ALPHA & OMEGA
SEMICONDUCTOR, INC.

January 2003

AO6407
P-Channel Enhancement Mode Field Effect Transistor

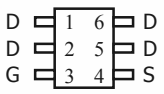
General Description

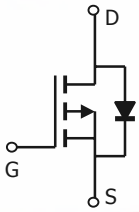
The AO6407 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications.

Features

V_{DS} (V) = -20V
I_D = -5 A
$R_{DS(ON)}$ < 45mΩ (V_{GS} = -4.5V)
$R_{DS(ON)}$ < 60mΩ (V_{GS} = -2.5V)
$R_{DS(ON)}$ < 85mΩ (V_{GS} = -1.8V)

TSOP6
Top View





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-20	V
Gate-Source Voltage		V_{GS}	±8	V
Continuous Drain Current [A]	T_A=25°C	I_D	-5.5	A
	T_A=70°C		-4.5	
Pulsed Drain Current [B]		I_{DM}	-30	
Power Dissipation [A]	T_A=25°C	P_D	2	W
	T_A=70°C		1.44	
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	$R_{\theta JA}$	47.5	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		74	110	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	37	50	°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	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-16V, V_{GS}=0V			-1	μA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±8V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250μA	-0.3	-0.55	-1	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}=-4.5V, I_D=-5A		34	45	mΩ
		T_J=125°C		48	60	
		V_{GS}=-2.5V, I_D=-4A		46	60	mΩ
		V_{GS}=-1.8V, I_D=-2A		61	85	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5A	7	14		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.78	-1	V
I_S	Maximum Body-Diode Continuous Current				-2.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-10V, f=1MHz		1180		pF
C_{oss}	Output Capacitance			176		pF
C_{rss}	Reverse Transfer Capacitance			142		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		15		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-10V, I_D=-5A		13		nC
Q_{gs}	Gate Source Charge			1.2		nC
Q_{gd}	Gate Drain Charge			3.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-4.5V, V_{DS}=-10V, R_L=2.0Ω, R_{GEN}=3Ω		13.2		ns
t_r	Turn-On Rise Time			21		ns
$t_{D(off)}$	Turn-Off DelayTime			93		ns
t_f	Turn-Off Fall Time			46		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5A, dI/dt=100A/μs		43		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5A, dI/dt=100A/μs		21		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

