ALPHA & OMEGA
SEMICONDUCTOR

AOD4504

200V N-Channel MOSFET

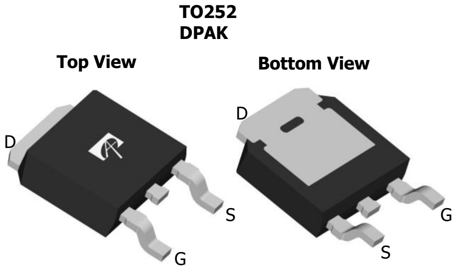
General Description

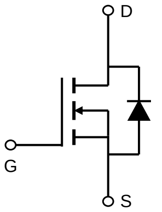
The AOD4504 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$.This device is ideal for boost converters and synchronous rectifiers for consumer, telecom, industrial power supplies and LED backlighting.

Product Summary

V_{DS}	200V
I_D (at V_{GS}=10V)	6A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 400mΩ

100% UIS Tested
100% R_g Tested





Absolute Maximum Ratings T_A=25°C unless otherwise noted				
Parameter		**Symbol**	**Maximum**	**Units**
Drain-Source Voltage		V_{DS}	200	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_C=25°C	I_D	6	A
	T_C=100°C		4.5	
Pulsed Drain Current [C]		I_{DM}	10	
Continuous Drain Current	T_A=25°C	I_{DSM}	1.5	A
	T_A=70°C		1	
Avalanche Current [C]		I_{AS}	3	A
Avalanche energy L=3.9mH [C]		E_{AS}	18	mJ
Power Dissipation [B]	T_C=25°C	P_D	42.5	W
	T_C=100°C		21	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.5	W
	T_A=70°C		1.6	
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]	t ≤ 10s	$R_{\theta JA}$	15	20	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		41	50	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	2.9	3.5	°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		200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=200V, V_{GS}=0V				1	µA
			T_J=55°C			5	
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		1.7	2.8	3.7	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V		10			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=3A			333	400	mΩ
			T_J=125°C		666	800	
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=3A			7		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V			0.75	1	V
I_S	Maximum Body-Diode Continuous Current					6	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz			328		pF
C_{oss}	Output Capacitance				20.5		pF
C_{rss}	Reverse Transfer Capacitance				8		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1	2	3	Ω
SWITCHING PARAMETERS							
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=100V, I_D=3A			82	115	nC
Q_g(4.5V)	Total Gate Charge				44	53	nC
Q_{gs}	Gate Source Charge				16		nC
Q_{gd}	Gate Drain Charge				30		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=100V, R_L=33.3Ω, R_{GEN}=3Ω			6		ns
t_r	Turn-On Rise Time				3.5		ns
$t_{D(off)}$	Turn-Off DelayTime				18		ns
t_f	Turn-Off Fall Time				3		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=3A, dI/dt=500A/µs			35		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=3A, dI/dt=500A/µs			150		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The Power dissipation P_{DSM} is based on $R_{\theta JA}$ 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. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=175° C. Ratings are based on low frequency and duty cycles to keep initial T_J =25° C.

D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ 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 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

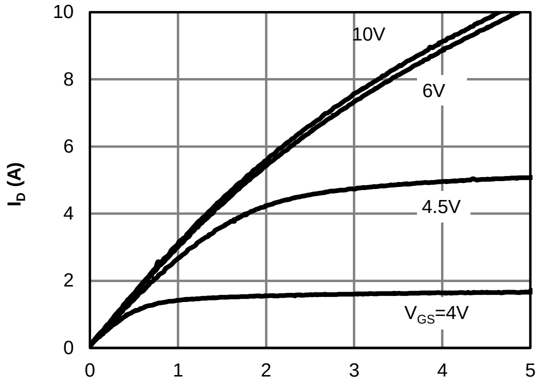


Fig 1: On-Region Characteristics (Note E)

