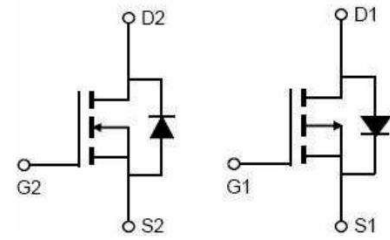


# AP3906GD

## N and P-Channel Enhancement Mosfet

### Feature

- N-Channel**  
 $V_{DD}=30V, I_D=7A$   
 $R_{DS(ON)} < 25m\Omega @ V_{GS}=10V$  TYP:18 mΩ  
 $R_{DS(ON)} < 38m\Omega @ V_{GS}=4.5V$  TYP:25 mΩ
- P-Channel**  
 $V_{DD}=-30V, I_D=-6A$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=-10V$  TYP:28 mΩ  
 $R_{DS(ON)} < 58m\Omega @ V_{GS}=-4.5V$  TYP:44 mΩ
- Lead free product is acquired
- High power and current handling capability
- Surface mount package



N-channel P-channel

Schematic diagram



Marking and pin assignment

### Application

- PWM applications
- Load Switch
- Power management

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
3906GD	AP3906GD-AU	PDFN5X6-D	13 inch	-	5000

### ABSOLUTE MAXIMUM RATINGS ( $T_J=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current ( $T_a = 25^\circ\text{C}$ )	$I_D$	7	-6	A
Continuous Drain Current ( $T_a = 100^\circ\text{C}$ )	$I_D$	4.5	-4	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	28	-24	A
Power Dissipation	$P_D$	2.15	2.15	W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	58	58	$^\circ\text{C}/\text{W}$
Junction Temperature	$T_J$	150	150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~ +150	-55~ +150	$^\circ\text{C}$

**N-CH ELECTRICAL CHARACTERISTICS(T<sub>J</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	30			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage <sup>(2)</sup>	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1	1.5	2.5	V
Drain-source on-resistance <sup>(2)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5A		18	25	mΩ
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3A		25	38	
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V, f = 1MHz		490		pF
Output Capacitance	C <sub>oss</sub>			79		
Reverse Transfer Capacitance	C <sub>rss</sub>			61		
<b>Switching characteristics</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15V, I <sub>D</sub> = 3A, R <sub>L</sub> = 6Ω V <sub>GS</sub> = 10V, R <sub>G</sub> = 3Ω		4.5		ns
Turn-on rise time	t <sub>r</sub>			2.5		
Turn-off delay time	t <sub>d(off)</sub>			14.5		
Turn-off fall time	t <sub>f</sub>			3.5		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 15V, I <sub>D</sub> = 5A, V <sub>GS</sub> = 10V		5.2		nC
Gate-Source Charge	Q <sub>gs</sub>			0.9		
Gate-Drain Charge	Q <sub>gd</sub>			1.3		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	V <sub>DS</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 7A			1.2	V
Diode Forward current <sup>(3)</sup>	I <sub>S</sub>		-	-	7	A

**P-CH ELECTRICAL CHARACTERISTICS(T<sub>J</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-30			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage <sup>(2)</sup>	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1	-1.5	-2.5	V
Drain-source on-resistance <sup>(2)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -4A		28	35	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A		44	58	
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1MHz		580		pF
Output Capacitance	C <sub>oss</sub>			98		
Reverse Transfer Capacitance	C <sub>rss</sub>			74		
<b>Switching characteristics</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -15V, I <sub>D</sub> = -1A, R <sub>L</sub> = 6Ω V <sub>GS</sub> = -10V, R <sub>G</sub> = 1Ω		14		ns
Turn-on rise time	t <sub>r</sub>			61		
Turn-off delay time	t <sub>d(off)</sub>			19		
Turn-off fall time	t <sub>f</sub>			10		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -15V, I <sub>D</sub> = -4.1A, V <sub>GS</sub> = -10V		6.8		nC
Gate-Source Charge	Q <sub>gs</sub>			1		
Gate-Drain Charge	Q <sub>gd</sub>			1.4		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	V <sub>DS</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = -4A			1.2	V
Diode Forward current <sup>(3)</sup>	I <sub>S</sub>		-	-	-5.1	A

**Notes:**

1. Repetitive Rating: pulse width limited by maximum junction temperature
2. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%
3. Surface Mounted on FR4 Board, t ≤ 10 sec

