

**120V N-Ch Power MOSFET**
**Feature**

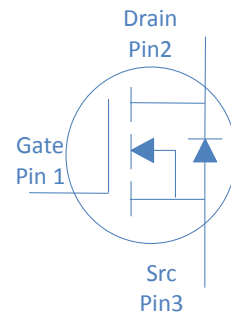
- ◇ High Speed Power Smooth Switching, Logic Level
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free

**Application**

- ◇ Synchronous Rectification in SMPS
- ◇ Hard Switching and High Speed Circuit
- ◇ Power Tools
- ◇ UPS
- ◇ Motor Control

$V_{DS}$		120	V
$R_{DS(on),typ}$	TO-263	4.7	m $\Omega$
$R_{DS(on),typ}$	TO-220	5.3	m $\Omega$
$I_D$ (Silicon Limited)		160	A
$I_D$ (Package Limited)		120	A

**TO-263**

**TO-220**


Part Number	Package	Marking
HGB059N12SL	TO-263	B059N12SL
HGP059N12SL	TO-220	P059N12SL

**Absolute Maximum Ratings at  $T_j=25^\circ\text{C}$  (unless otherwise specified)**

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current (Silicon Limited)	$I_D$	$T_C=25^\circ\text{C}$	160	A
		$T_C=100^\circ\text{C}$	113	
		$T_C=25^\circ\text{C}$	120	
Continuous Drain Current (Package Limited)		$T_C=25^\circ\text{C}$	120	
Drain to Source Voltage	$V_{DS}$	-	120	V
Gate to Source Voltage	$V_{GS}$	-	$\pm 20$	V
Pulsed Drain Current	$I_{DM}$	-	540	A
Avalanche Energy, Single Pulse	$E_{AS}$	$L=0.4\text{mH}, T_C=25^\circ\text{C}$	720	mJ
Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	333	W
Operating and Storage Temperature	$T_J, T_{stg}$	-	-55 to 175	$^\circ\text{C}$

**Absolute Maximum Ratings**

Parameter	Symbol	Max	Unit
Thermal Resistance Junction-Case	$R_{\theta JC}$	0.45	$^\circ\text{C/W}$
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	60	$^\circ\text{C/W}$

**Electrical Characteristics at T<sub>j</sub>=25°C (unless otherwise specified)**
**Static Characteristics**

Parameter	Symbol	Conditions	Value			Unit	
			min	typ	max		
Drain to Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	120	-	-	V	
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250μA	1.4	1.8	2.4		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =120V, T <sub>j</sub> =25°C	-	-	1	μA	
		V <sub>GS</sub> =0V, V <sub>DS</sub> =120V, T <sub>j</sub> =100°C	-	-	100		
Gate to Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA	
Drain to Source on Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	TO-263	-	4.7	5.6	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	TO-263	-	5	6.9	
		V <sub>GS</sub> =10V, I <sub>D</sub> =20A	TO-220	-	5	5.9	
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	TO-220	-	5.3	7.2	
Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =20A	-	90	-	S	
Gate Resistance	R <sub>G</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> Open, f=1MHz	-	0.7	-	Ω	

**Dynamic Characteristics**

Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =60V, f=1MHz	-	7690	-	pF
Output Capacitance	C <sub>oss</sub>		-	441	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	18.5	-	
Total Gate Charge	Q <sub>g</sub> (10V)	V <sub>DD</sub> =60V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	110	-	nC
Total Gate Charge	Q <sub>g</sub> (4.5V)		-	50	-	
Gate to Source Charge	Q <sub>gs</sub>		-	20	-	
Gate to Drain (Miller) Charge	Q <sub>gd</sub>		-	34	-	
Turn on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =60V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V, R <sub>G</sub> =10Ω,	-	30	-	ns
Rise time	t <sub>r</sub>		-	21	-	
Turn off Delay Time	t <sub>d(off)</sub>		-	50	-	
Fall Time	t <sub>f</sub>		-	17	-	

**Reverse Diode Characteristics**

Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>F</sub> =20A	-	0.9	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>R</sub> =60V, I <sub>F</sub> =20A, dI <sub>F</sub> /dt=500A/μs	-	80	-	ns
Reverse Recovery Charge	Q <sub>rr</sub>		-	420	-	nC

Fig 1. Typical Output Characteristics

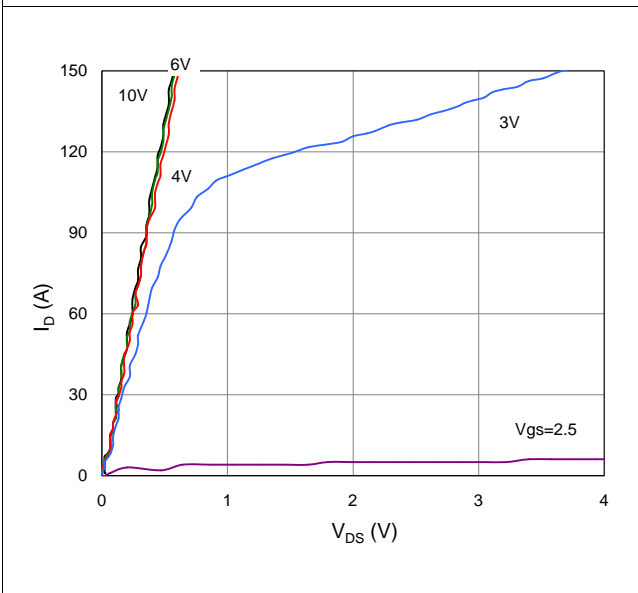


Figure 2. On-Resistance vs. Gate-Source Voltage

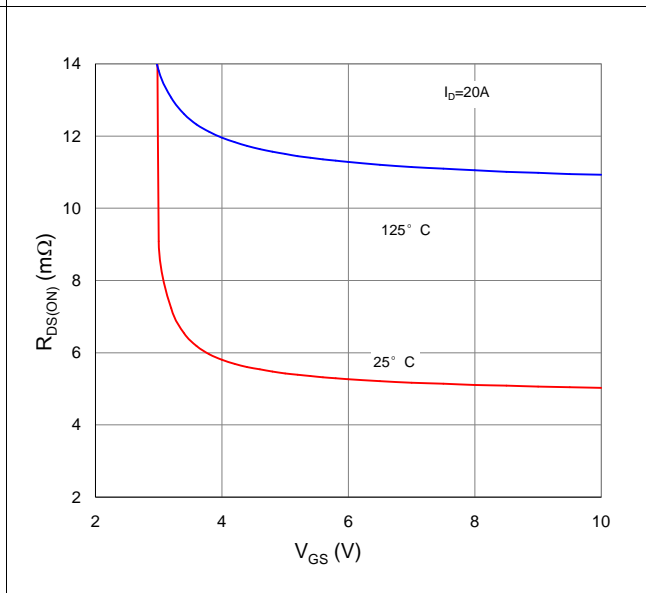


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

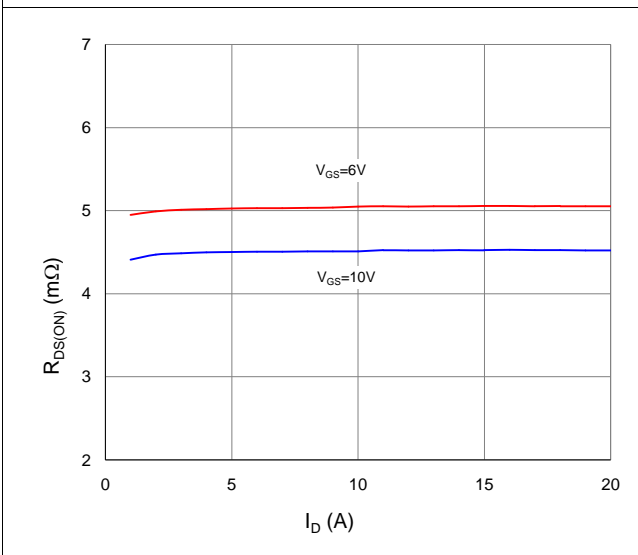


Figure 4. Normalized On-Resistance vs. Junction Temperature

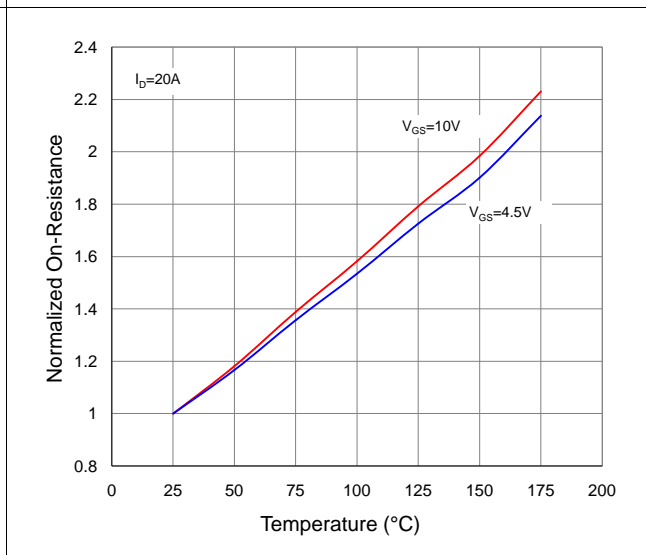


