

# AP3908QD

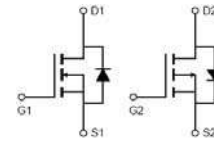
N and P-Channel Enhancement Mosfet

# AIPOWER

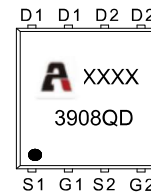
## DATA SHEET

### Feature

- **N-Channel**  
 $V_{DD}=30V, I_D=20A$   
 $R_{DS(ON)} < 13m\Omega @ V_{GS}=10V$   
 $R_{DS(ON)} < 19m\Omega @ V_{GS}=4.5V$
- **P-Channel**  
 $V_{DD}=-30V, I_D=-20A$   
 $R_{DS(ON)} < 23m\Omega @ V_{GS}=-10V$   
 $R_{DS(ON)} < 34m\Omega @ V_{GS}=-4.5V$
- Lead free product is acquired
- High power and current handing capability
- Surface mount package



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)
3908QD	AP3908QD	PDFN3X3	13 inch	-	5000

### ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ\text{C}$ 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 ( $T_a=25^\circ\text{C}$ )	$I_D$	20	-20	A
Continuous Drain Current ( $T_a=100^\circ\text{C}$ )	$I_D$	14.1	-14	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	80	-60	A
Power Dissipation	$P_D$	21		W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	6.25		$^\circ\text{C}/\text{W}$
Junction Temperature	$T_J$	150		$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~ +150		$^\circ\text{C}$

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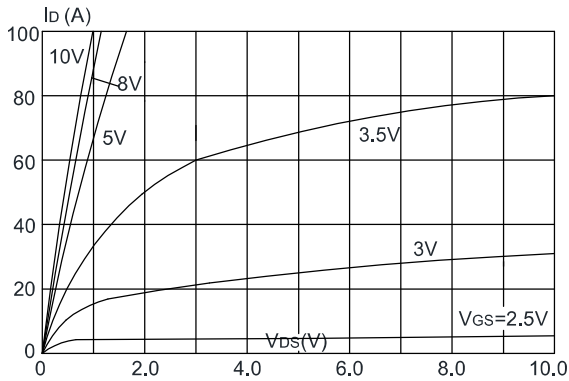
DATA SHEET

## N-CH ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$ unless otherwise noted)

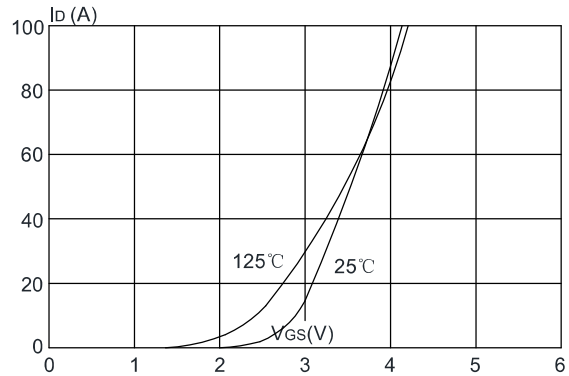
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	30			V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30V, V_{GS} = 0V$			1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
Gate threshold voltage <sup>(2)</sup>	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	1.5	2.5	V
Drain-source on-resistance <sup>(2)</sup>	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$		8.5	13	m $\Omega$
		$V_{GS} = 4.5V, I_D = 6A$		13	19	
Forward tranconductance <sup>(2)</sup>	$g_{FS}$	$V_{DS} = 10V, I_D = 10A$		10		S
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 15V, V_{GS} = 0V, f = 1MHz$		900		pF
Output Capacitance	$C_{oss}$			140		
Reverse Transfer Capacitance	$C_{rss}$			120		
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15V, I_D = 10A$ $V_{GS} = 10V, R_G = 3\Omega$		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	$Q_g$	$V_{DS} = 15V, I_D = 20A,$ $V_{GS} = 10V$		19		nC
Gate-Source Charge	$Q_{gs}$			6.3		
Gate-Drain Charge	$Q_{gd}$			4.5		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	$V_{DS}$	$V_{GS} = 0V, I_S = 10A$			1.2	V
Diode Forward current <sup>(3)</sup>	$I_S$		-	-	20	A

**Typical Performance Characteristics**

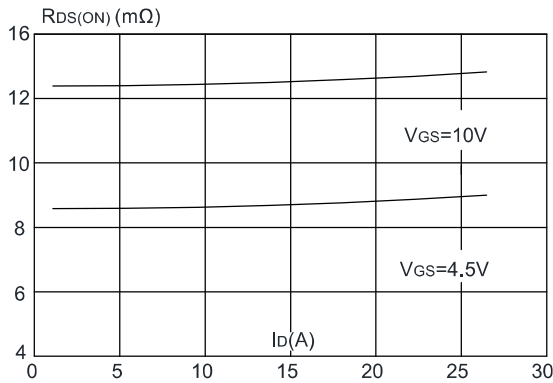
**Figure 1: Output Characteristics**



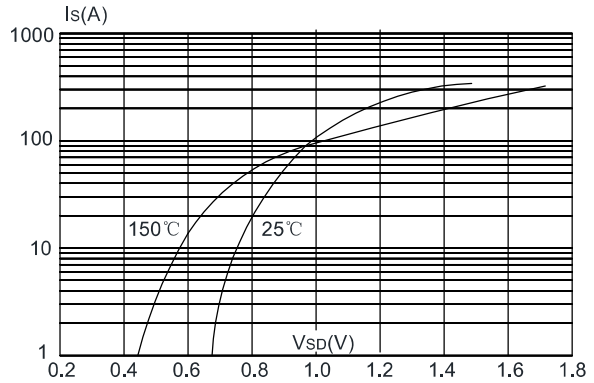
**Figure 2: Typical Transfer Characteristics**



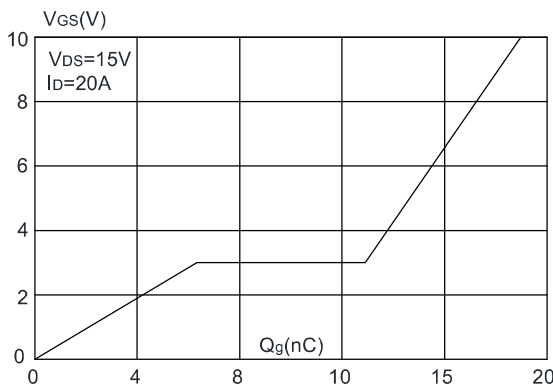
**Figure 3: On-resistance vs. Drain Current**



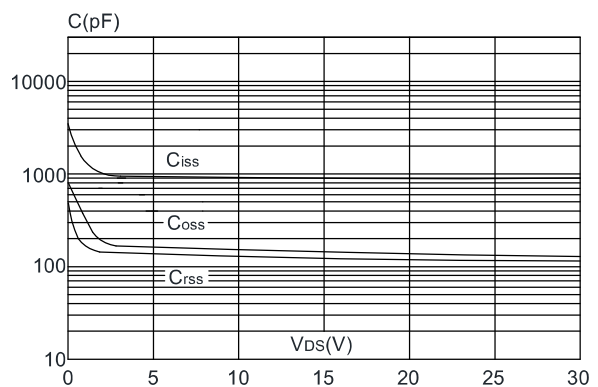
**Figure 4: Body Diode Characteristics**



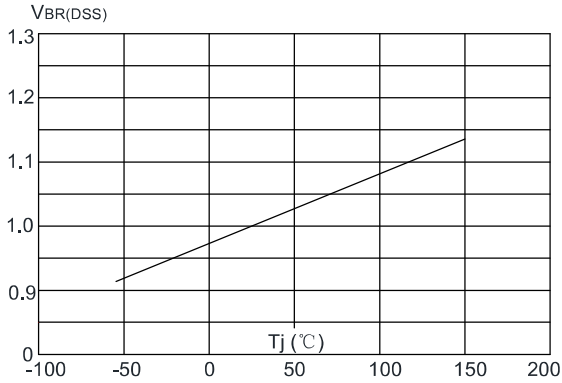
**Figure 5: Gate Charge Characteristics**



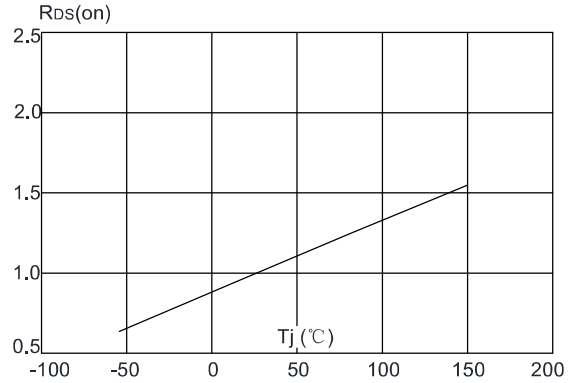
**Figure 6: Capacitance Characteristics**



