



ALPHA & OMEGA
SEMICONDUCTOR

AOD1R4A70Z/AOI1R4A70Z

700V, α MOSTM N-Channel Power Transistor

General Description

- Proprietary α MOS⁵™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

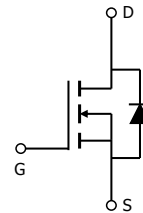
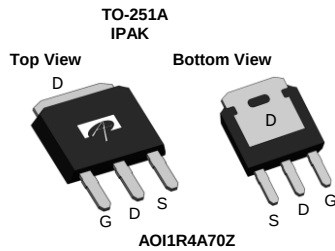
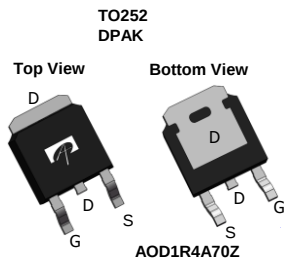
Applications

- Flyback for SMPS
- Charger, Adapter, lighting

Product Summary

$V_{DS} @ T_{j,max}$	800V
I_{DM}	15A
$R_{DS(ON),max}$	< 1.4 Ω
$Q_{g,typ}$	7.4nC
$E_{oss} @ 400V$	1 μ J

100% UIS Tested
100% R_g Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOD1R4A70Z	TO252	Tape & Reel	2500
AOI1R4A70Z	TO251A	Tube	3500

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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	700	V
Gate-Source Voltage	V_{GS}	± 20	V
Gate-Source Voltage (dynamic) AC($f>1\text{Hz}$)	V_{GS}	± 30	V
Continuous Drain Current	I_D	3.8	A
$T_C=25^\circ\text{C}$		2.4	
$T_C=100^\circ\text{C}$	I_D	2.4	A
Pulsed Drain Current ^C	I_{DM}	15	A
Avalanche Current ^C $L=1\text{mH}$	I_{AR}	1.1	A
Repetitive avalanche energy ^C	E_{AR}	0.6	mJ
Single pulsed avalanche energy ^H	E_{AS}	2.7	mJ
MOSFET dv/dt ruggedness	dv/dt	100	V/ns
Peak diode recovery dv/dt		20	
Power Dissipation ^B	P_D	48	W
		0.4	W/ $^\circ\text{C}$
$T_C=25^\circ\text{C}$	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$
Derate above 25°C			
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	45	55	$^\circ\text{C/W}$
Maximum Case-to-sink ^A	$R_{\theta CS}$	-	0.5	$^\circ\text{C/W}$
Maximum Junction-to-Case	$R_{\theta JC}$	2	2.6	$^\circ\text{C/W}$

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, T _J =25°C	700			V
		I _D =250μA, V _{GS} =0V, T _J =150°C		800		
BV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D =250μA, V _{GS} =0V		0.59		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =700V, V _{GS} =0V			1	μA
		V _{DS} =560V, T _J =125°C			10	
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =5V, I _D =250μA	2.9	3.5	4.1	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =1A		1.16	1.4	Ω
g _{FS}	Forward Transconductance	V _{DS} =10V, I _D =1A		1.8		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.8	1.2	V
I _S	Maximum Body-Diode Continuous Current				3.8	A
I _{SM}	Maximum Body-Diode Pulsed Current ^C				15	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		354		pF
C _{oss}	Output Capacitance			12		pF
C _{o(er)}	Effective output capacitance, energy related ^I	V _{GS} =0V, V _{DS} =0 to 480V, f=1MHz		11.2		pF
C _{o(tr)}	Effective output capacitance, time related ^J			46.9		pF
C _{rss}	Reverse Transfer Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		1.3		pF
R _g	Gate resistance	f=1MHz		7.3		Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =480V, I _D =1.9A		7.4		nC
Q _{gs}	Gate Source Charge			2.9		nC
Q _{gd}	Gate Drain Charge			2		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =400V, I _D =1.9A, R _G =5Ω		15		ns
t _r	Turn-On Rise Time			7.5		ns
t _{D(off)}	Turn-Off DelayTime			32		ns
t _f	Turn-Off Fall Time			13.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =1.9A, di/dt=100A/μs, V _{DS} =400V		176		ns
I _{rm}	Peak Reverse Recovery Current			11		A
Q _{rr}	Body Diode Reverse Recovery Charge			1.4		μC

A. The value of R_{θJA} is measured with the device in a still air environment with T_A=25° C.

B. The power dissipation P_D is based on T_{J(MAX)}=150° 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. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150° C. Ratings are based on low frequency and duty cycles to keep initial T_J=25° 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)}=150° C.

