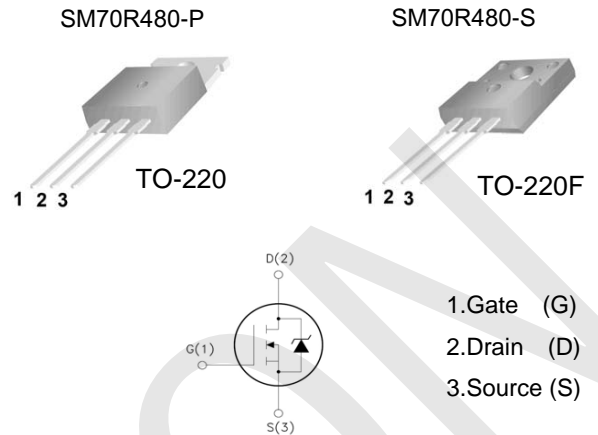


## SM70R480-P/SM70R480-S

### Features:

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge :Qg= 19.5nC (Typ.).
- BVDSS=700V, ID=10.5A
- RDS(on) : 0.48Ω (Max) @VG=10V
- 100% Avalanche Tested



### Absolute Maximum Ratings (TC=25°C unless otherwise noted)

Symbol	Parameter	SM70R480-P	SM70R480-S	Unit
V <sub>DSS</sub>	Drain-Source Voltage	700		V
I <sub>D</sub>	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	10.5* 6.7*		A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	42		A
V <sub>GSS</sub>	Gate-Source voltage	±30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	142		mJ
I <sub>AS</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>j</sub> max)	3.1		A
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15		V/ns
dV <sub>ds</sub> /dt	Drain Source voltage slope (V <sub>ds</sub> =480V)	50		V/ns
P <sub>D</sub>	Power Dissipation (TC = 25°C)	96	31	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/16" from Case for 10 Seconds	260		°C

\* Drain current limited by maximum junction temperature. Maximum duty cycle D=0.75.

### Thermal Characteristics

Symbol	Parameter	SM70R480-P	SM70R480-S	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	1.3	4.0	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink Typ.	0.5	-	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	62	80	°C/W

## Electrical Characteristics TC = 25°C unless otherwise noted

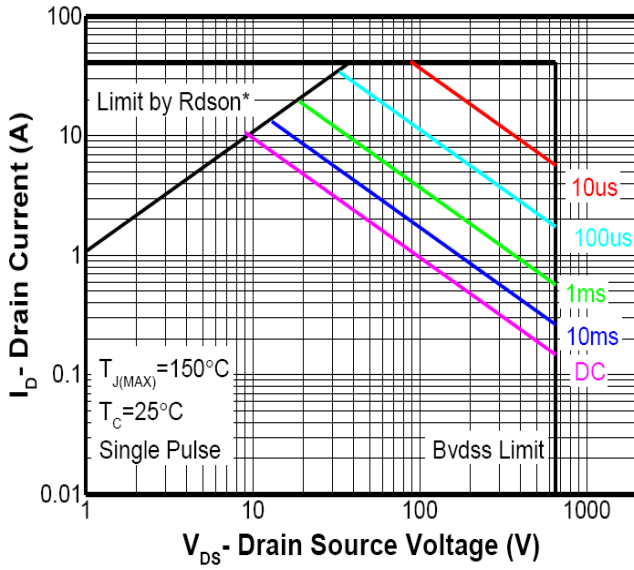
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 25°C	700	-	-	V
		V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 150°C	-	750	-	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	-	0.6	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 700V, V <sub>GS</sub> = 0V -T <sub>C</sub> = 125°C	-	-	1 100	μA 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	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0	3.0	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.5A	-	-	0.48	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V, f = 1.0MHz	-	700	-	pF
C <sub>oss</sub>	Output Capacitance		-	29	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	0.4	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 11A, V <sub>GS</sub> = 10V (Note 4)	-	19.5	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	4.5	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	8.5	-	nC
R <sub>g</sub>	Gate resistance		f=1 MHz, open drain	-	8.2	-
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DS</sub> = 400V, I <sub>D</sub> = 5.5A R <sub>G</sub> = 10Ω, V <sub>GS</sub> = 10V (Note 4)	-	12.2	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	22.5	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	40	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	19.5	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	10.5	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		-	-	42	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 11A	-	0.9	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 400V, I <sub>S</sub> = 5.5A, dI <sub>F</sub> /dt = 100A/μs	-	240	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	1.74	-	μC
I <sub>rrm</sub>	Peak Reverse Recovery Current		-	14.5	-	A