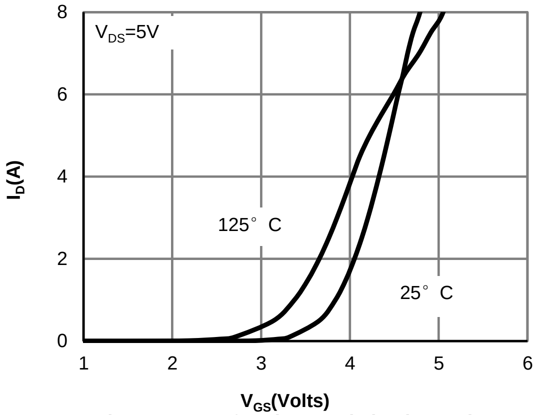


Figure 2: Transfer Characteristics (Note E)

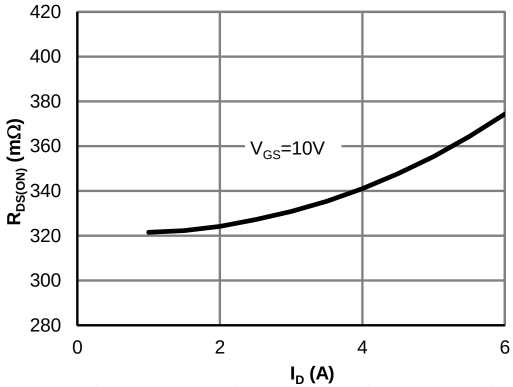


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

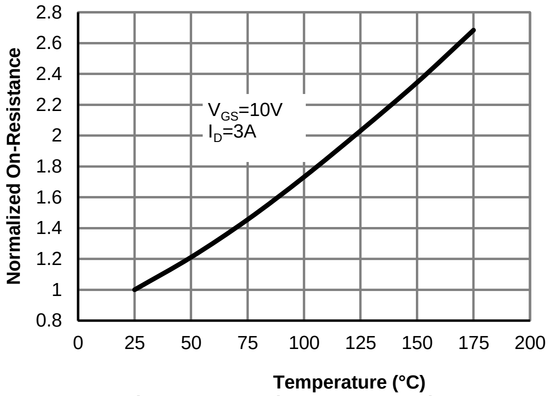


Figure 4: On-Resistance vs. Junction Temperature (Note E)

