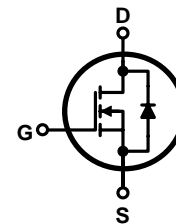
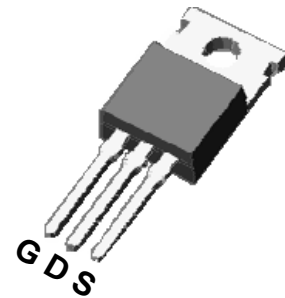


PIN Connection TO-220

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



Marking Diagram



Y = Year
 A = Assembly Location
 WW = Work Week
 FIR12N60AP = Specific Device Code

Features

- Fast Switching
- 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.

Absolute (Tc= 25°C 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 $T_C = 100^\circ C$	7.4	A
I_{DM}^{a1}	Pulsed Drain Current	48	A
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}^{a2}	Single Pulse Avalanche Energy	865	mJ
E_{AR}^{a1}	Avalanche Energy ,Repetitive	23.5	mJ
I_{AR}^{a1}	Avalanche Current	8.0	A
dv/dt^{a3}	Peak Diode Recovery dv/dt	4.5	V/ns
P_D	Power Dissipation	140	W
	Derating Factor above 25°C	1.1	W/°C
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
ΔBV _{DSS} /ΔT _J	Bvdss Temperature Coefficient	I _D =250μA, Reference 25°C	--	0.70	--	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 =6A	--	0.55	0.6	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	--	1850	--	pF
C _{oss}	Output Capacitance		--	180	--	
C _{rss}	Reverse Transfer Capacitance		--	20	--	

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	--	30	--	ns
t _r	Rise Time		--	90	--	
t _{d(OFF)}	Turn-Off Delay Time		--	140	--	
t _f	Fall Time		--	90	--	
Q _g	Total Gate Charge	I _D = 12.0A V _{DD} = 480V V _{GS} = 10V	--	52	--	nC
Q _{gs}	Gate to Source Charge		--	8.5	--	
Q _{gd}	Gate to Drain ("Miller") Charge		--	20	--	

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	$I_S=12.0A, V_{GS}=0V$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$I_S=12.0A, T_j = 25^\circ C$ $dI_f/dt=100A/us,$ $V_{GS}=0V$	--	430	--	ns
Q_{rr}	Reverse Recovery Charge		--	5.0	--	nC
I_{RRM}	Reverse Recovery Current		--	15	--	A
Pulse width $t_p \leq 380\mu s, \delta \leq 2\%$						

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

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

^{a2}: $L=10.0mH, I_D=12A, \text{Start } T_j=25^\circ C$

^{a3}: $I_{SD}=12A, di/dt \leq 100A/us, V_{DD} \leq BV_{DS}, \text{Start } T_j=25^\circ C$

Electrical Characteristics Curves

Fig. 1 $I_D - V_{DS}$

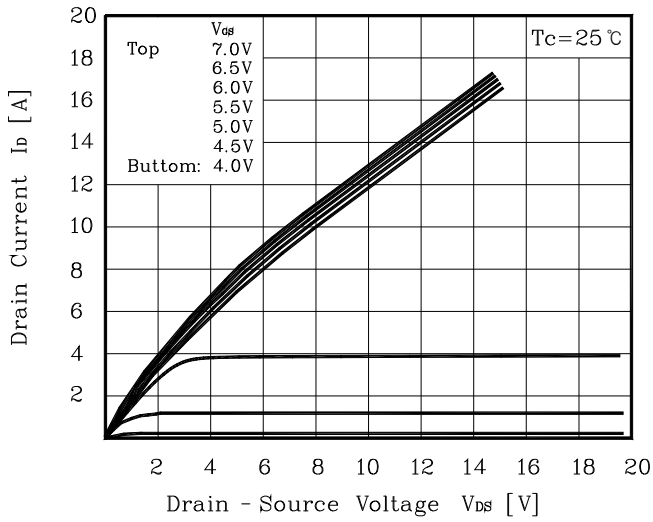


Fig. 2 $I_D - V_{GS}$

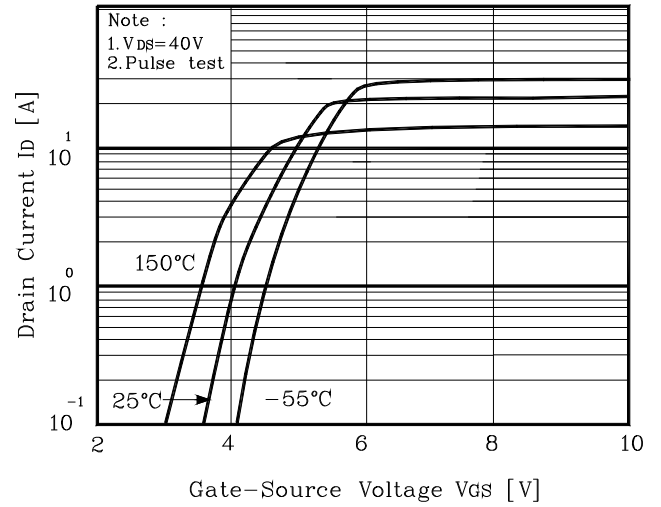


Fig. 3 $R_{DS(ON)} - I_D$

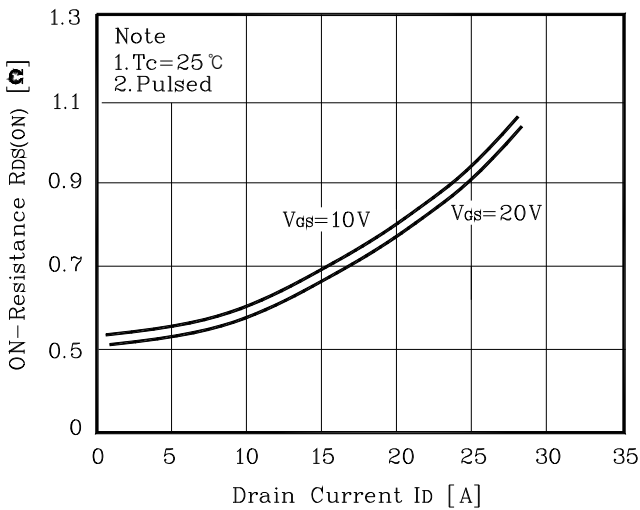


Fig. 4 $I_S - V_{SD}$

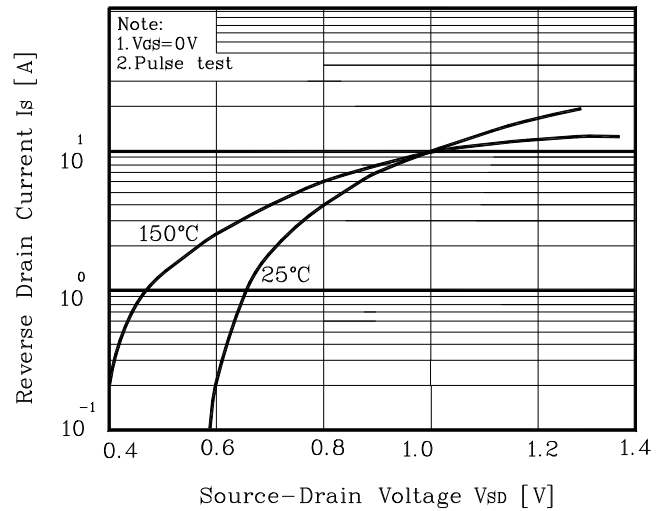


Fig. 5 Capacitance - V_{DS}

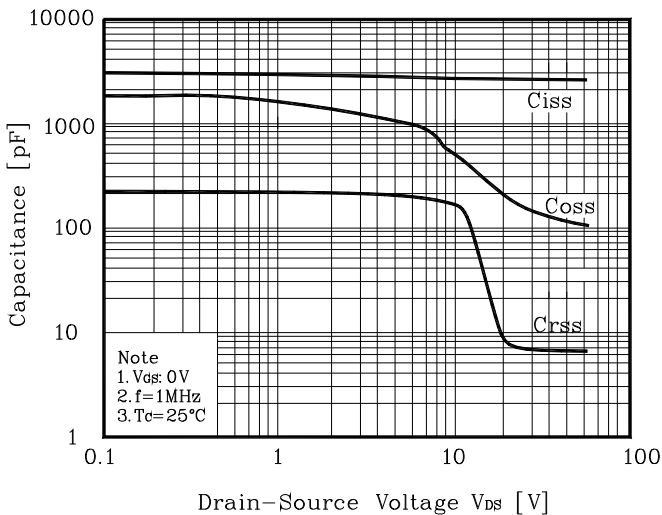
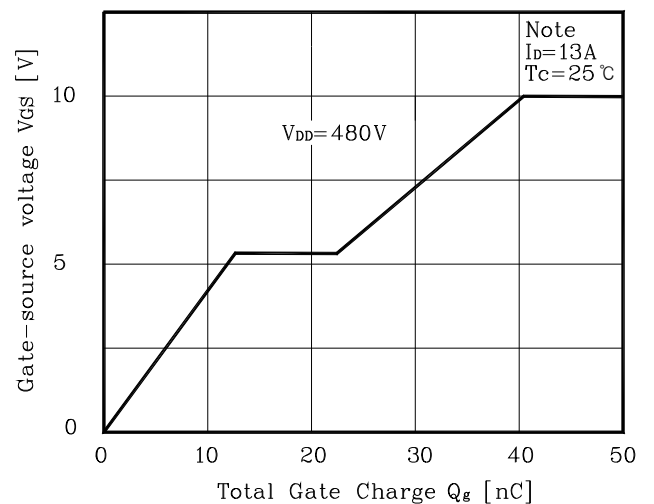


Fig. 6 $V_{GS} - Q_g$



Electrical Characteristics Curves (Continue)

Fig. 7 $V_{DSS} - T_J$

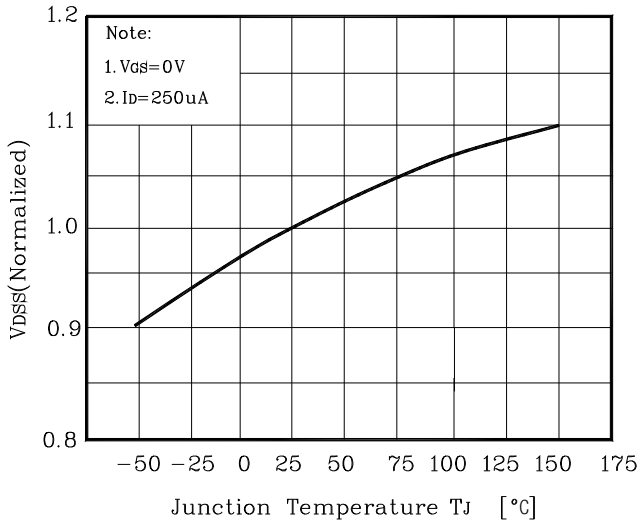


Fig. 8 $R_{DS(ON)} - T_J$

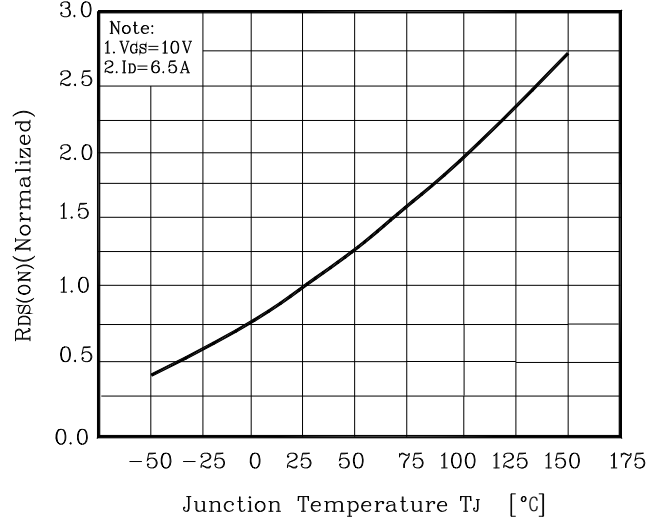


Fig. 9 $I_D - T_C$

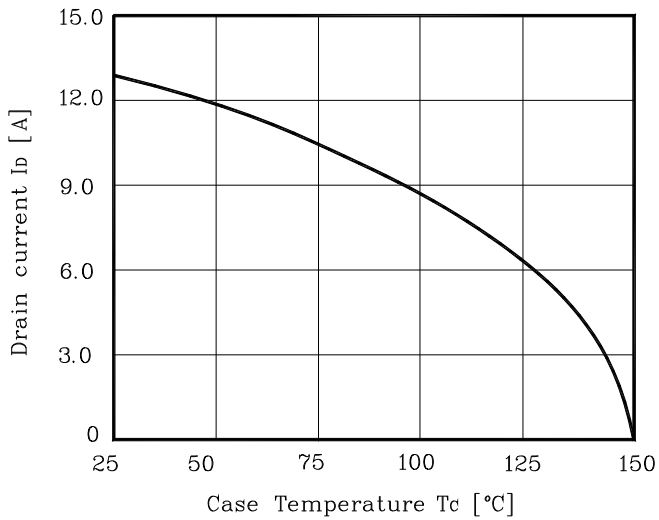


Fig. 10 Safe Operating Area

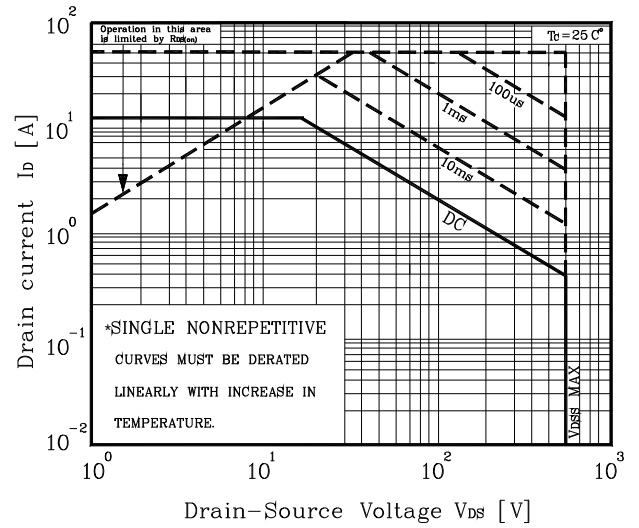


Fig. 11 Gate Charge Test Circuit & Waveform

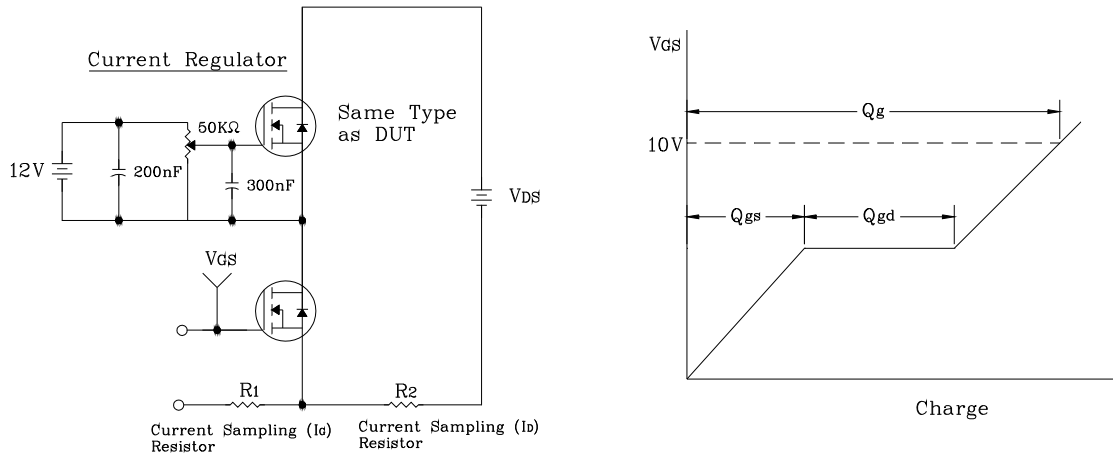


Fig. 12 Resistive Switching Test Circuit & Waveform

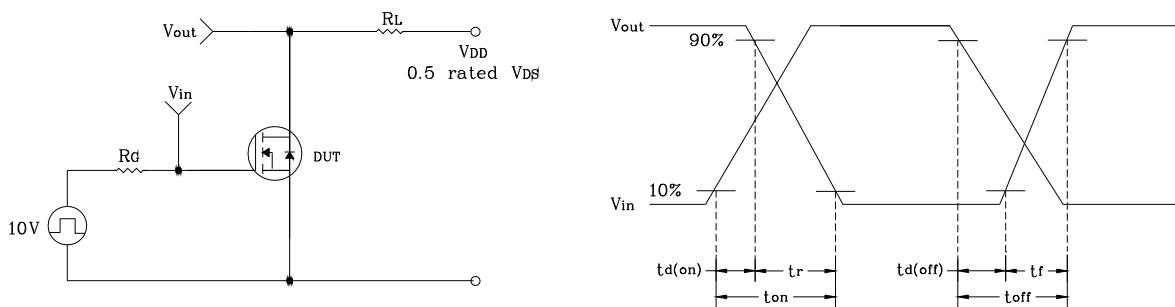


Fig. 13 E_{AS} Test Circuit & Waveform

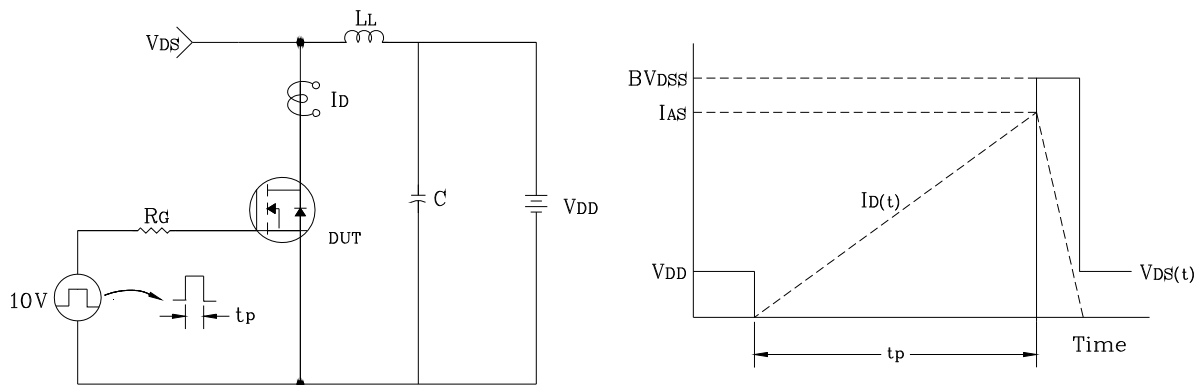
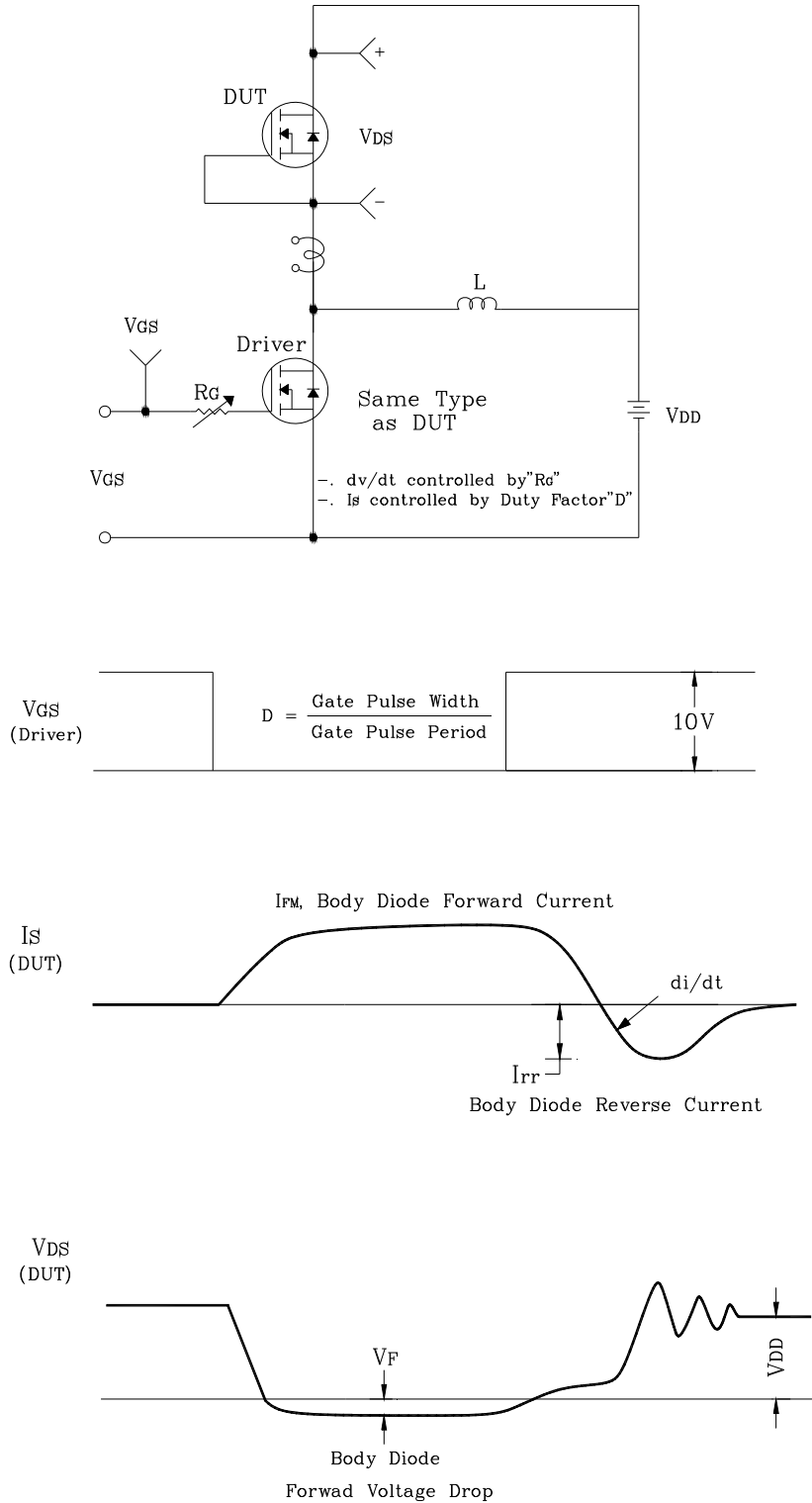
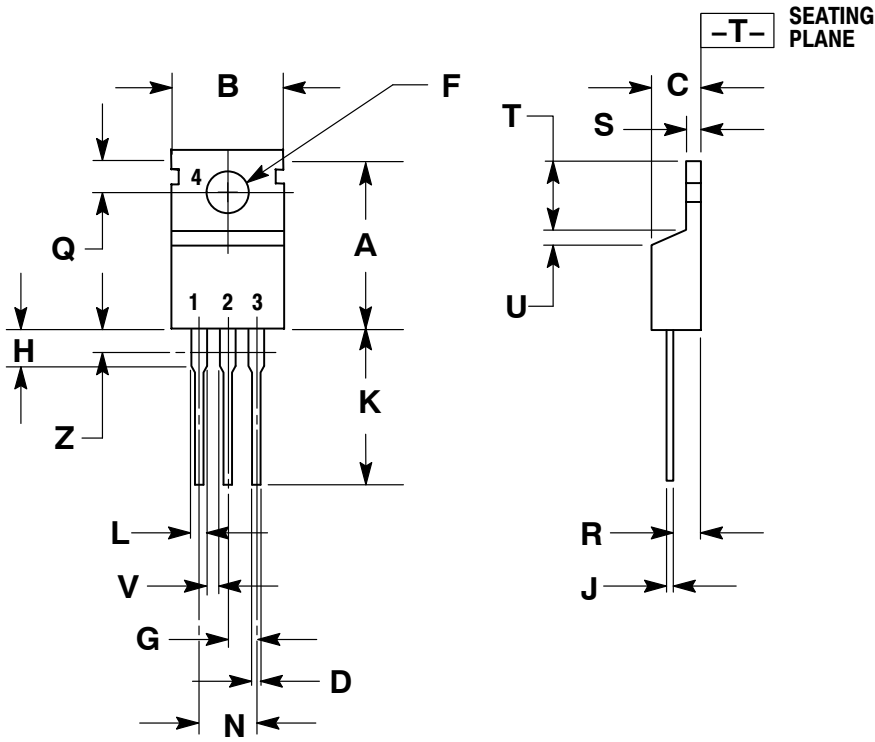


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Package Dimensions

TO-220



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

- STYLE 6:
- PIN 1. ANODE
 - 2. CATHODE
 - 3. ANODE
 - 4. CATHODE