



AOD409, AOD409L (Green Product)
P-Channel Enhancement Mode Field Effect Transistor

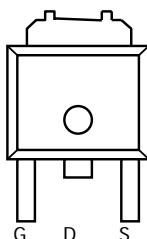
General Description

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. AOD409L (Green Product) is offered in a lead-free package.

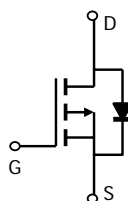
Features

- V_{DS} (V) = -60V
- I_D = -29A
- $R_{DS(ON)} < 40m\Omega$ ($V_{GS} = -10V$) @ -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	$T_C=25^\circ\text{C}$	A
		$T_C=100^\circ\text{C}$	
Pulsed Drain Current ^C	I_{DM}	-60	
Avalanche Current ^C	I_{AR}	-29	A
Repetitive avalanche energy $L=0.1\text{mH}$ ^C	E_{AR}	134	mJ
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	W
		$T_C=100^\circ\text{C}$	
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
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	$R_{\theta JA}$	16.7	25	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		Steady-State	40	50
Maximum Junction-to-Case ^C	$R_{\theta JL}$	1.9	2.5	$^\circ\text{C/W}$

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	-60			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-48V, V _{GS} =0V T _J =55°C		-0.003	-1	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	-1.2	-1.9	-2.4	V
I _{D(ON)}	On state drain current	V _{GS} =-10V, V _{DS} =-5V	-60			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-10V, I _D =-20A T _J =125°C		32	40	mΩ
		V _{GS} =-4.5V, I _D =-20A		53	55	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-20A		32		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V		-0.73	-1	V
I _S	Maximum Body-Diode Continuous Current				-30	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance			2977	3573	pF
C _{oss}	Output Capacitance	V _{GS} =0V, V _{DS} =-30V, f=1MHz		241		pF
C _{rss}	Reverse Transfer Capacitance			153		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		2	2.4	Ω
SWITCHING PARAMETERS						
Q _{g(10V)}	Total Gate Charge (10V)			44	54	nC
Q _{g(4.5V)}	Total Gate Charge (4.5V)			22.2	28	nC
Q _{gs}	Gate Source Charge	V _{GS} =-10V, V _{DS} =-30V, I _D =-20A		9		nC
Q _{gd}	Gate Drain Charge			10		nC
t _{D(on)}	Turn-On Delay Time			12		ns
t _r	Turn-On Rise Time	V _{GS} =-10V, V _{DS} =-30V, R _L =1.5Ω,		14.5		ns
t _{D(off)}	Turn-Off Delay Time	R _{GEN} =3Ω		38		ns
t _f	Turn-Off Fall Time			15		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-20A, di/dt=100A/μs		40	50	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-20A, di/dt=100A/μs		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°C. The Power dissipation PDSM is based on R qJA 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 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.

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

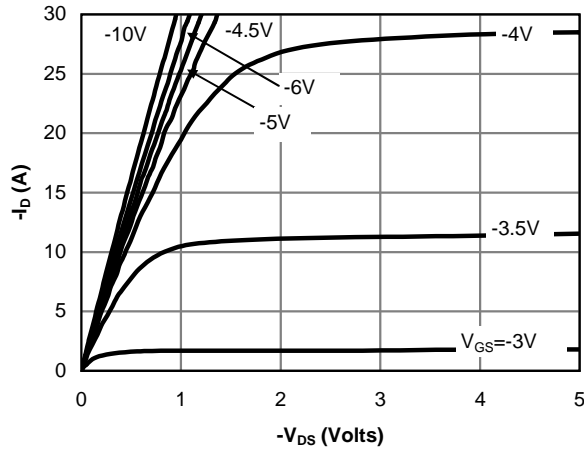


Fig 1: On-Region Characteristics

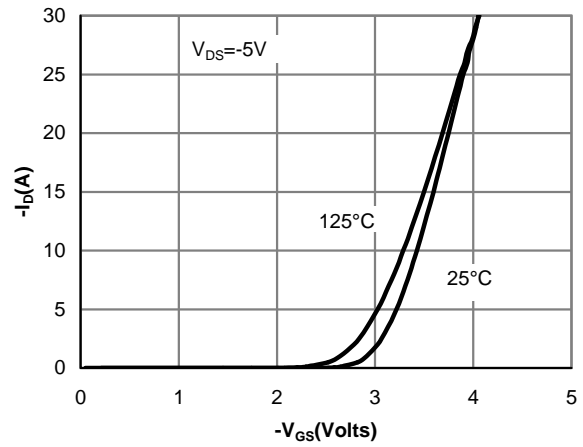


Figure 2: Transfer Characteristics

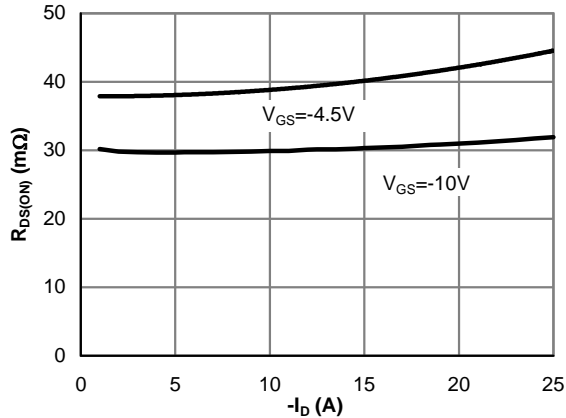


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

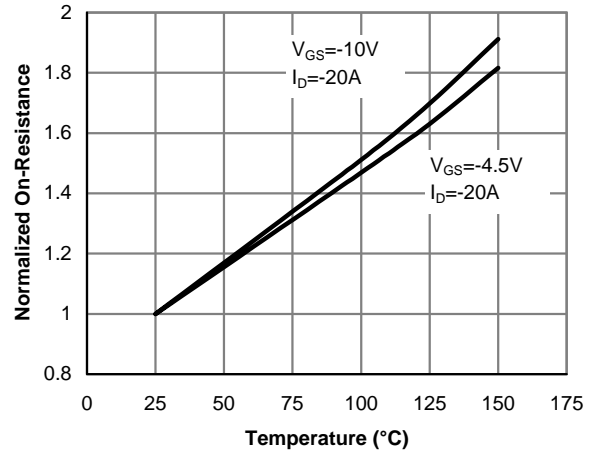


Figure 4: On-Resistance vs. Junction Temperature

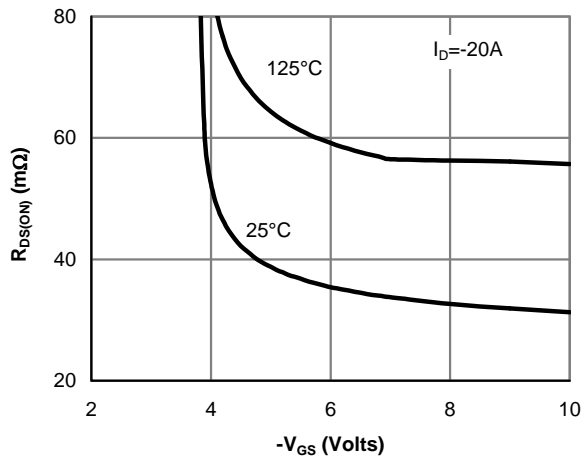


