ALPHA & OMEGA SEMICONDUCTOR

AO4425

38V P-Channel MOSFET

General Description

The AO4425 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications. It is ESD protected.

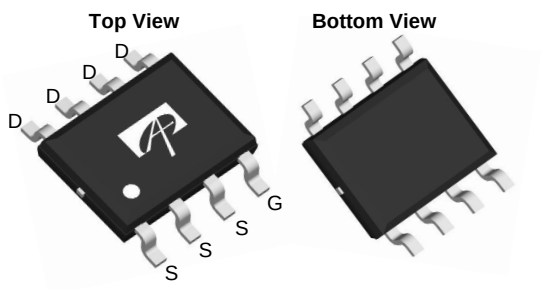
Product Summary

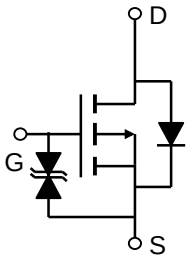
V_{DS} (V) = -38V
I_D = -14A (V_{GS} = -20V)
$R_{DS(ON)}$ < 10mΩ (V_{GS} = -20V)
$R_{DS(ON)}$ < 11mΩ (V_{GS} = -10V)
ESD Rating: 4000V HBM

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-38	V
Gate-Source Voltage		V_{GS}	±25	V
Continuous Drain Current [A]	T_A=25°C	I_D	-14	A
	T_A=70°C		-11	
Pulsed Drain Current [B]		I_{DM}	-50	
Power Dissipation [A]	T_A=25°C	P_D	3.1	W
	T_A=70°C		2	
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	$R_{\theta JA}$	26	40	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		50	75	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	14	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	-38			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-30V, V_{GS}=0V			-100	nA
		T_J=55°C			-500	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±1	µA
		V_{DS}=0V, V_{GS}=±25V			±10	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-2	-2.5	-3.5	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}=-20V, I_D=-14A		7.7	10	mΩ
		T_J=125°C		11	13.5	
		V_{GS}=-10V, I_D=-14A		8.8	11	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-14A		43		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		0.71	1	V
I_S	Maximum Body-Diode Continuous Current				4.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-20V, f=1MHz		3800		pF
C_{oss}	Output Capacitance			560		pF
C_{rss}	Reverse Transfer Capacitance			350		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		7.5		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=-10V, V_{DS}=-20V, I_D=-14A		63		nC
Q_{gs}	Gate Source Charge			14.1		nC
Q_{gd}	Gate Drain Charge			16.1		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-20V, R_L=1.35Ω, R_{GEN}=3Ω		12.4		ns
t_r	Turn-On Rise Time			9.2		ns
$t_{D(off)}$	Turn-Off DelayTime			97.5		ns
t_f	Turn-Off Fall Time			45.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-14A, dI/dt=100A/µs		35		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-14A, dI/dt=100A/µs		33		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. The current rating is based on the t ≤ 10s thermal resistance rating.

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 6,12,14 are obtained using <300 µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev 3 : Nov. 2010

