ALPHA & OMEGA
SEMICONDUCTOR, INC.

Aug 2002

AO6405
P-Channel Enhancement Mode Field Effect Transistor

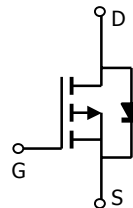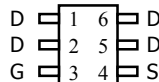### General Description

The AO6405 uses advanced trench technology to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use as a load switch or in PWM applications.

Features

V_{DS} (V) = -30V
I_D = -5 A
$R_{DS(ON)}$ < 52mΩ (V_{GS} = -10V)
$R_{DS(ON)}$ < 87mΩ (V_{GS} = -4.5V)

TSOP6
Top View

```
D  1  6  D
D  2  5  D
G  3  4  S
```

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}	±20	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}	-20	
Power Dissipation [A]	T_A=25°C	P_D	2	W
	T_A=70°C		1.4	
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	$R_{θJA}$	47.5	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		74	110	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{θJL}$	37	50	°C/W

Alpha & Omega Semiconductor, Ltd.

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$_{GS}$=±20V				±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=-250µA		-1	-1.8	-3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=-4.5V, V$_{DS}$=-5V		-10			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-10V, I$_D$=5.0A			39	52	mΩ
			T$_J$=125°C		54	70	
		V$_{GS}$=-4.5V, I$_D$=-4A			67	87	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-5A		6	8.6		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-1A,V$_{GS}$=0V			-0.77	-1	V
I$_S$	Maximum Body-Diode Continuous Current					-2.8	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=-15V, f=1MHz			700		pF
C$_{oss}$	Output Capacitance				120		pF
C$_{rss}$	Reverse Transfer Capacitance				75		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			10		Ω
SWITCHING PARAMETERS							
Q$_g$ (10V)	Total Gate Charge (10V)	V$_{GS}$=-10V, V$_{DS}$=-15V, I$_D$=-5A			14.7		nC
Q$_g$ (4.5V)	Total Gate Charge (4.5V)				7.6		nC
Q$_{gs}$	Gate Source Charge				2		nC
Q$_{gd}$	Gate Drain Charge				3.8		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-10V, V$_{DS}$=-15V, R$_L$=3Ω, R$_{GEN}$=3Ω			8.3		ns
t$_r$	Turn-On Rise Time				5		ns
t$_{D(off)}$	Turn-Off DelayTime				29		ns
t$_f$	Turn-Off Fall Time				14		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-5A, dI/dt=100A/µs			23.5		ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-5A, dI/dt=100A/µs			13.4		nC

A: The value of R$_{θJA}$ 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$_{θJA}$ 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 6,12,14 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.

Alpha & Omega Semiconductor, Ltd.

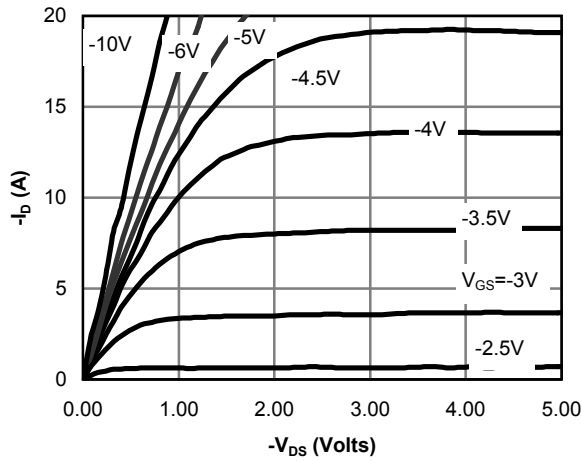TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
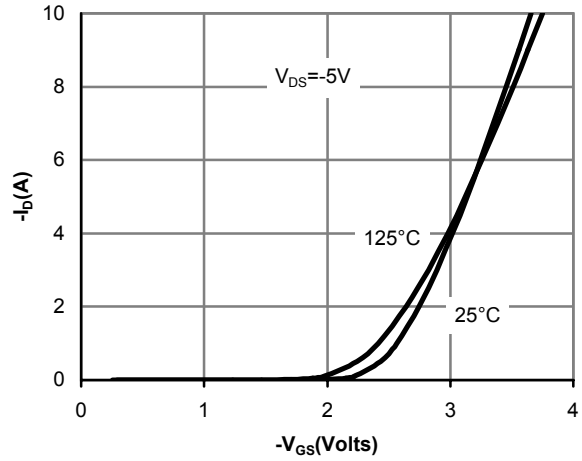
Figure 1: On-Region Characteristics

