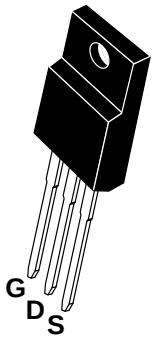
First Semiconductor

FIR9N50FG

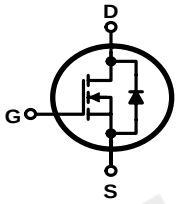
N-Channel Power MOSFET

V_{DSS}	500	V
I_D	9	A
P_D (T_C=25℃)	130	W
$R_{DS(ON)}$	0.68	Ω

PIN Connection TO-220F



Schematic diagram



Features

- **Fast Switching**
- **Low ON Resistance(Rdson 0.85Ω)**
- **Low Gate Charge (Typical Data:13nC)**
- **Low Reverse transfer capacitances(Typical:12pF)**
- **100% Single Pulse avalanche energy Test**

Applications

Power switch circuit of adaptor and charger.

Marking Diagram

Y = Year
A = Assembly Location
WW = Work Week
FIR9N50F = Specific Device Code

Absolute（Tc= 25℃ unless otherwise specified）

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	500	V
I_D	Continuous Drain Current	9	A
	Continuous Drain Current T_C = 100 °C	5	A
I_{DM} [a1]	Pulsed Drain Current	32	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS} [a2]	Single Pulse Avalanche Energy	510	mJ
E_{AR} [a1]	Avalanche Energy ,Repetitive	60	mJ
I_{AR} [a1]	Avalanche Current	11.1	A
dv/dt [a3]	Peak Diode Recovery dv/dt	5	V/ns
P_D	Power Dissipation	130	W
	Derating Factor above 25°C	1.04	W/℃
T_J， T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃
T_L	MaximumTemperature for Soldering	300	℃

Electrical Characteristics（Tc= 25℃ unless otherwise specified）

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	500	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.74	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 500V, V_{GS}= 0V, T_a = 25℃	--	--	1.0	μA
		V_{DS} =400V, V_{GS}= 0V, T_a = 125℃	--	--	±1.0	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS} =+30V	--	--	±100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-30V	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=10V,I_D=4.0A	--	0.68	0.85	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2.0	--	4.0	V
Pulse width tp≤380μs, δ ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g_{fs}	Forward Transconductance	V_{DS}=50V, I_D =4.0A	--	3	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	904	--	pF
C_{oss}	Output Capacitance		--	120	--	
C_{rss}	Reverse Transfer Capacitance		--	2.69	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =9.0A V_{DD} = 250V V_{GS} = 10V R_G = 25Ω	--	29.2	--	ns
tr	Rise Time		--	59.6	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	41.3	--	
t_f	Fall Time		--	29.2	--	
Q_g	Total Gate Charge	I_D =9.0A V_{DD} =400V V_{GS} = 10V	--	14.7	--	nC
Q_{gs}	Gate to Source Charge		--	5.6	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	4.4	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	9	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	32	A
V_{SD}	Diode Forward Voltage	I_S=9.0A,V_{GS}=0V	--	--	1.4	V
trr	Reverse Recovery Time	I_S=9.0A,T_j = 25° C dI_F/dt=100A/us, V_{GS}=0V	--	25	--	ns
Qrr	Reverse Recovery Charge		--	2.0	--	nC
I_{RRM}	Reverse Recovery Current		--	8.0	--	A
Pulse width tp≤380μs, δ ≤2%						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	0.96	℃/W
$R_{\theta JA}$	Junction-to-Ambient	120	℃/W

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=10.0mH, I_D=8A, Start T_J=25℃
[a3]: I_{SD} =8A,di/dt ≤100A/us,V_{DD}≤BV_{DS}, Start T_J=25℃

