ALPHA & OMEGA SEMICONDUCTOR

AOS Semiconductor
Product Reliability Report

AOZ18103DI-02 rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

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The AOS product reliability report summarizes the qualification results for AOZ18103DI-02 in DFN3X3-10L 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 AOZ18103DI-02 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. AOZ18103DI-02 Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Sample Size / Lots	Number of Failures	Reference Standard
HTOL	T_J = 125°C, V_{IN} = 20V	168 / 500 / 1000 hours	231 pcs (3 lots)	0	JESD22-A108
Preconditioning (Note A)	T_A = 85°C, RH = 85% + 3 cycle reflow @ 260°C (MSL 1)	168hours	924 pcs (3 lots)	0	JESD22-A113
HAST	T_A = 130°C, RH = 85%, P = 33.3psia, V_{IN} = 20V	96 hours	231 pcs (3 lots)	0	JESD22-A110
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
Autoclave	T_A = 121°C, RH = 100%, P =29.7psia	96 hours	231 pcs	0	JESD22-A102
HTGB (MOSFET)	T_J = 150°C, V_{GS} = 5V	168 / 500 hours	231 (3 lots)	0	JESD22-A108
HTRB (MOSFET)	T_J = 150°C, V_{DS} = 18V	168 / 500 hours	231 (3 lots)	0	JESD22-A108

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): 2.939
MTTF = 340.3 million hrs=38844.25 years
Condition: V_o = 5.5V, T_o = 55°C, $V_{s(IC)}$ = 20V, $V_{s(MOSFET)}$ = 18V, $T_{s(IC)}$ = 125°C and $T_{s(MOSFET)}$ = 150°C
Accumulated Sample Size x Hours: MOSFET = 280000, IC = 1077320

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 χ^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) :
$AF = AF_T \times AF_V = \exp[(E_a/k) \times (1/T_0-1/T_s)] \times \exp[\beta\ (Vs-Vo)]$ 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 = 5.5V, T_o = 55°C, E_a = 0.7eV, $V_{s(IC)}$ = 20V, $V_{s(MOSFET)}$ = 18V, $T_{s(IC)}$ = 125°C and $T_{s(MOSFET)}$ = 150°C, β = 0.5 (silicon defect)

$$AF(DriverIC) = exp\left[\left(\frac{0.7}{8.617E-5}\right)\bullet\left(\frac{1}{273+55}-\frac{1}{273+125}\right)\right]\bullet exp[\,0.5\bullet(20V-5.5V)]$$

$$AF(MOSFET) = exp\left[\left(\frac{0.7}{8.617E-5}\right)\bullet\left(\frac{1}{273+55}-\frac{1}{273+150}\right)\right]\bullet exp[\,0.5\bullet(18V-5.5V)]$$

Substituting the values in equation 1, we have

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

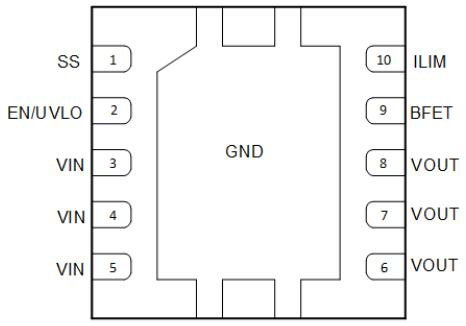
$\lambda = 2.939\ 10^{-9}$ hr $^{-1}$ or 2.939 FIT; MTTF = (1/ λ) = 340.3 million hrs = 38844.24 years

The calculation shows failure rate is 2.939 FIT, MTTF is 340.3 million hours under typical operating conditions.

III. AOZ18103DI-02 ESD and Latch Up Test Results

Test	Test Conditions	Total Sample Size	Number of Failures	Reference Standard
Electrostatic Discharge Human Body Model	**T_A = 25°C, +/-4kV**	**10**	**0**	**JESD-A114**
Electrostatic Discharge Charged Device Model	**T_A = 25°C, +/-1kV**	**10**	**0**	**JESD-C101**
Latch Up	**T_A = 25°C, +/-100mA, 1.27x OV**	**10**	**0**	**JESD78**
Latch Up	**T_A = 125°C, +/-100mA, 1.27x OV**	**10**	**0**	**JESD78**

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



DFN3x3-10L
(Top Transparent View)