



ALPHA & OMEGA
SEMICONDUCTOR, INC.

July 2001

AO4404

N-Channel Enhancement Mode Field Effect Transistor

General Description

The AO4404 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

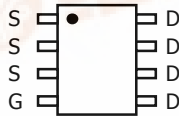
V_{DS} (V) = 30V

I_D = 8.5A

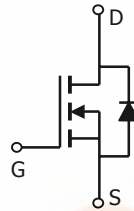
$R_{DS(ON)} < 24m\Omega$ ($V_{GS} = 10V$)

$R_{DS(ON)} < 30m\Omega$ ($V_{GS} = 4.5V$)

$R_{DS(ON)} < 48m\Omega$ ($V_{GS} = 2.5V$)



SOIC-8



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	I_D	8.5	A
		7.1	
Pulsed Drain Current ^B	I_{DM}	60	
Power Dissipation	P_D	3	W
		2.1	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	31	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		59	75	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	16	24	$^\circ\text{C/W}$



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 T _J =55°C			1 5	μA
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	1.4	V
I _{D(ON)}	On state drain current	V _{GS} =4.5V, V _{DS} =5V	40			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =8.5A T _J =125°C		20.5 30	24 36	mΩ
		V _{GS} =4.5V, I _D =8.5A		25	30	mΩ
		V _{GS} =2.5V, I _D =5A		40	48	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =5A	10	16		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.71	1	V
I _S	Maximum Body-Diode Continuous Current				4.3	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		857		pF
C _{oss}	Output Capacitance			97		pF
C _{rss}	Reverse Transfer Capacitance			71		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		1.4		Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =4.5V, V _{DS} =15V, I _D =8.5A		9.7		nC
Q _{gs}	Gate Source Charge			1.63		nC
Q _{gd}	Gate Drain Charge			3.1		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.8Ω, R _{GEN} =6Ω		14		ns
t _r	Turn-On Rise Time			4		ns
t _{D(off)}	Turn-Off DelayTime			33		ns
t _f	Turn-Off Fall Time			5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =5A, dI/dt=100A/μs		15		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =5A, dI/dt=100A/μs		8.6		nC

A: The value of R_{θJA} 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 a given application depends on the user's specific board design. The current rating is based on the t_s ≤ 10s thermal resistance rating.

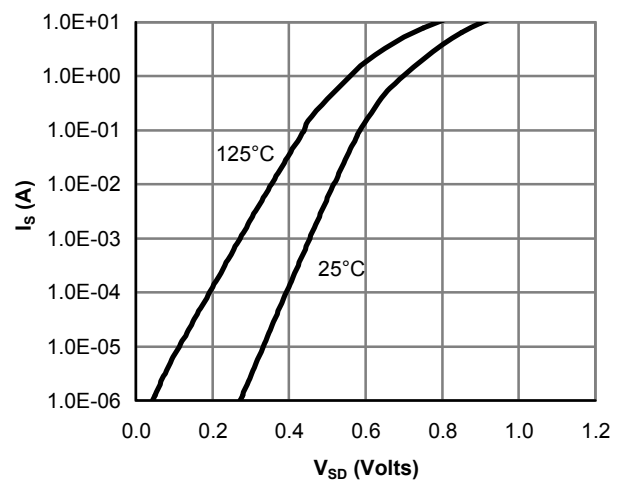
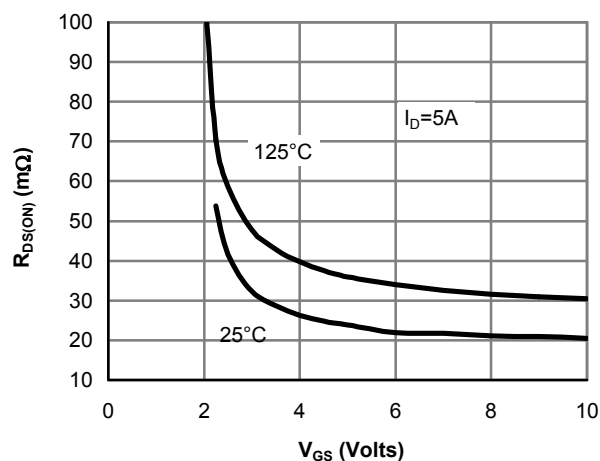
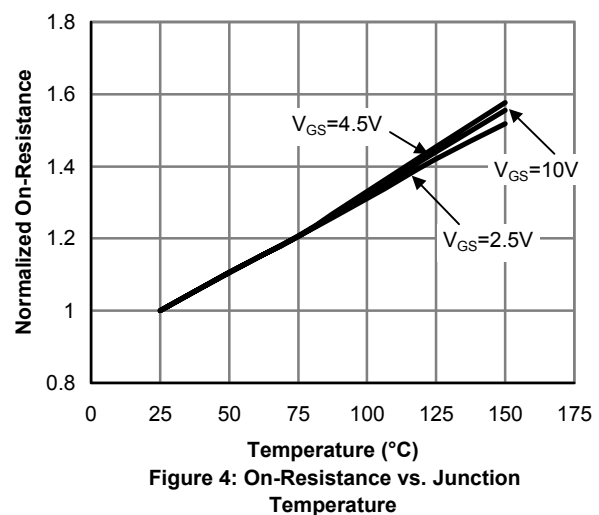
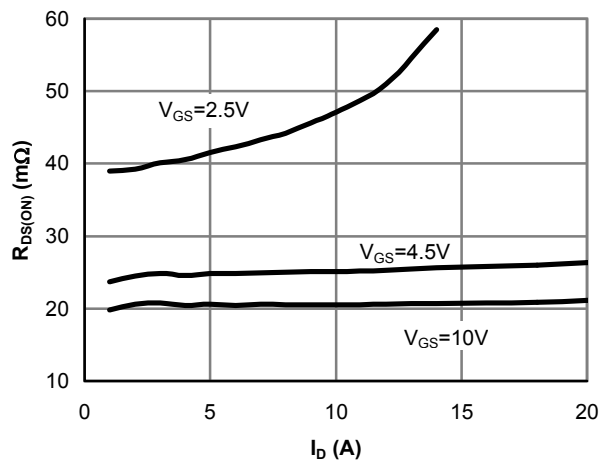
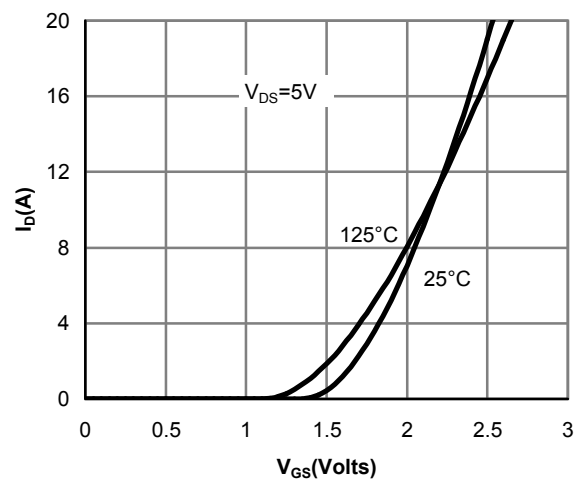
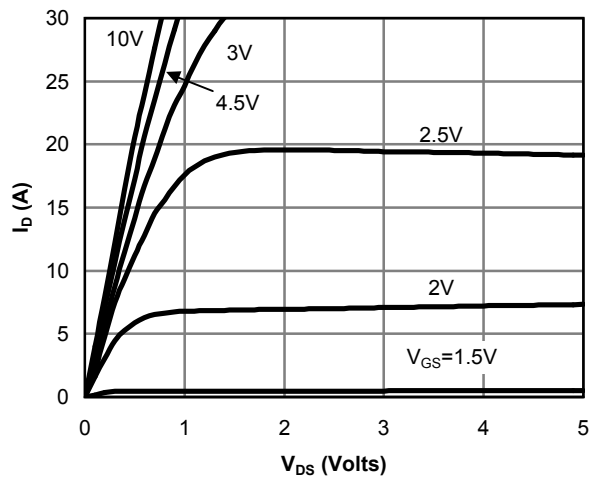
B: Repetitive rating, pulse width limited by junction temperature.

C. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using 80μs 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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



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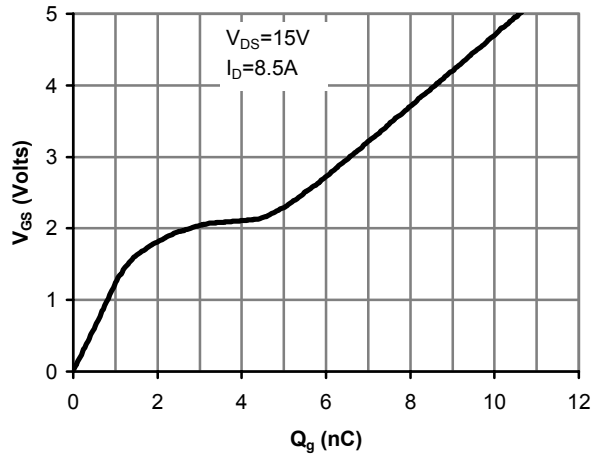


