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# FQPF9N50CF

## N-Channel QFET® FRFET® MOSFET

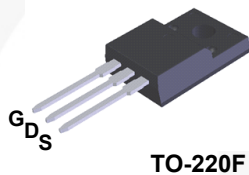
500 V, 9 A, 850 mΩ

### Description

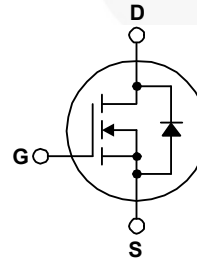
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

### Features

- 9 A, 500 V,  $R_{DS(on)} = 850 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 4.5 \text{ A}$
- Low Gate Charge (Typ. 28 nC)
- Low  $C_{rss}$  (Typ. 24 pF)
- 100% Avalanche Tested
- Fast Recovery Body Diode (Typ. 100 ns)



TO-220F



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

Symbol	Parameter	FQPF9N50CF	Unit
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	9*	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	5.4*	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	36*	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	360	mJ
$I_{AR}$	Avalanche Current (Note 1)	9	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	4.4	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	44	W
	- Derate above $25^\circ\text{C}$	0.35	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	$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FQPF9N50CF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.86	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQPF9N50CF	FQPF9N50CF	TO-220F	Tube	N/A	N/A	50 units

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

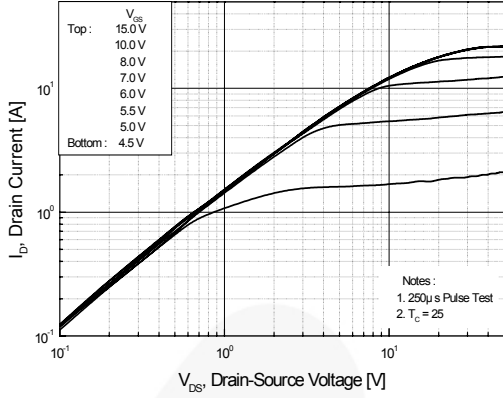
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.57	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V	--	--	10	μA
		V <sub>DS</sub> = 400 V, T <sub>C</sub> = 125°C	--	--	100	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
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0	--	4.0	
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4.5 A	--	0.70	0.85	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 4.5 A	--	6.5	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	790	1030	pF
C <sub>oss</sub>	Output Capacitance		--	130	170	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	24	30	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 9A, R <sub>G</sub> = 25 Ω	--	18	45	ns
t <sub>r</sub>	Turn-On Rise Time		--	65	140	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	93	195	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4)	--	64	125
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 9A, V <sub>GS</sub> = 10 V	--	28	35	nC
Q <sub>gs</sub>	Gate-Source Charge		--	4	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		(Note 4)	--	15	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	9*	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	36*	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 9 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 9 A, di <sub>F</sub> / dt = 100 A/μs	--	100	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	0.3	--	μC

### NOTES:

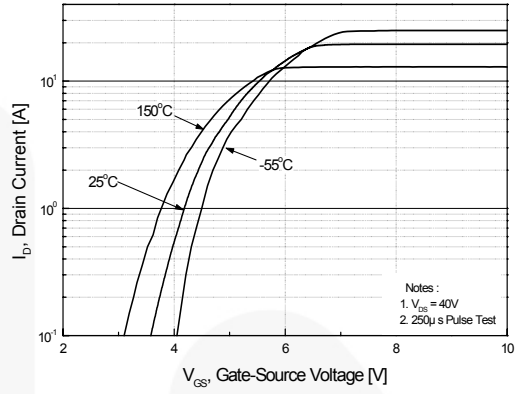
1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 8 mH, I<sub>AS</sub> = 9 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 11 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C.
4. Essentially independent of operating temperature.

