

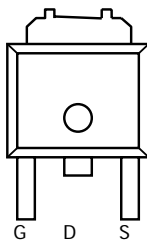
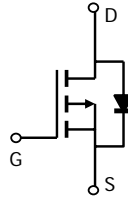
AOD409
P-Channel Enhancement Mode Field Effect Transistor

General Description

The AOD409 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and low gate resistance. With the excellent thermal resistance of the DPAK package, this device is well suited for high current load applications. *Standard Product AOD409 is Pb-free (meets ROHS & Sony 259 specifications). AOD409L is a Green Product ordering option. AOD409 and AOD409L are electrically identical.*

Features

V_{DS} (V) = -60V
 I_D = -26A (V_{GS} = -10V)
 $R_{DS(ON)} < 40m\Omega$ (V_{GS} = -10V) @ -20A
 $R_{DS(ON)} < 55m\Omega$ (V_{GS} = -4.5V)

 TO-252
 D-PAK

 Top View
 Drain Connected to
 Tab

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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	-60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^G	I_D	$T_C=25^\circ\text{C}$	-26
		$T_C=100^\circ\text{C}$	-18
Pulsed Drain Current ^C	I_{DM}	-60	A
Avalanche Current ^C	I_{AR}	-26	A
Repetitive avalanche energy $L=0.1\text{mH}$ ^C	E_{AR}	134	mJ
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	60
		$T_C=100^\circ\text{C}$	30
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ\text{C}$	2.5
		$T_A=70^\circ\text{C}$	1.6
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	$t \leq 10\text{s}$	16.7	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		Steady-State	40	50
Maximum Junction-to-Case ^C	$R_{\theta JC}$	1.9	2.5	$^\circ\text{C/W}$

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-60			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-48\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$		-0.003	-1	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.2	-1.9	-2.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	-60			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$, $I_D=-20\text{A}$ $T_J=125^\circ\text{C}$		32	40	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$, $I_D=-20\text{A}$		53		$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-20\text{A}$		32		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.73	-1	V
I_S	Maximum Body-Diode Continuous Current				-30	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-30\text{V}$, $f=1\text{MHz}$		2977	3600	pF
C_{oss}	Output Capacitance			241		pF
C_{rss}	Reverse Transfer Capacitance			153		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		2	2.4	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $I_D=-20\text{A}$		44	54	nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			22.2	28	nC
Q_{gs}	Gate Source Charge			9		nC
Q_{gd}	Gate Drain Charge			10		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $R_L=1.5\Omega$, $R_{GEN}=3\Omega$		12		ns
t_r	Turn-On Rise Time			14.5		ns
$t_{D(off)}$	Turn-Off DelayTime			38		ns
t_f	Turn-Off Fall Time			15		ns
t_{rr}	Body Diode Reverse Recovery Time		$I_F=-20\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		40	50
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-20\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		59		nC

A: The value of R_{qJA} is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The Power dissipation PDSM is based on R_{qJA} and the maximum allowed junction temperature of 150°C . The value in any given application depends on the user's specific board design, and the maximum temperature of 175°C may be used if the PCB allows it.

B: The power dissipation PD is based on $T_J(\text{MAX})=175^\circ\text{C}$, 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 $T_J(\text{MAX})=175^\circ\text{C}$.

D: The R_{qJA} is the sum of the thermal impedance from junction to case R_{qJC} and case to ambient.

E: The static characteristics in Figures 1 to 6 are obtained using <300 ms 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 $T_J(\text{MAX})=175^\circ\text{C}$.

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 $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

Rev 3: June 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

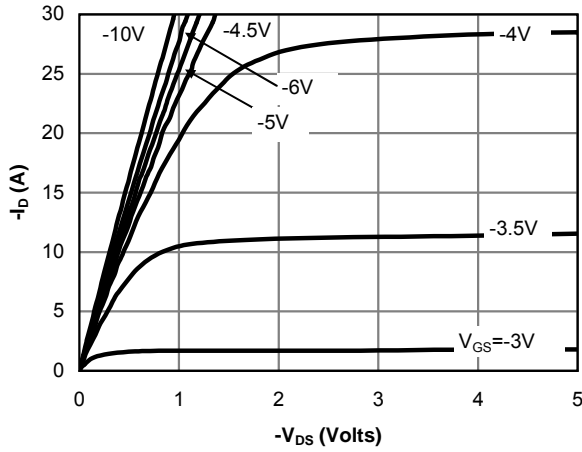


Fig 1: On-Region Characteristics

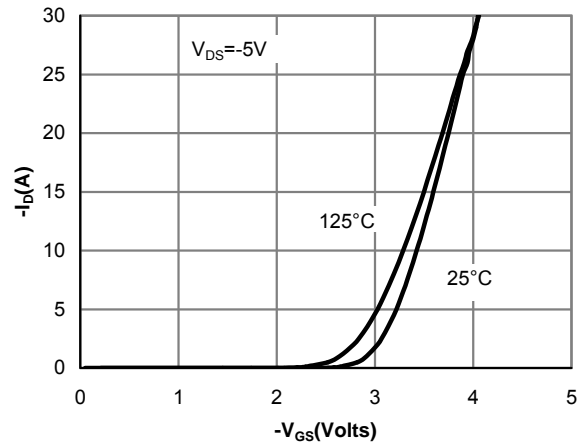


Figure 2: Transfer Characteristics

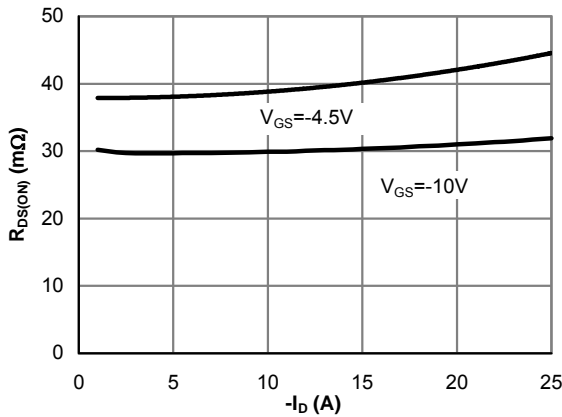


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

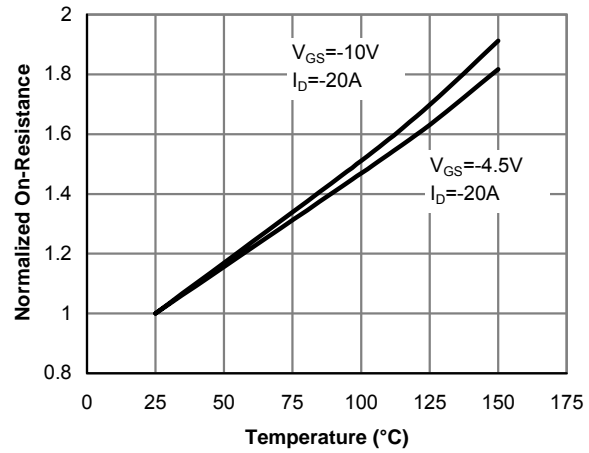


Figure 4: On-Resistance vs. Junction Temperature

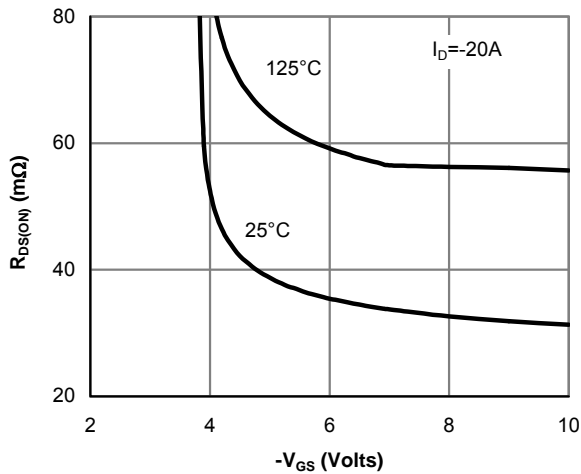


Figure 5: On-Resistance vs. Gate-Source Voltage

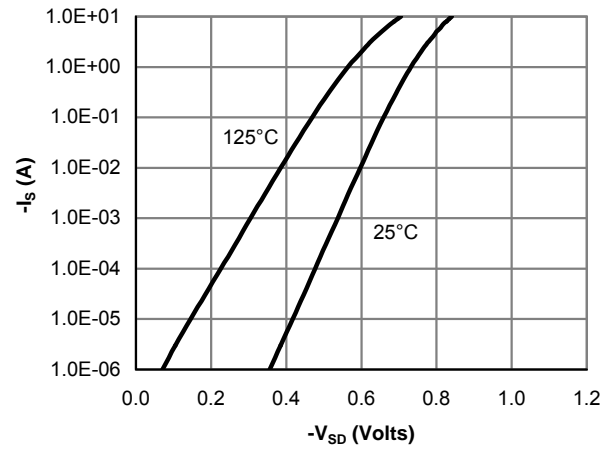


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

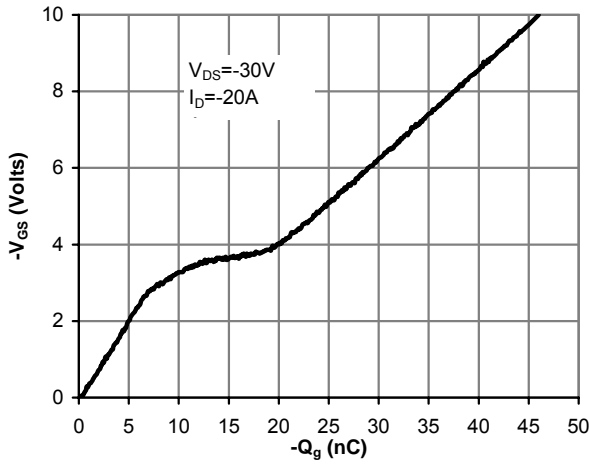


Figure 7: Gate-Charge Characteristics

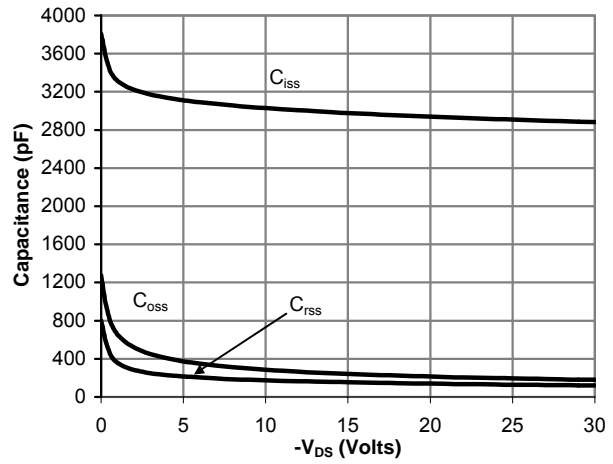


Figure 8: Capacitance Characteristics

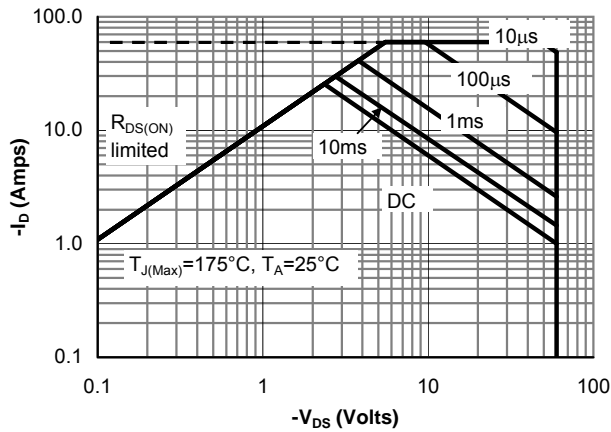


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

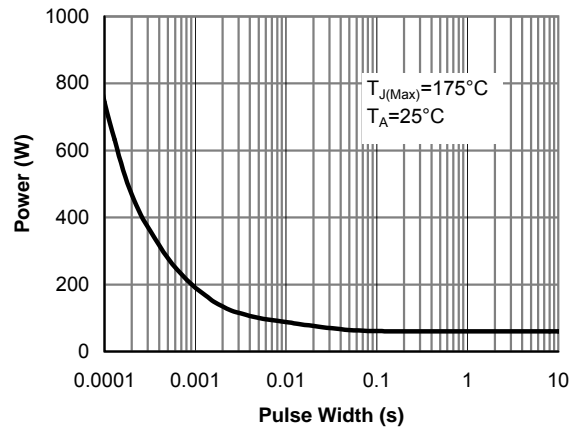


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

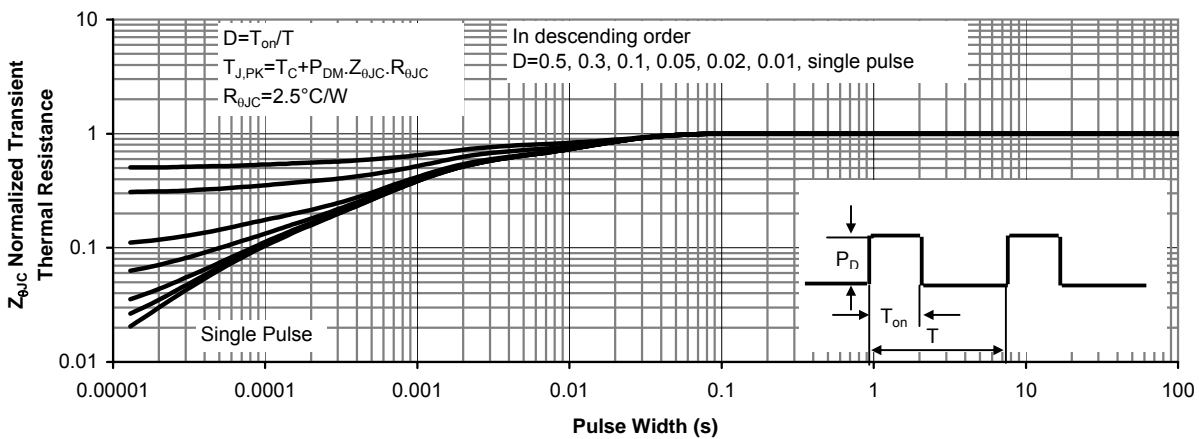


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

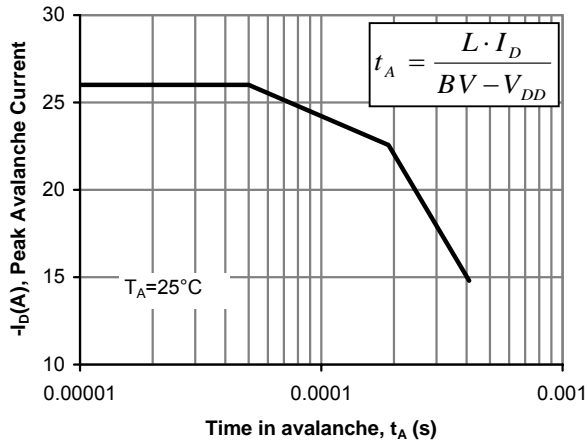


Figure 12: Single Pulse Avalanche capability

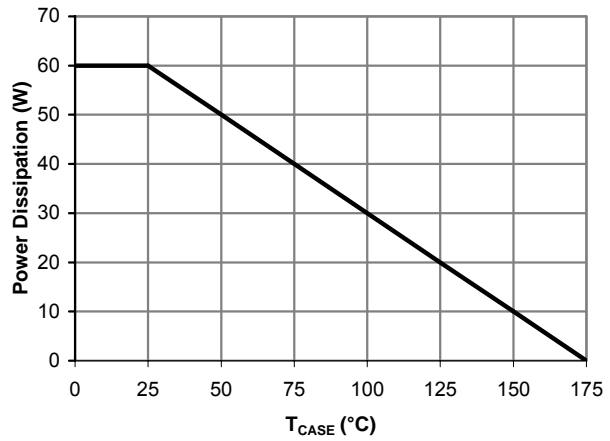


Figure 13: Power De-rating (Note B)

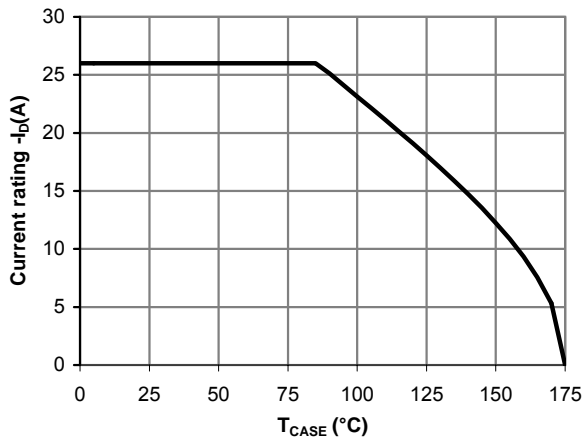


Figure 14: Current De-rating (Note B)

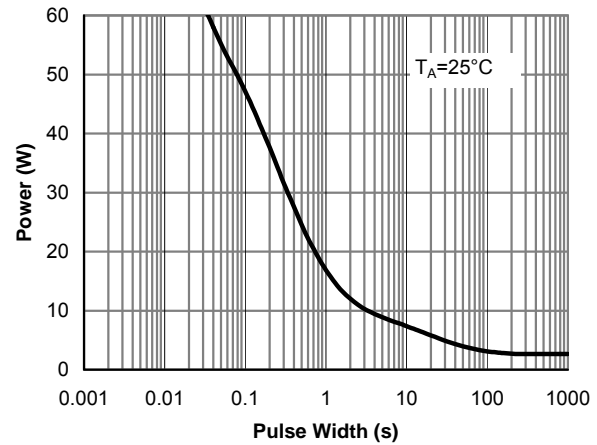


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

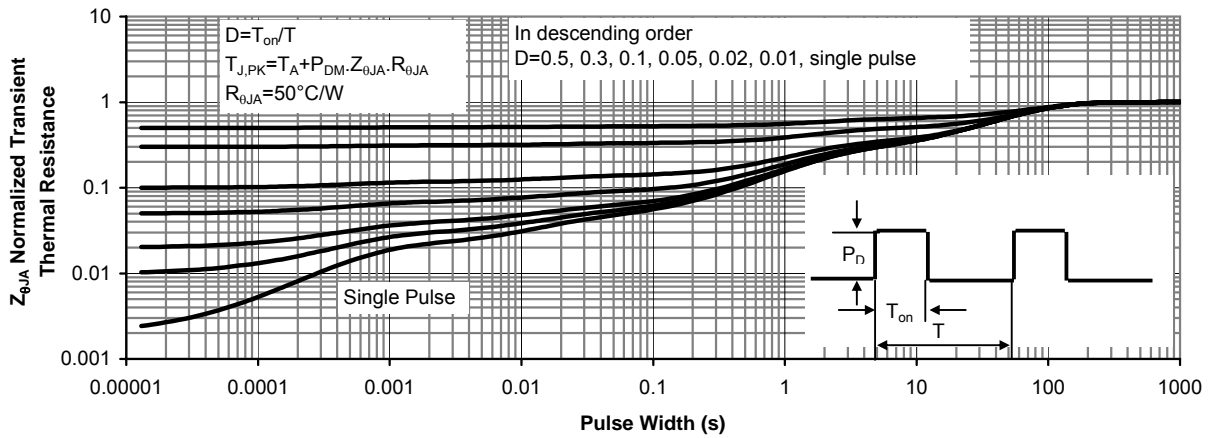


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)