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March 2016

FDP51N25 / FDPF51N25 N-Channel UniFETTM MOSFET

250 V, 51 A, 60 mΩ

Features

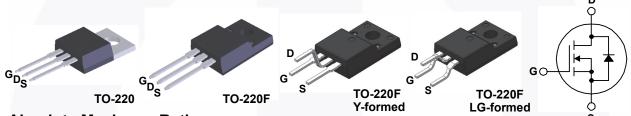
- $R_{DS(on)}$ = 48 $m\Omega(Typ.)$ @ V_{GS} = 10 V, I_D = 25.5 A
- Low Gate Charge (Typ. 55 nC)
- Low C_{rss} (Typ. 63 pF)

Applications

- 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. 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.



Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Para	meter	FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
V_{DSS}	Drain-Source Voltage			V	
l _D	Drain Current	- Continuous (T _C = 25°C) - Continuous (T _C = 100°C)	51 30	51* 30*	A A
I _{DM}	Drain Current	- Pulsed (Note 1)	204	204*	Α
V _{GSS}	Gate-Source voltage		:	V	
E _{AS}	Single Pulsed Avalanche Energy (Note 2)			mJ	
I _{AR}	Avalanche Current (Note 1)			Α	
E _{AR}	Repetitive Avalanche Energy (Note 1)			mJ	
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=0.3sec; $T_C = 25^{\circ}C$)		N/A	2500	٧
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P_D	Power Dissipation	(T _C = 25°C) - Derate Above 25°C	320 3.7	38 0.3	W W/°C
T _{J,} T _{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds			°C	

^{*}Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP51N25	FDPF51N25 FDPF51N25YDTU FDPF51N25RDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.39	3.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP51N25	FDP51N25	TO-220	Tube	N/A	N/A	50 units
FDPF51N25	FDPF51N25	TO-220F	Tube	N/A	N/A	50 units
FDPF51N25YDTU	FDPF51N25	TO-220F (Y-formed)	Tube	N/A	N/A	50 units
FDPF51N25RDTU	FDPF51N25	TO-220F (LG-formed)	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}, T_J = 25 ^{\circ}\text{C}$	250			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		0.25		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 250 \text{ V}, V_{GS} = 0 \text{ V}$ $V_{DS} = 200 \text{ V}, T_{C} = 125^{\circ}\text{C}$			1 10	μ Α μ Α
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V			100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0V			-100	nA
On Charac	cteristics		<u> </u>	!		•
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	3.0		5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 25.5 A		0.048	0.060	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 25.5 A	\	43		S
Dynamic C	Characteristics				1	
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V,		2620	3410	pF
C _{oss}	Output Capacitance	f = 1 MHz		530	690	pF
C _{rss}	Reverse Transfer Capacitance			63	90	pF
Switching	Characteristics					
t _{d(on)}	Turn-On Delay Time	$V_{DD} = 125 \text{ V}, I_D = 51 \text{ A},$ $V_{GS} = 10 \text{ V}, R_G = 25 \Omega$ (Note 4)		62	135	ns
t _r	Turn-On Rise Time			465	940	ns
t _{d(off)}	Turn-Off Delay Time			98	205	ns
t _f	Turn-Off Fall Time			130	270	ns
Qg	Total Gate Charge	$V_{DS} = 200 \text{ V, } I_D = 51 \text{ A,}$ $V_{GS} = 10 \text{ V}$ (Note 4)		55	70	nC
Q _{gs}	Gate-Source Charge			16		nC
Q _{gd}	Gate-Drain Charge			27		nC
Drain-Sou	rce Diode Characteristics and Maximur	n Ratings				
I _S	Maximum Continuous Drain-Source Diode Forward Current				51	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				204	Α
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 51 A			1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 51 A,		178	/	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100 A/\mu s$		4.0		μC

