ALPHA & OMEGA
SEMICONDUCTOR

AO4409

30V P-Channel MOSFET

General Description

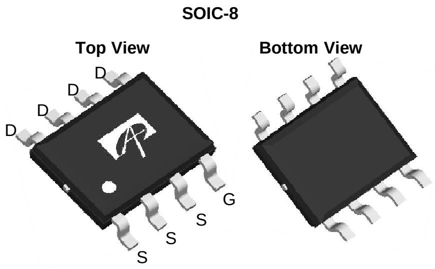
The AO4409 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge. This device is suitable for use as a load switch or in PWM applications.

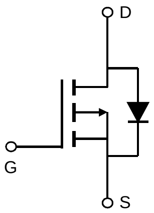
* RoHS and Halogen-Free Compliant

Product Summary

V_{DS}	-30V
I_D (at V_{GS}=-10V)	-15A
$R_{DS(ON)}$ (at V_{GS}=-10V)	< 7.5mΩ
$R_{DS(ON)}$ (at V_{GS} =-4.5V)	< 12mΩ

100% UIS Tested
100% R_g Tested





Absolute Maximum Ratings T_A=25℃ unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_A=25℃	I_D	-15	A
	T_A=70℃		-12.8	
Pulsed Drain Current [C]		I_{DM}	-80	
Avalanche Current [C]		I_{AS}, I_{AR}	30	A
Avalanche energy L=0.3mH [C]		E_{AS}, E_{AR}	135	mJ
Power Dissipation [B]	T_A=25℃	P_D	3.1	W
	T_A=70℃		2	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	℃

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	31	40	℃/W
Maximum Junction-to-Ambient [A D]	Steady-State		59	75	℃/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	16	24	℃/W

Electrical Characteristics (T_J=25℃ 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}=-30V, V_{GS}=0V			-5	µA
		T_J=55℃			-25	
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	-1.4	-1.9	-2.7	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-80			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-15A		6.2	7.5	mΩ
		T_J=125℃		8.2	11.5	
		V_{GS}=-4.5V, I_D=-10A		9.5	12	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-15A	35	50		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.71	-1	V
I_S	Maximum Body-Diode Continuous Current				-5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz		5270	6400	pF
C_{oss}	Output Capacitance			945		pF
C_{rss}	Reverse Transfer Capacitance			745		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		2	3	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=-10V, V_{DS}=-15V, I_D=-15A		100	120	nC
Q_g(4.5V)	Total Gate Charge			51.5		nC
Q_{gs}	Gate Source Charge			14.5		nC
Q_{gd}	Gate Drain Charge			23		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=1Ω, R_{GEN}=3Ω		14		ns
t_r	Turn-On Rise Time			16.5		ns
$t_{D(off)}$	Turn-Off DelayTime			76.5		ns
t_f	Turn-Off Fall Time			37.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-15A, dI/dt=100A/µs		36.7	45	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-15A, dI/dt=100A/µs		28		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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

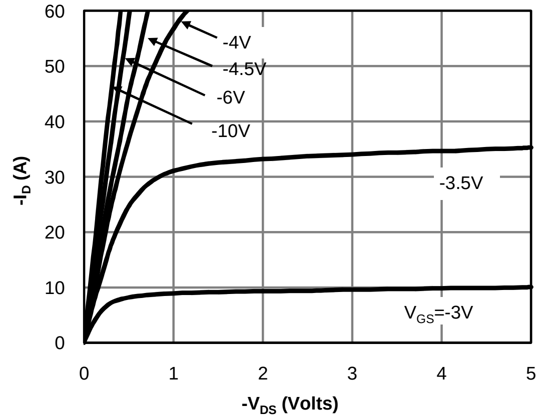


Fig 1: On-Region Characteristics (Note E)

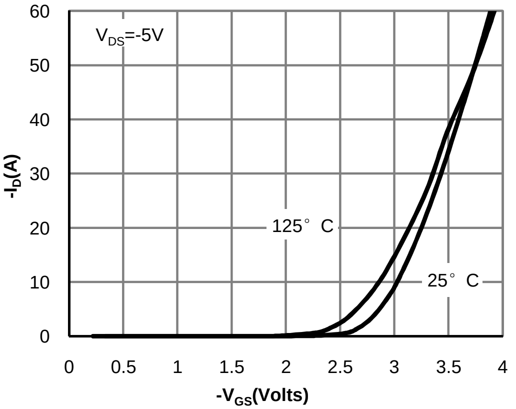


Figure 2: Transfer Characteristics (Note E)

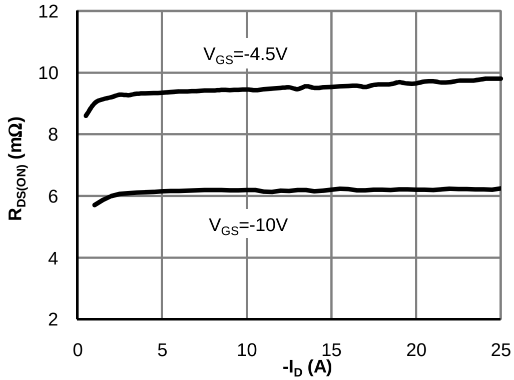


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

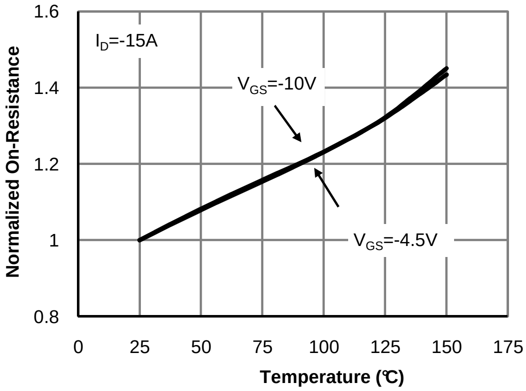


Figure 4: On-Resistance vs. Junction Temperature (Note E)

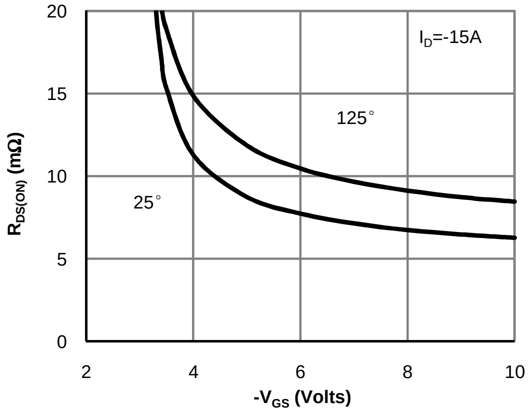


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

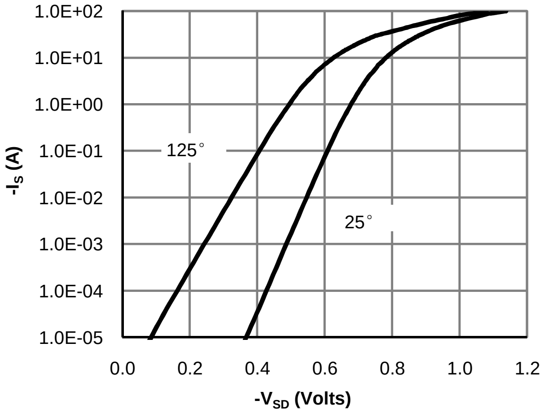


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

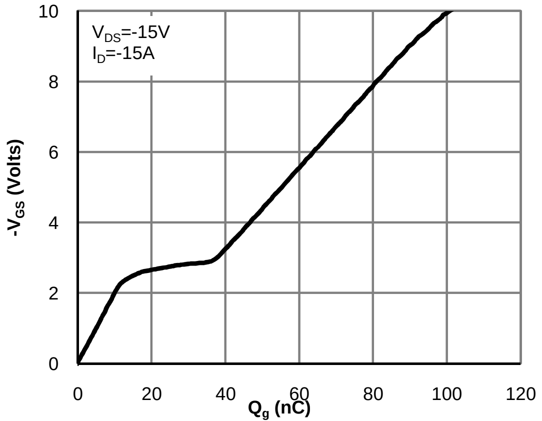


Figure 7: Gate-Charge Characteristics

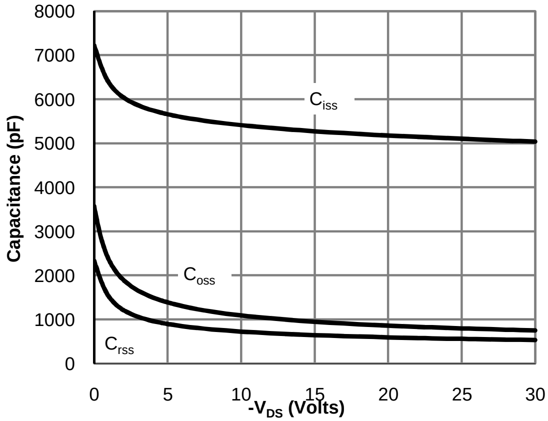


Figure 8: Capacitance Characteristics

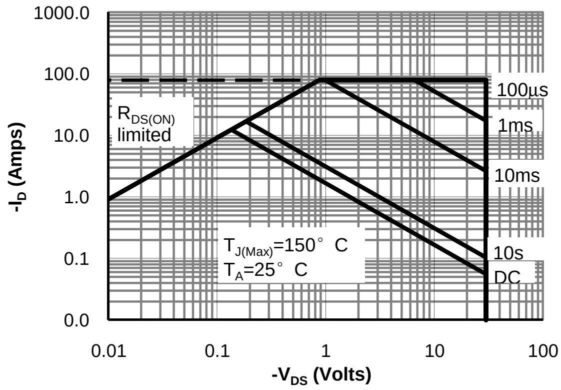


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

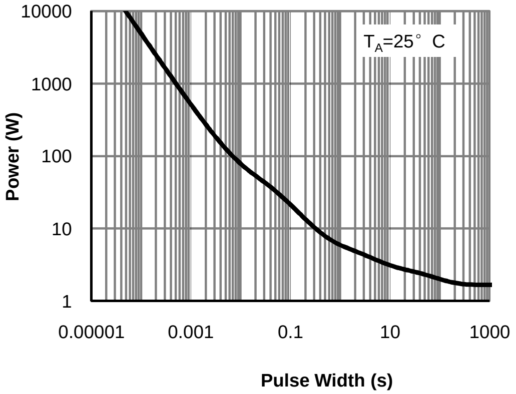


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

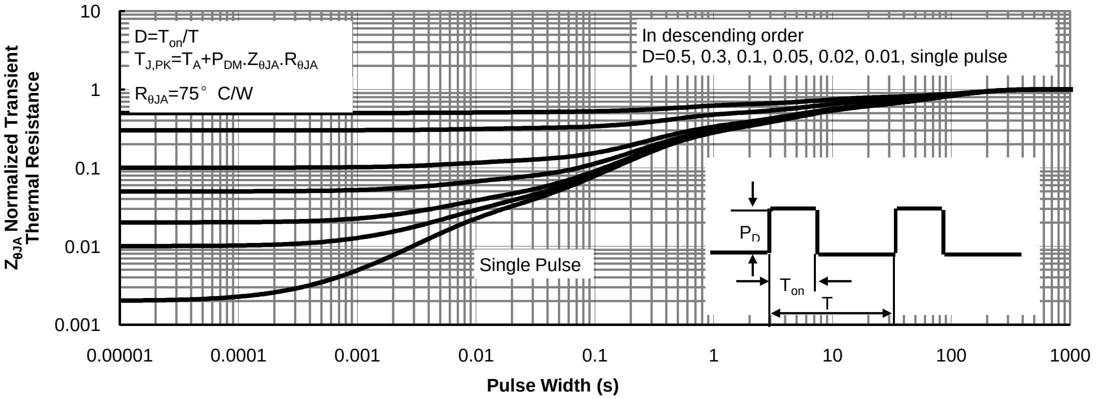
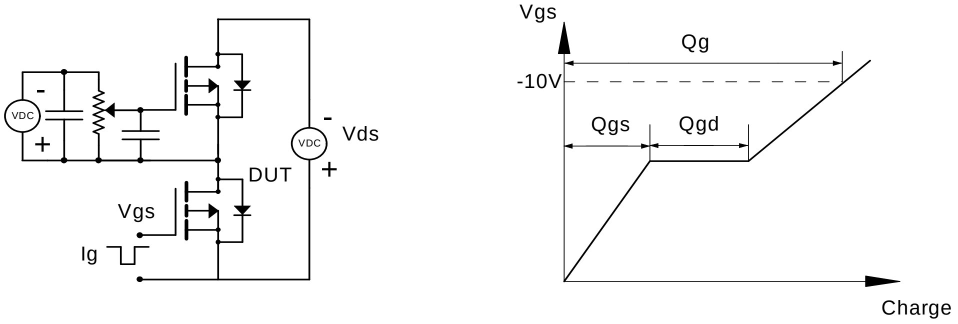
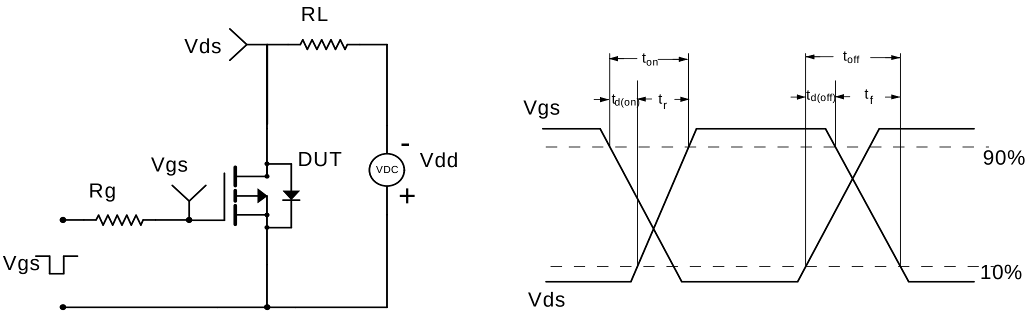


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

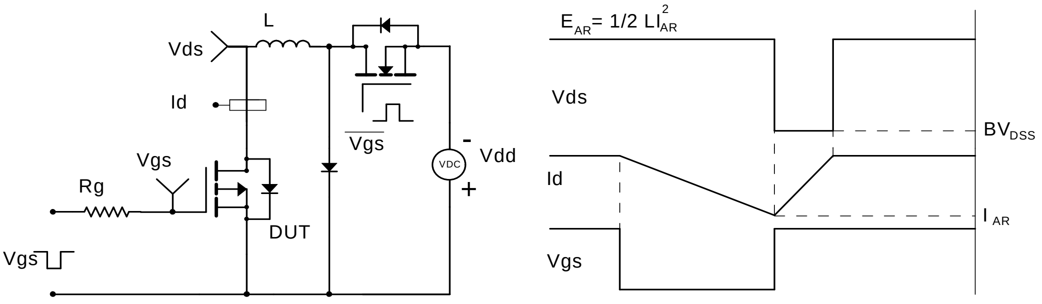
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms