



# **AOS Semiconductor**

## **Product Reliability Report**

**AON6708/AON6708L, rev A**

**Plastic Encapsulated Device**

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This AOS product reliability report summarizes the qualification result for AON6708. Accelerated environmental tests are performed on a specific sample size, and then followed by electrical test at end point. Review of final electrical test result confirms that AON6708 passes AOS quality and reliability requirements. The released product will be categorized by the process family and be monitored on a quarterly basis for continuously improving the product quality.

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### I. Product Description:

The AON6708 uses advanced trench technology with a monolithically integrated Schottky diode to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use as a low side FET in SMPS, load switching and general purpose applications. AON6708 and AON6708L are electrically identical.

| <b>Absolute Maximum Ratings <math>T_A=25^\circ\text{C}</math> unless otherwise noted</b> |                         |            |                  |
|--|-------------------------|------------|------------------|
| Parameter  | Symbol                  | Maximum    | Units            |
| Drain-Source Voltage   | $V_{DS}$                | 30         | V                |
| Gate-Source Voltage  | $V_{GS}$                | $\pm 12$   | V                |
| Continuous Drain Current   | $T_A=25^\circ\text{C}$  | 30         | A                |
|  | $T_A=100^\circ\text{C}$ | 30         |                  |
| Pulsed Drain Current   | $I_{DM}$                | 120        |                  |
| Power Dissipation  | $T_A=25^\circ\text{C}$  | 62         | W                |
|  | $T_A=100^\circ\text{C}$ | 25         |                  |
| Junction and Storage Temperature Range   | $T_J, T_{STG}$          | -55 to 150 | $^\circ\text{C}$ |

| <b>Thermal Characteristics</b> |                     |                 |      |     |                    |
|--------------------------------|---------------------|-----------------|------|-----|--------------------|
| Parameter                      |                     | Symbol          | Typ  | Max | Units              |
| Maximum Junction-to-Ambient    | $t \leq 10\text{s}$ | $R_{\theta JA}$ | 14.2 | 20  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient    | Steady-State        |                 | 42   | 50  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead       | Steady-State        | $R_{\theta JC}$ | 1.2  | 2.0 | $^\circ\text{C/W}$ |



## II. Die / Package Information:

|                                   | AON6708  | AON6708L (Green Compound)                            |
|-----------------------------------|--|--|
| <b>Process</b>                    | Standard sub-micron<br>Low voltage N channel process | Standard sub-micron<br>Low voltage N channel process |
| <b>Package Type</b>               | DFN 5x6_8L   | DFN 5x6_8L   |
| <b>Lead Frame</b>                 | A194 (FH), Ag spot                                   | A194 (FH), Ag spot                                   |
| <b>Die Attach</b>                 | Ag epoxy   | Ag epoxy   |
| <b>Bond wire</b>                  | G: Au 1.3mils; S: Cu 2mils                           | G: Au 1.3mils; S: Cu 2mils                           |
| <b>Mold Material</b>              | Epoxy resin with silica filler                       | Epoxy resin with silica filler                       |
| <b>Filler % (Spherical/Flake)</b> | 90/10  | 100/0  |
| <b>Flammability Rating</b>        | UL-94 V-0  | UL-94 V-0  |
| <b>Backside Metallization</b>     | Ti / Ni / Ag   | Ti / Ni / Ag   |
| <b>Moisture Level</b>             | Up to Level 1 *                                      | Up to Level 1 *                                      |

Note \* based on info provided by assembler and mold compound supplier

## III. Result of Reliability Stress for AON6708 (Standard) & AON6708L (Green)

| Test Item                  | Test Condition   | Time Point                    | Lot Attribution                     | Total Sample size              | Number of Failures |
|----------------------------|--|-------------------------------|-------------------------------------|--------------------------------|--------------------|
| Solder Reflow Precondition | Standard: 1hr PCT+3 cycle reflow @260°C<br>Green: 168hr 85°C /85%RH +3 cycle reflow @260°C | 0hr                           | Standard: 24 lots<br><br>(Note B**) | 4022 pcs                       | 0                  |
| HTGB                       | Temp = 150°C ,<br>Vgs=100% of Vgsmax   | 168 / 500 hrs<br><br>1000 hrs | 3 lots<br><br>(Note A*)             | 246 pcs<br><br>77+5 pcs / lot  | 0                  |
| HTRB                       | Temp = 150°C ,<br>Vds=80% of Vdsmax  | 168 / 500 hrs<br><br>1000 hrs | 3 lots<br><br>(Note A*)             | 246 pcs<br><br>77+5 pcs / lot  | 0                  |
| HAST                       | 130 +/- 2°C , 85%RH,<br>33.3 psi, Vgs = 80% of Vgs max                                     | 100 hrs                       | Standard: 12 lots<br><br>(Note B**) | 660 pcs<br><br>50+5 pcs / lot  | 0                  |
| Pressure Pot               | 121°C , 29.7psi,<br>RH=100%  | 96 hrs                        | Standard: 17 lots<br><br>(Note B**) | 1394 pcs<br><br>77+5 pcs / lot | 0                  |
| Temperature Cycle          | -65°C to 150°C ,<br>air to air   | 250 / 500 cycles              | Standard: 24 lots<br><br>(Note B**) | 1968 pcs<br><br>77+5 pcs / lot | 0                  |

### III. Result of Reliability Stress for AON6708 (Standard) & AON6708L (Green) Continues

|                |   |                       |                |                                  |   |
|----------------|---|-----------------------|----------------|----------------------------------|---|
| DPA            | Internal Vision<br>Cross-section<br>X-ray | NA                    | 5<br>5<br>5    | 5<br>5<br>5                      | 0 |
| CSAM           |   | NA                    | 5              | 5                                | 0 |
| Bond Integrity | Room Temp<br>150°C bake<br>150°C bake     | 0hr<br>250hr<br>500hr | 40<br>40<br>40 | 40 wires<br>40 wires<br>40 wires | 0 |
| Solderability  | 245°C                                     | 5 sec                 | 15             | 15 leads                         | 0 |

**Note A:** The HTGB and HTRB reliability data presents total of available AON6708 and AON6708L burn-in data up to the published date.

**Note B:** The pressure pot, temperature cycle and HAST reliability data for AON6708 and AON6708L comes from the AOS generic package qualification data.

### IV. Reliability Evaluation

**FIT rate (per billion): 14.4**  
**MTTF = 7927 years**

In general, 500 hrs of HTGB, 150 deg C accelerated stress testing is equivalent to 15 years of lifetime at 55 deg C operating conditions (by applying the Arrhenius equation with an activation energy of 0.7eV and 60% of upper confidence level on the failure rate calculation). AOS reliability group also routinely monitors the product reliability up to 1000 hr at and performs the necessary failure analysis on the units failed for reliability test(s).

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AON6708). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

$$\text{Failure Rate} = \text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 1.83 \times 10^9 / [2 (3 \times 164) (500) (258)] = 14.4$$

$$\text{MTTF} = 10^9 / \text{FIT} = 6.94 \times 10^7 \text{hrs} = 7927 \text{ years}$$

**Chi<sup>2</sup>** = Chi Squared Distribution, determined by the number of failures and confidence interval

**N** = Total Number of units from HTRB and HTGB tests

**H** = Duration of HTRB/HTGB testing

**Af** = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55°C)

Acceleration Factor [**Af**] =  $\text{Exp} [E_a / k (1/T_j - 1/T_u)]$

**Acceleration Factor ratio list:**

|           | 55 deg C   | 70 deg C  | 85 deg C  | 100 deg C | 115 deg C   | 130 deg C   | 150 deg C |
|-----------|------------|-----------|-----------|-----------|-------------|-------------|-----------|
| <b>Af</b> | <b>258</b> | <b>87</b> | <b>32</b> | <b>13</b> | <b>5.64</b> | <b>2.59</b> | <b>1</b>  |

**T<sub>js</sub>** = Stressed junction temperature in degree (Kelvin), K = C+273.16

**T<sub>ju</sub>** = The use junction temperature in degree (Kelvin), K = C+273.16

**k** = Boltzmann's constant, 8.617164 X 10<sup>-5</sup>eV/K



## V. Quality Assurance Information

Acceptable Quality Level for outgoing inspection: **0.1%** for electrical and visual.

Guaranteed Outgoing Defect Rate: **< 25 ppm**

Quality Sample Plan: conform to **Mil-Std-105D**