Figure 5. Typical Transfer Characteristics

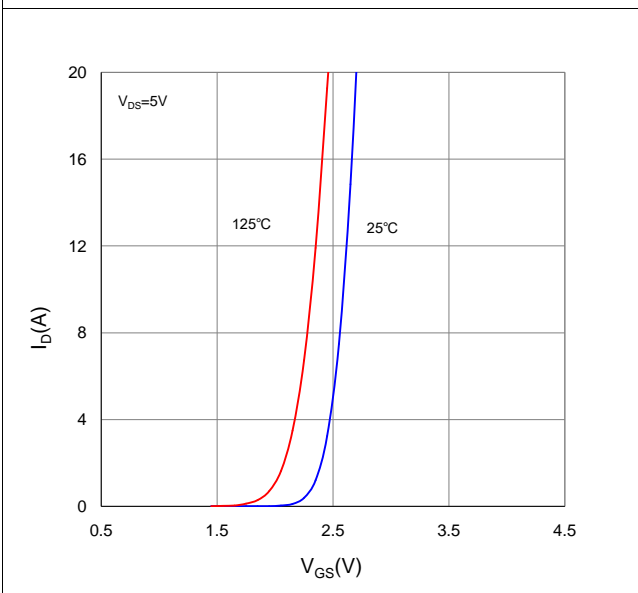


Figure 6. Typical Source-Drain Diode Forward Voltage

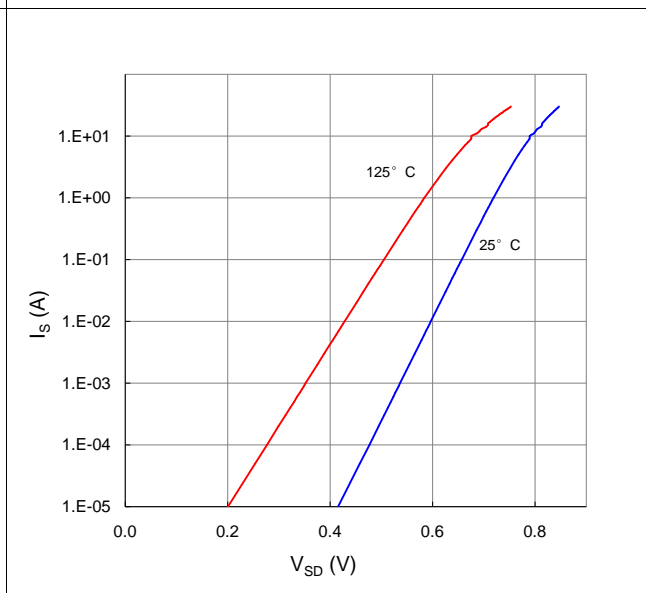


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

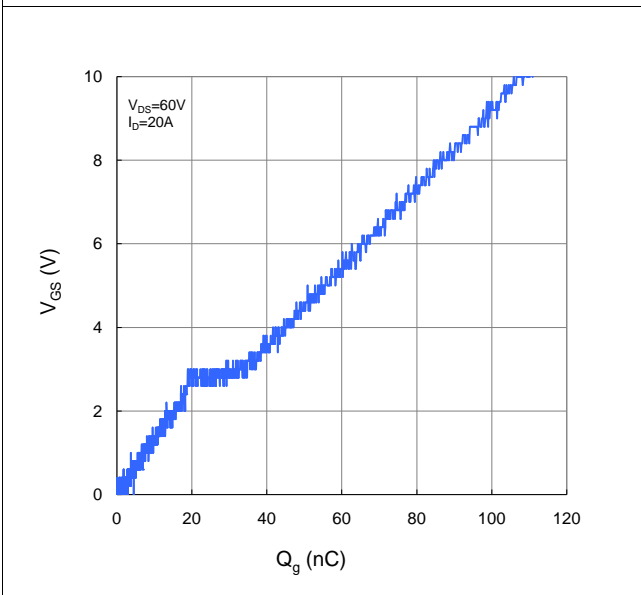


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

