

# FQP9N90C / FQPF9N90C

## N-Channel QFET® MOSFET

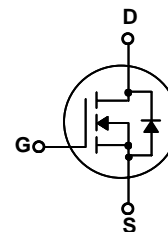
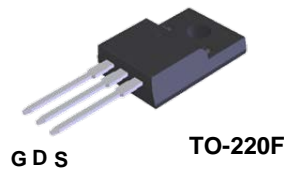
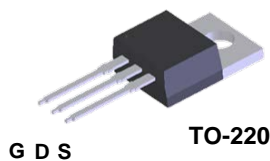
### 900 V, 8.0 A, 1.4 Ω

#### 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

- 8 A, 900V,  $R_{DS(on)} = 1.4 \Omega @ V_{GS} = 10 \text{ V}, I_D = 4 \text{ A}$
- Low Gate Charge (Typ. 45 nC)
- Low  $C_{rss}$  (Typ. 14 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQP9N90C	FQPF9N90C	Unit
$V_{DSS}$	Drain-Source Voltage	900		V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	8.0	8.0 *	A
		2.8	2.8 *	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	32	32 *	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	900		mJ
$I_{AR}$	Avalanche Current (Note 1)	8.0		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	20.5		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.0		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	205	68	W
		1.64	0.54	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 purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

#### Thermal Characteristics

Symbol	Parameter	FQP9N90C	FQPF9N90C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.61	1.85	$^\circ\text{C}/\text{W}$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	900	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.99	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 720\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4\text{ A}$	--	1.12	1.4	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4\text{ A}$ (Note 4)	--	9.2	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	2100	2730	pF
$C_{oss}$	Output Capacitance		--	175	230	pF
$C_{riss}$	Reverse Transfer Capacitance		--	14	18	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 450\text{ V}, I_D = 9.0\text{ A},$ $R_G = 25\ \Omega$	--	50	110	ns
$t_r$	Turn-On Rise Time		--	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	210	ns
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	75	160
$Q_g$	Total Gate Charge	$V_{DS} = 720\text{ V}, I_D = 9.0\text{ A},$ $V_{GS} = 10\text{ V}$	--	45	58	nC
$Q_{gs}$	Gate-Source Charge		--	13	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4, 5)	--	18	--

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	8.0	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	32.0	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 8\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 9\text{ A},$	--	550	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	6.5	--	$\mu\text{C}$

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 21\text{ mH}, I_{AS} = 9\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 9.0\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