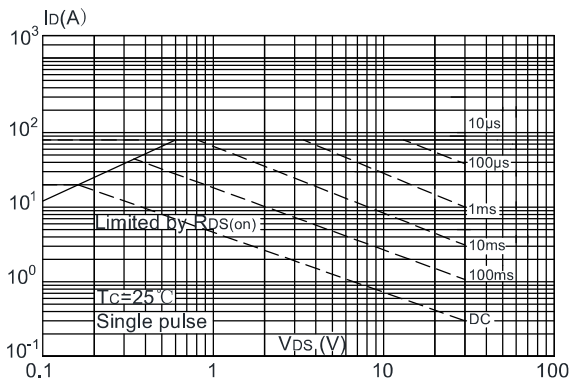
**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



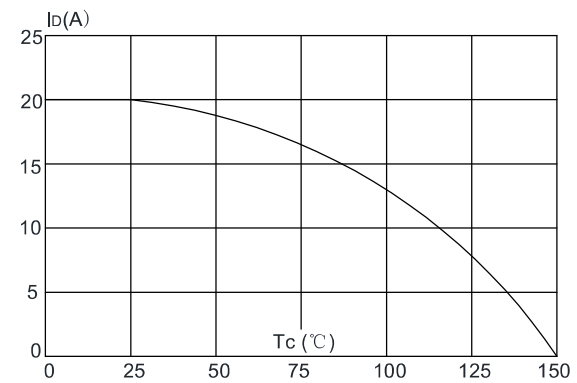
**Figure 8: Normalized on Resistance vs. Junction Temperature**



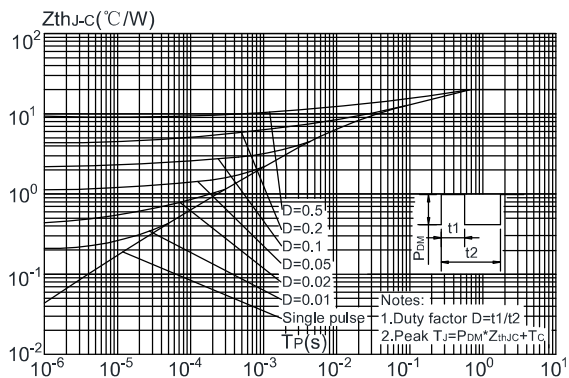
**Figure 9: Maximum Safe Operating Area**



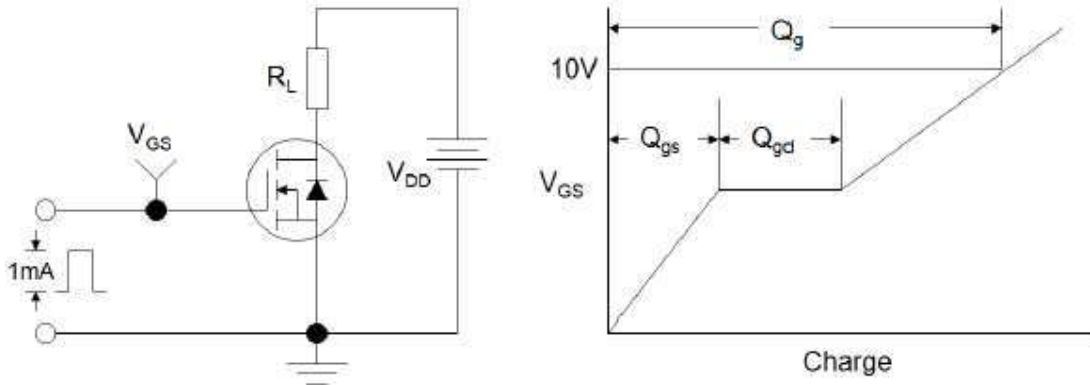
**Figure 10: Maximum Continuous Drain Current vs. Case Temperature**



