

## 650V GaN Power Transistor (FET)

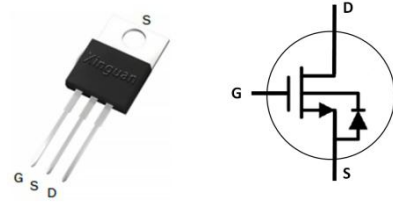
### Features

- 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
$R_{DS(on),max}$	150	m $\Omega$
$Q_{G Typ}$	22	nC
$Q_{RR Typ}$	65	nC

### Applications

- Telecom and datacom
- Industrial
- Automotive
- Servo motors



### Packaging

Part Number	Package
XGP6508B	3 Lead TO-220

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

Symbol	Parameter		Limit Value	Unit
$I_D$	Continuous drain current @ $T_c=25^\circ\text{C}$		21	A
	Continuous drain current @ $T_c=100^\circ\text{C}$		16	A
$I_{DM}$	Pulsed drain current (pulse width: 10us)		85	A
$V_{DSS}$	Drain to source voltage ( $T_j = -55^\circ\text{C}$ to $150^\circ\text{C}$ )		650	V
$V_{GSS}$	Gate to source voltage		$\pm 20$	V
$P_D$	Maximum power dissipation @ $T_c=25^\circ\text{C}$		83	W
$T_c$	Operating temperature	Case	-55 to 150	$^\circ\text{C}$
$T_j$		Junction	-55 to 150	$^\circ\text{C}$
$T_s$	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	1.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-ambient	50	$^\circ\text{C}/\text{W}$

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

Symbol	Min	Typ	Max	Unit	Test Conditions
<b>Forward Device Characteristics</b>					
$V_{DSS-MAX}$	650	-	-	V	$V_{GS}=0V$
$BV_{DSS}$	-	1200	-	V	$V_{GS}=0V, I_{DSS}=250\mu A$
$V_{GS(th)}$	-	1.62	-	V	$V_{DS}=V_{GS}, I_D=500\mu A$
$R_{DS(on)}^a$	-	125	150	m $\Omega$	$V_{GS}=8V, I_D=4A, T_J=25^\circ\text{C}$
	-	250	-		$V_{GS}=8V, I_D=4A, T_J=150^\circ\text{C}$
$I_{DSS}$	-	7	15	$\mu A$	$V_{DS}=700V, V_{GS}=0V, T_J=25^\circ\text{C}$
	-	20	-	$\mu A$	$V_{DS}=700V, V_{GS}=0V, T_J=150^\circ\text{C}$
$I_{GSS}$	-	-	150	nA	$V_{GS}=20V$
	-	-	-150	nA	$V_{GS}=-20V$
$C_{ISS}$	-	1470	-	pF	$V_{GS}=0V, V_{DS}=650V, f=1\text{MHz}$
$C_{OSS}$	-	55	-	pF	
$C_{RSS}$	-	1.5	-	pF	
$C_{O(er)}$	-	70	-	pF	$V_{GS}=0V, V_{DS}=0 \text{ to } 650V$
$C_{O(tr)}$	-	120	-	pF	
$Q_G$	-	22	-	nC	$V_{DS}=400V, V_{GS}=0V \text{ to } 8V, I_D=10A$
$Q_{GS}$	-	4.2	-		
$Q_{GD}$	-	3.6	-		
$t_{D(on)}$	-	30	-	nS	$V_{DS}=400V, V_{GS}=0V \text{ to } 10V, I_D=10A, R_G=11\Omega$
$t_R$	-	8	-		
$t_{D(off)}$	-	80	-		
$t_F$	-	9	-		
<b>Reverse Device Characteristics</b>					
$V_{SD}$	-	1.9	-	V	$V_{GS}=0V, I_S=10A, T_J=25^\circ\text{C}$
	-	3	-		$V_{GS}=0V, I_S=10A, T_J=150^\circ\text{C}$
	-	1.3	-		$V_{GS}=0V, I_S=5A, T_J=25^\circ\text{C}$
$t_{RR}$	-	30	-	ns	$I_S=10A, V_{GS}=0V, d_i/d_t=1000A/\mu s, V_{DD}=400V$
$Q_{RR}$	-	65	-	nC	

Notes:

