



ALPHA & OMEGA
SEMICONDUCTOR, LTD.

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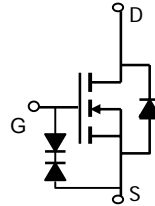
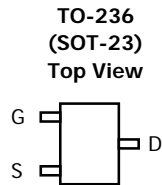
AO3416, AO3416L (Green Product) N-Channel Enhancement Mode Field Effect Transistor

General Description

The AO3416 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 or in PWM applications. It is ESD protected. AO3416L (Green Product) is offered in a lead-free package.

Features

V_{DS} (V) = 20V
 I_D = 6.5 A
 $R_{DS(ON)} < 22m\Omega$ ($V_{GS} = 4.5V$)
 $R_{DS(ON)} < 26m\Omega$ ($V_{GS} = 2.5V$)
 $R_{DS(ON)} < 34m\Omega$ ($V_{GS} = 1.8V$)
ESD Rating: 2000V HBM



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 8	V
Continuous Drain Current ^A	I_D	6.5	A
$T_A=25^\circ\text{C}$			
$T_A=70^\circ\text{C}$		5.2	
Pulsed Drain Current ^B	I_{DM}	30	
Power Dissipation ^A	P_D	1.4	W
$T_A=25^\circ\text{C}$			
$T_A=70^\circ\text{C}$		0.9	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	65	90	$^\circ\text{C/W}$
$t \leq 10s$				
Maximum Junction-to-Ambient ^A		85	125	$^\circ\text{C/W}$
Steady-State				
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	43	60	$^\circ\text{C/W}$
Steady-State				

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=16\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^{\circ}\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 4.5\text{V}$			± 1	μA
		$V_{DS}=0\text{V}$, $V_{GS}=\pm 8\text{V}$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	0.4	0.6	1	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}$, $V_{DS}=5\text{V}$	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=4.5\text{V}$, $I_D=6.5\text{A}$ $T_J=125^{\circ}\text{C}$		18 25	22 30	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}$, $I_D=5.5\text{A}$		21	26	$\text{m}\Omega$
		$V_{GS}=1.8\text{V}$, $I_D=5\text{A}$		26	34	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}$, $I_D=6.5\text{A}$		29		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}$, $V_{GS}=0\text{V}$		0.76	1	V
I_S	Maximum Body-Diode Continuous Current				2.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=10\text{V}$, $f=1\text{MHz}$		1160		pF
C_{oss}	Output Capacitance			187		pF
C_{rss}	Reverse Transfer Capacitance			146		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		1.5		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=4.5\text{V}$, $V_{DS}=10\text{V}$, $I_D=6.5\text{A}$		16		nC
Q_{gs}	Gate Source Charge			0.8		nC
Q_{gd}	Gate Drain Charge			3.8		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=5\text{V}$, $V_{DS}=10\text{V}$, $R_L=1.5\Omega$, $R_{GEN}=3\Omega$		6.2		ns
t_r	Turn-On Rise Time			12.7		ns
$t_{D(off)}$	Turn-Off DelayTime			51.7		ns
t_f	Turn-Off Fall Time			16		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=6.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		17.7		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=6.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		6.7		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 $T_A=25^{\circ}\text{C}$. The value in any a 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 6,12,14 are obtained using 80 μs 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

