Oct 2016

SemiHow
Know-How for Semiconductor

HFP50N06A / HFS50N06A

60V N-Channel MOSFET

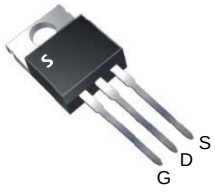
Features

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

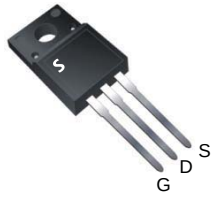
Key Parameters

Parameter	Value	Unit
BV_{DSS}	60	V
I_D	50	A
$R_{DS(on),\ Typ}$	18	mΩ
$Qg_{,\ Typ}$	27	nC

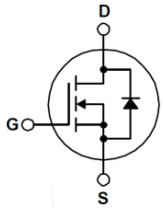
HFP50N06A
TO-220



HFS50N06A
TO-220F



Symbol



Absolute Maximum Ratings T_C=25℃ unless otherwise specified

Symbol	Parameter		TO-220	TO-220F	Unit
V_{DSS}	Drain-Source Voltage		60		V
I_D	Drain Current – Continuous (T_C = 25℃)		50.0	50.0 *	A
	Drain Current – Continuous (T_C = 100℃)		30.4	30.4 *	A
I_{DM}	Drain Current – Pulsed	(Note 1)	200	200 *	A
V_{GS}	Gate-Source Voltage		±25		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	490		mJ
I_{AR}	Avalanche Current	(Note 1)	50		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	12		mJ
P_D	Power Dissipation (T_C = 25℃)		120	48	W
	- Derate above 25℃		0.8	0.32	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175		℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		℃

* 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.	1.24	3.1	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	--	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	℃/W

Electrical Characteristics T_J=25℃ 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 = 25 A	--	18	22	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 25 V I_D = 25 A	--	22	--	S
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	60	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 60 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 48 V, T_C = 125℃	--	--	10	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS} = ±25 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	--	1290	1675	pF
C_{oss}	Output Capacitance		--	445	580	pF
C_{rss}	Reverse Transfer Capacitance		--	84	110	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	V_{DS} = 30 V, I_D = 25 A, R_G = 25 Ω (Note 4,5)	--	15	40	ns
t_r	Turn-On Rise Time		--	105	220	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	180	ns
t_f	Turn-Off Fall Time		--	85	180	ns
Q_g	Total Gate Charge	V_{DS} = 48 V, I_D = 25 A, V_{GS} = 10 V (Note 4,5)	--	27	34	nC
Q_{gs}	Gate-Source Charge		--	5.0	--	nC
Q_{gd}	Gate-Drain Charge		--	10.2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	50	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	200	
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 50 A	--	--	1.5	V
trr	Reverse Recovery Time	V_{GS} = 0 V, I_S = 50 A, di_F/dt = 100 A/μs	--	45	--	ns
Qrr	Reverse Recovery Charge		--	70	--	μC

Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=230μH, I_{AS}=50A, V_{DD}=25V, R_G=25Ω, Starting T_J =25°C
3. I_{SD}≤50A, di/dt≤300A/μs, V_{DD}≤BV_{DSS} , Starting T_J =25 °C
4. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature

Typical Characteristics

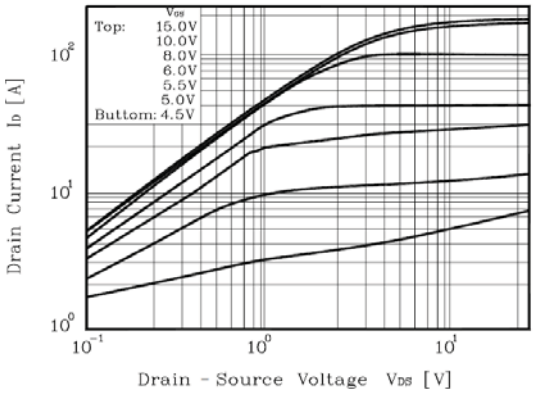


Figure 1. On Region Characteristics

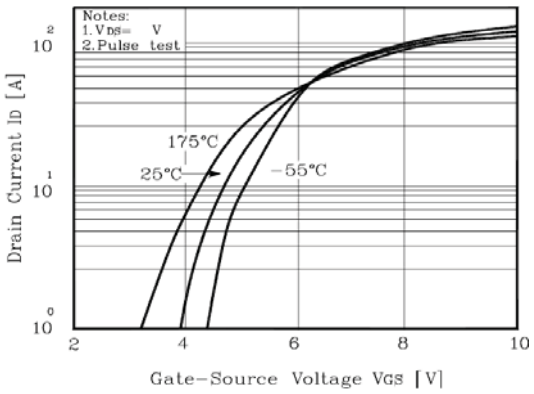


Figure 2. Transfer Characteristics

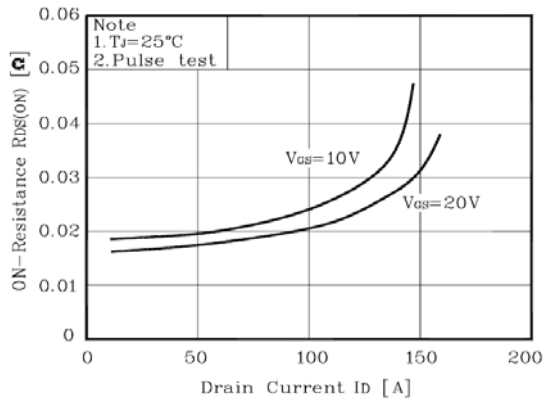


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

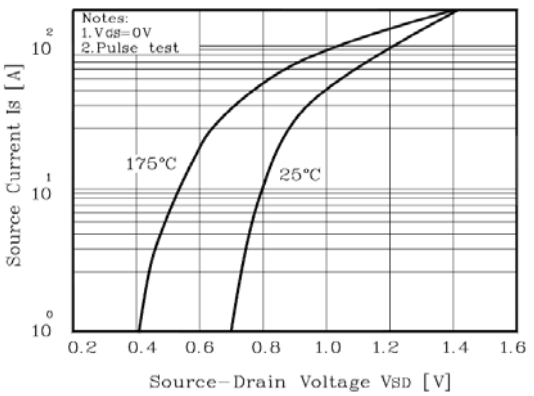


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

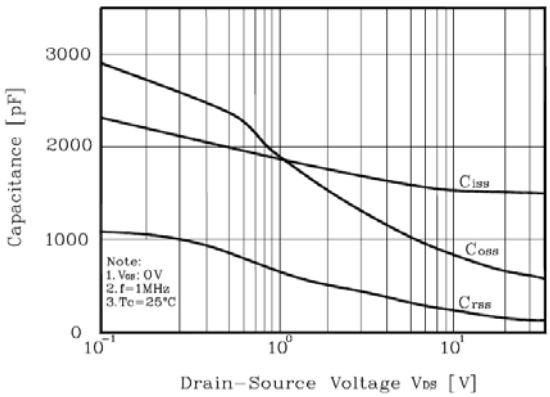


Figure 5. Capacitance Characteristics

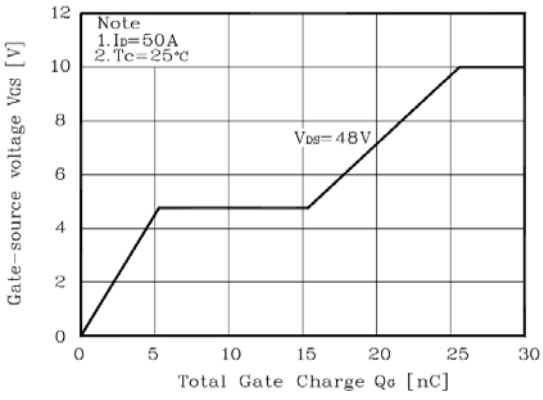


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

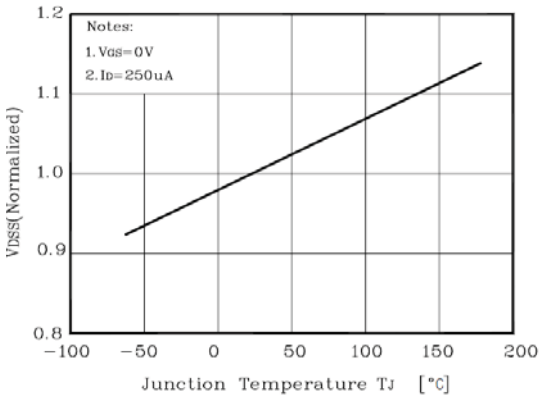


Figure 7. Breakdown Voltage Variation vs Temperature

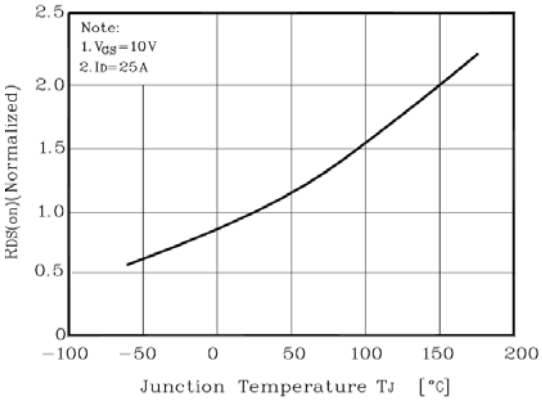


Figure 8. On-Resistance Variation vs Temperature

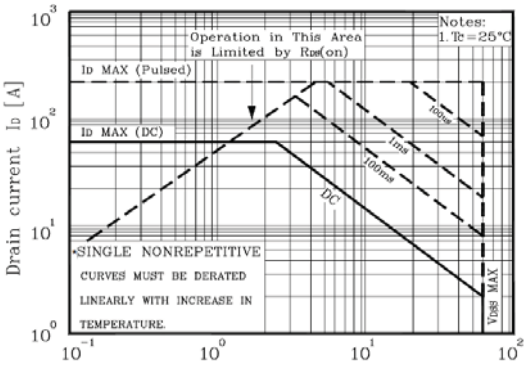


Figure 9-1. Maximum Safe Operating Area for TO-220

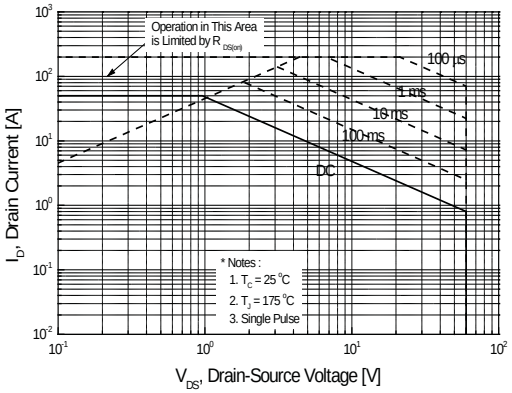


Figure 9-2. Maximum Safe Operating Area for TO-220F

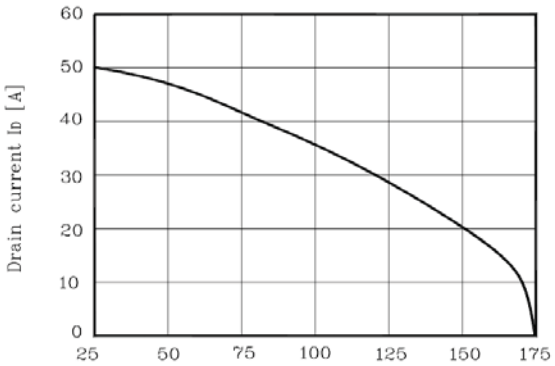


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

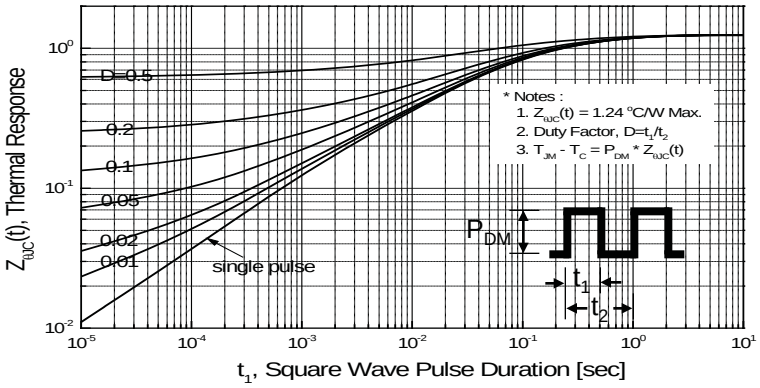


Figure 11-1. Transient Thermal Response Curve for TO-220

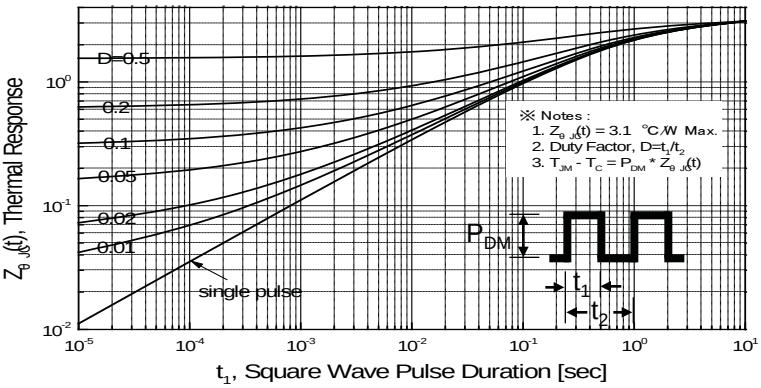