**N Test Circuit**

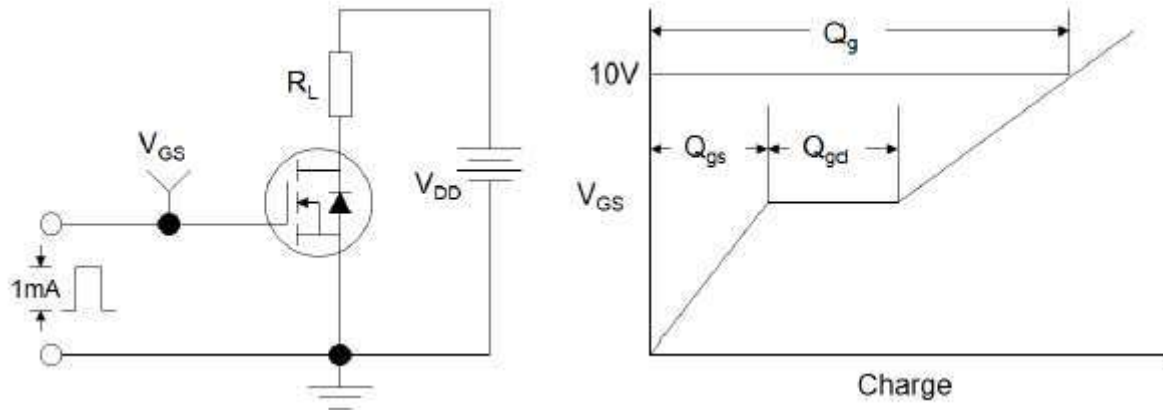


Figure1:Gate Charge Test Circuit & Waveform

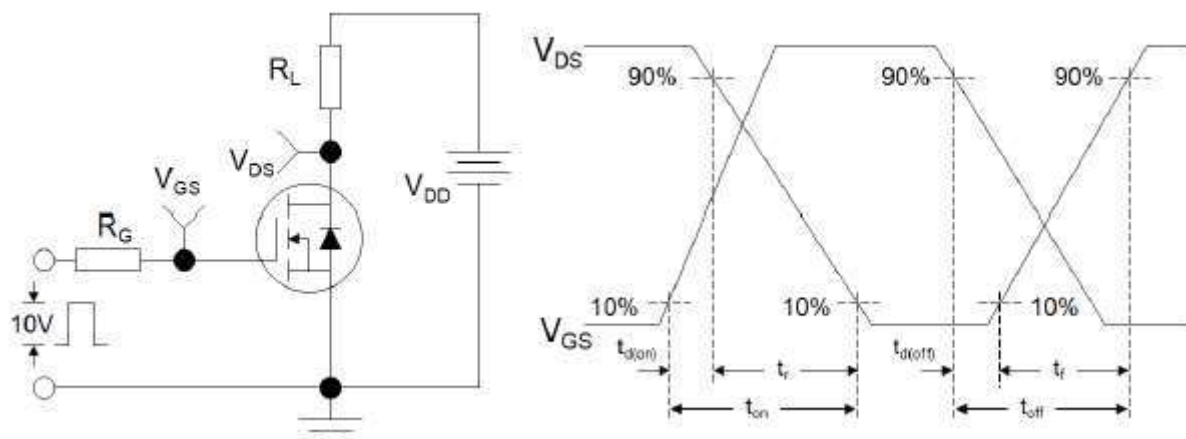


Figure 2: Resistive Switching Test Circuit & Waveforms

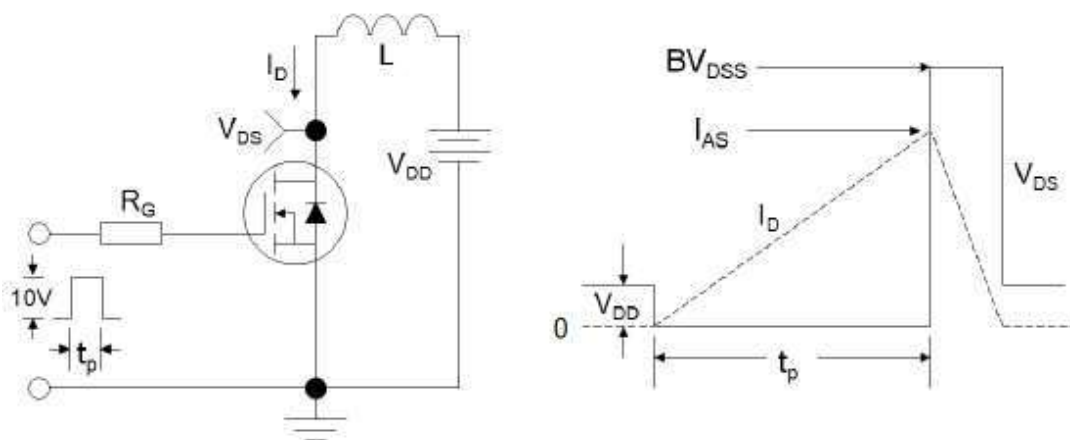
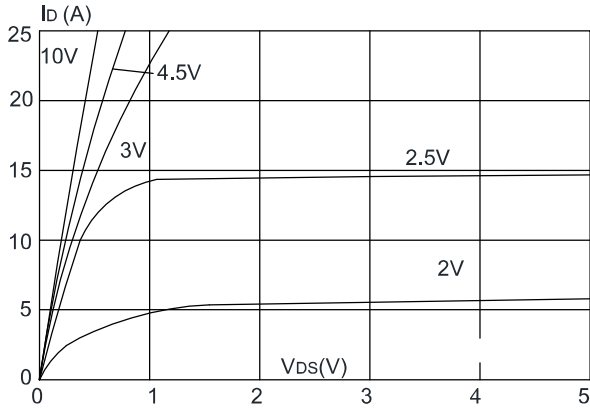
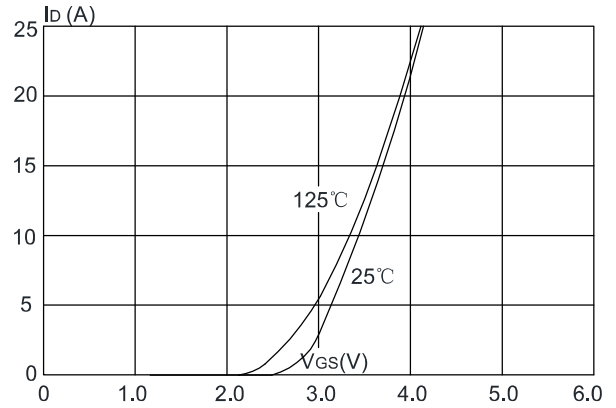


