



## CoreGaN 650V GaN HEMT

### Description

The CE65H110TOAI Series 650V, 110mΩ gallium nitride (GaN) FETs are normally-off devices.

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

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

### Application

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

### General Features

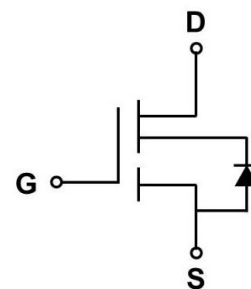
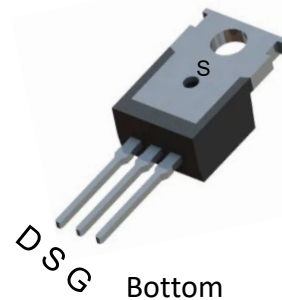
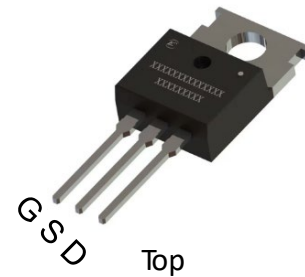
Easy to drive—compatible with standard gate drivers  
 Low conduction and switching losses  
 RoHS compliant and Halogen-free

### Benefits

Increased efficiency through fast switching  
 Increased power density  
 Reduced system size and weight

### Ordering Information

Part Number	Package	Package Configuration
CE65H110TOAI	TO220	Source



Circuit Symbol

### Features

$BV_{DSS}$	$R_{DS(ON)}$	$I_{DS}$	$Q_G$
650V	110mΩ	21A	6.9nC



## 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 $150^\circ\text{C}$ )	650		
$V_{(TR)DSS}$	Drain to source voltage-transient <sup>a</sup>	800	V	
$V_{GSS}$	Gate to source voltage	-20~+20		
$I_D$	Continuous drain current @ $T_c=25^\circ\text{C}$ <sup>b</sup>	21	A	
	Continuous drain current @ $T_c=125^\circ\text{C}$ <sup>b</sup>	9		
$I_{DM}$	Pulse drain current (pulse width: 10 $\mu\text{s}$ )	35	A	
$P_D$	Maximum power dissipation @ $T_c=25^\circ\text{C}$	125	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	$^{\circ}\text{C} / \text{W}$



## Electrical Parameters

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

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
<b>Forward Device Characteristics</b>						
$V_{(BL)DSS}$	Drain-source voltage	650	-	-	V	$V_{GS}=0V$
$V_{GS(th)}$	Gate threshold voltage	3.3	3.9	4.5	V	$V_{DS}=1V, I_{DS}=1mA$
$\Delta V_{GS(th)}/T_J$	Gate threshold voltage temperature coefficient	-	-7	-	mV/ $^\circ\text{C}$	
$R_{DS(on)}$	Drain-source on-Resistance	-	110	145	m $\Omega$	$V_{GS}=10V, I_D=1A, T_J=25^\circ\text{C}$
		-	230	-		$V_{GS}=10V, I_D=1A, T_J=150^\circ\text{C}$
$I_{DSS}$	Drain-to-source leakage current	-	1	10	$\mu\text{A}$	$V_{DS}=650V, V_{GS}=0V, T_J=25^\circ\text{C}$
		-	5	100		$V_{DS}=650V, V_{GS}=0V, T_J=150^\circ\text{C}$
$I_{GSS}$	Gate-to-source forward leakage current	-	-	$\pm 100$	nA	$V_{GS}=\pm 20V$
$C_{ISS}$	Input capacitance	-	330	-	pF	$V_{GS}=0V, V_{DS}=400V, f=1\text{MHz}$
$C_{OSS}$	Output capacitance	-	33	-		
$C_{RSS}$	Reverse capacitance	-	1.6	-		
$Q_G$	Total gate charge	-	6.9	-	nC	$V_{DS}=400V, V_{GS}=0V \text{ to } 10V, I_D=1A$
$Q_{GS}$	Gate-source charge	-	2	-		
$Q_{GD}$	Gate-drain charge	-	3	-		
$Q_{OSS}$	Output charge	-	48	-	nC	$V_{GS}=0V, V_{DS}=0V \text{ to } 400V, f=1\text{MHz}$
$t_{D(on)}$	Turn-on delay	-	3.2	-	ns	$V_{DS}=400V, V_{GS}=0V \text{ to } 10V, I_D=2.1A, R_{G-on(ext)}=6.8\Omega, R_{G-off(ext)}=2.2\Omega, L=250\mu\text{H}$
$t_R$	Rise time	-	5.5	-		
$t_{D(off)}$	Turn-off delay	-	7.4	-		
$t_F$	Fall time	-	27	-		



