



# THE DATASHEET OF AOD9N50



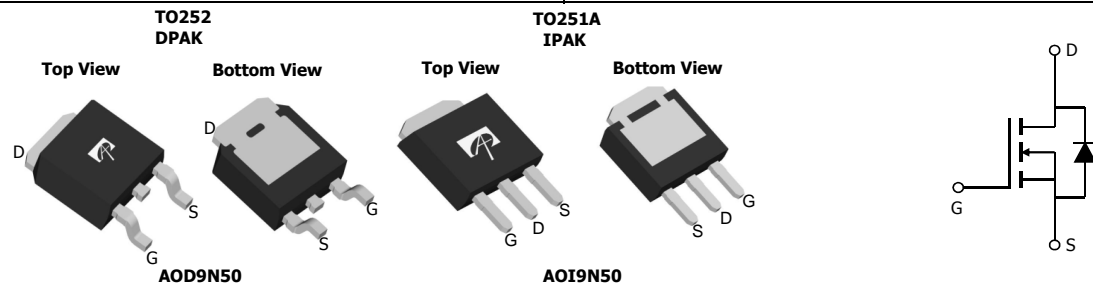
**General Description**

The AOD9N50 & AOI9N50 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications. By providing low  $R_{DS(on)}$ ,  $C_{iss}$  and  $C_{rss}$  along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

**Product Summary**

$V_{DS}$	600V@150°C
$I_D$ (at $V_{GS}=10V$ )	9A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 0.86Ω

100% UIS Tested!  
 100%  $R_g$  Tested!


**Absolute Maximum Ratings  $T_A=25^\circ\text{C}$  unless otherwise noted**

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	±30	V
Continuous Drain Current <sup>B</sup>	$I_D$	$T_C=25^\circ\text{C}$	9
		$T_C=100^\circ\text{C}$	5.7
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	27	A
Avalanche Current <sup>C</sup>	$I_{AR}$	3.8	A
Repetitive avalanche energy <sup>C</sup>	$E_{AR}$	216	mJ
Single pulsed avalanche energy <sup>H</sup>	$E_{AS}$	433	mJ
Peak diode recovery $dv/dt$	$dv/dt$	5	V/ns
Power Dissipation <sup>B</sup>	$P_D$	$T_C=25^\circ\text{C}$	178
		Derate above 25°C	1.4
Junction and Storage Temperature Range	$T_J, T_{STG}$	-50 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	$T_L$	300	°C

**Thermal Characteristics**

Parameter	Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient <sup>A,G</sup>	$R_{\theta JA}$	45	55	°C/W
Maximum Case-to-sink <sup>A</sup>	$R_{\theta CS}$	-	0.5	°C/W
Maximum Junction-to-Case <sup>D,F</sup>	$R_{\theta JC}$	0.5	0.7	°C/W

**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, T <sub>J</sub> =25°C	500			V
		I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C		600		
BV <sub>DSS</sub> /ΔT <sub>J</sub>	Zero Gate Voltage Drain Current	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V		0.56		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V			1	μA
		V <sub>DS</sub> =400V, T <sub>J</sub> =125°C			10	
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =5V, I <sub>D</sub> =250μA	3.3	3.9	4.5	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =4.5A		0.71	0.86	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =40V, I <sub>D</sub> =4.5A		9		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.72	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				9	A
I <sub>SM</sub>	Maximum Body-Diode Pulsed Current				27	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	760	962	1160	pF
C <sub>oss</sub>	Output Capacitance		65	98	130	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		4.5	8	12	pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	1.5	3.2	5	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =400V, I <sub>D</sub> =9A	15	19.5	24	nC
Q <sub>gs</sub>	Gate Source Charge		4.6			nC
Q <sub>gd</sub>	Gate Drain Charge		7.1			nC
t <sub>D(on)</sub>	Turn-On Delay Time	V <sub>GS</sub> =10V, V <sub>DS</sub> =250V, I <sub>D</sub> =9A, R <sub>G</sub> =25Ω		24		ns
t <sub>r</sub>	Turn-On Rise Time		44			ns
t <sub>D(off)</sub>	Turn-Off Delay Time		55			ns
t <sub>f</sub>	Turn-Off Fall Time		35			ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time		I <sub>F</sub> =9A, di/dt=100A/μs, V <sub>DS</sub> =100V	260	332	400
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =9A, di/dt=100A/μs, V <sub>DS</sub> =100V	2.8	3.5	4.5	μC

