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November 2015

#### **FCP125N60E**

# N-Channel SuperFET<sup>®</sup> II Easy-Drive MOSFET 600 V, 29 A, 125 m $\Omega$

#### **Features**

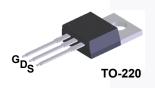
- 650 V @T<sub>J</sub> = 150°C
- Typ.  $R_{DS(on)}$  = 102 m $\Omega$
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 75 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff)</sub> = 258 pF)
- · 100% Avalanche Tested
- · RoHS Compliant

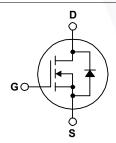
#### **Applications**

- · Telecom / Sever Power Supplies
- · Industrial Power Supplies

#### 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. Consequently, SuperFET II MOSFET easy-drive series offers slightly slower rise and fall times compared to the SuperFET II MOSFET series. Noted by the "E" part number suffix, this family helps manage EMI issues and allows for easier design implementation. For faster switching in applications where switching losses must be at an absolute minimum, please consider the SuperFET II MOSFET series.





#### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

Symbol		Parameter		FCP125N60E	Unit
V <sub>DSS</sub>	Drain to Source Voltage			600	V
.,	Cata ta Sauraa Valtaga	- DC		±20	V
$V_{GSS}$	Gate to Source Voltage	- AC	(f > 1 Hz)	±30	V
	Drain Current	- Continuous (T <sub>C</sub> = 25°C)		29	А
D	Drain Current	- Continuous (T <sub>C</sub> = 100°C)		18	_ A
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	87	Α
E <sub>AS</sub>	Single Pulsed Avalanche Energy	Single Pulsed Avalanche Energy (Note 2)		720	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)		6	Α	
E <sub>AR</sub>	Repetitive Avalanche Energy		(Note 1)	2.78	mJ
dv/dt	MOSFET dv/dt		100	\ //	
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	20	V/ns
D	Davier Dissipation	(T <sub>C</sub> = 25°C)		278	W
$P_{D}$	Power Dissipation  - Derate Above 25°C		2.2	W/°C	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range			-55 to +150	οС
T <sub>L</sub>	Maximum Lead Temperature for	Soldering, 1/8" from Case for 5 S	econds	300	°C

#### **Thermal Characteristics**

Symbol	Parameter	FCP125N60E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.45	°C/W
$R_{ heta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	*C/VV

### **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP125N60E	FCP125N60E	TO-220	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 Charae	cteristics					
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 10 \text{ mA}, T_J = 25^{\circ}\text{C}$	600	-	-	V
		$V_{GS} = 0 \text{ V}, I_D = 10 \text{ mA}, T_J = 150^{\circ}\text{C}$	650	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 10 mA, Referenced to 25°C	-	0.7	-	V/°C
1	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V	-	-	1	μА
I <sub>DSS</sub>		$V_{DS} = 480 \text{ V}, V_{GS} = 0 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	2	-	μΑ
I <sub>GSS</sub>	Gate to Body Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	±100	nA

#### **On Characteristics**

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	2.5	-	3.5	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 14.5 \text{ A}$	-	102	125	mΩ
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_{D} = 14.5 \text{ A}$	-	25	-	S

#### **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 200 V V 20V	-	2250	2990	pF
Coss	Output Capacitance	V <sub>DS</sub> = 380 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	60	80	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1 101112	-	17	-	pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	- \	258	-	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>DS</sub> = 380 V, I <sub>D</sub> = 14.5 A,	-	75	95	nC
$Q_{gs}$	Gate to Source Gate Charge	V <sub>GS</sub> = 10 V	-	10	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	(Note 4)	-	33	-	nC
ESR	Equivalent Series Resistance	f = 1 MHz	-	3.5	-	Ω

#### **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time		-	23	56	ns
t <sub>r</sub>		$V_{DD} = 380 \text{ V}, I_D = 14.5 \text{ A},$	- /	20	50	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS}$ = 10 V, $R_g$ = 4.7 $\Omega$	-/	106	222	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	-	23	56	ns

#### **Drain-Source Diode Characteristics**

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current			-	29	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Fo	Maximum Pulsed Drain to Source Diode Forward Current			87	Α
$V_{SD}$	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 14.5 A	-	-	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 14.5 A,	-	376	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt = 100 A/μs	-	6.5	-	μС

#### Notes:

- 1. Repetitive rating: pulse width limited by maximum junction temperature.
- 2.  $I_{AS}$  = 6.0 A,  $R_{G}$  = 25  $\Omega$ , Starting  $T_{J}$  = 25°C
- 3. I  $_{SD} \leq$  14.5 A, di/dt  $\leq$  200 A/µs, V  $_{DD} \leq$  380 V, Starting T  $_{J}$  = 25°C
- 4. Essentially independent of operating temperature.

#### **Typical Performance Characteristics**

Figure 1. On-Region Characteristics

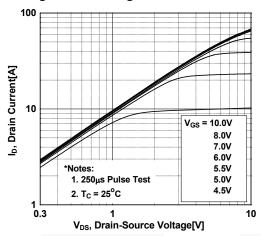


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

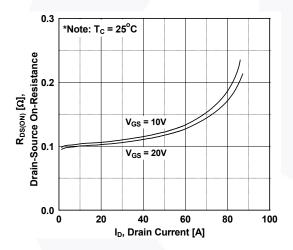


Figure 5. Capacitance Characteristics

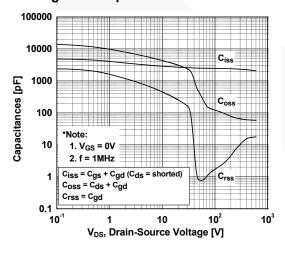


Figure 2. Transfer Characteristics

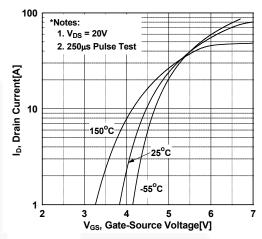


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

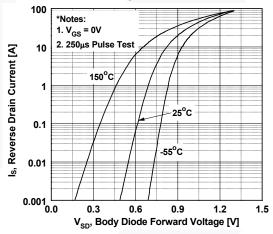
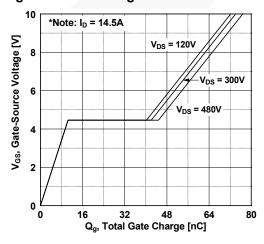


Figure 6. Gate Charge Characteristics



#### Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

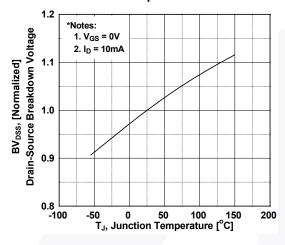


Figure 9. Maximum Safe Operating Area

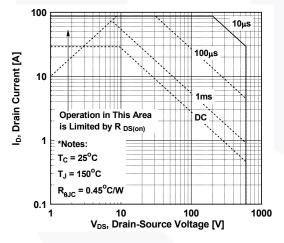


Figure 11. Eoss vs. Drain to Source Voltage

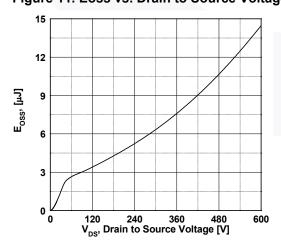


Figure 8. On-Resistance Variation vs. Temperature

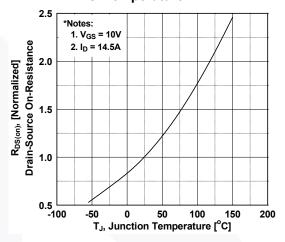
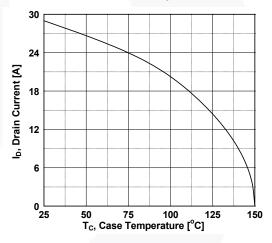
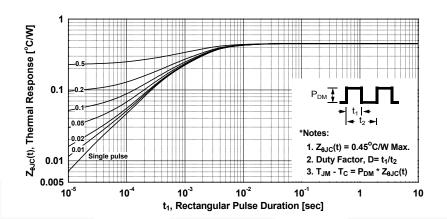


