AP3908QDR1

N and P-Channel Enhancement Mosfet

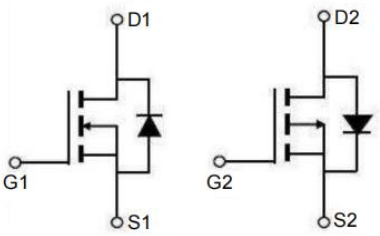
DATA SHEET

Features

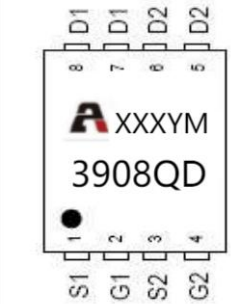
- **N-Channel**
  30V,20A
  $R_{DS(ON)}$ <10mΩ @V_{GS}=10V TYP:8.5mΩ
  $R_{DS(ON)}$ <14mΩ @V_{GS}=4.5V TYP:11.5mΩ

- **P-Channel**
  -30V,-20A
  $R_{DS(ON)}$ <25mΩ @V_{GS}=-10V TYP:20mΩ
  $R_{DS(ON)}$ <42mΩ @V_{GS}=-4.5V TYP:32mΩ

- Lead free product is acquired
- High power and current handing capability
- Surface mount package



Schematic Diagram



Marking and pin Assignment

Applications

- PWM applications
- Load switch
- Power management

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
3908QD	AP3908QDR1	PDFN3X3-D	-	-	5000

ABSOLUTE MAXIMUM RATINGS (T_J=25℃ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	±20	±20	V
Continuous Drain Current (Tc=25℃)	I_D	20	-20	A
Continuous Drain Current (Tc=100℃)		12	-12	
Pulsed Drain Current [1]	I_{DM}	80	-80	A
Drain Power Dissipation	P_D	2.15		W
Thermal Resistance- Junction to Ambient	$R_{\theta JA}$	58		℃/W
Junction Temperature	T_J	-55~ +150		℃
Storage Temperature	T_{STG}	-55~ +150		℃

Notes:

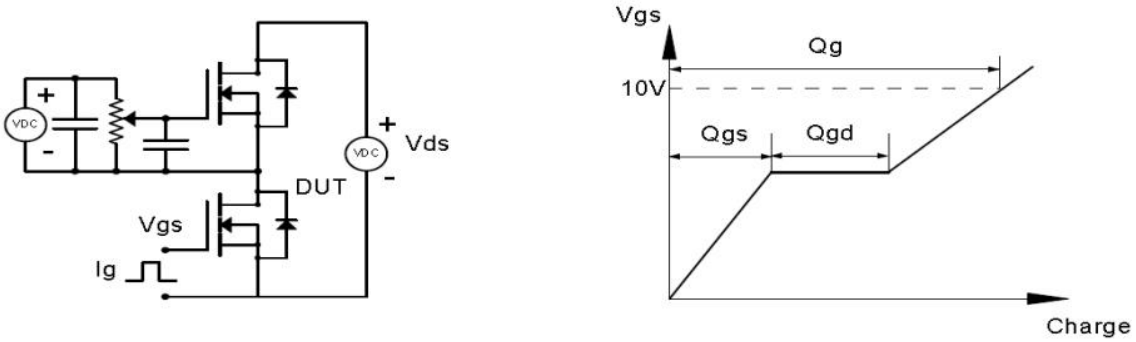
1) Repetitive Rating: pulse width limited by maximum junction temperature

N-CH ELECTRICAL CHARACTERISTICS(T_J=25℃ unless otherwise noted)

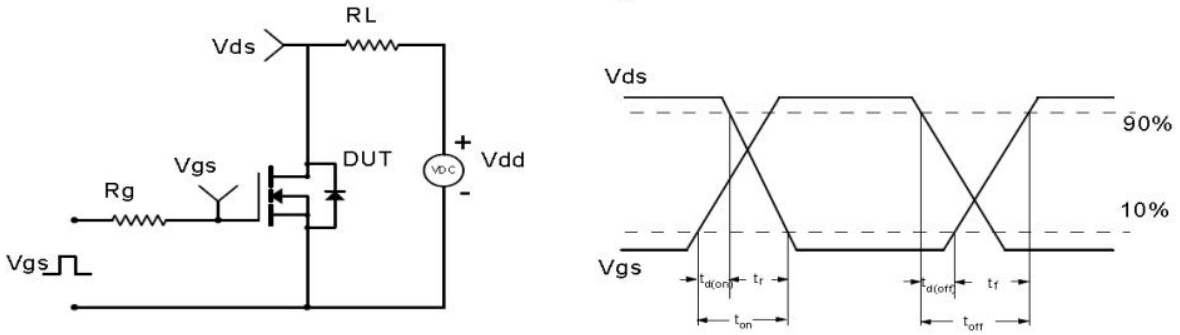
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
Static Characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D =250μA	30	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} =30V, V_{GS} = 0V	-	-	1	μA
Gate-body leakage current	I_{GSS}	V_{GS} =±20V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} =V_{GS}, I_D =250μA	1.0	1.4	2.0	V
Drain-source on-resistance	$R_{DS(on)}$	V_{GS} =10V, I_D =20A	-	8.5	10	mΩ
		V_{GS} =4.5V, I_D =10A	-	11.5	14	
Forward transconductance	R_g	V_{GS}= 0V, V_{DS}= 0V, f=1.0MHz	-	1.4	-	Ω
Dynamic characteristics						
Input Capacitance	C_{iss}	V_{DS} =15V, VGS=0V, f=1MHz	-	900	-	pF
Output Capacitance	C_{oss}		-	140	-	
Reverse Transfer Capacitance	C_{rss}		-	120	-	
Switching characteristics						
Turn-on delay time	$t_{d(on)}$	V_{DS}=15V, I_D=20A, R_G=3Ω, V_{GS}=10V	-	6	-	nS
Turn-on rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	25	-	
Turn-off fall time	t_f		-	7	-	
Total Gate Charge	Qg	V_{DS}=15V, I_D=20A, V_{GS}=10V	-	19	-	nC
Gate-Source Charge	Qgs		-	6.3	-	
Gate-Drain Charge	Qgd		-	4.5	-	
Source-Drain Diode characteristics						
Diode Forward voltage	V_{SD}	T_J=25℃, V_{GS} =0V, I_S=20A	-	-	1.2	V
Diode Forward current	I_S	T_C=25℃	-	-	20	A