A. The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub>=25° C.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150° C in a TO252 package, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150° 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 <300 μs pulses, duty cycle 0.5% max.

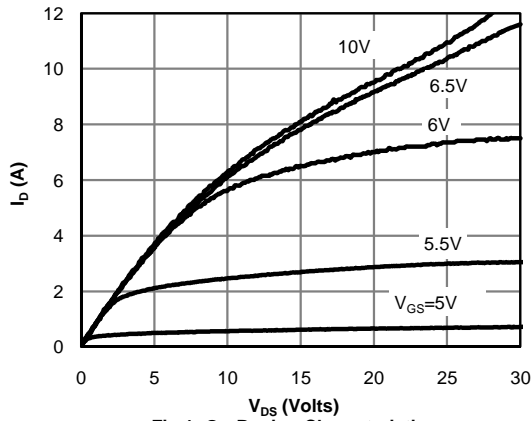
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C.

G. 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.

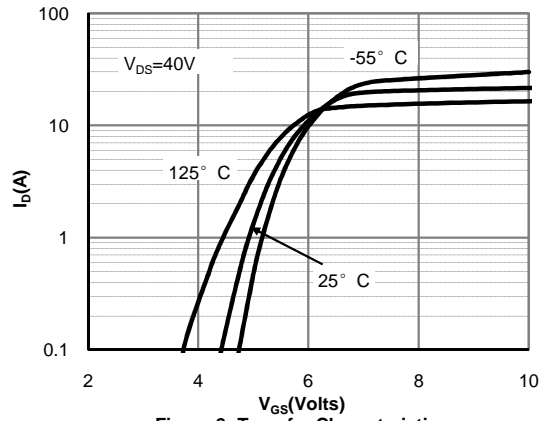
H. L=60mH, I<sub>AS</sub>=3.8A, V<sub>DD</sub>=150V, R<sub>G</sub>=10Ω, Starting T<sub>J</sub>=25° C

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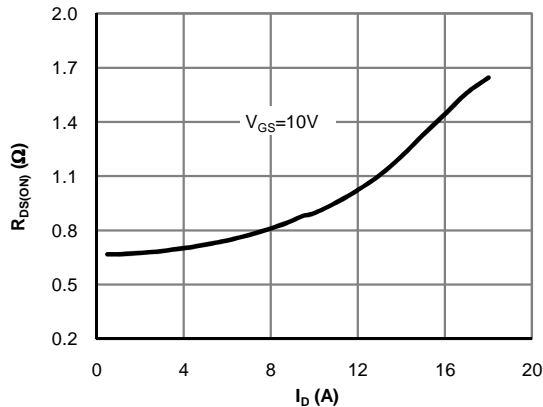
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



