



ALPHA & OMEGA
SEMICONDUCTOR



AOT5N50/AOTF5N50

500V, 5A N-Channel MOSFET

General Description

The AOT5N50 & AOTF5N50 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications. By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

Features

V_{DS} (V) = 600V @ 150°C

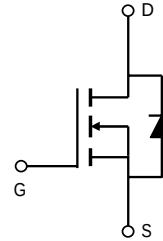
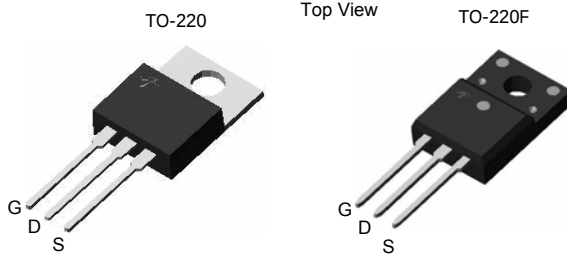
I_D = 5A

$R_{DS(on)} < 1.5\Omega$

($V_{GS} = 10V$)

100% UIS Tested!

100% R_g Tested!



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

Parameter	Symbol	AOT5N50	AOTF5N50	Units
Drain-Source Voltage	V_{DS}	500		V
Gate-Source Voltage	V_{GS}	± 30		V
Continuous Drain Current	I_D	5	5*	A
$T_C=25^\circ\text{C}$				
Current	$T_C=100^\circ\text{C}$	3.3	3.3*	
Pulsed Drain Current ^C	I_{DM}	18		
Avalanche Current ^{C, G}	I_{AR}	2.6		A
Repetitive avalanche energy ^{C, G}	E_{AR}	101		mJ
Single pulsed avalanche energy ^G	E_{AS}	203		mJ
Peak diode recovery dv/dt	dv/dt	5		V/ns
Power Dissipation ^B	P_D	104	35	W
		0.83	0.28	W/°C
$T_C=25^\circ\text{C}$				
Derate above 25°C				
Junction and Storage Temperature Range	T_J, T_{STG}	-50 to 150		°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300		°C

Thermal Characteristics

Parameter	Symbol	AOT5N50	AOTF5N50	Units
Maximum Junction-to-Ambient ^{A, D}	$R_{\theta JA}$	65	65	°C/W
Maximum Case-to-Sink ^A	$R_{\theta CS}$	0.5	--	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	1.2	3.6	°C/W

* Drain current limited by maximum junction temperature.

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	500			V
		I _D =250μA, V _{GS} =0V, T _J =150°C		600		V
BV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D =250μA, V _{GS} =0V		0.55		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =500V, V _{GS} =0V			1	μA
		V _{DS} =400V, T _J =125°C			10	
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±30V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	3.5	4.1	4.7	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =2.5A		1.1	1.5	Ω
g _{FS}	Forward Transconductance	V _{DS} =40V, I _D =2.5A		6		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.75	1	V
I _S	Maximum Body-Diode Continuous Current				5	A
I _{SM}	Maximum Body-Diode Pulsed Current				18	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =25V, f=1MHz	414	517	620	pF
C _{oss}	Output Capacitance		46	57	68	pF
C _{rss}	Reverse Transfer Capacitance		3.9	4.9	5.9	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	1.9	3.8	5.7	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =400V, I _D =5A		15.5	19.0	nC
Q _{gs}	Gate Source Charge			3.4	4.0	nC
Q _{gd}	Gate Drain Charge			7.2	8.6	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =250V, I _D =5A, R _G =25Ω		14.5	17.4	ns
t _r	Turn-On Rise Time			29	35.0	ns
t _{D(off)}	Turn-Off DelayTime			34.5	41.4	ns
t _f	Turn-Off Fall Time			24	29.0	ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =5A, dI/dt=100A/μs, V _{DS} =100V		166	199	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =5A, dI/dt=100A/μs, V _{DS} =100V		1.37	1.6	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 <300 μs 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. The SOA curve provides a single pulse rating.

G. L=60mH, I_{AS}=2.6A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

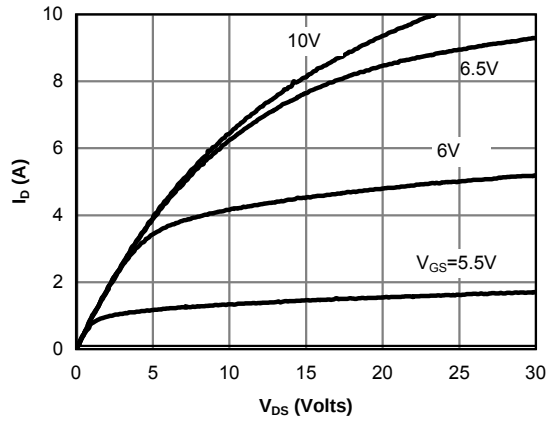


Fig 1: On-Region Characteristics

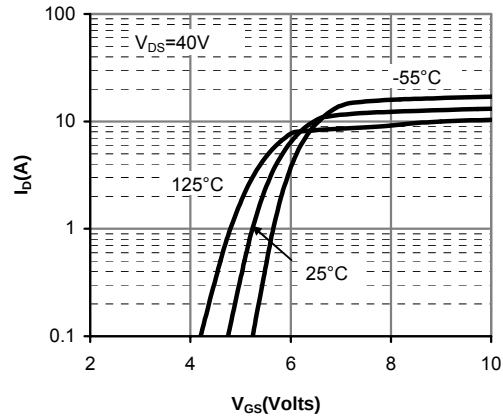


Figure 2: Transfer Characteristics

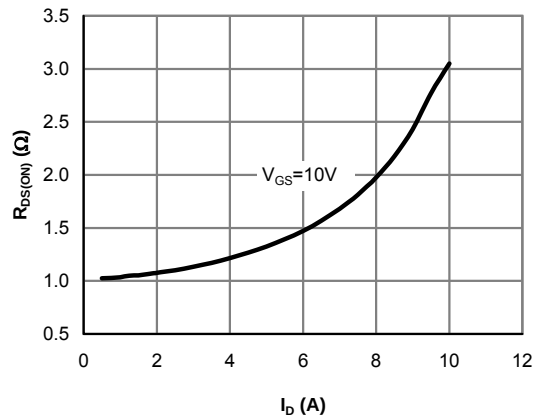


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

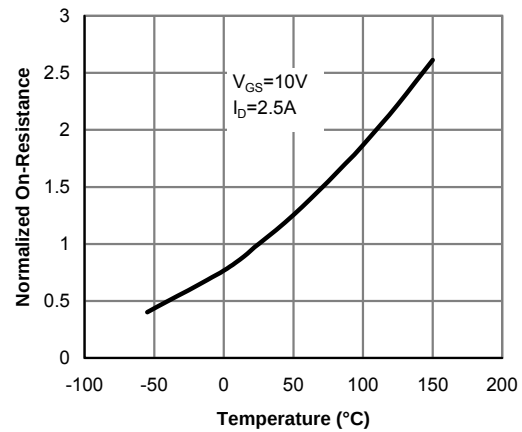


Figure 4: On-Resistance vs. Junction Temperature

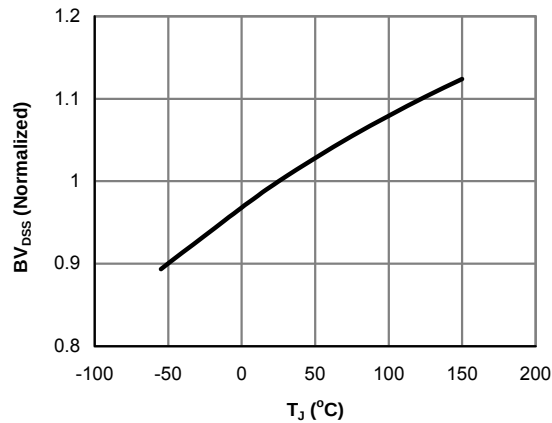


Figure 5: Break Down vs. Junction Temperature