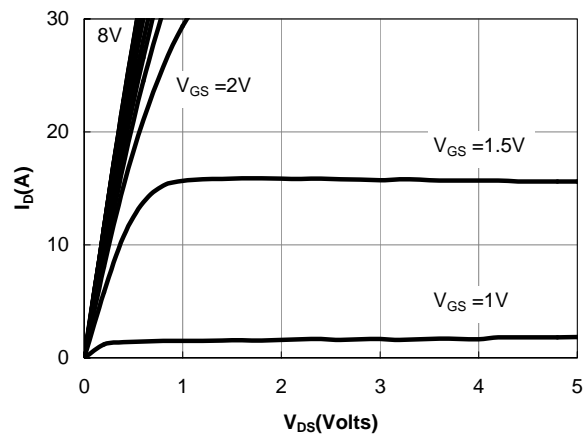


Figure 1: On-Regions Characteristics

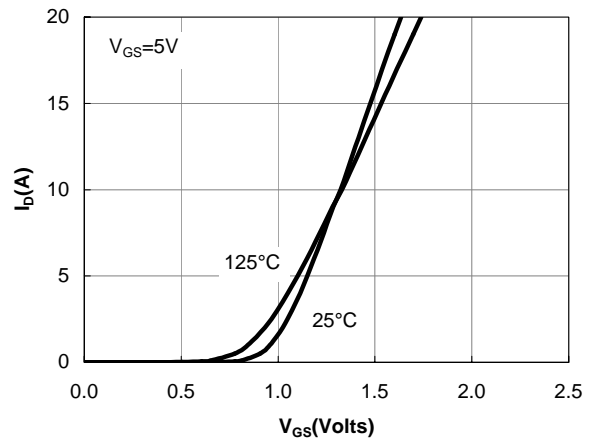


Figure 2: Transfer Characteristics

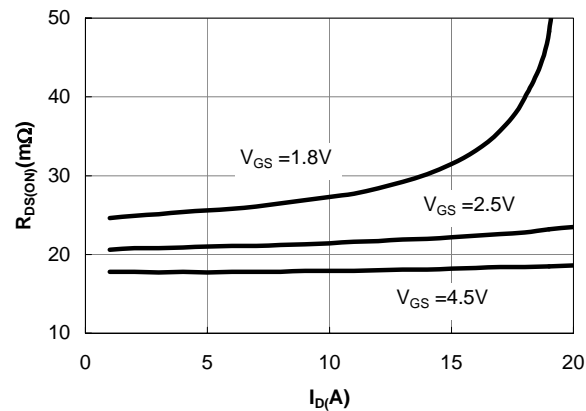


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

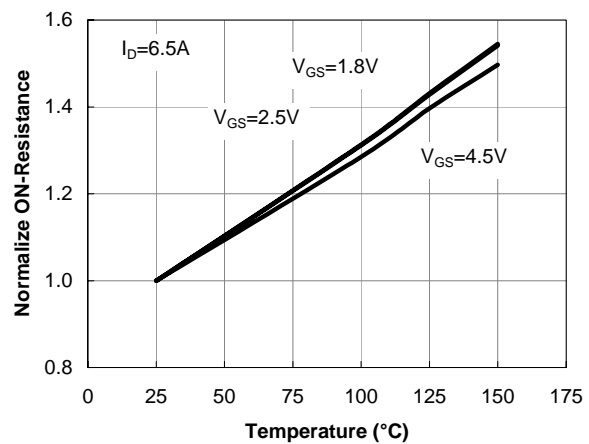


Figure 4: On-Resistance vs. Junction Temperature

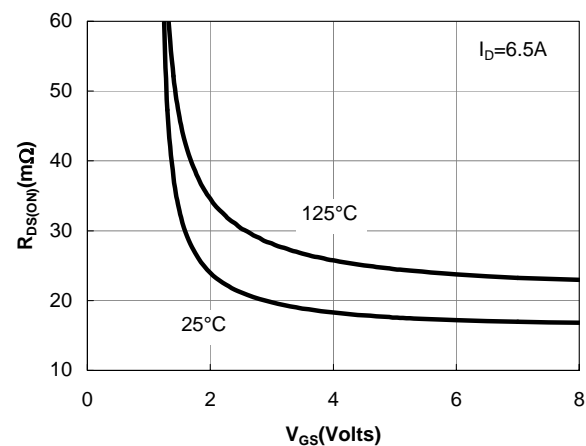


Figure 5: On-Resistance vs. Gate-Source Voltage

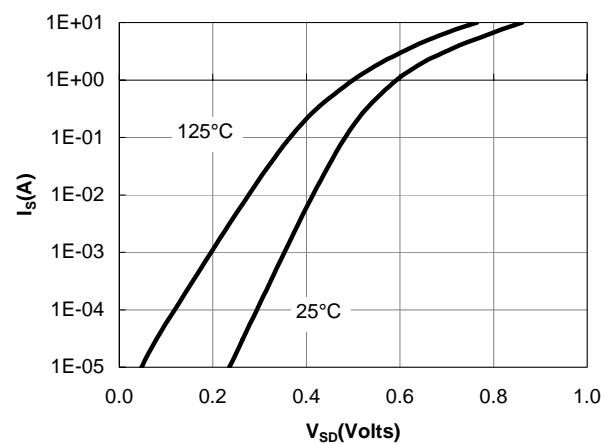