- 1. Repetitive rating: pulse-width limited by maximum junction temperature.
- 2. L = 0.68 mH, I $_{AS}$ = 51 A, V $_{DD}$ = 50 V, R $_{G}$ = 25 Ω starting T $_{J}$ = 25° C. 3. I $_{SD}$ \leq 51 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

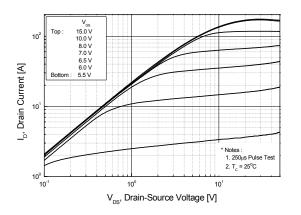


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

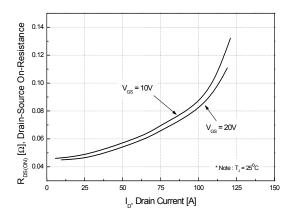


Figure 5. Capacitance Characteristics

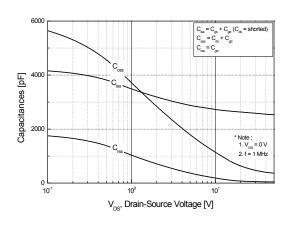


Figure 2. Transfer Characteristics

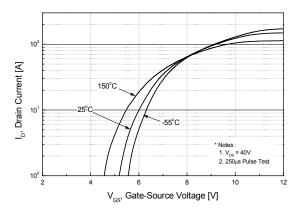


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

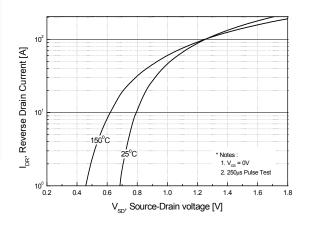
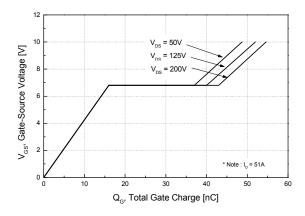


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

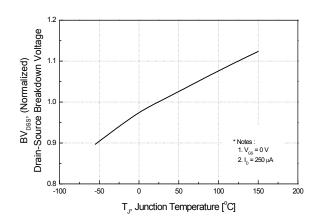


Figure 9-1. Maximum Safe Operating Area for FDP51N25



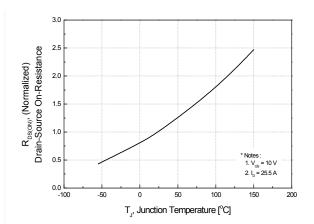


Figure 9-2. Maximum Safe Operating Area for FDPF51N25 / FDPF51N25YDTU

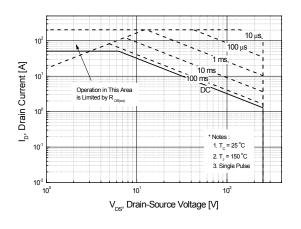
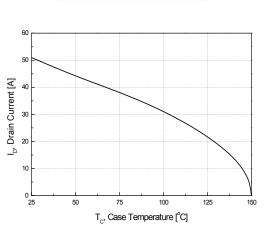
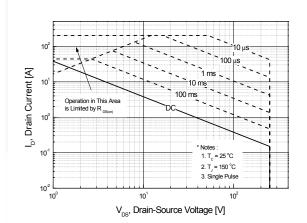


Figure 10. Maximum Drain Current vs. Case Temperature





Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FDP51N25

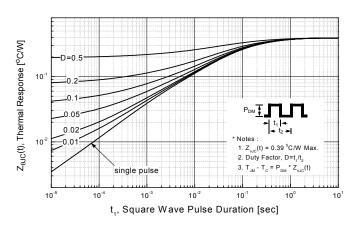
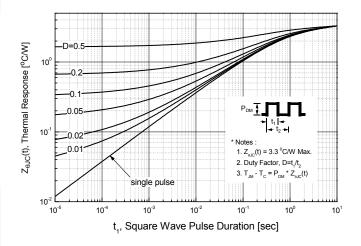


