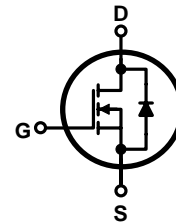
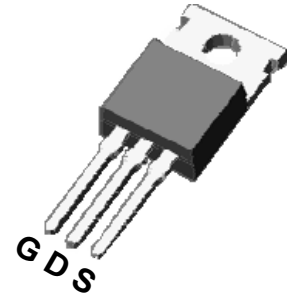
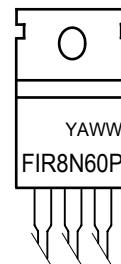


PIN Connection TO-220

Switchng Regulator Applications

Features

- High Voltage: $BV_{DSS}=600V(\text{Min.})$
- Low C_{rss} : $C_{rss}=9.7pF(\text{Typ.})$
- Low gate charge : $Qg=22nC(\text{Typ.})$
- Low $R_{DS(on)}$: $R_{DS(on)}=1.2\Omega(\text{Max.})$


Marking Diagram


Y = Year
 A = Assembly Location
 WW = Work Week
 FIR8N60P = Specific Device Code

Absolute maximum ratings ($T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	600	V
Gate-source voltage	V_{GSS}	± 30	V
Drain current (DC) *	I_D	($T_C=25^\circ\text{C}$)	7.5
		($T_C=100^\circ\text{C}$)	4.7
Drain current (Pulsed) *	I_{DM}	30	A
Drain power dissipation	P_D	90	W
Avalanche current (Single) ②	I_{AS}	7.5	A
Single pulsed avalanche energy ②	E_{AS}	325	mJ
Avalanche current (Repetitive) ①	I_{AR}	7.5	A
Repetitive avalanche energy ①	E_{AR}	21.7	mJ
Junction temperature	T_J	150	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55~150	

* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max	Unit
Thermal resistance	Junction-case	$R_{th(J-C)}$	-	1.38
	Junction-ambient	$R_{th(J-a)}$	-	62.5

Electrical Characteristics ($T_C=25^\circ\text{C}$ unless otherwise noted)

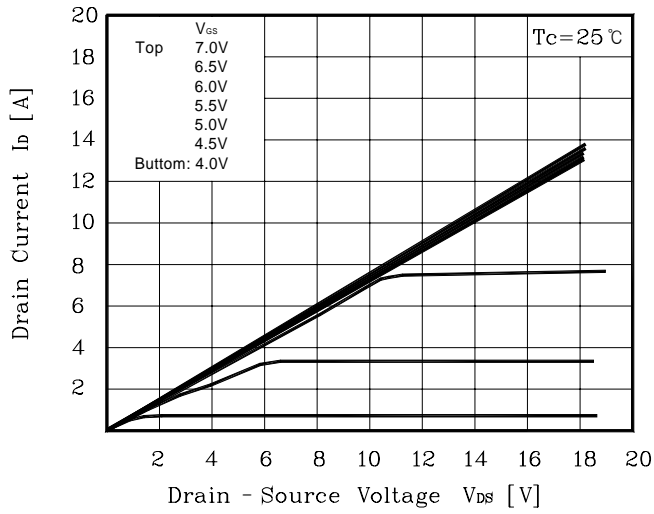
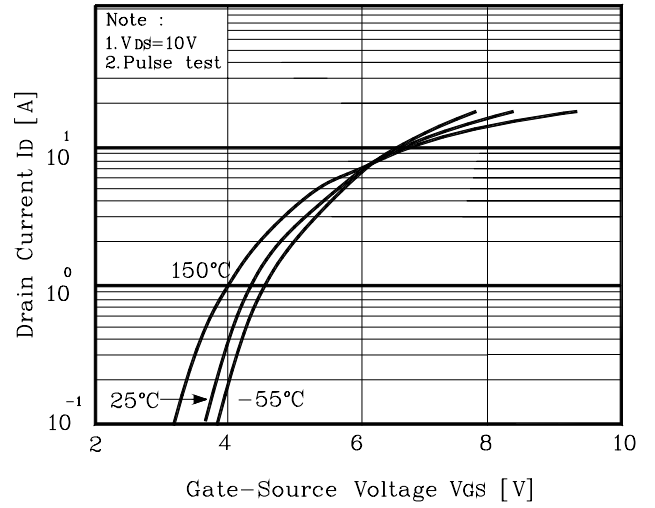
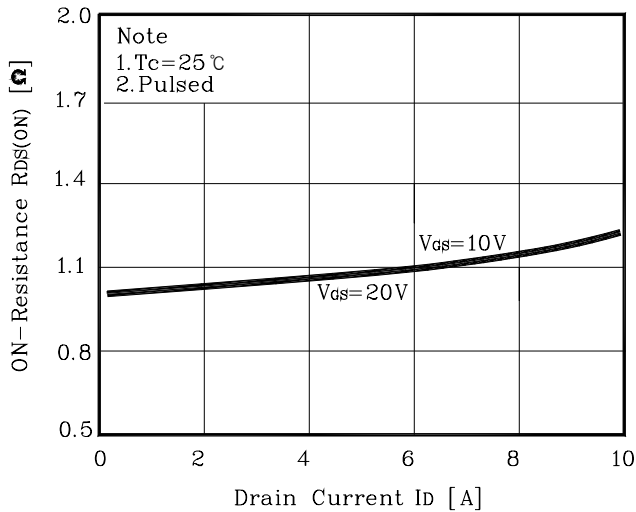
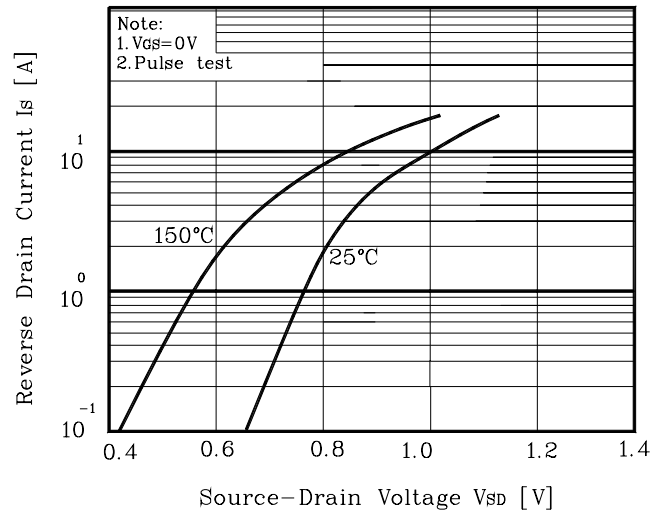
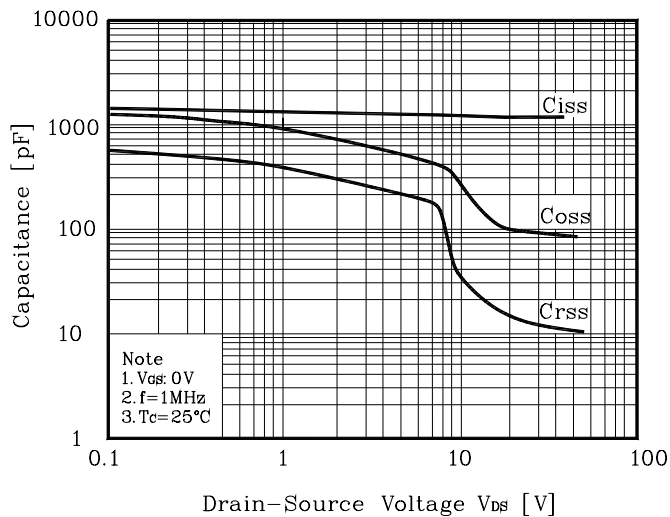
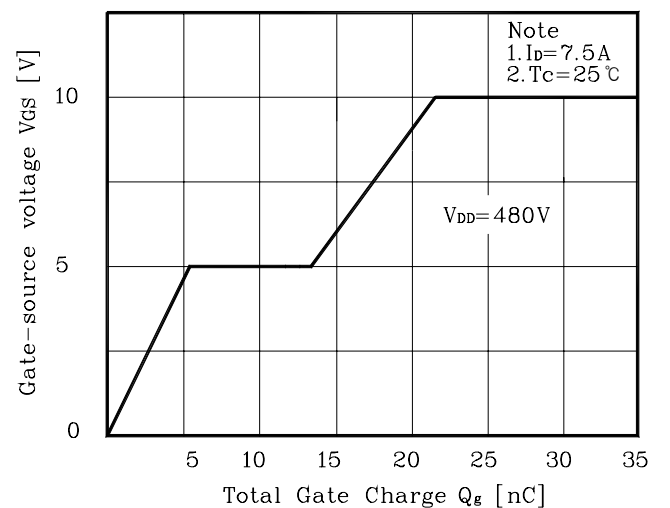
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Drain-source breakdown voltage	BV_{DSS}	$I_D=250\mu\text{A}, V_{GS}=0$	600	-	-	V	
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}, V_{DS}=V_{GS}$	2.0	-	4.0	V	
Drain-source cut-off current	I_{DSS}	$V_{DS}=600\text{V}, V_{GS}=0\text{V}$	-	-	1	μA	
Gate leakage current	I_{GSS}	$V_{DS}=0\text{V}, V_{GS}=\pm 30\text{V}$	-	-	± 100	nA	
Drain-source on-resistance ④	$R_{DS(ON)}$	$V_{GS}=10\text{V}, I_D=3.75\text{A}$	-	1.0	1.2	Ω	
Forward transfer conductance ④	g_{fs}	$V_{DS}=10\text{V}, I_D=3.75\text{A}$	-	7.3	-	S	
Input capacitance	C_{iss}	$V_{GS}=0\text{V}, V_{DS}=25\text{V}$ $f=1\text{MHz}$	-	968	1210	pF	
Output capacitance	C_{oss}		-	105	131		
Reverse transfer capacitance	C_{rss}		-	9.7	12.1		
Turn-on delay time	$t_{d(on)}$	$V_{DD}=300\text{V}, I_D=7.5\text{A}$ $R_G=25\Omega$	-	18	-	ns	
Rise time	t_r		-	19	-		
Turn-off delay time	$t_{d(off)}$		③④	-	72		-
Fall time	t_f		-	28	-		
Total gate charge	Q_g	$V_{DS}=480\text{V}, V_{GS}=10\text{V}$ $I_D=7.5\text{A}$	-	22	27	nC	
Gate-source charge	Q_{gs}		③④	-	5.2		-
Gate-drain charge	Q_{gd}		-	-	6.3		-

