60V N-Ch Power MOSFET

V_{DS}		60	V
$R_{DS(on),typ}$	V_{GS}=10V	2.9	mΩ
$R_{DS(on),typ}$	V_{GS}=4.5V	4.1	mΩ
$R_{DS(on),typ}$	V_{GS}=10V	3.2	mΩ
$R_{DS(on),typ}$	V_{GS}=4.5V	4.4	mΩ
$I_{D\ (Sillicon\ Limited)}$		140	A
$I_{D\ (Package\ Limited)}$		120	A

Feature

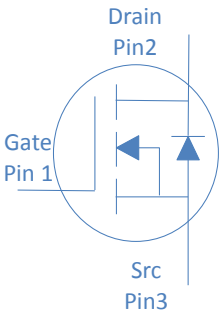
- ◇ Optimized for high speed switching, Logic Level
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free, Halogen Free

Application

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

TO-263

TO-220



Part Number	Package	Marking
HGB040N06SL	TO-263	GB040N06SL
HGP040N06SL	TO-220	GP040N06SL

Absolute Maximum Ratings at T_j=25℃ (unless otherwise specified)

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current (Silicon Limited)	I_D	T_C=25℃	140	A
		T_C=100℃	100	
Continuous Drain Current (Package Limited)		T_C=25℃	120	
Drain to Source Voltage	V_{DS}	-	60	V
Gate to Source Voltage	V_{GS}	-	±20	V
Pulsed Drain Current	I_{DM}	-	410	A
Avalanche Energy, Single Pulse	E_{AS}	L=0.3mH, T_C=25℃	240	mJ
Power Dissipation	P_D	T_C=25℃	176	W
Operating and Storage Temperature	T_J, T_{stg}	-	-55 to175	℃

Absolute Maximum Ratings

Parameter	Symbol	Max	Unit
Thermal Resistance Junction-Case	$R_{\theta JC}$	0.85	℃/W
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	60	℃/W

Electrical Characteristics at T_j=25℃ (unless otherwise specified)

Static Characteristics

Parameter	Symbol	Conditions		Value			Unit
				min	typ	max	
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=250μA		60	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=250μA		1	1.8	2.4	
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS}=0V, V_{DS}=60V, T_j=25℃		-	-	1	μA
		V_{GS}=0V, V_{DS}=60V, T_j=100℃		-	-	100	
Gate to Source Leakage Current	I_{GSS}	V_{GS}=±20V, V_{DS}=0V		-	-	±100	nA
Drain to Source on Resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=20A	TO-263	-	2.9	3.7	mΩ
		V_{GS}=4.5V, I_D=20A	TO-263	-	4.1	5.2	mΩ
Drain to Source on Resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=20A	TO-220	-	3.2	4	mΩ
		V_{GS}=4.5V, I_D=20A	TO-220	-	4.4	5.5	mΩ
Transconductance	g_{fs}	V_{DS}=5V, I_D=20A		-	58	-	S
Gate Resistance	R_G	V_{GS}=0V, V_{DS} Open, f=1MHz		-	1.6	-	Ω

Dynamic Characteristics

Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=30V, f=1MHz	-	3250	-	pF
Output Capacitance	C_{oss}		-	1270	-	
Reverse Transfer Capacitance	C_{rss}		-	45	-	
Total Gate Charge (10V)	Q_g (10V)	V_{DD}=30V, I_D=20A, V_{GS}=10V	-	49	-	nC
Total Gate Charge (4.5V)	Q_g (4.5V)		-	24	-	
Gate to Source Charge	Q_{gs}		-	8	-	
Gate to Drain (Miller) Charge	Q_{gd}		-	9	-	
Turn on Delay Time	$t_{d(on)}$	V_{DD}=30V, I_D=20A, V_{GS}=10V, R_G=10Ω,	-	12	-	ns
Rise time	t_r		-	10	-	
Turn off Delay Time	$t_{d(off)}$		-	55	-	
Fall Time	t_f		-	15	-	

Reverse Diode Characteristics

Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_F=20A	-	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R=30V, I_F=20A, dI_F/dt=300A/μs	-	50	-	ns
Reverse Recovery Charge	Q_{rr}		-	120	-	nC

