AOD446
N-Channel Enhancement Mode Field Effect Transistor

General Description

The AOD446 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate

charge. This device is suitable for use in PWM, load switching and general purpose applications.
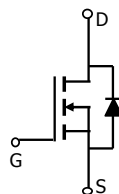
Features

V_{DS} (V) = 75V
I_D = 10 A (V_{GS} = 20V)
$R_{DS(ON)}$ < 130 mΩ (V_{GS} = 20V)
$R_{DS(ON)}$ < 140 mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 165 mΩ (V_{GS} = 4.5V)

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	75	V
Gate-Source Voltage		V_{GS}	±25	V
Continuous Drain Current [G]	T_C=25°C	I_D	10	A
	T_C=100°C		10	
Pulsed Drain Current [C]		I_{DM}	20	
Avalanche Current [C]		I_{AR}	10	A
Repetitive avalanche energy L=0.3mH [C]		E_{AR}	15	mJ
Power Dissipation [B]	T_C=25°C	P_D	20	W
	T_C=100°C		10	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.1	W
	T_A=70°C		1.3	
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]	t ≤ 10s	$R_{\theta JA}$	17.4	30	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		50	60	°C/W
Maximum Junction-to-Case [B]	Steady-State	$R_{\theta JC}$	4	7.5	°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$_D$=10mA, V$_{GS}$=0V		75			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=60V, 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	2.4	3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=10V, V$_{DS}$=5V		20			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=20V, I$_D$=5A			100	130	mΩ
			T$_J$=125°C		180	220	
		V$_{GS}$=10V, I$_D$=5A			105	140	mΩ
		V$_{GS}$=4.5V, I$_D$=2A			120	165	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=10A			9		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A, V$_{GS}$=0V			0.79	1	V
I$_S$	Maximum Body-Diode Continuous Current					10	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=30V, f=1MHz			293	350	pF
C$_{oss}$	Output Capacitance				51		pF
C$_{rss}$	Reverse Transfer Capacitance				20		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			2.2	3	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=37.5V, I$_D$=5A			5.2	6.5	nC
Q$_g$(4.5V)	Total Gate Charge				2.46	3.5	nC
Q$_{gs}$	Gate Source Charge				1		nC
Q$_{gd}$	Gate Drain Charge				1.34		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=37.5V, R$_L$=7.5Ω, R$_{GEN}$=3Ω			4.6		ns
t$_r$	Turn-On Rise Time				2.3		ns
t$_{D(off)}$	Turn-Off DelayTime				14.7		ns
t$_f$	Turn-Off Fall Time				1.7		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=5A, dI/dt=100A/μs			25	30	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=5A, dI/dt=100A/μs			27		nC

A: The value of R$_{θJA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25°C. The Power dissipation P$_{DSM}$ is based on R$_{θJA}$ and the maximum allowed junction temperature of 150°C. The value in any a given application depends on the user's specific board design, and the maximum temperature fo 175°C may be used if the PCB allows it.

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 impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=175°C.

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

H. 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. The SOA curve provides a single pulse rating.

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

Rev3: Sep 2008
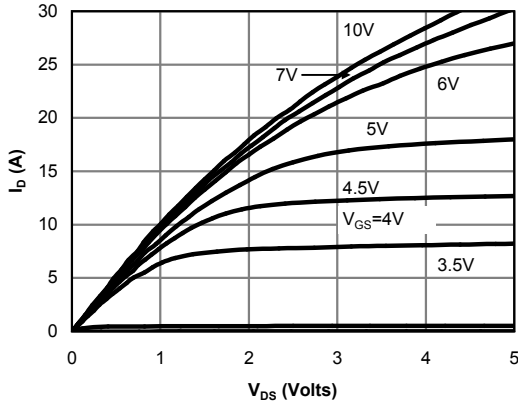
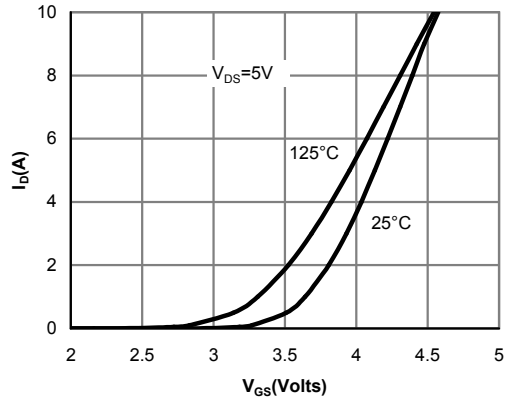## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

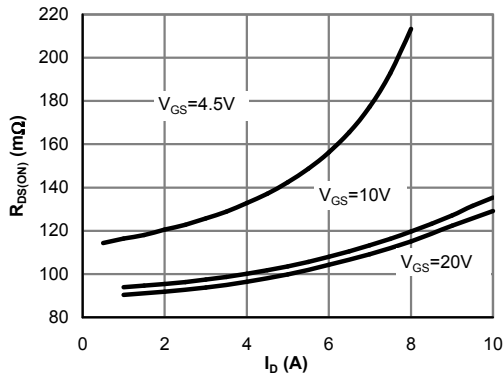**Fig 1: On-Region Characteristics**

Figure 2: Transfer Characteristics

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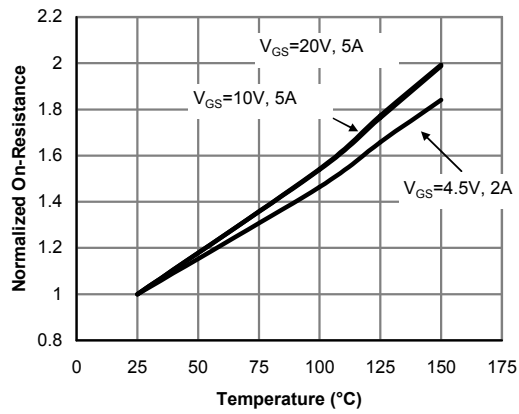

Figure 4: On-Resistance vs. Junction Temperature
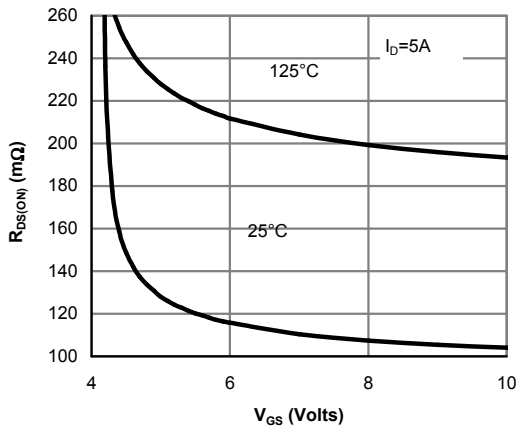

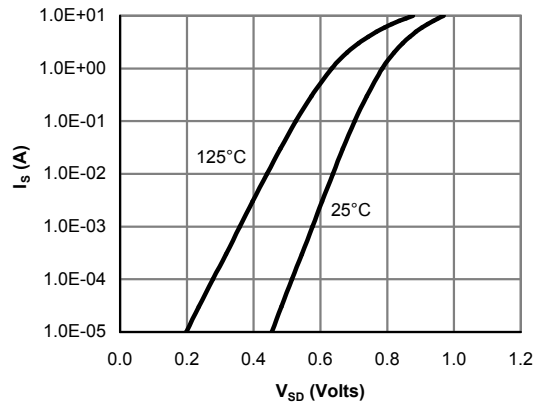**Figure 5: On-Resistance vs. Gate-Source Voltage**

Figure 6: Body-Diode Characteristics
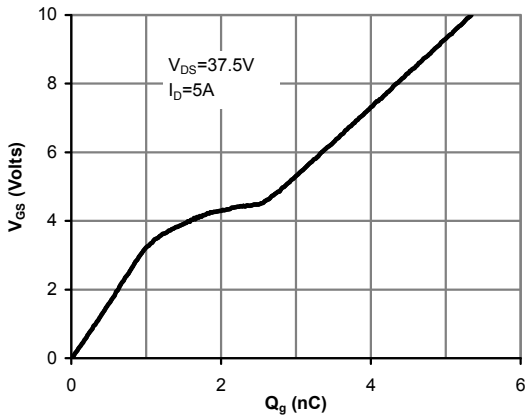
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
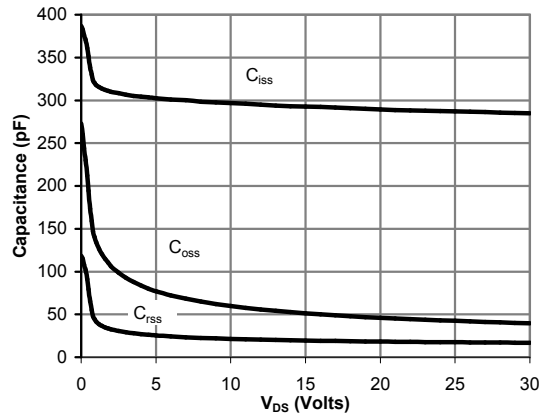

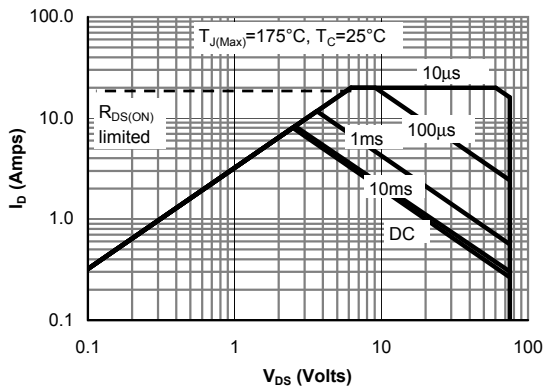Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)
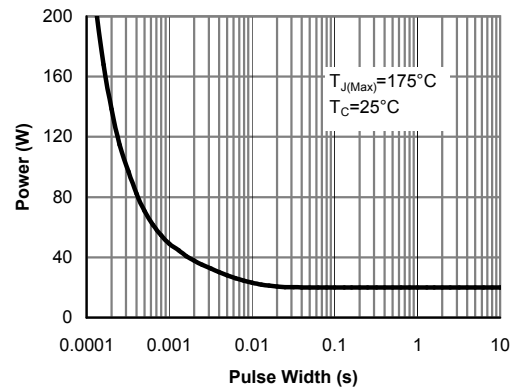
Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)
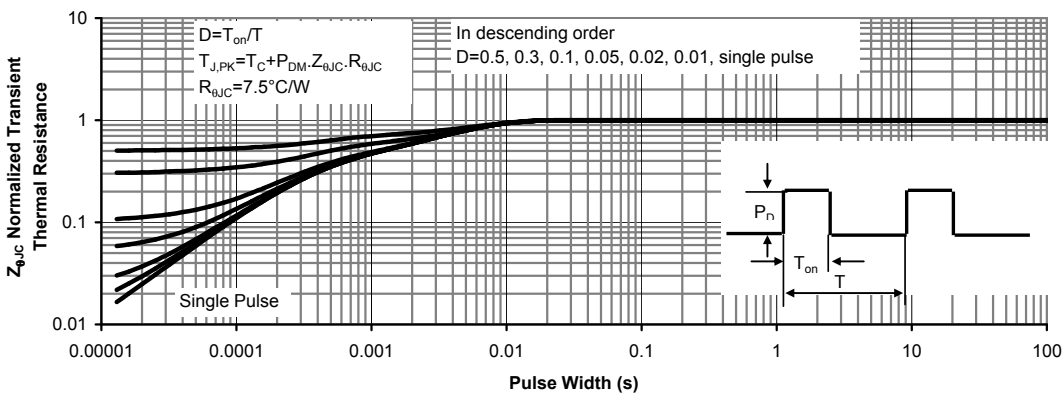
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$$t_A = \frac{L \cdot I_D}{BV - V_{DD}}$$
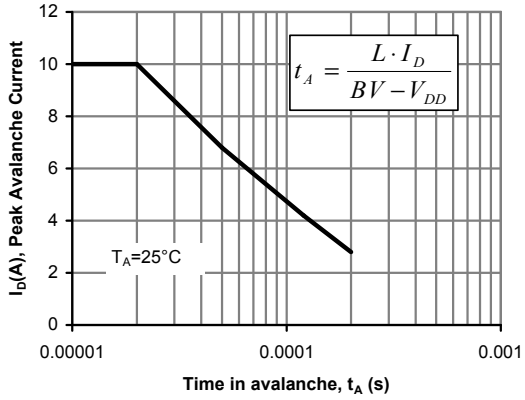
Figure 12: Single Pulse Avalanche capability
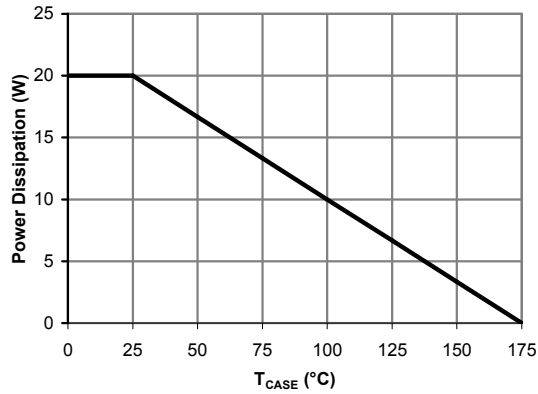
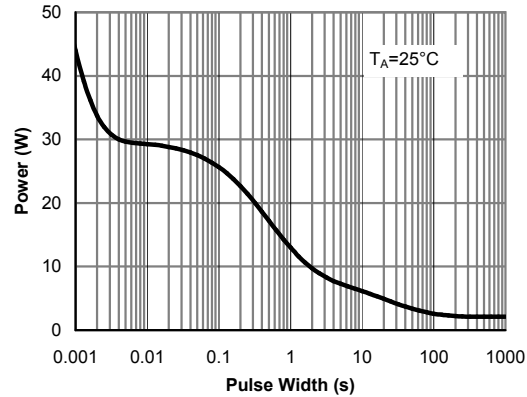**Figure 13: Power De-rating (Note B)**
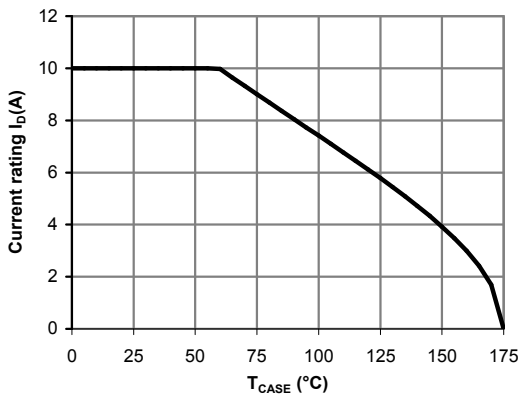
Figure 14: Current De-rating (Note B)

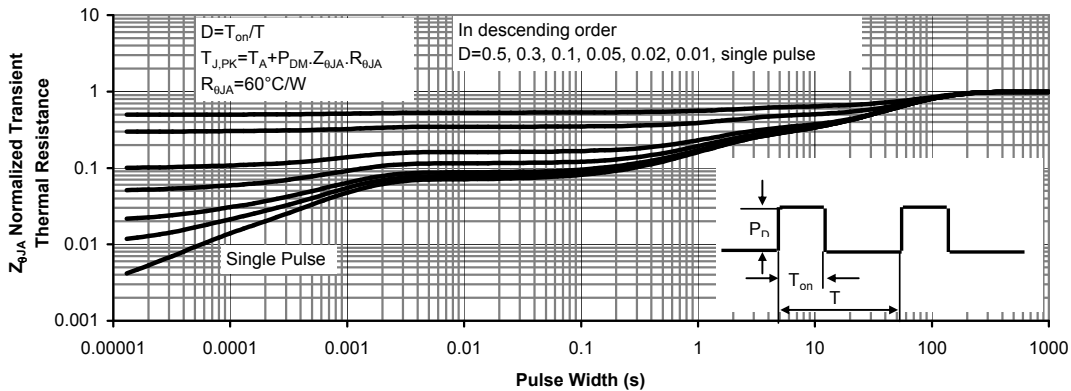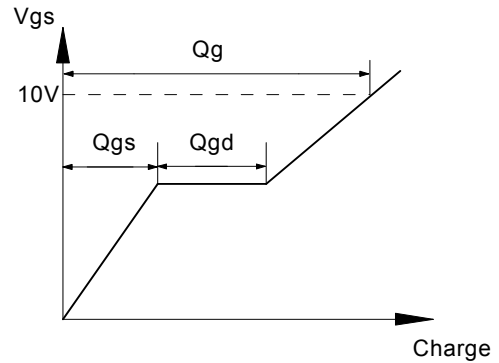**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)**
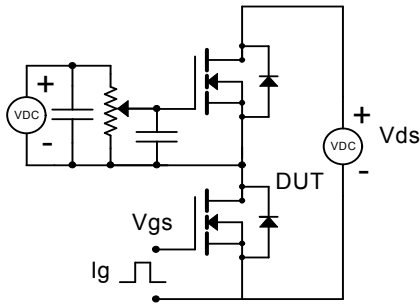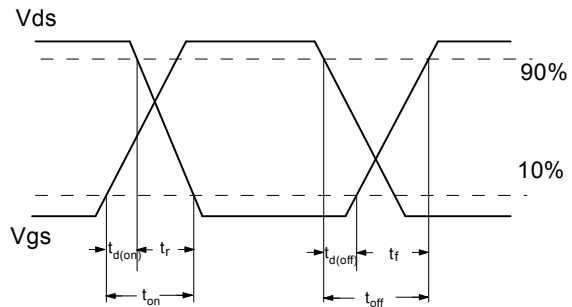
$D = T_{on}/T$
$T_{J,PK} = T_A + P_{DM} \cdot Z_{\theta JA} \cdot R_{\theta JA}$
$R_{\theta JA} = 60°C/W$

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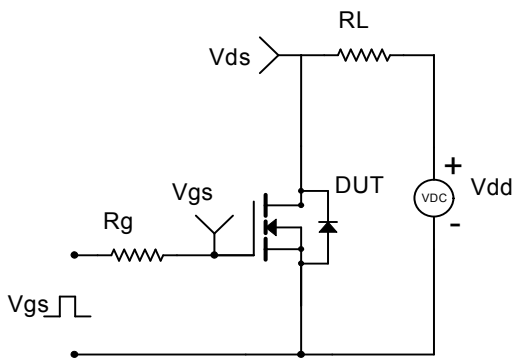D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)
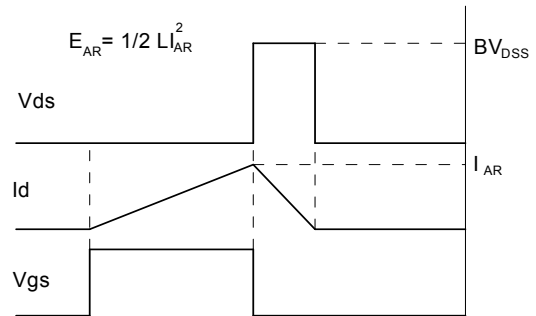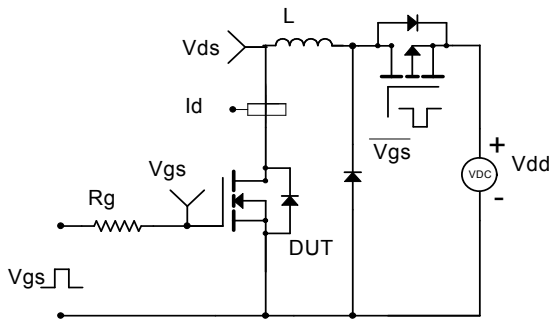
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

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

Diode Recovery Test Circuit & Waveforms

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