ALPHA & OMEGA SEMICONDUCTOR

AO6409AL

P-Channel Enhancement Mode Field Effect Transistor

General Description

The AO6409AL 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 applications.

- RoHS Compliant
- Halogen Free

Product Summary

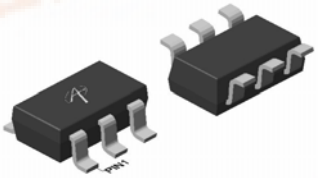
Parameter	
V_{DS}	-20V
I_D (at V_{GS}=-4.5V)	-5.5A
$R_{DS(ON)}$ (at V_{GS}= -4.5V)	< 44mΩ
$R_{DS(ON)}$ (at V_{GS}= -2.5V)	< 53mΩ
$R_{DS(ON)}$ (at V_{GS}= -1.8V)	< 68mΩ

ESD Protected

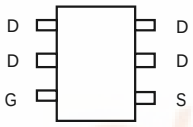
Green Product RoHS Compliant

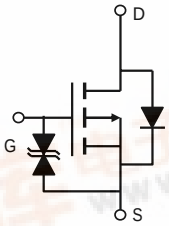
TSOP6

Top View Bottom View



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	T_A=25°C	I_D	-5.5	A
	T_A=70°C		-4	
Pulsed Drain Current [C]		I_{DM}	-30	
Power Dissipation [B]	T_A=25°C	P_D	2.1	W
	T_A=70°C		1.3	
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	$R_{\theta JA}$	48	60	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		75	90	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	37	45	°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}=-20V, V_{GS}=0V			-1	μA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±8V			±10	μA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250μA	-0.35	-0.57	-0.85	V
$I_{D(ON)}$	On state drain current	V_{GS}=-4.5V, V_{DS}=-5V	-30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-4.5V, I_D=-5.5A		36	44	mΩ
		T_J=125°C		51	61	
		V_{GS}=-2.5V, I_D=-5A		44	53	mΩ
		V_{GS}=-1.8V, I_D=-4A		53	68	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5.5A		20		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.64	-1	V
I_S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-10V, f=1MHz	620	780	940	pF
C_{oss}	Output Capacitance		80	115	150	pF
C_{rss}	Reverse Transfer Capacitance		50	80	110	pF
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=-4.5V, V_{DS}=-10V, I_D=-5.5A	7.4	9.3	11	nC
Q_{gs}	Gate Source Charge		1.2	1.5	1.8	nC
Q_{gd}	Gate Drain Charge		1	1.8	2.5	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-4.5V, V_{DS}=-10V, R_L=1.8Ω, R_{GEN}=3Ω		120		ns
t_r	Turn-On Rise Time			240		ns
$t_{D(off)}$	Turn-Off DelayTime			2.8		μs
t_f	Turn-Off Fall Time			2		μs
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5.5A, dI/dt=500A/μs	11	14	17	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5.5A, dI/dt=500A/μs	24	30	36	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 given application depends on the user's specific board design.

B. The power dissipation P_D is based on $T_{J(MAX)}$=150°C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C. Ratings are based on low frequency and duty cycles to keep initialT_J=25°C.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedence which is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.

Rev 0: January 2009

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

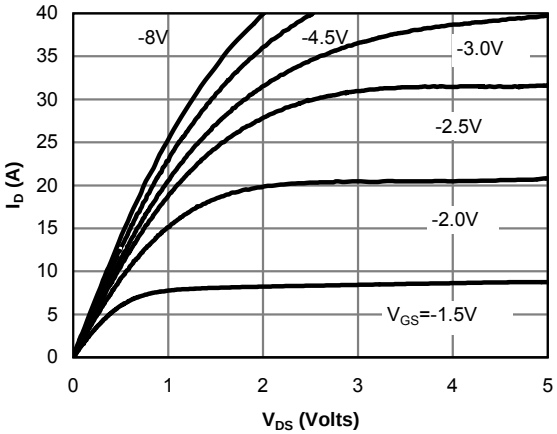


Fig 1: On-Region Characteristics (Note E)

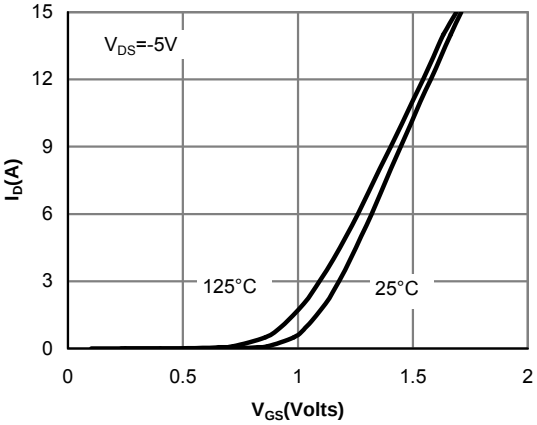


Figure 2: Transfer Characteristics (Note E)

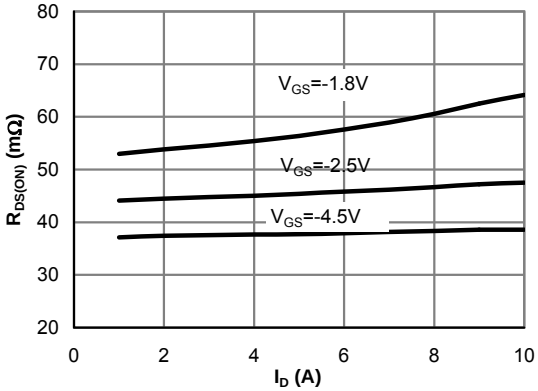


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

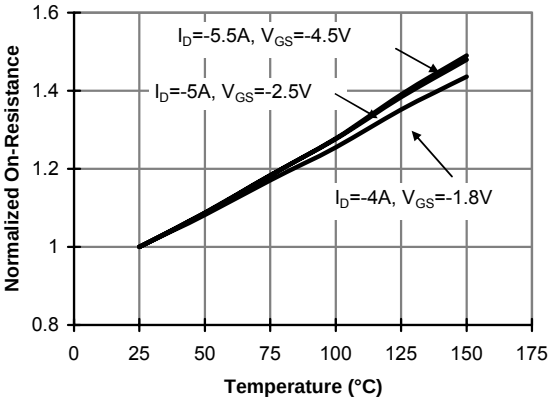


Figure 4: On-Resistance vs. Junction Temperature (Note E)