Figure 7: Gate-Charge Characteristics

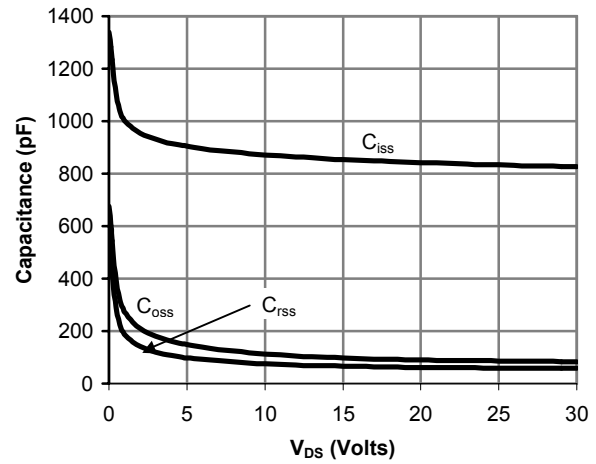


Figure 8: Capacitance Characteristics

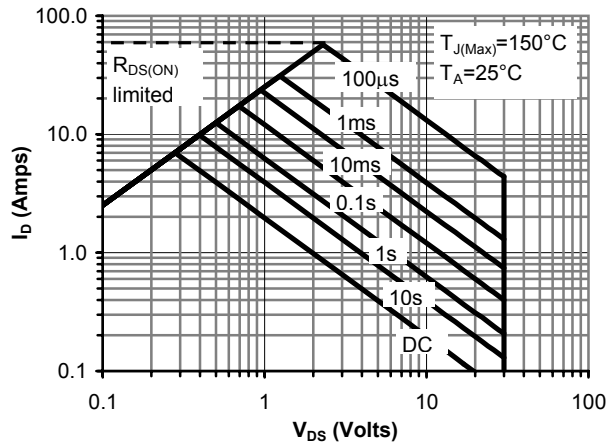


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

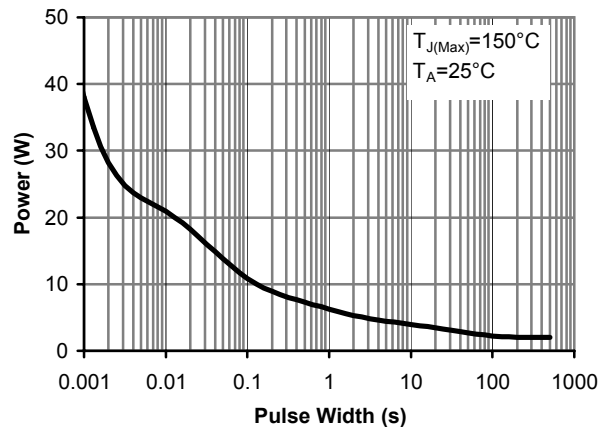


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

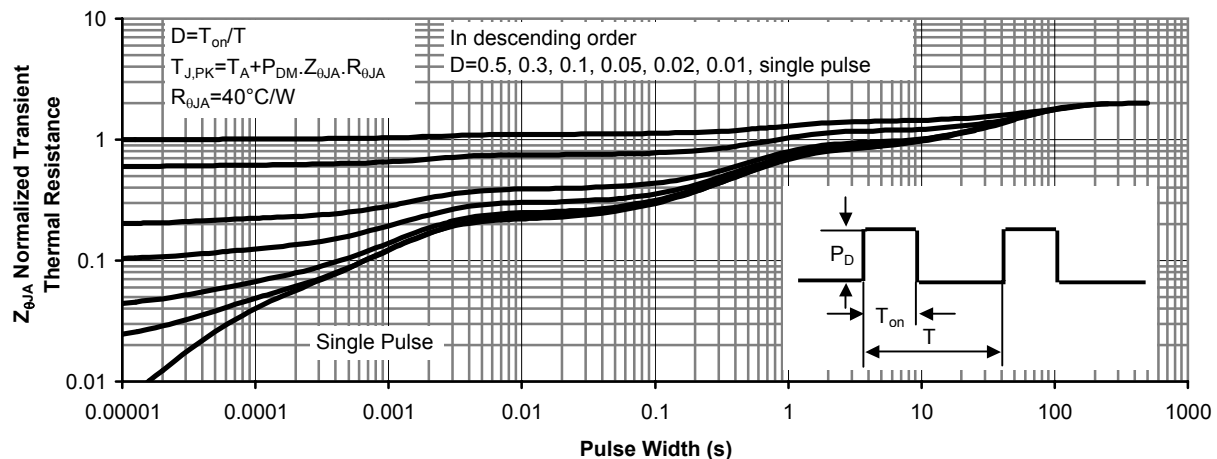
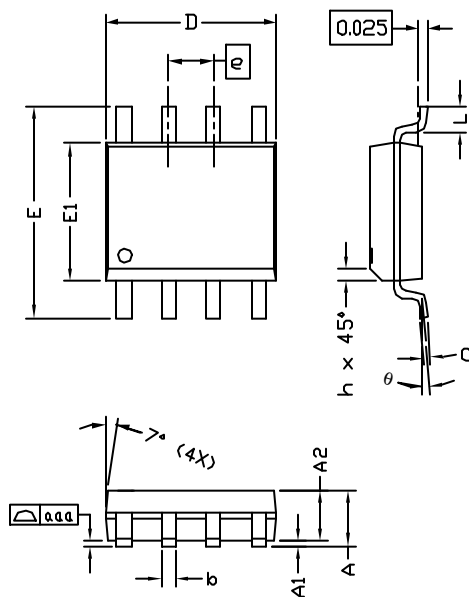


