



ALPHA & OMEGA
SEMICONDUCTOR, LTD

AO4435

P-Channel Enhancement Mode Field Effect Transistor



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

$V_{DS} = -30V$

$I_D = -11A$ ($V_{GS} = -20V$)

$R_{DS(ON)} < 14m\Omega$ ($V_{GS} = -20V$)

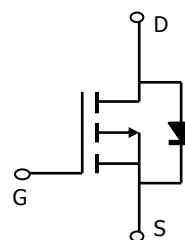
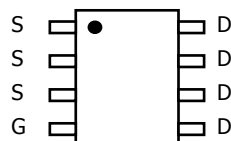
$R_{DS(ON)} < 18m\Omega$ ($V_{GS} = -10V$)

$R_{DS(ON)} < 36m\Omega$ ($V_{GS} = -5V$)

UIS TESTED!

Rg, Ciss, Coss, Crss Tested

SOIC-8
Top View



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}	± 25	V
Continuous Drain Current ^A	I_D	$T_A=25^\circ C$ -11	A
		$T_A=70^\circ C$ -8	
Pulsed Drain Current ^B	I_{DM}	-80	
Power Dissipation ^A	P_D	$T_A=25^\circ C$ 3.1	W
		$T_A=70^\circ C$ 2.0	
Avalanche Current ^B	I_{AR}	-20	A
Repetitive avalanche energy 0.3mH ^B	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 ^A	$R_{\theta JA}$	$t \leq 10s$ 32	40	$^\circ C/W$
Maximum Junction-to-Ambient ^A		Steady State 60	75	$^\circ C/W$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	Steady State 17	24	$^\circ C/W$

Electrical Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}$, $V_{GS} = 0\text{V}$	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -30\text{V}$, $V_{GS} = 0\text{V}$ $T_J = 55^{\circ}\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 25\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = -250\mu\text{A}$	-1.7	-2.3	-3	V
$I_{D(ON)}$	On state drain current	$V_{GS} = -10\text{V}$, $V_{DS} = -5\text{V}$	-80			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = -20\text{V}$, $I_D = -11\text{A}$		11	14	m Ω
		$T_J = 125^{\circ}\text{C}$		15	19	
		$V_{GS} = -10\text{V}$, $I_D = -10\text{A}$		15	18	
		$V_{GS} = -5\text{V}$, $I_D = -5\text{A}$		27	36	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{V}$, $I_D = -10\text{A}$		22		S
V_{SD}	Diode Forward Voltage	$I_S = -1\text{A}$, $V_{GS} = 0\text{V}$		-0.74	-1	V
I_S	Maximum Body-Diode Continuous Current				-3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$		1130	1400	pF
C_{oss}	Output Capacitance			240		pF
C_{rss}	Reverse Transfer Capacitance			155		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$	1	5.8	8	Ω
SWITCHING PARAMETERS						
$Q_{g(10V)}$	Total Gate Charge	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-10\text{A}$		18	24	nC
$Q_{g(4.5V)}$	Total Gate Charge			9.5		
Q_{gs}	Gate Source Charge			5.5		nC
Q_{gd}	Gate Drain Charge			3.3		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=1.5\Omega$, $R_{GEN}=3\Omega$		8.7		ns
t_r	Turn-On Rise Time			8.5		ns
$t_{D(off)}$	Turn-Off DelayTime			18		ns
t_f	Turn-Off Fall Time			7		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-10\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		25	30	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-10\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		12		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^{\circ}\text{C}$.

The value in any given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

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

D: The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ 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 $T_A=25^{\circ}\text{C}$. The SOA curve provides a single pulse rating.

F: The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

G: E_{AR} and I_{AR} ratings are based on low frequency and duty cycles to keep $T_J=25^{\circ}\text{C}$.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

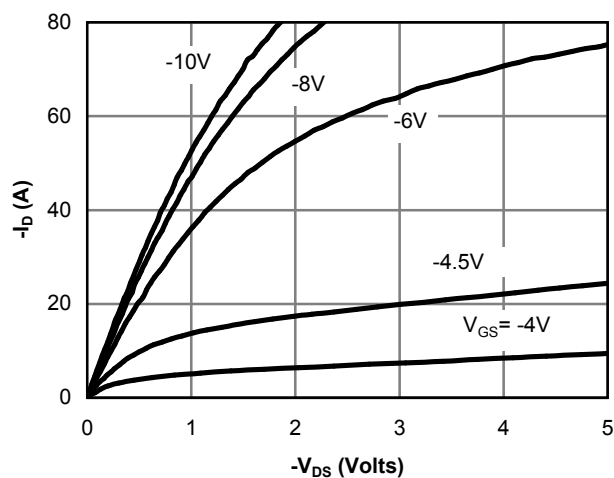


Figure 1: On-Region Characteristics

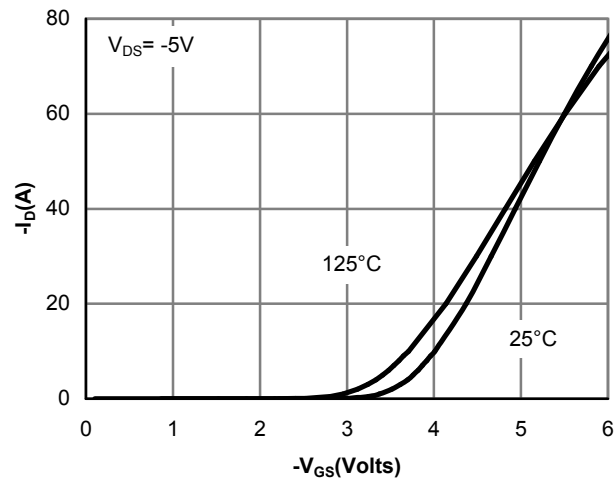


Figure 2: Transfer Characteristics

