

March 2013

FDP5N60NZ / FDPF5N60NZ N-Channel UniFETTM II MOSFET 600 V, 4.5 A, 2.0 Ω

Features

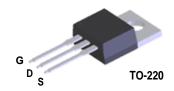
- $R_{DS(on)} = 1.65 \Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 2.25 \text{ A}$
- Low Gate Charge (Typ. 10 nC)
- Low C_{rss} (Typ. 5 pF)
- 100% Avalanche Tested
- · Improved dv/dt Capability
- · ESD Improved Capability
- RoHS Compliant

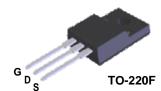
Applications

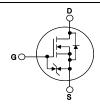
- LCD/LED TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFETTM 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_C = 25°C unless otherwise noted*

Symbol		Parameter		FDP5N60NZ	FDPF5N60NZ	Unit
V_{DSS}	Drain to Source Voltage			6	600	V
V_{GSS}	Gate to Source Voltage	Gate to Source Voltage		±25		V
	Drain Current	- Continuous (T _C = 25°C)		4.5	4.5*	۸
ID	Drain Current	- Continuous (T _C = 100°C)		2.7	2.7*	A
I _{DM}	Drain Current	- Pulsed	(Note 1)	18	18*	Α
E _{AS}	Single Pulsed Avalanche Energy		(Note 2)	175		mJ
I _{AR}	Avalanche Current		(Note 1)	4.5		Α
E _{AR}	Repetitive Avalanche Energy		(Note 1)	10		mJ
dv/dt	MOSFET dv/dt Ruggedness			20		V/ns
dv/di	Peak Diode Recovery dv/dt		(Note 3)	10		V/ns
D	Power Dissipation	$(T_C = 25^{\circ}C)$		100	33	W
P_{D}	Power Dissipation - Derate above 25°C			0.8 0.27		W/°C
T _J , T _{STG}	Operating and Storage Temperature Range			-55 to +150		°C
TL	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			3	300	°C

^{*}Dran current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP5N60NZ	FDPF5N60NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.25	3.75	
$R_{\theta CS}$	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

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP5N60NZ	FDP5N60NZ	TO-220	-	-	50
FDPF5N60NZ	FDPF5N60NZ	TO-220F	=	=	50

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	$I_D = 250 \mu A, V_{GS} = 0 V$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	-	0.6	-	V/°C
	Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	-	-	1	^
IDSS	Zero Gate voltage Drain Current	$V_{DS} = 480V, T_{C} = 125^{\circ}C$	-	-	10	μА
I _{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 25V, V_{DS} = 0V$	-	-	±10	μΑ

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	$V_{GS} = 10V, I_D = 2.25A$	-	1.65	2.0	Ω
9 _{FS}	Forward Transconductance	$V_{DS} = 20V, I_{D} = 2.25A$	İ	5	-	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V 05V V 0V		=	450	600	pF
C _{oss}	Output Capacitance	$V_{DS} = 25V, V_{GS} = 0V$ f = 1MHz		-	50	65	pF
C _{rss}	Reverse Transfer Capacitance	1 - 111112		-	5	7.5	pF
Qg	Total Gate Charge at 10V	V _{DS} = 480V, I _D = 4.5A		-	10	13	nC
Q _{gs}	Gate to Source Gate Charge	V _{GS} = 10V		-	2.5	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	4	-	nC

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	$V_{DD} = 300V, I_D = 4.5A$		-	15	40	ns
t _r	Turn-On Rise Time	$R_G = 25\Omega$		-	20	50	ns
t _{d(off)}	Turn-Off Delay Time			-	35	80	ns
t _f	Turn-Off Fall Time	(Not	e 4)	-	20	50	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Dioc	Maximum Continuous Drain to Source Diode Forward Current		-	4.5	Α
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	18	Α
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_{SD} = 4.5A$	-	-	1.4	V
t _{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_{SD} = 4.5A$	-	230	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	-	0.9	-	μС

Notes:

- ${\bf 1.}\ Repetitive\ Rating:\ Pulse\ width\ limited\ by\ maximum\ junction\ temperature$
- 2. L = 17.3mH, I_{AS} = 4.5A, V_{DD} = 50V, R_{G} = 25 Ω , Starting T_{J} = 25 $^{\circ}$ C
- 3. I_{SD} \leq 4.5A, di/dt \leq 200A/ $\mu s,~V_{DD} \leq$ BV $_{DSS},~Starting~T_J$ = 25°C
- 4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

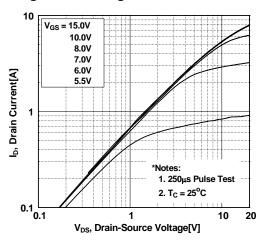


Figure 3. On-Resistance Variation vs.
Drain Current and Gate Voltage

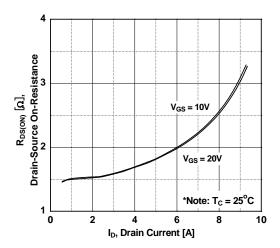


Figure 5. Capacitance Characteristics

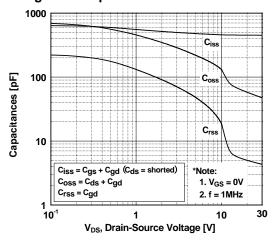


Figure 2. Transfer Characteristics

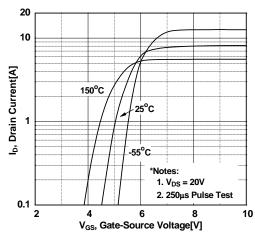


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

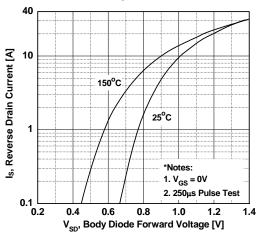
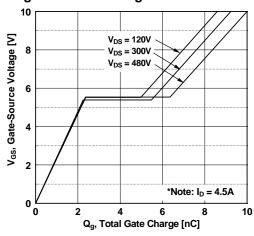


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

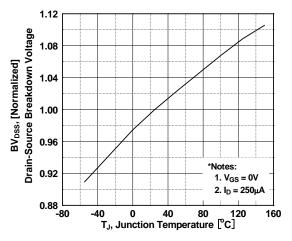


Figure 9. Maximum Safe Operating Area -FDP5N60NZ

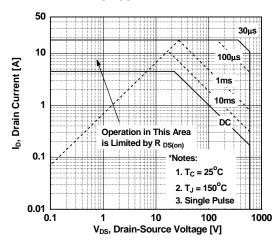


Figure 11. Maximum Drain Current vs.

Case Temperature

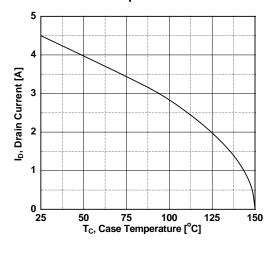


Figure 8. On-Resistance Variation vs. Temperature

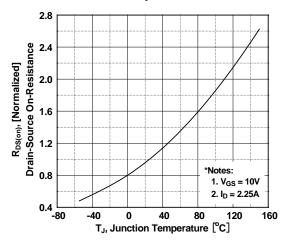


Figure 10. Maximum Safe Operating Area -FDPF5N60NZ

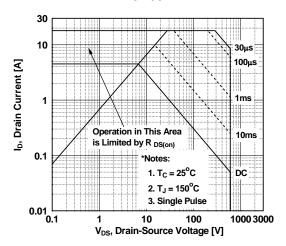
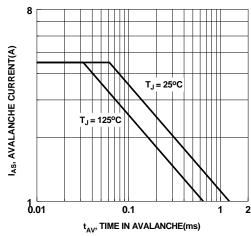


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve -FDP5N60NZ

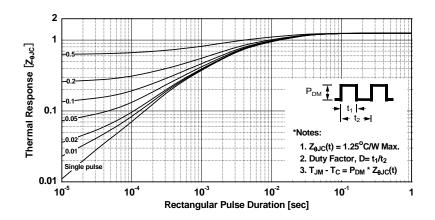
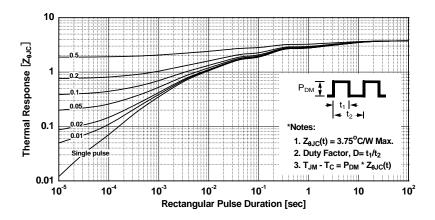
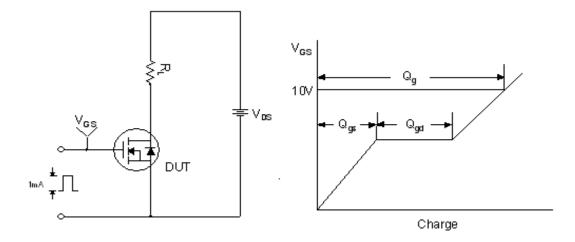


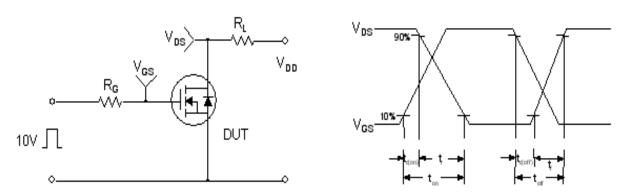
Figure 14. Transient Thermal Response Curve -FDPF5N60NZ



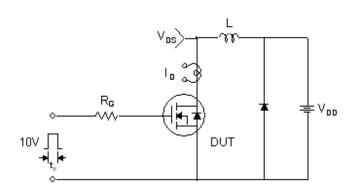
Gate Charge Test Circuit & Waveform

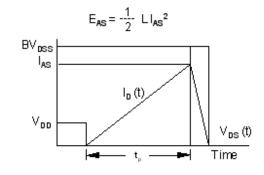


Resistive Switching Test Circuit & Waveforms

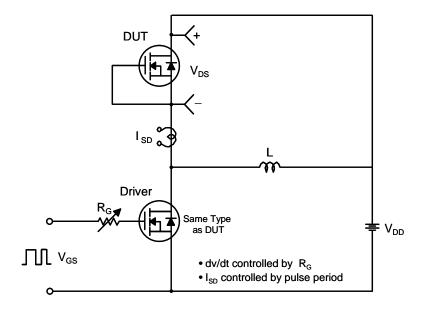


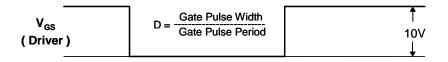
Unclamped Inductive Switching Test Circuit & Waveforms

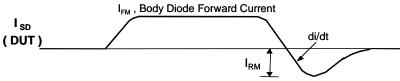




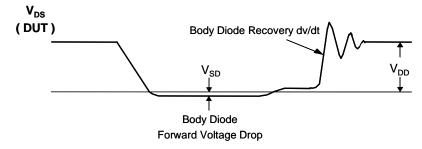
Peak Diode Recovery dv/dt Test Circuit & Waveforms





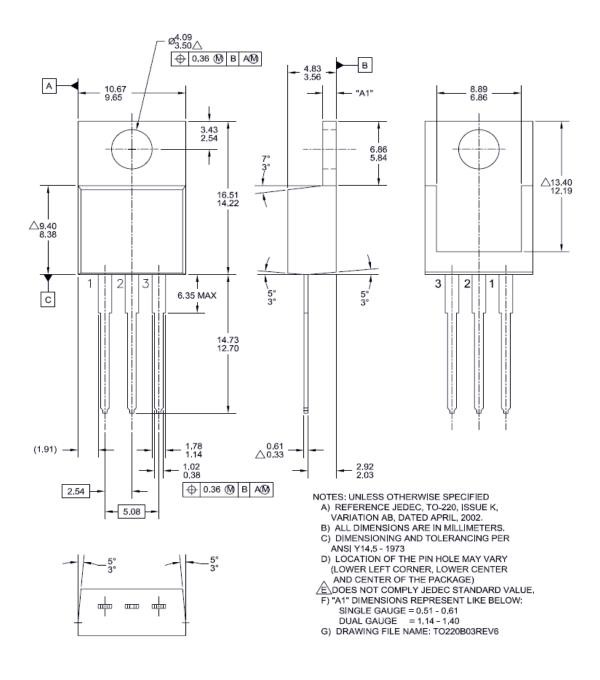


Body Diode Reverse Current



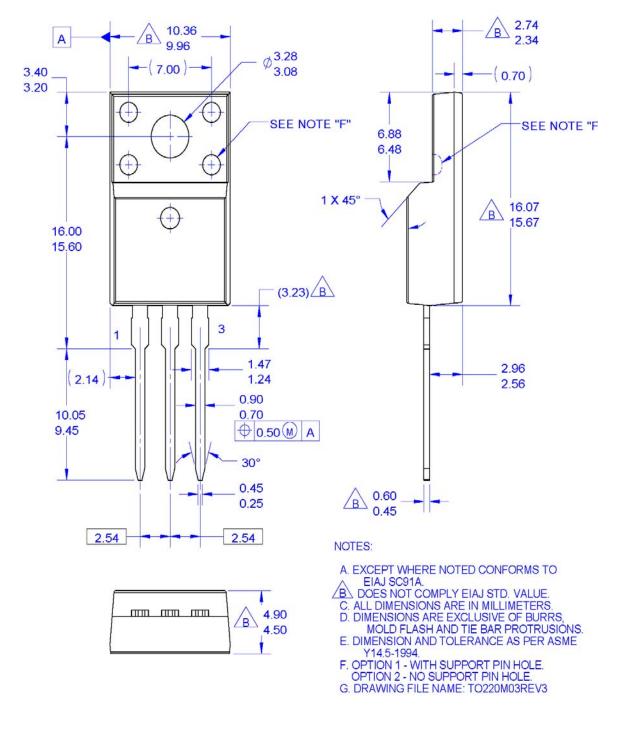
Mechanical Dimensions

TO-220B03



Package Dimensions

TO-220M03







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