G. 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.

H. L=60mH, I_{AS}=0.3 A, R_G=25Ω, Starting T_J=25° C.

I. C_{o(er)} is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{(BR)DSS}.

J. C_{o(tr)} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{(BR)DSS}.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

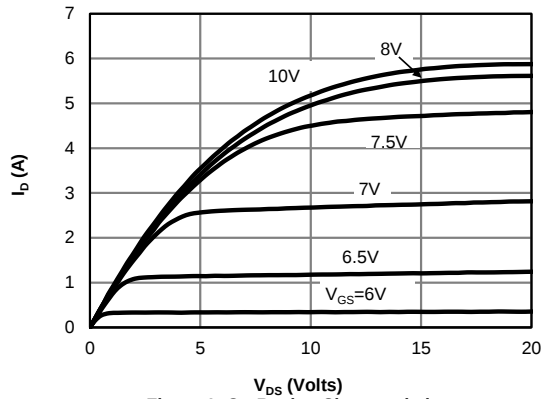


Figure 1: On-Region Characteristics

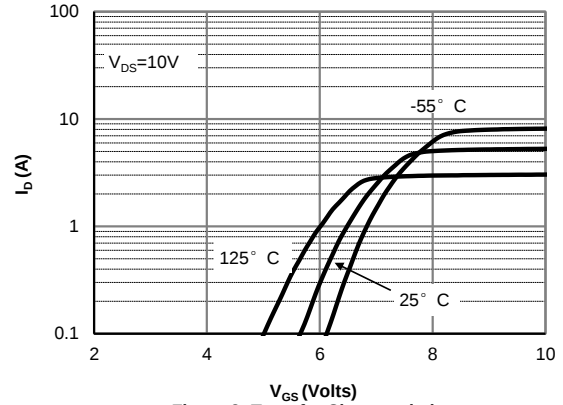


Figure 2: Transfer Characteristics

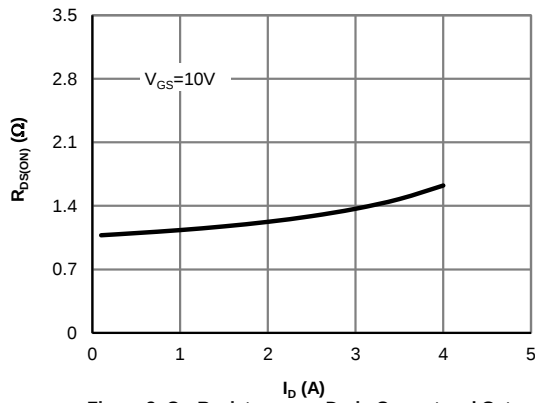


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

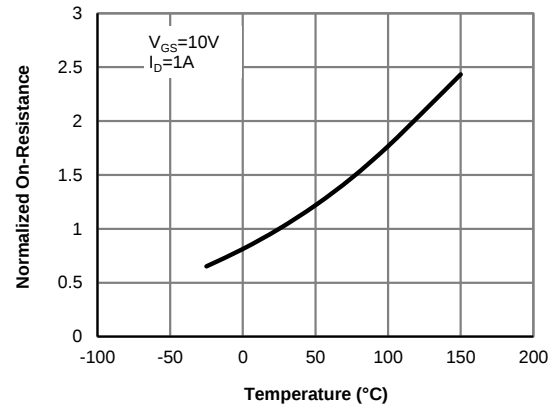


Figure 4: On-Resistance vs. Junction Temperature

