

650V GaN HEMT

Description

The CC65H160TOAIF Series 650V, 160mΩ gallium nitride (GaN) FETs are normally-off devices.

Classicchip GaN FETs offer better efficiency through lower gate charge, faster switching speeds, and lower dynamic onresistance, delivering significant advantages over traditional silicon (Si) devices.

Classicchip is a leading-edge wide band gap supplier with world-class innovation .

Automotive

- Adapter
- Renewable energy
- Telecom and data-com
- Servo motors
- Industrial
- Automotive

General Features

Easy to drive—compatible with standard gate drivers

Low conduction and switching losses

RoHS compliant and Halogen-free

Benefits

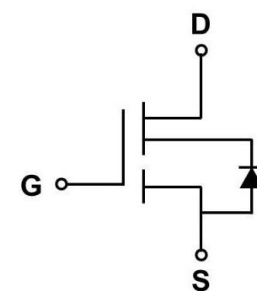
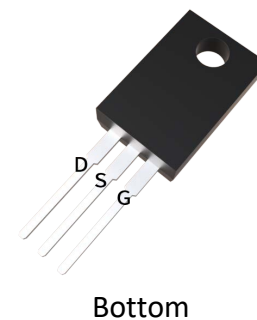
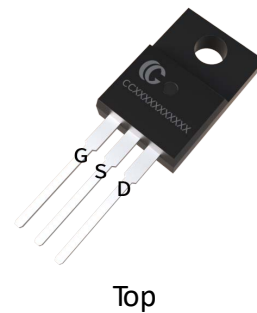
Increased efficiency through fast switching

Increased power density

Reduced system size and weight

Ordering Information

Part Number	Package	Package Configuration
CC65H160TOAIF	TO220F	Source



Circuit Symbol

Features

BV_{DSS}	$R_{DS(ON)}$	I_{DS}	Q_G
650V	160mΩ	16A	7.9nC

Absolute Maximum Ratings

$T_C=25^{\circ}\text{C}$ unless otherwise stated

Symbol	Parameter		Limit value	Unit
V_{DSS}	Drain to source voltage ($T_J = -55^{\circ}\text{C}$ to 150°C)		650	V
$V_{(TR)DSS}$	Drain to source voltage-transient ^a		800	
V_{GSS}	Gate to source voltage		-20 ~ +20	
I_D	Continuous drain current @ $T_C=25^{\circ}\text{C}$ ^b		16	A
	Continuous drain current @ $T_C=125^{\circ}\text{C}$ ^b		7	
I_{DM}	Pulse drain current (pulse width: 100 μs)		27	A
P_D	Maximum power dissipation @ $T_C=25^{\circ}\text{C}$		78	W
T_C	Operating temperature	Case	-55 ~ 150	$^{\circ}\text{C}$
T_J		Junction	-55 ~ 150	$^{\circ}\text{C}$
T_S	Storage temperature		-55 ~ 150	$^{\circ}\text{C}$

