ALPHA & OMEGA
SEMICONDUCTOR

AO6409A

20V P-Channel MOSFET

General Description

The AO6409A 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.

Product Summary

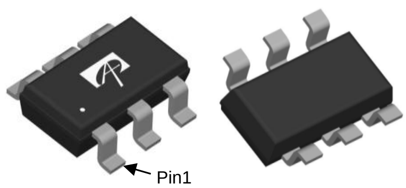
V_{DS}	-20V
I_D (at V_{GS}=-4.5V)	-5.5A
$R_{DS(ON)}$ (at V_{GS}= -4.5V)	< 41mΩ
$R_{DS(ON)}$ (at V_{GS}= -2.5V)	< 53mΩ
$R_{DS(ON)}$ (at V_{GS}= -1.8V)	< 65mΩ

ESD protected

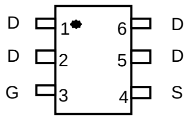
Green Product

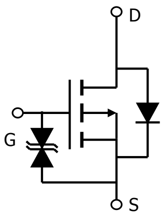
TSOP6

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		-4.2	
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		-0.3	-0.57	-0.9	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			34	41	mΩ
			T_J=125°C		49	59	
		V_{GS}=-2.5V, I_D=-4A			42	53	mΩ
		V_{GS}=-1.8V, I_D=-2A			52	65	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		600	751	905	pF
C_{oss}	Output Capacitance			80	115	150	pF
C_{rss}	Reverse Transfer Capacitance			48	80	115	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		6	13	20	Ω
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			0.8	1	1.2	nC
Q_{gd}	Gate Drain Charge			1.3	2.2	3.1	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-4.5V, V_{DS}=-10V, R_L=1.8Ω, R_{GEN}=3Ω			13		ns
t_r	Turn-On Rise Time				9		ns
$t_{D(off)}$	Turn-Off DelayTime				19		ns
t_f	Turn-Off Fall Time				29		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5.5A, dI/dt=500A/µs		20	26	32	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5.5A, dI/dt=500A/µs		40	51	62	nC

A. The value of $R_{\theta JA}$ 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 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 1in² 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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

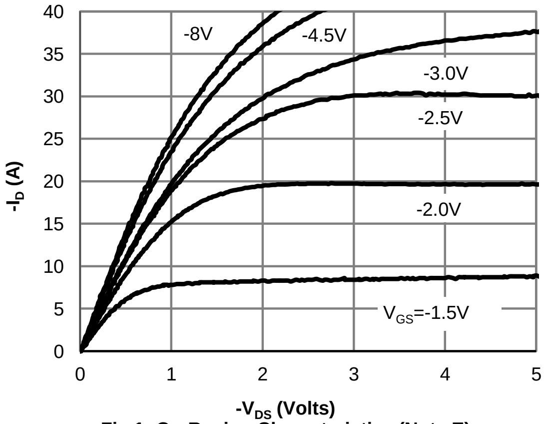


Fig 1: On-Region Characteristics (Note E)

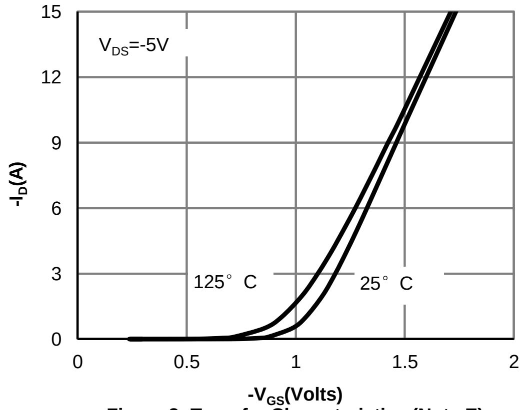


Figure 2: Transfer Characteristics (Note E)

