

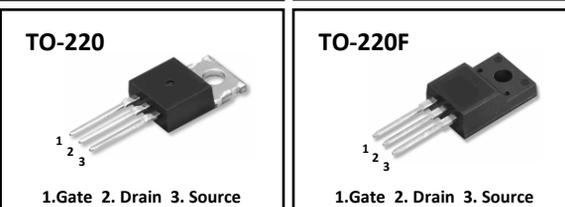
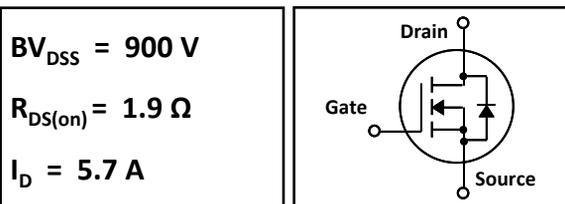
## PFP6N90E / PFF6N90E 900V N-Channel MOSFET

### FEATURES

- Originative New Design
- 100% EAS Test
- Rugged Gate Oxide Technology
- Extremely Low Intrinsic Capacitances
- Remarkable Switching Characteristics
- Unequalled Gate Charge : 30.5 nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$  : 1.9Ω (Typ.) @ $V_{GS}=10V$

### APPLICATION

- High current, High speed switching
- Suitable for power supplies, adaptors and PFC
- SMPS (Switched Mode Power Supplies)



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

Symbol	Parameter	PFP6N90E	PFF6N90E	Units
$V_{DSS}$	Drain-Source Voltage	900		V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	5.7	5.7*	A
	Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ )	3.6	3.6*	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	23.0	23.0*	A
$V_{GS}$	Gate-Source Voltage	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	630		mJ
$I_{AR}$	Avalanche Current (Note 1)	5.7		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	16.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	167	56	W
	- Derate above $25^\circ\text{C}$	1.3	0.4	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 Resistance Characteristics

Symbol	Parameter	PFP6N90E	PFF6N90E	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.75	2.25	$^\circ\text{C}/\text{W}$
$R_{\theta JS}$	Thermal Resistance, Junction-to-Sink	0.5	--	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	

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

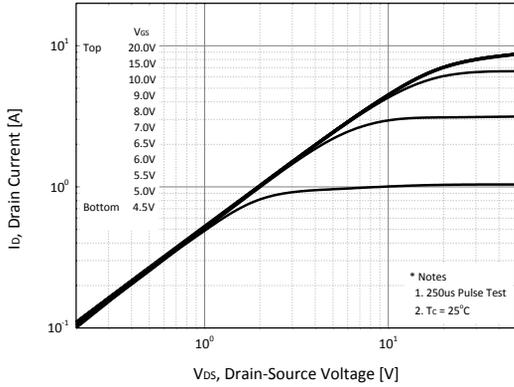
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 3.0 \text{ A}$	--	1.9	2.3	$\Omega$
<b>Off Characteristics</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 $25^\circ\text{C}$	--	0.5	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 900 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 720 \text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	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
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$	--	1660	2160	pF
$C_{oss}$	Output Capacitance		--	105	135	pF
$C_{rss}$	Reverse Transfer Capacitance		--	16	22	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 450 \text{ V}, I_D = 6.0 \text{ A},$ $R_G = 25 \Omega, R_L = 75 \Omega$  (Note 4,5)	--	28	55	ns
$t_r$	Turn-On Rise Time		--	22	45	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	120	ns
$t_f$	Turn-Off Fall Time		--	24	50	ns
$Q_g$	Total Gate Charge	$V_{DS} = 720 \text{ V}, I_D = 6.0 \text{ A},$ $V_{GS} = 10 \text{ V}$  (Note 4,5)	--	30.5	45	nC
$Q_{gs}$	Gate-Source Charge		--	10	--	nC
$Q_{gd}$	Gate-Drain Charge		--	7	--	nC
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	5.7	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	23.0	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 6.0 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S = 6.0 \text{ A}, V_{GS} = 0 \text{ V}$ $di_f/dt = 100 \text{ A}/\mu\text{s}$ (Note 4)	--	505	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	5.3	--	$\mu\text{C}$