a. In off-state, spike duty cycle $D < 0.01$, spike duration $< 1\mu\text{s}$

b. For increased stability at high current operation

Thermal Resistance

Symbol	Parameter	Limit value	Unit
$R_{\theta JC}$	Junction-to-case	1.6	°C /W

Electrical Parameters

T_J=25°C unless otherwise stated

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
Forward Device Characteristics						
V _{(BL)DSS}	Drain-source voltage	650	-	-	V	V _{GS} = 0V
V _{GS(th)}	Gate threshold voltage	-	4	-	V	V _{DS} =1V, I _{DS} =1mA
ΔV _{GS(th)} /T _J	Gate threshold voltage temperature coefficient	-	-7	-	mV/°C	
R _{DS(on)}	Drain-source on-resistance	-	160	190	mΩ	V _{GS} =10V, I _D =1A, T _J =25°C
		-	340	-		V _{GS} =10V, I _D =1A, T _J =150°C
I _{DSS}	Drain-to-source leakage current	-	-	10	μA	V _{DS} =650V, V _{GS} = 0V, T _J =25°C
		-	-	100		V _{DS} =650V, V _{GS} = 0V, T _J =150°C
I _{GSS}	Gate-to-source forward leakage current	-	-	±100	nA	V _{GS} =±20V
C _{ISS}	Input capacitance	-	293	-	pF	V _{GS} =0V, V _{DS} =400V, f=1MHz
C _{OSS}	Output capacitance	-	17	-		
C _{RSS}	Reverse capacitance	-	3.74	-		
Q _G	Total gate charge	-	7.9	-	nC	V _{DS} =400V, V _{GS} =0V to 10V, I _D =1A
Q _{GS}	Gate-source charge	-	2.31	-		
Q _{GD}	Gate-drain charge	-	1.65	-		
Q _{OSS}	Output charge	-	22.2	-	nC	V _{GS} =0V, V _{DS} =0V to 400V, f=1MHz
t _{D(on)}	Turn-on delay	-	3.2	-	ns	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
t _R	Rise time	-	5.5	-		
t _{D(off)}	Turn-off delay	-	7.4	-		
t _F	Fall time	-	27	-		

Electrical Parameters

T_J=25°C unless otherwise stated

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
Reverse Device Characteristics						
V _{SD}	Source-Drain reverse voltage	-	2.5	-	V	V _{GS} =0V, I _{SD} =10A
t _{RR}	Reverse recovery time	-	14	-	ns	I _F =10A, V _{DD} =400V, dI _F /dt=165A/μs
Q _{RR}	Reverse recovery charge	-	6.5	-	nC	

