
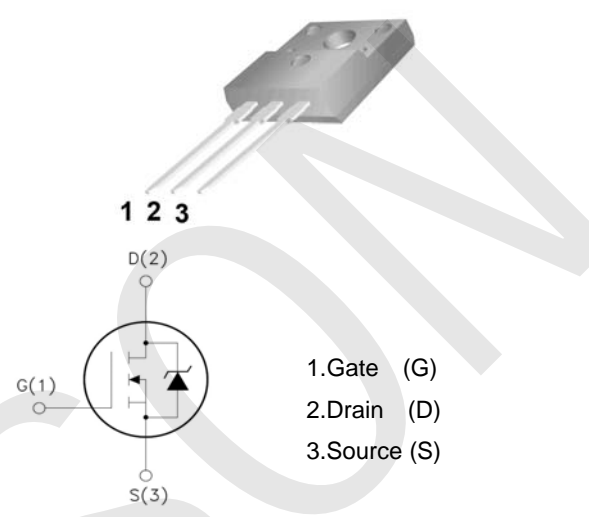


### SM18N60S

**Features:**

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge :Qg=75 nC (Typ.).
- BVDS=600V, I<sub>D</sub>=18A
- R<sub>DS(on)</sub> : 0.40Ω (Max) @V<sub>G</sub>=10V
- 100% Avalanche Tested

TO-220F

1. Gate (G)  
2. Drain (D)  
3. Source (S)

**Absolute Maximum Ratings** (Ta=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	600	V
I <sub>D</sub>	Drain Current	T <sub>C</sub> =25°C	18
		T <sub>C</sub> =100°C	12.5
V <sub>GS(TH)</sub>	Gate Threshold Voltage	±30	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (note1)	687	mJ
I <sub>AR</sub>	Avalanche Current (note2)	18	A
P <sub>D</sub>	Power Dissipation (Tc=25°C)	60	W
T <sub>j</sub>	Junction Temperature(Max)	150	°C
T <sub>stg</sub>	Storage Temperature	-55~+150	
TL	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	300	

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	-	2.08	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	-	62.5	

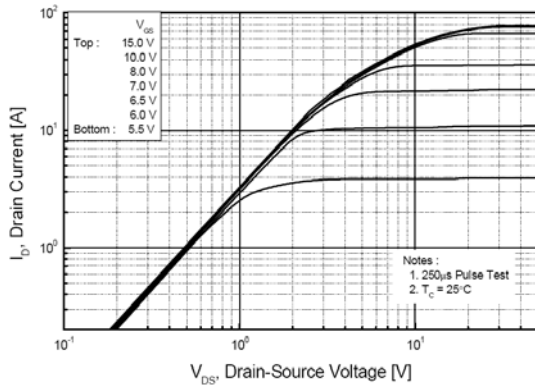
**Electrical Characteristics** (Ta=25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0	600	-	-	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, Reference to 25°C	-	0.6	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V V <sub>DS</sub> =480V, T <sub>C</sub> =125°C	-	-	10 100	μA
I <sub>GSSF</sub>	Gate-body leakage Current, Forward	V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V	-	-	100	nA
I <sub>GSSR</sub>	Gate-body leakage Current, Reverse	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	-	-	-100	
<b>On Characteristics</b>						
V <sub>GS(TH)</sub>	Gate Threshold Voltage	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	2	-	4	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	I <sub>D</sub> =9A, V <sub>GS</sub> =10V	-	0.3	0.40	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0, f=1.0MHz	-	3315	-	pF
C <sub>oss</sub>	Output Capacitance		-	1120	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	95	-	
<b>Switching Characteristics</b>						
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =300V, I <sub>D</sub> =18A R <sub>G</sub> =25Ω (Note 3,4)	-	62	135	ns
T <sub>r</sub>	Turn-On Rise Time		-	140	290	
T <sub>d(off)</sub>	Turn-Off Delay Time		-	230	470	
T <sub>f</sub>	Turn-Off Rise Time		-	65	140	
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =480, V <sub>GS</sub> =10V, I <sub>D</sub> =18A (Note 3,4)	-	75	98	nC
Q <sub>gs</sub>	Gate-Source Charge		-	13.5	18	
Q <sub>gd</sub>	Gate-Drain Charge		-	36	-	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Max. Diode Forward Current	-	-	-	18	A
I <sub>SM</sub>	Max. Pulsed Forward Current	-	-	-	72	
V <sub>SD</sub>	Diode Forward Voltage	I <sub>D</sub> =18A	-	-	1.4	V
T <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =18A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/μs	-	530	-	nS
Q <sub>rr</sub>	Reverse Recovery Charge	(Note3)	-	10.5	-	μC

