AOS Semiconductor
Product Reliability Report

AOD406 / AOD406L, rev A

Plastic Encapsulated Device

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September 20, 2004

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This AOS product reliability report summarizes the qualification result for AOD406/AOD406L. 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 AOD406/AOD406L 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:

AOD406 / AOD406L, a n channel MOSFET, is ideally suited for used as a low side switch in CPU core power conversion. The device uses the advanced trench technology to provide excellent Rdson, shoot-through immunity and body diode characteristics.

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}	±12	V
Continuous Drain Current [A]	T_A=25°C	I_D	85	A
	T_A=100°C		75	
Pulsed Drain Current [B]		I_{DM}	200	
Power Dissipation [A]	T_A=25°C	P_D	100	W
	T_A=70°C		50	
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	$R_{\theta JA}$	14.2	20	°C/W
Maximum Junction-to-Ambient	Steady-State		40	50	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	0.8	1.5	°C/W

II. Die / Package Information:

	AOD406	AOD406L (Green Compound)
Die Size	140 X 83 mils	140 X83 mils
Process	Standard sub-micron low voltage N channel process	Standard sub-micron low voltage N channel process
Package Type	3 lead TO252	3 lead TO252
Lead Frame	Copper with Solder Plate	Copper with Solder Plate
Die Attach	Silver-filled Epoxy	Silver-filled Epoxy
Bondwire	5 & 8 mils Al wire	5 & 8 mils Al wire
Mold Material	Epoxy resin with silica filler	Epoxy resin with silica filler
Filler % (Spherical/Flake)	50/50	100/0
Flammability Rating	UL-94 V-0	UL-94 V-0
Backside Metallization	Ti / N / Ag	Ti / N / 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 AOD406 (Standard) & AOD406L (Green)

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures
HTGB	Temp = 150 C, Vgs=100% of Vgsmax	168 / 500 hrs 1000 hrs	AOD406: 4 lots (note A*)	328 pcs 77+5 pcs / lot	0
HTRB	Temp = 150 C, Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	AOD406: 3 lots (note A*)	246 pcs 77+5 pcs / lot	0
HAST	130 +/- 2 C, 85%, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard compound: 1 lot **Green compound: 3 lots (note B**)**	220 pcs (3 lots) 50+5 pcs / lot	0
Pressure Pot	121 C, 15+/-1 PSIG, RH=100%	96 hrs	Standard compound: 1 lot **Green compound: 3 lots ** (note B**)**	220 pcs (3 lots) 50+5 pcs / lot	1
Temperature Cycle	-65 to 150 deg C, air to air, 0.5hr per cycle	250 / 500 cycles	Standard compound: 1 lot **Green compound: 3 lots ** (note B**)**	220 pcs (3 lots) 50+5 pcs / lot	0

III. Result of Reliability Stress for AOD406 (Standard) & AOD406L (Green), Cotinues

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	230°C	5 sec	15	15 leads	0
Die Shear		0hr	10	10	0
ESD Rating	Human Body Mode MIL-STD 883D Method 3025.7	3500V	10 pcs each from AOD406 and AOD406L	20 pcs	0

Note A: The HTGB and HTRB reliability data presents total of available AOD406 and AOD406L burn-in data up to the published date.
Note B: The pressure pot, temperature cycle and HAST reliability data for **AOD406L** comes from the AOS generic green compound package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 36.3

MTBF = 3144 years

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 (AO3401). 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 (574) (168) (258.24)**]** = 36.3

MTBF = 10^9 / 36.3 = 27548209 hours = 3144 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)

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**

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