



November 2015

## FCP125N60E

### N-Channel SuperFET® II Easy-Drive MOSFET

600 V, 29 A, 125 mΩ

#### Features

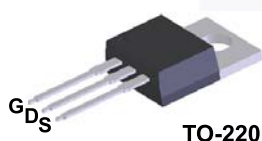
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 102\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 75\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff)} = 258\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

#### Applications

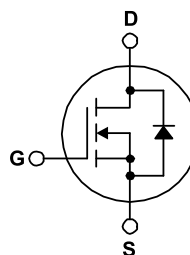
- Telecom / Server Power Supplies
- Industrial Power Supplies

#### 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.



TO-220



#### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter		FCP125N60E	Unit
$V_{DSS}$	Drain to Source Voltage		600	V
$V_{GSS}$	Gate to Source Voltage	- DC	$\pm 20$	V
		- AC ( $f > 1\text{ Hz}$ )	$\pm 30$	
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	29	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	18	
$I_{DM}$	Drain Current	- Pulsed (Note 1)	87	A
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	720	mJ
$I_{AR}$	Avalanche Current	(Note 1)	6	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	2.78	mJ
$dv/dt$	MOSFET $dv/dt$		100	V/ns
	Peak Diode Recovery $dv/dt$	(Note 3)	20	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	278	W
		- Derate Above $25^\circ\text{C}$	2.2	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	FCP125N60E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.45	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## 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 $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	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
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$ , Referenced to $25^\circ\text{C}$	-	0.7	-	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	2	-	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 14.5\text{ A}$	-	102	125	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 14.5\text{ A}$	-	25	-	S

### Dynamic Characteristics

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

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 14.5\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$ (Note 4)	-	23	56	ns
$t_r$	Turn-On Rise Time		-	20	50	ns
$t_{d(off)}$	Turn-Off Delay Time		-	106	222	ns
$t_f$	Turn-Off Fall Time		-	23	56	ns

### Drain-Source Diode Characteristics

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	29	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	87	A
V <sub>SD</sub>	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	-	μC

#### Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2.  $I_{AS} = 6.0\text{ A}, R_g = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 14.5\text{ A}, dI/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

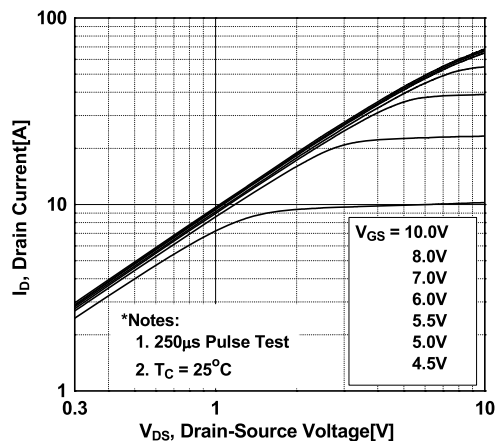


Figure 2. Transfer Characteristics

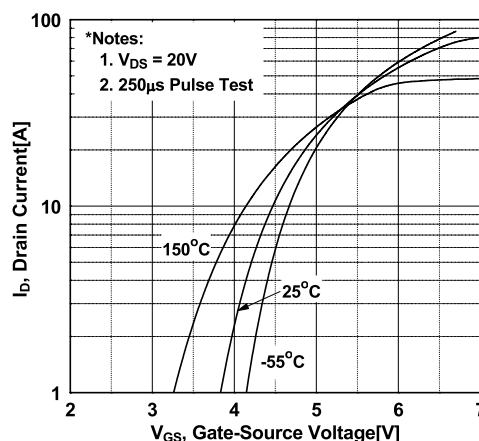


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

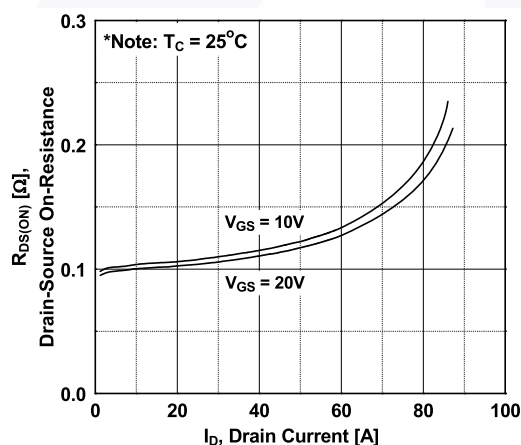


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

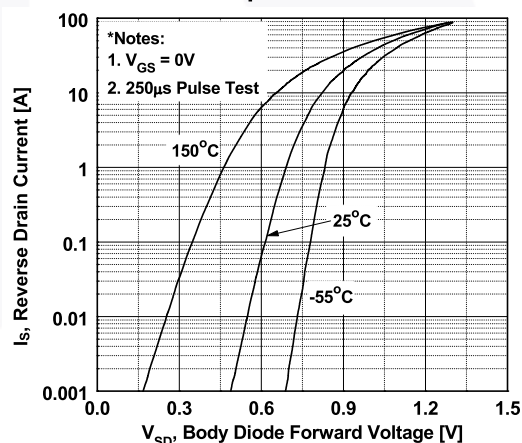


Figure 5. Capacitance Characteristics

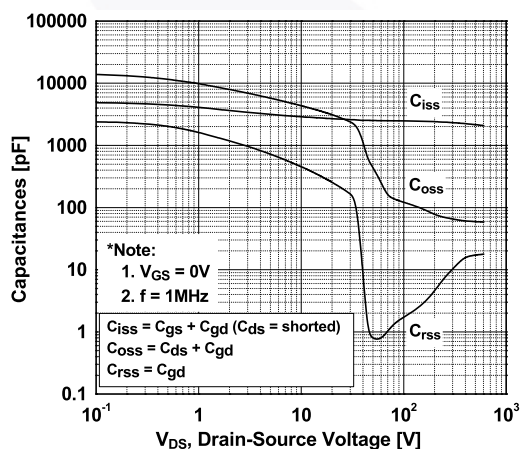
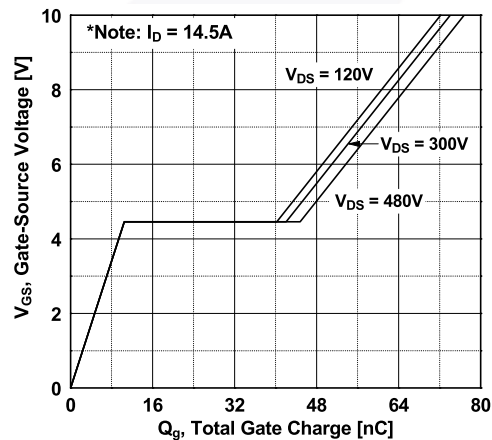


Figure 6. Gate Charge Characteristics



## Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

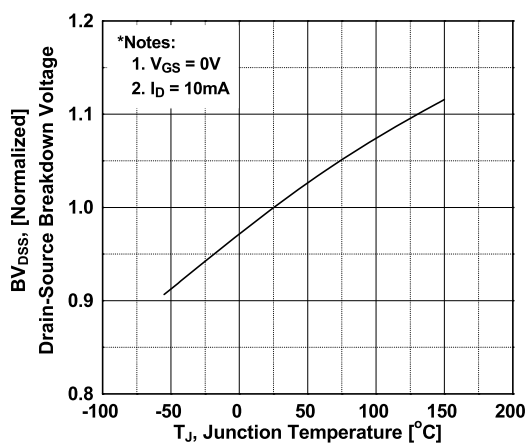


Figure 8. On-Resistance Variation vs. Temperature

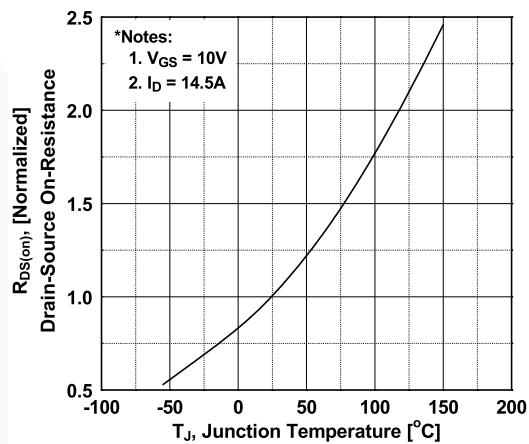


Figure 9. Maximum Safe Operating Area

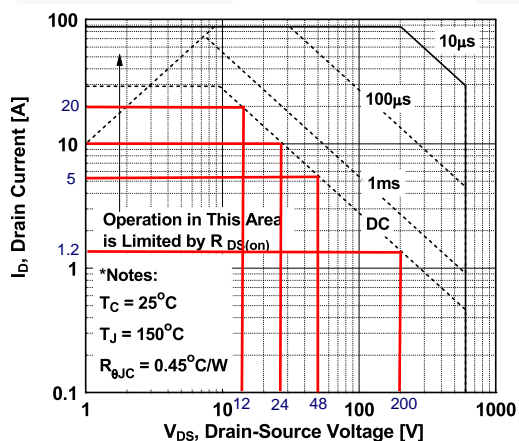


Figure 10. Maximum Drain Current vs. Case Temperature

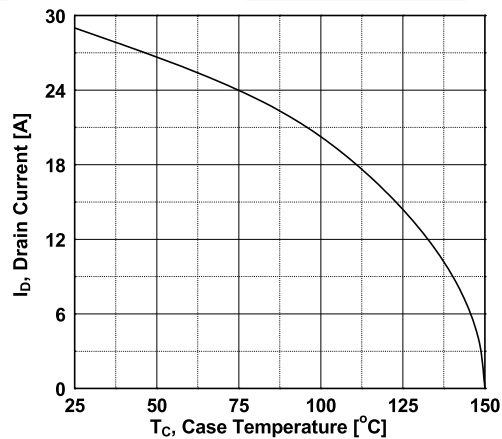
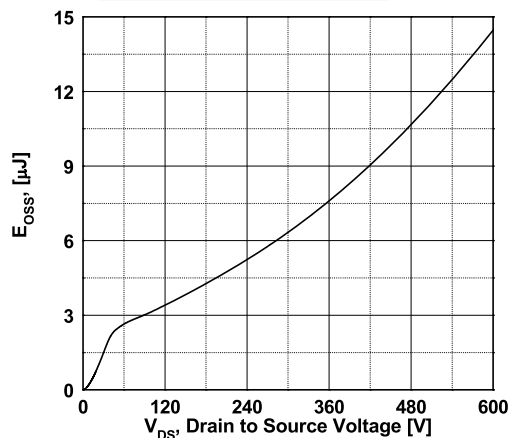


Figure 11. E\_oss vs. Drain to Source Voltage



# Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

