

650V GaN Power Transistor (FET)

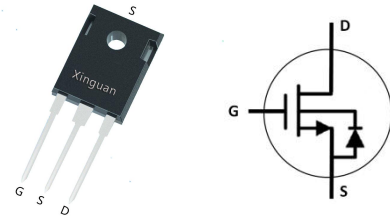
Features

- Easy to use, compatible with standard gate drivers
- Low Q_{rr} , no free-wheeling diode required
- Excellent $Q_g \times R_{DS(on)}$ product (FOM)
- Low switching loss
- RoHS compliant and Halogen-free

Product Summary		
V_{DSS}	650	V
$R_{DS(on),max}$	65	m Ω
$Q_{G Typ}$	24	nC
$Q_{RR Typ}$	180	nC

Applications

- Telecom and datacom
- Industrial
- Automotive
- Servo motors



Packaging

Part Number	Package
XGP6504A	3 Lead TO-247

Maximum ratings, at $T_c=25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Limit Value	Unit
I_D	Continuous drain current @ $T_c=25^\circ\text{C}$	37	A
	Continuous drain current @ $T_c=100^\circ\text{C}$	22	A
I_{DM}	Pulsed drain current (pulse width: 10us)	150	A
V_{DSS}	Drain to source voltage ($T_j = -55^\circ\text{C}$ to 150°C)	650	V
V_{GSS}	Gate to source voltage	± 20	V
P_D	Maximum power dissipation @ $T_c=25^\circ\text{C}$	125	W
T_c	Operating temperature	Case	-55 to 150
T_j		Junction	-55 to 150
T_s	Storage temperature	-55 to 150	$^\circ\text{C}$
T_{CSOLD}	Soldering peak temperature	260	$^\circ\text{C}$

Thermal Resistance

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Junction-to-case	1	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-ambient	40	$^\circ\text{C}/\text{W}$

Electrical Parameters, at $T_J=25^\circ\text{C}$, unless otherwise specified

Symbol	Min	Typ	Max	Unit	Test Conditions
Forward Device Characteristics					
$V_{DSS-MAX}$	650	-	-	V	$V_{GS}=0V$
BV_{DSS}	-	1800	-	V	$V_{GS}=0V, I_{DSS}=250\mu A$
$V_{GS(th)}$	-	1.62	-	V	$V_{DS}=V_{GS}, I_D=500\mu A$
$R_{DS(on)}^a$	-	55	65	m Ω	$V_{GS}=8V, I_D=4A, T_J=25^\circ\text{C}$
	-	110	-		$V_{GS}=8V, I_D=4A, T_J=150^\circ\text{C}$
I_{DSS}	-	5	0.2	μA	$V_{DS}=700V, V_{GS}=0V, T_J=25^\circ\text{C}$
	-	50	-	μA	$V_{DS}=700V, V_{GS}=0V, T_J=150^\circ\text{C}$
I_{GSS}	-	-	150	nA	$V_{GS}=20V$
	-	-	-150	nA	$V_{GS}=-20V$
C_{ISS}	-	1460	-	pF	$V_{GS}=0V, V_{DS}=650V, f=1\text{MHz}$
C_{OSS}	-	130	-	pF	
C_{RSS}	-	2	-	pF	
$C_{O(er)}$	-	165	-	pF	$V_{GS}=0V, V_{DS}=0 \text{ to } 650V$
$C_{O(tr)}$	-	230	-	pF	
Q_G	-	24	-	nC	$V_{DS}=400V, V_{GS}=0V \text{ to } 8V, I_D=22A$
Q_{GS}	-	5	-		
Q_{GD}	-	3	-		
$t_{D(on)}$	-	45	-	nS	$V_{DS}=400V, V_{GS}=0V \text{ to } 10V, I_D=22A, R_G=11\Omega$
t_R	-	16	-		
$t_{D(off)}$	-	90	-		
t_F	-	8	-		
Reverse Device Characteristics					
V_{SD}	-	1.8	-	V	$V_{GS}=0V, I_S=22A, T_J=25^\circ\text{C}$
	-	2.2	-		$V_{GS}=0V, I_S=22A, T_J=150^\circ\text{C}$
	-	1.3	-		$V_{GS}=0V, I_S=11A, T_J=25^\circ\text{C}$
t_{RR}	-	20	-	ns	$I_S=22A, V_{GS}=0V, d_i/d_t=1500A/\mu s, V_{DD}=400V$
Q_{RR}	-	180	-	nC	

