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March 2013

FDP20N50F / FDPF20N50FT N-Channel UniFETTM FRFET[®] MOSFET 500 V, 20 A, 260 m Ω

Features

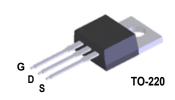
- $R_{DS(on)} = 210 \text{ m}\Omega \text{ (Typ.)} @ V_{GS} = 10 \text{ V, } I_D = 10 \text{ A}$
- Low Gate Charge (Typ. 50 nC)
- Low C_{rss} (Typ. 27 pF)
- · 100% Avalanche Aested
- · Improve dv/dt Capability
- · RoHS Compliant

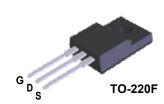
Applications

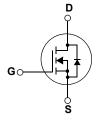
- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply
- · AC-DC Power Supply

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			FDP20N50F	FDPF20N50FT	Unit	
V_{DSS}	Drain to Source Voltage	Drain to Source Voltage			500		
V _{GSS}	Gate to Source Voltage	Gate to Source Voltage		4	:30	V	
	Drain Current	- Continuous (T _C = 25°C)		20 20*		^	
ID	Drain Current	- Continuous (T _C = 100°C)		12.9	12.9*	Α	
I _{DM}	Drain Current	- Pulsed	(Note 1)	80	80*	Α	
E _{AS}	Single Pulsed Avalanche Energy		(Note 2)) 1110		mJ	
I _{AR}	Avalanche Current		(Note 1)	20		Α	
E _{AR}	Repetitive Avalanche Energy		(Note 1)) 25		mJ	
dv/dt	Peak Diode Recovery dv/d	t	(Note 3)) 20		V/ns	
В	Dawer Discinction	(T _C = 25°C)		250	38.5	W	
P_D	Power Dissipation	- Derate above 25°C		2.0	0.3	W/oC	
T _J , T _{STG}	Operating and Storage Temperature Range		-55 t	o +150	οС		
T _L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	οС		

^{*}Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP20N50F	FDPF20N50FT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.5	3.3	
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.5	-	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information T_C = 25°C unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP20N50F	FDP20N50F	TO-220	-	-	50
FDPF20N50FT	FDPF20N50FT	TO-220F	-	-	50

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	eteristics					
BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250 \mu A$, $V_{GS} = 0V$, $T_J = 25^{\circ}C$	500	-	-	V
ΔBV _{DSS} / ΔΤ _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	-	0.7	-	V/°C
ı	Zoro Coto Voltago Droin Current	V _{DS} = 500V, V _{GS} = 0V	-	-	10	
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 400V, T_C = 125^{\circ}C$	-	-	100	μΑ
I _{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	±100	nA

On Characteristics

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

Dynamic Characteristics

C _{iss}	Input Capacitance	V 05V V 0V	-	2550	3390	pF
C _{oss}	Output Capacitance	V _{DS} = 25V, V _{GS} = 0V f = 1MHz	-	350	465	pF
C _{rss}	Reverse Transfer Capacitance	1 = 11V1112		27	40	pF
Q _{g(tot)}	Total Gate Charge at 10V		-	50	65	nC
Q_{gs}	Gate to Source Gate Charge	$V_{DS} = 400V, I_{D} = 20A$	-	14	-	nC
Q_{gd}	Gate to Drain "Miller" Charge	V _{GS} = 10V (Note 4)	-	20	-	nC

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time		-	45	100	ns
t _r	Turn-On Rise Time	$V_{DD} = 250V, I_{D} = 20A$	-	120	250	ns
t _{d(off)}	Turn-Off Delay Time	$R_G = 25\Omega$	-	100	210	ns
t _f	Turn-Off Fall Time	(Note 4)	-	60	130	ns

Drain-Source Diode Characteristics

I _S	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} = 0V, I _{SD} = 20A		-	-	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _{SD} = 20A	-	154	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	-	0.5	-	μС

- Notes:

 1. Repetitive Rating: Pulse width limited by maximum junction temperature
- 2. L = 5mH, I_{AS} = 20A, V_{DD} = 50V, R_G = 25 Ω , Starting T_J = 25 $^{\circ}$ C
- 3. $I_{SD} \le 20 A$, di/dt $\le 200 A/\mu s$, $V_{DD} \le BV_{DSS}$, Starting T_J = 25°C
- 4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

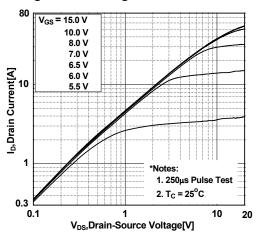


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

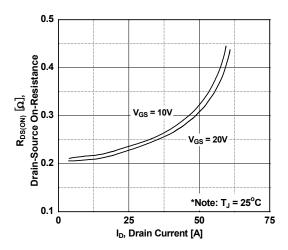


Figure 5. Capacitance Characteristics

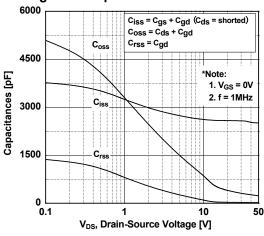


Figure 2. Transfer Characteristics

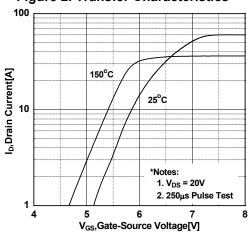


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

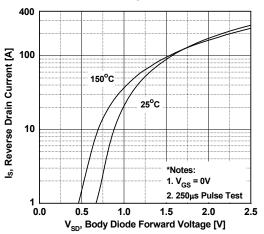
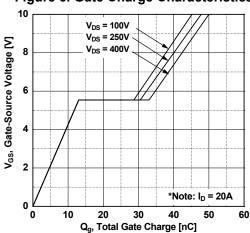


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

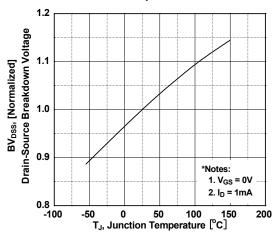


Figure 8. Maximum Safe Operating Area - FDP20N50F

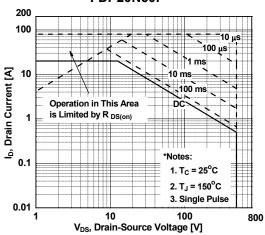


Figure 9. Maximum Safe Operating Area - FDPF20N50FT

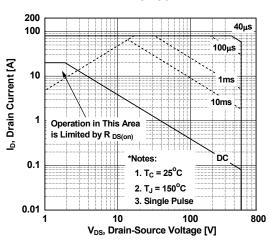


Figure 10. Maximum Drain Current vs. Case Temperature

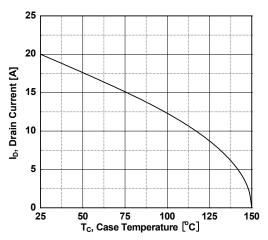
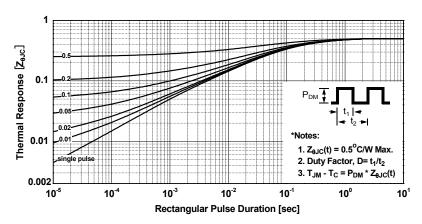
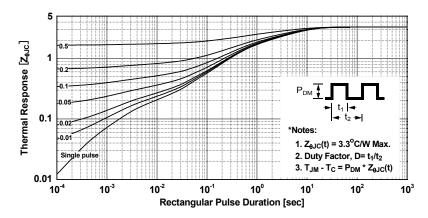


Figure 11. Transient Thermal Response Curve - FDP20N50F

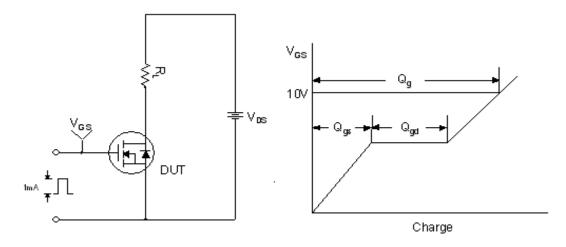


Typical Performance Characteristics (Continued)

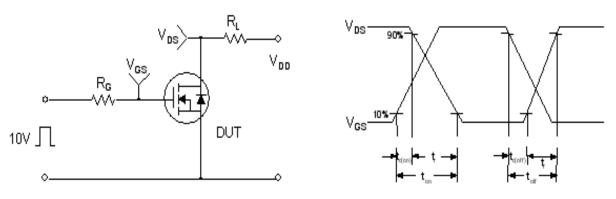
Figure 12. Transient Thermal Response Curve - FDPF20N50FT



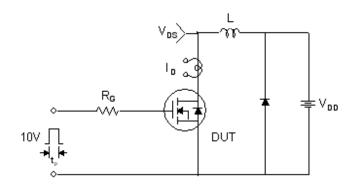
Gate Charge Test Circuit & Waveform

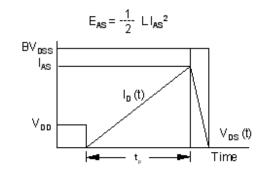


Resistive Switching Test Circuit & Waveforms

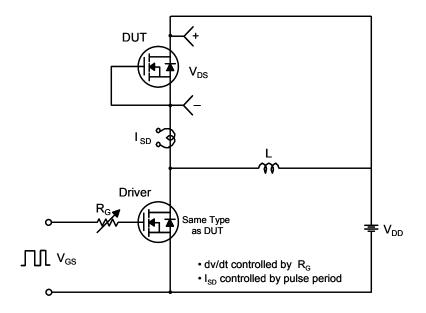


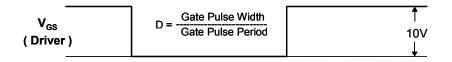
Unclamped Inductive Switching Test Circuit & Waveforms

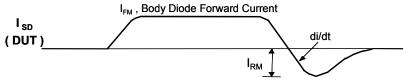




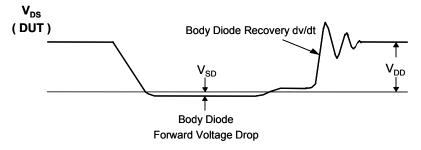
Peak Diode Recovery dv/dt Test Circuit & Waveforms





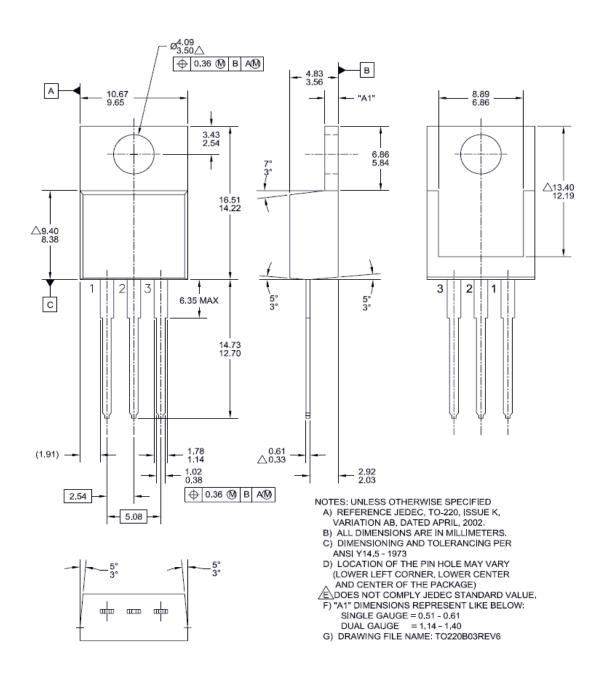


Body Diode Reverse Current



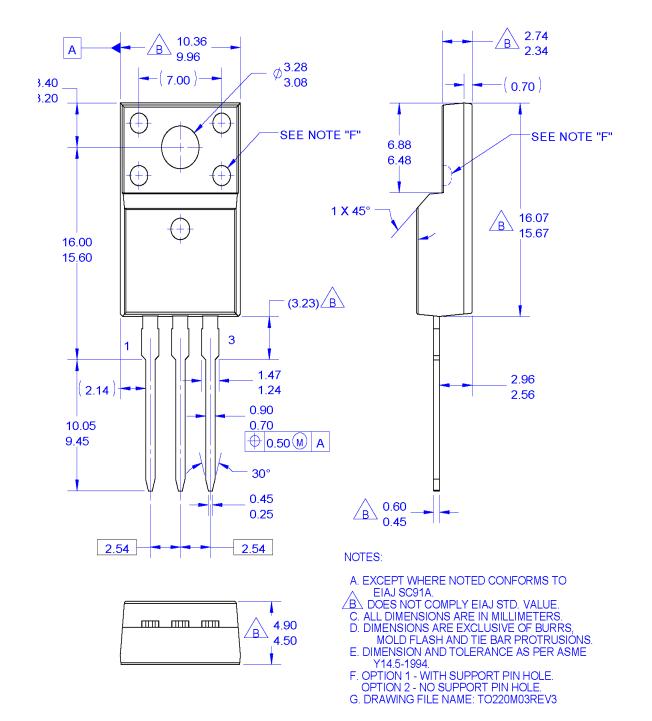
Mechanical Dimensions

TO-220B03



Mechanical Dimensions

TO-220M03



Dimensions in Millimeters





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