650V Enhancement-mode GaN Transistor

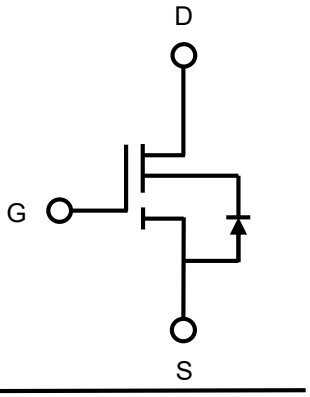
Description

650V Normally-OFF GaN			
V_{DS}(V)	$R_{DS(on)}$(mΩ)	I_{DS}(A)	Q_G(nC)
650	270	7.9	7.9

TO-220F (Top View)

Feature

- Normally-off device combines high voltage GaN HEMT and low voltage silicon MOSFET
- Normally off power switch
- Low reverse-recovery charge
- High switching frequency
- Low gate charge, low output charge
- Qualified for industrial applications according to JEDEC Standards
- Package:TO-220F



Circuit Diagram

Applications

- Fast charger
- Renewable energy
- Telecom and data-com
- Servo motors
- Industrial
- Automotive

Absolute maximum rating@25℃

Rating		Symbol	Value	Units
Drain-Source Voltage		V_{DS}	650	V
Drain-Source Voltage-transient[1)]		$V_{DS(transient)}$	800	V
Gate-Source Voltage		V_{GS}	-20 to +20	V
Drain Current-Continuous[2)]	T_C =25℃	I_D	7.9	A
	T_C =125℃		3.5	A
Pulse Drain Current (pulse width: 100μs)		I_{DM}	14	A
Maximum Power Dissipation		P_D	32	W
Junction and Storage Temperature Range		T_J,T_{STG}	-55~+150	℃

Notes:
1. In off-state, spike duty cycle D<0.01, spike duration <1μs
2. For increased stability at high current operation.

Thermal characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Thermal Resistance, Junction - Case	$R_{\theta JC}$	-	3.9	-	℃/W

Electrical characteristics per line@25℃ (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}= 0V	650	-	-	V
Total Drain Leakage Current	I_{DSS}	V_{DS}= 650V,V_{GS}= 0V， T_J=25℃	-	-	10	μA
		V_{DS}= 650V,V_{GS}= 0V, T_J=150℃	-	-	100	
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}= V_{DS}, I_D= 1mA	3.3	4	4.8	V
Gate Threshold Voltage Temperature Coefficient	$\triangle V_{GS(th)}/T_J$		-	-7	-	mV/℃
Gate-Source Leakage Current	I_{GSS}	V_{GS}= ±20V	-	-	±100	nA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}= 10V, I_D= 1A, T_J=25℃	-	270	320	mΩ
		V_{GS}= 10V, I_D= 1A, T_J=150℃	-	570	-	
Input Capacitance	C_{iss}	V_{DS}= 400V,V_{GS}= 0V, f= 1MHz	-	293	-	pF
Output Capacitance	C_{oss}		-	17	-	
Reverse Transfer Capacitance	C_{rss}		-	3.74	-	
Output Charge	Q_{oss}	V_{GS}=0V, V_{DS}=0V to 400V, f=1MHz	-	22.2	-	nC
Total Gate Charge	Q_g	V_{GS}=0 to 10V, V_{DS}=400V, I_D=1A	-	7.9	-	nC
Gate-Source Charge	Q_{gs}		-	2.31	-	
Gate-Drain Charge	Q_{gd}		-	1.65	-	
Turn-on Delay Time	$t_{d(on)}$	V_{DS}=400V, V_{GS}=0V to 10V, I_D=2.1A, $R_{G-on(ext)}$=6.8Ω, $R_{G-off(ext)}$=2.2Ω, L=250μH	-	3.2	-	ns
Turn-on Rise Time	t_r		-	5.5	-	
Turn-Off Delay Time	$t_{d(off)}$		-	7.4	-	
Turn-Off Fall Time	t_f		-	27	-	
Reverse Device Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}= 0V,I_{SD}= 5A	-	2.3	-	V
Reverse Recovery Time	t_{rr}	I_F=10A, V_{DD}=400V, dI_F/dt=165A/μs	-	14	-	ns
Reverse Recovery Charge	Q_{rr}		-	6.5	-	nC

