



# THE DATASHEET OF AO3414


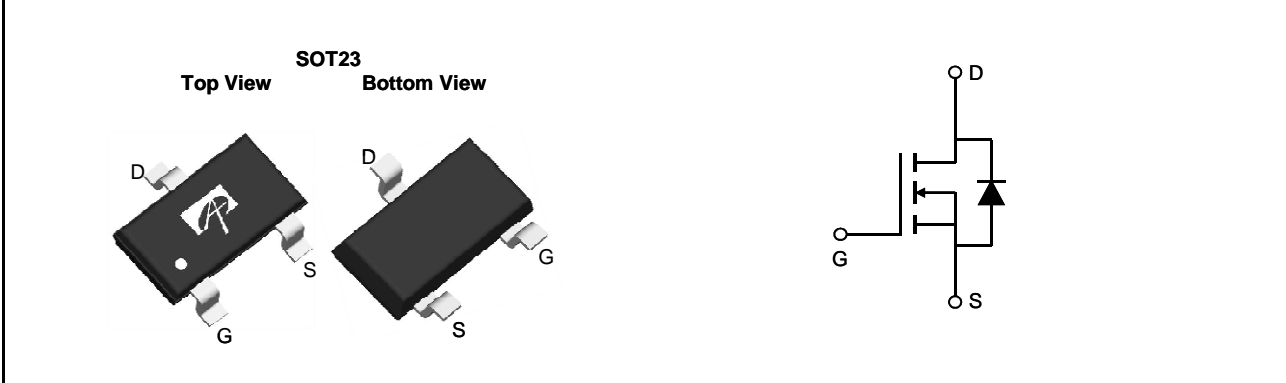


**General Description**

The AO3414 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.

**Features**

$V_{DS} = 20V$   
 $I_D = 3A$  ( $V_{GS} = 4.5V$ )  
 $R_{DS(ON)} < 62m\Omega$  ( $V_{GS} = 4.5V$ )  
 $R_{DS(ON)} < 70m\Omega$  ( $V_{GS} = 2.5V$ )  
 $R_{DS(ON)} < 85m\Omega$  ( $V_{GS} = 1.8V$ )

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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ C$	3	A
	$T_A=70^\circ C$	2.5	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	16	
Power Dissipation <sup>A</sup>	$T_A=25^\circ C$	1.4	W
	$T_A=70^\circ C$	0.9	
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>	$R_{\theta JA}$	70	90	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	100	125
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	63	80	$^\circ C/W$

**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	20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =20V, 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> =±8V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	0.4	0.7	1	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	16			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A T <sub>J</sub> =125°C		51 68	62 85	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =2.8A		58	70	
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =2.5A		68	85	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =3A		11		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.7	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				2	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =10V, f=1MHz		260	320	pF
C <sub>oss</sub>	Output Capacitance		48		pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		27		pF	
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		3	4.5	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, I <sub>D</sub> =3A		2.9	3.8	nC
Q <sub>gs</sub>	Gate Source Charge		0.4		nC	
Q <sub>gd</sub>	Gate Drain Charge		0.6		nC	
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =5V, V <sub>DS</sub> =10V, R <sub>L</sub> =3.3Ω, R <sub>GEN</sub> =6Ω		2.5		ns
t <sub>r</sub>	Turn-On Rise Time		3.2		ns	
t <sub>D(off)</sub>	Turn-Off DelayTime		21		ns	
t <sub>f</sub>	Turn-Off Fall Time		3		ns	
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =3A, di/dt=100A/μs		14	19	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =3A, di/dt=100A/μs		3.8		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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