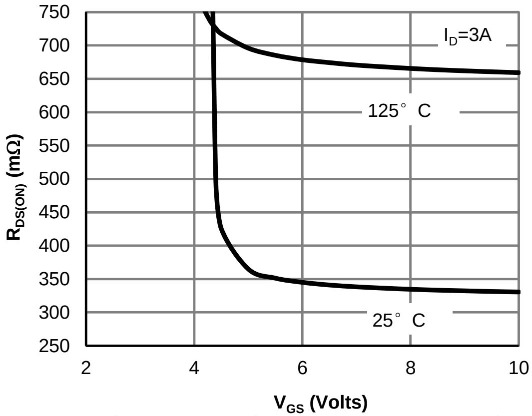


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

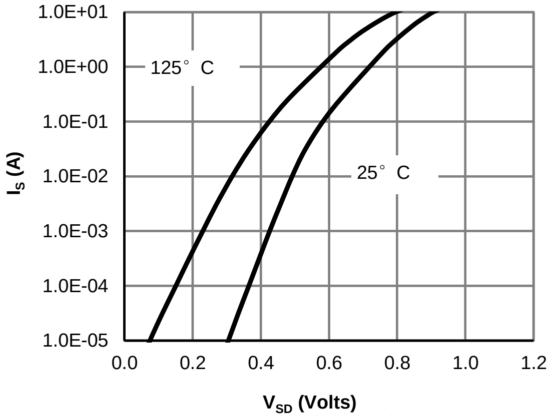


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

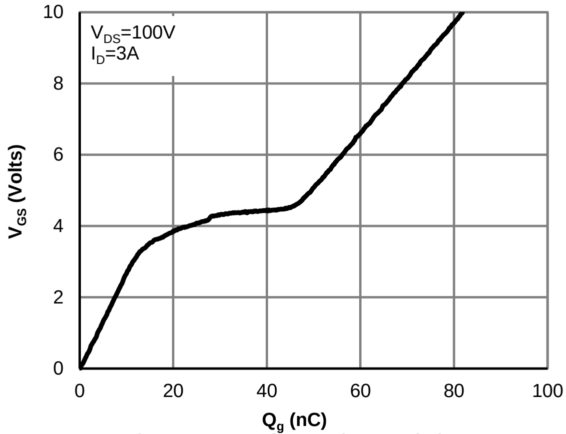


Figure 7: Gate-Charge Characteristics

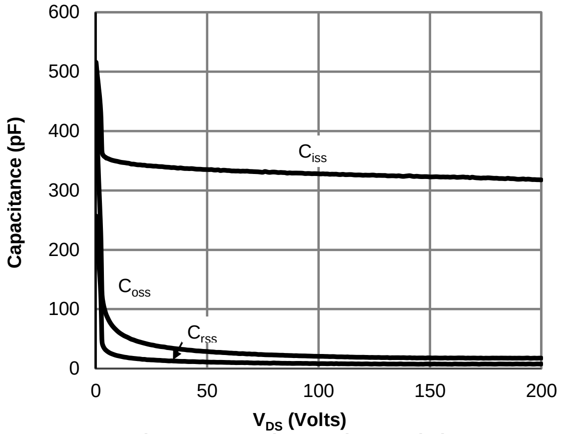


Figure 8: Capacitance Characteristics

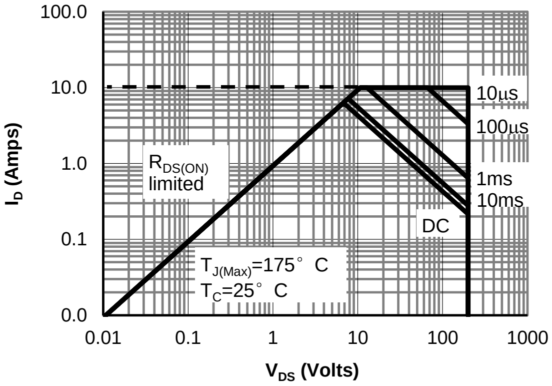