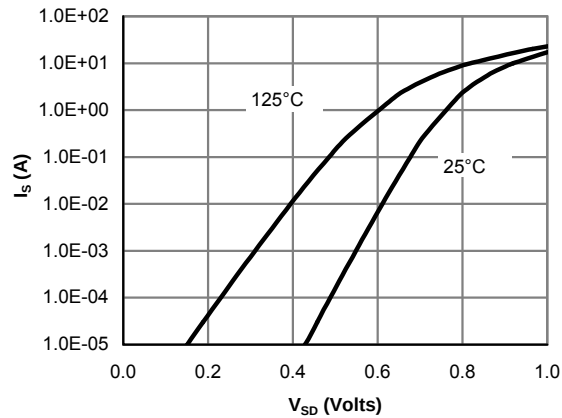


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

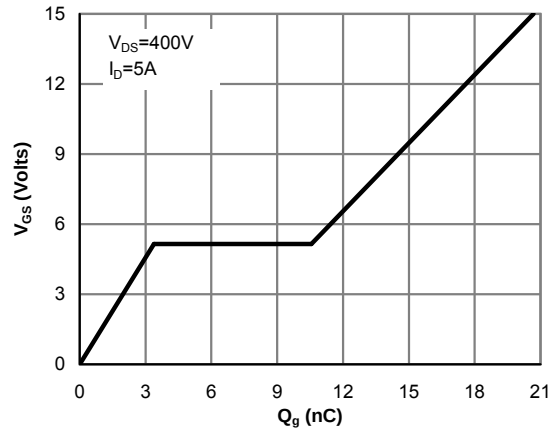


Figure 7: Gate-Charge Characteristics

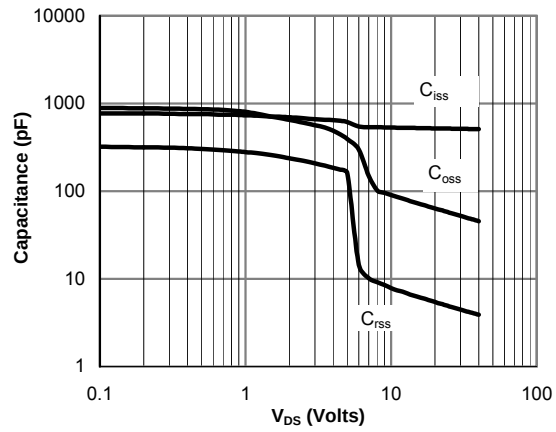


Figure 8: Capacitance Characteristics

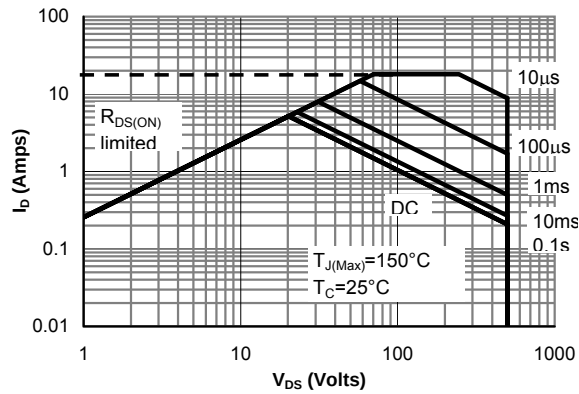


Figure 9: Maximum Forward Biased Safe Operating Area for AOT5N50 (Note F)

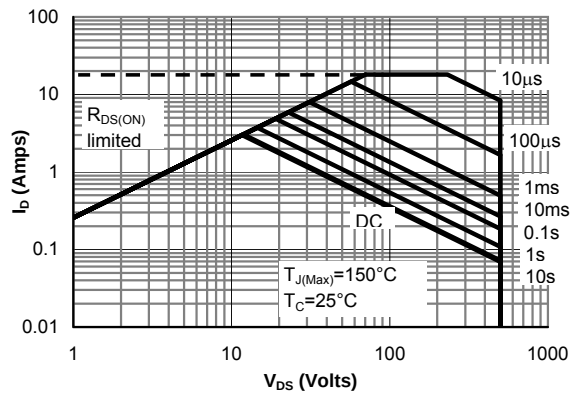


Figure 10: Maximum Forward Biased Safe Operating Area for AOTF5N50 (Note F)

