



AOS Semiconductor

Product Reliability Report

AOTF404/AOTF404L, rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

**495 Mercury Drive
Sunnyvale, CA 94085
U.S.**

Tel: (408) 830-9742

www.aosmd.com

This AOS product reliability report summarizes the qualification result for AOTF404. 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 AOTF404 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 AOTF404/L uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in high voltage synchronous rectification, load switching and general purpose applications.

- RoHs Compliant
- AOTF404L is Halogen free

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted					
Parameter		Symbol	Maximum		Units
Drain-Source Voltage		V_{DS}	105		V
Gate-Source Voltage		V_{GS}	± 25		V
Continuous Drain Current	$T_C=25^\circ\text{C}$	I_D	26		A
	$T_C=100^\circ\text{C}$		18		
Pulsed Drain Current ^c		I_{DM}	90		
Continuous Drain Current	$T_A=25^\circ\text{C}$	I_{DSM}	5.8		A
	$T_A=70^\circ\text{C}$		4.5		
Avalanche Current ^c		I_{AR}	37		A
Repetitive avalanche energy $L=0.1\text{mH}$ ^c		E_{AR}	68		mJ
Power Dissipation ^B	$T_C=25^\circ\text{C}$	P_D	43		W
	$T_C=100^\circ\text{C}$		21		
Power Dissipation ^A	$T_A=25^\circ\text{C}$	P_{DSM}	2.2		W
	$T_A=70^\circ\text{C}$		1.38		
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	$t \leq 10\text{s}$	$R_{\theta JA}$	10	12	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A D}	Steady-State		48.5	58	$^\circ\text{C/W}$
Maximum Junction-to-Case ^B	Steady-State	$R_{\theta JC}$	2.9	3.5	$^\circ\text{C/W}$

II. Die / Package Information:

	AOTF404	AOTF404L (Green Compound)
Process	Standard sub-micron Low voltage N channel process	Standard sub-micron Low voltage N channel process
Package Type	3 leads TO220FL	3 leads TO220FL
Lead Frame	Bare Cu	Bare Cu
Die Attach	Soft solder	Soft solder
Bond wire	Al 5&15 mils	Al 5&15 mils
Mold Material	Epoxy resin with silica filler	Epoxy resin with silica filler
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 AOTF404 (Standard) & AOTF404L (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: 11 lots Green: 3 lots	2442pcs	0
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168hrs 500 hrs 1000 hrs	3 lots (Note A*)	231pcs 77pcs / lot	0
HTRB	Temp = 150°C , Vds=80% of Vdsmax	168hrs 500 hrs 1000 hrs	3 lots (Note A*)	231pcs 77 pcs / lot	0
HAST	130 +/- 2°C , 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard : 5 lots Green: 3 lots (Note B**)	440pcs 55 pcs / lot	0r
Pressure Pot	121°C , 29.7psi, 100%RH	96 hrs	Standard :11 lots Green: 3 lots (Note B**)	1078pcs 77 pcs / lot	0
Temperature Cycle	-65°C to 150°C , air to air,	250 / 500 cycles	Standard : 9 lots Green: 3 lots (Note B**)	924pcs 77 pcs / lot	0

III. Result of Reliability Stress for AOTF404 (Standard) & AOTF404L (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 AOTF404 and AOTF404L burn-in data up to the published date.

Note B: The pressure pot, temperature cycle, HAST and HTS reliability data for AOTF404 and AOTF404L comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion): 8

MTTF = 14871 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AOTF404). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

$$\text{Failure Rate} = \text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 1.83 \times 10^9 / [2 \times 6 \times 77 \times 1000 \times 258] = 8$$

$$\text{MTTF} = 10^9 / \text{FIT} = 1.30 \times 10^8 \text{ hrs} = 14871 \text{ years}$$

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)

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

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 X 10⁻⁵eV / K