ALPHA & OMEGA SEMICONDUCTOR

AOS Semiconductor Product Reliability Report

AOD609, rev B

Plastic Encapsulated Device

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This AOS product reliability report summarizes the qualification result for AOD609. 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 AOD609 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.

Table of Contents:

I. Product Description:

The AOD609 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications.

-RoHS Compliant
-Halogen Free*

Absolute Maximum Ratings T_A=25°C unless otherwise noted					
Parameter		Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage		V_{DS}	40	-40	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current [B,H]	T_C=25°C	I_D	23	-20	A
	T_C=100°C		17	-14	
Pulsed Drain Current [B]		I_{DM}	30	-30	
Avalanche Current [C]		I_{AR}	14	-20	
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	9.8	20	mJ
Power Dissipation	T_C=25°C	P_D	27	30	W
	T_C=100°C		14	15	
Power Dissipation	T_A=25°C	P_{DSM}	2	2	W
	T_A=70°C		1.3	1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	-55 to 175	°C

Thermal Characteristics: n-channel and p-channel						
Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient [A,D]	t ≤ 10s	$R_{\theta JA}$	n-ch	17.4	25	°C/W
Maximum Junction-to-Ambient [A,D]	Steady-State		n-ch	50	60	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JC}$	n-ch	4	5.5	°C/W
Maximum Junction-to-Ambient [A,D]	t ≤ 10s	$R_{\theta JA}$	p-ch	16.7	25	°C/W
Maximum Junction-to-Ambient [A,D]	Steady-State		p-ch	50	60	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JC}$	p-ch	3.5	5	°C/W

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II. Die / Package Information:

	AOD609
Process	Standard sub-micron Low voltage N+P channel process
Package Type	3 leads TO252
Lead Frame	Cu, S/pad, Ag spot
Die Attach	Ag epoxy
Bond wire	G:1.3 mils Au; S: 2mils Cu
Mold Material	Epoxy resin with silica filler
Flammability Rating	UL-94 V-0
Backside Metallization	Ti / Ni / Ag
Moisture Level	Up to Level 1 *

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

III. Result of Reliability Stress for AOD609

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures
Solder Reflow Precondition	**168hr 85°c /85%RH +3 cycle reflow@260°c**	**-**	**9 lots**	**1210pcs**	**0**
HTGB	**Temp = 150°c , Vgs=100% of Vgsmax**	**168 / 500 hrs** **1000 hrs**	**1 lot** **(Note A*)**	**82pcs** **77+5 pcs / lot**	**0**
HTRB	**Temp = 150°c , Vds=80% of Vdsmax**	**168 / 500 hrs** **1000 hrs**	**1 lot** **(Note A*)**	**82pcs** **77+5 pcs / lot**	**0**
HAST	**130 +/- 2°c , 85%RH, 33.3 psi, Vgs = 80% of Vgs max**	**100 hrs**	**9 lots** **(Note B**)**	**495pcs** **50+5 pcs / lot**	**0**
Pressure Pot	**121°c , 29.7psi, RH=100%**	**96 hrs**	**5 lots** **(Note B**)**	**275pcs** **50+5 pcs / lot**	**0**
Temperature Cycle	**-65°c to 150°c , air to air,**	**250 / 500 cycles**	**8 lots** **(Note B**)**	**440pcs** **50+5 pcs / lot**	**0**

III. Result of Reliability Stress for AOD609

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**
Solder dunk	**260°c**	**10secs** **3 cycles**	**1**	**30 units**	**0**

Note A: The HTGB and HTRB reliability data presents total of available AOD609 burn-in data up to the published date.
Note B: The pressure pot, temperature cycle and HAST reliability data for AOD609 comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 64
MTTF = 1780 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOD609). 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 x 10^9 / **[**2 (164) (500) (258)**]** = 64
MTTF = 10^9 / FIT = 1.56 x 10^7hrs = 1780 years

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

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