- a. Dynamic on-resistance

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

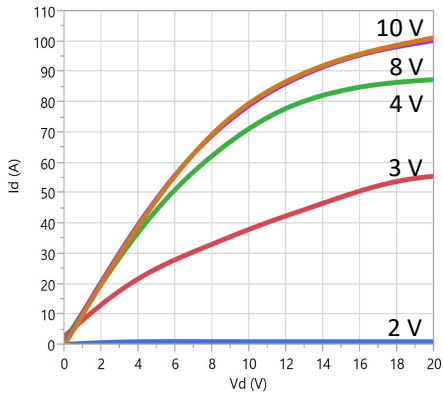


Figure 1. Typical Output Characteristics  $T_j=25^\circ\text{C}$

Parameter:  $V_{GS}$

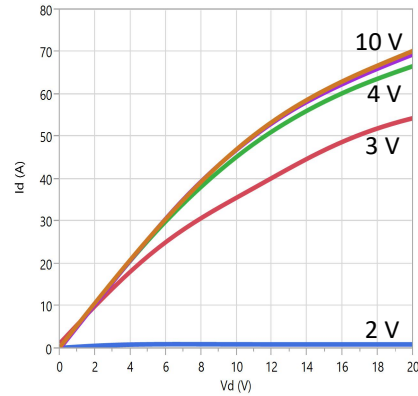


Figure 2. Typical Output Characteristics  $T_j=150^\circ\text{C}$

Parameter:  $V_{GS}$

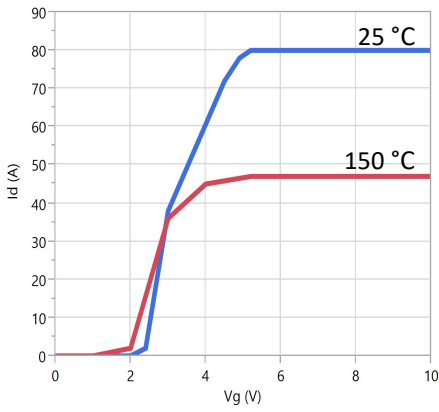


Figure3. Typical Transfer Characteristics

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

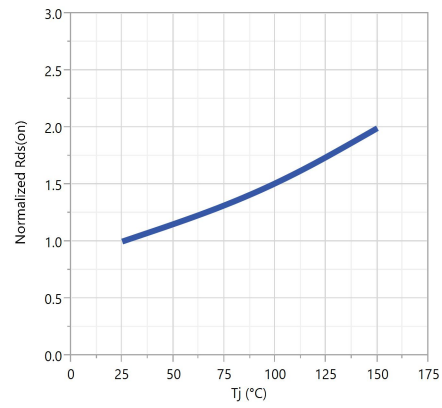


Figure 4. Normalized On-resistance

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

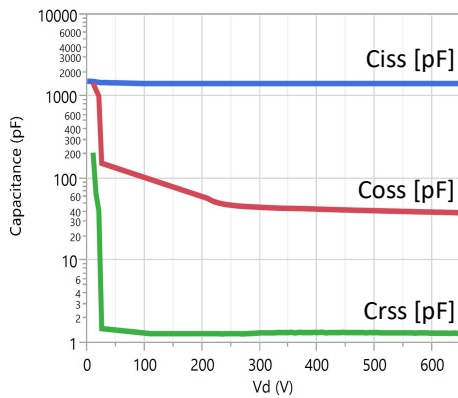


Figure 5. Typical Capacitance

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