Figure 10. Maximum Drain Current vs. Case Temperature



### **Typical Performance Characteristics** (Continued)

Figure 12. Transient Thermal Response Curve



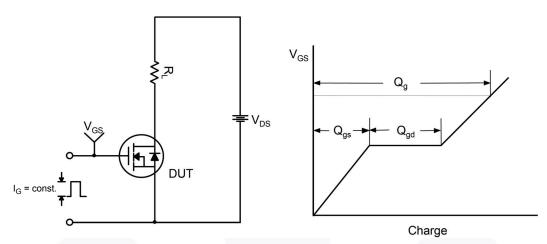


Figure 13. Gate Charge Test Circuit & Waveform

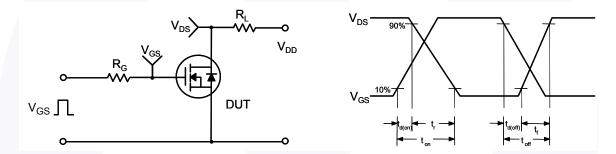


Figure 14. Resistive Switching Test Circuit & Waveforms

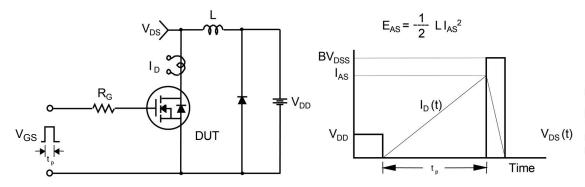


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

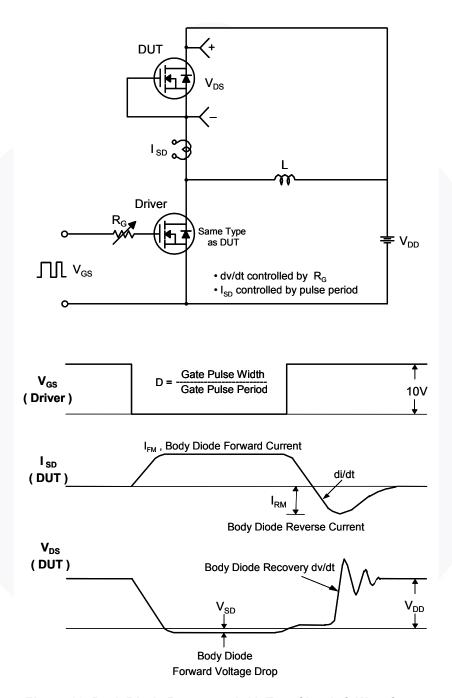
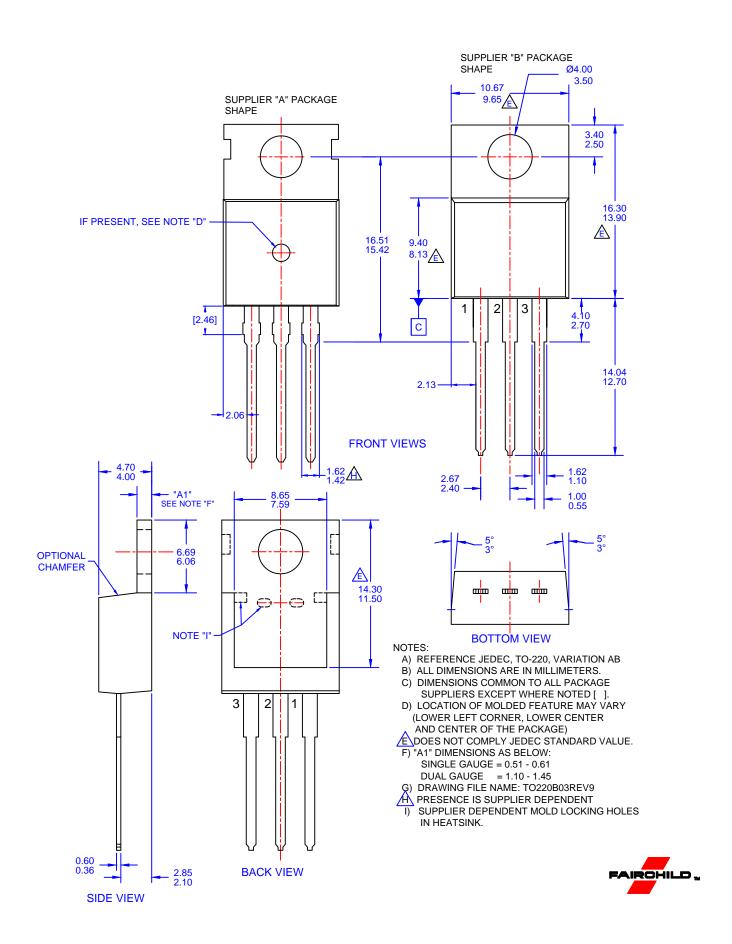


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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