

HFP3N90 / HFS3N90

900V N-Channel MOSFET

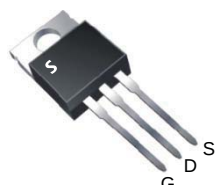
Features

- ❑ Superior Avalanche Rugged Technology
- ❑ Robust Gate Oxide Technology
- ❑ Very Low Intrinsic Capacitances
- ❑ Excellent Switching Characteristics
- ❑ 100% Avalanche Tested
- ❑ RoHS Compliant

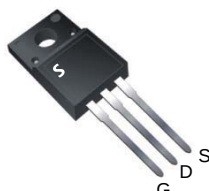
Key Parameters

Parameter	Value	Unit
BV_{DSS}	900	V
I_D	3	A
$R_{DS(on), Typ}$	5	Ω
Qg, Typ	17	nC

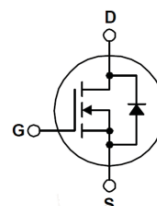
HFP3N90
TO-220



HFS3N90
TO-220F



Symbol



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

Symbol	Parameter	TO-220	TO-220F	Unit
V_{DSS}	Drain-Source Voltage	900		V
I_D	Drain Current – Continuous ($T_C = 25^\circ\text{C}$)	3.0	3.0 *	A
	Drain Current – Continuous ($T_C = 100^\circ\text{C}$)	1.9	1.9 *	A
I_{DM}	Drain Current – Pulsed (Note 1)	12	12 *	A
V_{GS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	200		mJ
I_{AR}	Avalanche Current (Note 1)	3.0		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	10.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	107	39	W
	- Derate above 25°C	0.85	0.31	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	TO-220	TO-220F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.17	3.2	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	$^\circ\text{C}/\text{W}$

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
On Characteristics						
V _{GS}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	2.0	--	4.0	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 1.5 A	--	5.0	6.2	Ω
g _{FS}	Forward Transconductance	V _{DS} = 50 V I _D = 1.5 A	--	1.8	--	S
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	900	--	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to25℃	--	1.0	--	V/℃
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 900 V, V _{GS} = 0 V	--	--	10	μA
		V _{DS} = 720 V, T _C = 125℃	--	--	100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V	--	--	±100	nA
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	700	910	pF
C _{oss}	Output Capacitance		--	70	90	pF
C _{rss}	Reverse Transfer Capacitance		--	7	9	pF
Switching Characteristics						
t _{d(on)}	Turn-On Time	V _{DS} = 450 V, I _D = 3 A, R _G = 25 Ω (Note 4,5)	--	20	40	ns
t _r	Turn-On Rise Time		--	55	110	ns
t _{d(off)}	Turn-Off Delay Time		--	30	60	ns
t _f	Turn-Off Fall Time		--	40	80	ns
Q _g	Total Gate Charge	V _{DS} = 720 V, I _D = 3 A, V _{GS} = 10 V (Note 4,5)	--	17	22	nC
Q _{gs}	Gate-Source Charge		--	4.5	--	nC
Q _{gd}	Gate-Drain Charge		--	7.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2.2	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	8.8	
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3 A	--	400	--	ns
Q _{rr}	Reverse Recovery Charge	di _F /dt = 100 A/μs	--	1.6	--	μC

Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L=43\text{mH}$, $I_{AS}=3\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$
3. $I_{SD}\leq 3\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, 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