## NOTES:

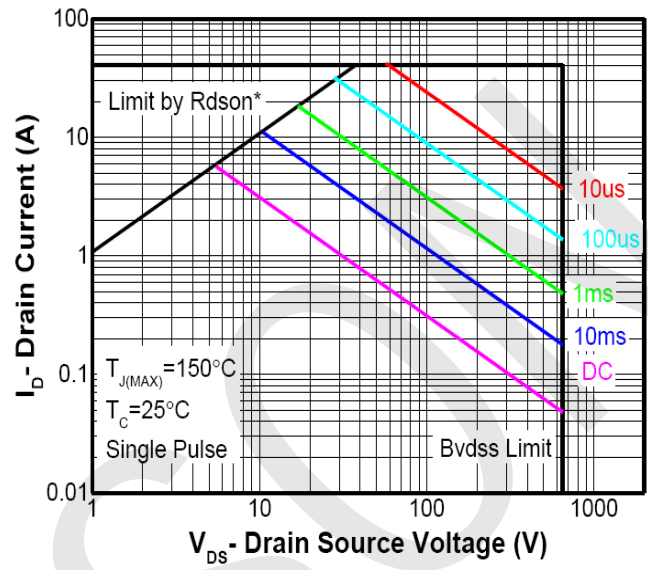
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>D</sub>=I<sub>AS</sub>, V<sub>DD</sub>=50V, Starting T<sub>J</sub>=25 °C
3. I<sub>SD</sub>≤I<sub>D</sub>, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25 °C
4. Essentially Independent of Operating Temperature Typical Characteristics

