

200V N-Ch Power MOSFET

Feature

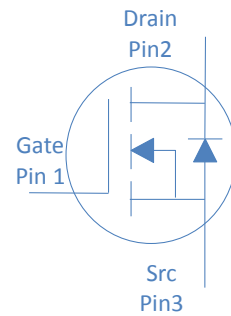
- ◇ High Speed Power Smooth Switching, Logic Level
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free

Application

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

V_{DS}		200	V
$R_{DS(on),typ}$	$V_{GS}=10V$	95	$m\Omega$
$R_{DS(on),typ}$	$V_{GS}=4.5V$	106	$m\Omega$
I_D		6.57	A

TO-220F



Part Number	Package	Marking
HGA1K2N20ML	TO-220F	GA1K2N20ML

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

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	9.3	A
		$T_C=100^\circ\text{C}$	6.6	
Drain to Source Voltage	V_{DS}	-	200	V
Gate to Source Voltage	V_{GS}	-	± 20	V
Pulsed Drain Current	I_{DM}	-	25	A
Avalanche Energy, Single Pulse	E_{AS}	$L=0.4\text{mH}, T_C=25^\circ\text{C}$	5	mJ
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	23	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	$R_{\theta JC}$	6.5	$^\circ\text{C/W}$
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	65	$^\circ\text{C/W}$

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 =250μA	200	-	-	V
Gate Threshold Voltage	V _{GS(th)}	V _{GS} =V _{DS} , I _D =250μA	1	2.1	3	
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} =0V, V _{DS} =200V, T _j =25°C	-	-	1	μA
		V _{GS} =0V, V _{DS} =200V, T _j =100°C	-	-	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 =5A	-	95	120	mΩ
	R _{DS(on)}	V _{GS} =4.5V, I _D =3A	-	106	140	mΩ
Transconductance	g _{fs}	V _{DS} =5V, I _D =20A	-	15	-	S
Gate Resistance	R _G	V _{GS} =0V, V _{DS} Open, f=1MHz	-	5.5	-	Ω

Dynamic Characteristics

Input Capacitance	C _{iss}	V _{GS} =0V, V _{DS} =100V, f=1MHz	-	491	-	pF
Output Capacitance	C _{oss}		-	22	-	
Reverse Transfer Capacitance	C _{rss}		-	5.5	-	
Total Gate Charge	Q _g (10V)	V _{DD} =100V, I _D =5A, V _{GS} =10V	-	9.8	-	nC
Total Gate Charge	Q _g (4.5V)		-	5.8	-	
Gate to Source Charge	Q _{gs}		-	1.6	-	
Gate to Drain (Miller) Charge	Q _{gd}		-	3.2	-	
Turn on Delay Time	t _{d(on)}	V _{DD} =100V, I _D =5A, V _{GS} =10V, R _G =10Ω,	-	9	-	ns
Rise time	t _r		-	5	-	
Turn off Delay Time	t _{d(off)}		-	13	-	
Fall Time	t _f		-	4	-	

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 =100V, I _F =5A, dI _F /dt=100A/μs	-	60	-	ns
Reverse Recovery Charge	Q _{rr}		-	126	-	nC

Fig 1. Typical Output Characteristics

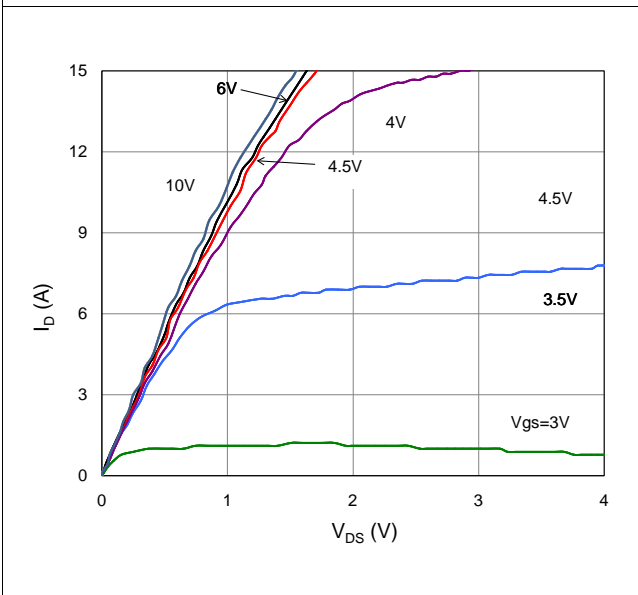


Figure 2. On-Resistance vs. Gate-Source Voltage

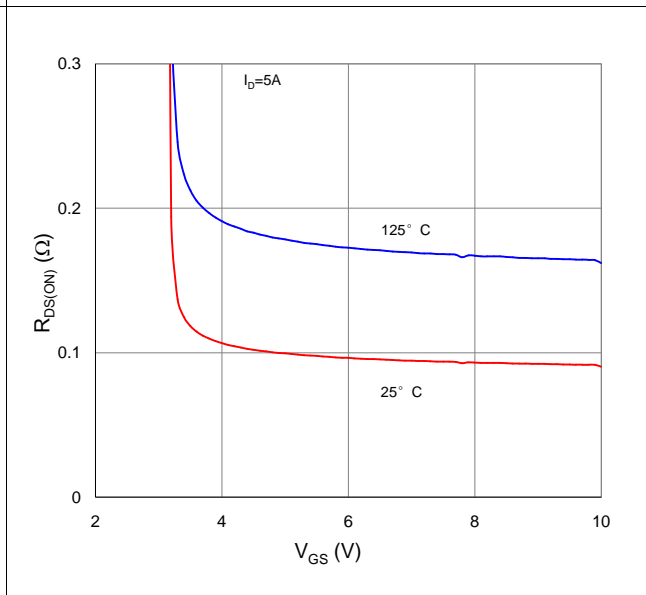


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

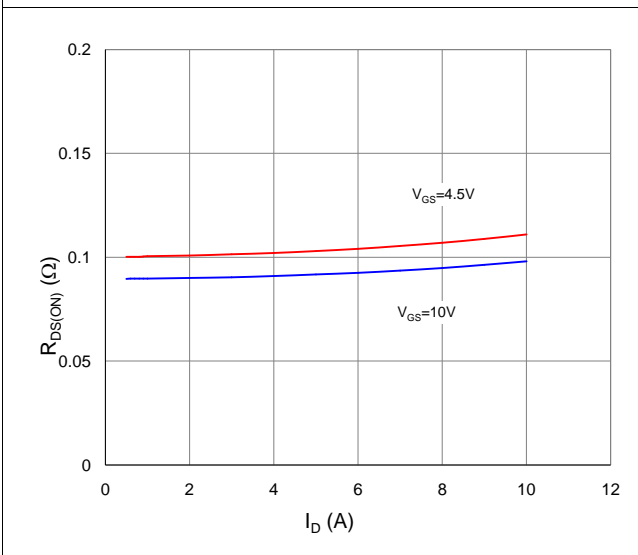


Figure 4. Normalized On-Resistance vs. Junction Temperature

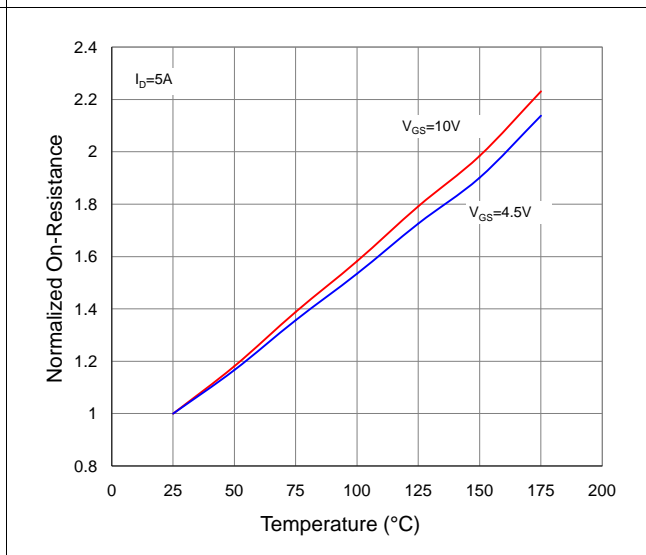


Figure 5. Typical Transfer Characteristics

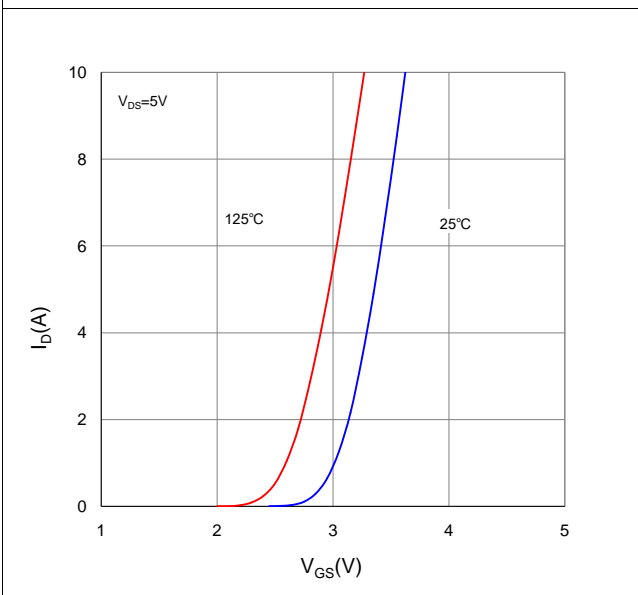


Figure 6. Typical Source-Drain Diode Forward Voltage

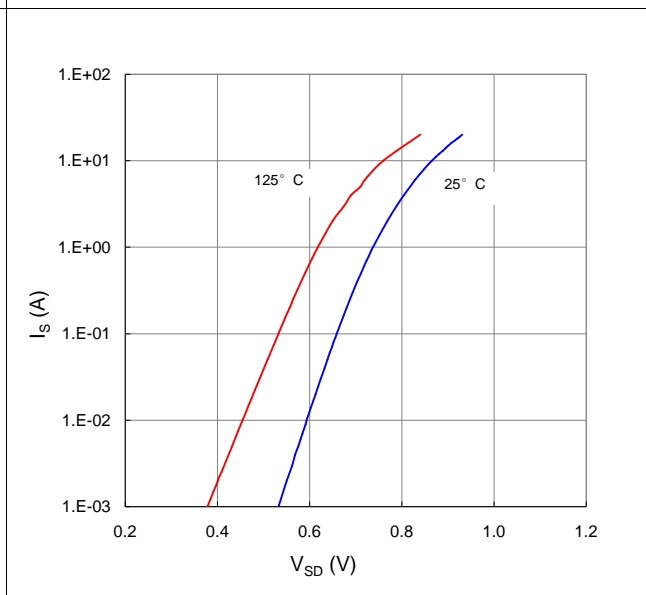


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

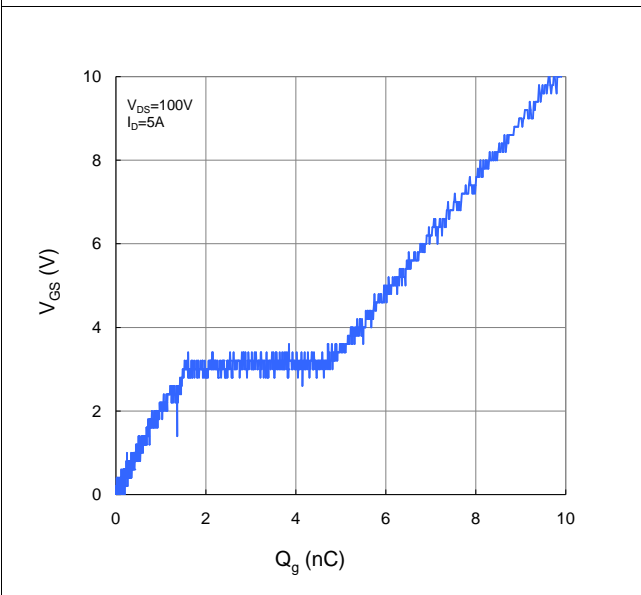


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

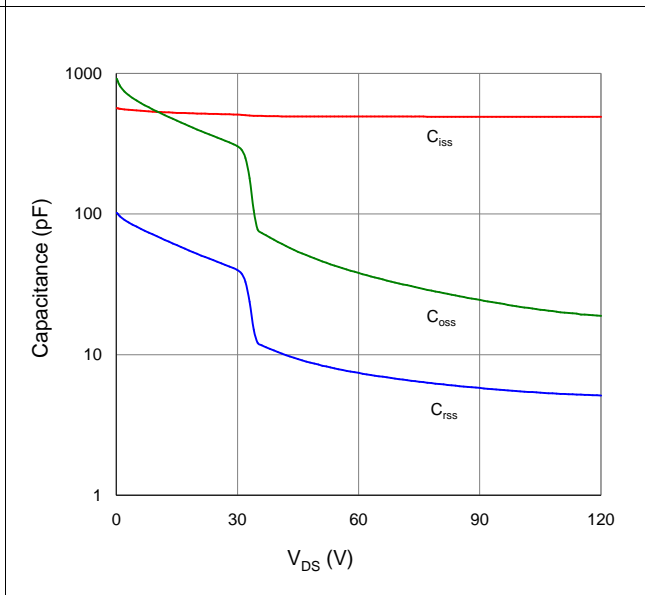


Figure 9. Maximum Safe Operating Area

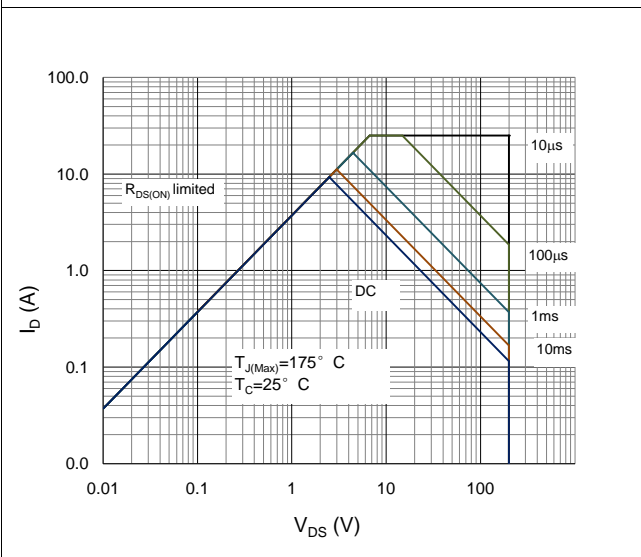


Figure 10. Maximum Drain Current vs. Case Temperature

