

## PFP730E/PFF730E

### 400V N-Channel MOSFET

#### FEATURES

- ◆ Originative New Design
- ◆ 100% EAS Test
- ◆ Rugged Gate Oxide Technology
- ◆ Extremely Low Intrinsic Capacitances
- ◆ Remarkable Switching Characteristics
- ◆ Unequalled Gate Charge : 10.5 nC (Typ.)
- ◆ Extended Safe Operating Area
- ◆ Lower  $R_{DS(ON)}$  : 0.7  $\Omega$  (Typ.) @  $V_{GS}=10V$

#### APPLICATION

- ◆ Electronic lamp ballasts based on half bridge topology
- ◆ PFC (Power Factor Correction)
- ◆ SMPS (Switched Mode Power Supplies)

<b><math>BV_{DSS} = 400 V</math></b> <b><math>R_{DS(ON)} = 0.7 \Omega</math></b> <b><math>I_D = 6.0 A</math></b>	
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<b>TO-220</b>  <b>1.Gate 2. Drain 3. Source</b>	<b>TO-220F</b>  <b>1.Gate 2. Drain 3. Source</b>
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#### Absolute Maximum Ratings T<sub>c</sub>=25°C unless otherwise specified

Symbol	Parameter	PFP730E	PFF730E	Units
$V_{DSS}$	Drain-Source Voltage	400		V
$I_D$	Drain Current – Continuous (T <sub>c</sub> = 25°C)	6.0	6.0*	A
	Drain Current – Continuous (T <sub>c</sub> = 100°C)	3.8	3.8*	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	24	24*	A
$V_{GS}$	Gate-Source Voltage	±30		V
EAS	Single Pulsed Avalanche Energy (Note 2)	270		mJ
$I_{AR}$	Avalanche Current (Note 1)	6.0		A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	7.8		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5		V/ns
$P_D$	Power Dissipation (T <sub>c</sub> = 25°C)	78	38	W
	- Derate above 25°C)	0.63	0.30	W/°C
T <sub>I</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		°C

\* Drain current limited by maximum junction temperature

#### Thermal Resistance Characteristics

Symbol	Parameter	PFP730E	PFF730E	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.6	3.3	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-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>						
$V_{GS(TH)}$	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	$V_{GS} = 10 \text{ V}, I_D = 3.0 \text{ A}$	--	0.7	0.95	$\Omega$
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	400	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	--	0.4	--	$\text{V}/^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 400 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 320 \text{ V}, T_C = 125^{\circ}\text{C}$	--	--	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	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	--	580	754	pF
$C_{oss}$	Output Capacitance		--	80	104	pF
$C_{rss}$	Reverse Transfer Capacitance		--	6	15	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 200 \text{ V}, I_D = 6.0 \text{ A}$ , $R_G = 25 \Omega$  (Note 4,5)	--	13.5	27	ns
$t_r$	Turn-On Rise Time		--	6.6	13	ns
$t_{d(off)}$	Turn-Off Delay Time		--	27	54	ns
$t_f$	Turn-Off Fall Time		--	5.5	11	ns
$Q_g$	Total Gate Charge	$V_{DS} = 320\text{V}, I_D = 6.0 \text{ A}$ , $V_{GS} = 10 \text{ V}$  (Note 4,5)	--	10.5	15	nC
$Q_{gs}$	Gate-Source Charge		--	3.5	--	nC
$Q_{gd}$	Gate-Drain Charge		--	3.9	--	nC
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	6.0	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	24	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 6.0 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S = 6.0 \text{ A}, V_{GS} = 0 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$ (Note 4)	--	200	--	nS
$Q_{rr}$	Reverse Recovery Charge		--	1.1	--	$\mu\text{C}$

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $I_{AS}=6.0\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$
3.  $I_{SD}\leq 6.0\text{A}, di/dt\leq 300\text{A}/\mu\text{s}, V_{DD}\leq BV_{DSS}$ , 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

