# UMW®

AOD4189
P-Channel MOSFET

Features

- $V_{DS\,(V)}$ = -40V
- I_D = -40A
- $R_{DS(ON)} <$ 22mΩ (V_{GS} =-10V)
- $R_{DS(ON)} <$ 29mΩ (V_{GS} =-4.5V)

1.G   2.D   3.S
TO-252(DPAK) top view

General Description

The AOD4189 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. With the excellent thermal resistance of the TO-252 package, this device is well suited for high current load applications.

Absolute Maximum Ratings T_C=25°C 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°C		-40	A
	T_C=100°C	I_D	-28	
Pulsed Drain Current [C]		I_{DM}	-50	
Avalanche Current [C]		I_{AR}	-35	
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	61	mJ
Power Dissipation [B]	T_C=25°C	P_D	62.5	W
	T_C=100°C		31	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.5	
	T_A=70°C		1.6	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

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

Electrical Characteristics (T$_J$=25°C 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°C			-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		-50			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-10V, I$_D$=-12A			18	22	mΩ
		V$_{GS}$=-4.5V, I$_D$=-8A			23	29	
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-12A			35		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-1A,V$_{GS}$=0V			-0.74	-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			1870		pF
C$_{oss}$	Output Capacitance				185		pF
C$_{rss}$	Reverse Transfer Capacitance				155		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz		2.5	4.5	6.5	Ω
SWITCHING PARAMETERS							
Q$_g$ (-10V)	Total Gate Charge	V$_{GS}$=-10V, V$_{DS}$=-20V, I$_D$=-12A			31.4	41	nC
Q$_g$ (-4.5V)	Total Gate Charge				7.9	10	
Q$_{gs}$	Gate Source Charge				7.6		nC
Q$_{gd}$	Gate Drain Charge				6.2		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-10V, V$_{DS}$=-20V, R$_L$=1.6Ω, R$_{GEN}$=3Ω			10		ns
t$_r$	Turn-On Rise Time				18		ns
t$_{D(off)}$	Turn-Off DelayTime				38		ns
t$_f$	Turn-Off Fall Time				24		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-12A, dI/dt=100A/μs			32	42	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-12A, dI/dt=100A/μs			30		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 impedance from junction to case R$_{θJC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using t ⩽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$_{J(MAX)}$=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.

