

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

**AOZ1360AIL\_4 & AOZ1364AIL** rev B

**Plastic Encapsulated Device**

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The AOS product reliability report summarizes the qualification results for AOZ1360AIL\_4/AOZ1364AIL in SO8 package. Accelerated environmental tests are performed on a specific sample size, samples are electrically tested before and after each stress time point. Review of final electrical test results confirm that AOZ1360AIL\_4/AOZ1364AIL pass the AOS quality and reliability requirements. The released products will be categorized by its process family and routinely monitored for continuous improvement of product quality.

## I. Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Sample Size / Lots	Number of Failures	Reference Standard
HTOL	$T_J = 150^{\circ}\text{C}$ , $V_{IN} = 28\text{V}$	168 / 500 / 1000 hours	231 pcs (3 lots)	0	JESD22-A108
Preconditioning (Note A)	$T_A = 85^{\circ}\text{C}$ , RH = 85% + 3 cycle reflow @ $260^{\circ}\text{C}$ (MSL 1)	168 hours	924 pcs (3 lots)	0	JESD22-A113
HAST	$T_A = 130^{\circ}\text{C}$ , RH = 85%, P = 33.3psia, $V_{IN} = 28\text{V}$	96 hours	231 pcs (3 lots)	0	JESD22-A110
Pre-con + PCT (autoclave)	$121^{\circ}\text{C}$ , 29.7psia, RH=100%	168 hours	231 pcs (3 lots)	0	JESD22-A102
Temperature Cycle	$T_A = -65^{\circ}\text{C}$ to $150^{\circ}\text{C}$ , air to air	250 / 500 / 1000 cycles	231 pcs (3 lots)	0	JESD22-A104
HTSL	$T_A = 150^{\circ}\text{C}$	500 / 1000 hours	231 pcs (3 lots)	0	JESD22-A103

**Note:** The reliability data presents total of available generic data up to the published date.

Note A: MSL (Moisture Sensitivity Level) 1 based on J-STD-020

## II. Reliability Evaluation

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the product technology. Failure Rate Determination is based on JEDEC Standard JESD 85.

**FIT rate (failures per billion device hours): 0.460**

**MTTF = 2,174.7 million hrs**

The failure rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \chi^2[\text{CL}, (2f+2)] / 2 \times [1 / (\text{SS} \times t \times \text{AF})]; \text{ [equation 1]} \quad \text{where} \quad \begin{array}{l} \text{CL} = \% \text{ of confidence level} \\ f = \text{number of failure} \\ \text{SS} = \text{sample size} \\ t = \text{stress time} \end{array}$$

Looking up the  $\chi^2/2$  table for zero failure (burn-in) with 60% confidence, the value of  $\chi^2[\text{CL}, (2f+2)] / 2$  is 0.92.

The Acceleration Factor (AF) is calculated from the following formula (both temperature and voltage acceleration factors are used in the final acceleration factor calculation) :

$$\text{AF} = \text{AF}_T \times \text{AF}_V = \exp[(E_a/k) \times (1/T_o - 1/T_s)] \times \exp[\beta (V_s - V_o)] \text{ where} \quad \begin{array}{l} E_a = \text{activation energy} \\ k = \text{Boltzmann constant} \\ T_o = \text{operating } T_J \\ T_s = \text{stress } T_J \\ V_s = \text{stress voltage} \\ V_o = \text{operating voltage} \end{array}$$

$\beta$  = voltage acceleration coefficient

Assuming typical operating environment,  $V_o = 25V$ ,  $T_o = 55^\circ C$ ,  $E_a = 0.7eV$ ,  $V_{s(DriverIC)} = 28V$ ,  $V_{s(MOSFET)} = 30V$ ,  $T_s = 150^\circ C$ ,  $\beta = 0.5$  (silicon defect)

$$AF(DriverIC) = \exp\left[\left(\frac{0.7}{8.617E-5}\right) \cdot \left(\frac{1}{273+55} - \frac{1}{273+150}\right)\right] \cdot \exp[0.5 \cdot (28V - 25V)]$$

$$AF(MOSFET) = \exp\left[\left(\frac{0.7}{8.617E-5}\right) \cdot \left(\frac{1}{273+55} - \frac{1}{273+150}\right)\right] \cdot \exp[0.5 \cdot (30V - 25V)]$$

Substituting the values in equation 1, we have  $\lambda = 2 \cdot \lambda(MOSFET) + \lambda(DriverIC) =$

$$0.92 \cdot \frac{2}{Sample\ Size \cdot Stress\ Duration \cdot AF(MOSFET)} + \frac{1}{sample\ Size \cdot Stress\ Duration \cdot AF(DriverIC)} hr^{-1}$$

$\lambda = 0.460 \cdot 10^{-9} hr^{-1}$  or 0.460 FIT; MTTF =  $(1/\lambda) = 2,174.7$  million hrs = 248,251 years

The calculation shows failure rate is 0.460 FIT, MTTF is 2,174.7 million hours under typical operating conditions.

# ELECTROSTATIC DISCHARGE, LATCH UP TEST REPORT

Part Number: AOZ1360AIL\_4 / AOZ1364AIL

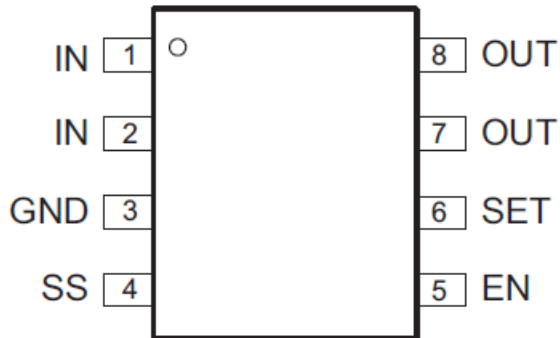
Package: SO8

<b>ESD, LATCH UP RESULTS</b>					
Test	Specification	Conditions	Temperature	Sample Size	Results
Electrostatic Discharge	JESD-A114	$\pm 2.5\text{kV}$ (HBM)	25C	3	PASS
Electrostatic Discharge	JESD-C101	$\pm 1\text{kV}$ (CDM)	25C	3	PASS
Latch Up	JESD78	$\pm 100\text{mA}$ , 1.5x OV	25C	6	PASS
Latch Up	JESD78	$\pm 100\text{mA}$ , 1.5x OV	125C	6	PASS

**Note:**

- ATE results are used to determine PASS/FAIL. Parametric shift <10%.

**Pin Configuration:**



**SO-8**  
(Top View)