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November 2014

FCPF400N80ZL1

N-Channel SuperFET[®] II MOSFET 800 V, 11 A, 400 m Ω

Features

- Typ. $R_{DS(on)}$ = 340 m Ω
- Ultra Low Gate Charge (Typ. Q_q = 43 nC)
- Low E_{oss} (Typ. 4.1 uJ @ 400 V)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 138 pF$)
- 100% Avalanche Tested
- · RoHS Compliant
- · ESD Improved Capability

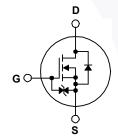
Applications

- AC-DC Power Supply
- · LED Lighting

Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. In addition, internal gate-source ESD diode allows to withstand over 2kV HBM surge stress. Consequently, SuperFET II MOSFET is very suitable for the switching power applications such as Audio, Laptop adapter, Lighting, ATX power and industrial power applications.





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

Symbol		Parameter		FCPF400N80ZL1	Unit	
V_{DSS}	Drain to Source Voltage			800	V	
V	Cata ta Sauraa Valtaga	- DC		±20	V	
V_{GSS}	Gate to Source Voltage	- AC	(f >1 Hz)	±30	V	
	Drain Current	- Continuous (T _C = 25°C)		11*	А	
ID	Dialii Current	- Continuous (T _C = 100°C)		6.9*	A	
I _{DM}	Drain Current	- Pulsed	(Note 1)	33*	Α	
E _{AS}	Single Pulsed Avalanche Ene	ergy	(Note 2)	339	mJ	
I _{AR}	Avalanche Current		(Note 1)	2.2	Α	
E _{AR}	Repetitive Avalanche Energy		(Note 1)	0.36	mJ	
dv/dt	MOSFET dv/dt			100	V/ns	
uv/ut	Peak Diode Recovery dv/dt		(Note 3)	20	V/IIS	
В	Power Dissipation	(T _C = 25°C)		35.7	W	
P_{D}	Fower Dissipation	- Derate Above 25°C		0.29	W/°C	
T _J , T _{STG}	Operating and Storage Temp	erature Range		-55 to +150	°C	
TL	Maximum Lead Temperature 1/8" from Case for 5 Seconds	•		300	°C	

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

Thermal Characteristics

Symbol	Parameter	FCPF400N80ZL1	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	*C/VV

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCPF400N80ZL1	FCPF400N80ZL1	TO-220F	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Chara	cteristics					
BV _{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}, T_J = 25^{\circ}\text{C}$	800	-	-	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C	-	0.8	-	V/°C
1	Zero Gate Voltage Drain Current	V _{DS} = 800 V, V _{GS} = 0 V	-	-	25	
IDSS		$V_{DS} = 640 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	-	250	μΑ
I _{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	±10	μΑ

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 1.1 \text{ mA}$	2.5	-	4.5	V
		$V_{GS} = V_{DS}, I_D = 0.68 \text{ mA}$	2.5	-	4.5	'
/	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 5.5 \text{ A}$	-	0.34	0.4	
R _{DS(on)}		$V_{GS} = 10 \text{ V}, I_D = 7.1 \text{ A}$	-	0.35	0.4	Ω
		$V_{GS} = 10 \text{ V}, I_D = 7.1 \text{ A}, T_C = 150^{\circ}\text{C}$	\ -	0.89	-	
9 _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 5.5 A	-	12	-	S

Dynamic Characteristics

C _{iss}	Input Capacitance	100 1/ 1/ 0 1/	-	1770	2350	pF
C _{oss}	Output Capacitance	V _{DS} = 100 V, V _{GS} = 0 V, f = 1 MHz	-	51	70	pF
C _{rss}	Reverse Transfer Capacitance	1 - 1 101112	-	0.5	-	pF
C _{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1 MHz	-	28	-	pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 480 V, V _{GS} = 0 V	-	138	-	pF
Q _{g(tot)}	Total Gate Charge at 10V	V _{DS} = 640 V, I _D = 11 A,	-	43	56	nC
Q _{gs}	Gate to Source Gate Charge	V _{GS} = 10 V	-	8.6	-	nC
Q _{gd}	Gate to Drain "Miller" Charge	(Note 4)	-	17	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	- /	2.3	-	Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time		-	20	50	ns
t _r		$V_{DD} = 400 \text{ V}, I_{D} = 11 \text{ A},$	/ -	12	34	ns
t _{d(off)}	Turn-Off Delay Time	$V_{GS} = 10 \text{ V}, R_g = 4.7 \Omega$	-	51	112	ns
t _f	Turn-Off Fall Time	(Note 4)	-	2.6	15	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	11	Α
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	33	Α
V_{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 11 A	- >	-	1.2	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 11 A,	-	395	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100 A/\mu s$	-	7.4	-	μС