Typical Characteristics

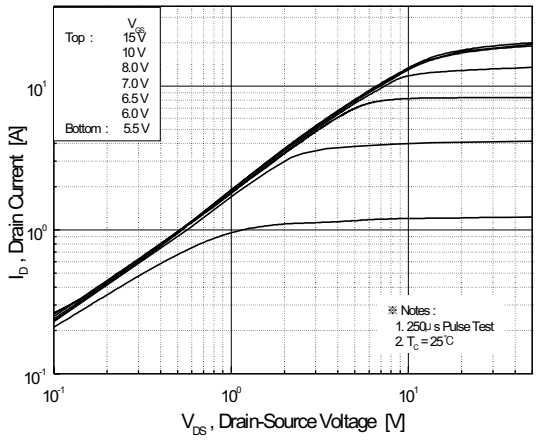


Figure 1. On-Region Characteristics

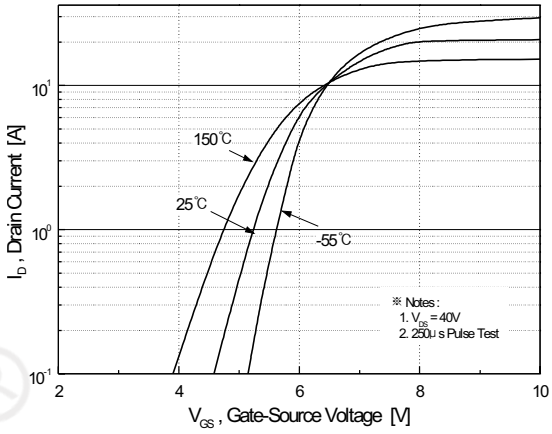


Figure 2. Transfer Characteristics

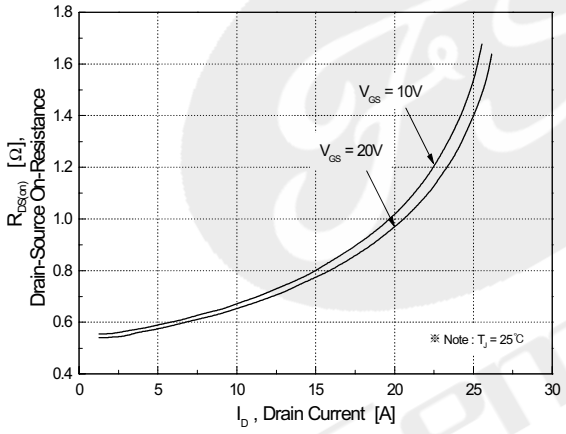


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

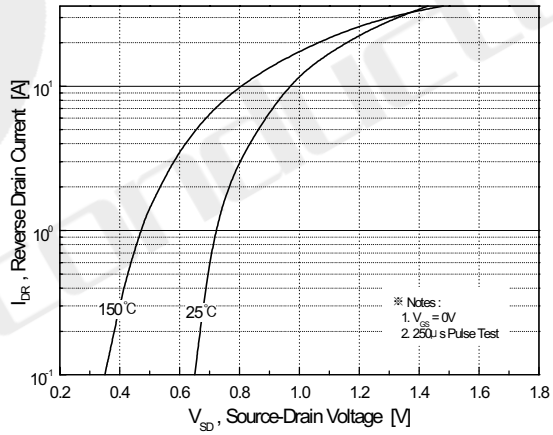


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

