ALPHA & OMEGA
SEMICONDUCTOR

AOS Semiconductor
Product Reliability Report

AOZ13937DI-04 rev A

Plastic Encapsulated Device

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The AOS product reliability report summarizes the qualification results for AOZ13937DI-04 in DFN3x3-12L 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 AOZ13937DI-04 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 (TP006B2 & TP006D0)	T_J = 150°C, V_{IN} = 32V	168 / 500 / 1000 hours & 168 hrs	231 pcs (3 lots) & 77 pcs (1 lot)	0	JESD22-A108
Preconditioning (Note A)	T_A = 85°C, RH = 85% + 3 cycle reflow @ 260°C (MSL 1)	168 hours	924 pcs (3 lots)	0	JESD22-A113
HAST	T_A = 130°C, RH = 85%, P = 33.3psia, V_{IN} = 32V	96 hours	231 pcs (3 lots)	0	JESD22-A110
Pre-con + PCT (autoclave)	121°C , 29.7psia, RH=100%	96 hours	231 pcs (3 lots)	0	JESD22-A102
Temperature Cycle	T_A = -65°C to 150°C, air to air	500 / 1000 cycles	231 pcs (3 lots)	0	JESD22-A104
HTSL	T_A = 150°C	1000 hours	231 pcs (3 lots)	0	JESD22-A103
HTGB (MOSFET)	T_J = 150°C, V_{GS} = 10V	168 / 500 / 1000 hours	231 (3 lots)	0	JESD22-A108
HTRB (MOSFET)	T_J = 150°C, V_{DS} = 39V	168 / 500 / 1000 hours	231 (3 lots)	0	JESD22-A108
Mechanical Shock	Condition B a = 1500g; t = 0.5ms	5 shocks / side	30 (3 lots)	0	JESD22-B110B

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 (λ) is calculated as follows:

$\lambda = \chi^2[CL,(2f+2)] / 2 \times [1/(SS \times t \times AF)]$; [equation 1] where

CL = % of confidence level
f = number of failure
SS = sample size
t = stress time

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) :

$AF = AF_T \times AF_V = \exp[(E_a/k) \times (1/T_0 - 1/T_s)] \times \exp[\beta\ (V_s - V_o)]$ where

E_a = activation energy
k = Boltzmann constant
T_o = operating T_J
T_s = stress T_J
V_s = stress voltage
V_o = operating voltage
β = voltage acceleration coefficient

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

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

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

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

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

λ = 0.460 10^{-9} hr^{-1} or 0.460 FIT; MTTF = (1/ λ) = 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.

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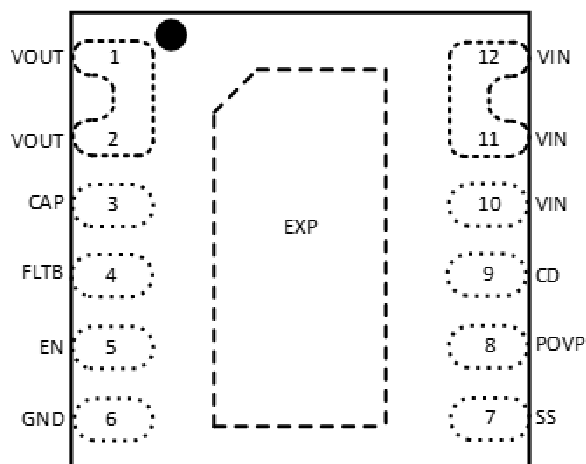
ELECTROSTATIC DISCHARGE, LATCH UP TEST REPORT

Part Number: AOZ13937DI-04
Package: DFN3x3_12L

ESD, LATCH UP RESULTS					
Test	**Specification**	**Conditions**	**Temperature**	**Sample Size**	**Results** (2)
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 (1)
Latch Up	JESD78	±100mA, 1.5x OV	125C	6	PASS (1)

Note:
1. CAP pin Current Inject ±20mA and FLTB pin Current Inject ±50mA, Immunity Level B
2. ATE results are used to determine PASS/FAIL. Parametric shift <10%.

Pin Configuration



DFN3x3-12L
(Top Transparent View)