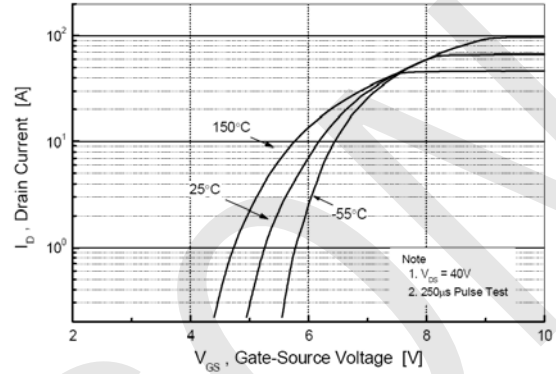
- Notes : 1, L=3.45mH, I<sub>AS</sub>=20A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C  
 2, Repetitive Rating : Pulse width limited by maximum junction temperature  
 3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%  
 4, Essentially Independent of Operating Temperature

### Typical Characteristics

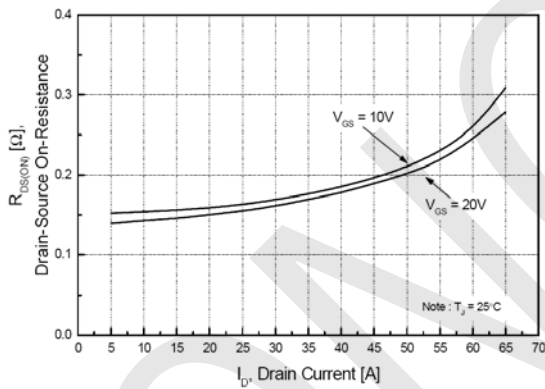
**Figure 1. On-Region Characteristics**



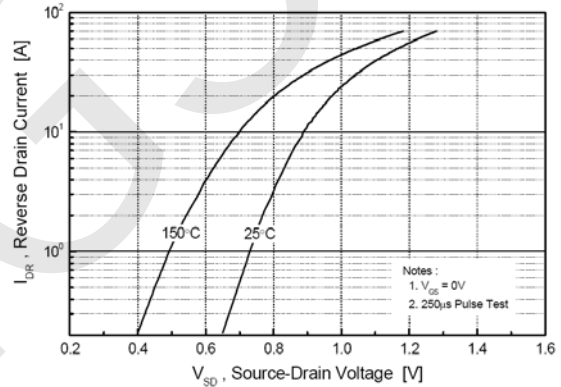
**Figure 2. Transfer Characteristics**



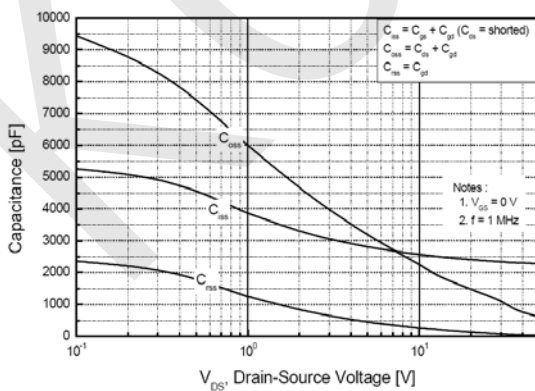
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



