



ALPHA & OMEGA
SEMICONDUCTOR, LTD.

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AO6409, AO6409L (Green Product)
P-Channel Enhancement Mode Field Effect Transistor

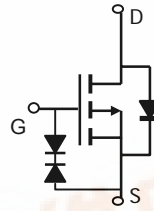
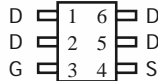
General Description

The AO6409 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. It is ESD protected. AO6409L (Green Product) is offered in a lead-free package.

Features

V_{DS} (V) = -20V
 I_D = -5 A
 $R_{DS(ON)} < 45m\Omega$ ($V_{GS} = -4.5V$)
 $R_{DS(ON)} < 56m\Omega$ ($V_{GS} = -2.5V$)
 $R_{DS(ON)} < 75m\Omega$ ($V_{GS} = -1.8V$)
 ESD Rating: 3000V HBM

TSOP6
Top View



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	I_D	$T_A=25^\circ\text{C}$	-5.0
		$T_A=70^\circ\text{C}$	-4.2
Pulsed Drain Current ^B	I_{DM}	-30	A
Power Dissipation ^A	P_D	$T_A=25^\circ\text{C}$	2
		$T_A=70^\circ\text{C}$	1.28
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	$R_{\theta JA}$	47.5	62.5	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A				
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	74	110	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	37	50	$^\circ\text{C/W}$



Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
B _V 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 T _J =55°C			-1 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±4.5V			±1	μA
		V _{DS} =0V, V _{GS} =±8V			±10	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =-250μA	-0.3	-0.55	-1	
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 T _J =125°C		37 48	45 60	mΩ
		V _{GS} =-2.5V, I _D =-4A		46	56	mΩ
		V _{GS} =-1.8V, I _D =-2A		57	75	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-5A	8	16		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		1450		pF
C _{oss}	Output Capacitance			205		pF
C _{rss}	Reverse Transfer Capacitance			160		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		6.5		Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-10V, I _D =-5A		17.2		nC
Q _{gs}	Gate Source Charge			1.3		nC
Q _{gd}	Gate Drain Charge			4.5		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-4.5V, V _{DS} =-10V, R _L =2.0Ω, R _{GEN} =3Ω		9		ns
t _r	Turn-On Rise Time			14		ns
t _{D(off)}	Turn-Off DelayTime			91		ns
t _f	Turn-Off Fall Time			31		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-5A, di/dt=100A/μs		33		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-5A, di/dt=100A/μs		14		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 ≤ 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 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

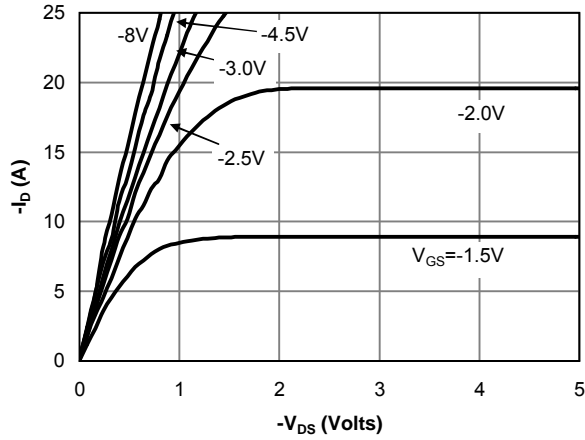


Fig 1: On-Region Characteristics

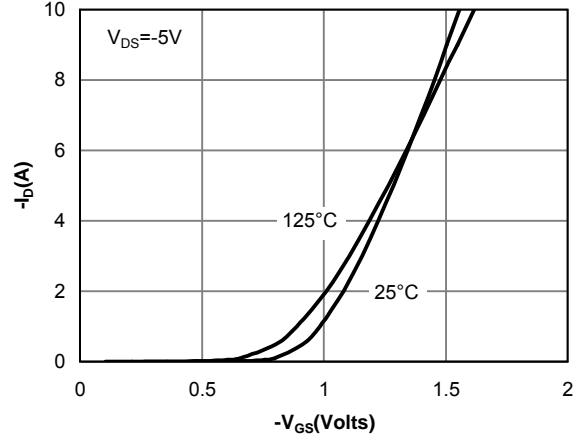


Figure 2: Transfer Characteristics

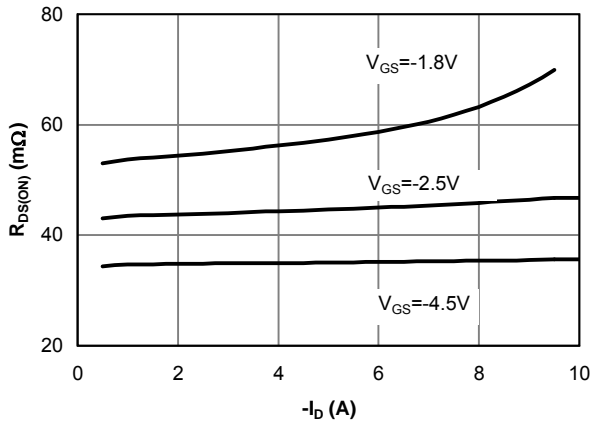


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

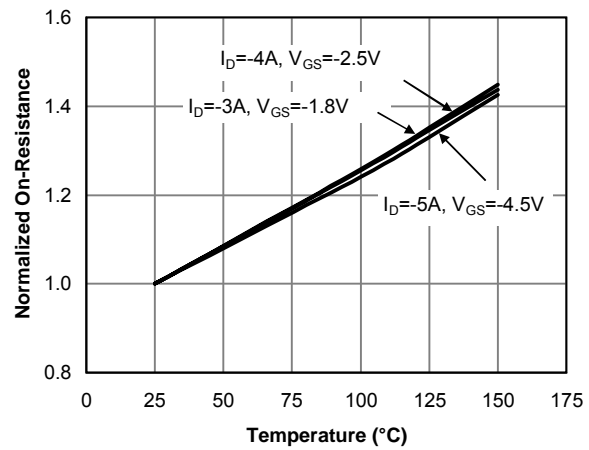


Figure 4: On-Resistance vs. Junction Temperature

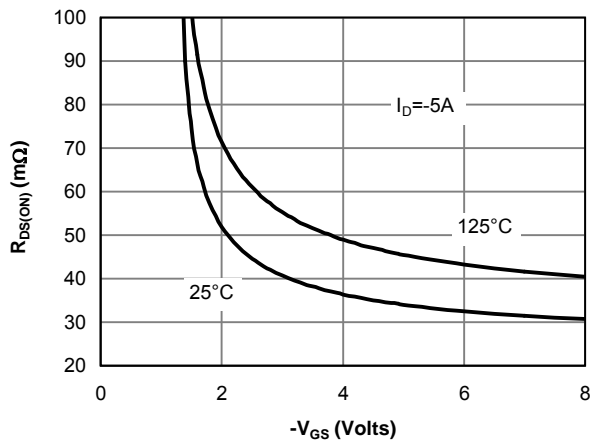


Figure 5: On-Resistance vs. Gate-Source Voltage

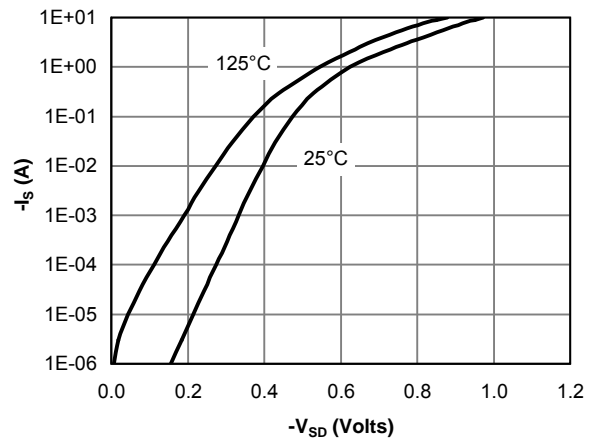