Fig 1. Typical Output Characteristics

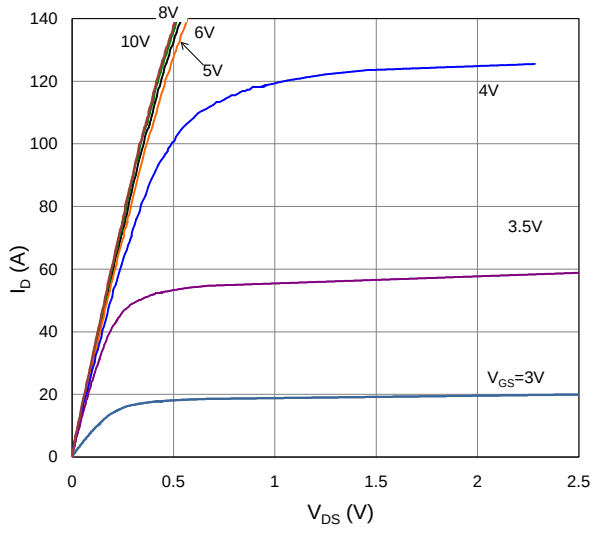


Figure 2. On-Resistance vs. Gate-Source Voltage

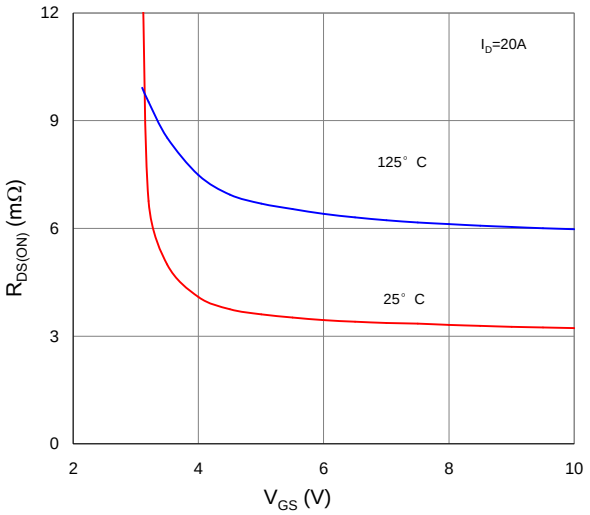


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

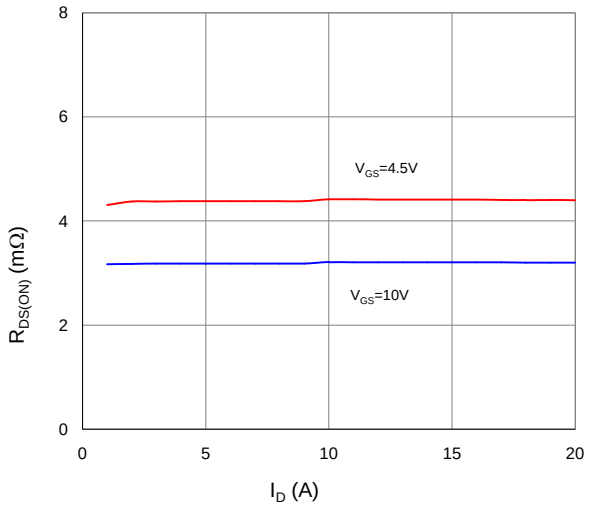


Figure 4. Normalized On-Resistance vs. Junction Temperature