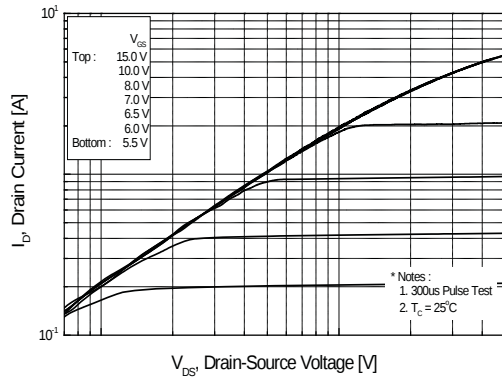


Figure 1. On Region Characteristics

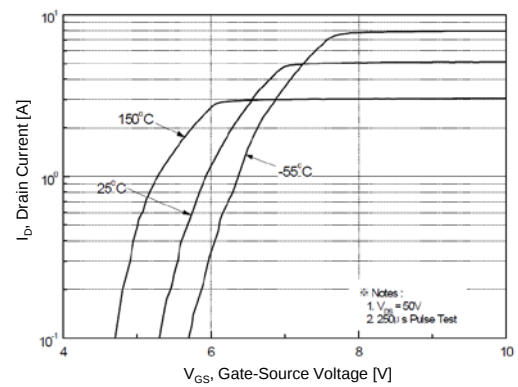


Figure 2. Transfer Characteristics

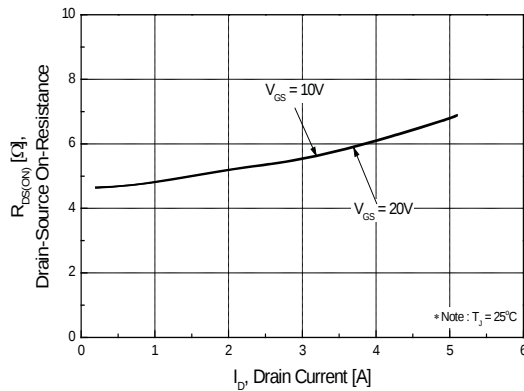


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

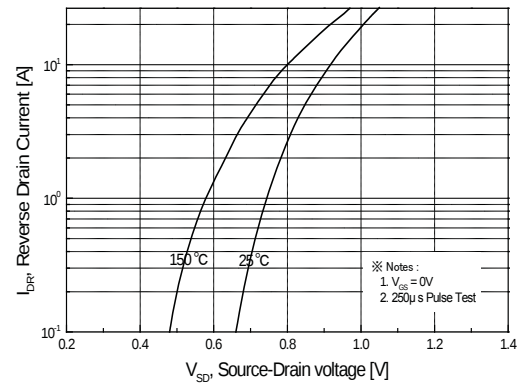


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

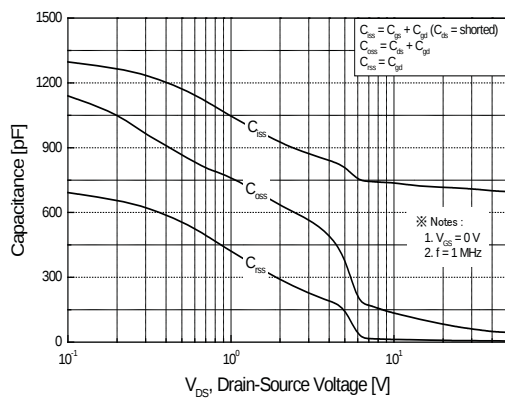


Figure 5. Capacitance Characteristics

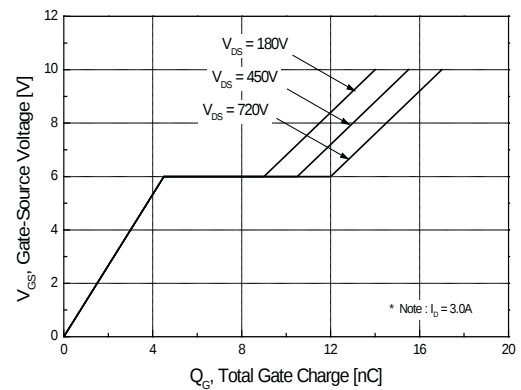


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

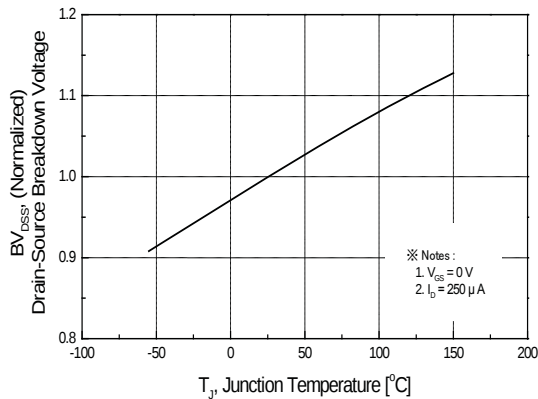


Figure 7. Breakdown Voltage Variation vs Temperature

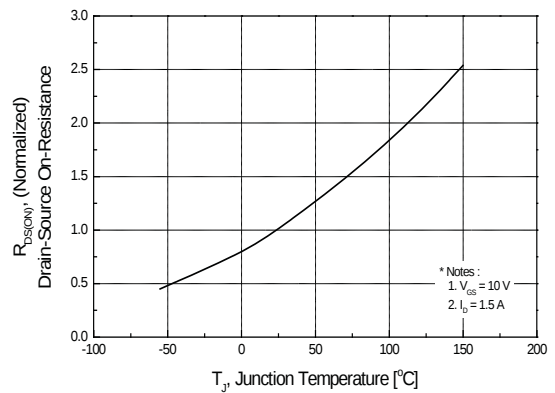


Figure 8. On-Resistance Variation vs Temperature

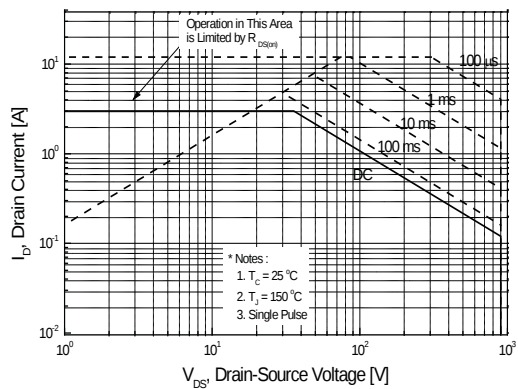


Figure 9-1. Maximum Safe Operating Area for TO-220

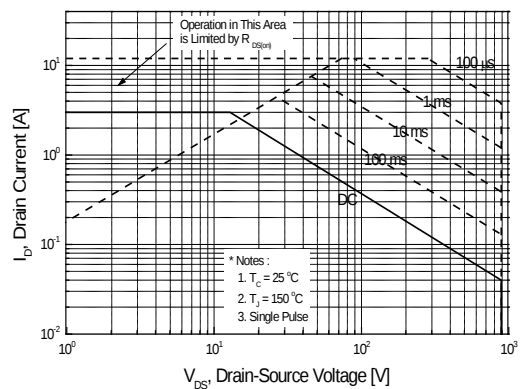


Figure 9-2. Maximum Safe Operating Area for TO-220F

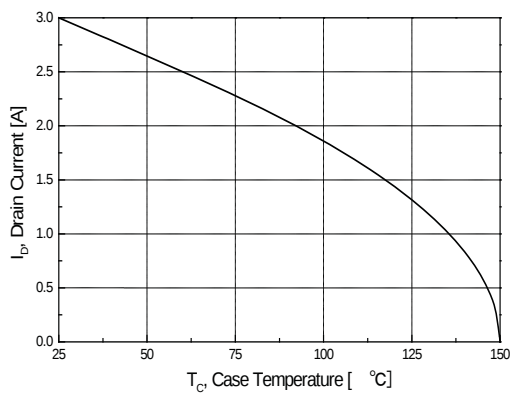


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

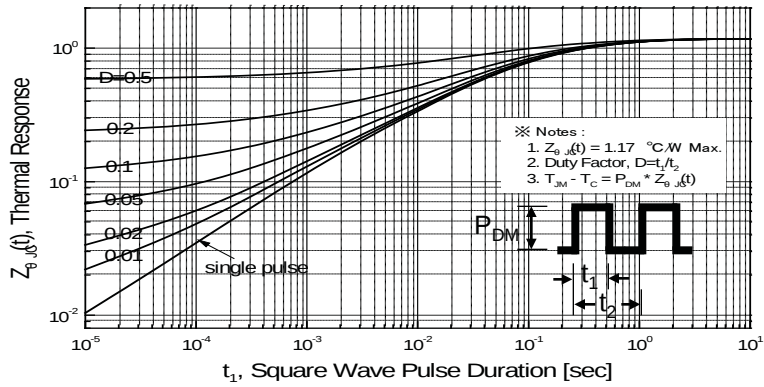


Figure 11-1. Transient Thermal Response Curve for TO-220

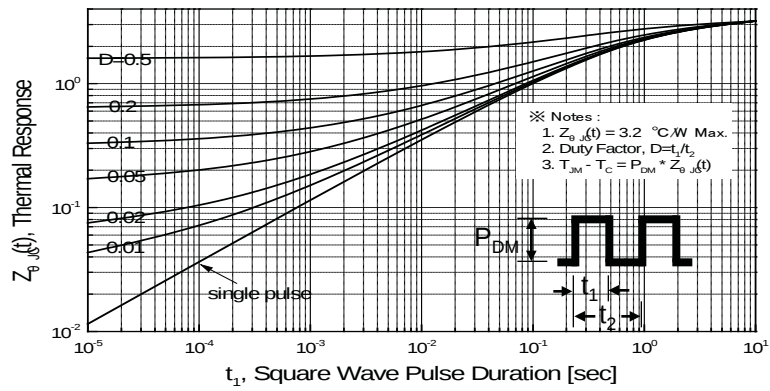


Figure 11-2. Transient Thermal Response Curve for TO-220F

Fig 12. Gate Charge Test Circuit & Waveform

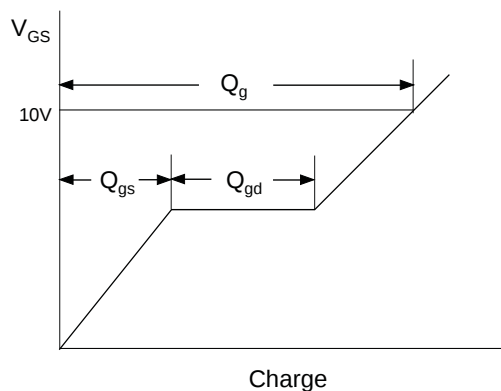
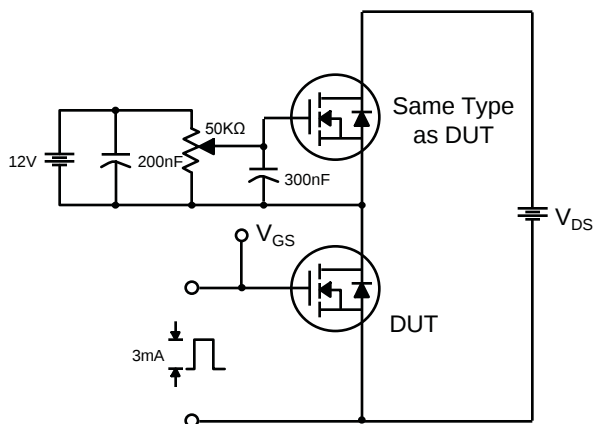


Fig 13. Resistive Switching Test Circuit & Waveforms

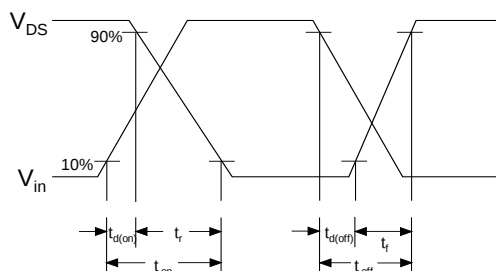
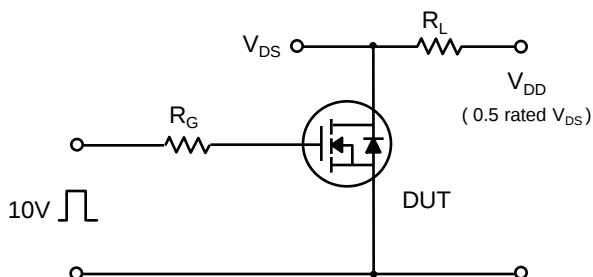


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

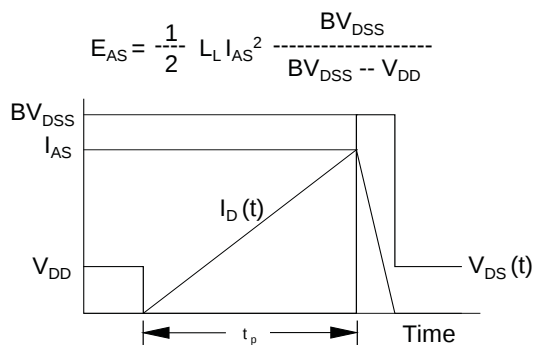
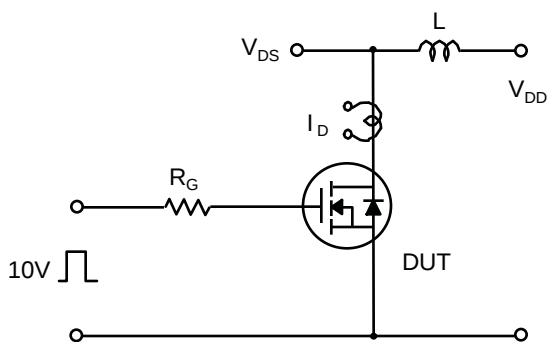
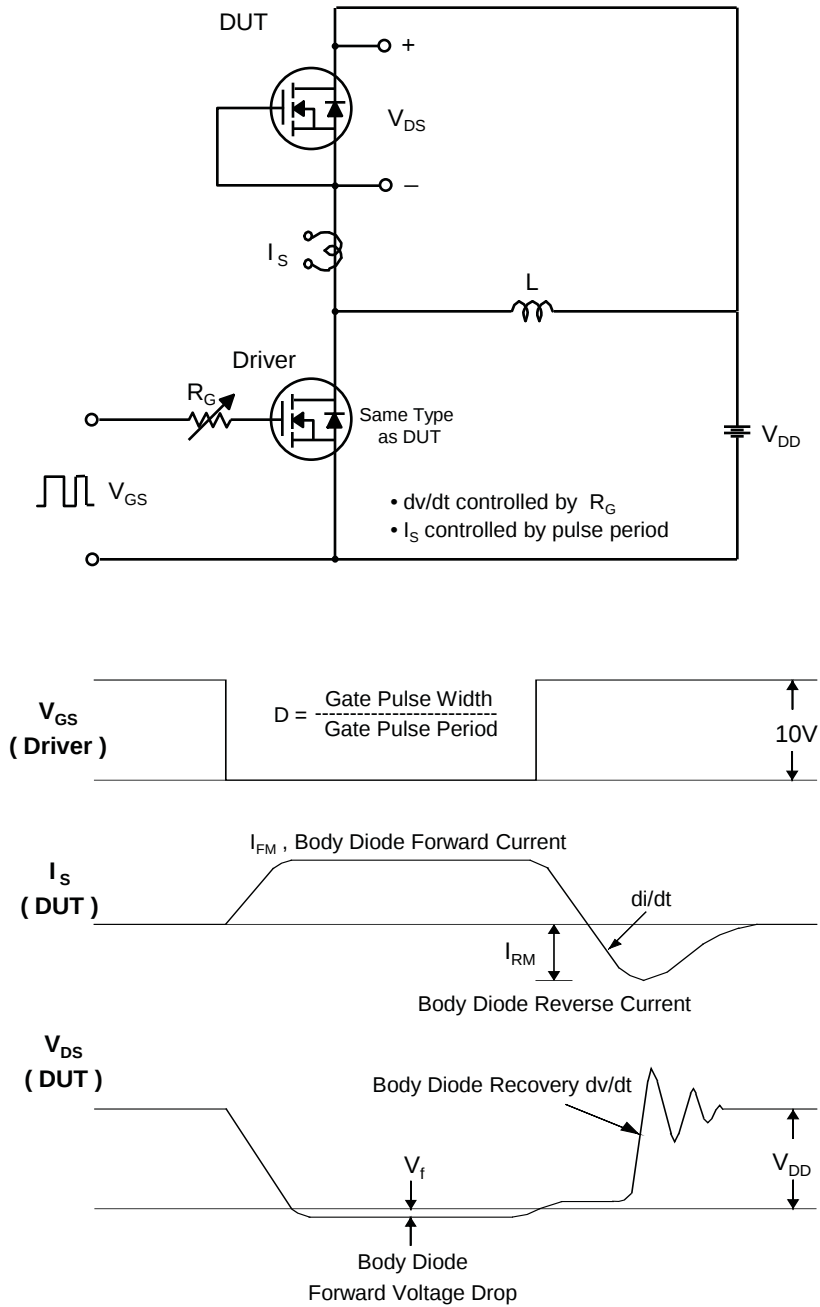
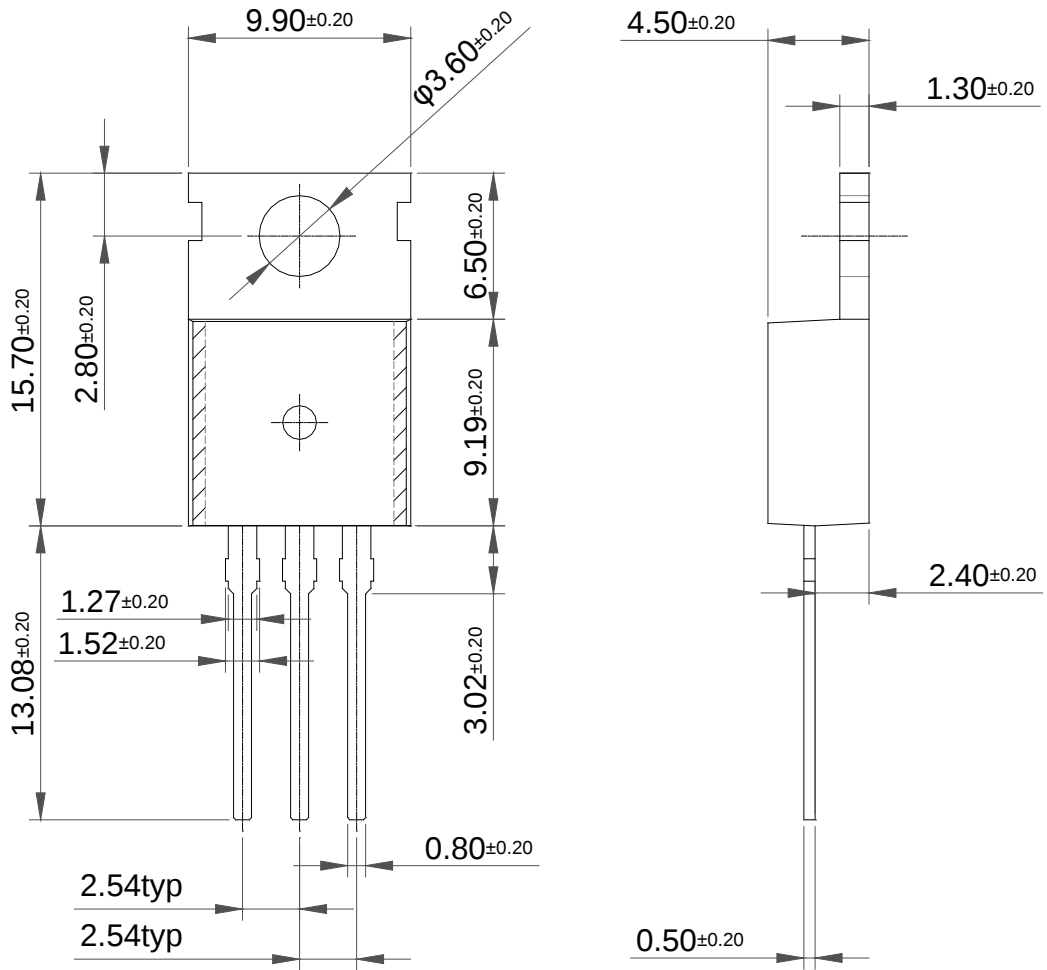


