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December 2013

FDB20N50F

N-Channel UniFETTM FRFET[®] MOSFET 500 V, 20 A, 260 m Ω

Features

- $R_{DS(on)}$ = 220 m Ω (Typ.) @ V_{GS} = 10 V, I_D = 10 A
- Low Gate Charge (Typ. 50 nC)
- Low C_{rss} (Typ. 27 pF)
- · 100% Avalanche Tested
- · Improve dv/dt Capability
- RoHS Compliant
- Qualified according to JEDEC Standards JESD22-A113F and IPC/JEDEC J-STD-020D.1

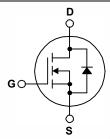
Applications

- LCD/LED/PDP TV
- Lighting
- · Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFETTM MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. The body diode's reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its t_{rr} is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.





MOSFET Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol		Parameter	FDB20N50F	Unit
V_{DSS}	Drain to Source Voltage		500	V
V_{GSS}	Gate to Source Voltage		±30	V
	Drain Current	- Continuous (T _C = 25°C)	20	А
ID	DrainCurrent	- Continuous (T _C = 100°C)	12.9	_ A
I _{DM}	Drain Current	- Pulsed (Note	e 1) 80	Α
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		e 2) 1110	mJ
I _{AR}	Avalanche Current (Note 1)		e 1) 20	Α
E _{AR}	Repetitive Avalanche Energy (Note 1)		e 1) 25	mJ
dv/dt	Peak Diode Recovery dv/dt	(Not	e 3) 10	V/ns
Б	Dower Dissinction	(T _C = 25°C)	250	W
P_{D}	Power Dissipation	- Derate Above 25°C	2.0	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T _L	Maximum Lead Temperature	e for Soldering, 1/8" from Case for 5 Seconds	300	οС

Thermal Characteristics

Symbol	Parameter	FDB20N50F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.5	
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDB20N50F	FDB20N50F	D ² -PAK	Tape and Reel	330 mm	24 mm	800 units

Electrical Characteristics $T_C = 25^{\circ}C$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
BV _{DSS}	Drain to Source Breakdown Voltage	$I_D = 500 \text{ uA}, V_{GS} = 0 \text{ V}, T_J = 25^{\circ}\text{C}$	500	-	-	V
ΔBV _{DSS} / ΔΤ _J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.7	-	V/°C
I	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V	-	-	200	
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 400 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	-	500	μΑ
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V	-	-	±100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu\text{A}$	3.0	-	5.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 10 A	-	0.22	0.26	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 10 A	-	25	-	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V 05 V V 0 V	-	2550	3390	pF
C _{oss}	Output Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz		350	465	pF
C _{rss}	Reverse Transfer Capacitance			27	40	pF
Q _{g(tot)}	Total Gate Charge at 10V	V _{DS} = 400 V, I _D = 20 A,	-	50	65	nC
Q _{gs}	Gate to Source Gate Charge	V _{GS} = 10 V	-	14	-	nC
Q_{gd}	Gate to Drain "Miller" Charge	(Note 4) -	20	-	nC

Switching Characteristics

t _{d(on)}	Turn-On Delay Time		-	45	100	ns
t _r		$V_{DD} = 250 \text{ V}, I_D = 20 \text{ A},$	-	120	250	ns
t _{d(off)}	Turn-Off Delay Time	V_{GS} = 10 V, R_G = 25 Ω	- /	100	210	ns
t _f	Turn-Off Fall Time	(Note 4)	- /	60	130	ns

Drain-Source Diode Characteristics

Is	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	Α
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	80	Α
V_{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 20 A	-	-	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 20 A,	-	154	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100 A/\mu s$	-	0.5	_	μC

- 1. Repetitive rating: pulse-width limited by maximum junction temperature.
- 2. L = 5 mH, I_{AS} = 20 A, V_{DD} = 50 V, R_G = 25 Ω , starting T_J = 25°C. 3. I_{SD} \leq 20 A, di/dt \leq 200 A/ μ s, V_{DD} \leq BV_{DSS}, starting T_J = 25°C.
- 4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

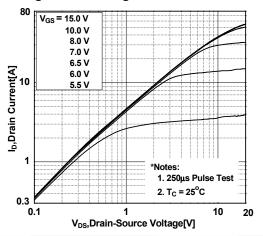


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

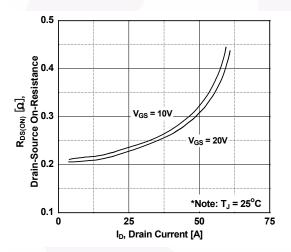


Figure 5. Capacitance Characteristics

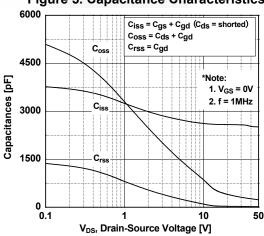


Figure 2. Transfer Characteristics

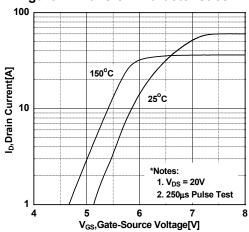


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

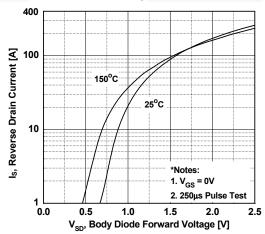
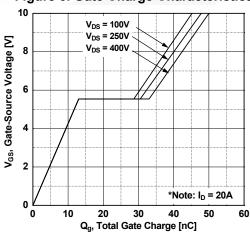


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

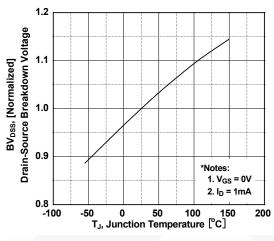


Figure 9. Maximum Drain Current vs. Case Temperature

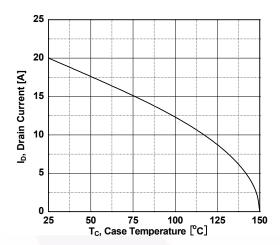


Figure 8. Maximum Safe Operating Area

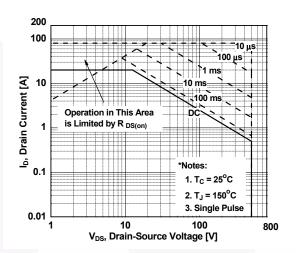


Figure 10. Unclemped Inductive Switching Capability

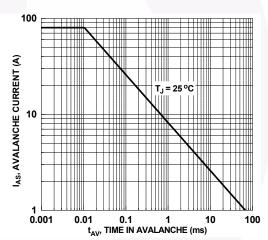
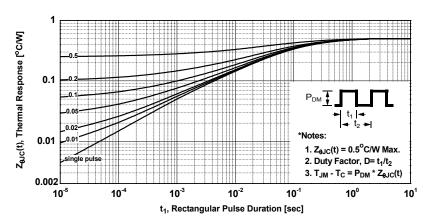


Figure 11. Transient Thermal Response Curve



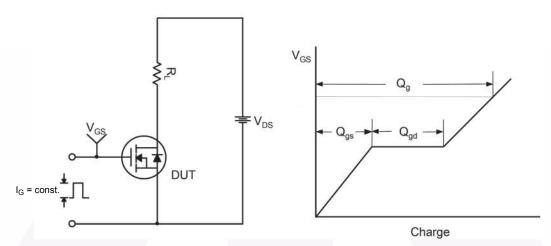


Figure 12. Gate Charge Test Circuit & Waveform

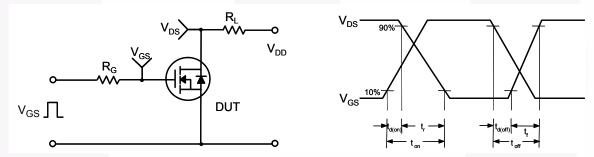


Figure 13. Resistive Switching Test Circuit & Waveforms

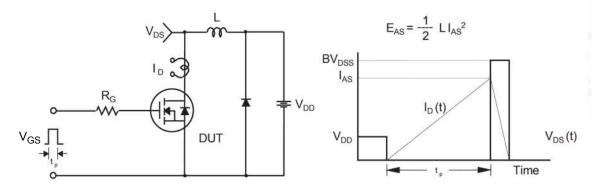


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

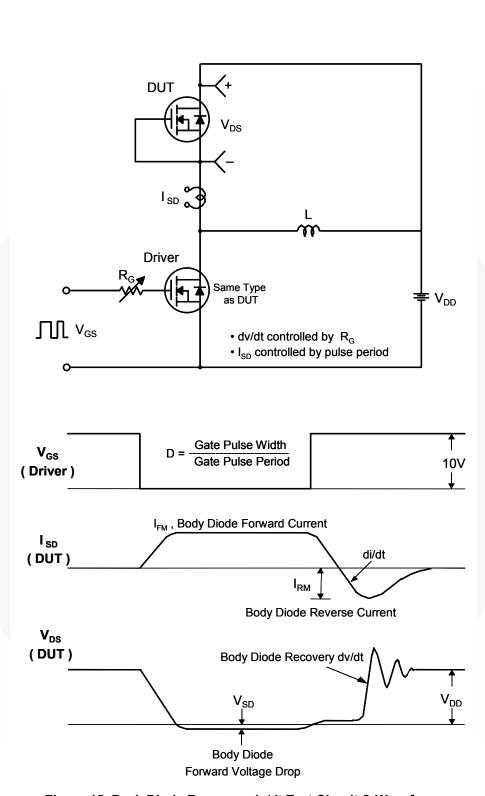


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

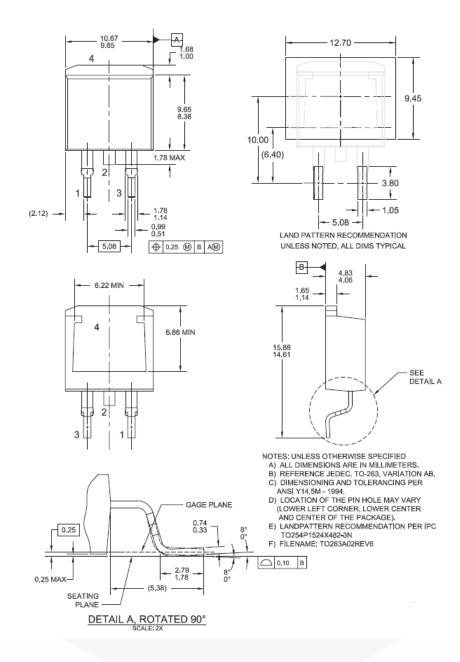


Figure 16. TO263 (D²PAK), Molded, 2-Lead, Surface Mount

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