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

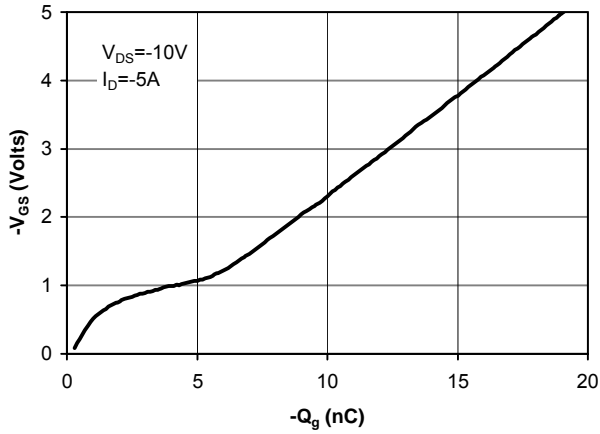


Figure 7: Gate-Charge Characteristics

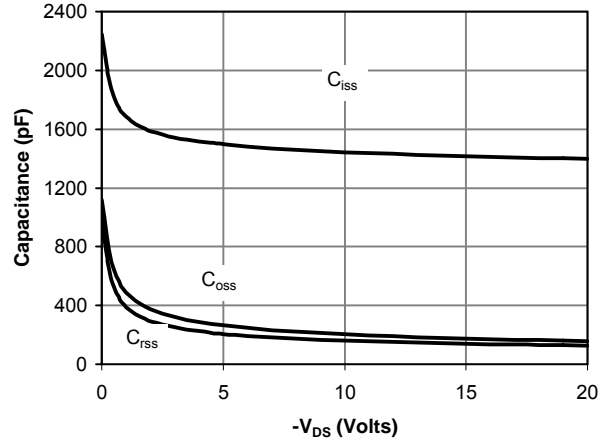


Figure 8: Capacitance Characteristics

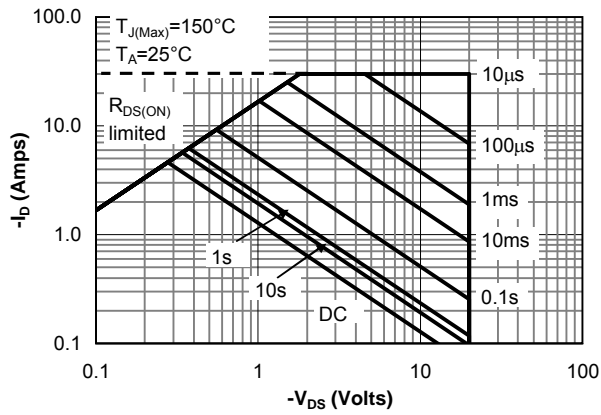


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

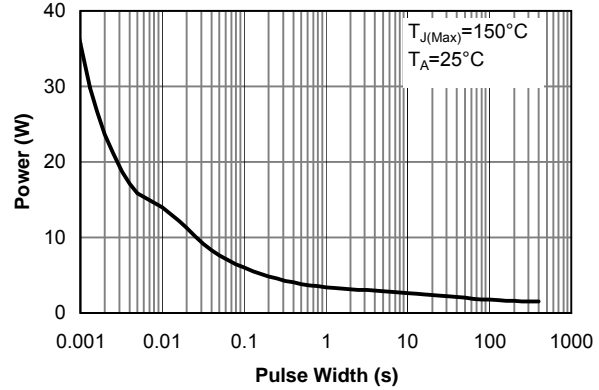


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

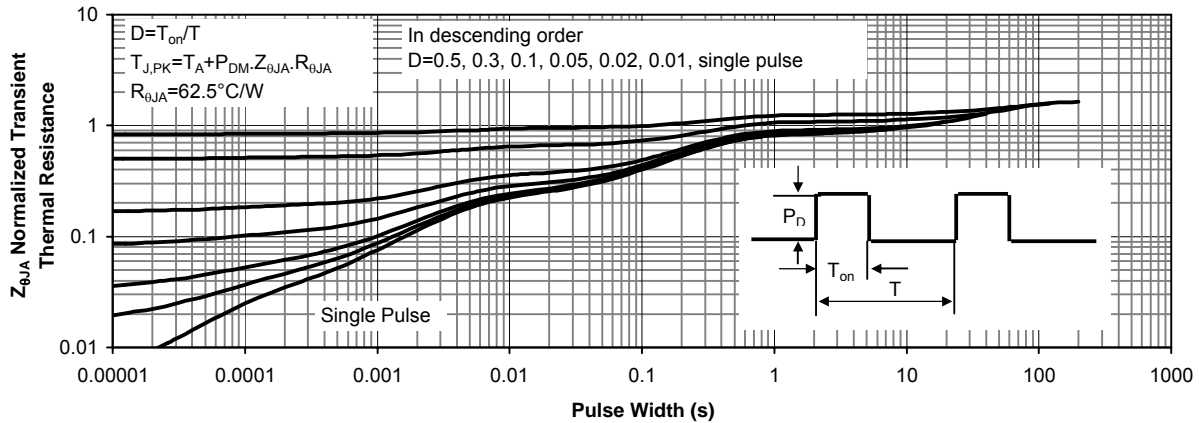


Figure 11: Normalized Maximum Transient Thermal Impedance