Typical Characteristics

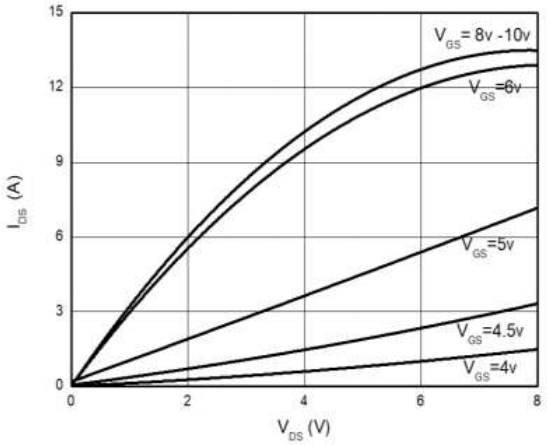


Figure 1. Typical Output Characteristics T_J=25°C

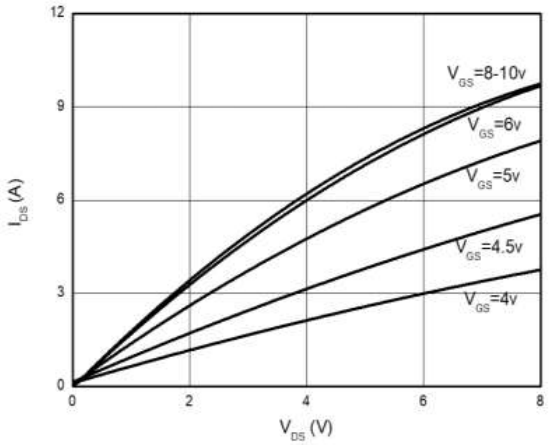


Figure 2. Typical Output Characteristics T_J=125°C

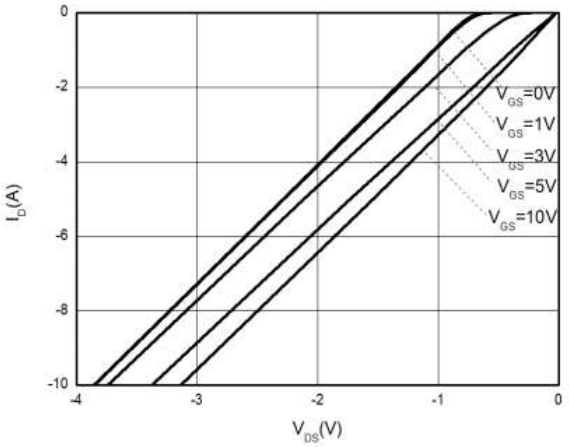


Figure 3. Channel Reverse Characteristics T_J=25°C

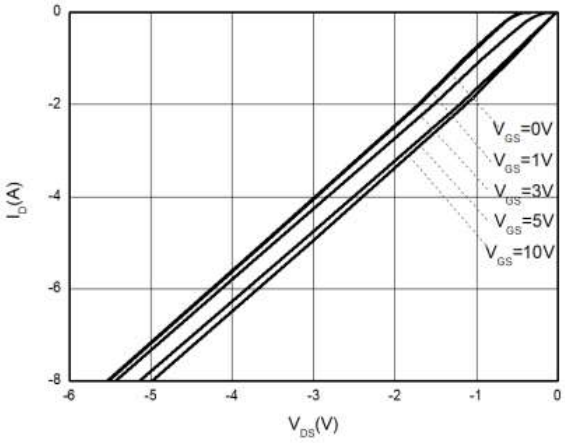


Figure 4. Channel Reverse Characteristics T_J=125°C

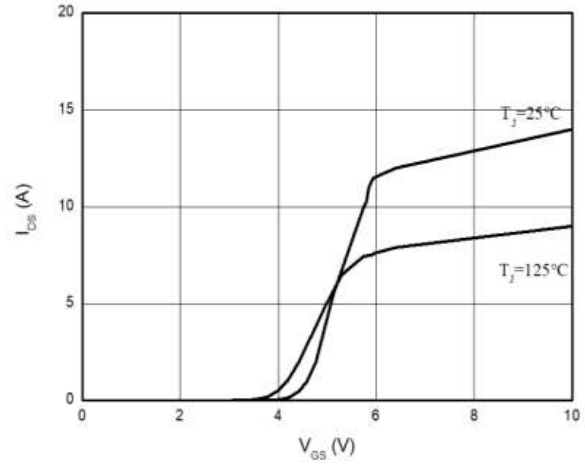


Figure 5. Typical Transfer Characteristics (V_{DS}=5V)