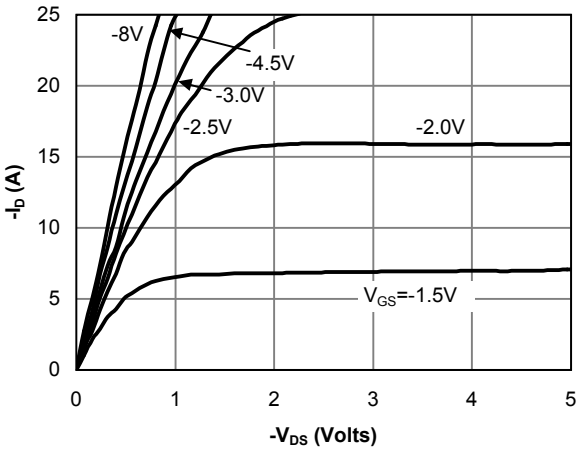


Fig 1: On-Region Characteristics

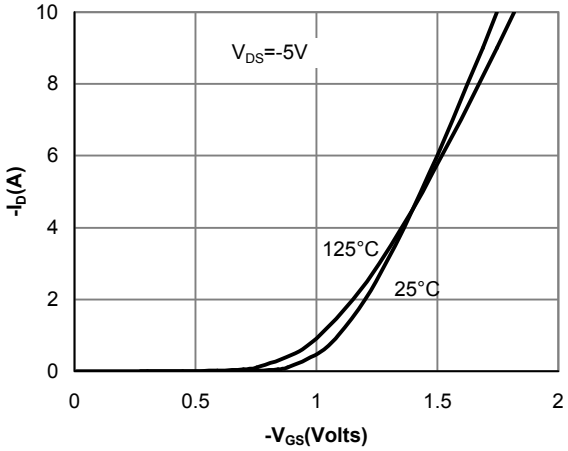


Figure 2: Transfer Characteristics

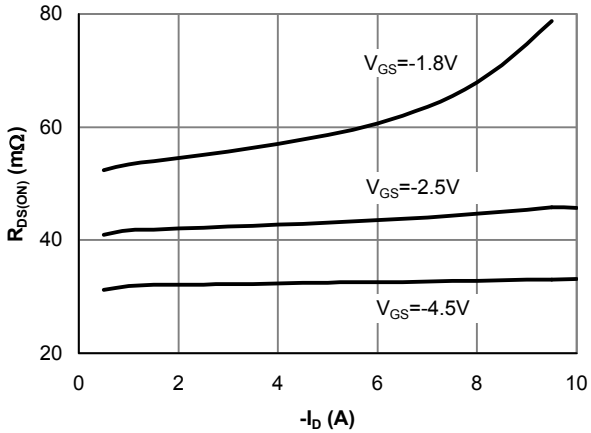


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

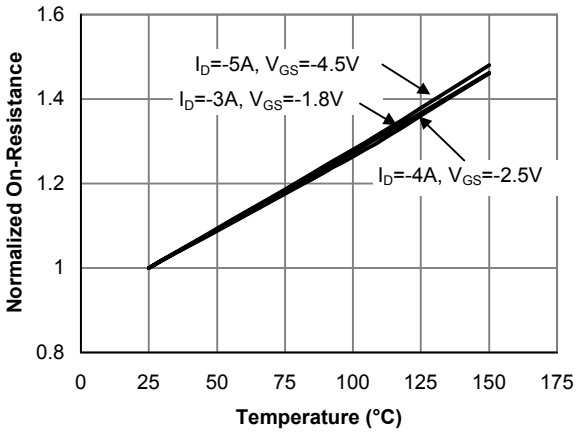


Figure 4: On-Resistance vs. Junction Temperature

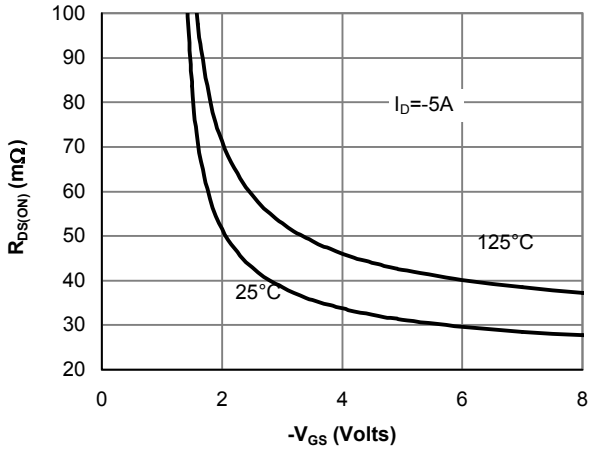


Figure 5: On-Resistance vs. Gate-Source Voltage

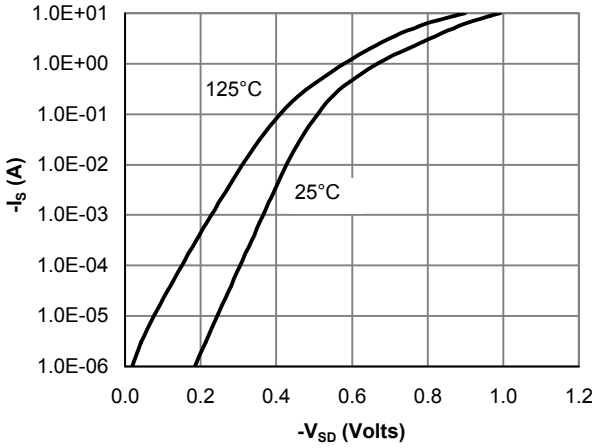


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

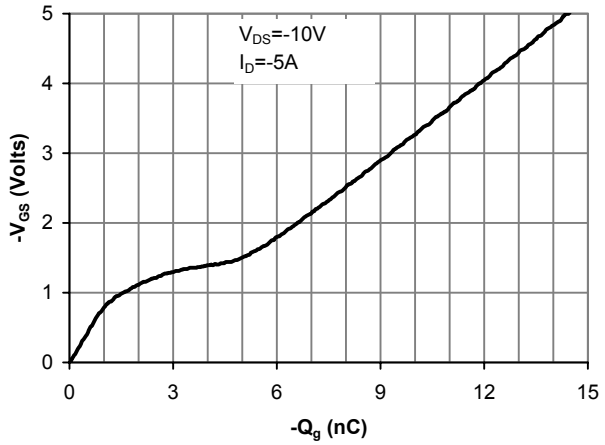


Figure 7: Gate-Charge Characteristics

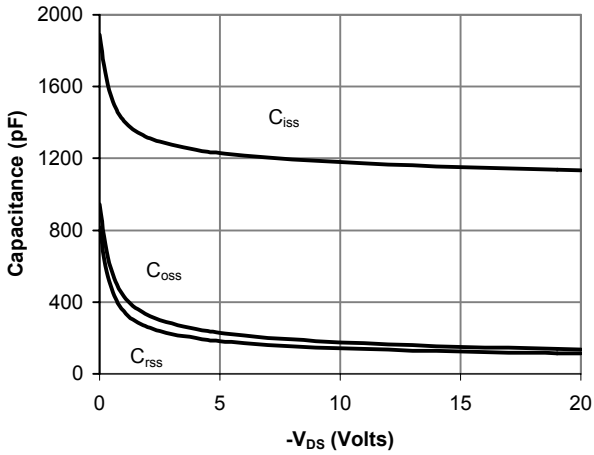


Figure 8: Capacitance Characteristics

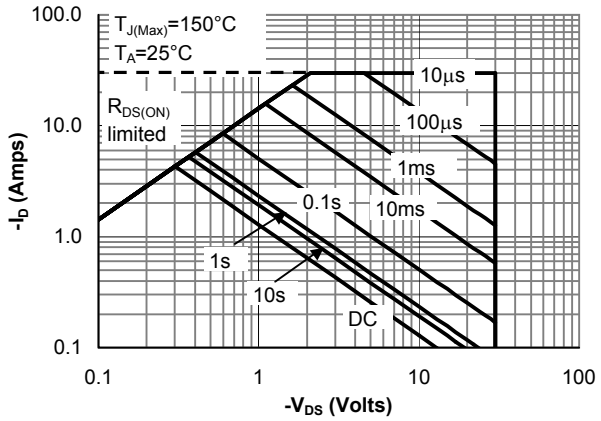


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

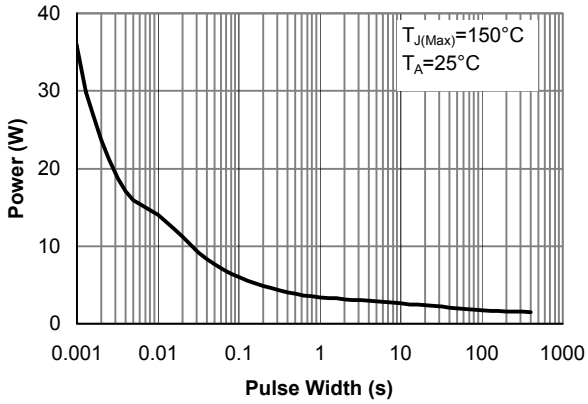


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

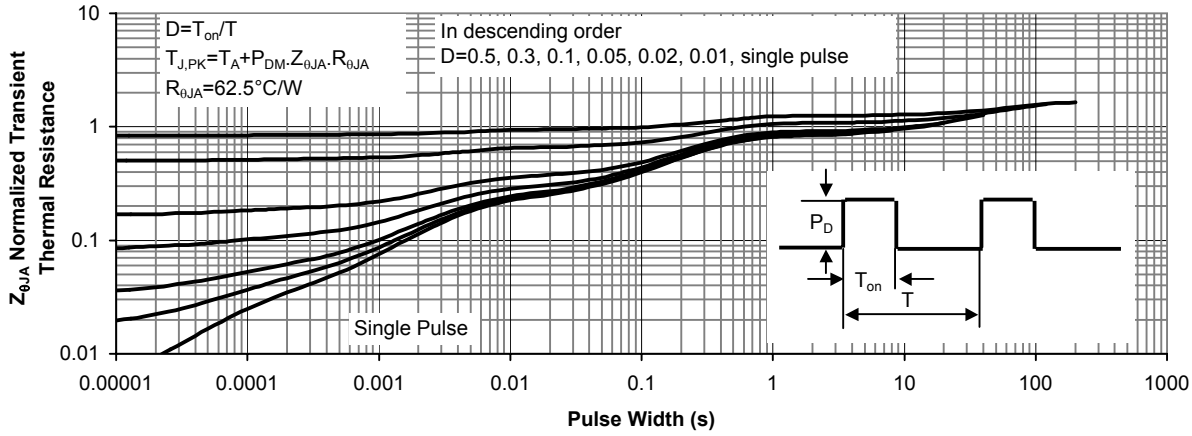


Figure 11: Normalized Maximum Transient Thermal Impedance

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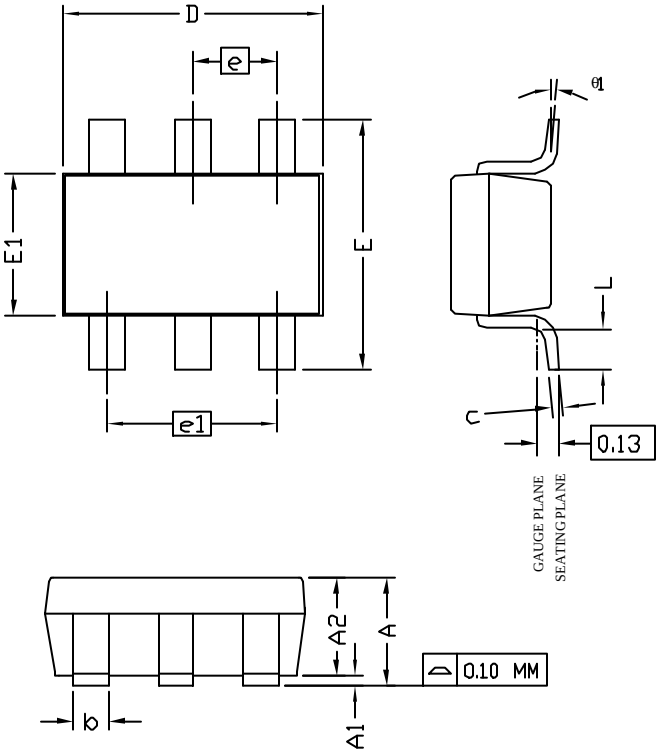
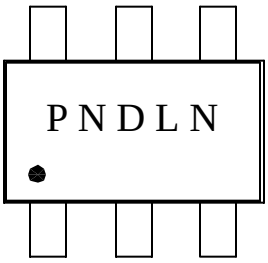
TSOP-6 Package Data