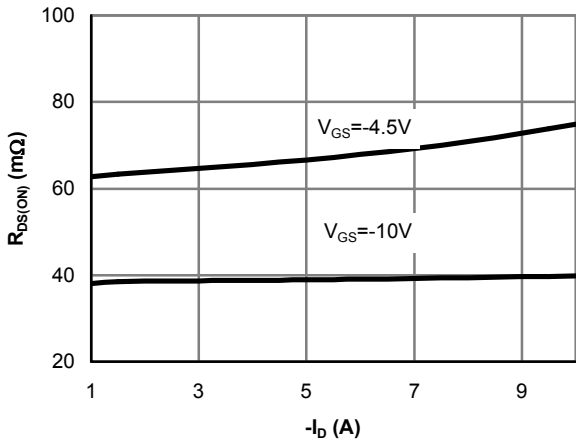**Figure 2: Transfer Characteristics**

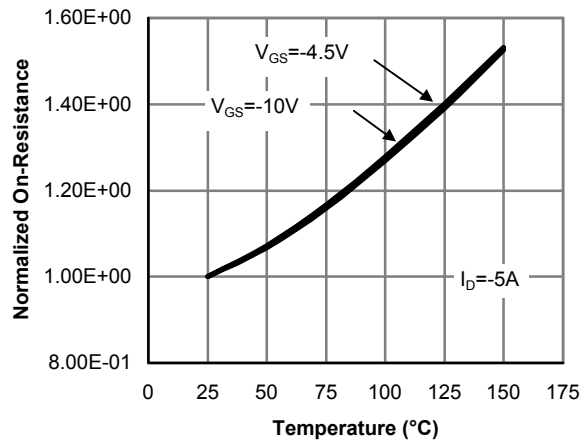**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

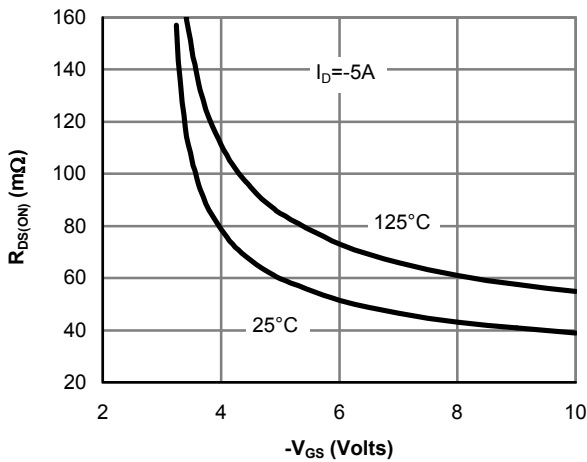**Figure 4: On-Resistance vs. Junction Temperature**
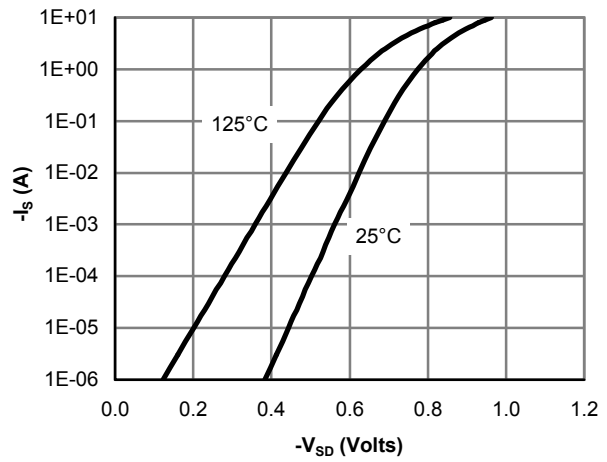
Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

Alpha and Omega Semiconductor, Ltd.
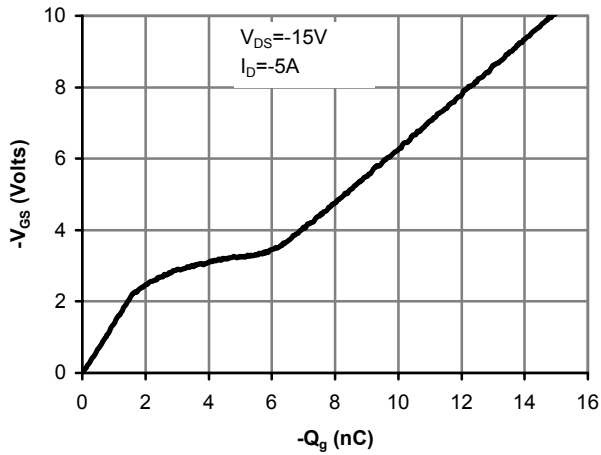
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

