ALPHA & OMEGA
SEMICONDUCTOR, INC.

July 2001

AO4701
P-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

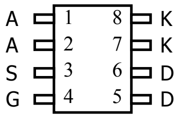
General Description

The AO4701 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch.

Features

V_{DS} (V) = -30V
I_D = -5A
$R_{DS(ON)} < 49m\Omega$ (V_{GS} = 10V)
$R_{DS(ON)} < 64m\Omega$ (V_{GS} = 4.5V)
$R_{DS(ON)} < 120m\Omega$ (V_{GS} = 2.5V)

SCHOTTKY
V_{DS} (V) = 30V, I_F = 3A, V_F=0.5V@1A



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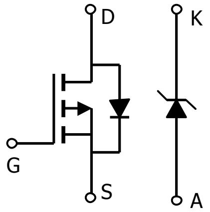


Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	MOSFET	Schottky	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	-5		A
	T_A=70°C		-4.2		
Pulsed Drain Current[B]		I_{DM}	-30		
Schottky reverse voltage		V_{KA}		30	V
Continuous Forward Current[A]	T_A=25°C	I_F		4.4	A
	T_A=70°C			3.2	
Pulsed Forward Current[B]		I_{FM}		30	
Power Dissipation	T_A=25°C	P_D	2	2	W
	T_A=70°C		1.44	1.44	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Parameter: Thermal Characteristics MOSFET		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		74	110	
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	35	40	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	49	62.5	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		72	110	
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	37	42	

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}=-24V, V_{GS}=0V				-1	μA
			T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±12V				±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250μA		-0.7	-1	-1.3	V
$I_{D(ON)}$	On state drain current	V_{GS}=-4.5V, V_{DS}=-5V		-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-5A			42.5	49	mΩ
			T_J=125°C			74	
		V_{GS}=-4.5V, I_D=-4A			54	64	mΩ
		V_{GS}=-2.5V, I_D=-1A			83	120	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5A		7	11		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V			-0.75	-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			952		pF
C_{oss}	Output Capacitance				103		pF
C_{rss}	Reverse Transfer Capacitance				77		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz			5.9		Ω
SWITCHING PARAMETERS							
Q_g	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-15V, I_D=-4A			9.5		nC
Q_{gs}	Gate Source Charge				2		nC
Q_{gd}	Gate Drain Charge				3.1		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=3.6Ω, R_{GEN}=6Ω			12		ns
t_r	Turn-On Rise Time				4		ns
$t_{D(off)}$	Turn-Off DelayTime				37		ns
t_f	Turn-Off Fall Time				12		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5A, dI/dt=100A/μs			21		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5A, dI/dt=100A/μs			13		nC
SCHOTTKY PARAMETERS							
V_F	Forward Voltage Drop	I_F=1.0A			0.45	0.5	V
I_{rm}	Maximum reverse leakage current	V_R=30V			0.007	0.05	mA
		V_R=30V, T_J=125°C			3.2	10	
		V_R=30V, T_J=150°C			12	20	
C_T	Junction Capacitance	V_R=15V			37		pF

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 a 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 80μs 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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

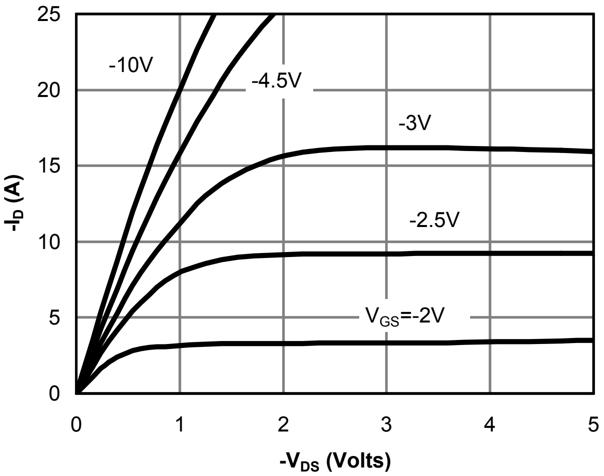


Fig 1: On-Region Characteristics

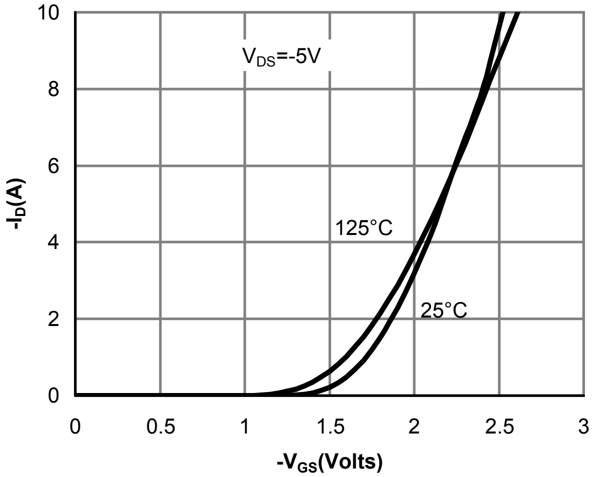


Figure 2: Transfer Characteristics

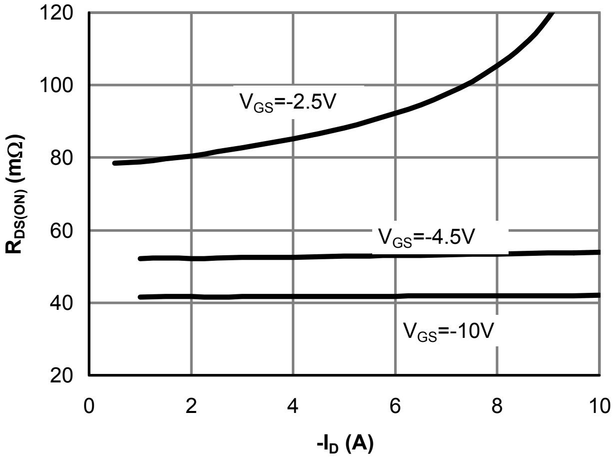


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

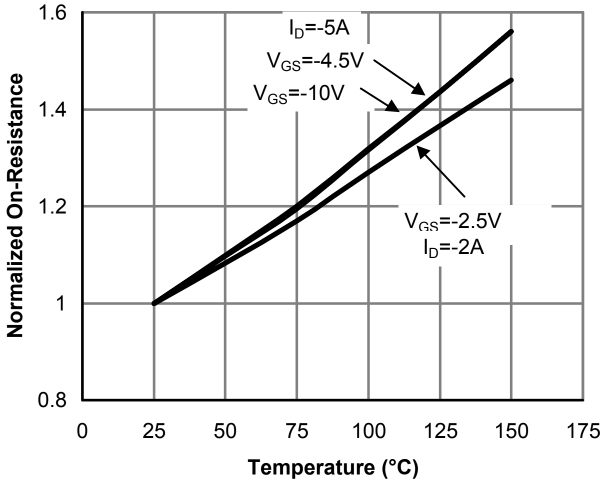


Figure 4: On-Resistance vs. Junction Temperature

