



**ALPHA & OMEGA**  
SEMICONDUCTOR

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

**AON4703/AON4703L, rev B**

**Plastic Encapsulated Device**

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This AOS product reliability report summarizes the qualification result for AON4703. 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 AON4703 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
- V. Quality Assurance Information

**I. Product Description:**

The AON4703 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for DC-DC conversion applications. Standard Product AON4703 is Pb-free (meets ROHS & Sony 259 specifications). AON4703L is a Green Product ordering option. AON4703 and AON4703L are electrically identical.

<b>Absolute Maximum Ratings <math>T_A=25^\circ\text{C}</math> unless otherwise noted</b>					
Parameter	Symbol	MOSFET	Schottky	Units	
Drain-Source Voltage	$V_{DS}$	-20		V	
Gate-Source Voltage	$V_{GS}$	$\pm 8$		V	
Continuous Drain Current	$T_A=25^\circ\text{C}$	-3.4		A	
	$T_A=70^\circ\text{C}$	-2.7			
Pulsed Drain Current	$I_{DM}$	-15			
Schottky reverse voltage	$V_{KA}$		20	V	
Continuous Forward Current	$T_A=25^\circ\text{C}$		1.9	A	
	$T_A=70^\circ\text{C}$		1.2		
Pulsed Forward Current	$I_{FM}$		7		
Power Dissipation	$T_A=25^\circ\text{C}$	$P_D$	1.7	0.96	W
	$T_A=70^\circ\text{C}$		1.1	0.62	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ\text{C}$	

<b>Parameter: Thermal Characteristics</b>		<b>Symbol</b>	<b>Typ</b>		<b>Max</b>	<b>Units</b>
<b>MOSFET</b>						
Maximum Junction-to-Ambient	$T \leq 10\text{s}$	$R_{\theta JA}$	51	75	$^\circ\text{C/W}$	
Maximum Junction-to-Ambient	Steady-State		88	110		
Maximum Junction-to-Lead	Steady-State	$R_{\theta JC}$	28	35	$^\circ\text{C/W}$	

Thermal Characteristics Schottky		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient	T ≤ 10s	R <sub>θJA</sub>	66	80	°C/W
Maximum Junction-to-Ambient	Steady-State		95	130	°C/W
Maximum Junction-to-Lead	Steady-State	R <sub>θJC</sub>	40	50	°C/W

## II. Die / Package Information:

	<b>AON4703</b>	<b>AON4703L (Green Compound)</b>
<b>Process</b>	Standard sub-micron Low voltage P channel process	Standard sub-micron Low voltage P channel process
<b>Package Type</b>	DFN 3X2	DFN 3X2
<b>Lead Frame</b>	Copper with Ag spot	Copper with Ag spot
<b>Die Attach</b>	Ag epoxy	Ag epoxy
<b>Bond wire</b>	Au 2mils	Au 2 mils
<b>Mold Material</b>	Epoxy resin with silica filler	Epoxy resin with silica filler
<b>Filler % (Spherical/Flake)</b>	90/10	100/0
<b>Flammability Rating</b>	UL-94 V-0	UL-94 V-0
<b>Backside Metallization</b>	Ti / Ni / Ag	Ti / Ni / Ag
<b>Moisture Level</b>	Up to Level 1 *	Up to Level 1 *

Note \* based on info provided by assembler and mold compound supplier

## III. Result of Reliability Stress for AON4703 (Standard) & AON4703L (Green)

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures
<b>Solder Reflow Precondition</b>	Standard: 1hr PCT+3 cycle reflow @260°C Green: 168hr 85°C /85%RH +3 cycle reflow @260°C	0hr	Standard: 3 lots Green: 9 lots  (Note B**)	1760 pcs	0
<b>HTGB</b>	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 hrs  1000 hrs	6 lots  (Note A*)	492 pcs  77+5 pcs / lot	0
<b>HTRB</b>	Temp = 150°C , Vds=80% of Vdsmax	168 / 500 hrs  1000 hrs	6 lots  (Note A*)	492 pcs  77+5 pcs / lot	0
<b>HAST</b>	130 +/- 2°C , 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard: 3 lots Green: 7 lots  (Note B**)	550 pcs  50+5 pcs / lot	0
<b>Pressure Pot</b>	121°C , 29.7psi, RH=100%	96 hrs	Standard: 3 lots Green: 8 lots  (Note B**)	605 pcs  50+5 pcs / lot	0
<b>Temperature Cycle</b>	-65°C to 150°C , air to air,	250 / 500 cycles	Standard: 2 lots Green: 9 lot  (Note B**)	605 pcs  50+5 pcs / lot	0

### III. Result of Reliability Stress for AON4703 (Standard) & AON4703L (Green) Continued

DPA	Internal Vision Cross-section X-ray	NA	5 5 5	5 5 5	0
CSAM		NA	5	5	0
Bond Integrity	Room Temp 150°C bake 150°C bake	0hr 250hr 500hr	40 40 40	40 wires 40 wires 40 wires	0
Solderability	245°C	5 sec	15	15 leads	0
Die shear	150°C	0hr	10	10	0

**Note A:** The HTGB and HTRB reliability data presents total of available AON4703 and AON4703L burn-in data up to the published date.

**Note B:** The pressure pot, temperature cycle and HAST reliability data for AON4703 and AON4703L comes from the AOS generic package qualification data.

### IV. Reliability Evaluation

**FIT rate (per billion): 16**

**MTTF = 7134 years**

In general, 500 hrs of HTGB, 150 deg C accelerated stress testing is equivalent to 15 years of lifetime at 55 deg C operating conditions (by applying the Arrhenius equation with an activation energy of 0.7eV and 60% of upper confidence level on the failure rate calculation). AOS reliability group also routinely monitors the product reliability up to 1000 hr at and performs the necessary failure analysis on the units failed for reliability test(s).

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AON4703). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

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

$$= 1.83 \times 10^9 / [2 (5 \times 164) (168) (258) + 2 (164) (500) (258)] = 16$$

$$\text{MTTF} = 10^9 / \text{FIT} = 6.25 \times 10^7 \text{ hrs} = 7134 \text{ years}$$

**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>

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

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

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

## **V. Quality Assurance Information**

Acceptable Quality Level for outgoing inspection: **0.1%** for electrical and visual.

Guaranteed Outgoing Defect Rate: **< 25 ppm**

Quality Sample Plan: conform to **Mil-Std-105D**