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

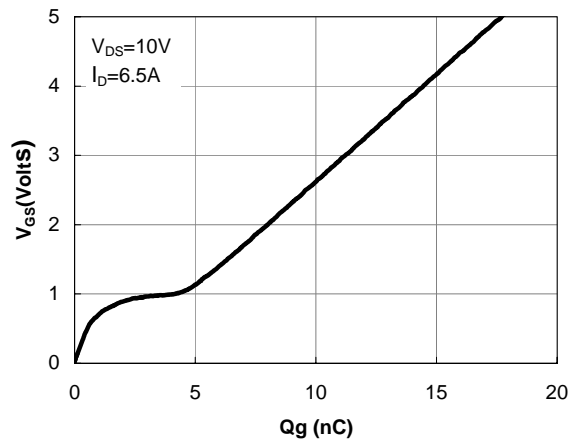


Figure 7: Gate-Charge Characteristics

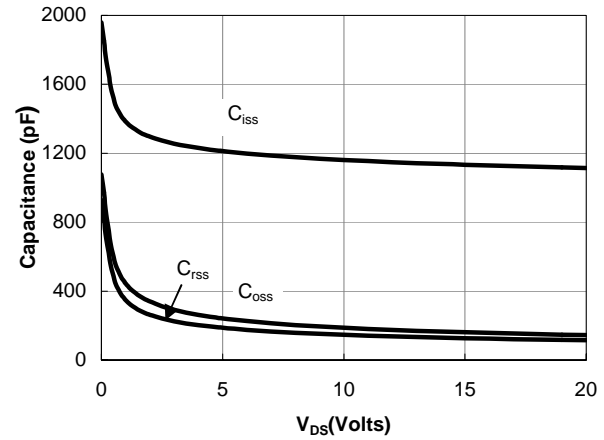


Figure 8: Capacitance Characteristics

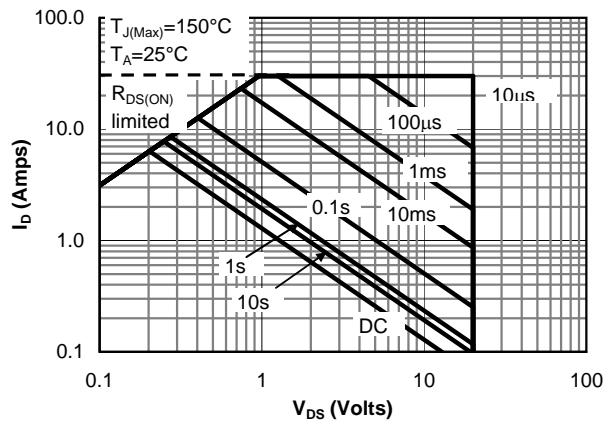


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

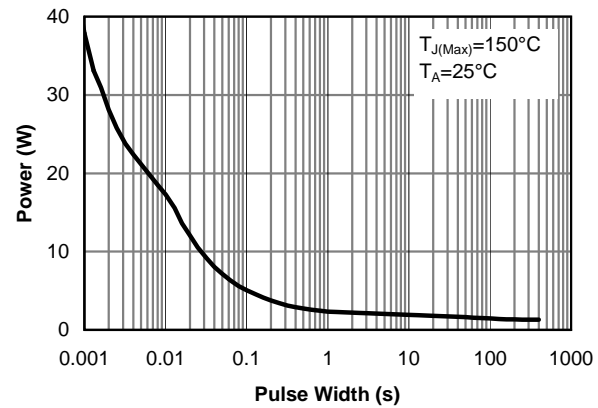


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

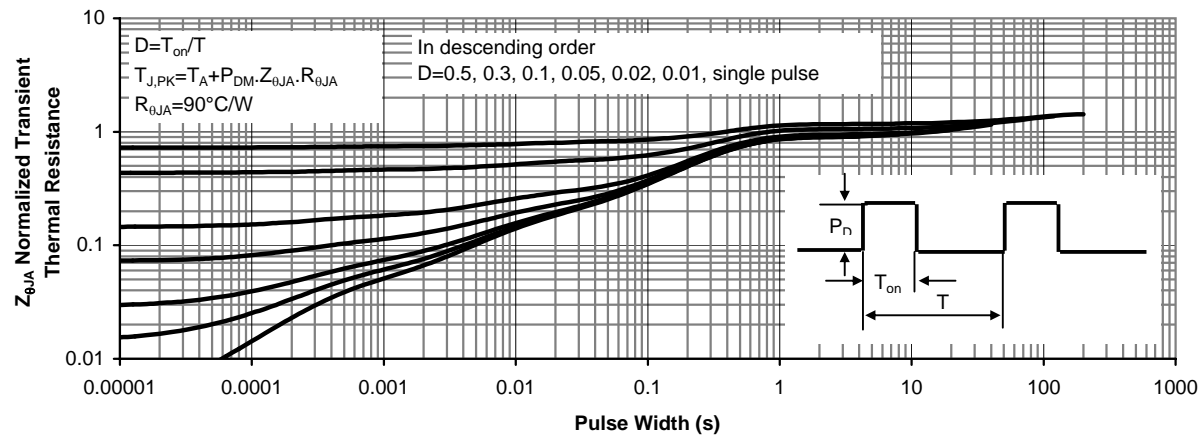


Figure 11: Normalized Maximum Transient Thermal Impedance