Notes:

 $^{{\}it 1. Repetitive\ rating: pulse-width\ limited\ by\ maximum\ junction\ temperature.}$

^{2.} I_{AS} = 2.2 A, V_{DD} = 50 V, R_G = 25 Ω , starting T_J = 25°C.

^{3.} I_{SD} \leq 11 A, di/dt \leq 200 A/µs, 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

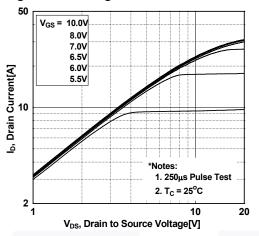


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

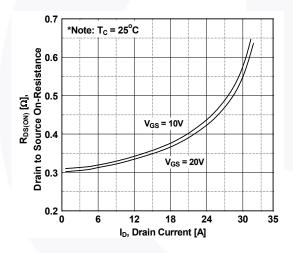


Figure 5. Capacitance Characteristics

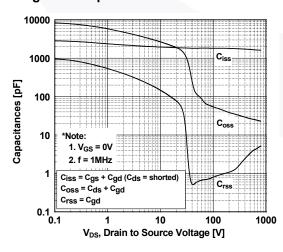


Figure 2. Transfer Characteristics

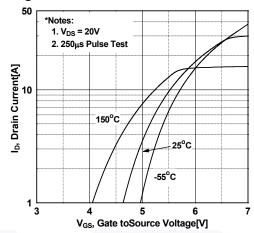


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

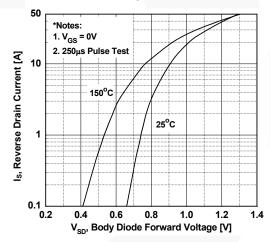
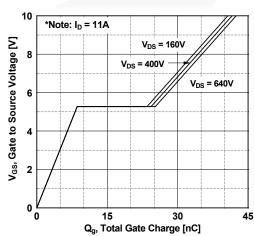


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

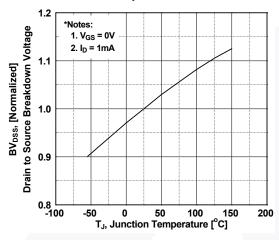


Figure 9. Maximum Safe Operating Area

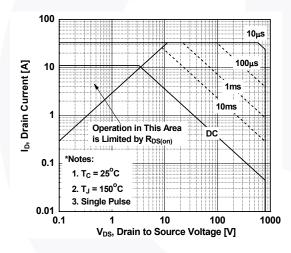


Figure 11. Eoss vs. Drain to Source Voltage

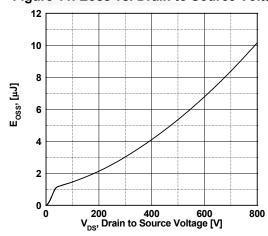


Figure 8. On-Resistance Variation vs. Temperature

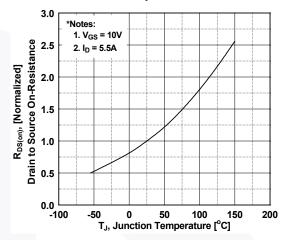
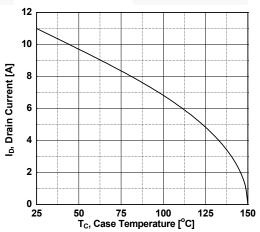
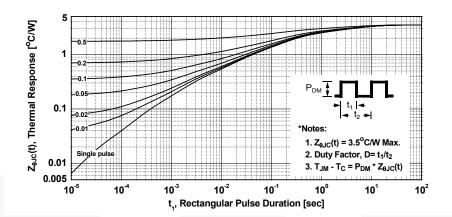