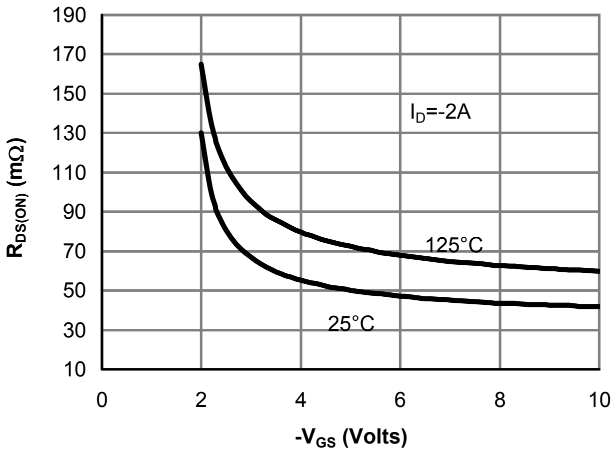


Figure 5: On-Resistance vs. Gate-Source Voltage

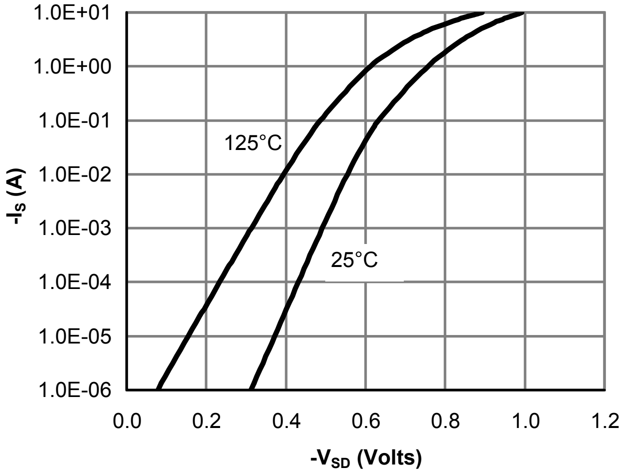
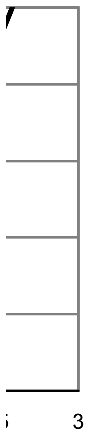
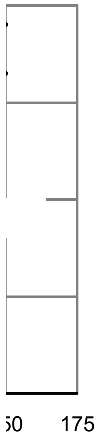


Figure 6: Body-Diode Characteristics





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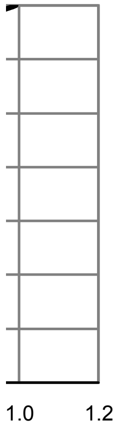