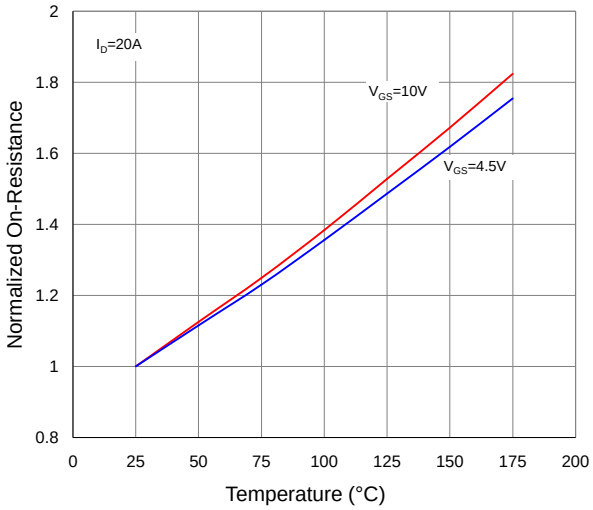


Figure 5. Typical Transfer Characteristics

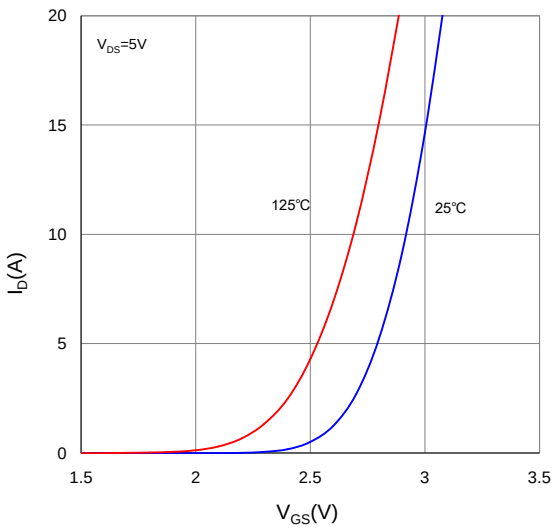


Figure 6. Typical Source-Drain Diode Forward Voltage

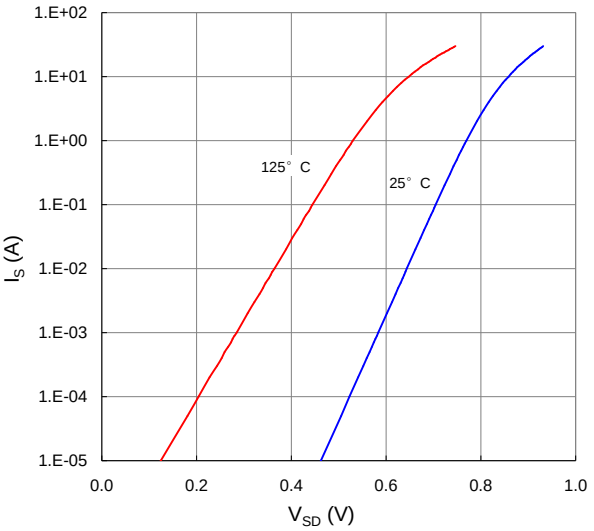


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

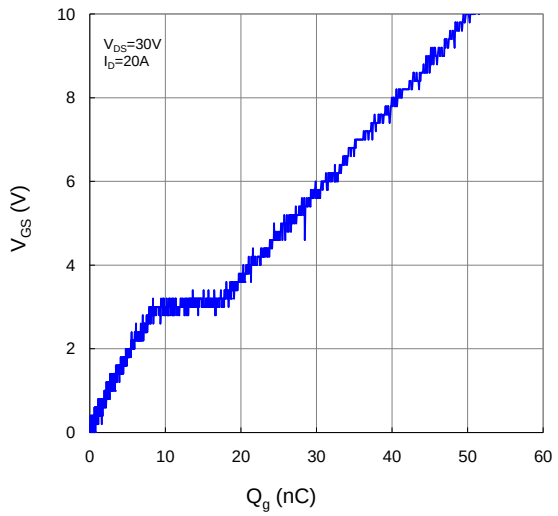


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