## Electrical Parameters

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

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
<b>Reverse Device Characteristics</b>						
$V_{SD}$	Source-Drain reverse voltage	-	2.1	-	V	$V_{GS}=0\text{V}$ , $I_{SD}=10\text{A}$
$t_{RR}$	Reverse recovery time	-	14	-	ns	$I_F=10\text{A}$ , $V_{DD}=400\text{V}$ , $dI_F/dt=165\text{A}/\mu\text{s}$
$Q_{RR}$	Reverse recovery charge	-	6.5	-	nC	



### Typical Characteristics

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

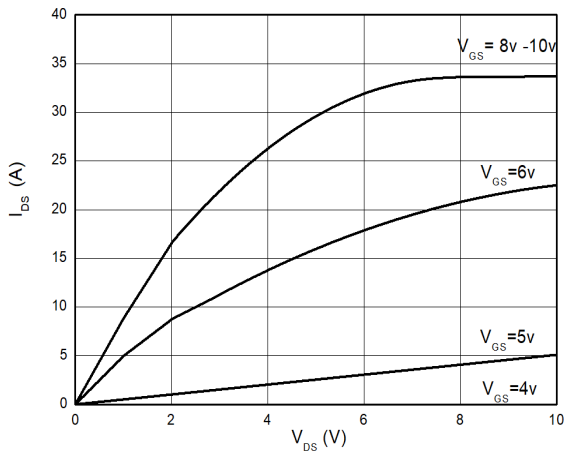


Figure 1. Typical Output Characteristics  $T_j=25^\circ\text{C}$

