

AOS Semiconductor Product Reliability Report

AOZ8000CI, rev 2

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

**495 Mercury Drive
Sunnyvale, CA 94085
U.S.**

Tel: (408) 830-9742

www.aosmd.com

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This AOS product reliability report summarizes the qualification result for AOZ8000CI.

Review of the electrical test results confirm that AOZ8000CI pass AOS quality and reliability requirements for product release. The continuous qualification testing and reliability monitoring program ensure that all outgoing products will continue to meet AOS quality and reliability standards.

Table of Contents:

- I. Product Description
- II. Package and Die information
- III. Qualification Test Requirements
- IV. Qualification Tests Result
- V. Reliability Evaluation
- VI. Quality Assurance Information

I. Product Description:

The AOZ8000CI is a transient voltage suppressor array designed to protect high speed data lines from ESD and lightning. The product comes in RoHS compliant, SOT-23 package and is rated over a -40°C to +85°C ambient temperature range.

Absolute Maximum Ratings	
Parameter	
VP-VN	6V
Peak Pulse Current (Ipp), tp=8/20uS	5A
Storage Temperature (Ts)	-65°C to +150°C
ESD Rating per IEC61000-4-2, contact ⁽¹⁾	±12kV
ESD Rating per IEC61000-4-2, air ⁽²⁾	±15kV
ESD Rating per Human Body Model ⁽²⁾	±15kV
Junction Temperature (Tj)	-40°C to +125°C

Notes:

(1) IEC-61000-4-2 discharge with $C_{Discharge}=150pF$, $R_{Discharge}=330\Omega$

(2) Human Body Discharge per MIL-STD-883, Method 3015 $C_{Discharge}=100pF$, $R_{Discharge}=1.5k\Omega$

II. Package and Die Information:

Product ID	AOZ8000CI
Process	UMC 0.5um 5/18V 2P3M process
Package Type	SOT-23
Die	UE003A3 (size: 716 x 616 um)
L/F material	Copper A194FH
Die attach material	84-3J epoxy
Die bond wire	Au, 1mil
Mold Material	MP8000CH4
Plating Material	Pure Tin

III. Qualification Tests Requirements

- 2 lots of AOZ8000CI up to 168 hrs of B/I for New Product release.
- 2 lots of package qual testing (PCT, 250 cycles TC) for SOT-23 for package release to manufacturing.

IV. Qualification Tests Result

Test Item	Test Condition	Sample Size	Result	Comment
Pre-Conditioning	Per JESD 22-A113 85 C ⁰ /85%RH, 3 cyc reflow@260 °C	2 lots (82 /lot)	pass	Lot 1 (wafer lot# FN2MT.54, marking: AB002), 82 units, passed pre-conditioning. Lot 2 (wafer lot# FN2MT.54, marking: AB003), 82 units, passed pre-conditioning.
HTOL (old UE003A process)	Per JESD 22-A108_B Vdd=6V Temp = 125 °C	2 lots (80 /lot)	pass	Lot 1 (wafer lot# F9AN1.51, wafer# 4, marking: AB001), 80 units, passed 168 hrs . Lot 2 (wafer lot# FN2MT.54, wafer# 18, marking: AB003), 80 units, passed 168 hrs .
HTOL (new UH_EPI process)	Per JESD 22-A108_B Vdd=6V Temp = 125 °C	2 lots (80 /lot)	pass	Lot 1 (wafer lot# FNG88-2/3, marking: AC001), 80 units, passed 500 hrs . Lot 2 (wafer lot# FAYY3.02-3 marking: AB008), 80 units, passed 168 hrs .
HAST	'130 +/- 2 °C, 85%RH, 33.3 psi, at VCC min power dissipation.	2 lots (60 /lot)	pass	Lot 1 (wafer lot# FN2MT.54, marking: AB002), 60 units, passed HAST 100 hrs. Lot 2 (wafer lot# FN2MT.54, marking: AB003), 60 units, passed HAST 100 hrs.
Temperature Cycle	'-65 °C to +150 °C, air to air (2cyc/hr)	2 lots (82 /lot)	pass	Lot 1 (wafer lot# FN2MT.54, marking: AB002), 82 units, passed TC 500 cycles. Lot 2 (wafer lot# FN2MT.54, marking: AB003), 82 units, passed TC 500 cycles.
Pressure Pot	121C, 15+/-1 PSIG, RH= 100%	2 lots (82 /lot)	pass	Lot 1 (wafer lot# FN2MT.54, marking: AB002), 82 units, passed PCT 96 hrs. Lot 2 (wafer lot# FN2MT.54, marking: AB003), 82 units, passed PCT 96 hrs.
ESD Rating	Per IEC-61000-4-2, contact	30 units	pass	Lot 1 (wafer lot# F9AN1.51, assembly marking: Z96R11), 20 units passed ±12kV Lot 2 (wafer lot# F162T, assembly marking: B1001), 10 units passed ±12kV
ESD Rating	Per IEC-61000-4-2, air	20 units	pass	Lot 1 (wafer lot# F9AN1.51, assembly marking: Z96R11), 20 units passed ±15kV
Latch-up	Per JESD78A	3 units	pass	Lot 1 (wafer lot# F162T, assembly marking: B1001), 3 units passed Latch-up.

The qualification test results confirm that AOZ8000CI pass AOS quality and reliability requirements for product release.

V. Reliability Evaluation

A. Failure Rate Prediction

FIT rate (per billion): see note 1

MTBF = see note 1

¹ The presentation of FIT rate for the individual product reliability is restricted by the limited burn-in sample size of AOZ8000CI. The calculation will be presented (using the method discussed below) on the final qualification report when more data are available.

AOS uses industry standard techniques (JEDEC Standard JESD 85) for failure rate prediction by applying the Arrhenius equation with an activation energy of 0.7eV and 60% of upper confidence level on the failure rate calculation. FIT means one failure per billion hours.

The failure rate and MTBF are calculated as follows:

$$AF = \exp\left\{\left(\frac{E_a}{k}\right) \times \left[\frac{1}{T_0} - \frac{1}{T_s}\right]\right\}$$



Looking up the $\chi^2/2$ table (see above) for zero failure (see HTOL result above) with 60% confidence, the value of $(\chi^2[CL, (2f+2)] / 2)$ is 0.92.

$$\text{Failure Rate} = \text{Chi}^2 [CL, (2f+2)] \times 10^9 / [2 (ss) (t) (AF)]$$

$$\text{MTBF} = 10^9 / \text{FIT}$$

Chi² (χ^2) = Chi Squared Distribution, determined by the number of failures and confidence interval

ss = Total Number of units from HTOL testing

t = Duration of HTOL testing

AF = Acceleration Factor from Test to Use Conditions ($E_a = 0.7\text{eV}$ and $T_{\text{use}} = 55^\circ\text{C}$)

Acceleration Factor [**AF**] = $\exp [E_a / k (1/T_j u - 1/T_j s)]$

Tj s = Stressed junction temperature in degree (Kelvin), $K = C+273$

Tj u = Used junction temperature in degree (Kelvin), $K = C+273$

k = Boltzman's constant, $8.617 \times 10^{-5} \text{ V / K}$

B. Package Qualification Testing

Package qual. testing are performed (see section IV) to ensure the product meet AOS quality and reliability standards.

VI. Quality Assurance Information

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

Outgoing Defect Rate: **< 50 ppm**

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