Typical Characteristics

$T_J=25^\circ\text{C}$ unless otherwise stated

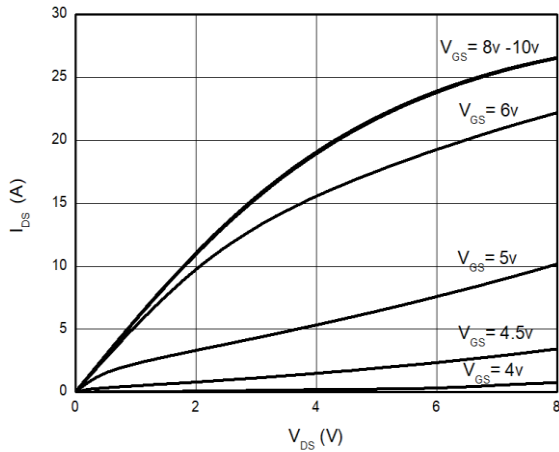


Figure 1. Typical Output Characteristics $T_J=25^\circ\text{C}$

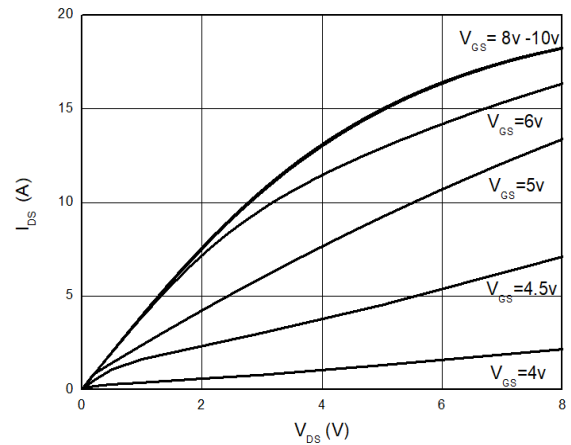


Figure 2. Typical Output Characteristics $T_J=125^\circ\text{C}$

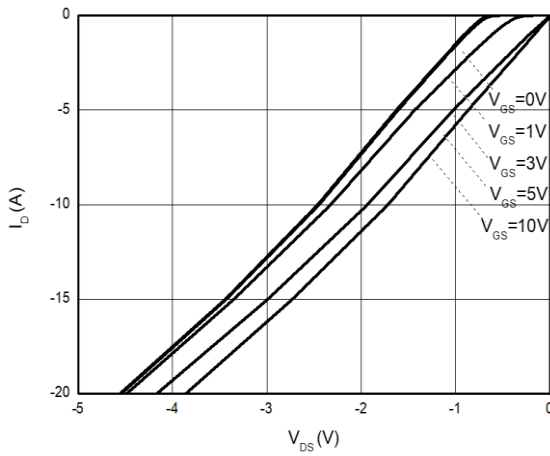


Figure 3. Channel Reverse Characteristics $T_J=25^\circ\text{C}$

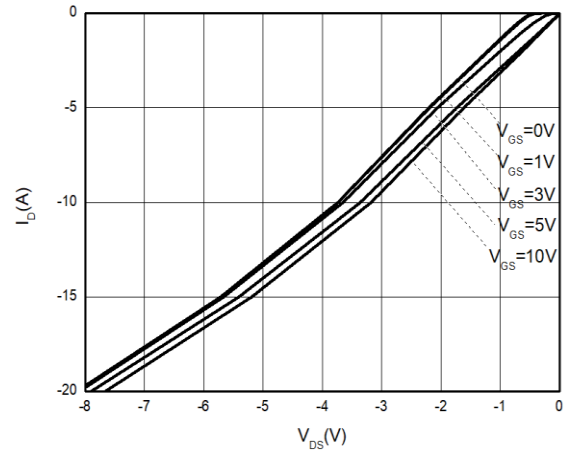


Figure 4. Channel Reverse Characteristics $T_J=125^\circ\text{C}$

Typical Characteristics

$T_J = 25^\circ\text{C}$ unless otherwise stated

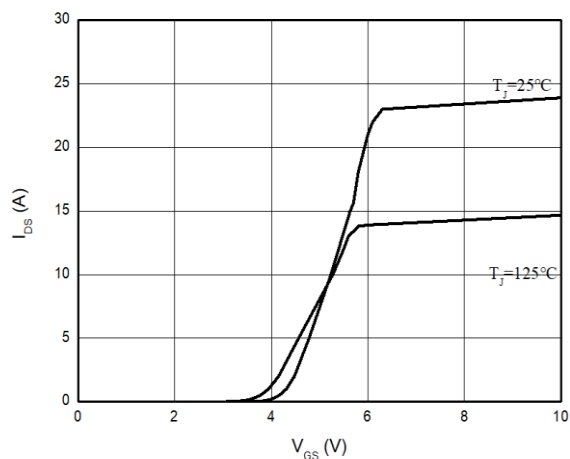


Figure 5. Typical Transfer Characteristics ($V_{DS}=5V$)

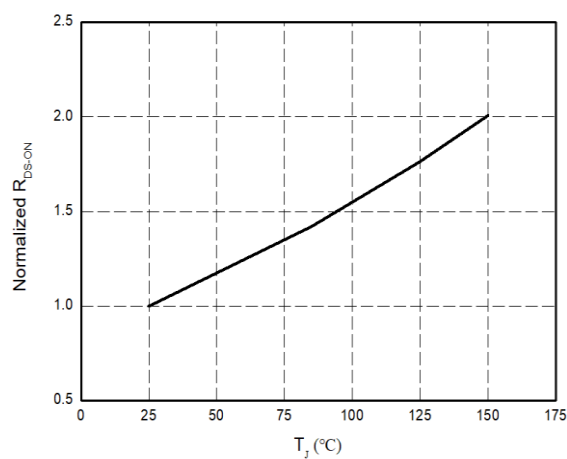


Figure 6. Normalized On-resistance

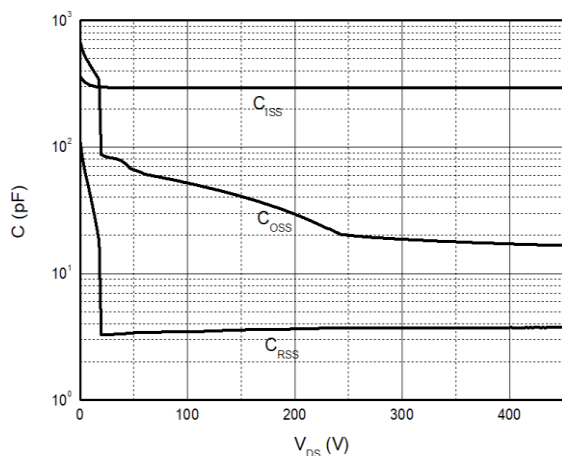


Figure 7. Typical Capacitance ($f=1\text{MHz}$)

