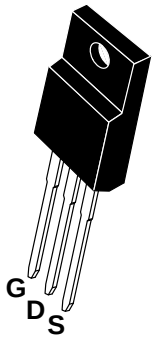
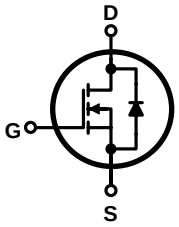
FIR12N60FG

Silicon N-Channel Power MOSFET

V_{DSS}	600	V
I_D	12	A
P_D (T_C=25℃)	140	W
$R_{DS(ON)}$	0.55	Ω

PIN Connection TO-220F





Features

- **Fast Switching**
- **ESD Improved Capability**
- **Low Gate Charge (Typical Data:58nC)**
- **Low Reverse transfer capacitances(Typical:90pF)**
- **100% Single Pulse avalanche energy Test**

Applications

Power switch circuit of adaptor and charger.

Marking Diagram

Y = Year
A = Assembly Location
WW = Work Week
FIR12N60F = Specific Device Code

Absolute（Tc= 25℃ unless otherwise specified）

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	600	V
I_D	Continuous Drain Current	12	A
	Continuous Drain Current T_C = 100 °C	7.2	A
I_{DM} [a1]	Pulsed Drain Current	48	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS} [a2]	Single Pulse Avalanche Energy	320	mJ
E_{AR} [a1]	Avalanche Energy ,Repetitive	33	mJ
I_{AR} [a1]	Avalanche Current	8.0	A
dv/dt [a3]	Peak Diode Recovery dv/dt	5.5	V/ns
P_D	Power Dissipation	140	W
	Derating Factor above 25°C	1.1	W/℃
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5kΩ)	4000	V
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	600	--	--	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} = 600V, V_{GS}= 0V, T_a = 25℃	--	--	25	μA
		V_{DS} =480V, V_{GS}= 0V, T_a = 125℃	--	--	250	
V_{GSO}	Gate Source Breakdown Voltage	I_{GS}= ±1mA (Open Drain)	±20			V
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS} =+20V	--	--	10	μA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-20V	--	--	-10	μA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=10V,I_D=6A	--	0.55	0.75	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2.0	3.0	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}=15V, I_D =6.0A	--	9.2	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	1730	--	pF
C_{oss}	Output Capacitance		--	180	--	
C_{rss}	Reverse Transfer Capacitance		--	90	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =12.0A V_{DD} = 300V V_{GS} = 10V R_G = 4.7Ω	--	20	--	ns
tr	Rise Time		--	28	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	55	--	
t_f	Fall Time		--	30	--	
Q_g	Total Gate Charge	I_D =12.0A V_{DD} =480V V_{GS} = 10V	--	58	65	nC
Q_{gs}	Gate to Source Charge		--	14	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	32	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	12	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	48	A
V_{SD}	Diode Forward Voltage	I_S=12.0A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=12.0A,T_j = 25° C dI_F/dt=100A/us, V_{GS}=0V	--	600	--	ns
Qrr	Reverse Recovery Charge		--	4.3	--	nC
I_{RRM}	Reverse Recovery Current		--	15	--	A
Pulse width tp≤380μs, δ ≤2%						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	0.89	℃/W
$R_{\theta JA}$	Junction-to-Ambient	100	℃/W

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=10.0mH, I_D=12A, Start T_J=25℃
[a3]: I_{SD}=12A,di/dt ≤100A/us,V_{DD}≤$BV_{DS,}$ Start T_J=25℃

