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# FQPF3N25

## N-Channel QFET® MOSFET

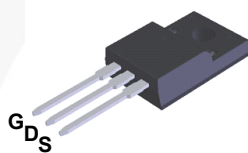
250 V, 2.3 A, 2.2 Ω

### Description

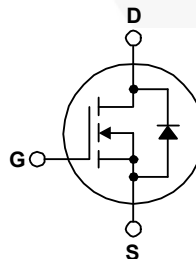
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supply.

### Features

- 2.3 A, 250 V,  $R_{DS(on)} = 2.2 \Omega$  (Max.) @  $V_{GS} = 10 V$ ,  $I_D = 1.15 A$
- Low Gate Charge (Typ. 4.0 nC)
- Low Crss (Typ. 4.7 pF)
- 100% Avalanche Tested



TO-220F



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

Symbol	Parameter	FQPF3N25	Unit
$V_{DSS}$	Drain-Source Voltage	250	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ C$ )	2.3	A
	- Continuous ( $T_C = 100^\circ C$ )	1.45	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	9.2	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	40	mJ
$I_{AR}$	Avalanche Current (Note 1)	2.3	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	2.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ )	27	W
	- Derate above $25^\circ C$	0.22	W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	FQPF3N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	4.63	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ C/W$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQPF3N25	FQPF3N25	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	Typ	Max	Unit
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### Off Characteristics

BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	250	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.24	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA

### On Characteristics

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.15 A	--	1.75	2.2	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 1.15 A	--	1.4	--	S

### Dynamic Characteristics

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	130	170	pF
C <sub>oss</sub>	Output Capacitance		--	30	40	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	4.7	6.1	pF

### Switching Characteristics

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 125 V, I <sub>D</sub> = 2.8 A, R <sub>G</sub> = 25 Ω  (Note 4)	--	6.6	23	ns
t <sub>r</sub>	Turn-On Rise Time		--	25	60	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	5.5	21	ns
t <sub>f</sub>	Turn-Off Fall Time		--	20	50	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200 V, I <sub>D</sub> = 2.8 A, V <sub>GS</sub> = 10 V  (Note 4)	--	4.0	5.2	nC
Q <sub>gs</sub>	Gate-Source Charge		--	1.1	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	2.2	--	nC

### Drain-Source Diode Characteristics and Maximum Ratings

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current	--	--	2.3	A	
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current	--	--	9.2	A	
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.3 A	--	--	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.8 A,	--	100	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> / dt = 100 A/μs	--	0.3	--	μC

#### Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 12 mH, I<sub>AS</sub> = 2.3 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 2.8 A, di/dt ≤ 300 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.
4. Essentially independent of operating temperature.