Source-Drain Diode Ratings and Characteristics ($T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Source current (DC)	I_S	Integral reverse diode in the MOSFET	-	-	7.5	A
Source current (Pulsed) ①	I_{SM}		-	-	30	
Forward voltage ④	V_{SD}	$V_{GS}=0\text{V}, I_S=7.5\text{A}$	-	-	1.4	V
Reverse recovery time	t_{rr}	$I_S=7.5\text{A}, V_{GS}=0,$ $di_S/dt=100\text{A}/\mu\text{s}$	-	365	-	ns
Reverse recovery charge	Q_{rr}		-	3.4	-	μC

Note ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ② $L=10.6\text{mH}, I_{AS}=7.5\text{A}, V_{DD}=50\text{V}, R_G=27\Omega$
- ③ Pulse Test : Pulse Width < 300 μs , Duty cycle $\leq 2\%$
- ④ Essentially independent of operating temperature

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 $V_{GS} - Q_G$


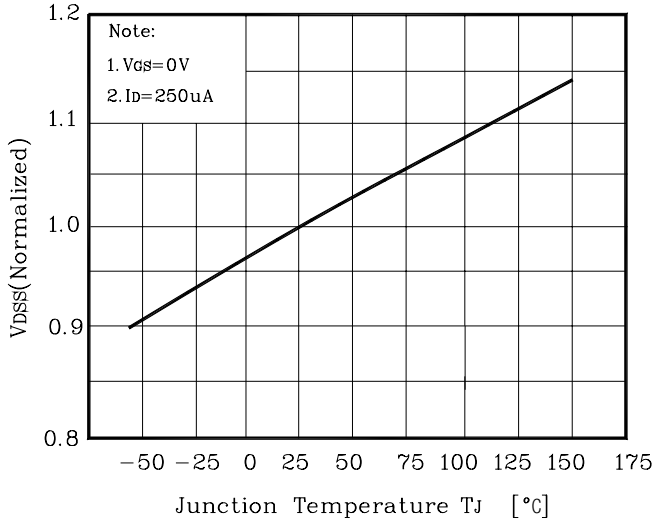
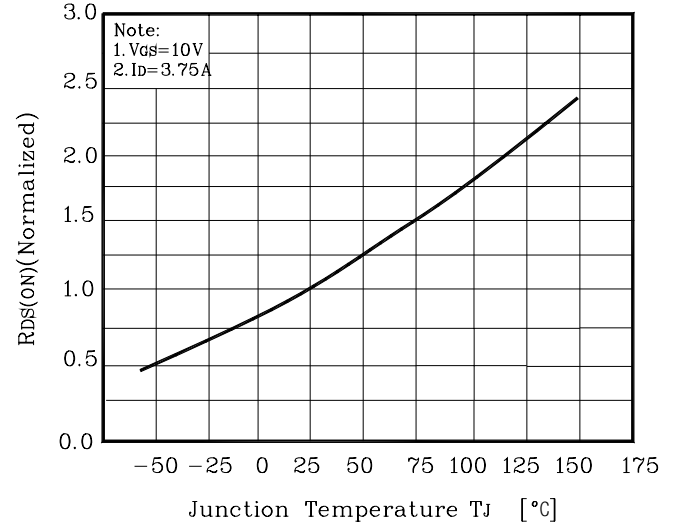
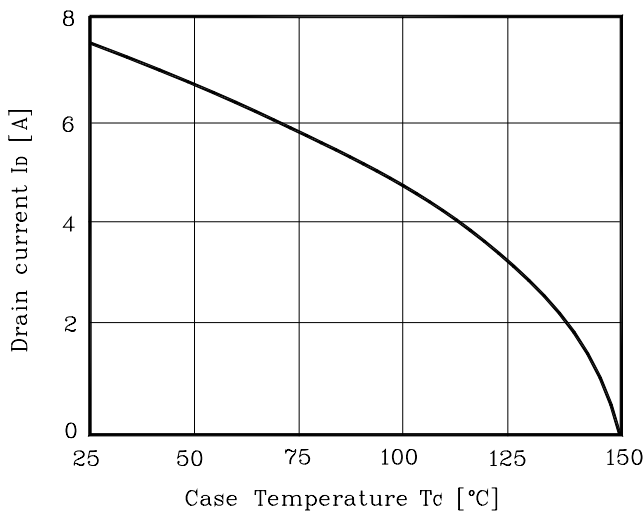
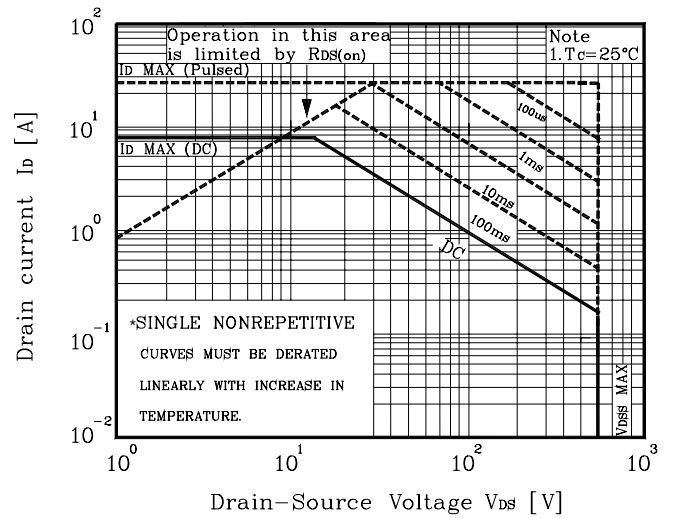
Electrical Characteristic Curves
Fig. 7 $V_{DSS} - T_J$

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

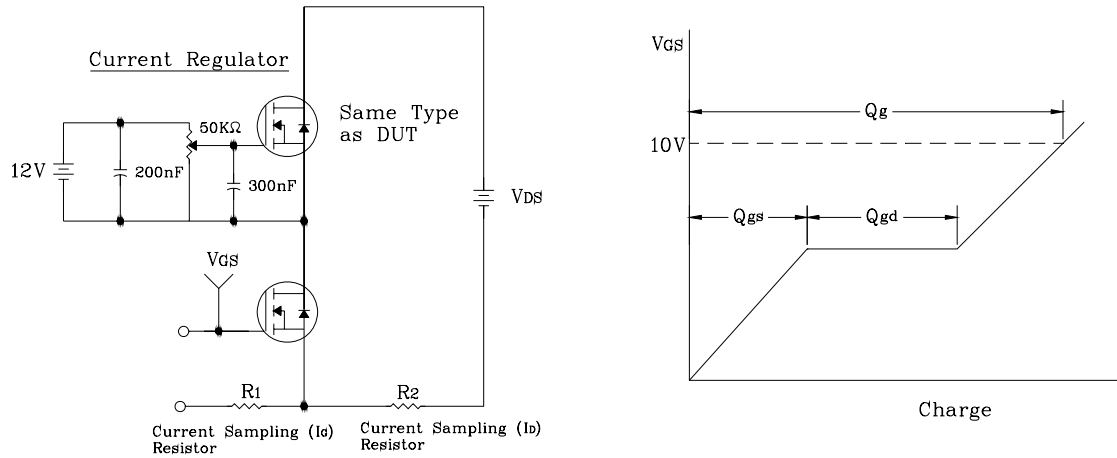


Fig. 11 Resistive Switching Test Circuit & Waveform

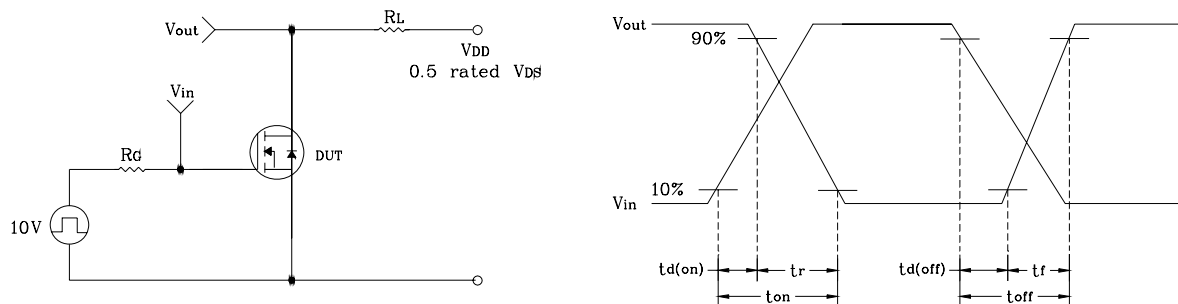


Fig. 12 E_{AS} Test Circuit & Waveform

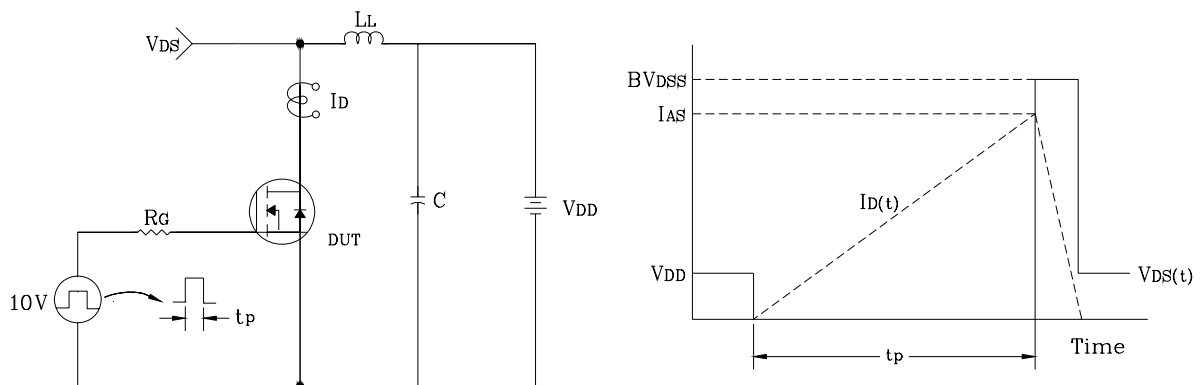
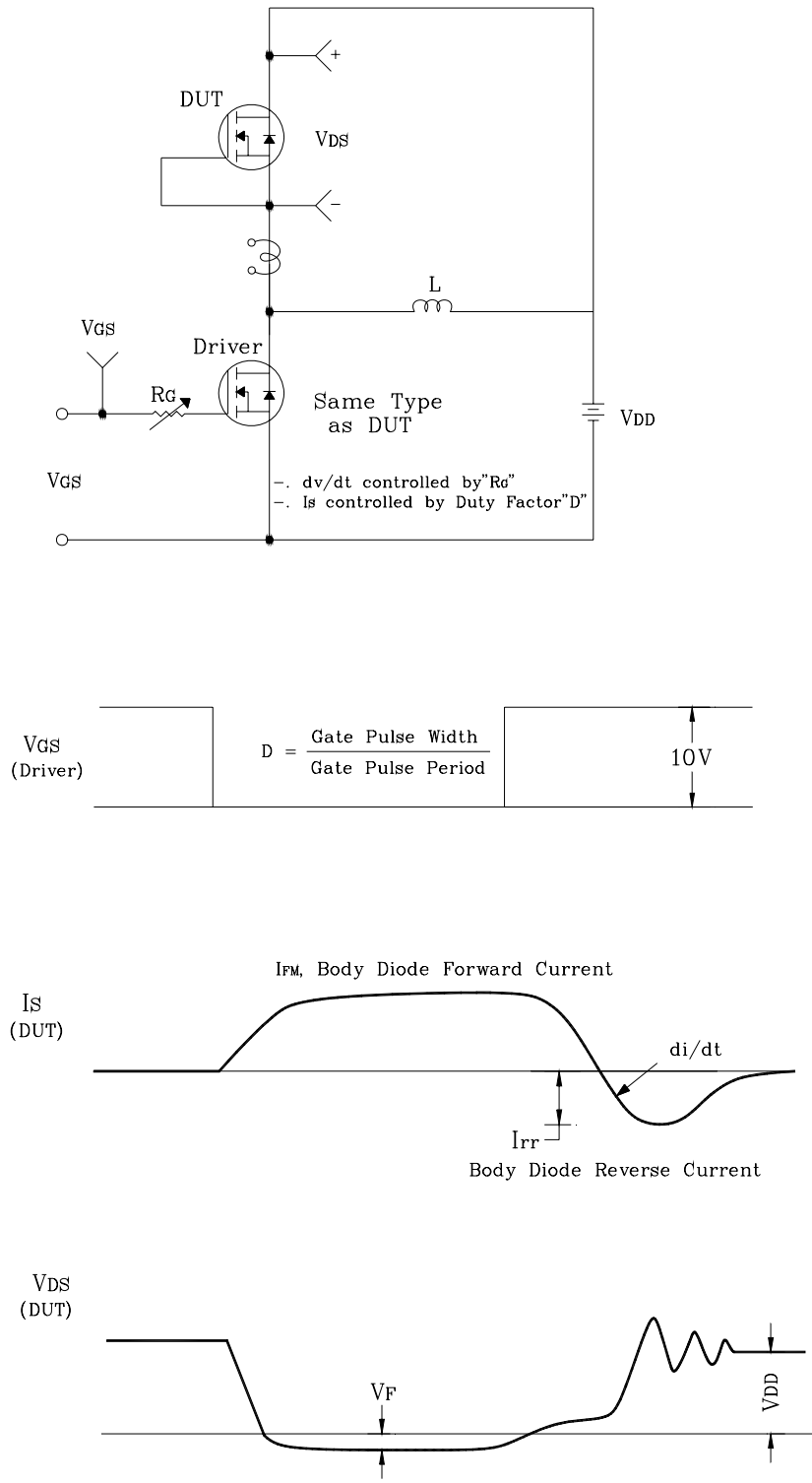