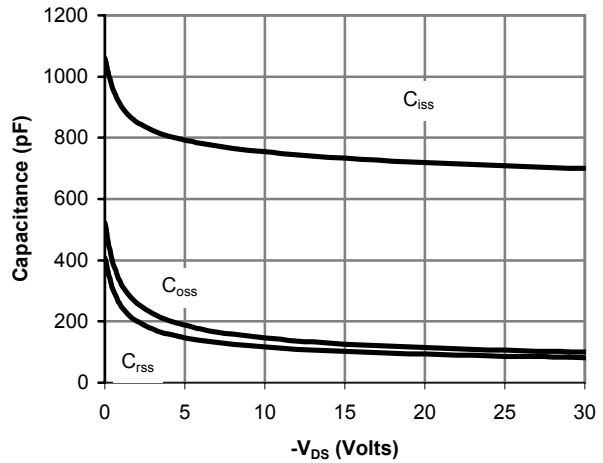Figure 7: Gate-Charge Characteristics
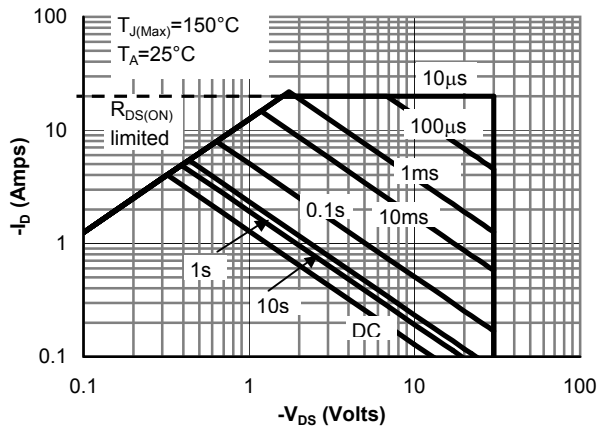
Figure 8: Capacitance Characteristics

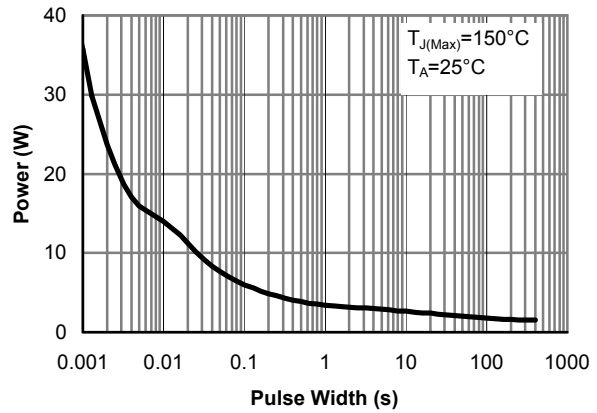Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

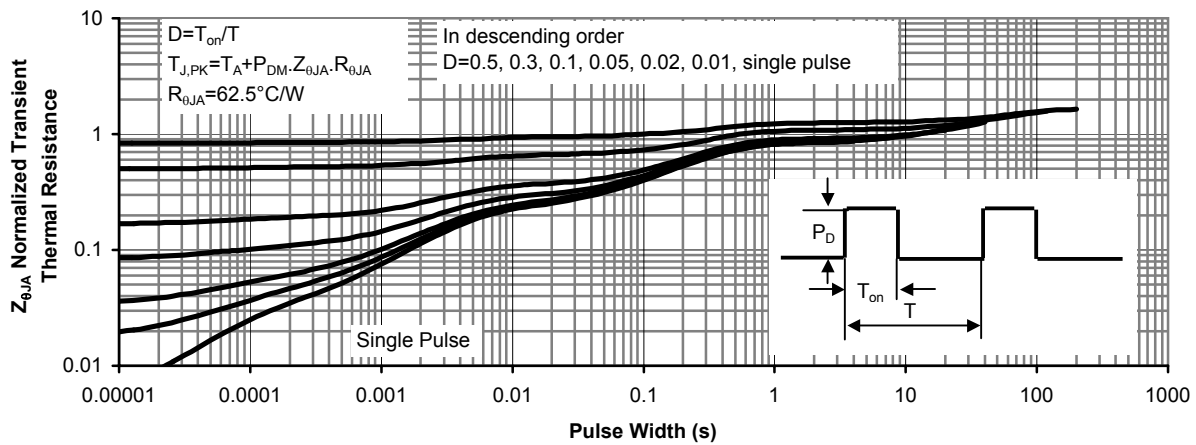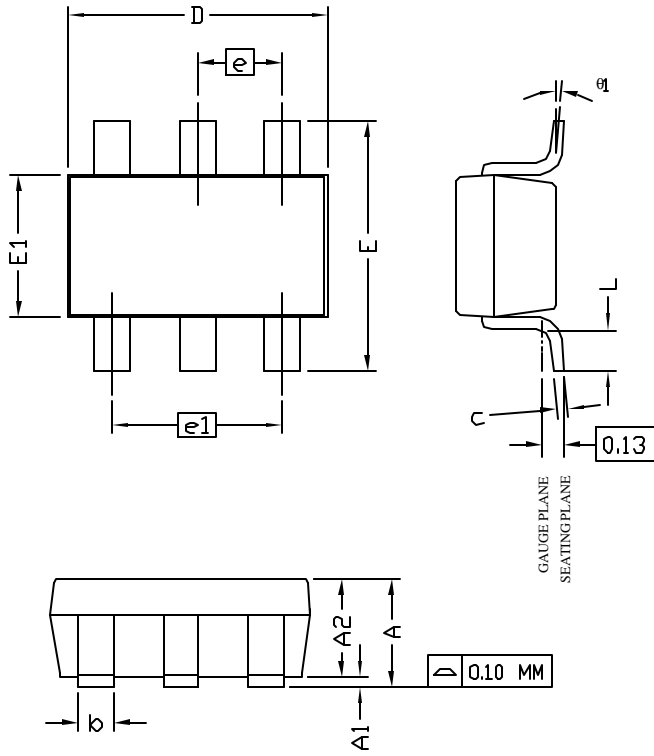Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

