

250V 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

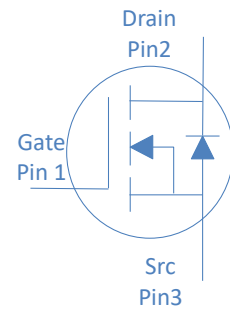
- ◇ Synchronous Rectification in SMPS
- ◇ Hard Switching and High Speed Circuit
- ◇ Power Tools
- ◇ UPS
- ◇ Motor Control

V_{DS}	250	V
$R_{DS(on),typ}$	31	m Ω
I_D (Silicon Limited)	50	A

TO-220



TO-247



Part Number	Package	Marking
HGK390N25S	TO-247	GK390N25S
HGP390N25S	TO-220	GP390N25S

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	$T_C=25^\circ\text{C}$	50	A
		$T_C=100^\circ\text{C}$	36	
Drain to Source Voltage	V_{DS}	-	250	V
Gate to Source Voltage	V_{GS}	-	± 20	V
Pulsed Drain Current	I_{DM}	-	150	A
Avalanche Energy, Single Pulse	E_{AS}	$L=0.4\text{mH}, T_C=25^\circ\text{C}$	58	mJ
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	300	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	$R_{\theta JC}$	0.5	$^\circ\text{C/W}$
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	60	$^\circ\text{C/W}$

Electrical Characteristics at $T_j=25^{\circ}\text{C}$ (unless otherwise specified)
Static Characteristics

Parameter	Symbol	Conditions	Value			Unit	
			min	typ	max		
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	250	-	-	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}	$V_{GS}=0V, V_{DS}=250V, T_j=25^{\circ}\text{C}$	-	-	1	μA	
		$V_{GS}=0V, V_{DS}=250V, T_j=100^{\circ}\text{C}$	-	-	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-247	-	31	39	m Ω
			TO-220	-	31	39	
Transconductance	g_{fs}	$V_{DS}=5V, I_D=20A$	-	58	-	S	
Gate Resistance	R_G	$V_{GS}=0V, V_{DS}$ Open, $f=1\text{MHz}$	-	3.9	-	Ω	

Dynamic Characteristics

Input Capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=100V, f=1\text{MHz}$	-	2905	-	pF
Output Capacitance	C_{oss}		-	172	-	
Reverse Transfer Capacitance	C_{rss}		-	10.7	-	
Total Gate Charge	Q_g	$V_{DD}=125V, I_D=20A, V_{GS}=10V$	-	34	-	nC
Gate to Source Charge	Q_{gs}		-	11	-	
Gate to Drain (Miller) Charge	Q_{gd}		-	4.0	-	
Turn on Delay Time	$t_{d(on)}$	$V_{DD}=125V, I_D=20A, V_{GS}=10V,$ $R_G=10\Omega,$	-	10	-	ns
Rise time	t_r		-	18	-	
Turn off Delay Time	$t_{d(off)}$		-	22	-	
Fall Time	t_f		-	8	-	

Reverse Diode Characteristics

Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_F=20A$	-	0.9	-	V
Reverse Recovery Time	t_{rr}	$V_R=125V, I_F=20A, di_F/dt=100A/\mu s$	-	140	-	ns
Reverse Recovery Charge	Q_{rr}		-	630	-	nC