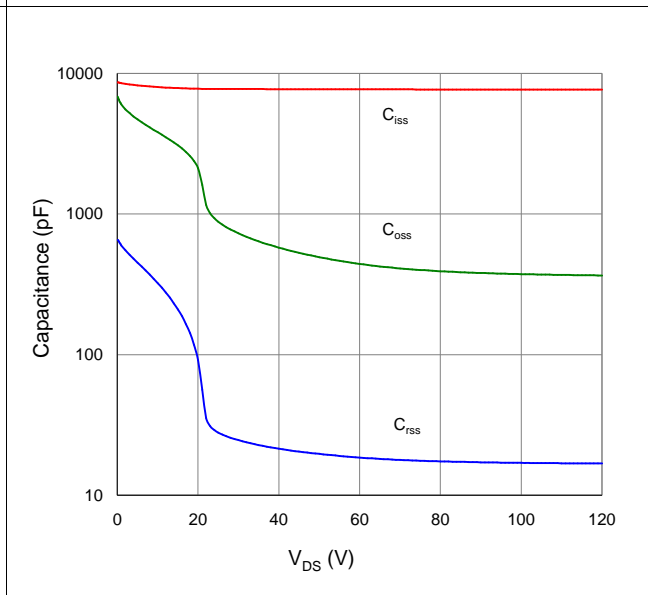


Figure 9. Maximum Safe Operating Area

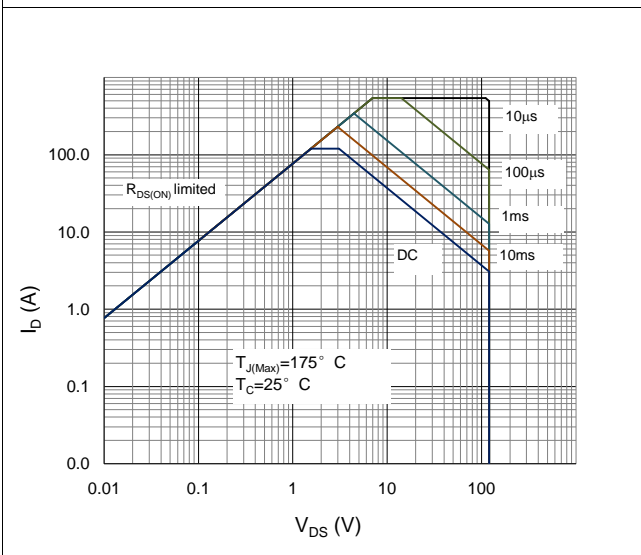


Figure 10. Maximum Drain Current vs. Case Temperature

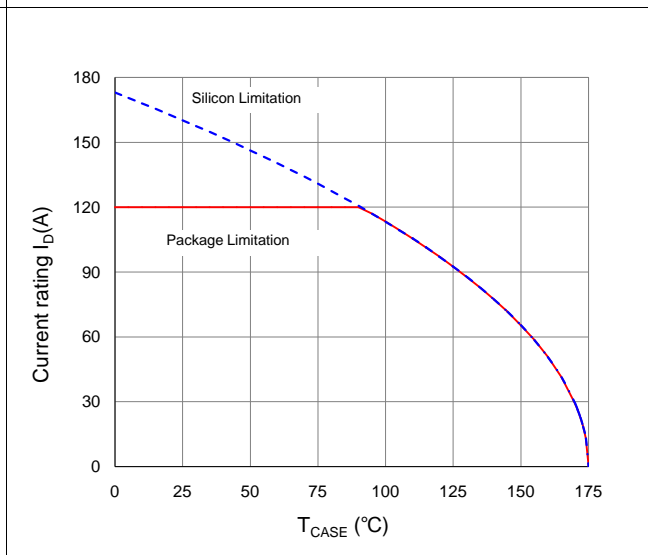
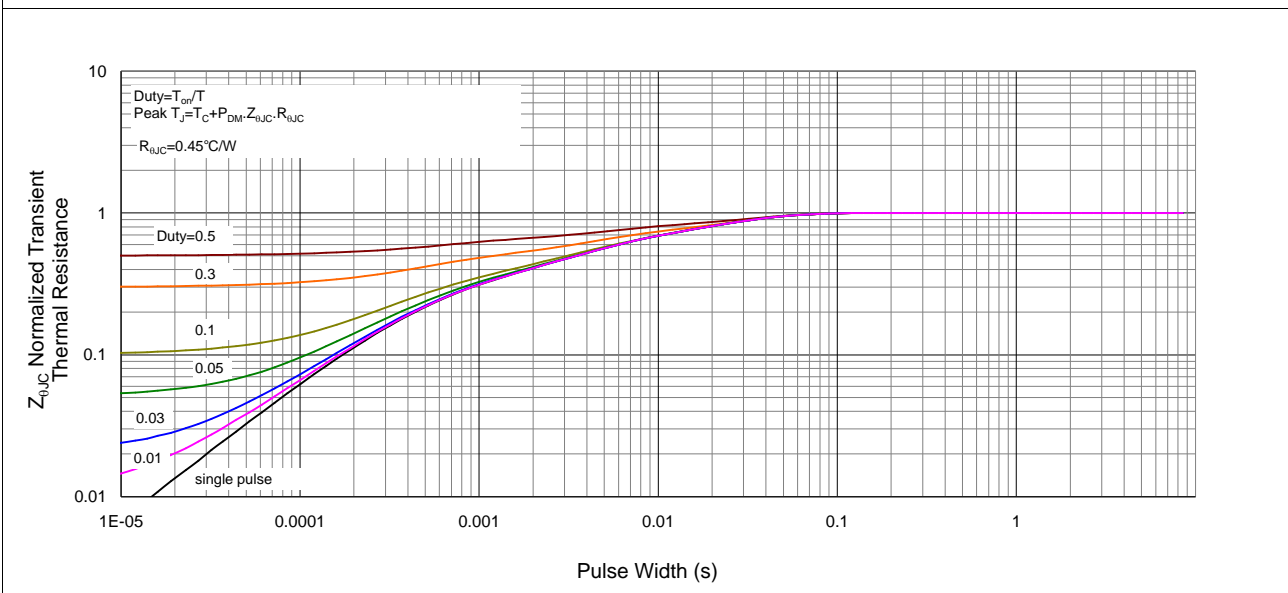
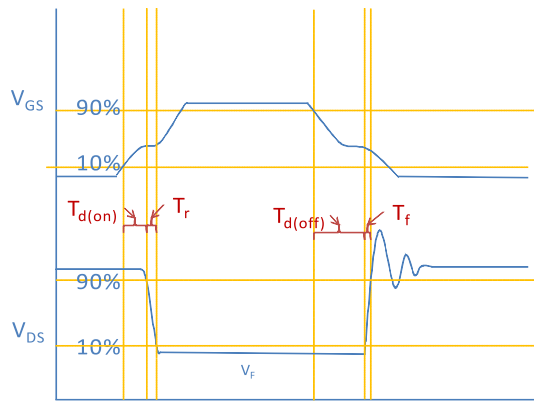
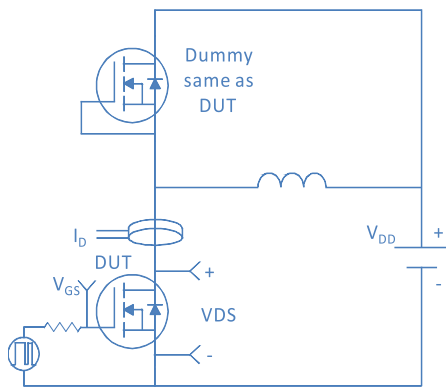