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

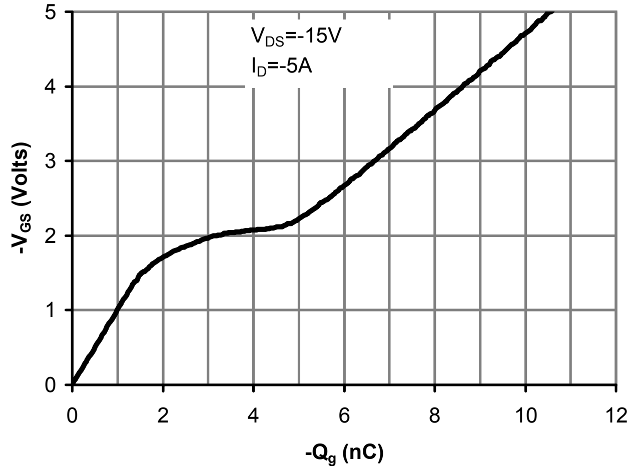


Figure 7: Gate-Charge Characteristics

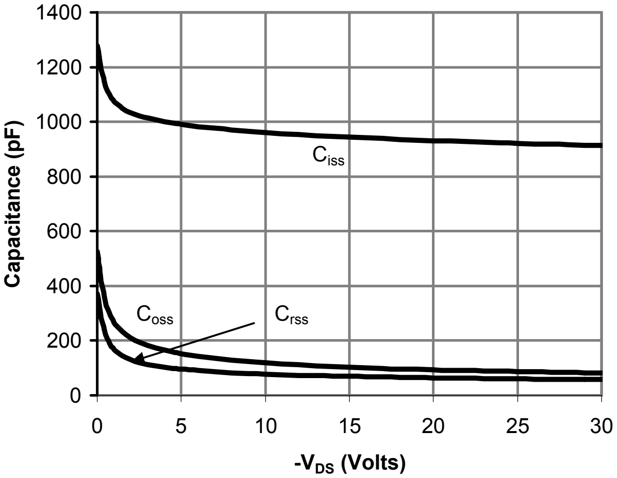


Figure 8: Capacitance Characteristics

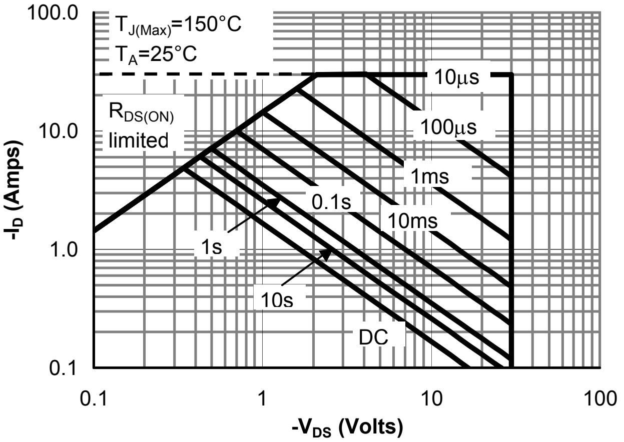


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

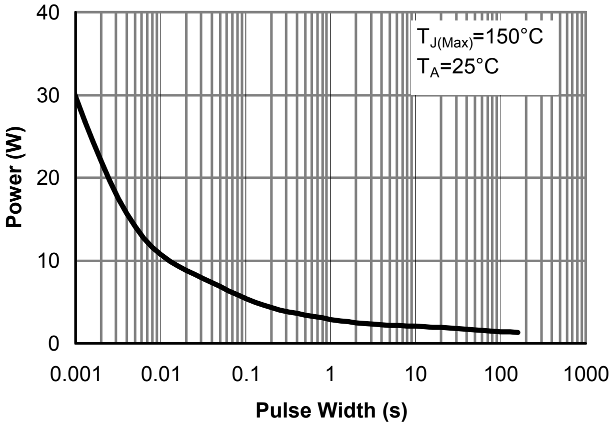


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

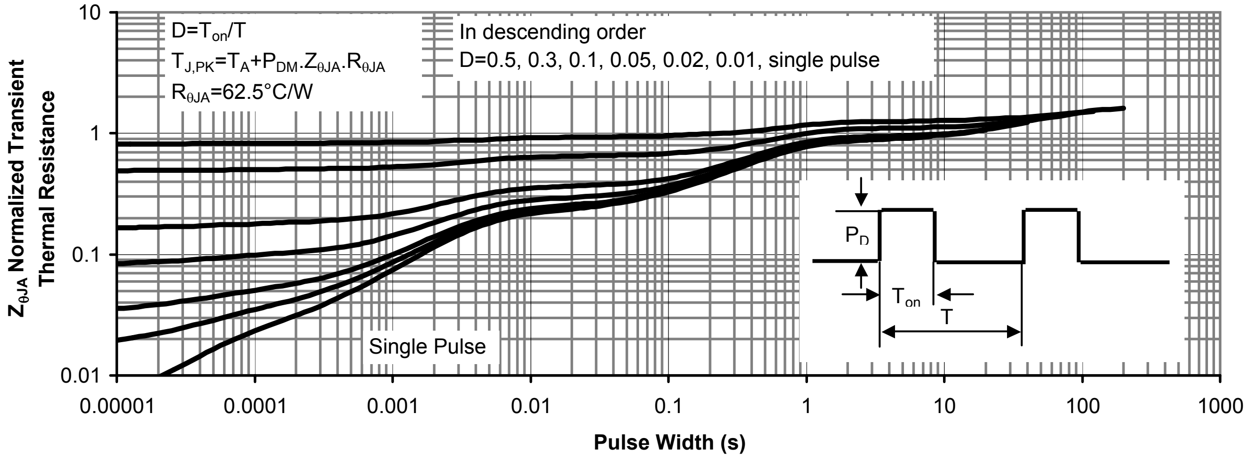


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