Figure 11-2. Transient Thermal Response Curve for TO-220F

Fig 12. Gate Charge Test Circuit & Waveform

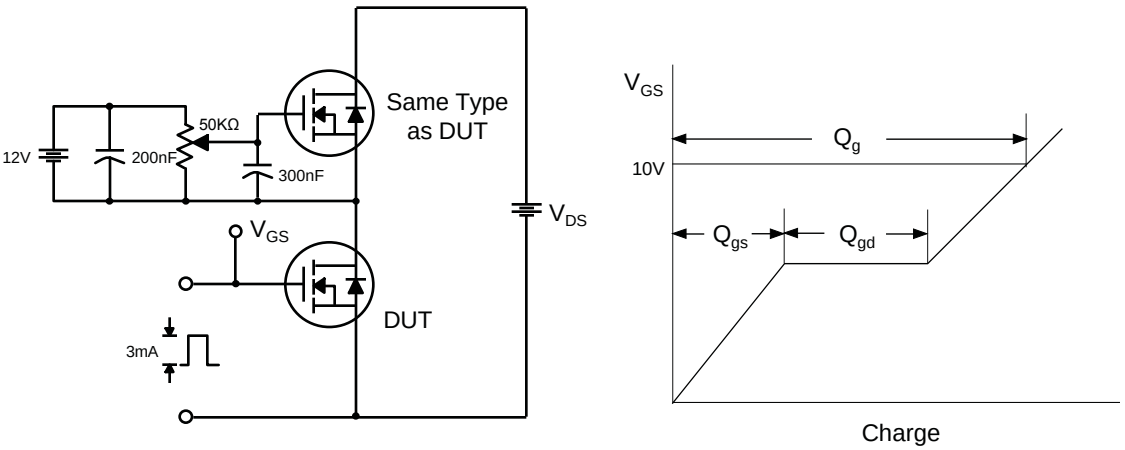


Fig 13. Resistive Switching Test Circuit & Waveforms

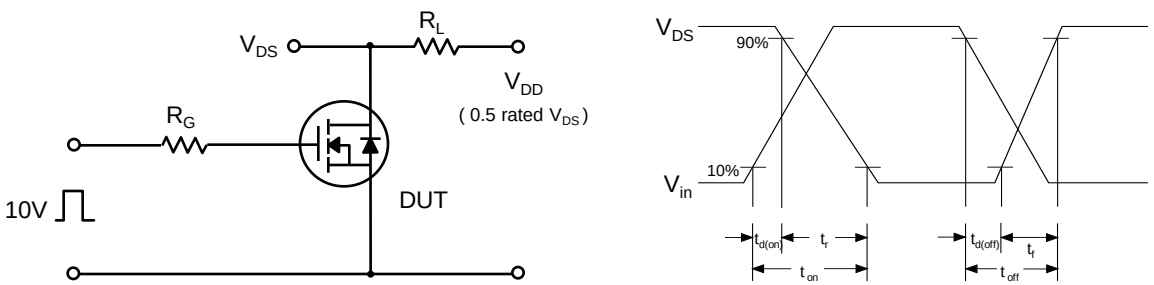


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

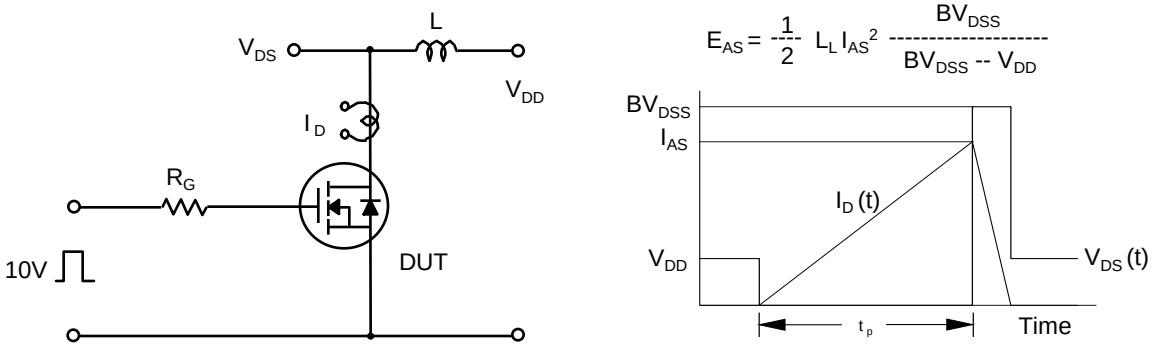
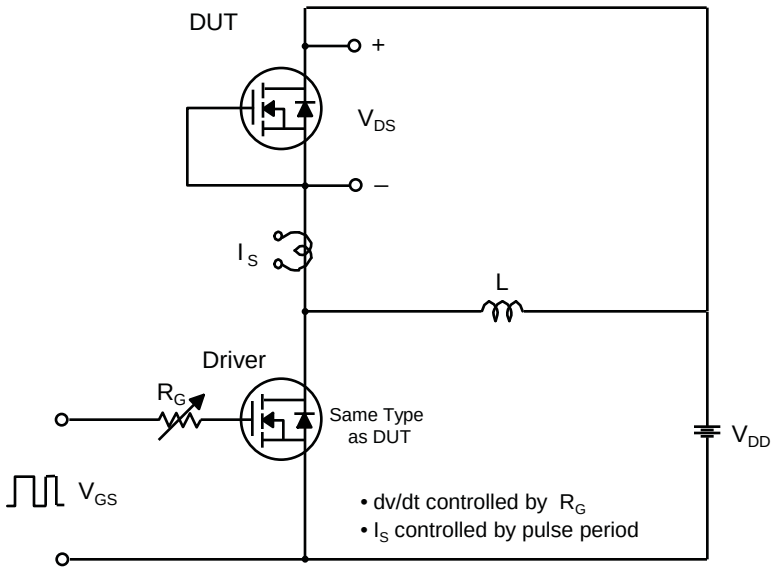
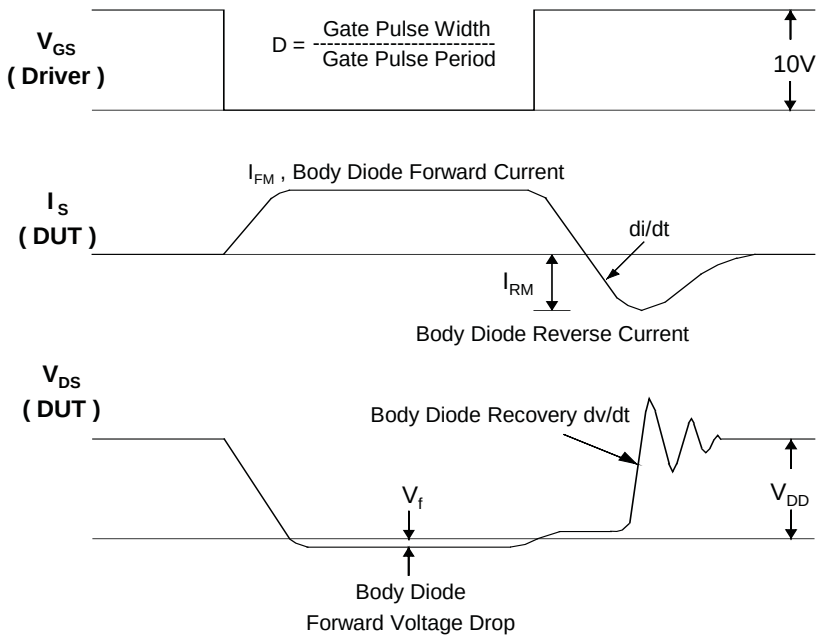


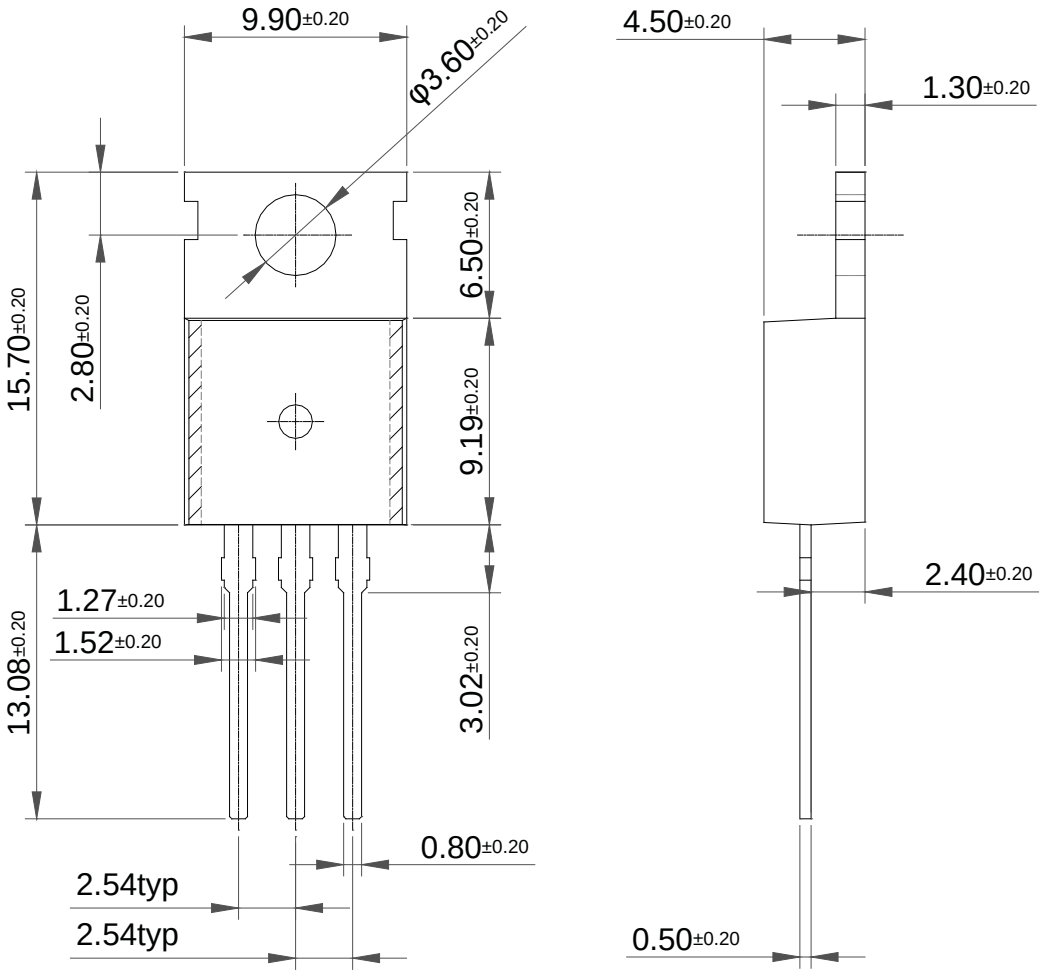
Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





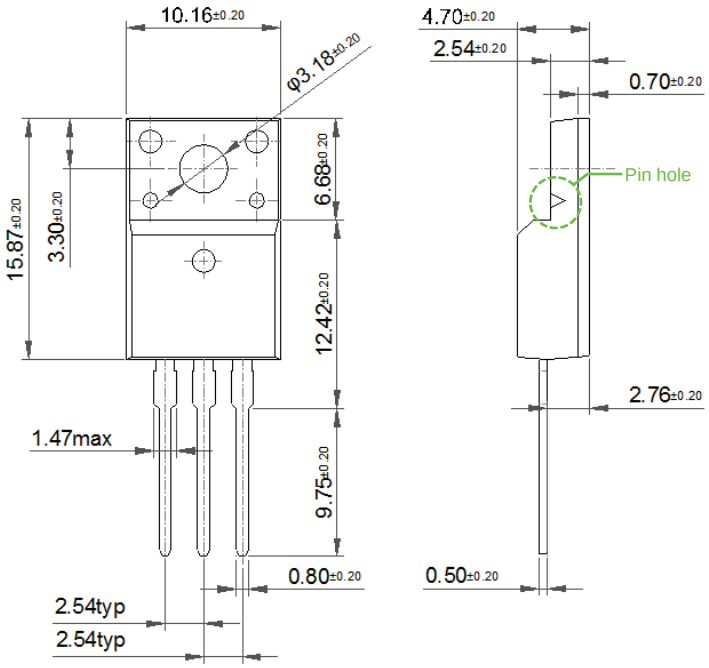
Package Dimension

TO-220



Package Dimension

TO-220F



TO-220F-FM