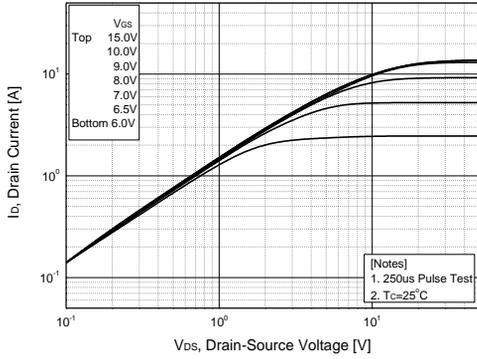


Figure 1. On Region Characteristics

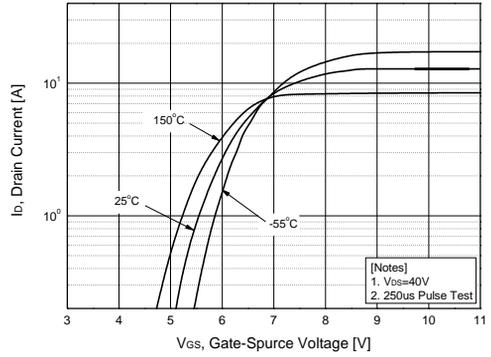


Figure 2. Transfer Characteristics

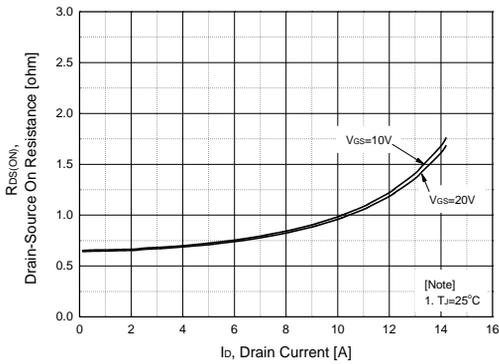


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

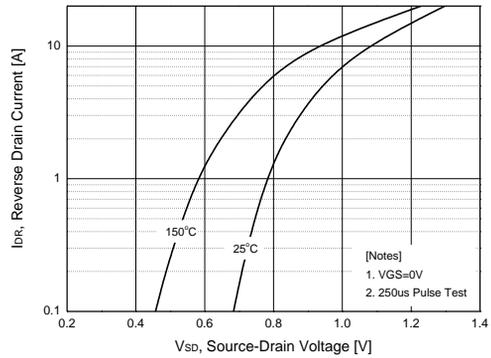


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

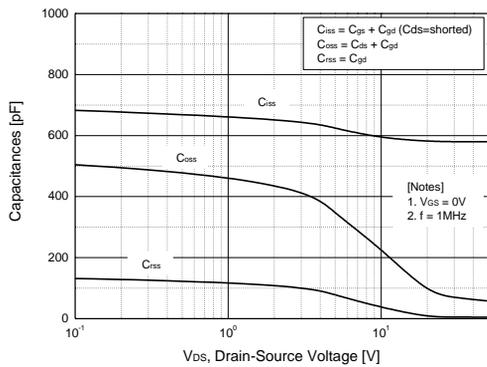


Figure 5. Capacitance Characteristics

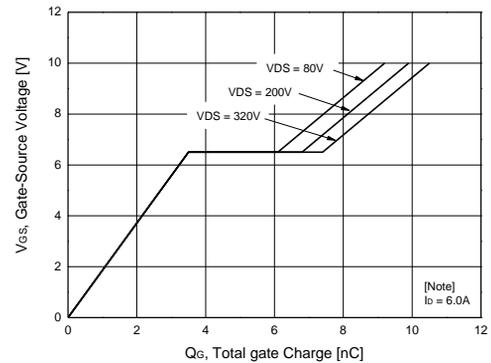


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