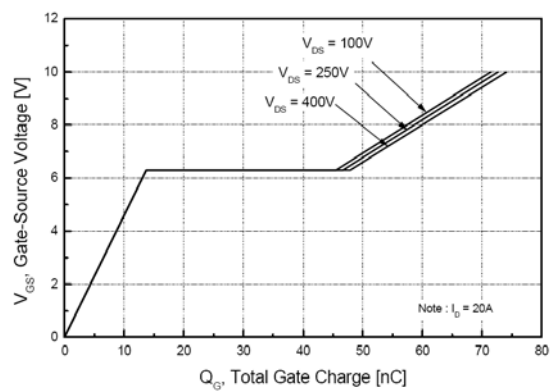
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

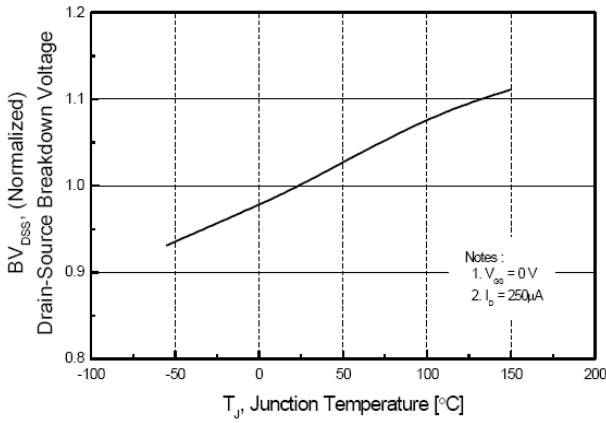


**Figure 6. Gate Charge Characteristics**

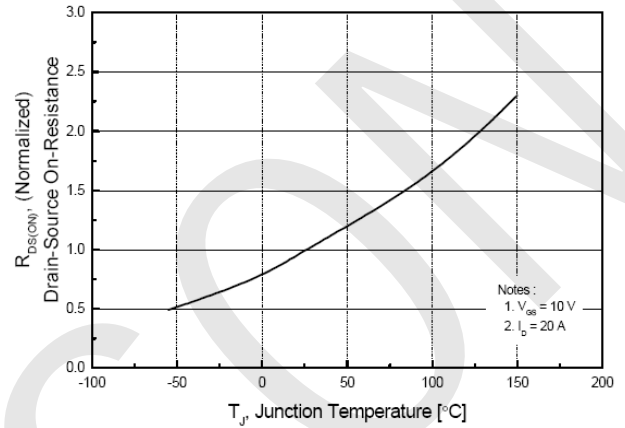


### Typical Characteristics (Continued)

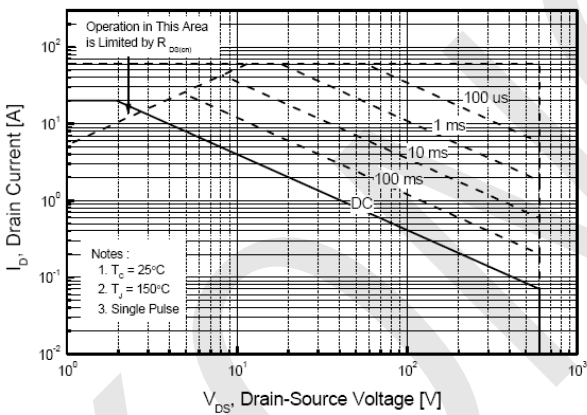
**Figure 7. Breakdown Voltage Variation vs. Temperature**



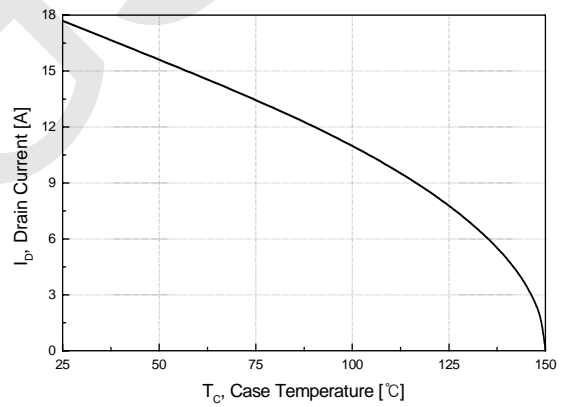
**Figure 8. On-Resistance Variation vs. Temperature**



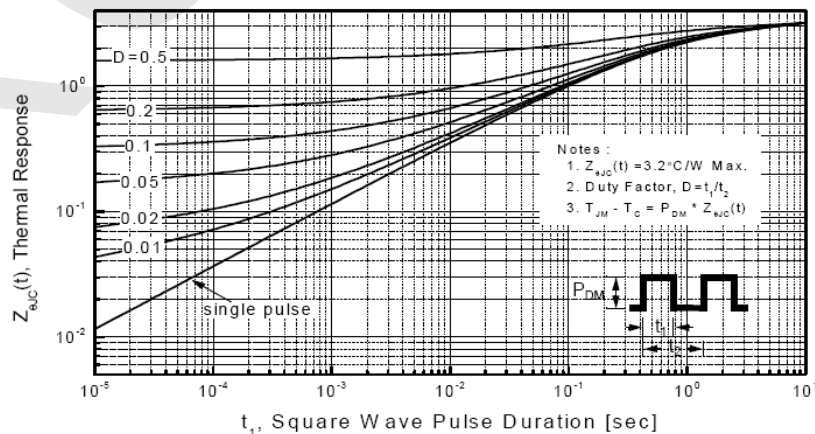
**Figure 9. Maximum Safe Operating Area**



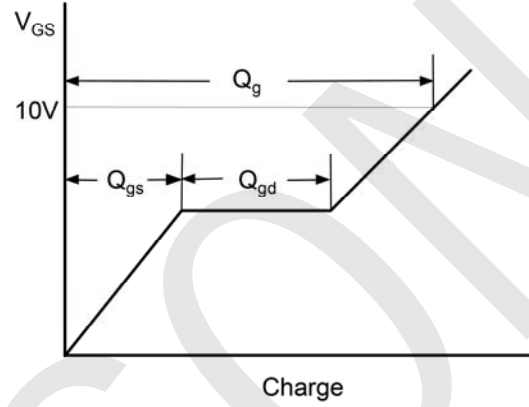
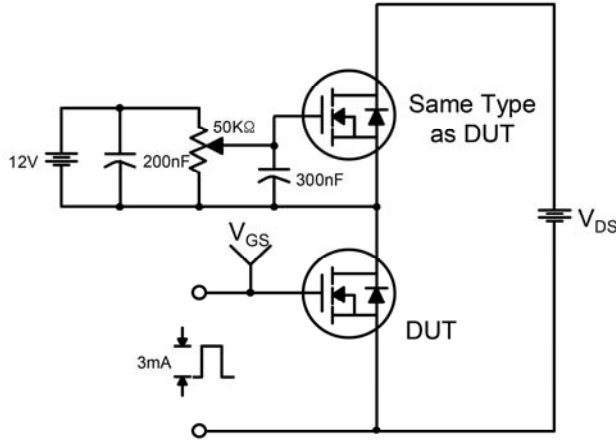
**Figure 10. Maximum Drain Current vs. Case Temperature**



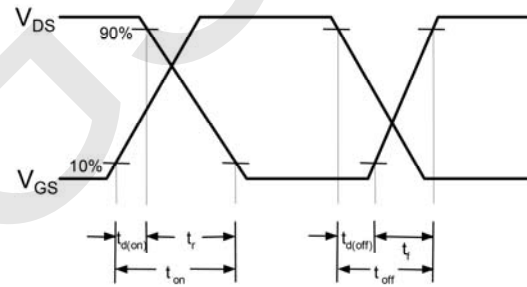
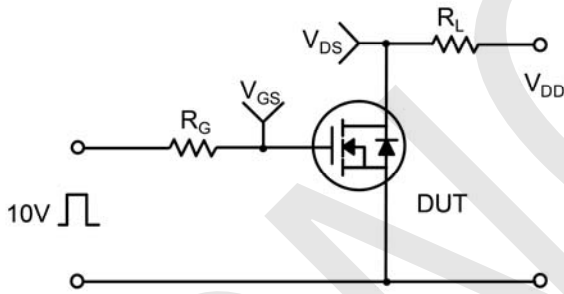
**Figure 11. Transient Thermal Response Curve**



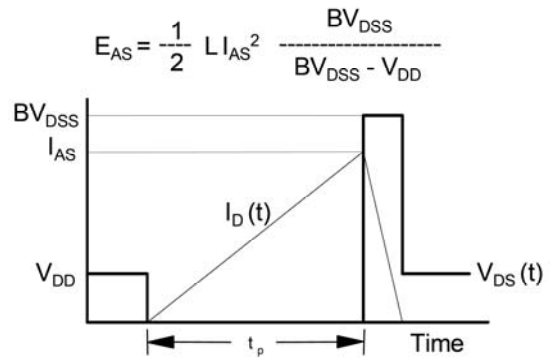
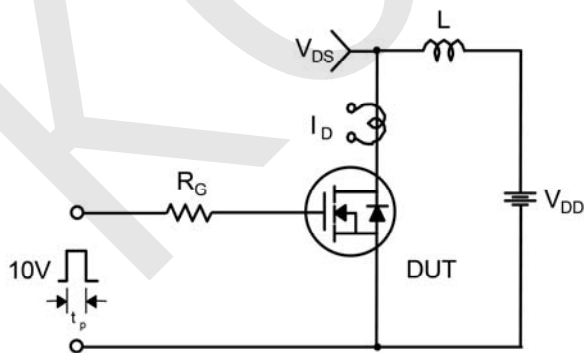
### Gate Charge Test Circuit & Waveform



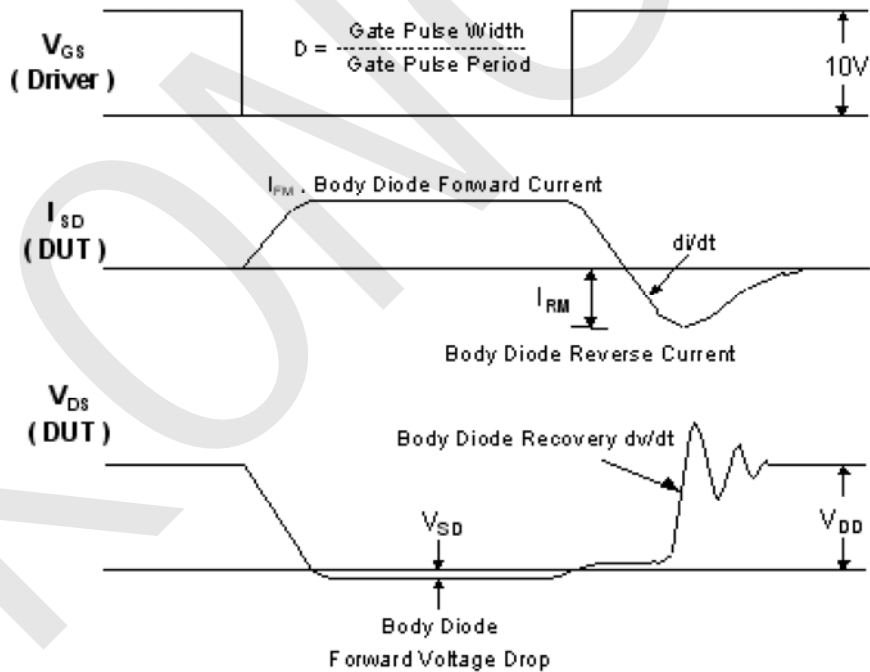
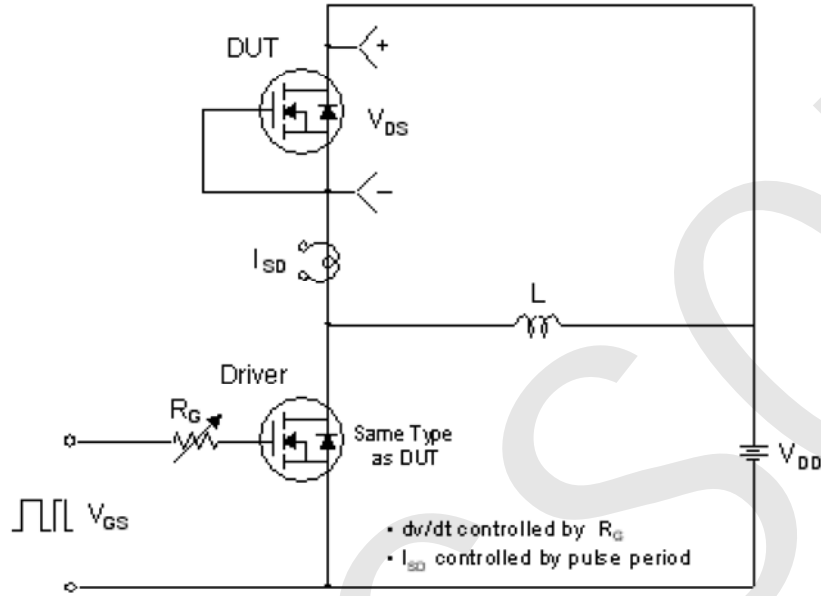
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