## Typical Characteristics

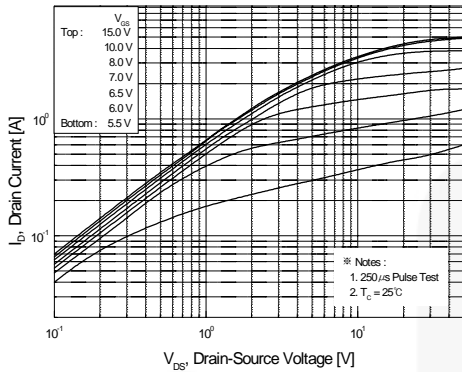


Figure 1. On-Region Characteristics

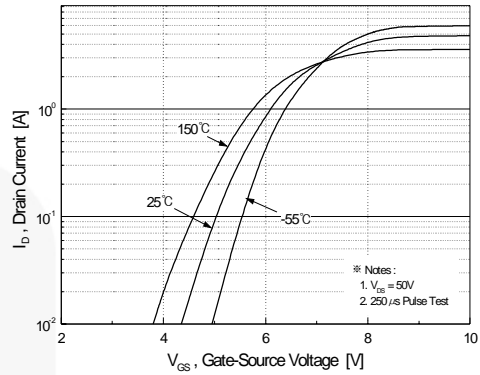


Figure 2. Transfer Characteristics

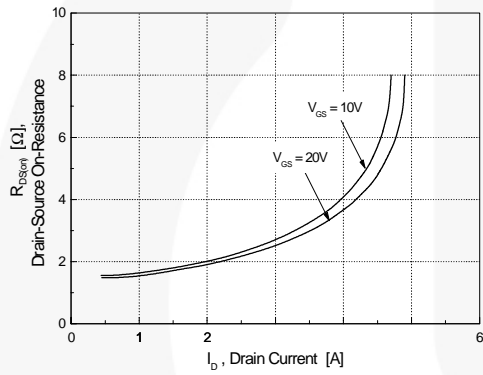


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

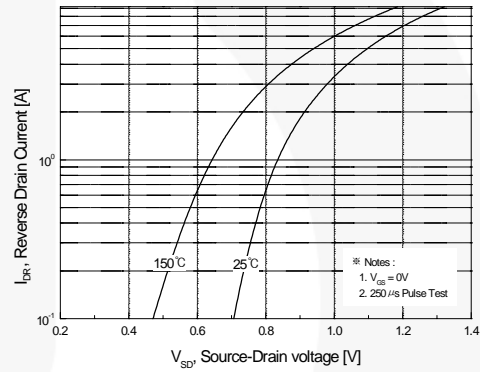


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

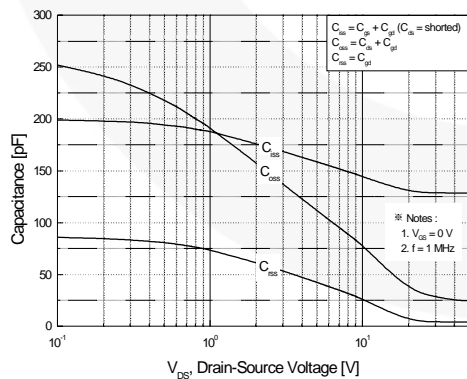


Figure 5. Capacitance Characteristics

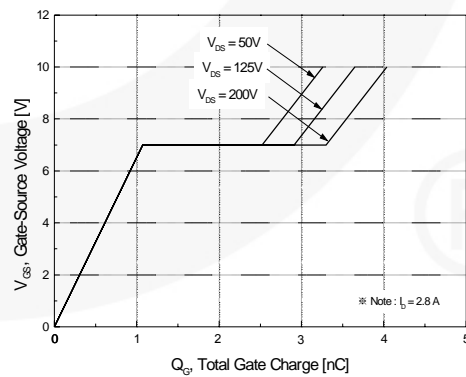
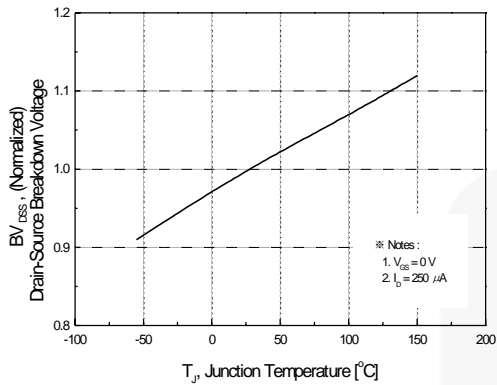
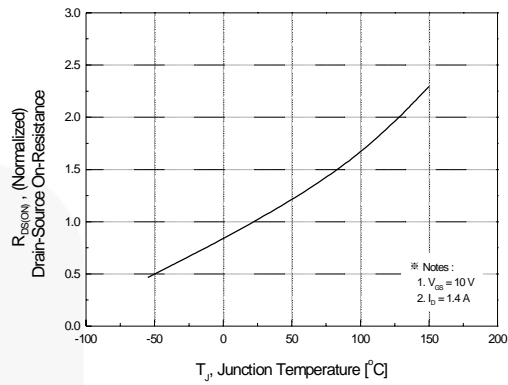


Figure 6. Gate Charge Characteristics

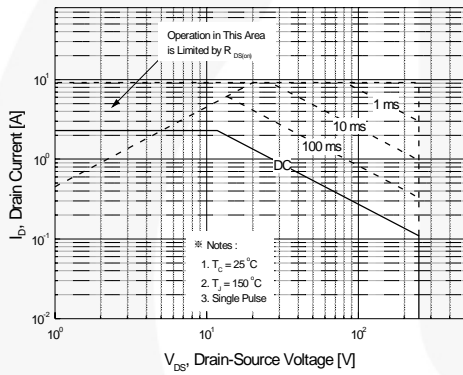
**Typical Characteristics** (continued)



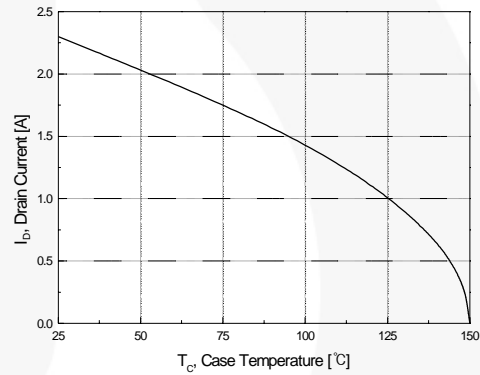
**Figure 7. Breakdown Voltage Variation vs. Temperature**



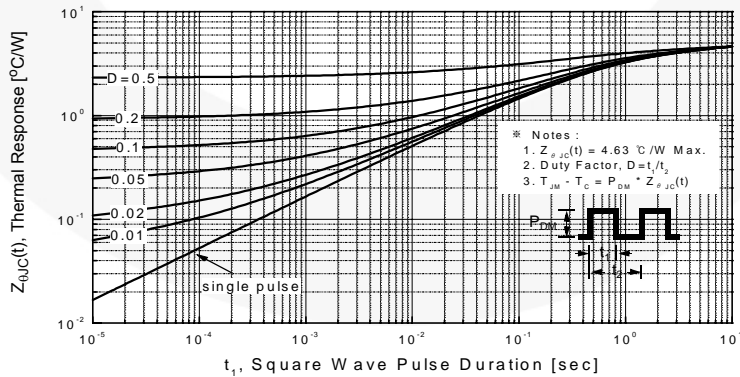
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

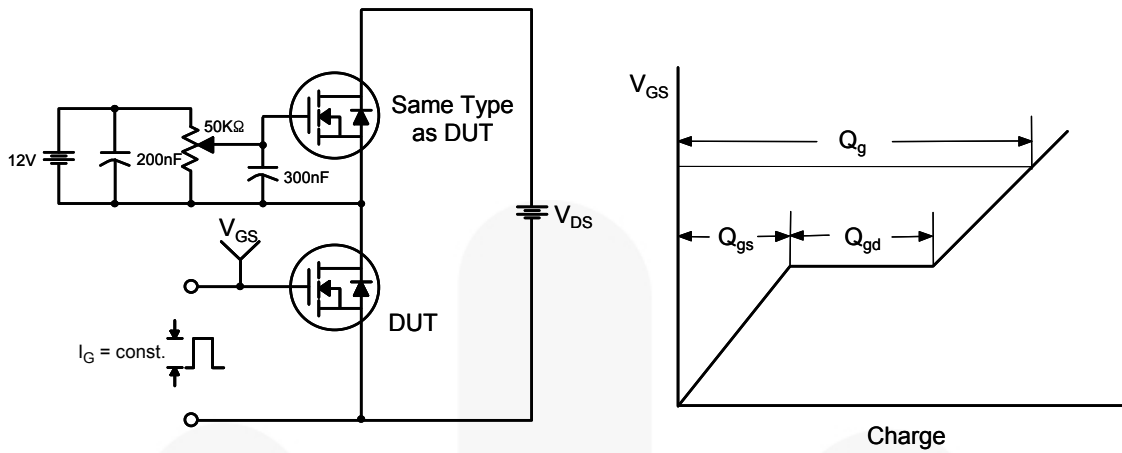


Figure 12. Gate Charge Test Circuit & Waveform

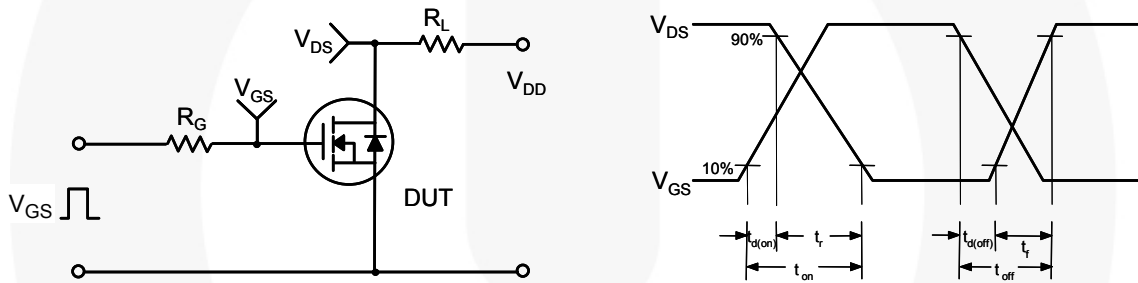


Figure 13. Resistive Switching Test Circuit & Waveforms

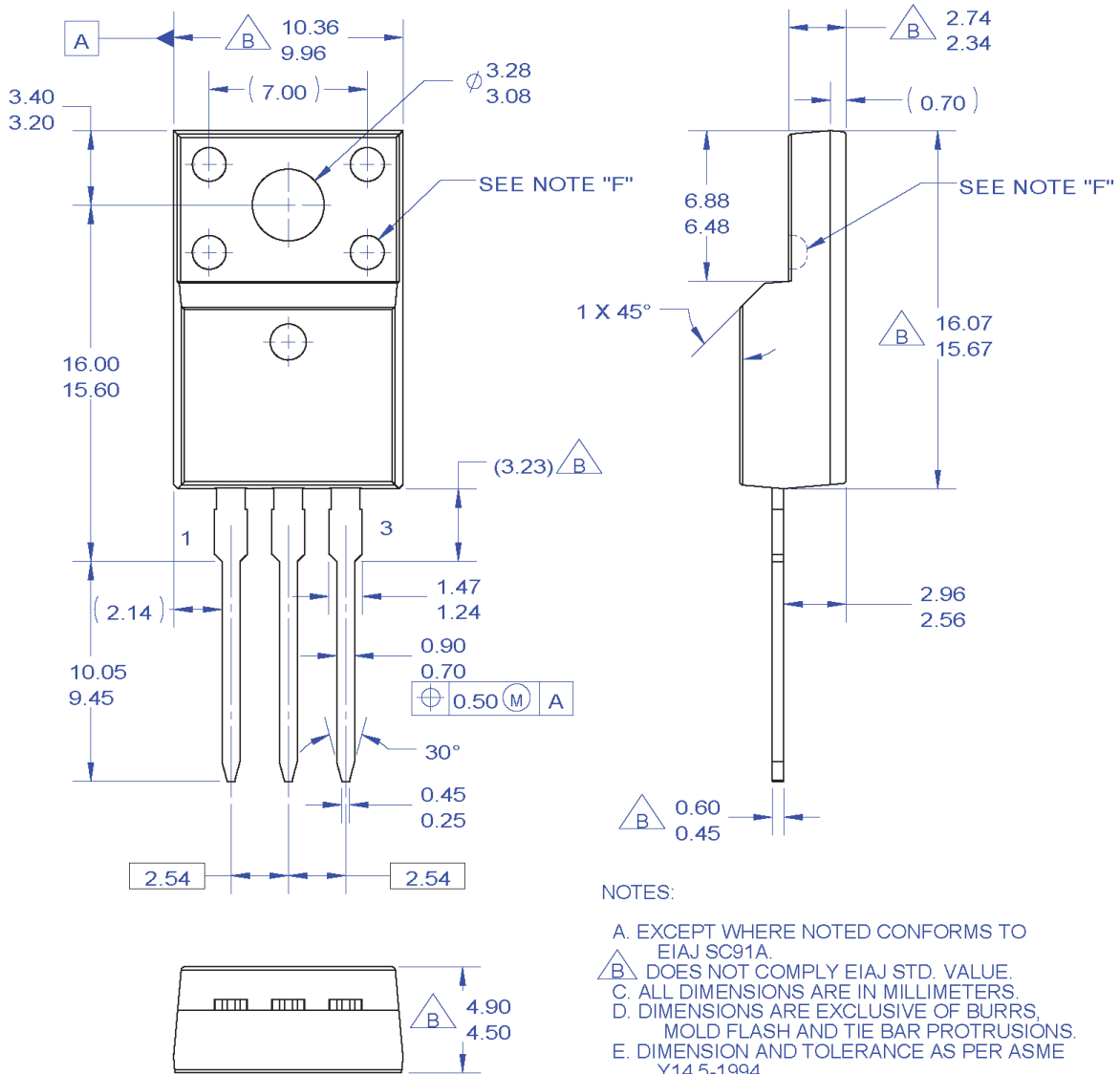


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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

## Mechanical Dimensions



### NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- $\triangle B$  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 Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.  
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3

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

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