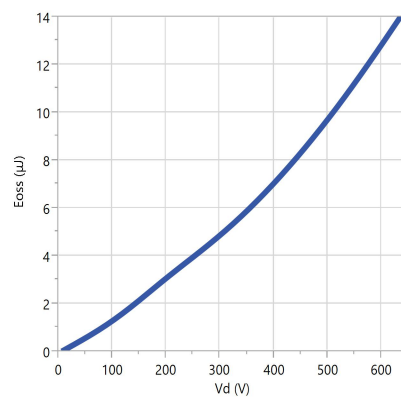


Figure 6. Typical  $C_{oss}$  Stored Energy

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

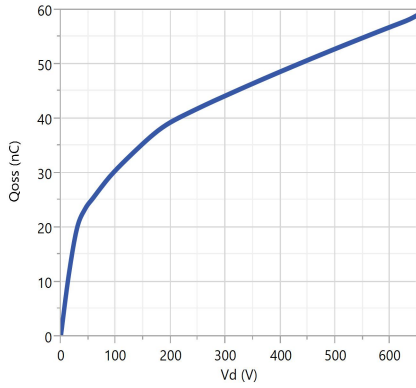


Figure 7. Typical Qoss

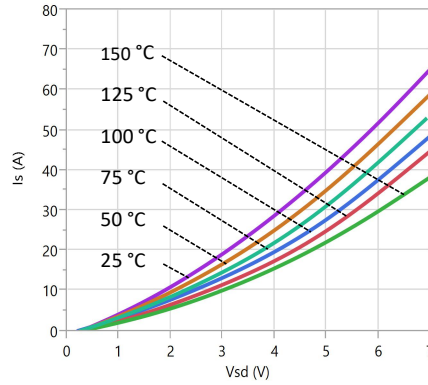


Figure 8. Forward Characteristic of Rev. Diode

$$I_s = f(V_{SD}), \text{ Parameter } T_j$$

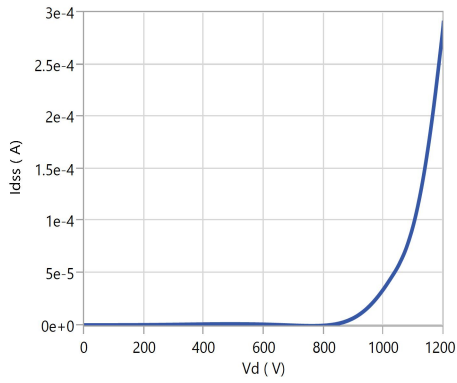


Figure 9. Drain-Source breakdown voltage

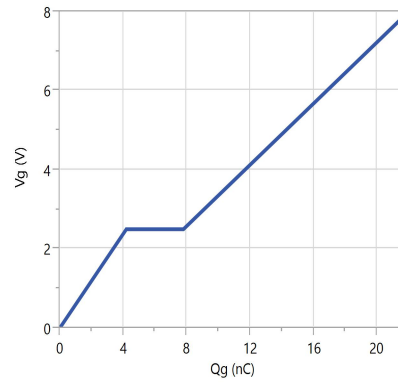


Figure 10. Typical Gate Charger

$$I_{DS}=10A, V_{DS}=400V$$

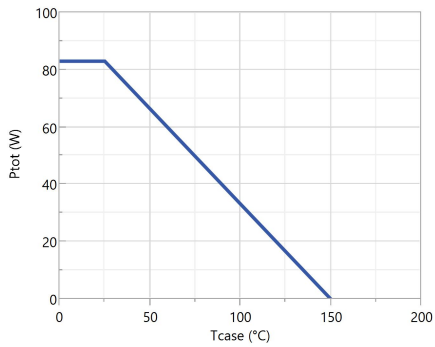


Figure 11. Power Dissipation

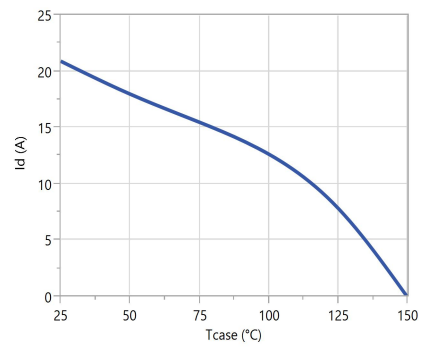
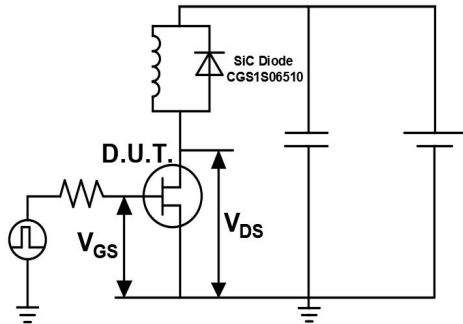
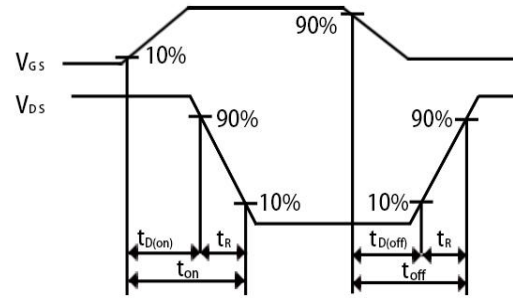


