ALPHA & OMEGA
SEMICONDUCTOR

AO4807

30V Dual P-Channel MOSFET

General Description

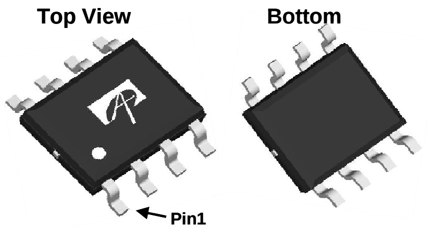
The AO4807 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge. This device is suitable for use as a load switch or in PWM applications.

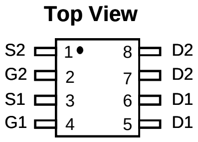
Product Summary

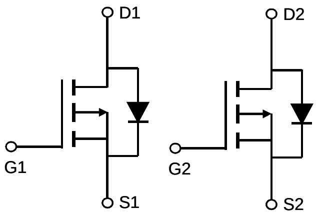
V_{DS}	-30V
I_D (at V_{GS}=-10V)	-6A
$R_{DS(ON)}$ (at V_{GS}=-10V)	< 35mΩ
$R_{DS(ON)}$ (at V_{GS} = -4.5V)	< 58mΩ

100% UIS Tested
100% R_g Tested

SOIC-8







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}	±20	V
Continuous Drain Current	T_A=25°C	I_D	-6	A
	T_A=70°C		-5	
Pulsed Drain Current [C]		I_{DM}	-30	
Avalanche Current [C]		I_{AS}, I_{AR}	23	A
Avalanche energy L=0.1mH [C]		E_{AS}, E_{AR}	26	mJ
Power Dissipation [B]	T_A=25°C	P_D	2	W
	T_A=70°C		1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		74	90	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	32	40	°C/W

Electrical Characteristics (T_J=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=-250µA, V_{GS}=0V	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-30V, V_{GS}=0V			-1	µA
		T_J=55℃			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±20V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-1.3	-1.85	-2.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-6A		21	35	mΩ
		T_J=125℃		31.5	45	
		V_{GS}=-4.5V, I_D=-5A		33	58	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-6A		19		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.8	-1	V
I_S	Maximum Body-Diode Continuous Current				-3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		760		pF
C_{oss}	Output Capacitance			140		pF
C_{rss}	Reverse Transfer Capacitance			95		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	1.5	3.2	5.0	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=-10V, V_{DS}=-15V, I_D=-6A		13.6	16	nC
Q_g(4.5V)	Total Gate Charge			6.7	8	nC
Q_{gs}	Gate Source Charge			2.5		nC
Q_{gd}	Gate Drain Charge			3.2		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=2.7Ω, R_{GEN}=3Ω		8		ns
t_r	Turn-On Rise Time			6		ns
$t_{D(off)}$	Turn-Off DelayTime			17		ns
t_f	Turn-Off Fall Time			5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-6A, dI/dt=100A/µs		15		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-6A, dI/dt=100A/µs		9.7		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The value in any given application depends on the user's specific board design.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° C, using ⩽ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initialT_J=25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-ambient thermal impedence which is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

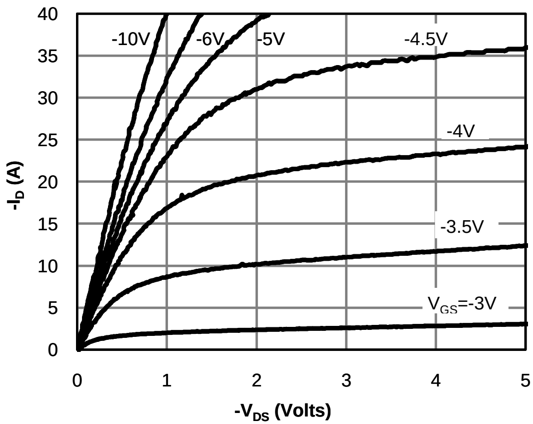


Fig 1: On-Region Characteristics (Note E)

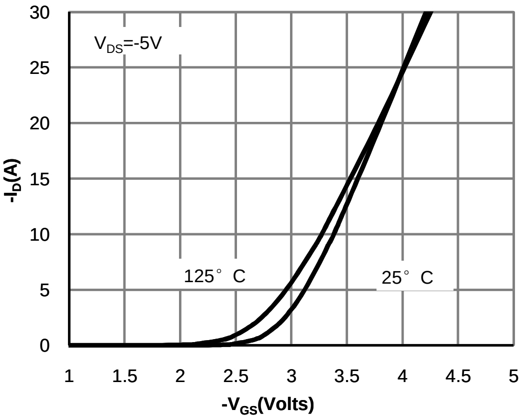


Figure 2: Transfer Characteristics (Note E)

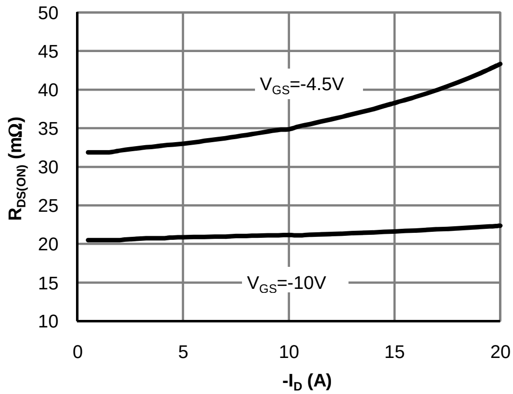


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

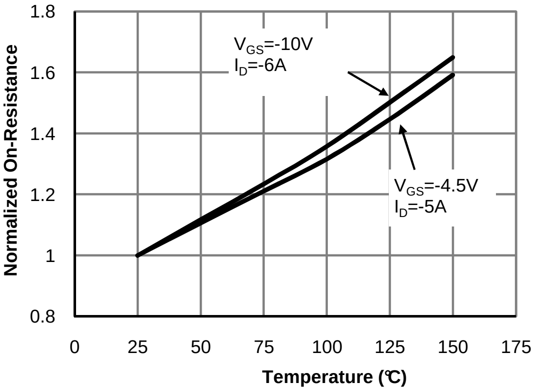


Figure 4: On-Resistance vs. Junction Temperature (Note E)

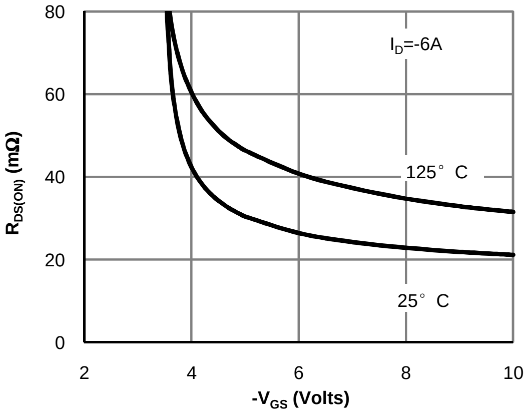


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

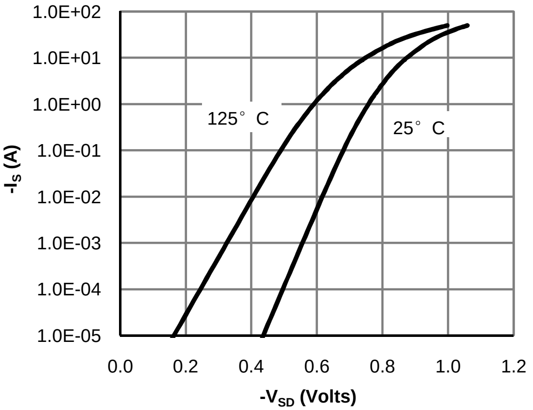


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

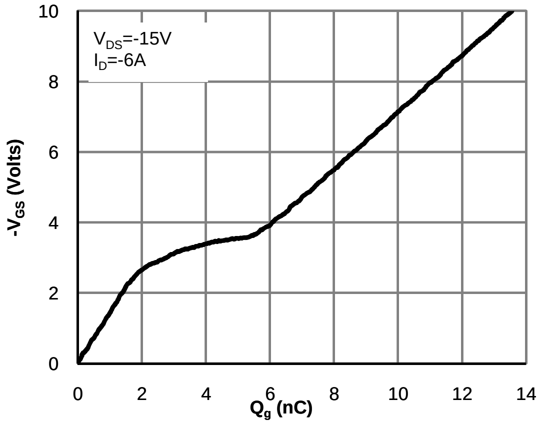


Figure 7: Gate-Charge Characteristics

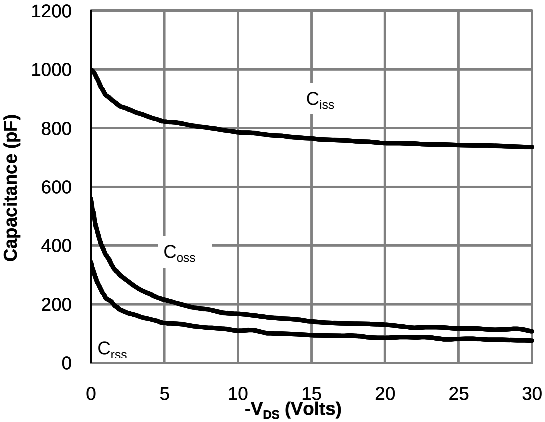


Figure 8: Capacitance Characteristics

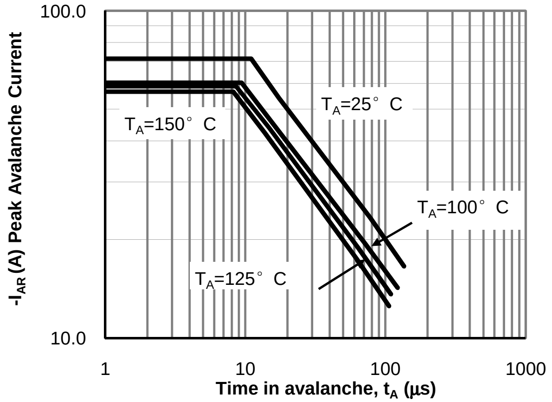


Figure 9: Single Pulse Avalanche capability (Note C)

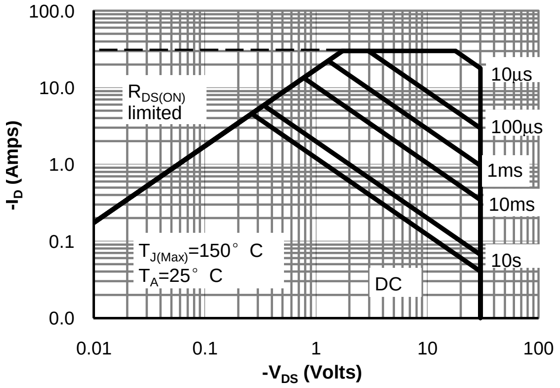


Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

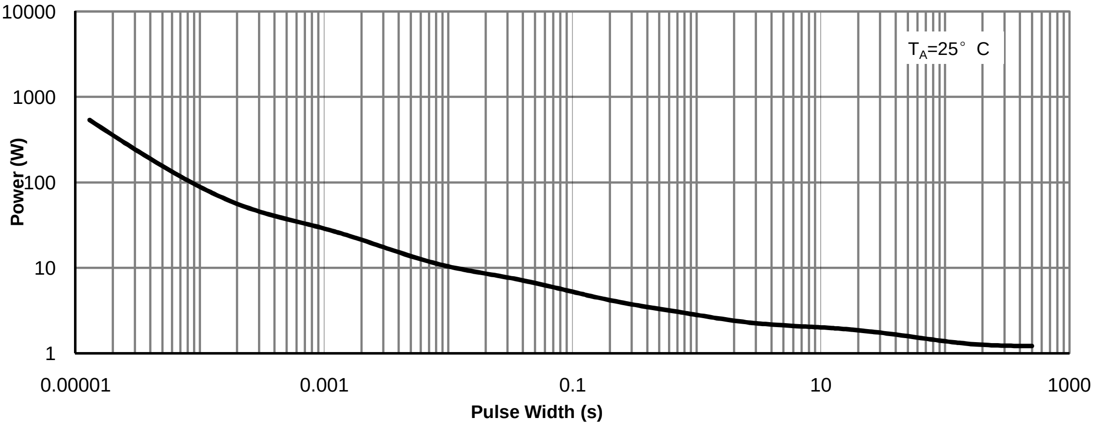


Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

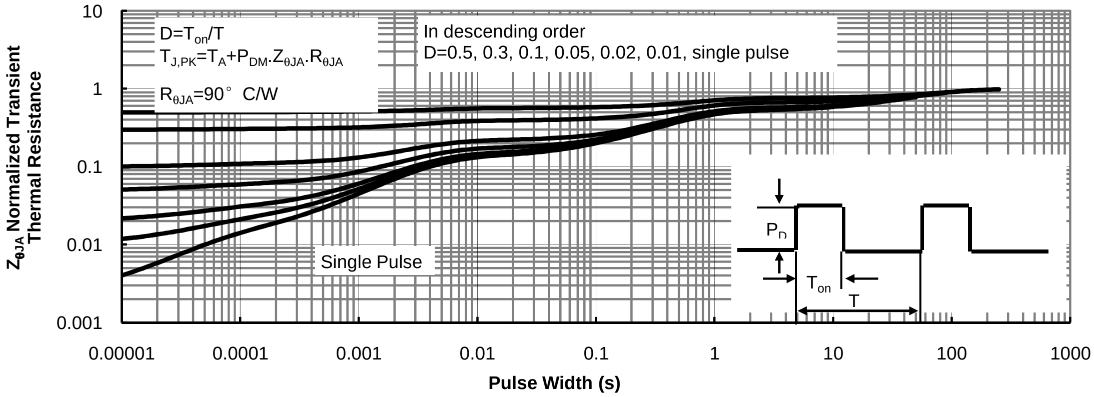
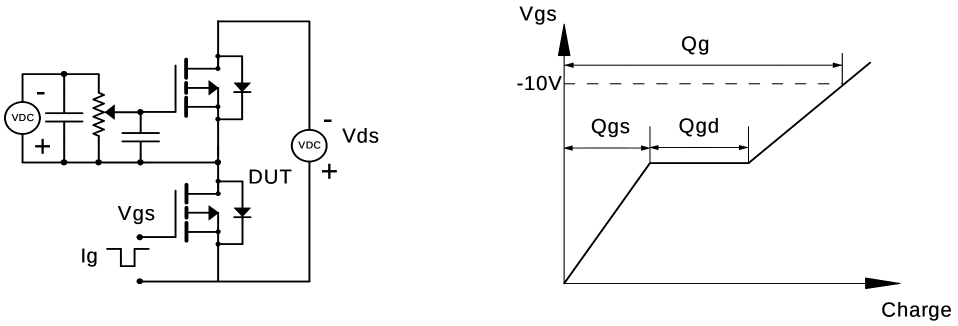
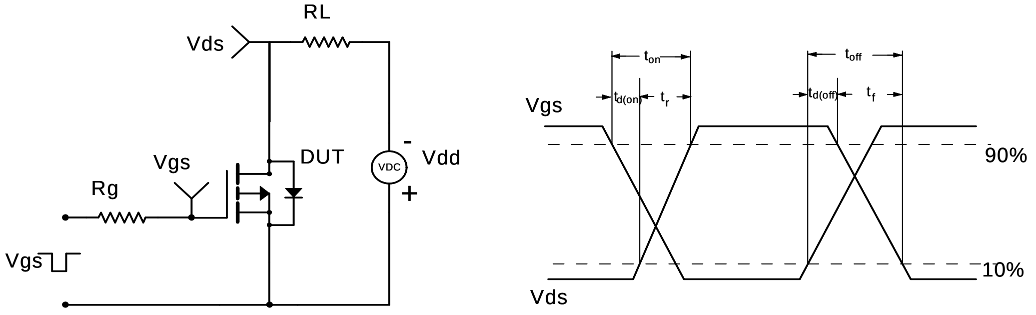


Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)

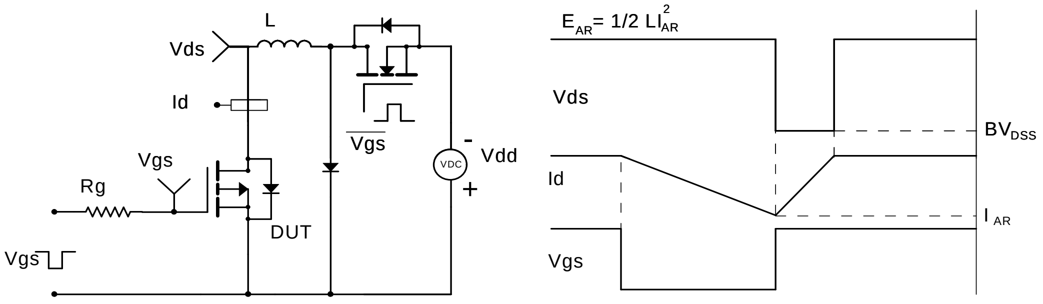
Gate Charge Test Circuit & Waveform



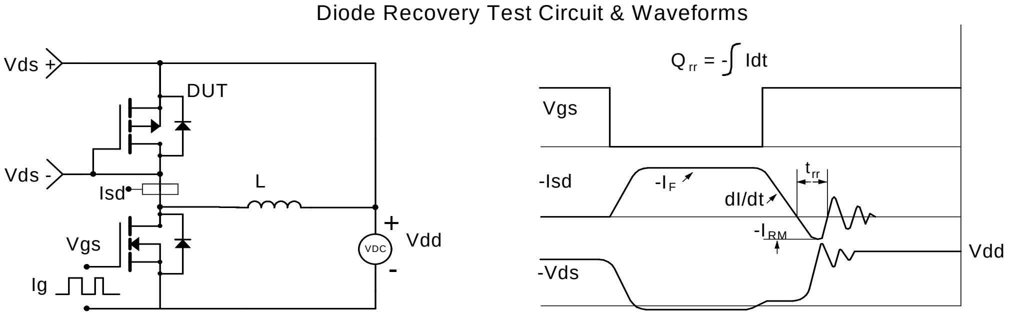
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

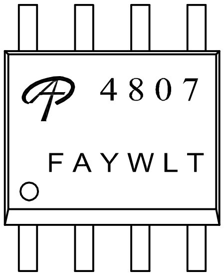


Diode Recovery Test Circuit & Waveforms



Document No.	PD-00035
Version	F
Title	AO4807 Marking Description

SO-8 PACKAGE MARKING DESCRIPTION



Green product

NOTE:

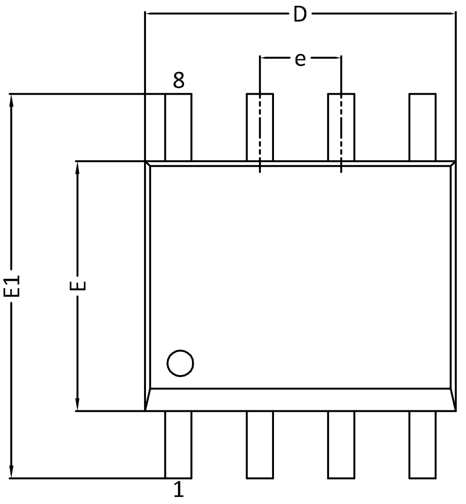
LOGO	- AOS Logo
4807	- Part number code
F	- Fab code
A	- Assembly location code
Y	- Year code
W	- Week code
L&T	- Assembly lot code

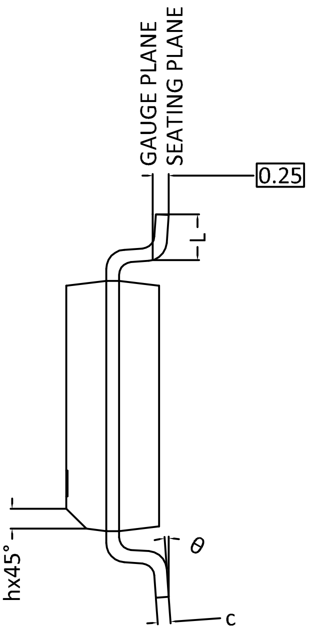
PART NO.	DESCRIPTION	CODE
AO4807	Green product	4807
AO4807L	Green product	4807

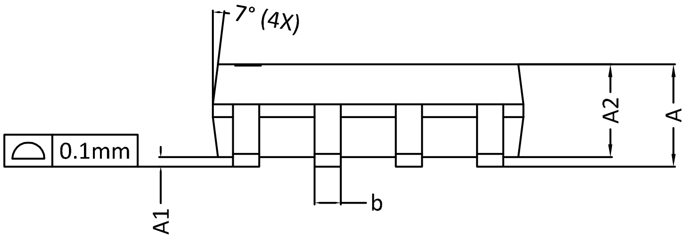
ALPHA & OMEGA
SEMICONDUCTOR

Document No.	PO-00004
Version	K

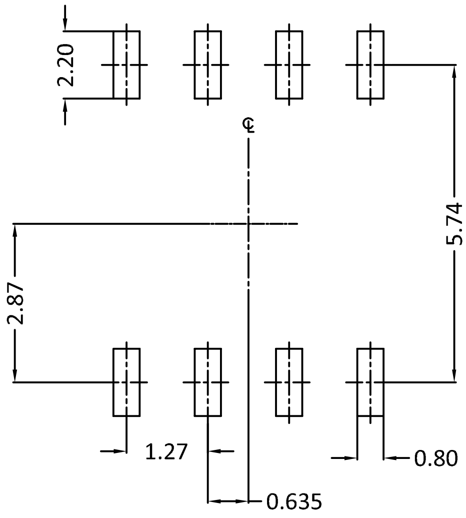
SO8(SOP-8L) PACKAGE OUTLINE







RECOMMENDED LAND PATTERN



UNIT: mm

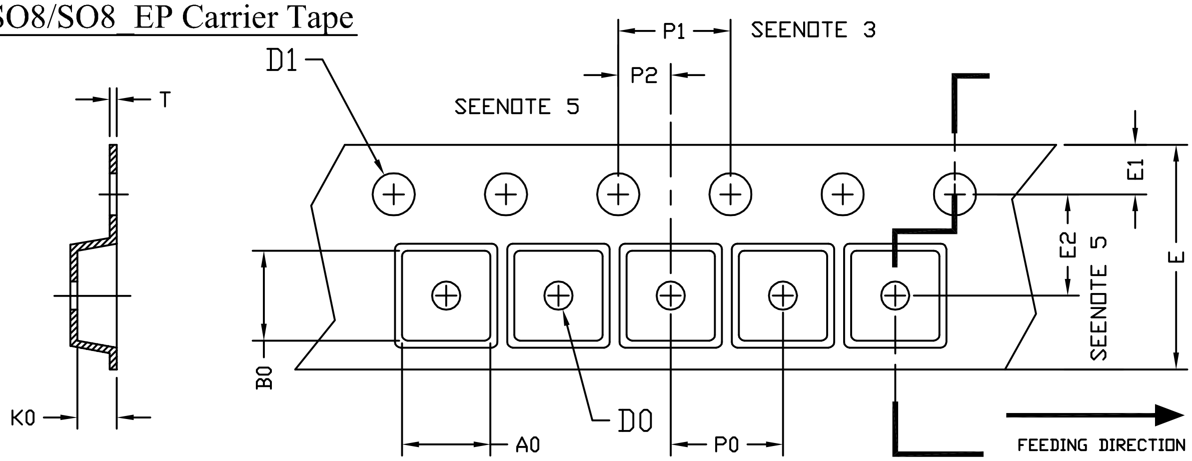
SYMBOLS	DIMENSION IN MM			DIMENSION IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.65	1.75	0.053	0.065	0.069
A1	0.10	0.15	0.25	0.004	0.006	0.010
A2	1.25	1.50	1.65	0.049	0.059	0.065
b	0.31	0.41	0.51	0.012	0.016	0.020
c	0.17	0.20	0.25	0.007	0.008	0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e		1.27 BSC			0.050 BSC	
h	0.25	0.30	0.50	0.010	0.012	0.020
L	0.40	0.69	1.27	0.016	0.027	0.050
θ	0°	4°	8°	0°	4°	8°

NOTE

1. ALL DIMENSIONS ARE IN MILLMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
   MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
4. DIMENSION L IS MEASURED IN GAUGE PLANE.
5. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

SO7/SO8/SO8_EP Tape and Reel Data

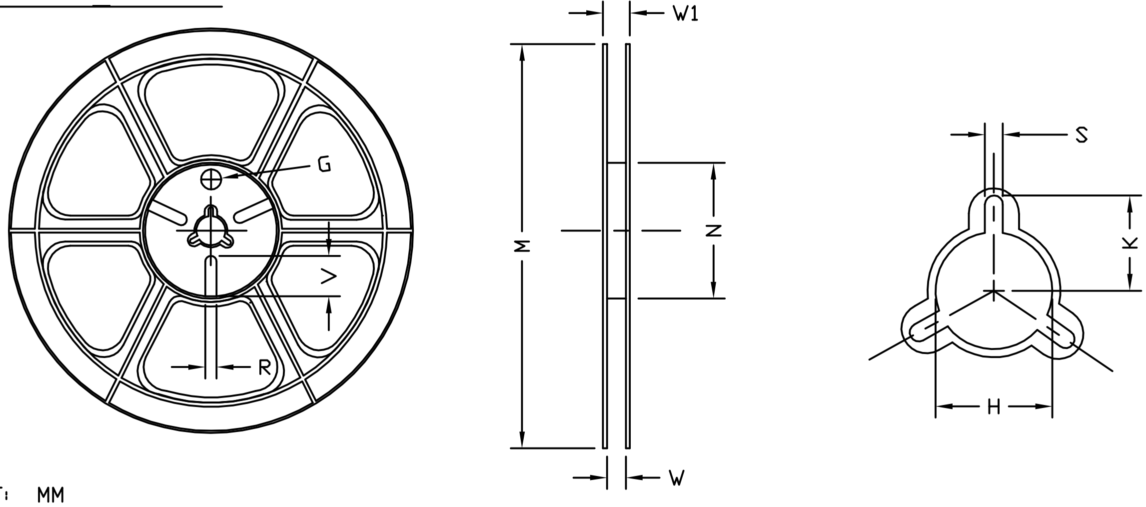
SO7/SO8/SO8_EP Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SO7/SO-8 (12 mm)	6.40 ±0.10	5.20 ±0.10	2.10 ±0.10	1.60 ±0.10	1.50 +0.10	12.00 ±0.30	1.75 ±0.10	5.50 ±0.05	8.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.25 ±0.05

SO7/SO8/SO8_EP Reel



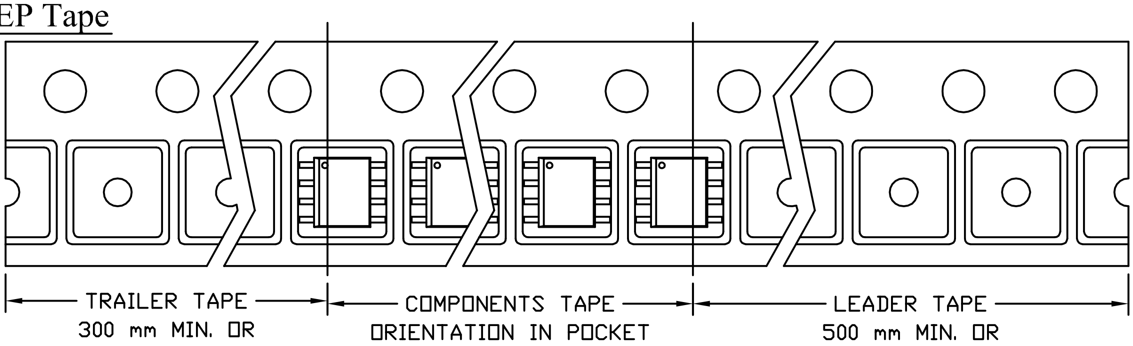
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
12 mm	ø330	ø330.00 ±0.50	ø97.00 ±0.10	13.00 ±0.30	17.40 ±1.00	ø13.00 +0.50 -0.20	10.60	2.00 ±0.50	---	---	---

SO7/SO8/SO8_EP Tape

Leader / Trailer
& Orientation

Unit Per Reel:
3000pcs



AOS Semiconductor
Product Reliability Report

AO4807/AO4807L, rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

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Tel: (408) 830-9742 **www.aosmd.com**

May 15, 2006

This AOS product reliability report summarizes the qualification result for AO4807. 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 AO4807 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 AO4807 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge. This device is suitable for use as a load switch or in PWM applications. Standard Product AO4807 is Pb-free (meets ROHS & Sony 259 specifications). AO4807L is a Green Product ordering option. AO4807 and AO4807L are electrically identical.

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}	±20	V
Continuous Drain Current	T_A=25°C	I_D	-6	A
	T_A=70°C		-5	
Pulsed Drain Current		I_{DM}	-30	
Power Dissipation	T_A=25°C	P_D	2	W
	T_A=70°C		1.44	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient	T ≤ 10s	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient	Steady-State		74	110	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	35	40	°C/W

II. Die / Package Information:

	AO4807	AO4807L (Green Compound)
Process	Standard sub-micron low voltage P channel process	Standard sub-micron low voltage P channel process
Package Type	8 leads SOIC	8 leads SOIC
Lead Frame	Copper with Solder Plate	Copper with Solder Plate
Die Attach	Ag epoxy	Ag epoxy
Bond wire	Au 2mils	Au 2 mils
Mold Material	Epoxy resin with silica filler	Epoxy resin with silica filler
Filler % (Spherical/Flake)	90/10	100/0
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 AO4807 (Standard) & AO4807L (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	0hr	Standard: 83 lots Green: 29 lots	17380 pcs	0
HTGB	Temp = 150°c , Vgs=100% of Vgsmax	168 / 500 hrs 1000 hrs	12 lots (Note A*)	984 pcs 77+5 pcs / lot	0
HTRB	Temp = 150°c , Vds=80% of Vdsmax	168 / 500 hrs 1000 hrs	12 lots (Note A*)	984 pcs 77+5 pcs / lot	0
HAST	130 +/- 2°c , 85%RH, 33.3 psi, Vgs = 80% of Vgs max	100 hrs	Standard: 81 lots Green: 16 lots (Note B**)	5335 pcs 50+5 pcs / lot	0
Pressure Pot	121°c , 15+/-1 PSIG, RH=100%	96 hrs	Standard: 83 lots Green: 20 lots (Note B**)	5665 pcs 50+5 pcs / lot	0
Temperature Cycle	-65°c to 150°c , air to air	250 / 500 cycles	Standard: 87 lots Green: 29 lots (Note B**)	6380 pcs 50+5 pcs / lot	0

III. Result of Reliability Stress for AO4807 (Standard) & AO4807L (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	**230°C**	**5 sec**	**15**	**15 leads**	**0**
Die shear	**150°C**	**0hr**	**10**	**10**	**0**

Note A: The HTGB and HTRB reliability data presents total of available AO4807 and AO4807L burn-in data up to the published date.
Note B: The pressure pot, temperature cycle and HAST reliability data for AO4807 and AO4807L comes from the AOS generic package qualification data.

IV. Reliability Evaluation

FIT rate (per billion):4.3
MTTF = 26547years

In general, 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 (AO4807). Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

Failure Rate = $\text{Chi}^2 \times 10^9$ **/** **[**2 (N) (H) (Af)**]**
= 1.83×10^9 / **[**2 (6×164) (168) (258) + 2 (4×164) (500) (258) + 2 (2×164) (1000) (258)**]** = 4.3
MTTF = 10^9 / FIT = 2.32×10^8hrs =26547years

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, 8.617164×10^{-5}eV / K

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**