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

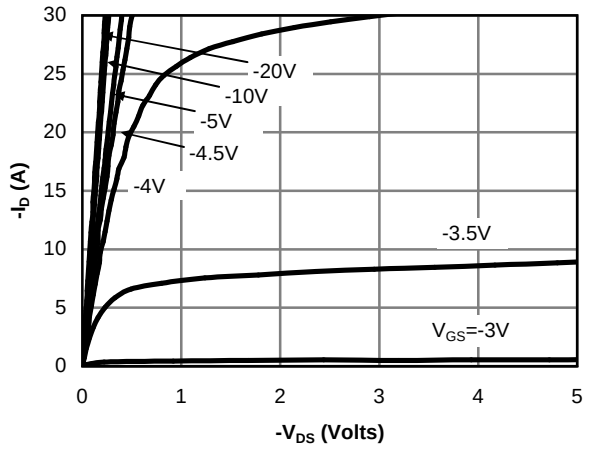


Fig 1: On-Region Characteristics

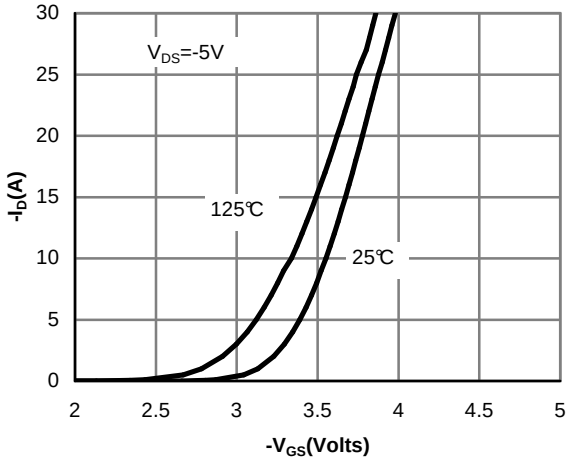


Figure 2: Transfer Characteristics

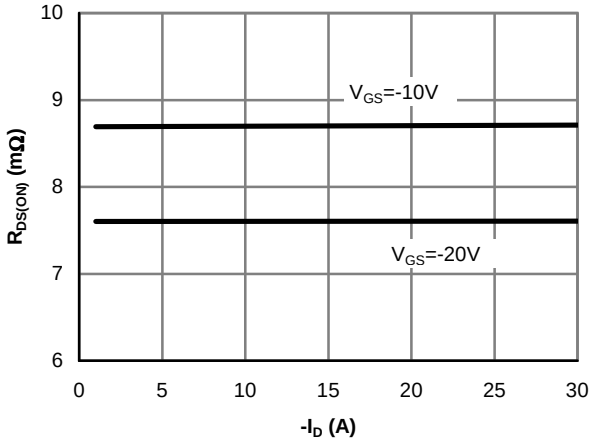


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

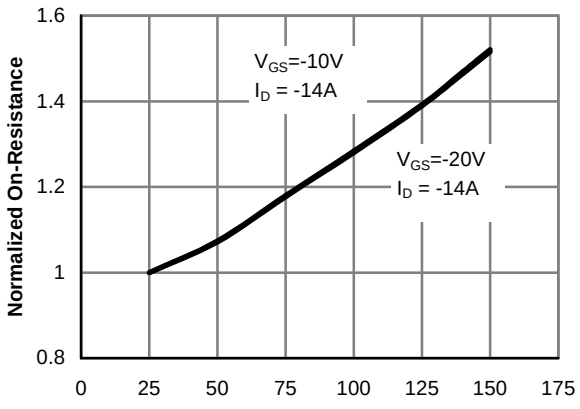


Figure 4: On-Resistance vs. Junction Temperature

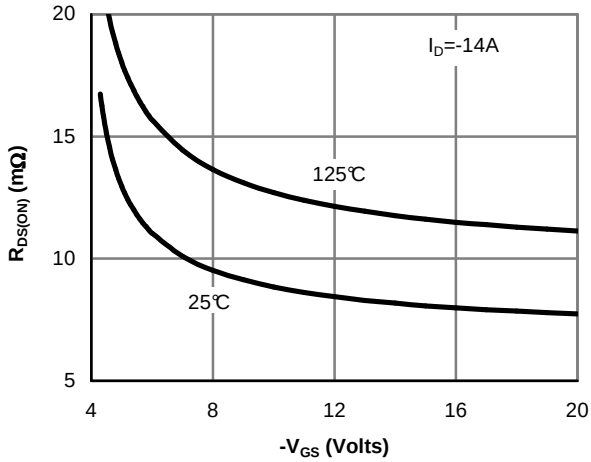


Figure 5: On-Resistance vs. Gate-Source Voltage

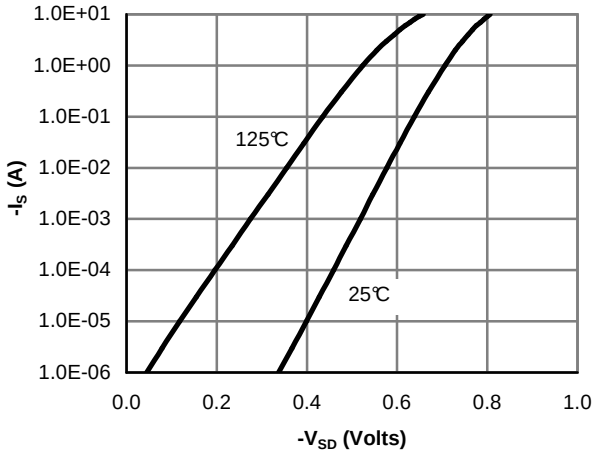


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

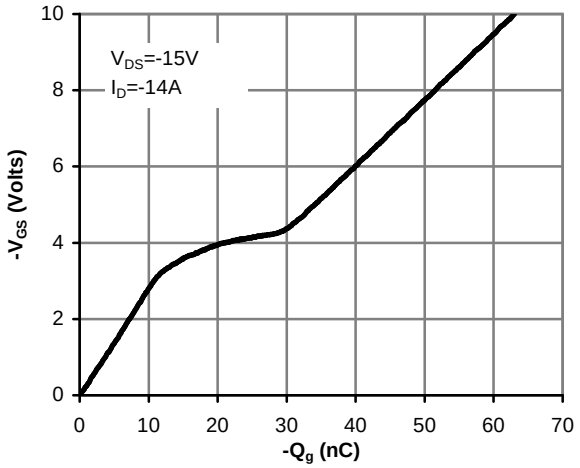


Figure 7: Gate-Charge Characteristics

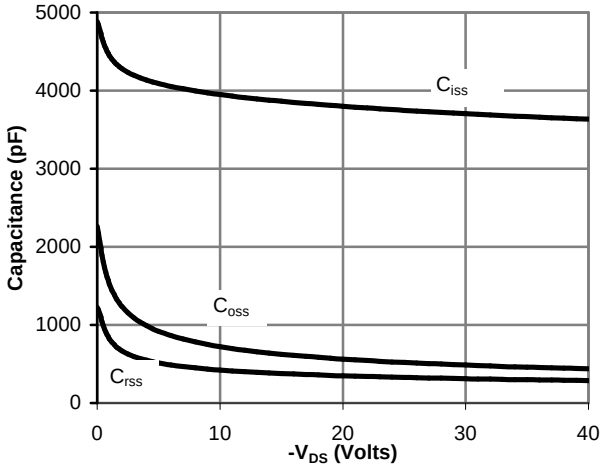


Figure 8: Capacitance Characteristics

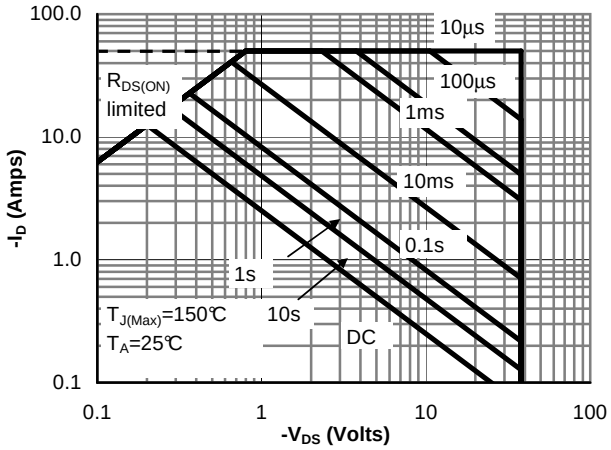


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

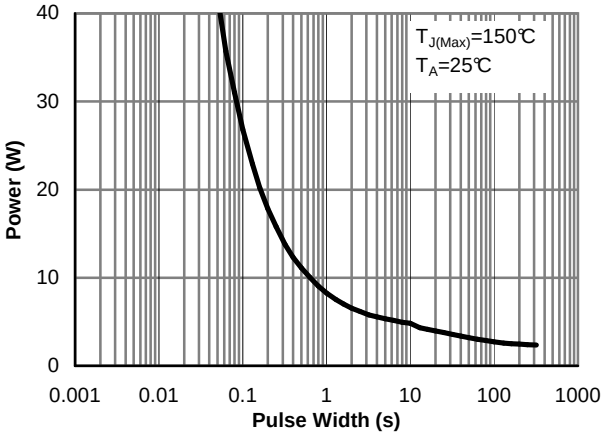


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

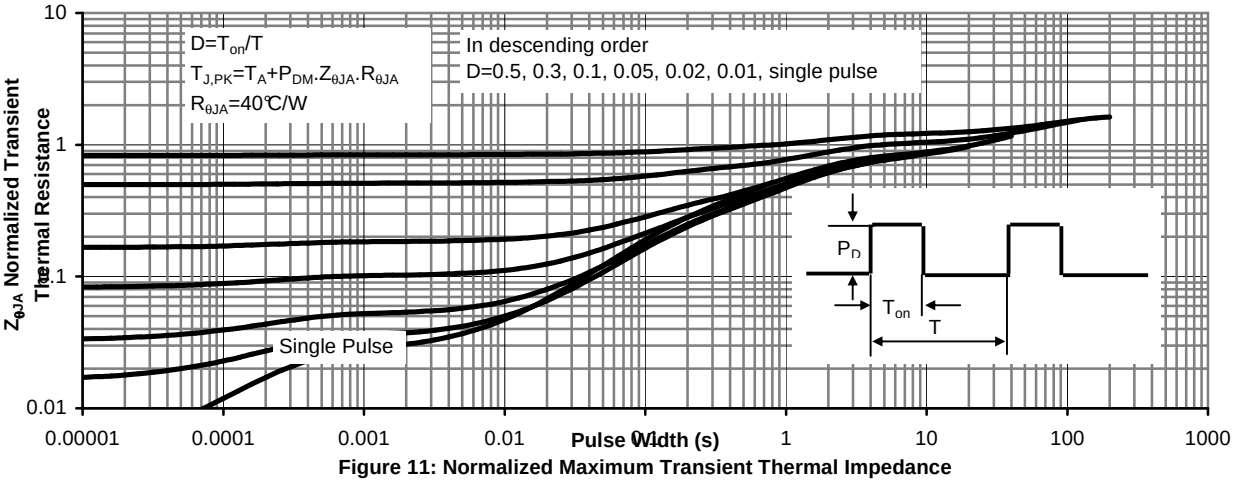
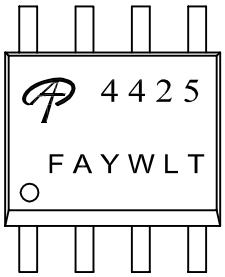


Figure 11: Normalized Maximum Transient Thermal Impedance

ALPHA & OMEGA SEMICONDUCTOR

Document No.	PD-00219
Version	D
Title	AO4425 Marking Description

SO-8 PACKAGE MARKING DESCRIPTION

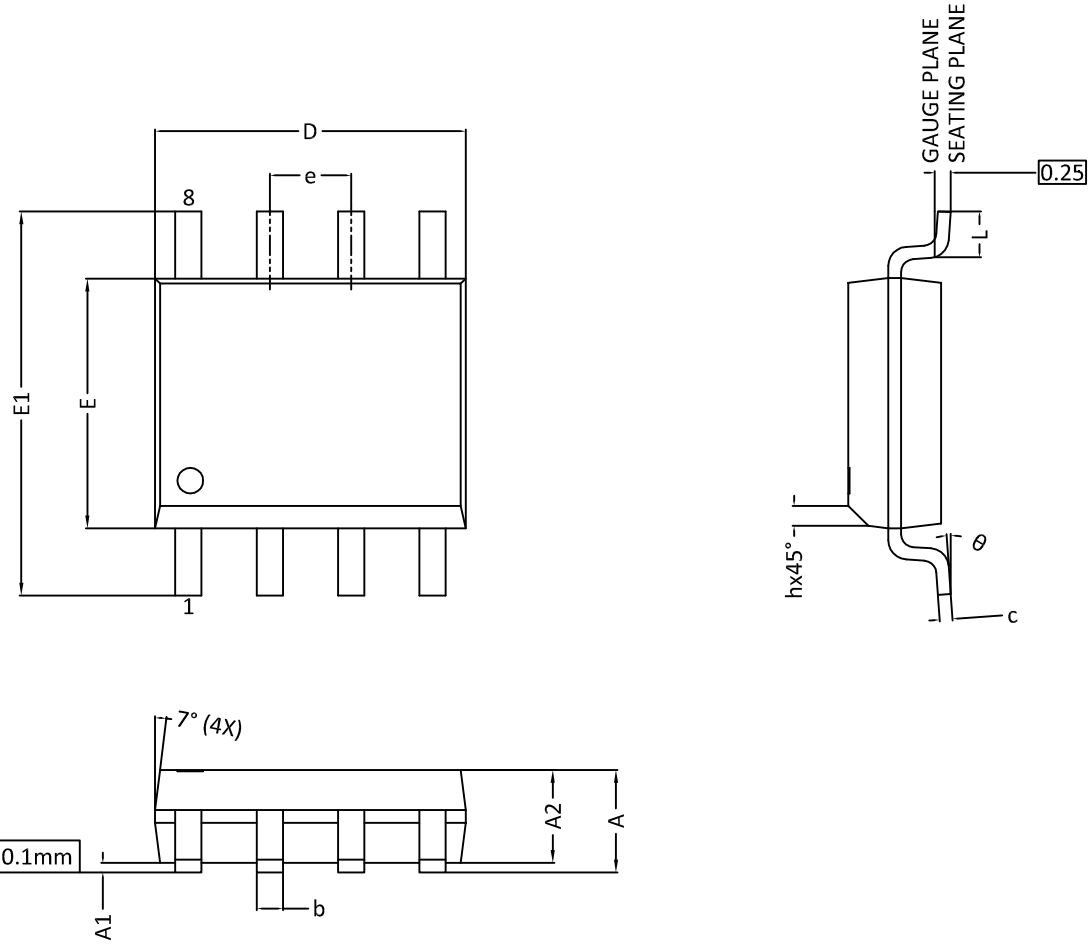


Green product

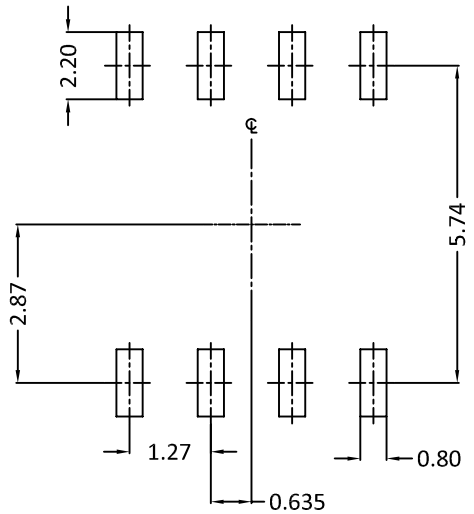
NOTE:
LOGO - AOS Logo
4425 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

PART NO.	DESCRIPTION	CODE
AO4425	Green product	4425
AO4425L	Green product	4425

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°

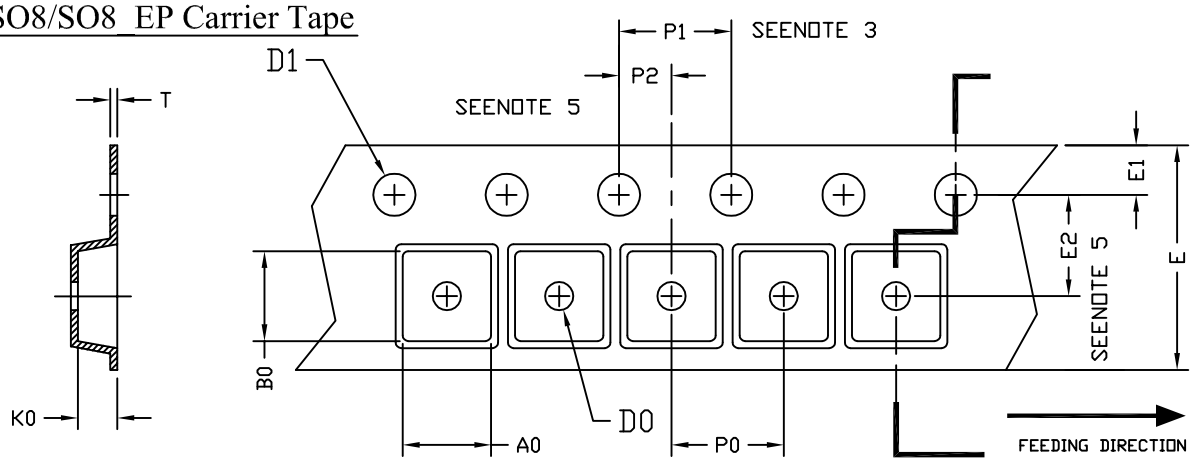
UNIT: mm

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

SO7/SO8/SO8_EP Tape and Reel Data

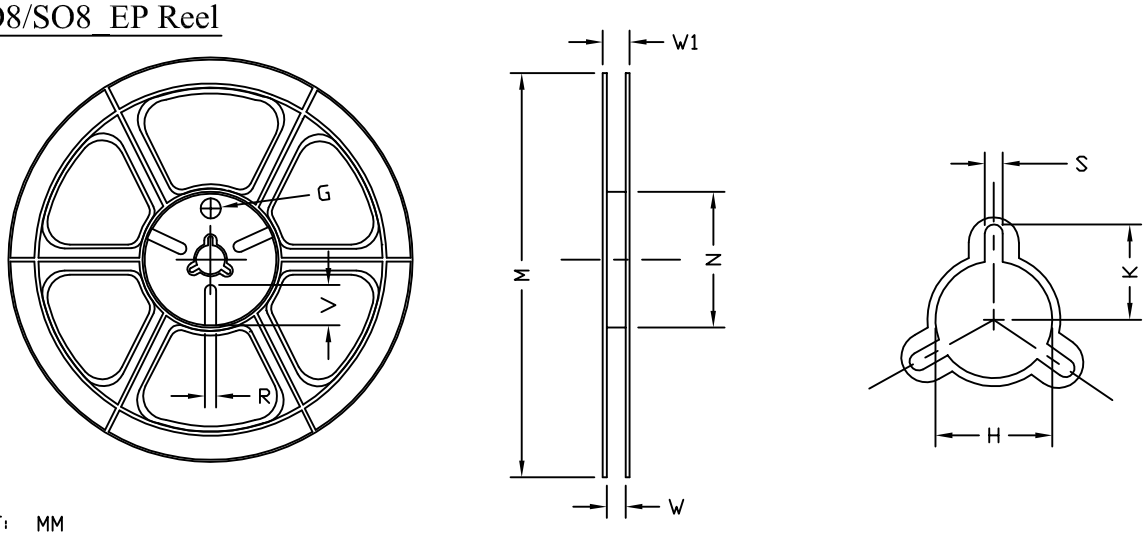
SO7/SO8/SO8_EP Carrier Tape



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



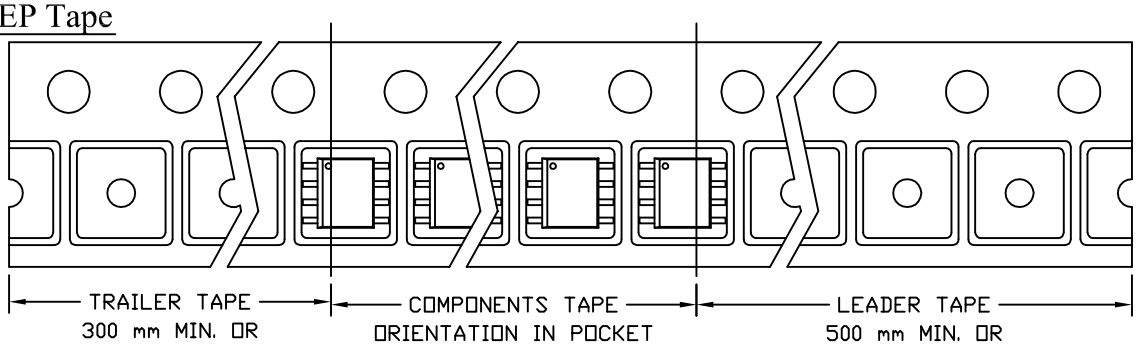
UNIT: MM

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

AO4425, rev C

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

www.aosmd.com

Mar, 2018

ALPHA & OMEGA SEMICONDUCTOR

This AOS product reliability report summarizes the qualification result for AO4425. 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 AO4425 passes AOS quality and reliability requirements. The released product will be categorized by the process family and be routine monitored for continuously improving the product quality.

I. Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Total Sample Size	Number of Failures	Reference Standard
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 / 1000 hours	924 pcs	0	JESD22-A108
HTRB	Temp = 150°C , Vds=80% of Vdsmax	168 / 500 / 1000 hours	924 pcs	0	JESD22-A108
