

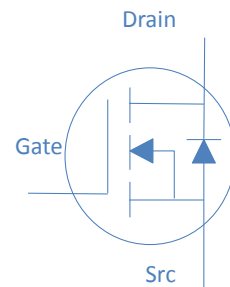
45V N-Ch Power MOSFET
Feature

- ◇ 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

V_{DS}		45	V
$R_{DS(on),typ}$	$V_{GS}=10V$	3.5	m Ω
$R_{DS(on),typ}$	$V_{GS}=4.5V$	4.6	m Ω
I_D (Silicon Limited)		59	A

TO-220F


Part Number	Package	Marking
HGA045NE4SL	TO-220F	GA045NE4SL

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	$T_C=25^\circ\text{C}$	59	A
		$T_C=100^\circ\text{C}$	42	
Drain to Source Voltage	V_{DS}	-	45	V
Gate to Source Voltage	V_{GS}	-	± 20	V
Pulsed Drain Current	I_{DM}	-	200	A
Avalanche Energy, Single Pulse	E_{AS}	$L=0.3\text{mH}, T_C=25^\circ\text{C}$	60	mJ
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	33	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	$R_{\theta JC}$	4.5	$^\circ\text{C/W}$
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 =250μA	45	-	-	V
Gate Threshold Voltage	V _{GS(th)}	V _{GS} =V _{DS} , I _D =250μA	1	1.8	2.2	
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} =0V, V _{DS} =45V, T _j =25°C	-	-	1	μA
		V _{GS} =0V, V _{DS} =45V, 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 =20A	-	3.5	4.5	mΩ
		V _{GS} =4.5V, I _D =20A	-	4.6	7.0	mΩ
Transconductance	g _{fs}	V _{DS} =5V, I _D =20A	-	40	-	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} =20V, f=1MHz	-	2159	-	pF
Output Capacitance	C _{oss}		-	756	-	
Reverse Transfer Capacitance	C _{rss}		-	118	-	
Total Gate Charge (10V)	Q _g (10V)	V _{DD} =20V, I _D =20A, V _{GS} =10V	-	42	-	nC
Total Gate Charge (4.5V)	Q _g (4.5V)		-	22	-	
Gate to Source Charge	Q _{gs}		-	4	-	
Gate to Drain (Miller) Charge	Q _{gd}		-	10	-	
Turn on Delay Time	t _{d(on)}	V _{DD} =20V, I _D =20A, V _{GS} =10V, R _G =10Ω,	-	12	-	ns
Rise time	t _r		-	10	-	
Turn off Delay Time	t _{d(off)}		-	41	-	
Fall Time	t _f		-	16	-	

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 =20V, I _F =20A, dI _F /dt=200A/μs	-	30	-	ns
Reverse Recovery Charge	Q _{rr}		-	30	-	nC