## Typical Performance Characteristics

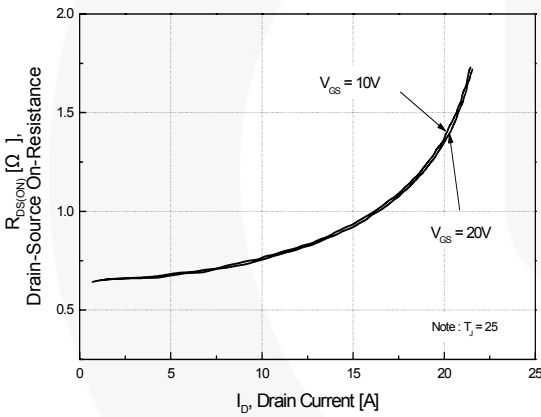
**Figure 1. On-Region Characteristics**



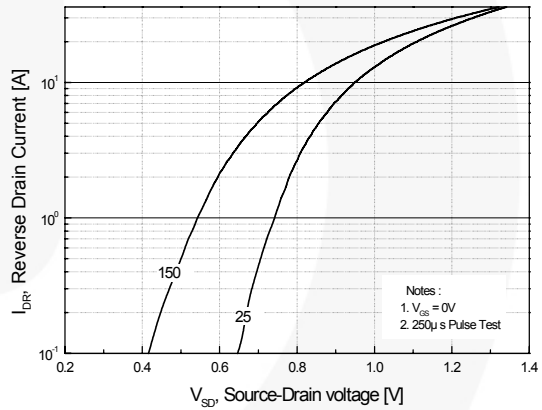
**Figure 2. Transfer Characteristics**



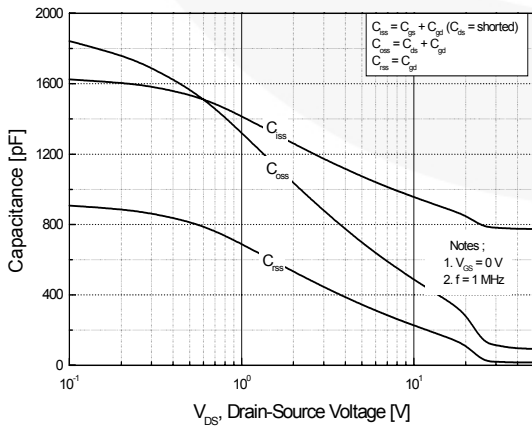
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



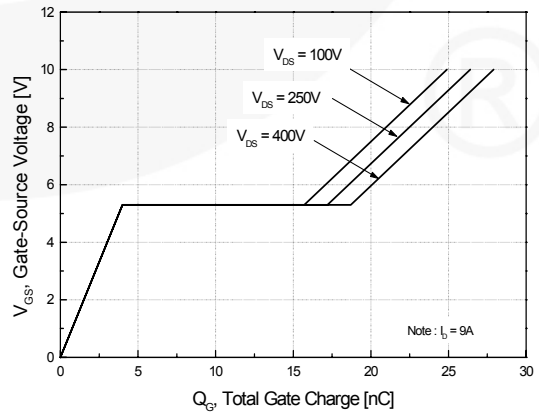
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

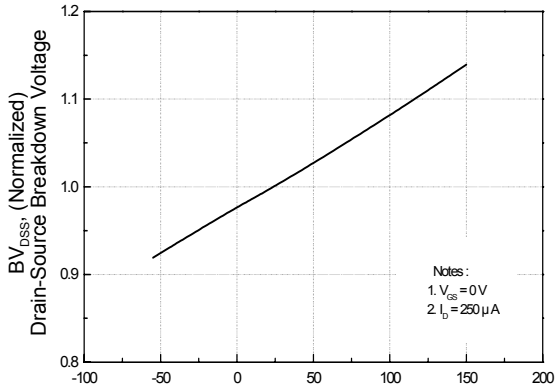


**Figure 6. Gate Charge Characteristics**

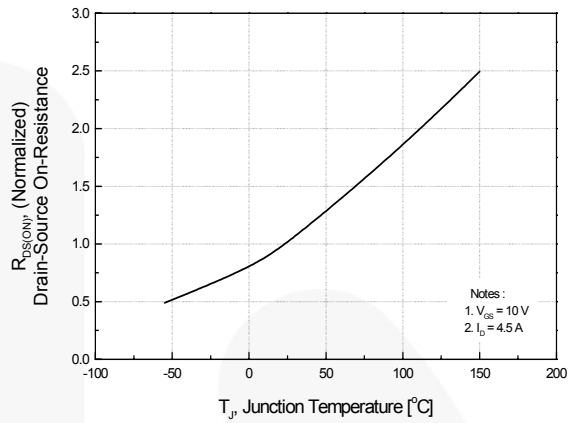


**Typical Performance Characteristics** (Continued)

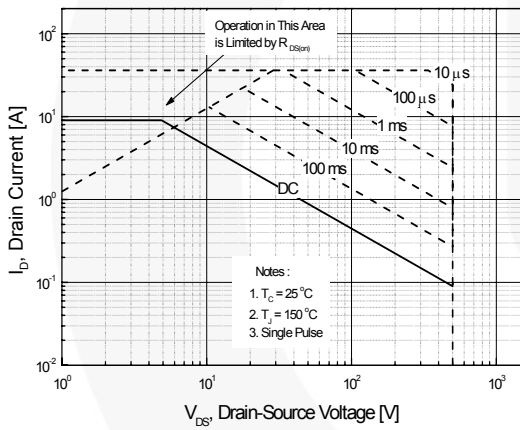
**Figure 7. Breakdown Voltage Variation vs. Temperature**