Precondition (Note A)	168hr 85°C / 85%RH + 3 cycle reflow@260°C (MSL 1)	-	4620 pcs	0	JESD22-A113
HAST	130°C , 85%RH, 33.3 psia, Vds = 80% of Vdsmax	96 hours	693 pcs	0	JESD22-A110
H3TRB	85°C , 85%RH, Vds = 80% of Vdsmax	1000 hours	693 pcs	0	JESD22-A101
Autoclave	121°C , 29.7psia, RH=100%	96 hours	924 pcs	0	JESD22-A102
Temperature Cycle	-65°C to 150°C , air to air,	1000cycles	924 pcs	0	JESD22-A104
HTSL	Temp = 150°C	1000 hours	693 pcs	0	JESD22-A103
IOL	∆ Tj = 100°C	15000 cycles	693 pcs	0	AEC Q101

Note: The reliability data presents total of available generic data up to the published date.
Note A: MSL (Moisture Sensitivity Level) 1 based on J-STD-020

II. Reliability Evaluation

FIT rate (per billion): 1.91
MTTF = 59839 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size. 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)**] =** 1.91
MTTF = 10^9 / FIT =59839 years

Chi² = Chi Squared Distribution, determined by the number of failures and confidence interval
N = Total Number of units from burn-in tests
H = Duration of burn-in 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	259	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^{-5}eV / K