**Notes ;**

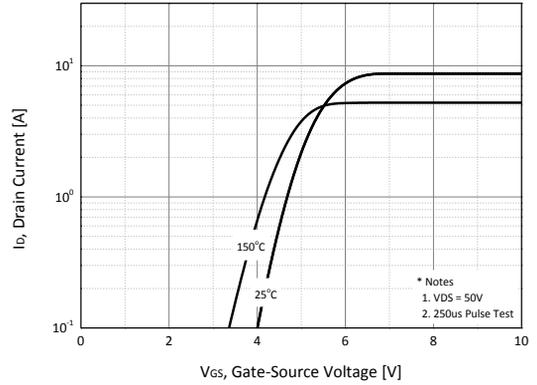
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=35\text{mH}, I_{AS}=6.0\text{A}, V_{OD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3.  $I_{SD}\leq 6.0\text{A}, di/dt\leq 200\text{A}/\mu\text{s}, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
4. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

# Typical Characteristics

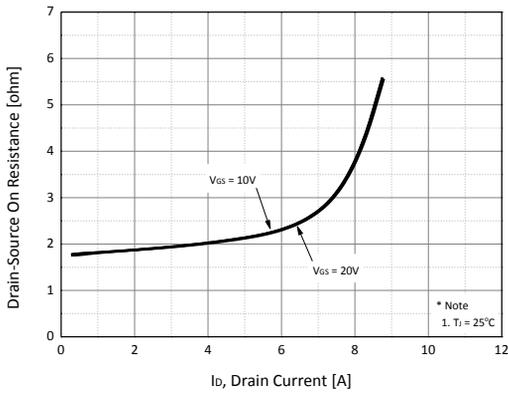
**Fig.1 On Region Characteristics**



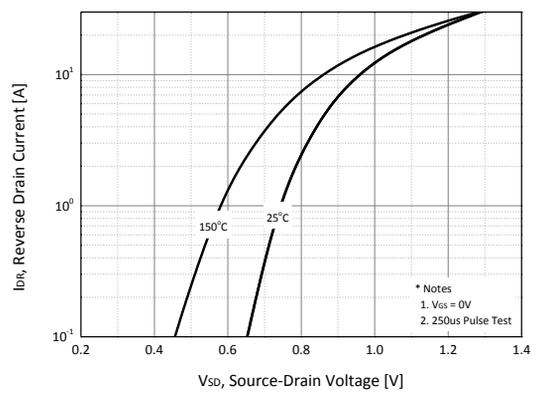
**Fig.2 Transfer Characteristics**



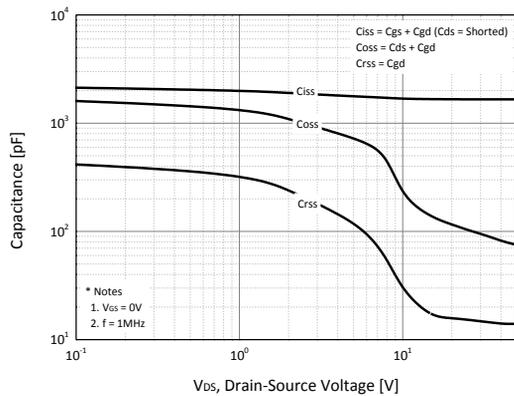
**Fig.3 Static Drain-Source On Resistance**