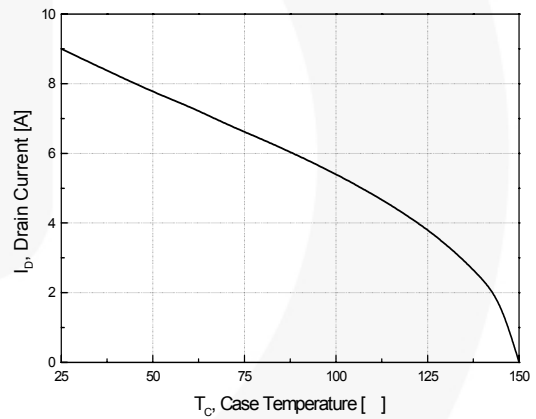
**Figure 8. On-Resistance Variation vs. Temperature**



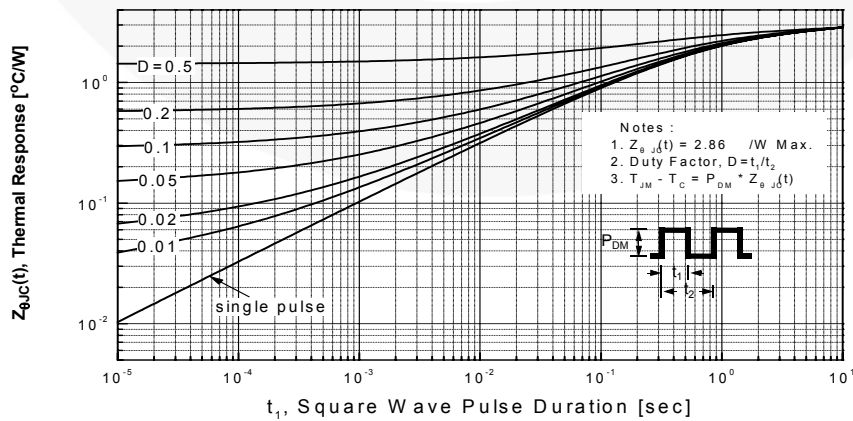
**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**



