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October 2013

# FDP8N50NZ / FDPF8N50NZ N-Channel UniFET<sup>TM</sup> II MOSFET 500 V, 8 A, 850 m $\Omega$

#### **Features**

- $R_{DS(on)}$  = 770 m $\Omega$  (Typ.) @  $V_{GS}$  = 10 V,  $I_D$  = 4 A
- Low Gate Charge (Typ. 14 nC)
- Low C<sub>rss</sub> (Typ. 5 pF)
- · 100% Avalanche Tested
- · Improve dv/dt Capability
- · ESD Improved Capability
- · RoHS Compliant

# **Applications**

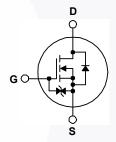
- · LCD/LED TV
- · Uninterruptible Power Supply
- Lighting
- · AC-DC Power Supply

# Description

UniFET<sup>TM</sup> II MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET II MOSFET to withstand over 2kV HBM surge stress. 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<sub>C</sub> = 25°C unless otherwise noted\*

Symbol		Parameter			FDPF8N50NZ	Unit	
$V_{DSS}$	Drain to Source Voltage	Drain to Source Voltage			500		
$V_{GSS}$	Gate to Source Voltage			4	£25	V	
	Drain Current	- Continuous (T <sub>C</sub> = 25°C)		8	8*	۸	
ID	Drain Current	- Continuous (T <sub>C</sub> = 100°C)		4.8	4.8*	Α	
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	32	32*	Α	
E <sub>AS</sub>	Single Pulsed Avalanche Energy		(Note 2)	122		mJ	
I <sub>AR</sub>	Avalanche Current		(Note 1)	8		Α	
E <sub>AR</sub>	Repetitive Avalanche Energy		(Note 1)	13		mJ	
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	10		V/ns	
Б	Davies Dissipation	(T <sub>C</sub> = 25°C)		130	40.3	W	
$P_{D}$	Power Dissipation	- Derate above 25°C		1	0.3	W/°C	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range			-55 to +150		°С	
TL	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300		°C	

<sup>\*</sup>Drain current limited by maximum junction temperature

#### **Thermal Characteristics**

Symbol	Parameter	FDP8N50NZ	FDPF8N50NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.96	3.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	*C/VV

# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8N50NZ	FDP8N50NZ	TO-220	Tube	N/A	50 units
FDPF8N50NZ	FDPF8N50NZ	TO-220F	Tube	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250 \mu A$ , $V_{GS} = 0 V$ , $T_C = 25 ^{\circ} C$	500	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	-	0.5	-	V/°C
I	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V	-	-	1	
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 400V, T_{C} = 125^{\circ}C$	-	-	10	μА
I <sub>GSS</sub>	Gate to Body Leakage Current	$V_{GS} = \pm 25V, V_{DS} = 0V$	-	-	±10	μΑ

#### On Characteristics

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	3.0	-	5.0	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 4A	-	0.77	0.85	Ω
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 20V, I_{D} = 4A$	-	6.3	-	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	.,	05)/ )/ 0)/		-	565	735	pF
C <sub>oss</sub>	Output Capacitance		<sub>S</sub> = 25V, V <sub>GS</sub> = 0V 1MHz		-\	80	105	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	'-	11VII 12		- \	5	8	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V				- \	14	18	nC
$Q_{gs}$	Gate to Source Gate Charge	VDS	<sub>S</sub> = 400V,I <sub>D</sub> = 8A <sub>S</sub> = 10V		-	4	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	VG	S = 10V	(Note 4)	-	6	-	nC

# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time		-	17	45	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 250V, I_D = 8A$	-	34	80	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$R_G = 25\Omega$ , $V_{GS} = 10V$	-	43	95	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	- /	27	60	ns

# **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Dio	Maximum Continuous Drain to Source Diode Forward Current		-	8	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Fo	Maximum Pulsed Drain to Source Diode Forward Current		-	30	Α
$V_{SD}$	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 8A	-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 8A	-	228	/ <b>-</b>	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	-	1.43	-	μС

#### Notes

- 1. Repetitive Rating: Pulse width limited by maximum junction temperature
- 2. L = 3.8mH, I<sub>AS</sub> = 8A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 $\Omega$ , Starting T<sub>J</sub> = 25 $^{\circ}$ C
- 3. I  $_{SD} \leq 8 \text{A}, \text{ di/dt} \leq 200 \text{A/}\mu\text{s}, \text{ V}_{DD} \leq \text{BV}_{DSS}, \text{ Starting T}_{J} \text{ = } 25^{\circ}\text{C}$
- 4. Essentially Independent of Operating Temperature Typical Characteristics