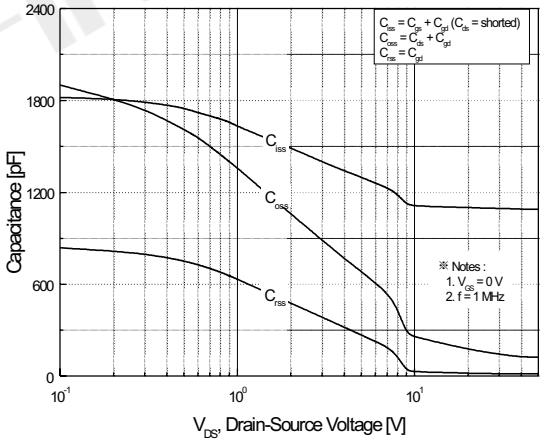


Figure 5. Capacitance Characteristics

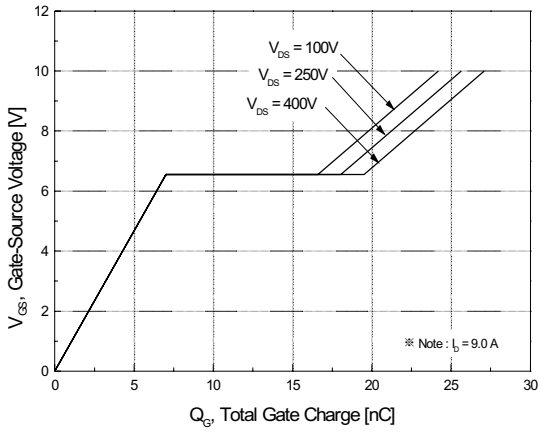


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

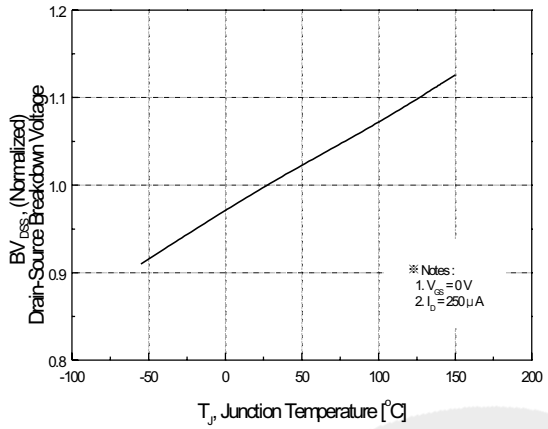


Figure 7. Breakdown Voltage Variation vs. Temperature

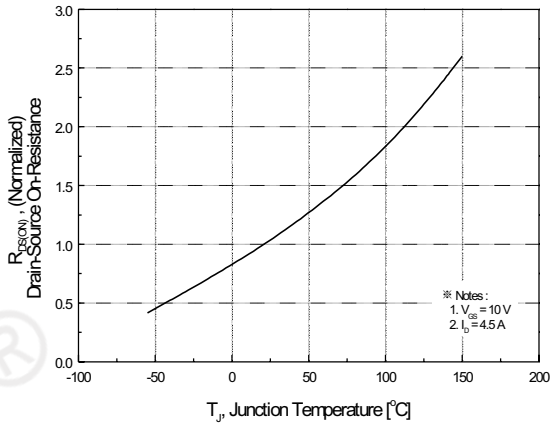


Figure 8. On-Resistance Variation vs. Temperature