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



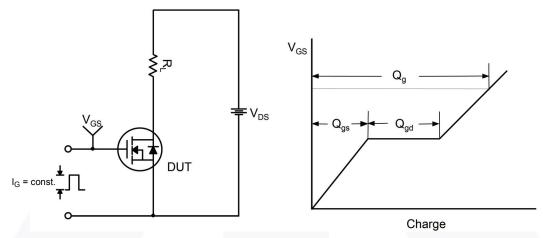


Figure 13. Gate Charge Test Circuit & Waveform

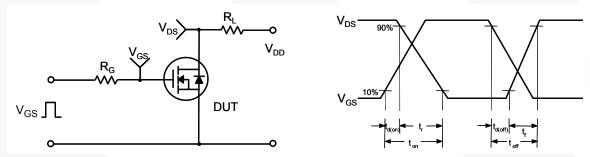


Figure 14. Resistive Switching Test Circuit & Waveforms

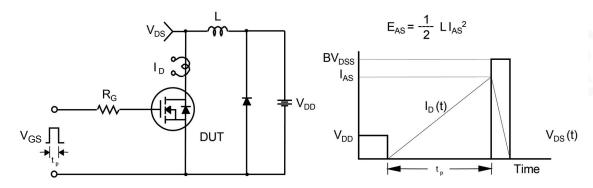


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

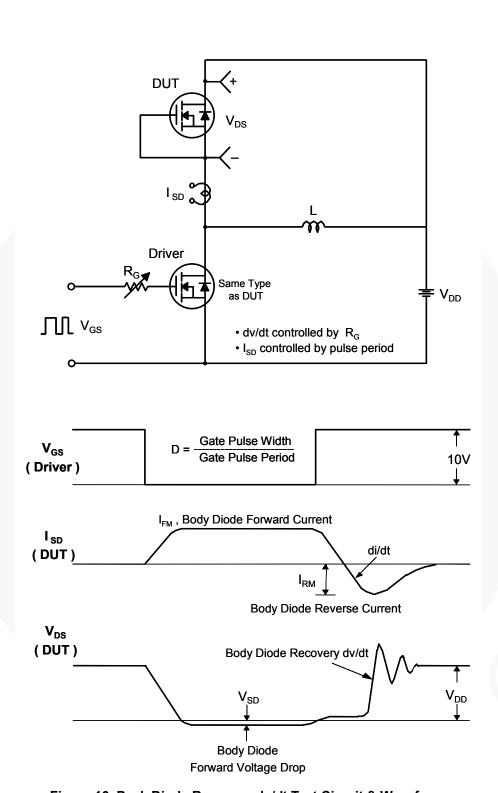
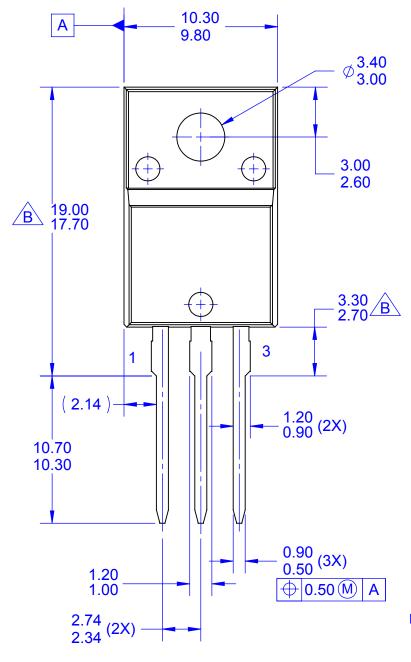
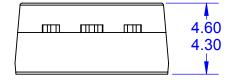
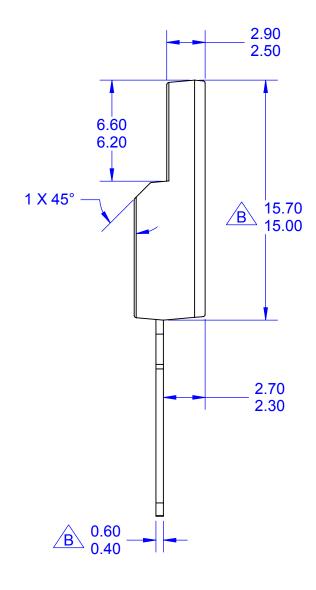


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms







NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.

 B DOES NOT COMPLY EIAJ STD. VALUE.
 C. ALL DIMENSIONS ARE IN MILLIMETERS.

- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS. E. DIMENSION AND TOLERANCE AS PER ASME
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