



AOS Semiconductor Product Reliability Report

AOD472A/AOD472AL, rev C

Plastic Encapsulated Device

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This AOS product reliability report summarizes the qualification result for AOD472A. 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 AOD472A 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
- II. Package and Die information
- III. Environmental Stress Test Summary and Result
- IV. Reliability Evaluation

I. Product Description:

The AOD472A/L is fabricated with SDMOSTM trench technology that combines excellent $R_{DS(ON)}$ with low gate charge. The result is outstanding efficiency with controlled switching behavior. This universal technology is well suited for PWM, load switching and general purpose applications. AOD472A and AOD472AL are electrically identical.

- RoHS Compliant
- AOD472AL is Halogen Free

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted			
Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	25	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^a	I_D	$T_C=25^\circ\text{C}$	55
		$T_C=100^\circ\text{C}$	43
Pulsed Drain Current ^c	I_{DM}	100	A
Pulsed Forward Diode Current ^c	I_{SM}	100	
Avalanche Current ^c	I_{AR}	50	
Repetitive avalanche energy $L=50\mu\text{H}$ ^c	E_{AR}	63	
Power Dissipation ^b	P_D	$T_C=25^\circ\text{C}$	50
		$T_C=100^\circ\text{C}$	25
Power Dissipation ^a	P_{DSM}	$T_A=25^\circ\text{C}$	2.5
		$T_A=70^\circ\text{C}$	1.6
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10\text{s}$	$R_{\theta JA}$	15	20	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		41	50	$^\circ\text{C/W}$
Maximum Junction-to-Case ^B	Steady-State	$R_{\theta JC}$	2.1	3	$^\circ\text{C/W}$
Maximum Junction-to-TAB ^B	Steady-State	$R_{\theta JC-TAB}$	2.4	3.4	$^\circ\text{C/W}$

II. Die / Package Information:

	AOD472A	AOD472AL (Green Compound)
Process	Standard sub-micron low voltage N channel process	Standard sub-micron low voltage N channel process
Package Type	3 leads TO252	3 leads TO252
Lead Frame	Copper with Ni pad	Copper with Ni pad
Die Attach	Soft solder	Soft solder
Bond wire	G: Au 1.3mils, S: Al 12mils	G: Au 1.3mils, S: Al 12mils
Mold Material	Soft solder	Soft solder
Flammability Rating	UL-94 V-0	UL-94 V-0
Backside Metallization	Ti / Ni / Ag	Ti / Ni / Ag
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 AOD472A (Standard) & AOD472AL (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	-	Standard: 26 lots Green: 3 lots	4675pcs	0
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 hrs 1000 hrs	4 lots (Note A*)	328pcs 77+5 pcs / lot	0
HTRB	Temp = 150°C , Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	4 lots (Note A*)	328pcs 77+5 pcs / lot	0
HAST	130 +/- 2°C , 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard : 26 lots Green: 3 lots (Note B**)	1595pcs 50+5 pcs / lot	0
Pressure Pot	121°C , 15+/-1 PSIG, RH=100%	96 hrs	Standard : 25 lots Green: 3 lots (Note B**)	1540pcs 50+5 pcs / lot	0
Temperature Cycle	-65°C to 150°C , air to air	250 / 500 cycles	Standard : 25 lots Green: 3 lots (Note B**)	1540pcs 50+5 pcs / lot	0
High Temperature Storage	Temp = 150°C	500/1000 hrs	Standard : 15 lots (Note B**)	1230pcs 77+5 pcs / lot	0

III. Result of Reliability Stress for AOD472A (Standard) & AOD472AL (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
Solder dunk	260°C	10secs 3 cycles	1	30 units	0

Note A: The HTGB and HTRB reliability data presents total of available AOD472A and AOD472AL burn-in data up to the published date.

Note B: The pressure pot, temperature cycle, HAST and HTS reliability data for AOD472A and AOD472AL comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 10

MTTF = 11445 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOD472A). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

$$\text{Failure Rate} = \text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)]$$

$$= 1.83 \times 10^9 / [2 (164 \times 168 + 2 \times 164 \times 500 + 164 \times 1000) \times 258] = 10$$

$$\text{MTTF} = 10^9 / \text{FIT} = 1.01 \times 10^8 \text{ hrs} = 11445 \text{ years}$$

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 = 55C)

Acceleration Factor [**Af**] = $\text{Exp} [Ea / k (1/Tj u - 1/Tj s)]$

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, $8.617164 \times 10^{-5} \text{ eV} / \text{K}$