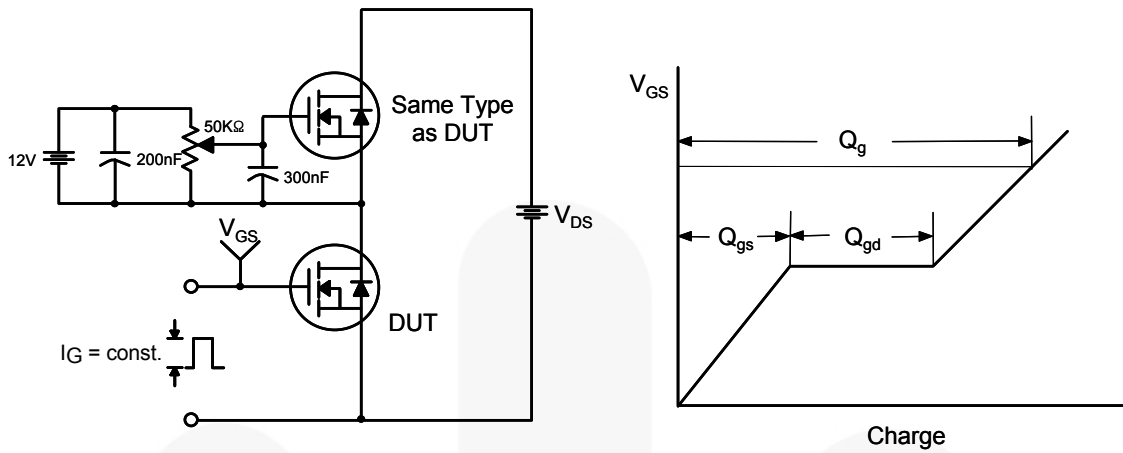


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

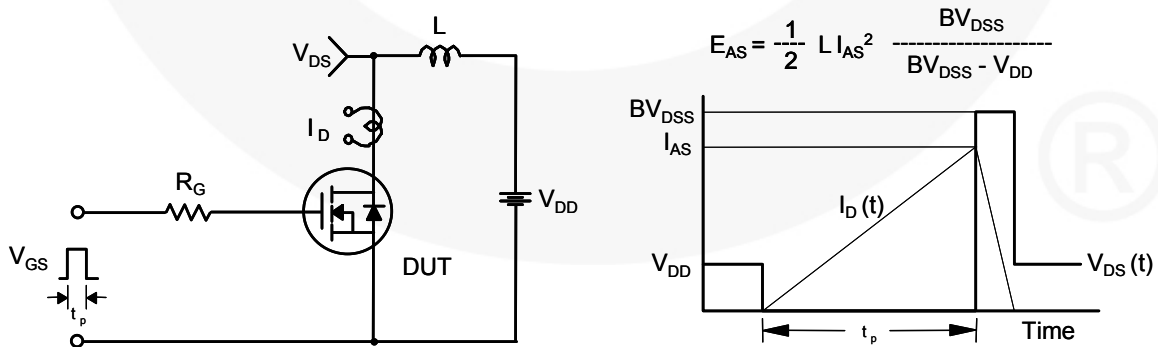


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

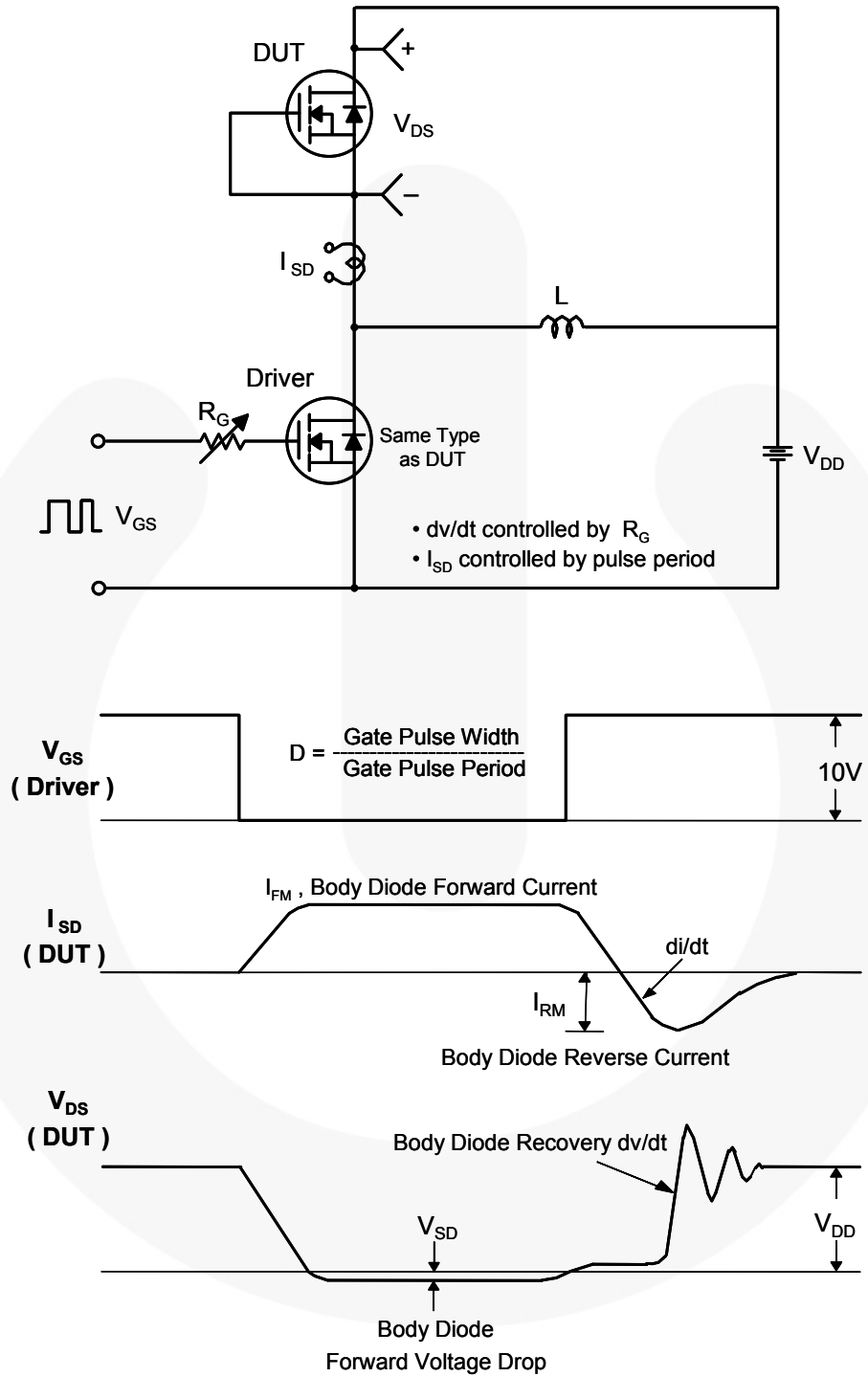