Figure 11: Normalized Maximum Transient Thermal Impedance



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SO-8 Package Data

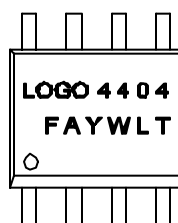


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.45	1.50	1.55	0.057	0.059	0.061
A1	0.00	—	0.10	0.000	—	0.004
A2	—	1.45	—	—	0.057	—
b	0.33	—	0.51	0.013	—	0.020
c	0.19	—	0.25	0.007	—	0.010
D	4.80	—	5.00	0.189	—	0.197
E1	3.80	—	4.00	0.150	—	0.157
e	1.27 BSC			0.050 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

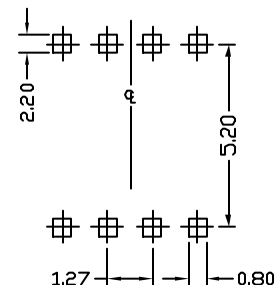


NOTE:
 LOGO - AOS LOGO
 4404 - PART NUMBER CODE.
 F - FAB LOCATION
 A - ASSEMBLY LOCATION
 Y - YEAR CODE
 W - WEEK CODE.
 L N - ASSEMBLY LOT CODE

SO-8 PART NO. CODE

PART NO.	CODE
AO4404	4404

RECOMMENDED LAND PATTERN



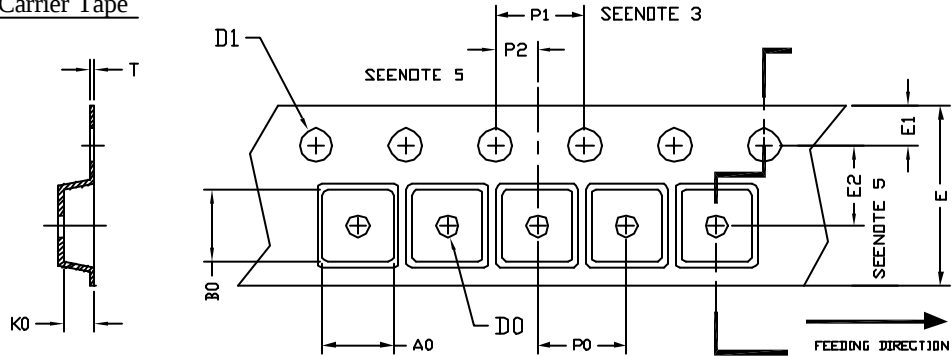
UNIT: mm



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SO-8 Tape and Reel Data

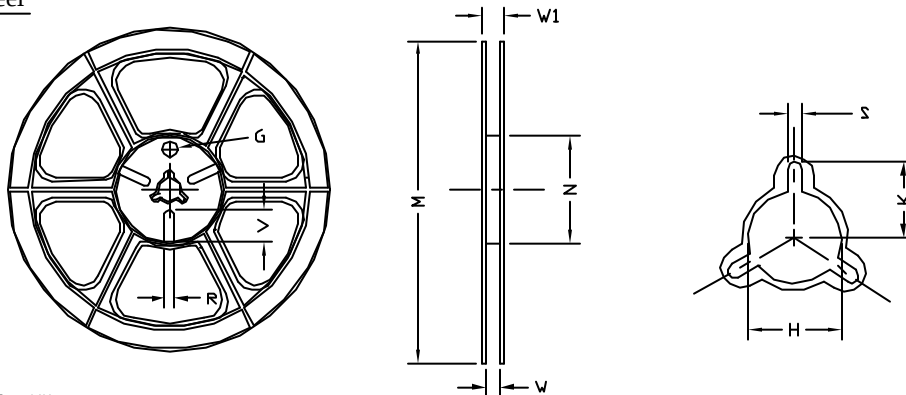
SO-8 Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SO-8 (12 mm)	6.40 ±0.10	3.20 ±0.10	2.10 ±0.10	1.60 ±0.10	1.30 ±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