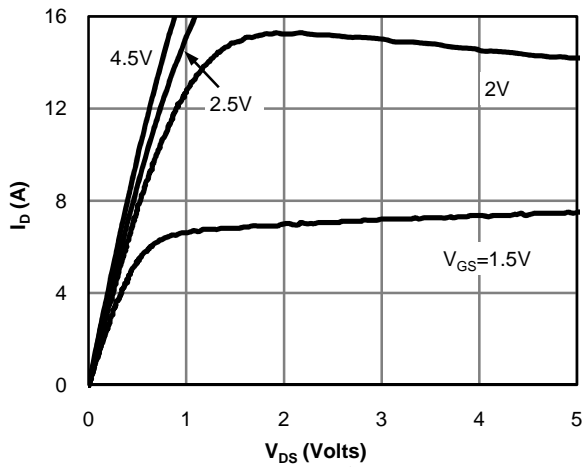


Figure 1: On-Region Characteristics

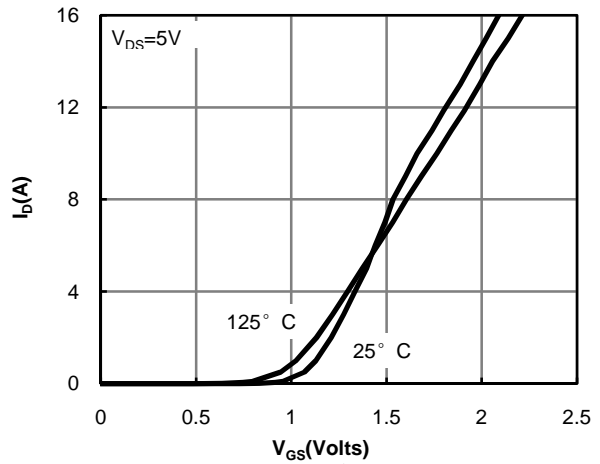


Figure 2: Transfer Characteristics

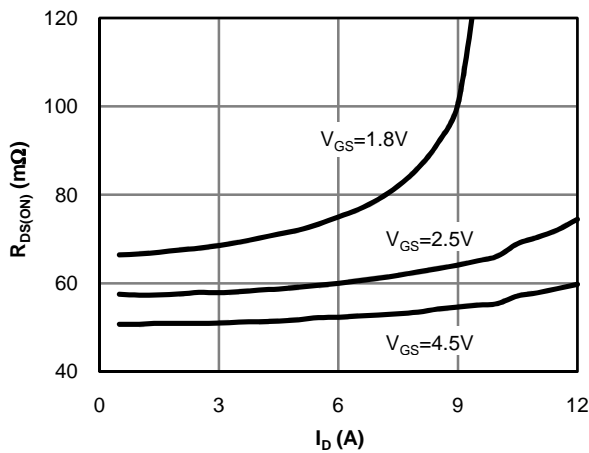


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

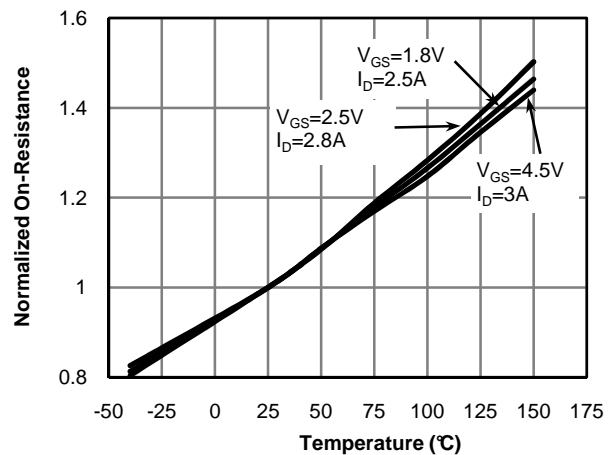


Figure 4: On-Resistance vs. Junction Temperature

