



Datasheet

X3G6503ATL

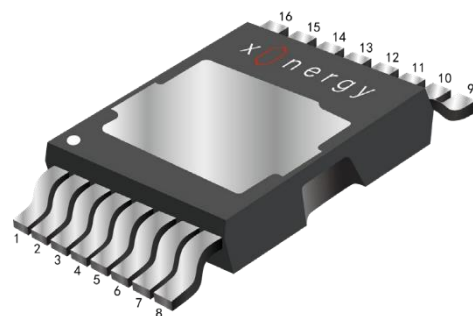
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Features

V_{DS}	$R_{DS(on)}$	I_{DS}
700V	32mΩ	50A

- High reliability
- High dv/dt capability
- Extremely low input capacitance
- Zero Qrr
- Outstanding switching performance
- Low system profile

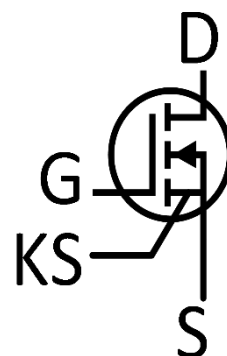


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Applications

- Switching power supplies
- PC and server power supplies
- Adapters, quick chargers
- 5G power supplies



Description

- The X3G6503ATL is a 700V power GaN HEMT in TOLT package. Based on p-GaN enhancement mode (E-mode) GaN-on-silicon technology, it is a normally off and stand-alone device. The device can be switched at very high frequencies in both soft-switching and hard-switching modes while still achieve high efficiency. In addition, advanced packaging methods are implemented to obtain low thermal resistance and high device performance.

Type	Package	Qty
X3G6503ATL	TOLT	1300

Device Characteristics

Static Parameters

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{GS(th)}$	Gate threshold voltage	1.2	1.6	2.3	V	$V_{DS}=V_{GS}$, $I_D=3.5mA$, $T_J=25^{\circ}C$
BV_{DSS}	Drain-Source breakdown voltage	700			V	$V_{GS}=0V$, $I_D=250\mu A$, $T_J=25^{\circ}C$
I_{DSS}	Drain-Source leakage current		1	100	μA	$V_{GS}=0V$, $V_{DS}=700V$, $T_J=25^{\circ}C$
			40		μA	$V_{GS}=0V$, $V_{DS}=700V$, $T_J=150^{\circ}C$
I_{GSS}	Gate-Source leakage current		100	400	μA	$V_{GS}=6V$, $V_{DS}=0V$, $T_J=25^{\circ}C$
				900	μA	$V_{GS}=6V$, $V_{DS}=0V$, $T_J=125^{\circ}C$
$R_{DS(on)}$	Static drain-source on resistance		32	38	mΩ	$V_{GS}=6V$, $I_D=5A$, $T_J=25^{\circ}C$
			75		mΩ	$V_{GS}=6V$, $I_D=5A$, $T_J=150^{\circ}C$
V_{SD}	Reverse conduction voltage	1	1.6	2	V	$I_{SD}=1A$, $V_{GS}=0V$, $T_J=25^{\circ}C$
R_G	Internal gate resistance		1.3		Ω	$f=5MHz$, open drain, $T_J=25^{\circ}C$

Dynamic Parameters

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input capacitance		291		pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=1MHz$ $T_J=25^{\circ}C$
C_{oss}	Output capacitance		81		pF	
C_{rss}	Reverse transfer capacitance		3.2		pF	
Q_g	Gate charge		7.6		nC	$V_{DS}=400V$, $I_D=6A$, $V_{GS}=6V$ $T_J=25^{\circ}C$
Q_{gs}	Gate to source charge		1		nC	
Q_{gd}	Gate to drain charge		1.5		nC	
Q_{rr}	Reverse recovery charge		0		nC	
DR_2/DR_1	Dynamic resistance ratio			1.1	-	$V_{DS}=400V$, $T_J=25^{\circ}C$

Switching Performance

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on delay time		3.9		ns	$V_{DS}=400V, I_D=20A$ $V_{GS}=+6V/0V$ $R_{g(on)}=15\Omega, R_{g(off)}=6\Omega$ $L=70\mu H$ $T_J=25^\circ C$
t_r	Rise time		3.3		ns	
$t_{d(off)}$	Turn-off delay time		18.6		ns	
t_f	Fall time		4.8		ns	
E_{on}	Turn on switching energy		29.5		μJ	
E_{off}	Turn off switching energy		20.5		μJ	