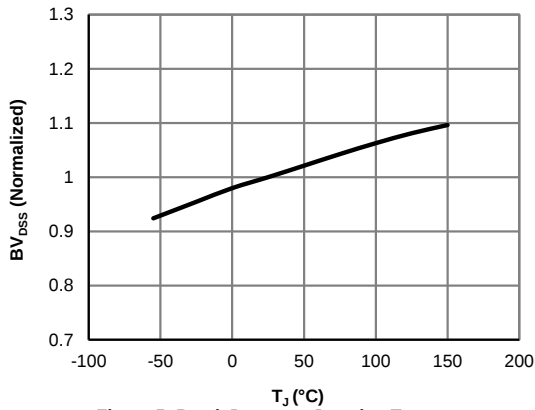


Figure 5: Break Down vs. Junction Temperature

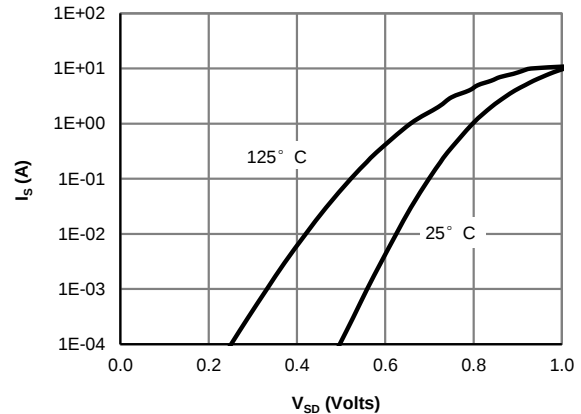


Figure 6: Body-Diode Characteristics

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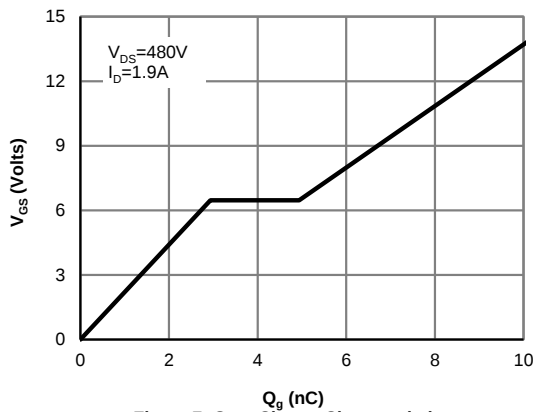


Figure 7: Gate-Charge Characteristics

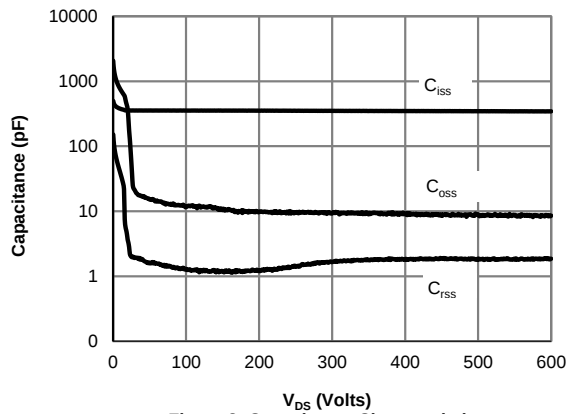


Figure 8: Capacitance Characteristics

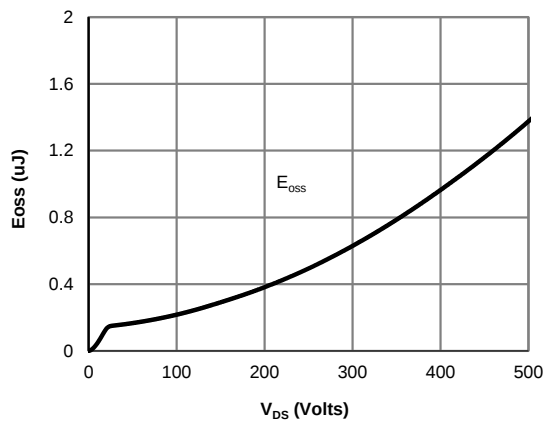


Figure 9: Coss stored Energy

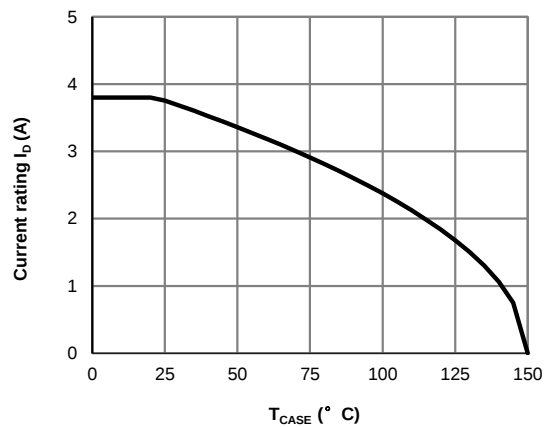


Figure 10: Current De-rating (Note F)

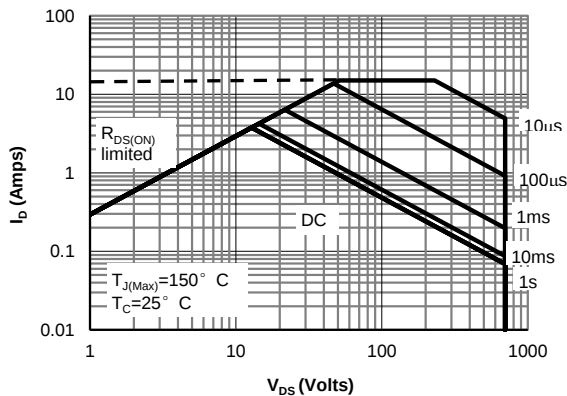


Figure 11: Maximum Forward Biased Safe Operating Area for AOD(I)1R4A70Z (Note F)

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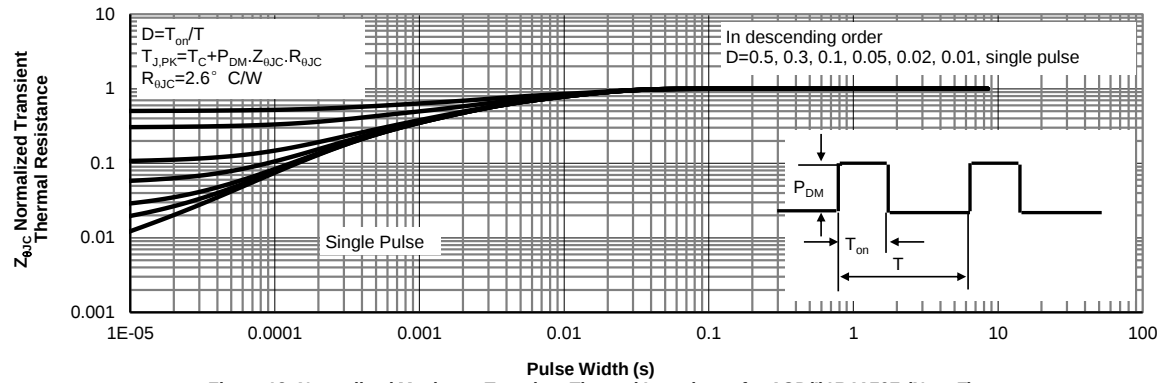
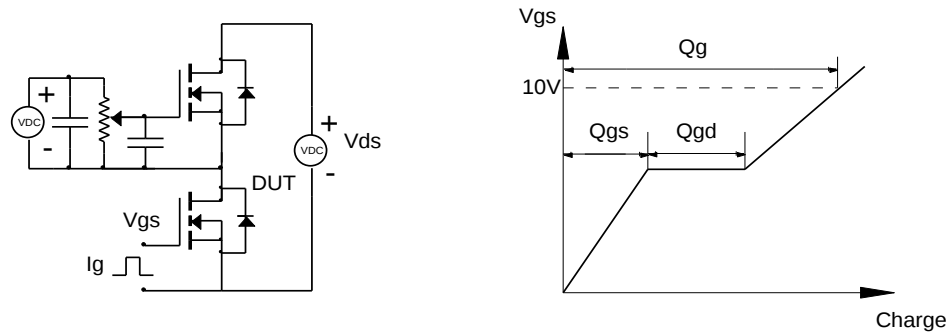
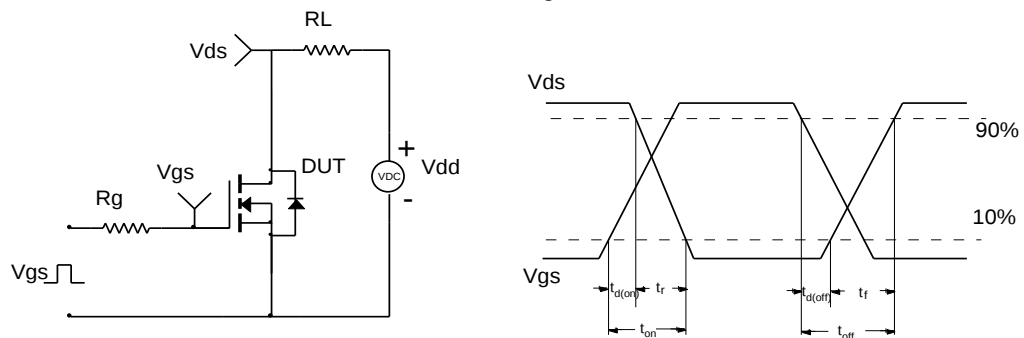


Figure 12: Normalized Maximum Transient Thermal Impedance for AOD(I)1R4A70Z (Note F)

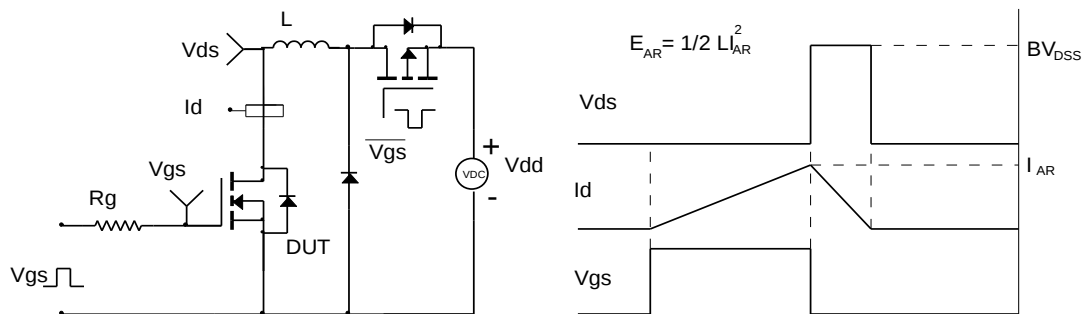
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