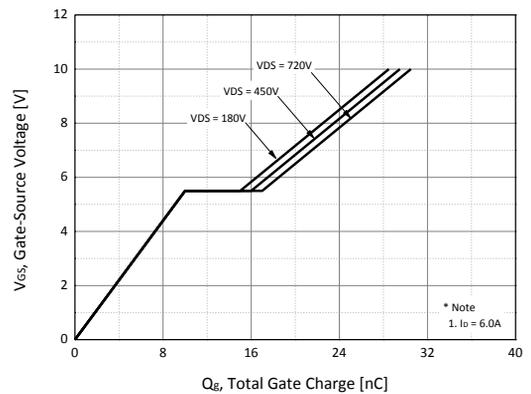
**Fig.4 Body Diode Forward Voltage**



**Fig.5 Capacitance Characteristics**

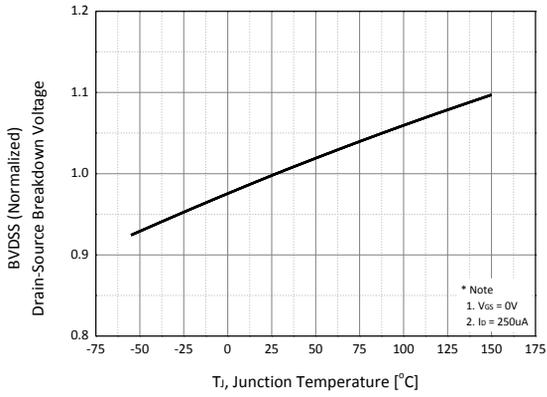


**Fig.6 Gate Charge Characteristics**

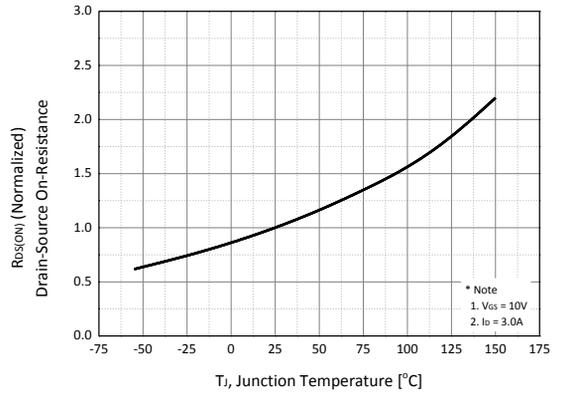


# Typical Characteristics

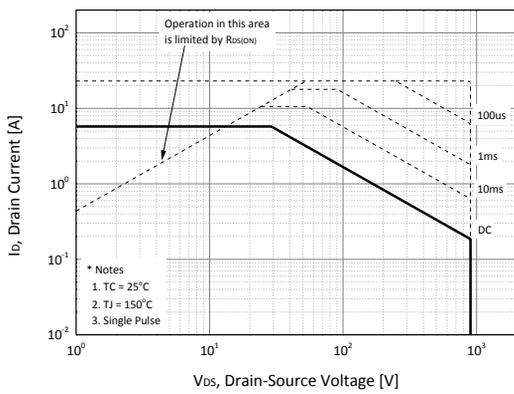
**Fig.7 BV<sub>DSS</sub> Variation vs. Temperature**



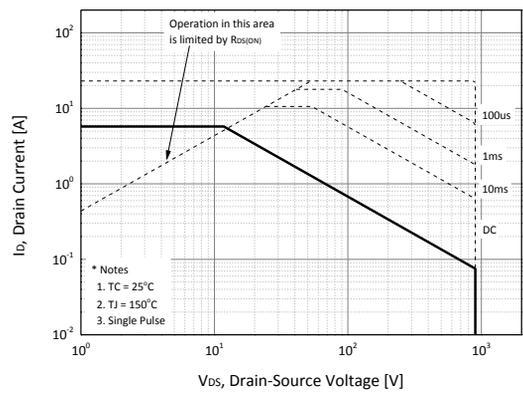
**Fig.8 On-Resistance Variation vs. Temperature**



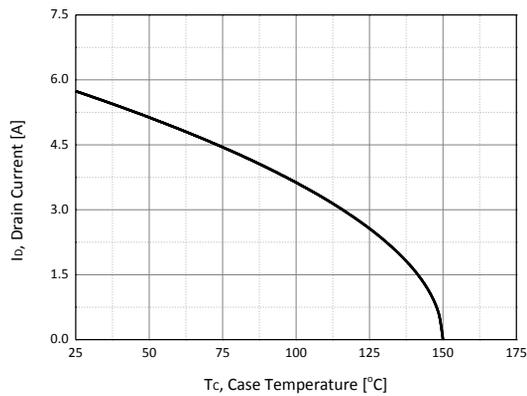
**Fig.9-1 Safe Operation Area for TO-220**



