The AOS product reliability report summarizes the qualification results for AOZ13937DI-02 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-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. Reliability Stress Test Summary and Results

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Test Condition</th>
<th>Time Point</th>
<th>Sample Size / Lots</th>
<th>Number of Failures</th>
<th>Reference Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTOL</td>
<td>$T_J = 150^\circ C$, $V_{IN} = 32V$</td>
<td>168 / 500 / 1000 hrs</td>
<td>231 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A108</td>
</tr>
<tr>
<td>Preconditioning</td>
<td>$T_A = 85^\circ C$, RH = 85% + 3 cycle reflow @ 260^\circ C$ (MSL 1)</td>
<td>168 hours</td>
<td>924 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A113</td>
</tr>
<tr>
<td>HAST</td>
<td>$T_A = 130^\circ C$, RH = 85%, $P = 33.3$psia, $V_{IN} = 32V$</td>
<td>96 hours</td>
<td>231 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A110</td>
</tr>
<tr>
<td>Pre-con + PCT (autoclave)</td>
<td>121°C, 29.7psia, RH=100%</td>
<td>96 hours</td>
<td>231 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A102</td>
</tr>
<tr>
<td>Temperature Cycle</td>
<td>$T_A = -65^\circ C$ to 150°C, air to air</td>
<td>500 / 1000 cycles</td>
<td>231 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A104</td>
</tr>
<tr>
<td>HTSL</td>
<td>$T_A = 150^\circ C$</td>
<td>1000 hours</td>
<td>231 pcs (3 lots)</td>
<td>0</td>
<td>JESD22-A103</td>
</tr>
<tr>
<td>HTGB (MOSFET)</td>
<td>$T_J = 150^\circ C$, $V_{GS} = 10V$</td>
<td>168 / 500 / 1000 hrs</td>
<td>231 (3 lots)</td>
<td>0</td>
<td>JESD22-A108</td>
</tr>
<tr>
<td>HTRB (MOSFET)</td>
<td>$T_J = 150^\circ C$, $V_{DS} = 39V$</td>
<td>168 / 500 / 1000 hrs</td>
<td>231 (3 lots)</td>
<td>0</td>
<td>JESD22-A108</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>Condition B $a = 1500g$; $t = 0.5ms$</td>
<td>5 shocks / side</td>
<td>30 (3 lots)</td>
<td>0</td>
<td>JESD22-B110B</td>
</tr>
</tbody>
</table>

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:

$$\lambda = \frac{\chi^2(\text{CL},(2f+2))}{2} \times \frac{1}{(SS \times t \times AF)}; \text{[equation 1]}$$

where

- $\text{CL} = \%$ of confidence level
- $f = \text{number of failure}$
- $SS = \text{sample size}$
- $t = \text{stress time}$

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): 

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

where:
- \( E_a \) = activation energy
- \( k \) = Boltzmann constant
- \( T_0 \) = operating \( T_J \)
- \( T_s \) = stress \( T_J \)
- \( V_s \) = stress voltage
- \( V_o \) = operating voltage
- \( \beta \) = voltage acceleration coefficient

Assuming typical operating environment, \( V_o = 25V, T_0 = 55°C, E_a = 0.7eV, V_s(DriverIC) = 28V, V_s(MOSFET) = 30V, T_s = 150°C, \beta = 0.5 \) (silicon defect)

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

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

Substituting the values in equation 1, we have \( \lambda = 2 \cdot \lambda(MOSFET) + \lambda(DriverIC) = 0.92 \cdot \frac{2}{\text{Sample Size} \cdot \text{Stress Duration} \cdot AF(MOSFET)} + \frac{1}{\text{Sample Size} \cdot \text{Stress Duration} \cdot AF(DriverIC)} \) hr\(^{-1}\)

\[ \lambda = 0.460 \times 10^{-9} \text{ hr}^{-1} \text{ or } 0.460 \text{ FIT}; \text{MTTF} = \frac{1}{\lambda} = 2,174.7 \text{ million hrs} = 248,251 \text{ years} \]

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: AOZ13937DI-02
Package: DFN3x3_12L

<table>
<thead>
<tr>
<th>Test</th>
<th>Specification</th>
<th>Conditions</th>
<th>Temperature</th>
<th>Sample Size</th>
<th>Results (^{(2)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic Discharge</td>
<td>JESD-A114</td>
<td>±2.5kV (HBM)</td>
<td>25°C</td>
<td>3</td>
<td>PASS</td>
</tr>
<tr>
<td>Electrostatic Discharge</td>
<td>JESD-C101</td>
<td>±1kV (CDM)</td>
<td>25°C</td>
<td>3</td>
<td>PASS</td>
</tr>
<tr>
<td>Latch Up</td>
<td>JESD78</td>
<td>±100mA, 1.5x OV</td>
<td>25°C</td>
<td>6</td>
<td>PASS (^{(1)})</td>
</tr>
<tr>
<td>Latch Up</td>
<td>JESD78</td>
<td>±100mA, 1.5x OV</td>
<td>125°C</td>
<td>6</td>
<td>PASS (^{(1)})</td>
</tr>
</tbody>
</table>

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

[Diagram of pin configuration for DFN3x3-12L]

(Top Transparent View)