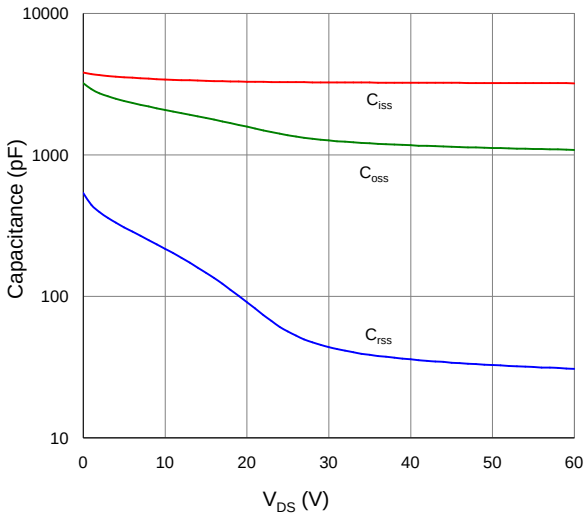


Figure 9. Maximum Safe Operating Area

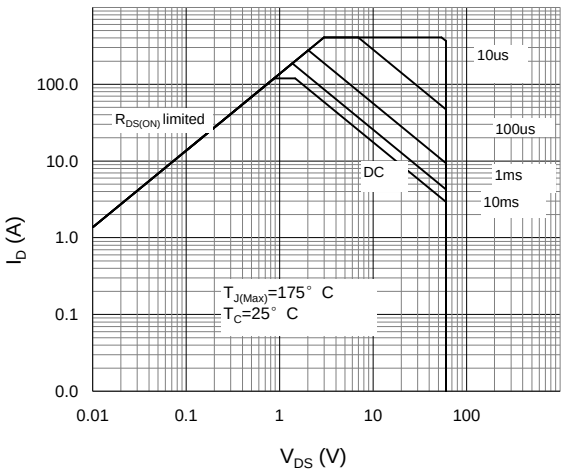


Figure 10. Maximun Drain Current vs. Case Temperature

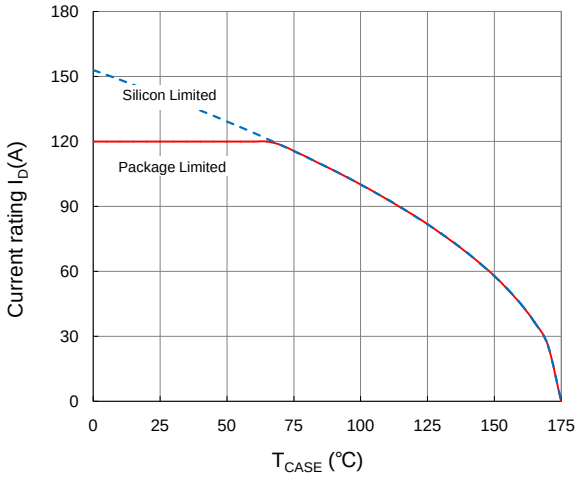
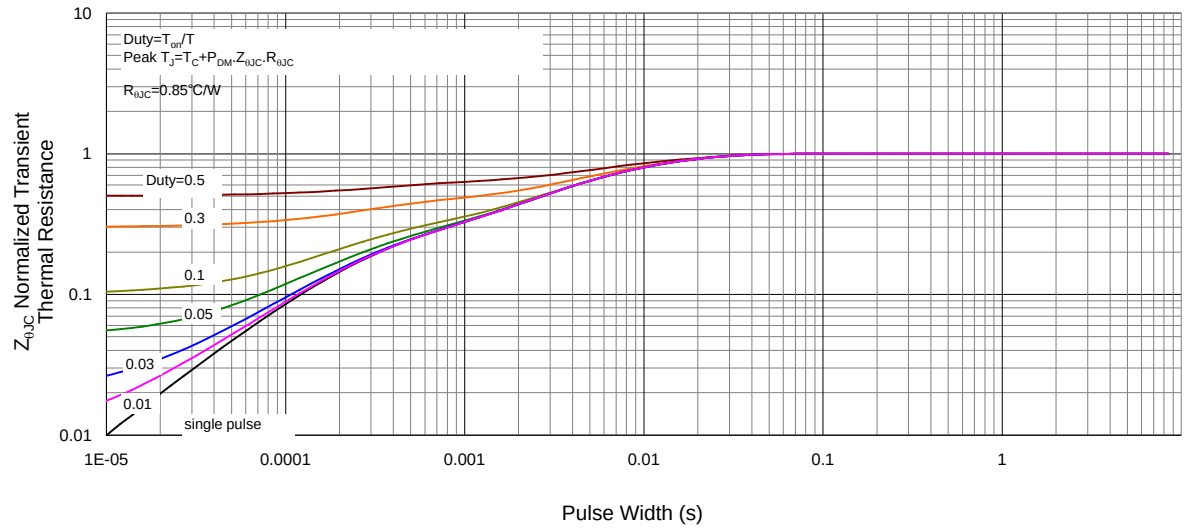
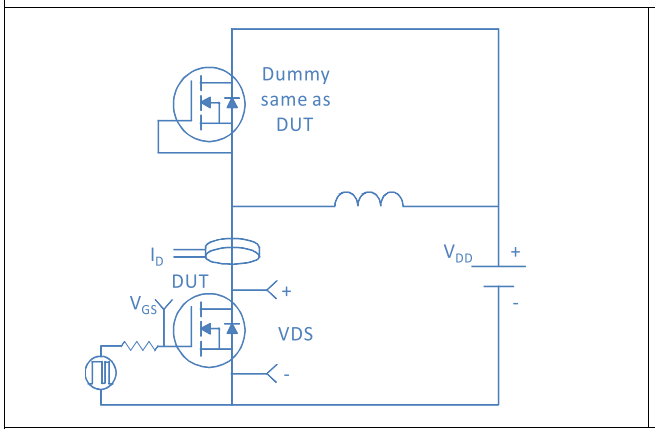
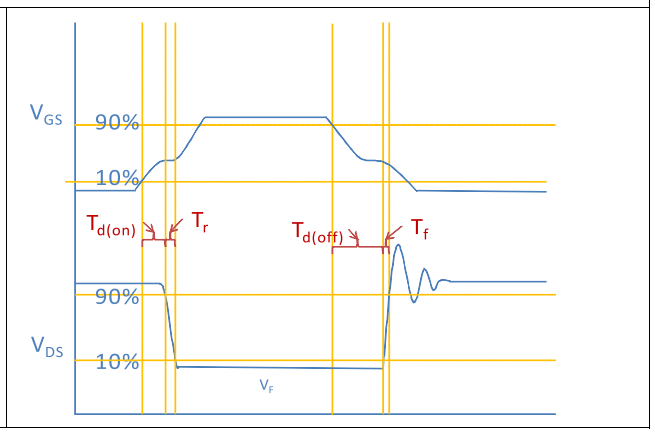


Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case

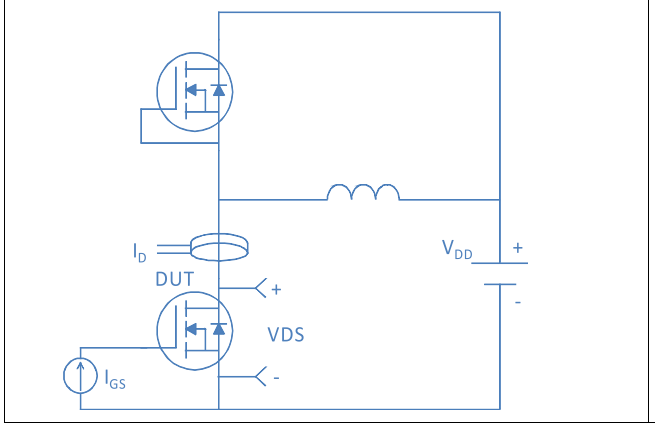


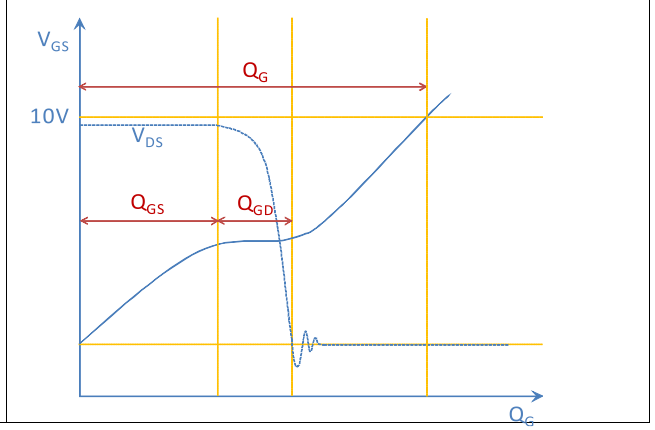
Inductive switching Test



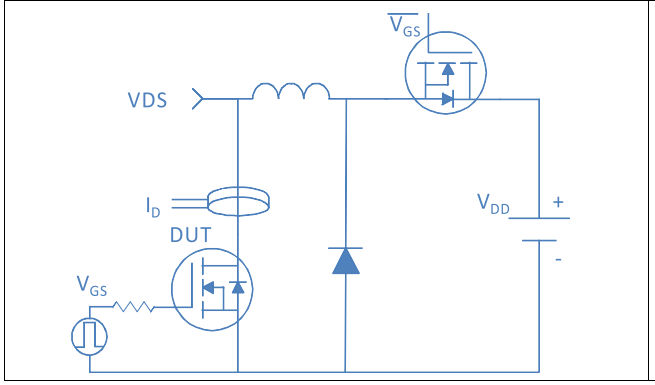


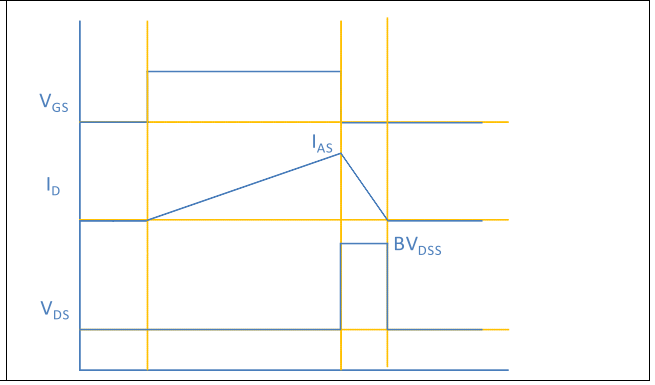
Gate Charge Test



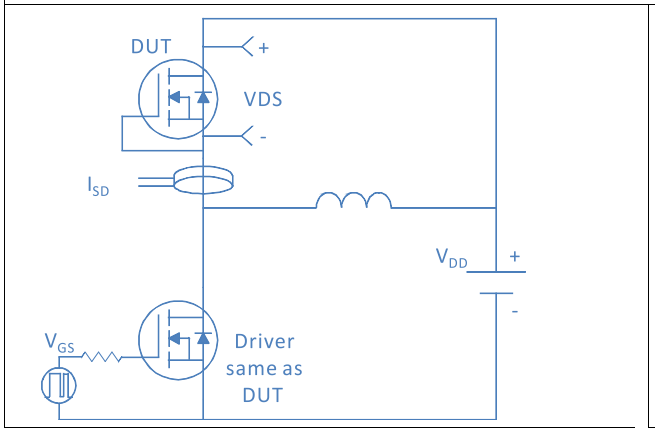


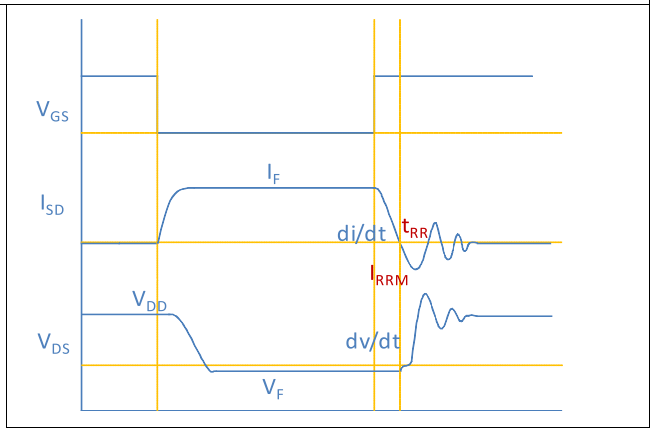