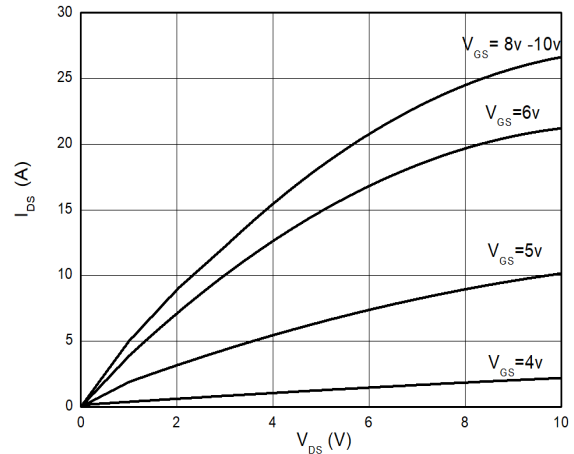


Figure 2. Typical Output Characteristics  $T_j=125^\circ\text{C}$

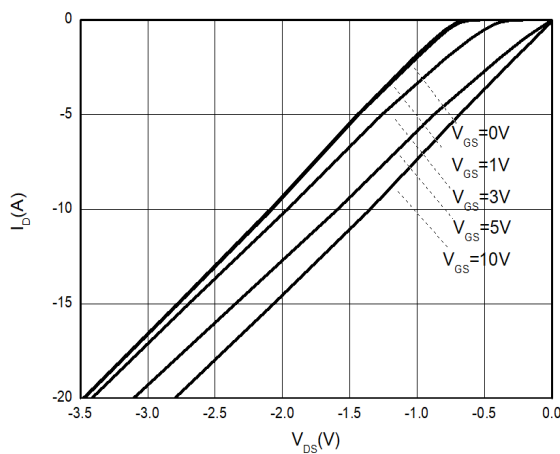


Figure 3. Channel Reverse Characteristics  $T_j=25^\circ\text{C}$

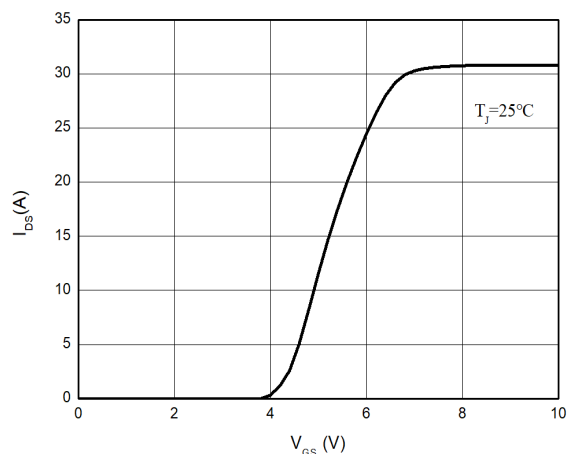


Figure 4. Typical Transfer Characteristics ( $V_{DS}=10\text{V}$ )



### Typical Characteristics

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

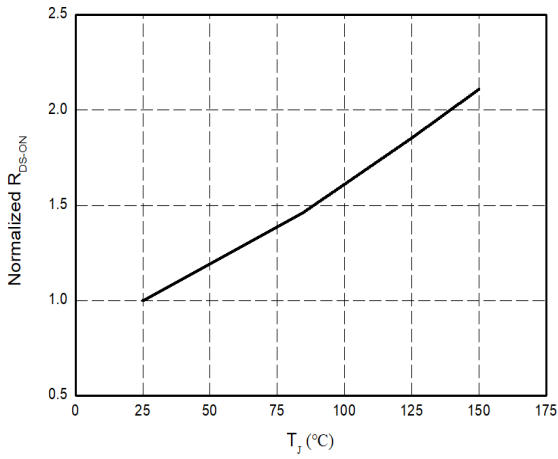


Figure 5. Normalized On-resistance

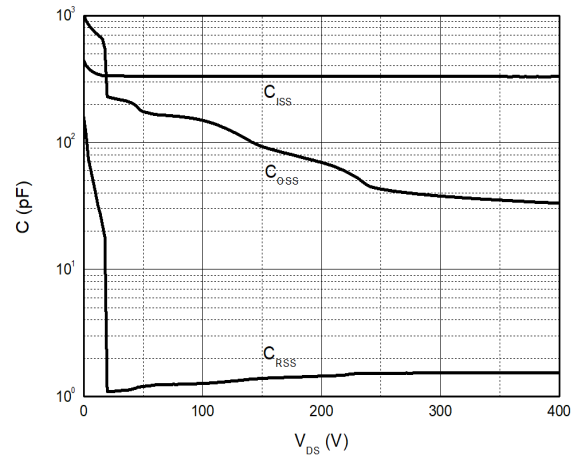


Figure 6. Typical Capacitance (f=1MHz)