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



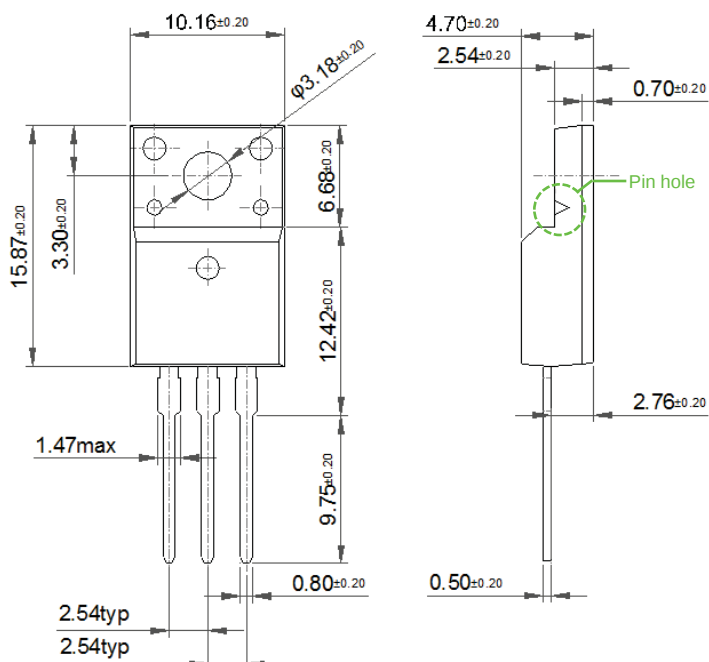
Package Dimension

TO-220



Package Dimension

TO-220F



TO-220F-FM

