



AOS Semiconductor Product Reliability Report

AOD442, rev C

Plastic Encapsulated Device

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This AOS product reliability report summarizes the qualification result for AOD442. 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 AOD442 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 AOD442 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device is suitable for use as a load switch or in PWM applications.

- RoHS Compliant
- Halogen Free

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted				
Parameter	Symbol	Maximum	Units	
Drain-Source Voltage	V_{DS}	60	V	
Gate-Source Voltage	V_{GS}	± 20	V	
Continuous Drain Current ^{B,G}	I_D	$T_C=25^\circ\text{C}$ ^G	38	A
		$T_C=100^\circ\text{C}$ ^B	27	
Pulsed Drain Current	I_{DM}	60		
Continuous Drain Current	I_{DSM}	$T_A=25^\circ\text{C}$	7.5	A
		$T_A=70^\circ\text{C}$	6	
Avalanche Current ^C	I_{AR}	30	A	
Repetitive avalanche energy $L=0.1\text{mH}$ ^C	E_{AR}	140	mJ	
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	60	W
		$T_C=100^\circ\text{C}$	30	
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ\text{C}$	2	W
		$T_A=70^\circ\text{C}$	1.3	
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	$R_{\theta JA}$	$t \leq 10\text{s}$	17.4	25	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		Steady-State	51	60	$^\circ\text{C/W}$
Maximum Junction-to-Case ^C	$R_{\theta JC}$	Steady-State	1.8	2.5	$^\circ\text{C/W}$



II. Die / Package Information:

	AOD442
Process	Standard sub-micron Low voltage N channel process
Package Type	3 leads TO252
Lead Frame	Bare Cu
Die Attach	Soft solder
Bond wire	Al,5& 8mils
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 AOD442

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	10 lots (Note A*)	820pcs 77+5 pcs / lot	0
HTRB	Temp = 150°c , Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	10 lots (Note A*)	820pcs 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 AOD442

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 AOD442 burn-in data up to the published date.

Note B: The pressure pot, temperature cycle and HAST reliability data for AOD442 comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 3

MTTF = 33447 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOD442). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

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

$$= 1.83 \times 10^9 / [2 \times (2 \times 164 \times 168 + 4 \times 164 \times 500 + 4 \times 164 \times 1000) \times 258] = 3$$

$$\text{MTTF} = 10^9 / \text{FIT} = 2.93 \times 10^8 \text{hrs} = 33447 \text{years}$$

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 = 55°C)

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

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