P-Channel MOSFET

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
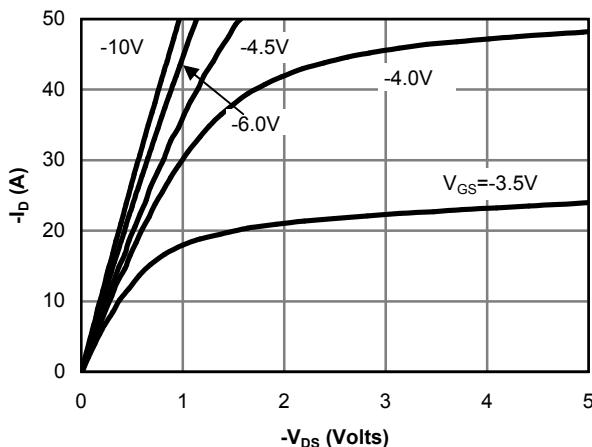
Figure 1: On-Region Characteristics
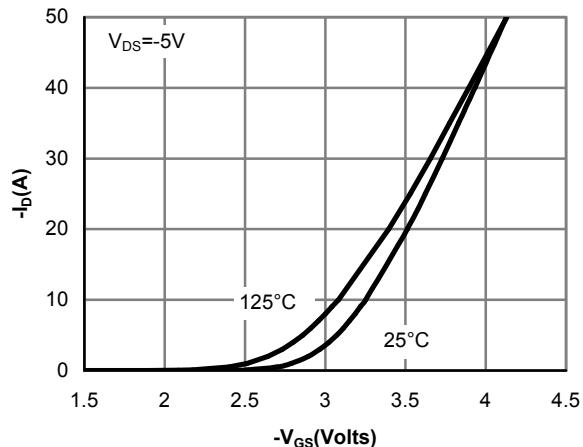
Figure 2: Transfer Characteristics
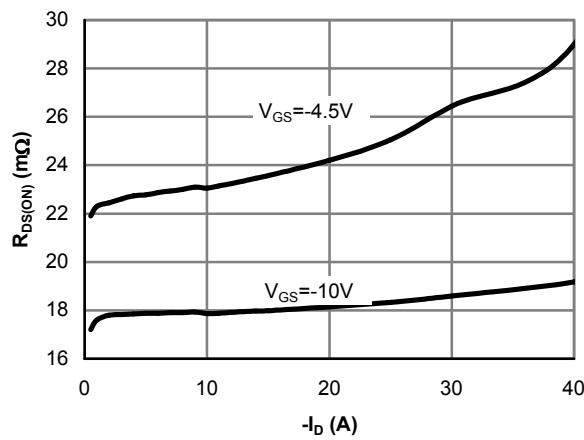
Figure 3: On-Resistance vs. Drain Current and Gate Voltage
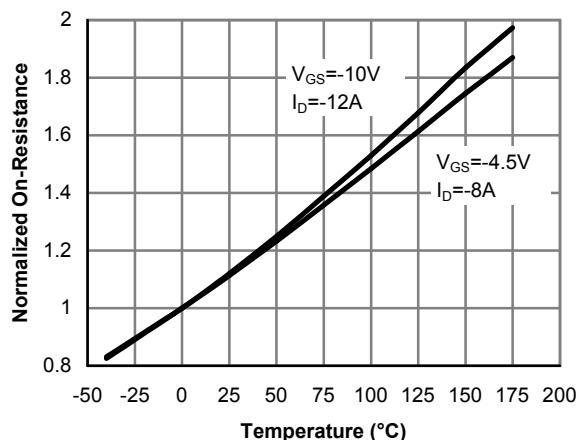
Figure 4: On-Resistance vs. Junction Temperature
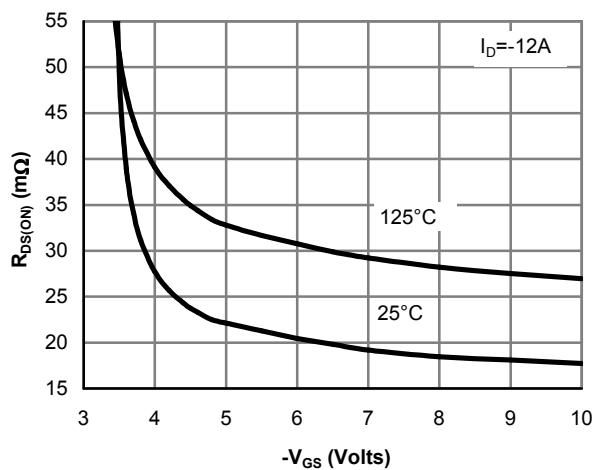
Figure 5: On-Resistance vs. Gate-Source Voltage
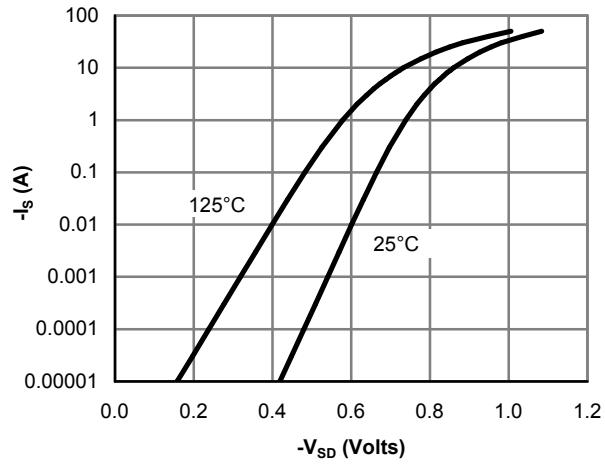
Figure 6: Body-Diode Characteristics

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
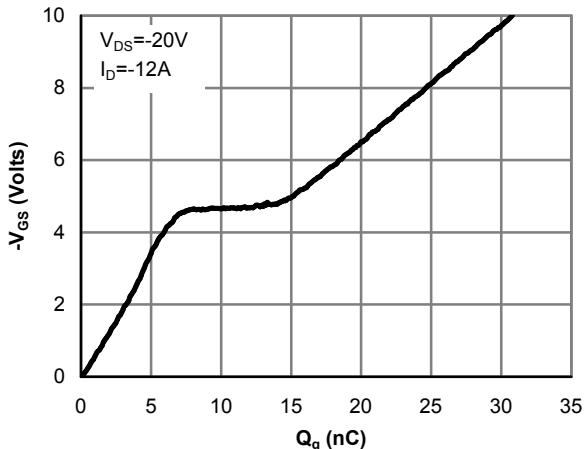
Figure 7: Gate-Charge Characteristics

V_{DS}=-20V
I_D=-12A
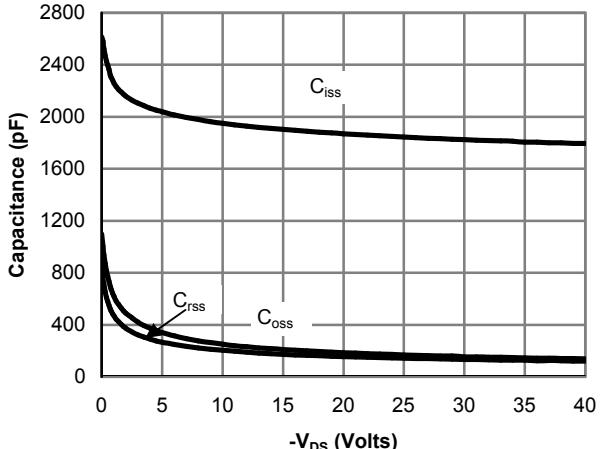
Figure 8: Capacitance Characteristics

C_{iss}
C_{rss}
C_{oss}
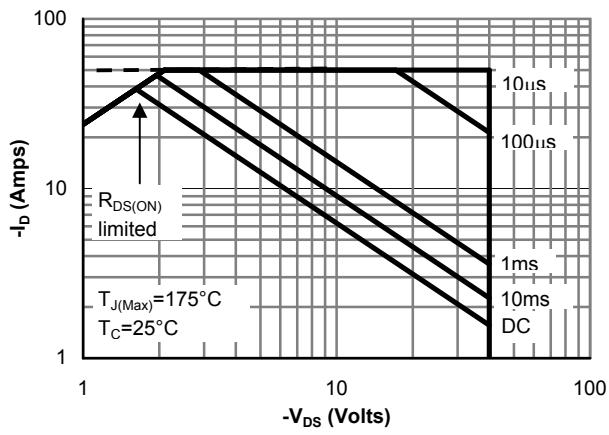
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

$R_{DS(ON)}$ limited

$T_{J(Max)}$=175°C
T_C=25°C

10μs
100μs
1ms
10ms
DC
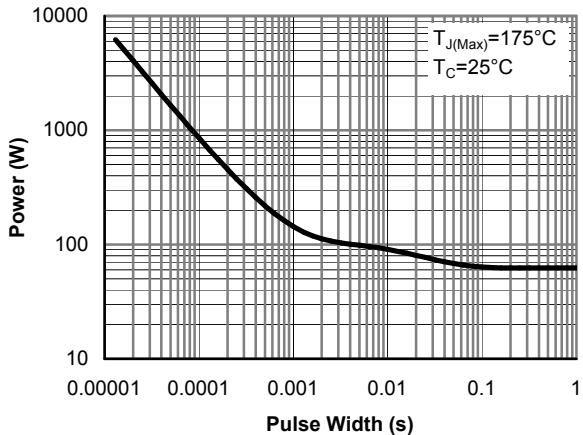
Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

$T_{J(Max)}$=175°C
T_C=25°C

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

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

Single Pulse

P_D
T_{on}
T
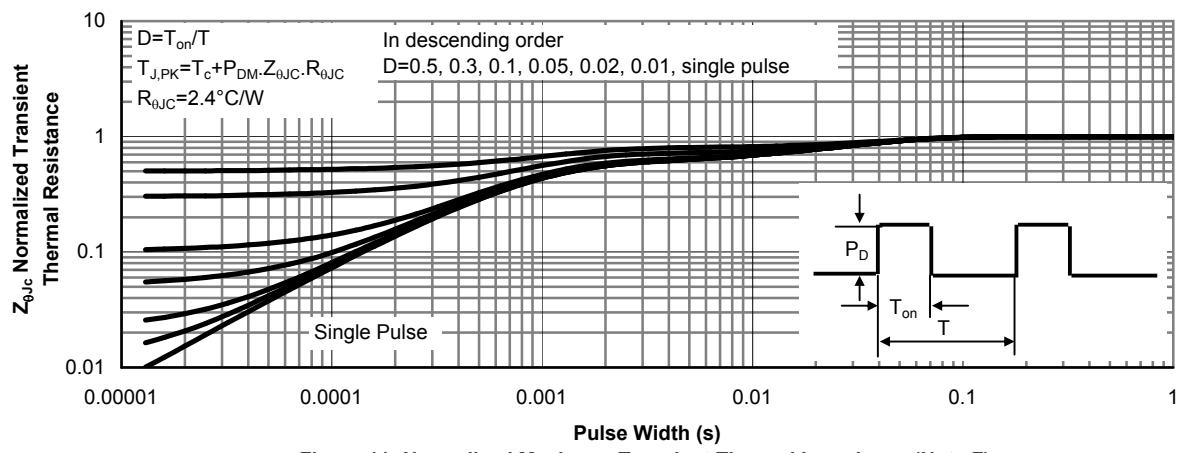
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
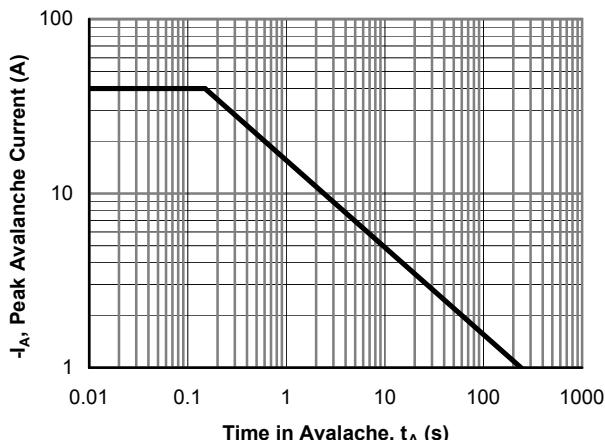
**Figure 12: Single Pulse Avalanche Capability**
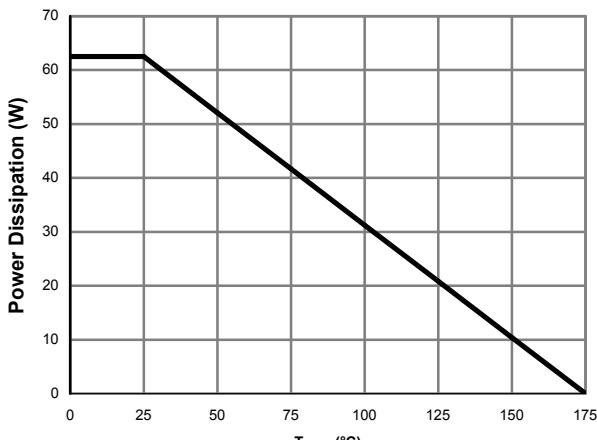
**Figure 13: Power De-rating (Note B)**
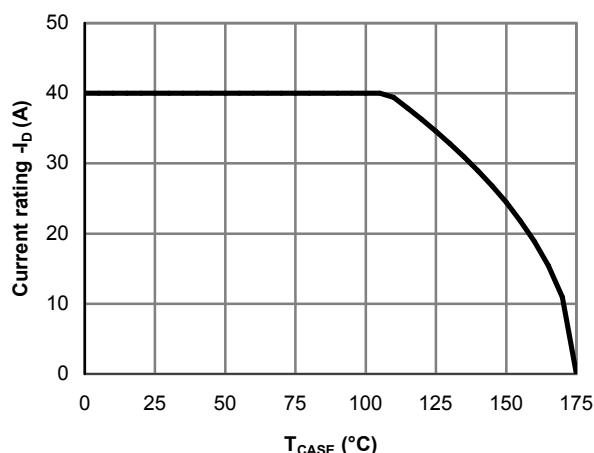
**Figure 14: Current De-rating (Note B)**
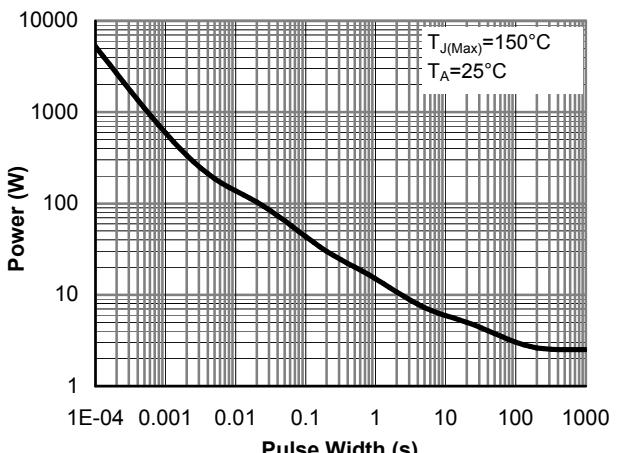
**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note G)**

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

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

Single Pulse

$T_{J(Max)} = 150°C$
$T_A = 25°C$
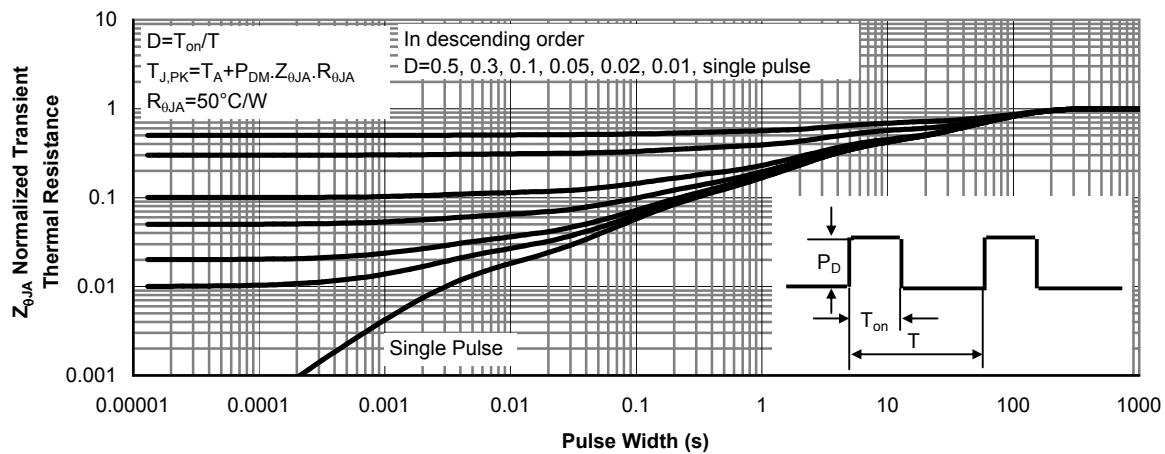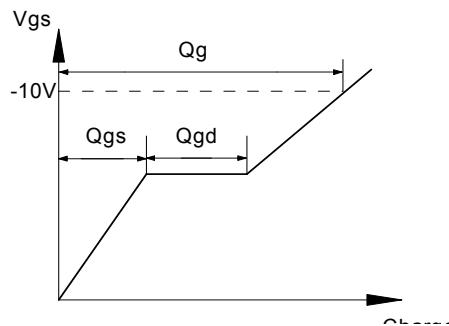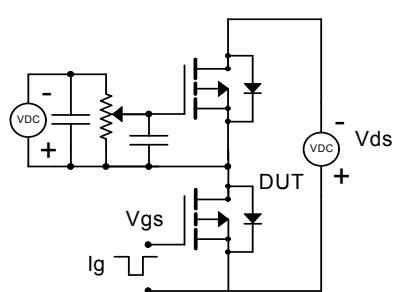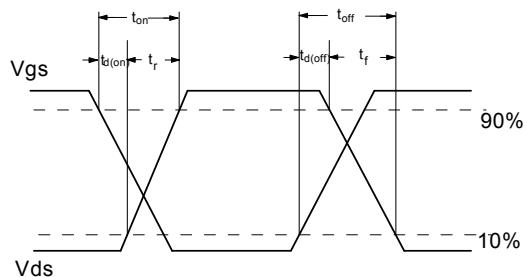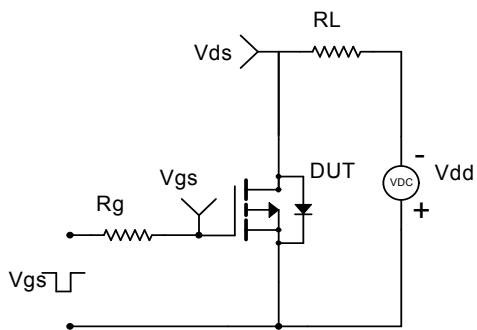
Figure 16: Normalized Maximum Transient Thermal Impedance (Note G)
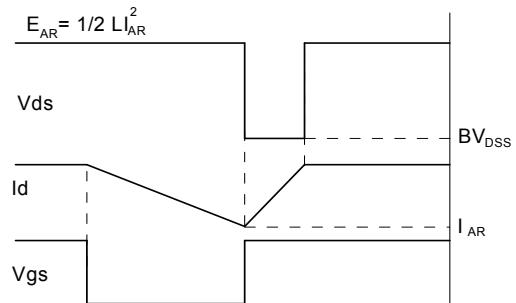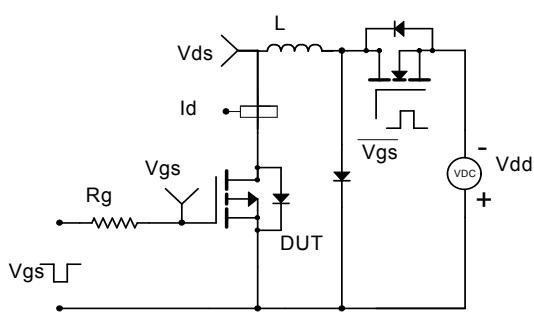
Gate Charge Test Circuit & Waveform

Q_g

-10V

Q_{gs} Q_{gd}

Charge
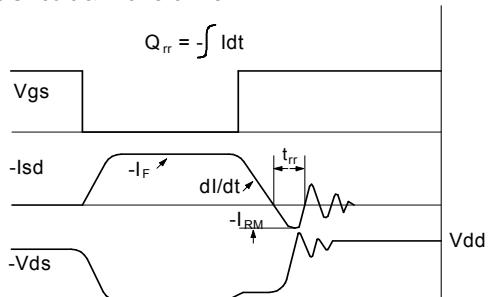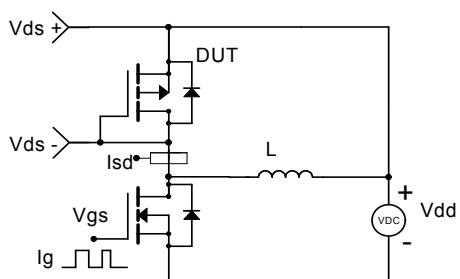
Resistive Switching Test Circuit & Waveforms

t_{on} t_{off}

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

90%

10%
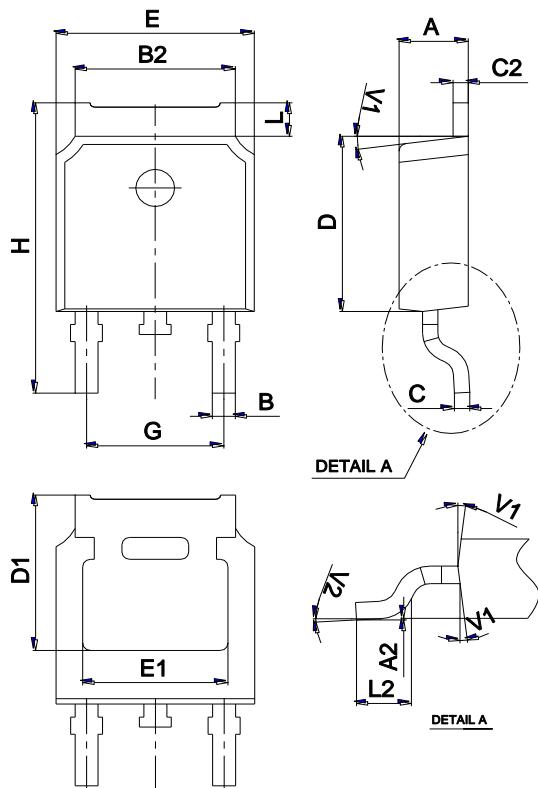
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

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

BV_{DSS}

I_{AR}

Diode Recovery Test Circuit & Waveforms

$Q_{rr} = -\int I dt$

$-I_F$

t_{rr}

dI/dt

$-I_{RM}$

V_{dd}
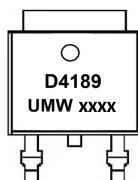
Package Mechanical Data TO-252

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

Marking

D4189
UMW xxxx

Ordering information

Order code	Package	Baseqty	Deliverymode
UMW AOD4189	TO-252	2500	Tape and reel

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