



**ALPHA & OMEGA**  
SEMICONDUCTOR, LTD.

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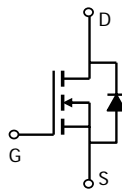
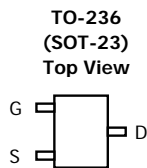
## AO3402, AO3402L ( Green Product ) N-Channel Enhancement Mode Field Effect Transistor

### General Description

The AO3402 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. AO3402L ( Green Product ) is offered in a lead-free package.

### Features

$V_{DS}$  (V) = 30V  
 $I_D$  = 4 A  
 $R_{DS(ON)} < 55m\Omega$  ( $V_{GS} = 10V$ )  
 $R_{DS(ON)} < 70m\Omega$  ( $V_{GS} = 4.5V$ )  
 $R_{DS(ON)} < 110m\Omega$  ( $V_{GS} = 2.5V$ )



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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current <sup>A</sup>	$I_D$	4	A
		$T_A=25^\circ\text{C}$	
	$T_A=70^\circ\text{C}$	3.4	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	15	
Power Dissipation <sup>A</sup>	$P_D$	1.4	W
		$T_A=25^\circ\text{C}$	
	$T_A=70^\circ\text{C}$	1	
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 <sup>A</sup>	$R_{\theta JA}$	70	90	$^\circ\text{C/W}$
		$t \leq 10s$		
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	100	125	$^\circ\text{C/W}$
		Steady-State		
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	63	80	$^\circ\text{C/W}$

**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> =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> =±12V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.6	1	1.4	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	10			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =4A T <sub>J</sub> =125°C		45 66	55 80	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A		55	70	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =2A		83	110	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =4A		8		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.8	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				2.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		390		pF
C <sub>oss</sub>	Output Capacitance			54.5		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			41		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		3		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =15V, I <sub>D</sub> =4A		4.34		nC
Q <sub>gs</sub>	Gate Source Charge			0.6		nC
Q <sub>gd</sub>	Gate Drain Charge			1.38		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =3.75Ω, R <sub>GEN</sub> =6Ω		3.3		ns
t <sub>r</sub>	Turn-On Rise Time			1		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			21.7		ns
t <sub>f</sub>	Turn-Off Fall Time			2.1		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =4A, di/dt=100A/μs		12		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =4A, di/dt=100A/μs		6.3		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 a 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 6,12,14 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

