
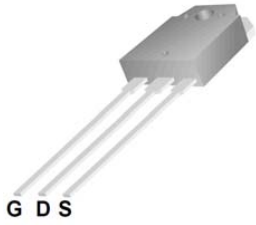


### SM20N50

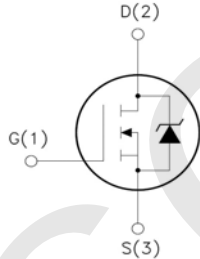
**Features:**

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge :Qg=50 nC (Typ.).
- BVDSS=500V, I<sub>D</sub>=20A
- R<sub>DS(on)</sub> : 0.27Ω (Max) @V<sub>G</sub>=10V
- 100% Avalanche Tested

TO-3P

G D S



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	500	V
I <sub>D</sub>	Drain Current	T <sub>C</sub> =25°C	20
		T <sub>C</sub> =100°C	12.9
V <sub>GS(TH)</sub>	Gate Threshold Voltage	±30	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (note1)	1110	mJ
I <sub>AR</sub>	Avalanche Current (note2)	20	A
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> =25°C)	239	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	-	0.52	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	-	62.5	

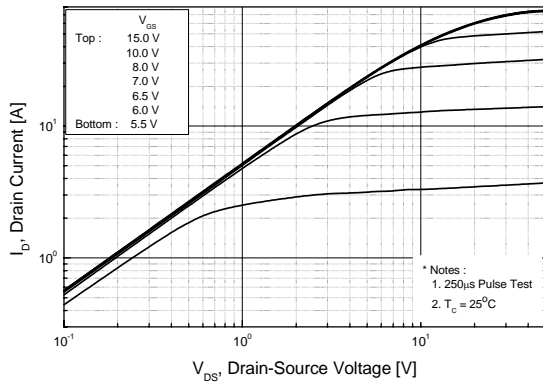
**Electrical Characteristics** (Ta=25°C unless otherwise noted)

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	500	-	-	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, Reference to 25°C	-	0.53	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V V <sub>DS</sub> =400V, T <sub>C</sub> =125°C	-	-	1 10	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>	2.5	-	4.5	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	I <sub>D</sub> =10A, V <sub>GS</sub> =10V	-	-	0.27	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0, f=1.0MHz	-	3620	-	pF
C <sub>oss</sub>	Output Capacitance		-	355	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	27	-	
<b>Switching Characteristics</b>						
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =250V, I <sub>D</sub> =20A R <sub>G</sub> =25Ω (Note 3,4)	-	95	200	nS
T <sub>r</sub>	Turn-On Rise Time		-	375	760	
T <sub>d(off)</sub>	Turn-Off Delay Time		-	100	210	
T <sub>f</sub>	Turn-Off Rise Time		-	105	220	
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =400V, V <sub>GS</sub> =10V, I <sub>D</sub> =20A (Note 3,4)	-	50	65	nC
Q <sub>gs</sub>	Gate-Source Charge		-	14.8	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	21.6	-	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Max. Diode Forward Current	-	-	-	20	A
I <sub>SM</sub>	Max. Pulsed Forward Current	-	-	-	80	
V <sub>SD</sub>	Diode Forward Voltage	I <sub>D</sub> =20A	-	-	1.5	V
T <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =20A, V <sub>GS</sub> =0V diF/dt=100A/μs	-	507	-	nS
Q <sub>rr</sub>	Reverse Recovery Charge	(Note3)	-	7.2	-	μC