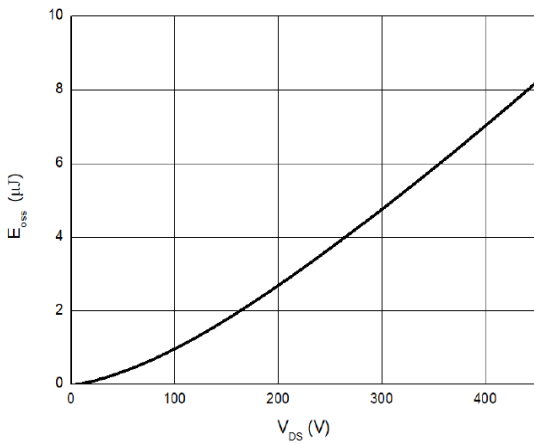


Figure 7. Typical  $C_{OSS}$  Stored Energy

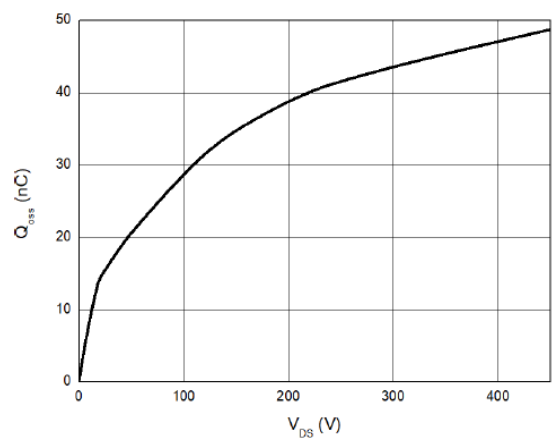


Figure 8. Typical  $Q_{OSS}$



### Typical Characteristics

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

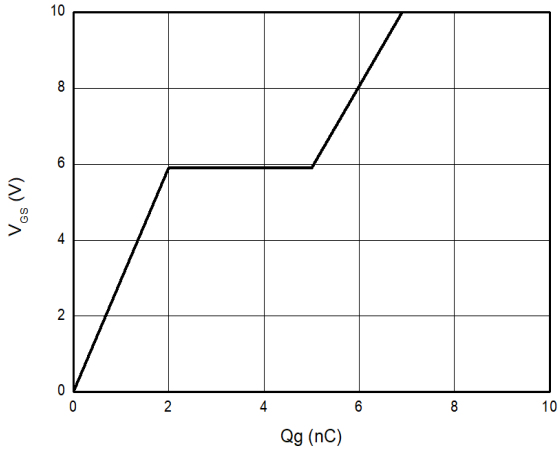


Figure 9. Typical Gate Charge ( $V_{DS}=400\text{V}$ ,  $I_D=1\text{A}$ )

