ALPHA & OMEGA SEMICONDUCTOR

AOS Semiconductor Product Reliability Report

AON6408/AON6408L, rev A

Plastic Encapsulated Device

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This AOS product reliability report summarizes the qualification result for AON6408. 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 AON6408 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 AON6408/L combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is for PWM applications. AON6408 & AON6408L are electrically identical.
-RoHs Compliant
-AON6408L is Halogen Free

Absolute Maximum Ratings T_A=25°C unless otherwise noted				
Parameter		**Symbol**	**Maximum**	**Units**
Drain-Source Voltage		V_{DS}	30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_A=25°C	I_D	25	A
	T_A=100°C		20	
Pulsed Drain Current		I_{DM}	130	
Continuous Drain Current	T_A=25°C	I_{DSM}	14.5	
	T_A=70°C		11.5	
Avalanche Current		I_{AR}	51	mJ
Power Dissipation	T_A=25°C	P_D	31	W
	T_A=100°C		12.5	
Power Dissipation	T_A=25°C	P_{DSM}	2.4	W
	T_A=70°C		1.5	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient	T ≤ 10s	$R_{\theta JA}$	17	21	°C/W
Maximum Junction-to-Ambient	Steady-State		44	53	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JC}$	3.4	4	°C/W

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II. Die / Package Information:

	AON6408	AON6408L (Green Compound)
Process	Standard sub-micron Low voltage N channel process	Standard sub-micron Low voltage N channel process
Package Type	8 leads DFN 5×6	8 leads DFN 5×6
Lead Frame	Bare Cu	Bare Cu
Die Attach	Solder paste	Solder paste
Bond wire	S: Cu 2mils, G: Au 1.3mils	S: Cu 2mils, G: Au 1.3mils
Mold Material	Epoxy resin with silica filler	Epoxy resin with silica filler
Filler % (Spherical/Flake)	90/10	100/0
Flammability Rating	UL-94 V-0	UL-94 V-0
Moisture Level	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 AON6408 (Standard) & AON6408L (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** **Green: 168hr 85°c /85%RH +3 cycle reflow @260°c**	**0hr**	**Standard: 6 lots** **(Note B**)**	**902 pcs**	**0**
HTGB	**Temp = 150°c , Vgs=100% of Vgsmax**	**168 / 500 hrs** **1000 hrs**	**2 lots** **(Note A*)**	**164 pcs** **77+5 pcs / lot**	**0**
HTRB	**Temp = 150°c , Vds=80% of Vdsmax**	**168 / 500 hrs** **1000 hrs**	**2 lots** **(Note A*)**	**164 pcs** **77+5 pcs / lot**	**0**
HAST	**130 +/- 2°c , 85%RH, 33.3 psi, Vgs = 80% of Vgs max**	**100 hrs**	**Standard: 2 lots** **(Note B**)**	**164 pcs** **50+5 pcs / lot**	**0**
Pressure Pot	**121°c , 29.7psi, RH=100%**	**96 hrs**	**Standard: 3 lots** **(Note B**)**	**246 pcs** **50+5 pcs / lot**	**0**
Temperature Cycle	**-65°c to 150°c , air to air**	**250 / 500 cycles**	**Standard: 6 lots** **(Note B**)**	**492 pcs** **50+5 pcs / lot**	**0**

III. Result of Reliability Stress for AON6408 (Standard) & AON6408L (Green) Continues

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

Note A: The HTGB and HTRB reliability data presents total of available AON6408 and AON6408L burn-in data up to the published date.
Note B: The pressure pot, temperature cycle and HAST reliability data for AON6408 and AON6408L comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 64
MTTF =1774 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 (AON6408). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

Failure Rate = $Chi^2 \times 10^9$ **/ [**2 (N) (H) (Af)**]** = 1.83×10^9 / **[**2 (2×164) (168) (258)**]** = 64
MTTF = 10^9 / FIT =1.55×10^7hrs = 1774years

Chi² = 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**] = **Exp** [Ea / **k** (1/Tj u – 1/Tj s)]
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
Af	258	87	32	13	5.64	2.59	1

Tjs = Stressed junction temperature in degree (Kelvin), K = C+273.16
Tju =The use junction temperature in degree (Kelvin), K = C+273.16
k = Boltzmann's constant, 8.617164 X 10^{-5}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**