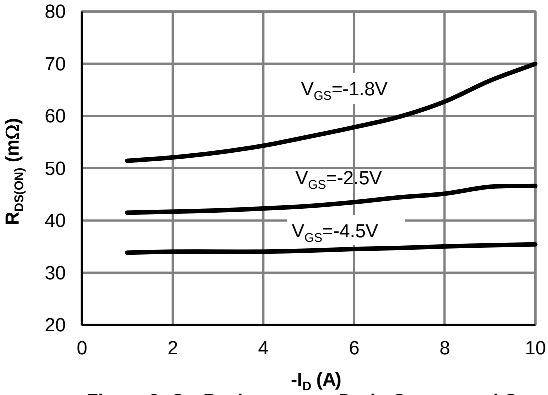


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

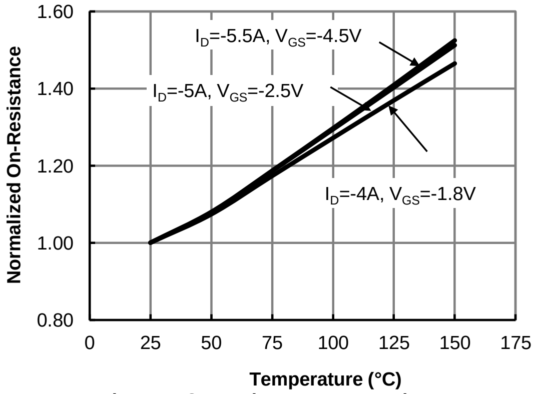


Figure 4: On-Resistance vs. Junction Temperature (Note E)

