FAIRCHILD SEMICONDUCTOR®

August 2006

FDFS6N754

Integrated N-Channel PowerTrench® MOSFET and Schottky Diode
30V, 4A, 56mΩ

Features

- Max $r_{DS(on)}$ = 56mΩ at V_{GS} = 0V, I_D = 4A

  Max $r_{DS(on)}$ = 75mΩ at V_{GS} = 4.5V, I_D = 3.5A
- 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 Gate Charge (Qg = 4nC)
- Low Miller Charge

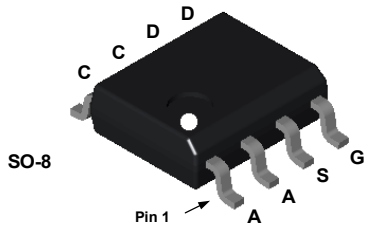
General Description

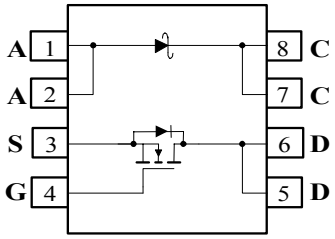
The FDFS6N754 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in an SO-8 package.

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.

Applications

- DC/DC converters





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)	4	A
	-Pulsed		20	
P_D	Power Dissipation for Dual Operation		2	W
	Power Dissipation for Single Operation	(Note 1a)	1.6	
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 Temperature		-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/W

Package Marking and Ordering Information

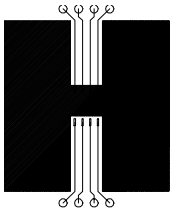
Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDFS6N754	FDFS6N754	SO-8	330mm	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

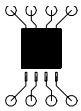
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		24.5		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24V, V_{GS} = 0V			1	μA
		V_{DS} = 24V, V_{GS} = 0V, T_J = 125°C			20	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V, V_{DS} = 0V			±100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	1	1.7	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		-4.2		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 4A		42	56	mΩ
		V_{GS} = 4.5V, I_D =3.5A		53	75	mΩ
		V_{GS} = 10V, I_D = 4A, T_J = 125°C		61	81	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 5V, I_D = 4A		10		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1.0MHz		225	299	pF
C_{oss}	Output Capacitance			80	107	pF
C_{rss}	Reverse Transfer Capacitance			42	63	pF
R_G	Gate Resistance	f = 1.0MHz		5.1		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15V, I_D = 1A, V_{GS} = 10V, R_{GS} = 6Ω		6	12	ns
t_r	Rise Time			8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			20	32	ns
t_f	Fall Time			2	10	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{DS} = 15V, I_D = 4A		4	6	nC
$Q_{g(5)}$	Total Gate Charge at 5V			2	3	nC
Q_{gs}	Gate to Source Gate Charge			0.6		nC
Q_{gd}	Gate to Drain “Miller” Charge			1		nC
Drain-Source Diode Characteristics and Maximum Ratings						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 1.3A (Note 2)		0.8	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 4A, di/dt = 100A/μs		13	20	ns
Q_{rr}	Reverse Recovery Charge	I_F = 4A, di/dt = 100A/μs		4	6	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
		V_R = -10V, T_J = 125°C		18		mA
V_F	Forward Voltage	I_F = 100mA, T_J = 25°C		225	280	mV
		I_F = 100mA, T_J = 125°C		140		mV
		I_F = 2A, T_J = 25°C		364	450	mV
		I_F = 2A, T_J = 125°C		290		mV

Notes:

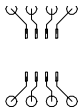
1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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