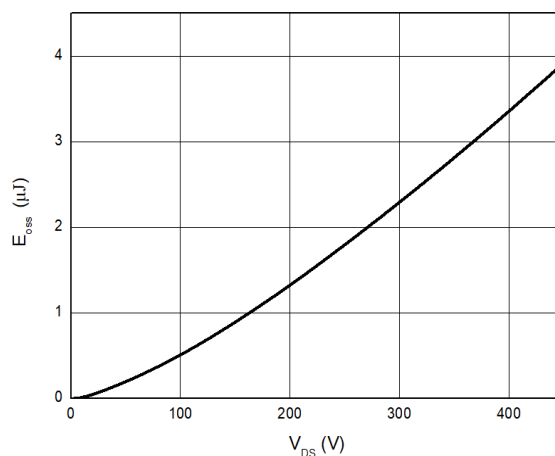


Figure 8. Typical C_{OSS} Stored Energy

Typical Characteristics

$T_J = 25^\circ\text{C}$ unless otherwise stated

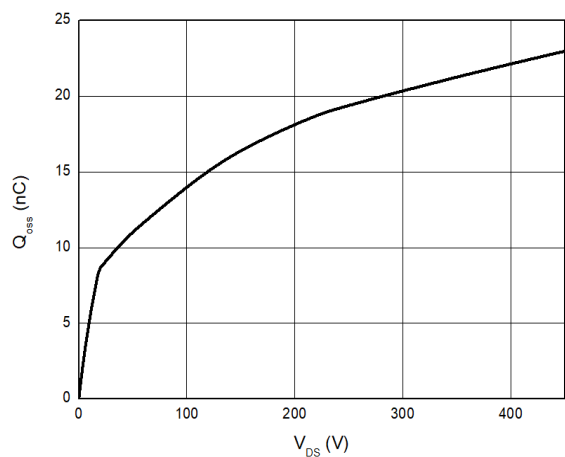


Figure 9. Typical Q_{oss}

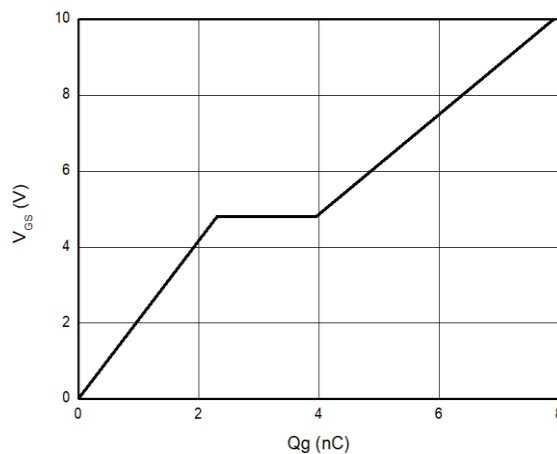


Figure 10. Typical Gate Charge ($V_{DS}=400\text{V}$, $I_D=1\text{A}$)

