ALPHA & OMEGA SEMICONDUCTOR

Green Product **RoHS** Compliant

AOD4185/AOI4185
P-Channel Enhancement Mode Field Effect Transistor
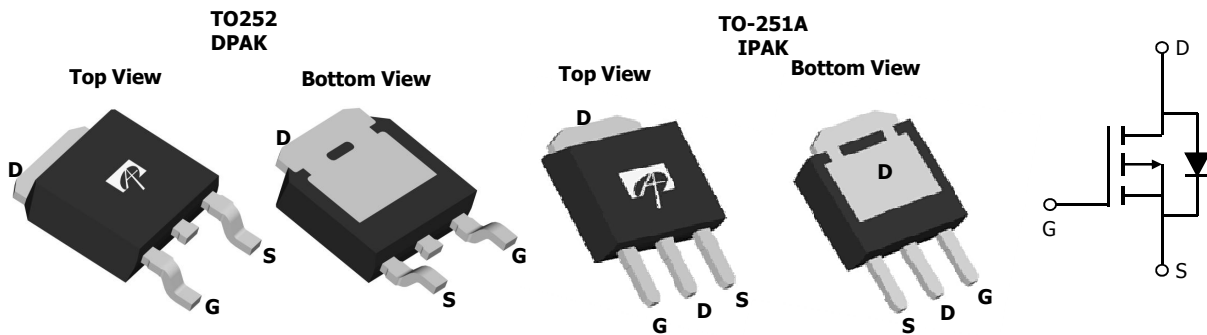
General Description

The AOD4185/AOI4185 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. With the excellent thermal resistance of the DPAK/IPAK package, this device is well suited for high current applications.

-RoHS Compliant
-Halogen Free*

Features

V_{DS} (V) = -40V
I_D = -40A   (V_{GS} = -10V)
$R_{DS(ON)}$ < 15mΩ   (V_{GS} = -10V)
$R_{DS(ON)}$ < 20mΩ   (V_{GS} = -4.5V)

100% UIS Tested!
100% Rg Tested!

TO252 DPAK — Top View / Bottom View

TO-251A IPAK — Top View / Bottom View

Absolute Maximum Ratings T_C=25℃ unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-40	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [B,H]	T_C=25℃	I_D	-40	A
	T_C=100℃		-31	
Pulsed Drain Current [C]		I_{DM}	-115	
Avalanche Current [C]		I_{AR}	-42	
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	88	mJ
Power Dissipation [B]	T_C=25℃	P_D	62.5	W
	T_C=100℃		31	
Power Dissipation [A]	T_A=25℃	P_{DSM}	2.5	
	T_A=70℃		1.6	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	℃

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A,G]	t ≤ 10s	$R_{\theta JA}$	15	20	℃/W
Maximum Junction-to-Ambient [A,G]	Steady-State		41	50	℃/W
Maximum Junction-to-Case [D,F]	Steady-State	$R_{\theta JC}$	2	2.4	℃/W

Electrical Characteristics (T$_J$=25℃ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV$_{DSS}$	Drain-Source Breakdown Voltage	I$_D$=-250µA, V$_{GS}$=0V		-40			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=-40V, V$_{GS}$=0V				-1	µA
			T$_J$=55℃			-5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$= ±20V				±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=-250µA		-1.7	-1.9	-3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=-10V, V$_{DS}$=-5V		-115			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-10V, I$_D$=-20A			12.5	15	mΩ
			T$_J$=125℃		19	23	
		V$_{GS}$=-4.5V, I$_D$=-15A			16	20	
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-20A			50		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-1A,V$_{GS}$=0V			-0.72	-1	V
I$_S$	Maximum Body-Diode Continuous Current					-20	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=-20V, f=1MHz			2550		pF
C$_{oss}$	Output Capacitance				280		pF
C$_{rss}$	Reverse Transfer Capacitance				190		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz		2.5	4	6	Ω
SWITCHING PARAMETERS							
Q$_g$ (-10V)	Total Gate Charge	V$_{GS}$=-10V, V$_{DS}$=-20V, I$_D$=-20A			42	55	nC
Q$_g$ (-4.5V)	Total Gate Charge				18.6		
Q$_{gs}$	Gate Source Charge				7		nC
Q$_{gd}$	Gate Drain Charge				8.6		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-10V, V$_{DS}$=-20V, R$_L$=1Ω, R$_{GEN}$=3Ω			9.4		ns
t$_r$	Turn-On Rise Time				20		ns
t$_{D(off)}$	Turn-Off DelayTime				55		ns
t$_f$	Turn-Off Fall Time				30		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-20A, dI/dt=100A/µs			38	49	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-20A, dI/dt=100A/µs			47		nC

A: The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$ =25° C. The power dissipation P$_{DSM}$ and current rating I$_{DSM}$ are based on T$_{J(MAX)}$=150° C, using steady state junction-to-ambient thermal resistance.

B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=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: Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=175° C.

D. The R$_{θJA}$ is the sum of the thermal impedence from junction to case R$_{θJC}$ 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 impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=175° C. The SOA curve provides a single pulse rating.

G. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25° C.

H. The maximum current rating is limited by bond-wires.

*This device is guaranteed green after data code 8X11 (Sep 1ST 2008).

Rev4: April, 2012

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
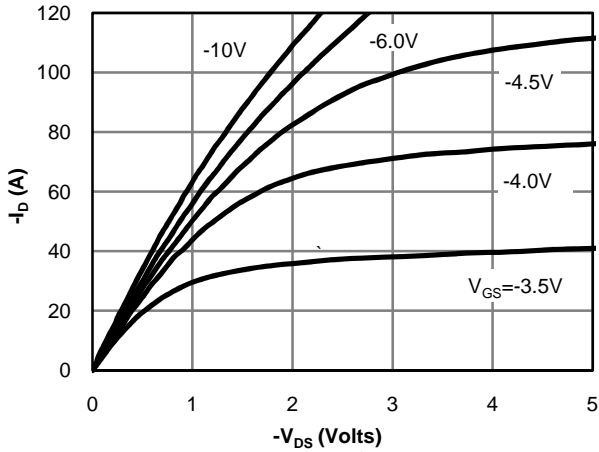

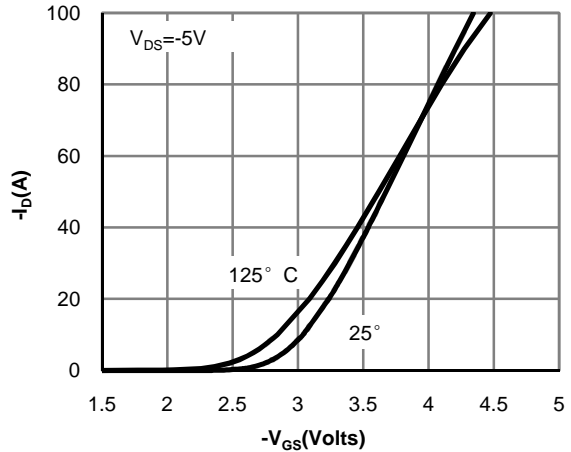**Figure 1: On-Region Characteristics**
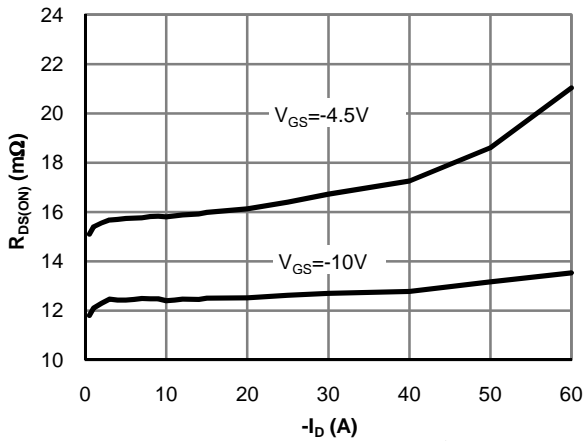

Figure 2: Transfer Characteristics

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

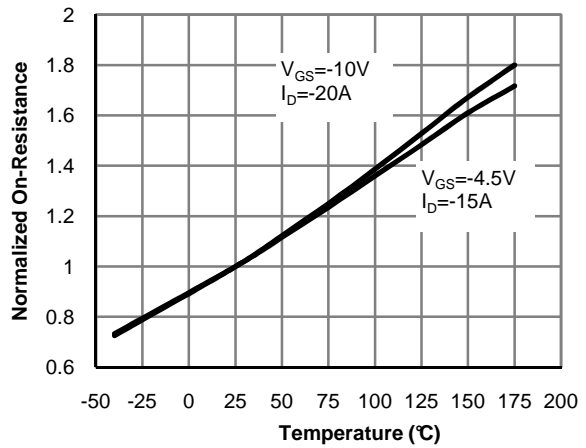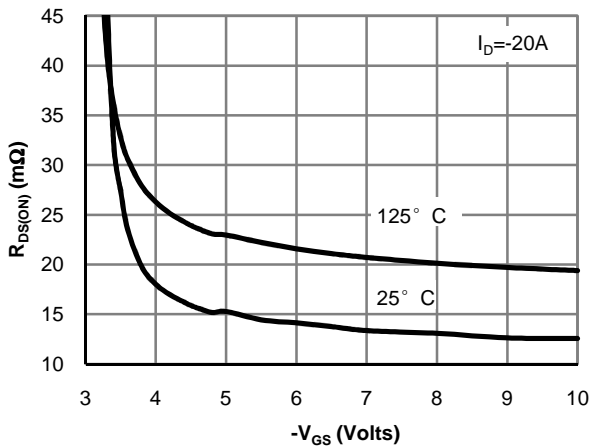**Figure 4: On-Resistance vs. Junction Temperature**
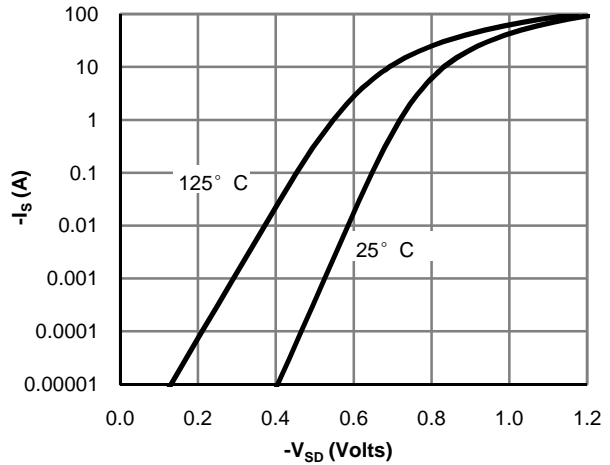

Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

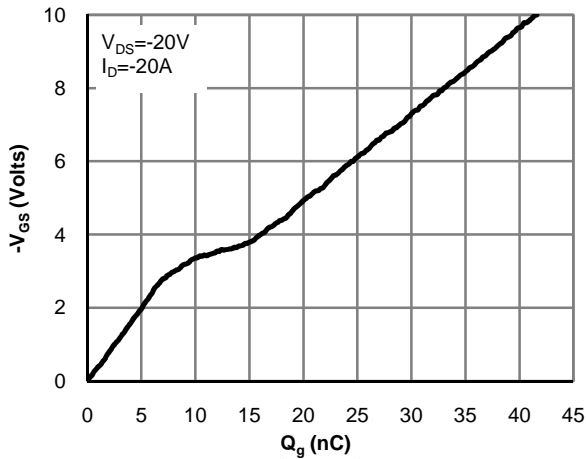## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$V_{DS}=-20V$
$I_D=-20A$

Figure 7: Gate-Charge Characteristics
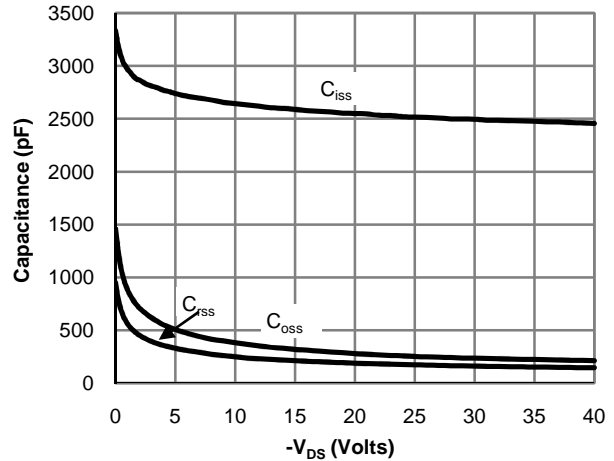
Figure 8: Capacitance Characteristics
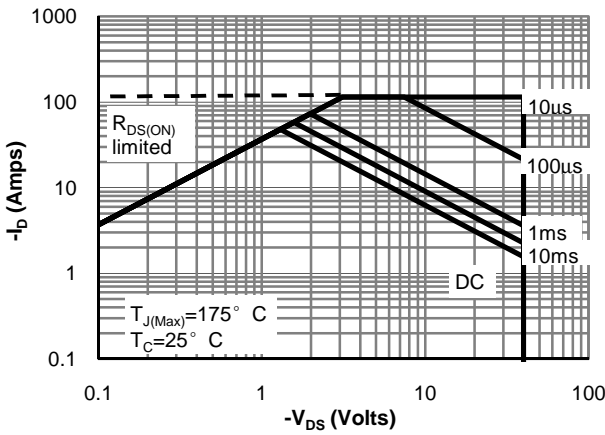
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

$T_{J(Max)}=175°C$
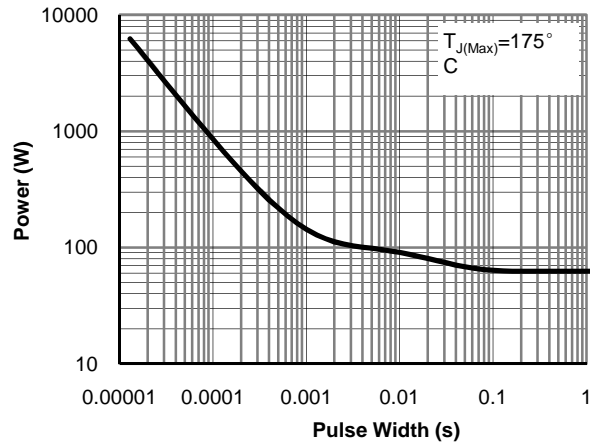
Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

$D=T_{on}/T$
$T_{J,PK}=T_c+P_{DM}\cdot Z_{\theta JC}\cdot R_{\theta JC}$
$R_{\theta JC}=2.4°C/W$

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
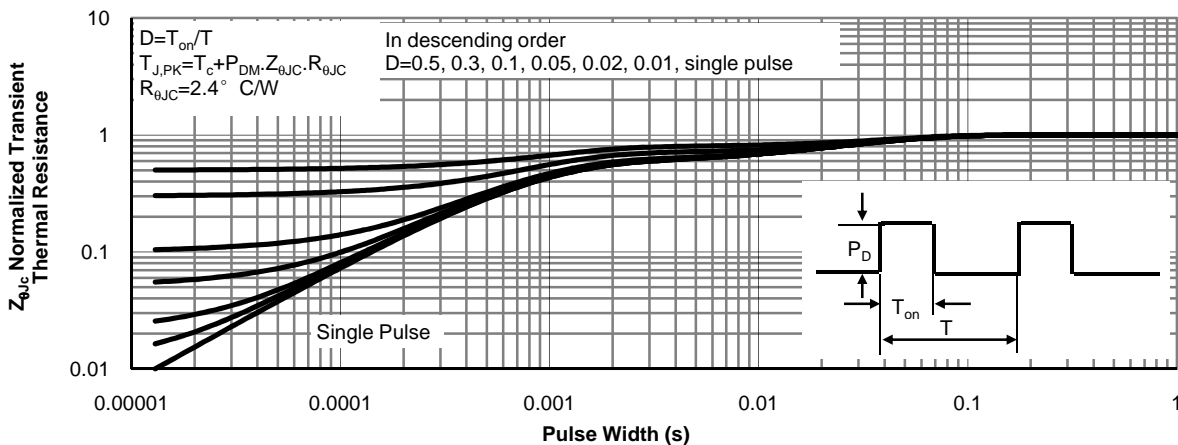
Single Pulse

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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
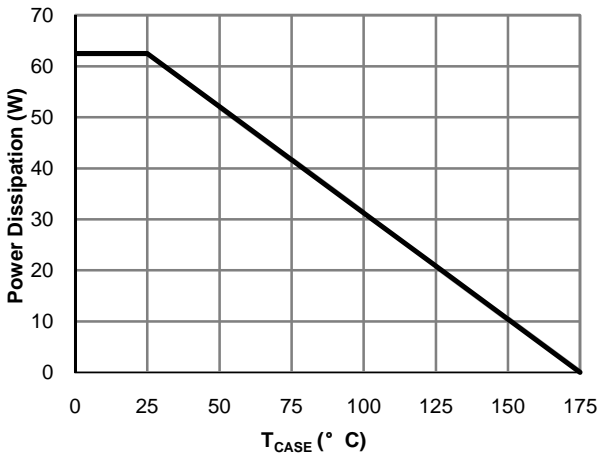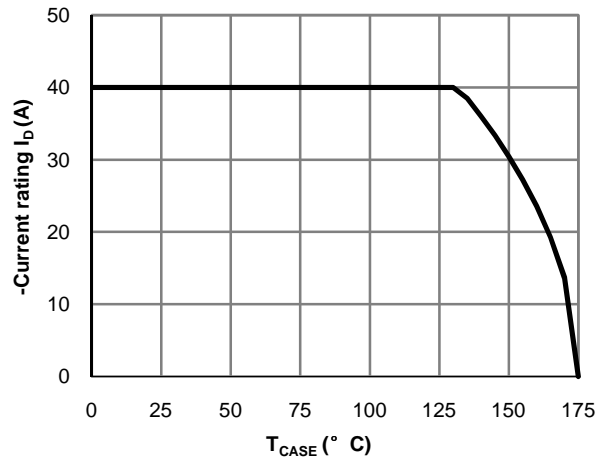
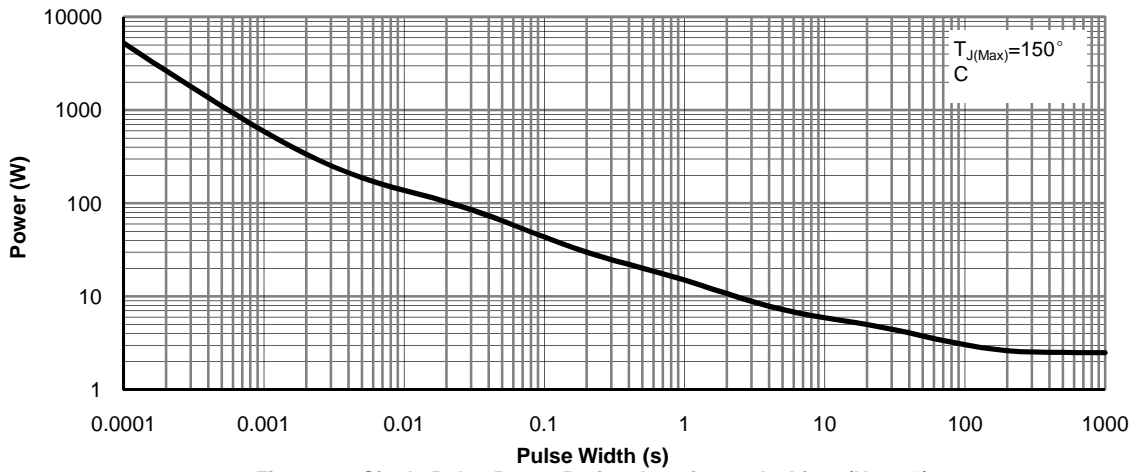**Figure 12: Power De-rating (Note B)**

Figure 13: Current De-rating (Note B)

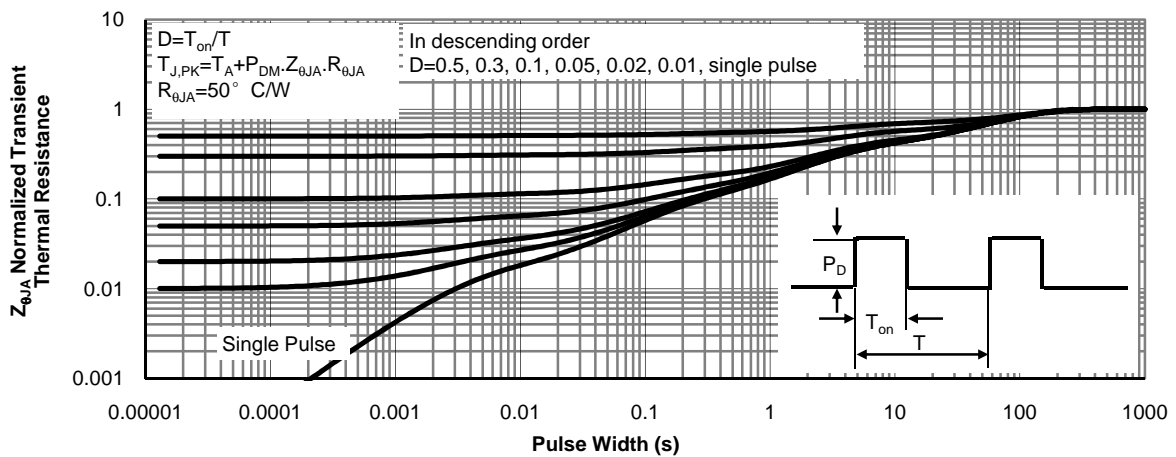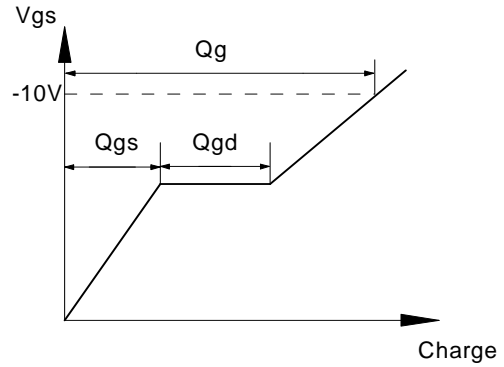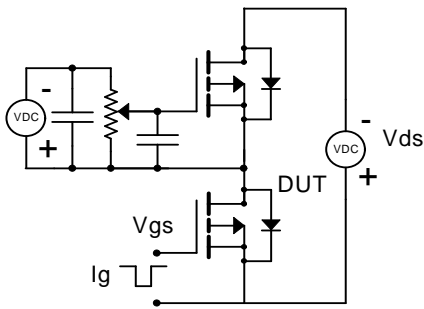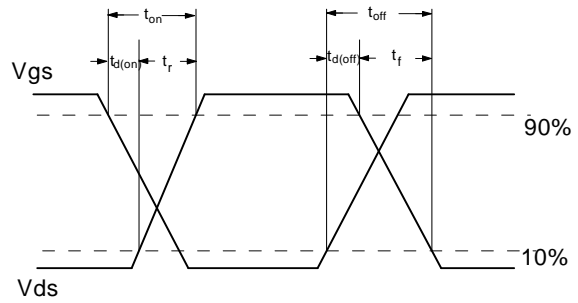**Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)**

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM} \cdot Z_{\theta JA} \cdot R_{\theta JA}$
$R_{\theta JA}=50^\circ C/W$

In descending order
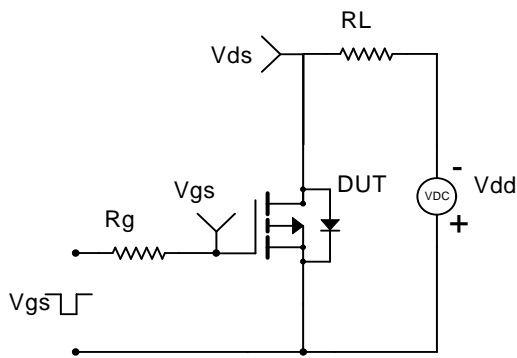D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse
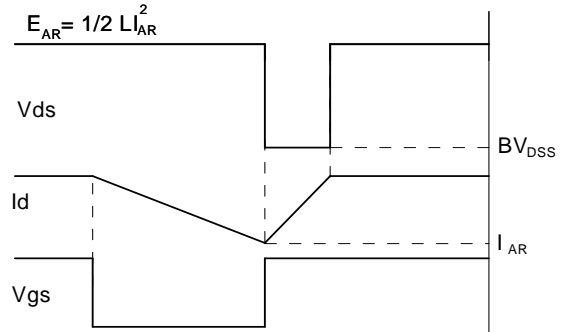
Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)
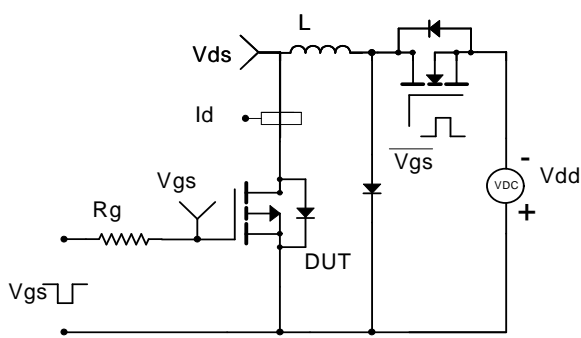
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$$E_{AR} = 1/2\, LI_{AR}^2$$

BV$_{DSS}$

I$_{AR}$

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int Idt$$