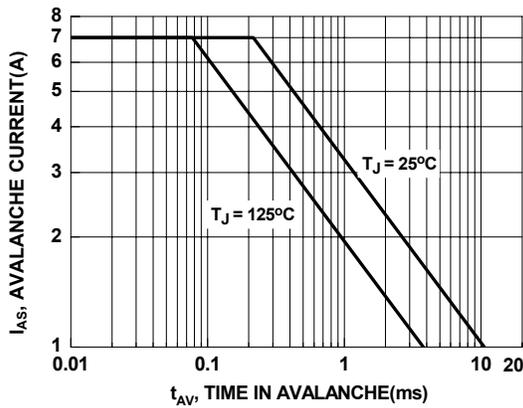
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



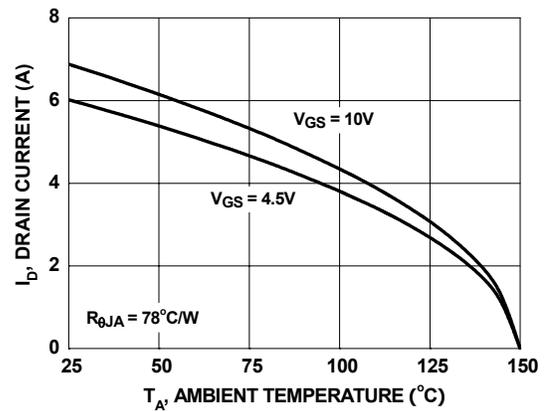
**Figure 7. Gate Charge Characteristics**



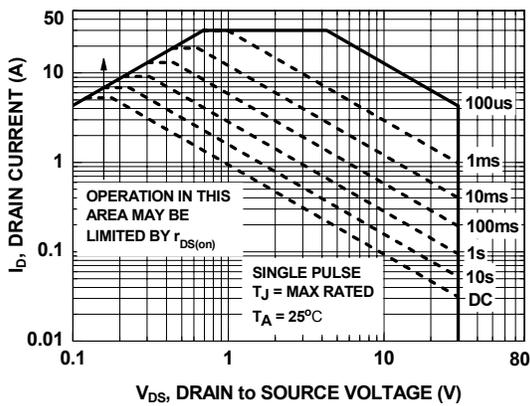
**Figure 8. Capacitance vs Drain to Source Voltage**



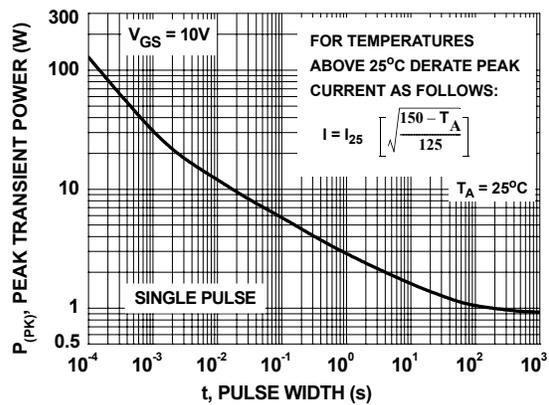
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Ambient Temperature**

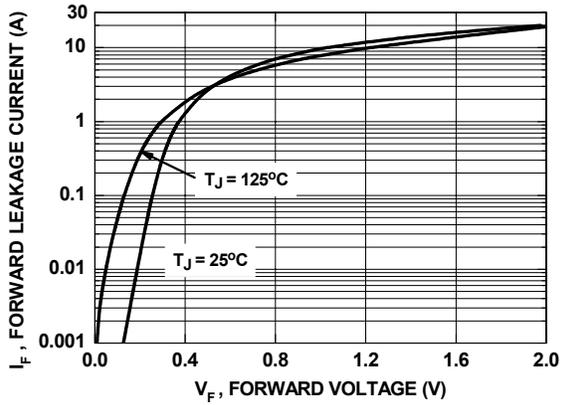


**Figure 11. Forward Bias Safe Operating Area**

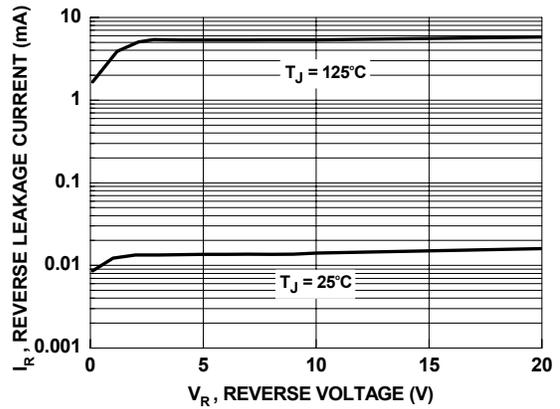


**Figure 12. Single Pulse Maximum Power Dissipation**

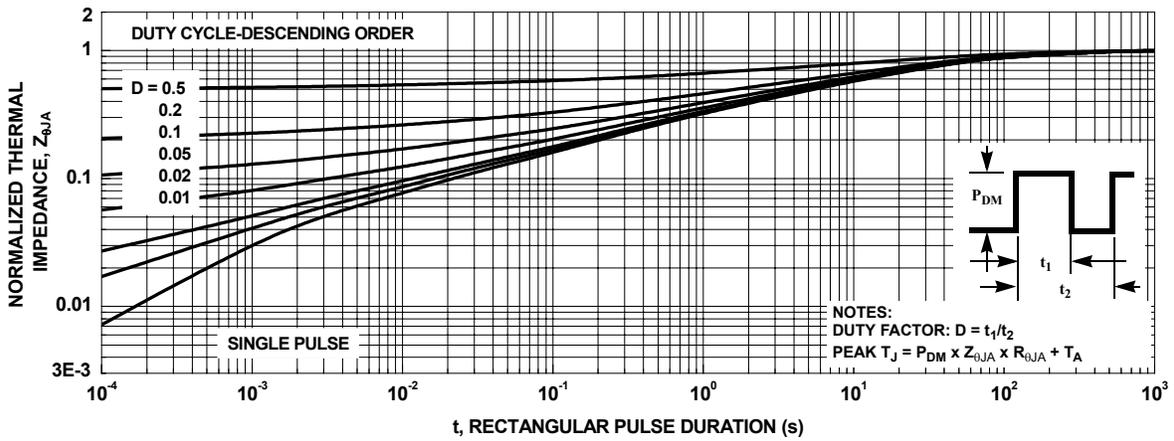
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



**Figure 13. Schottky Diode Forward Characteristics**



**Figure 14. Schottky Diode Reverse Characteristics**



**Figure 15. Transient Thermal Response Curve**

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