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

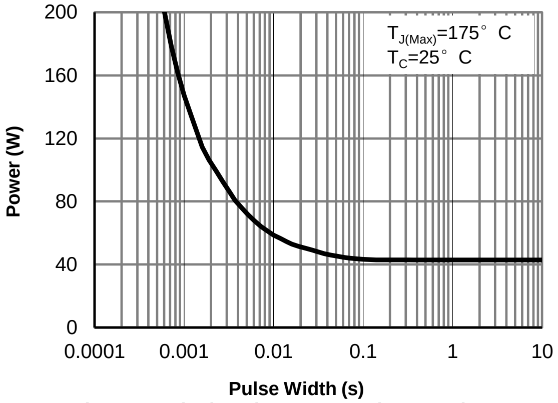


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

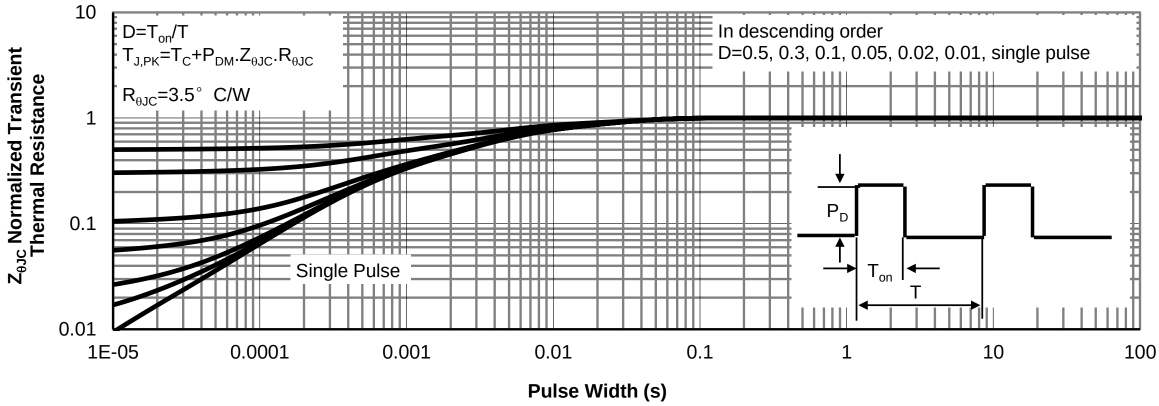


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

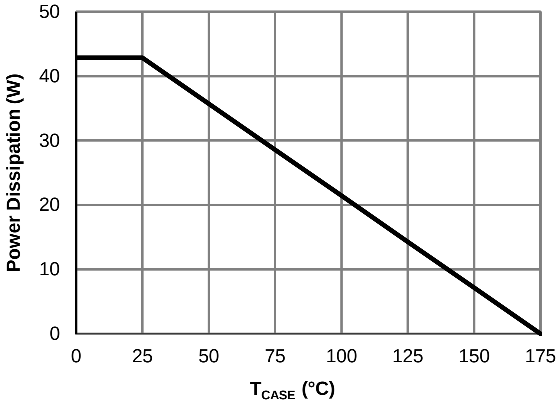


Figure 12: Power De-rating (Note F)

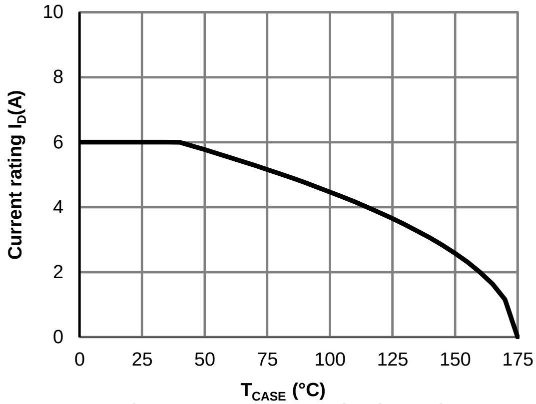


Figure 13: Current De-rating (Note F)