Uclamped Inductive Switching (UIS) Test





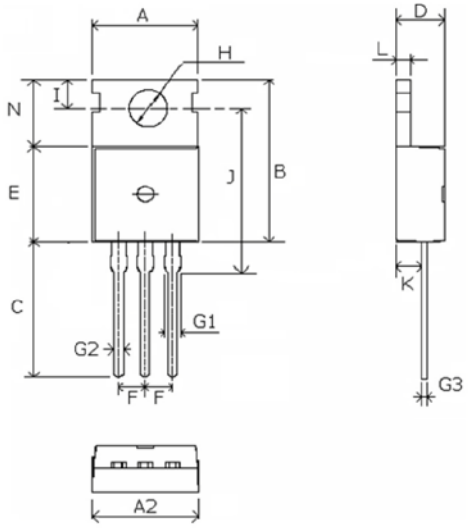
Diode Recovery Test





Package Outline

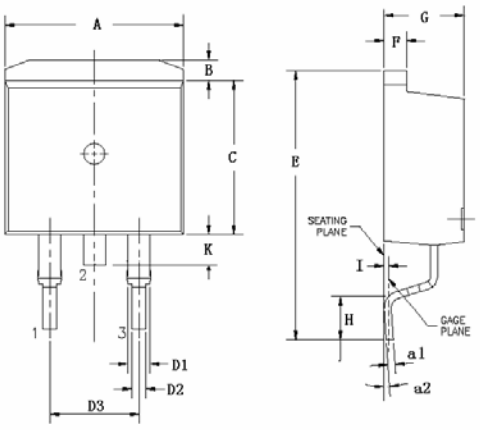
TO-220, 3 leads



Dimentions 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



Dimentions 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°