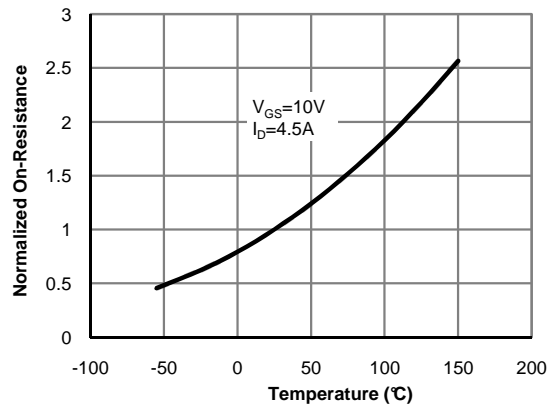
**Fig 1: On-Region Characteristics**



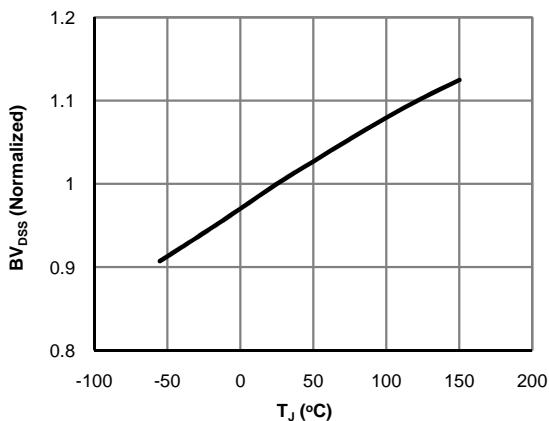
**Figure 2: Transfer Characteristics**



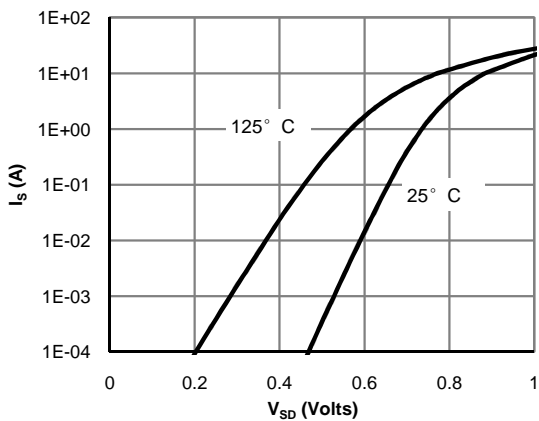
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**



**Figure 5: Break Down vs. Junction Temperature**



**Figure 6: Body-Diode Characteristics**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

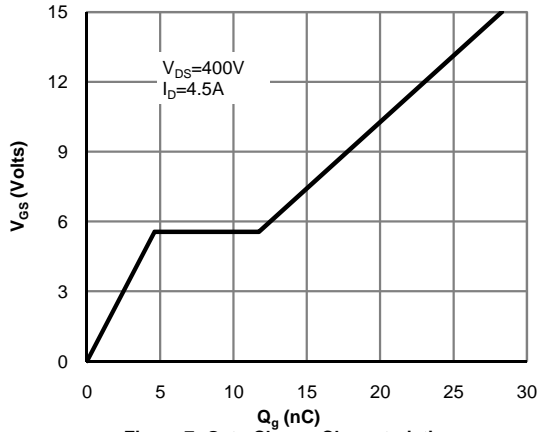


Figure 7: Gate-Charge Characteristics

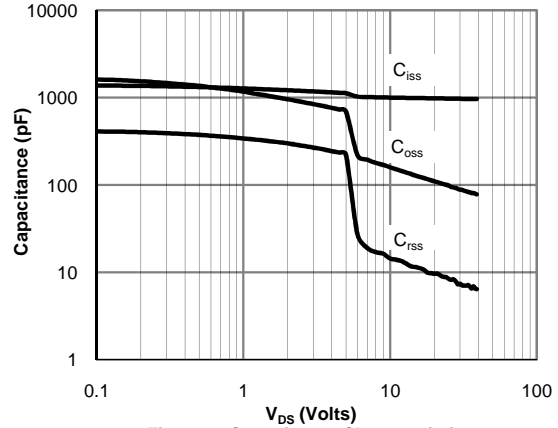


Figure 8: Capacitance Characteristics

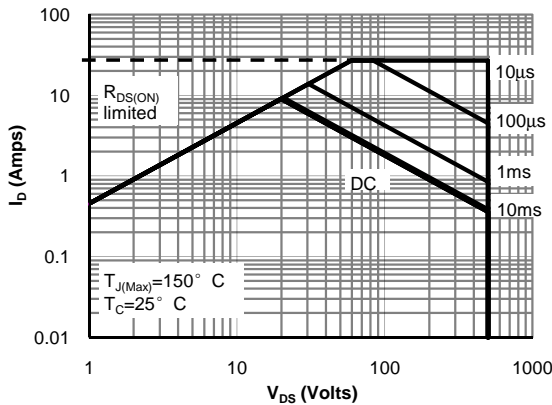


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

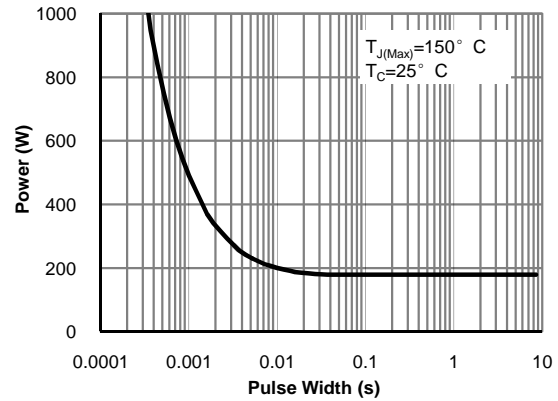


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

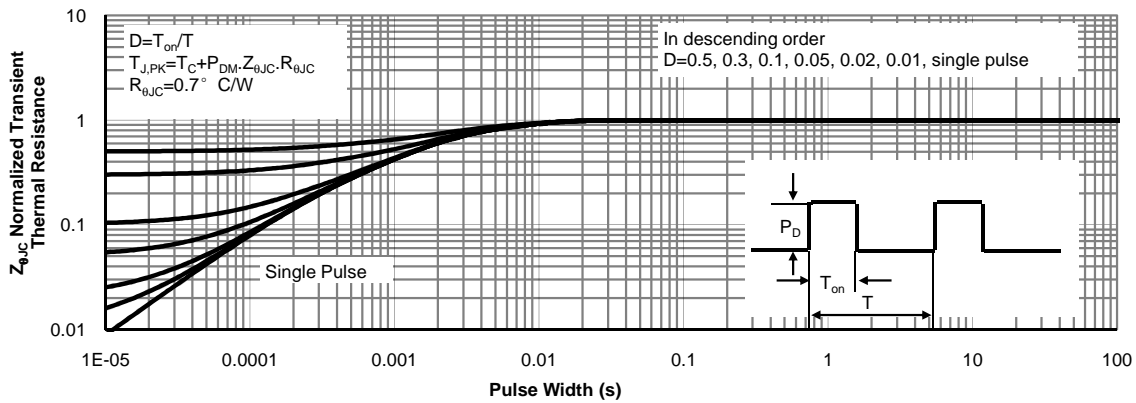


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

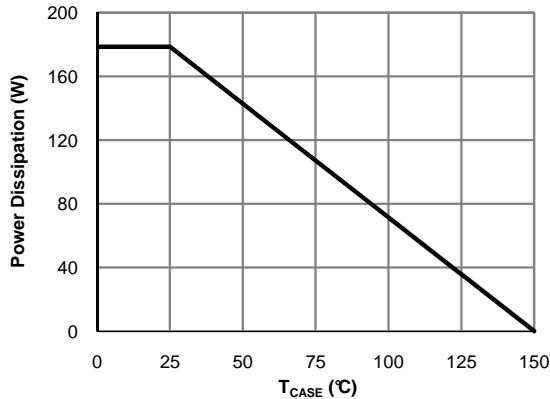


Figure 12: Power De-rating (Note B)

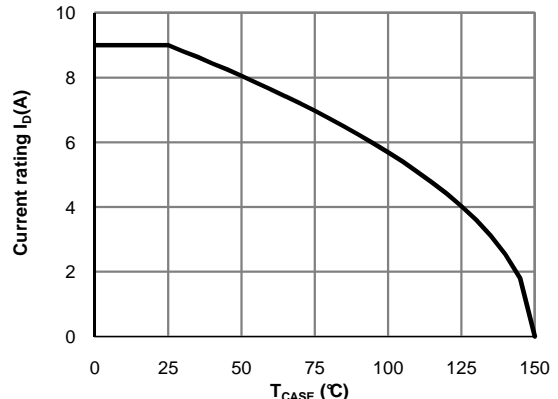


Figure 13: Current De-rating (Note B)

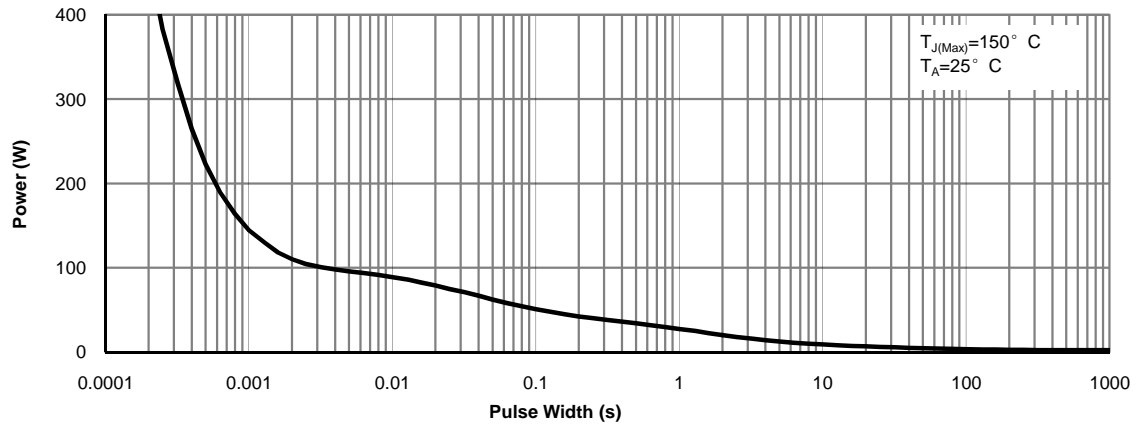


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

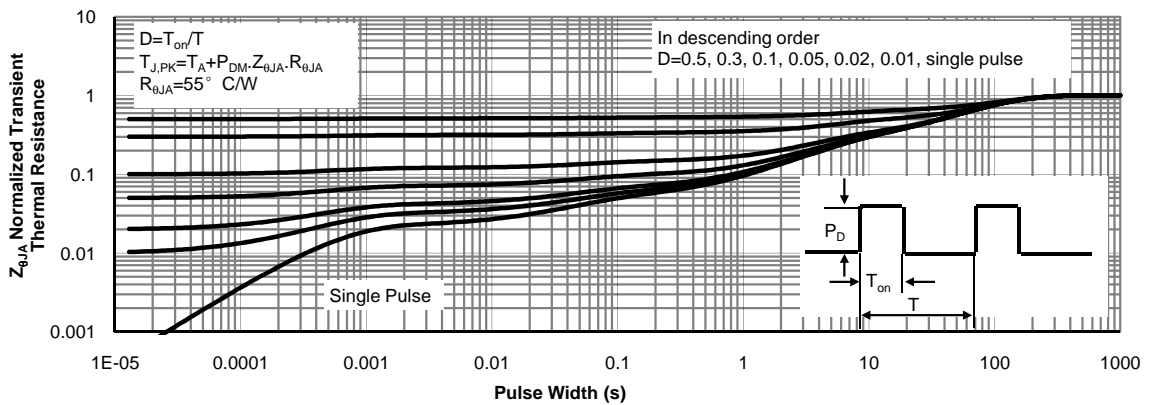
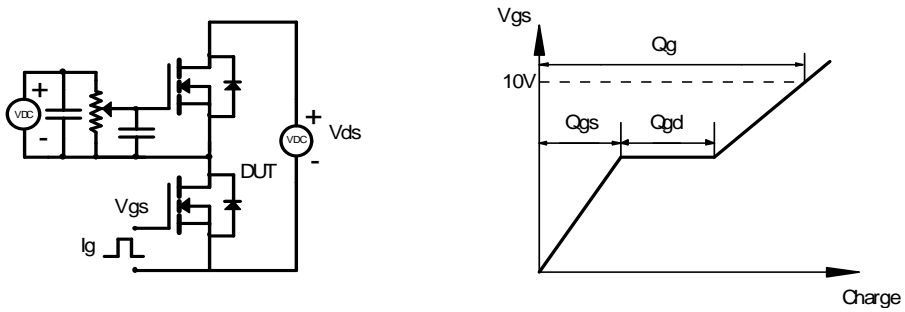
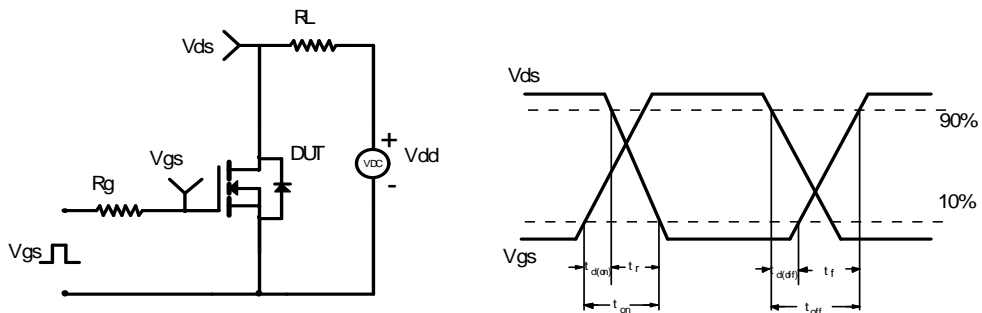


Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

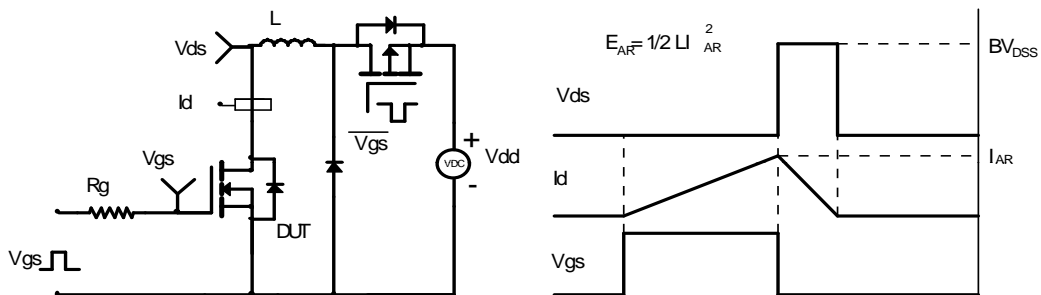
Gate Charge Test Circuit & Waveform



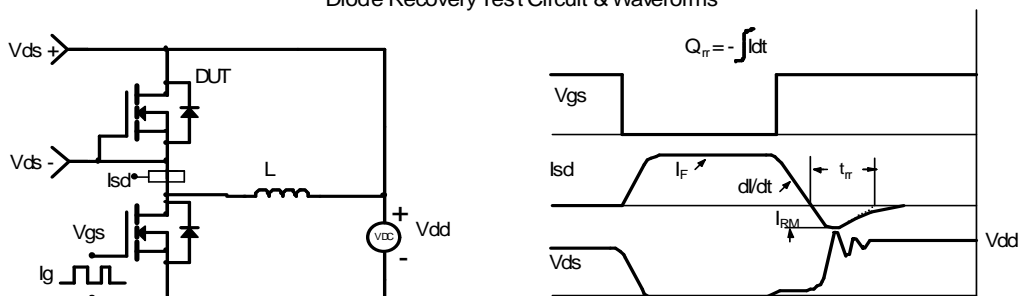
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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