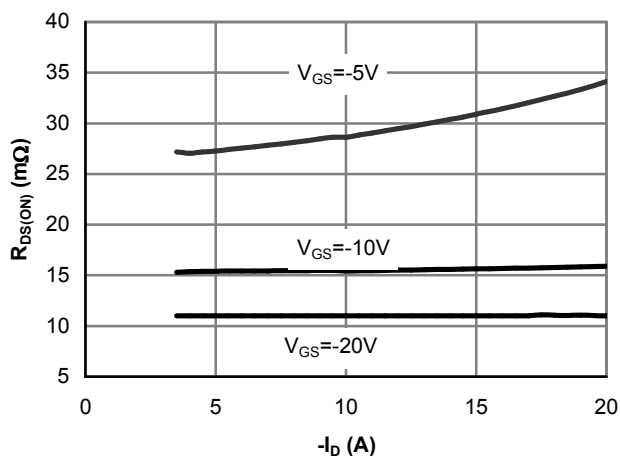


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

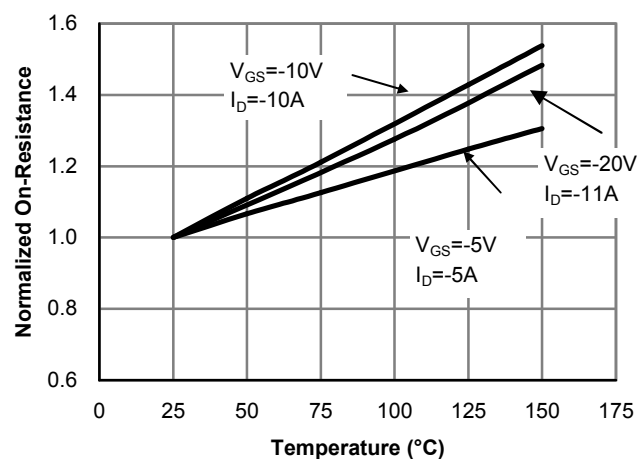


Figure 4: On-Resistance vs. Junction Temperature

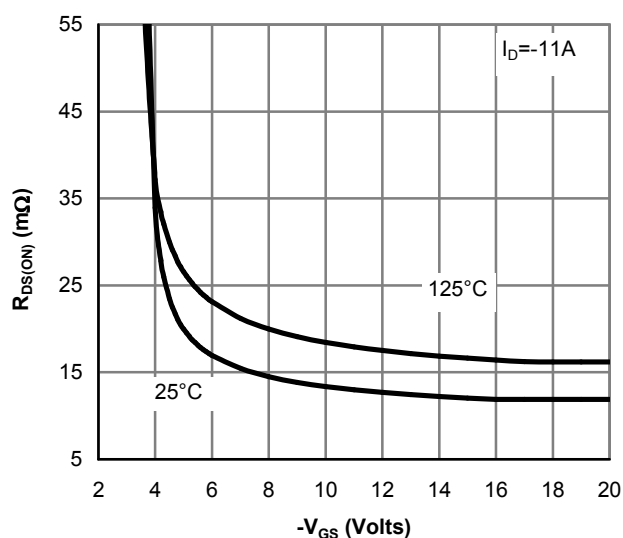


Figure 5: On-Resistance vs. Gate-Source Voltage

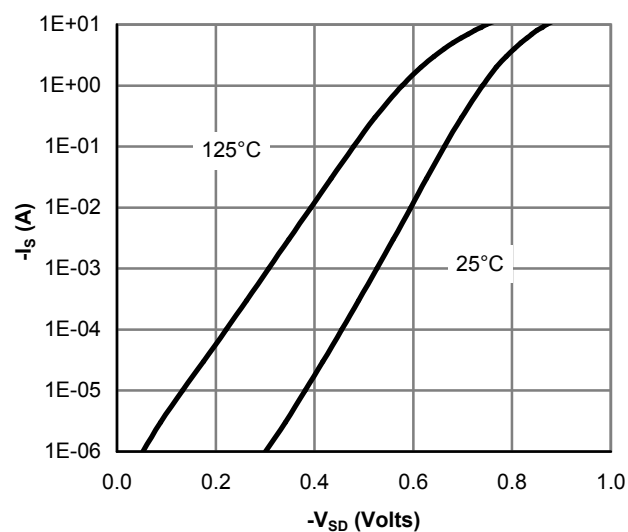


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

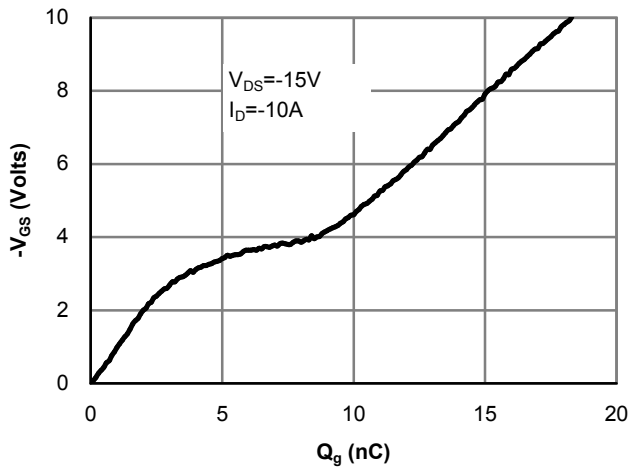


Figure 7: Gate-Charge Characteristics

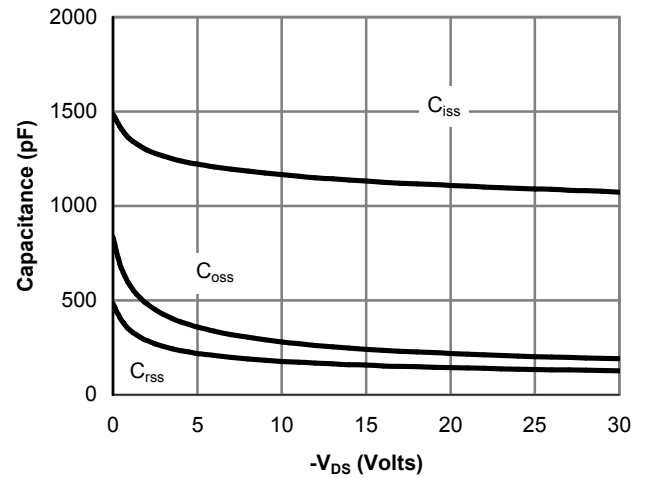


Figure 8: Capacitance Characteristics

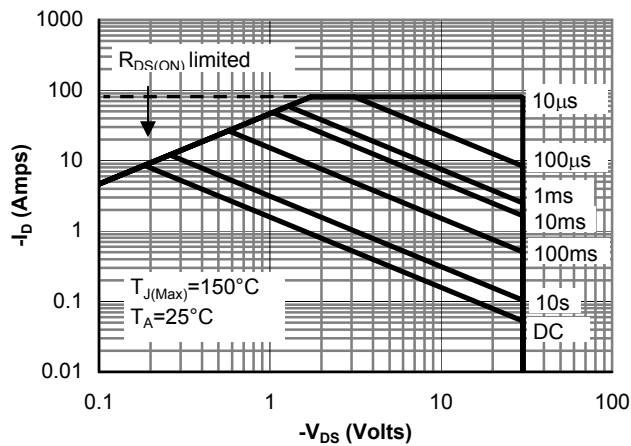


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

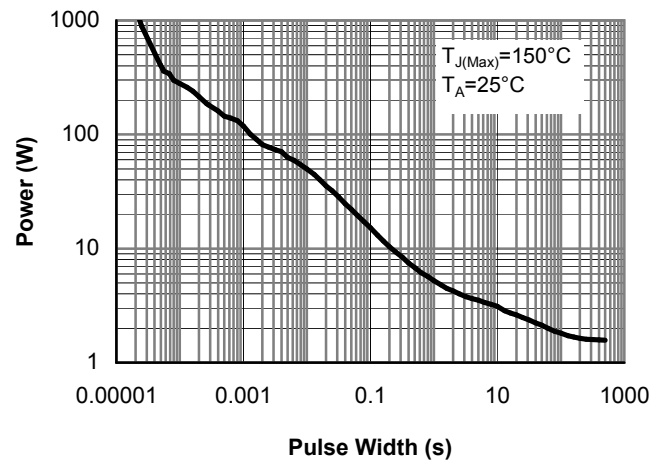


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

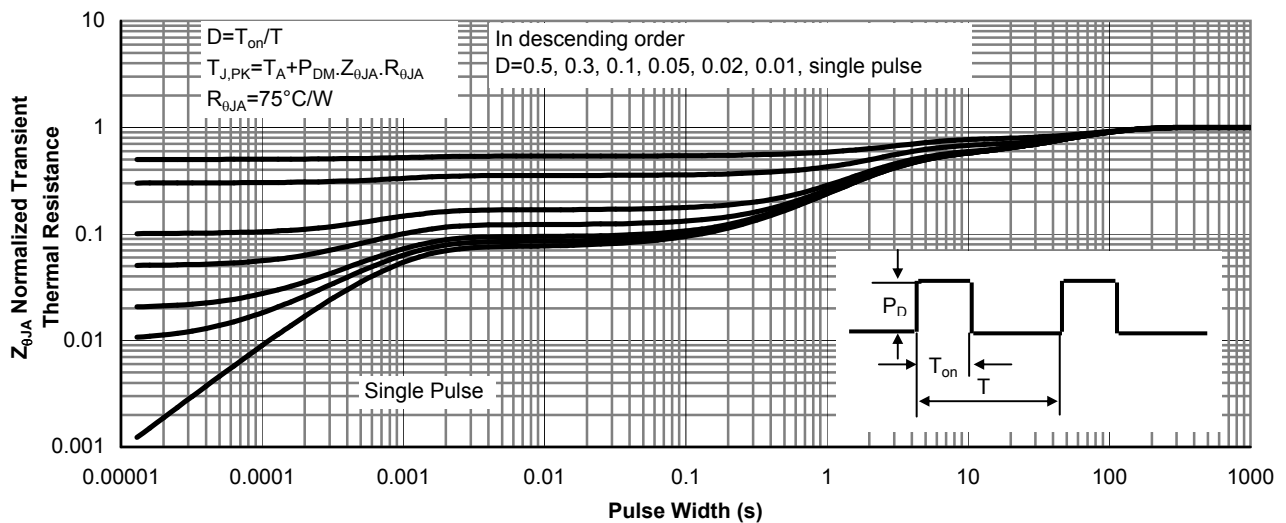
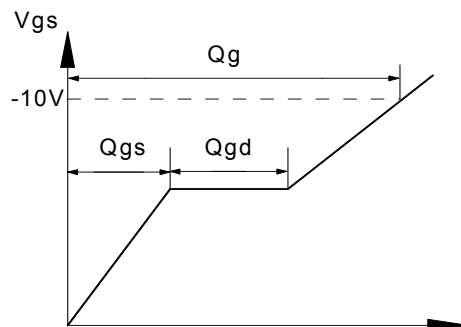
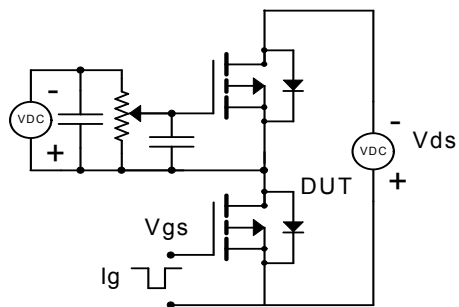
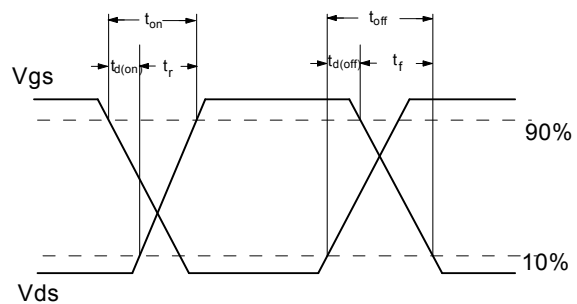
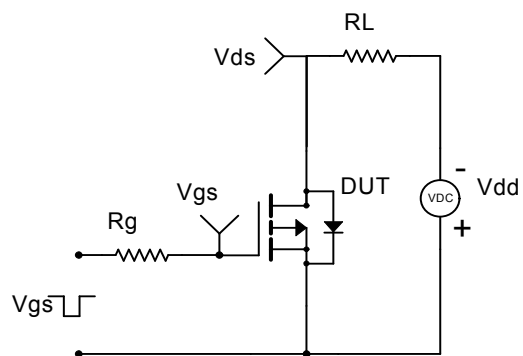


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

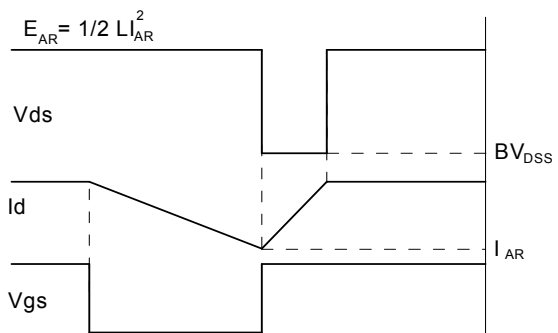
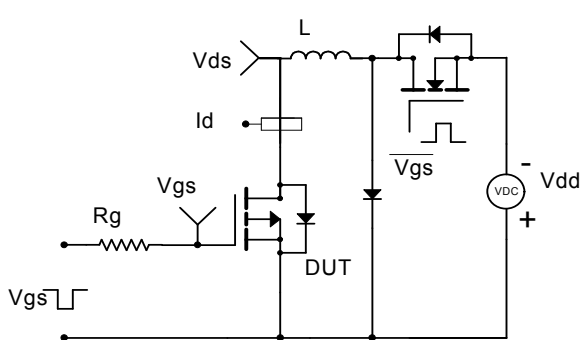
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