#### Typical Characteristics

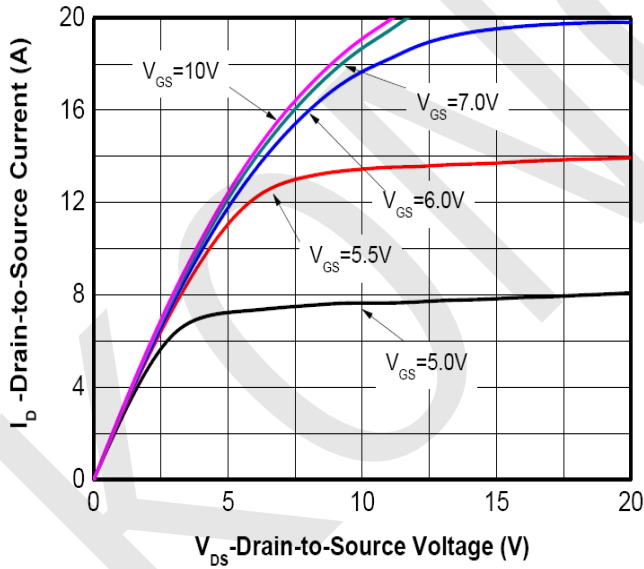
Safe operating area TC=25 °CTO-220



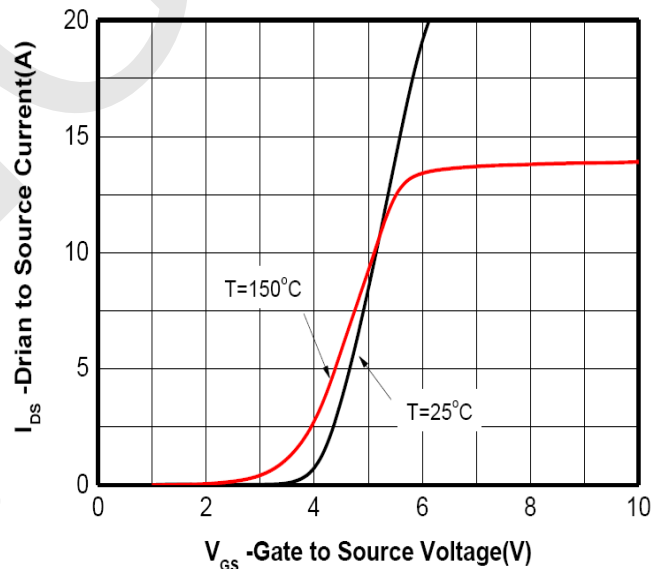
Safe operating area TC=25 °CTO-220F



Typ. output characteristics T<sub>J</sub>=25 °C

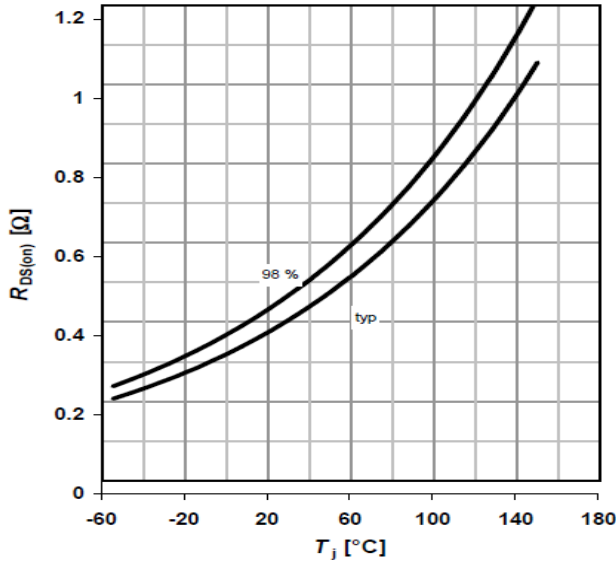


Typ. transfer characteristics

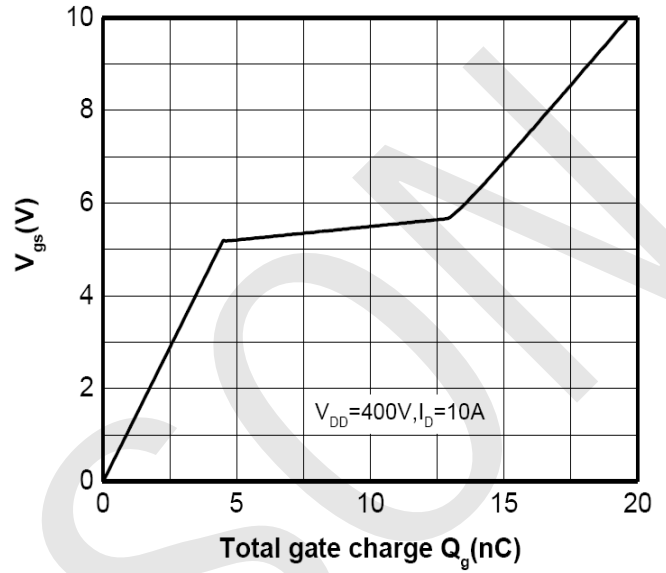


#### Typical Characteristics

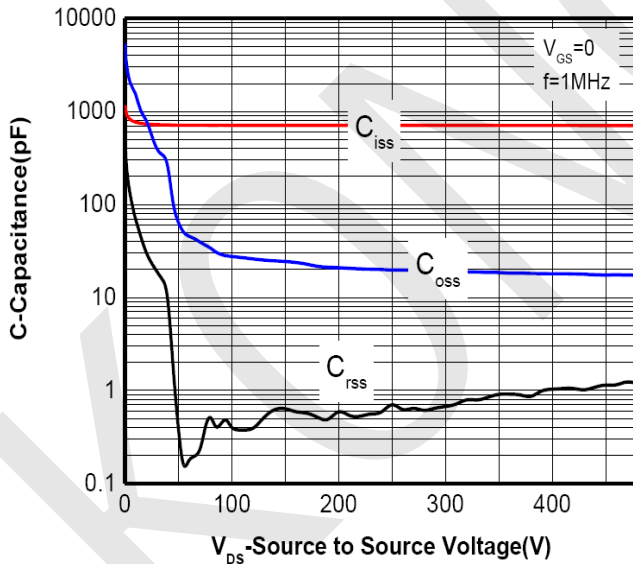
Typ. drain-source on-state resistance  
TO-220/TO-220F