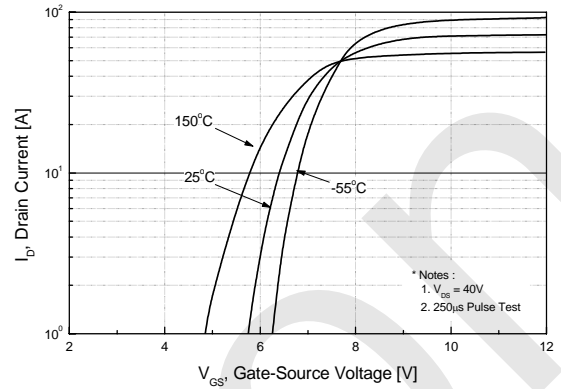
- Notes : 1, L=5.0mH, I<sub>AS</sub>=20A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub> =25°C  
 2, Repetitive Rating : Pulse width limited by maximum junction temperature  
 3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%  
 4, Essentially Independent of Operating Temperature

## Typical Characteristics

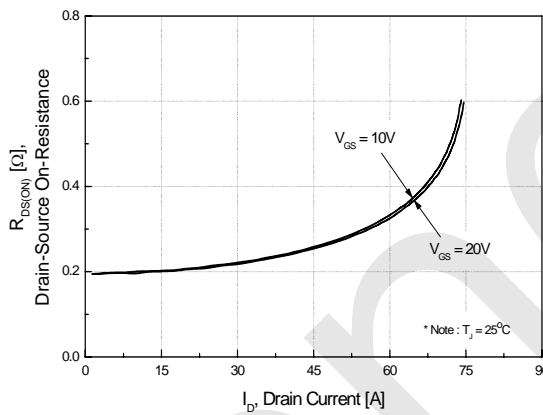
**Figure 1. On-Region Characteristics**



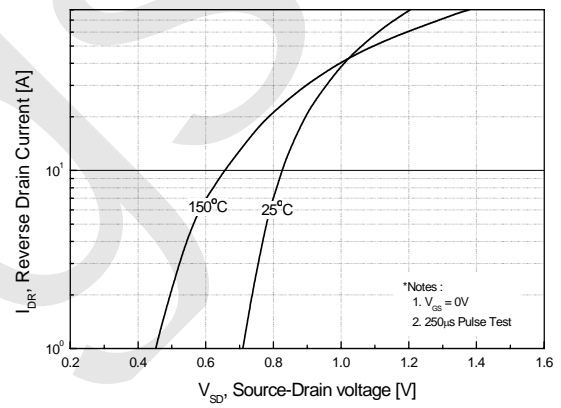
**Figure 2. Transfer Characteristics**



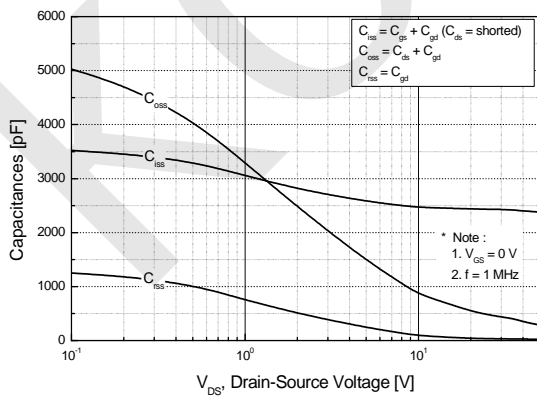
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



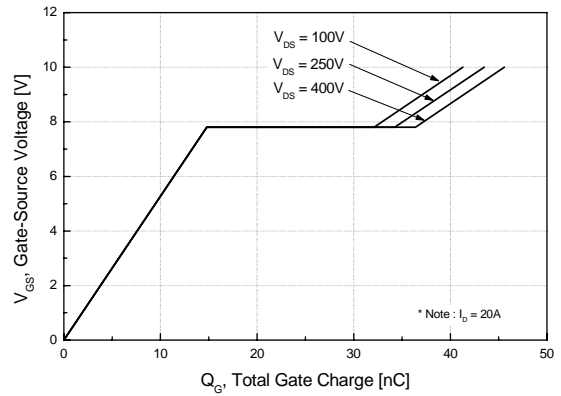
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