Test Circuit & Waveform

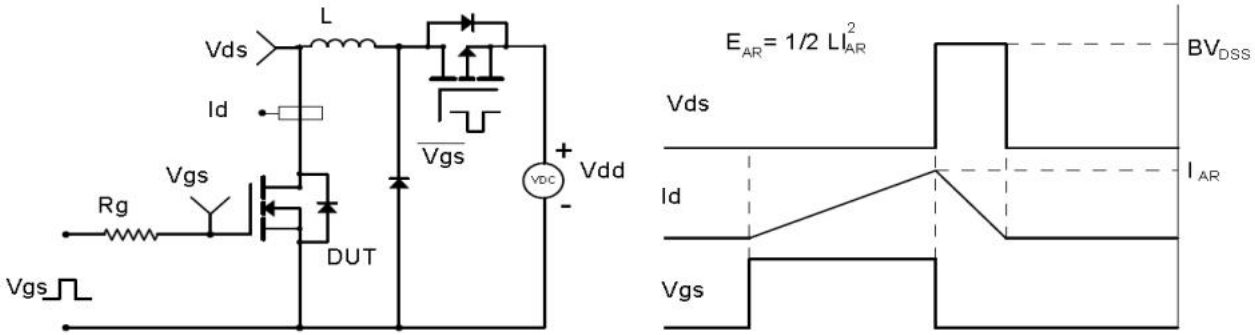
Gate Charge Test Circuit & Waveform



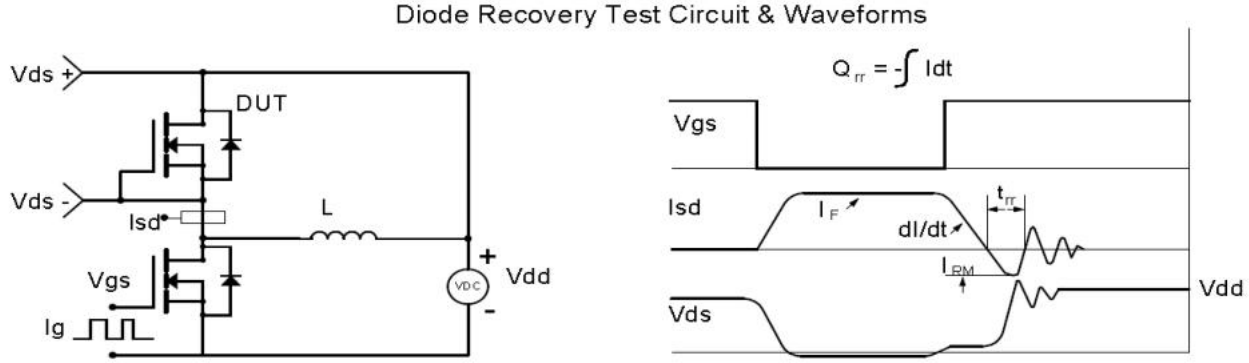
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Typical Characteristics：N-Channel