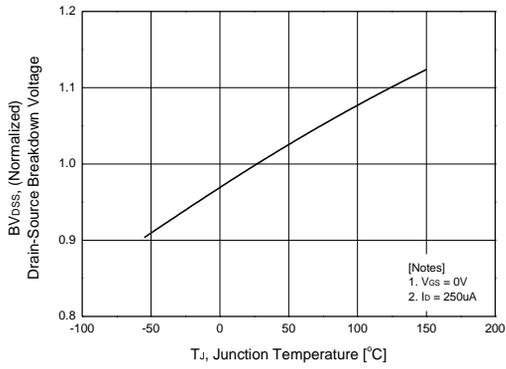


Figure 7. Breakdown Voltage Variation vs Temperature

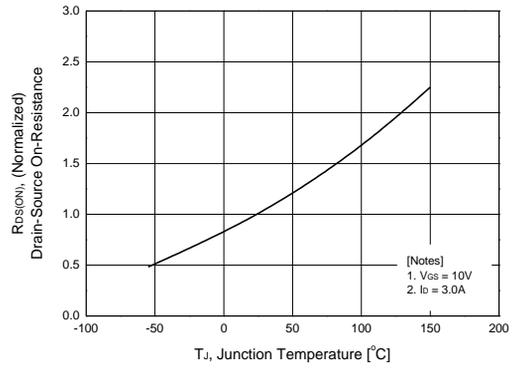


Figure 8. On-Resistance Variation vs Temperature

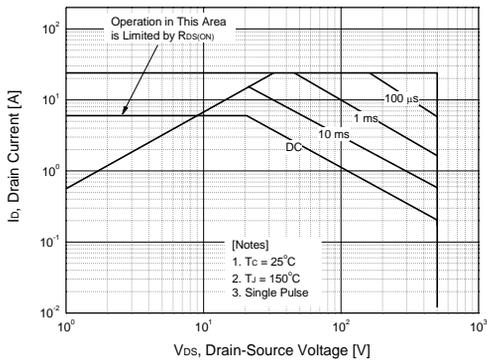


Figure 9. Maximum Safe Operating Area for PFP730E

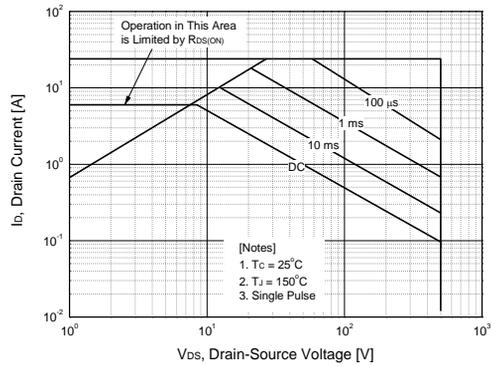


Figure 10. Maximum Safe Operating Area for PFF730E

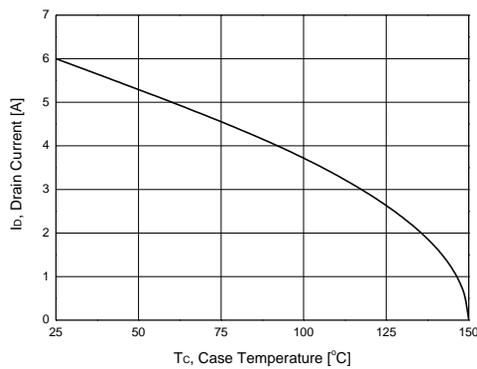


Figure 11. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

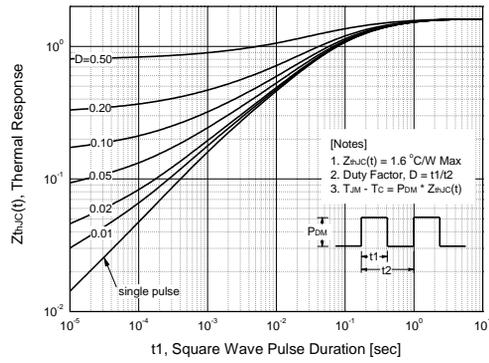


Figure 12. Transient Thermal Response Curve for PFP730E

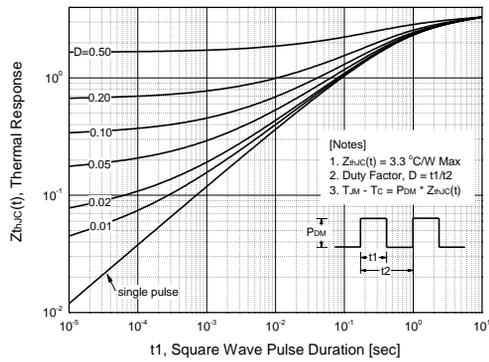


Figure 13. Transient Thermal Response Curve for PFF730E

Characteristics Test Circuit & Waveform

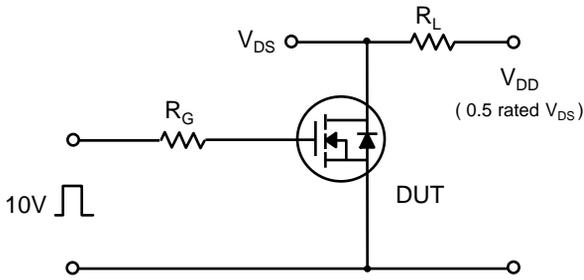


Fig 14. Resistive Switching Test Circuit & Waveforms

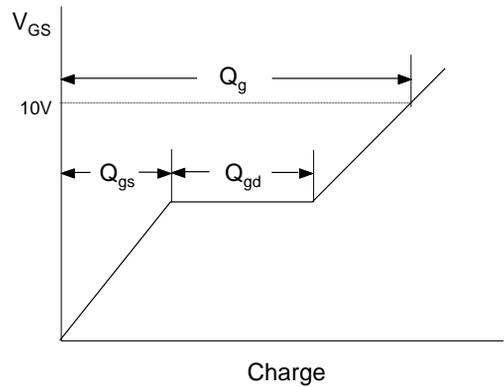
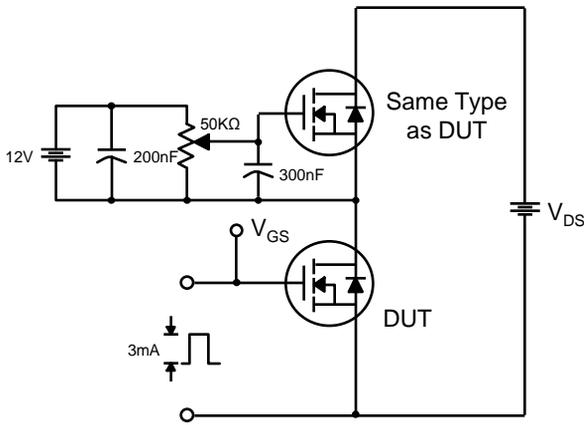


Fig 15. Gate Charge Test Circuit & Waveform

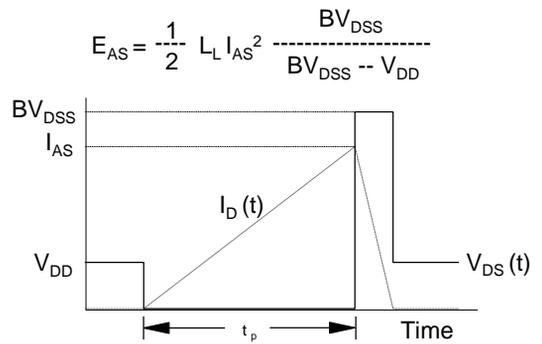
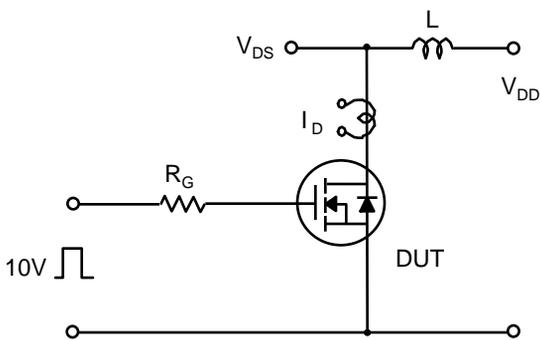


Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)

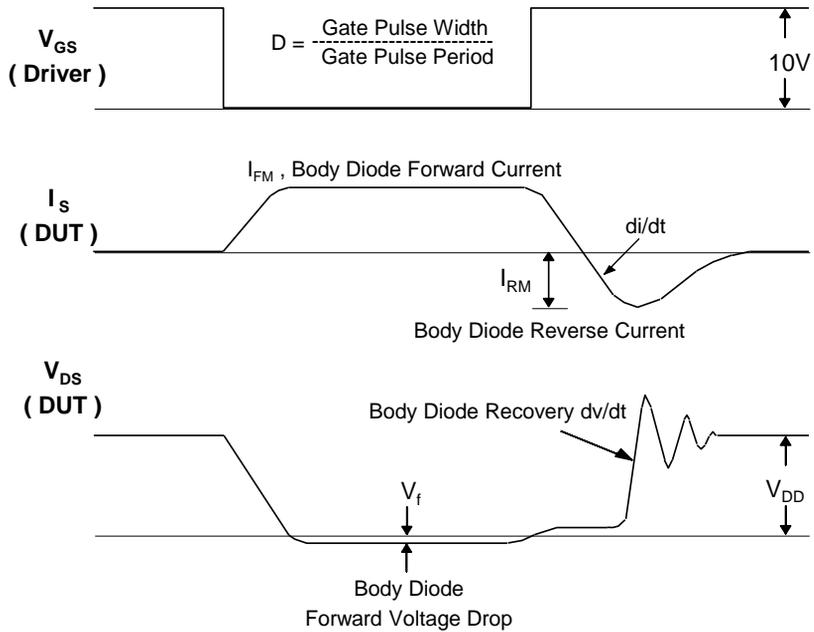
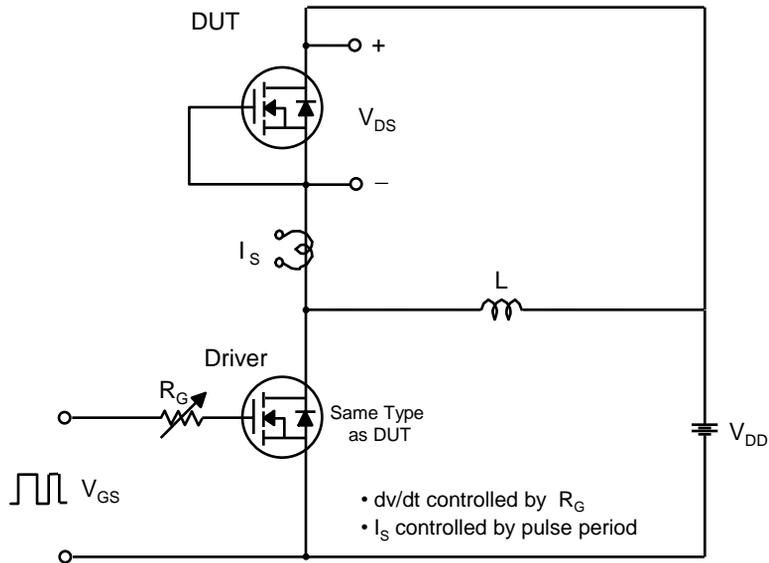
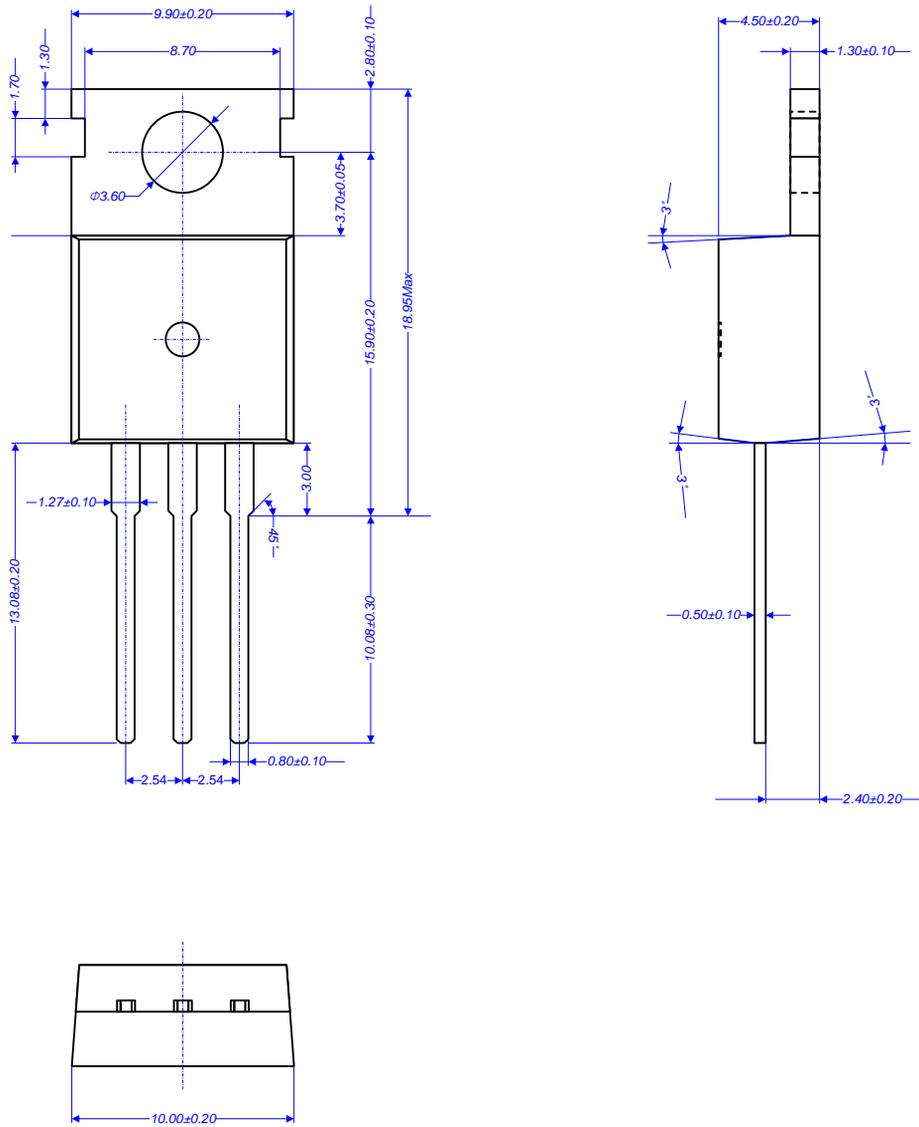


Fig 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Package Dimension

## TO-220



# Package Dimension

## TO-220F (1)

