

AOS Semiconductor Product Reliability Report

AO4915/AO4915L, rev A

Plastic Encapsulated Device

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This AOS product reliability report summarizes the qualification result for AO4915. 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 AO4915 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:

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted				
Parameter	Symbol	Max Q1	Max Q2	Units
Drain-Source Voltage	V_{DS}			V
Gate-Source Voltage	V_{GS}			V
Continuous Drain Current ^A	$T_A=25^\circ\text{C}$	I_D		A
	$T_A=70^\circ\text{C}$			
Pulsed Drain Current ^B	I_{DM}			
Power Dissipation ^A	$T_A=25^\circ\text{C}$	P_D		
	$T_A=70^\circ\text{C}$			
Junction and Storage Temperature Range	T_J, T_{STG}			$^\circ\text{C}$

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted				
Parameter	Symbol	Max Schottky		Units
Drain-Source Voltage	V_{DS}			V
Continuous Drain Current ^A	$T_A=25^\circ\text{C}$	I_D		A
	$T_A=70^\circ\text{C}$			
Pulsed Drain Current ^B	I_{DM}			
Power Dissipation ^A	$T_A=25^\circ\text{C}$	P_D		
	$T_A=70^\circ\text{C}$			
Junction and Storage Temperature Range	T_J, T_{STG}			$^\circ\text{C}$

Thermal Characteristics : n-channel , p-channel and schottky						
Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient	t ≤ 10s	R _{θJA}	n-ch	48	62.5	°C/W
Maximum Junction-to-Ambient	Steady-State		n-ch	74	110	
Maximum Junction-to-Lead	Steady-State	R _{θJL}	n-ch	35	40	
Maximum Junction-to-Ambient	t ≤ 10s	R _{θJA}	p-ch	48	62.5	°C/W
Maximum Junction-to-Ambient	Steady-State		p-ch	74	110	
Maximum Junction-to-Lead	Steady-State	R _{θJL}	p-ch	35	40	
Maximum Junction-to-Ambient	t ≤ 10s	R _{θJA}	schottky	47.5	62.5	°C/W
Maximum Junction-to-Ambient	Steady-State		schottky	71	110	
Maximum Junction-to-Lead	Steady-State	R _{θJL}	schottky	32	40	

II. Package Information:

	AO4915	AO4915 (Green Compound)
Process	Standard sub-micron low voltage P channel process	Standard sub-micron low voltage P channel process
Package Type	8 lead SOIC	8 lead SOIC
Lead Frame	Copper with Solder Plate	Copper with Solder Plate
Die Attach	Silver epoxy	Silver epoxy
Bond wire	2 mils Au wire	2 mils Au wire
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 AO4915 (Standard) & AO4915L (Green)

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures
Solder Reflow Precondition	Normal: 1hr PCT+3 cycle IR reflow@240°C (260°C for Green)	0hr	Normal: 81 lots Green: 23 lots (Note B**)	14410 pcs	0
HTGB	Temp = 150 C, Vgs=100% of Vgsmax	168 / 500 hrs 1000 hrs	(Note A*)	246 pcs 77+5 pcs / lot	0
HTRB	Temp = 150 C, Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	(Note A*)	246 pcs 77+5 pcs / lot	0
HAST	130 +/- 2 C, 85%, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Normal: 52 lots Green: 16 lots (Note B**)	3740 pcs 50+5 pcs / lot	0
Pressure Pot	121 C, 15+/-1 PSIG, RH=100%	96 hrs	Normal: 70 lots Green: 20 lots (Note B**)	4950 pcs 50+5 pcs / lot	0
Temperature Cycle	-65 to 150 deg C, air to air, 0.5hr per cycle	250 / 500 cycles	Normal: 81 lots Green: 23 lots (Note B**)	5720 pcs 50+5 pcs / lot	0
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	230 C	5 sec	15	15 leads	0

Note A: The HTGB and HTRB reliability data presents total of available AO4915 and AO4915L burn-in data up to the published date.

Note B: The pressure pot, temperature cycle and HAST reliability data for AO4915L comes from the AOS generic green compound package qualification data.

IV. Reliability Evaluation

FIT rate (per billion):

MTTF = years

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 (AO4915). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

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

$$\text{MTBF} = 10^9 / \text{FIT} = \times 10^7 \text{hrs} = \text{years}$$

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 = 55C)

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

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

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 = Boltzman's constant, 8.617164 X 10E-5V / 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**