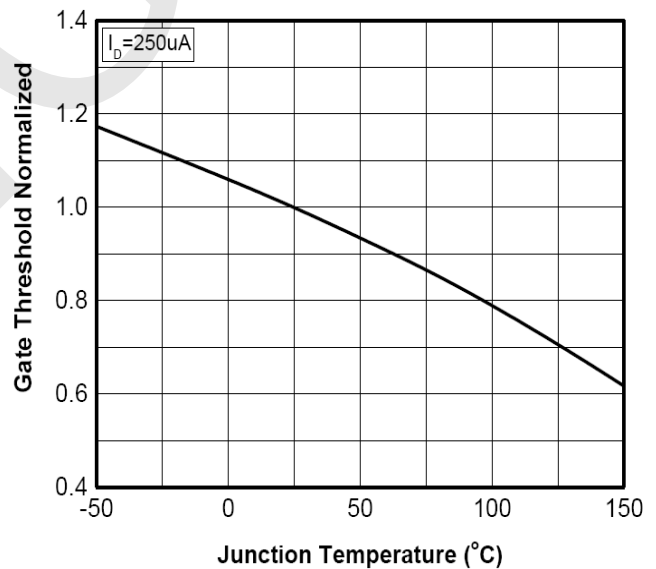
Typ. gate charge characteristics



Typ. capacitances

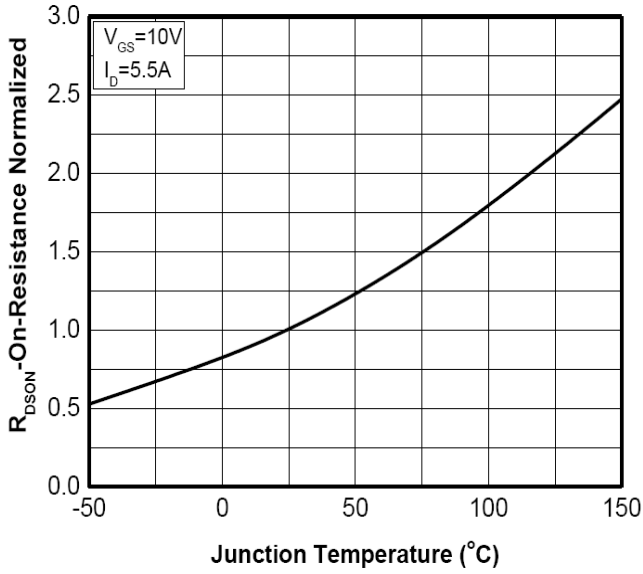


Normalized  $V_{GS(th)}$  characteristics

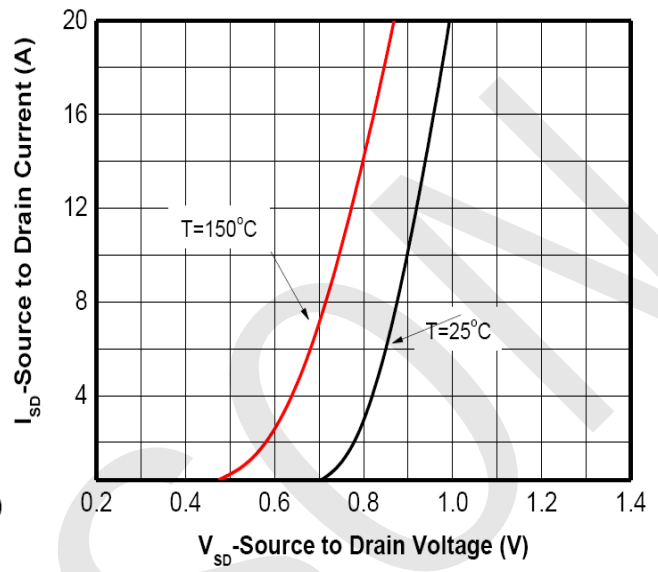


### Typical Characteristics

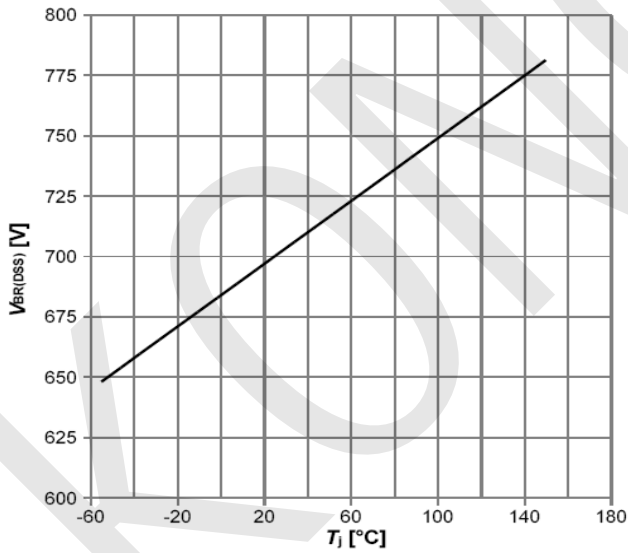
Normalized on resistance vs temperature



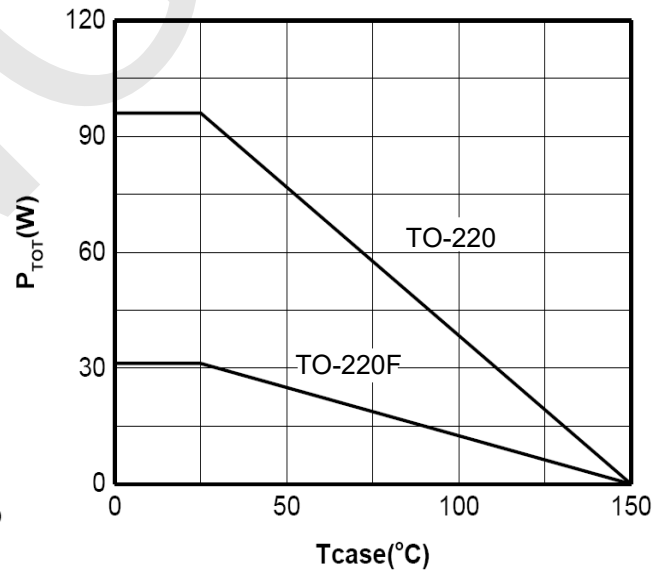
Forward characteristics of reverse diode