Electrical Characteristics Curves

Fig. 1 I_D - V_{DS}

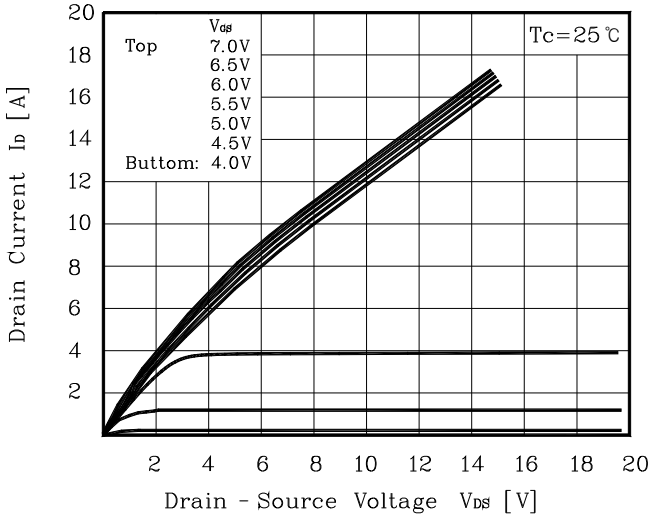


Fig. 2 I_D – V_{GS}

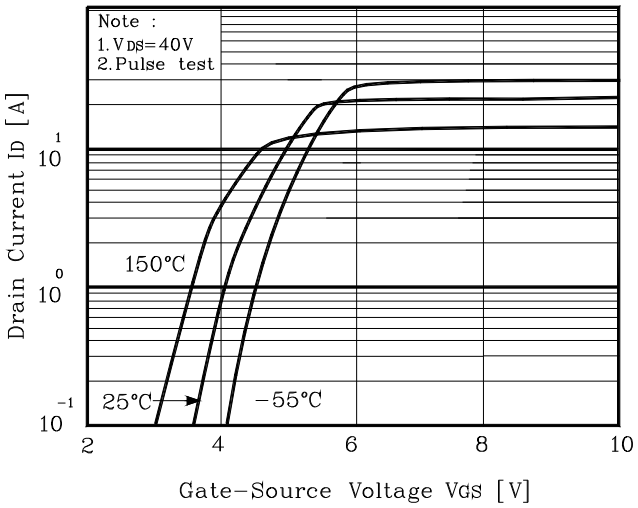


Fig. 3 $R_{DS(ON)}$ - I_D

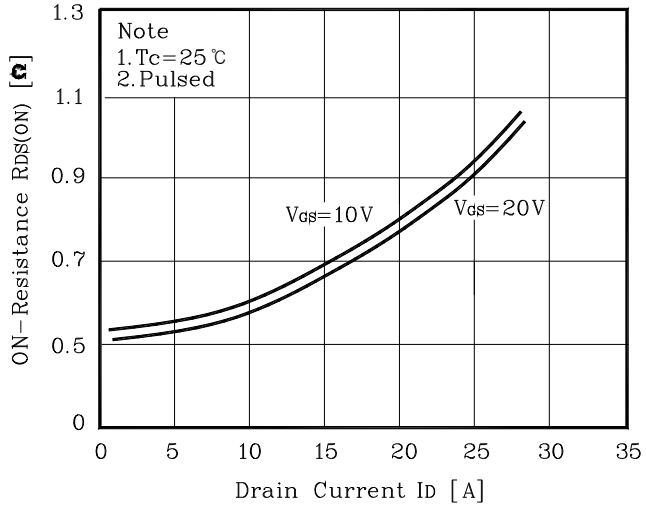


Fig. 4 I_S - V_{SD}

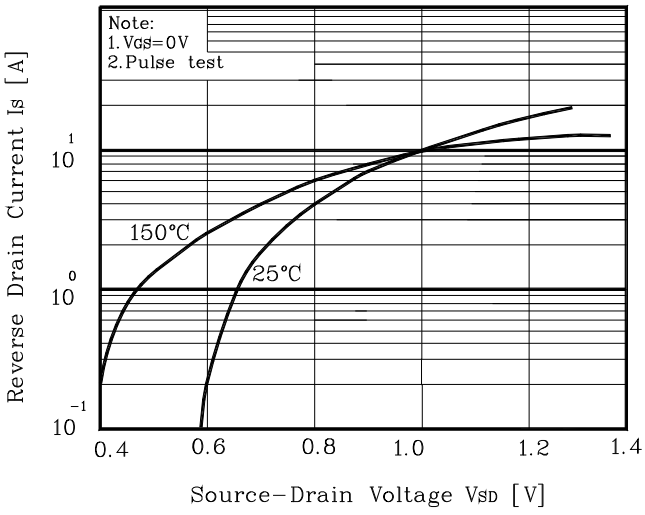


Fig. 5 Capacitance - V_{DS}

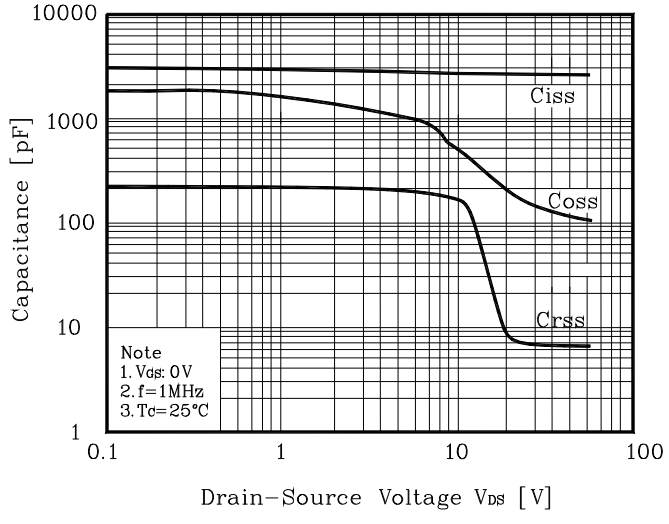
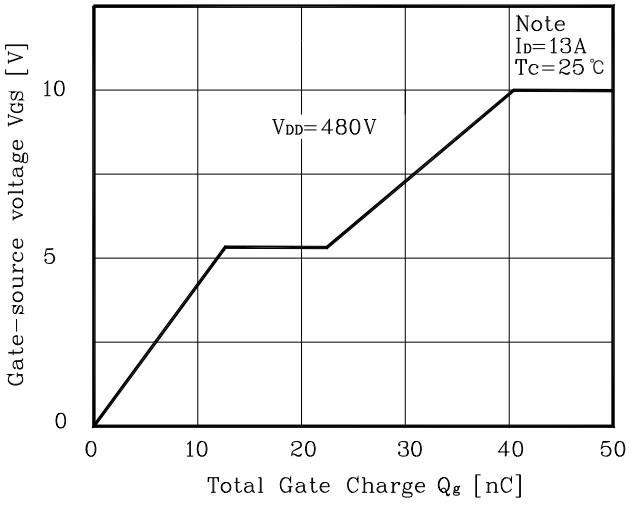


Fig. 6 V_{GS} - Q_G



Electrical Characteristics Curves (Continue)