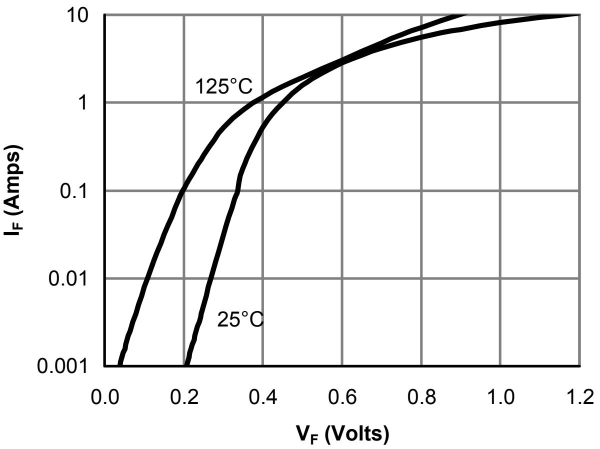


Figure 12: Schottky Forward Characteristics

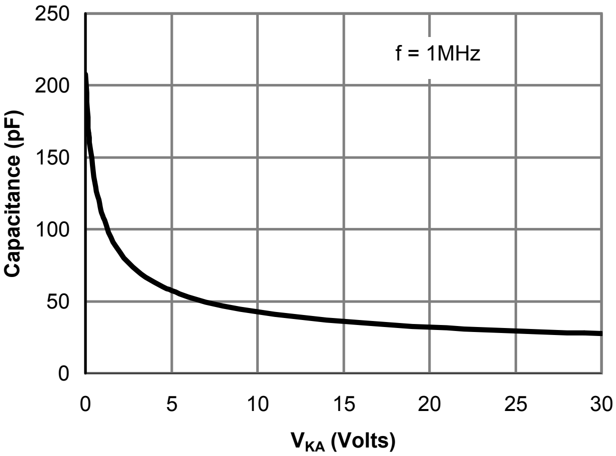


Figure 13: Schottky Capacitance Characteristics

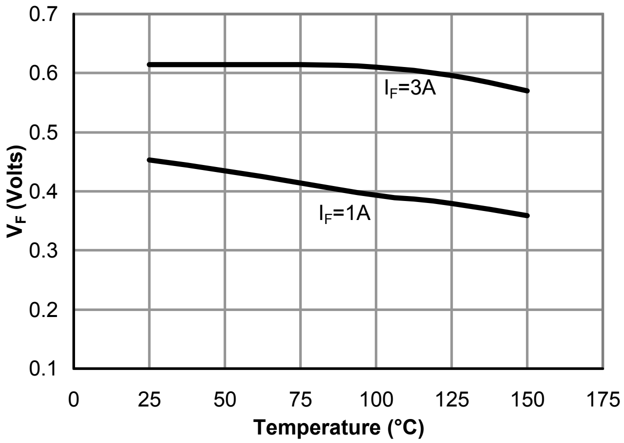


Figure 14: Schottky Forward Drop vs. Junction Temperature

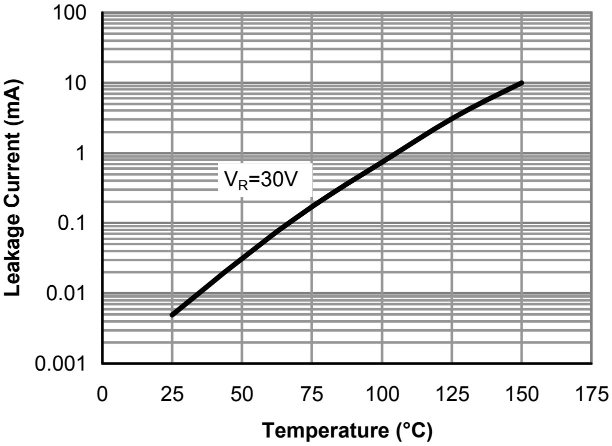


Figure 15: Schottky Leakage current vs. Junction Temperature

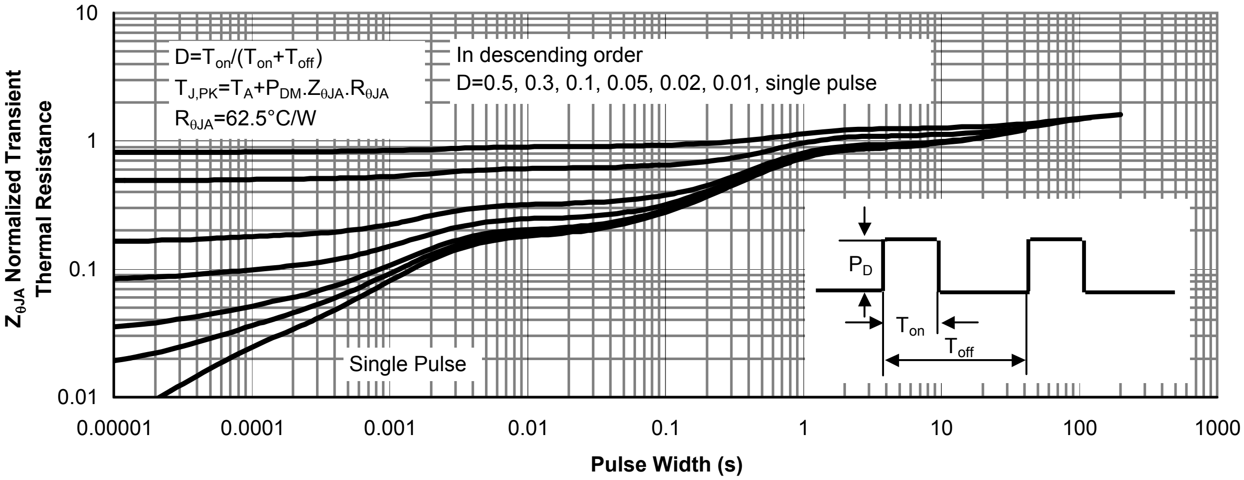
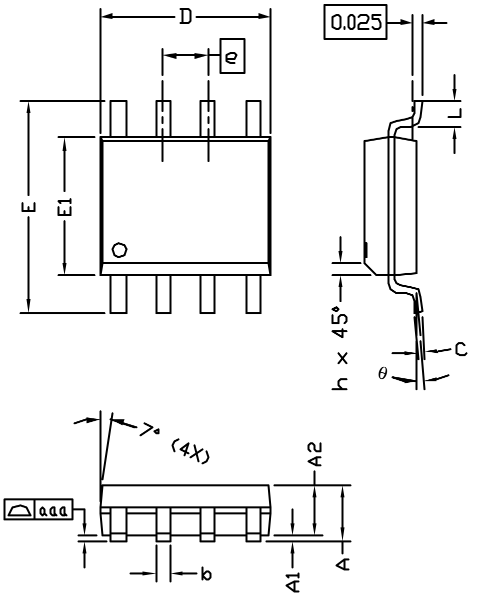


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance

ALPHA & OMEGA

SEMICONDUCTOR, INC.

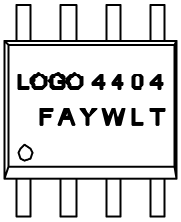
SO-8 Package Data



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.45	1.50	1.55	0.057	0.059	0.061
A1	0.00	–––	0.10	0.000	–––	0.004
A2	–––	1.45	–––	–––	0.057	–––
b	0.33	–––	0.51	0.013	–––	0.020
c	0.19	–––	0.25	0.007	–––	0.010
D	4.80	–––	5.00	0.189	–––	0.197
E1	3.80	–––	4.00	0.150	–––	0.157
e	1.27 BSC			0.050 BSC		
E	5.80	–––	6.20	0.228	–––	0.244
h	0.25	–––	0.50	0.010	–––	0.020
L	0.40	–––	1.27	0.016	–––	0.050
aaa	–––	–––	0.10	–––	–––	0.004
θ	0°	–––	8°	0°	–––	8°

