

November 2013

## FQPF30N06L

## N-Channel QFET® MOSFET

60 V, 22.5 A, 35 mΩ

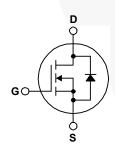
### **Description**

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

#### **Features**

- 22.5 A, 60 V,  $R_{DS(on)}$  = 35 m $\Omega$  (Max.) @  $V_{GS}$ =10 V,  $I_D$  = 11.3 A
- Low Gate Charge (Typ. 15 nC)
- Low Crss (Typ. 50 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating





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

<b>3</b> °				
Symbol	Parameter		FQPF30N06L	Unit
$V_{DSS}$	Drain-Source Voltage		60	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°	°C)	22.5	Α
	- Continuous (T <sub>C</sub> = 100	O°C)	15.9	Α
I <sub>DM</sub>	Drain Current - Pulsed	(Note 1)	90	Α
V <sub>GSS</sub>	Gate-Source Voltage		± 20	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy	(Note 2)	350	mJ
I <sub>AR</sub>	Avalanche Current	(Note 1)	22.5	A
E <sub>AR</sub>	Repetitive Avalanche Energy	(Note 1)	3.8	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	7.0	V/ns
$P_{D}$	Power Dissipation (T <sub>C</sub> = 25°C)		38	W
	- Derate above 25°C		0.25	W/°C
$T_J$ , $T_{STG}$	Operating and Storage Junction Temperature Range		-55 to +175	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	°C

#### **Thermal Characteristics**

Symbol	Parameter	FQPF30N06L	Unit
$R_{ heta JC}$	Thermal Resistance, Junction-to-Case, Max.	3.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	°C/W

## **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQPF30N06L	FQPF30N06L	TO-220F	Tube	N/A	N/A	50 units

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Cha	aracteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	60			V
$\Delta BV_{DSS}$ / $\Delta T_{J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C		0.06		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			1	μΑ
		V <sub>DS</sub> = 48 V, T <sub>C</sub> = 150°C			10	μΑ
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V			100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	$V_{GS} = -20 \text{ V}, V_{DS} = 0 \text{ V}$		1	-100	nA
On Cha	aracteristics					
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$	1.0		2.5	V
R <sub>DS(on)</sub>	Static Drain-Source	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11.3 A		0.027	0.035	Ω
	On-Resistance	$V_{GS} = 5 \text{ V}, I_D = 11.3 \text{ A}$		0.035	0.045	52
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 25 \text{ V}, I_{D} = 11.3 \text{ A}$		22		S
Dynam	ic Characteristics					
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		800	1040	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz		270	350	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			50	65	pF
Switchi	ing Characteristics					
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 16 A,		15	40	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 30 \text{ V}, I_{D} = 10 \text{ A},$ $R_{G} = 25 \Omega$		210	430	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	11.6 - 20 22		60	130	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)		110	230	ns
Qg	Total Gate Charge	V <sub>DS</sub> = 48 V, I <sub>D</sub> = 32 A,		15	20	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 5 V		3.5		nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)		8.5		nC
Drain-S	Source Diode Characteristics a	nd Maximum Ratings				
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				22.5	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current				90	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{S} = 22.5 \text{ A}$			1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 32 A,		60		ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> / dt = 100 A/μs		90		nC

Notes: 1. Repetitive rating : pulse-width limited by maximum junction temperature. 2. L = 810  $\mu$ H, I<sub>AS</sub> = 22.5 A, V<sub>DD</sub> = 25 V, R<sub>G</sub> = 25  $\Omega$ , starting T<sub>J</sub> = 25°C. 3. I<sub>SD</sub> ≤ 32 A, di/dt ≤ 300  $\Delta$ / $\mu$ s, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C. 4. Essentially independent of operating temperature.

## **Typical Characteristics**

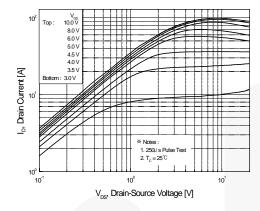


Figure 1. On-Region Characteristics

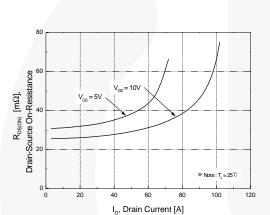


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

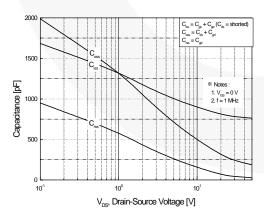


Figure 5. Capacitance Characteristics

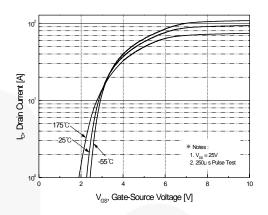


Figure 2. Transfer Characteristics

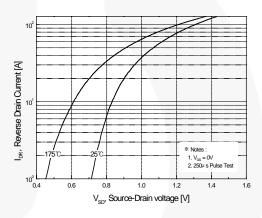


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

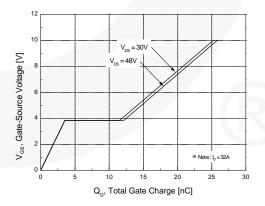


Figure 6. Gate Charge Characteristics

## Typical Characteristics (continued)

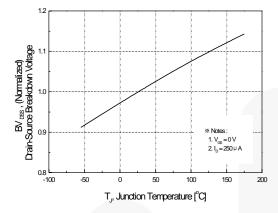


Figure 7. Breakdown Voltage Variation vs. Temperature

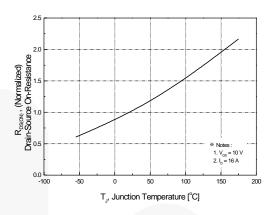


Figure 8. On-Resistance Variation vs. Temperature

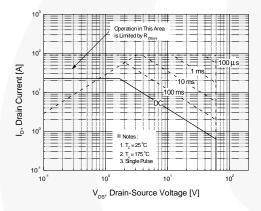


Figure 9. Maximum Safe Operating Area

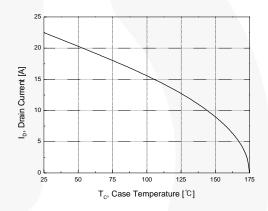


Figure 10. Maximum Drain Current vs. Case Temperature

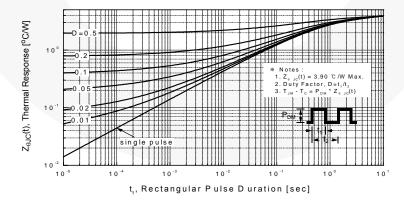


Figure 11. Transient Thermal Response Curve

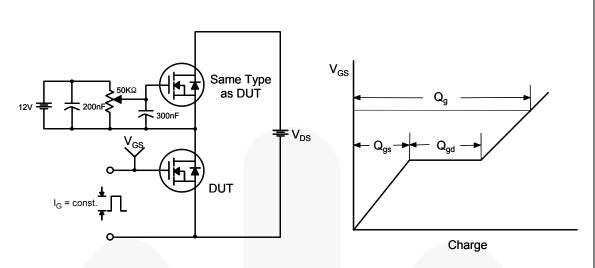


Figure 12. Gate Charge Test Circuit & Waveform

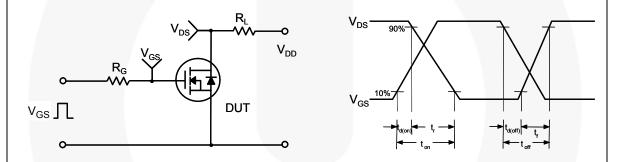


Figure 13. Resistive Switching Test Circuit & Waveforms

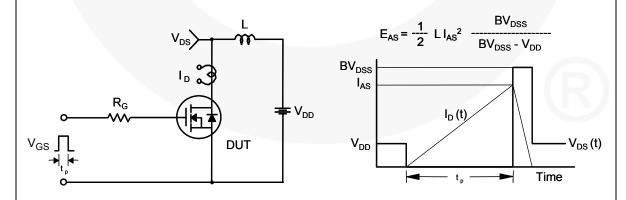
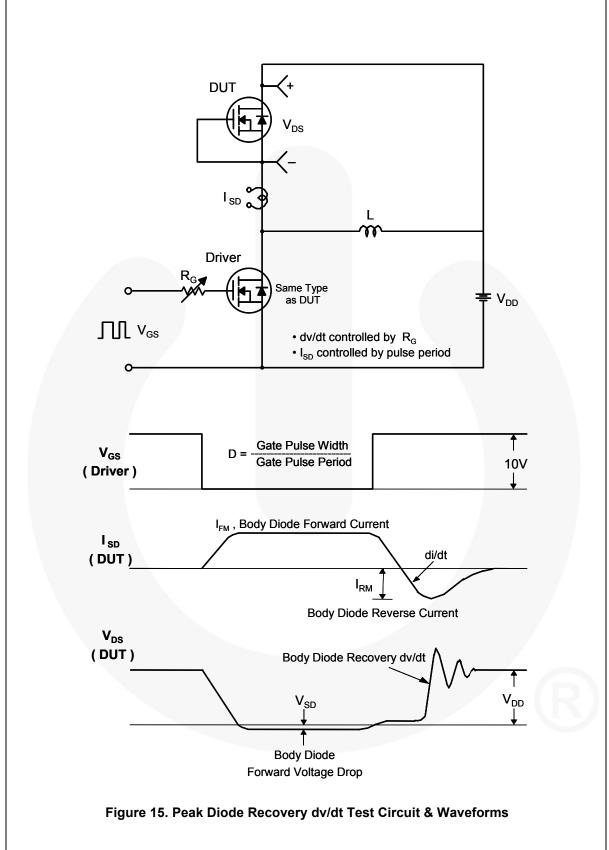


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



### **Mechanical Dimensions**

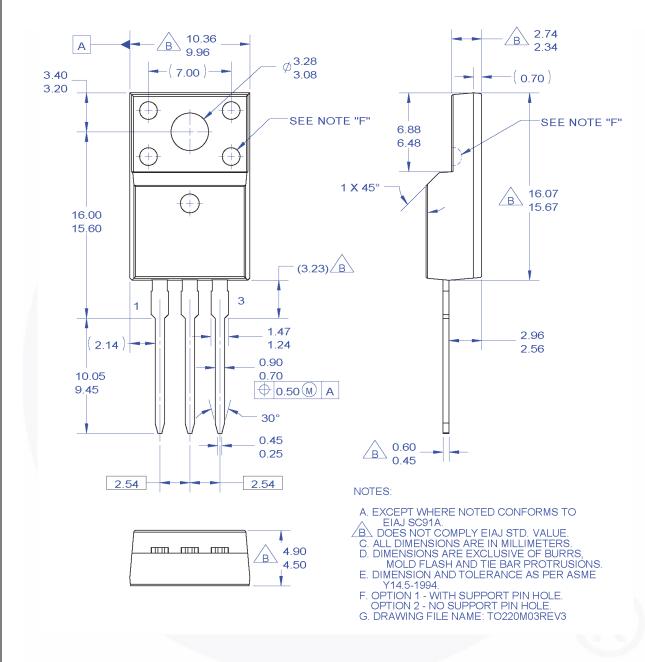


Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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