



**THE DATASHEET OF  
AOD609G**



### General Description

The AOD609G uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications.

- RoHS Compliant
- Halogen Free\*

### Features

#### n-channel

$V_{DS}$  (V) = 40V,  $I_D$  = 12A ( $V_{GS}=10V$ )

$R_{DS(ON)} < 30m\Omega$  ( $V_{GS}=10V$ )

$R_{DS(ON)} < 40m\Omega$  ( $V_{GS}=4.5V$ )

#### p-channel

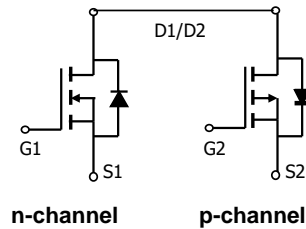
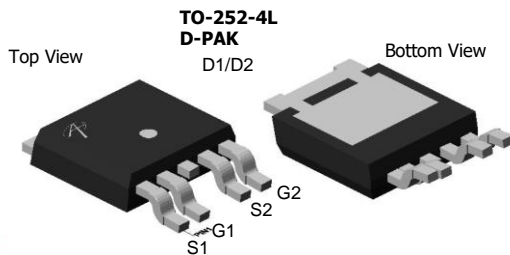
$V_{DS}$  (V) = -40V,  $I_D$  = -12A ( $V_{GS}=-10V$ )

$R_{DS(ON)} < 45m\Omega$  ( $V_{GS}= -10V$ )

$R_{DS(ON)} < 66m\Omega$  ( $V_{GS}= -4.5V$ )

**100% UIS Tested!**

**100% Rg Tested!**



### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>B,G</sup>	$I_D$	$T_C=25^\circ C$	12	A
		$T_C=100^\circ C$	12	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	-30	A
Avalanche Current <sup>C</sup>	$I_{AR}$	14	-20	
Repetitive avalanche energy $L=0.1mH$ <sup>C</sup>	$E_{AR}$	9.8	20	mJ
Power Dissipation	$P_D$	$T_C=25^\circ C$	27	W
		$T_C=100^\circ C$	14	
Power Dissipation	$P_{DSM}$	$T_A=25^\circ C$	2	W
		$T_A=70^\circ C$	1.3	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 175	-55 to 175	$^\circ C$

### Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A,D</sup>	$R_{\theta JA}$	n-ch	17.4	25	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A,D</sup>					
Maximum Junction-to-Case	$R_{\theta JC}$	n-ch	4	5.5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A,D</sup>					
Maximum Junction-to-Ambient <sup>A,D</sup>	$R_{\theta JA}$	p-ch	16.7	25	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A,D</sup>					
Maximum Junction-to-Case	$R_{\theta JC}$	p-ch	3.5	5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A,D</sup>					

**N Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.7	2.5	3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =10V, V <sub>DS</sub> =5V	30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =12A T <sub>J</sub> =125°C		24 37	30 46	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A		31	40	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =12A		25		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.76	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				12	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, f=1MHz		545		pF
C <sub>oss</sub>	Output Capacitance			65		pF
C <sub>rfs</sub>	Reverse Transfer Capacitance			40		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	1.6	3.2	4.8	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub> (10V)	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =12A		10	13	nC
Q <sub>gs</sub>	Gate Source Charge			2		nC
Q <sub>gd</sub>	Gate Drain Charge			2.2		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, R <sub>L</sub> =1.4Ω, R <sub>GEN</sub> =3Ω		5.5		ns
t <sub>r</sub>	Turn-On Rise Time			3		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			19		ns
t <sub>f</sub>	Turn-Off Fall Time			4		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =12A, di/dt=100A/μs		13		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =12A, di/dt=100A/μs		6.5		nC

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> =25° C. The Power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> t<sub>s</sub> ≤ 10s and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature T<sub>J(MAX)</sub>=175° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C.

\*This device is guaranteed green after data code 8X11 (Sep 1<sup>ST</sup> 2008).