Fig. 7 BV_{DSS} - T_J

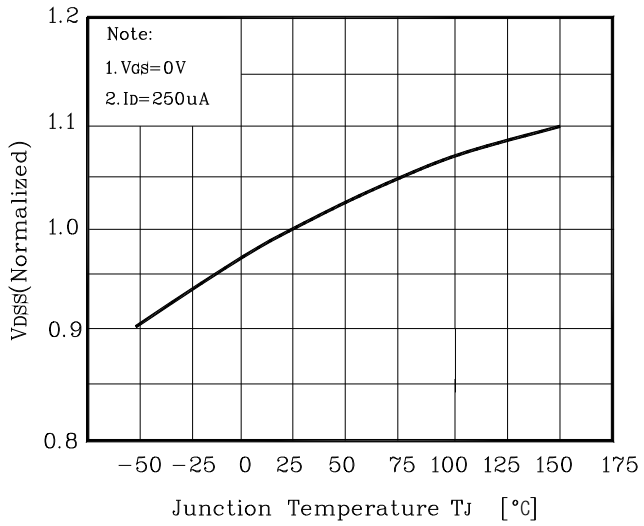


Fig. 8 $R_{DS(ON)}$ - T_J

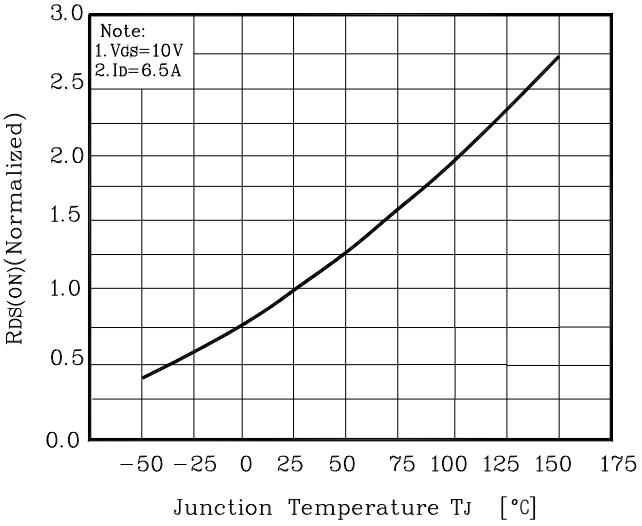


Fig. 9 I_D - T_C

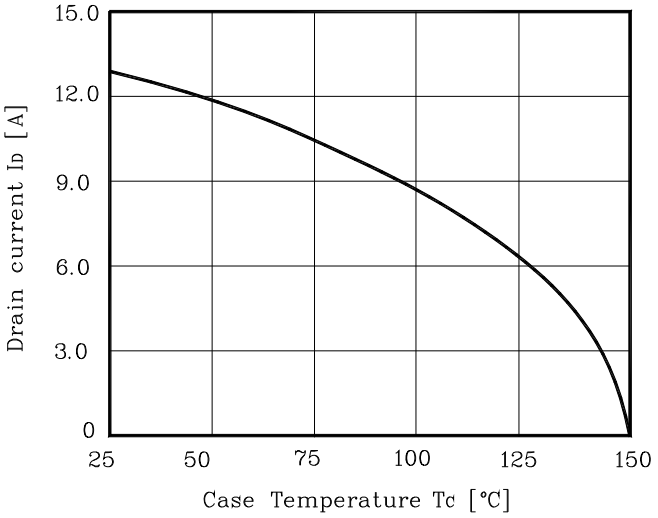


Fig. 10 Safe Operating Area