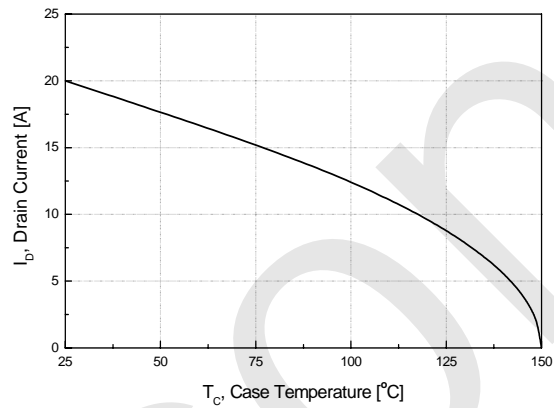
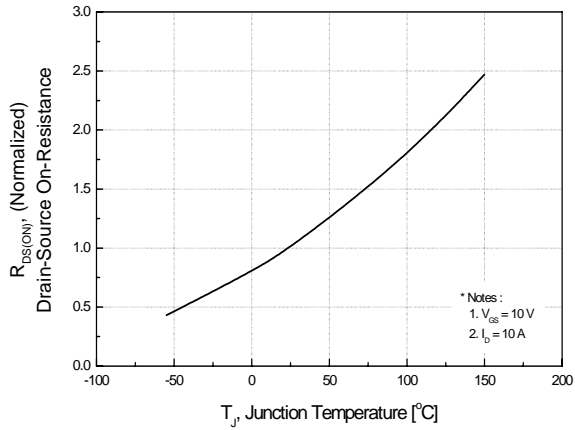


**Figure 6. Gate Charge Characteristics**

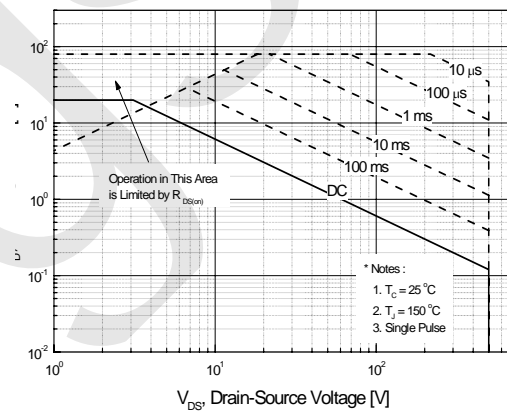
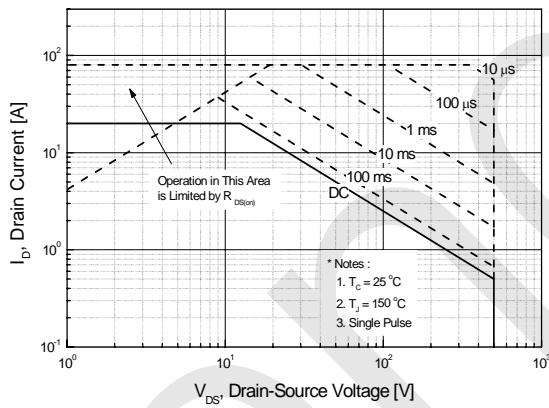


## Typical Characteristics (Continued)

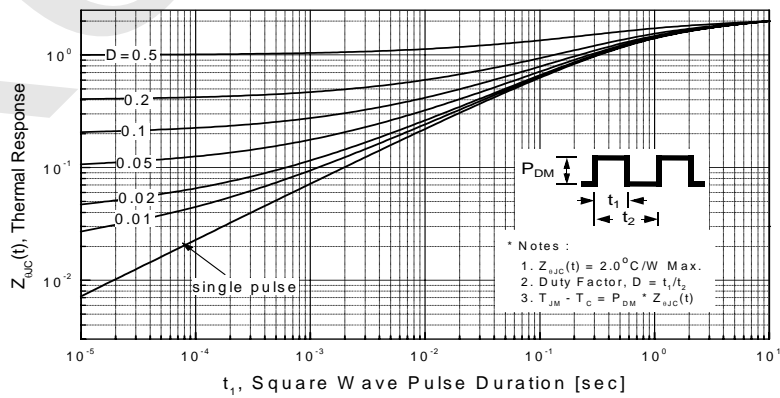
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9-2. Maximum Safe Operating Area**