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**P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> = -250μA, V <sub>GS</sub> =0V	-40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -40V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> = -250μA	-1.7	-2	-3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -5V	-30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = -10V, I <sub>D</sub> = -12A T <sub>J</sub> =125°C V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -8A		36 52 51	45 65 66	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -5V, I <sub>D</sub> = -12A		22		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> = -1A, V <sub>GS</sub> =0V		-0.76	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-12	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> = -20V, f=1MHz		890		pF
C <sub>oss</sub>	Output Capacitance			90		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			60		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	6.5	13	19.5	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub> (-10V)	Total Gate Charge	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, I <sub>D</sub> = -12A		15.5	21	nC
Q <sub>g</sub> (-4.5V)	Total Gate Charge			7	9	nC
Q <sub>gs</sub>	Gate Source Charge			3.2		nC
Q <sub>gd</sub>	Gate Drain Charge			3.5		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, R <sub>L</sub> =1.4Ω, R <sub>GEN</sub> =3Ω		10		ns
t <sub>r</sub>	Turn-On Rise Time			15.5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			35		ns
t <sub>f</sub>	Turn-Off Fall Time			50		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> = -12A, di/dt=100A/μs		20		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> = -12A, di/dt=100A/μs		11		nC

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The Power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> ≤ 10s and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature T<sub>J(MAX)</sub>=175° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

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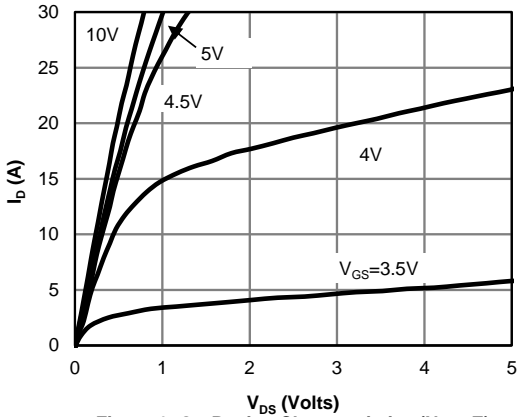
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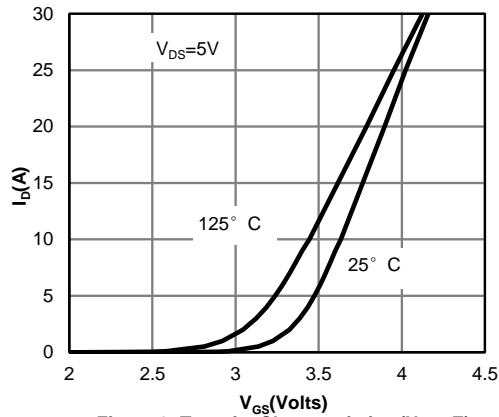
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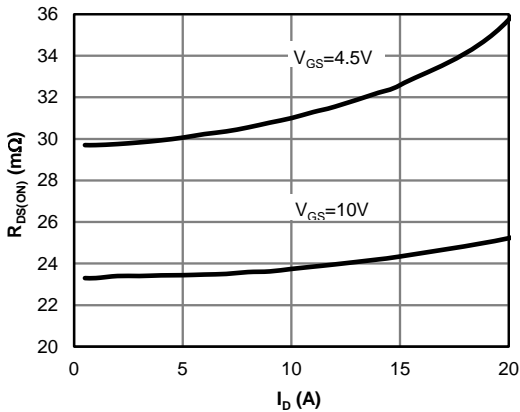
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CANNEL**



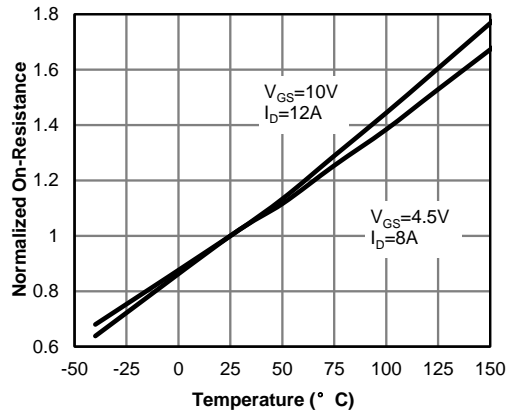
**Figure 1: On-Region Characteristics (Note E)**