Fig 1. Typical Output Characteristics

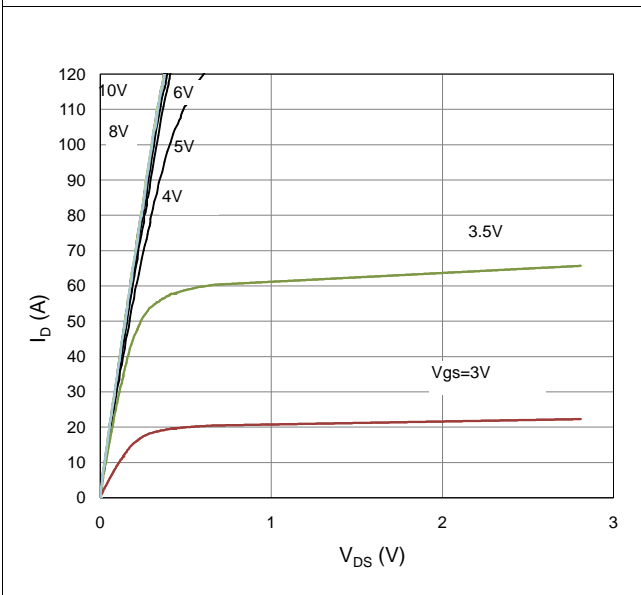


Figure 2. On-Resistance vs. Gate-Source Voltage

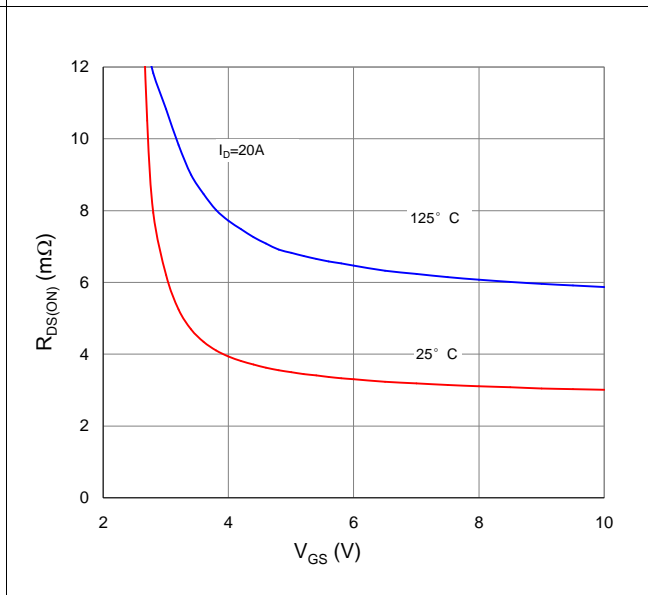


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

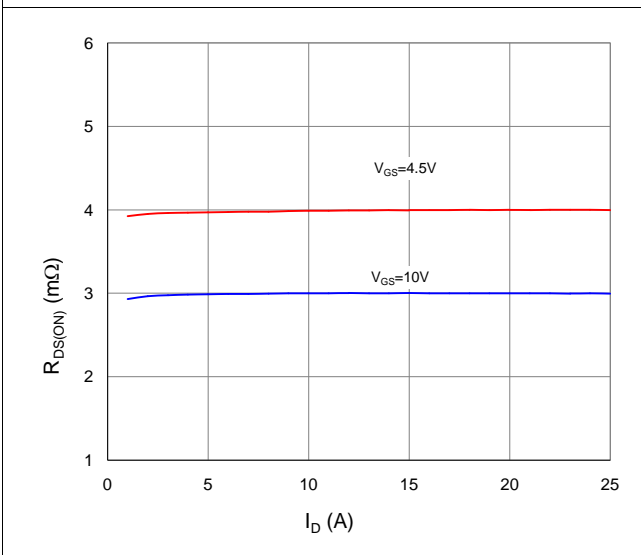


Figure 4. Normalized On-Resistance vs. Junction Temperature

