

120V N-Ch Power MOSFET

Feature

- ◇ High Speed Power Smooth Switching
- ◇ 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
$R_{DS(on),TYP}$	3.6	m Ω
I_D (Silicon Limited)	197	A
I_D (Package Limited)	180	A

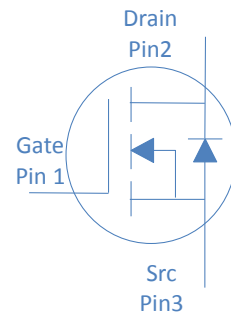
Part Number	Package	Marking
HGB039N12S	TO-263	GB039N12S
HGK039N12S	TO-247	GK039N12S
HGP039N12S	TO-220	GP039N12S

TO-263

TO-220



TO-247



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	$T_C=25^\circ\text{C}$	197	A
		$T_C=100^\circ\text{C}$	139	
		$T_C=25^\circ\text{C}$	180	
Continuous Drain Current (Package Limited)		$T_C=25^\circ\text{C}$	180	
Drain to Source Voltage	V_{DS}	-	120	V
Gate to Source Voltage	V_{GS}	-	± 20	V
Pulsed Drain Current	I_{DM}	-	550	A
Avalanche Energy, Single Pulse	E_{AS}	$L=0.4\text{mH}, T_C=25^\circ\text{C}$	720	mJ
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	357	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	$R_{\theta JC}$	0.42	$^\circ\text{C/W}$
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	60	$^\circ\text{C/W}$

Electrical Characteristics at T_j=25°C (unless otherwise specified)
Static Characteristics

Parameter	Symbol	Conditions	Value			Unit	
			min	typ	max		
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	120	-	-	V	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2	3	4		
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS}=0V, V_{DS}=120V, T_j=25^\circ C$	-	-	1	μA	
		$V_{GS}=0V, V_{DS}=120V, T_j=100^\circ C$	-	-	100		
Gate to Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA	
Drain to Source on Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	TO-263	-	3.6	3.9	m Ω
			TO-247	-	3.6	3.9	
			TO-220	-	3.6	4.2	
Transconductance	g_{fs}	$V_{DS}=5V, I_D=20A$	-	70	-	S	
Gate Resistance	R_G	$V_{GS}=0V, V_{DS}$ Open, $f=1MHz$	-	2.9	-	Ω	

Dynamic Characteristics

Input Capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=60V, f=1MHz$	-	6427	-	pF
Output Capacitance	C_{oss}		-	716	-	
Reverse Transfer Capacitance	C_{rss}		-	10	-	
Total Gate Charge	Q_g	$V_{DD}=60V, I_D=20A, V_{GS}=10V$	-	68	-	nC
Gate to Source Charge	Q_{gs}		-	20	-	
Gate to Drain (Miller) Charge	Q_{gd}		-	8	-	
Turn on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=20A, V_{GS}=10V, R_G=10\Omega,$	-	27	-	ns
Rise time	t_r		-	20	-	
Turn off Delay Time	$t_{d(off)}$		-	39	-	
Fall Time	t_f		-	12	-	

Reverse Diode Characteristics

Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_F=20A$	-	0.9	1.2	V
Reverse Recovery Time	t_{rr}	$V_R=60V, I_F=20A, di_F/dt=500A/\mu s$	-	60	-	ns
Reverse Recovery Charge	Q_{rr}		-	420	-	nC