Absolute Max. Ratings

Symbol	Parameter	Value	Unit
V_{DS-max}	Breakdown voltage transient @ $T_J=25^\circ C$	850	V
V_{GS-max}	Gate to source max. transient voltage @ $T_J=25^\circ C$	-15 to 7	V
I_{DS-max}	Gate to source DC current @ $T_C=25^\circ C$	50	A
I_{DS-max}	Gate to source DC current @ $T_C=100^\circ C$	30	A
$I_{DS \text{ Pulse-max}}$	Pulse drain current(Pulse width 50 μs , $V_{GS}=6V$)	100	A
$dv/dt-max$	Drain to source voltage slew rate	150	V/ns
T_{J-max}	Max junction temperature	150	$^\circ C$
T_{S-max}	Storage temperature	-55 to 150	$^\circ C$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
R_{thJC}	Thermal resistance from junction to case	0.6		$^\circ C/W$
R_{thJA}	Thermal resistance from junction to ambient		40	
T_{solder}	Reflow soldering temperature	260		$^\circ C$

Characteristics Diagrams

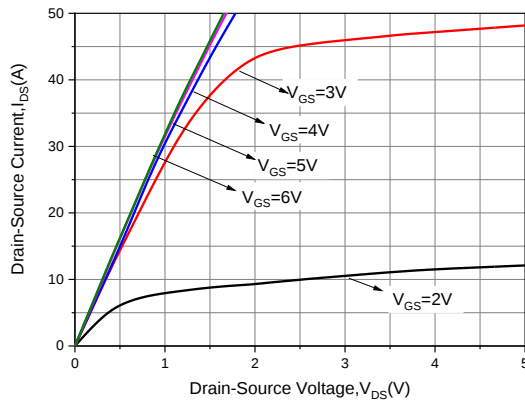


Figure 1. Output Characteristics $T_j=25^\circ\text{C}$

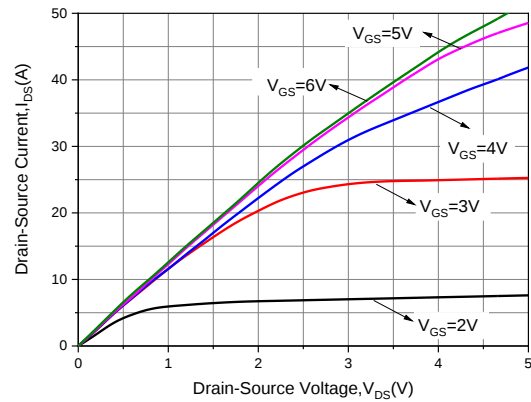


Figure 2. Output Characteristics $T_j=150^\circ\text{C}$

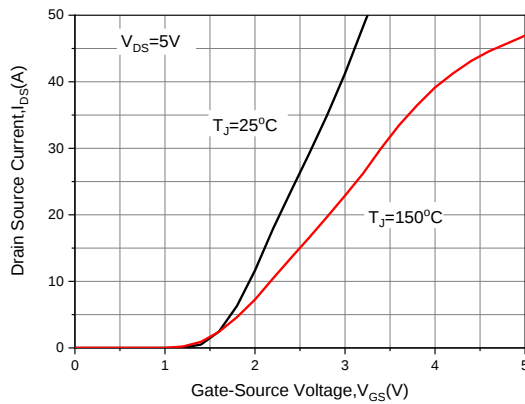