Fig 1. Typical Output Characteristics

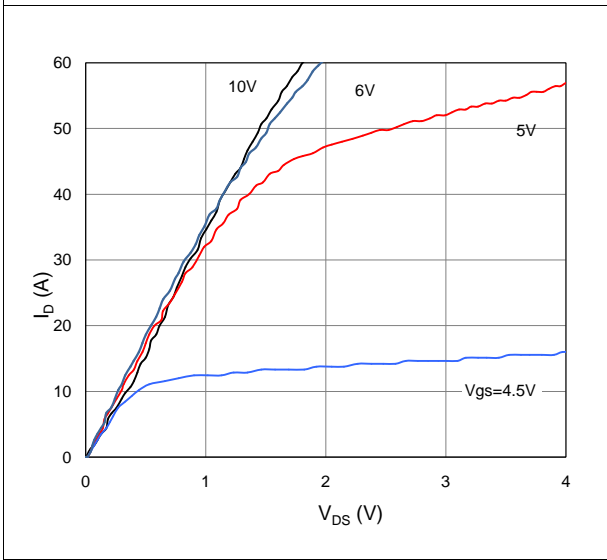


Figure 2. On-Resistance vs. Gate-Source Voltage

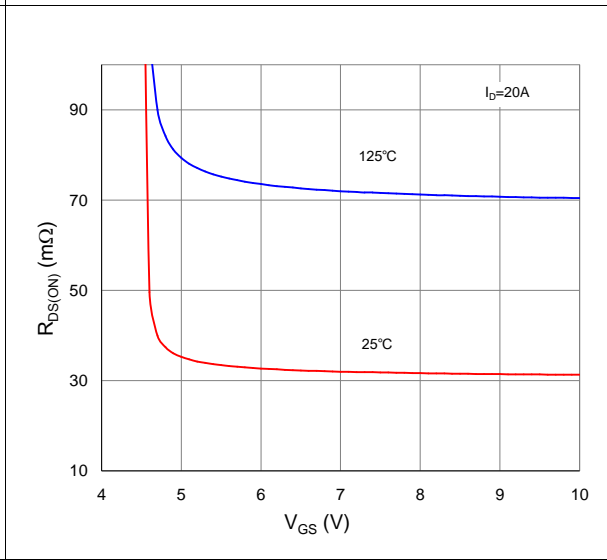


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

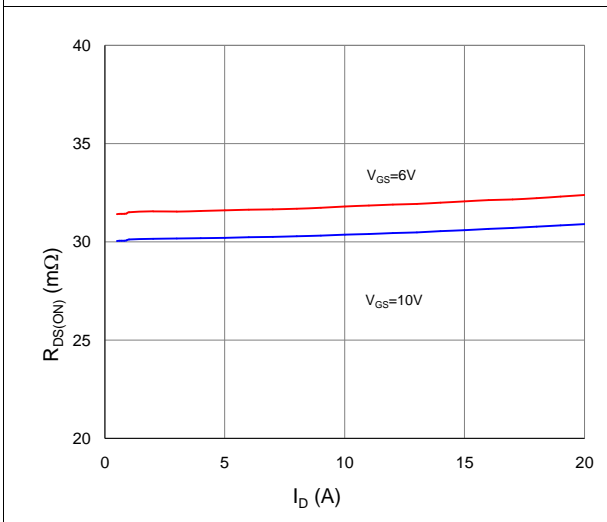


Figure 4. Normalized On-Resistance vs. Junction Temperature