Figure1: Output Characteristics

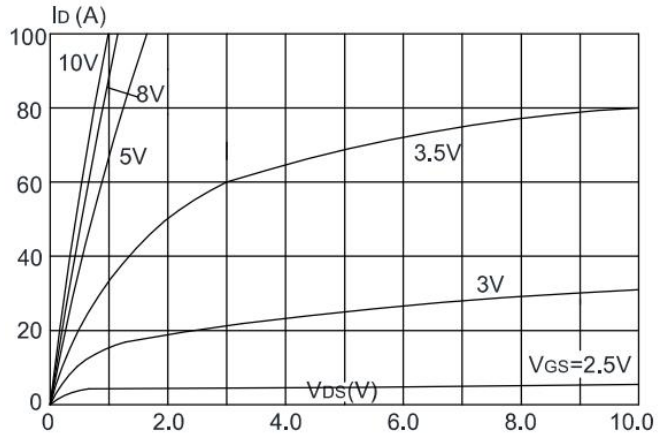


Figure 2: Typical Transfer Characteristics

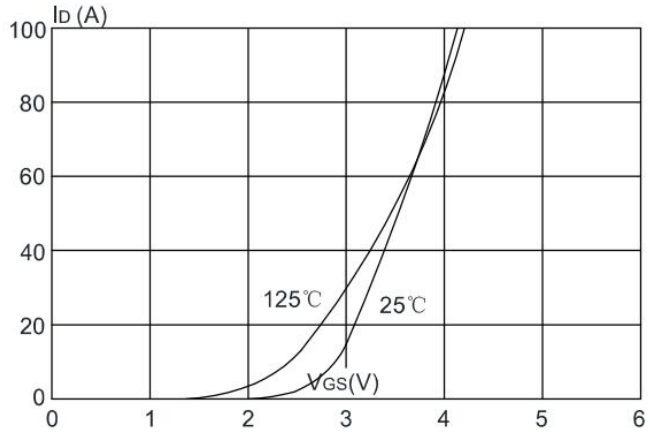


Figure 3: On-resistance vs. Drain Current

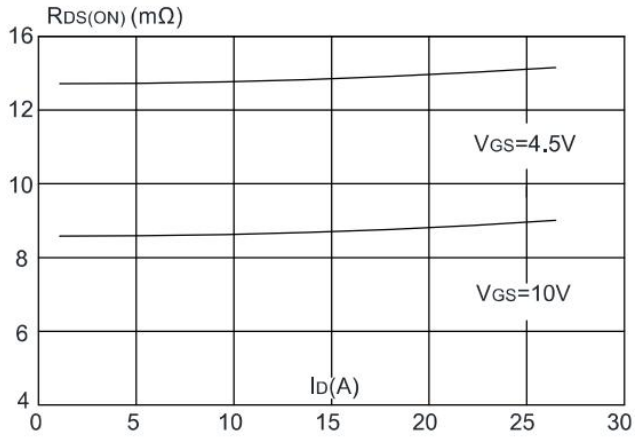


Figure 4: Body Diode Characteristics

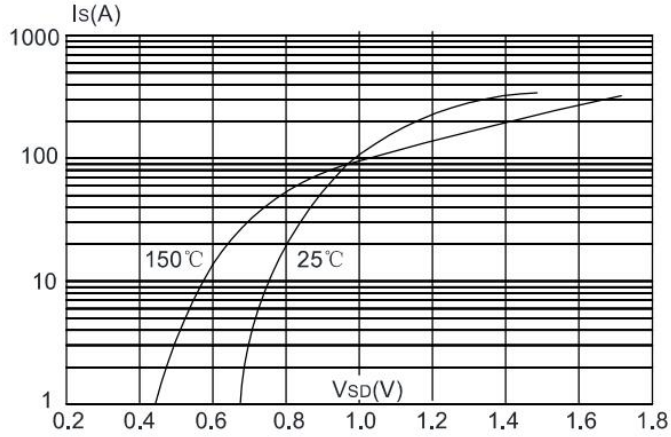


Figure 5: Gate Charge Characteristics

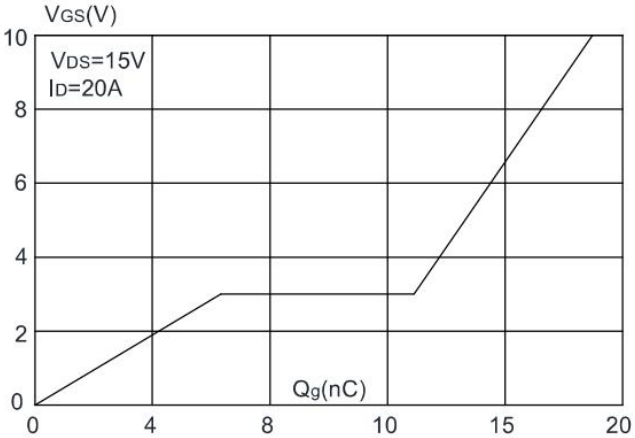
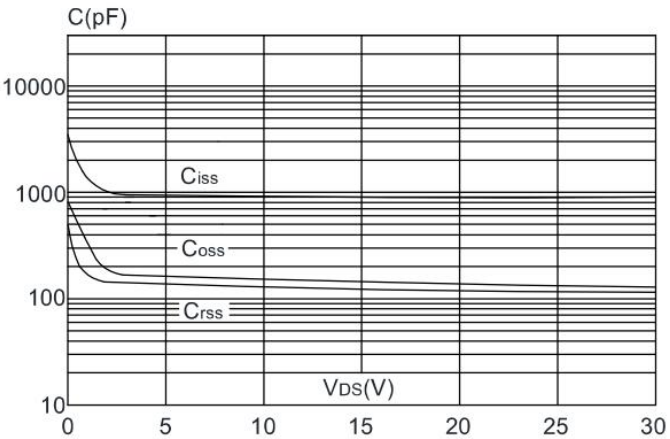


Figure 6: Capacitance Characteristics



Typical Characteristics：N-Channel

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

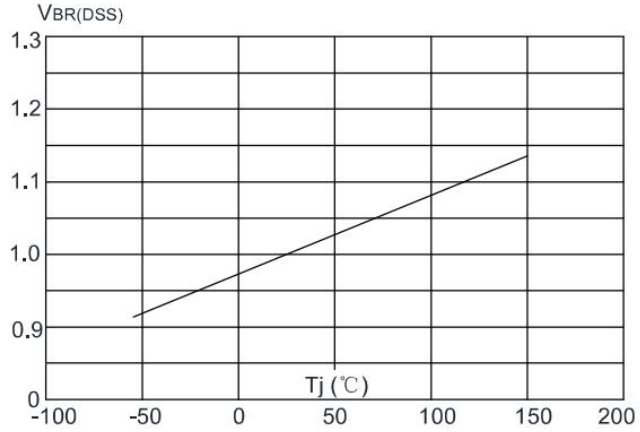


Figure 8: Normalized on Resistance vs. Junction Temperature

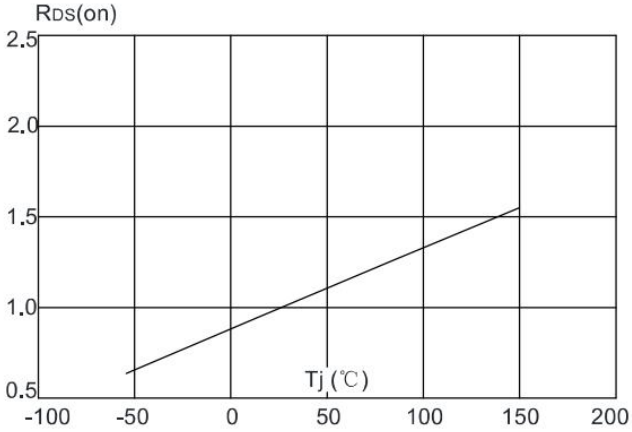


Figure 9: Maximum Safe Operating Area

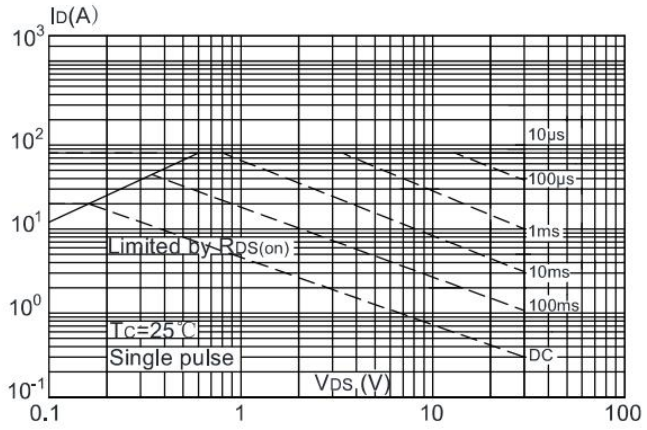


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

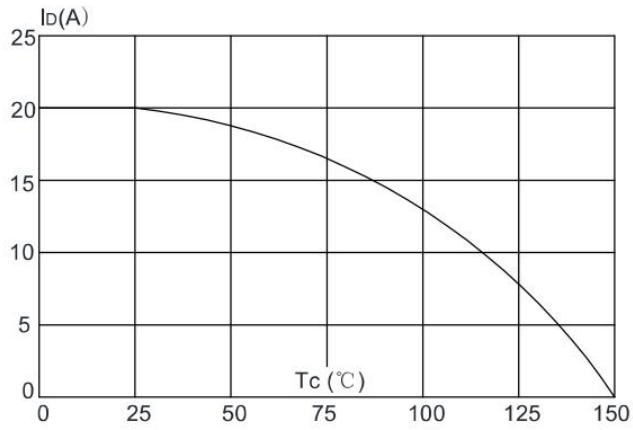
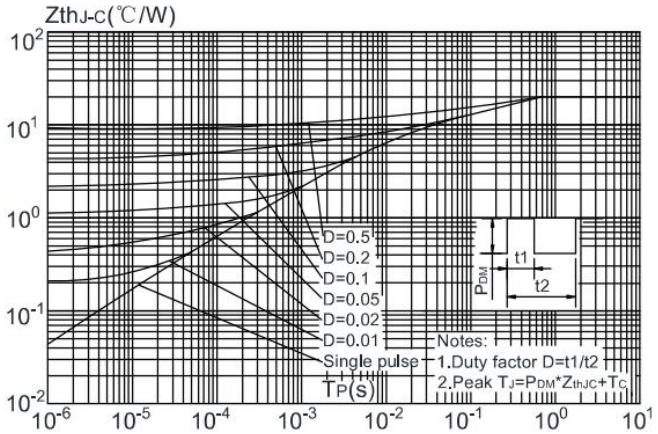