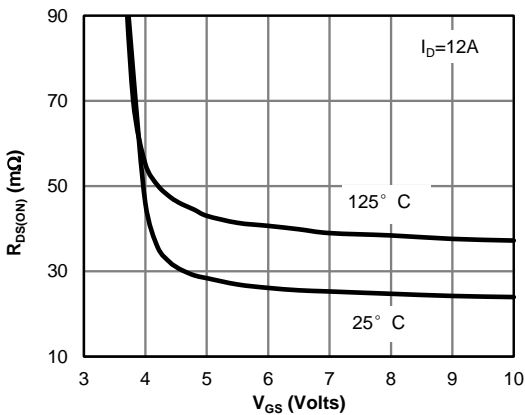
**Figure 2: Transfer Characteristics (Note E)**



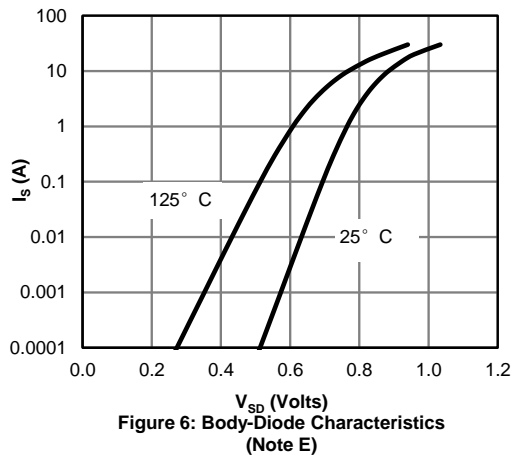
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

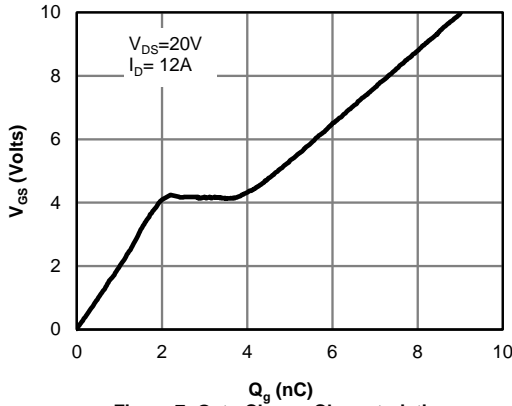


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

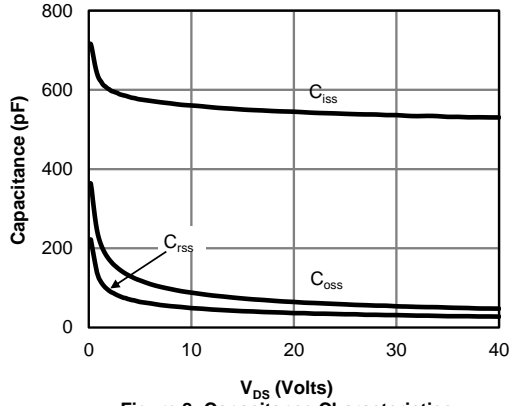


**Figure 6: Body-Diode Characteristics (Note E)**

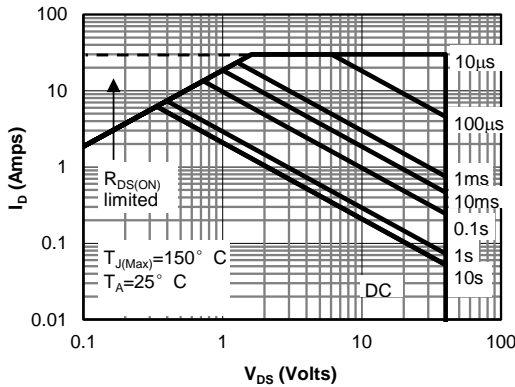
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL**



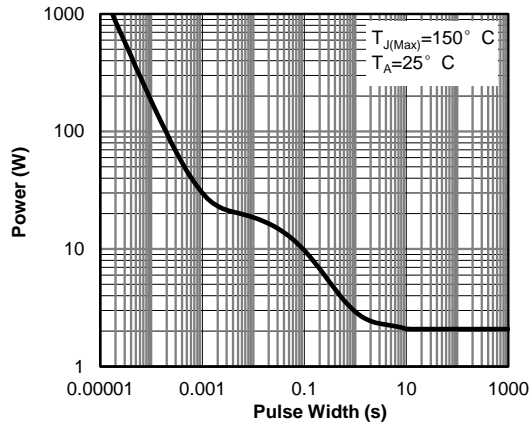
**Figure 7: Gate-Charge Characteristics**



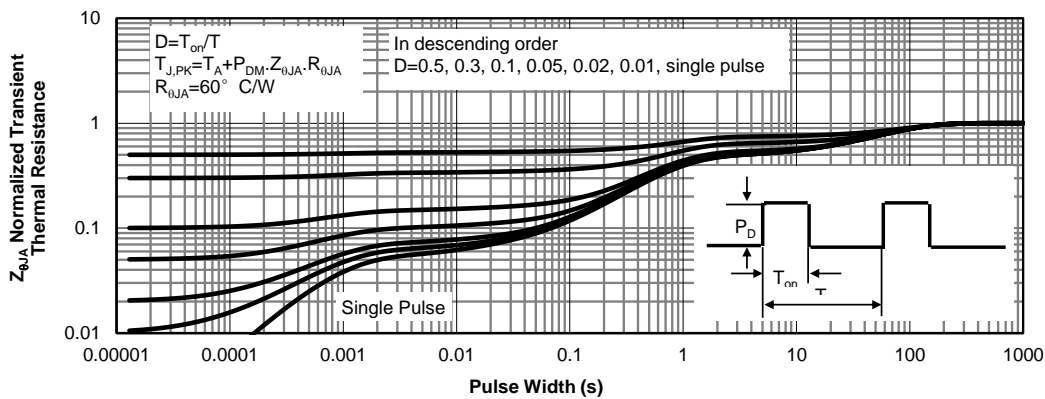
**Figure 8: Capacitance Characteristics**



**Figure 9: Maximum Forward Biased Safe Operating Area (Note F)**



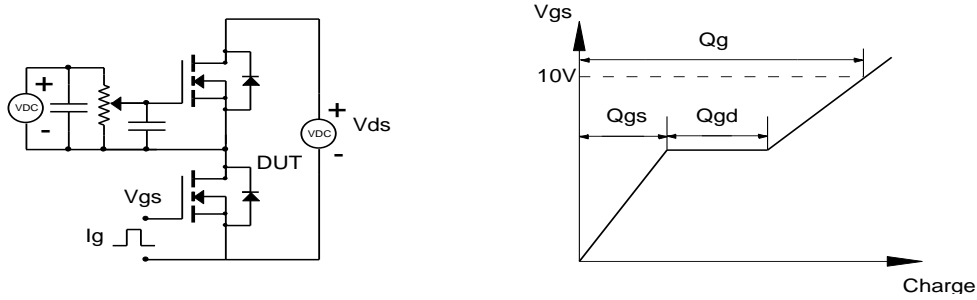
**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note H)**



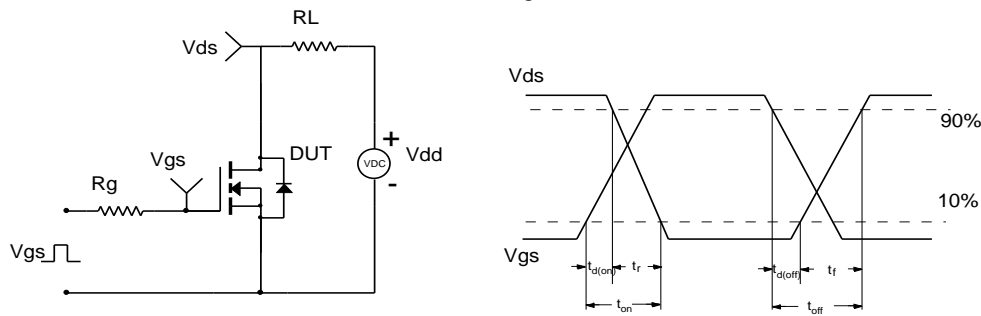
**Figure 11: Normalized Maximum Transient Thermal Impedance (Note H)**