Notes:

- a. Dynamic on-resistance

Typical Characteristic, at $T_c=25\text{ }^\circ\text{C}$, unless otherwise specified

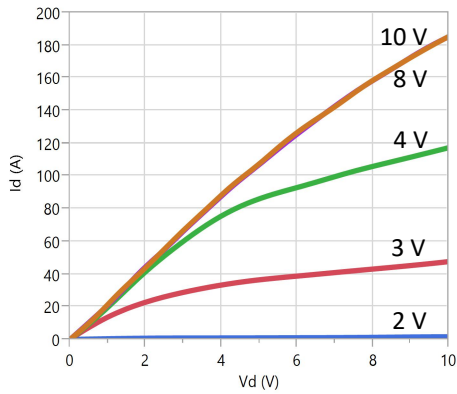


Figure 1. Typical Output Characteristics $T_j=25^\circ\text{C}$

Parameter: V_{GS}

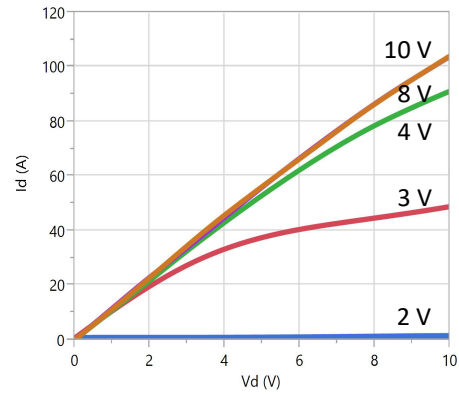


Figure 2. Typical Output Characteristics $T_j=150^\circ\text{C}$

Parameter: V_G

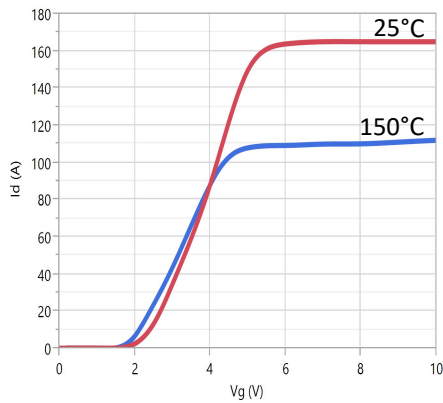


Figure 3. Typical Transfer Characteristics

$V_{DS}=10\text{V}$, Parameter: T_j

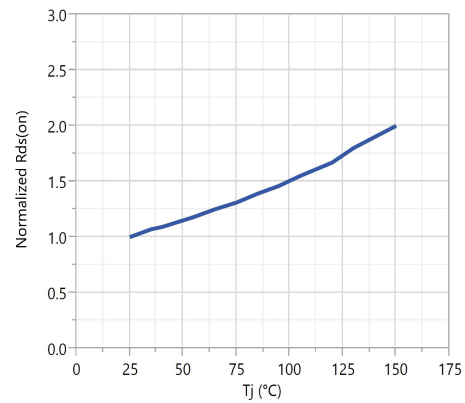


Figure 4. Normalized On-resistance

$I_D=4\text{A}$, $V_{GS}=8\text{V}$

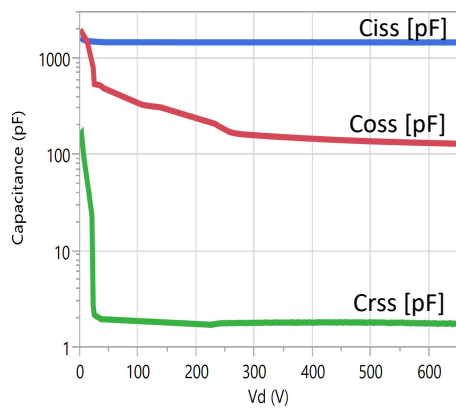


Figure 5. Typical Capacitance

$V_{GS}=0\text{V}$, $f=1\text{MHz}$

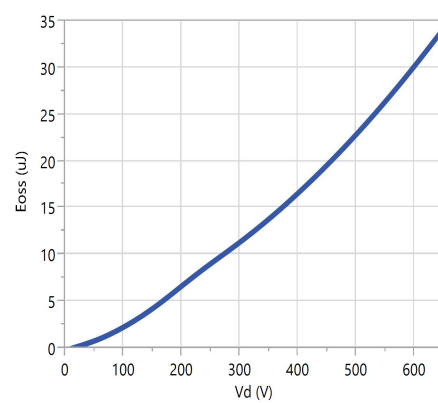


Figure 6. Typical Coss Stored Energy

Typical Characteristic, at $T_c=25\text{ }^\circ\text{C}$, unless otherwise specified