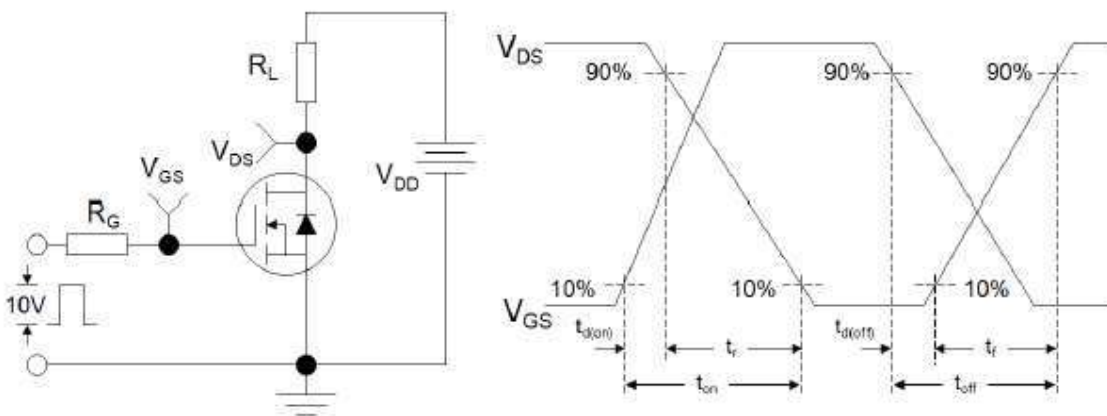
**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case**



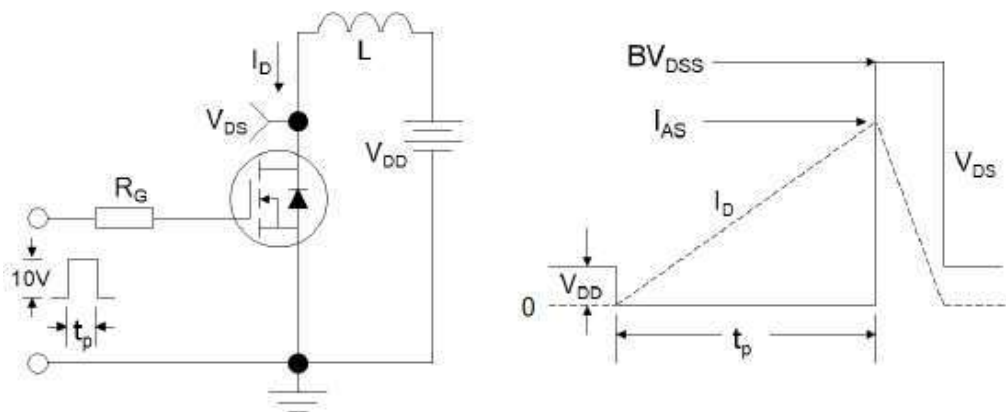
**Test Circuit**



**Figure1:Gate Charge Test Circuit & Waveform**



**Figure 2: Resistive Switching Test Circuit & Waveforms**



**Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms**

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## DATA SHEET

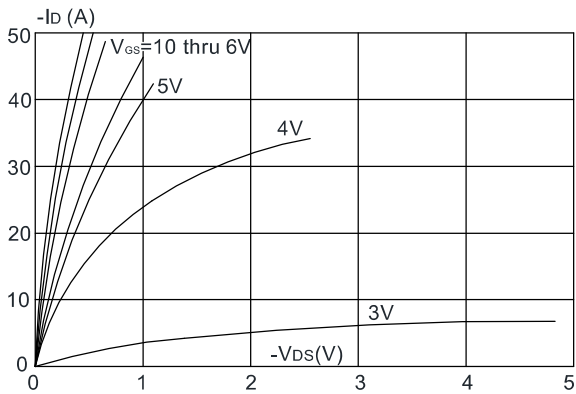
### P-CH ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-30			V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -30V, V_{GS} = 0V$			1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
Gate threshold voltage <sup>(2)</sup>	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\mu A$	-1	-1.5	-2.5	V
Drain-source on-resistance <sup>(2)</sup>	$R_{DS(on)}$	$V_{GS} = -10V, I_D = -10A$		16	23	m $\Omega$
		$V_{GS} = -4.5V, I_D = -5A$		25	34	
Forward transconductance <sup>(2)</sup>	$g_{FS}$	$V_{DS} = -10V, I_D = -10A$		20		S
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -15V, V_{GS} = 0V, f = 1MHz$		1550		pF
Output Capacitance	$C_{oss}$			327		
Reverse Transfer Capacitance	$C_{rss}$			278		
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -15V, I_D = -6A$ $V_{GS} = -10V, R_G = 2.5\Omega$		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	$Q_g$	$V_{DS} = -15V, I_D = -10A,$ $V_{GS} = -10V$		30		nC
Gate-Source Charge	$Q_{gs}$			5.3		
Gate-Drain Charge	$Q_{gd}$			7.6		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	$V_{DS}$	$V_{GS} = 0V, I_S = -10A$			1.2	V
Diode Forward current <sup>(3)</sup>	$I_S$		-	-	-20	A

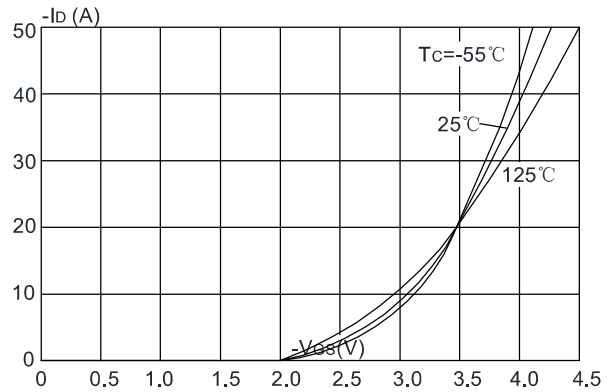
#### Notes:

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

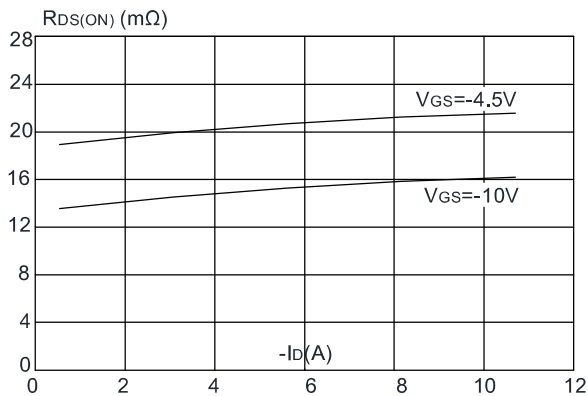
**Figure 1: Output Characteristics**



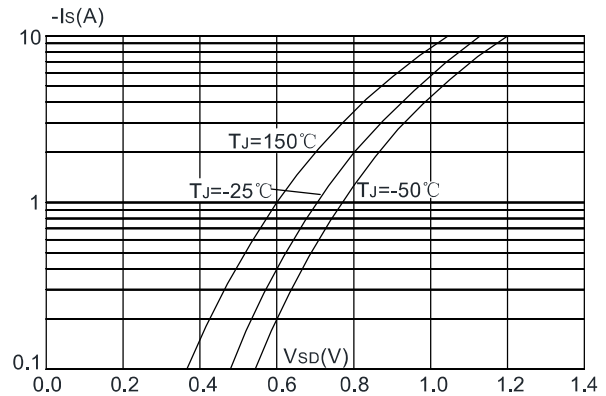
**Figure 2: Typical Transfer Characteristics**



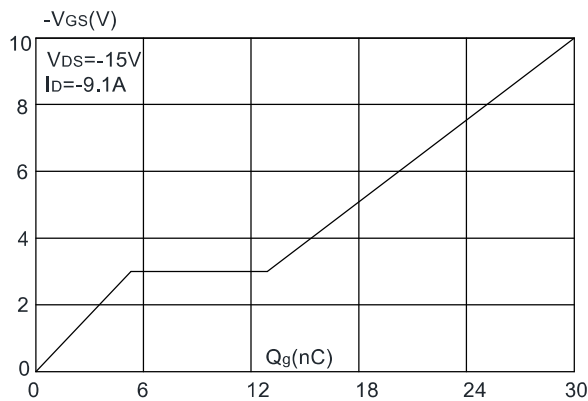
**Figure 3: On-resistance vs. Drain Current**



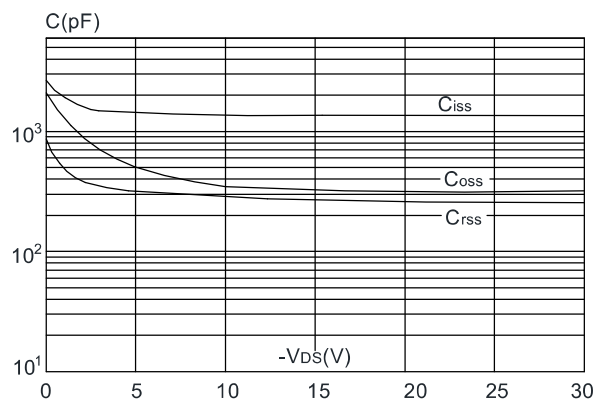
**Figure 4: Body Diode Characteristics**



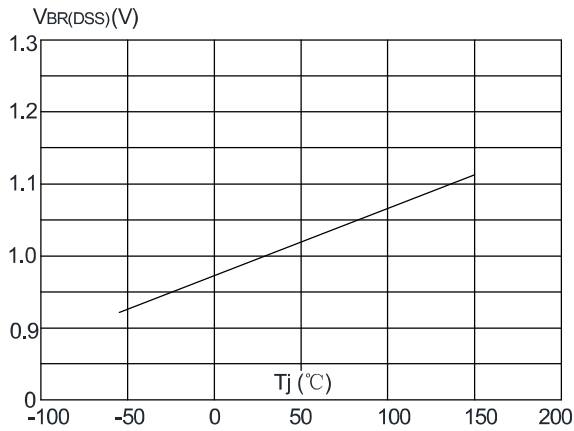
**Figure 5: Gate Charge Characteristics**



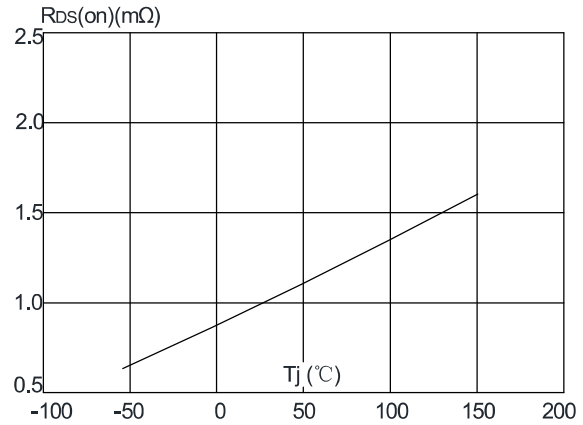
**Figure 6: Capacitance Characteristics**



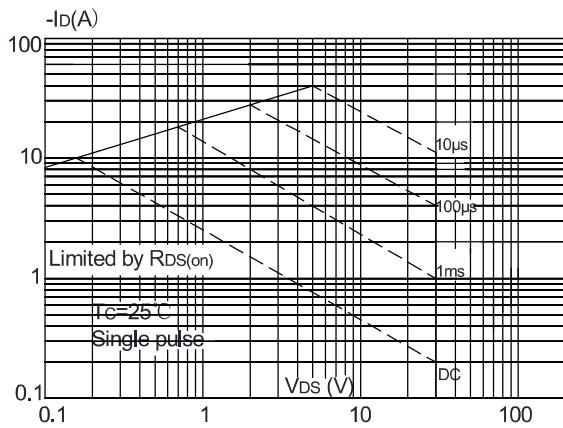
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



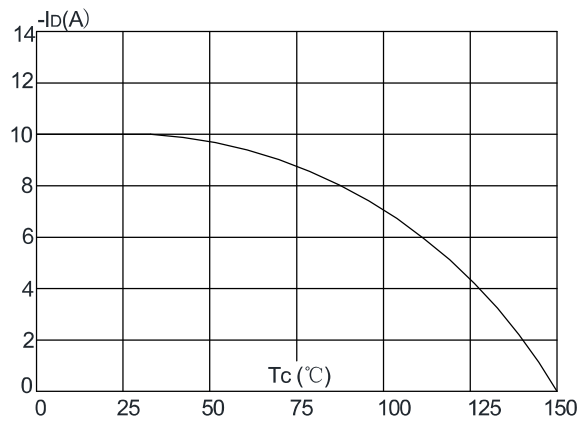
**Figure 8:** Normalized on Resistance vs. Junction Temperature



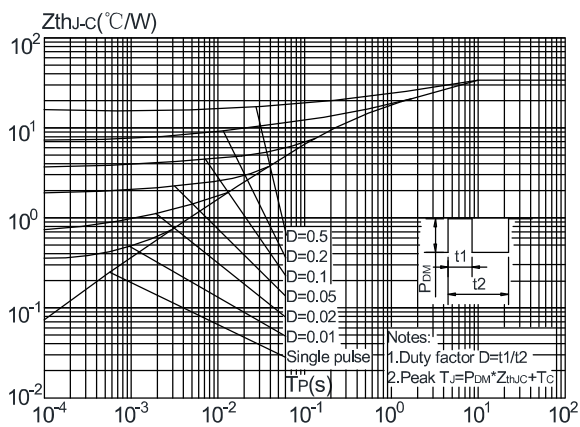
**Figure 9:** Maximum Safe Operating Area



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

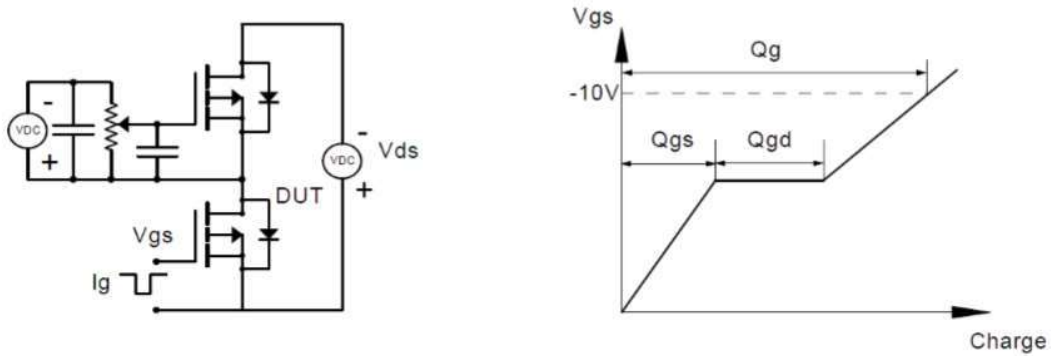


**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

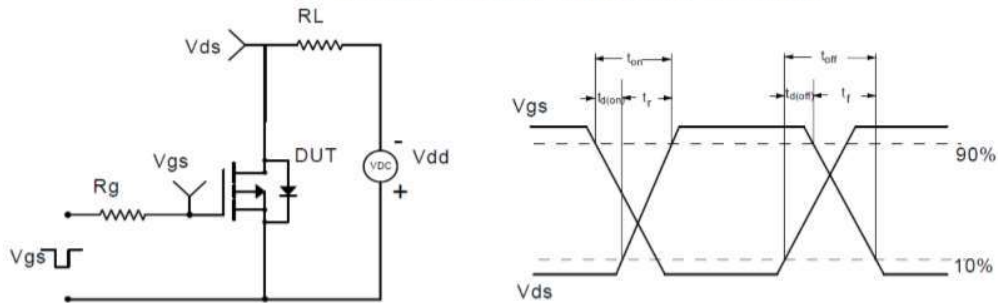




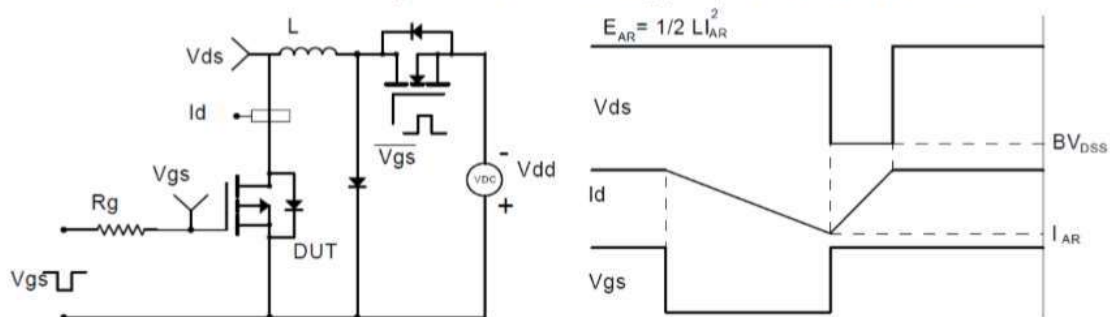
Gate Charge Test Circuit & Waveform



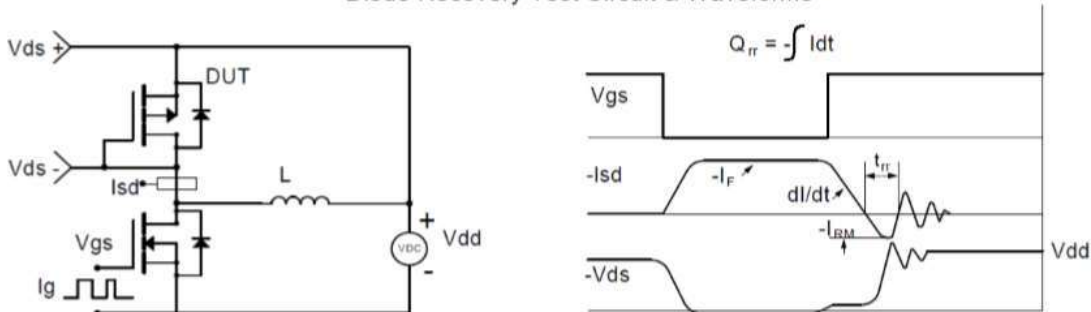
Resistive Switching Test Circuit & Waveforms



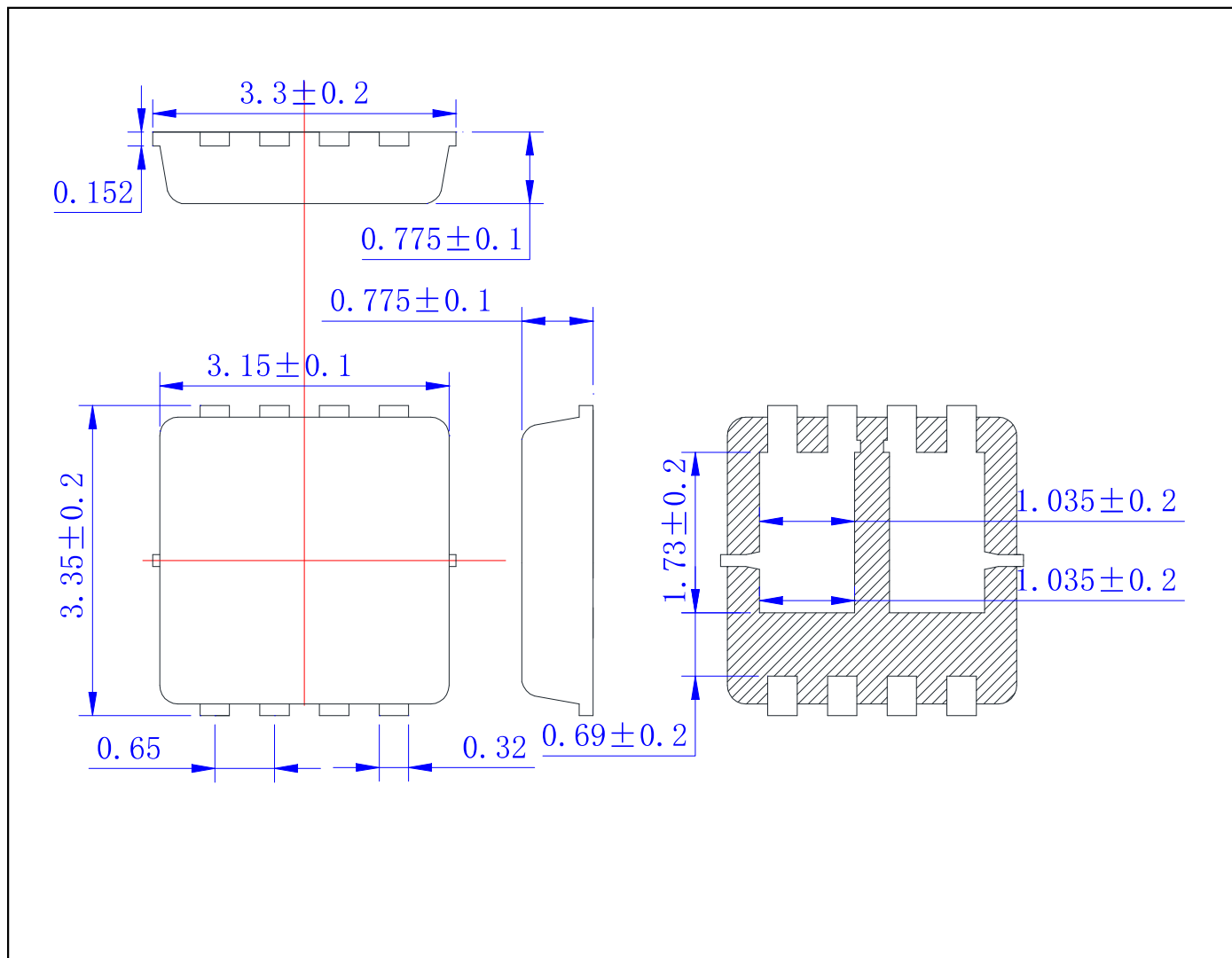
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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