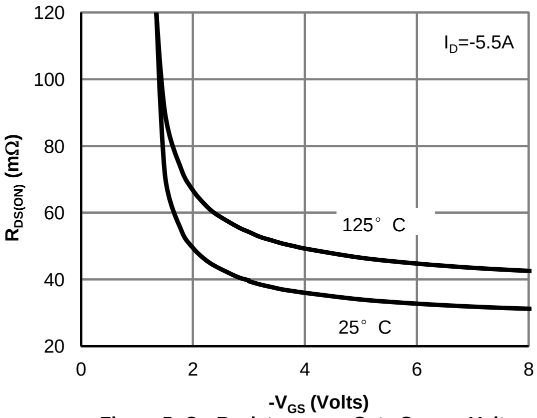


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

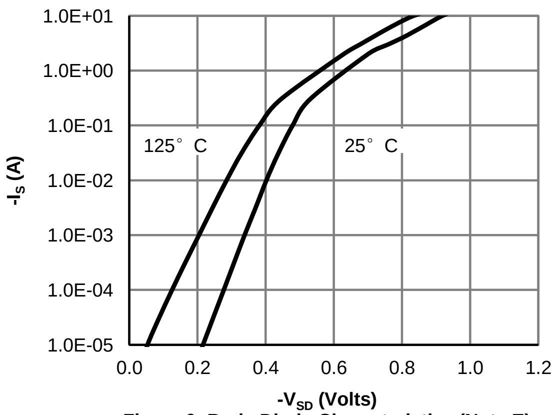


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

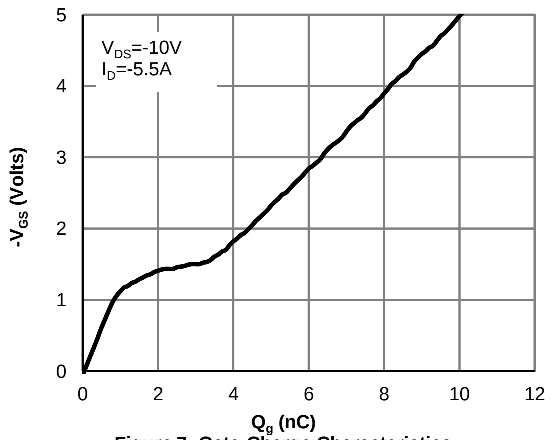


Figure 7: Gate-Charge Characteristics

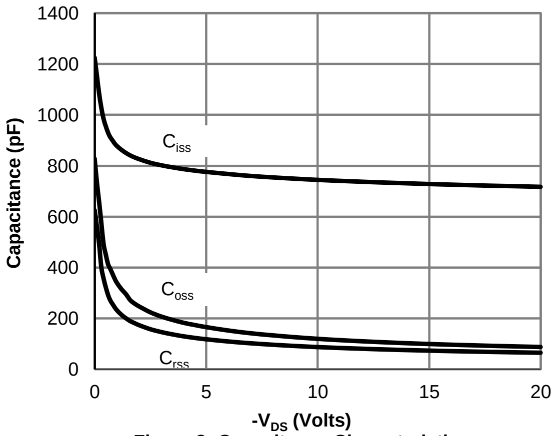


Figure 8: Capacitance Characteristics

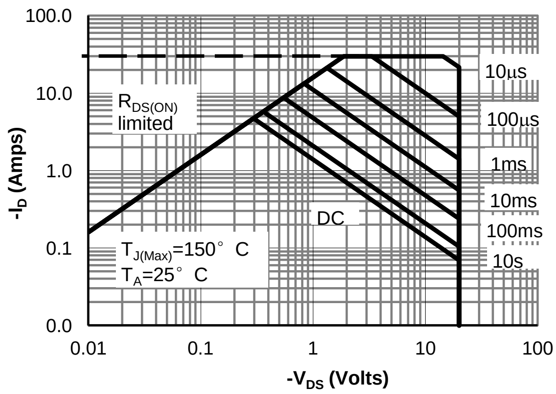


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

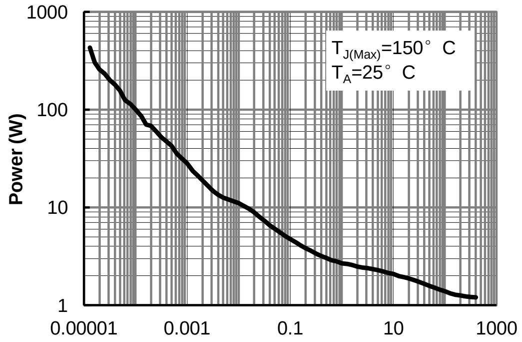


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

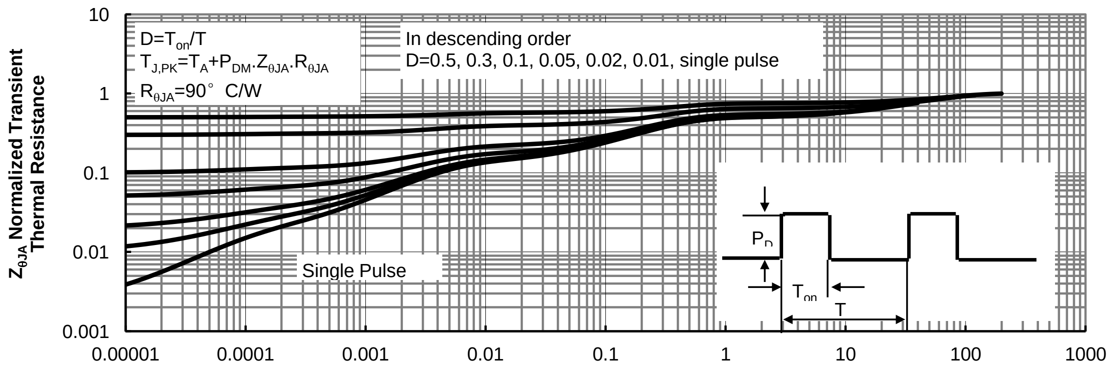
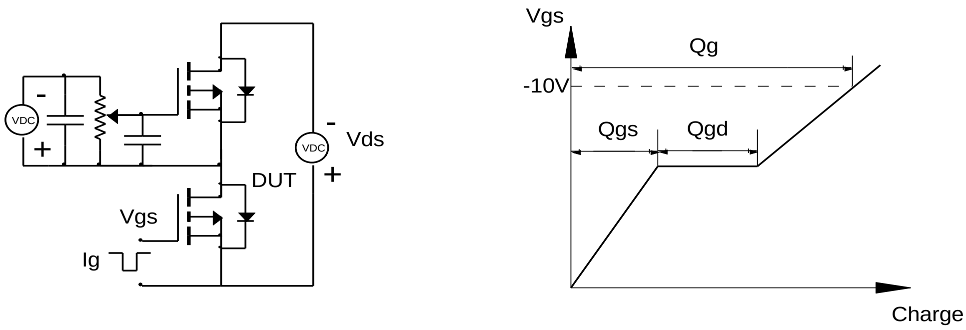
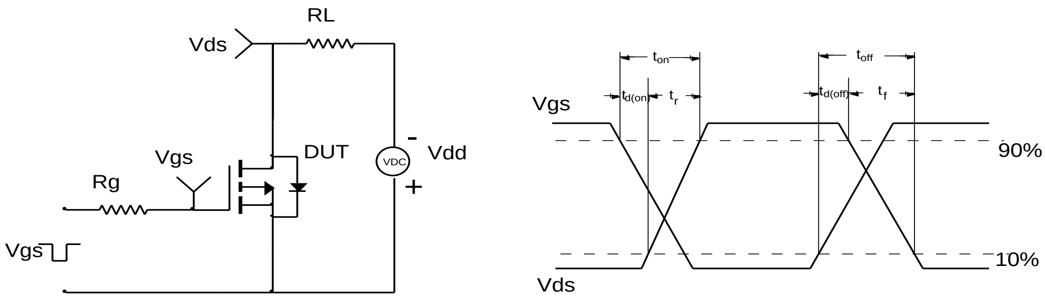


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms