



**ALPHA & OMEGA**  
SEMICONDUCTOR, LTD

**AO4435**

**30V P-Channel MOSFET**



**General Description**

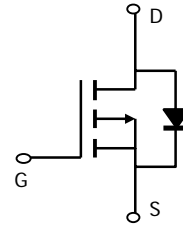
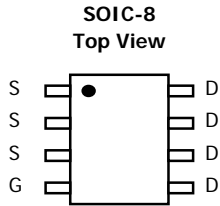
The AO4435/L uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications.  
*AO4435 and AO4435L are electrically identical.*

- RoHS Compliant
- AO4435L is Halogen Free

**Features**

- $V_{DS} = -30V$
- $I_D = -10.5A$  ( $V_{GS} = -20V$ )
- $R_{DS(ON)} < 14m\Omega$  ( $V_{GS} = -20V$ )
- $R_{DS(ON)} < 18m\Omega$  ( $V_{GS} = -10V$ )
- $R_{DS(ON)} < 36m\Omega$  ( $V_{GS} = -5V$ )

UIS TESTED!  
Rg, Ciss, Coss, Crss Tested



**Absolute Maximum Ratings  $T_A=25^\circ C$  unless otherwise noted**

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 25$	V
Continuous Drain Current <sup>A</sup>	$I_D$	$T_A=25^\circ C$	-10.5
		$T_A=70^\circ C$	-8
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-80	A
Power Dissipation <sup>A</sup>	$P_D$	$T_A=25^\circ C$	3.1
		$T_A=70^\circ C$	2.0
Avalanche Current <sup>B</sup>	$I_{AR}$	-20	A
Repetitive avalanche energy 0.3mH <sup>B</sup>	$E_{AR}$	60	mJ
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$

**Thermal Characteristics**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	32	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		Steady State	60	75
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	17	24	$^\circ C/W$

Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> = -250μA, V <sub>GS</sub> = 0V	-30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V T <sub>J</sub> = 55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±25V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.7	-2.3	-3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -5V	-80			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = -20V, I <sub>D</sub> = -11A		11	14	mΩ
		T <sub>J</sub> =125°C		15	19	
		V <sub>GS</sub> = -10V, I <sub>D</sub> = -10A		15	18	
		V <sub>GS</sub> = -5V, I <sub>D</sub> = -5A		27	36	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -5V, I <sub>D</sub> = -10A		22		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> = -1A, V <sub>GS</sub> = 0V		-0.74	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-3.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		1130	1400	pF
C <sub>oss</sub>	Output Capacitance			240		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			155		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	1	5.8	8	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-10A		18	24	nC
Q <sub>g(4.5V)</sub>	Total Gate Charge			9.5		
Q <sub>gs</sub>	Gate Source Charge			5.5		nC
Q <sub>gd</sub>	Gate Drain Charge			3.3		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =1.5Ω, R <sub>GEN</sub> =3Ω		8.7		ns
t <sub>r</sub>	Turn-On Rise Time			8.5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			18		ns
t <sub>f</sub>	Turn-Off Fall Time			7		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time		I <sub>F</sub> =-10A, dI/dt=100A/μs		25	30
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-10A, dI/dt=100A/μs		12		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> = 25°C. The value in any 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<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

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

E. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

F. The current rating is based on the t ≤ 10s thermal resistance rating.

G. E<sub>AR</sub> and I<sub>AR</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub>=25°C.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

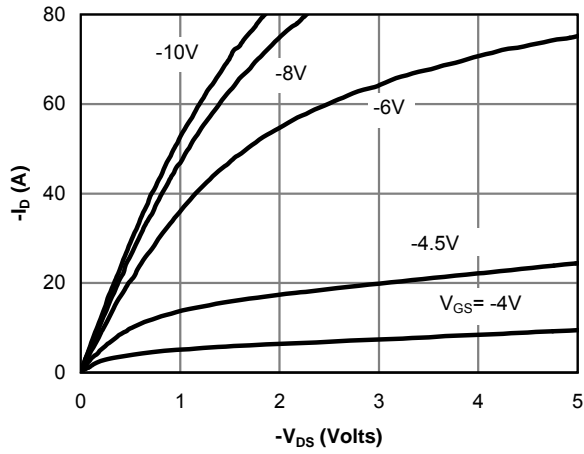


Figure 1: On-Region Characteristics

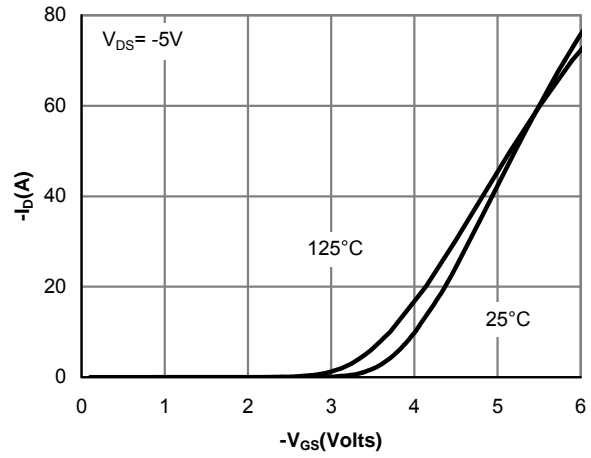


Figure 2: Transfer Characteristics

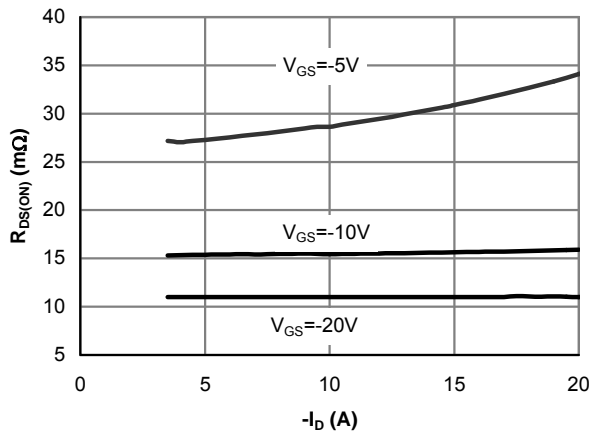


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

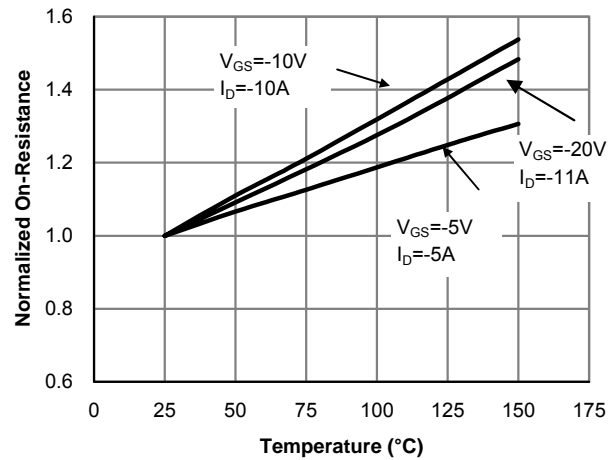


Figure 4: On-Resistance vs. Junction Temperature

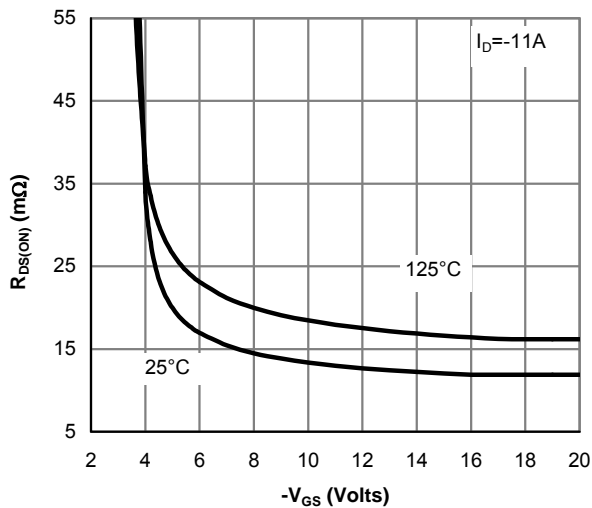


Figure 5: On-Resistance vs. Gate-Source Voltage

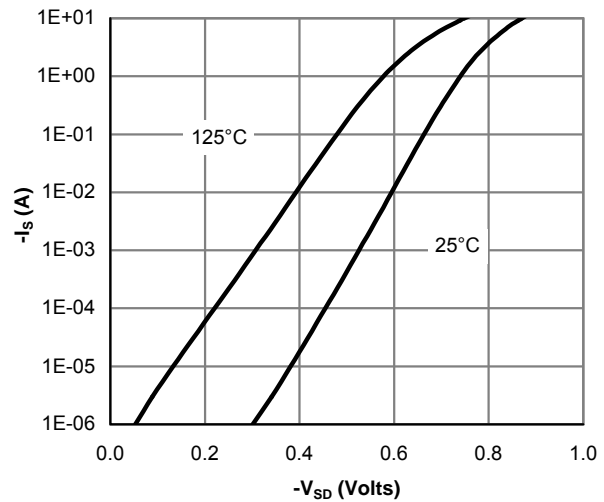


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

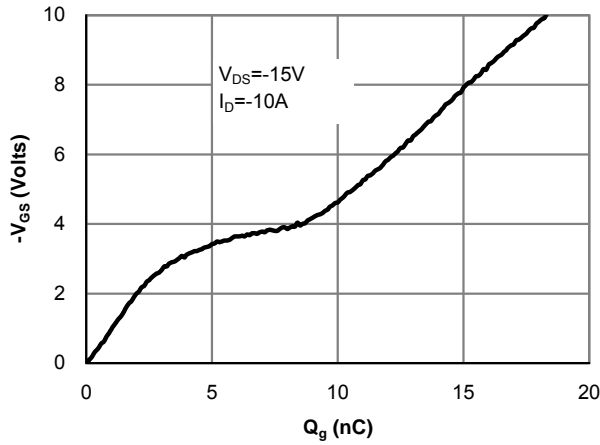


Figure 7: Gate-Charge Characteristics

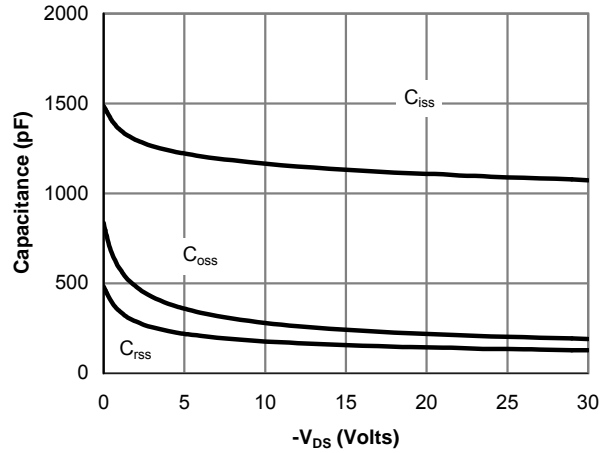


Figure 8: Capacitance Characteristics

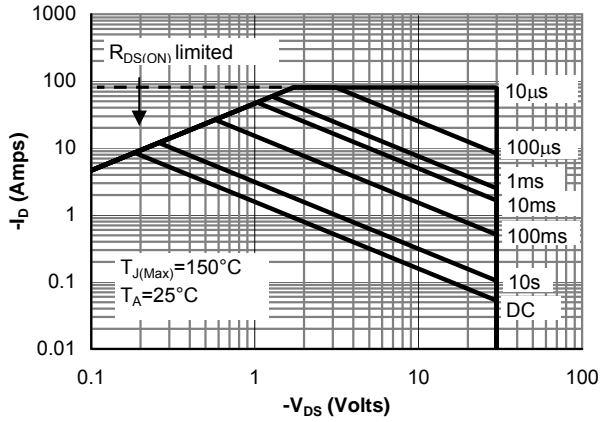


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

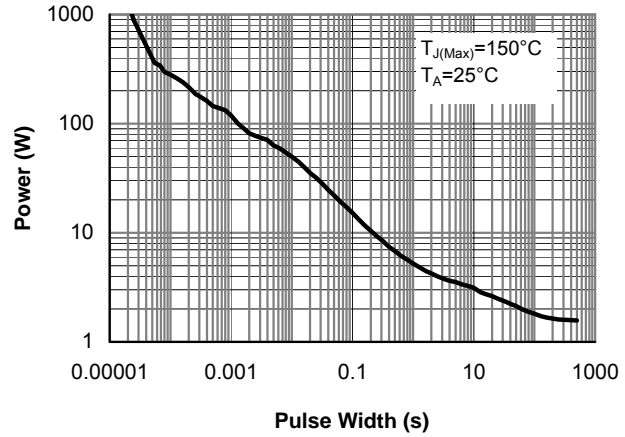


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

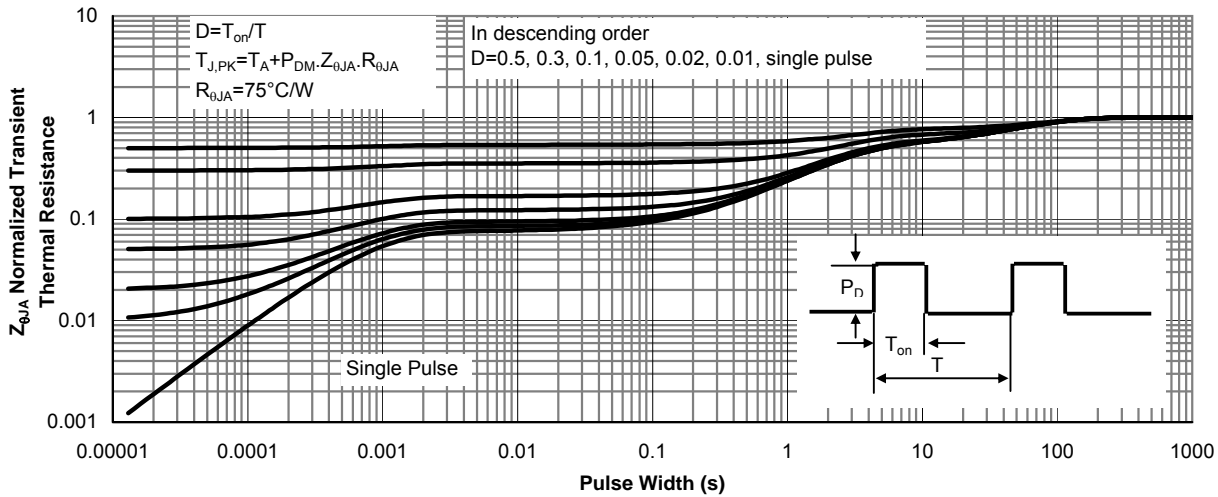
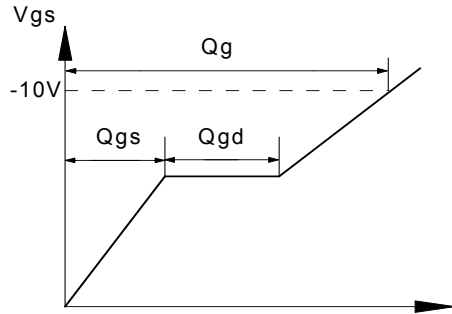
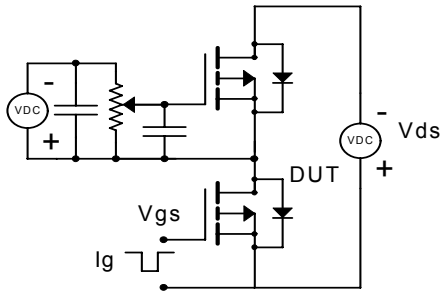
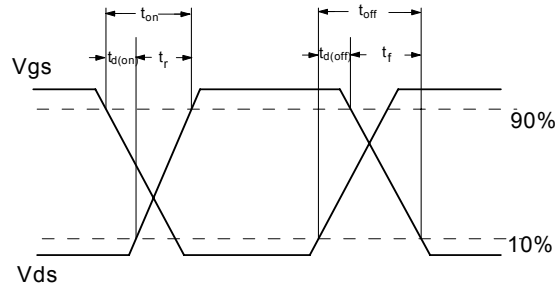
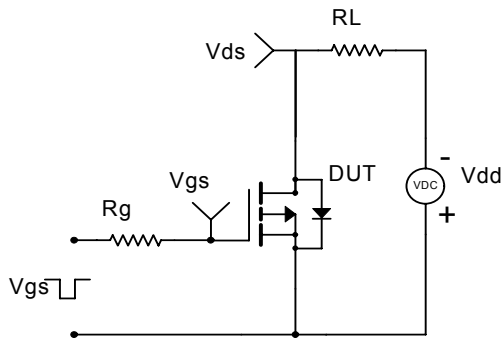


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

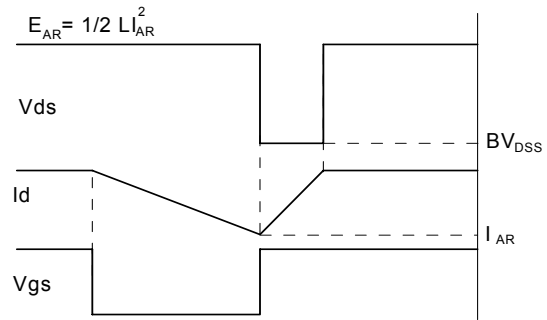
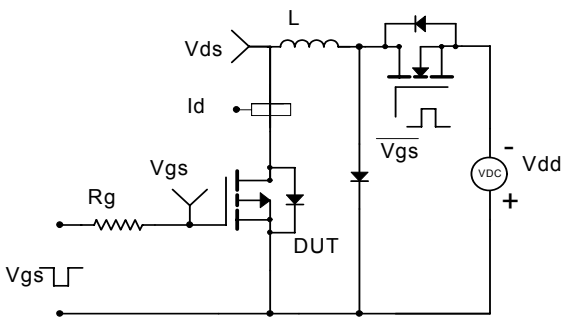
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

