



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

**AO4611/AO4611L, rev A**

**Plastic Encapsulated Device**

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This AOS product reliability report summarizes the qualification result for AO4611. 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 AO4611 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 AO4611 uses advanced trench technology MOSFETs to provide excellent RDS(ON) and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. Standard Product AO4611 is Pb-free (meets ROHS & Sony 259 specifications).

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted					
Parameter	Symbol	Max n-channel	Max p-channel	Units	
Drain-Source Voltage	$V_{DS}$	60	-60	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V	
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ\text{C}$	6.3	-4.9	A
		$T_A=70^\circ\text{C}$	5	-3.9	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	40	-30		
Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	2	2	W
		$T_A=70^\circ\text{C}$	1.28	1.28	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ\text{C}$	

Thermal Characteristics: n-channel and p-channel						
Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10\text{s}$	$R_{\theta JA}$	n-ch	48	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		n-ch	74	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	n-ch	35	60	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>	$t \leq 10\text{s}$	$R_{\theta JA}$	p-ch	48	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		p-ch	74	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	p-ch	35	40	$^\circ\text{C/W}$

**II. Die / Package Information:**
**AO4611**
**AO4611L (Green Compound)**

<b>Process</b>	Standard sub-micron Low voltage N+P channel,	Standard sub-micron Low voltage N+P channel,
<b>Package Type</b>	8 lead SOIC	8 lead SOIC
<b>Lead Frame</b>	Cu, D/pad, Ag spot	Cu, D/pad, Ag spot
<b>Die Attach</b>	Ag epoxy	Ag epoxy
<b>Bond wire</b>	Au 2mils	Au 2mils
<b>Mold Material</b>	Epoxy resin with silica filler	Epoxy resin with silica filler
<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 information provided by assembler and mold compound supplier

**III. Result of Reliability Stress for AO4611 (Standard) & AO4611L (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	-	Standard: 83 lots Green: 29 lots	17380 pcs	0
HTGB	Temp = 150°C, Vgs=100% of Vgsmax	168 hrs 500 hrs 1000 hrs	2 lots 1lot  (Note A*)	246 pcs  77+5 pcs / lot	0
HTRB	Temp = 150°C, Vds=80% of Vdsmax	168 hrs 500 hrs 1000 hrs	2 lots 1lot  (Note A*)	246 pcs  77+5 pcs / lot	0
HAST	130 +/- 2°C, 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard: 81 lots Green: 16 lots  (Note B**)	5335 pcs  50+5 pcs / lot	0
Pressure Pot	121°C, 29.7psi, RH=100%	96 hrs	Standard: 83 lots Green: 20 lots  (Note B**)	5665 pcs  50+5 pcs / lot	0
Temperature Cycle	-65°C to 150°C, air to air	250 / 500 cycles	Standard: 87 lots Green: 29 lots  (Note B**)	6380 pcs  50+5 pcs / lot	0

### III. Result of Reliability Stress for AO4611 (Standard) & AO4611L (Green) Continues

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

**Note A:** The HTGB and HTRB reliability data presents total of available AO4611 and AO4611L burn-in data up to the published date.

**Note B:** The pressure pot, temperature cycle and HAST reliability data for AO4611 and AO4611L comes from the AOS generic package qualification data.

### IV. Reliability Evaluation

**FIT rate (per billion): 11**

**MTTF = 10558 years**

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AO4611). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

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

$$= 1.83 \times 10^9 / [2 \times (4 \times 82 \times 500 + 2 \times 82 \times 1000) \times 258] = 11$$

$$\text{MTTF} = 10^9 / \text{FIT} = 9.25 \times 10^7 \text{hrs} = 10558 \text{ years}$$

**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:**

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