ALPHA & OMEGA
SEMICONDUCTOR, INC.

December 2001

AO4403
P-Channel Enhancement Mode Field Effect Transistor

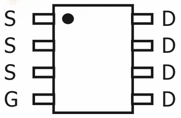
General Description

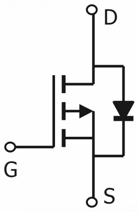
The AO4403 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. The source leads are separated to allow a Kelvin connection to the source, which may be used to bypass the source inductance.

Features

V_{DS} (V) = -30V
I_D = -6.1 A
$R_{DS(ON)}$ < 46mΩ (V_{GS} = -10V)
$R_{DS(ON)}$ < 61mΩ (V_{GS} = -4.5V)
$R_{DS(ON)}$ < 117mΩ (V_{GS} = -2.5V)

SOIC-8
Top View





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}	±12	V
Continuous Drain Current [A]	T_A=25°C	I_D	-6.1	A
	T_A=70°C		-5.1	
Pulsed Drain Current [B]		I_{DM}	-60	
Power Dissipation [A]	T_A=25°C	P_D	3	W
	T_A=70°C		2.1	
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}=-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				A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-6.1A		38	46	mΩ
		T_J=125°C			70	
		V_{GS}=-4.5V, I_D=-5A		49	61	mΩ
		V_{GS}=-2.5V, I_D=-1A		76	117	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				-4.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		940		pF
C_{oss}	Output Capacitance			104		pF
C_{rss}	Reverse Transfer Capacitance			73		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		6		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-15V, I_D=-5A		9.4		nC
Q_{gs}	Gate Source Charge			2		nC
Q_{gd}	Gate Drain Charge			3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=2.4Ω, R_{GEN}=6Ω		7.6		ns
t_r	Turn-On Rise Time			8.6		ns
$t_{D(off)}$	Turn-Off DelayTime			44.7		ns
t_f	Turn-Off Fall Time			16.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5A, dI/dt=100A/μs		22.7		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5A, dI/dt=100A/μs		15.9		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 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 SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