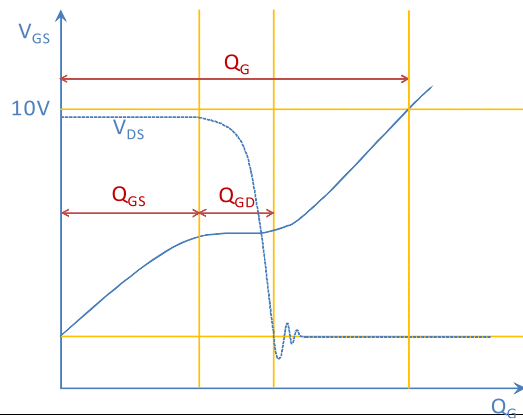
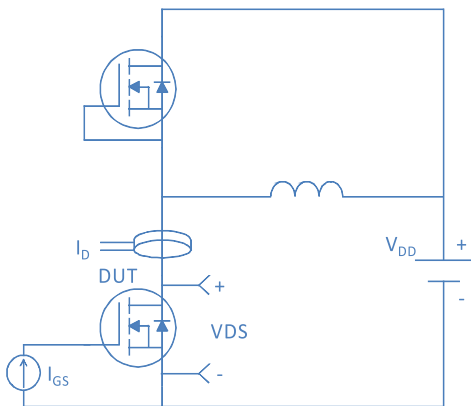
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



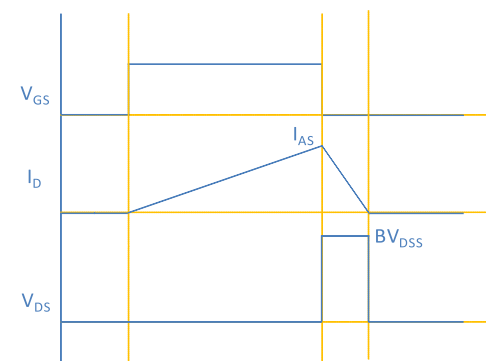
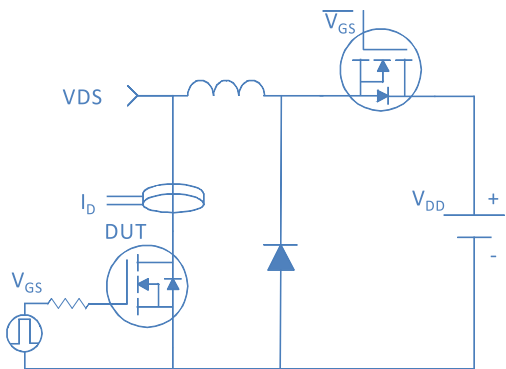
### Inductive switching Test



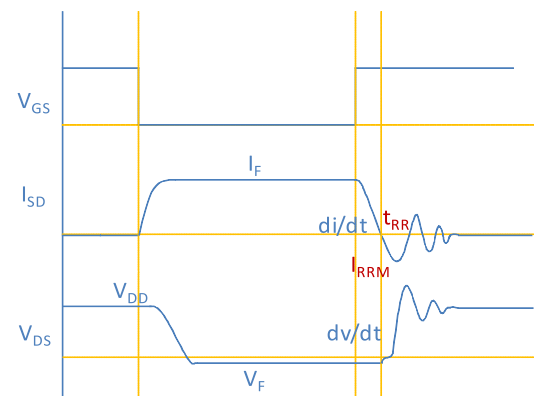
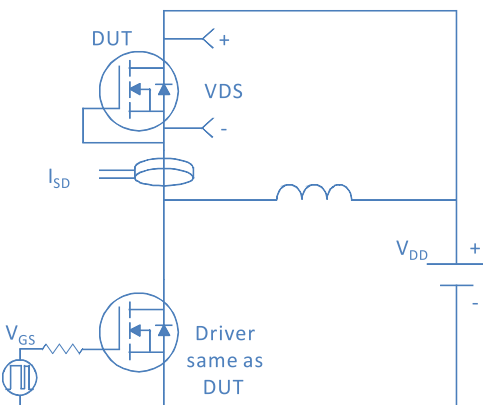
### Gate Charge Test



### Uclamped Inductive Switching (UIS) Test

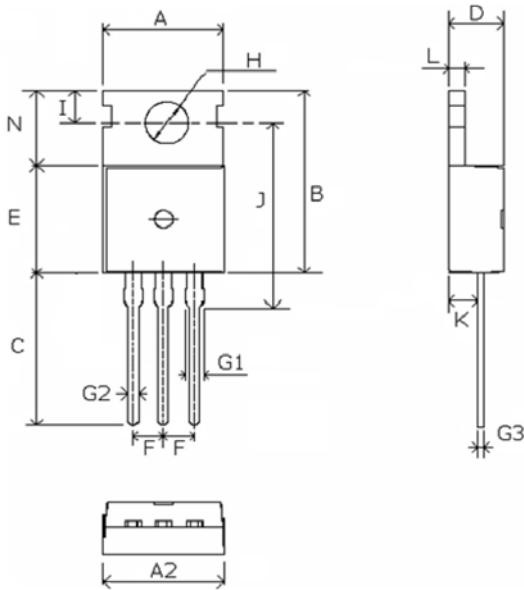


### Diode Recovery Test



**TO-220, 3 leads**

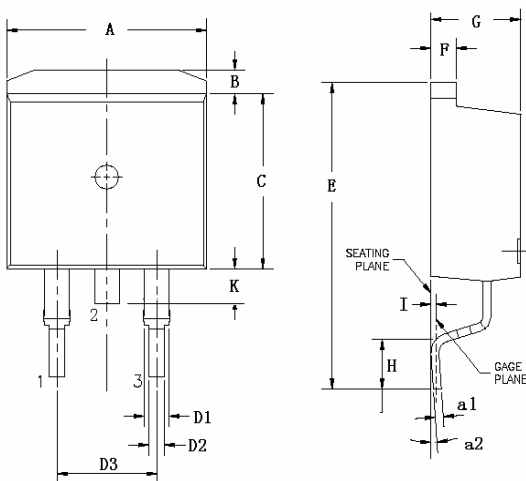
Dimensions in mm unless otherwise specified



Symbol	Min	Nom	Max
A	9.66	9.97	10.28
A2	9.80	10.00	10.20
B	15.60	15.70	15.80
C	12.70	13.48	14.27
D	4.30	4.50	4.70
E	9.00	9.20	9.40
F		2.54	
G1	1.32	1.52	1.72
G2	0.70	0.82	0.95
G3	0.45	0.52	0.60
H	3.50	3.60	3.70
I	2.70	2.80	2.90
J	15.70	15.97	16.25
K	2.20	2.40	2.60
L	1.15	1.27	1.40
N	6.40	6.60	6.80

**TO-263, 2 leads**

Dimensions in mm unless otherwise specified



Symbol	Min	Nom	Max
A	9.66	9.97	10.28
B	1.02	1.17	1.32
C	8.59	9.00	9.40
D1	1.14	1.27	1.40
D2	0.70	0.83	0.95
D3		5.08	
E	15.09	15.24	15.39
F	1.15	1.28	1.40
G	4.30	4.50	4.70
H	2.29	2.54	2.79
I		0.25	
K	1.30	1.45	1.60
a1	0.45	0.55	0.65
a2(degree)	0°		8°