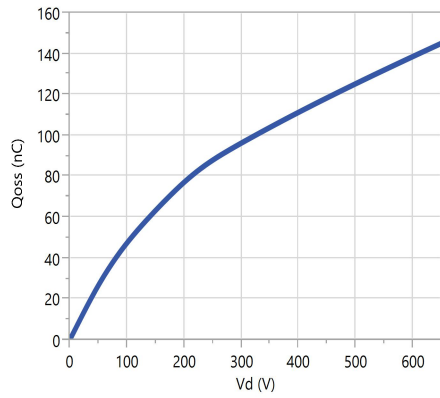


Figure 7. Typical Qoss

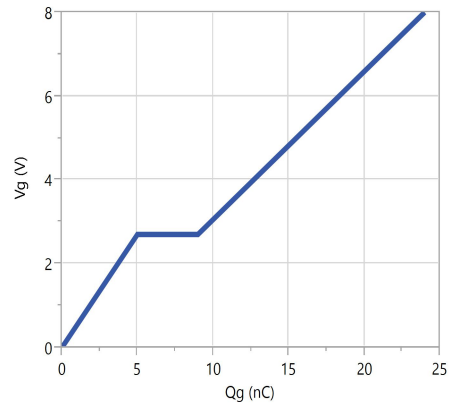


Figure 8. Typical Gate Charge

$I_D=22\text{A}, V_{DS}=400\text{V}$

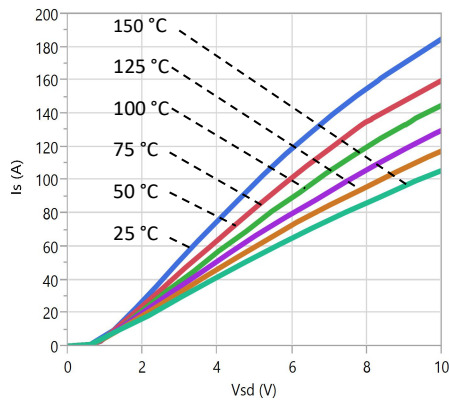


Figure 9. Forward Characteristic of Rev. Diode

$I_S=f(V_{SD}),$ Parameter $T_J,$ Pulse width = 20us

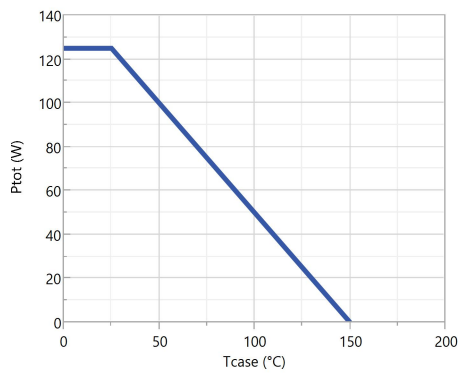


Figure 11. Power Dissipation

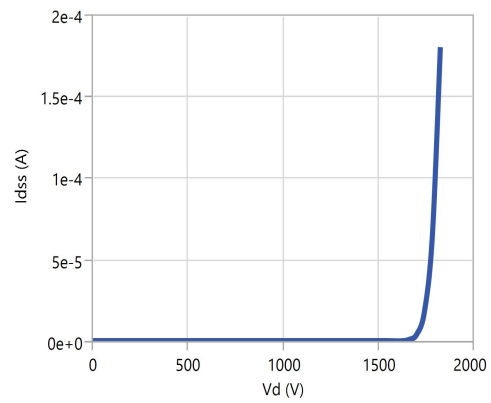


Figure 10. Drain-Source Breakdown Voltage

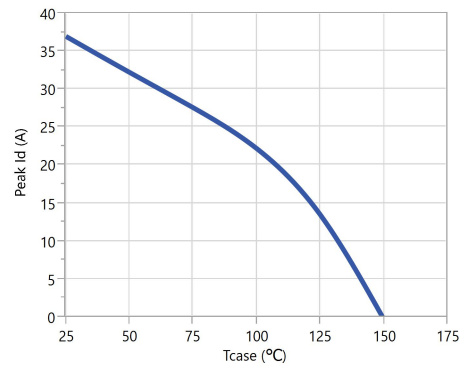


Figure 12. Current Derating

Typical Characteristic, at $T_c=25\text{ }^\circ\text{C}$, unless otherwise specified