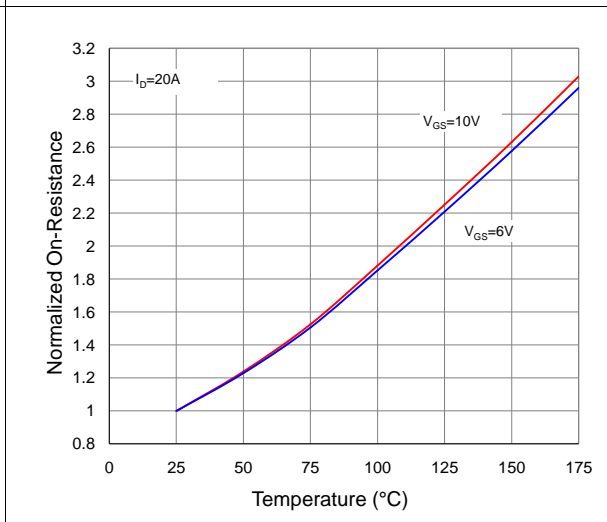


Figure 5. Typical Transfer Characteristics

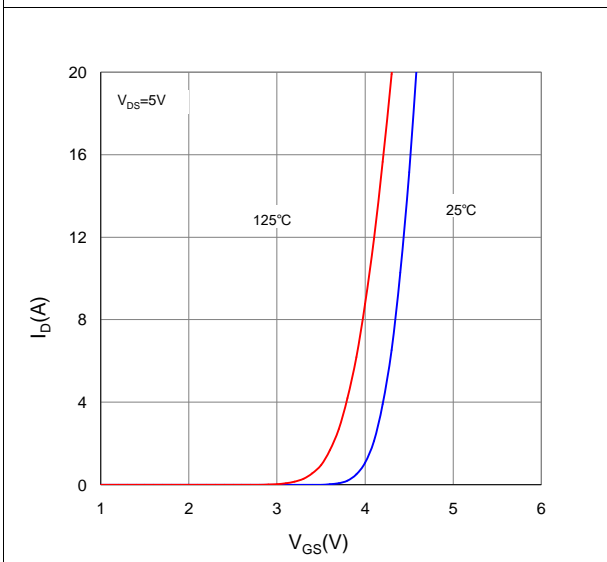


Figure 6. Typical Source-Drain Diode Forward Voltage

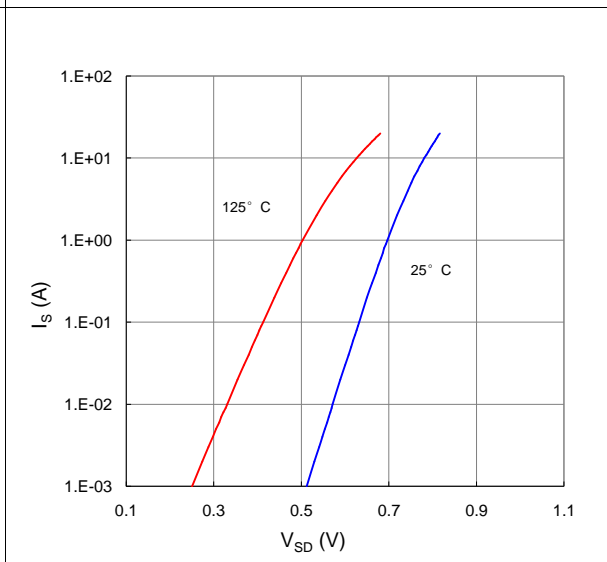


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

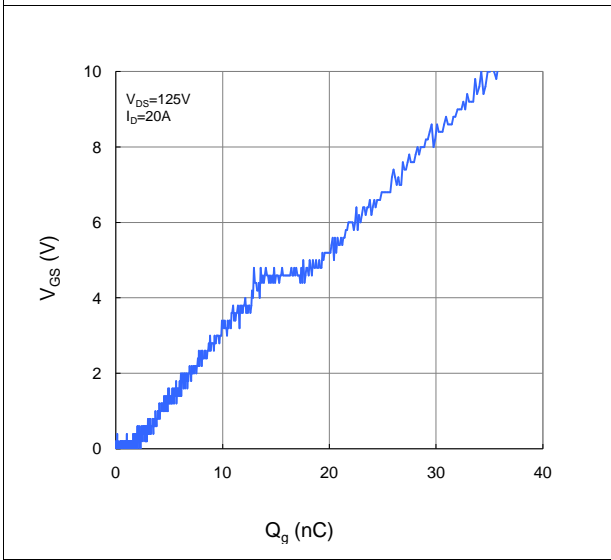


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