**TEST CIRCUITS AND WAVEFORMS: N-CHANNEL**

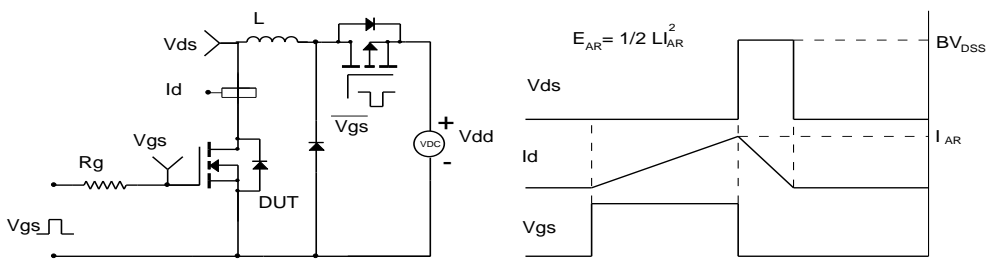
**Gate Charge Test Circuit & Waveform**



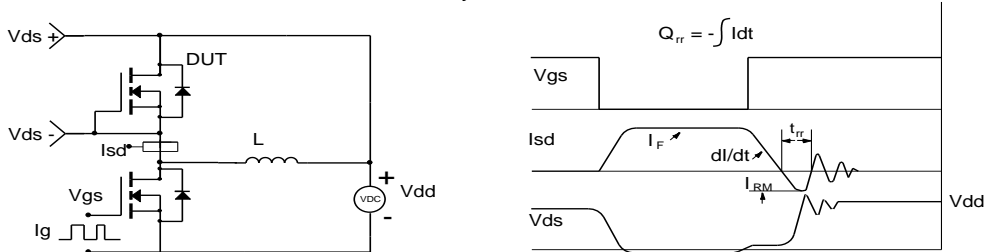
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**



**Diode Recovery Test Circuit & Waveforms**



**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**

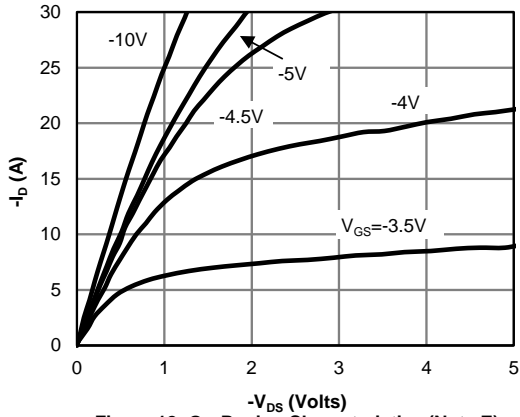


Figure 12: On-Region Characteristics (Note E)

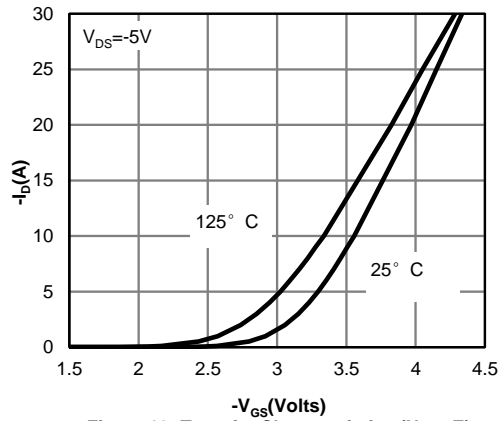


Figure 13: Transfer Characteristics (Note E)

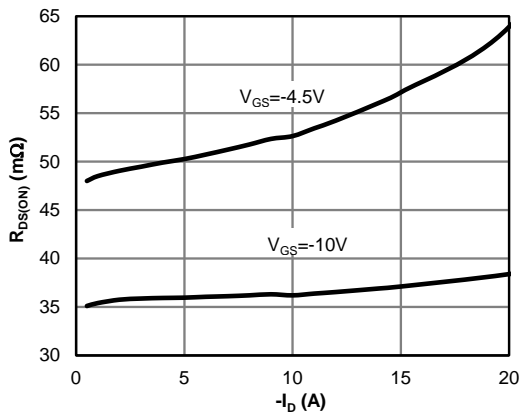


Figure 14: On-Resistance vs. Drain Current and Gate Voltage (Note E)