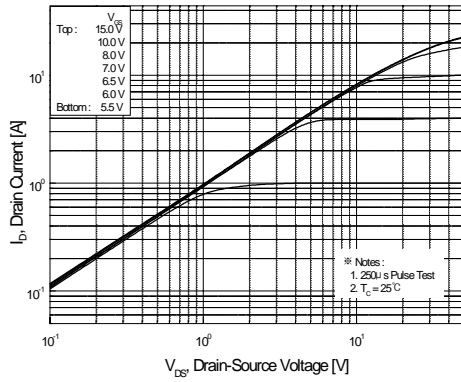


Figure 1. On-Region Characteristics

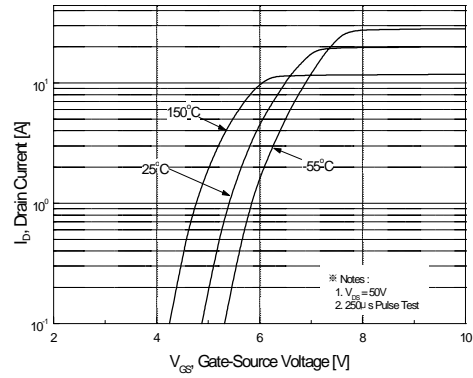


Figure 2. Transfer Characteristics

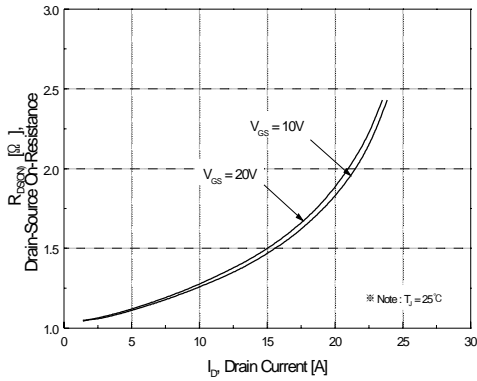


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

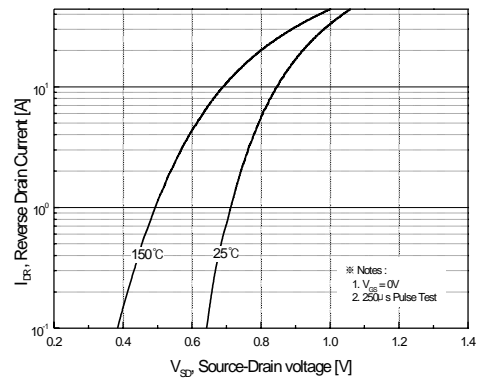


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

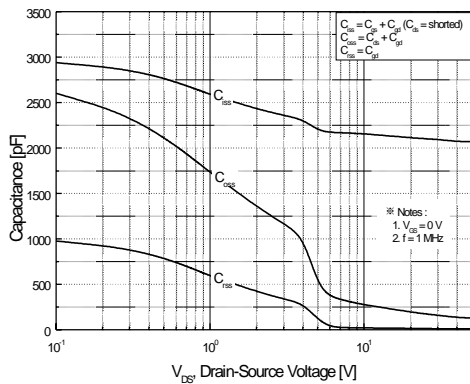


Figure 5. Capacitance Characteristics

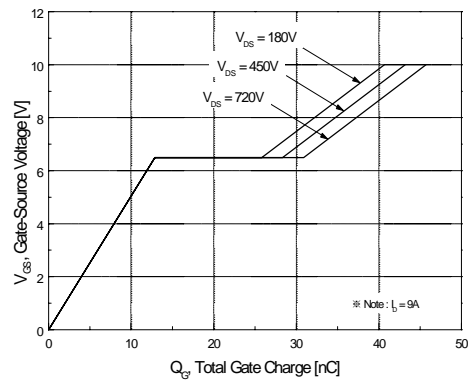
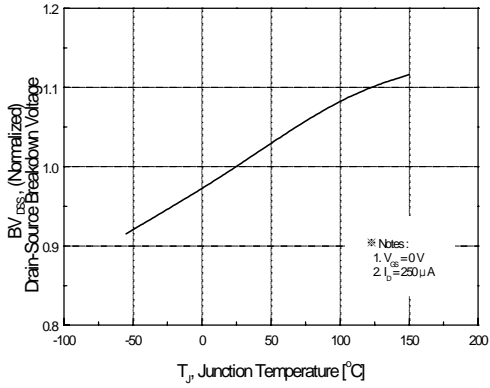
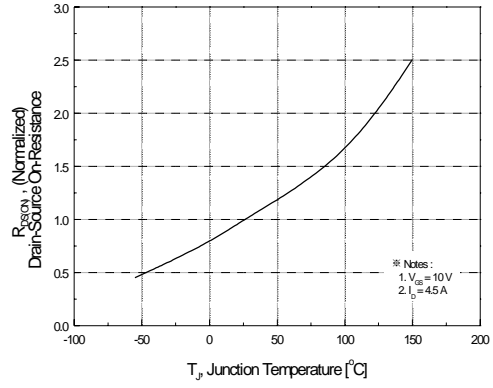


Figure 6. Gate Charge Characteristics

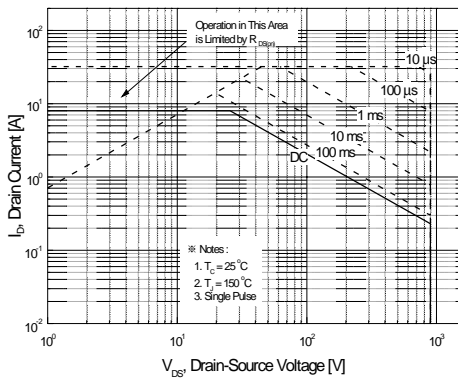
**Typical Characteristics** (Continued)



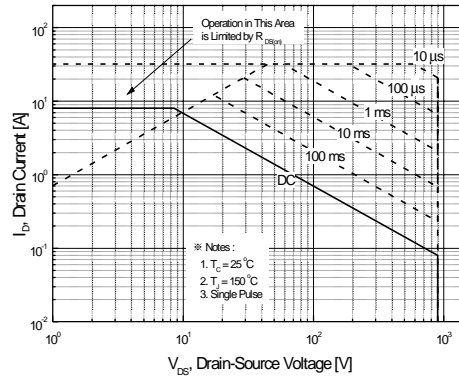
**Figure 7. Breakdown Voltage Variation vs Temperature**



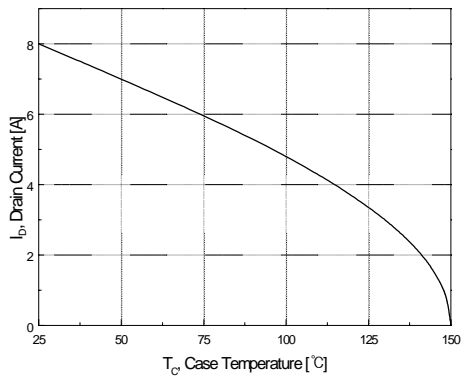
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP9N90C**

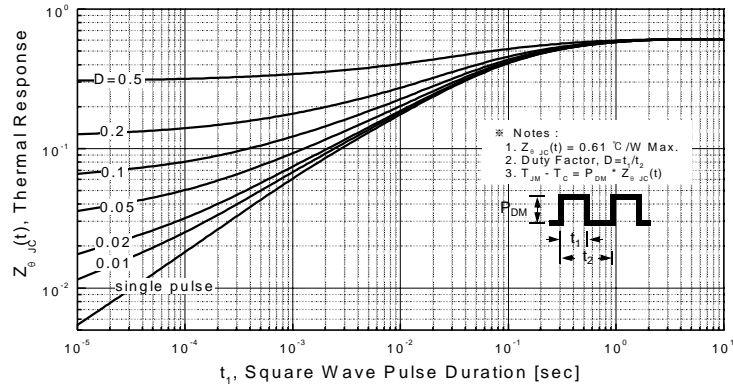


**Figure 9-2. Maximum Safe Operating Area for FQPF9N90C**

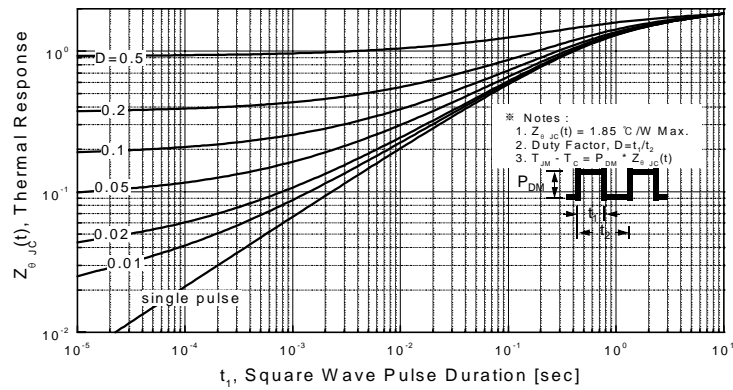


**Figure 10. Maximum Drain Current vs Case Temperature**

**Typical Characteristics** (Continued)

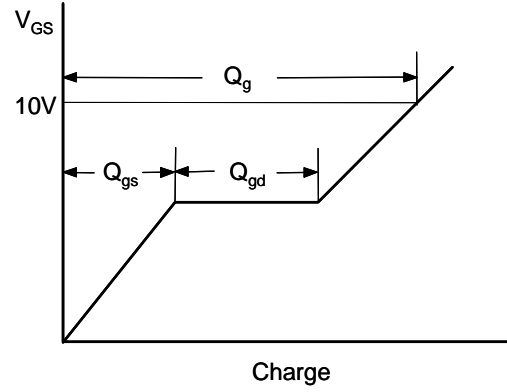
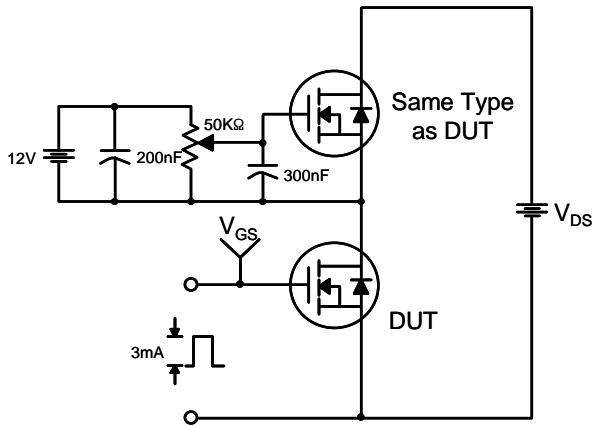


**Figure 11-1. Transient Thermal Response Curve for FQP9N90C**

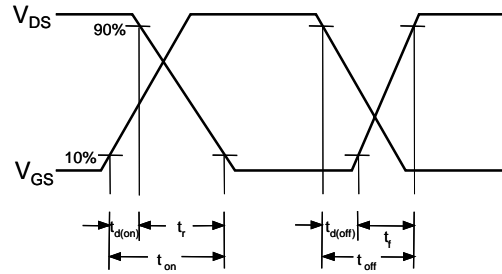
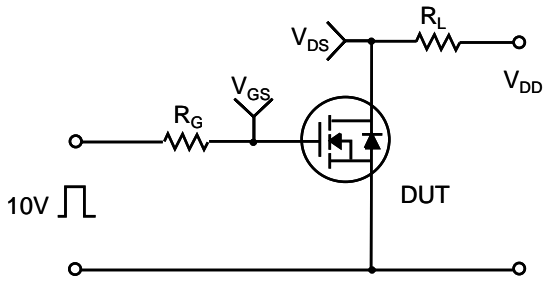


**Figure 11-2. Transient Thermal Response Curve for FQPF9N90C**

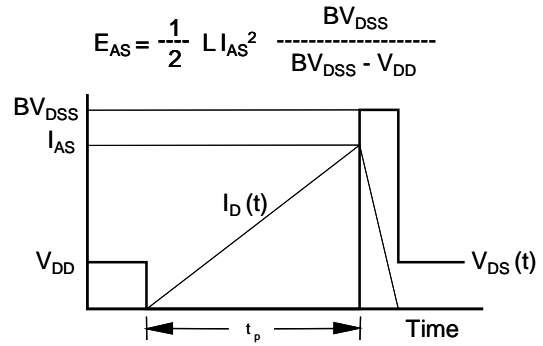
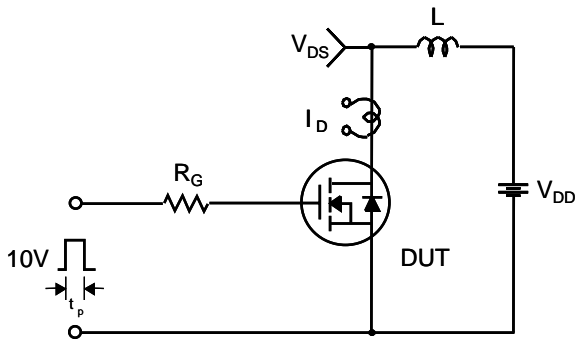
**Gate Charge Test Circuit & Waveform**



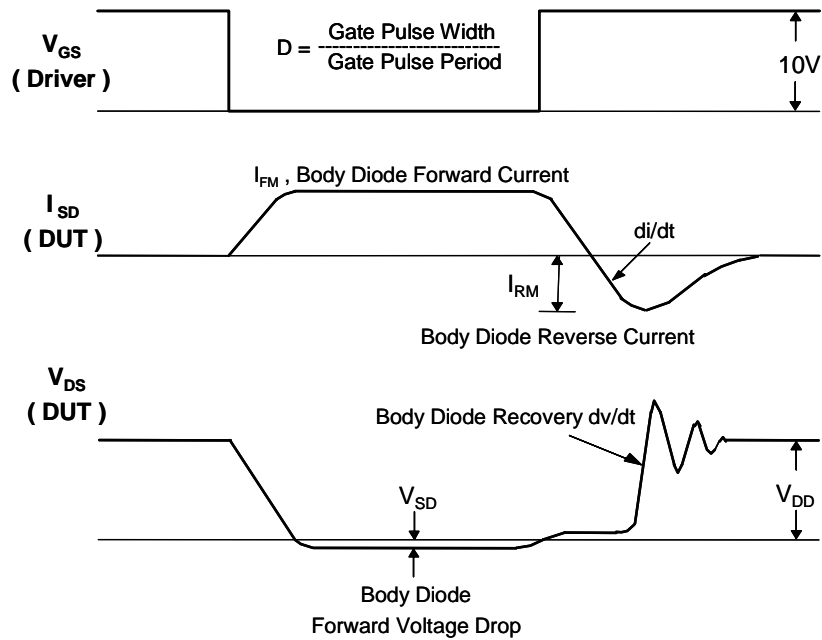
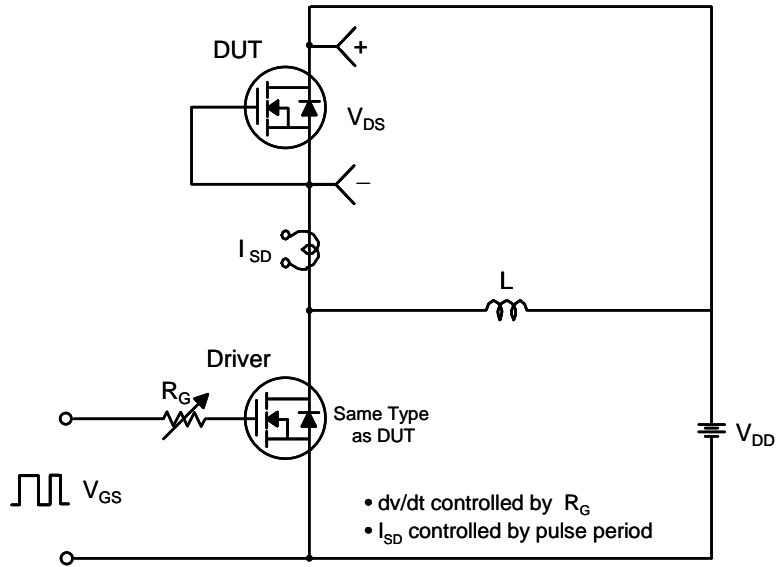
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

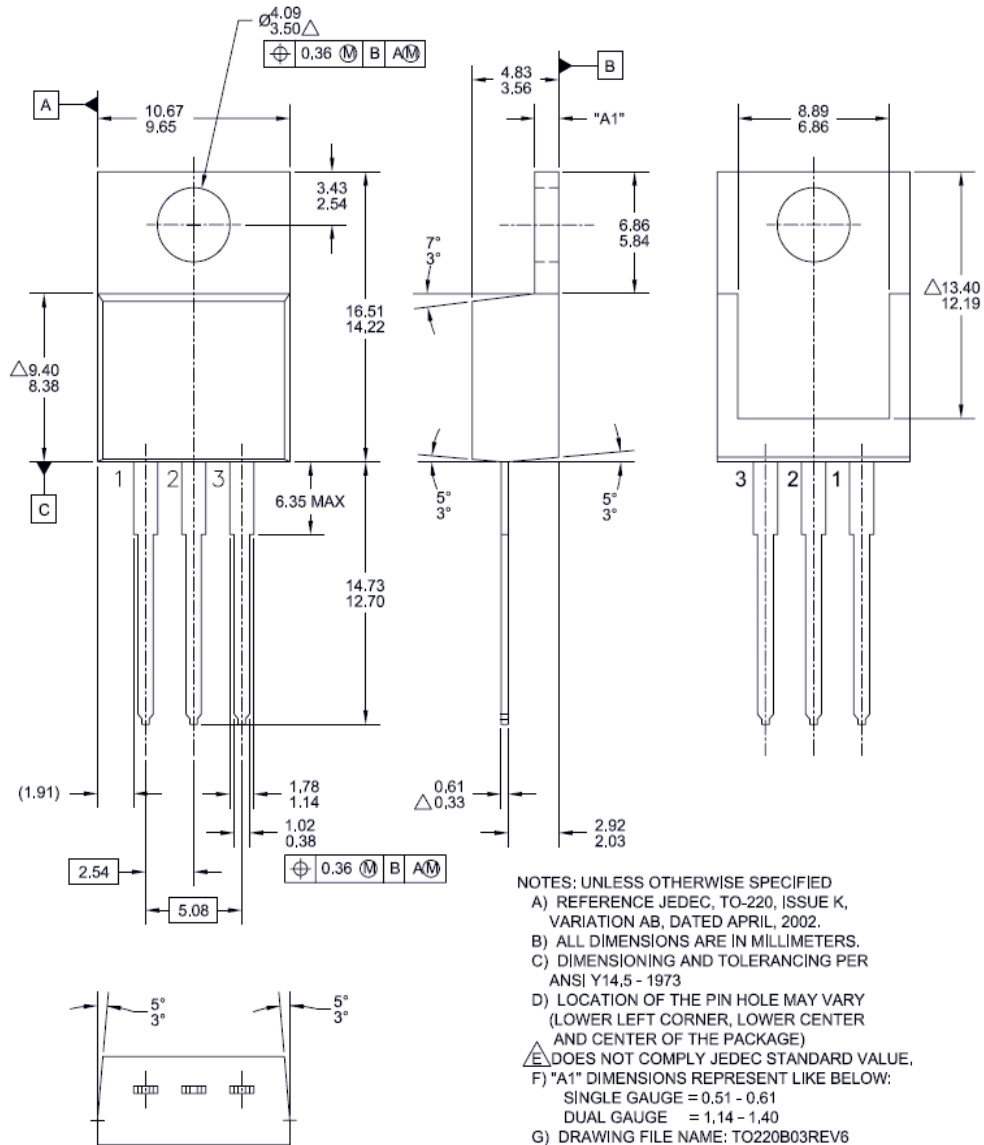


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-220**

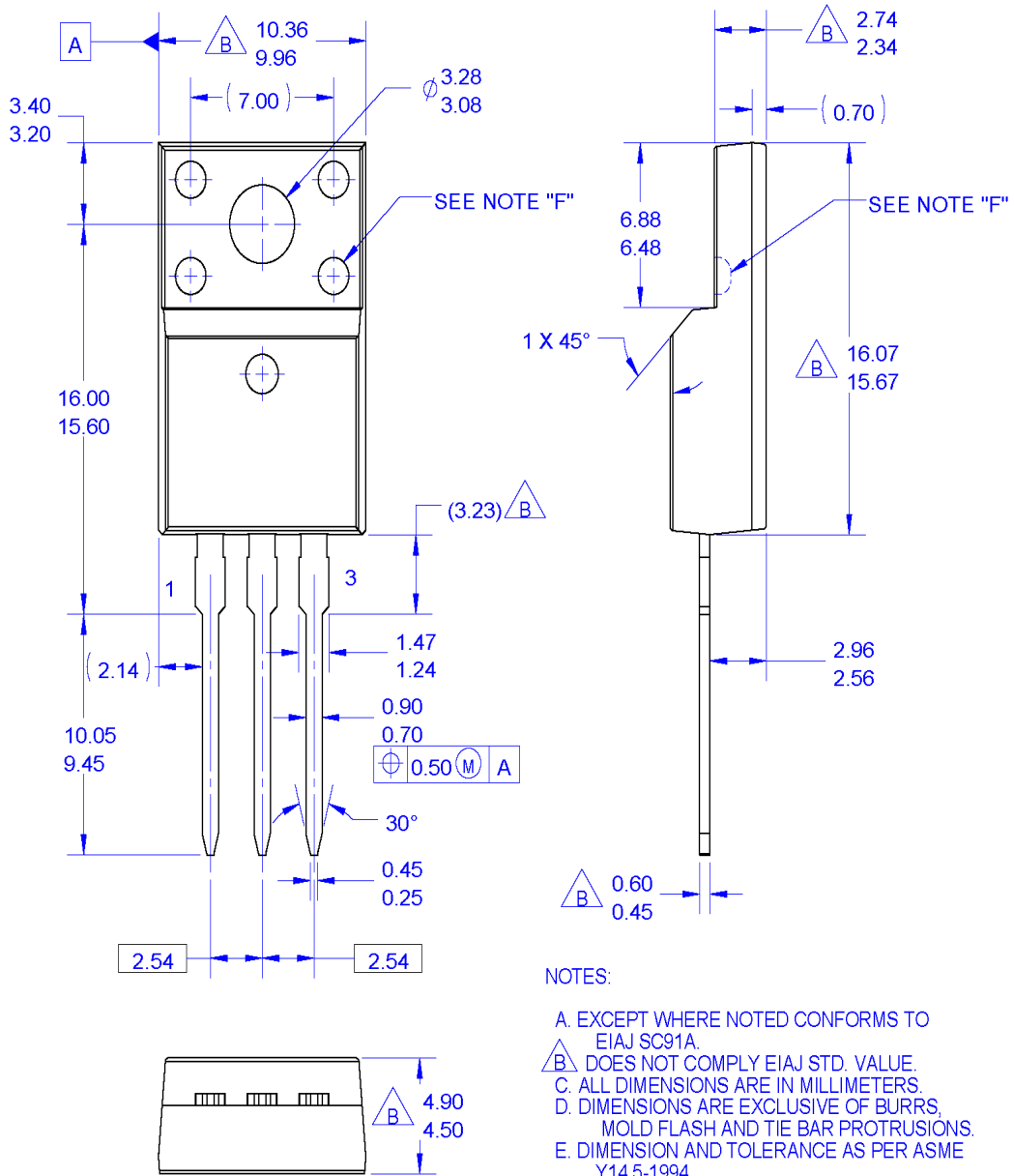


Dimensions in Millimeters



**Mechanical Dimensions**

**TO-220F**



**NOTES:**

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- 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

Dimensions in Millimeters



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| Build it Now™            | Green Bridge™                                   | TinyCalc™        |
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|                          | PowerXS™  |                  |
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|                          | QFET®   |                  |
|                          | QS™   |                  |
|                          | Quiet Series™                                   |                  |
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|                          | SignalWise™                                     |                  |
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