**Fig.9-2 Safe Operation Area for TO-220F**

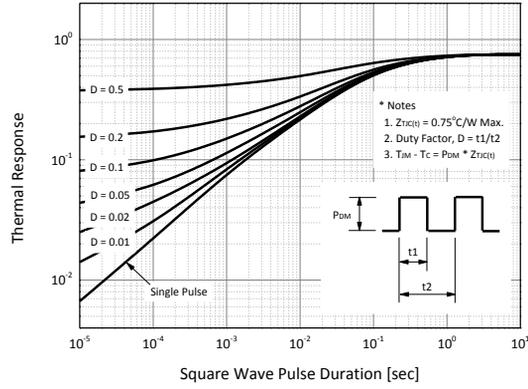


**Fig.10 Maximum I<sub>D</sub> vs. Case Temperature**

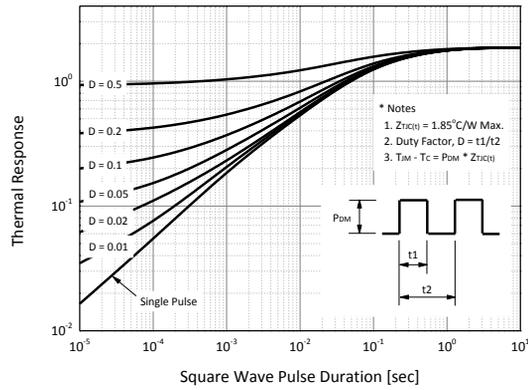


# Typical Characteristics

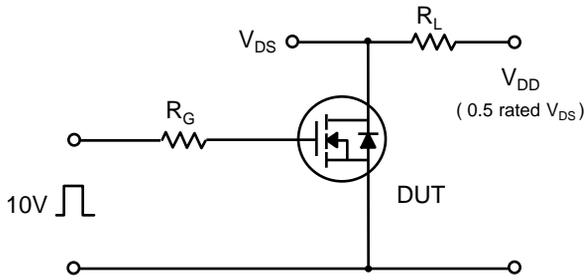
**Fig.11-1 Transient Thermal Response Curve**



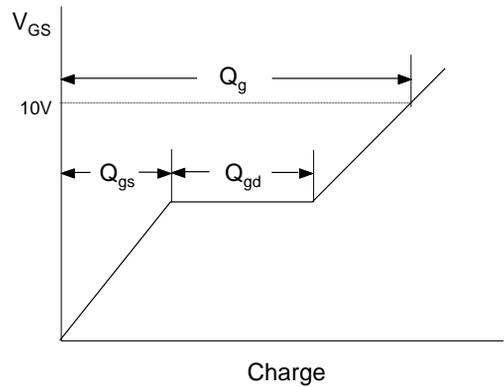
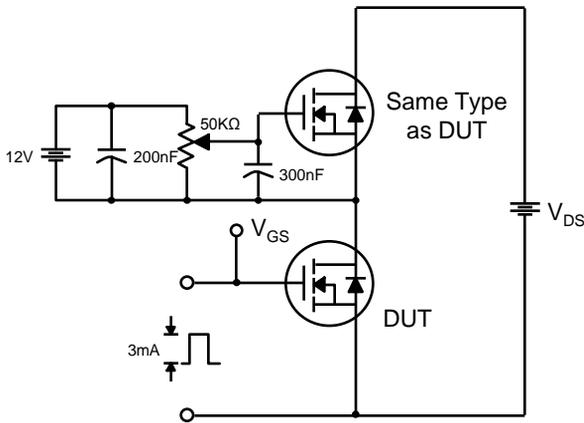
**Fig.11-2 Transient Thermal Response Curve**