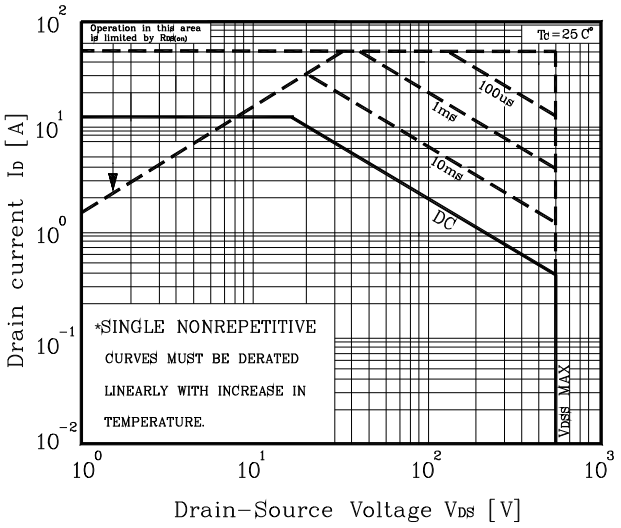


Fig. 11 Gate Charge Test Circuit & Waveform

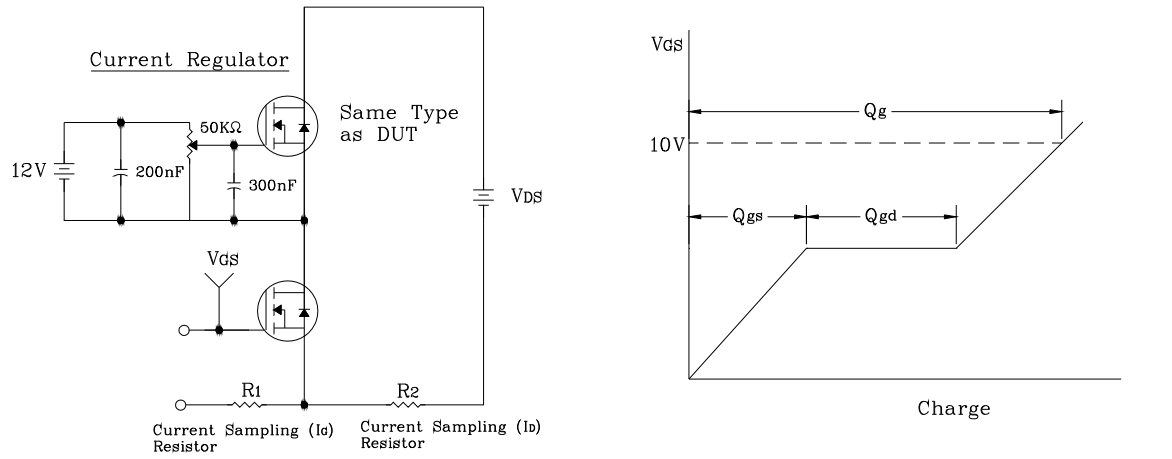


Fig. 12 Resistive Switching Test Circuit & Waveform

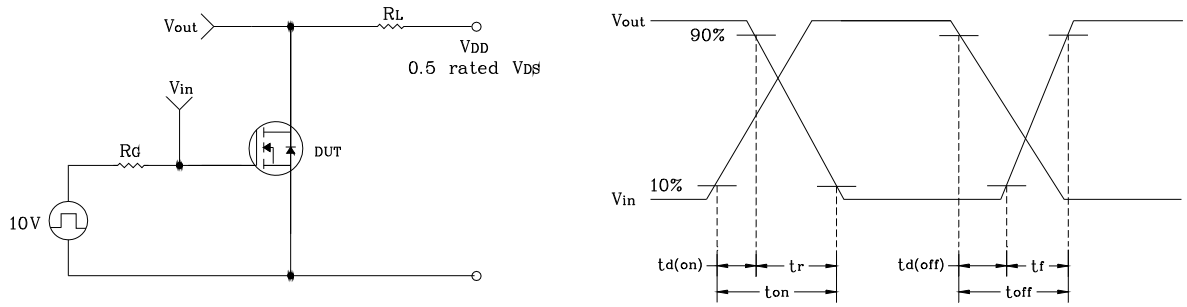