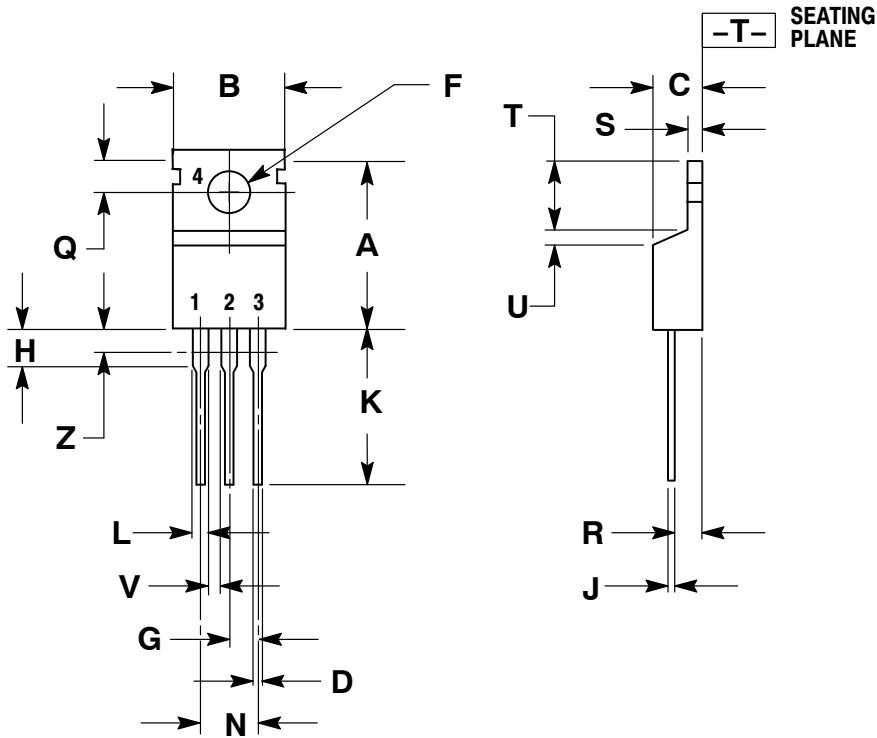


Fig. 13 Diode Reverse Recovery Time Test Circuit & Waveform


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