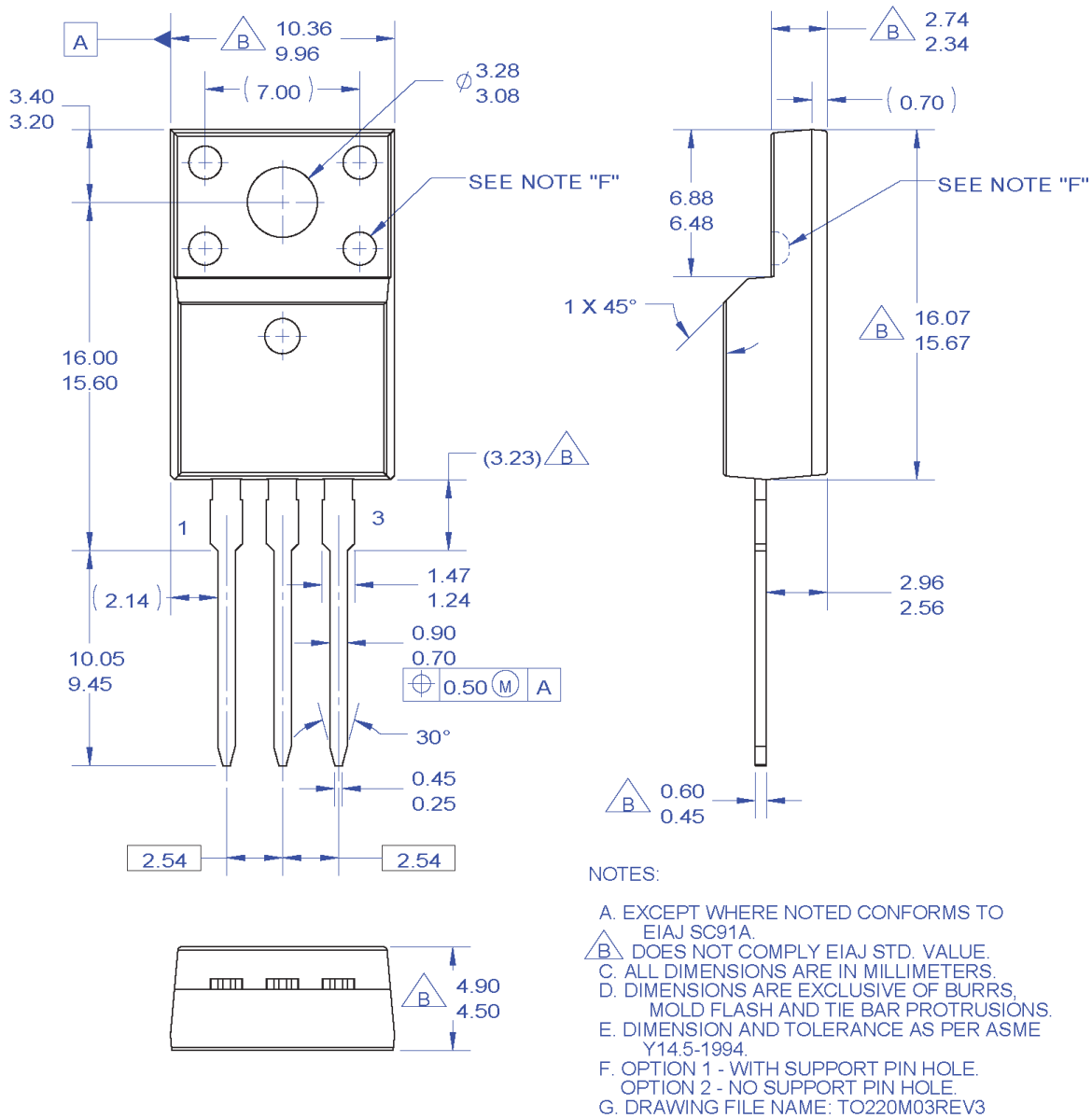


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



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

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