



ALPHA & OMEGA
SEMICONDUCTOR

AOD538/AOI538
30V N-Channel α MOS™

General Description

- Trench Power AlphaMOS (α MOS™ LV) technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Application

- DC/DC Converters in Computing, Servers, and POL
- Isolated DC/DC Converters in Telecom and Industrial

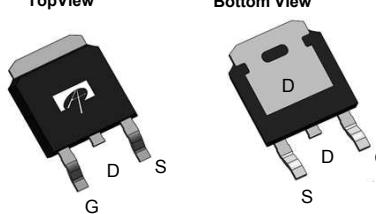
Product Summary

V_{DS}	30V
I_D (at $V_{GS}=10V$)	70A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 3.1mΩ
$R_{DS(ON)}$ (at $V_{GS}=4.5V$)	< 4.8mΩ

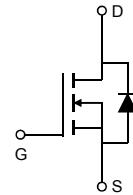
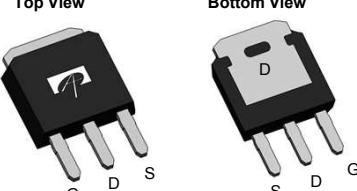
100% UIS Tested
100% R_g Tested



TopView
TO252
DPAK



Top View
TO-251A
IPAK



Orderable Part Number

Package Type

Form

Minimum Order Quantity

AOD538	TO-252	Tape & Reel	2500
AOI538	TO-251A	Tube	3500

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}	± 20	V
Continuous Drain Current ^G	I_D	70	A
$T_C=100^\circ C$		54	
Pulsed Drain Current ^C	I_{DM}	280	
Continuous Drain Current	I_{DSM}	34	A
$T_A=70^\circ C$		27	
Avalanche Current ^C	I_{AS}	36	A
Avalanche energy $L=0.1mH$ ^C	E_{AS}	65	mJ
V_{DS} Spike	V_{SPIKE}	36	V
		93	W
Power Dissipation ^B	P_D	46	
		6.2	W
Power Dissipation ^A	P_{DSM}	4	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	15	20	°C/W
Steady-State		40	50	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	1.3	1.6	°C/W

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$\text{ID}=250\mu\text{A}, \text{VGS}=0\text{V}$	30			V
I_{DSS}	Zero Gate Voltage Drain Current	$\text{V}_{\text{DS}}=30\text{V}, \text{V}_{\text{GS}}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$\text{V}_{\text{DS}}=0\text{V}, \text{V}_{\text{GS}}=\pm20\text{V}$			±100	nA
$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	$\text{V}_{\text{DS}}=\text{V}_{\text{GS}}, \text{I}_{\text{D}}=250\mu\text{A}$	1.4	1.8	2.2	V
$\text{R}_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$\text{V}_{\text{GS}}=10\text{V}, \text{I}_{\text{D}}=20\text{A}$ $T_J=125^\circ\text{C}$		2.5 3.6	3.1 4.5	$\text{m}\Omega$
		$\text{V}_{\text{GS}}=4.5\text{V}, \text{I}_{\text{D}}=20\text{A}$		3.8	4.8	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$\text{V}_{\text{DS}}=5\text{V}, \text{I}_{\text{D}}=20\text{A}$		91		S
V_{SD}	Diode Forward Voltage	$\text{I}_{\text{S}}=1\text{A}, \text{V}_{\text{GS}}=0\text{V}$		0.7	1	V
I_{S}	Maximum Body-Diode Continuous Current ^G				70	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$\text{V}_{\text{GS}}=0\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{f}=1\text{MHz}$		2160		pF
C_{oss}	Output Capacitance			915		pF
C_{rss}	Reverse Transfer Capacitance			115		pF
R_{g}	Gate resistance	$\text{f}=1\text{MHz}$	0.9	1.8	2.7	Ω
SWITCHING PARAMETERS						
$\text{Q}_{\text{g}}(10\text{V})$	Total Gate Charge	$\text{V}_{\text{GS}}=10\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{I}_{\text{D}}=20\text{A}$		30	42	nC
$\text{Q}_{\text{g}}(4.5\text{V})$	Total Gate Charge			14	20	nC
Q_{gs}	Gate Source Charge			5.1		nC
Q_{gd}	Gate Drain Charge			6.3		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$\text{V}_{\text{GS}}=10\text{V}, \text{V}_{\text{DS}}=15\text{V}, \text{R}_{\text{L}}=0.75\Omega, \text{R}_{\text{GEN}}=3\Omega$		8		ns
t_{r}	Turn-On Rise Time			4		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			29		ns
t_{f}	Turn-Off Fall Time			5.5		ns
t_{rr}	Body Diode Reverse Recovery Time	$\text{I}_{\text{F}}=20\text{A}, \text{dI}/\text{dt}=500\text{A}/\mu\text{s}$		16.5		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$\text{I}_{\text{F}}=20\text{A}, \text{dI}/\text{dt}=500\text{A}/\mu\text{s}$		34.2		nC

A. The value of R_{gJA} is measured 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 Power dissipation P_{DSM} is based on R_{gJA} $t \leq 10\text{s}$ 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 $T_{\text{J(MAX)}}=175^\circ\text{C}$, 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 $T_{\text{J(MAX)}}=175^\circ\text{C}$.

D. The R_{gJA} is the sum of the thermal impedance from junction to case R_{gJC} and case to ambient.

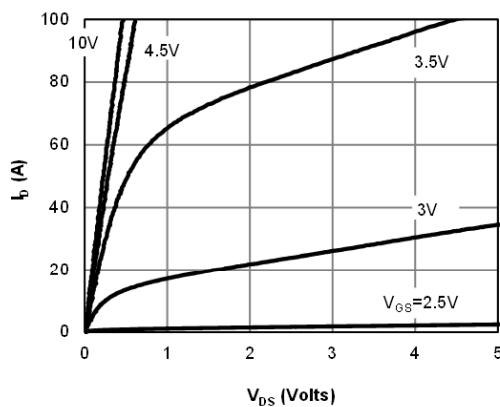
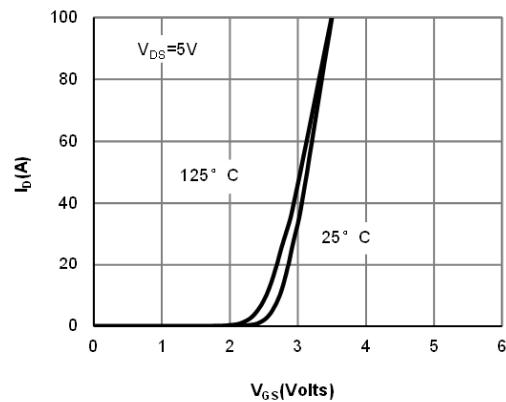
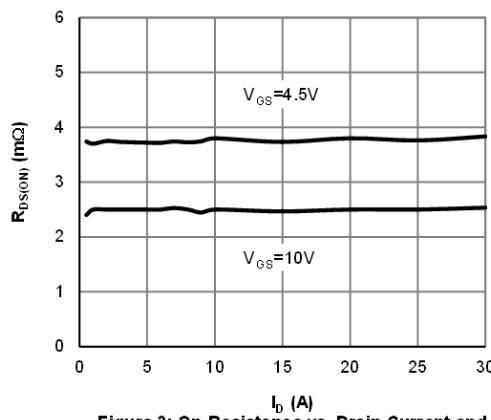
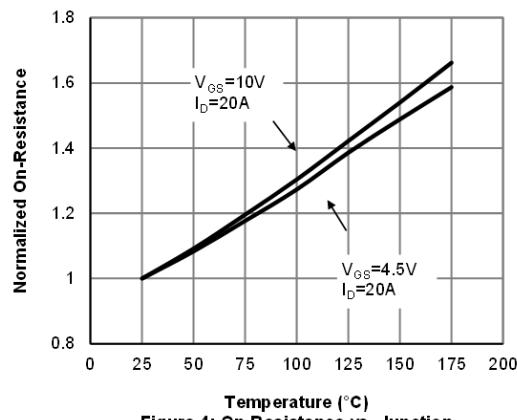
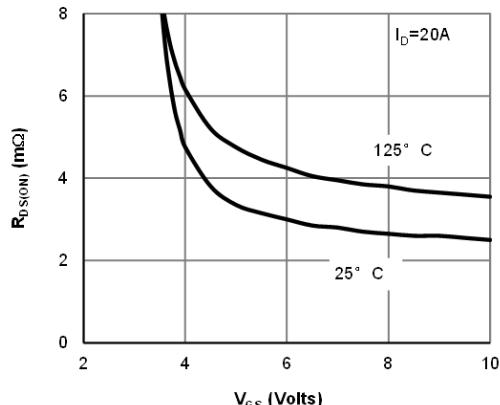
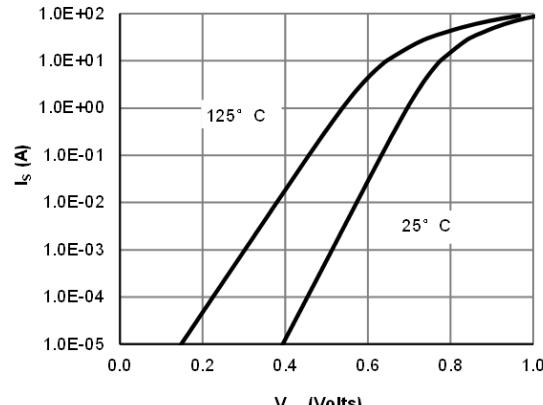
E. The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

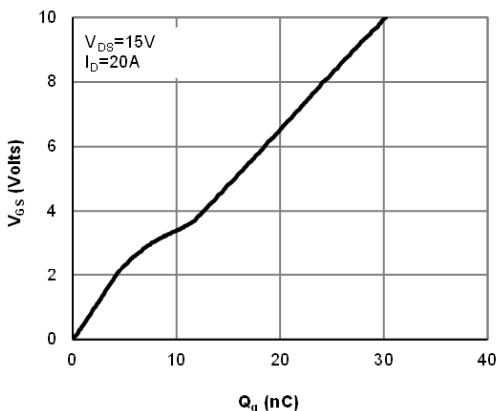
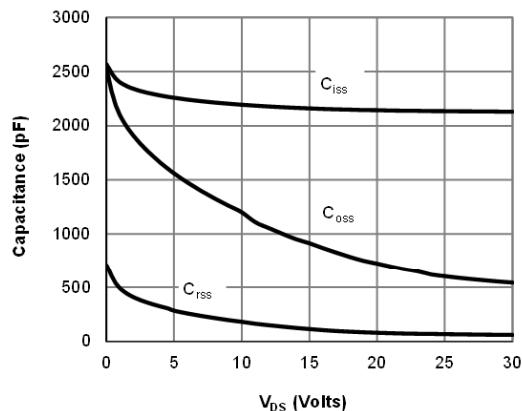
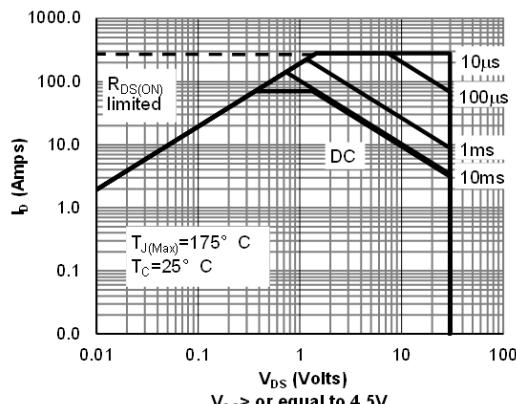
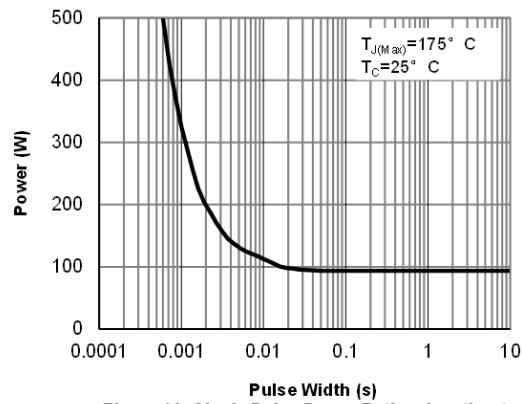
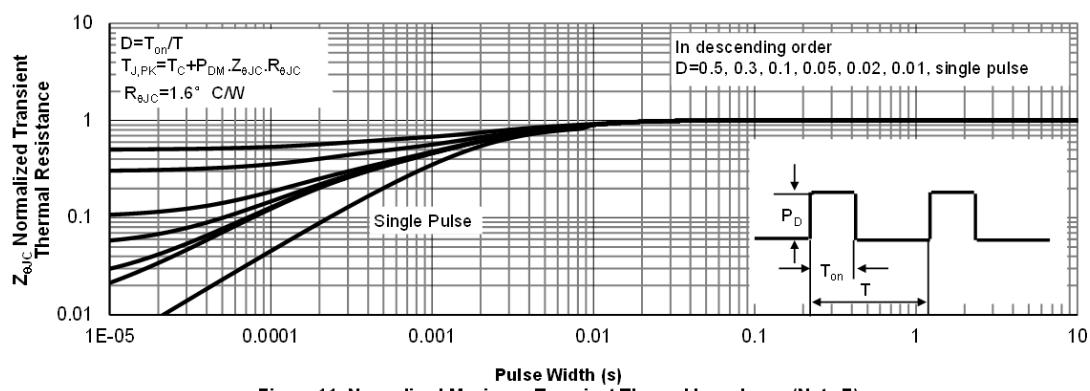
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{\text{J(MAX)}}=175^\circ\text{C}$. The SOA curve provides a single pulse rating.

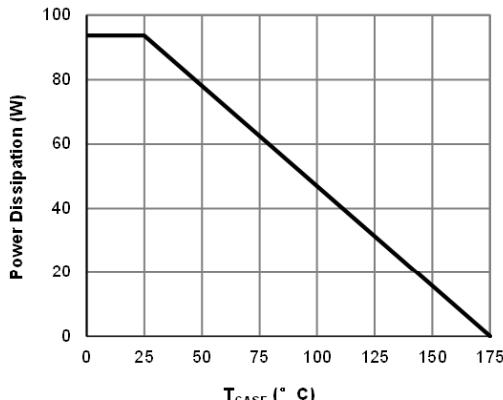
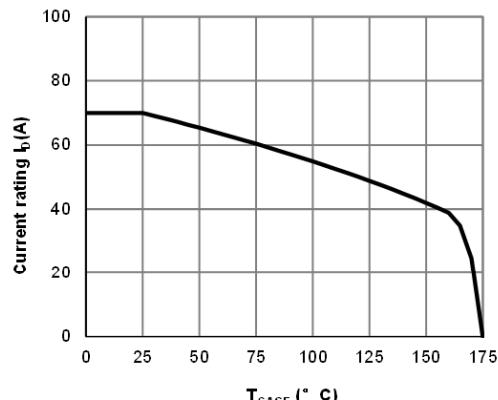
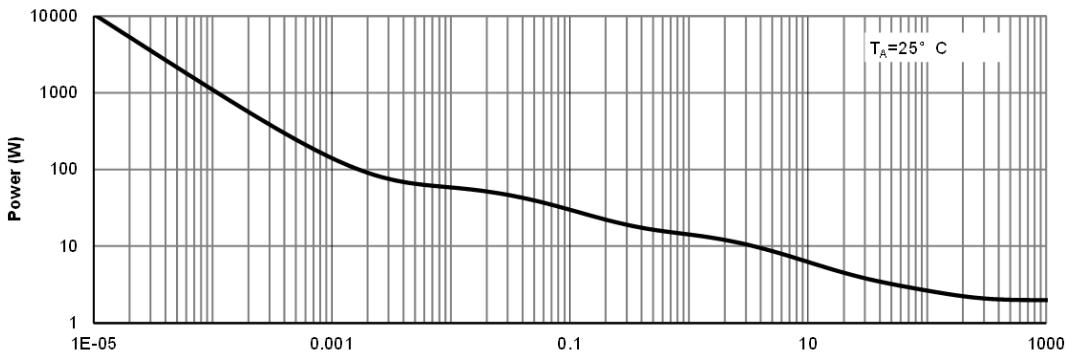
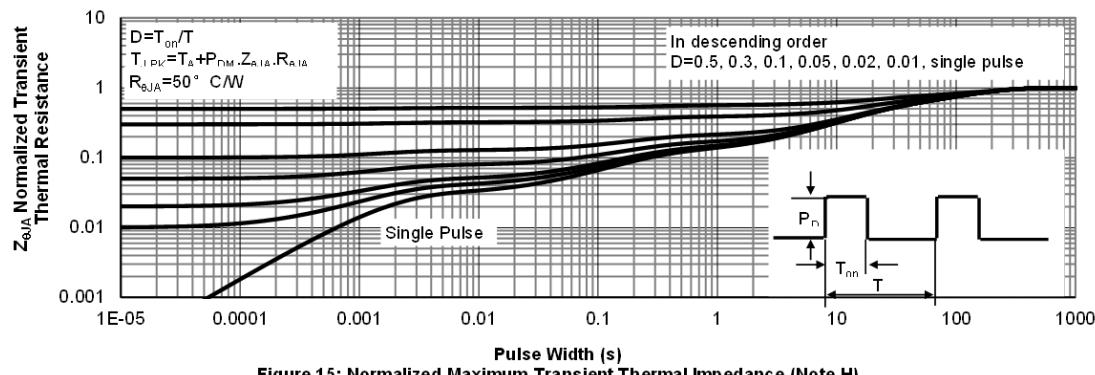
G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$.

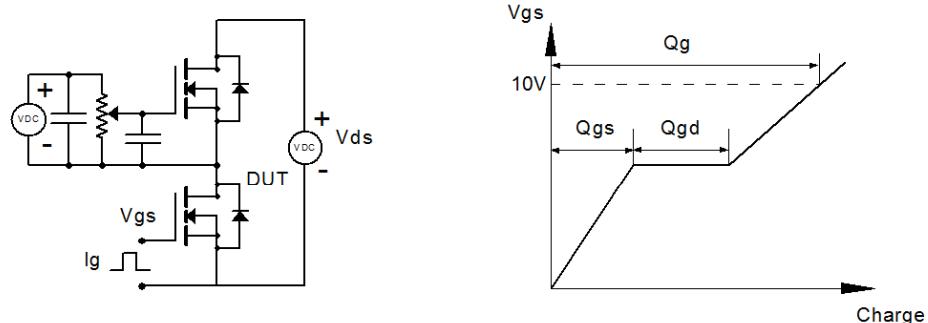
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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 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)

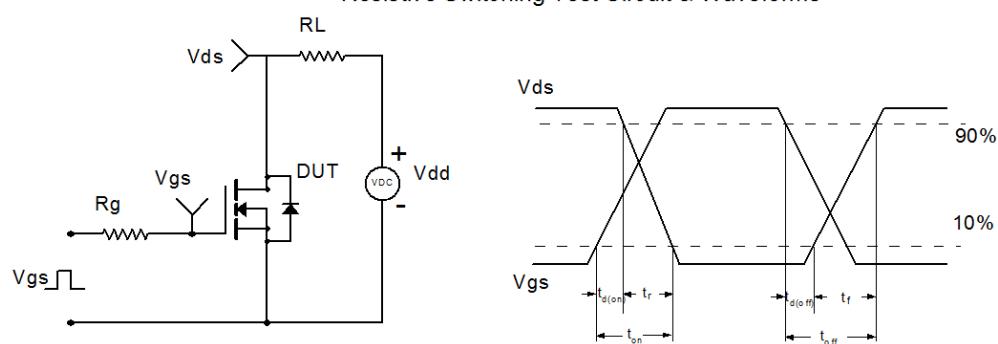
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

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)

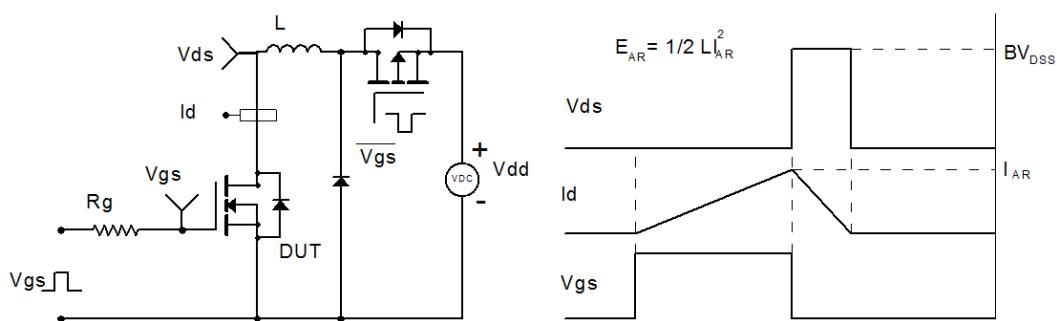
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

