



**ALPHA & OMEGA**  
SEMICONDUCTOR

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

**AOD4186**, rev B

**Plastic Encapsulated Device**

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This AOS product reliability report summarizes the qualification result for AOD4186. 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 AOD4186 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.

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### I. Product Description:

The AOD4186 combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . This device is ideal for low voltage inverter applications.

- RoHS Compliant
- Halogen Free\*

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	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current <sup>G</sup>	$I_D$	$T_C=25^\circ\text{C}$	35	A
		$T_C=100^\circ\text{C}$	27	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	70		
Continuous Drain Current	$I_{DSM}$	$T_A=25^\circ\text{C}$	10	A
		$T_A=70^\circ\text{C}$	8	
Avalanche Current <sup>C</sup>	$I_{AR}$	24	A	
Repetitive avalanche energy $L=0.1\text{mH}$ <sup>C</sup>	$E_{AR}$	29	mJ	
Power Dissipation <sup>B</sup>	$P_D$	$T_C=25^\circ\text{C}$	50	W
		$T_C=100^\circ\text{C}$	25	
Power Dissipation <sup>A</sup>	$P_{DSM}$	$T_A=25^\circ\text{C}$	2.5	W
		$T_A=70^\circ\text{C}$	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 <sup>A</sup>	$R_{\theta JA}$	16.7	25	$^\circ\text{C/W}$	
Maximum Junction-to-Ambient <sup>A,D</sup>				Steady-State	40
Maximum Junction-to-Case	$R_{\theta JC}$	2.5	3	$^\circ\text{C/W}$	

## II. Die / Package Information:

	<b>AOD4186</b>
<b>Process</b>	Standard sub-micron Low voltage N channel process
<b>Package Type</b>	3 leads TO252
<b>Lead Frame</b>	Bare Cu
<b>Die Attach</b>	Soft solder
<b>Bond wire</b>	S: Al, 15mils; G: Au 1.3mils
<b>Mold Material</b>	Epoxy resin with silica filler
<b>Flammability Rating</b>	UL-94 V-0
<b>Backside Metallization</b>	Ti / Ni / Ag
<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 AOD4186

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures
<b>Solder Reflow Precondition</b>	168hr 85°c /85%RH +3 cycle reflow@260°c	-	9 lots	1210pcs	0
<b>HTGB</b>	Temp = 150°c , Vgs=100% of Vgsmax	168 / 500 hrs 1000 hrs	1 lot (Note A*)	82pcs 77+5 pcs / lot	0
<b>HTRB</b>	Temp = 150°c , Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	1 lot (Note A*)	82pcs 77+5 pcs / lot	0
<b>HAST</b>	130 +/- 2°c , 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	9 lots (Note B**)	495pcs 50+5 pcs / lot	0
<b>Pressure Pot</b>	121°c , 29.7psi, RH=100%	96 hrs	5 lots (Note B**)	275pcs 50+5 pcs / lot	0
<b>Temperature Cycle</b>	-65°c to 150°c , air to air,	250 / 500 cycles	8 lots (Note B**)	440pcs 50+5 pcs / lot	0

### III. Result of Reliability Stress for AOD4186

Continues

<b>DPA</b>	<b>Internal Vision Cross-section X-ray</b>	<b>NA</b>	<b>5 5 5</b>	<b>5 5 5</b>	<b>0</b>
<b>CSAM</b>		<b>NA</b>	<b>5</b>	<b>5</b>	<b>0</b>
<b>Bond Integrity</b>	<b>Room Temp 150°c bake 150°c bake</b>	<b>0hr 250hr 500hr</b>	<b>40 40 40</b>	<b>40 wires 40 wires 40 wires</b>	<b>0</b>
<b>Solderability</b>	<b>245°c</b>	<b>5 sec</b>	<b>15</b>	<b>15 leads</b>	<b>0</b>
<b>Solder dunk</b>	<b>260°c</b>	<b>10secs 3 cycles</b>	<b>1</b>	<b>30 units</b>	<b>0</b>

**Note A:** The HTGB and HTRB reliability data presents total of available AOD4186 burn-in data up to the published date.

**Note B:** The pressure pot, temperature cycle and HAST reliability data for AOD4186 comes from the AOS generic package qualification data.

### IV. Reliability Evaluation

**FIT rate (per billion): 128**

**MTTF = 887 years**

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOD4186). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

$$\text{Failure Rate} = \text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 1.83 \times 10^9 / [2 \times 164 \times 168 \times 258] = 128$$

$$\text{MTTF} = 10^9 / \text{FIT} = 7.77 \times 10^6 \text{hrs} = 887 \text{ years}$$

**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)

Acceleration Factor [**Af**] = **Exp** [Ea / k (1/Tj u - 1/Tj s)]

**Acceleration Factor ratio list:**

	<b>55 deg C</b>	<b>70 deg C</b>	<b>85 deg C</b>	<b>100 deg C</b>	<b>115 deg C</b>	<b>130 deg C</b>	<b>150 deg C</b>
<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