Figure 5: On-Resistance vs. Gate-Source Voltage

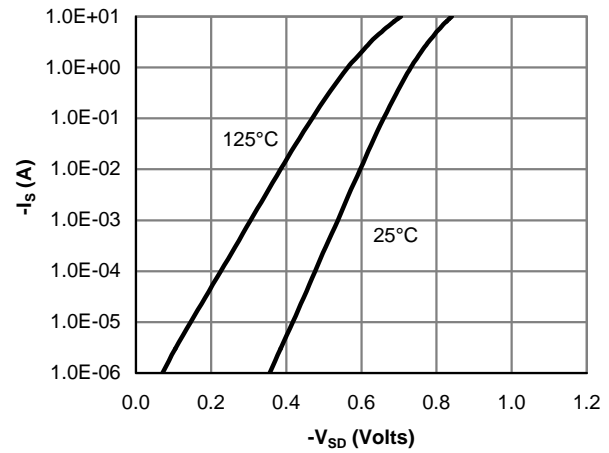


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

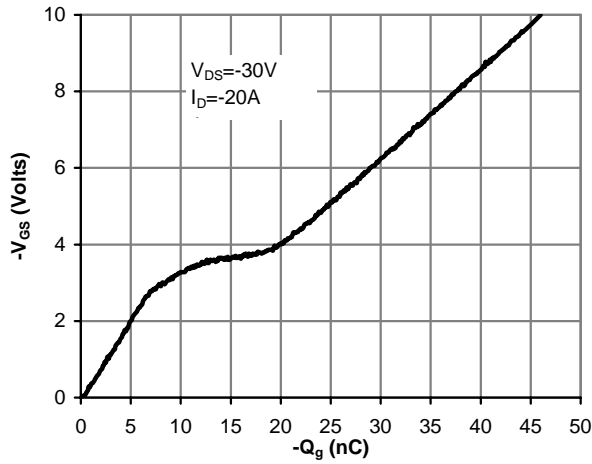


Figure 7: Gate-Charge Characteristics

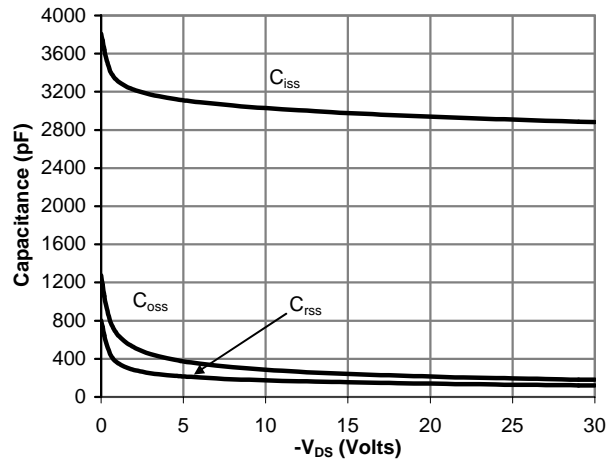


Figure 8: Capacitance Characteristics

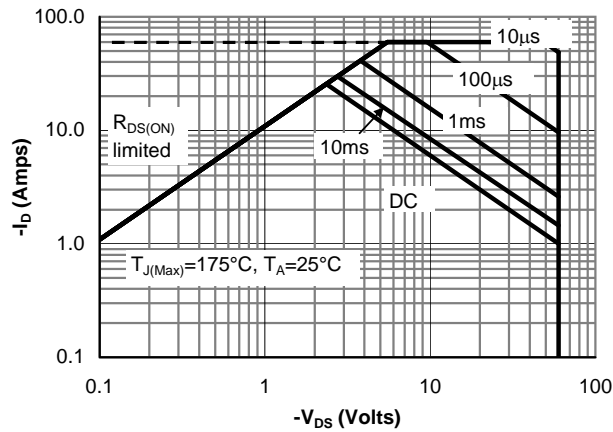


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

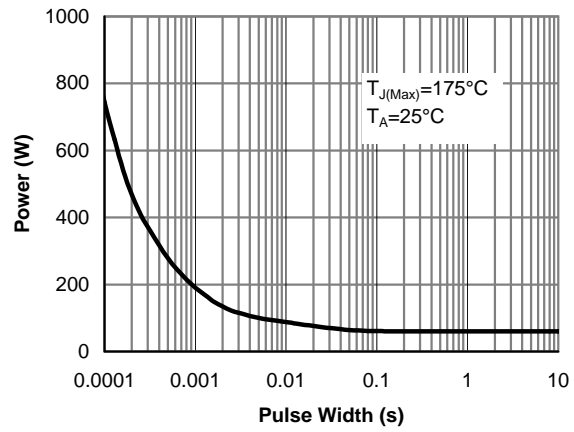


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

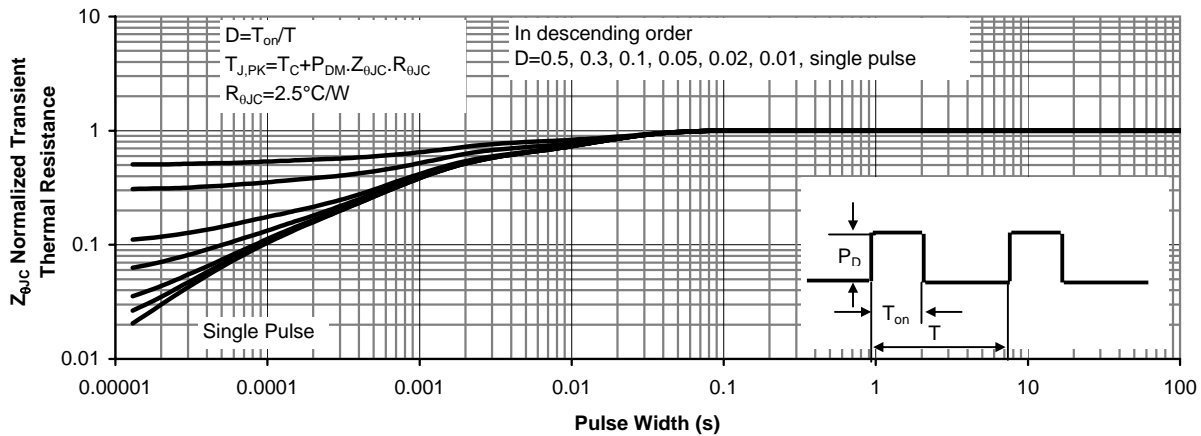


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

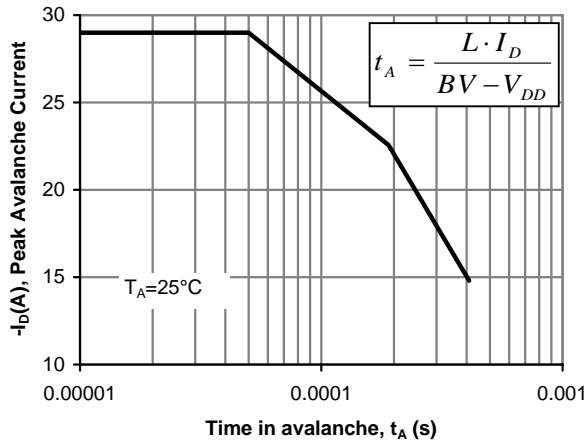


Figure 12: Single Pulse Avalanche capability

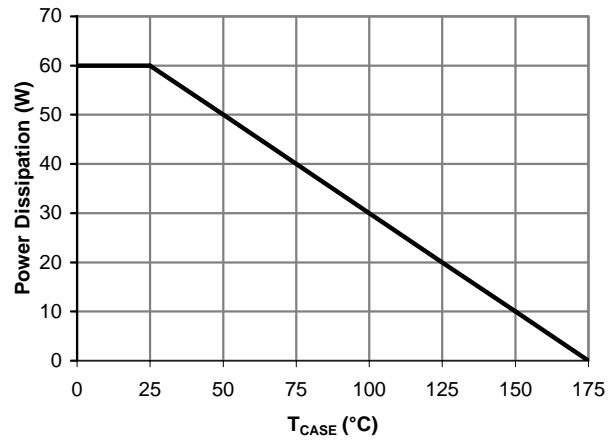


Figure 13: Power De-rating (Note B)

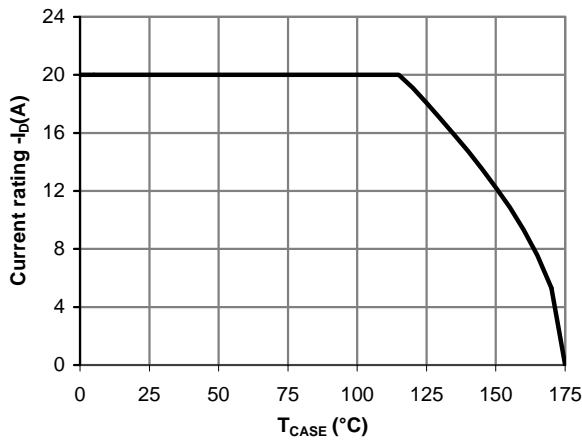


Figure 14: Current De-rating (Note B)

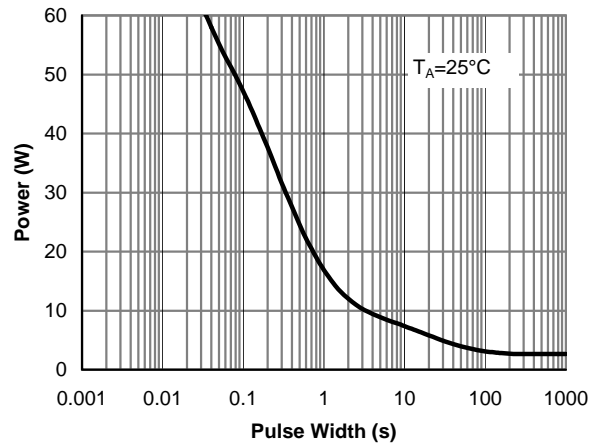


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note H)

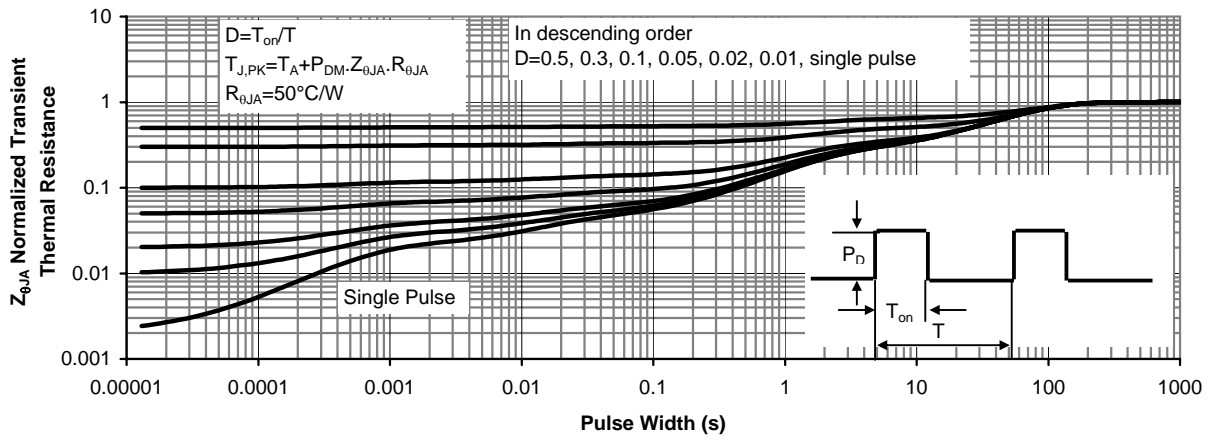
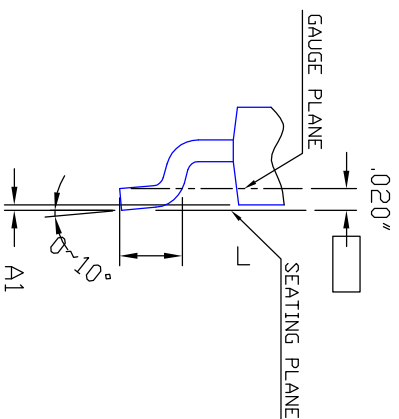
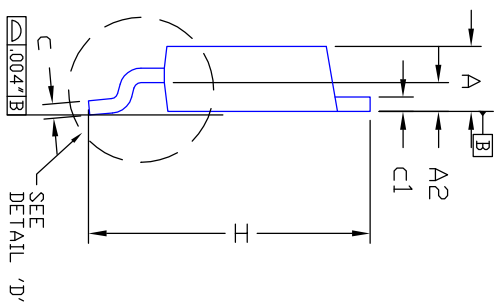
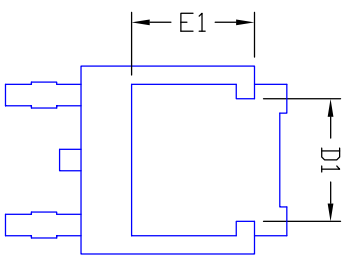
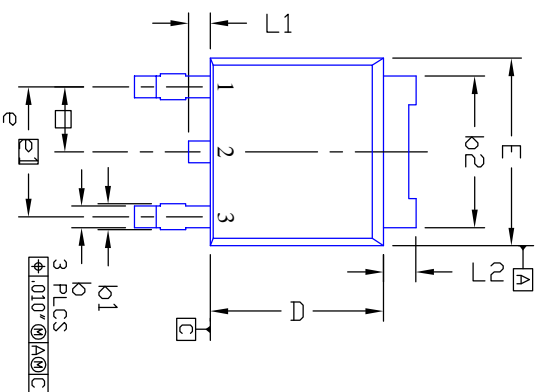
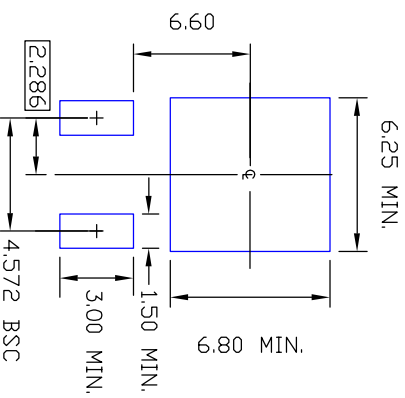


Figure 11: Normalized Maximum Transient Thermal Impedance (Note H)



RECOMMENDED LAND PATTERN



- 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)

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

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

DECIMAL ±

XXX ±

XXXX ±

INTERPRET DIM AND TOL PER
ASME Y14.5M - 1994

PRINTING IS SCALED TO FIT
DO NOT SCALE DRAWING



Document No.

