



**ALPHA & OMEGA**  
SEMICONDUCTOR



**AO4415**

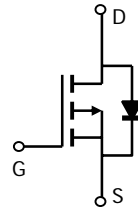
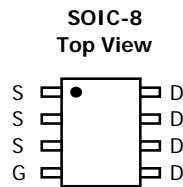
**P-Channel Enhancement Mode Field Effect Transistor**

**General Description**

The AO4415 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. *Standard Product AO4415 is Pb-free (meets ROHS & Sony 259 specifications). AO4415L is a Green Product ordering option. AO4415 and AO4415L are electrically identical*

**Features**

$V_{DS} (V) = -30V$   
 $I_D = -8 A (V_{GS} = -20V)$   
 $R_{DS(ON)} < 26m\Omega (V_{GS} = -20V)$   
 $R_{DS(ON)} < 35m\Omega (V_{GS} = -10V)$



**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>	$T_A=25^\circ C$ $T_A=70^\circ C$	$I_D$	A
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-40	
Power Dissipation <sup>A</sup>	$T_A=25^\circ C$ $T_A=70^\circ C$	$P_D$	W
		2.1	
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>	$R_{\theta JA}$	24	40	$^\circ C/W$
$t \leq 10s$				
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JL}$	21	30	$^\circ C/W$
Steady-State				
Maximum Junction-to-Lead <sup>C</sup>				

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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> =-24V, 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	-2.8	-3.5	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V	40			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-20V, I <sub>D</sub> =-8A T <sub>J</sub> =125°C		21.5 29	26 35	mΩ
		V <sub>GS</sub> =-10V, I <sub>D</sub> =-8A		28.5	35	mΩ
		V <sub>GS</sub> =-6V, I <sub>D</sub> =-5A		41		mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-8A		11.5		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		-0.76	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-4.2	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		893	1100	pF
C <sub>oss</sub>	Output Capacitance			204		pF
C <sub>riss</sub>	Reverse Transfer Capacitance			151		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		4	6	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g(10V)</sub>	Total Gate Charge (10V)	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-8A		16.6	21	nC
Q <sub>gs</sub>	Gate Source Charge			3.2		nC
Q <sub>gd</sub>	Gate Drain Charge			5.2		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =1.8Ω, R <sub>GEN</sub> =3Ω		10.5		ns
t <sub>r</sub>	Turn-On Rise Time			7.3		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			15.1		ns
t <sub>f</sub>	Turn-Off Fall Time			8.6		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-8A, dI/dt=100A/μs		21	26	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-8A, dI/dt=100A/μs		10.7		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<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 ≤ 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 6,12,14 are obtained using 80μs 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

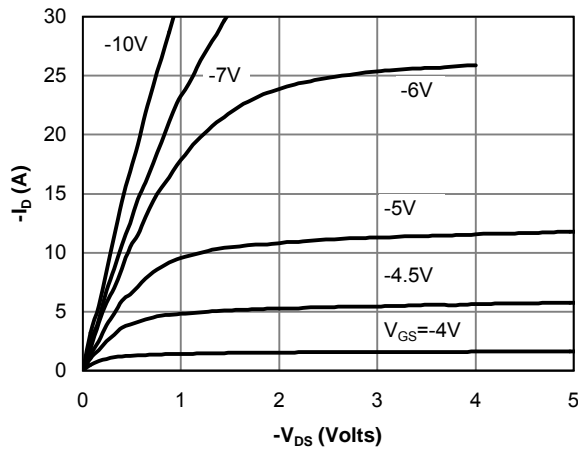


Fig 1: On-Region Characteristics

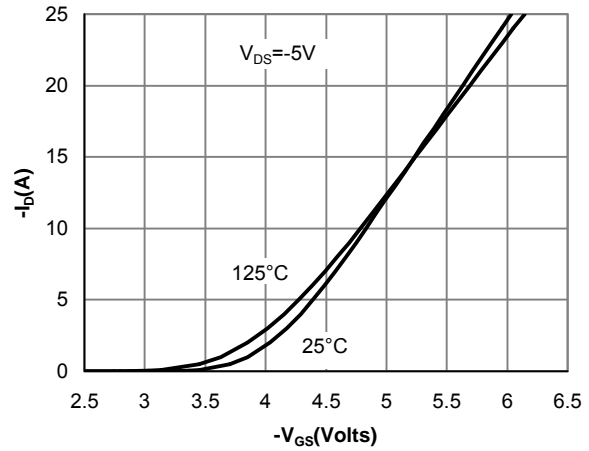


Figure 2: Transfer Characteristics

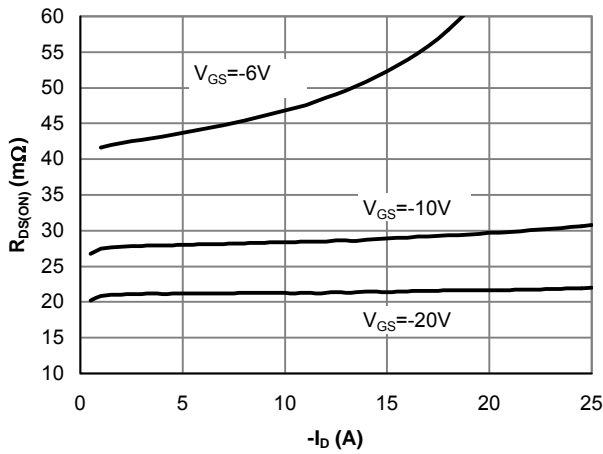


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

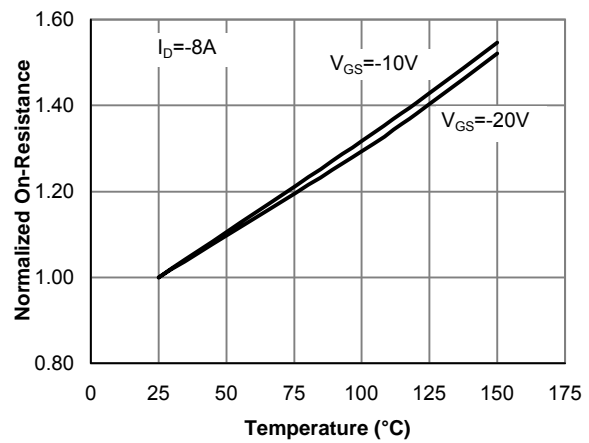


Figure 4: On-Resistance vs. Junction Temperature

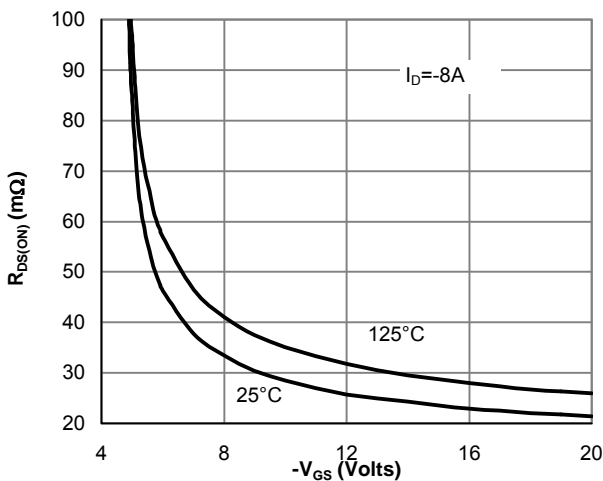


Figure 5: On-Resistance vs. Gate-Source Voltage

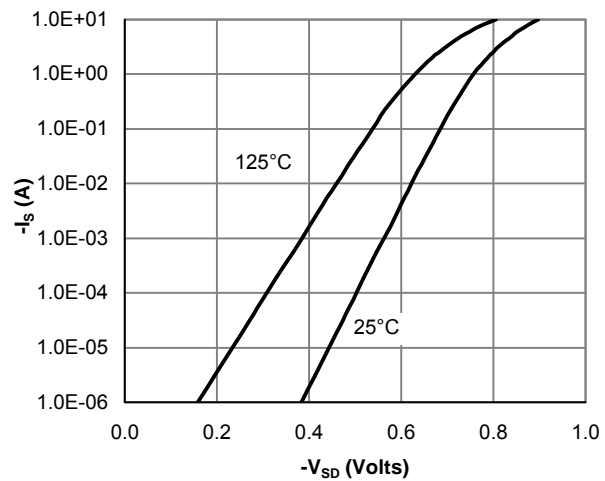