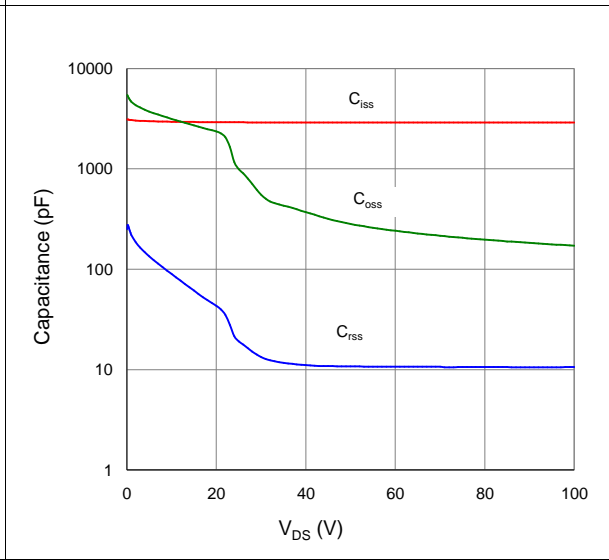


Figure 9. Maximum Safe Operating Area

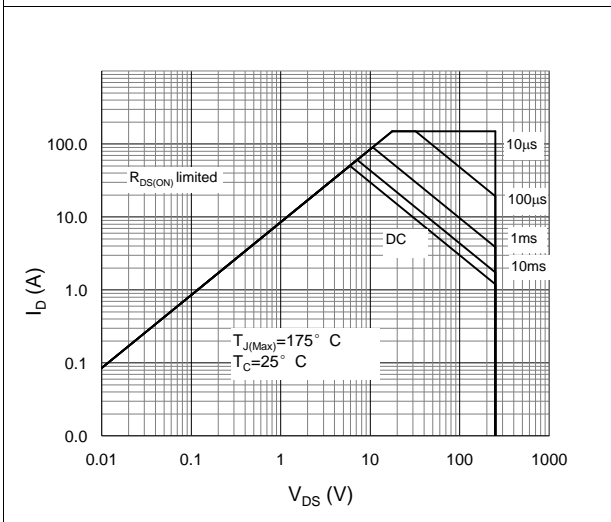


Figure 10. Maximum Drain Current vs. Case Temperature

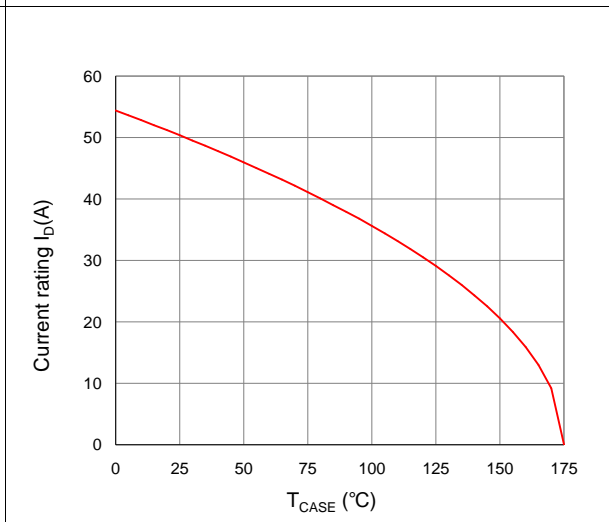
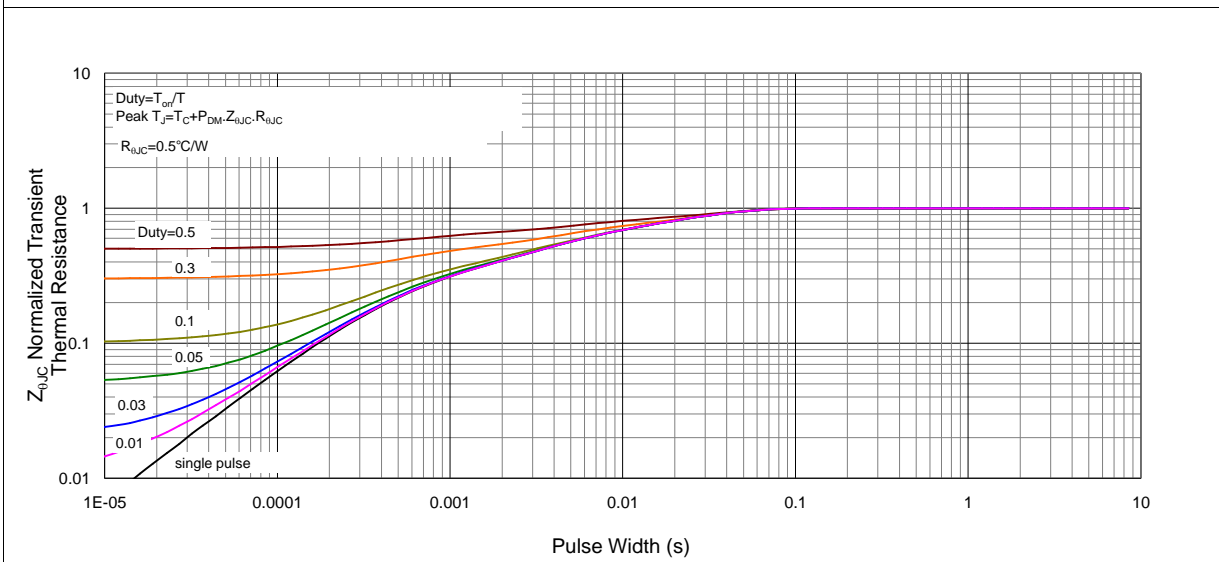
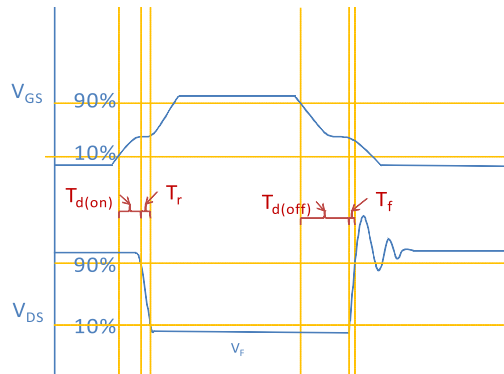
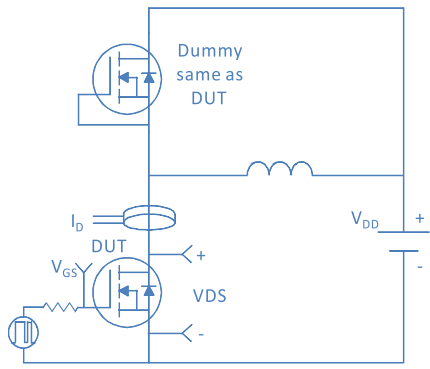