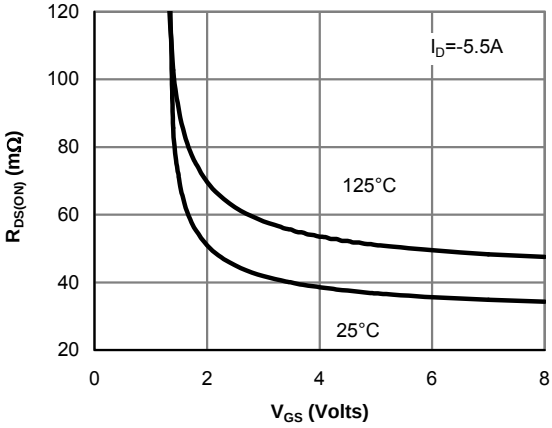


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

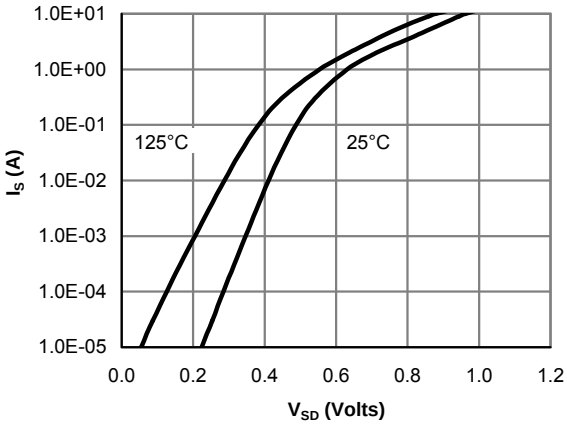


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

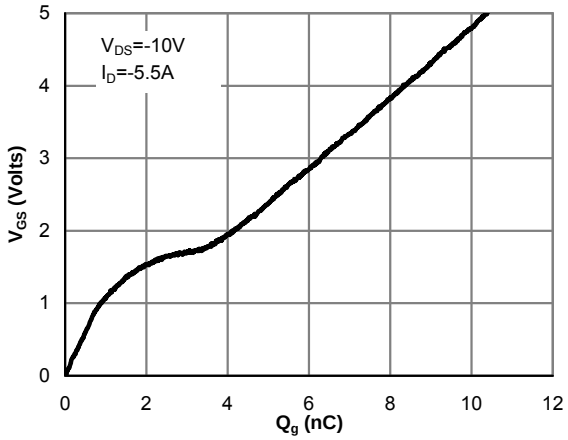


Figure 7: Gate-Charge Characteristics

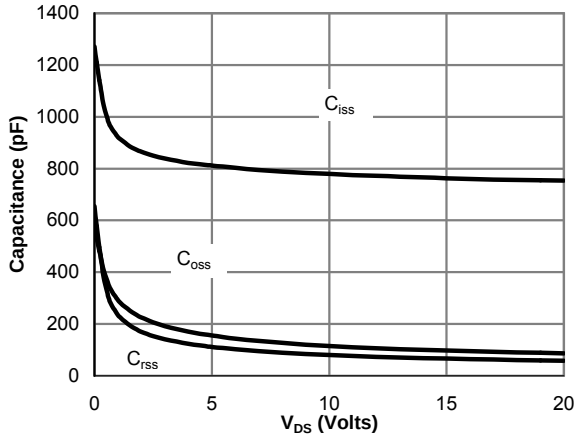


Figure 8: Capacitance Characteristics

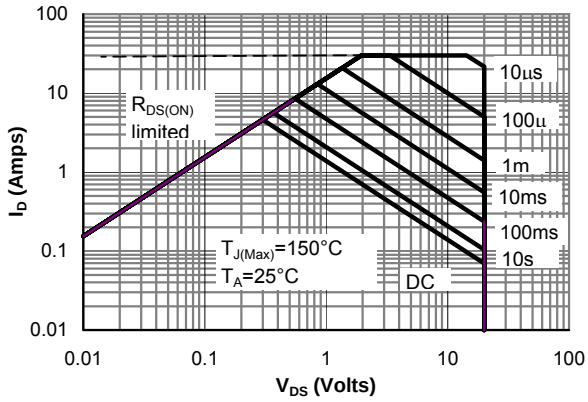


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

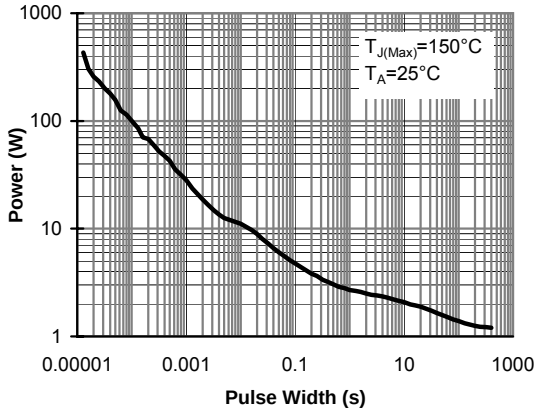


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

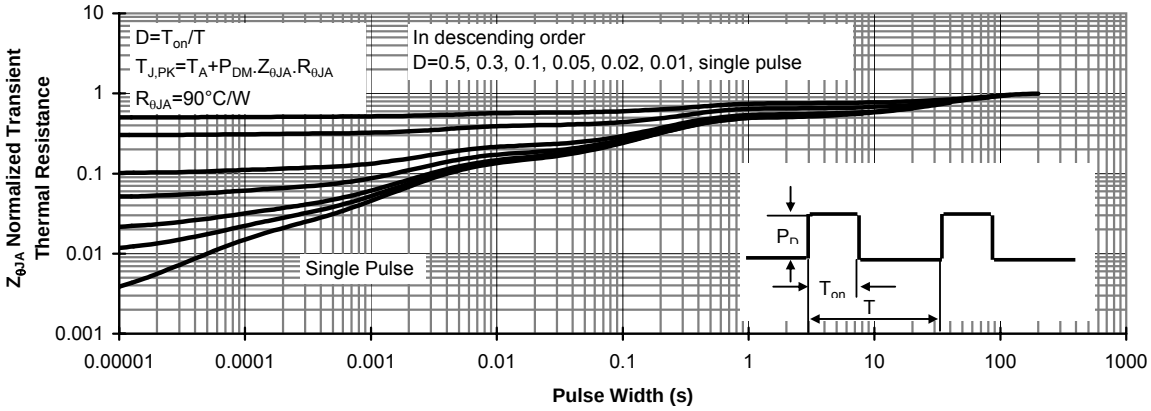
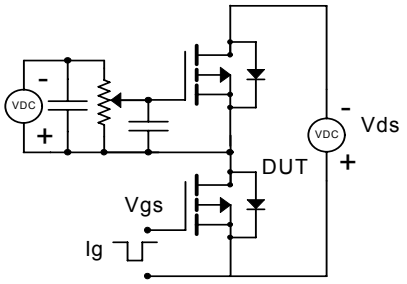
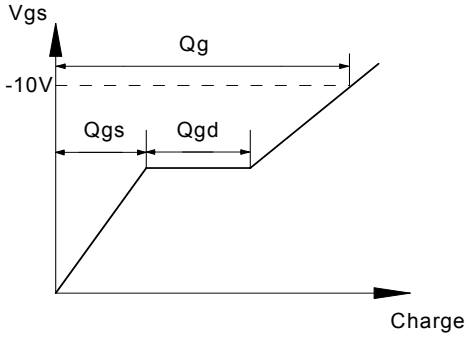


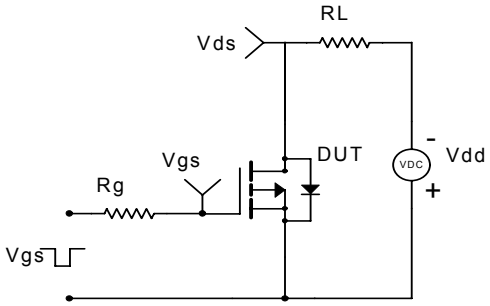
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

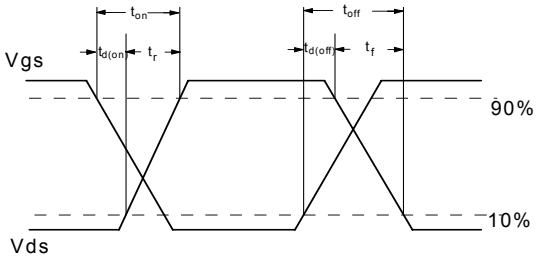
Gate Charge Test Circuit & Waveform





Resistive Switching Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms