ALPHA & OMEGA SEMICONDUCTOR

AO4496

General Description

The AO4496 uses advanced trench technology to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use as a DC-DC converter application.

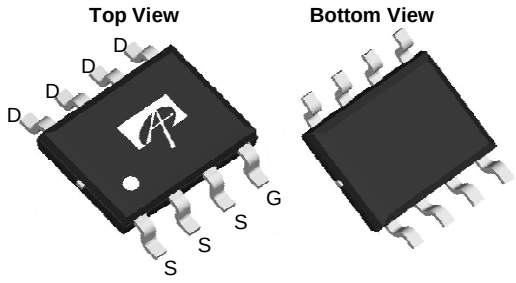
Product Summary

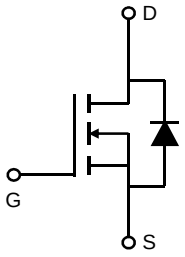
V_{DS} (V) = 30V
I_D = 10A (V_{GS} = 10V)
$R_{DS(ON)}$ < 19.5mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 26mΩ (V_{GS} = 4.5V)

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8





Absolute Maximum Ratings T_J=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 [A]	T_A=25°C	I_D	10	A
	T_A=70°C		7.5	
Pulsed Drain Current [B]		I_{DM}	50	
Avalanche Current [G]		I_{AR}	17	
Repetitive avalanche energy L=0.1mH [G]		E_{AR}	14	mJ
Power Dissipation [A]	T_A=25°C	P_D	3.1	W
	T_A=70°C		2.0	
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	$R_{\theta JA}$	31	40	°C/W
Maximum Junction-to-Ambient [A]	Steady State		59	75	°C/W
Maximum Junction-to-Lead [C]	Steady State	$R_{\theta JL}$	16	24	°C/W

Electrical Characteristics (T_J=25°C 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°C			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	1.4	1.8	2.5	V
$I_{D(ON)}$	On state drain current	V_{GS} = 10V, V_{DS} = 5V	50			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 10A		16	19.5	mΩ
		T_J=125°C		24	29	
		V_{GS} = 4.5V, I_D = 7.5A		21	26	
g_{FS}	Forward Transconductance	V_{DS} = 5V, I_D = 10A		30		S
V_{SD}	Diode Forward Voltage	I_S = 1A,V_{GS} = 0V		0.76	1	V
I_S	Maximum Body-Diode Continuous Current				3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		550	715	pF
C_{oss}	Output Capacitance			110		pF
C_{rss}	Reverse Transfer Capacitance			55		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	3	4	4.9	Ω
SWITCHING PARAMETERS						
Q_g (10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=10A		9.8	13	nC
Q_g (4.5V)	Total Gate Charge			4.6	6.1	nC
Q_{gs}	Gate Source Charge			1.8		nC
Q_{gd}	Gate Drain Charge			2.2		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L= 1.5Ω, R_{GEN}=3Ω		5		ns
t_r	Turn-On Rise Time			3.2		ns
$t_{D(off)}$	Turn-Off DelayTime			24		ns
t_f	Turn-Off Fall Time			6		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=10A, dI/dt=500A/µs		22	29	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=10A, dI/dt=500A/µs		14		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in² 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: Repetitive rating, pulse width limited by junction temperature.
C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.
D. The static characteristics in Figures 1 to 6 are obtained using t ≤ 300µs pulses, duty cycle 0.5% max.
E. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The SOA curve provides a single pulse rating.
F. The current rating is based on the t ≤ 10s thermal resistance rating.
G. E_{AR} and I_{AR} ratings are based on low frequency and duty cycles to keep T_j=25C.
Rev5: Nov. 2010

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

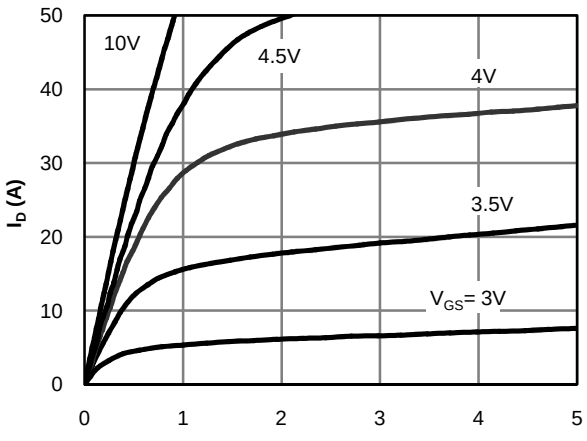


Figure 1: On-Region Characteristics

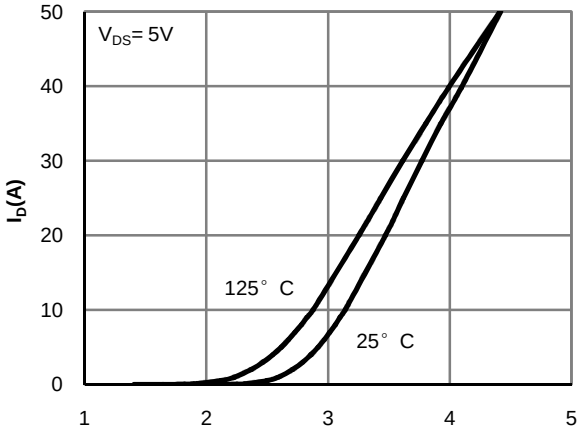


Figure 2: Transfer Characteristics

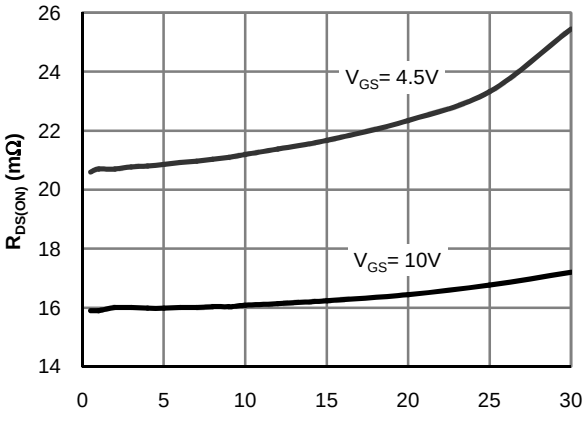


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

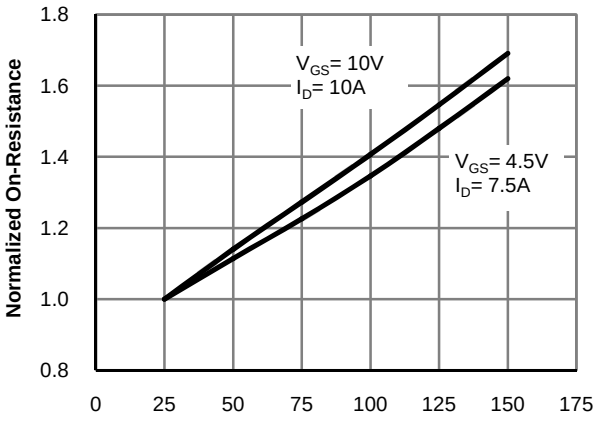


Figure 4: On-Resistance vs. Junction Temperature

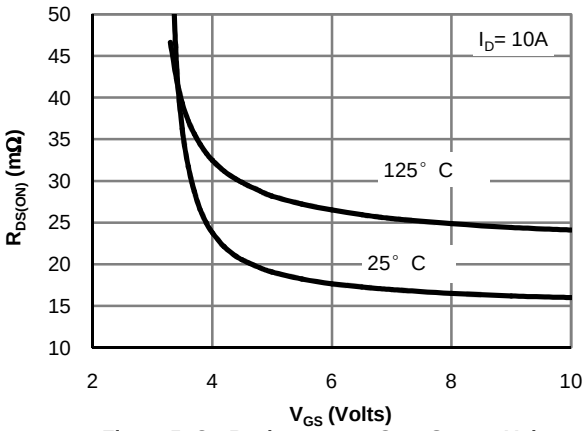


Figure 5: On-Resistance vs. Gate-Source Voltage

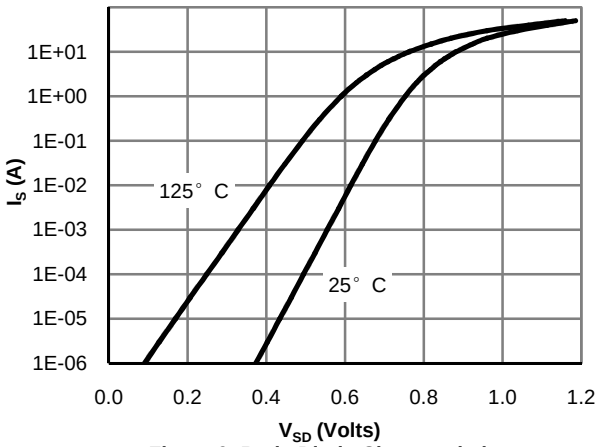


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

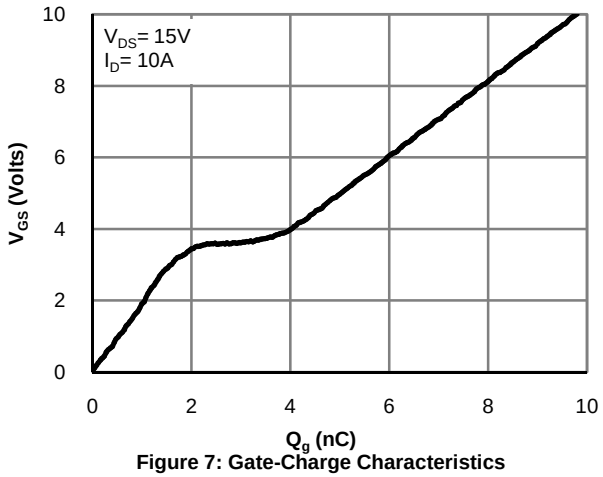


Figure 7: Gate-Charge Characteristics

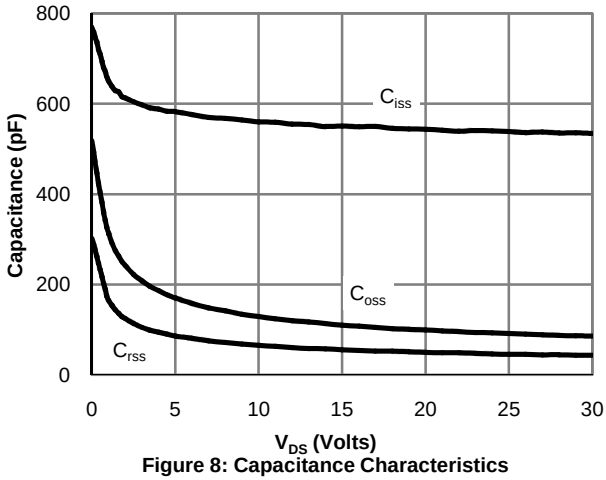


Figure 8: Capacitance Characteristics

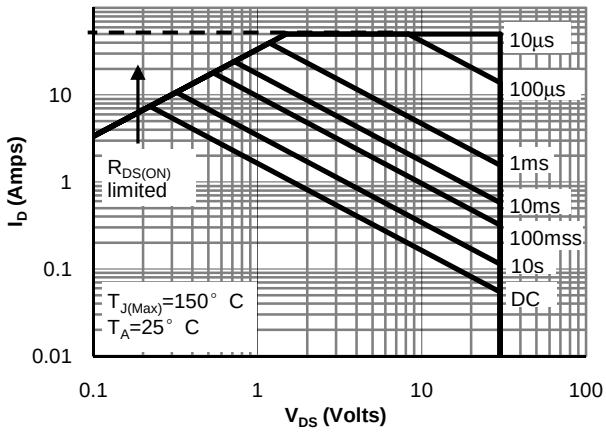


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

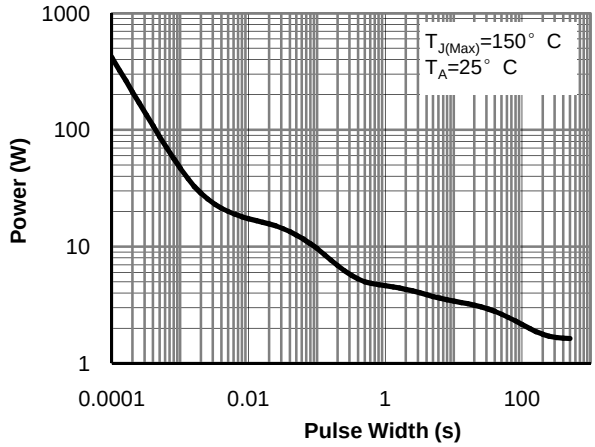


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

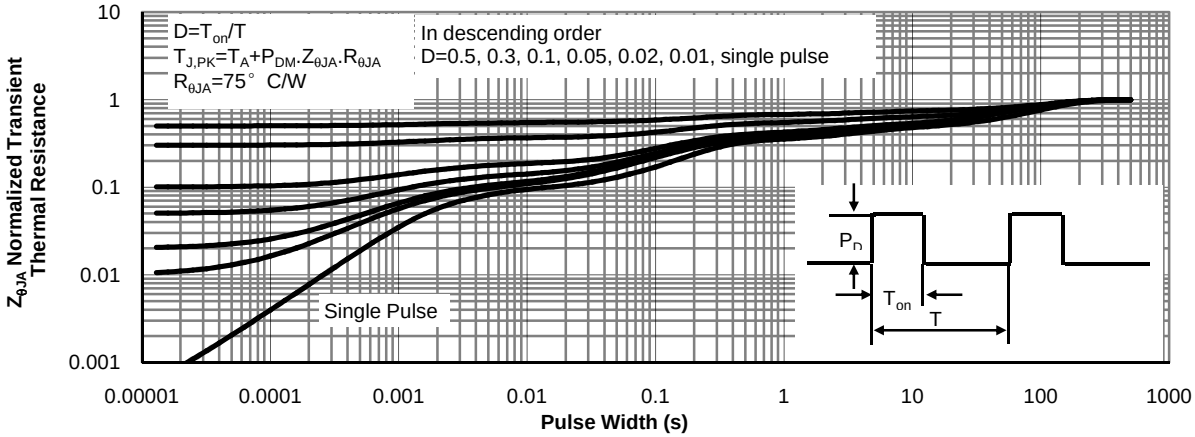
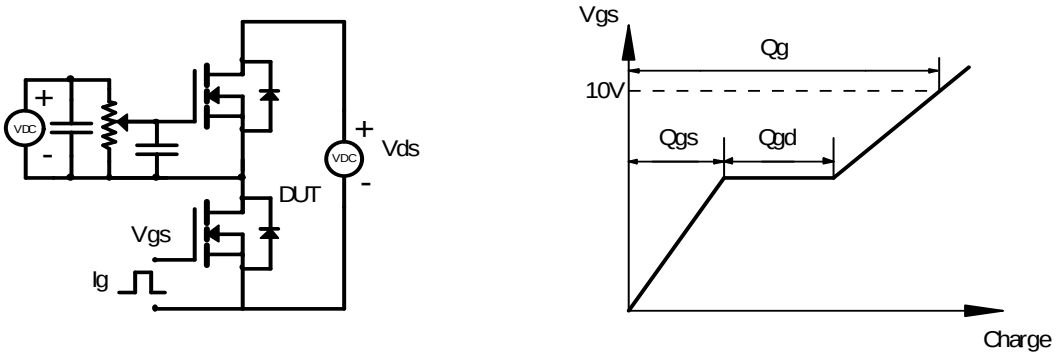
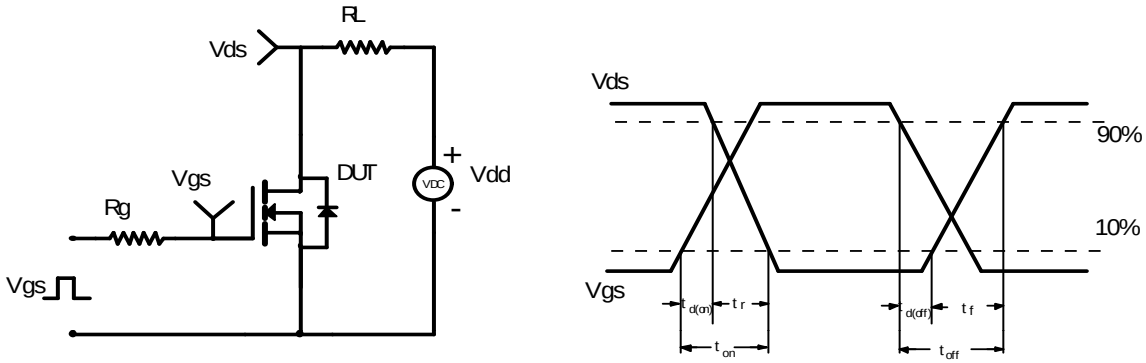


Figure 11: Normalized Maximum Transient Thermal Impedance(Note E)

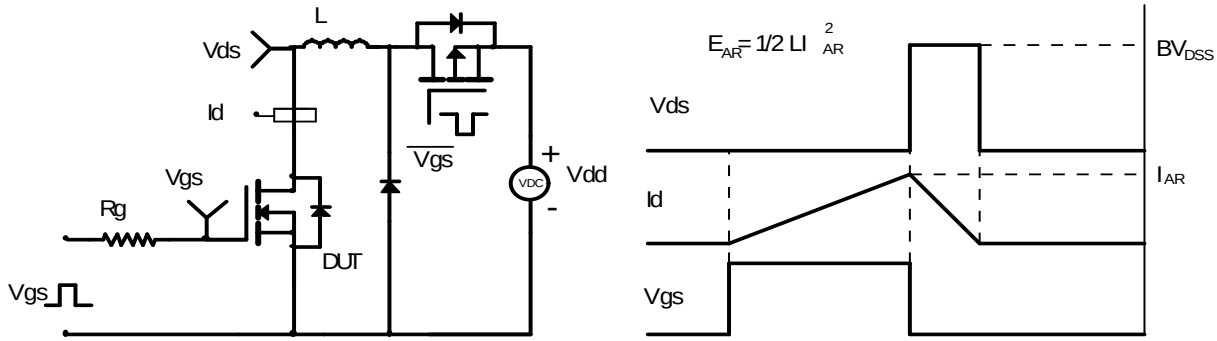
Gate Charge Test Circuit & Waveform



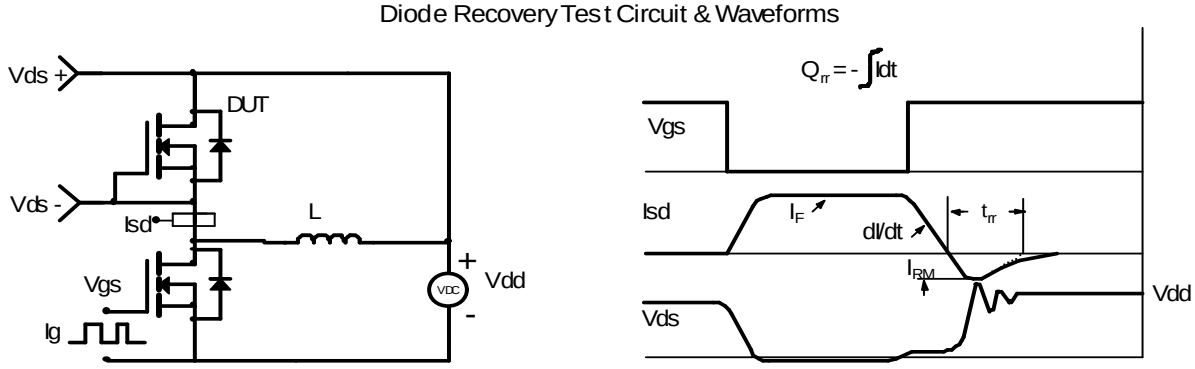
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



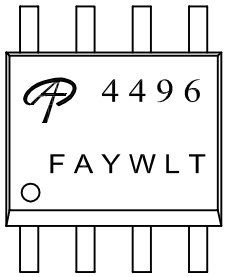
Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA SEMICONDUCTOR

Document No.	PD-00803
Version	B
Title	AO4496 Marking Description

SO-8 PACKAGE MARKING DESCRIPTION



Green product

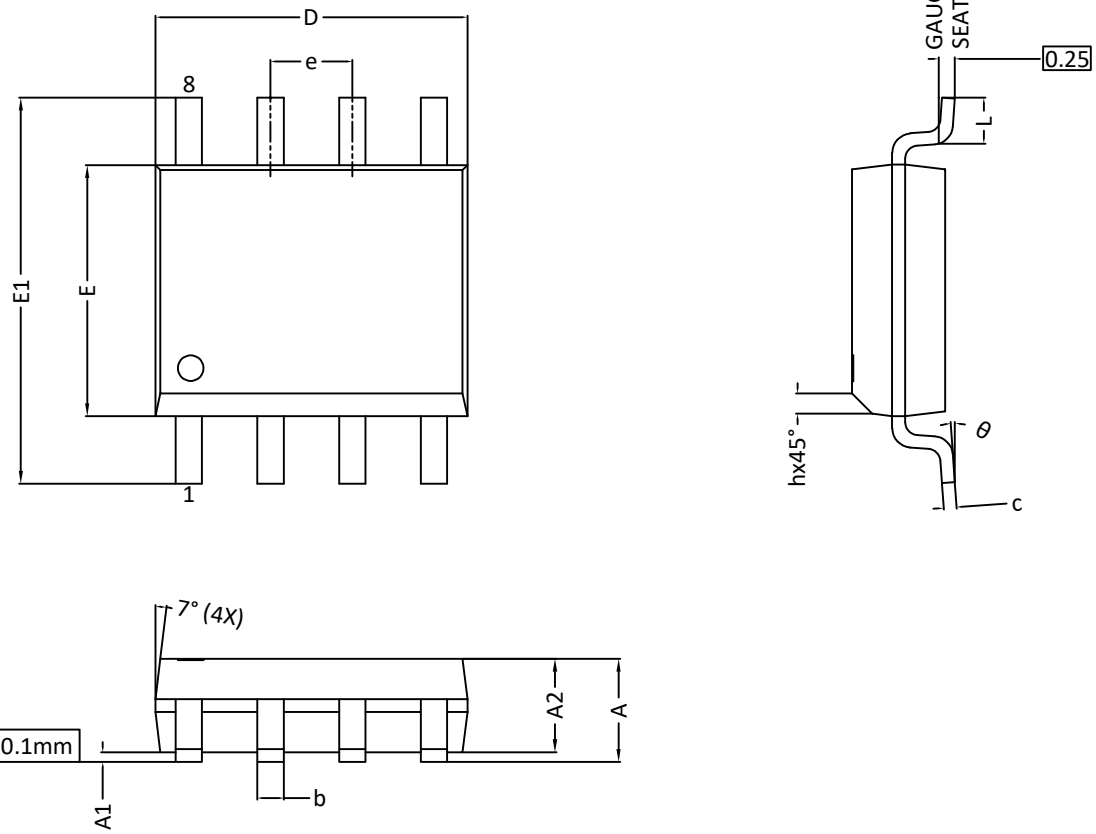
NOTE:
LOGO - AOS Logo
4496 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

PART NO.	DESCRIPTION	CODE
AO4496	Green product	4496
AO4496L	Green product	4496

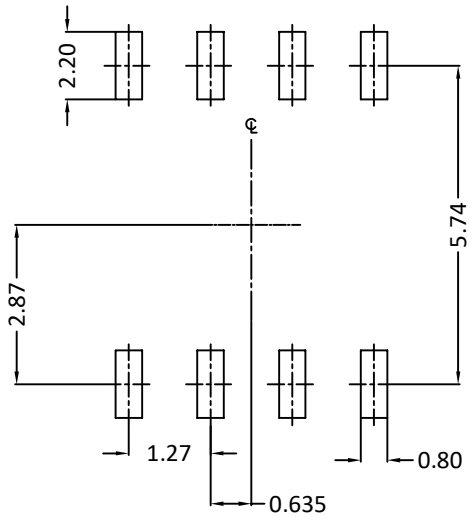
ALPHA & OMEGA SEMICONDUCTOR

Document No.	PO-00004
Version	L

SO8(SOP-8L) PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



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°

UNIT: mm

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.

ALPHA & OMEGA SEMICONDUCTOR

AOS Semiconductor
Product Reliability Report

AO4496, rev C

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

www.aosmd.com

This AOS product reliability report summarizes the qualification result for AO4496. 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 AO4496 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 AO4496 uses advanced trench technology to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use as a DC-DC converter application.

-RoHS Compliant
-Halogen Free

Detailed information refers to datasheet.

II. Die / Package Information:

	AO4496
Process	Standard sub-micron 30V N-Channel MOSFET
Package Type	SO8
Lead Frame	Cu
Die Attach	Ag epoxy
Bonding	Cu wire
Mold Material	Epoxy resin with silica filler
MSL (moisture sensitive level)	Level 1 based on J-STD-020

Note * based on information provided by assembler and mold compound supplier

ALPHA & OMEGA SEMICONDUCTOR

III. Result of Reliability Stress for AO4496

Test Item	Test Condition	Time Point	Lot Attribution	Total Sample size	Number of Failures	Standard
MSL Precondition	**168hr 85°c /85%RH +3 cycle reflow@260°c**	**-**	**33 lots**	**5489pcs**	**0**	**JESD22-A113**
HTGB	**Temp = 150 °c, Vgs=100% of Vgsmax**	**168hrs 500 hrs 1000 hrs**	**4 lot 6 lot 5 lot (Note A*)**	**1155pcs 77pcs / lot**	**0**	**JESD22-A108**
HTRB	**Temp = 150 °c, Vds=80% of Vdsmax**	**168hrs 500 hrs 1000 hrs**	**4 lot 6 lot 5 lot (Note A*)**	**1155pcs 77pcs / lot**	**0**	**JESD22-A108**
HAST	**130°c, 85%RH, 33.3 psi, Vgs = 100% of Vgs max**	**96 hrs**	**20 lots (Note A*)**	**1100pcs 55 pcs / lot**	**0**	**JESD22-A110**
Pressure Pot	**121°c, 29.7psi, RH=100%**	**96 hrs**	**24lots (Note A*)**	**1848pcs 77 pcs / lot**	**0**	**JESD22-A102**
Temperature Cycle	**-65°c to 150°c, air to air**	**250 / 500 cycles**	**33 lots (Note A*)**	**2541pcs 77 pcs / lot**	**0**	**JESD22-A104**

Note A: The reliability data presents total of available generic data up to the published date.

IV. Reliability Evaluation

FIT rate (per billion): 3
MTTF = 42987 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size of the selected product (AO4496). 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 x (8x77x168 +16x77x500 +10x77x1000) x 258**] =** 3
MTTF = 10^9 / FIT = 3.77×10^8hrs = 42987 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**]** = **Exp** [Ea / **k** (1/Tj u – 1/Tj s)]

Acceleration Factor ratio list:

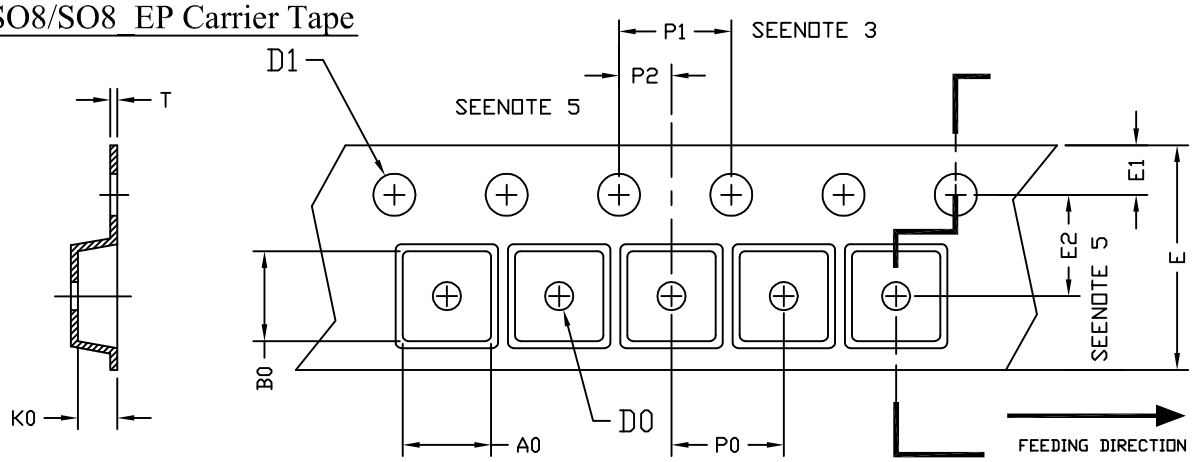
	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
Af	**258**	**87**	**32**	**13**	**5.64**	**2.59**	**1**

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

ALPHA & OMEGA SEMICONDUCTOR

SO7/SO8/SO8_EP Tape and Reel Data

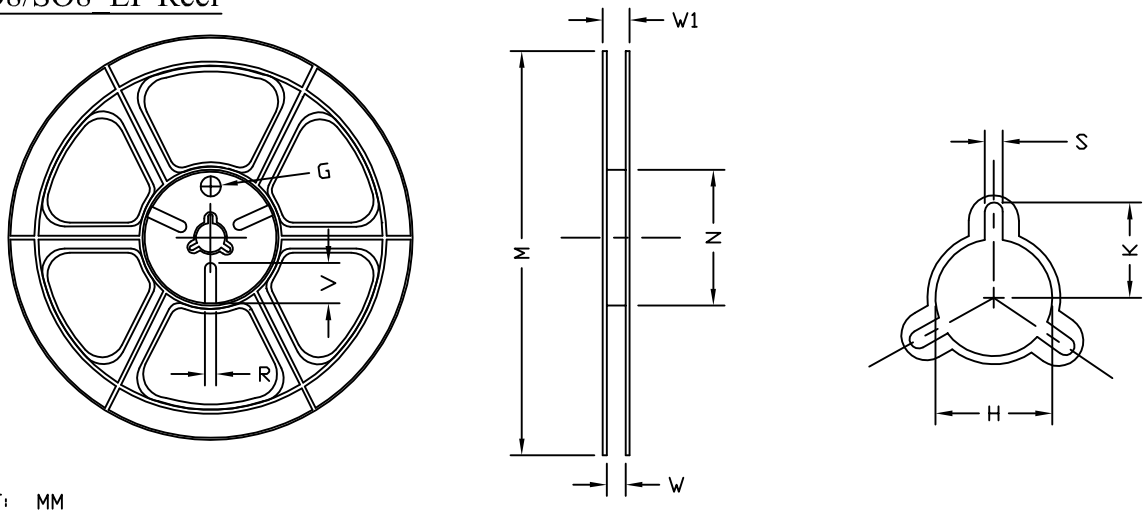
SO7/SO8/SO8_EP Carrier Tape



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