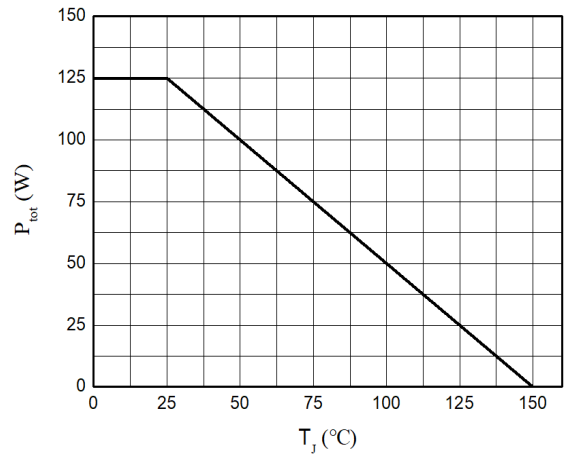


Figure 10. Power Dissipation

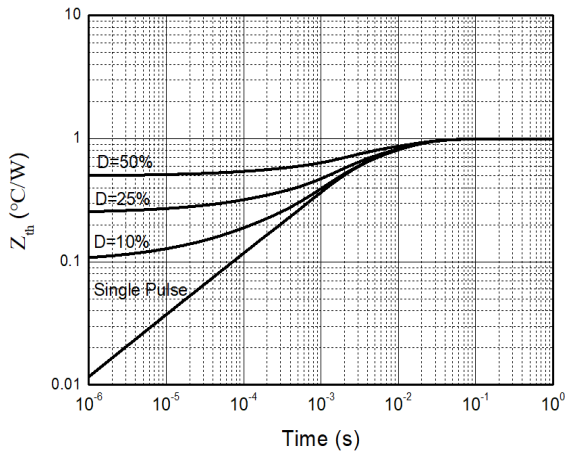


Figure 11. Transient Thermal Resistance

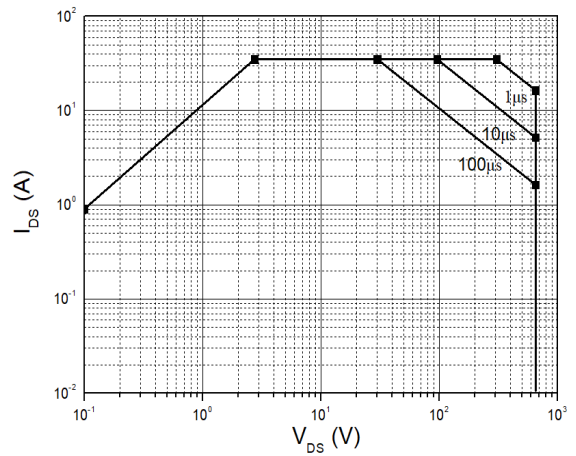


Figure 12. Safe Operating Area  $T_J=25^\circ\text{C}$



## Typical Characteristics

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

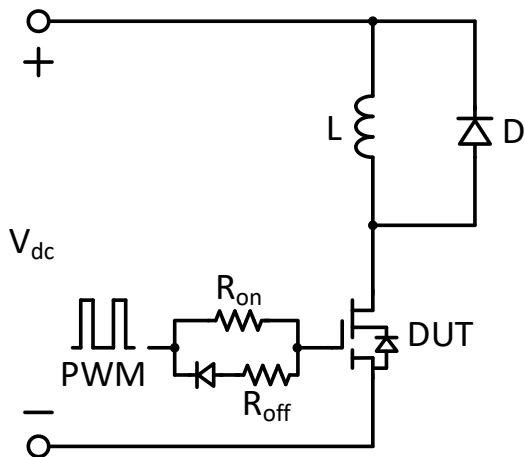


Figure 13. Switching times with inductive load

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

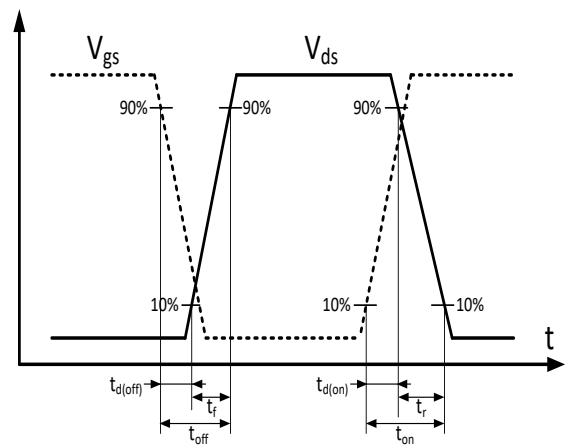
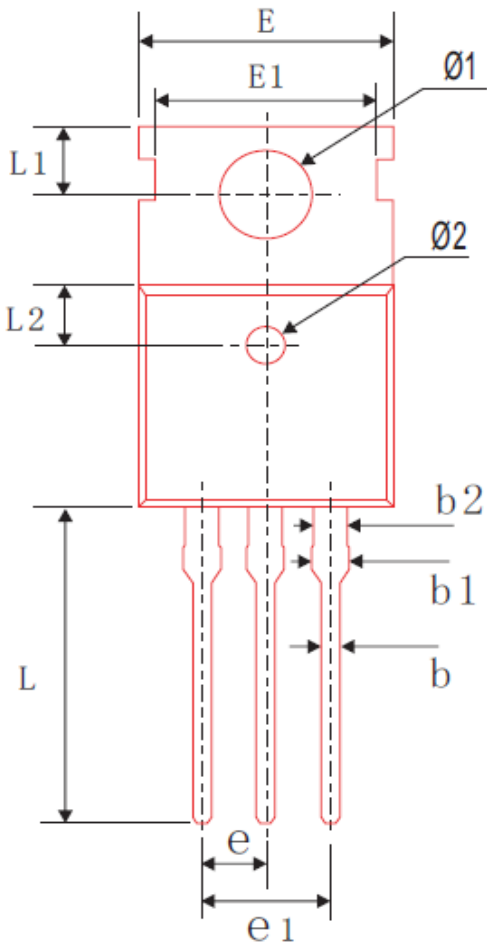