Fig. 13 E_{AS} Test Circuit & Waveform

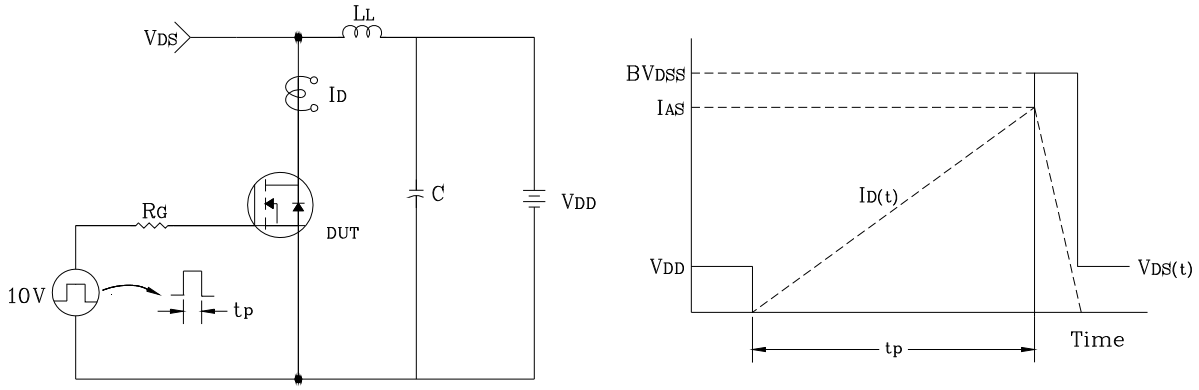
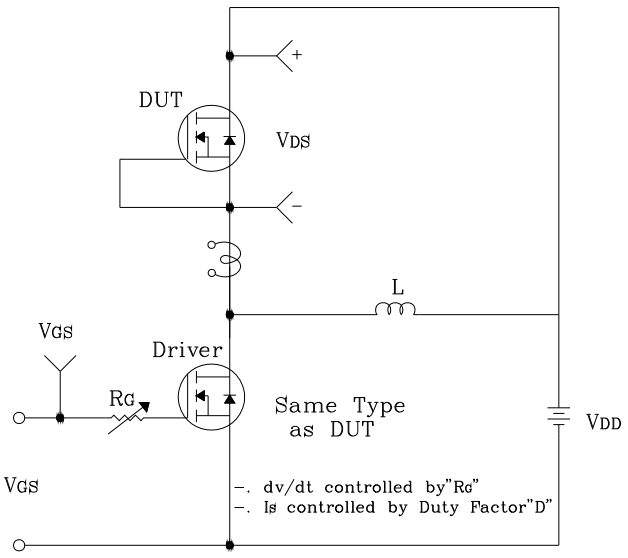
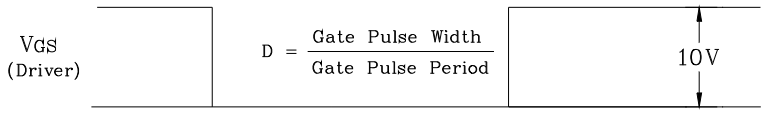
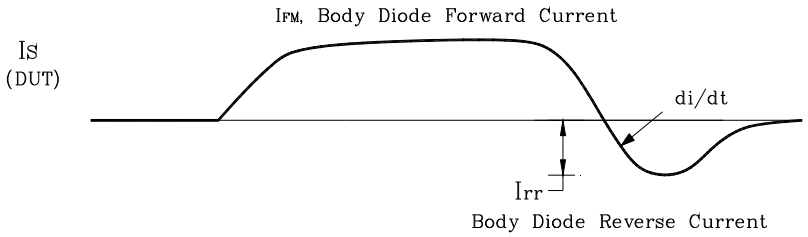
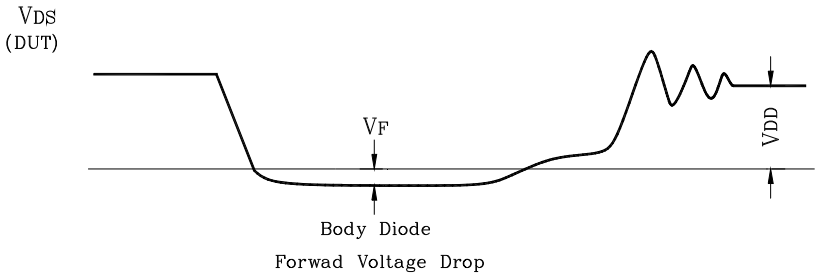


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



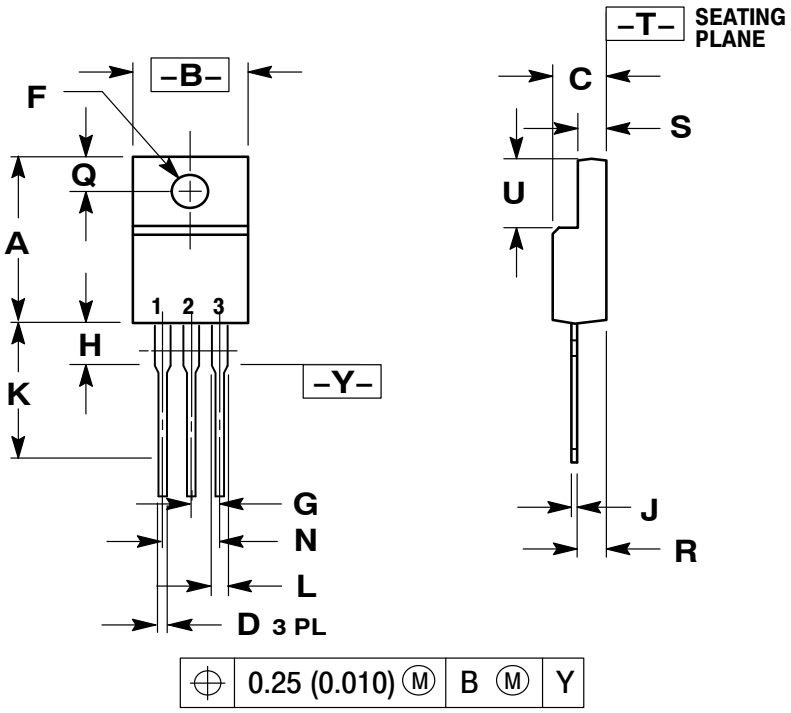






Package Dimensions

TO-220F



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88