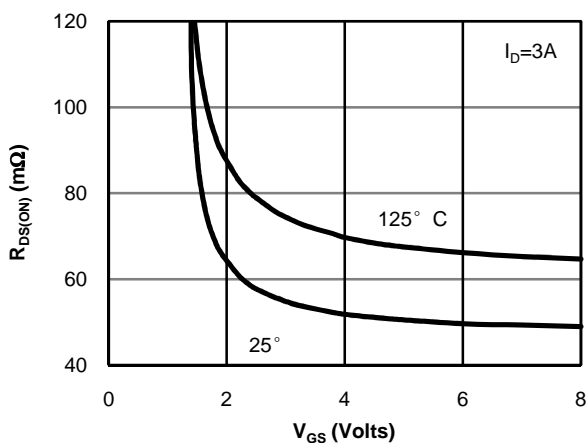


Figure 5: On-Resistance vs. Gate-Source Voltage

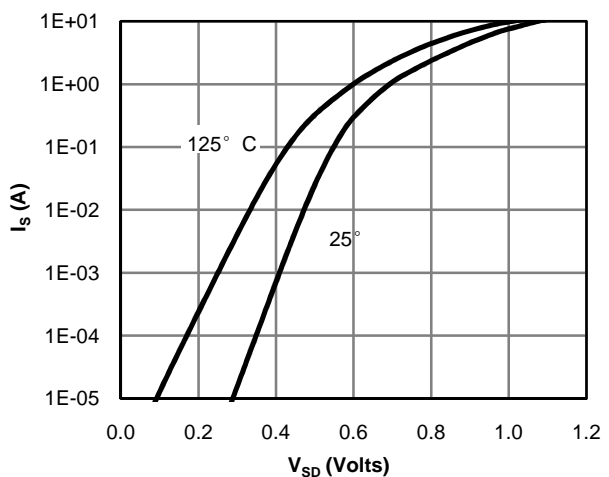
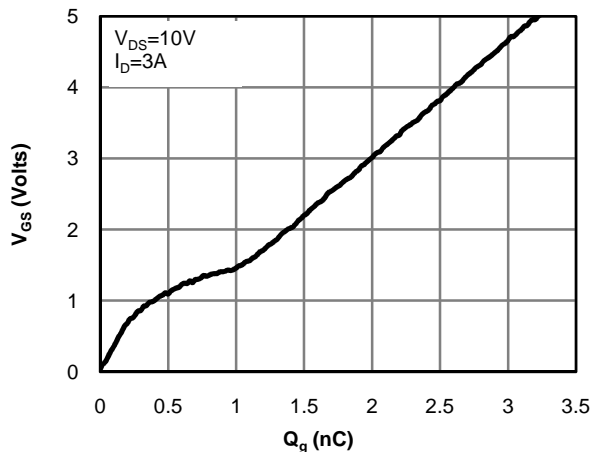
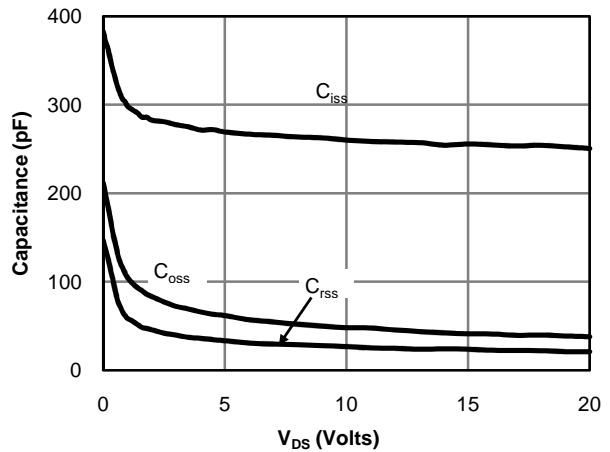


Figure 6: Body-Diode Characteristics

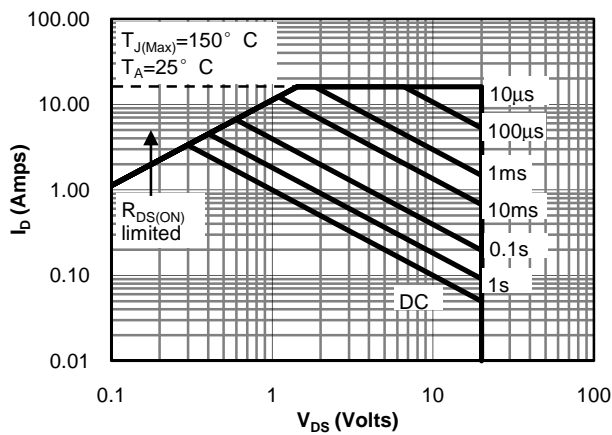
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



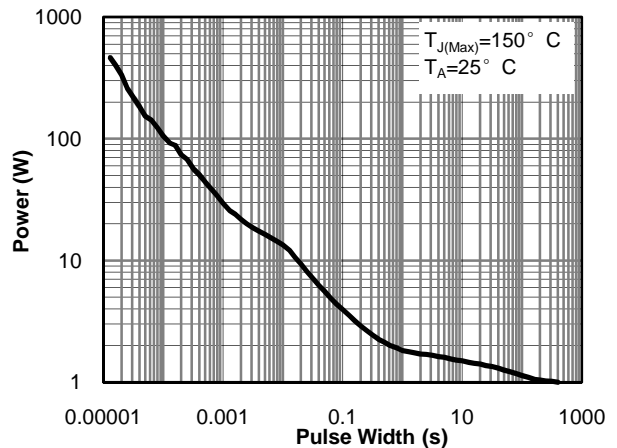
**Figure 7: Gate-Charge Characteristics**



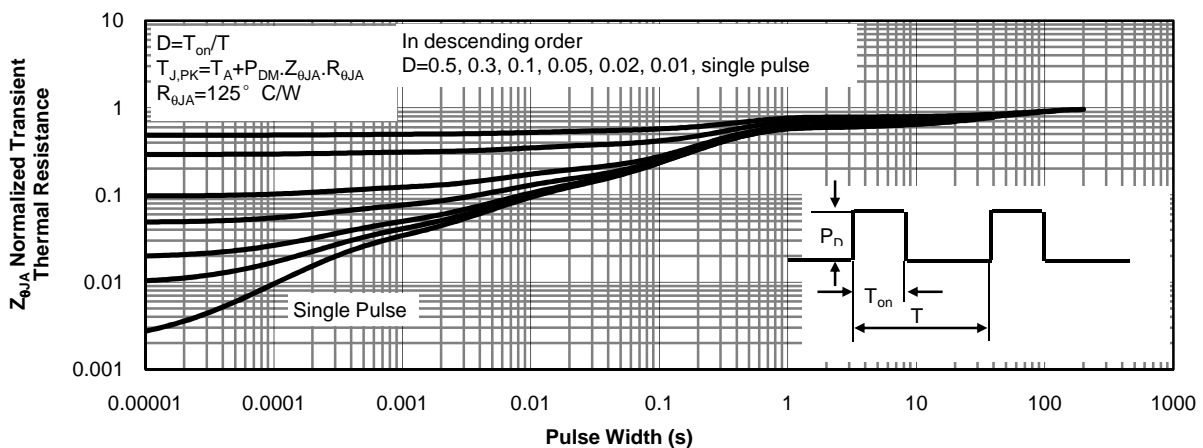
**Figure 8: Capacitance Characteristics**