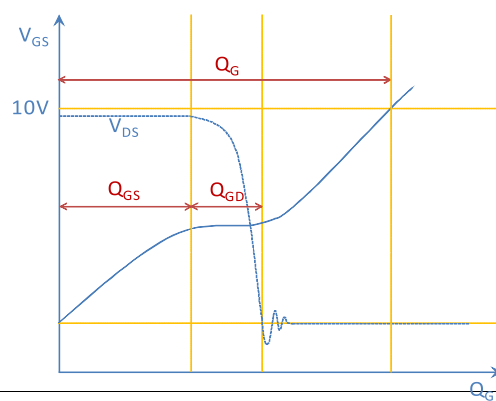
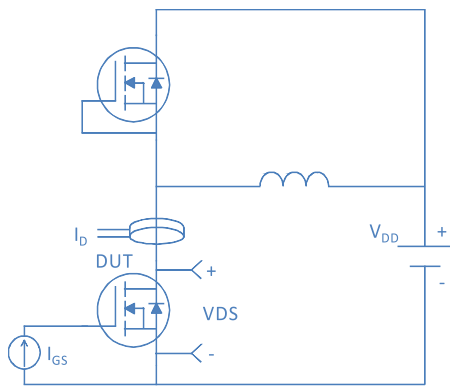
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



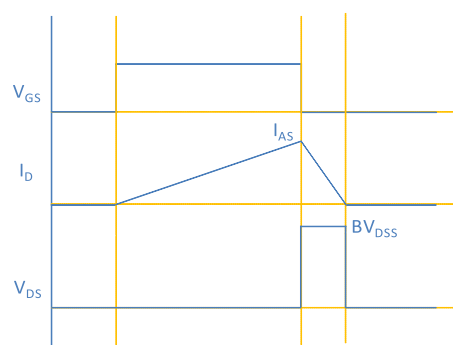
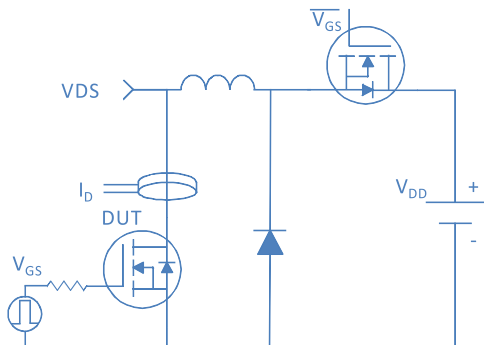
Inductive switching Test