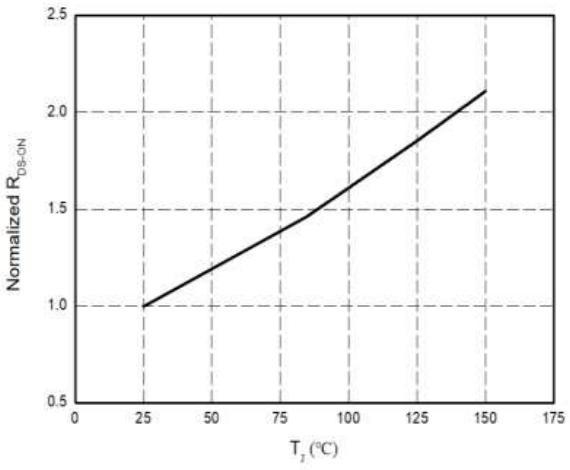


Figure 6. Normalized On-resistance

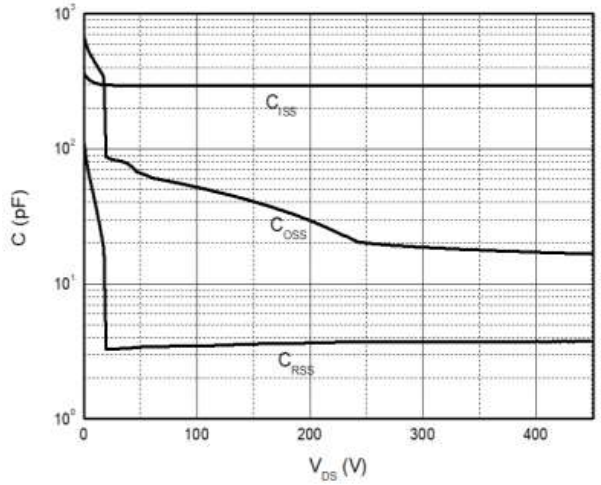


Figure 7. Typical Capacitance (f=1MHz)

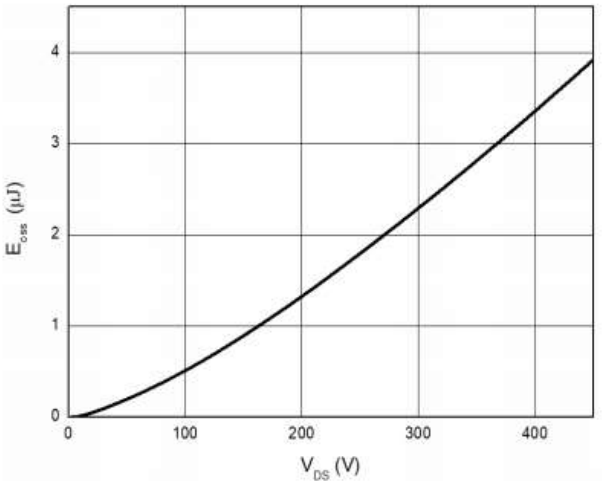


Figure 8. Typical C_{OSS} Stored Energy

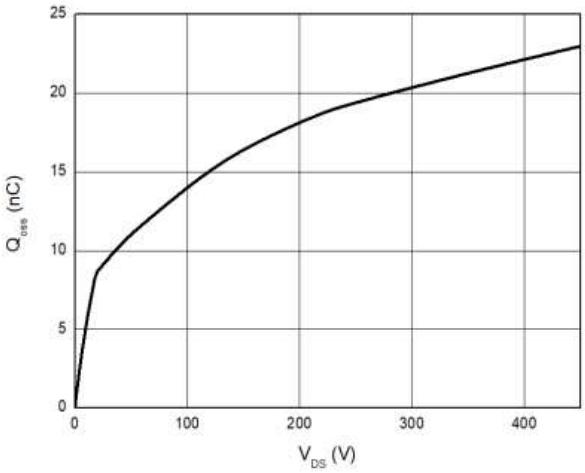


Figure 9. Typical Q_{OSS}

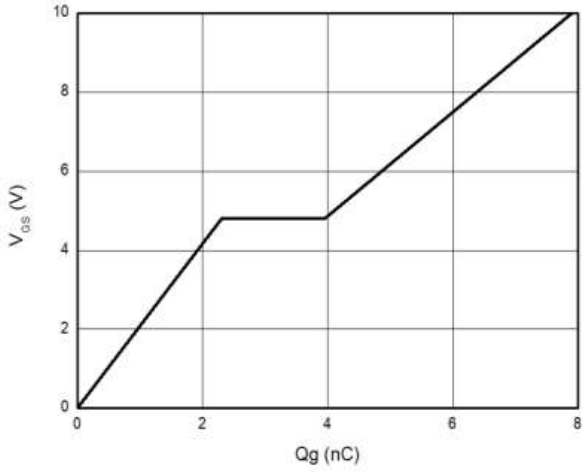


Figure 10. Typical Gate Charge (V_{DS}=400V, I_D=1A)

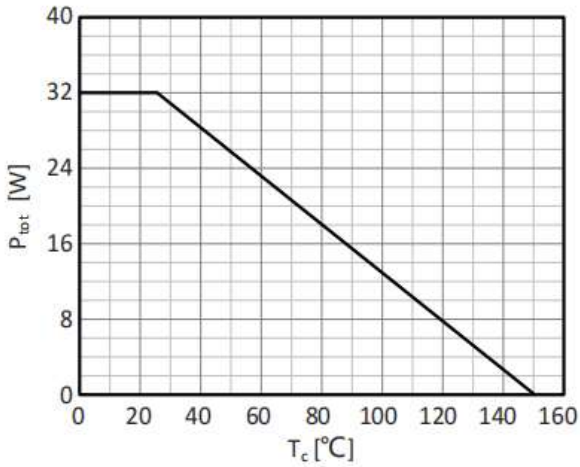


Figure 11. Power Dissipation

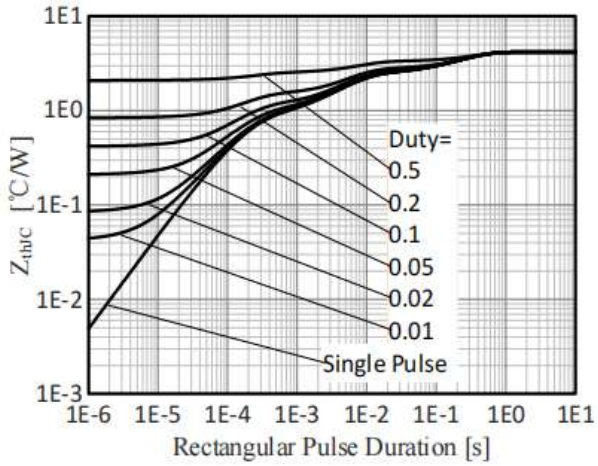


Figure 12. Transient Thermal Resistance

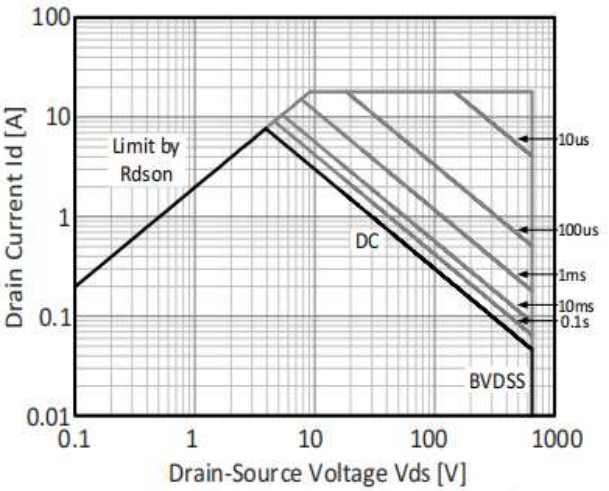


Figure 13. Safe Operating Area T_C=25°C

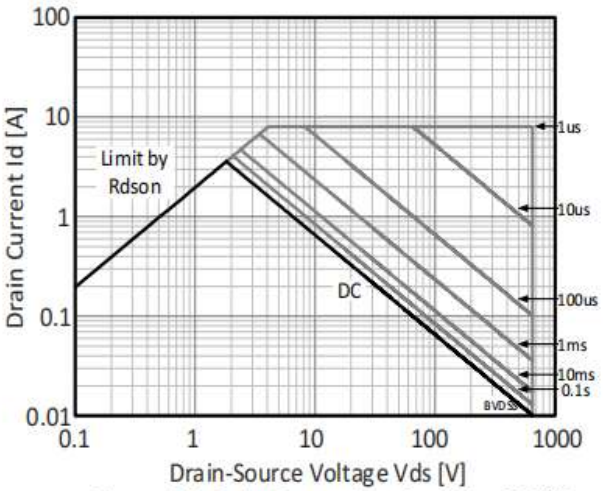
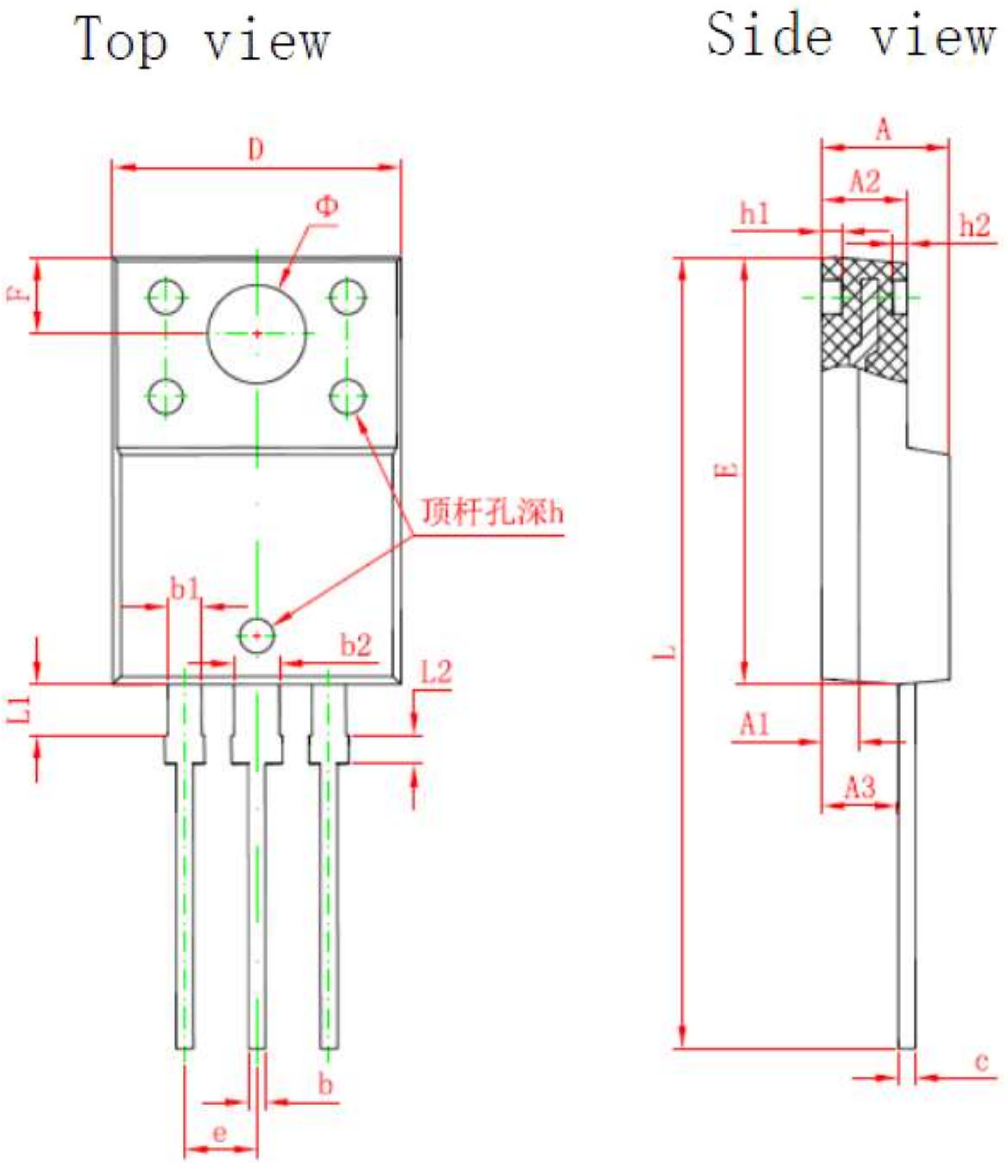


Figure 14. Safe Operating Area T_C=125°C

Product Dimension (TO-220F)



Dim	Millimeters		Inches		Dim	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	4.300	4.700	0.169	0.185	e	2.540 TYP.		0.100 TYP.	
A1	1.300 REF.		1.300 REF.		F	2.700REF.		0.106 REF.	
A2	2.800	3.200	0.110	0.126	Φ	3.500 REF.		0.138 REF.	
A3	2.500	2.900	0.098	0.114	h	0.000	0.300	0.000	0.012
b	0.500	0.750	0.020	0.030	h1	0.800 REF.		0.031 REF.	
b1	1.100	1.350	0.043	0.053	h2	0.500 REF.		0.020 REF.	
b2	1.500	1.750	0.059	0.069	L	28.000	28.400	1.102	1.118
c	0.500	0.750	0.020	0.030	L1	1.700	1.900	0.067	0.075
D	9.960	10.360	0.392	0.408	L2	0.900	1.100	0.035	0.043
E	14.800	15.200	0.583	0.598					

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