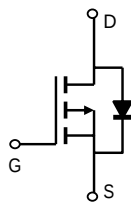
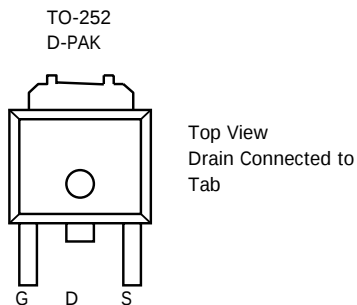


**AOD413****P-Channel Enhancement Mode Field Effect Transistor****General Description**

The AOD413 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 AOD413 is Pb-free (meets ROHS & Sony 259 specifications). AOD413L is a Green Product ordering option. AOD413 and AOD413L are electrically identical.*

Features

V_{DS} (V) = -40V
 I_D = -12A (V_{GS} = -10V)
 $R_{DS(ON)}$ < 45m Ω (V_{GS} = -10V)
 $R_{DS(ON)}$ < 69m Ω (V_{GS} = -4.5V)

**Absolute Maximum Ratings** $T_A=25^\circ\text{C}$ 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,G}	I_D	-12	A
$T_A=25^\circ\text{C}$ ^G		-12	
$T_A=100^\circ\text{C}$ ^G	I_{DM}	-30	
Pulsed Drain Current	I_{AR}	-12	A
Avalanche Current ^C	E_{AR}	30	mJ
Repetitive avalanche energy L=0.1mH ^C	P_D	50	W
$T_C=25^\circ\text{C}$		25	
Power Dissipation ^B	P_{DSM}	2.5	W
$T_C=100^\circ\text{C}$		1.6	
Power Dissipation ^A	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	16.7	25	$^\circ\text{C/W}$
$t \leq 10\text{s}$		40	50	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	$R_{\theta JL}$	2.5	3	$^\circ\text{C/W}$
Steady-State				
Maximum Junction-to-Case ^C				

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	-40			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-32V, V _{GS} =0V T _J =55°C			-1 -5	μA
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	-1.9	-3	V
I _{D(ON)}	On state drain current	V _{GS} =-10V, V _{DS} =-5V	-30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-10V, I _D =-12A T _J =125°C		36 56	45 70	mΩ
		V _{GS} =-4.5V, I _D =-8A		51	69	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-12A		16		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V		-0.75	-1	V
I _S	Maximum Body-Diode Continuous Current				-12	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-20V, f=1MHz		657	850	pF
C _{oss}	Output Capacitance			143	185	pF
C _{rss}	Reverse Transfer Capacitance			63	90	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		6.5		Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge (10V)	V _{GS} =-10V, V _{DS} =-20V, I _D =-12A		14.1		nC
Q _g (4.5V)	Total Gate Charge (4.5V)			7		nC
Q _{gs}	Gate Source Charge			2.2		nC
Q _{gd}	Gate Drain Charge			4.1		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-10V, V _{DS} =-20V, R _L =1.7Ω, R _{GEN} =3Ω		8		ns
t _r	Turn-On Rise Time			12.2		ns
t _{D(off)}	Turn-Off DelayTime			24		ns
t _f	Turn-Off Fall Time			12.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-12A, dI/dt=100A/μs		23.2		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-12A, dI/dt=100A/μs		18.2		nC

A: The value of R qJA 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 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(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 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(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.

Rev 3: Jan 2006

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

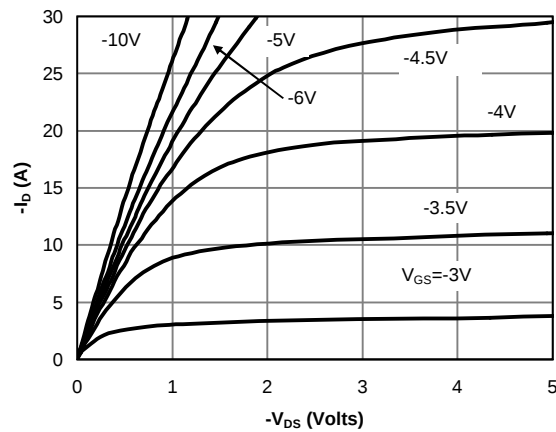


Fig 1: On-Region Characteristics

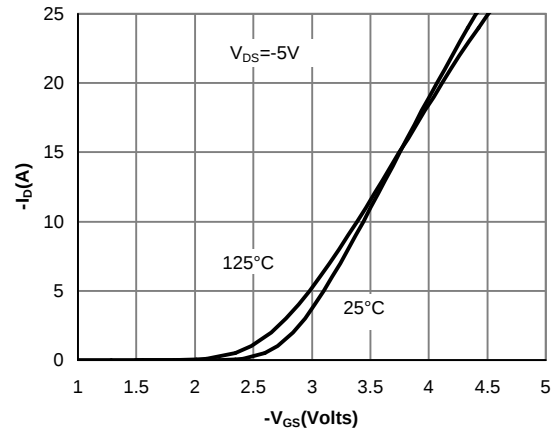


Figure 2: Transfer Characteristics

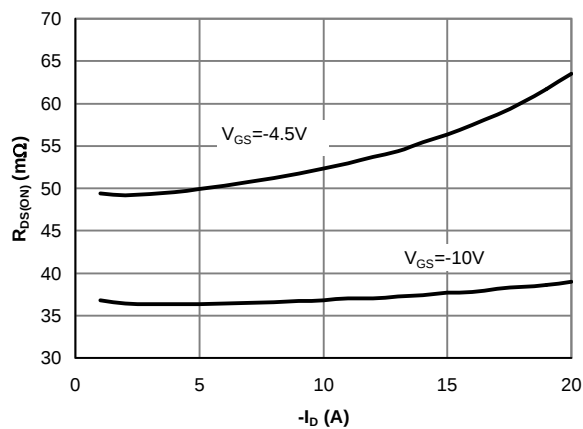


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

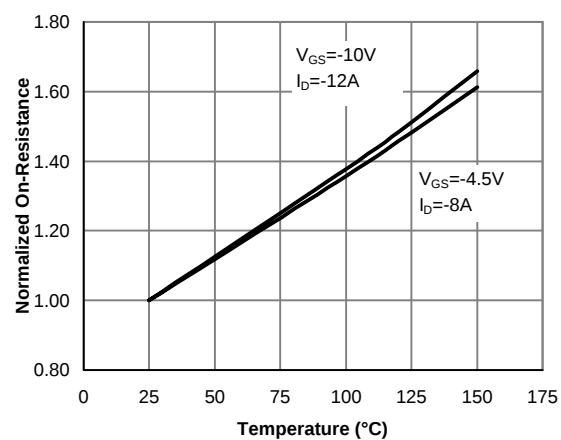


Figure 4: On-Resistance vs. Junction Temperature

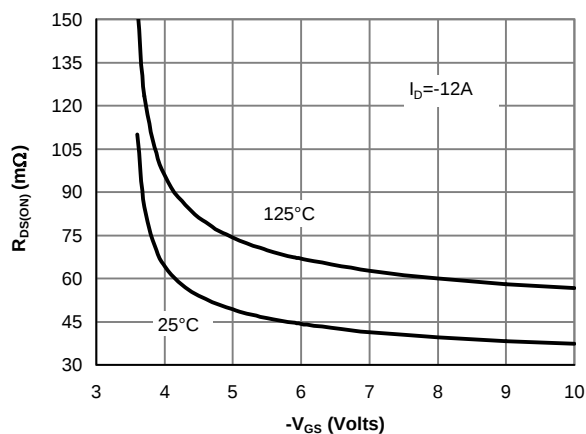


Figure 5: On-Resistance vs. Gate-Source Voltage

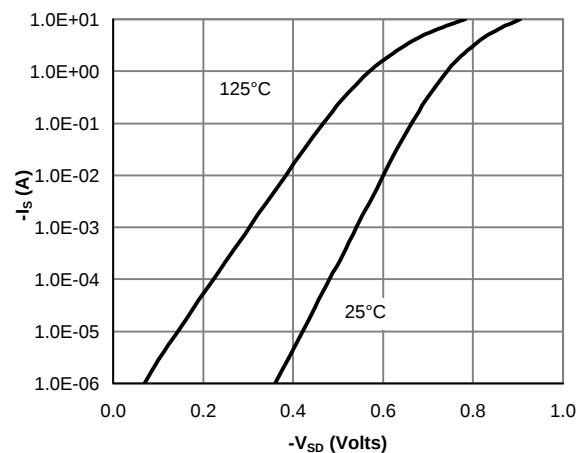
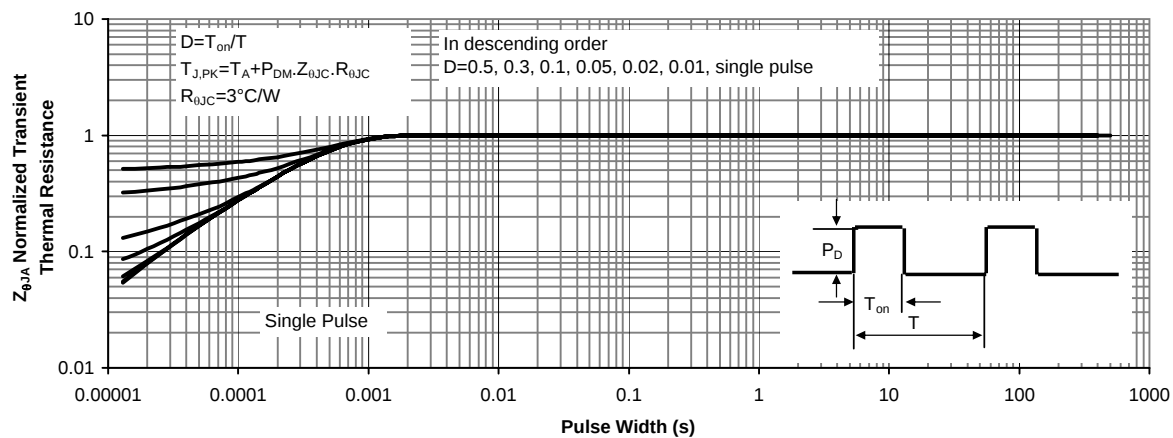
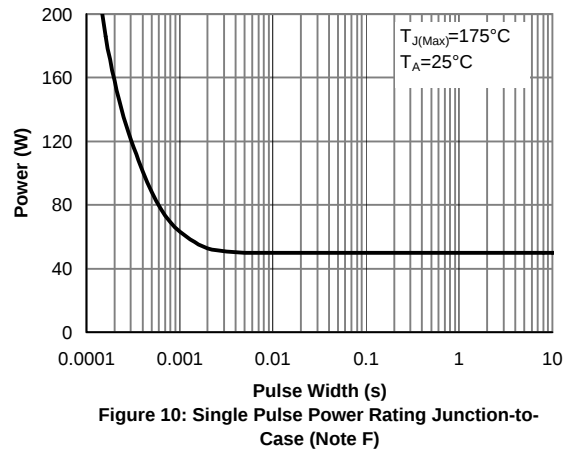
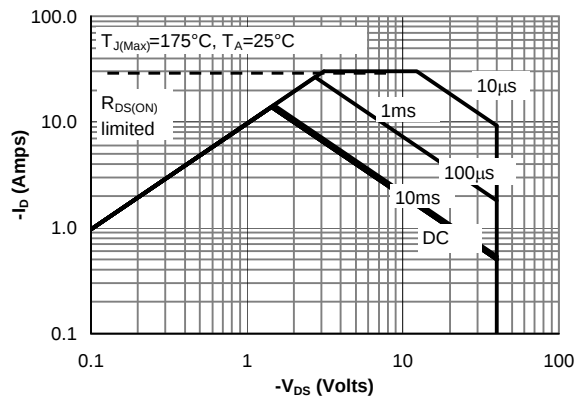
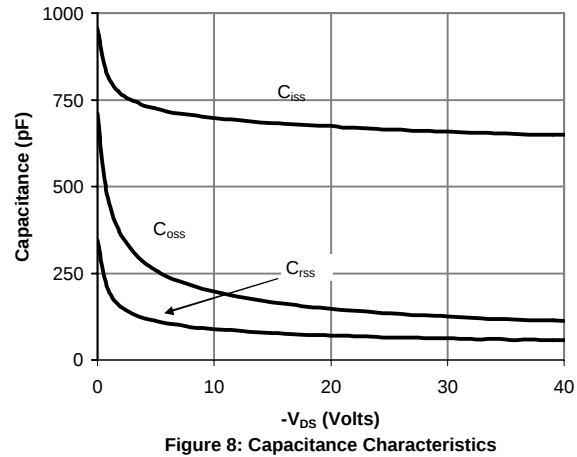
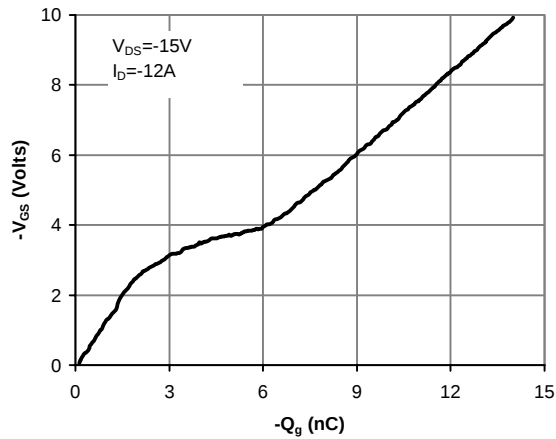


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

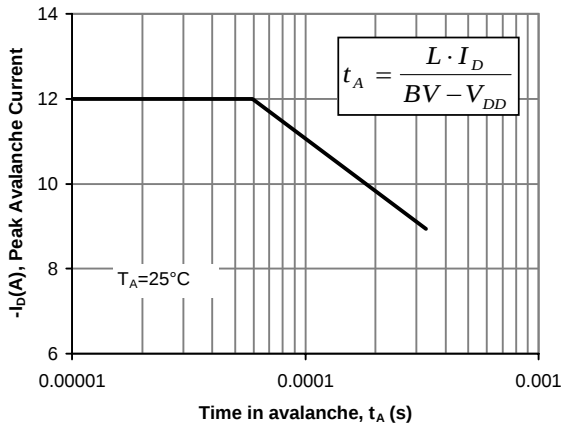


Figure 12: Single Pulse Avalanche capability

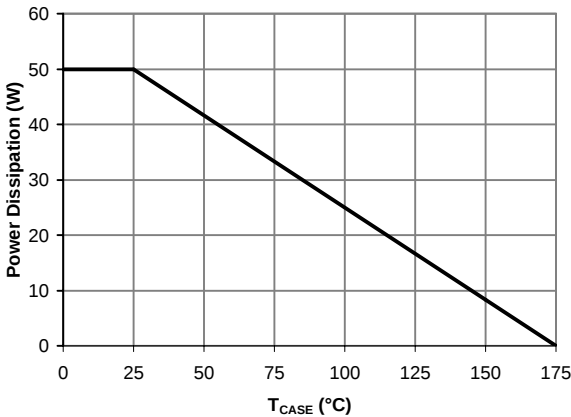


Figure 13: Power De-rating (Note B)

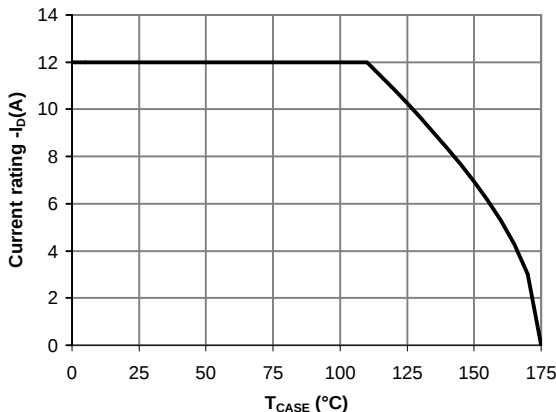


Figure 14: Current De-rating (Note B)

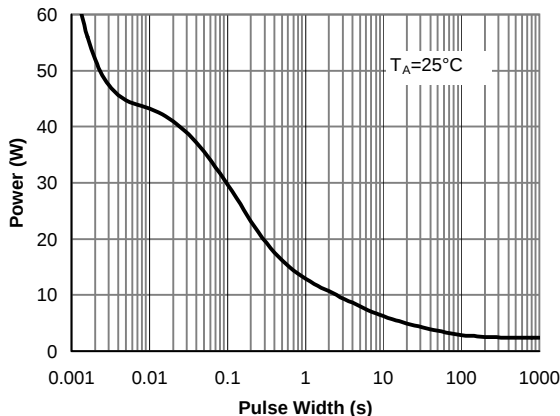


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

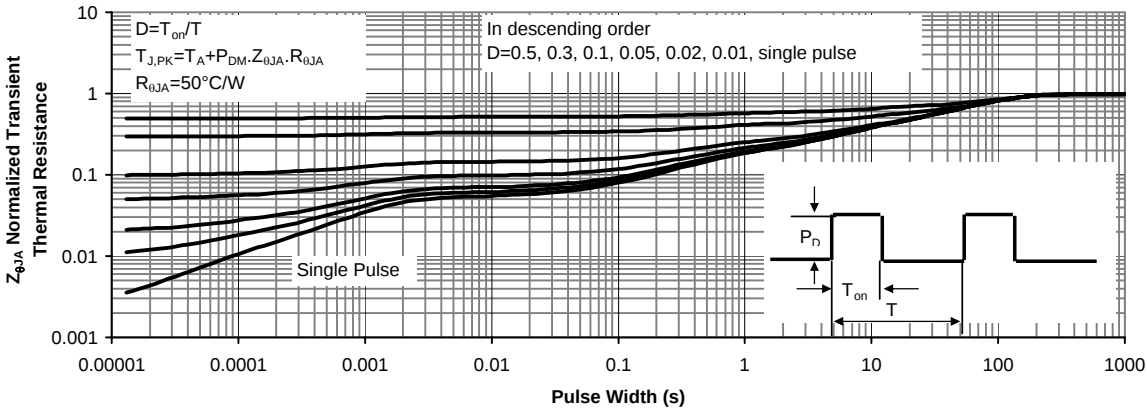


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)