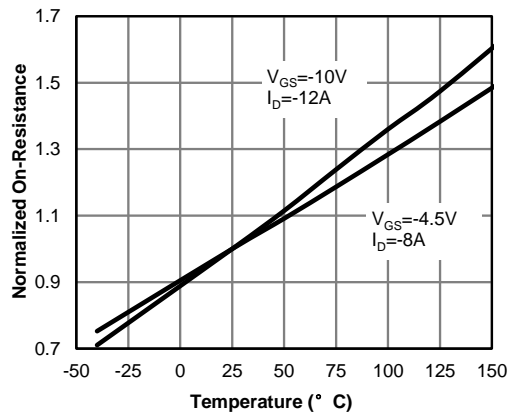


Figure 15: On-Resistance vs. Junction Temperature (Note E)

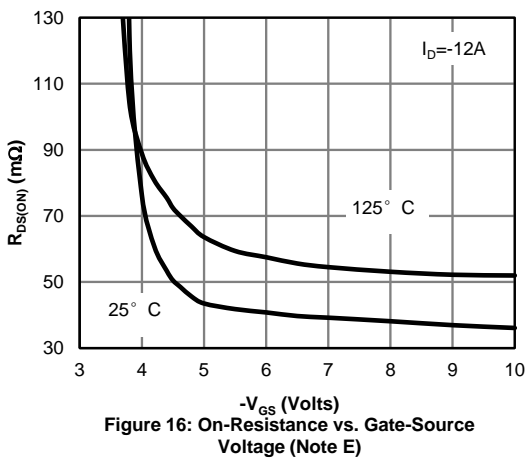


Figure 16: On-Resistance vs. Gate-Source Voltage (Note E)

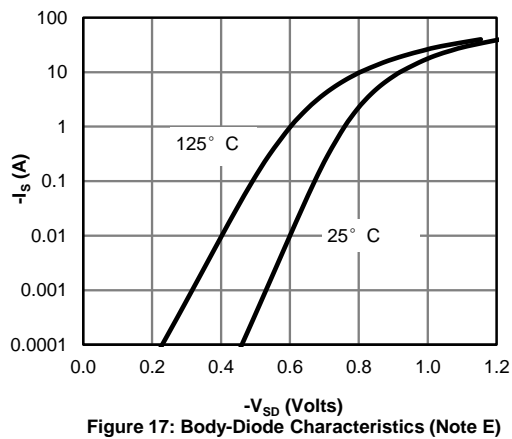
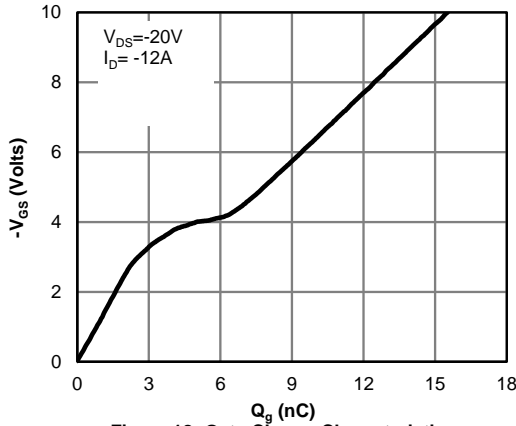
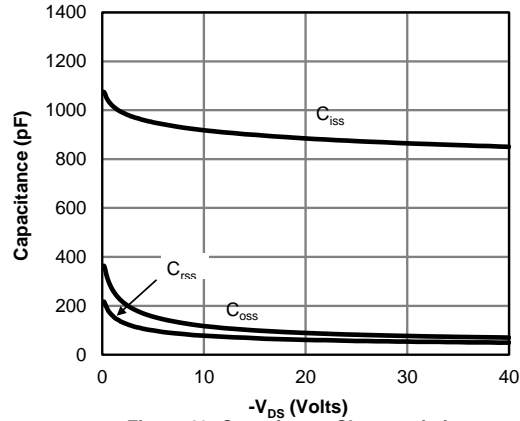