Figure 3. Transfer Characteristic for Various Junction Temperature

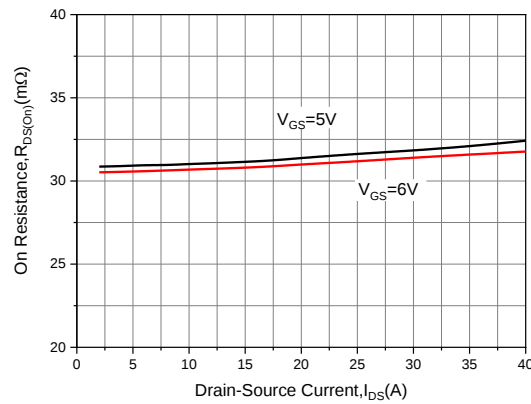


Figure 4. On-resistance vs. Drain Current for Various Gate Voltage @ 25°C

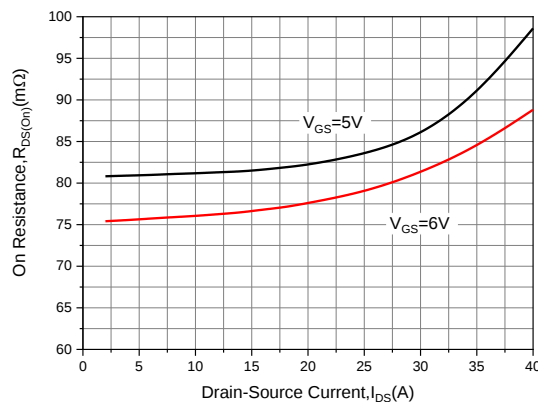


Figure 5. On-resistance vs. Temperature for Various Gate Voltage @ 150°C

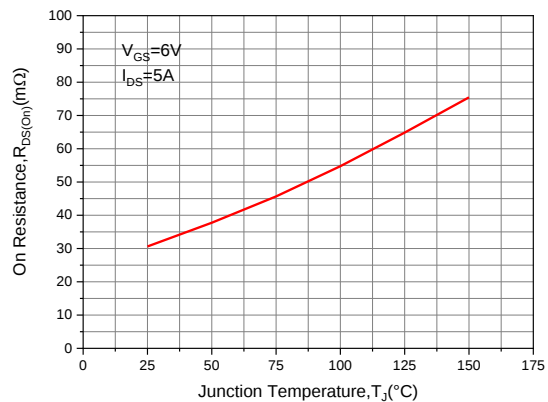


Figure 6. On-Resistance vs. Temperature

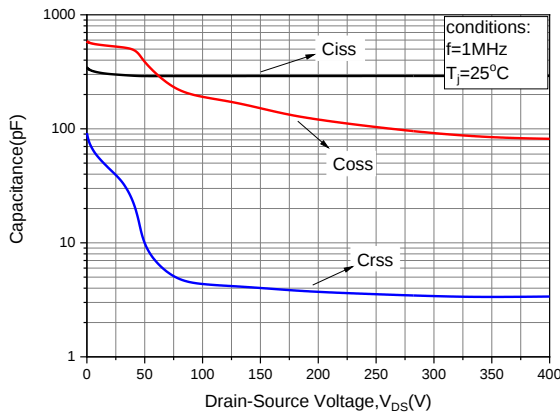


Figure 7. Capacitances vs. Drain-Source Voltage

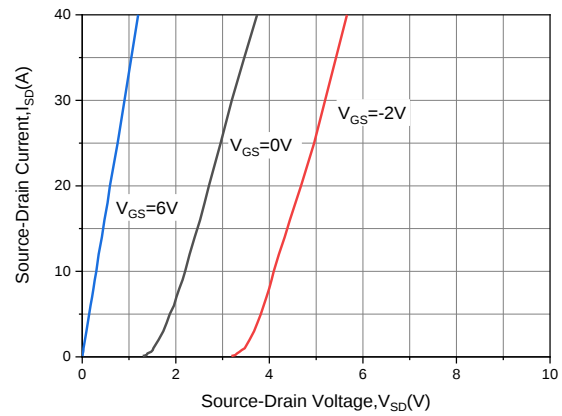


Figure 8. Channel Reverse Characteristic

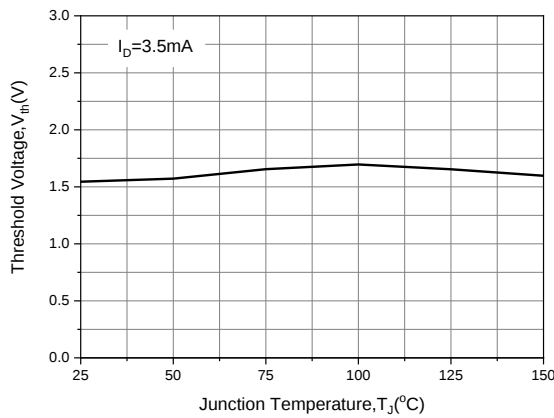


Figure 9. Threshold Voltage vs. Temperature

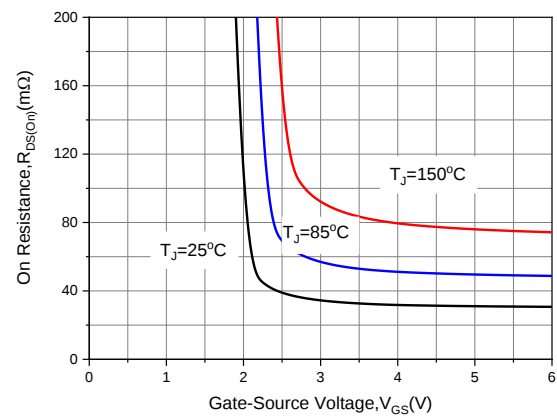


Figure 10. On-resistance vs. Gate Voltage @6A

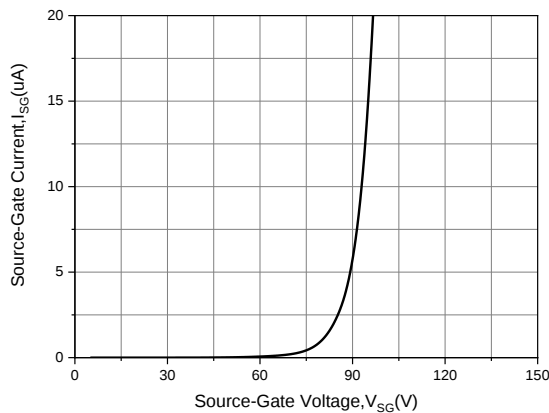


Figure 11. Reverse Gate Voltage

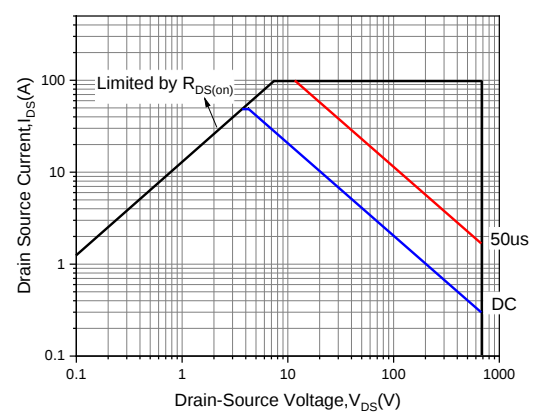


Figure 12. Safe Operating Area

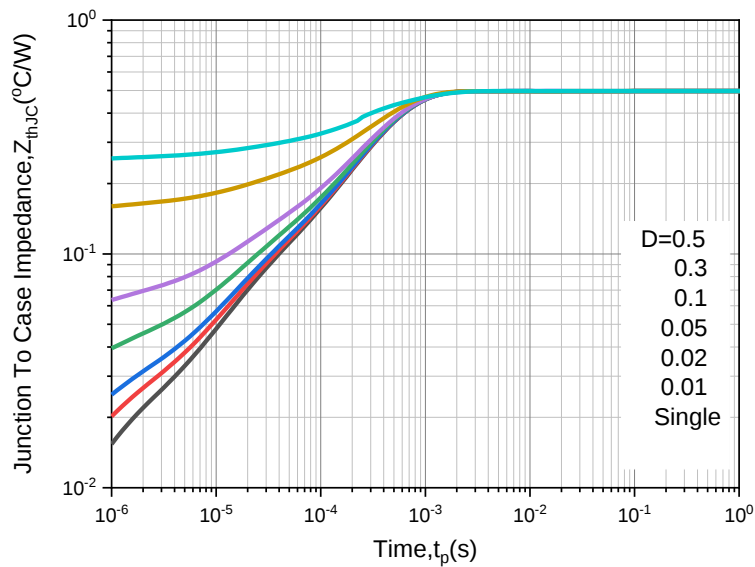
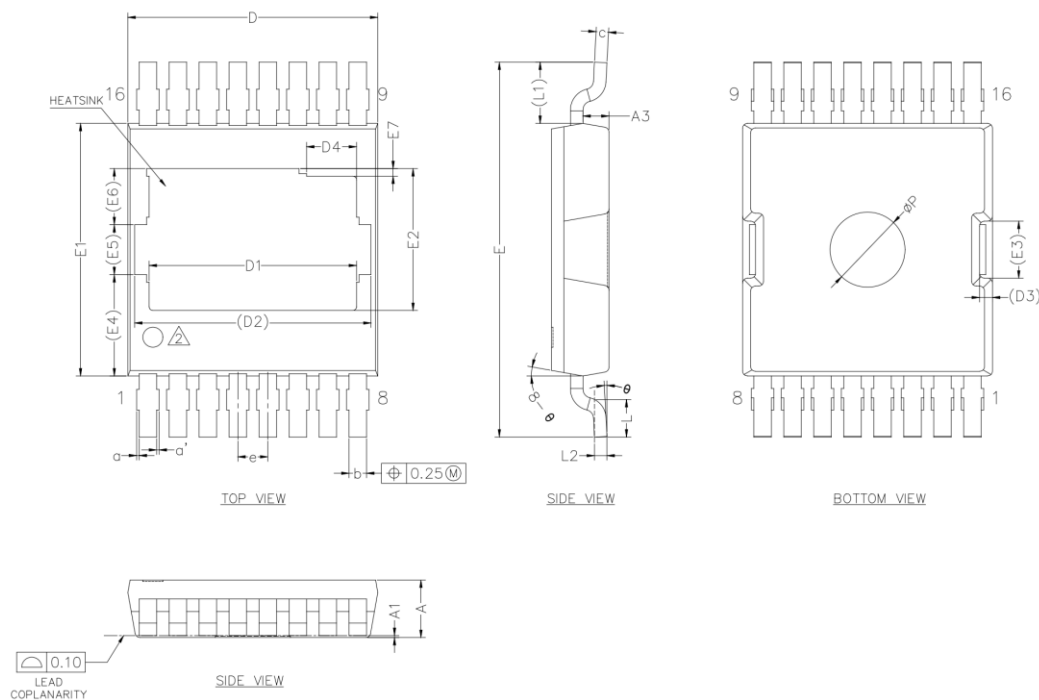


Figure 13. Transient Thermal Impedance (Junction-Case)

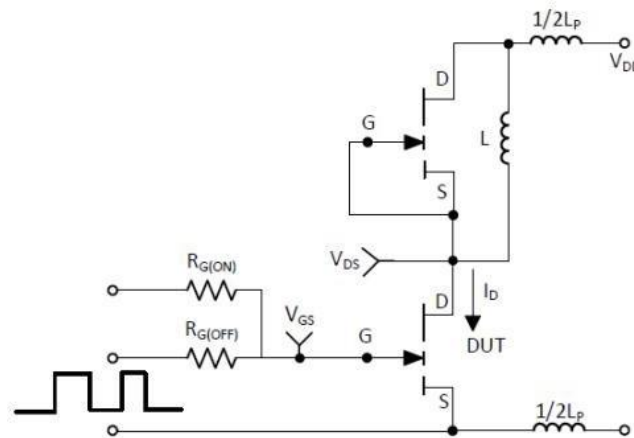
Package Dimensions



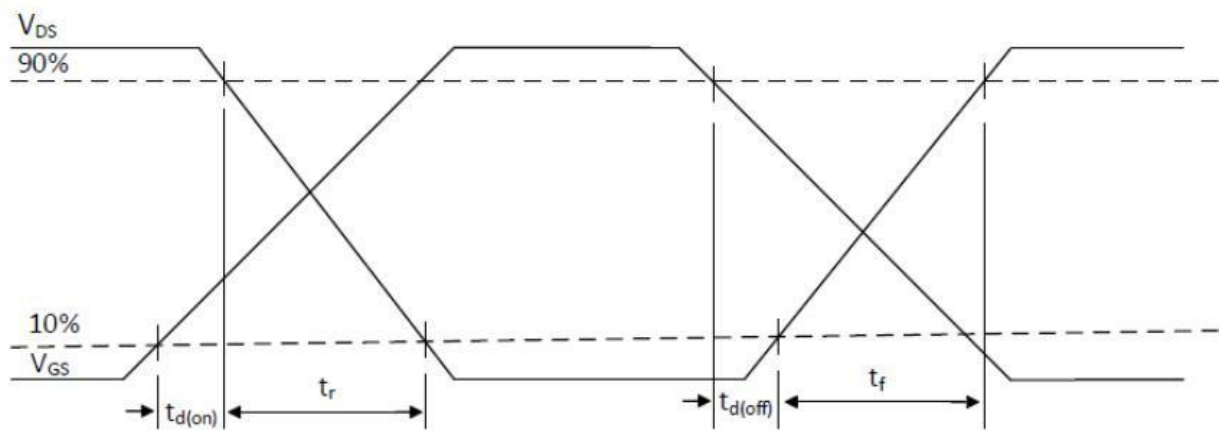
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.25	2.30	2.35
A1	0.01	0.08	0.16
A3	0.99	1.04	1.09
a	0.00	—	0.15
a'	0.00	—	0.15
b	0.60	0.70	0.80
c	0.40	0.50	0.60
D	9.70	10.00	10.10
D1	8.20	8.30	8.40
D2		9.46REF	
D3		0.52REF	
D4	1.90	2.00	2.10
E	14.80	15.00	15.20
E1	10.00	10.10	10.30
E2	5.57	5.67	5.77
E3		2.28REF	
E4		4.05REF	
E5		2.00REF	
E6		2.24REF	
E7	0.20	0.30	0.40
e	1.10	1.20	1.30
L	1.40	1.50	1.60
L1		2.45REF	
L2		0.50BSC	
θP	2.90	3.00	3.10
θ	0°	—	8°
θ1	8°	10°	12°

Testing Conditions

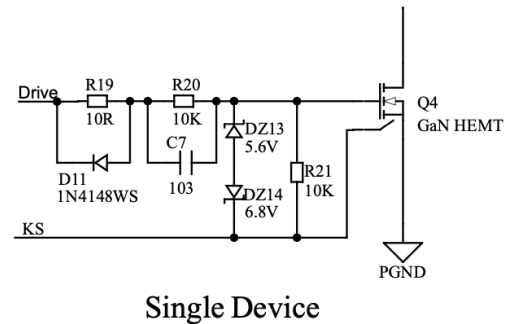
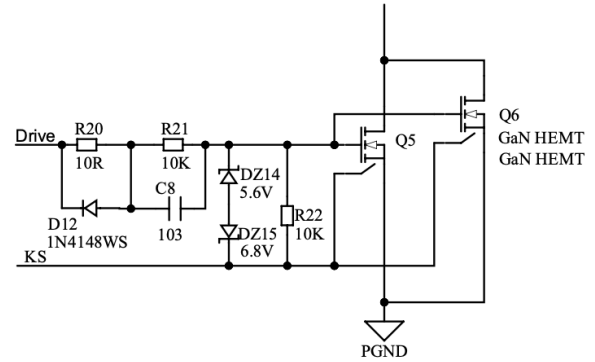
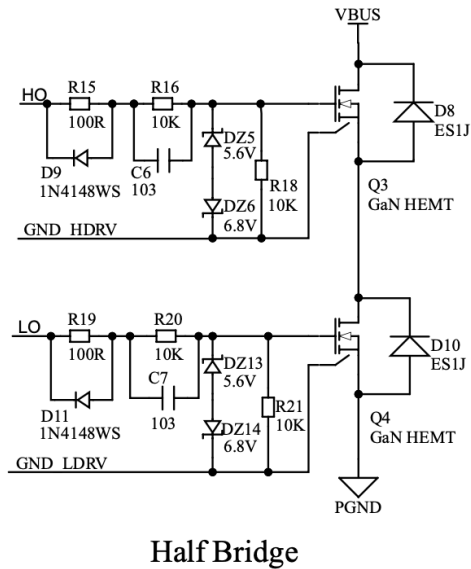


Switching Test Circuit



Switching Time Waveform

Gate Driving Examples



Revision History

Document revision	Date	Description of changes
1.0	2025.02.18	Target datasheet
1.1	2025.3.6	Revise Vth



X3G6503ATL

700V 32mΩ E-Mode GaN HEMT

Important Notice

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