Figure 12. Current Derating

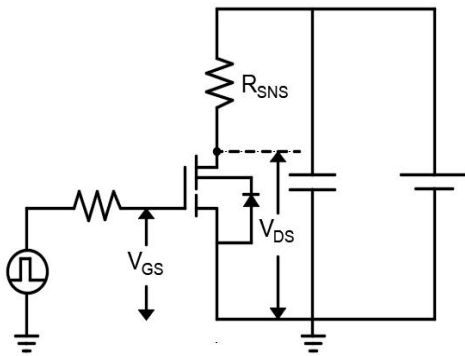
**Test Circuits and Waveforms**



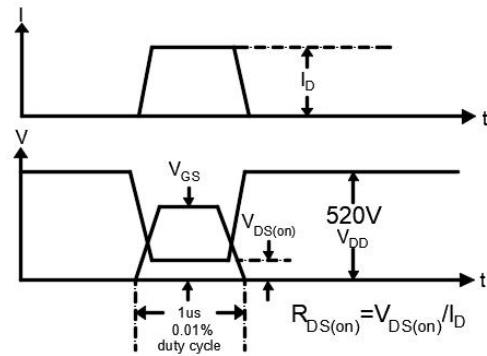
**Figure 13. Switching Time Test Circuits**



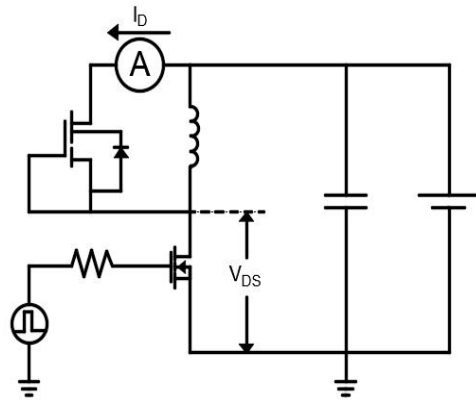
**Figure 14. Switching Time Waveform**



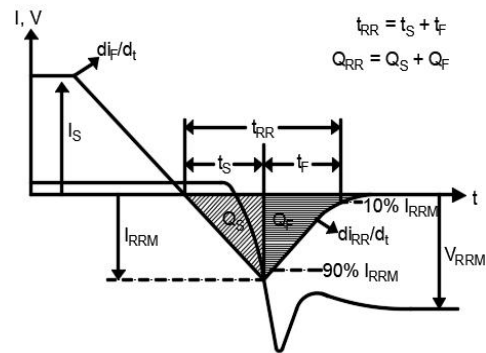
**Figure 15. Dynamic  $R_{DS(on)eff}$  Test Circuits**



**Figure 16. Dynamic  $R_{DS(on)eff}$  Waveform**



**Figure 17. Diode Characteristics Test Circuits**

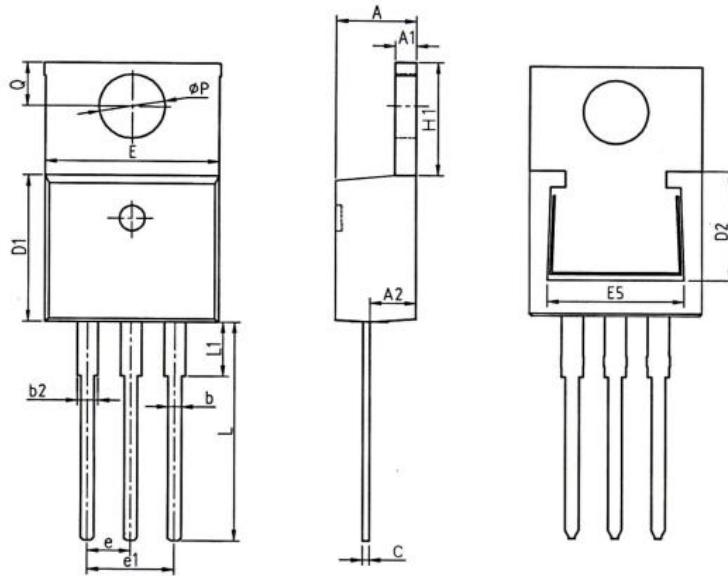


**Figure 18. Diode Recovery Waveform**

**Mechanical**

**3 Lead TO-220 (PS) Package**

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



**COMMON DIMENSIONS**

SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
b	0.75	0.81	0.96
b2	1.22	1.27	1.47
c	0.30	0.38	0.48
D1	8.50	8.70	8.90
D2	5.20	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.10	6.30	6.50
L	13.10	13.40	13.70
L1	-	3.75	4.10
ΦP	3.70	3.84	3.99
Q	2.54	2.74	2.94

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