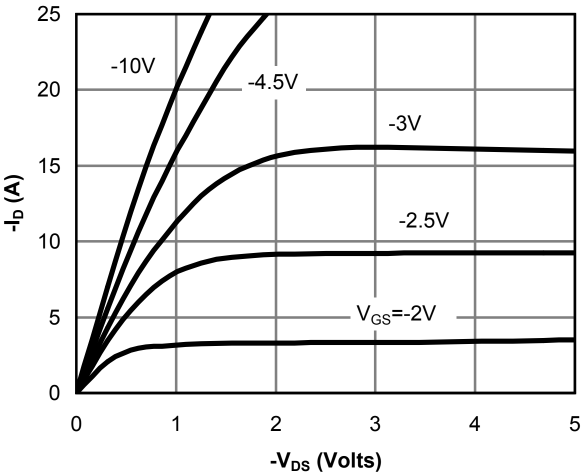


Fig 1: On-Region Characteristics

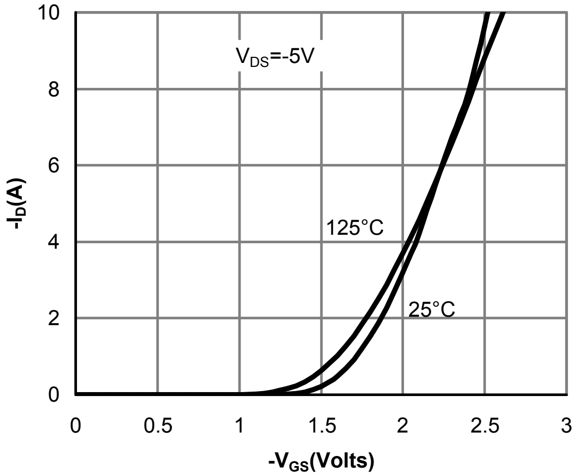


Figure 2: Transfer Characteristics

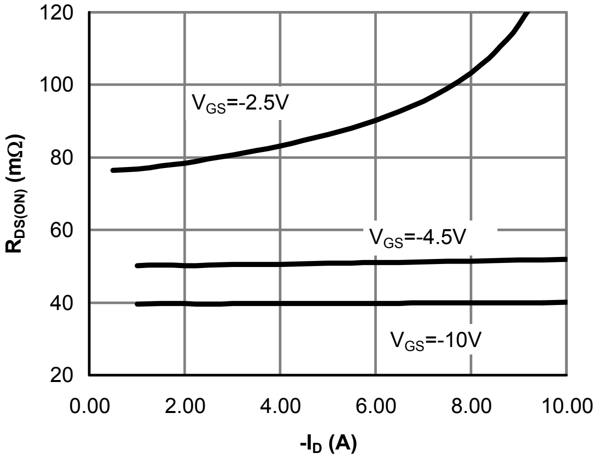


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

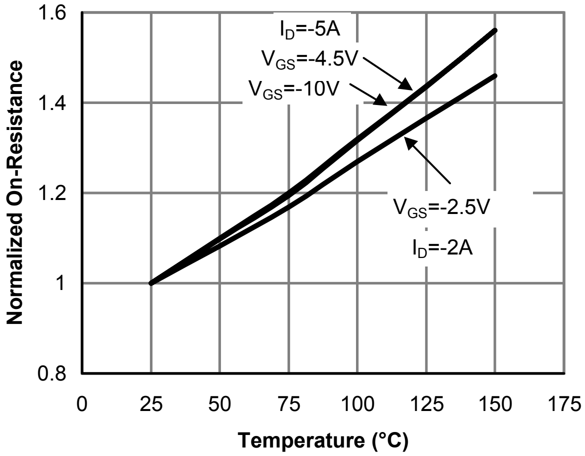


Figure 4: On-Resistance vs. Junction Temperature

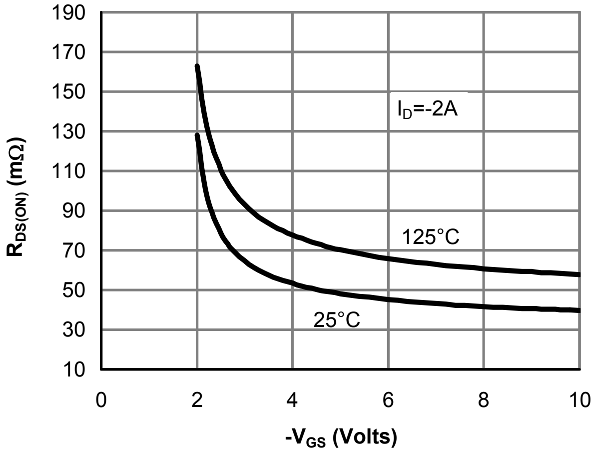


Figure 5: On-Resistance vs. Gate-Source Voltage

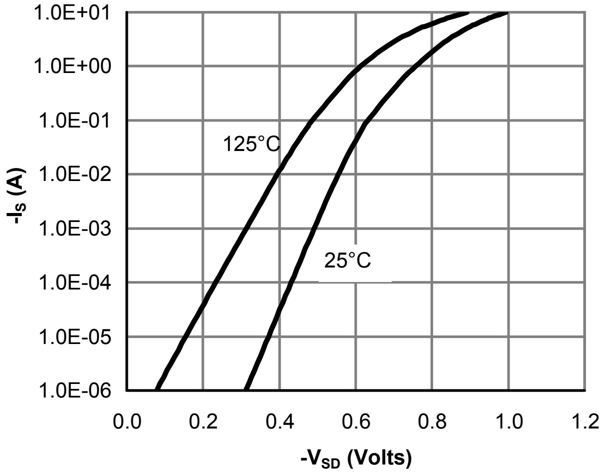


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

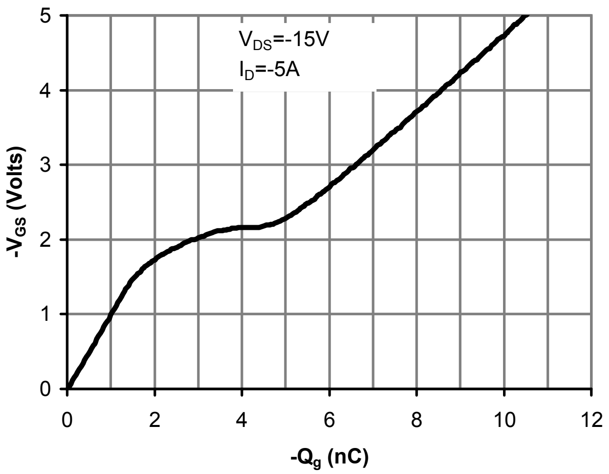


Figure 7: Gate-Charge Characteristics

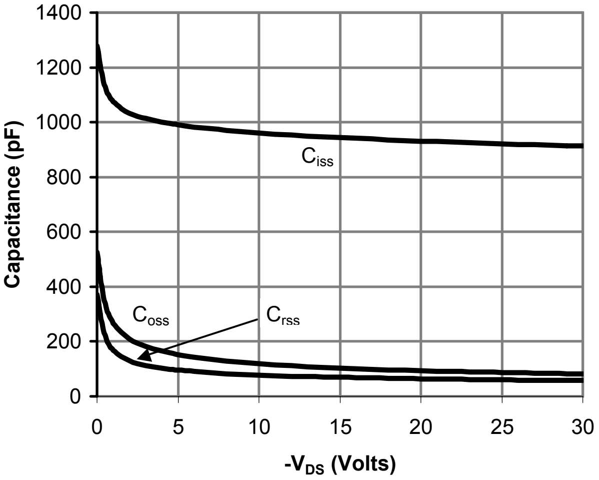


Figure 8: Capacitance Characteristics

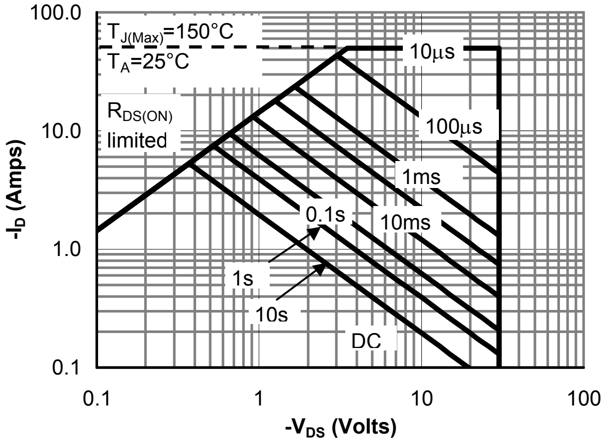


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

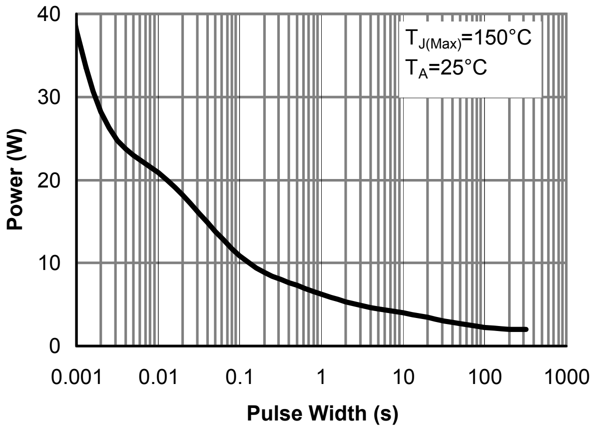


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

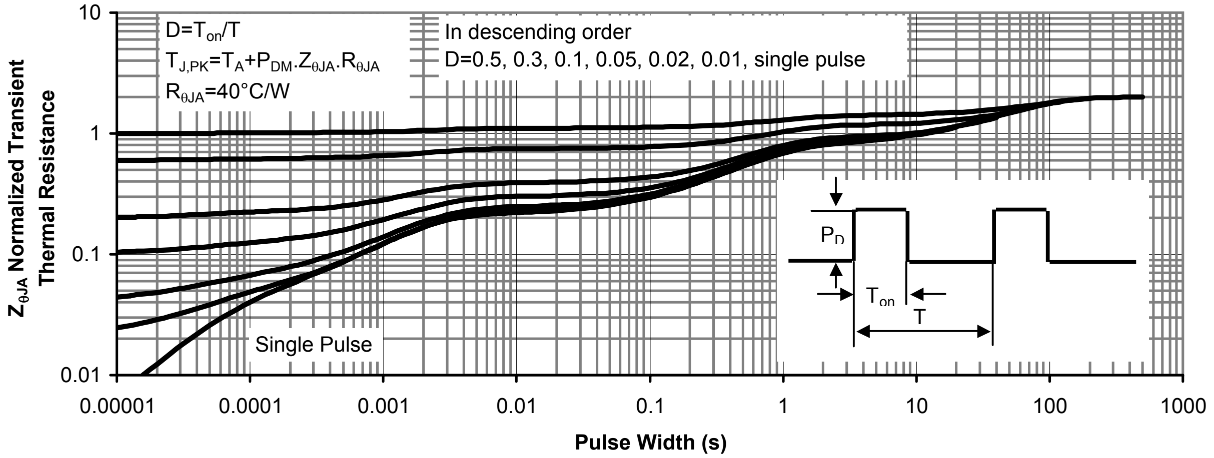
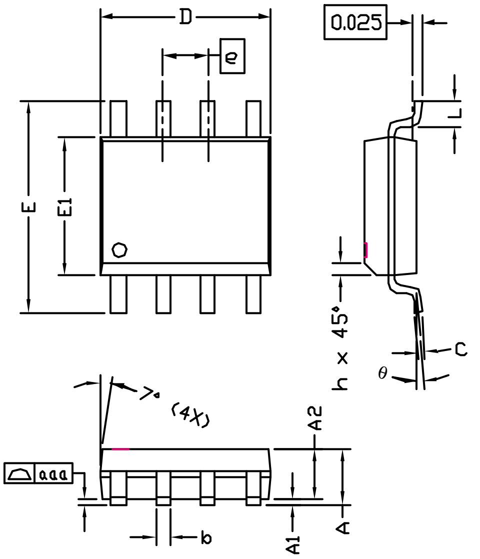


