

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

**AOZ1360AIL\_4 & AOZ1364AIL** rev A

**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 <sub>J</sub> = 150°C,<br>V <sub>IN</sub> = 28V                            | 168 / 500 /<br>1000 hours  | 231 pcs<br>(3 lots) | 0                  | JESD22-A108        |
| Preconditioning<br>(Note A)  | T <sub>A</sub> = 85°C, RH = 85% +<br>3 cycle reflow @ 260°C<br>(MSL 1)      | 168 hours                  | 924 pcs<br>(3 lots) | 0                  | JESD22-A113        |
| HAST                         | T <sub>A</sub> = 130°C, RH = 85%,<br>P = 33.3psia,<br>V <sub>IN</sub> = 28V | 96 hours                   | 231 pcs<br>(3 lots) | 0                  | JESD22-A110        |
| Pre-con +<br>PCT (autoclave) | 121°C , 29.7psia,<br>RH=100%  | 168 hours                  | 231 pcs<br>(3 lots) | 0                  | JESD22-A102        |
| Temperature<br>Cycle         | T <sub>A</sub> = -65°C to 150°C,<br>air to air                              | 250 / 500 /<br>1000 cycles | 231 pcs<br>(3 lots) | 0                  | JESD22-A104        |
| HTSL                         | T <sub>A</sub> = 150°C  | 500 / 1000<br>hours        | 231 pcs<br>(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:

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

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

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

$\beta$  = 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  $\lambda = 2 \cdot \lambda(MOSFET) + \lambda(DriverIC) =$

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

$\lambda = 0.460 \cdot 10^{-9} \text{ hr}^{-1}$  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: AOZ1360DIL\_4

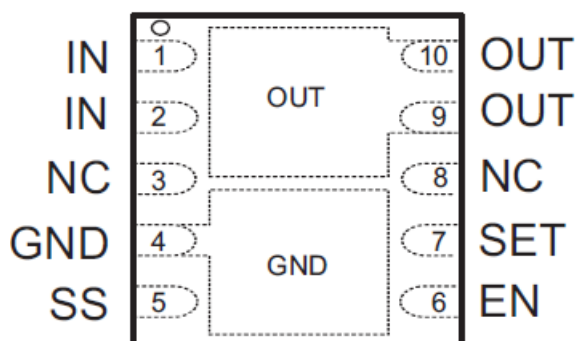
Package: DFN4x4\_10L

| ESD, LATCH UP RESULTS   |               |                 |             |             |         |
|-------------------------|---------------|-----------------|-------------|-------------|---------|
| Test                    | Specification | Conditions      | Temperature | Sample Size | Results |
| Electrostatic Discharge | JESD-A114     | ±2.5kV (HBM)    | 25C         | 3           | PASS    |
| Electrostatic Discharge | JESD-C101     | ±1kV (CDM)      | 25C         | 3           | PASS    |
| Latch Up                | JESD78        | ±100mA, 1.5x OV | 25C         | 6           | PASS    |
| Latch Up                | JESD78        | ±100mA, 1.5x OV | 125C        | 6           | PASS    |

**Note:**

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

**Pin Configuration:**



**DFN-10**  
(Top View)