Figure 11-2. Transient Thermal Response Curve for FDPF51N25 / FDPF51N25YDTU



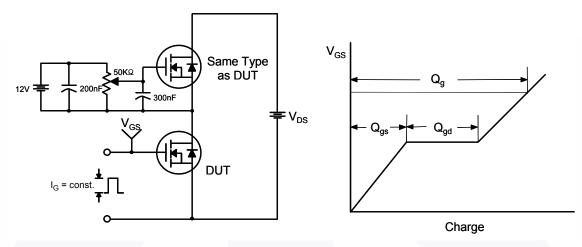


Figure 12. Gate Charge Test Circuit & Waveform

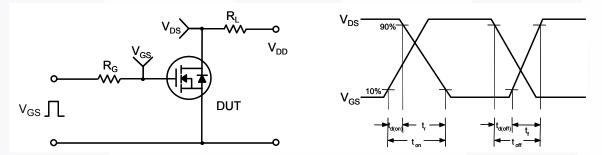


Figure 13. Resistive Switching Test Circuit & Waveforms

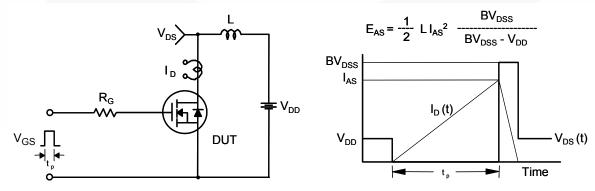


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

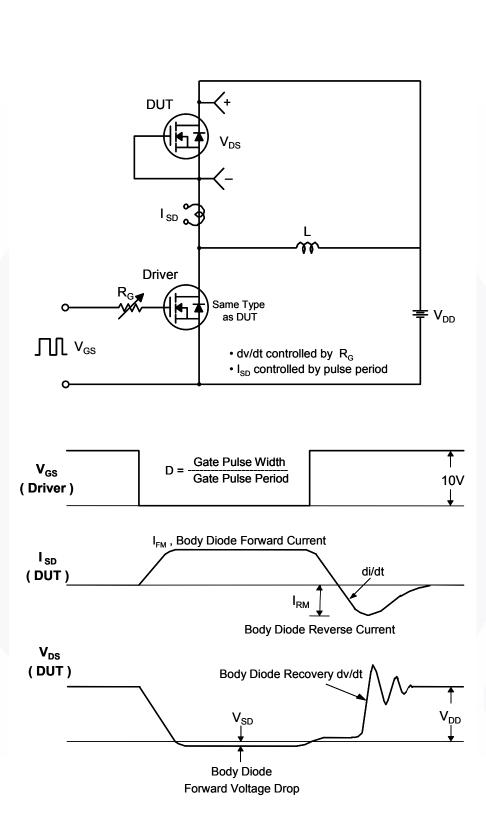
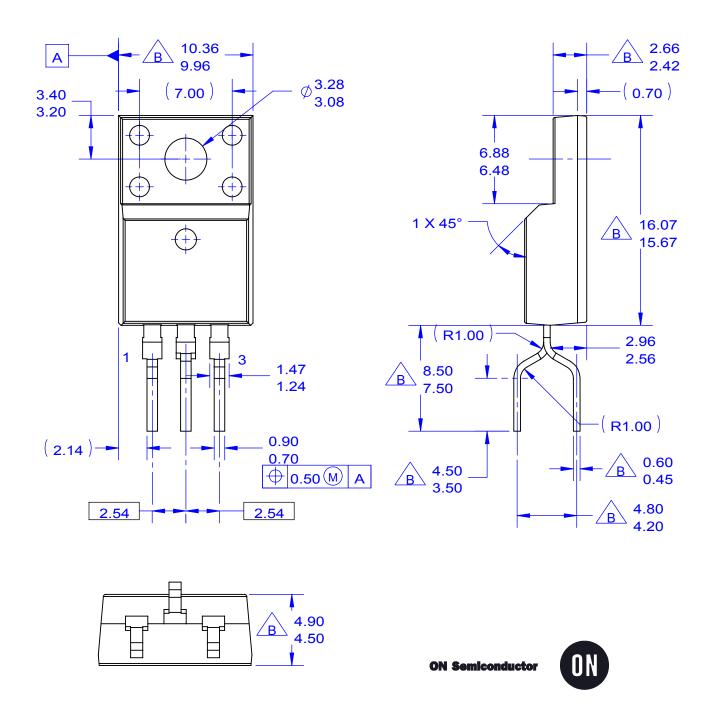