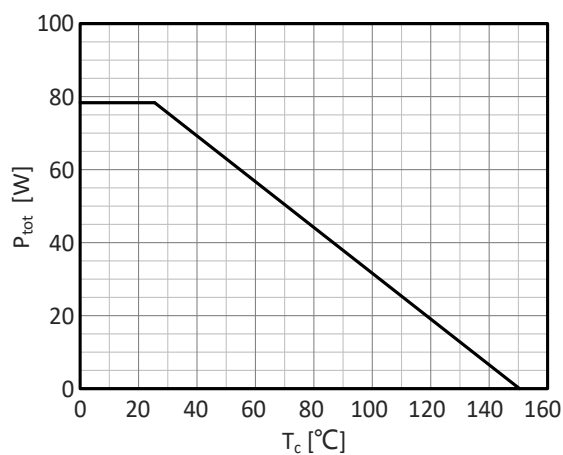


Figure 11. Power Dissipation

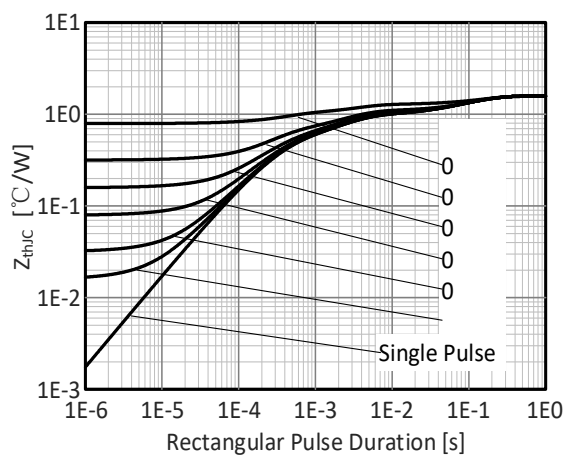


Figure 12. Transient Thermal Resistance

Typical Characteristics

$T_J=25^\circ\text{C}$ unless otherwise stated

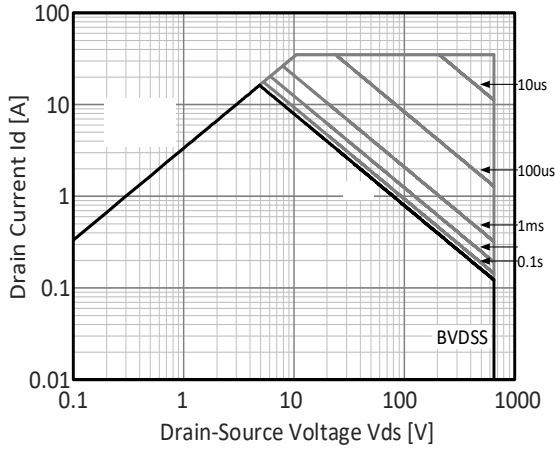


Figure 13. Safe Operating Area $T_c=25^\circ\text{C}$

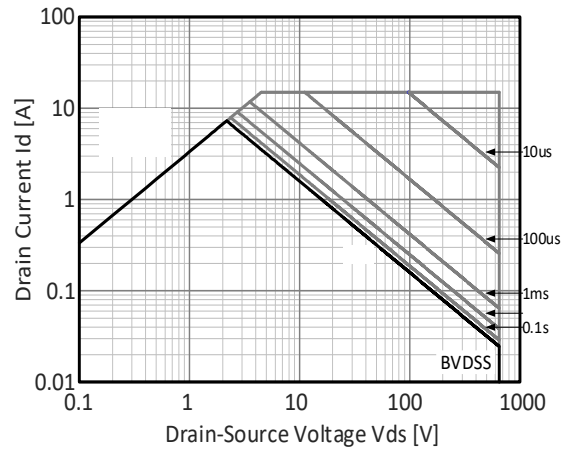


Figure 14. Safe Operating Area $T_c=125^\circ\text{C}$

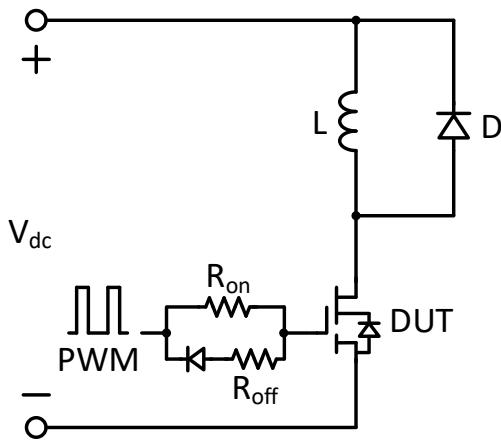


Figure 15. Switching times with inductive load

$V_{DS}=400\text{V}$, $V_{GS}=0\text{V}$ to 10V , $I_D=2.1\text{A}$,
 $R_{G-on(ext)}=6.8\Omega$, $R_{G-off(ext)}=2.2\Omega$, $L=250\mu\text{H}$