NOTE:
1. LEAD FINISH: 150 MICROINCHES (3.8 um) MIN. THICKNESS OF Tin/Lead (SOLDER) PLATED ON LEAD
2. TOLERANCE ±0.10 mm (4 mil) UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.10 mm
4. DIMENSION L IS MEASURED IN GAGE PLANE

PACKAGE MARKING DESCRIPTION



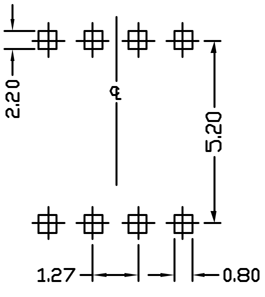
NOTE:

LOGO	- AOS LOGO
4701	- PART NUMBER CODE.
F	- FAB LOCATION
A	- ASSEMBLY LOCATION
Y	- YEAR CODE
W	- WEEK CODE.
L N	- ASSEMBLY LOT CODE

SO-8 PART NO. CODE

PART NO.	CODE
AO4701	4701

RECOMMENDED LAND PATTERN

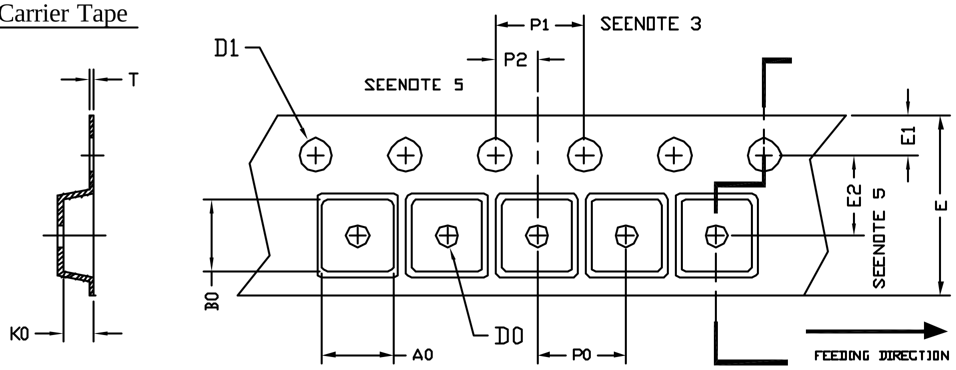


UNIT: mm

Rev. A

SO-8 Tape and Reel Data

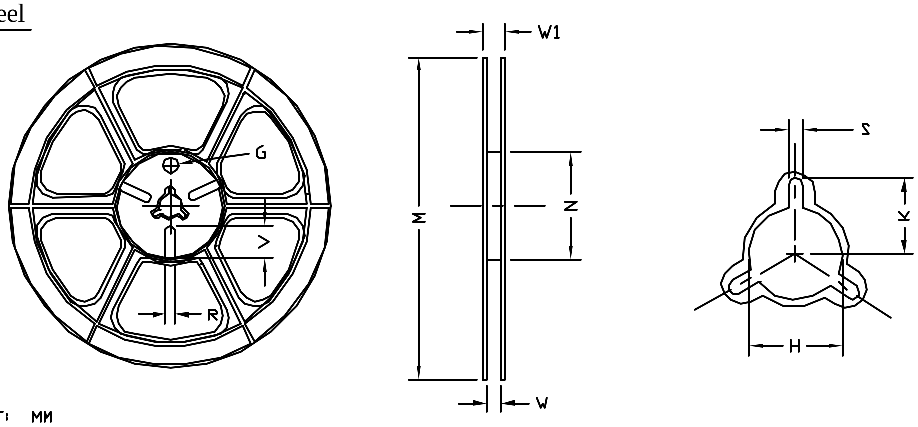
SO-8 Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
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

SO-8 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	---	---	---

SO-8 Tape

Leader / Trailer
& Orientation