ALPHA & OMEGA SEMICONDUCTOR

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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.

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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.

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

Parameter: Thermal Characteristics MOSFET		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient	T ≤ 10s	$R_{\theta JA}$	51	75	°C/W
Maximum Junction-to-Ambient	Steady-State		88	110	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JC}$	28	35	°C/W

Thermal Characteristics Schottky		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient	T ≤ 10s	$R_{\theta JA}$	66	80	°C/W
Maximum Junction-to-Ambient	Steady-State		95	130	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JC}$	40	50	°C/W

II. Die / Package Information:

	AON4703	AON4703L (Green Compound)
Process	Standard sub-micron Low voltage P channel process	Standard sub-micron Low voltage P channel process
Package Type	DFN 3X2	DFN 3X2
Lead Frame	Copper with Ag spot	Copper with Ag spot
Die Attach	Ag epoxy	Ag epoxy
Bond wire	Au 2mils	Au 2 mils
Mold Material	Epoxy resin with silica filler	Epoxy resin with silica filler
Filler % (Spherical/Flake)	90/10	100/0
Flammability Rating	UL-94 V-0	UL-94 V-0
Backside Metallization	Ti / Ni / Ag	Ti / Ni / Ag
Moisture Level	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
Solder Reflow Precondition	**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**
HTGB	**Temp = 150°c , Vgs=100% of Vgsmax**	**168 / 500 hrs 1000 hrs**	**6 lots (Note A*)**	**492 pcs 77+5 pcs / lot**	**0**
HTRB	**Temp = 150°c , Vds=80% of Vdsmax**	**168 / 500 hrs 1000 hrs**	**6 lots (Note A*)**	**492 pcs 77+5 pcs / lot**	**0**
HAST	**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**
Pressure Pot	**121°c , 29.7psi, RH=100%**	**96 hrs**	**Standard: 3 lots Green: 8 lots (Note B**)**	**605 pcs 50+5 pcs / lot**	**0**
Temperature Cycle	**-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.

Failure Rate = $Chi^2 \times 10^9$ **/ [**2 (N) (H) (Af)**]**
= 1.83×10^9 / **[**2 (5×164) (168) (258) + 2 (164) (500) (258)**]** = 16
MTTF = 10^9 / FIT = 6.25×10^7hrs = 7134 years
Chi² = 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:

	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
Af	**258**	**87**	**32**	**13**	**5.64**	**2.59**	**1**

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, 8.617164×10^{-5}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**