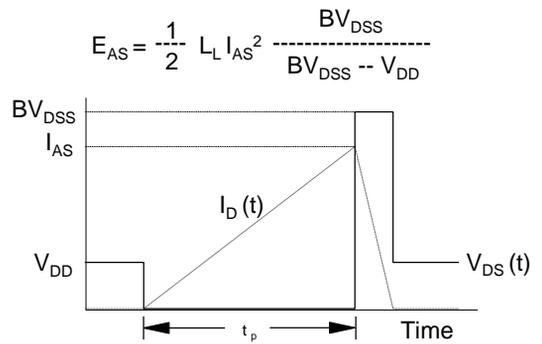
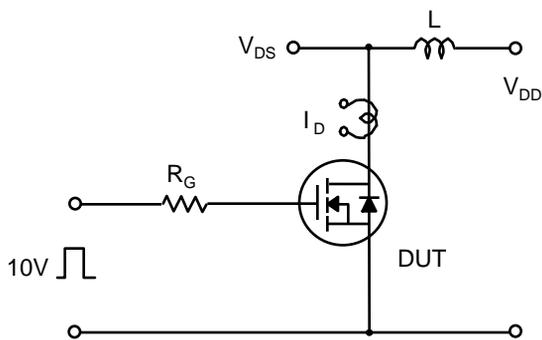
**Characteristics Test Circuit & Waveform**



**Fig 14. Resistive Switching Test Circuit & Waveforms**



**Fig 15. Gate Charge Test Circuit & Waveform**



**Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms**

Characteristics Test Circuit & Waveform (continued)

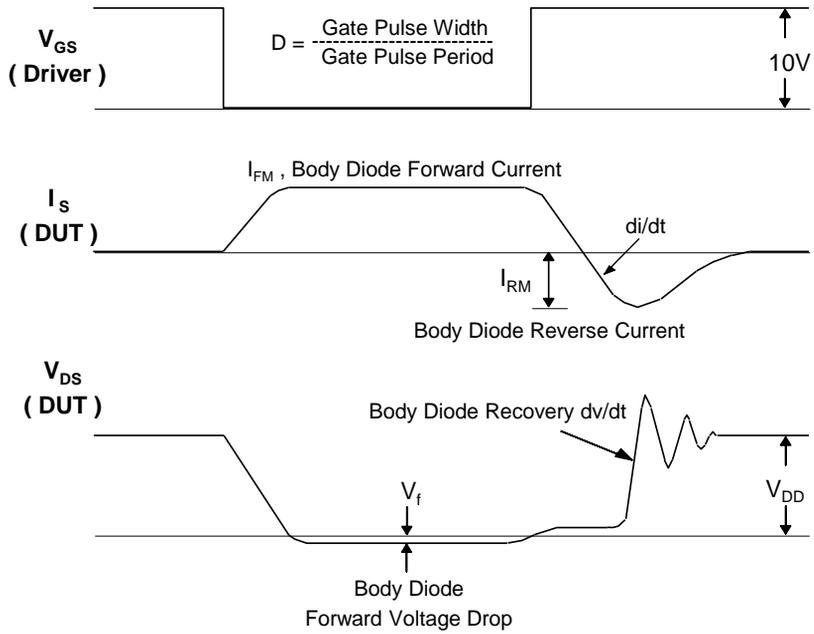
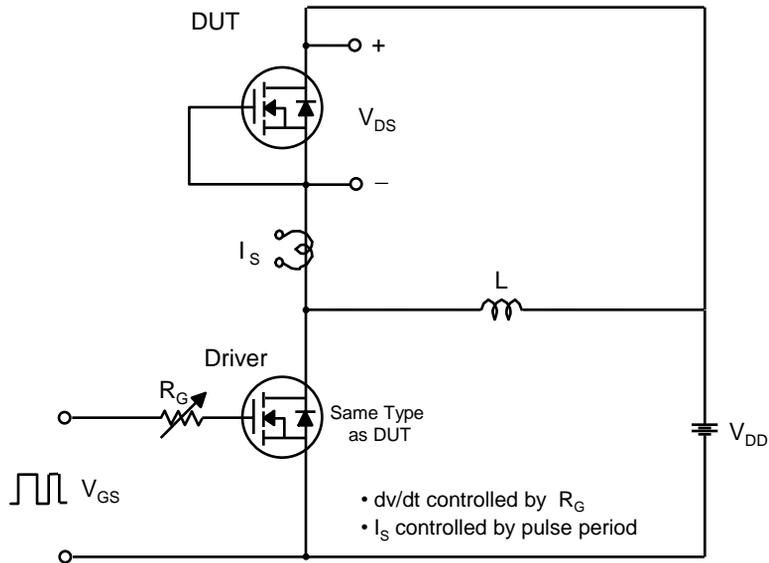
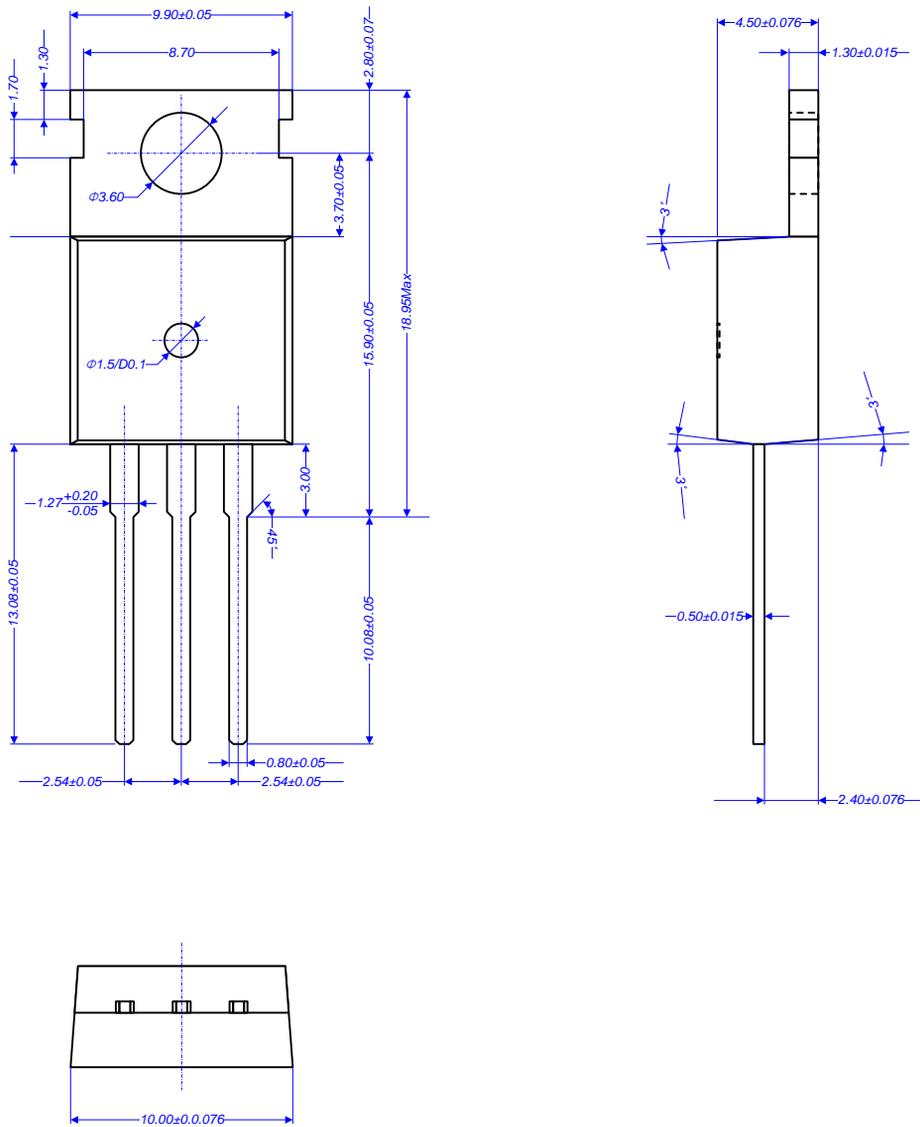


Fig 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Package Dimension

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## TO-220



PFP6N90E / PFF6N90E