Figure 17: Body-Diode Characteristics (Note E)

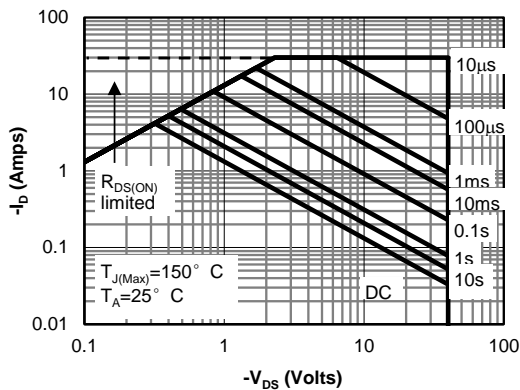
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**



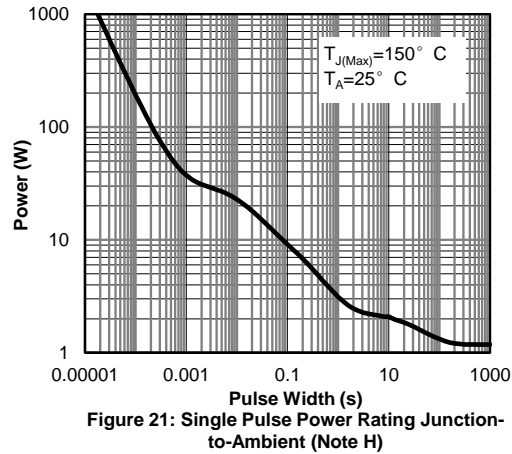
**Figure 18: Gate-Charge Characteristics**



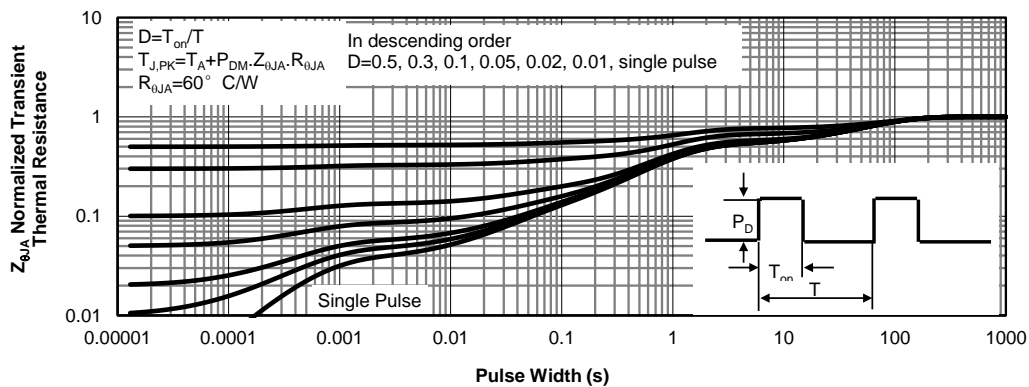
**Figure 19: Capacitance Characteristics**



**Figure 20: Maximum Forward Biased Safe Operating Area (Note F)**



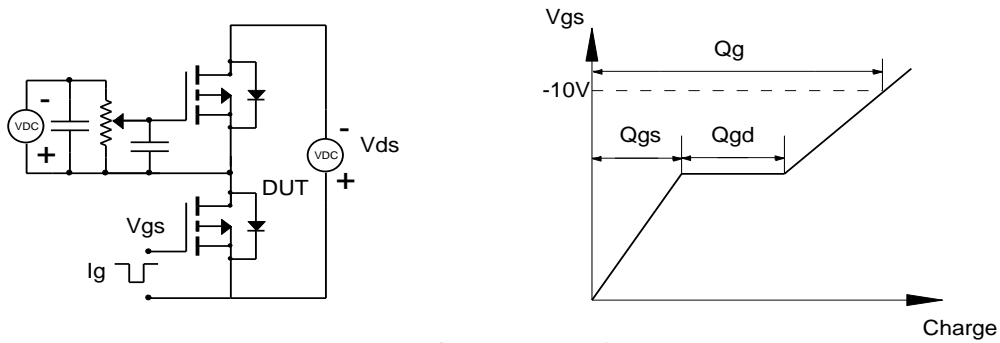
**Figure 21: Single Pulse Power Rating Junction-to-Ambient (Note H)**