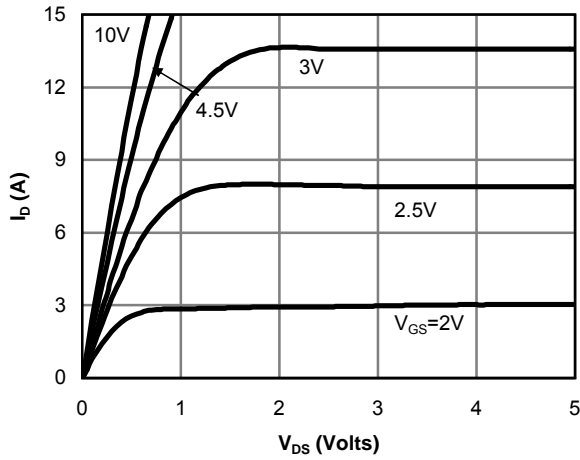


Fig 1: On-Region Characteristics

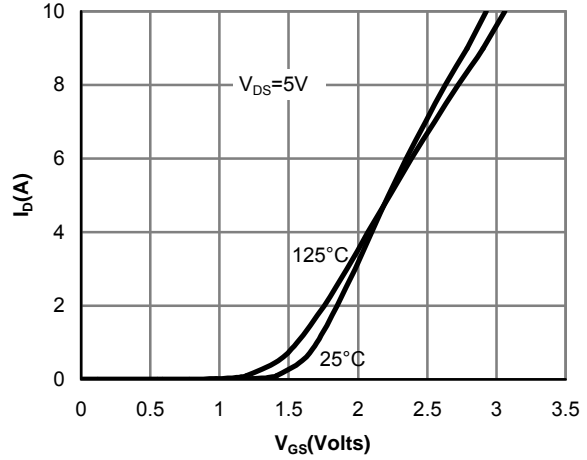


Figure 2: Transfer Characteristics

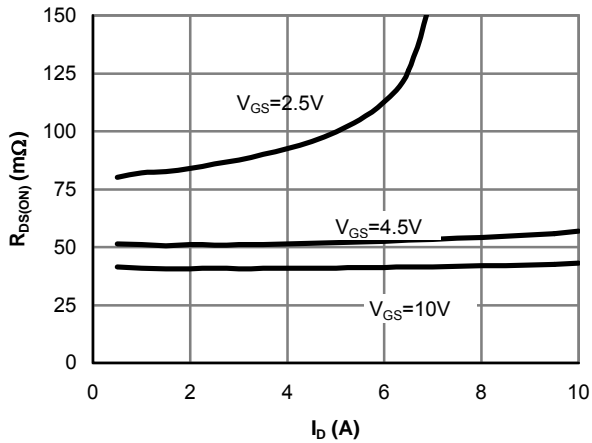


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

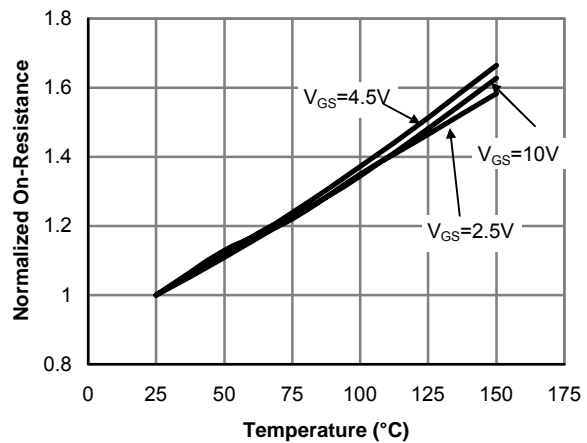


Figure 4: On-Resistance vs. Junction Temperature

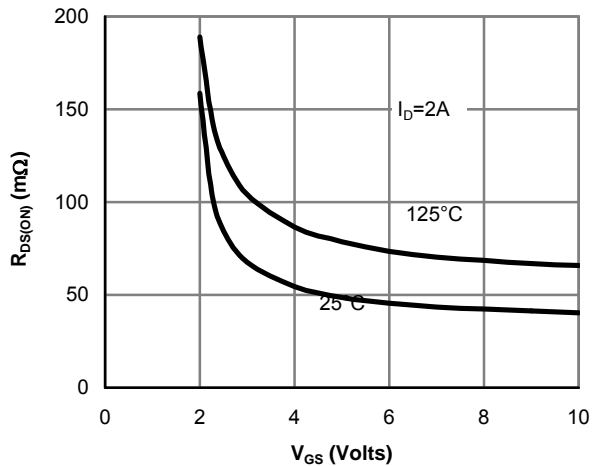


Figure 5: On-Resistance vs. Gate-Source Voltage

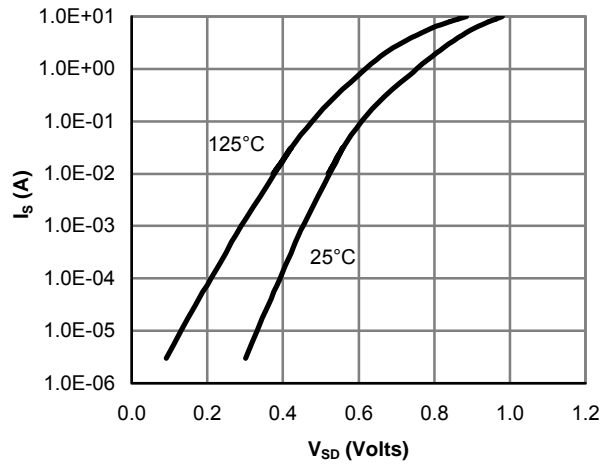


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

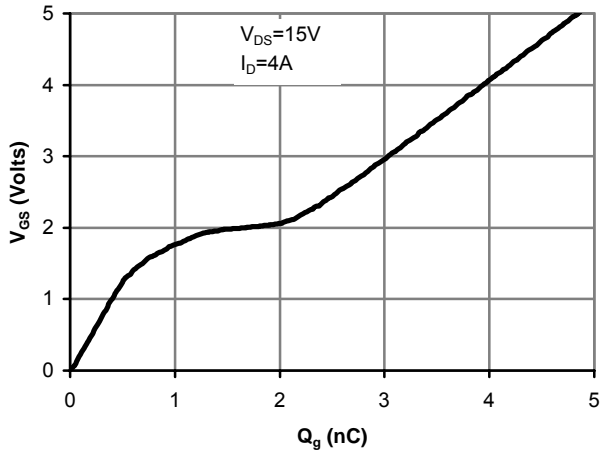


Figure 7: Gate-Charge Characteristics

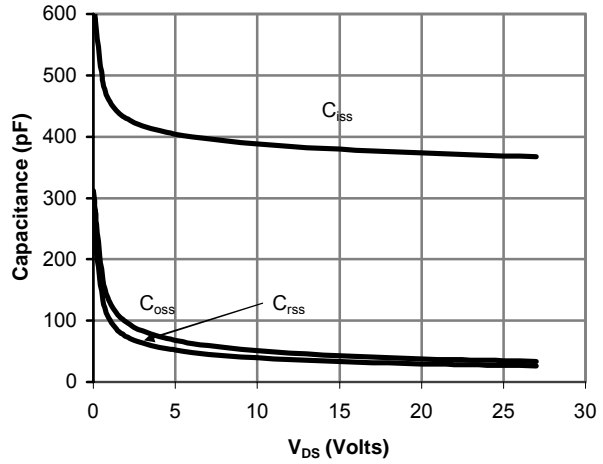


Figure 8: Capacitance Characteristics

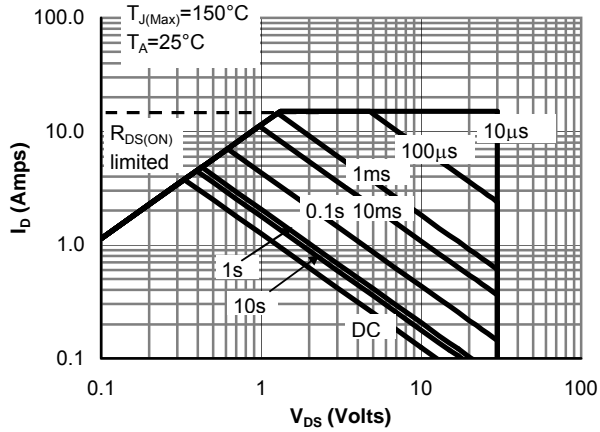


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

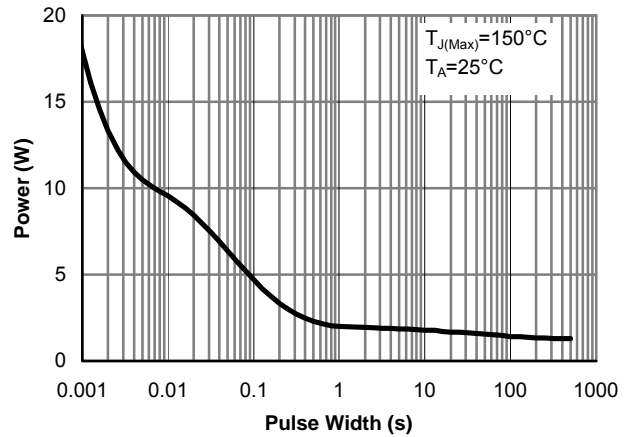


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

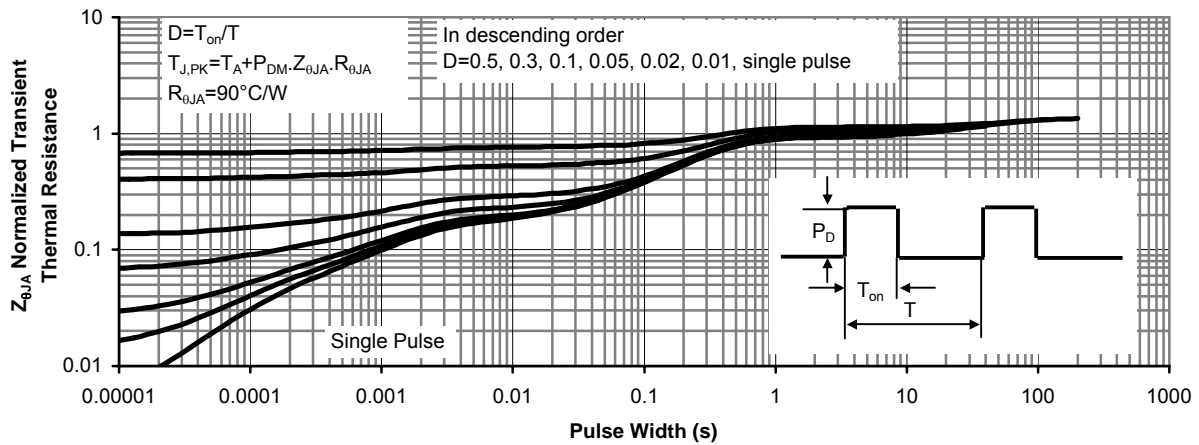


Figure 11: Normalized Maximum Transient Thermal Impedance