Scale 1 : 1 on letter size paper

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

Typical Characteristics T_J = 25°C unless otherwise noted

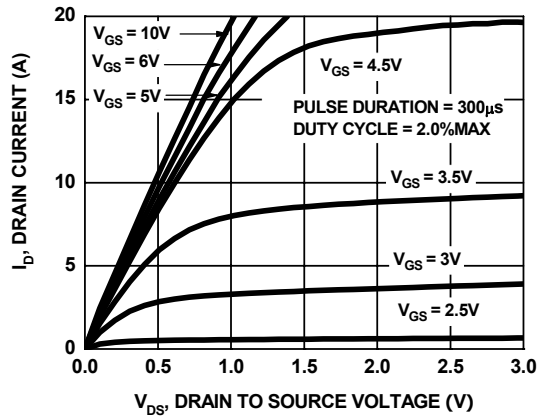


Figure 1. On Region Characteristics

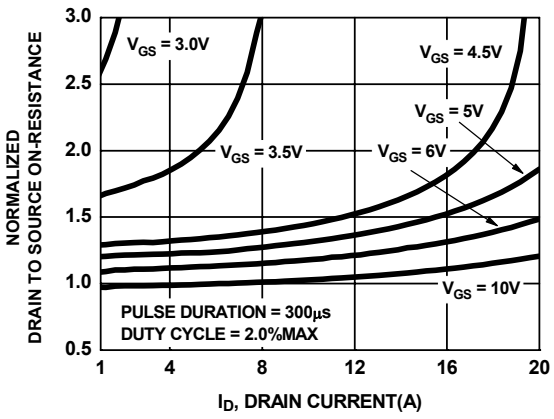


Figure 2. On-Resistance vs Drain Current and Gate Voltage

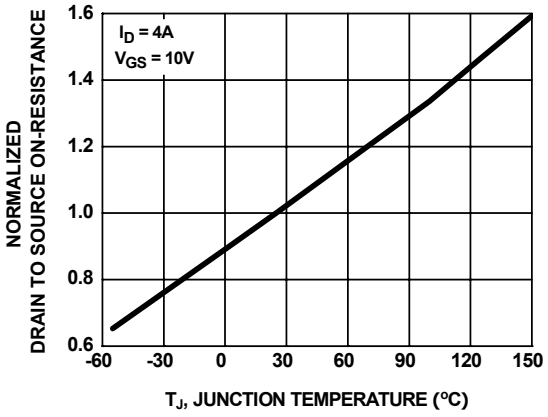


Figure 3. On Resistance vs Temperature

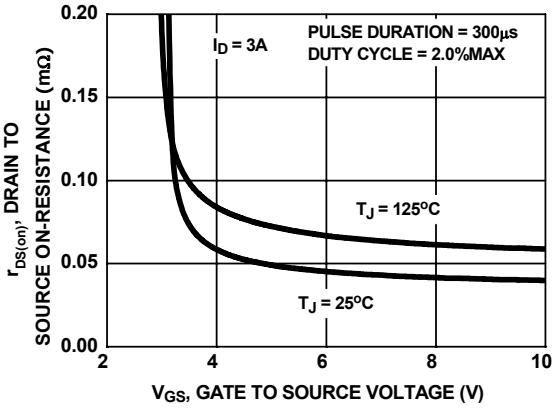


Figure 4. On-Resistance vs Gate to Source Voltage