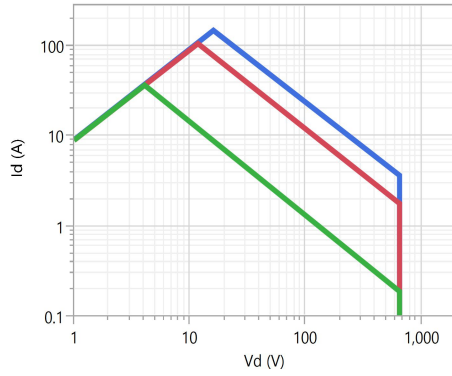


Figure 13. Safe operating Area $T_c=25\text{ }^\circ\text{C}$
(calculated based on thermal limit)

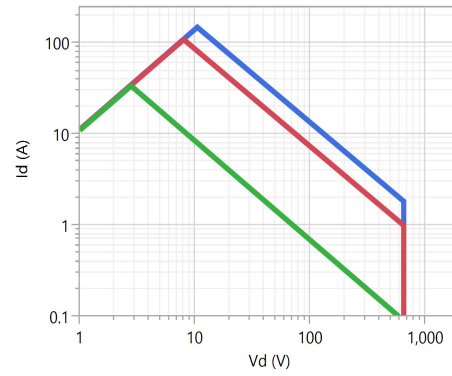


Figure 14. Safe operating Area $T_c=80\text{ }^\circ\text{C}$
(calculated based on thermal limit)

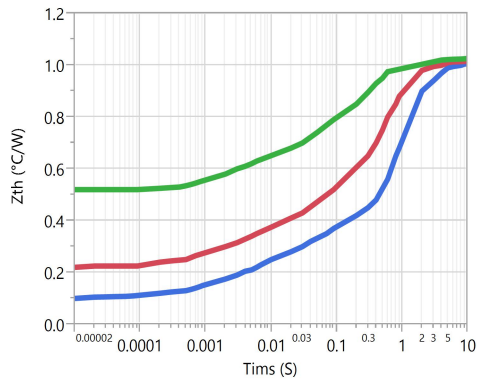


Figure 15. Transient Thermal Resistance

Test Circuits and Waveforms

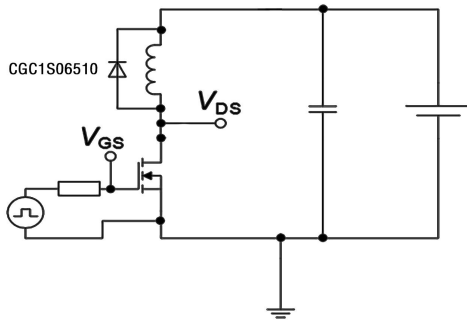


Figure 16. Switching Time Test Circuits

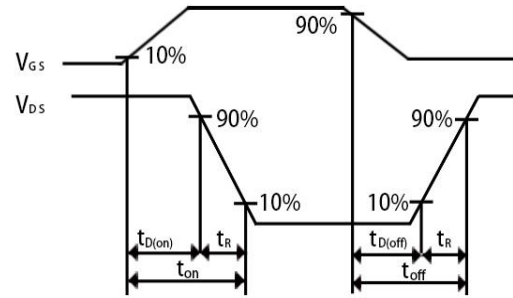


Figure 17. Switching Time Waveform

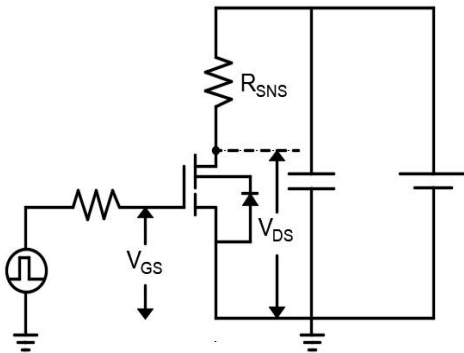


Figure 18. Dynamic $R_{DS(on)eff}$ Test Circuits

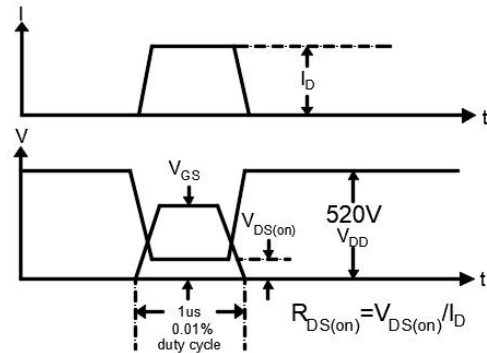


Figure 19. Dynamic $R_{DS(on)eff}$ Waveform

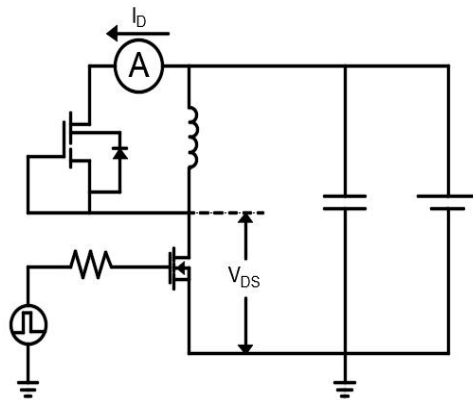


Figure 20. Diode Characteristics Test Circuits

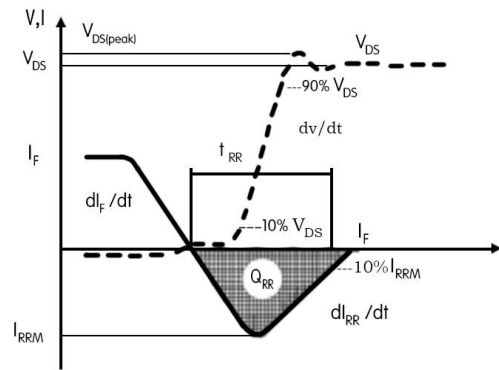
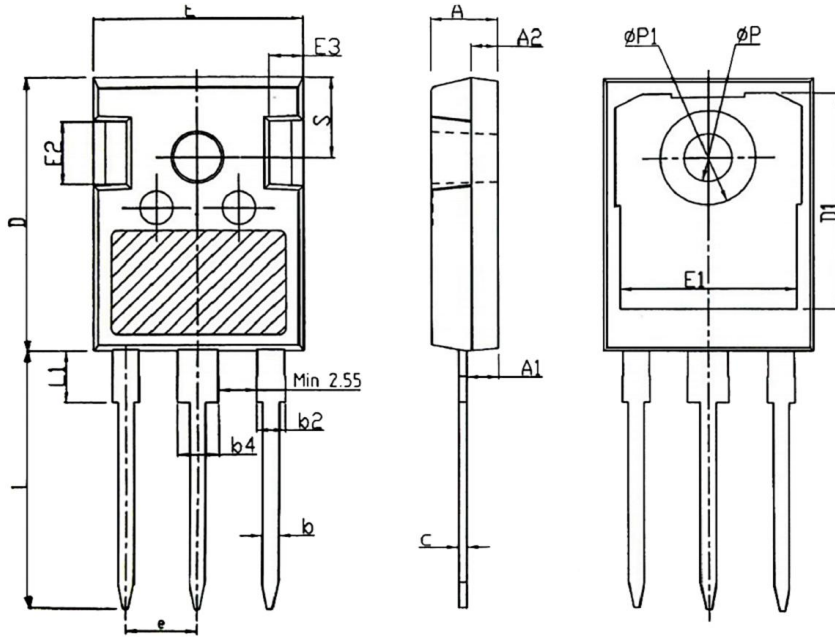


Figure 21. Diode Recovery Waveform

Mechanical

3 Lead TO-247 (PS) Package

Pin 1: Gate; Pin 2: Source; Pin 3: Drain; Tab: Source



COMMON DIMENSION

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ϕP	3.40	3.60	3.80
$\phi P1$	-	-	7.30
S	6.15BSC		