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

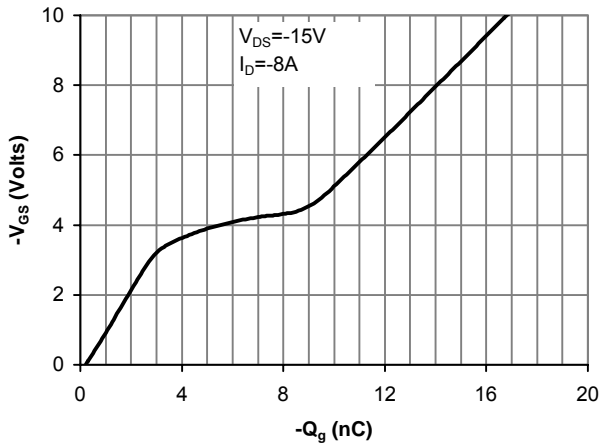


Figure 7: Gate-Charge Characteristics

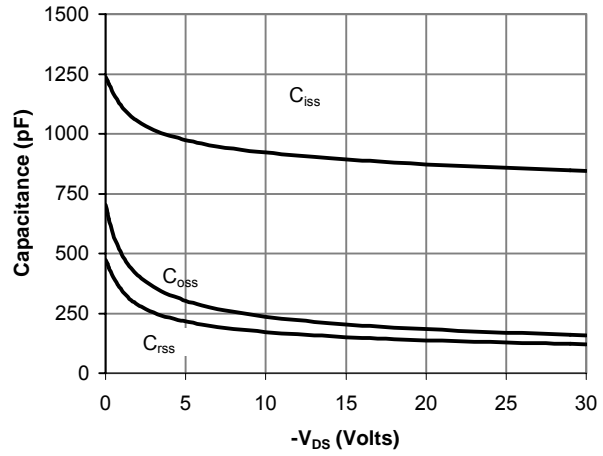


Figure 8: Capacitance Characteristics

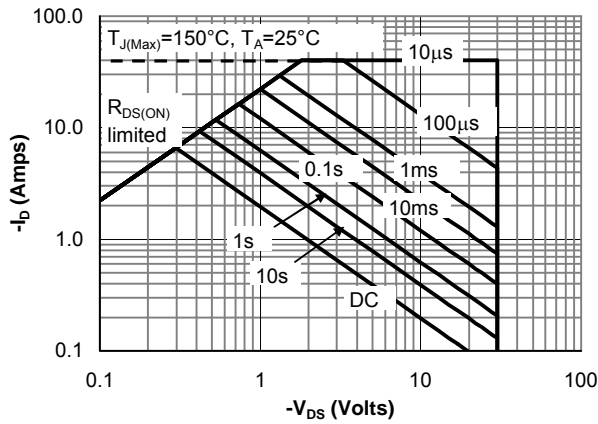


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

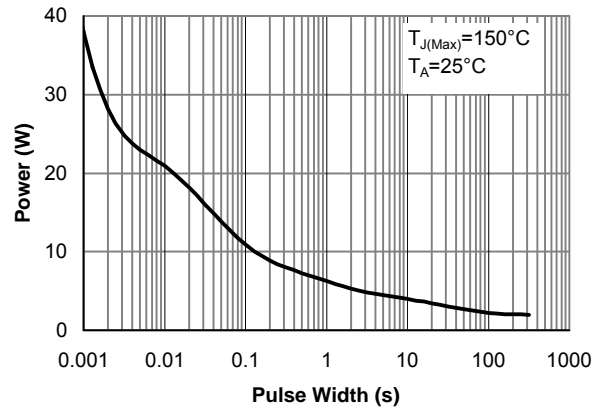


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

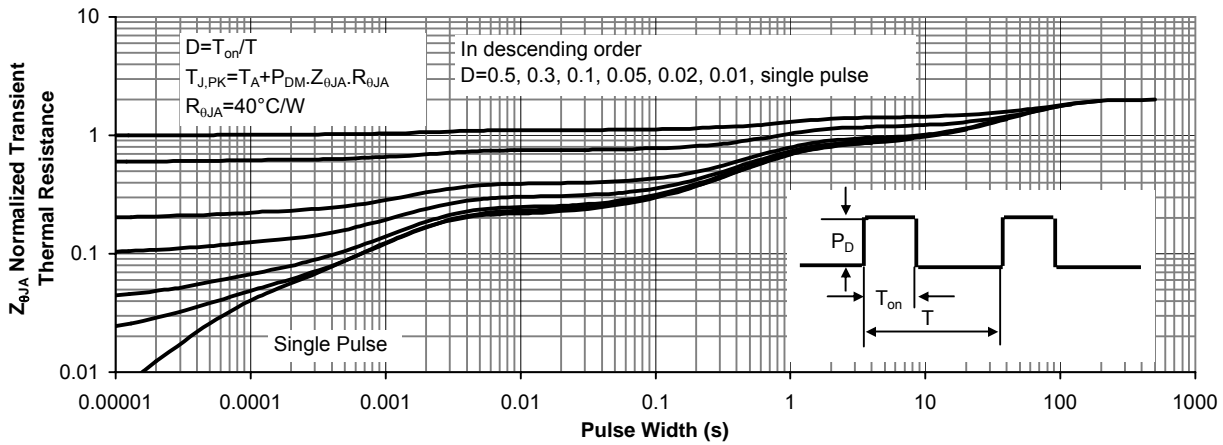


Figure 11: Normalized Maximum Transient Thermal Impedance