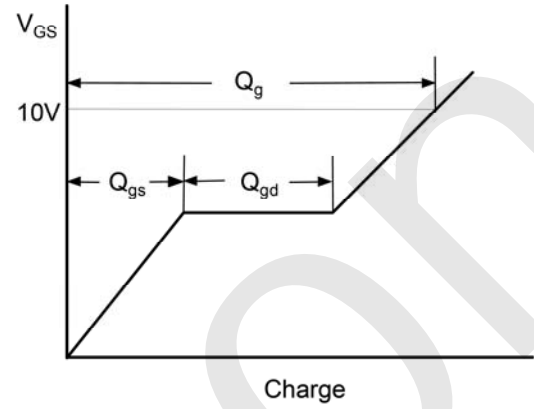
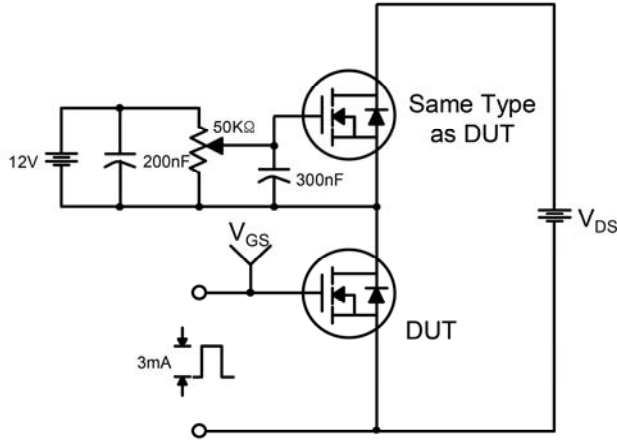


**Figure 10. Maximum Drain Current vs. Case Temperature**

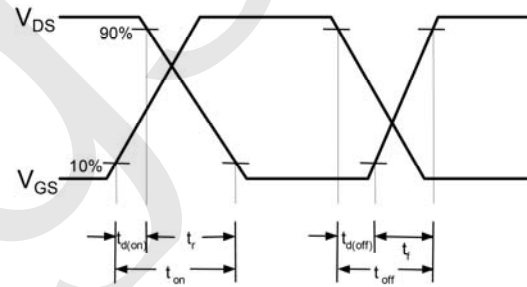
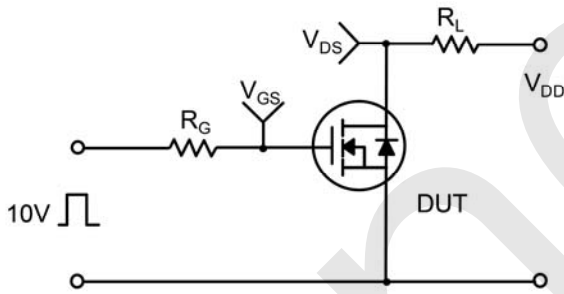