Drain-source breakdown voltage

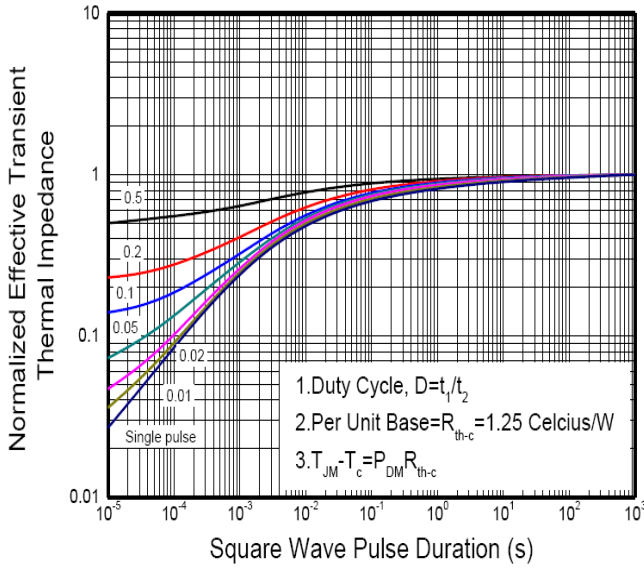


Power dissipation

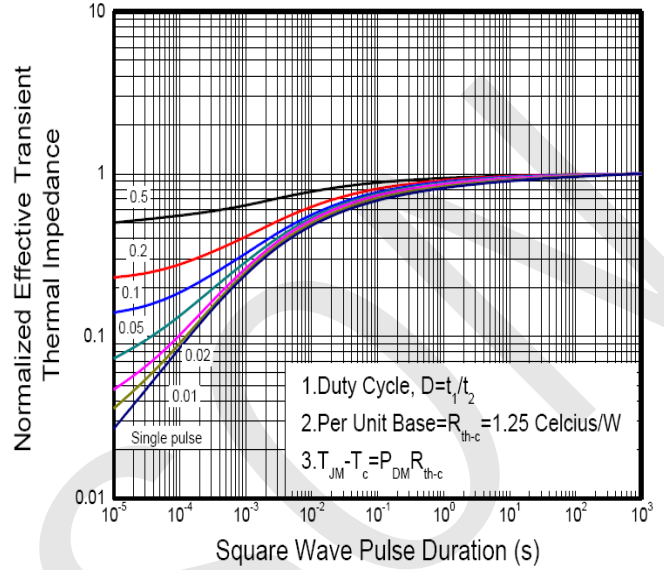


### Typical Characteristics

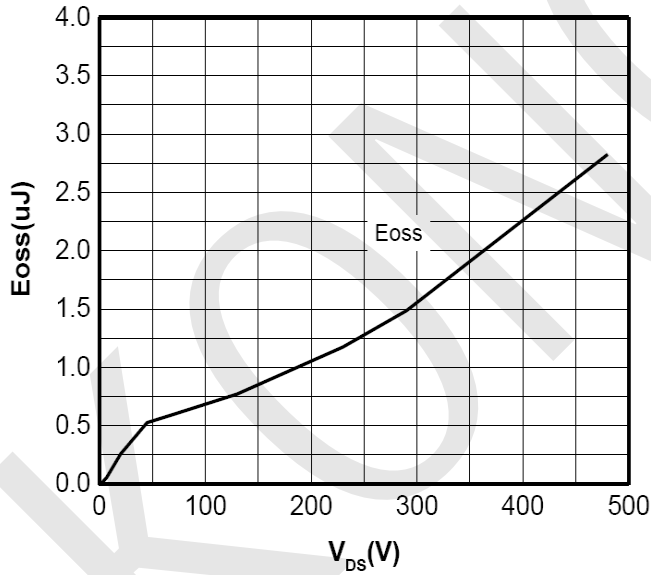
Max. transient thermal impedance  
TO-220