Figure 11: Normalized Maximum Transient Thermal Impedance

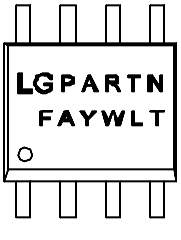
SO-8 Package Data



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 ±0.100 mm (4 mil) UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.1000 mm
4. DIMENSION L IS MEASURED IN GAGE PLANE

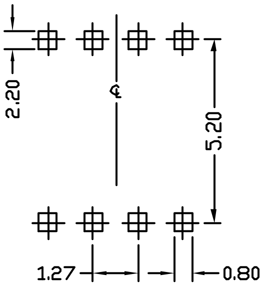
PACKAGE MARKING DESCRIPTION



NOTE:

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

RECOMMENDED LAND PATTERN



UNIT: mm

SO-8 PART NO. CODE

PART NO.	CODE	PART NO.	CODE	PART NO.	CODE
AO4400	4400	AO4800	4800	AO4700	4700
AO4401	4401	AO4801	4801	AO4701	4701

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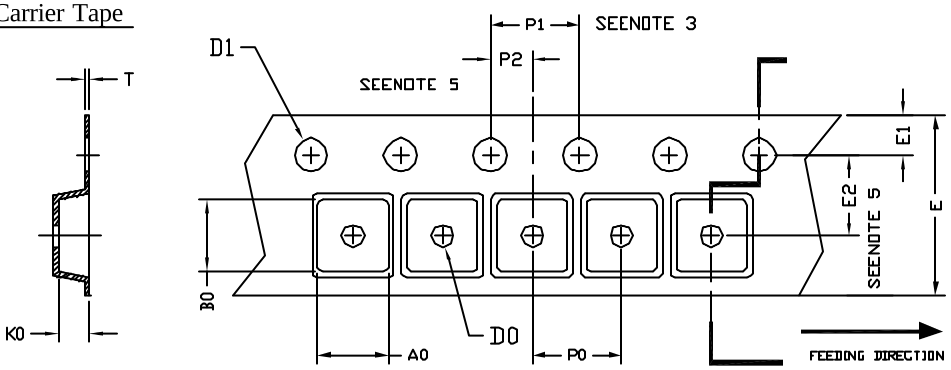
SO-8 Tape and Reel Data

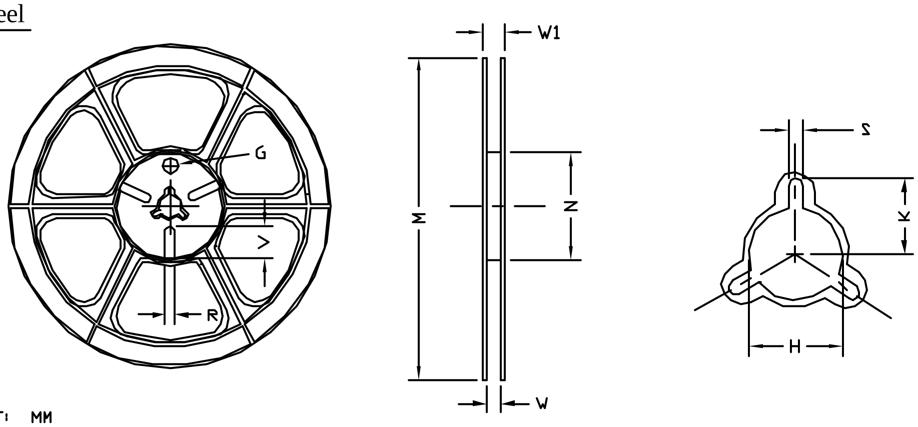
SO-8 Carrier Tape



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