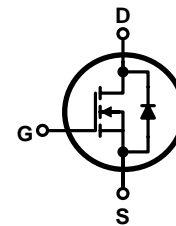
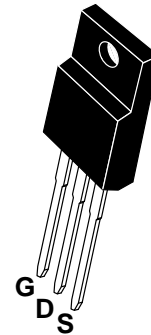


PIN Connection TO-220F

V_{DSS}	600	V
I_D	10	A
$P_D (T_C=25^\circ C)$	125	W
$R_{DS(ON)}$	0.63	Ω



Marking Diagram



Y = Year
 A = Assembly Location
 WW = Work Week
 FIR10N60F = Specific Device Code

Features

- Fast Switching
- ESD Improved Capability
- Low Gate Charge (Typical Data:60nC)
- Low Reverse transfer capacitances(Typical:28pF)
- 100% Single Pulse avalanche energy Test

Applications

Power switch circuit of adaptor and charger.

Absolute (Tc= 25°C unless otherwise specified)

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	600	V
I_D	Continuous Drain Current	10	A
	Continuous Drain Current $T_C = 100^\circ C$	6.4	A
I_{DM}^{a1}	Pulsed Drain Current	40	A
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}^{a2}	Single Pulse Avalanche Energy	300	mJ
E_{AR}^{a1}	Avalanche Energy ,Repetitive	30	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	125	W
	Derating Factor above 25°C	1.0	W/°C
$V_{ESD(G-S)}$	Gate source ESD (HBM-C= 100pF, R=1.5k Ω)	4000	V
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, -55 to 150	°C
T_L	Maximum Temperature for Soldering	300	°C

Electrical Characteristics (Tc= 25°C 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
Δ BV _{DSS} / Δ T _J	Bvdss Temperature Coefficient	I _D =250uA, Reference 25°C	--	0.74	--	V/°C
I _{DSS}	Drain to Source Leakage Current	V _{DS} = 600V, V _{GS} = 0V, T _a = 25°C	--	--	25	μA
		V _{DS} = 480V, V _{GS} = 0V, T _a = 125°C	--	--	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 =5A	--	0.63	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 =5.0A	--	8.5	--	S
C _{iss}	Input Capacitance	V _{GS} = 0V V _{DS} = 25V f = 1.0MHz	--	1430	--	pF
C _{oss}	Output Capacitance		--	160	--	
C _{rss}	Reverse Transfer Capacitance		--	28	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
t _{d(ON)}	Turn-on Delay Time	I _D = 10.0A V _{DD} = 300V V _{GS} = 10V R _G = 4.7Ω	--	20	--	ns
t _r	Rise Time		--	20	--	
t _{d(OFF)}	Turn-Off Delay Time		--	55	--	
t _f	Fall Time		--	30	--	
Q _g	Total Gate Charge	I _D = 10.0A V _{DD} = 480V V _{GS} = 10V	--	60	70	nC
Q _{gs}	Gate to Source Charge		--	12	--	
Q _{gd}	Gate to Drain ("Miller") Charge		--	28	--	

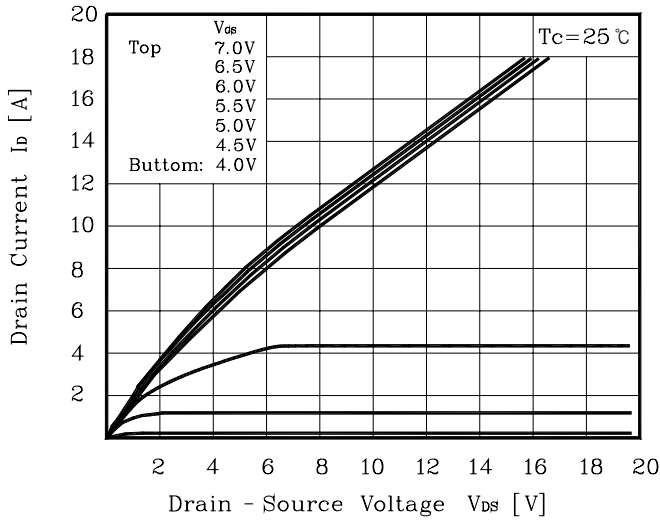
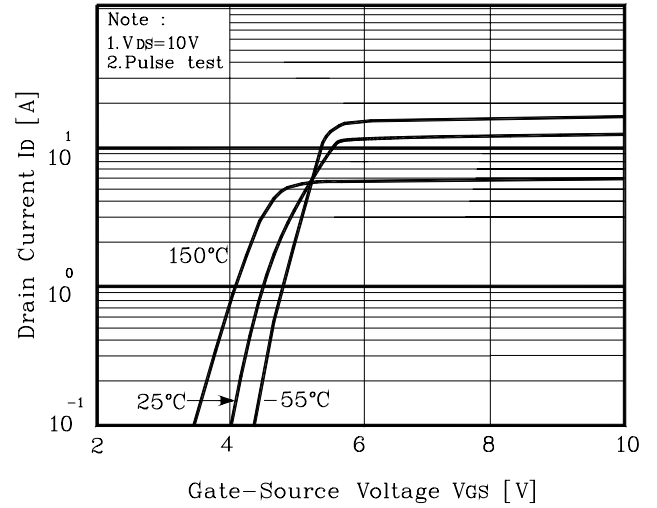
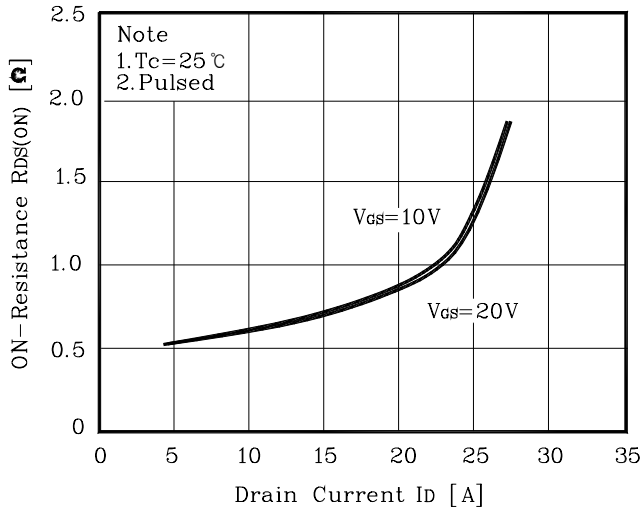
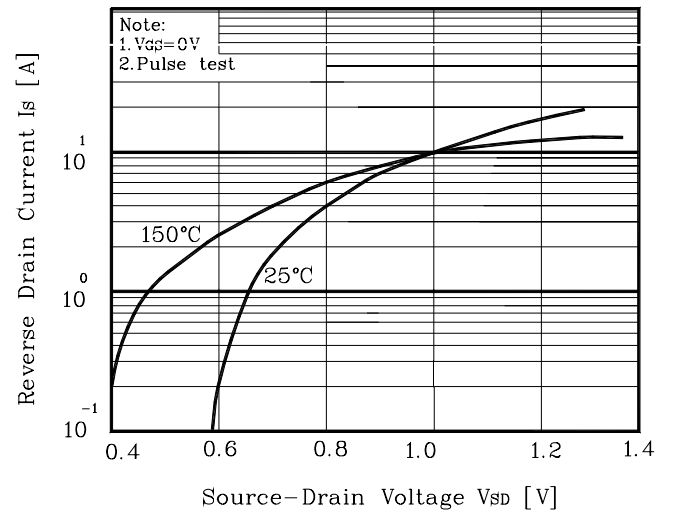
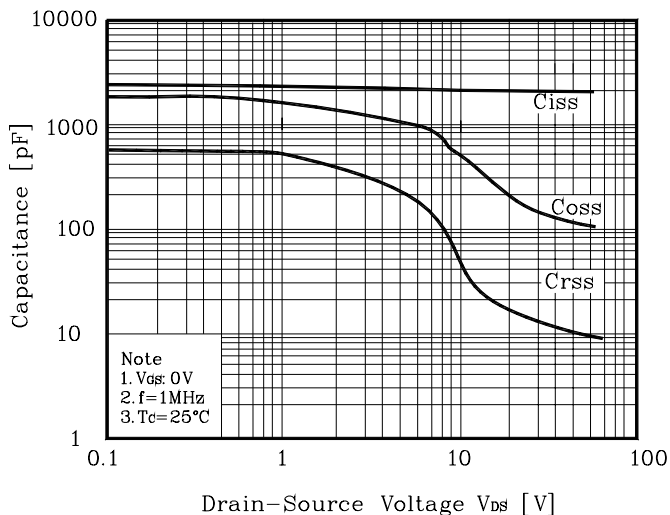
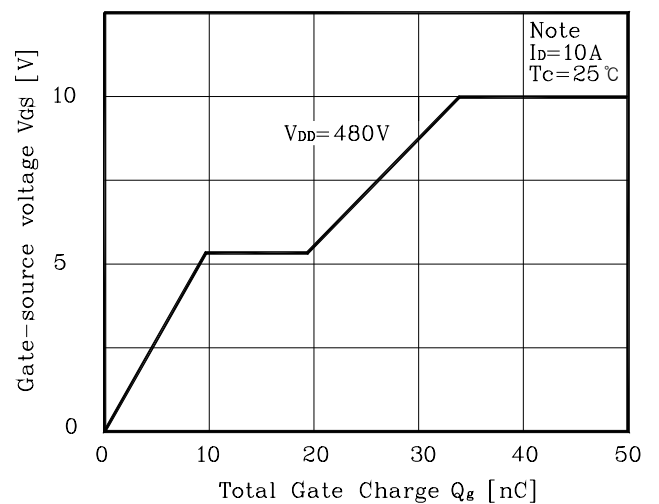
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	10	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	40	A
V_{SD}	Diode Forward Voltage	$I_S=10.0A, V_{GS}=0V$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$I_S=10.0A, T_j = 25^\circ C$ $dI_F/dt=100A/us,$ $V_{GS}=0V$	--	600	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.3	--	nC
I_{RRM}	Reverse Recovery Current		--	13	--	A
Pulse width $t_p \leq 380\mu s, \delta \leq 2\%$						

Symbol	Parameter	Typ.	Units
$R_{\theta JC}$	Junction-to-Case	1.0	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient	62	$^\circ C/W$

^{a1}: Repetitive rating; pulse width limited by maximum junction temperature

^{a2}: $L=10.0mH, I_P=10A, Start T_j=25^\circ C$

^{a3}: $I_{SD}=10A, di/dt \leq 100A/us, V_{DD} \leq BV_{DS}, Start T_j=25^\circ C$

Electrical Characteristic 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 Characteristic Curves

Fig. 7 $V_{DSS} - T_J$

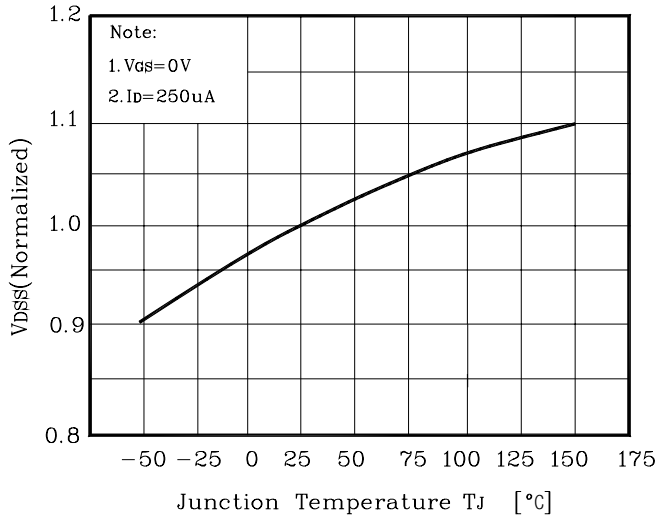


Fig.8 $R_{DS(on)} - T_J$

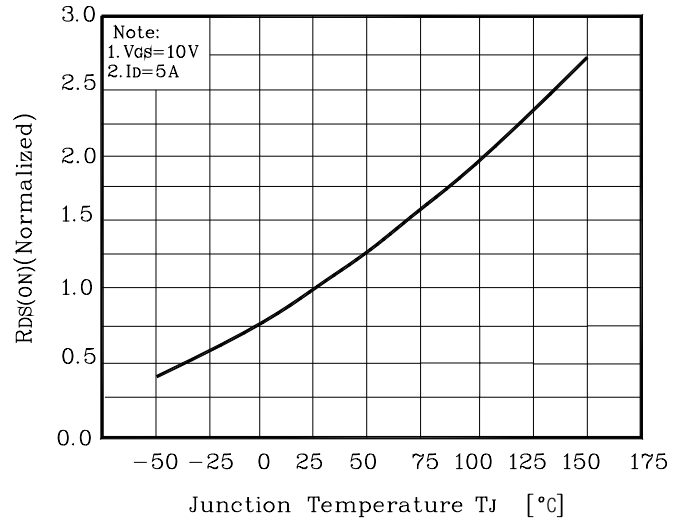


Fig. 9 $I_D - T_C$

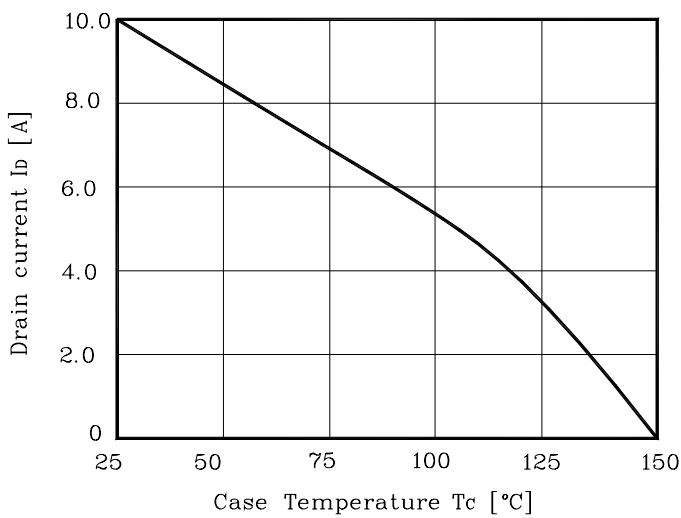


Fig. 10 Safe Operating Area

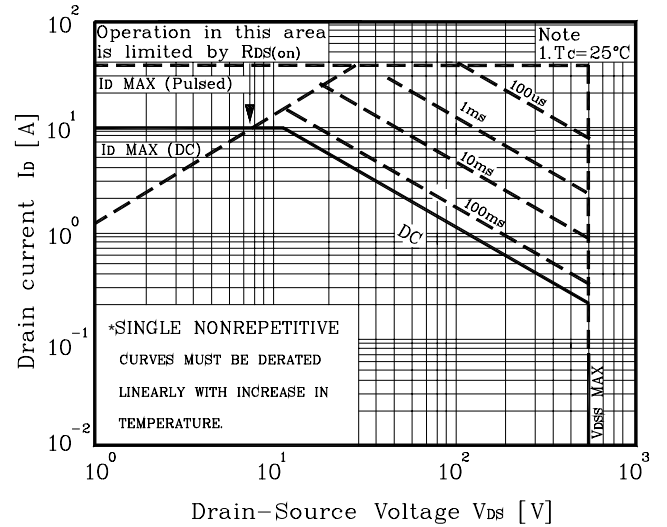


Fig. 10 Gate Charge Test Circuit & Waveform

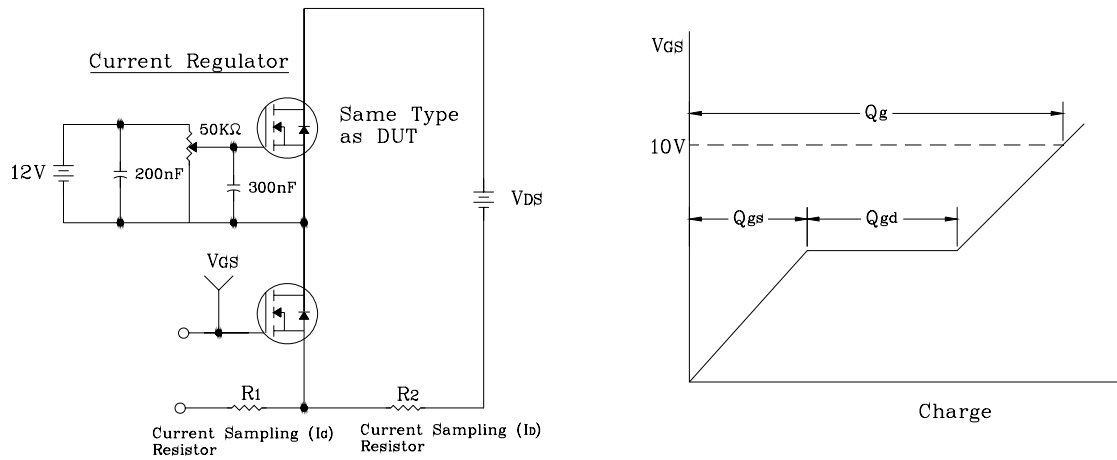


Fig. 11 Resistive Switching Test Circuit & Waveform

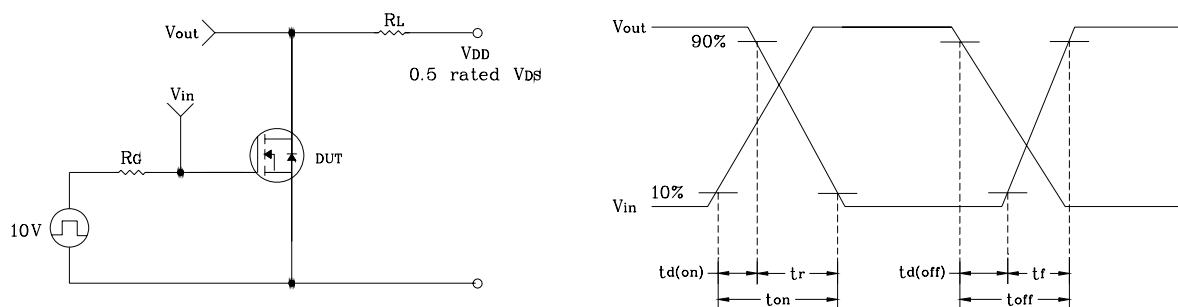


Fig. 12 EAS Test Circuit & Waveform

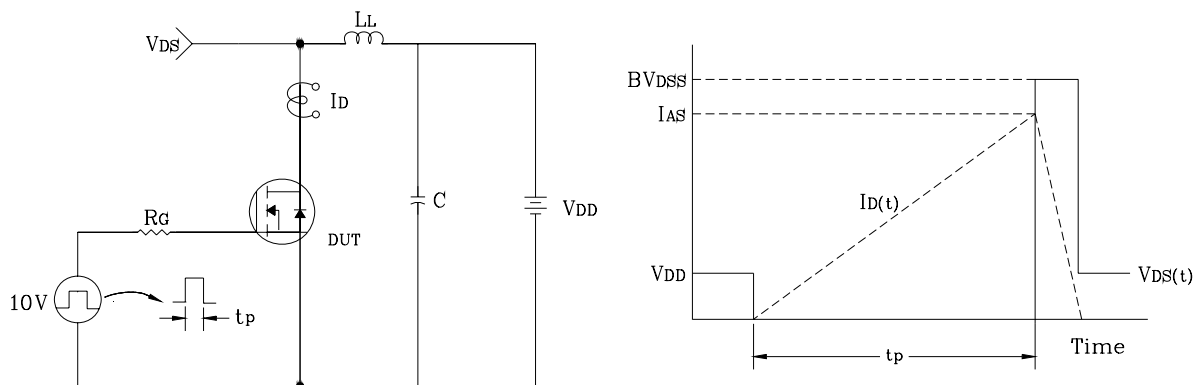
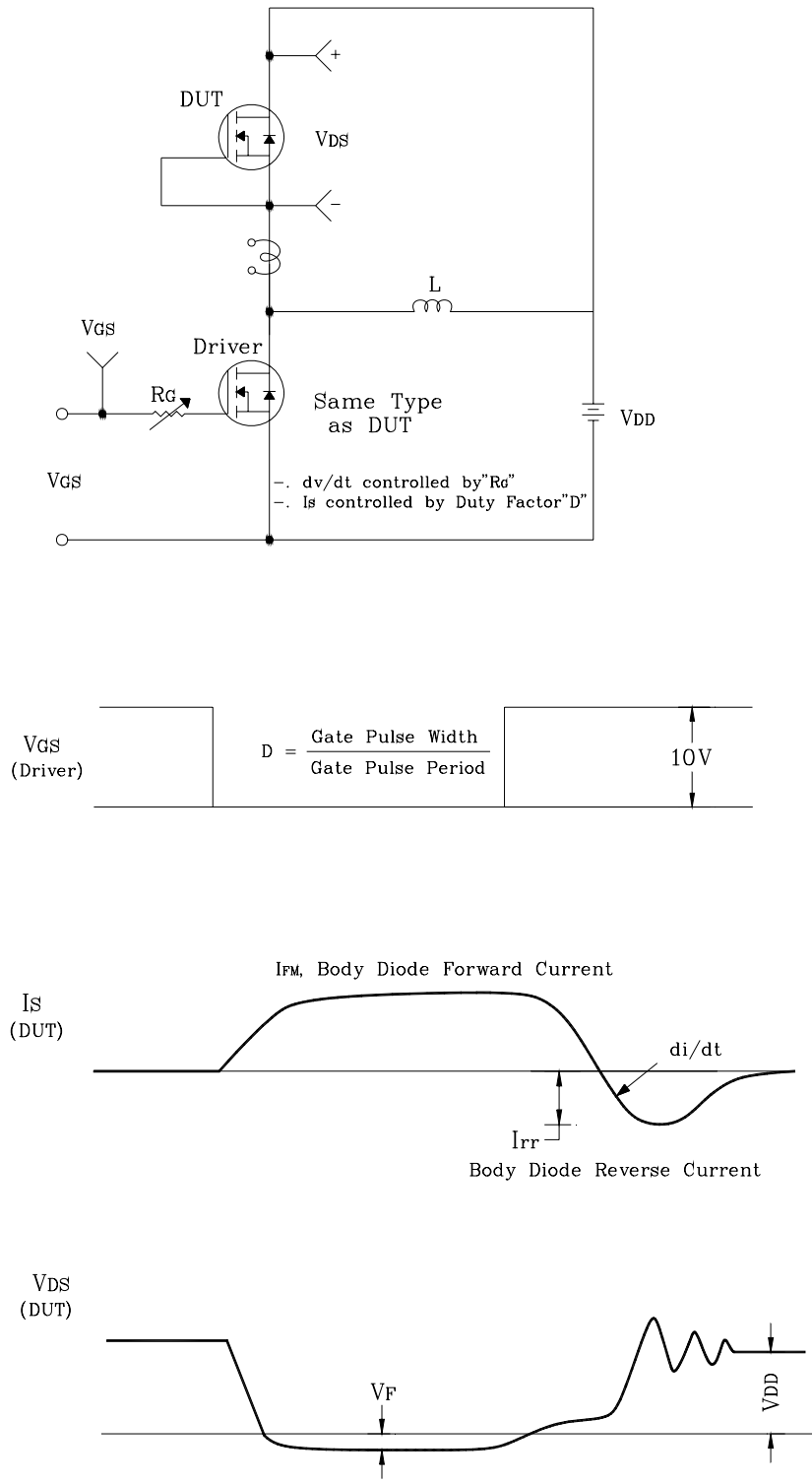
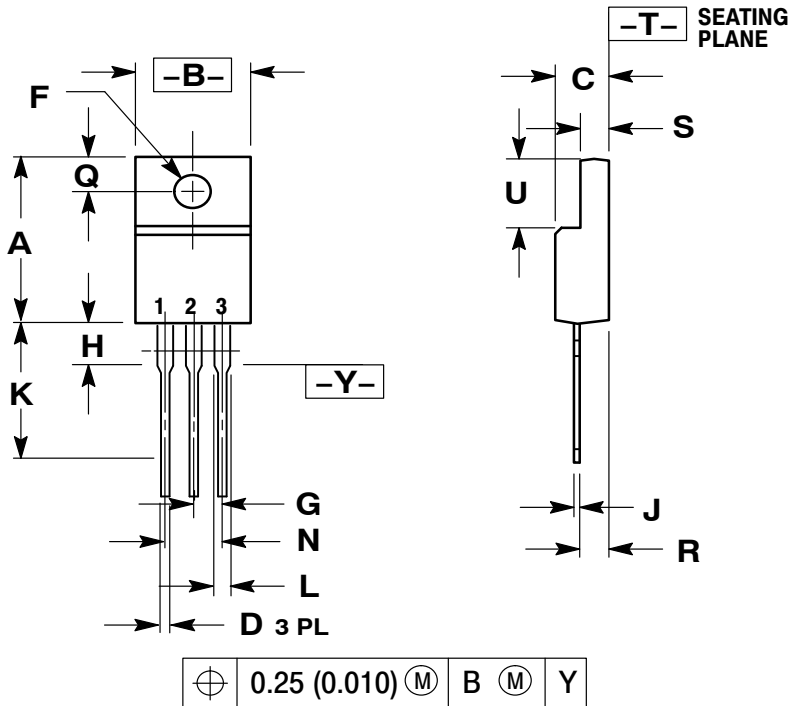


Fig. 13 Diode Reverse Recovery Time Test Circuit & Waveform


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.

DIM	INCHES		MILLIMETERS	
	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

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[IRS2092STRPBF-EL](#) [IPS70R2K0CEAKMA1](#) [BSF024N03LT3 G](#) [PSMN4R2-30MLD](#) [TK31J60W5,S1VQ\(O](#) [2SK2614\(Te16L1,Q\)](#)
[DMN1017UCP3-7](#) [EFC2J004NUZTDG](#) [P85W28HP2F-7071](#) [DMN1053UCP4-7](#) [SQJ469EP-T1-GE3](#) [NTE2384](#) [NTE6400A](#)
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[IPS60R3K4CEAKMA1](#) [DMN1006UCA6-7](#) [DMN16M9UCA6-7](#) [STF5N65M6](#) [IRF40H233XTMA1](#) [IPSA70R950CEAKMA1](#)
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