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

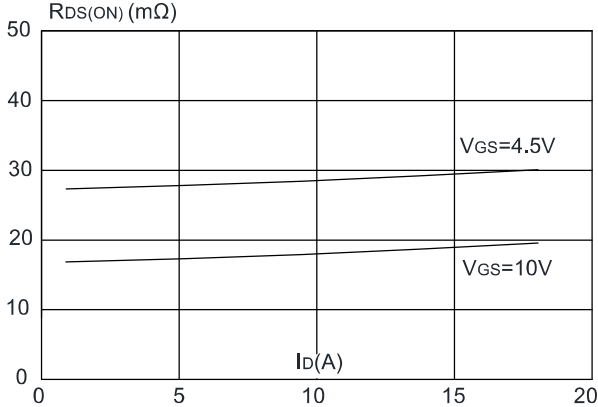
**Figure 1: Output Characteristics**



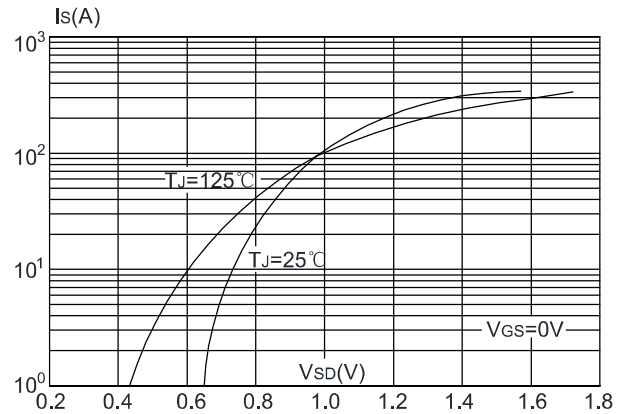
**Figure 2: Typical Transfer Characteristics**



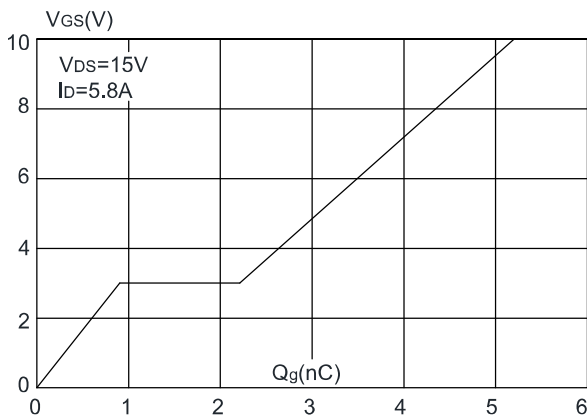
**Figure 3: On-resistance vs. Drain Current**