Fig 1. Typical Output Characteristics

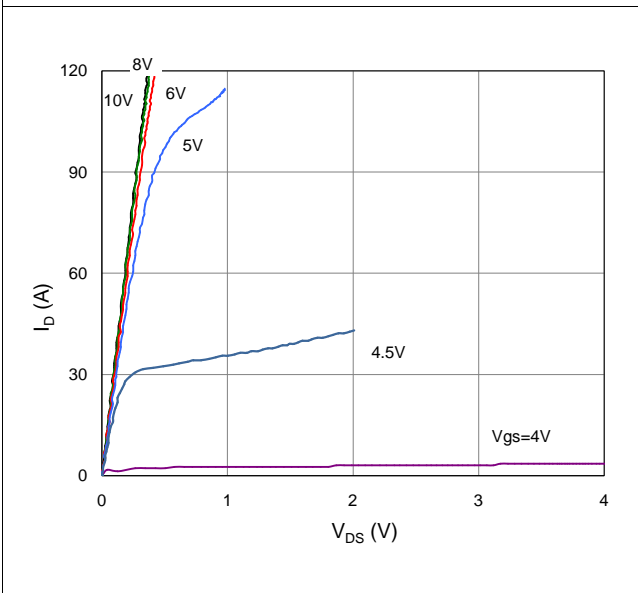


Figure 2. On-Resistance vs. Gate-Source Voltage

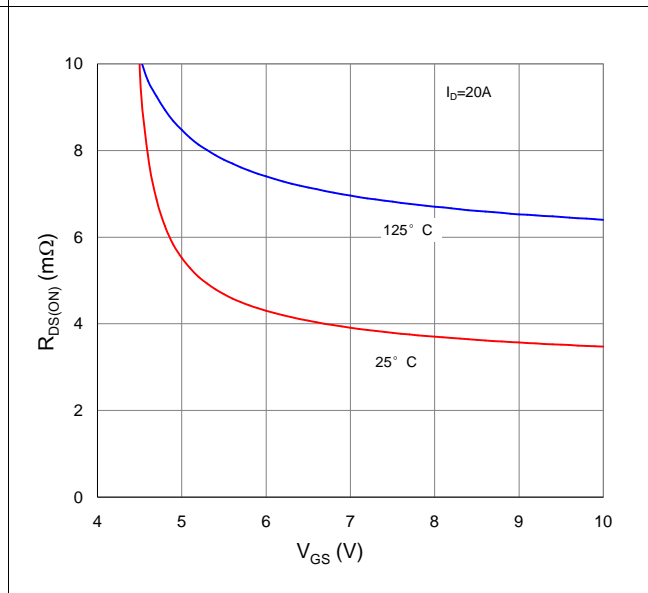


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

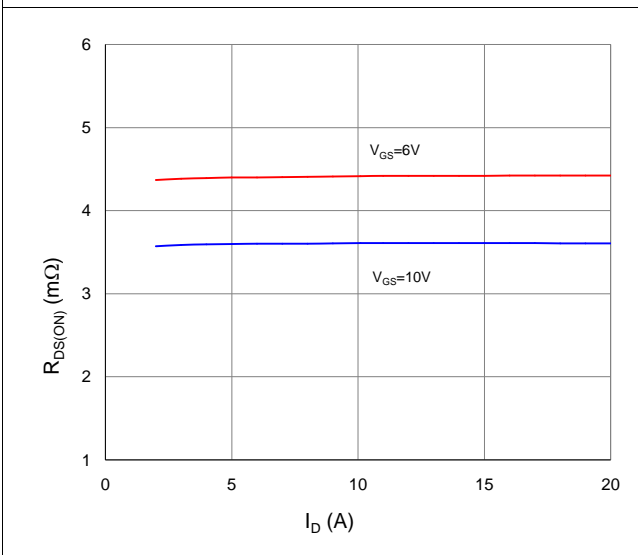


Figure 4. Normalized On-Resistance vs. Junction Temperature

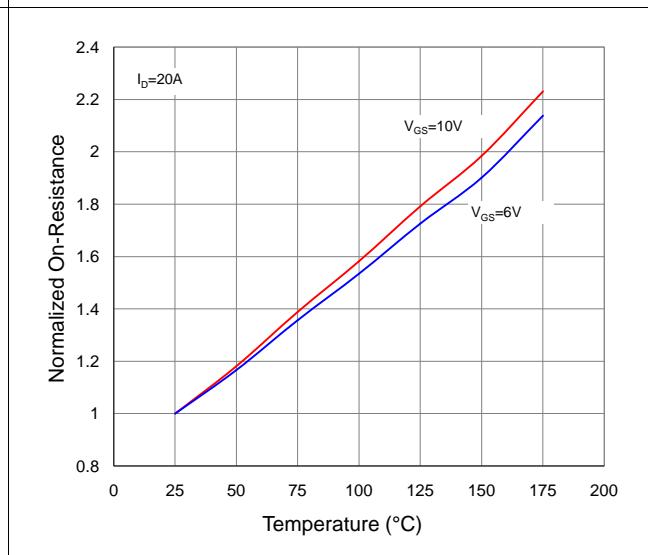


Figure 5. Typical Transfer Characteristics

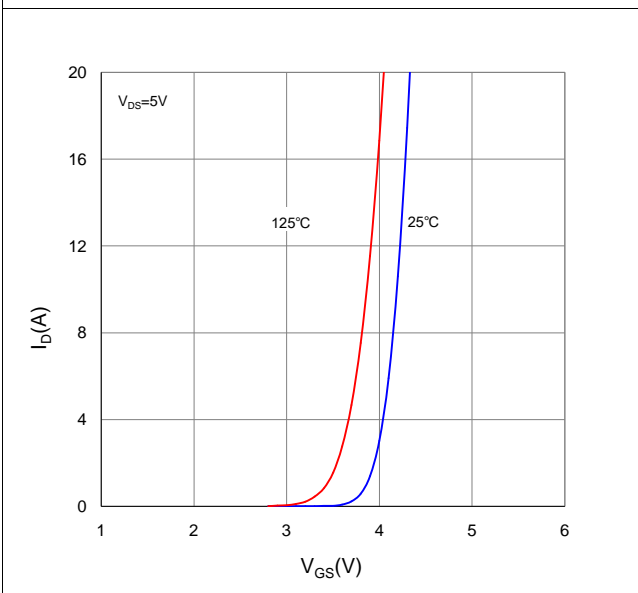


Figure 6. Typical Source-Drain Diode Forward Voltage

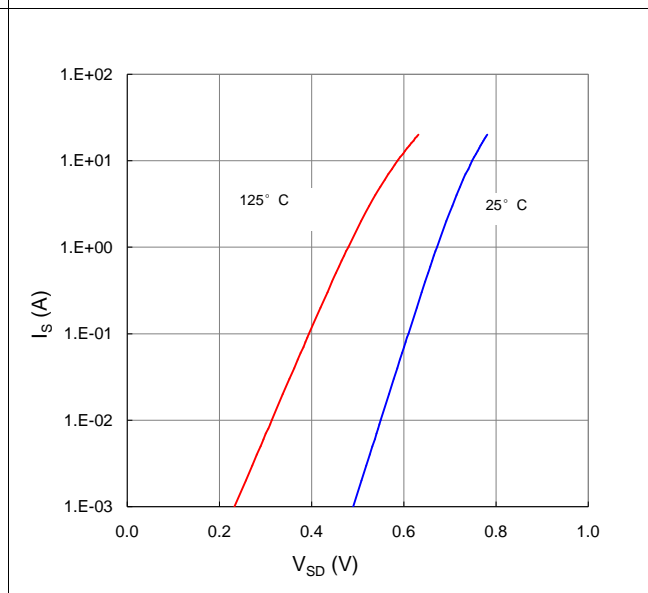


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

