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ALPHA & OMEGA
SEMICONDUCTOR

AOD514/AOI514/AOY514

30V N-Channel AlphaMOS

General Description

- Latest Trench Power MOSFET technology
- Very Low $R_{DS(on)}$ at 4.5V V_{GS}
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Application

- DC/DC Converters in Computing
- Isolated DC/DC Converters in Telecom and Industrial

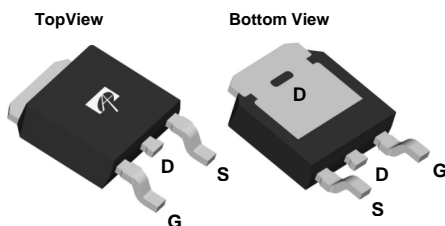
Product Summary

V_{DS}	30V
I_D (at $V_{GS}=10V$)	46A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 5.9m Ω
$R_{DS(ON)}$ (at $V_{GS} = 4.5V$)	< 11.9m Ω

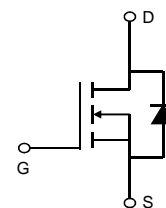
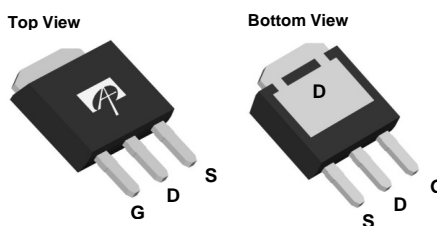
100% UIS Tested
100% R_g Tested



TO252 DPAK: AOD514



TO251A IPAK: AOI514
TO251B (IPAK short lead): AOY514



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}	± 20	V
Continuous Drain Current ^G	I_D	46	A
$T_C=25^\circ\text{C}$		36	
$T_C=100^\circ\text{C}$			
Pulsed Drain Current ^C	I_{DM}	163	
Continuous Drain Current	I_{DSM}	17	A
$T_A=25^\circ\text{C}$		13	
$T_A=70^\circ\text{C}$			
Avalanche Current ^C	I_{AS}	25	A
Avalanche energy $L=0.1\text{mH}$ ^C	E_{AS}	31	mJ
V_{DS} Spike	V_{SPIKE}	36	V
Power Dissipation ^B	P_D	50	W
		$T_C=25^\circ\text{C}$	
$T_C=100^\circ\text{C}$			
Power Dissipation ^A	P_{DSM}	2.5	W
		$T_A=25^\circ\text{C}$	
$T_A=70^\circ\text{C}$			
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	16	20	$^\circ\text{C/W}$
$t \leq 10\text{s}$		41	50	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A,B}	$R_{\theta JC}$	2.5	3	$^\circ\text{C/W}$
Steady-State				
Maximum Junction-to-Case				

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±20V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.6	2	2.4	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A T _J =125°C		4.3	5.9	mΩ
		V _{GS} =4.5V, I _D =20A		8.5	11.9	
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		91		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.7	1	V
I _S	Maximum Body-Diode Continuous Current ^G				46	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		1187		pF
C _{oss}	Output Capacitance			483		pF
C _{rss}	Reverse Transfer Capacitance			60		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	0.7	1.5	2.3	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A		18		nC
Q _g (4.5V)	Total Gate Charge			8.8		nC
Q _{gs}	Gate Source Charge			4.1		nC
Q _{gd}	Gate Drain Charge			3.6		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		7.3		ns
t _r	Turn-On Rise Time			10.5		ns
t _{D(off)}	Turn-Off DelayTime			21.8		ns
t _f	Turn-Off Fall Time			5		ns
t _{rr}	Body Diode Reverse Recovery Time		I _F =20A, dI/dt=500A/μs		14.7	
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs		24		nC

- A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_D is based on R_{θJA} and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.
- B. The power dissipation P_D is based on T_{J(MAX)}=175° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
- C. Single pulse width limited by junction temperature T_{J(MAX)}=175° C.
- D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.
- E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
- F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=175° C. The SOA curve provides a single pulse rating.
- G. The maximum current rating is package limited.
- H. 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° C.

OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

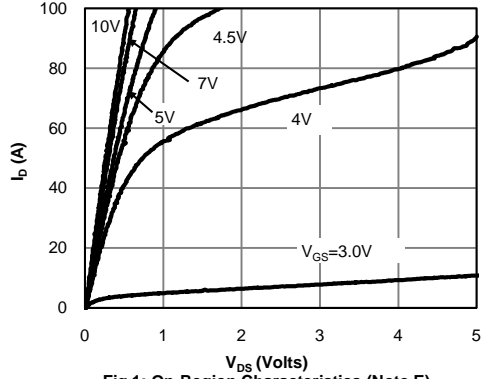


Fig 1: On-Region Characteristics (Note E)

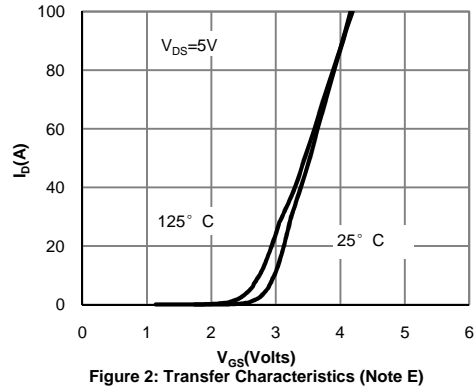


Figure 2: Transfer Characteristics (Note E)

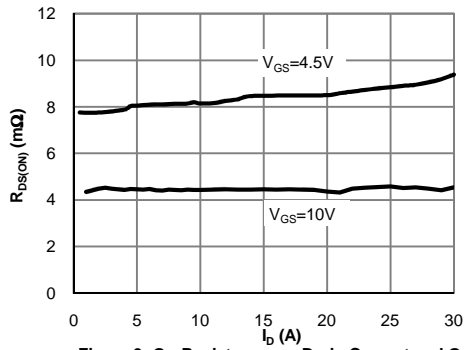


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

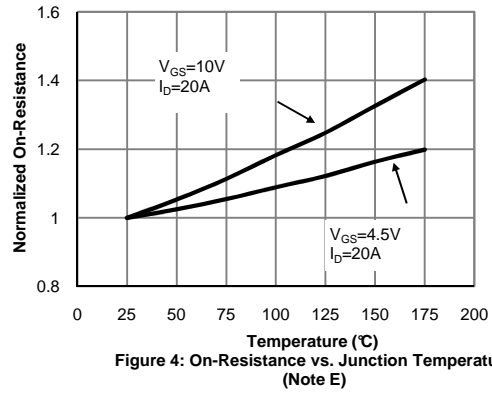


Figure 4: On-Resistance vs. Junction Temperature (Note E)

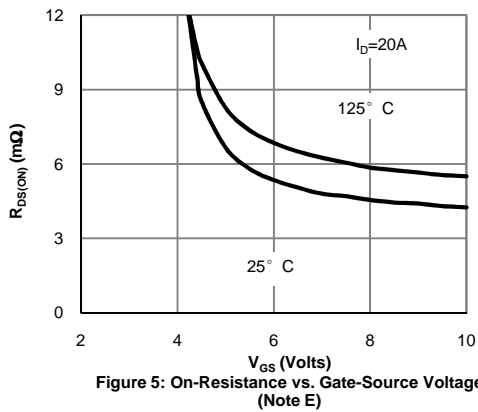


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

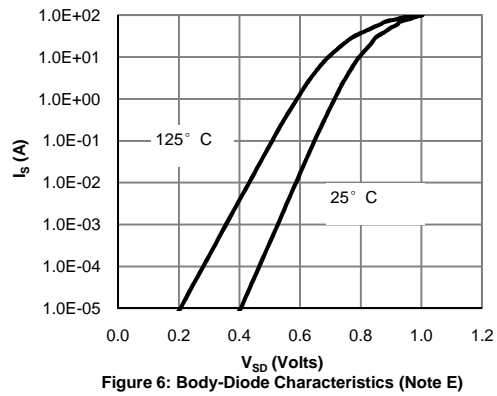


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

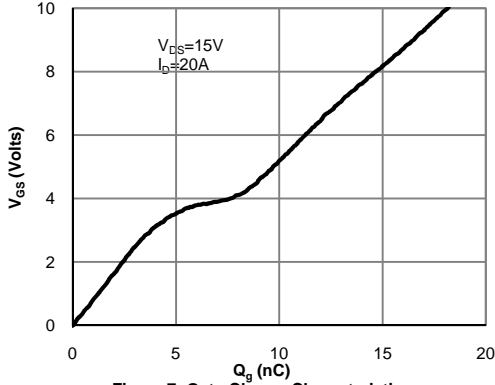


Figure 7: Gate-Charge Characteristics

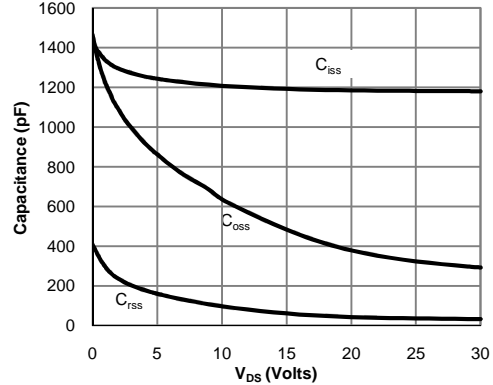


Figure 8: Capacitance Characteristics

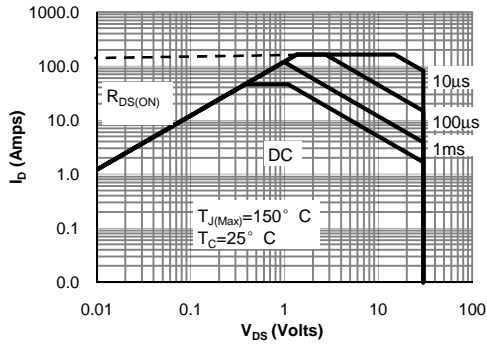


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

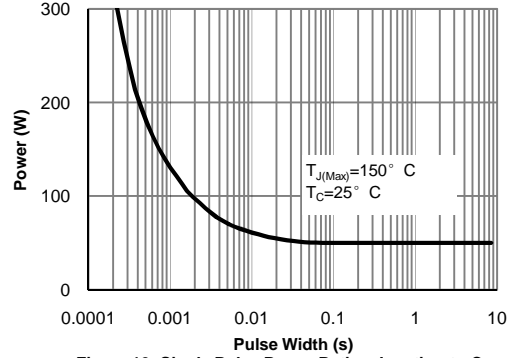


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

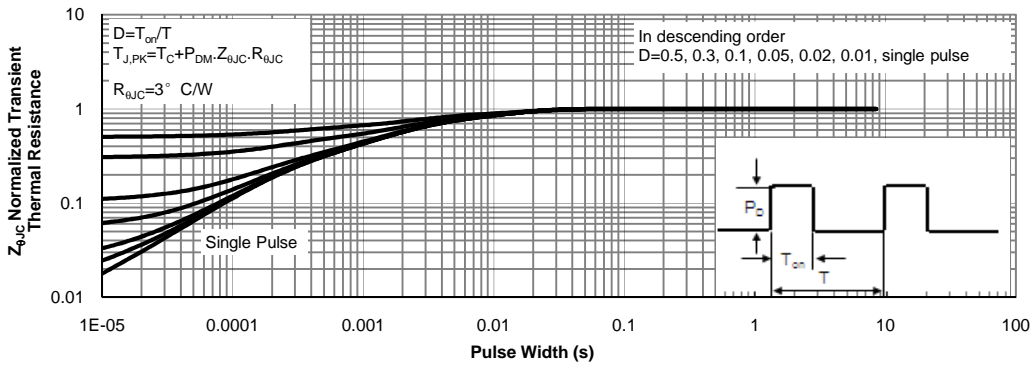


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

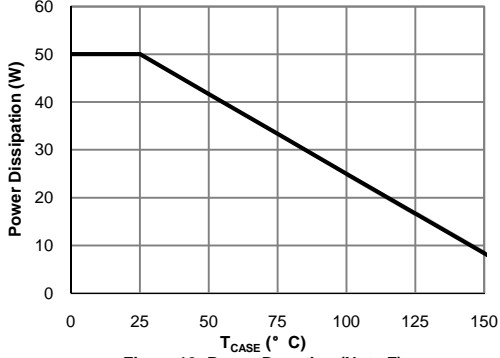


Figure 12: Power De-rating (Note F)

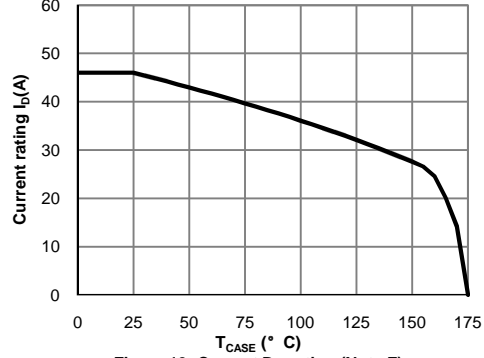


Figure 13: Current De-rating (Note F)

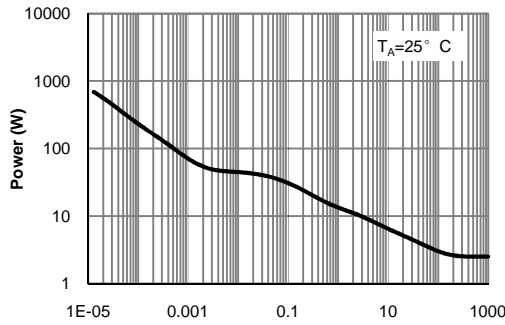


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

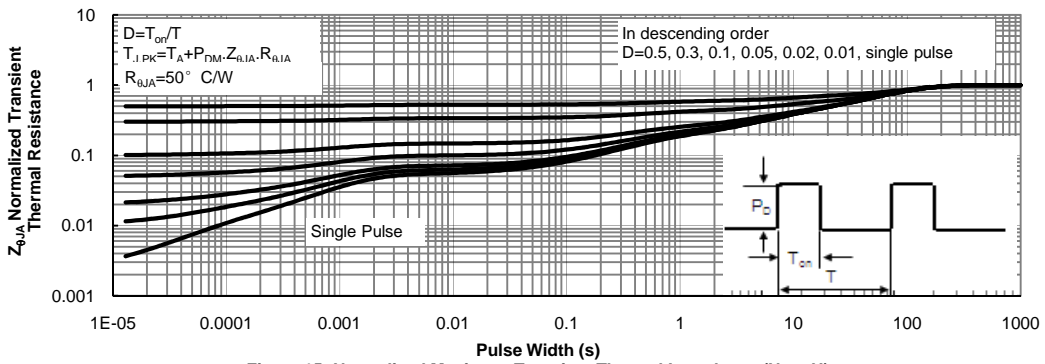
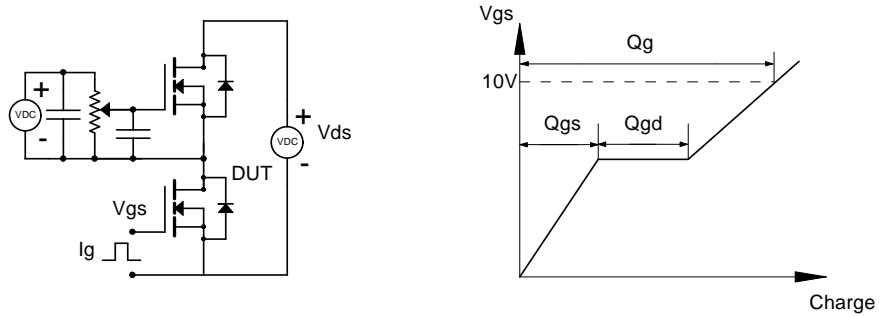
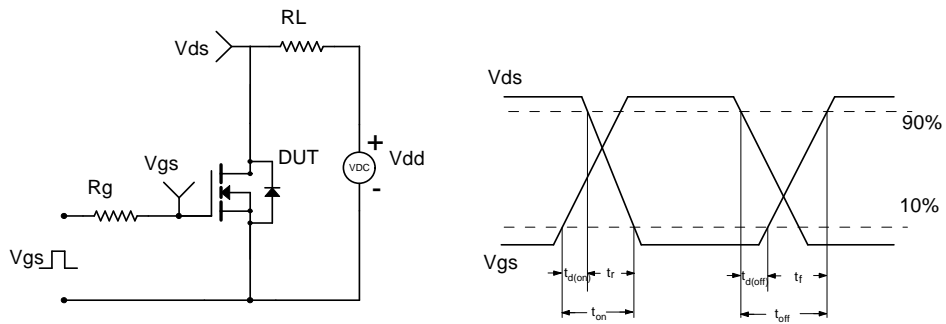


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

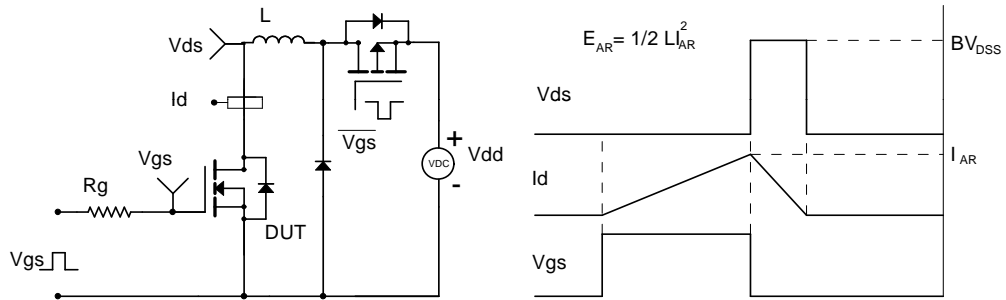
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

