

# **AOS Semiconductor**

## **Product Reliability Report**

**AO7600/AO7600L, rev A**

**Plastic Encapsulated Device**

**ALPHA & OMEGA Semiconductor, Inc**

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This AOS product reliability report summarizes the qualification result for AO7600/AO7600L. 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 AO7600/AO7600L 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 AO7600/AO7600L uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, an inverter, and for a host of other applications. Both devices are ESD protected. AO7600 and AO7600L are electrically identical.

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted					
Parameter		Symbol	Max n channel	Max p channel	Units
Drain-Source Voltage		$V_{DS}$	20	-20	V
Gate-Source Voltage		$V_{GS}$	$\pm 8$	$\pm 8$	V
Continuous Drain Current	$T_A=25^\circ\text{C}$	$I_D$	0.9	-0.6	A
	$T_A=70^\circ\text{C}$		0.7	-0.48	
Pulsed Drain Current		$I_{DM}$	5	-3	
Power Dissipation	$T_A=25^\circ\text{C}$	$P_D$	0.3	0.3	W
	$T_A=70^\circ\text{C}$		0.19	0.19	
Junction and Storage Temperature Range		$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ\text{C}$

Thermal Characteristics						
Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient	$T = 10\text{s}$	$R_{\theta JA}$	n-ch	360	415	$^\circ\text{C/W}$
	Steady-State		n-ch	400	460	
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	n-ch	300	350	
Maximum Junction-to-Ambient	$T = 10\text{s}$	$R_{\theta JA}$	p-ch	360	415	
Maximum Junction-to-Ambient	Steady-State		p-ch	400	460	
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	p-ch	300	350	

## II. Die / Package Information:

	<b>AO7600</b>	<b>AO7600L (Green Compound)</b>
<b>Process</b>	Standard sub-micron low voltage N/P channel process	Standard sub-micron low voltage N/P channel process
<b>Package Type</b>	SC-70 6L	SC-70 6L
<b>Lead Frame</b>	Alloy 42 Ag spot	Alloy 42 Ag spot
<b>Die Attach</b>	Silver epoxy	Silver epoxy
<b>Bond wire</b>	1.3mils Au wire	1.3mils Au wire
<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 info provided by assembler and mold compound supplier

## III. Result of Reliability Stress for AO7600 (Standard) & AO7600L (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@260 °c Green: 168hr 85°c /85RH +3 cycle IR reflow @260 °c	0hr	Normal: 10 lots Green: 3 lots	1925 pcs	0
HTGB	Temp = 150 C, Vgs=100% of Vgsmax	168 / 500 hrs  1000 hrs	3 lots  (Note A*)	246 pcs  77+5 pcs / lot	0
HTRB	Temp = 150 C, Vds=80% of Vdsmax	168 / 500 hrs  1000 hrs	3 lots  (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: 6 lots Green: 3 lots  (Note B**)	495 pcs  50+5 pcs / lot	0
Pressure Pot	121 C, 15+/-1 PSIG, RH=100%	96 hrs	Normal: 10 lots Green: 3 lots  (Note B**)	715 pcs  50+5 pcs / lot	0
Temperature Cycle	-65 to 150 deg C, air to air, 0.5hr per cycle	250 / 500 cycles	Normal: 10 lots Green: 3 lots  (Note B**)	715 pcs  50+5 pcs / lot	0
DPA	Internal Vision Cross-section X-ray	NA	5 5 5	5 5 5	0

<b>CSAM</b>		<b>NA</b>	<b>5</b>	<b>5</b>	<b>0</b>
<b>Bond Integrity</b>	Room Temp 150° C bake 150° C bake	0hr 250hr 500hr	40 40 40	40 wires 40 wires 40 wires	0
<b>Solderability</b>	230° C	5 sec	15	15 leads	0
<b>Die shear</b>	150° C	0hr	10	10	0

**Note A:** The HTGB and HTRB reliability data presents total of available AO7600 and AO7600L burn-in data up to the published date.

**Note B:** The pressure pot, temperature cycle and HAST reliability data for AO7600L comes from the AOS generic green compound package qualification data.

#### IV. Reliability Evaluation

**FIT rate (per billion): 10**

**MTTF = 11415 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 (AO7600). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

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

$$= 1.83 \times 10^9 / [2 (164) (168) (258) + 2 (2 \times 164) (1000) (258)] = 10$$

$$\text{MTTF} = 10^9 / \text{FIT} = 1.0 \times 10^8 \text{hrs} = 11415 \text{ years}$$

**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 = 55C)

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

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