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

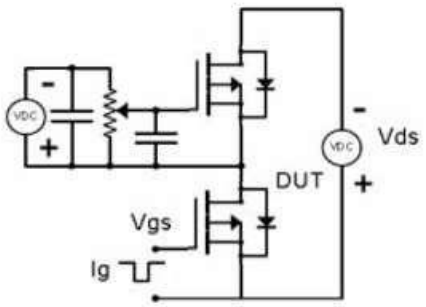


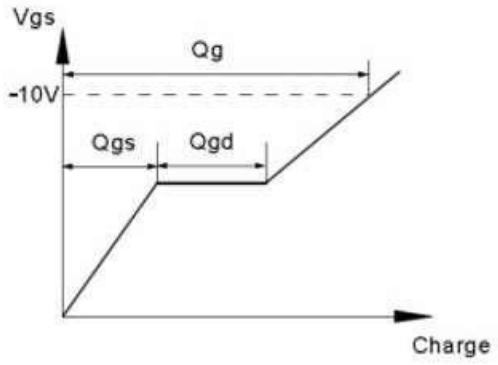
P-CH ELECTRICAL CHARACTERISTICS(T_J=25℃ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
Static Characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D =-250μA	-30	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} =-30V, V_{GS} = 0V	-	-	-1	μA
Gate-body leakage current	I_{GSS}	V_{GS} =±20V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} =V_{GS}, I_D =-250μA	-1.2	-1.8	-2.2	V
Drain-source on-resistance	$R_{DS(on)}$	V_{GS} =-10V, I_D =-7.5A	-	20	25	mΩ
		V_{GS} =-4.5V, I_D =-5A	-	32	42	
Forward transconductance	R_g	V_{GS}= 0V, V_{DS}= 0V, f=1.0MHz	-	5.0	-	Ω
Dynamic characteristics						
Input Capacitance	C_{iss}	V_{DS} =-15V, VGS=0V, f=1MHz	-	1550	-	pF
Output Capacitance	C_{oss}		-	327	-	
Reverse Transfer Capacitance	C_{rss}		-	278	-	
Switching characteristics(						
Turn-on delay time	$t_{d(on)}$	V_{DS}=-15V, I_D=-7.5A, R_G=3Ω, V_{GS}=-10V	-	14	-	nS
Turn-on rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	95	-	
Turn-off fall time	t_f		-	65	-	
Total Gate Charge	Qg	V_{DS}=-10V, I_D=-7.5A, V_{GS}=-10V	-	30	-	nC
Gate-Source Charge	Qgs		-	5.3	-	
Gate-Drain Charge	Qgd		-	7.6	-	
Source-Drain Diode characteristics						
Diode Forward voltage(	V_{SD}	T_J=25℃, V_{GS} =0V, I_S=-7.5A	-	-	-1.2	V
Diode Forward current	I_S	T_C=25℃	-	-	-10	A

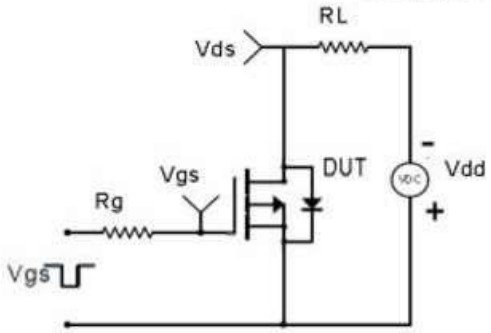
Test Circuit & Waveform

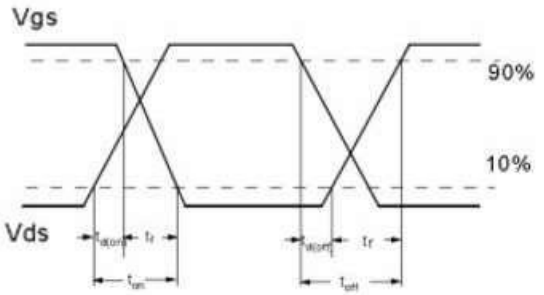
Gate Charge Test Circuit & Waveform



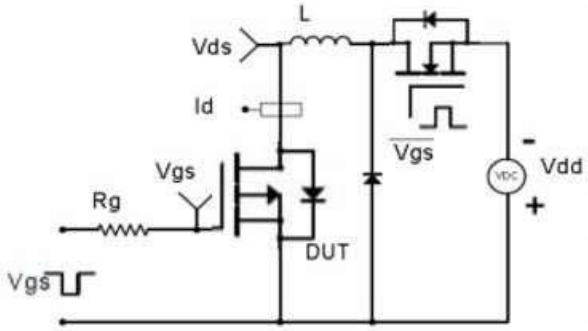


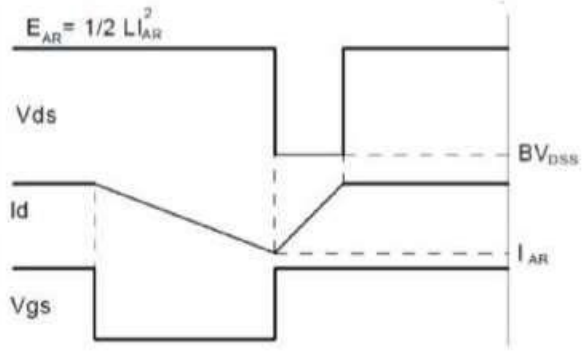
Resistive Switching Test Circuit & Waveforms



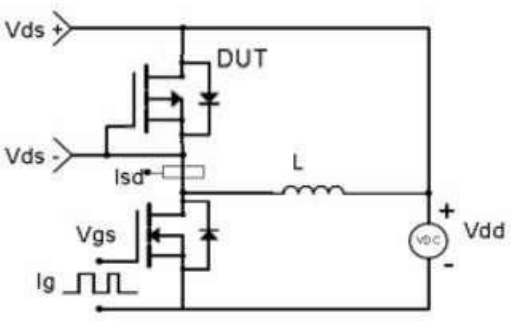


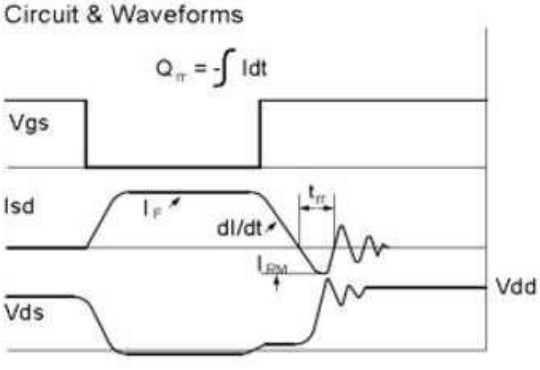
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms





Typical Characteristic：P-Channel

Figure1: Output Characteristics

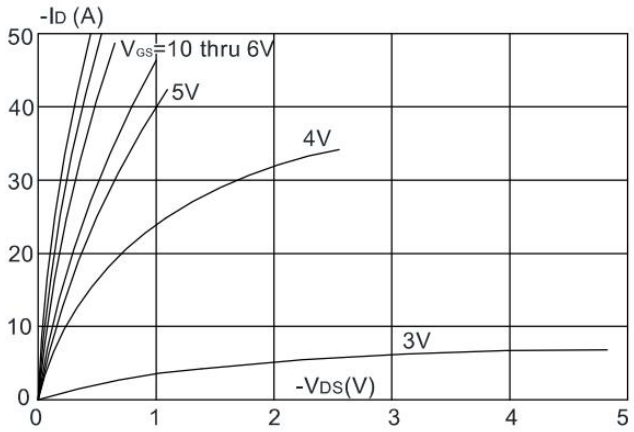


Figure 2: Typical Transfer Characteristics

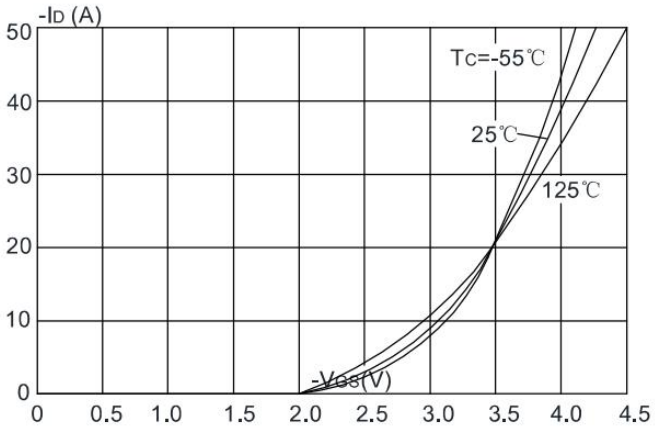


Figure 3: On-resistance vs. Drain Current

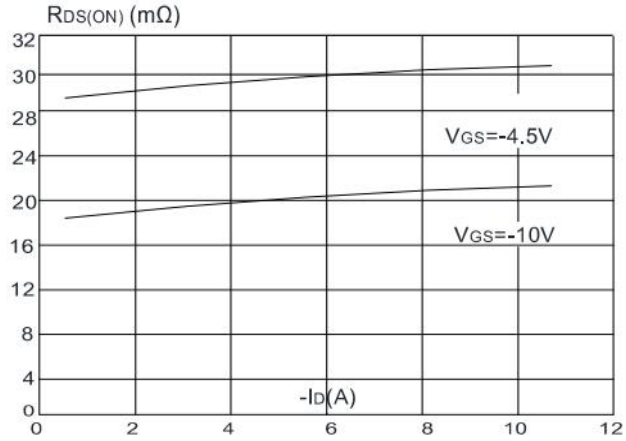


Figure 4: Body Diode Characteristics

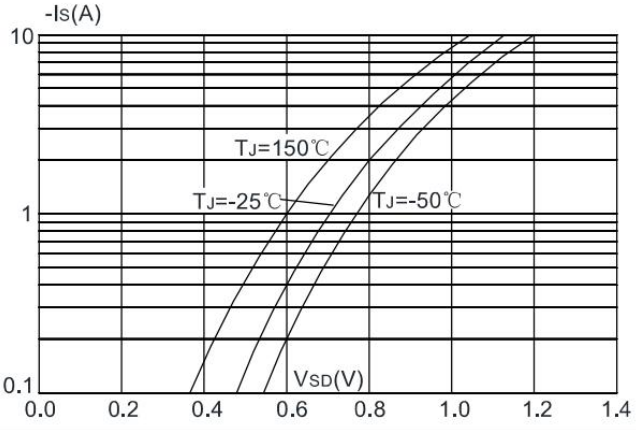


Figure 5: Gate Charge Characteristics

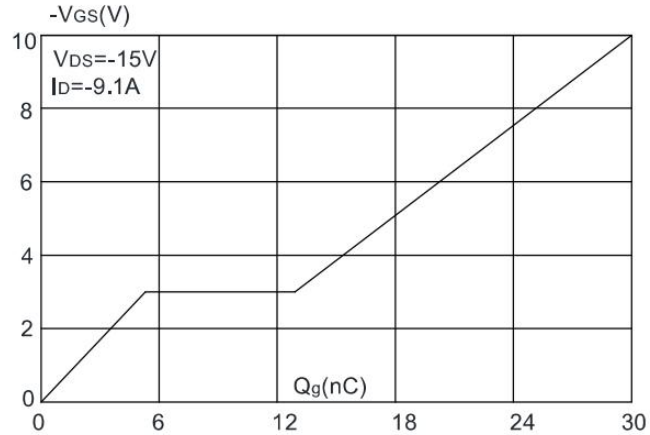
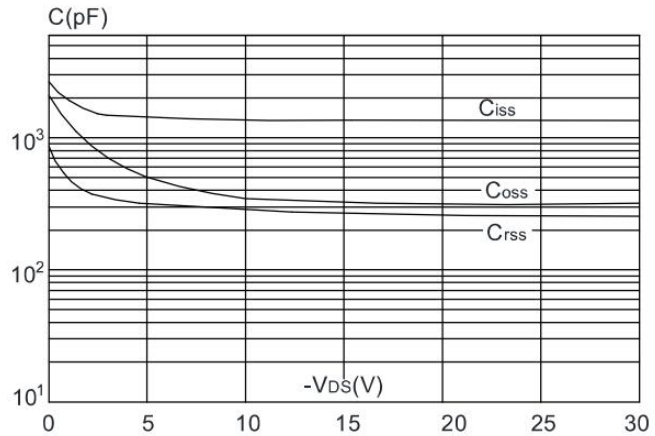


Figure 6: Capacitance Characteristics



Typical Characteristic：P-Channel

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

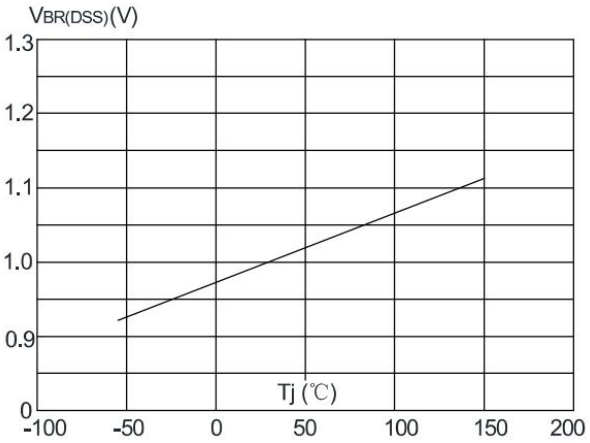


Figure 8: Normalized on Resistance vs. Junction Temperature

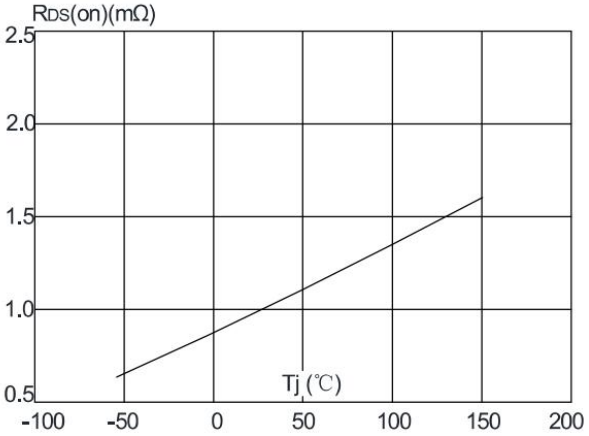


Figure 9: Maximum Safe Operating Area

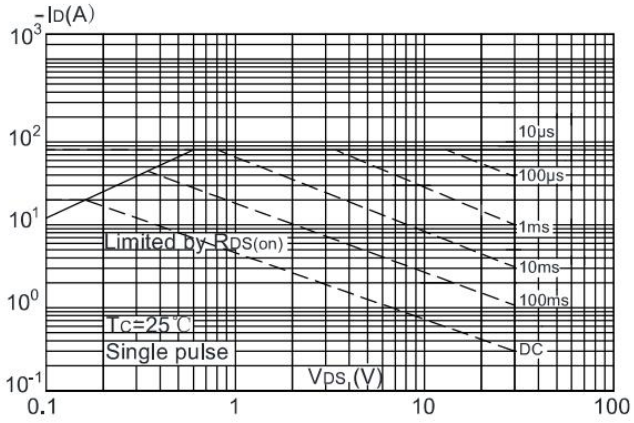


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

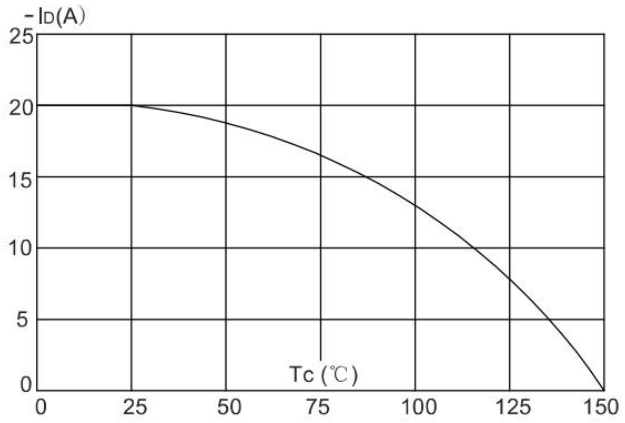
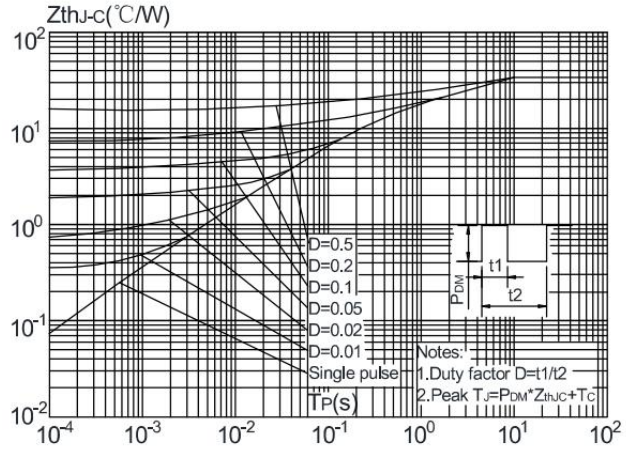
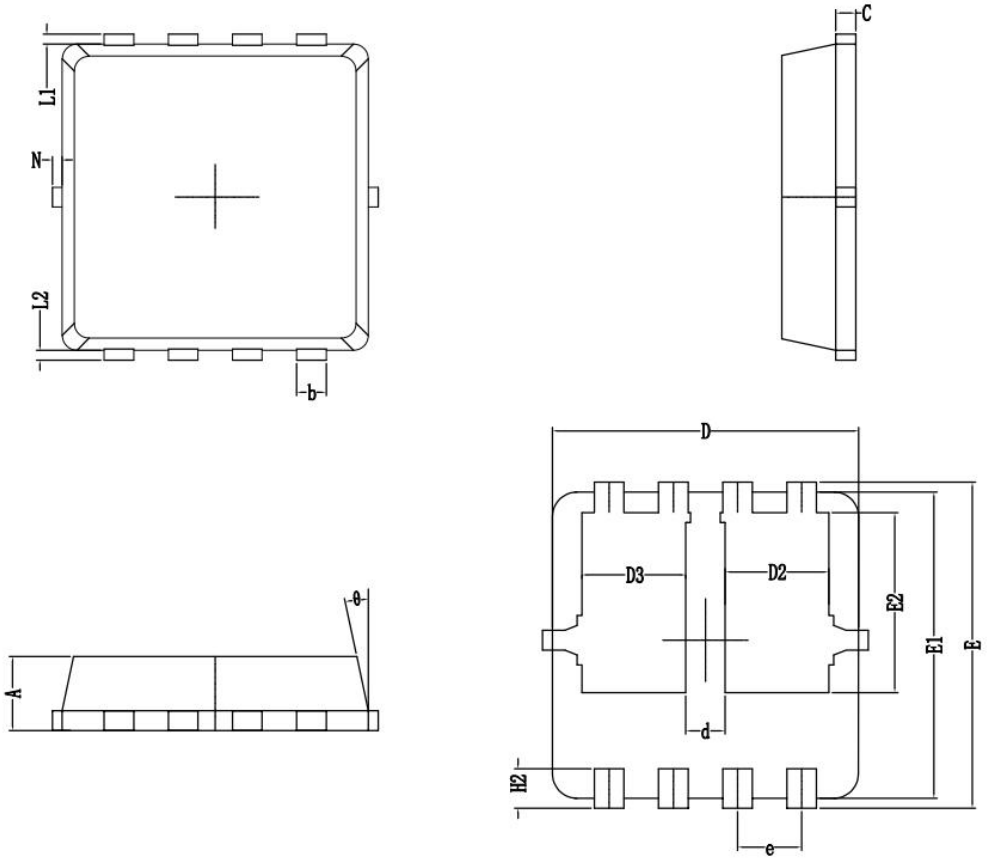


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



Package Dimensions of PDFN3X3-D Package



Symbols	Millimeters		
	MIN.	NOM.	MAX.
A	0.70	0.80	0.90
b	0.25	0.30	0.35
C	0.14	0.15	0.16
D	3.00	3.10	3.20
L1/L2	0.10 REF.		
D2/D3	0.95	1.05	1.10
d	0.30	0.40	0.50
E	3.20	3.30	3.40
E1	3.00	3.10	3.20
E2	1.72	1.82	1.92
e	0.65 BSC.		
θ	11°	12°	13°
H2	0.30	0.40	0.50
N	0	-	0.10

Revision History

Revision	Release	Remark
V1.0	2024/05/21	Initial Release

Disclaimer

The information given in this document describes the independent performance of the product,but similar performance is not guaranteed under other working conditions,and cannot be guaranteed when installed with other products or equipment.To achieve the required performance of the product in actual scenarios,the customer should conduct a complete application test to assess the functionality of the product.

Allpower assumes no responsibility for equipment failures result from using products at values that exceed the ratings,operating conditions,or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which
requires high reliability.Customers using or selling these products for use in medical,life-saving,or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements,the information described or contained herein may be changed without prior notice.