FAIRCHILD SEMICONDUCTOR TM

October 2003

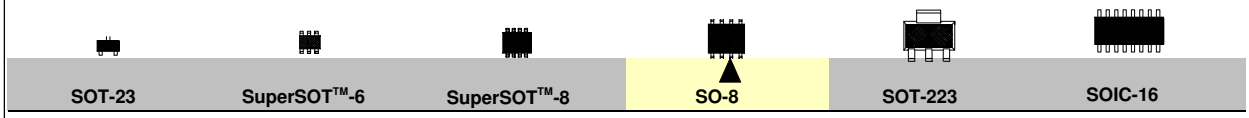
FDFS6N303
N-Channel MOSFET with Schottky Diode

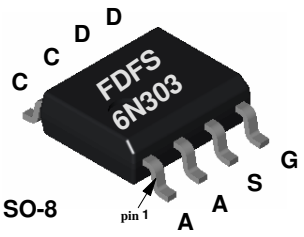
General Description

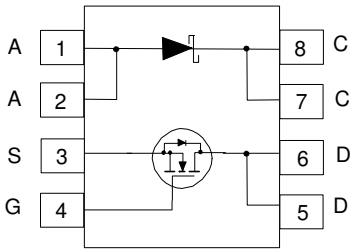
The FDFS6N303 incorporates a high cell density MOSFET and low forward drop (0.35V) Schottky diode into a single surface mount power package. The MOSFET and Schottky diode are isolated inside the package. The general purpose pinout has been chosen to maximize flexibility and ease of use. This product is particularly suited for switching applications such as DC/DC buck, boost, synchronous, and non-synchronous converters where the MOSFET is driven as low as 4.5V and fast switching, high efficiency and small PCB footprint is desirable.

Features

- 6 A, 30 V. $R_{DS(ON)}$ = 0.035 Ω @ V_{GS} = 10 V.
  $R_{DS(ON)}$ = 0.055 Ω @ V_{GS} = 4.5 V.
- V_F < 0.28 V @ 0.1 A
  V_F < 0.42 V @ 3 A
  V_F < 0.50 V @ 6 A.
- Schottky and MOSFET incorporated into single power surface mount SO-8 package.
- General purpose pinout for design flexibility.
- Ideal for DC/DC converter applications.







MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	FDFS6N303	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	±20	V
I_D	Drain Current - Continuous (Note 1a)	6	A
	- Pulsed	30	
P_D	Power Dissipation for Dual Operation	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
	(Note 1c)	0.9	
T_J,T_{STG}	Operating and Storage Temperature Range	-55 to 150	°C

Schottky Diode Maximum Ratings T_A = 25°C unless otherwise noted

V_{RRM}	Repetitive Peak Reverse Voltage	30	V
I_O	Average Forward Current (Note 1a)	2	A

Electrical Characteristics (T_A = 25 °C unless otherwise noted)

MOSFET ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	µA
		T_J =125°C			20	µA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS}= 0 V			-100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.7	3	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 6 A		0.025	0.035	Ω
		V_{GS} = 4.5 V, I_D = 4.8 A		0.043	0.055	
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 6 A		12		S
$I_{D(ON)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	15			A
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V,		350		pF
C_{oss}	Output Capacitance	f = 1.0 MHz		220		pF
C_{rss}	Reverse Transfer Capacitance			80		pF
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 6 A, V_{GS} = 10 V		12	17	nC
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 10 V, I_D = 1 A,		7.5	15	ns
t_r	Turn - On Rise Time	V_{GS} = 4.5 V, R_{GEN} = 6 Ω		12	25	ns
$t_{D(off)}$	Turn - Off Delay Time			13	25	ns
t_f	Turn - Off Fall Time			6	15	ns

MOSFET DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I_S	Maximum Continuous Drain-Source Diode Forward Current				1.3	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 1.3 A (Note 2)		0.8	1.2	V

SCHOTTKY DIODE CHARACTERISTICS

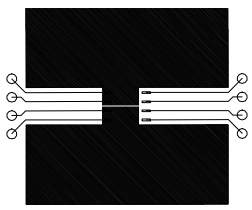
B_V	Reverse Breakdown Voltage	I_R = 1 mA	30			V
I_R	Reverse Leakage	V_R = 30 V			0.5	mA
V_F	Forward Voltage	I_F = 0.1 A			280	mV
		I_F = 3 A			420	
		I_F = 6 A			500	

THERMAL CHARACTERISTICS

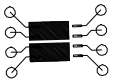
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)		78		°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)		40		°C/W

Notes:

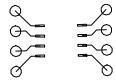
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 78°C/W on a 0.5 in² pad of 2oz copper.



b. 125°C/W on a 0.02 in² pad of 2oz copper.



c. 135°C/W on a 0.003 in² pad of 2oz copper.

Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

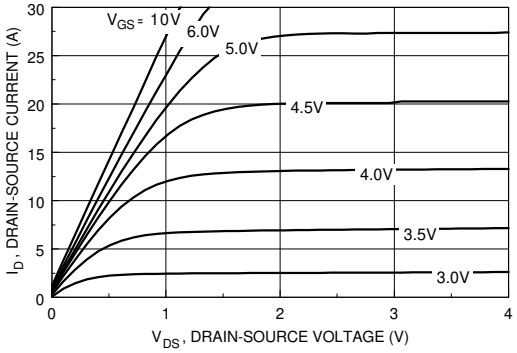


Figure 1. On-Region Characteristics.

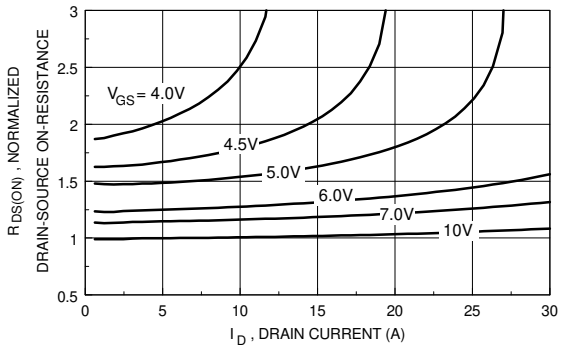


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

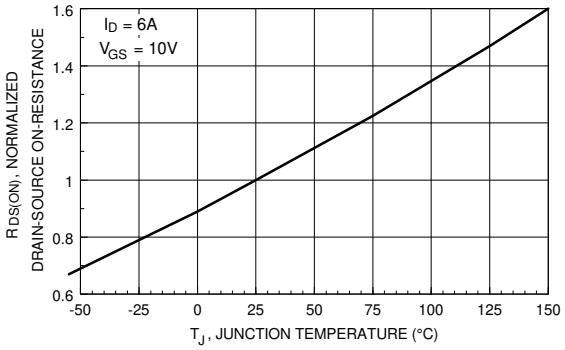


Figure 3. On-Resistance Variation with Temperature.

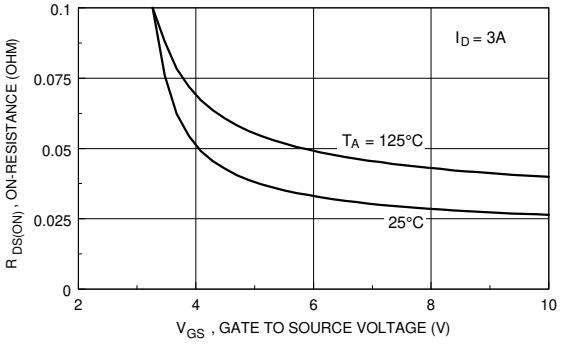


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

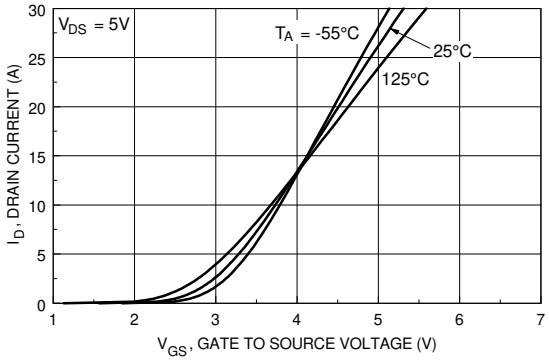


Figure 5. Transfer Characteristics.

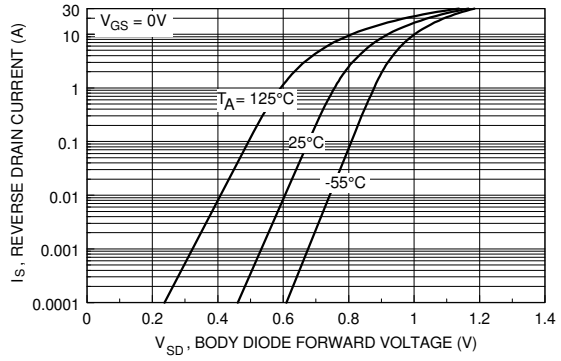


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Fet And Schottky Electrical Characteristics

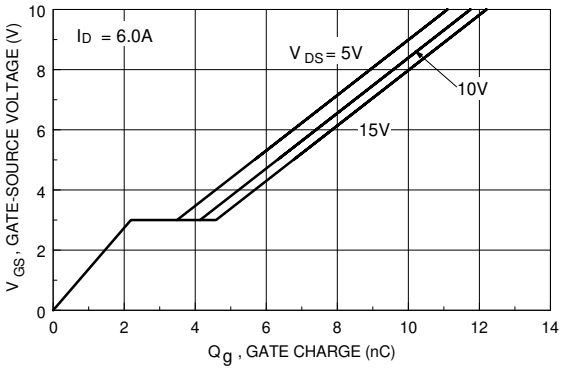


Figure 7. Gate Charge Characteristics.

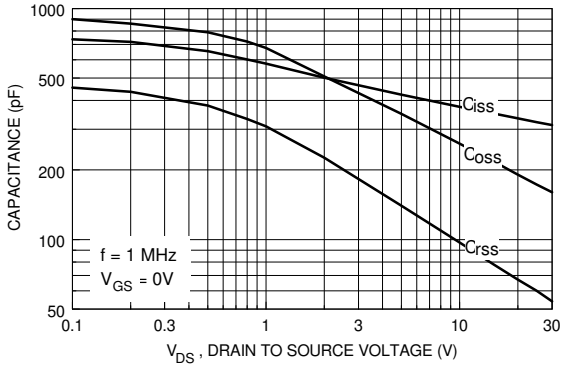


Figure 8. Capacitance Characteristics.

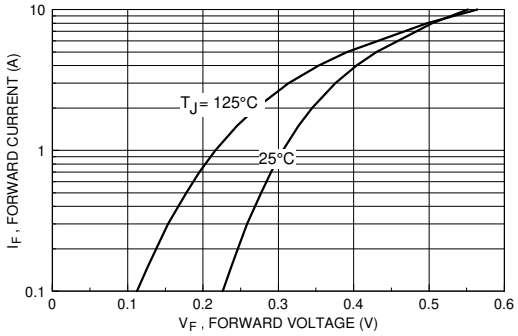


Figure 9. Schottky Diode Forward Voltage.

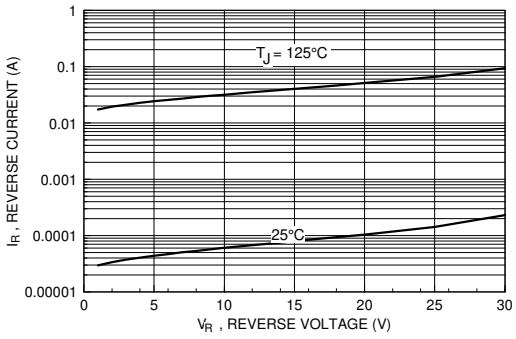


Figure 10. Schottky Diode Reverse Current.

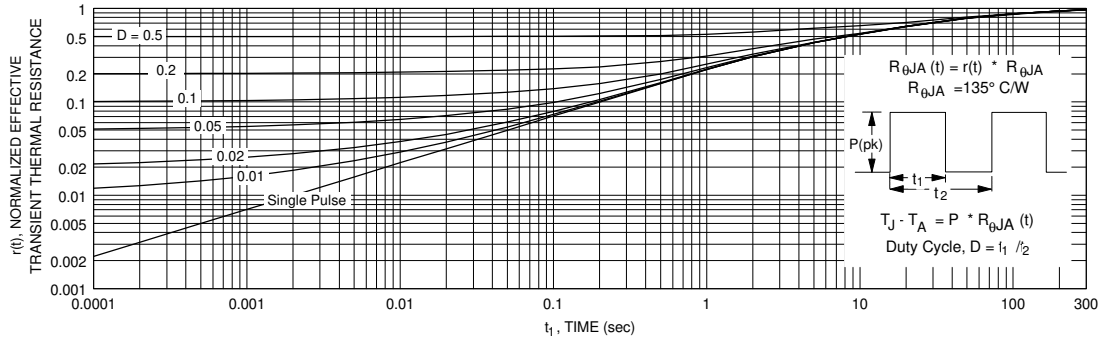


Figure 11. Transient Thermal Response Curve.

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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