**Transient Thermal Response Curve**

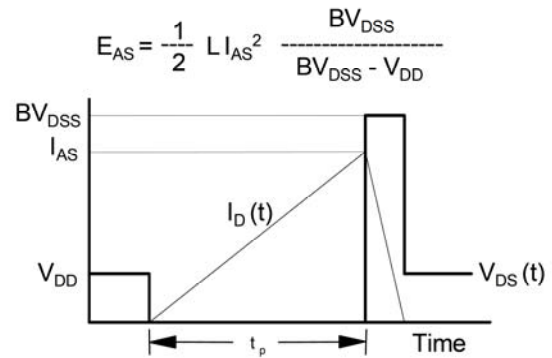
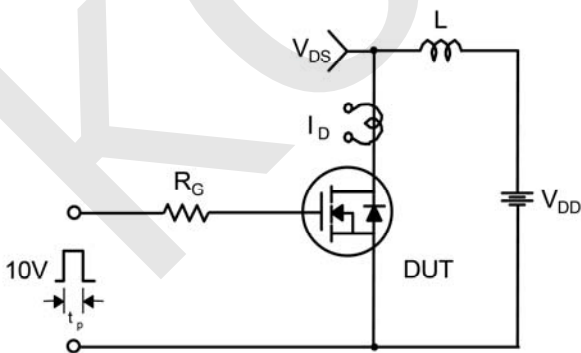
### Gate Charge Test Circuit & Waveform



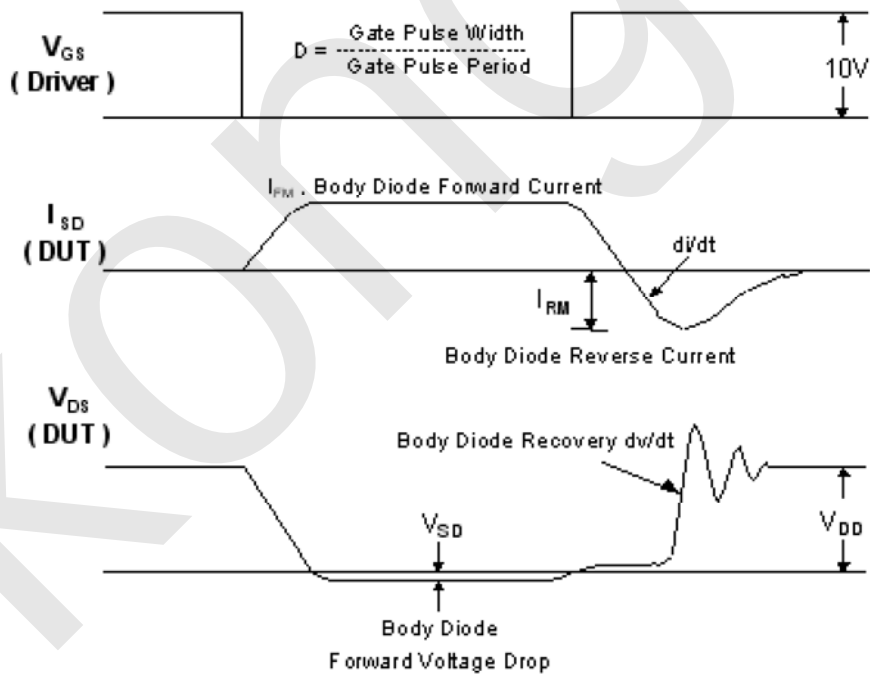
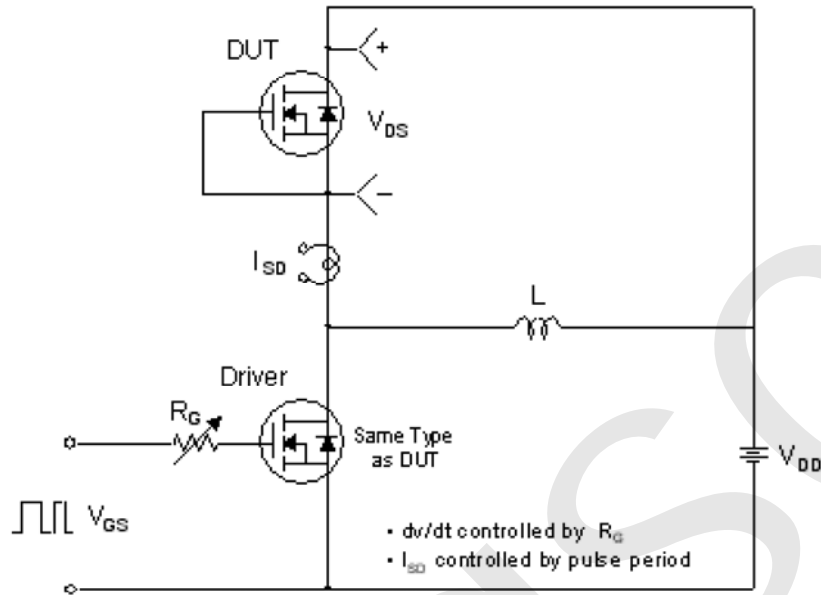
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