Max. transient thermal impedance  
TO-220F

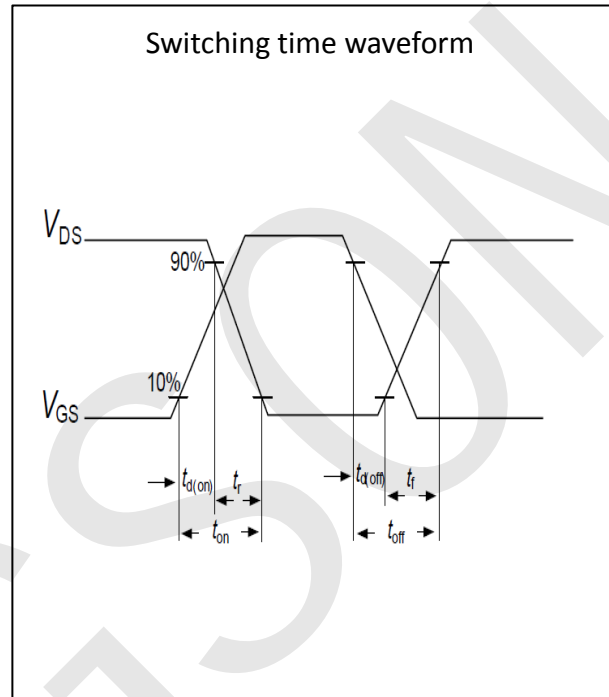
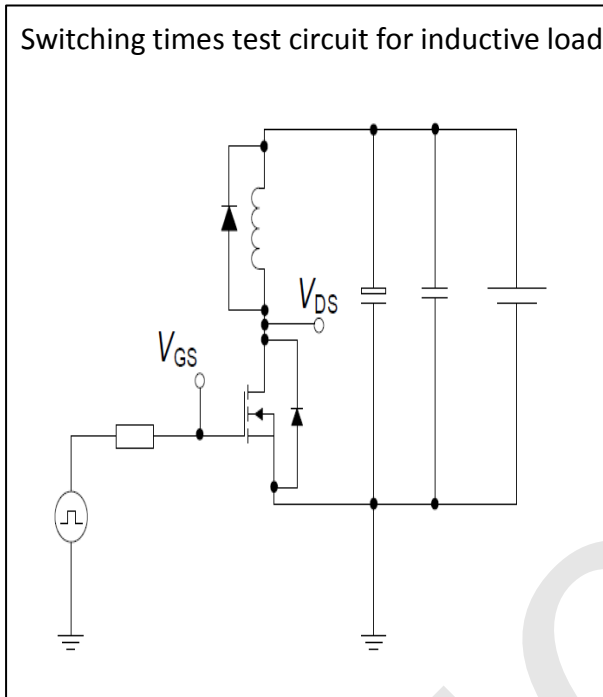


Coss stored energy

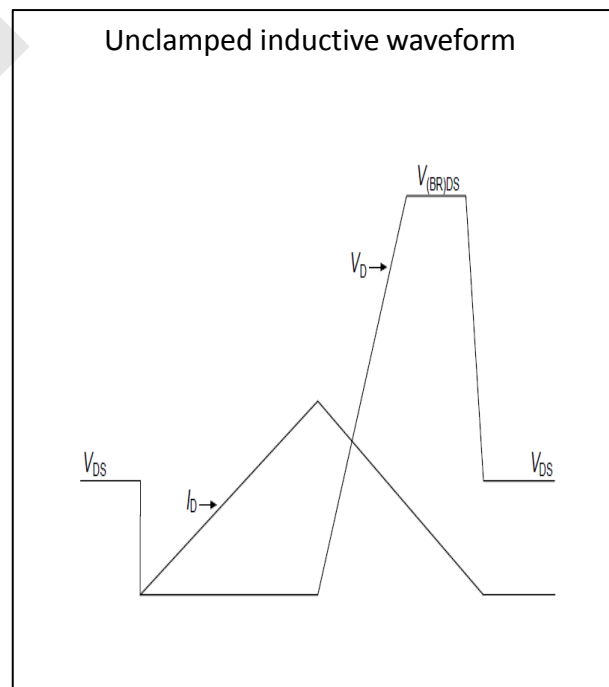
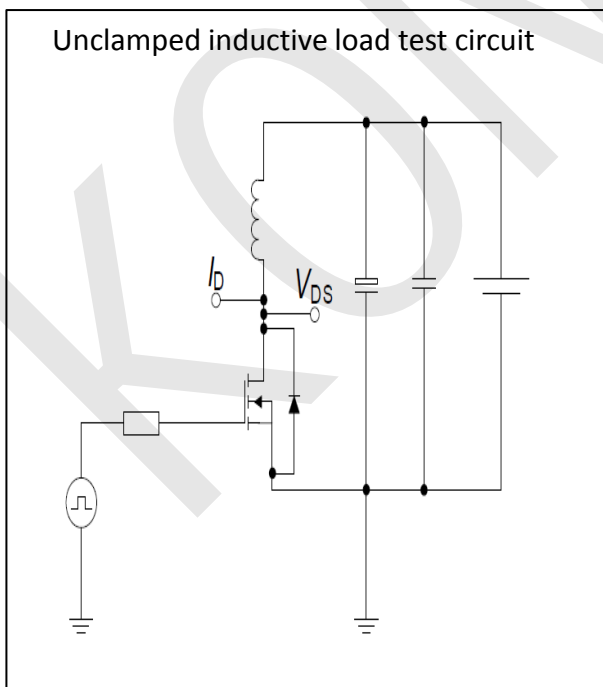