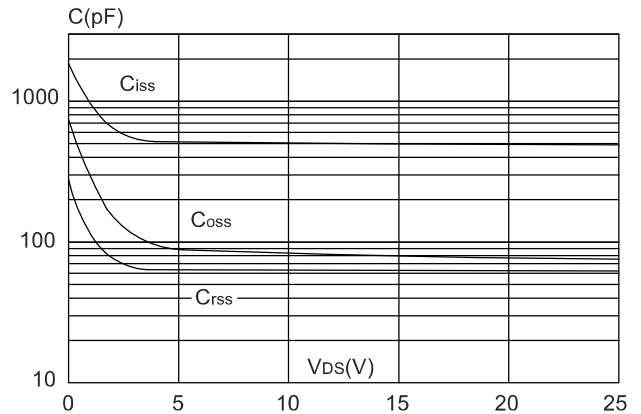
**Figure 4: Body Diode Characteristics**



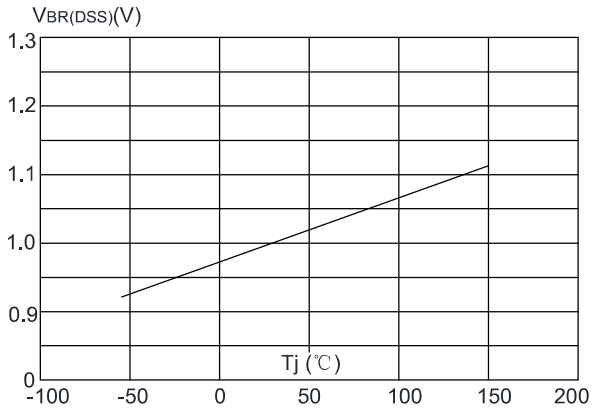
**Figure 5: Gate Charge Characteristics**



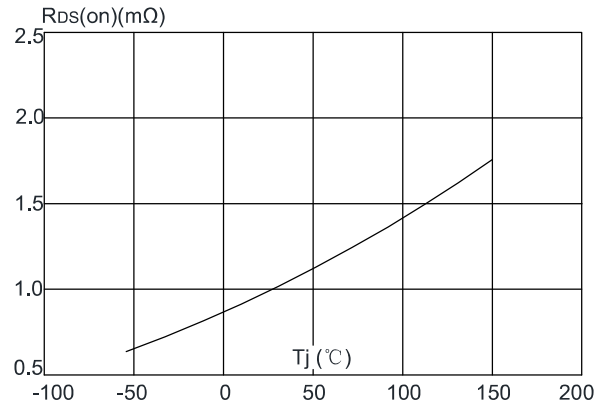
**Figure 6: Capacitance Characteristics**



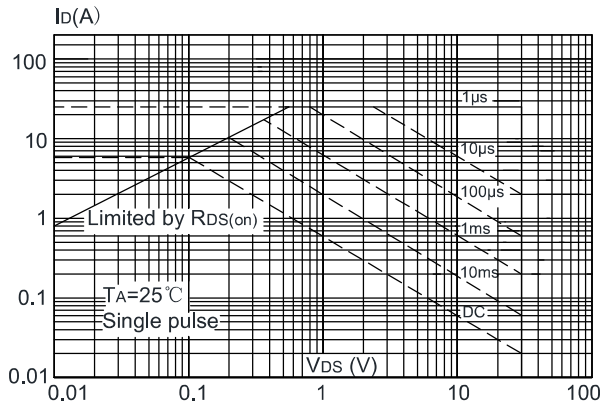
**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



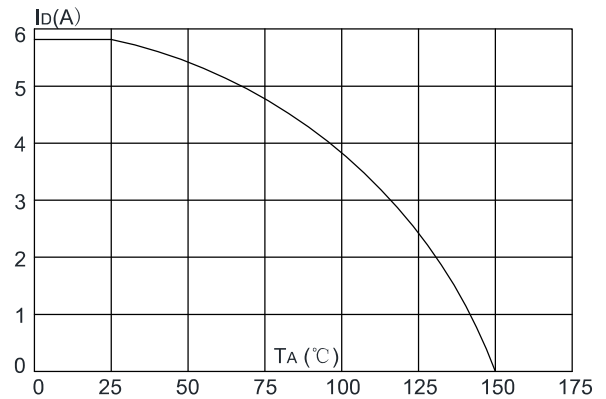
**Figure 8: Normalized on Resistance vs. Junction Temperature**



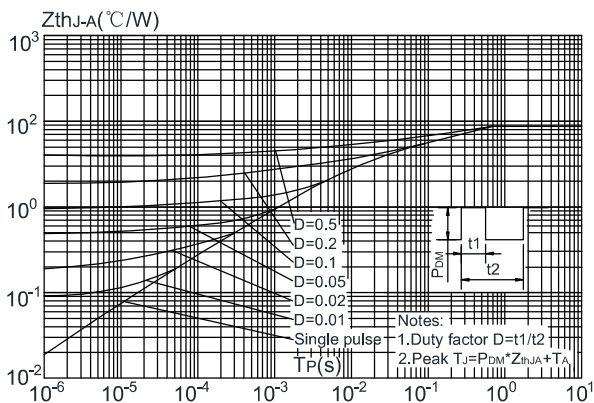
**Figure 9: Maximum Safe Operating Area**



**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**

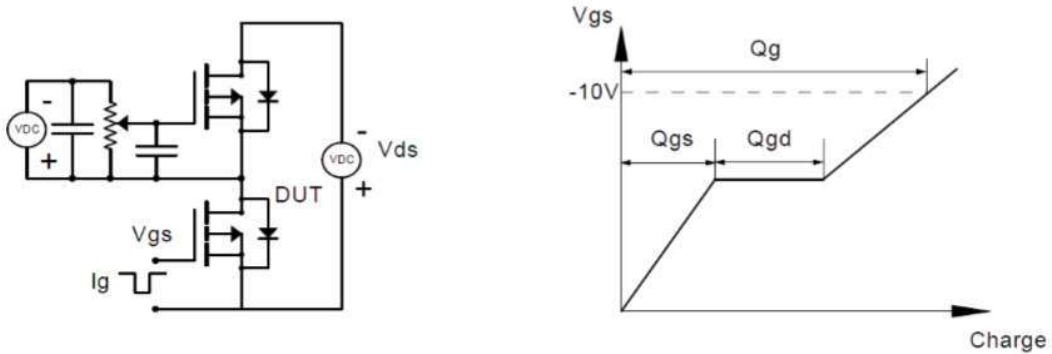


**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient**

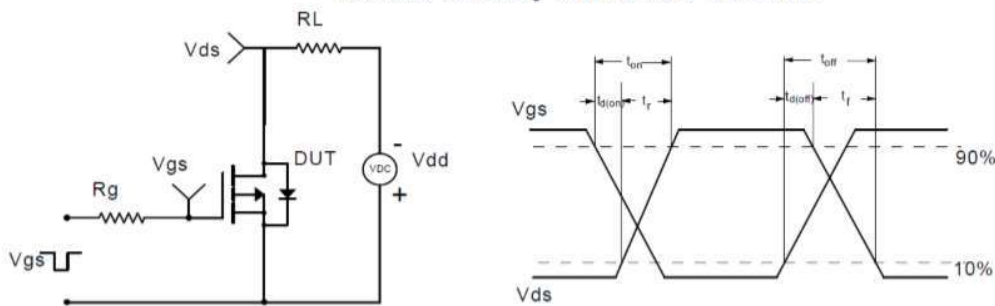


**P Typical Performance Characteristics**

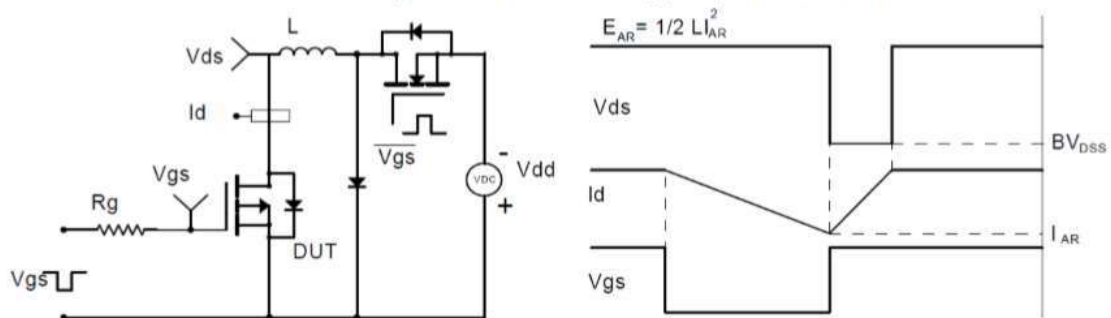
Gate Charge Test Circuit & Waveform



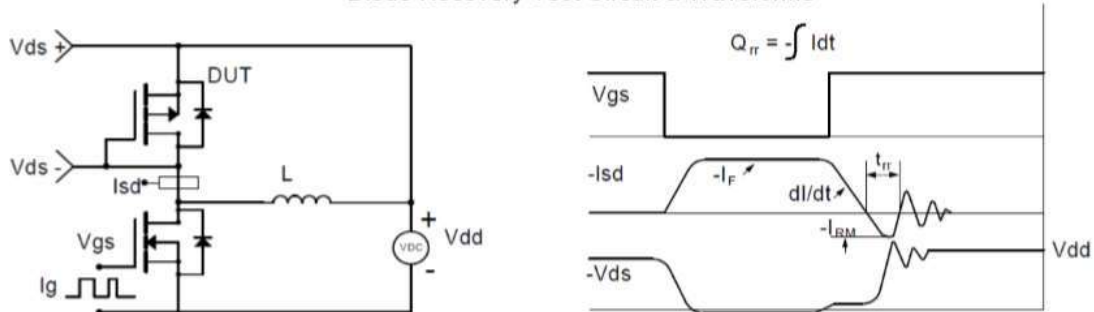
Resistive Switching Test Circuit & Waveforms



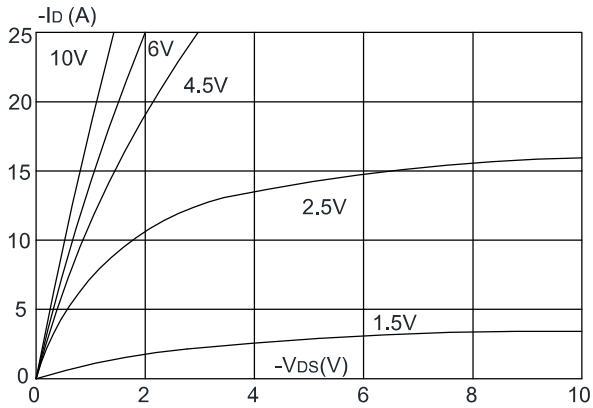
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



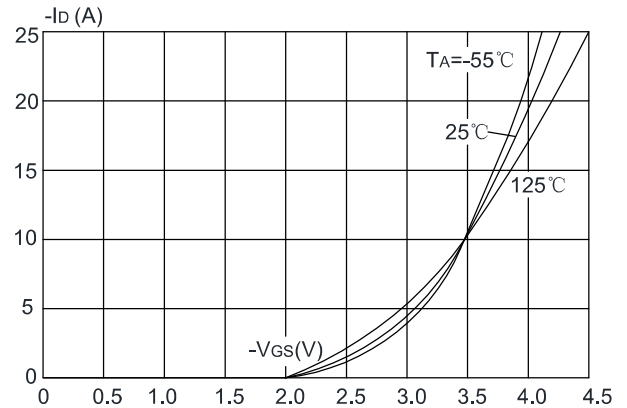
Diode Recovery Test Circuit & Waveforms



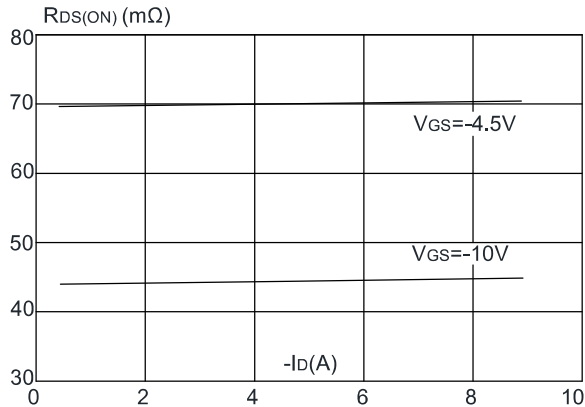
**Figure 1: Output Characteristics**



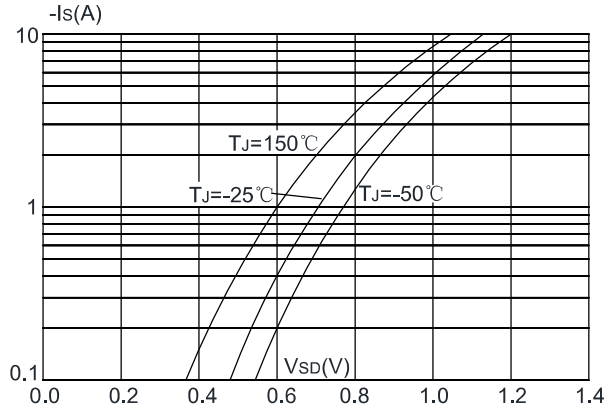
**Figure 2: Typical Transfer Characteristics**



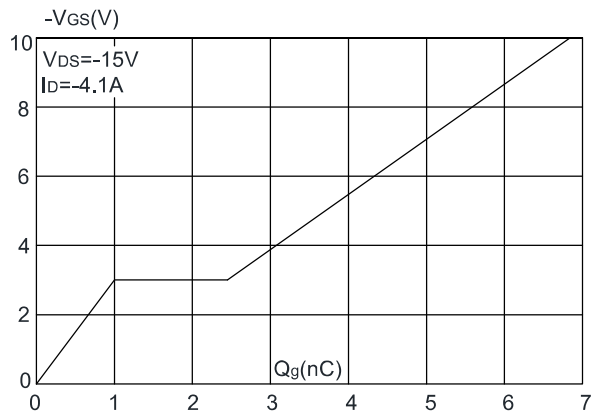
**Figure 3: On-resistance vs. Drain Current**



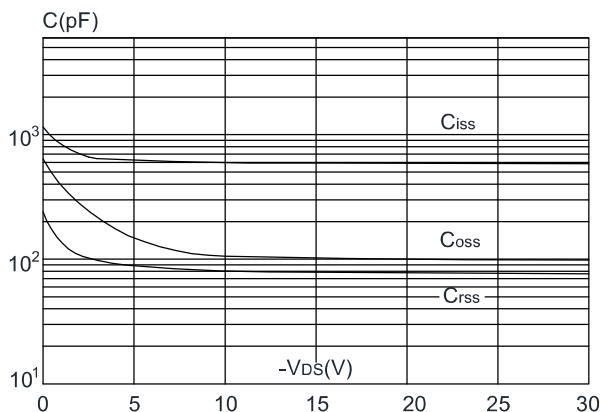
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**

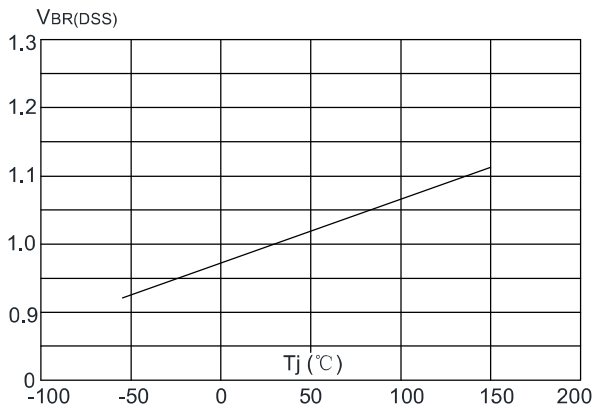


**Figure 6: Capacitance Characteristics**

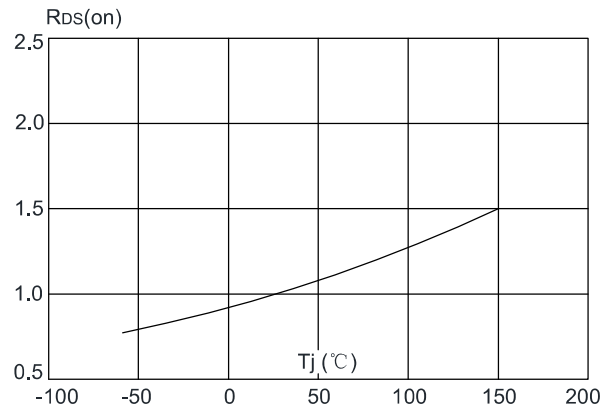




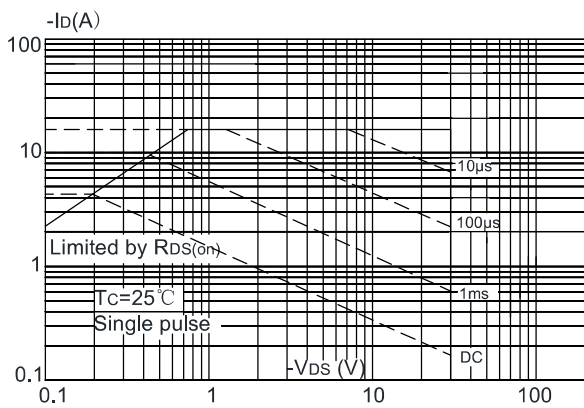
**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



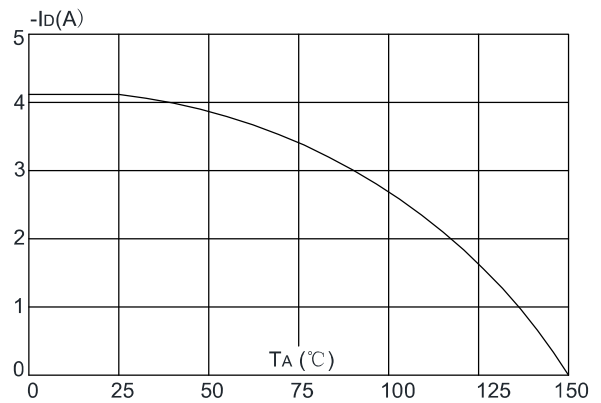
**Figure 8: Normalized on Resistance vs. Junction Temperature**



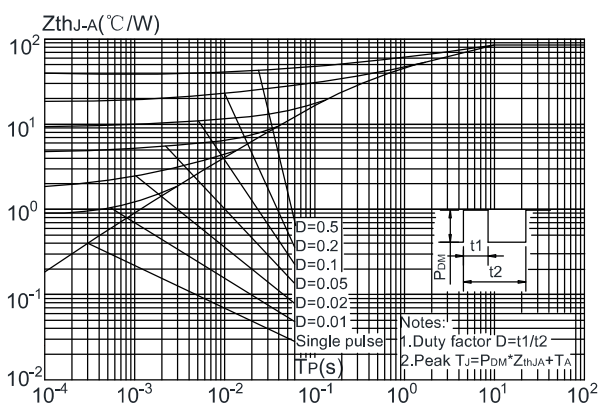
**Figure 9: Maximum Safe Operating Area**



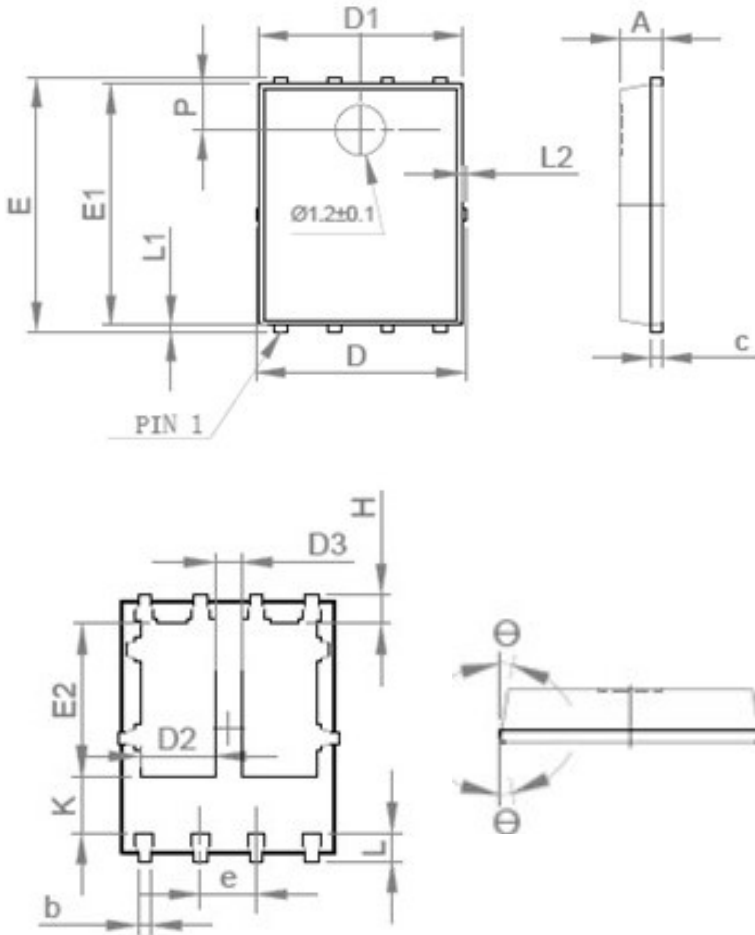
**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**



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



**Package Mechanical Data**



COMMON DIMENSIONS  
( UNITS OF MEASURE = MILLIMETER )

SYMBOL	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.25	0.30	0.35
c	0.21	0.25	0.34
D	-	-	5.10
D1	4.80	4.90	5.00
D2	1.605	1.705	1.805
D3	0.55	0.60	0.65
e	1.27 BSC		
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.375	3.475	4.475
H	0.55	0.65	0.75
K	1.20	-	-
L	0.60	0.65	0.70
L1	0.05	0.15	0.25
L2	-	-	0.12
Θ	8°	10°	12°
P	1.00	1.10	1.20