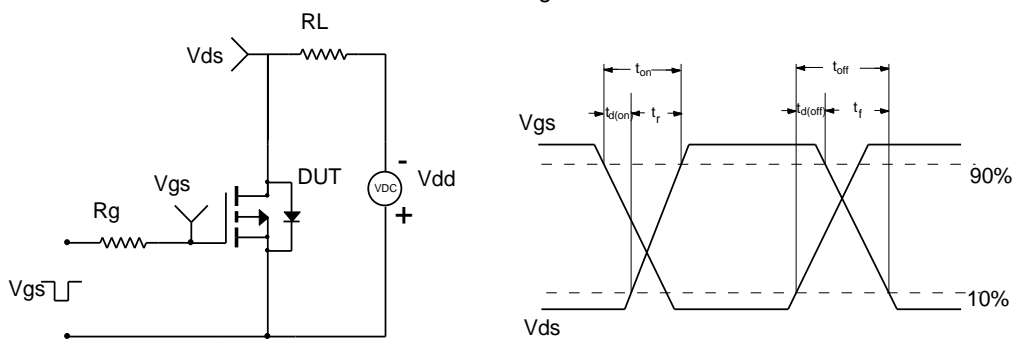
**Figure 22: Normalized Maximum Transient Thermal Impedance (Note H)**

**TEST CIRCUITS AND WAVEFORMS: P-CHANNEL**

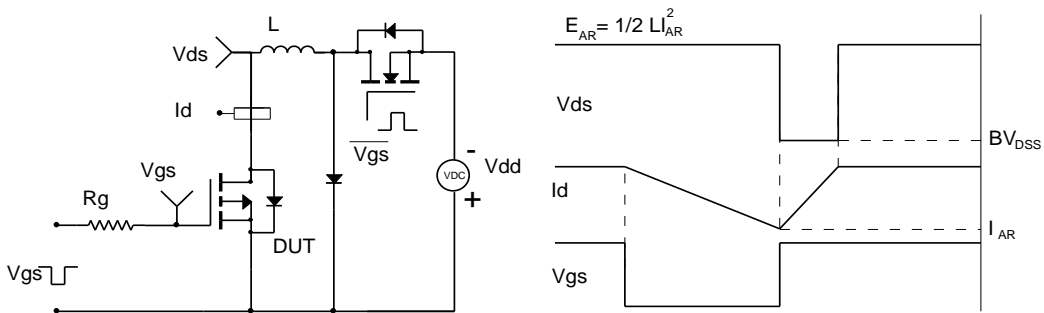
**Gate Charge Test Circuit & Waveform**



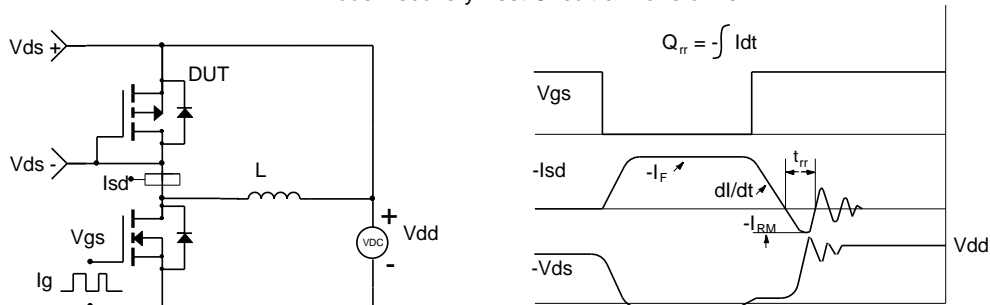
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**



**Diode Recovery Test Circuit & Waveforms**



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