

# PFP50R150 / PFF50R150

## N-Channel Super Junction MOSFET

### FEATURES

- New technology for high voltage device
- Low  $R_{DS(on)}$  low conduction losses
- Small package
- Ultra low gate charge cause lower driving requirement
- 100% avalanche tested

<b><math>BV_{DSS} = 500\text{ V}</math></b> <b><math>R_{DS(on)} = 0.13\Omega</math></b> <b><math>I_D = 22.5\text{ A}</math></b>	
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### APPLICATION

- Power Factor Correction(PFC)
- Switched mode power supply (SMPS)
- Uninterruptible Power Supply (UPS)

<b>TO-220</b> 	<b>TO-220F</b> 
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### Absolute Maximum Ratings $T_c=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	PFP50R150	PFF50R150	Units
$V_{DS}$	Drain-Source Voltage ( $V_{GS}=0\text{V}$ )	500		V
$I_D$	Drain Current – Continuous ( $T_c = 25^\circ\text{C}$ )	22.5	22.5*	A
	Drain Current – Continuous ( $T_c = 100^\circ\text{C}$ )	14.2	14.2*	A
$I_{DM(pulse)}$	Drain Current – Pulsed * Note 1	67.5	67.5*	A
$V_{GS}$	Gate-Source Voltage ( $V_{DS}=0\text{V}$ )	$\pm 20$		V
$E_{AS}$	Single Pulsed Avalanche Energy * Note 2	880		mJ
$I_{AR}$	Avalanche Current * Note 1	22.5		A
$E_{AR}$	Repetitive Avalanche Energy * Note 1	20.8		mJ
dv/dt	Drain Source Voltage Slope, $V_{DS} \leq 400\text{V}$	50		V/ns
	Reverse Diode dv/dt, $V_{DS} \leq 400\text{V}$	5		V/ns
$P_D$	Maximum Power Dissipation ( $T_c = 25^\circ\text{C}$ )	208	34.7	W
	Derate above $25^\circ\text{C}$	0.80	0.26	W/ $^\circ\text{C}$
$T_I, T_{STG}$	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$

\* Limited by maximum junction temperature

### Thermal Resistance Characteristics

Symbol	Parameter	PFP50R150	PFF50R150	Units
$R_{\theta JC}$	Junction-to-Case (Maximum)	0.6	3.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient (Maximum)	62	80	

**Electrical Characteristics**  $T_A=25\text{ }^\circ\text{C}$  unless otherwise specified

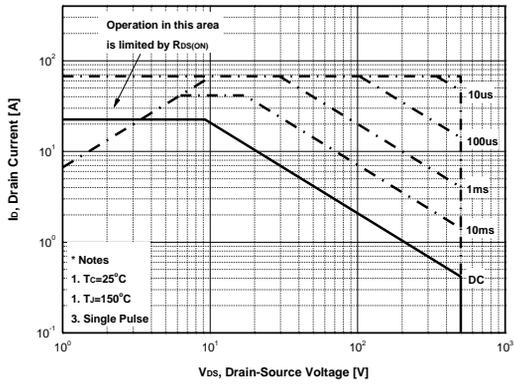
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.5	4.0	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	--	0.13	0.15	ohm
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	500	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 500\text{ V}, T_C = 125\text{ }^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
<b>Dynamic Characteristics</b>						
$g_{FS}$	Forward Transconductance	$V_{DS} = 30\text{ V}, I_D = 20\text{ A}$	--	18.8	--	S
$R_G$	Intrinsic Gate Resistance	$f = 1.0\text{ MHz}$ , open drain	--	1.0	--	ohm
$C_{iss}$	Input Capacitance	$V_{DS} = 70\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	2140	--	pF
$C_{oss}$	Output Capacitance		--	300	--	pF
$C_{rss}$	Reverse Transfer Capacitance		--	18	--	pF
$Q_g$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 20\text{ A}, V_{GS} = 10\text{ V}$	--	54	70	nC
$Q_{gs}$	Gate-Source Charge		--	10	--	nC
$Q_{gd}$	Gate-Drain Charge		--	20	--	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 250\text{ V}, I_D = 20\text{ A}, R_G = 12.5\text{ }\Omega, V_{GS} = 10\text{ V}$	--	18	--	ns
$t_r$	Turn-On Rise Time		--	16	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	1754	--	ns
$t_f$	Turn-Off Fall Time		--	16	--	ns
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	22.5	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	65	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 20\text{ A}, V_{GS} = 0\text{ V}$	--	0.9	1.3	V
$t_{rr}$	Reverse Recovery Time	$I_S = 20\text{ A}$	--	310	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{s}$	--	5	--	$\mu\text{C}$

**Notes ;**

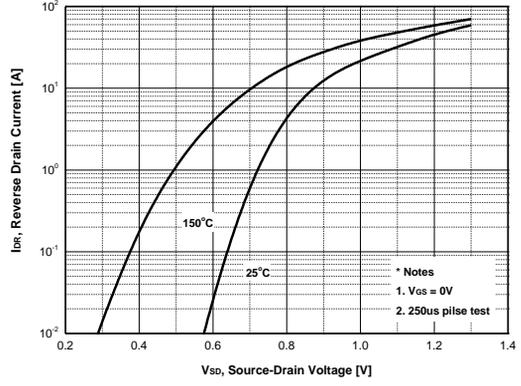
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=3.48\text{mH}, I_{AS}=22.5\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25\text{ }^\circ\text{C}$
3. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
4. Essentially Independent of Operating Temperature

# Typical Characteristics

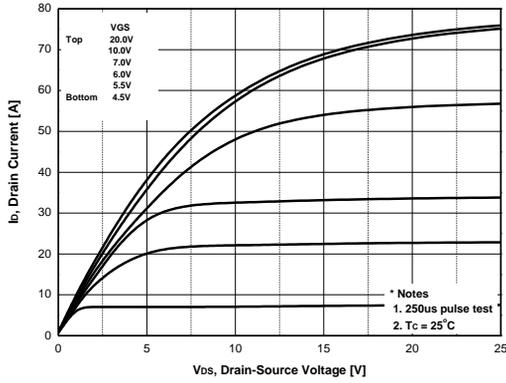
**Fig 1. Safe Operation Area**



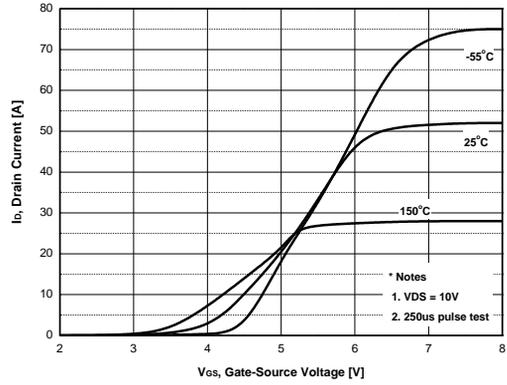
**Fig 2. Source-Drain Diode Forward Voltage**



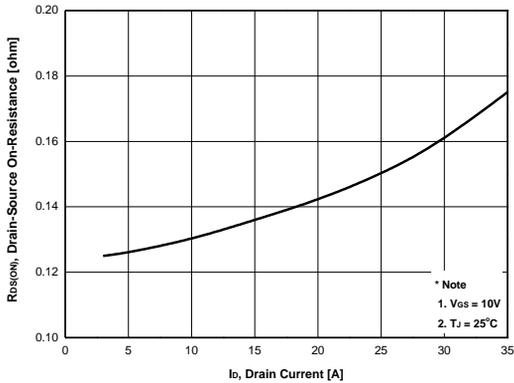
**Fig 3. Output Characteristics**



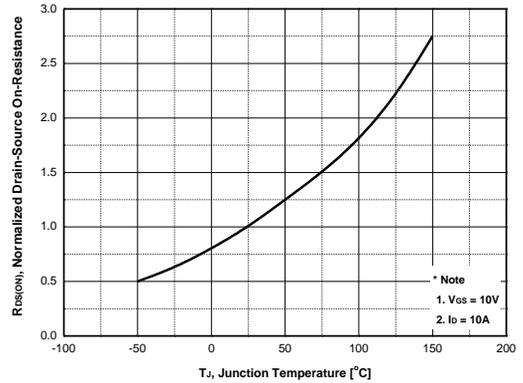
**Fig 4. Transfer Characteristics**



**Fig 5. Static Drain-Source On Resistance**



**Fig 6.  $R_{DS(ON)}$  vs. Junction Temperature**



Typical Characteristics (continued)

Fig 7. Threshold Voltage vs. Temperature

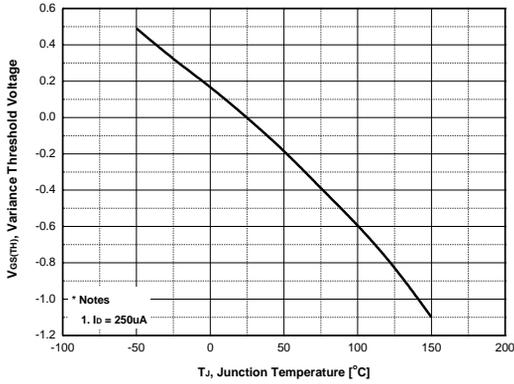


Fig 8. Maximum ID vs. Case Temperature

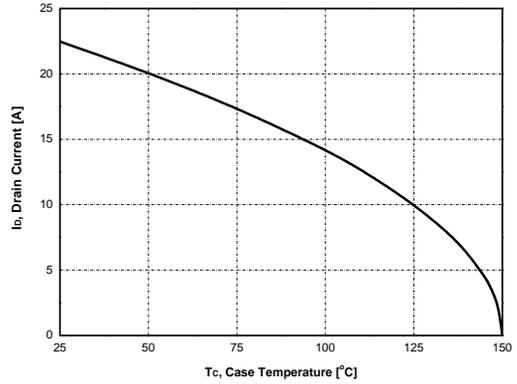


Fig 9. Gate Charge Characteristics

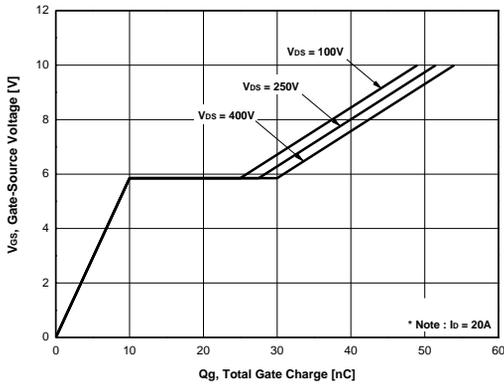


Fig 10. Capacitance Characteristics

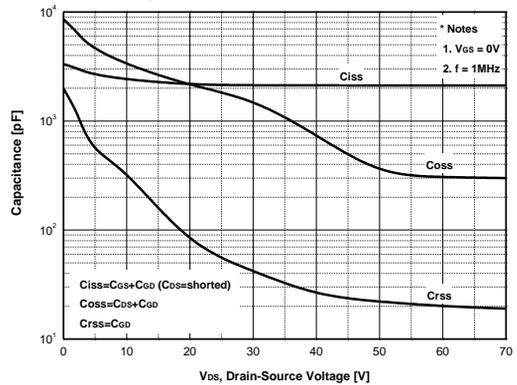


Fig 11. Transient Thermal Response Curve for TO-220

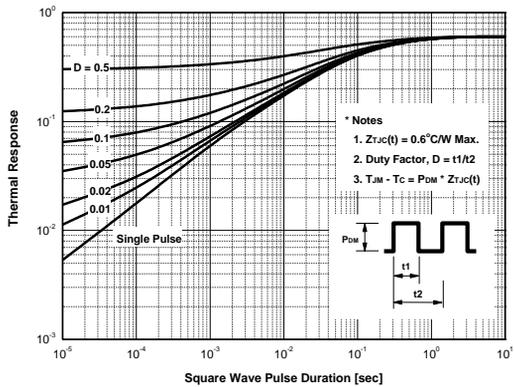
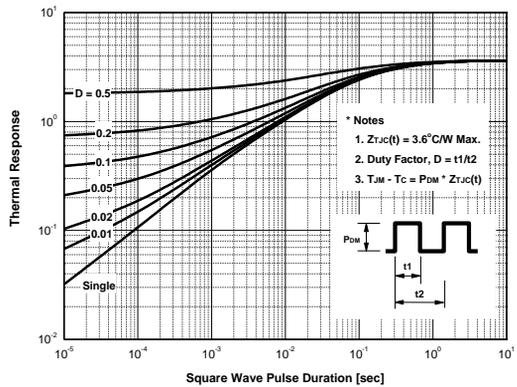
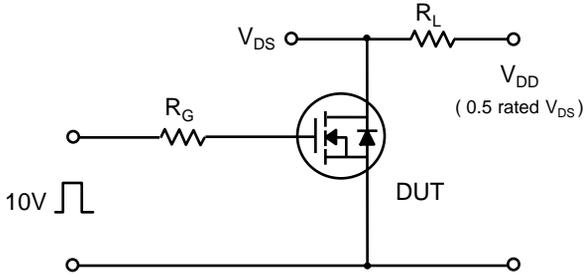


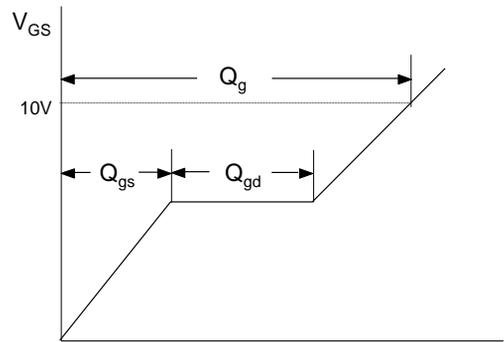
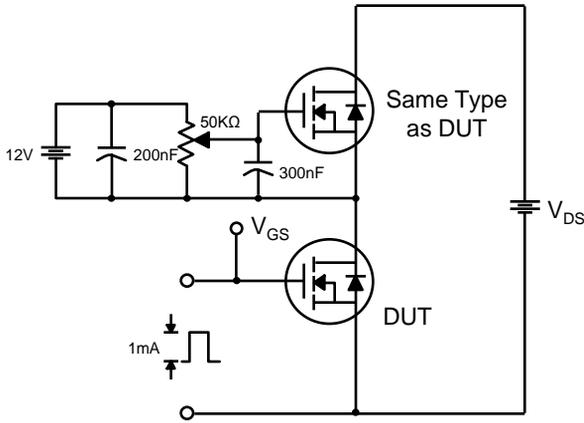
Fig 12. Transient Thermal Response Curve for TO-220F



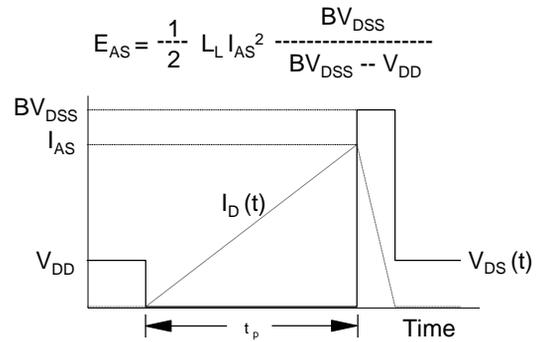
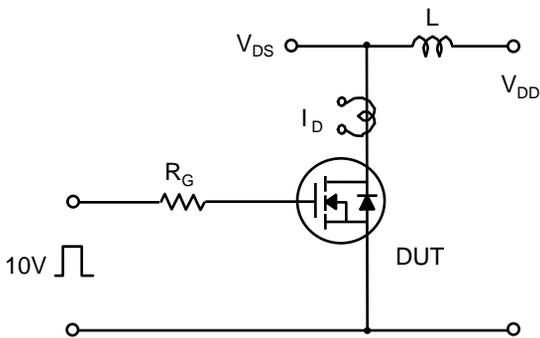
### Characteristics Test Circuit & Waveform



**Switching Time Test Circuit & Waveforms**

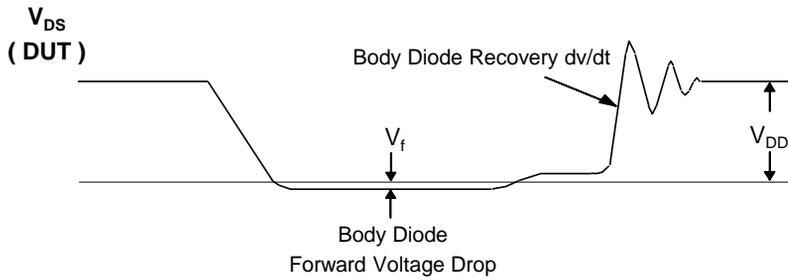
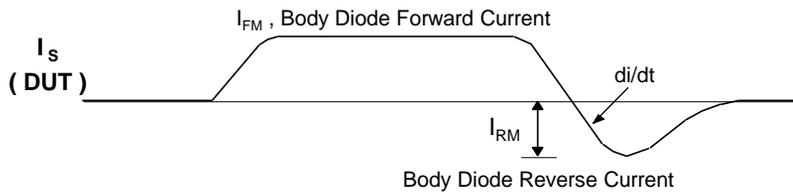
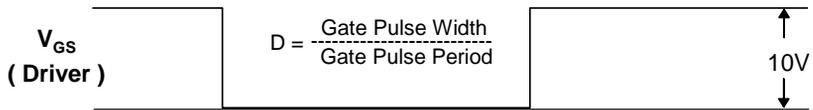
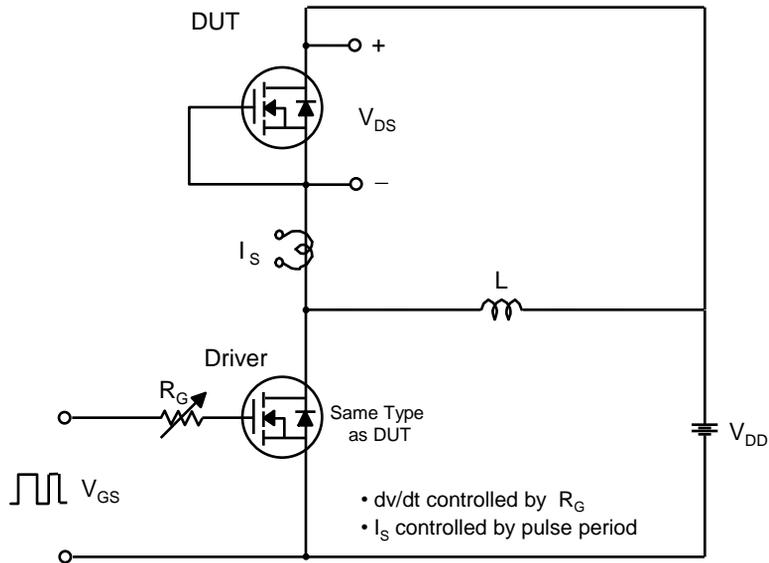


**Gate Charge Test Circuit & Waveform**



**Unclamped Inductive Switching Test Circuit & Waveforms**

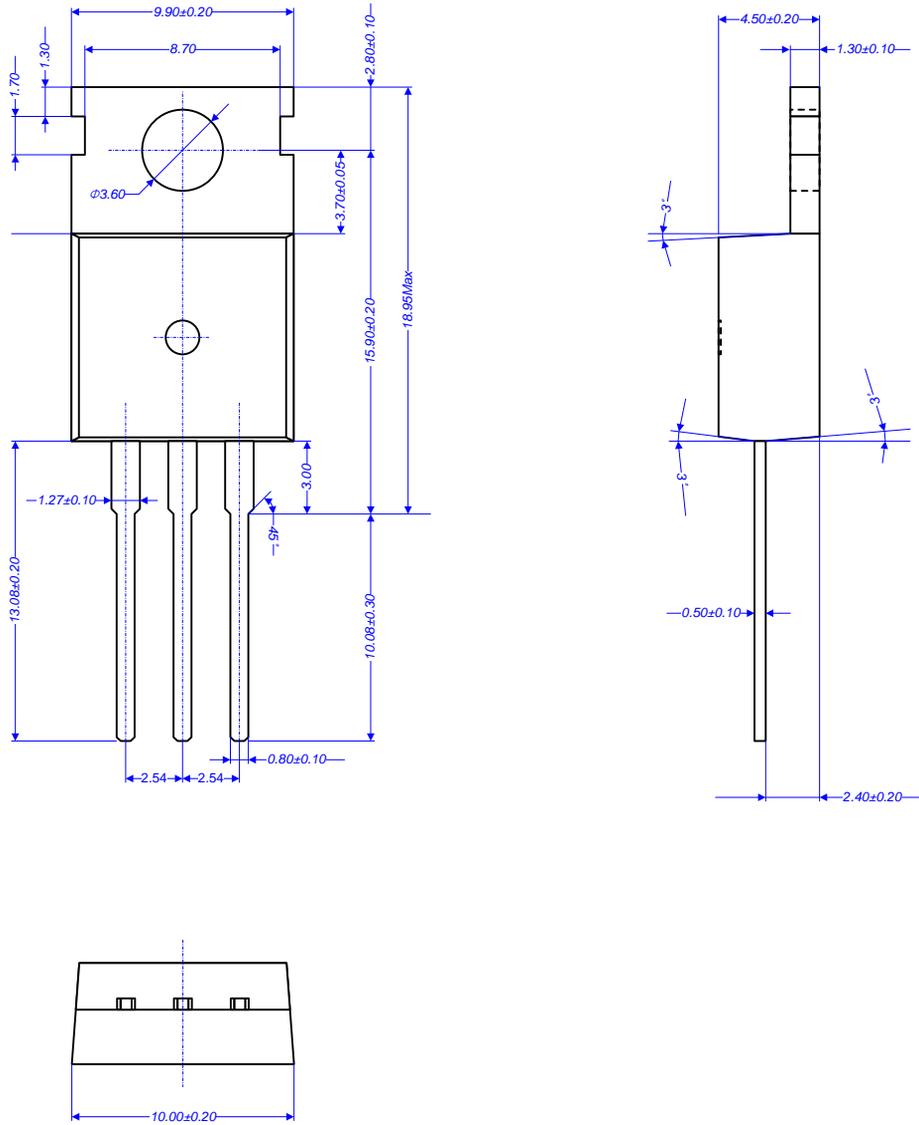
Characteristics Test Circuit & Waveform (continued)



Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Package Dimension

## TO-220





# Package Dimension

## TO-220F (2)