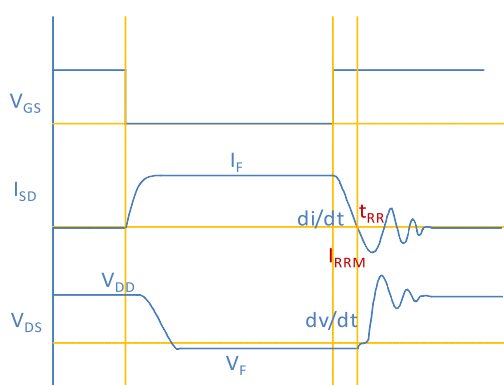
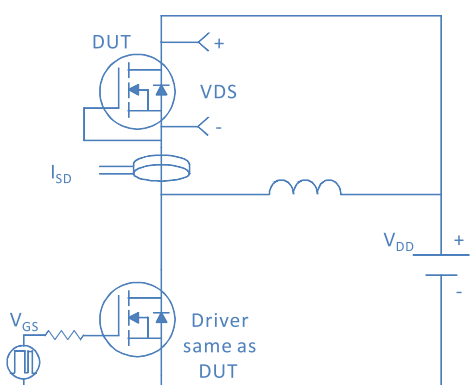
Gate Charge Test

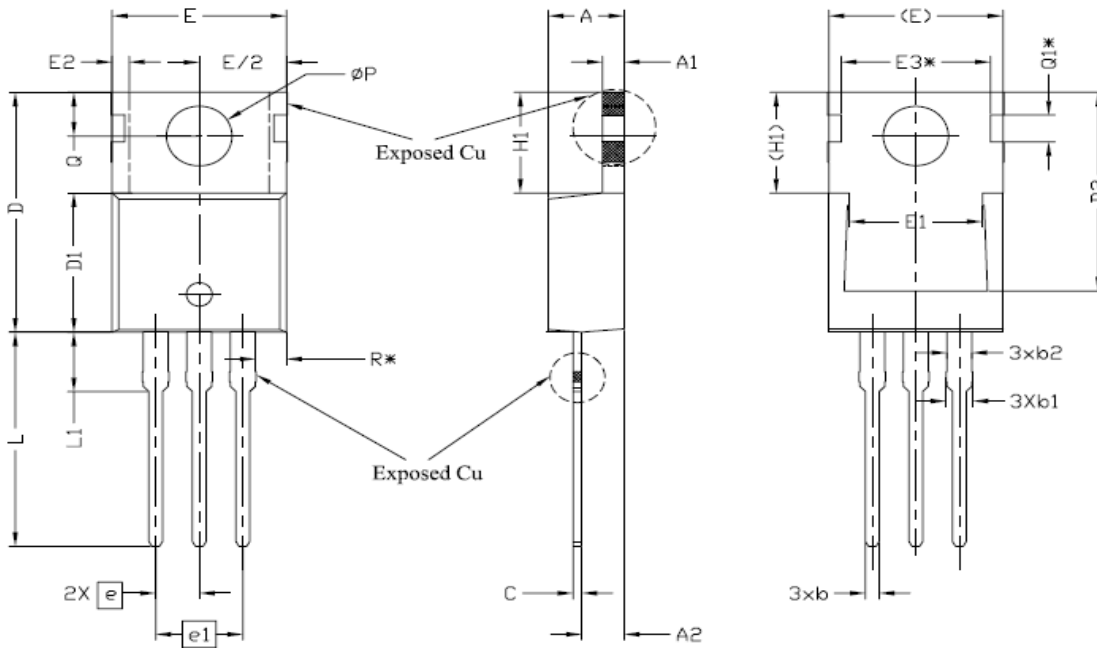


Uclamped Inductive Switching (UIS) Test



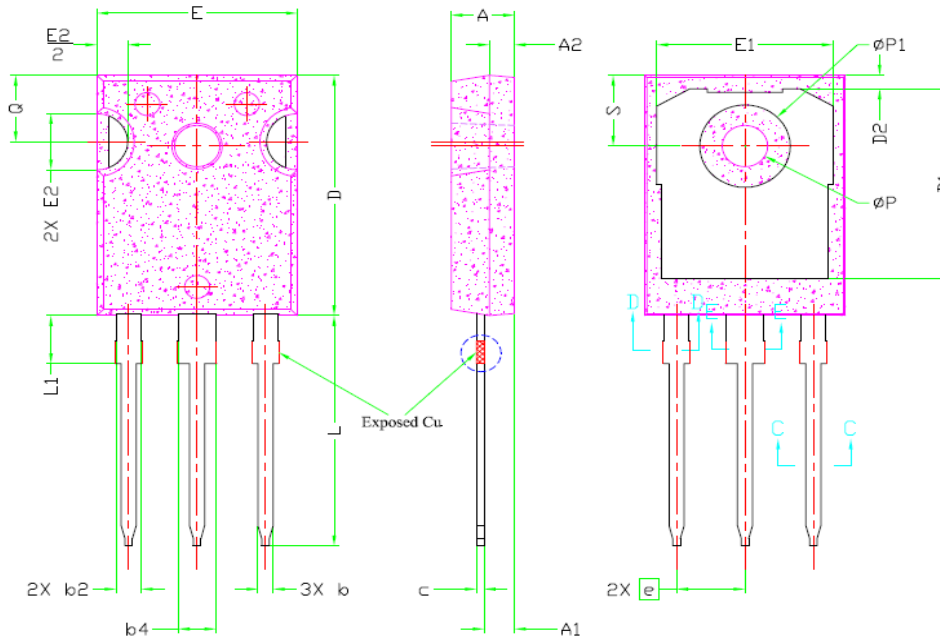
Diode Recovery Test



TO-220, 3 leads


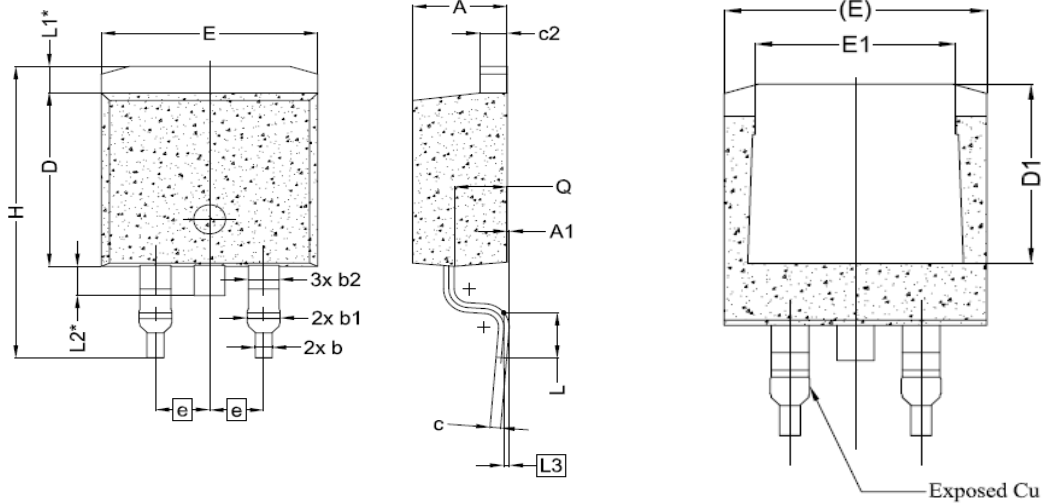
SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.24	4.44	4.64	
A1	1.15	1.27	1.40	
A2	2.30	2.48	2.70	
b	0.70	0.80	0.90	
b1	1.20	1.55	1.75	
b2	1.20	1.45	1.70	
c	0.40	0.50	0.60	
D	14.70	15.37	16.00	4
D1	8.82	8.92	9.02	
D2	12.63	12.73	12.83	5
E	9.96	10.16	10.36	4,5
E1	6.86	7.77	8.89	5
E2	-	-	0.76	6
E3*	8.70REF.			
e	2.54BSC			
e1	5.08BSC			
H1	6.30	6.45	6.60	5,6
L	13.47	13.72	13.97	
L1	3.60	3.80	4.00	
ϕP	3.75	3.84	3.93	
Q	2.60	2.80	3.00	
Q1*	1.73REF.			
R*	1.82REF.			

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	

TO-263, 2 leads



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4,24	4,44	4,64
A1	0,00	0,10	0,25
b	0,70	0,80	0,90
b1	1,20	1,55	1,75
b2	1,20	1,45	1,70
c	0,40	0,50	0,60
c2	1,15	1,27	1,40
D	8,82	8,92	9,02
D1	6,86	7,65	—
E	9,96	10,16	10,36
E1	6,89	7,77	7,89
e	2,54 BSC		
H	14,61	15,00	15,88
L	1,78	2,32	2,79
L1	1,36 REF.		
L2	1,50 REF.		
L3	0,25 BSC		
Q	2,30	2,48	2,70