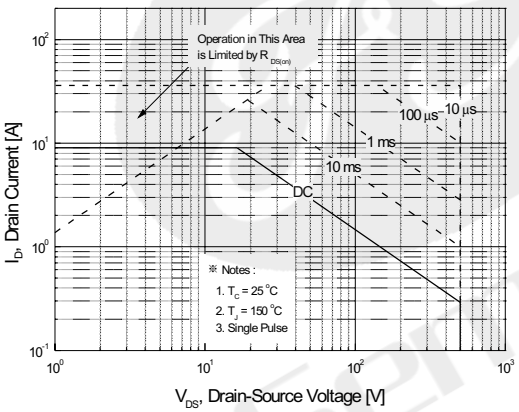


Figure 9. Maximum Safe Operating Area

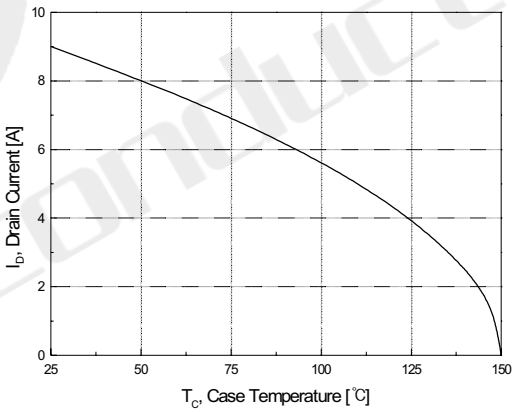


Figure 10. Maximum Drain Current vs. Case Temperature

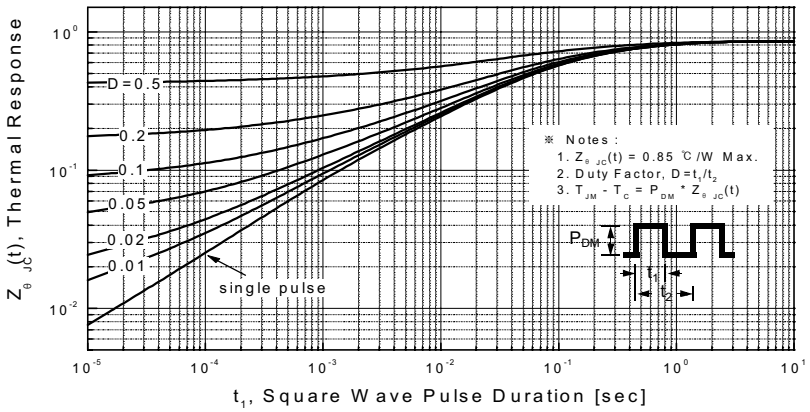
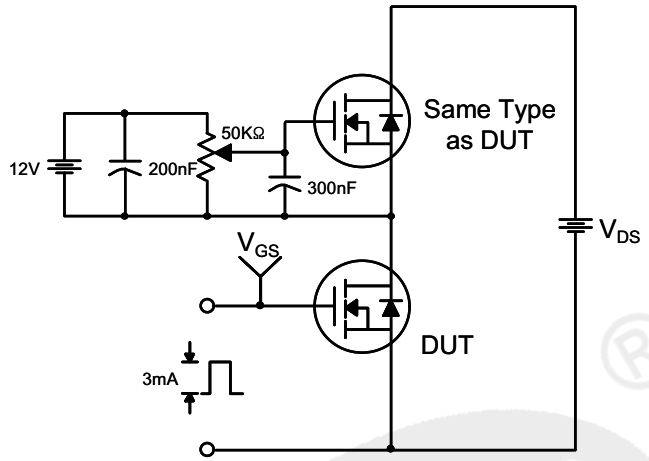
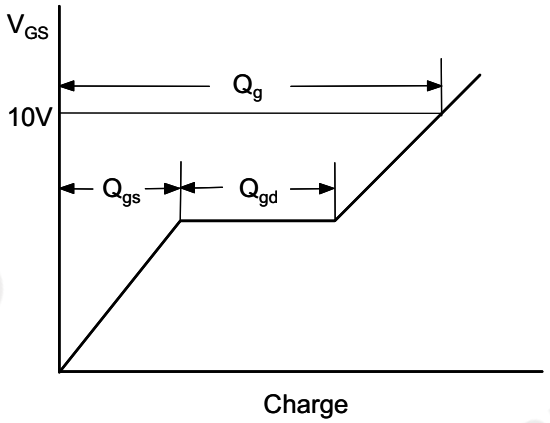


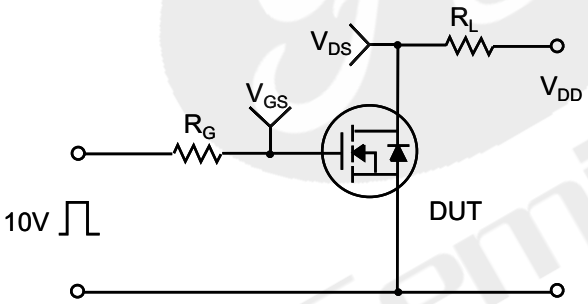
Figure 11. Transient Thermal Response Curve

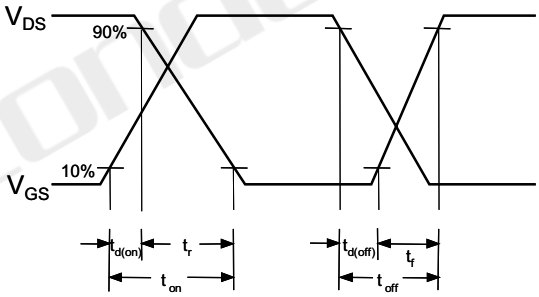
Gate Charge Test Circuit & Waveform



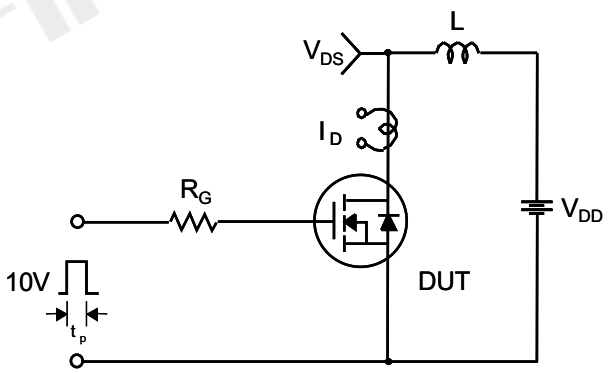


Resistive Switching Test Circuit & Waveforms

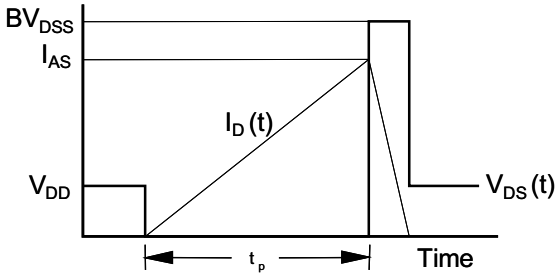




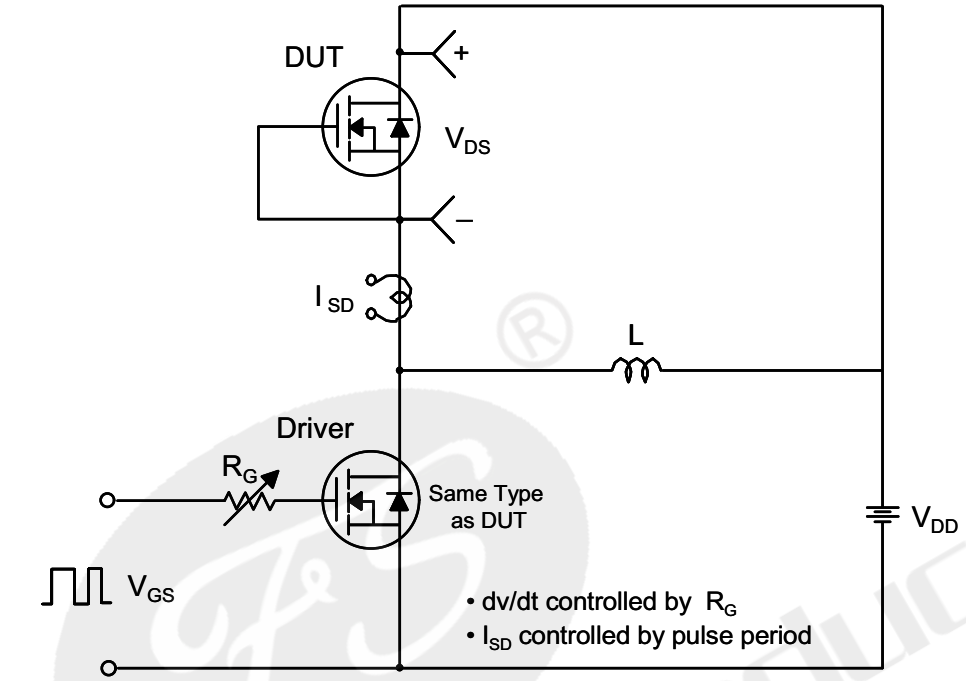
Unclamped Inductive Switching Test Circuit & Waveforms

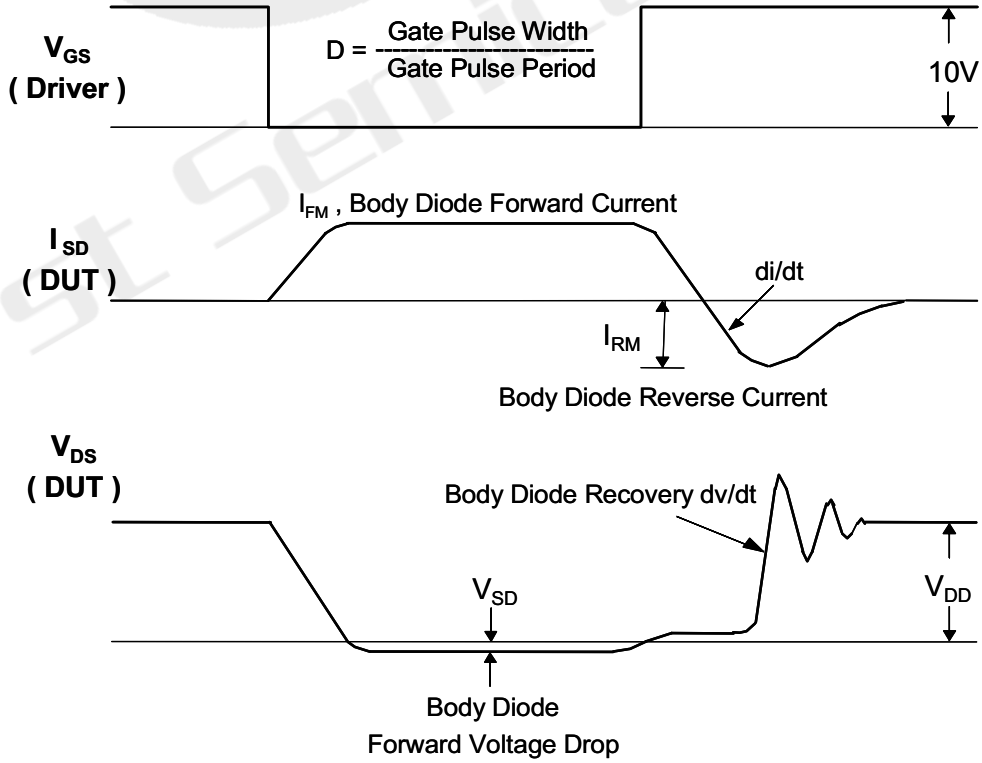


$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



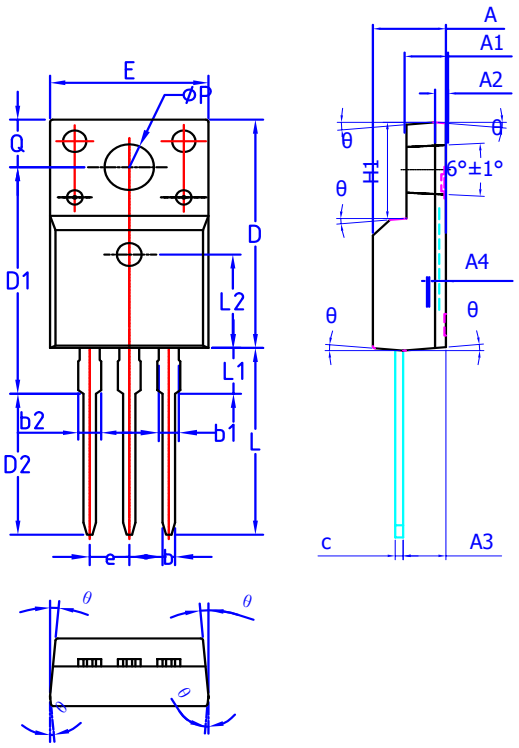
Peak Diode Recovery dv/dt Test Circuit & Waveforms

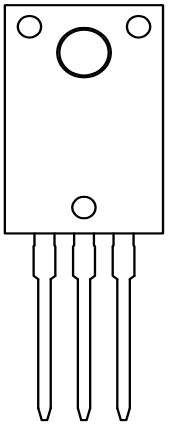




Package Dimensions

TO-220F





Units: mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2		0.70 REF	
A3	2.56	2.76	2.96
b	0.70	0.80	0.90
b1	1.17	1.2	1.25
b2	1.17	1.2	1.25
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	10.0	10.2	10.4
E	9.96	10.16	10.36
e		2.54BSC	
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2		6.50REF	
ΦP	3.08	3.18	3.28
Q	3.20	3.30	3.40
θ1	1°	3°	5°
A4	0.53	0.56	0.59

Declaration

- FIRST reserves the right to change the specifications, the same specifications of products due to different packaging line mold, the size of the appearance will be slightly different, shipped in kind, without notice! Customers should obtain the latest version information before ordering, and verify whether the relevant information is complete and up-to-date.
- Any semiconductor product under certain conditions has the possibility of failure or failure,The buyer has the responsibility to comply with safety standards and take safety measures when using FIRST products for system design and manufacturing,To avoid To avoid potential failure risks, which may cause personal injury or property damage!
- Product promotion endless, our company will wholeheartedly provide customers with better products!

ATTACHMENT

Revision History

Date	REV	Description	Page
2018.01.01	1.0	Initial release	