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

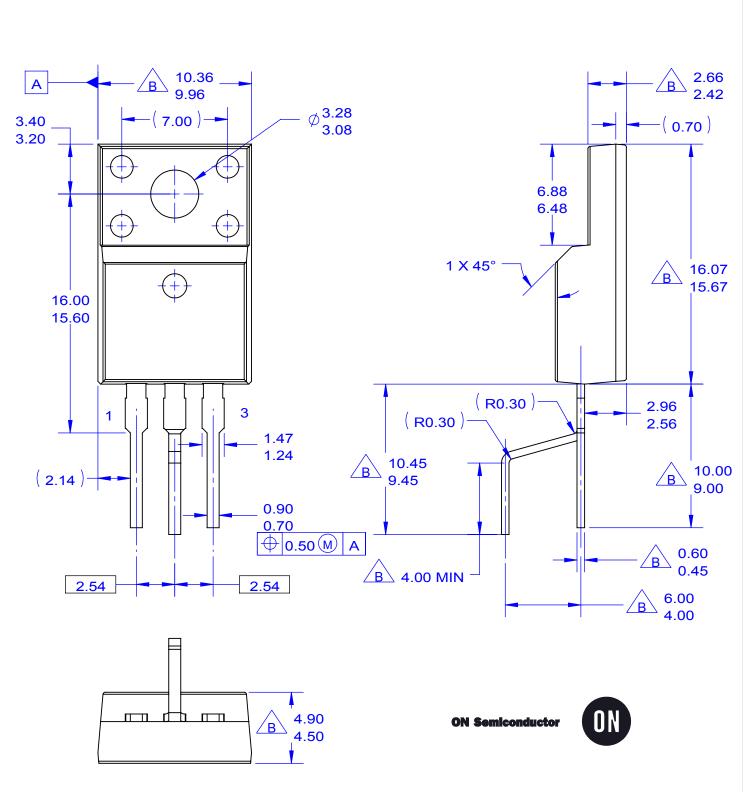


NOTES:

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 C. ALL DIMENSIONS ARE IN MILLIMETERS.

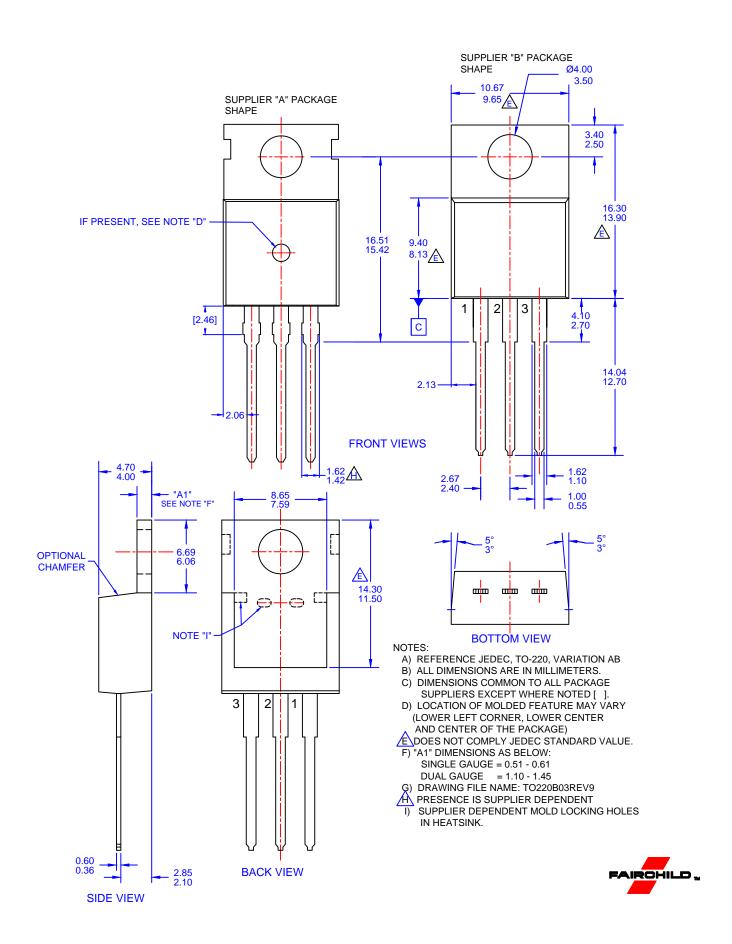
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS MOLD FLASH AND TIE BAR PROTRUSIÓNS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. DRAWING FILE NAME: TO220N03REV2

