ALPHA & OMEGA SEMICONDUCTOR, INC.

Jan 2004

AOD405
P-Channel Enhancement Mode Field Effect Transistor

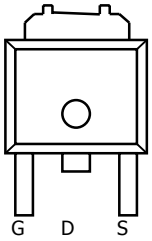
General Description

The AOD405 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate chargeand low gate resistance. With the excellent thermal resistance of the DPAK package, this device is well suited for high current load applications.

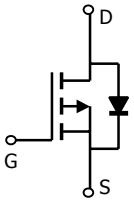
Features

V_{DS} (V) = -30V
I_D = -18A
$R_{DS(ON)}$ < 32mΩ (V_{GS} = 20V)
$R_{DS(ON)}$ < 60mΩ (V_{GS} = 10V)

TO-252
D-PAK



Top View
Drain Connected to Tab



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [B,G]	T_A=25°C [G]	I_D	-18	A
	T_A=100°C [B]		-18	
Pulsed Drain Current		I_{DM}	-40	
Avalanche Current [C]		I_{AR}	-18	A
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	16	mJ
Power Dissipation [B]	T_C=25°C	P_D	60	W
	T_C=100°C		30	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.5	W
	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]	t ≤ 10s	$R_{\theta JA}$	16.7	25	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		40	50	°C/W
Maximum Junction-to-Case [C]	Steady-State	$R_{\theta JL}$	1.9	2.5	°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=-250µA, V_{GS}=0V	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-24V, 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	-2	-2.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-18A		24.5	32	mΩ
		T_J=125°C		36	43	
		V_{GS}=-4.5V, I_D=-10A		41	60	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-18A		17		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.76	-1	V
I_S	Maximum Body-Diode Continuous Current				-18	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		920	1100	pF
C_{oss}	Output Capacitance			190		pF
C_{rss}	Reverse Transfer Capacitance			122		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		3.6	4.5	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge (10V)	V_{GS}=-10V, V_{DS}=-15V, I_D=-18A		18.7	23	nC
Q_g(4.5V)	Total Gate Charge (4.5V)			9.7		nC
Q_{gs}	Gate Source Charge			2.54		nC
Q_{gd}	Gate Drain Charge			5.4		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=0.82Ω, R_{GEN}=3Ω		7.8		ns
t_r	Turn-On Rise Time			8.7		ns
$t_{D(off)}$	Turn-Off DelayTime			17.7		ns
t_f	Turn-Off Fall Time			8.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-18A, dI/dt=100A/µs		21.4	26	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-18A, dI/dt=100A/µs		13		nC

A: The value of $R_{\theta JA}$ 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 value in any a given application depends on the user's specific board design. The current rating is based on the t≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80µs pulses, duty cycle 0.5% max.

E. 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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

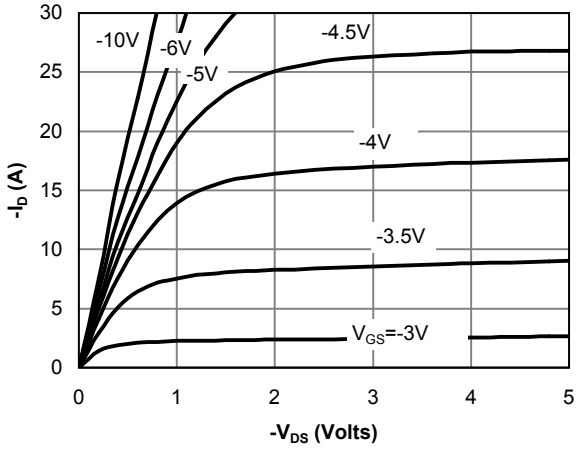


Fig 1: On-Region Characteristics

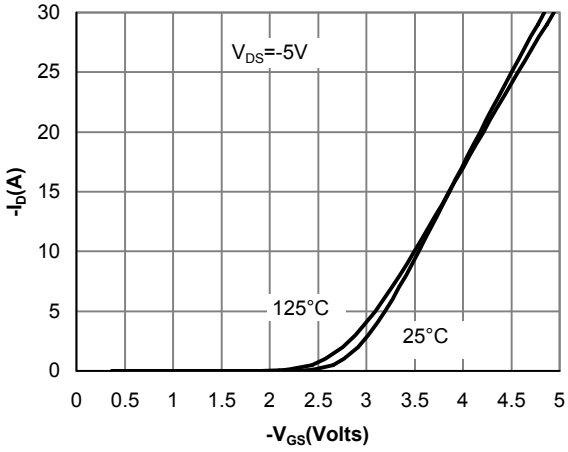


Figure 2: Transfer Characteristics

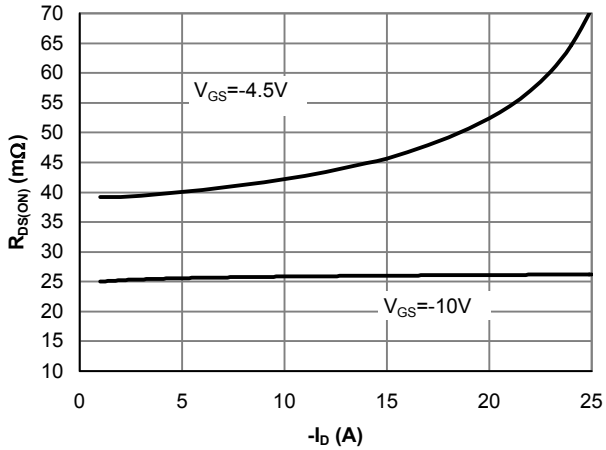


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

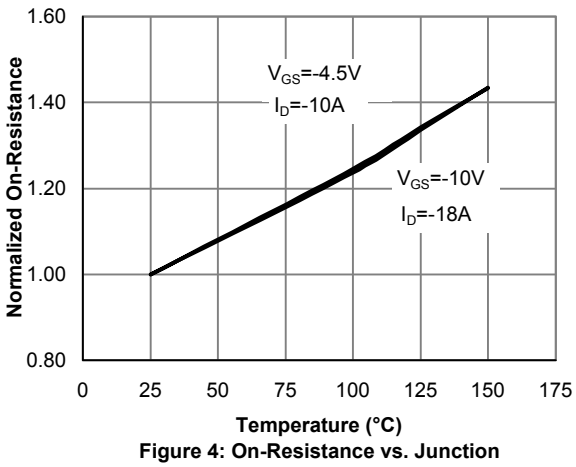


Figure 4: On-Resistance vs. Junction Temperature

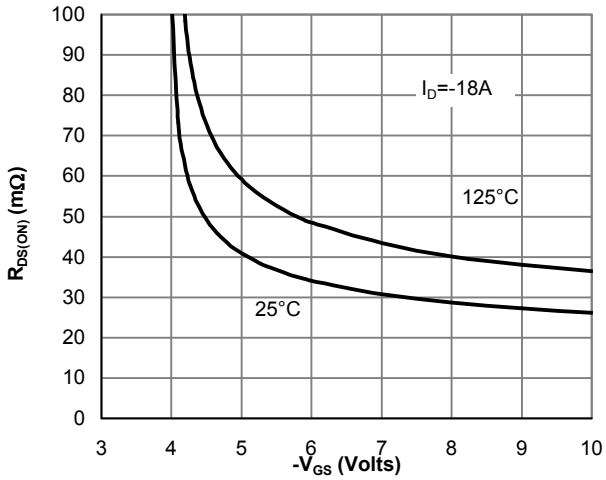


Figure 5: On-Resistance vs. Gate-Source Voltage

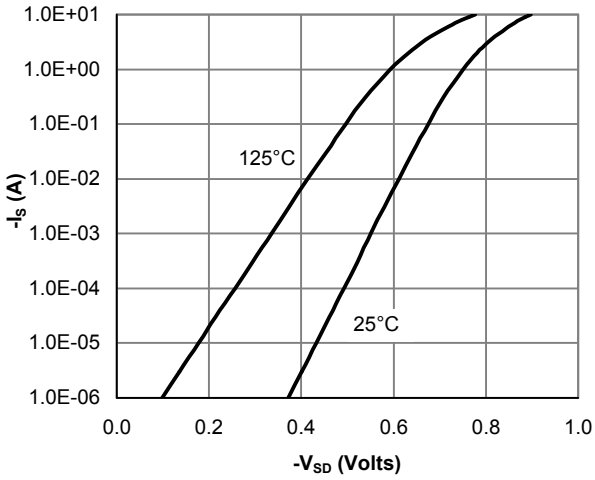


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

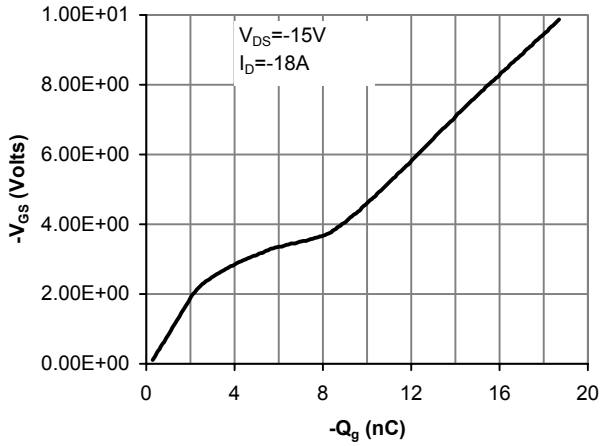


Figure 7: Gate-Charge Characteristics

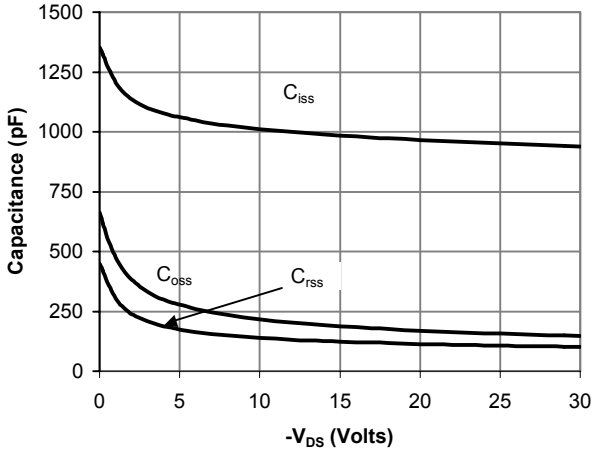


Figure 8: Capacitance Characteristics

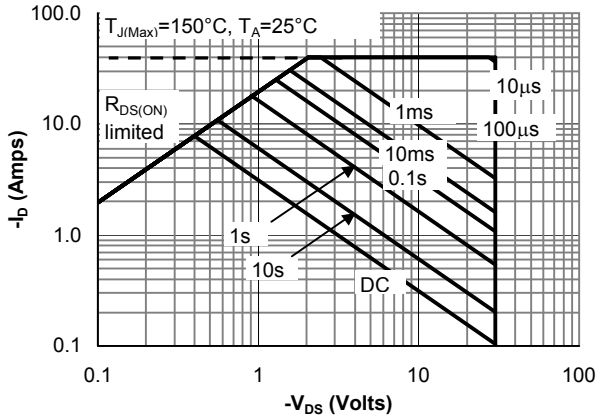


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

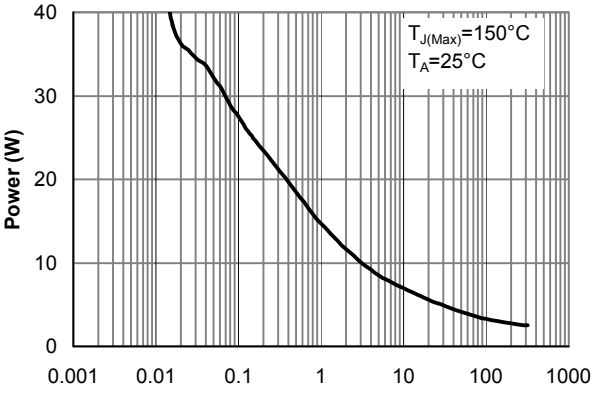


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

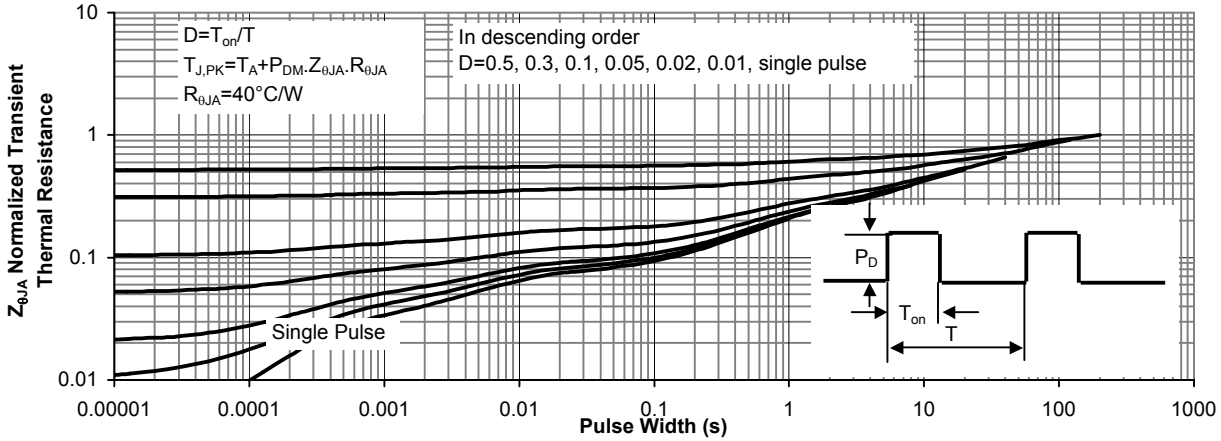
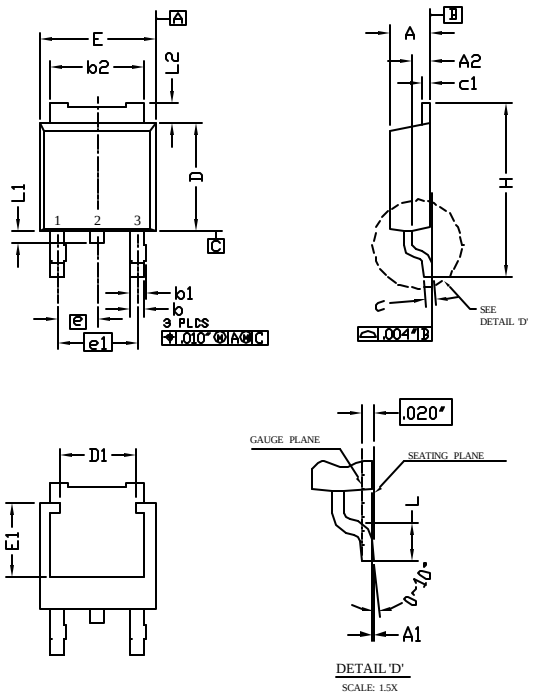


Figure 11: Normalized Maximum Transient Thermal Impedance

Document No.	PD-00115
Version	rev A
Title	AOD405 Package Data Sheet

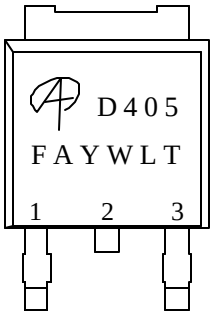
ALPHA & OMEGA
SEMICONDUCTOR, INC.



SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.235	2.286	2.388	0.088	0.090	0.094
A1	0.000	-----	0.102	0.000	-----	0.004
A2	0.889	-----	1.143	0.035	-----	0.045
b	0.686	0.762	0.889	0.027	0.030	0.035
b1	0.889	-----	1.143	0.035	-----	0.045
b2	5.207	4.45	5.461	0.205	-----	0.215
c	0.457	0.508	0.559	0.018	0.020	0.022
c1	0.483	-----	0.584	0.019	-----	0.023
D	5.969	6.096	6.223	0.235	0.240	0.245
D1	4.318	-----	5.334	0.170	-----	0.210
E	6.477	6.604	6.731	0.255	0.260	0.265
E1	4.318	-----	-----	0.170	-----	-----
e	2.286 BSC.			0.090 BSC.		
e1	4.572 BSC.			0.180 BSC.		
H	9.779	-----	10.414	0.385	-----	0.410
L	1.270	-----	2.032	0.050	-----	0.080
L1	0.635	-----	1.016	0.025	-----	0.040
L2	0.889	-----	1.270	0.035	-----	0.050

NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS
2. DIMENSION L IS MEASURED IN GAGE PLANE
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. FOLLOWED FROM JEDEC TO-252 (AA)

PACKAGE MARKING DESCRIPTION



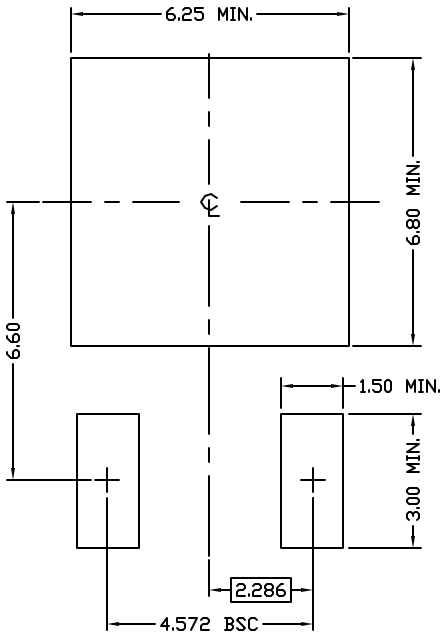
NOTE:

- AOS LOGO
D405 - PART NUMBER CODE.
F&A -FOUNDRY AND ASSEMBLY LOCATION
Y - YEAR CODE
W - WEEK CODE.
L T - ASSEMBLY LOT CODE

DPAK PART NO. CODE

PART NO.	CODE
AOD405	D405

RECOMMENDED LAND PATTERN

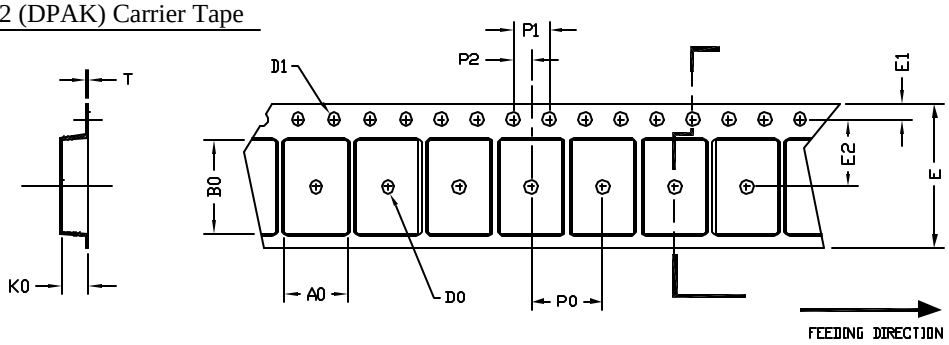


UNIT: mm

ALPHA & OMEGA
SEMICONDUCTOR, INC.

TO-252 (DPAK)
Tape and Reel Data

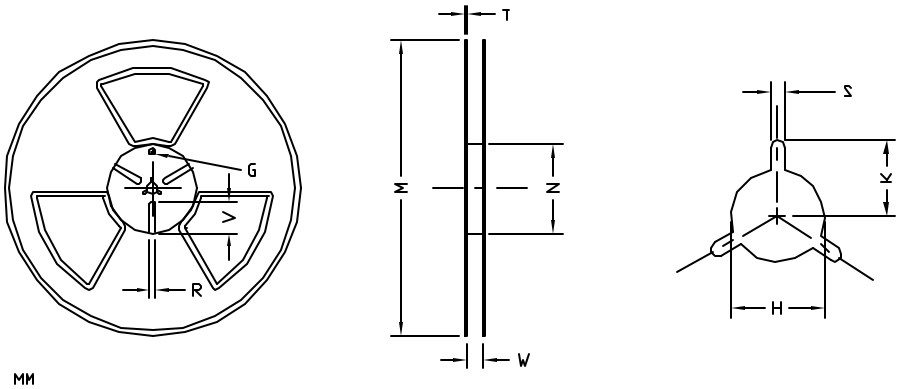
TO-252 (DPAK) Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO-252(DPAK) (16 mm)	6.90 ±0.10	10.50 ±0.10	2.70 ±0.10	1.50 ±0.10	1.50 MIN.	16.00 ±0.10	1.75 ±0.10	7.50 ±0.10	8.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.05

TO-252 (DPAK) Reel



UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	T	H	K	S	G	R	V
16 mm	ø330	ø330.00 ±0.10	ø99.50 ±0.10	17.50 ±0.50	2.30	ø13.50 ±0.10	10.60	2.50 ±0.10	---	---	---

TO-252 (DPAK)

Leader / Trailer & Orientation