#### Test circuits

#### Switching times test circuit and waveform for inductive load

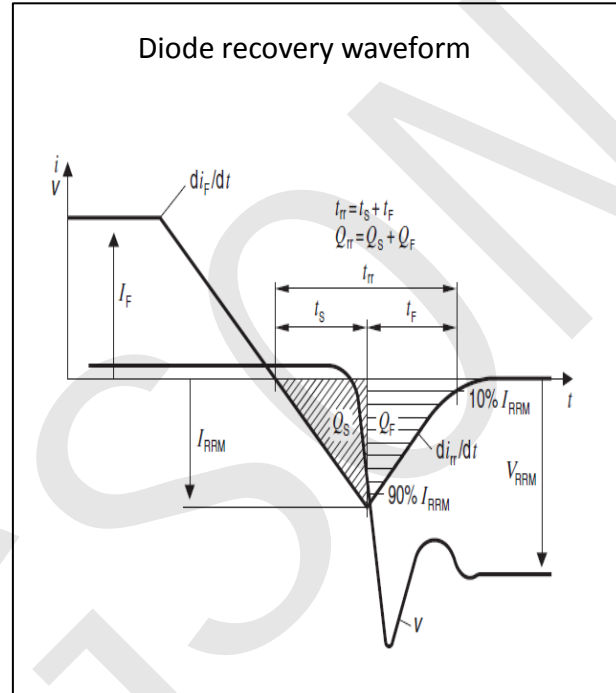
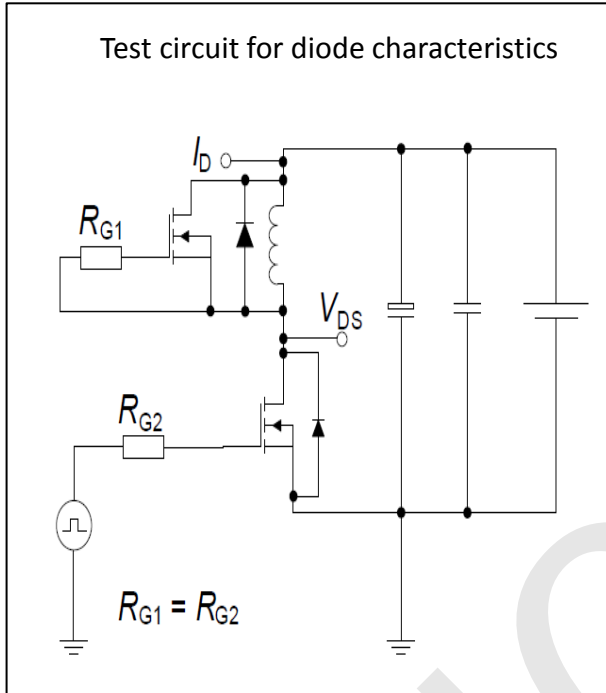