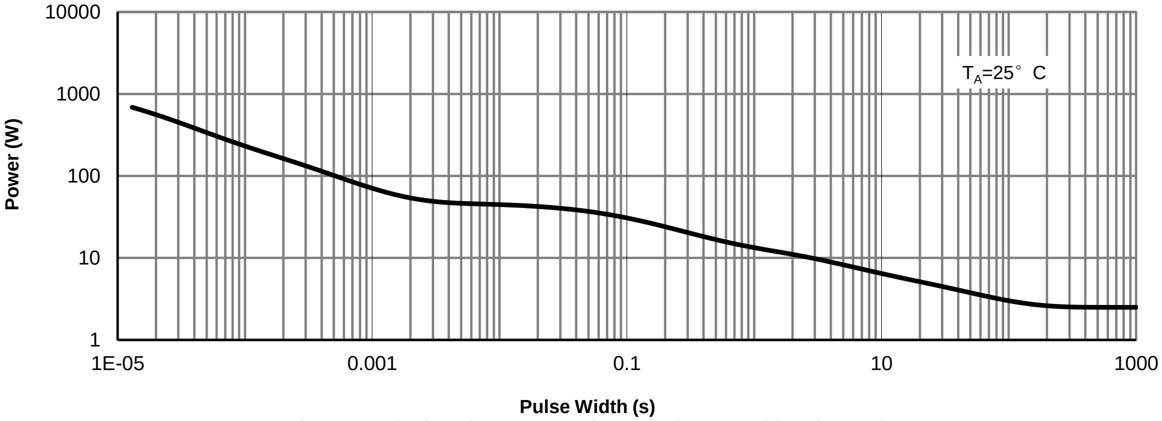


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

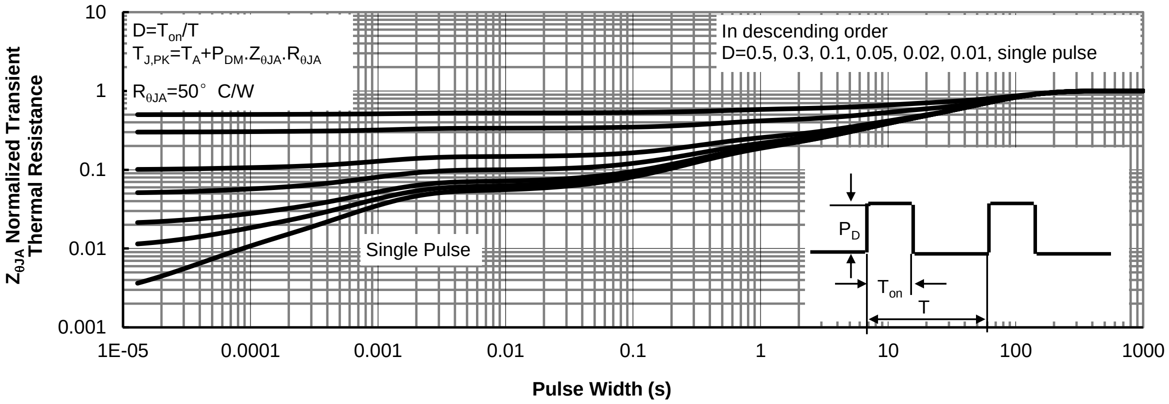
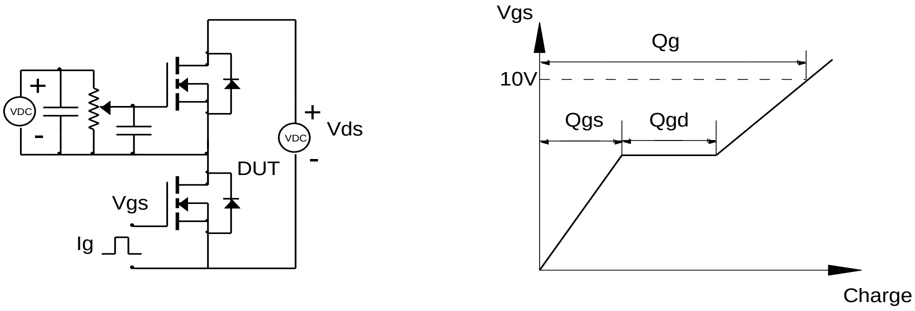
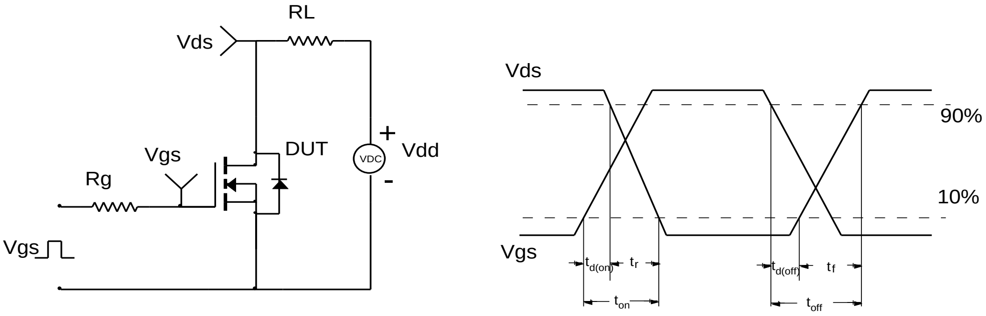


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

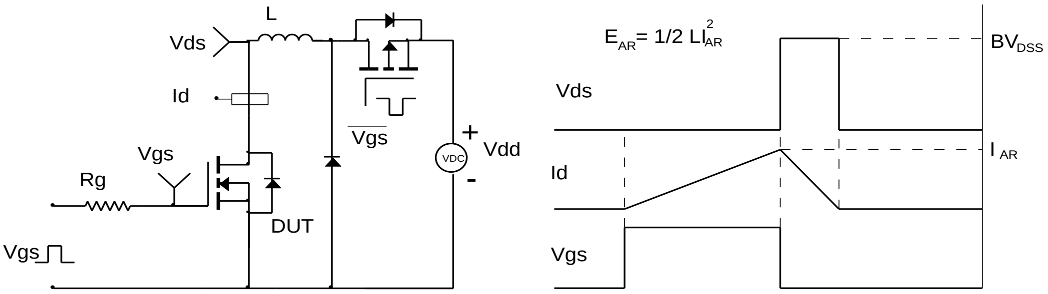
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms