

### General Description

- Latest Trench Power AlphaMOS (αMOS LV) technology
- Very Low RDS(on) at 4.5V<sub>GS</sub>
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

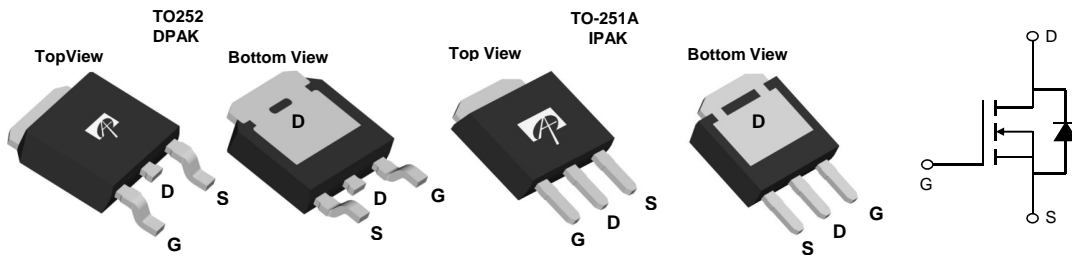
### Application

- DC/DC Converters in Computing, Servers, and POL
- Isolated DC/DC Converters in Telecom and Industrial

### Product Summary

V <sub>DS</sub>	30V
I <sub>D</sub> (at V <sub>GS</sub> =10V)	70A
R <sub>DS(ON)</sub> (at V <sub>GS</sub> =10V)	< 2.6mΩ
R <sub>DS(ON)</sub> (at V <sub>GS</sub> =4.5V)	< 4mΩ

100% UIS Tested  
 100% R<sub>g</sub> Tested



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V <sub>DS</sub>	30	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current <sup>C</sup>	I <sub>D</sub>	T <sub>C</sub> =25°C	70
		T <sub>C</sub> =100°C	54
Pulsed Drain Current <sup>C</sup>	I <sub>DM</sub>	280	A
Continuous Drain Current	I <sub>DSM</sub>	T <sub>A</sub> =25°C	45
		T <sub>A</sub> =70°C	37
Avalanche Current <sup>C</sup>	I <sub>AS</sub>	45	A
Avalanche energy L=0.1mH <sup>C</sup>	E <sub>AS</sub>	101	mJ
V <sub>DS</sub> Spike	V <sub>SPIKE</sub>	36	V
Power Dissipation <sup>B</sup>	P <sub>D</sub>	T <sub>C</sub> =25°C	60
		T <sub>C</sub> =100°C	30
Power Dissipation <sup>A</sup>	P <sub>DSM</sub>	T <sub>A</sub> =25°C	7.5
		T <sub>A</sub> =70°C	5.2
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to 175	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	R <sub>θJA</sub>	16	20	°C/W
Maximum Junction-to-Ambient <sup>A,D</sup>		Steady-State	41	50
Maximum Junction-to-Case	R <sub>θJC</sub>	1.9	2.5	°C/W

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.2	1.7	2.2	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =20A T <sub>J</sub> =125°C		2.1	2.6	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A		3.2	4	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =20A		85		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.7	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current <sup>G</sup>				70	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance			2719		pF
C <sub>oss</sub>	Output Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		1204		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			169		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	0.9	2	3	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =20A		44	60	nC
Q <sub>g(4.5V)</sub>	Total Gate Charge			21	28	nC
Q <sub>gs</sub>	Gate Source Charge			9		nC
Q <sub>gd</sub>	Gate Drain Charge			7		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =0.75Ω, R <sub>GEN</sub> =3Ω		9.7		ns
t <sub>r</sub>	Turn-On Rise Time			5.2		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			32.5		ns
t <sub>f</sub>	Turn-Off Fall Time			10.3		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =20A, dI/dt=500A/μs		19.6		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =20A, dI/dt=500A/μs		42.7		nC

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The Power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=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. Single pulse width limited by junction temperature T<sub>J(MAX)</sub>=175° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

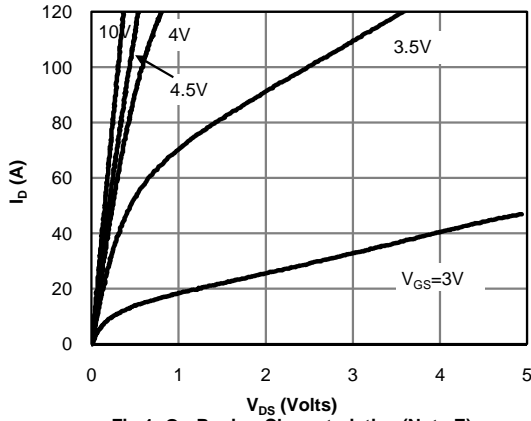
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=175° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

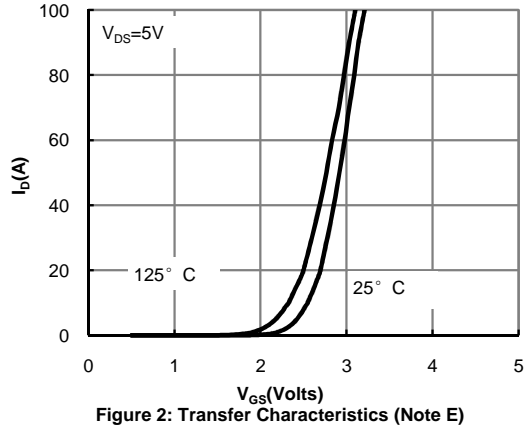
H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C.

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.

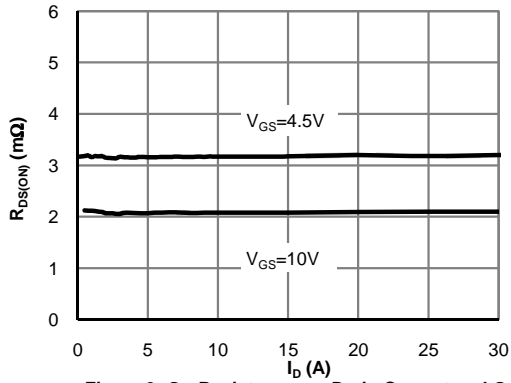
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



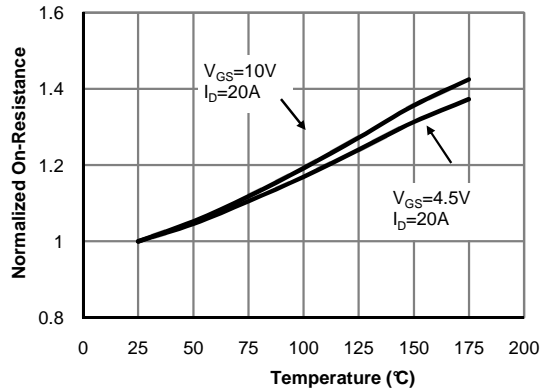
**Figure 1: On-Region Characteristics (Note E)**



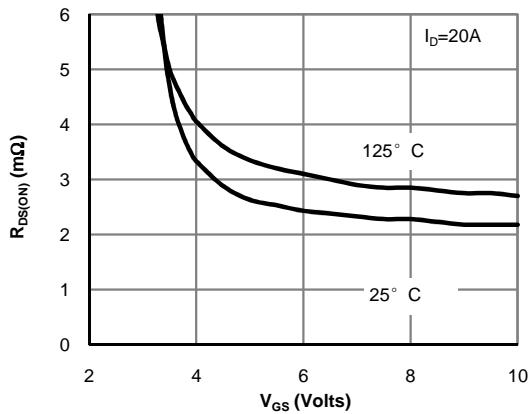
**Figure 2: Transfer Characteristics (Note E)**



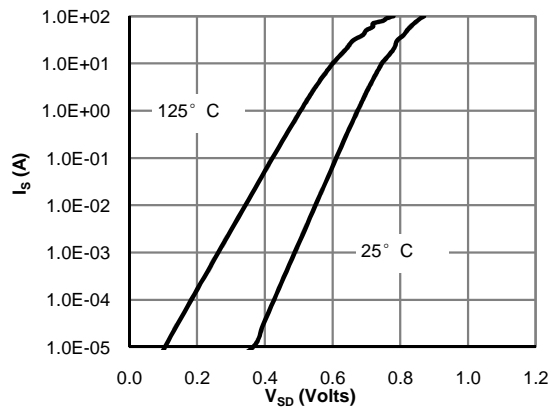
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

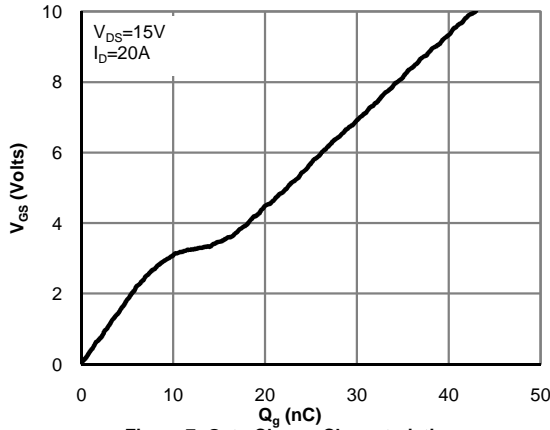


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

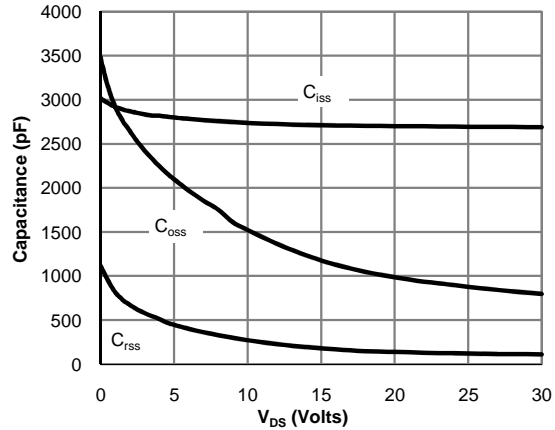


**Figure 6: Body-Diode Characteristics (Note E)**

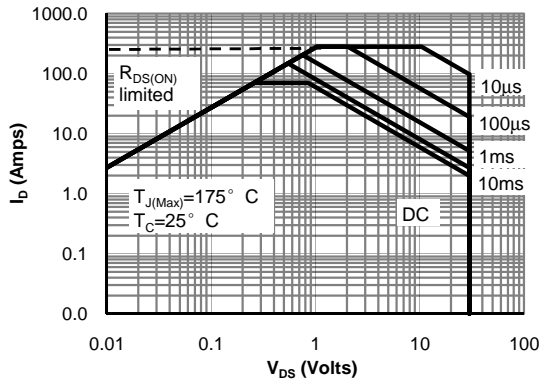
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



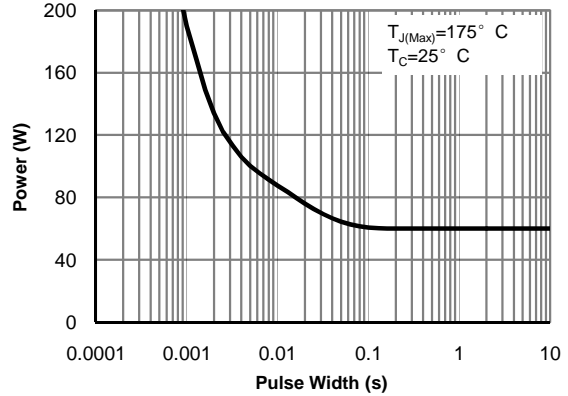
**Figure 7: Gate-Charge Characteristics**



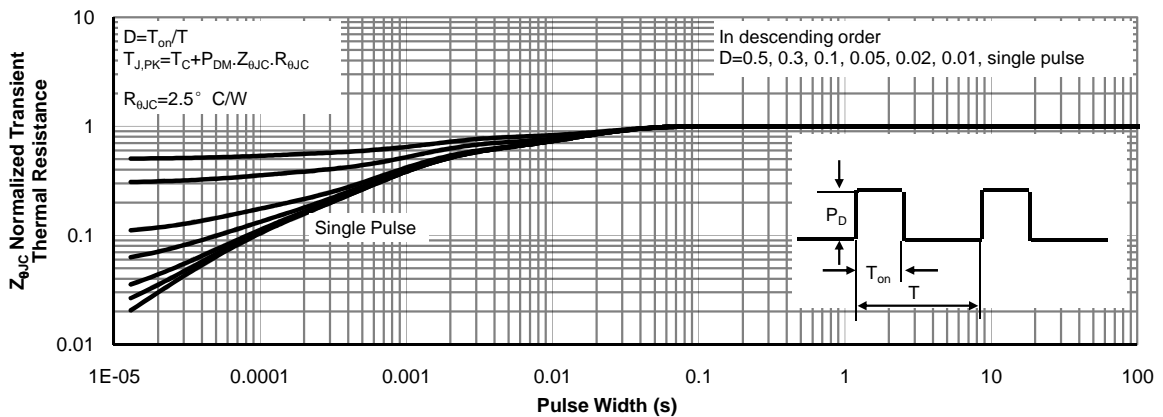
**Figure 8: Capacitance Characteristics**



**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**

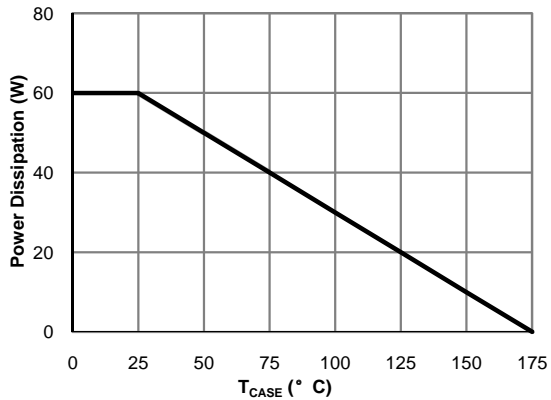


Figure 12: Power De-rating (Note F)

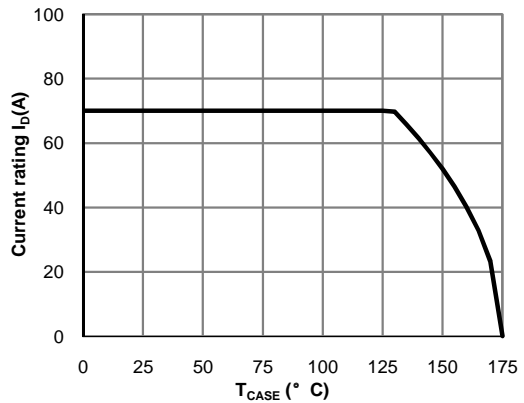


Figure 13: Current De-rating (Note F)

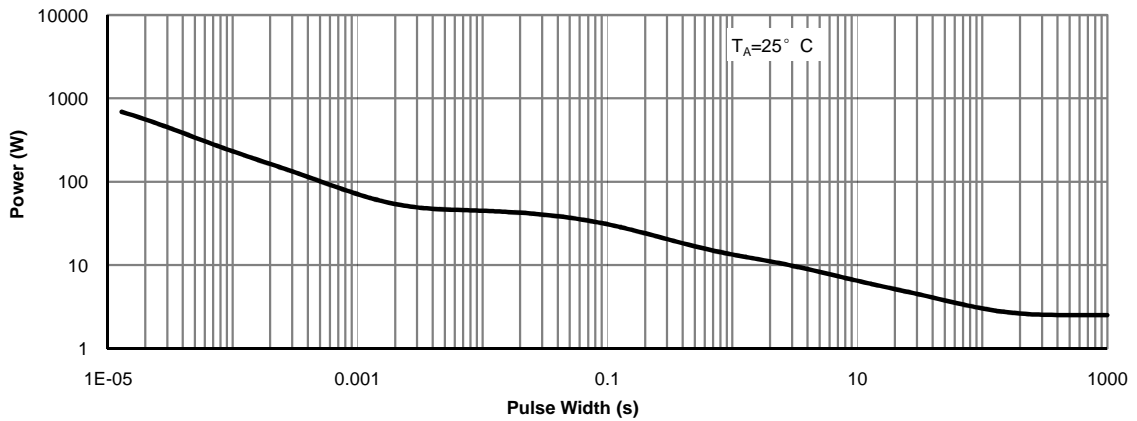


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

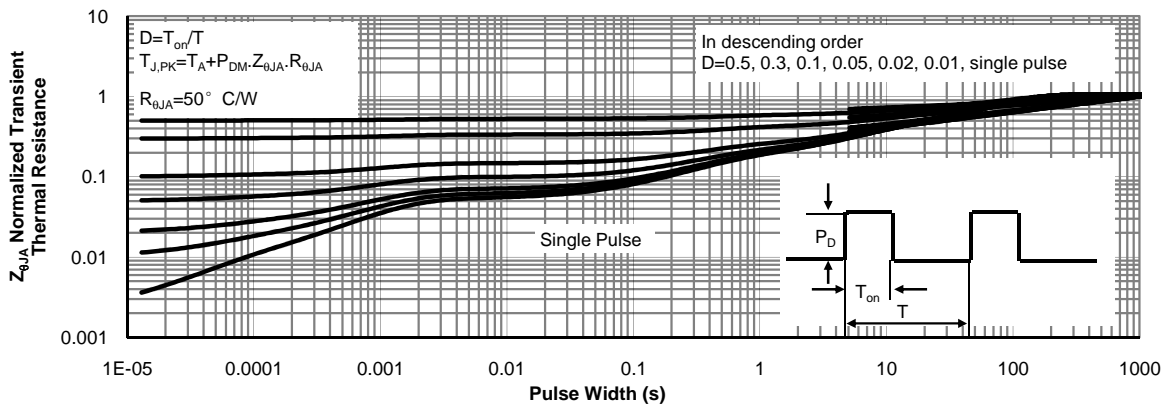


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**



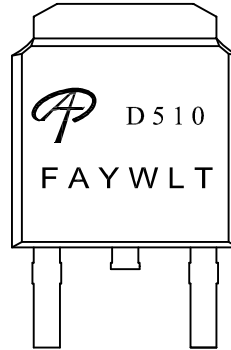
**Diode Recovery Test Circuit & Waveforms**





Document No.	PD-01749
Version	A
Title	AOD510 Marking Description

DPAK (TO-252) PACKAGE MARKING DESCRIPTION



Green product

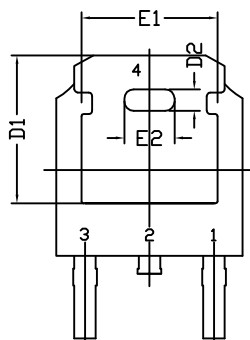
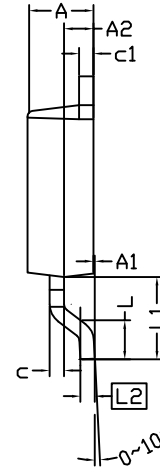
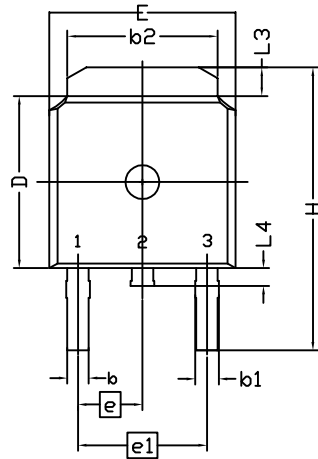
NOTE:

- LOGO - AOS Logo
- D510 - Part number code
- F - Fab code
- A - Assembly location code
- Y - Year code
- W - Week code
- L&T - Assembly lot code

PART NO.	DESCRIPTION	CODE
AOD510	Green product	D510
AOD510L	Green product	D510

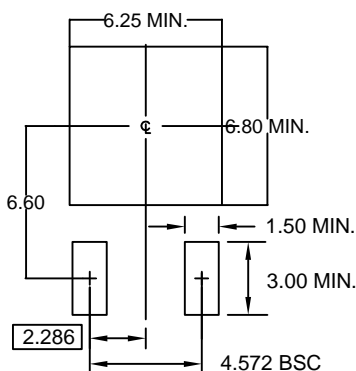


### TO252(DPAK) PACKAGE OUTLINE



SYMBOL	DIMENSION IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	2.184	2.286	2.388	0.086	0.090	0.094
A1	0.000	-----	0.127	0.000	-----	0.005
A2	0.889	1.041	1.143	0.035	0.041	0.045
b	0.635	0.762	0.889	0.025	0.030	0.035
b1	0.762	0.840	1.143	0.030	0.033	0.045
b2	4.953	5.340	5.461	0.195	0.210	0.215
c	0.450	0.508	0.610	0.018	0.020	0.024
c1	0.450	0.508	0.610	0.018	0.020	0.024
D	5.969	6.096	6.223	0.235	0.240	0.245
D1	5.210	5.249	5.380	0.205	0.207	0.212
D2	0.662	0.762	0.862	0.026	0.030	0.034
E	6.350	6.604	6.731	0.250	0.260	0.265
E1	4.318	4.826	4.901	0.170	0.190	0.193
E2	1.678	1.778	1.878	0.066	0.070	0.074
e	2.286 BSC			0.090 BSC		
e1	4.572 BSC			0.180 BSC		
H	9.398	10.033	10.414	0.370	0.395	0.410
L	1.270	1.520	2.032	0.050	0.060	0.080
L1	2.921 REF.			0.115REF.		
L2	0.408	0.508	0.608	0.016	0.020	0.024
L3	0.889	1.016	1.270	0.035	0.040	0.050
L4	0.635	-----	1.016	0.025	-----	0.040

#### RECOMMENDED LAND PATTERN



UNIT: mm

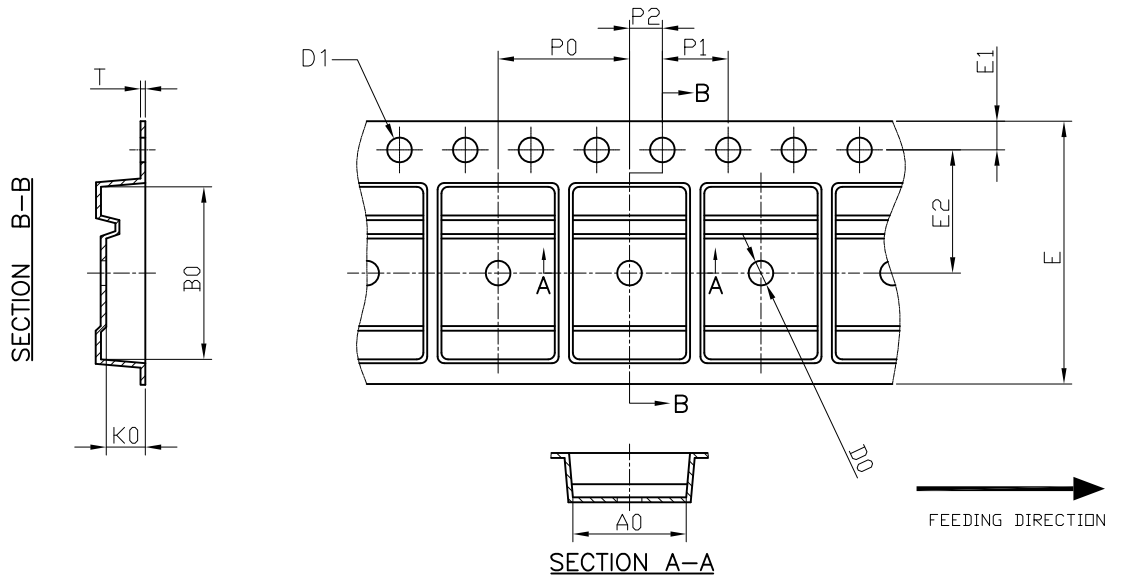
#### NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MILS.
2. DIMENSION L IS MEASURED IN GAUGE PLANE
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. REFER TO JEDEC TO-252 (AA)





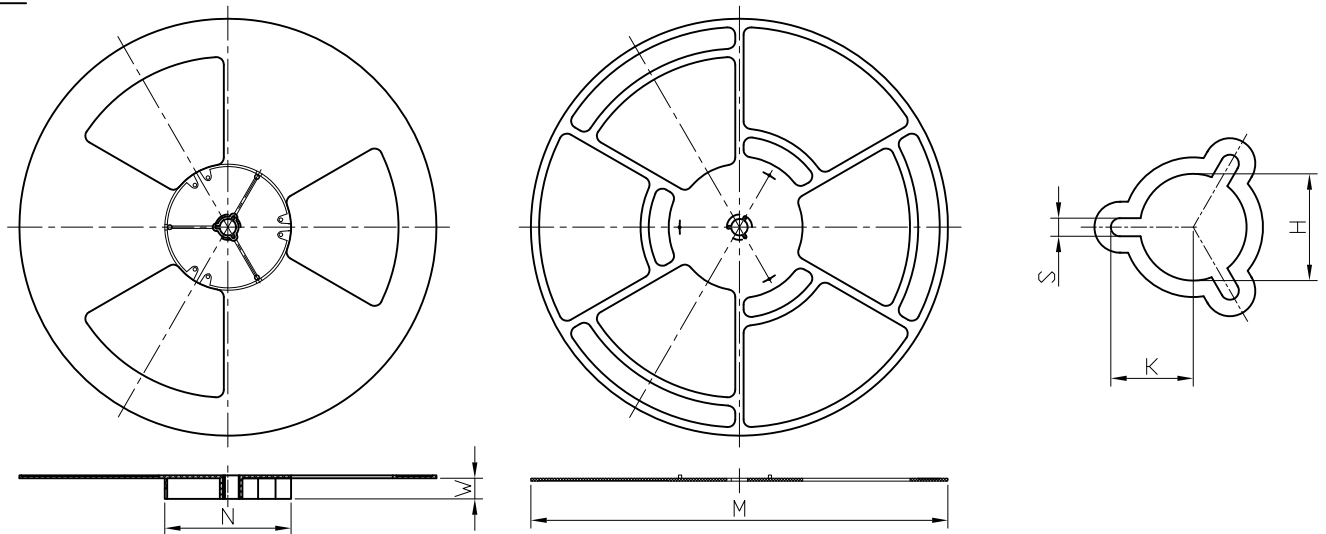
DPAK Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DPAK (16 mm)	6.90 ±0.10	10.50 ±0.10	2.50 ±0.10	1.50 +0.1 -0	1.50 +0.1 -0	16.00 ±0.30	1.75 ±0.10	7.50 ±0.10	8.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.05

DPAK Reel



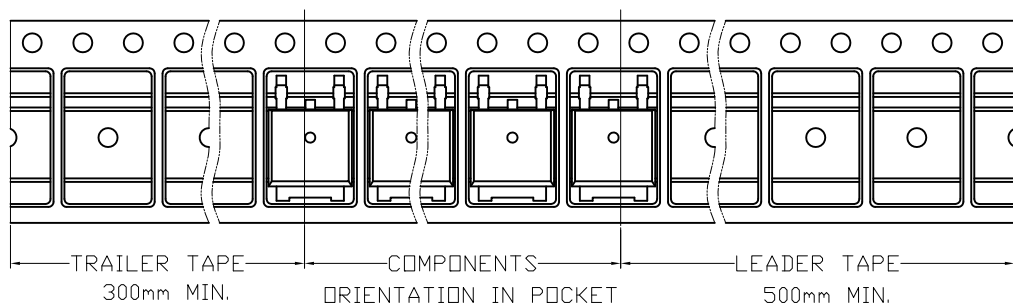
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	H	K	S
16 mm	ø330	ø330.00 +0.25 -4.00	ø100.00 ±0.2	16.4 +2.0 -0.0	ø13.00 +0.50 -0.20	10.5 ±0.25	2.2 ±0.25

DPAK Tape

Leader / Trailer  
& Orientation

Unit Per Reel:  
2500pcs





# ***AOS Semiconductor Product Reliability Report***

**AOD510**, rev A

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

**[www.aosmd.com](http://www.aosmd.com)**



This AOS product reliability report summarizes the qualification result for AOD510. Accelerated environmental tests are performed on a specific sample size, and then followed by electrical test at end point. Review of final electrical test result confirms that AOD510 passes AOS quality and reliability requirements. The released product will be categorized by the process family and be monitored on a quarterly basis for continuously improving the product quality.

## Table of Contents:

- I. Product Description
- II. Package and Die information
- III. Environmental Stress Test Summary and Result
- IV. Reliability Evaluation

### I. Product Description:

#### General Description

- Latest Trench Power AlphaMOS (  $\alpha$  MOS LV) technology
- Very Low RDS(on) at 4.5VGS
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

#### Application

- DC/DC Converters in Computing, Servers, and POL
- Isolated DC/DC Converters in Telecom and Industrial

Details refer to the datasheet.

### II. Die / Package Information:

	<b>AOD510</b>
<b>Process</b>	Standard sub-micron Low voltage N channel process
<b>Package Type</b>	TO252
<b>Lead Frame</b>	Bare Cu
<b>Die Attach</b>	Soft solder
<b>Bonding</b>	Al & Au wire
<b>Mold Material</b>	Epoxy resin with silica filler
<b>Moisture Level</b>	Up to Level 1 *
<b>Note</b> * based on info provided by assembler and mold compound supplier	

### III. Result of Reliability Stress for AOD510

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures	Reference Standard
MSL Precondition	168hr 85°c /85%RH +3 cycle reflow @260°c	-	9 lots	1210pcs	0	JESD22-A113
HTGB	Temp = 150°c , Vgs=100% of Vgsmax	168hrs 500 hrs 1000 hrs	1 lot 3 lots	308pcs 77 pcs / lot	0	JESD22-A108
HTRB	Temp = 150°c , Vds=80% of Vdsmax	168hrs 500 hrs 1000 hrs	1 lot 3 lots	308pcs 77 pcs / lot	0	JESD22-A108
HAST	130 +/- 2°c , 85%RH, 33.3 psi, Vgs = 100% of Vgs max	100 hrs	9 lots (Note A*)	495pcs 55 pcs / lot	0	JESD22-A110
Pressure Pot	121°c , 29.7psi, RH=100%	96 hrs	5 lots (Note A*)	275pcs 55 pcs / lot	0	JESD22-A102
Temperature Cycle	-65°c to 150°c , air to air,	250 / 500 cycles	8 lots (Note A*)	440pcs 55 pcs / lot	0	JESD22-A104

**Note A:** The reliability data presents total of available generic data up to the published date.

### IV. Reliability Evaluation

**FIT rate (per billion): 7**

**MTTF = 15704 years**

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOD510). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

$$\text{Failure Rate} = \text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)]$$

$$= 1.83 \times 10^9 / [2 \times (2 \times 77 \times 168 + 6 \times 77 \times 1000) \times 258] = 7$$

$$\text{MTTF} = 10^9 / \text{FIT} = 1.38 \times 10^8 \text{hrs} = 15704 \text{ years}$$

**Chi<sup>2</sup>** = Chi Squared Distribution, determined by the number of failures and confidence interval

**N** = Total Number of units from HTRB and HTGB tests

**H** = Duration of HTRB/HTGB testing

**Af** = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55°C)

$$\text{Acceleration Factor [Af]} = \text{Exp} [Ea / k (1/Tj u - 1/Tj s)]$$

**Acceleration Factor ratio list:**

	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
<b>Af</b>	<b>258</b>	<b>87</b>	<b>32</b>	<b>13</b>	<b>5.64</b>	<b>2.59</b>	<b>1</b>

**Tj s** = Stressed junction temperature in degree (Kelvin), K = C+273.16

**Tj u** = The use junction temperature in degree (Kelvin), K = C+273.16

**k** = Boltzmann's constant, 8.617164 X 10<sup>-5</sup>eV / K