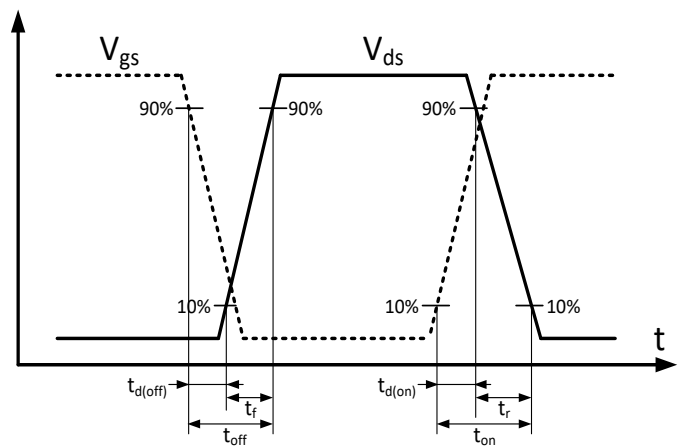
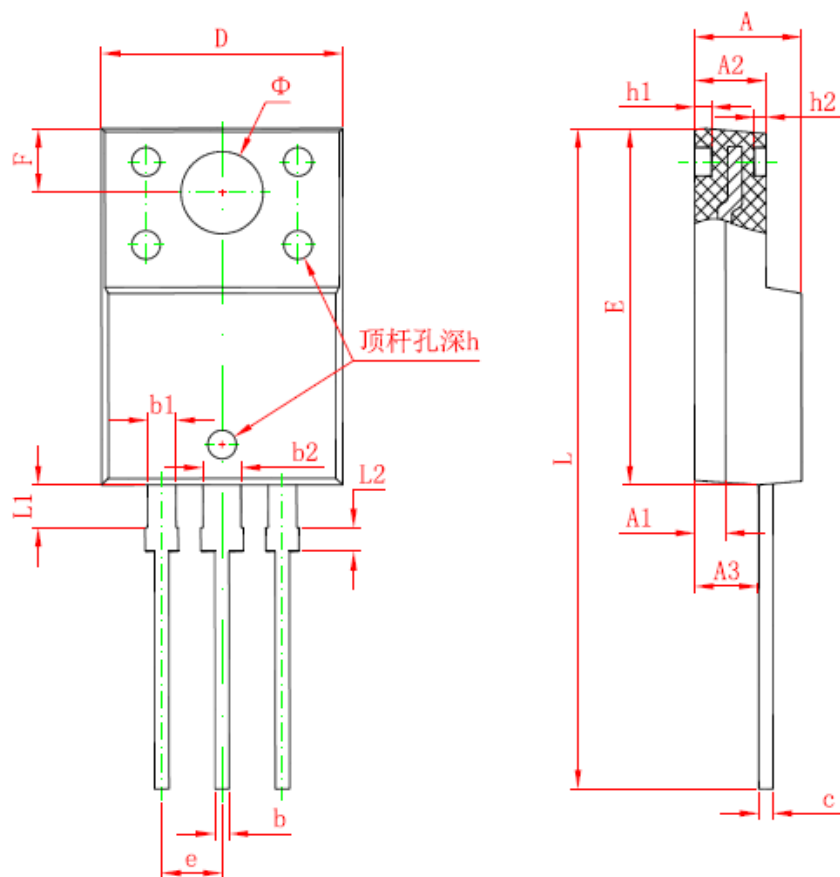


Figure 16. Switching times with waveform

PACKAGE DIMENSIONS

TO220F-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300 REF.		0.051 REF.	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
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	1.700	1.900	0.067	0.075
L2	0.900	1.100	0.035	0.043