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°

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

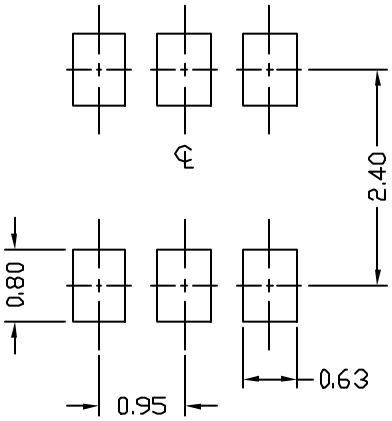


NOTE:
P N - PART NUMBER CODE.
D - YAER AND WEEK CODE.
L N - ASSEMBLY LOT CODE, FAB AND ASSEMBLY LOCATION CODE.

TSOP-6 PART NO. CODE

PART NO.	CODE
AO6407	D7

RECOMMENDED LAND PATTERN



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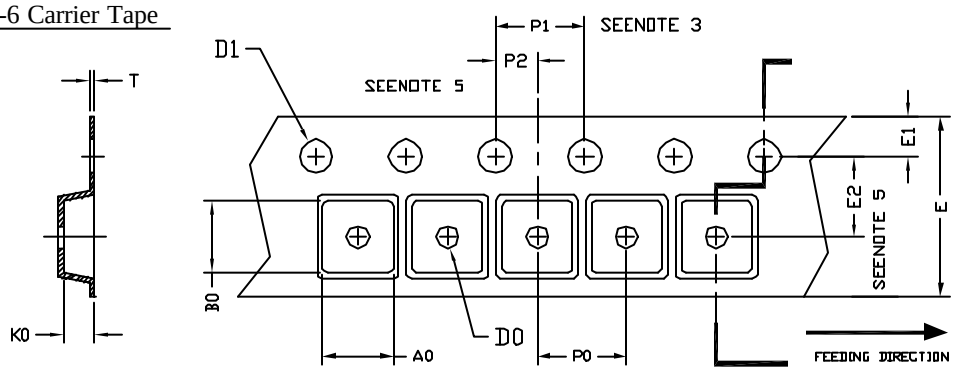
TSOP-6 Tape and Reel Data

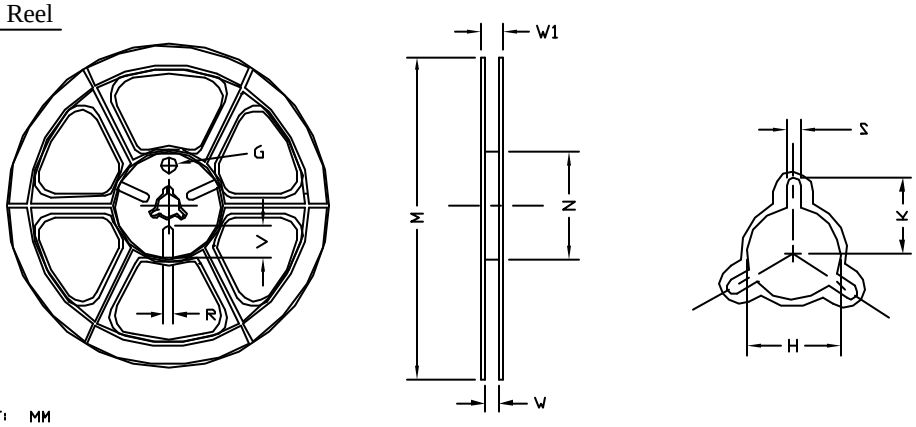
TSOP-6 Carrier Tape



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