# **Typical Characteristics**

Figure 1. On-Region Characteristics

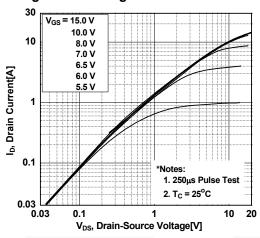


Figure 3. On-Resistance Variation vs.
Drain Current and Gate Voltage

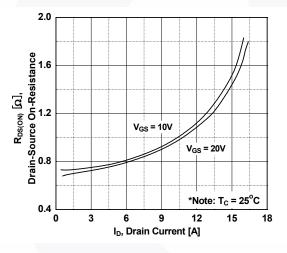


Figure 5. Capacitance Characteristics

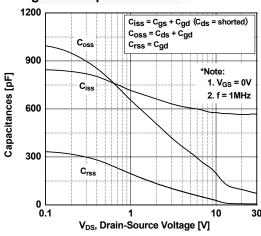


Figure 2. Transfer Characteristics

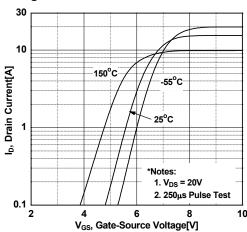


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

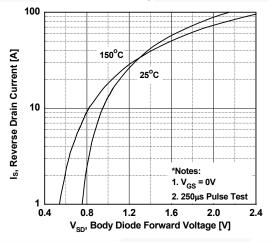
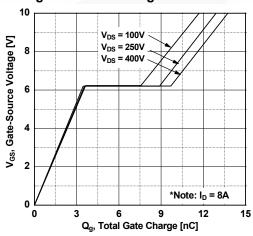


Figure 6. Gate Charge Characteristics



# **Typical Characteristics** (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

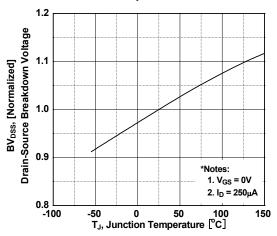


Figure 8. On-Resistance Variation vs. Temperature

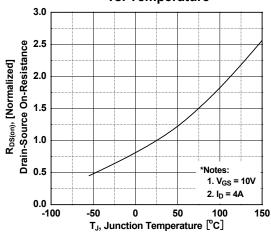


Figure 9. Maximum Safe Operating Area - FDP8N50NZ

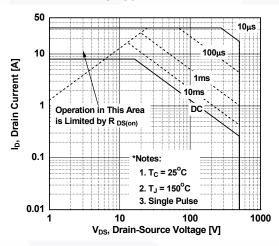


Figure 10. Maximum Safe Operating Area - FDPF8N50NZ

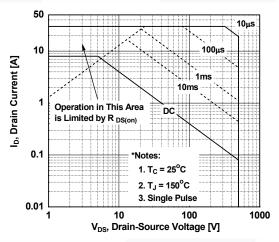


Figure 11. Maximum Drain Current vs. Case Temperature

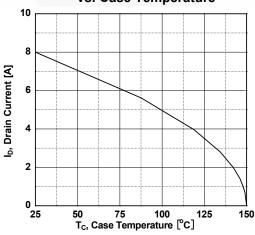
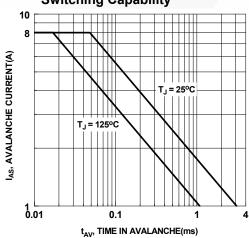


Figure 12. Unclamped Inductive Switching Capability



# **Typical Characteristics** (Continued)

Figure 13. Transient Thermal Response Curve - FDP8N50NZ

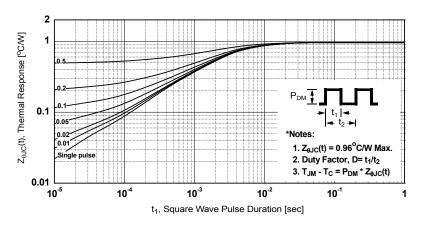


Figure 14. Transient Thermal Response Curve - FDPF8N50NZ

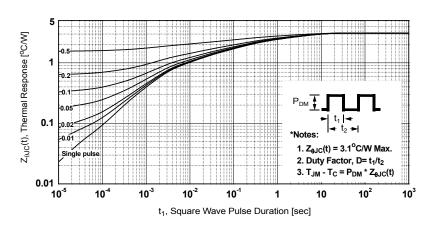


Figure 15. Gate Charge Test Circuit & Waveform

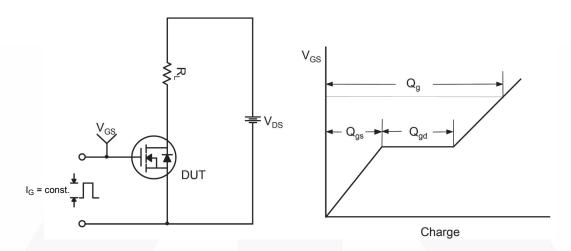


Figure 16. Resistive Switching Test Circuit & Waveforms

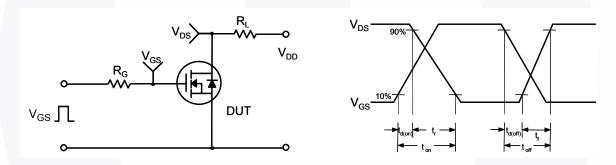
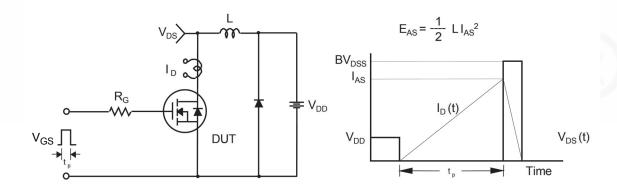


Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms



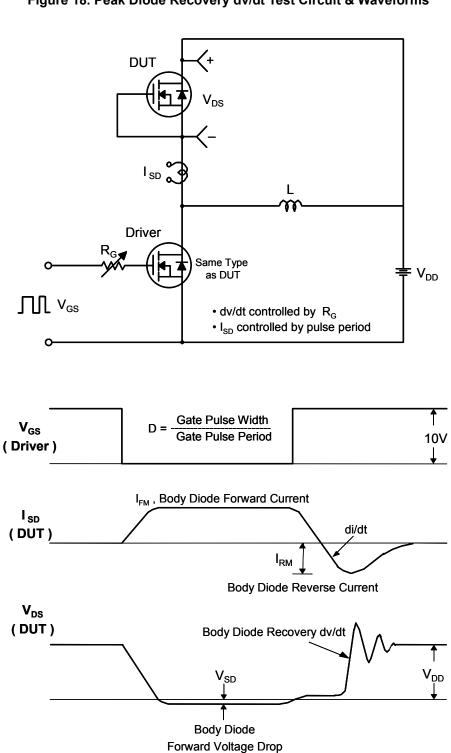


Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms

## **Mechanical Dimensions**

# TO-220 3L

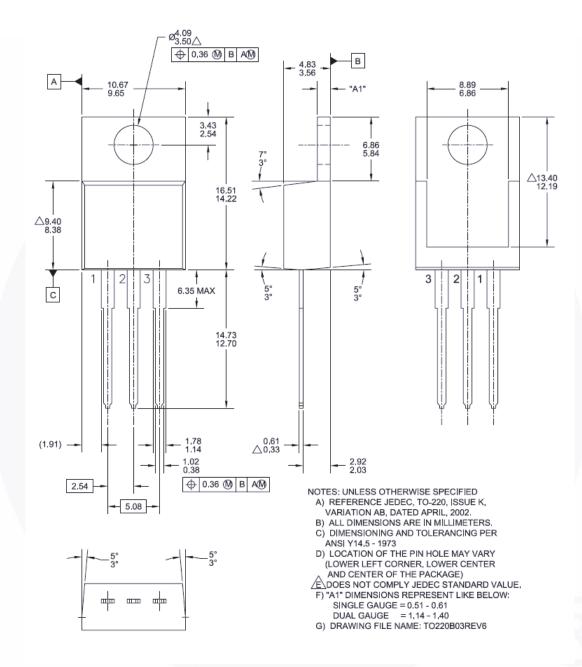


Figure 19. TO-220, Molded, 3Lead, Jedec Variation AB

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Dimension in Millimeters

## **Mechanical Dimensions**

# TO-220F 3L

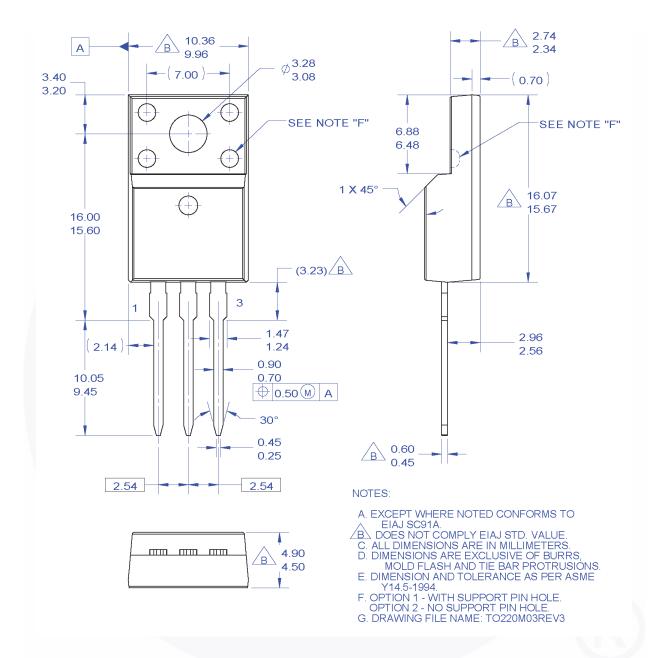


Figure 20. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Straight Lead

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Dimension in Millimeters





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