Figure 14. Switching times with waveform

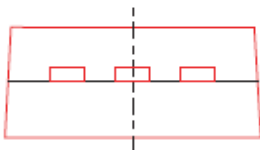


**CE65H110TOAI**

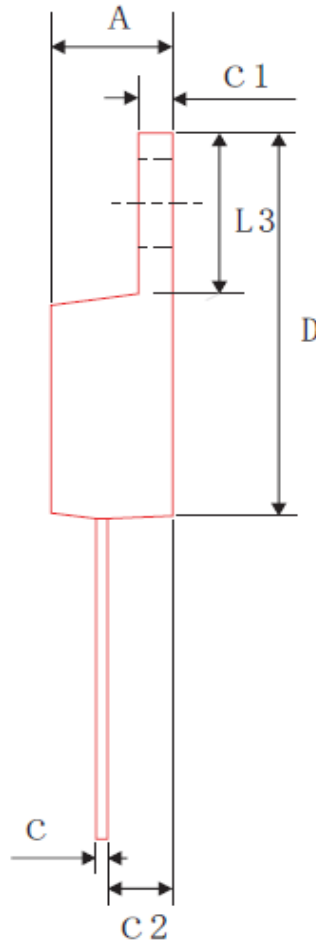
**TO220-3L**



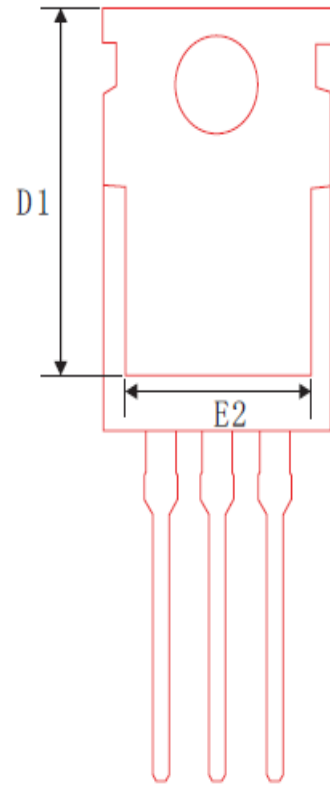
**TOP VIEW**



**SIDE VIEW**



**SIDE VIEW**



**BOTTOM VIEW**

SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
b	0.70	0.80	0.90
b1	---	---	1.42
b2	1.17	1.27	1.37
c	0.40	0.50	0.60
C1	1.25	1.30	1.35
C2	2.20	2.40	2.60
D	15.45	15.65	15.85
D1	13.20	13.40	13.60
E	9.80	10.0	10.2
E1	8.60	8.70	8.80
E2	7.80	8.00	8.20
e1	4.88	5.08	5.28
L	12.95	13.15	13.35
L1	2.70	2.80	2.90
L2	2.40	2.50	2.60
L3	6.30	6.50	6.70
Ø1	3.50	3.60	3.70
Ø2	1.35	1.50	1.65
e	2.54BSC		



## Revision history

### Major changes since the last revision

Revision	Date	Description of changes
1.0	2022-02-28	Initial release
2.0	2023-10-30	Enrich dynamic specification curves
3.0	2023-12-25	Update dynamic parameters