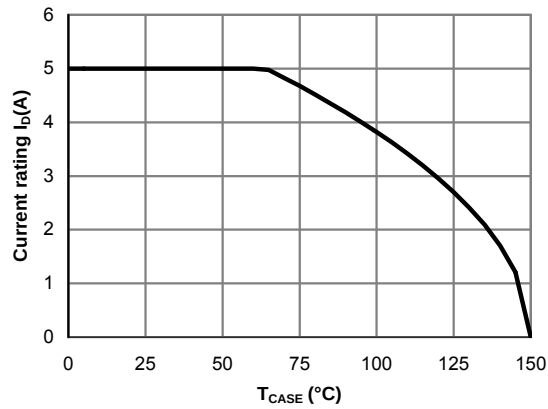


Figure 11: Current De-rating (Note B)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

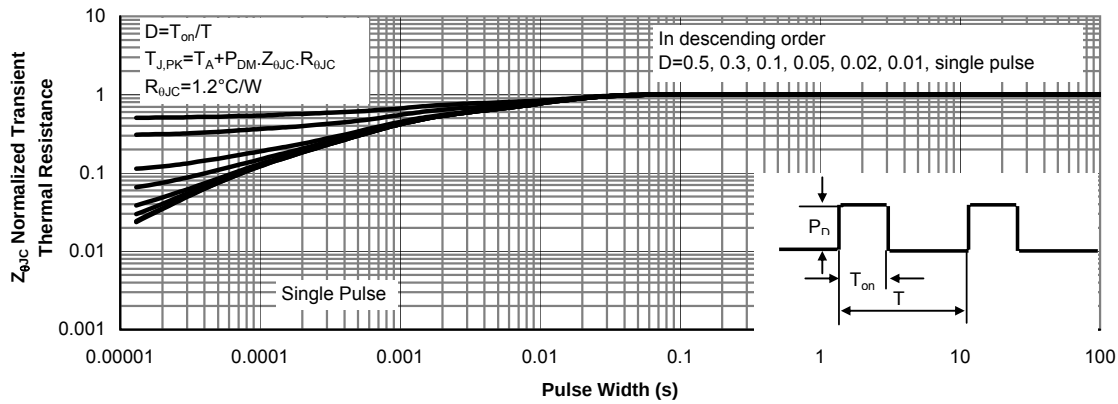


Figure 12: Normalized Maximum Transient Thermal Impedance for AOT5N50 (Note F)