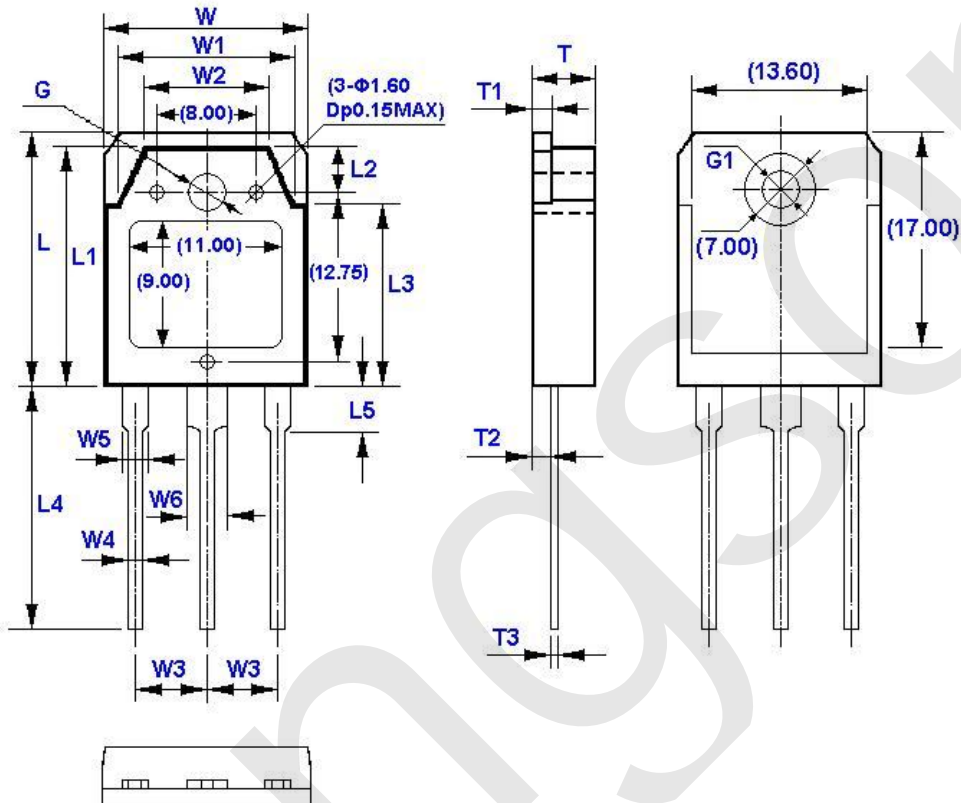
### Peak Diode Recovery dv/dt Test Circuit & Waveform



### Package Dimension

### TO-3P

Unit: mm



Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	15.40	15.80	W5	1.80	2.20	L3	13.70	14.10	T2	1.20	1.60
W1	13.40	13.80	W6	2.80	3.20	L4	19.70	20.30	T3	0.55	0.75
W2	9.40	9.80	L	19.70	20.10	L5	3.30	3.70	G (Φ) (Front)	3.30	3.50
W3	5.45 (TYP)		L1	18.50	18.90	T	4.60	5.00	G1(Φ) (Back)	3.10	3.30
W4	0.80	1.20	L2	3.60	4.00	T1	1.45	1.65			