Figure 11: Normalized Maximum Transient Thermal Impedance
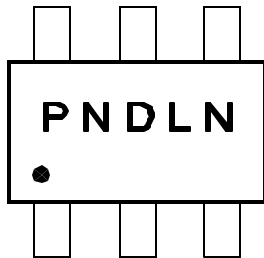
Alpha & Omega Semiconductor, Ltd.

ALPHA & OMEGA
SEMICONDUCTOR, INC.

TSOP-6 Package Data

SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	——	1.25
A1	0.00	——	0.10
A2	1.00	1.10	1.15
b	0.35	0.40	0.50
c	0.10	0.13	0.20
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.60	1.80	2.00
e	0.95 BSC		
e1	1.90 BSC		
L	0.37	——	——
θ1	1°	5°	8°

GAUGE PLANE
SEATING PLANE

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
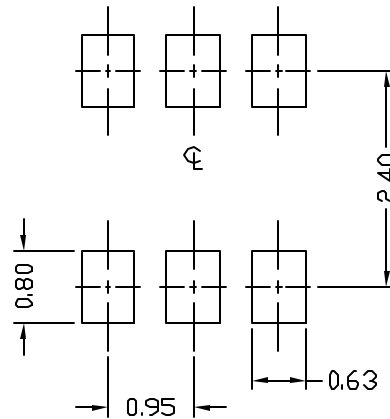
0.10 MM

PACKAGE MARKING DESCRIPTION

RECOMMENDED LAND PATTERN

PNDLN

TSOP-6 PART NO. CODE

PART NO.	CODE
AO6405	D5

NOTE:
P N - PART NUMBER CODE.
D   - YAER AND WEEK CODE.
L N - ASSEMBLY LOT CODE, FAB AND
          ASSEMBLY LOCATION CODE.

2.40
0.80
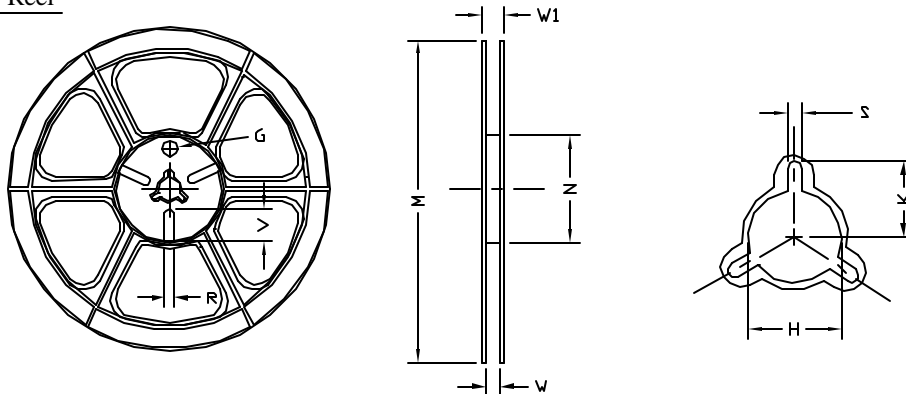0.95
0.63

ALPHA & OMEGA

SEMICONDUCTOR, INC.

TSOP-6 Carrier Tape

UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SOT-23 (8 mm)	3.15 ±0.10	3.27 ±0.10	1.34 ±0.10	1.10 ±0.01	1.50 +0.10	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.25 ±0.05

TSOP-6 Reel

UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
8 mm	Ø180	Ø180.00 ±0.50	Ø60.50	9.00 ±0.30	11.40 ±1.00	Ø13.00 +0.50 -0.20	10.60	2.00 ±0.50	Ø9.00	5.00	18.00

TSOP-6 Tape

Leader / Trailer & Orientation

TRAILER TAPE 300 mm MIN. OR 75 EMPTY POCKETS — COMPONENTS TAPE ORIENTATION IN POCKET — LEADER TAPE 500 mm MIN. OR 125 EMPTY POCKETS