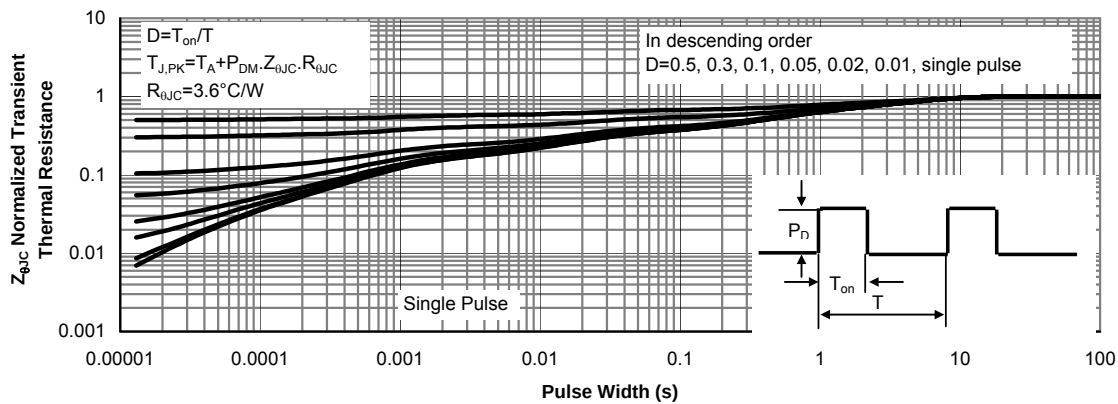
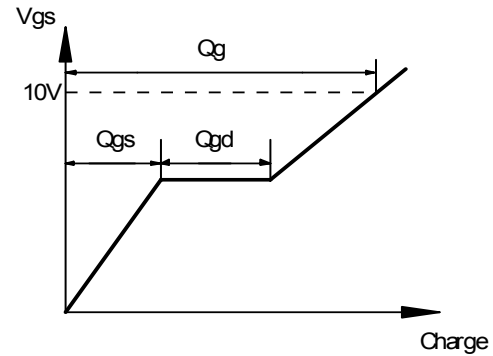
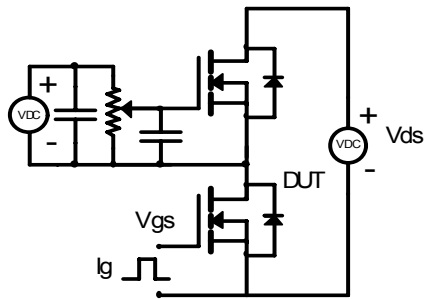
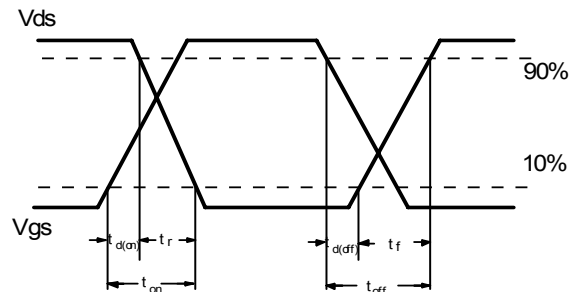
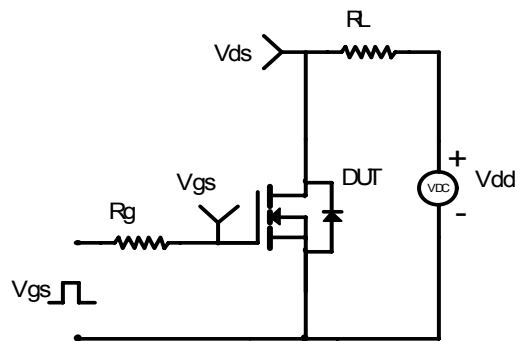


Figure 13: Normalized Maximum Transient Thermal Impedance for AOTF5N50 (Note F)

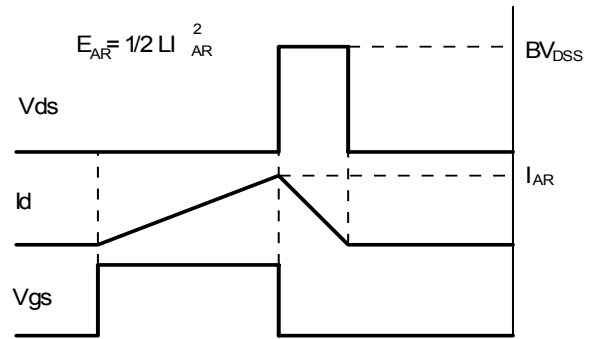
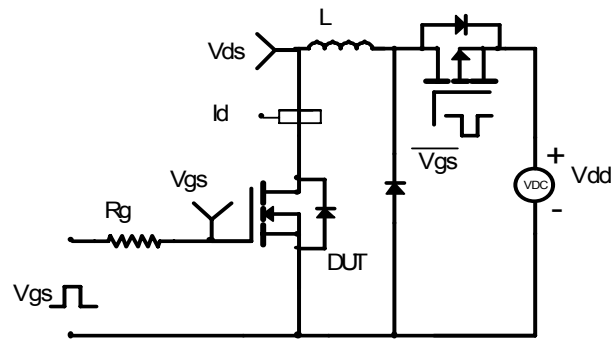
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