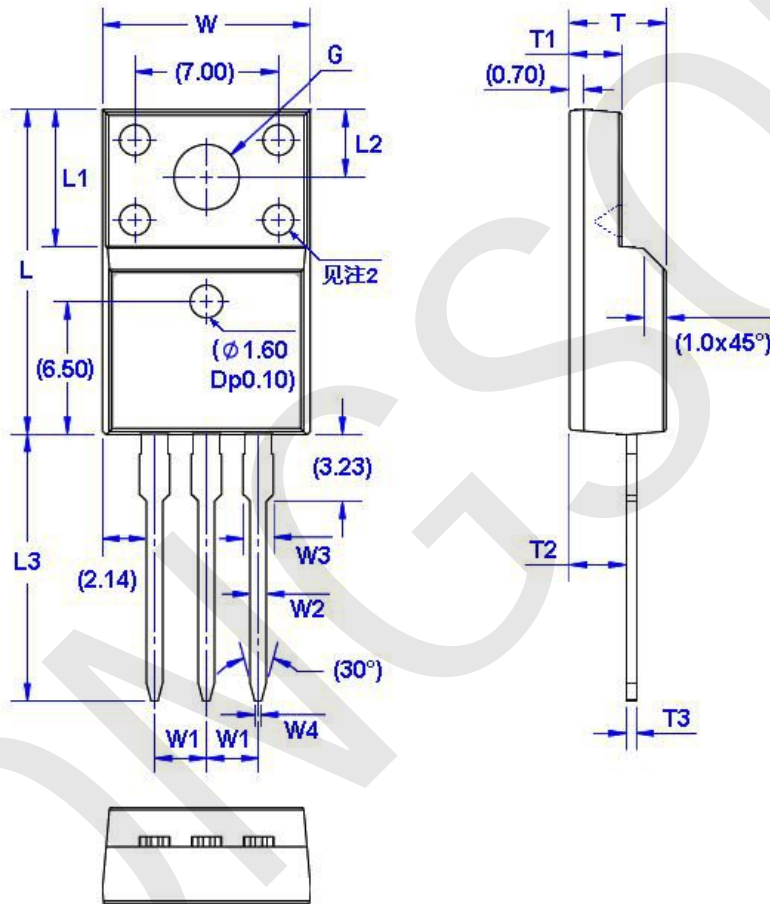
### Peak Diode Recovery dv/dt Test Circuit & Waveform



### Package Dimension

### TO-220F

Unit: mm



Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	9.96	10.36	W4	0.25	0.45	L3	12.78	13.18	T3	0.45	0.60
W1	2.54 (TYP)		L	15.67	16.07	T	4.50	4.90	G(Φ)	3.08	3.28
W2	0.70	0.90	L1	6.48	6.88	T1	2.34	2.74			
W3	1.24	1.47	L2	3.20	3.40	T2	2.56	2.96			