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

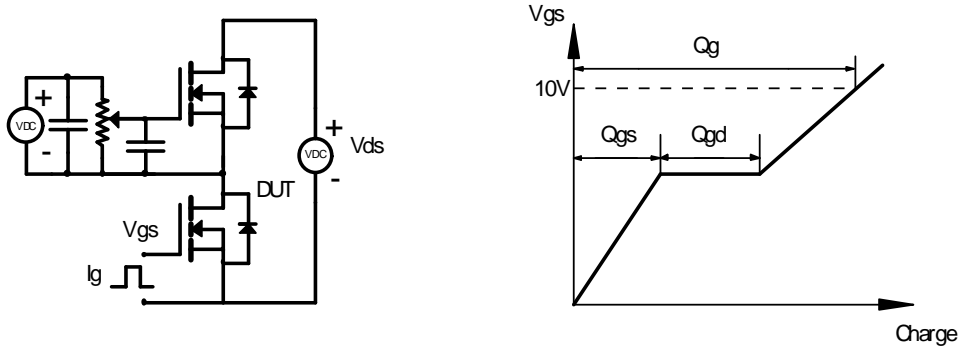


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

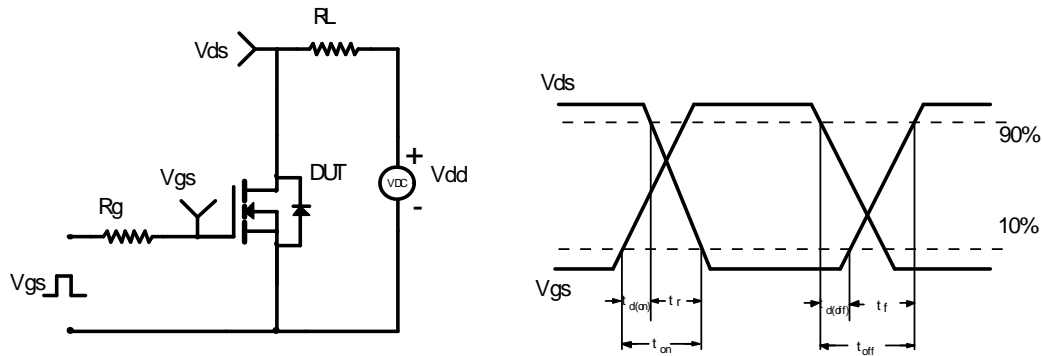


**Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)**

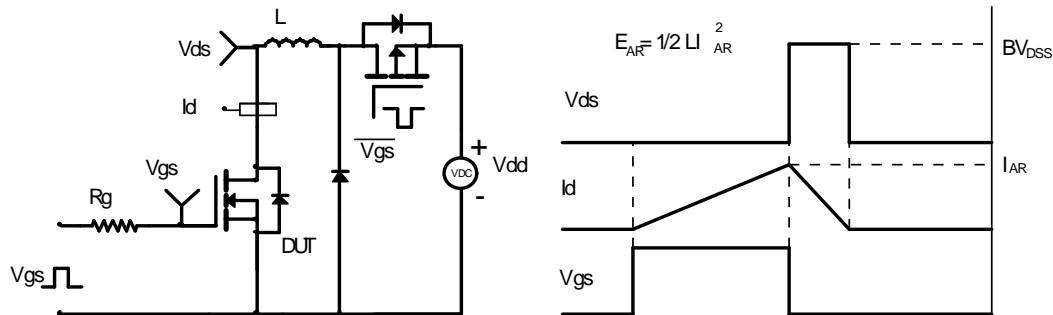
Gate Charge Test Circuit & Waveform



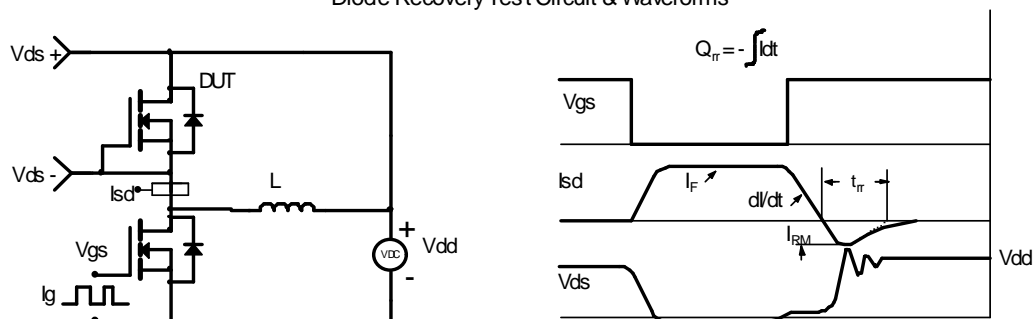
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms



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