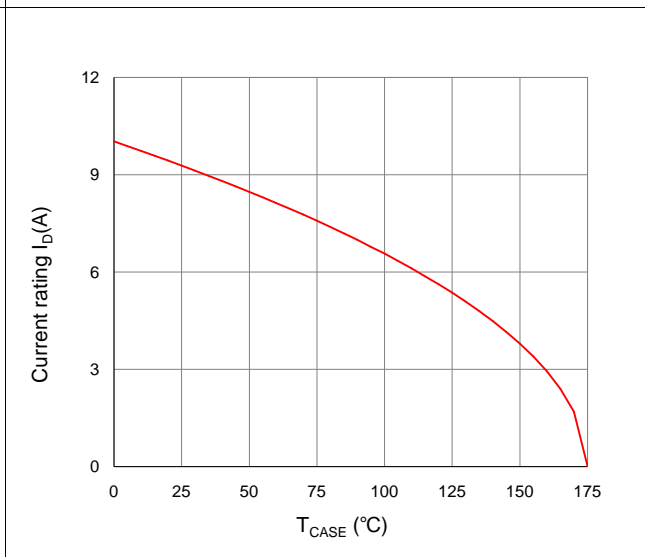
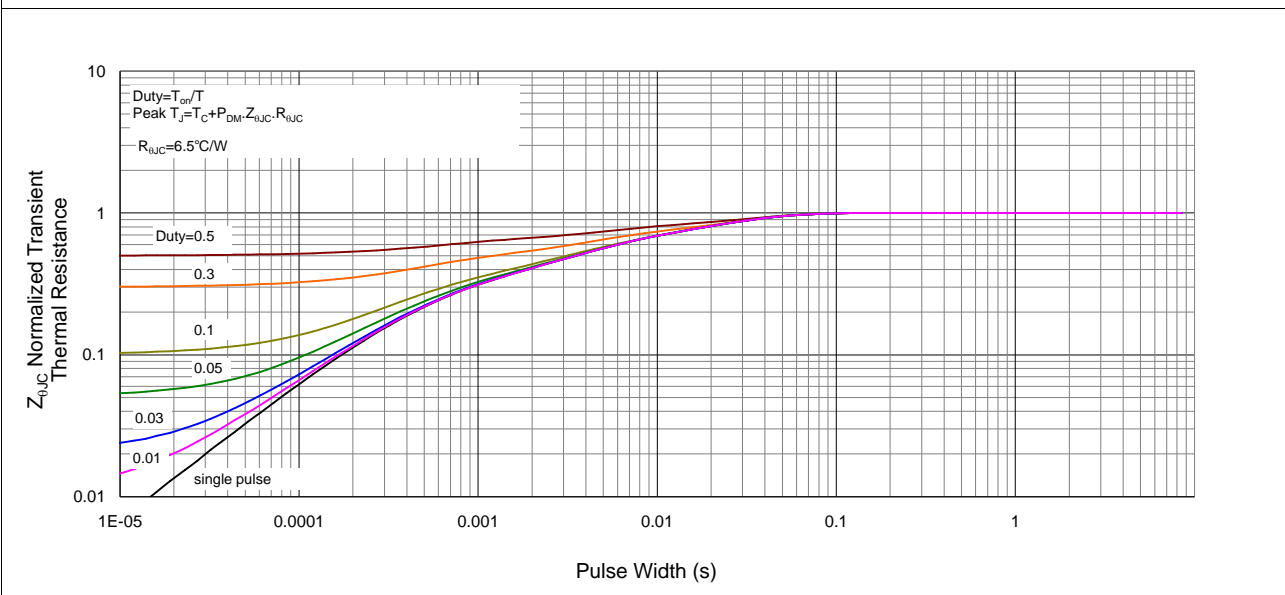
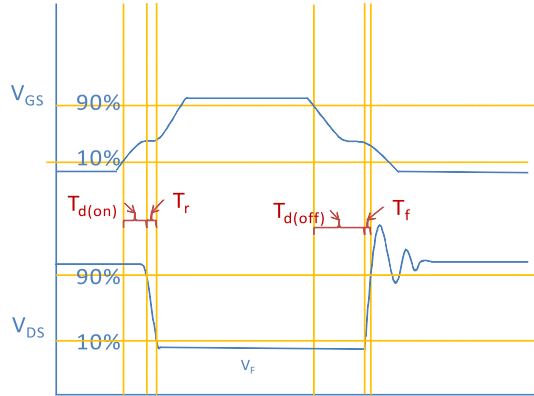
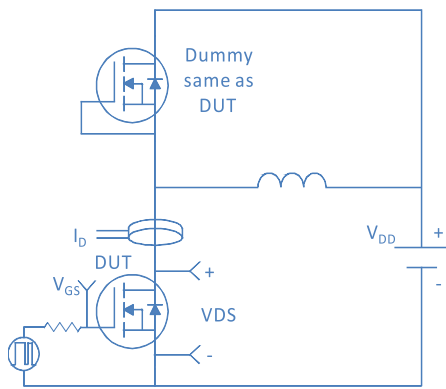


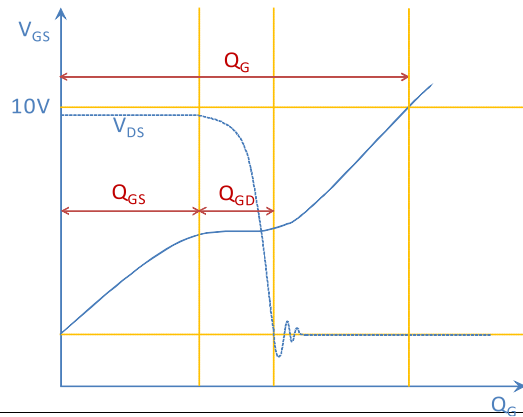
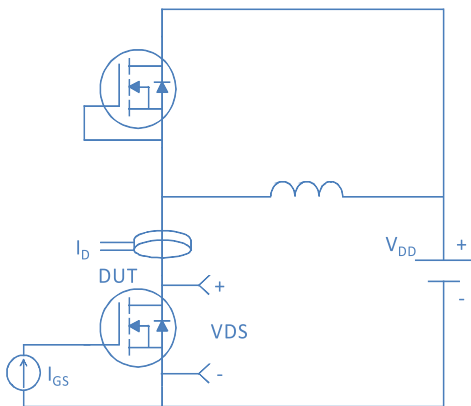
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



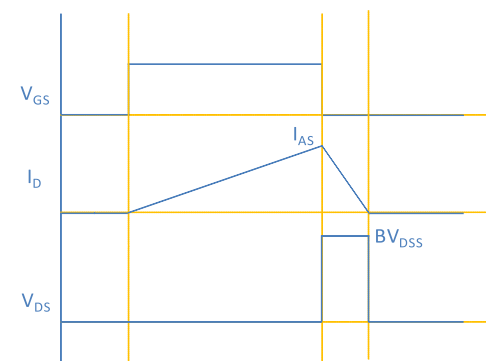
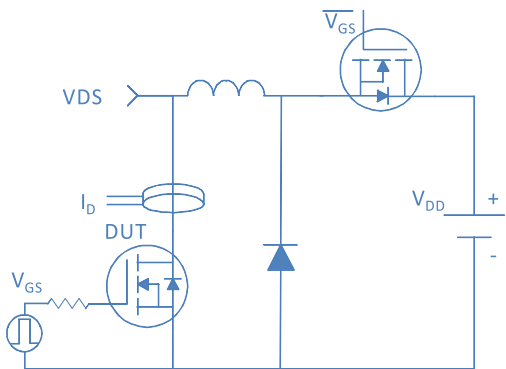
Inductive switching Test



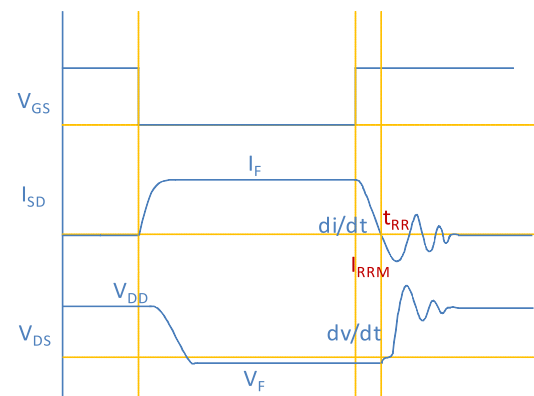
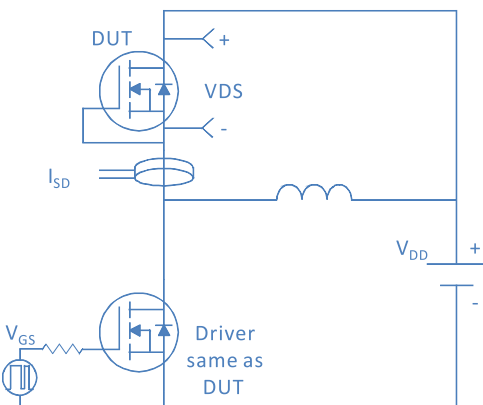
Gate Charge Test



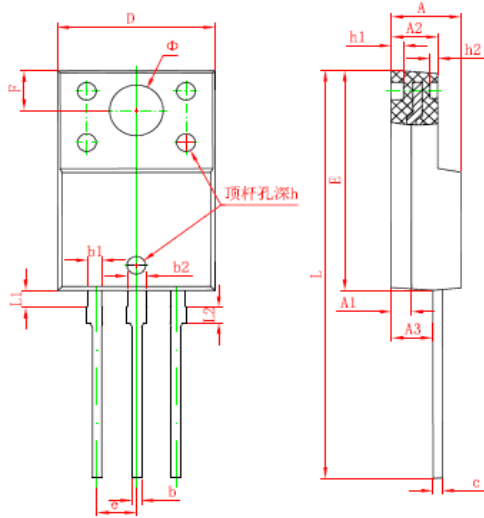
Uclamped Inductive Switching (UIS) Test



Diode Recovery Test



TO-220F, 3 leads



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.350	4.650	0.169	0.185
A1	1.300 REF.		0.051 REF.	
A2	2.850	3.150	0.112	0.124
A3	2.600	2.800	0.102	0.110
b	0.500	0.750	0.020	0.030
b1	0.800	1.050	0.031	0.041
b2	1.100	1.350	0.043	0.053
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540 TYP.		0.100 TYP.	
F	2.700 REF.		0.106 REF.	
Φ	3.500 REF.		0.138 REF.	
h	0.000	0.300	0.000	0.012
h1	0.800 REF.		0.031 REF.	
h2	0.500 REF.		0.020 REF.	
L	28.000	28.400	1.102	1.118
L1	1.100	1.300	0.043	0.051
L2	0.920	1.080	0.036	0.043