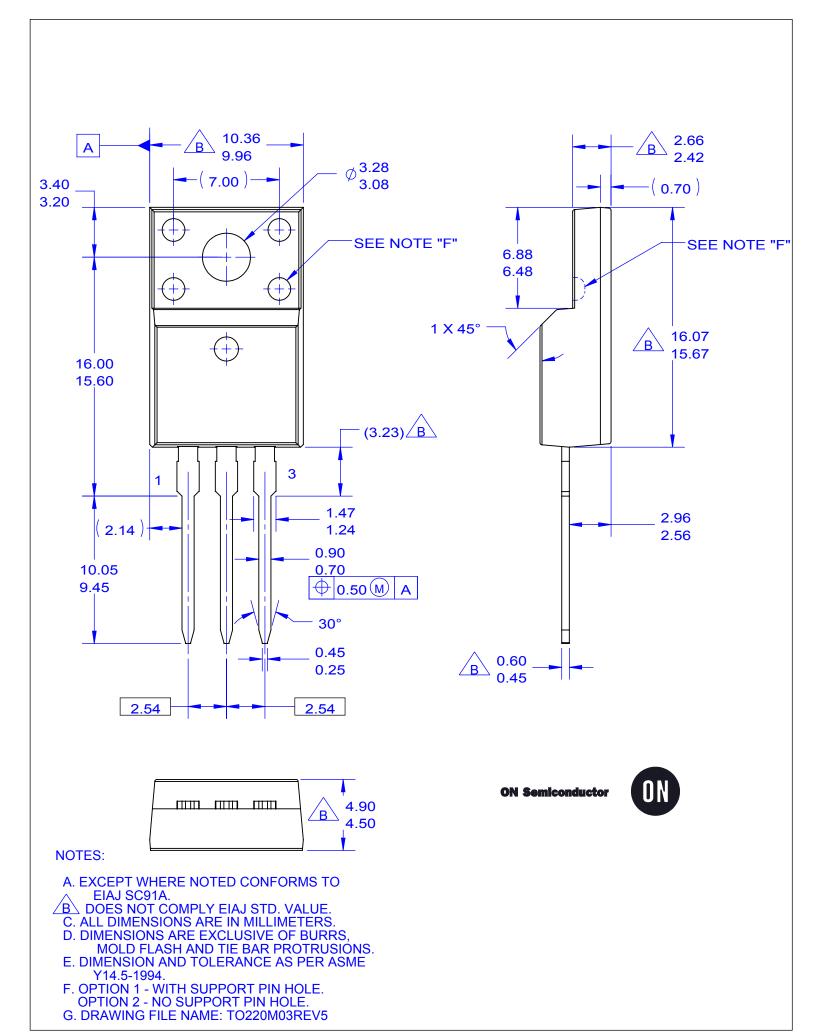


NOTES:

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