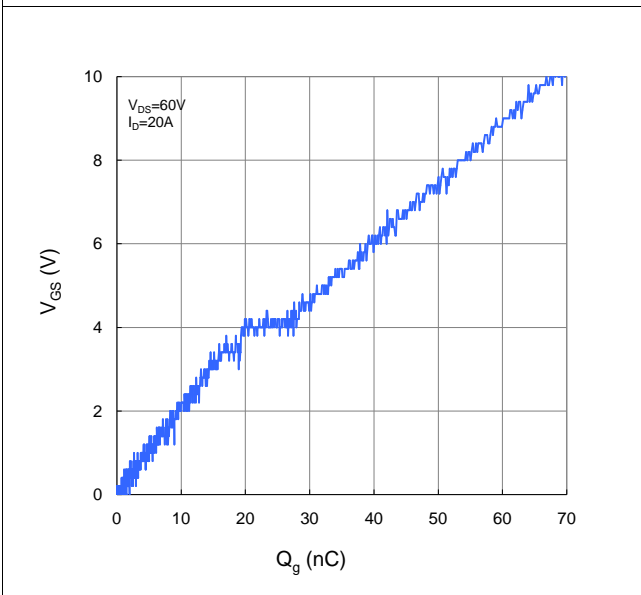


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

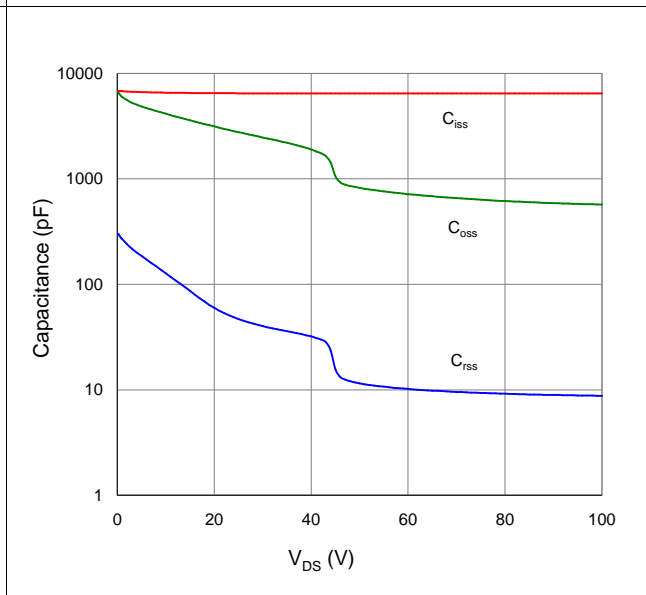


Figure 9. Maximum Safe Operating Area

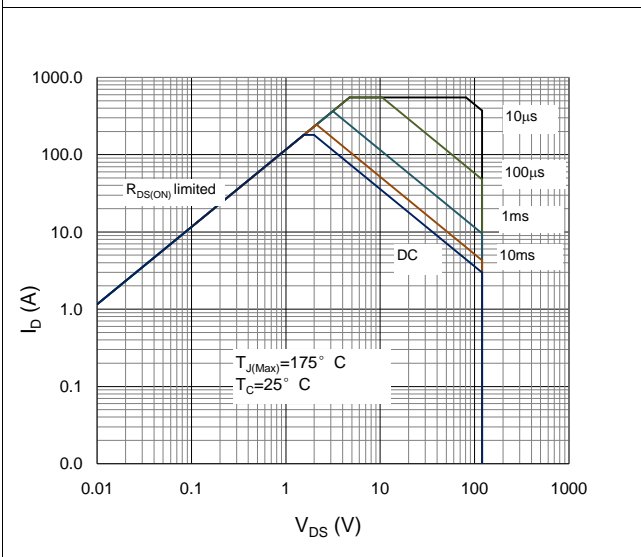


Figure 10. Maximum Drain Current vs. Case Temperature

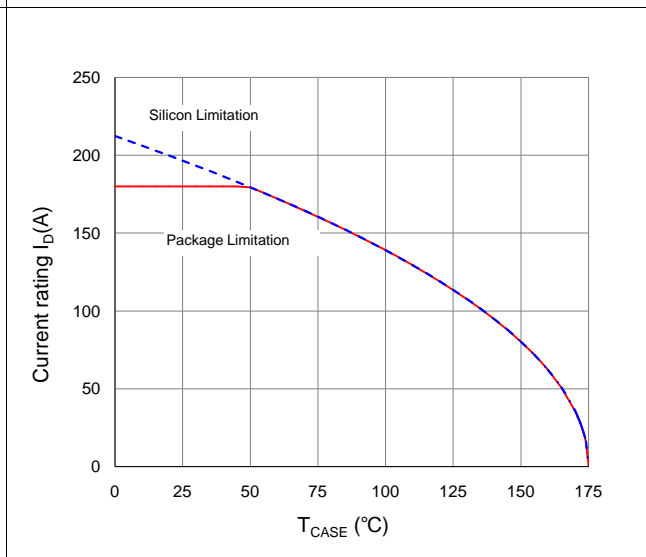
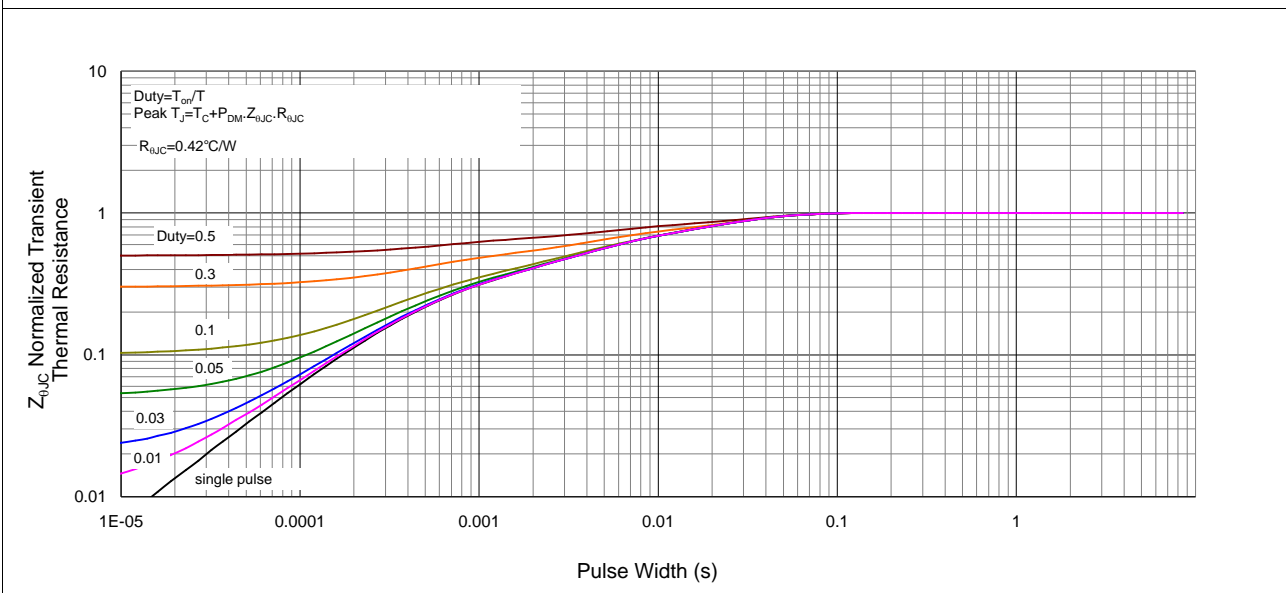
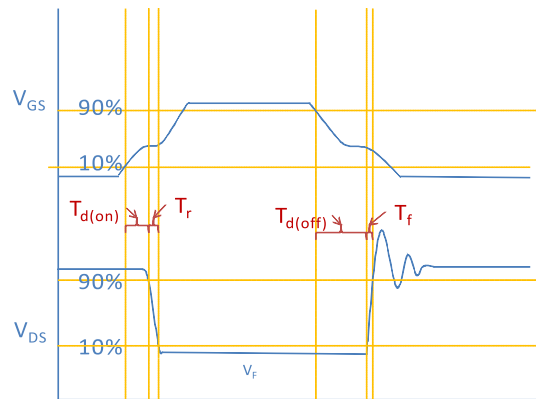
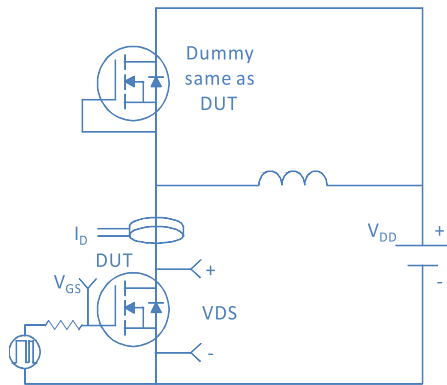


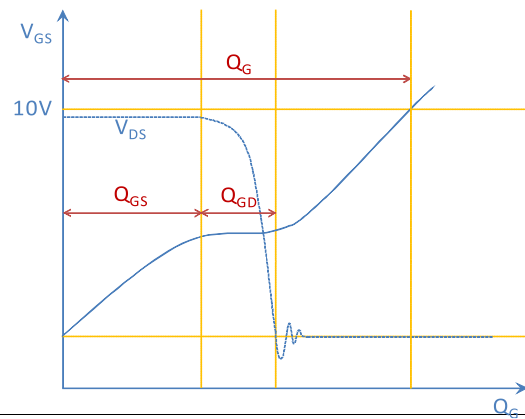
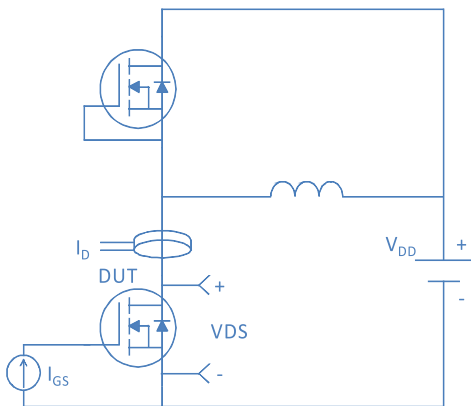
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



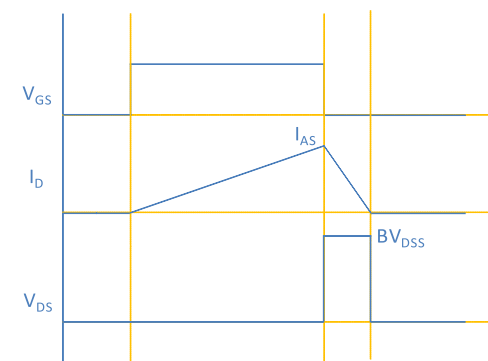
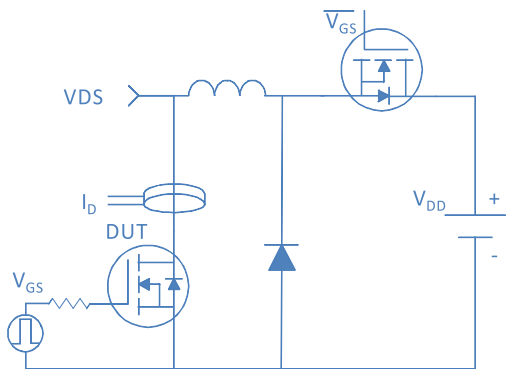
Inductive switching Test



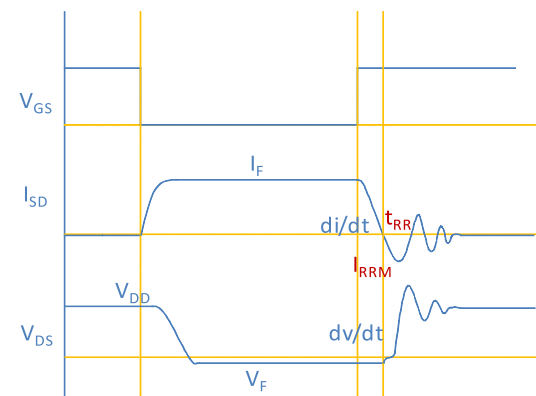
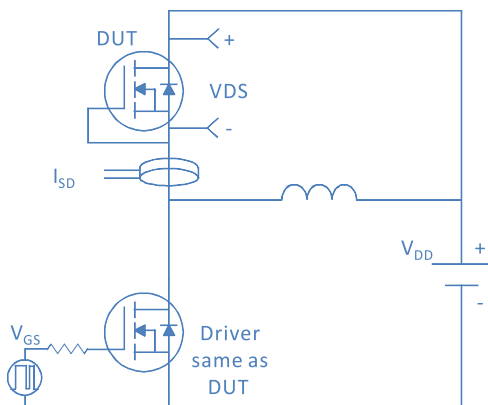
Gate Charge Test



Uclamped Inductive Switching (UIS) Test

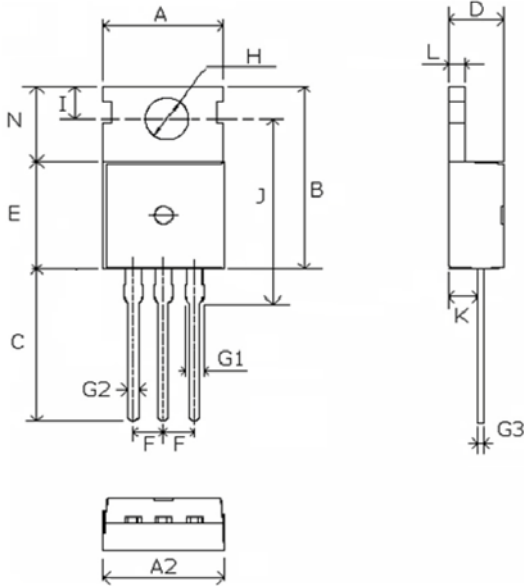


Diode Recovery Test



TO-220, 3 leads

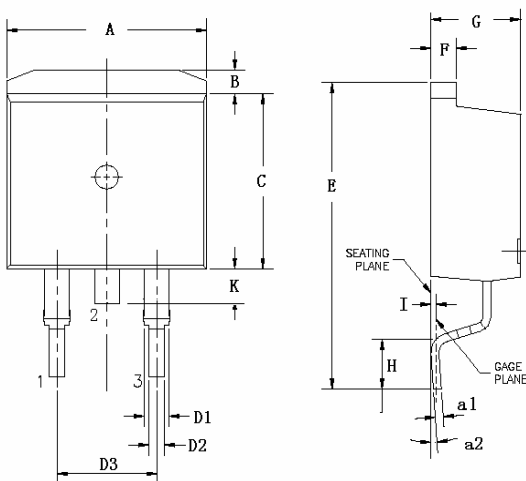
Dimensions in mm unless otherwise specified



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

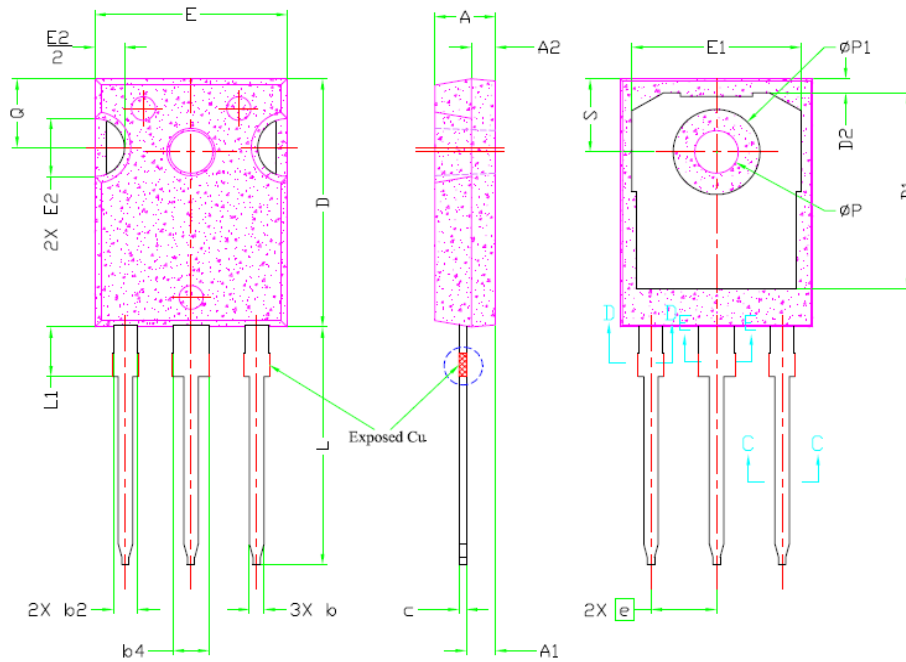
TO-263, 2 leads

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°

TO-247, 3 leads



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4,83	5,02	5,21	
A1	2,29	2,41	2,55	
A2	1,50	2,00	2,49	
b	1,12	1,20	1,33	
b1	1,12	1,20	1,28	
b2	1,91	2,00	2,39	6
b3	1,91	2,00	2,34	
b4	2,87	3,00	3,22	6, 8
b5	2,87	3,00	3,18	
c	0,55	0,60	0,69	6
c1	0,55	0,60	0,65	
D	20,80	20,95	21,10	4
D1	16,25	16,55	17,65	5
D2	0,51	1,19	1,35	
E	15,75	15,94	16,13	4
E1	13,46	14,02	14,16	5
E2	4,32	4,91	5,49	3
e	5,44BSC			
L	19,81	20,07	20,32	
L1	4,10	4,19	4,40	6
ØP	3,56	3,61	3,65	7
ØP1	7,19REF.			
Q	5,39	5,79	6,20	
S	6,04	6,17	6,30	