#### Unclamped inductive load test circuit and waveform



#### Test circuits

Test circuit and waveform for diode characteristics

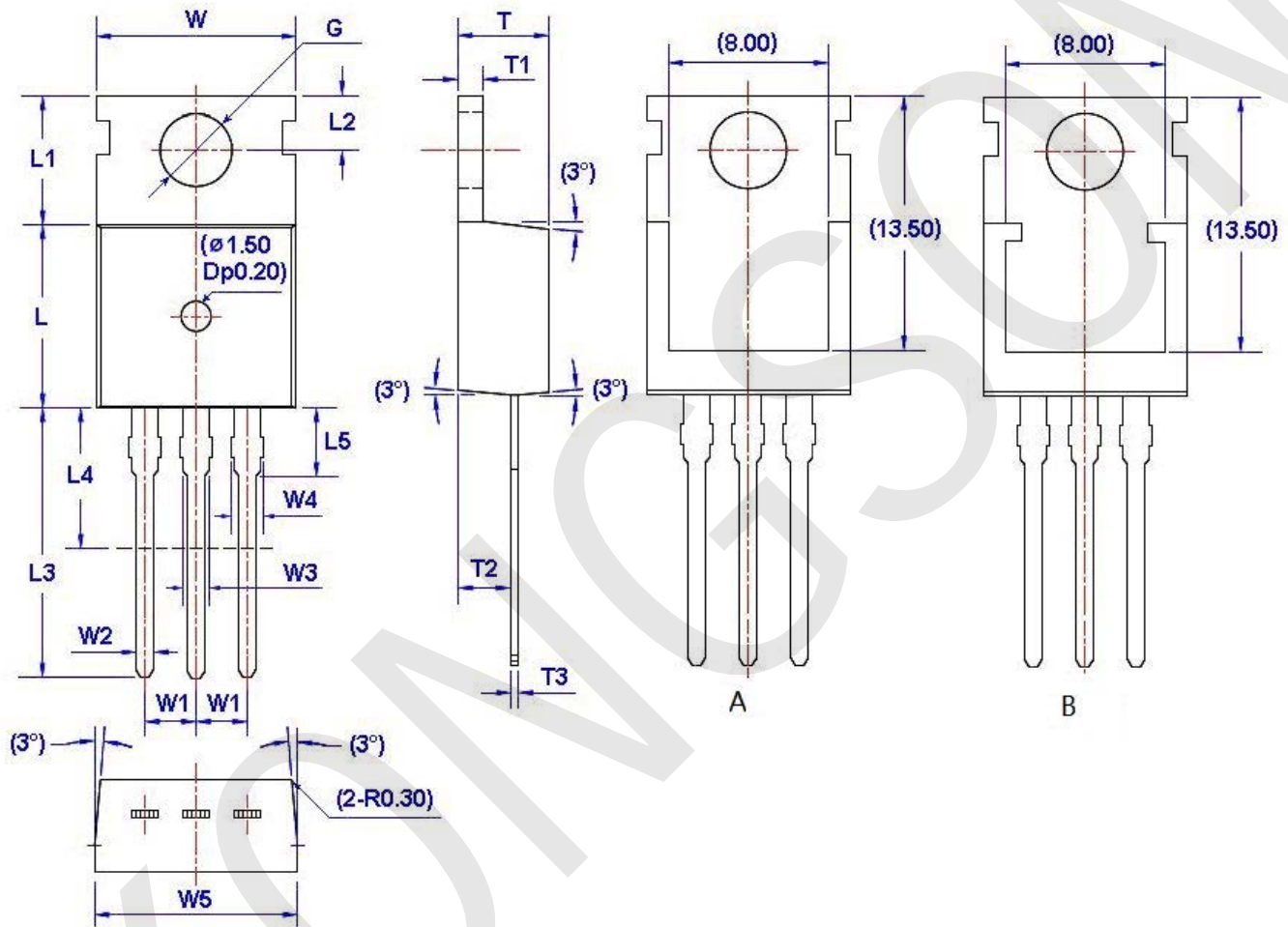




### Package Dimension

### TO-220

Unit: mm

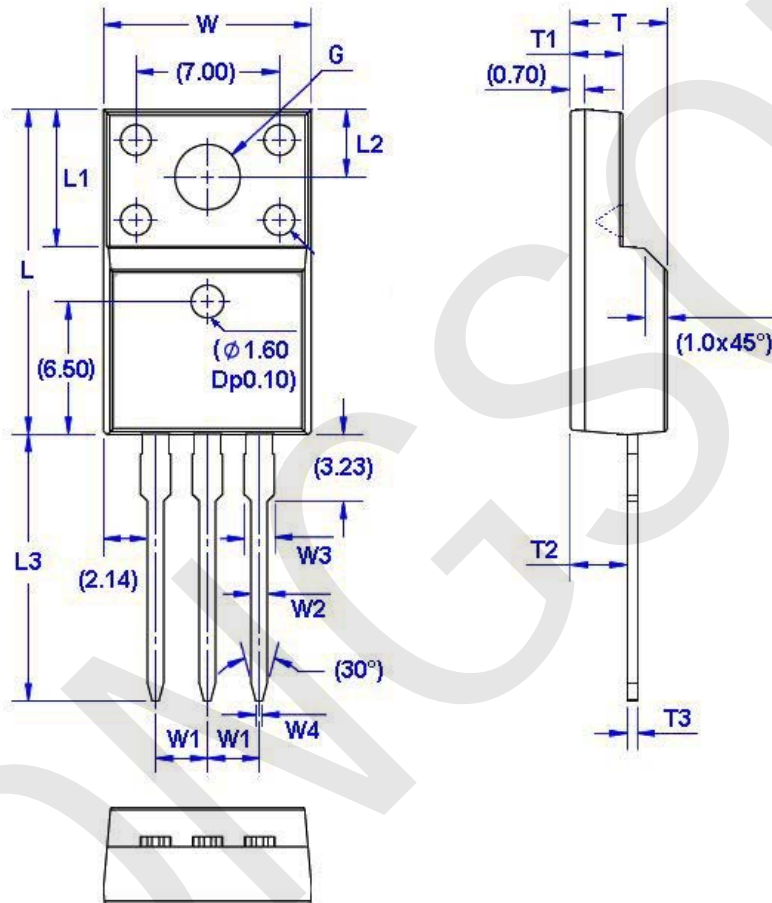


Symbol	Size		Symbol	Size		Symbol	Size		Symbol	Size	
	Min	Max		Min	Max		Min	Max		Min	Max
W	9.66	10.28	W5	9.80	10.20	L4**	6.20	6.60	T3	0.45	0.60
W1	2.54 (TYP)		L	9.00	9.40	L5	2.79	3.30	G(Φ)	3.50	3.70
W2	0.70	0.95	L1	6.40	6.80	T	4.30	4.70			
W3	1.17	1.37	L2	2.70	2.90	T1	1.15	1.40			
W4	1.32	1.72	L3	12.70	14.27	T2	2.20	2.60			

### 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( $\Phi$ )	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			