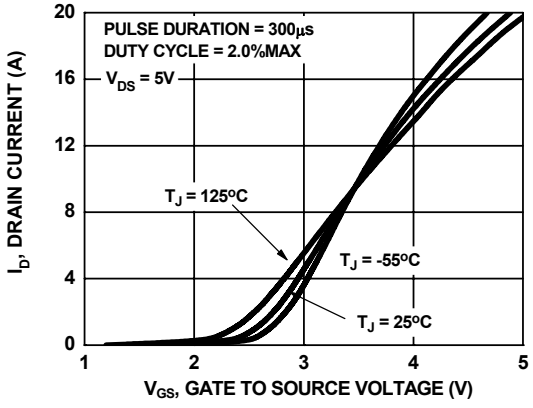


Figure 5. Transfer Characteristics

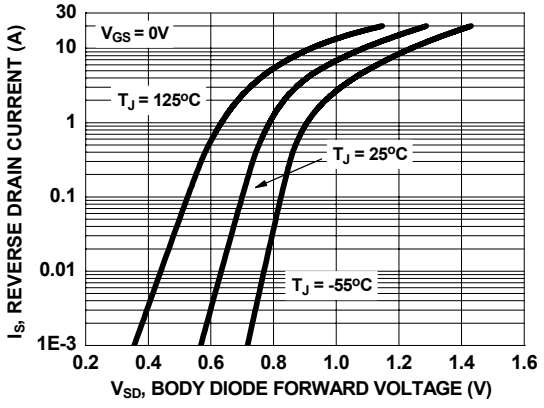


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

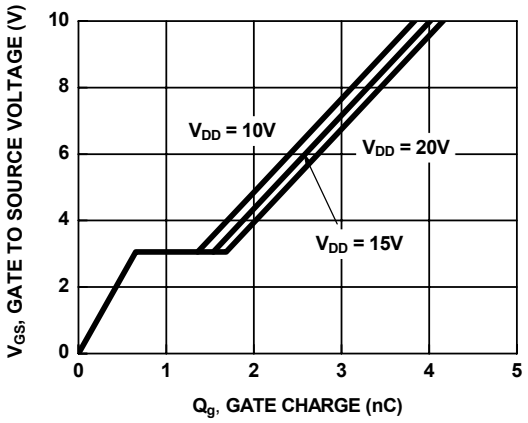


Figure 7. Gate Charge Characteristics

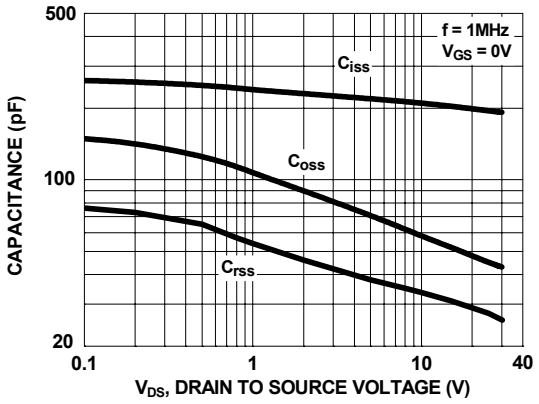


Figure 8. Capacitance vs Drain to Source Voltage

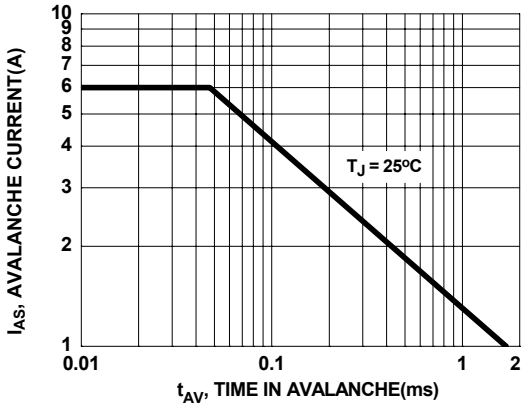


Figure 9. Unclamped Inductive Switching Capability

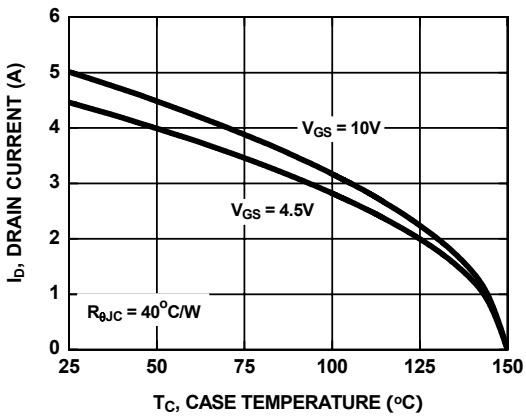


Figure 10. Maximum Continuous Drain Current vs Case Temperature

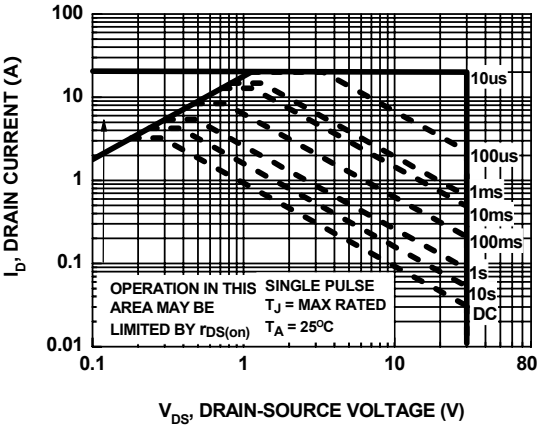


Figure 11. Forward Bias Safe Operating Area

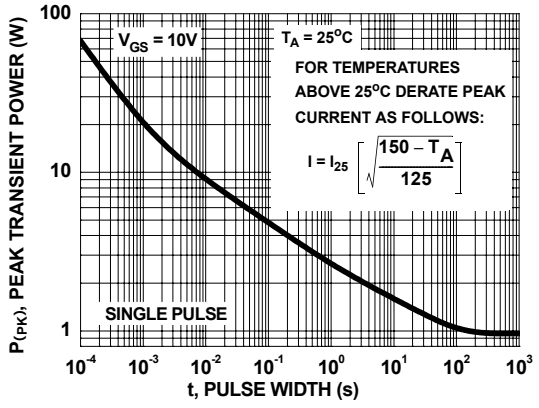


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

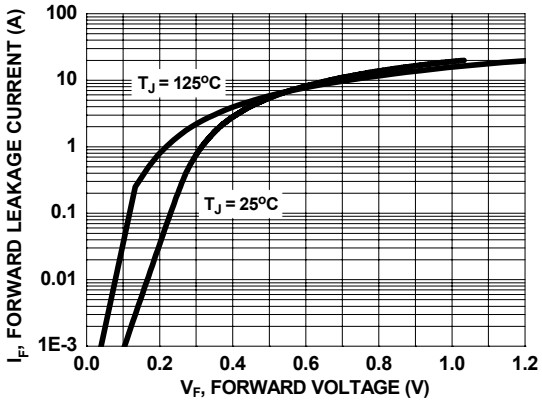


Figure 13. Schottky Diode Forward Voltage

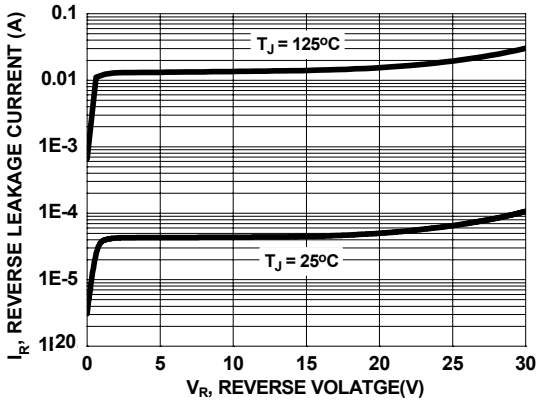


Figure 14. Schottky Diode Reverse Current

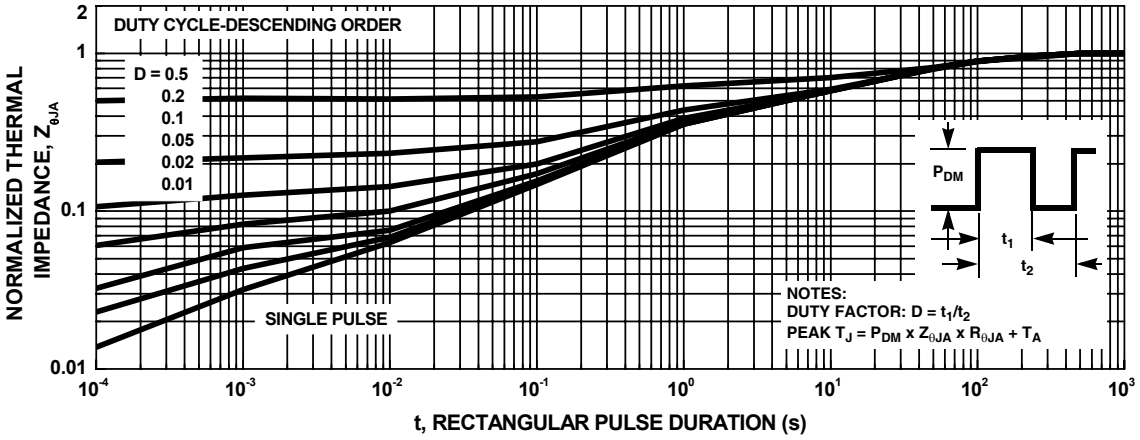


Figure 15. Transient Thermal Response Curve

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