PD-00009

Version

rev B

Title

DPAK TO-252 PACKAGE OUTLINE

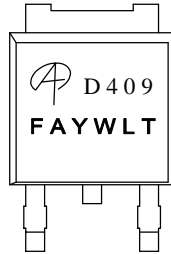
UNIT: mm



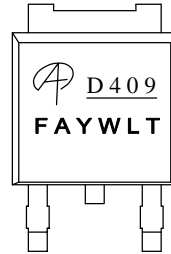
ALPHA & OMEGA
SEMICONDUCTOR, LTD.

Document No.	PD-00243
Version	rev B
Title	AOD409 Marking Description

DPAK PACKAGE MARKING DESCRIPTION



Standard product



Green product

NOTE:
LOGO - AOS LOGO
D409 - PART NUMBER CODE.
F&A - FOUNDRY AND ASSEMBLY LOCATION
Y - YEAR CODE
W - WEEK CODE.
L T - ASSEMBLY LOT CODE

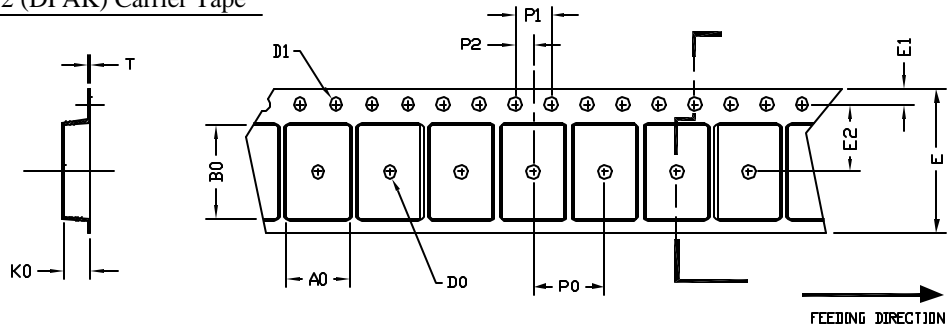
PART NO.	DESCRIPTION	CODE
AOD409	Standard product	D409
AOD409L	Green product	<u>D409</u>



ALPHA & OMEGA
SEMICONDUCTOR, LTD.

TO-252 (DPAK) Tape and Reel Data

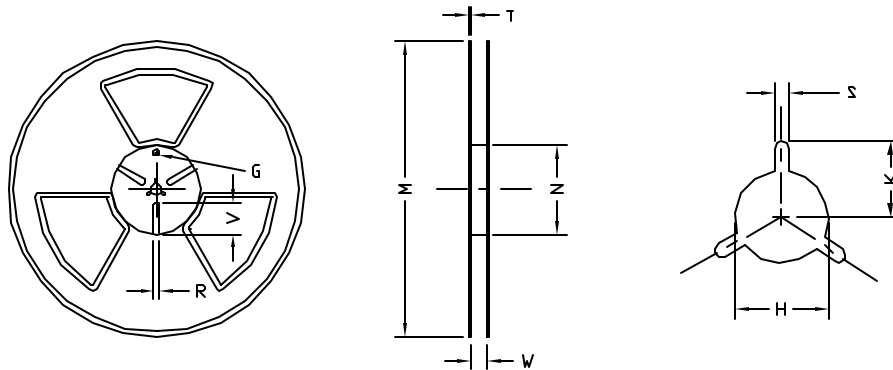
TO-252 (DPAK) Carrier Tape



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	φ330	φ330.00 ±0.10	φ99.50 ±0.10	17.50 ±0.50	2.30	φ13.50 ±0.10	10.60	2.50 ±0.10	---	---	---

TO-252 (DPAK)

Leader / Trailer
& Orientation