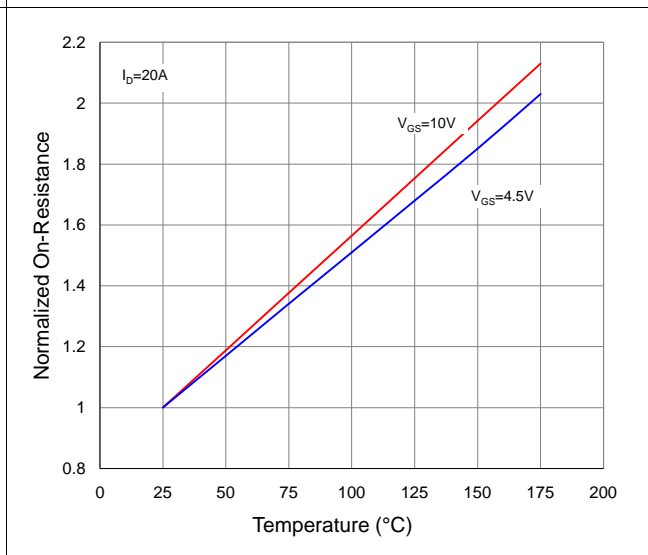


Figure 5. Typical Transfer Characteristics

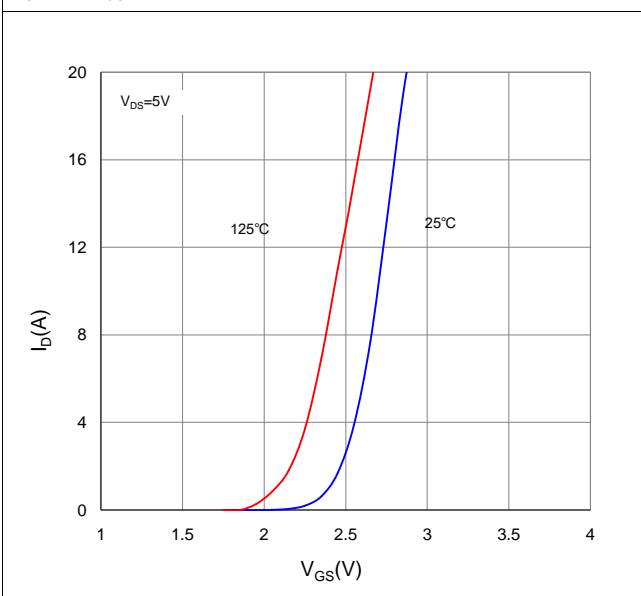


Figure 6. Typical Source-Drain Diode Forward Voltage

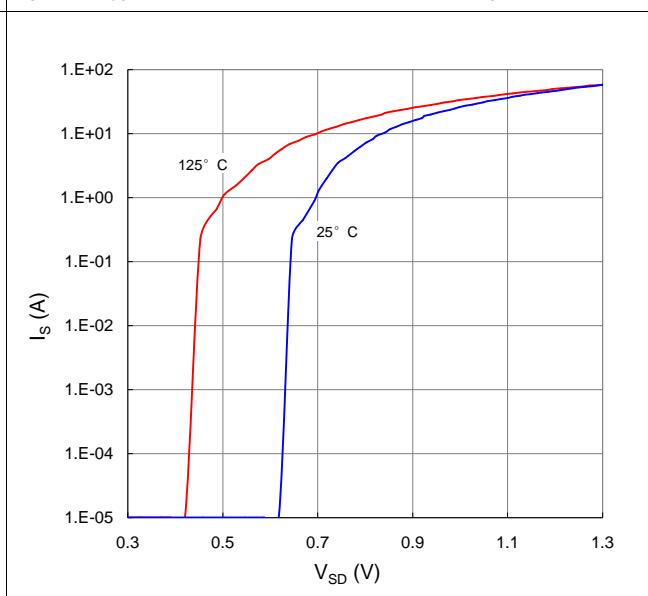


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

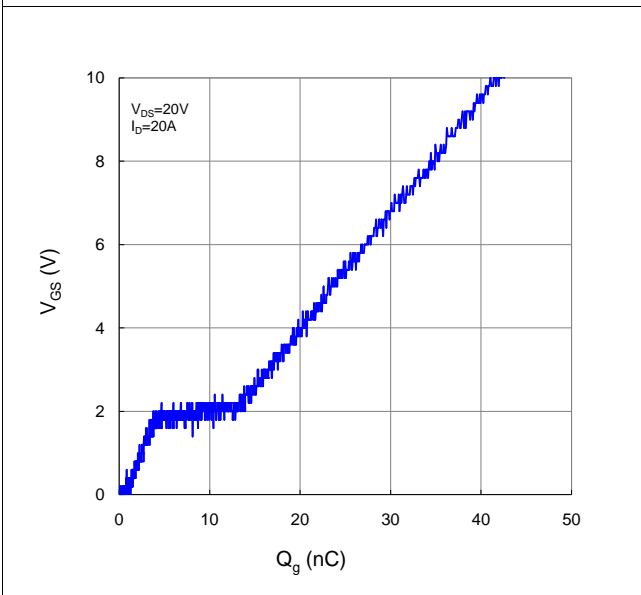


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

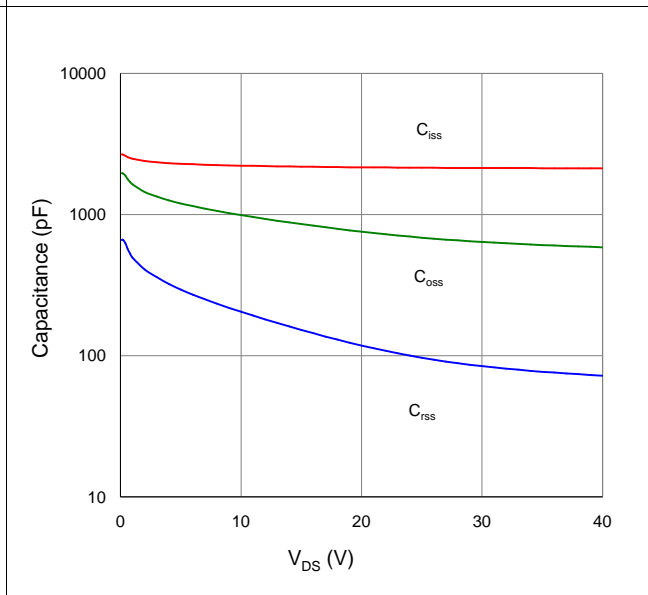


Figure 9. Maximum Safe Operating Area

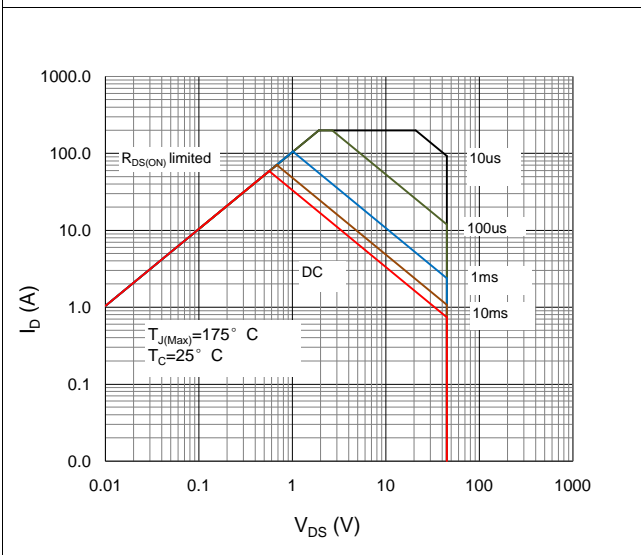


Figure 10. Maximum Drain Current vs. Case Temperature

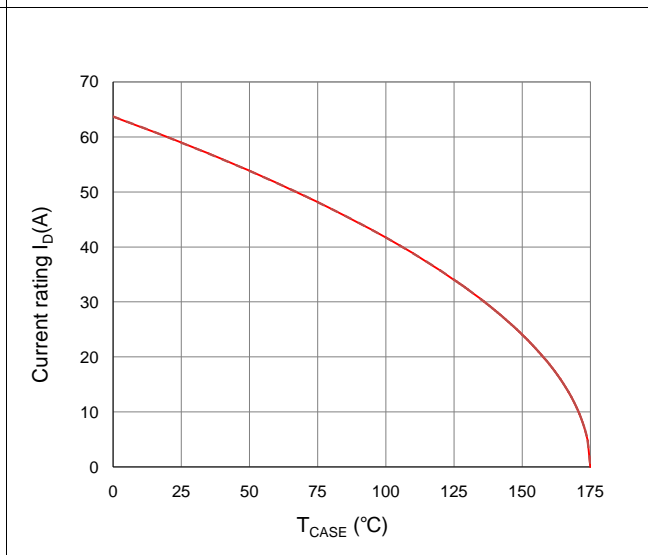
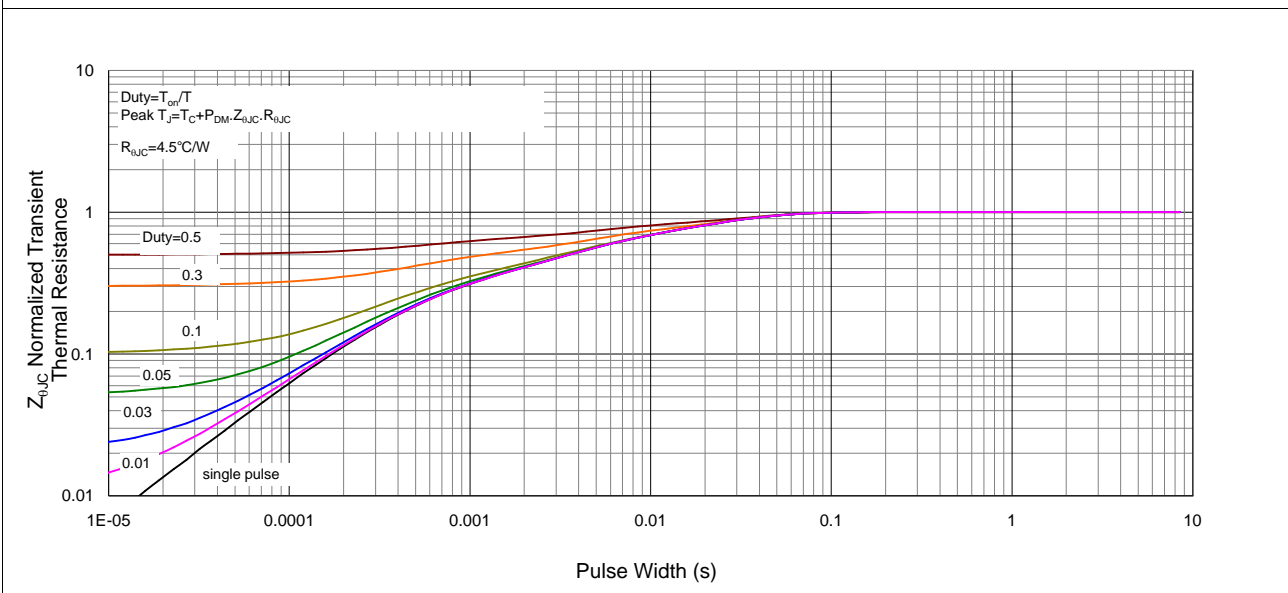
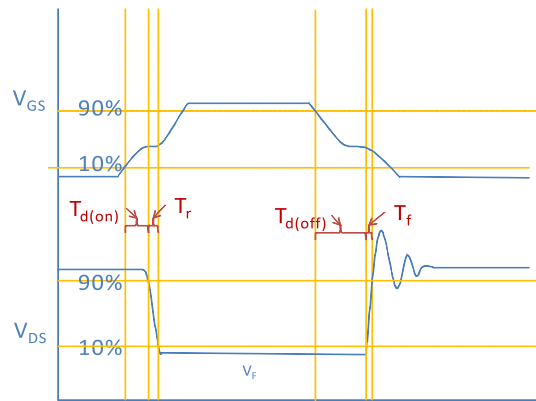


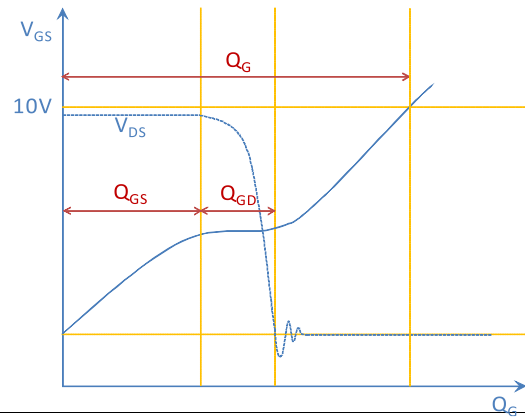
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



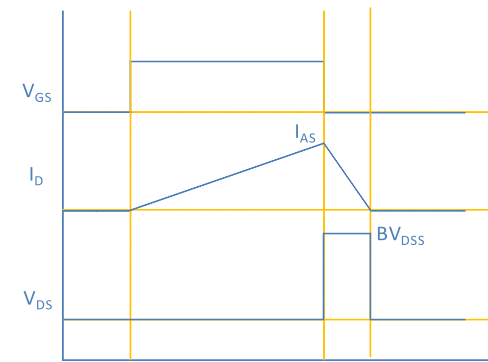
Inductive switching Test



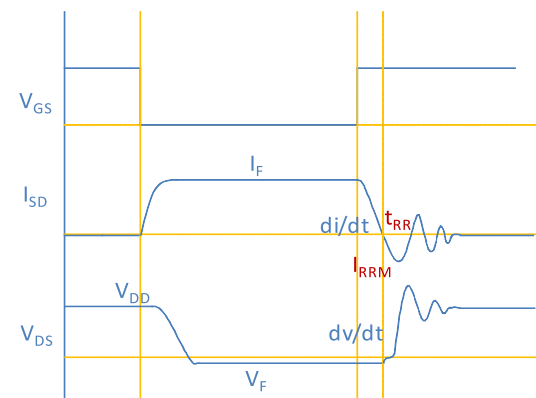
Gate Charge Test



Uclamped Inductive Switching (UIS) Test

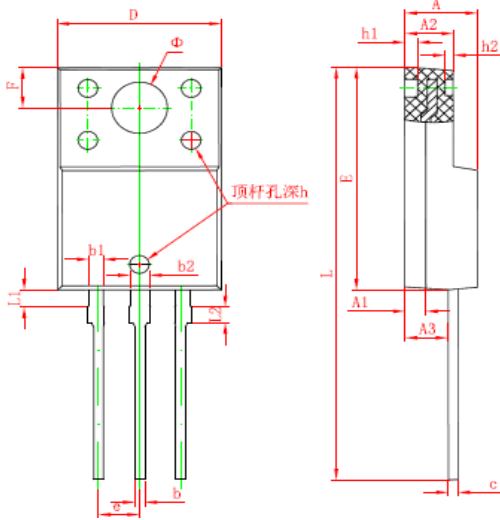


Diode Recovery Test



Package Outline

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

