

AOTF12T50P

500V, 12A N-Channel MOSFET

General Description

- Latest Trench Power AlphaMOS-II technology
- Low $R_{DS(ON)}$
- Low C_{iss} and C_{rss}
- High Current Capability
- RoHS and Halogen Free Compliant

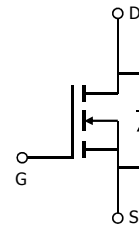
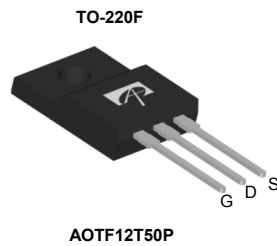
Applications

- General Lighting for LED and CCFL
- AC/DC Power supplies for Industrial, Consumer, and Telecom

Product Summary

$V_{DS} @ T_{j,max}$	600V
I_{DM}	48A
$R_{DS(ON),max}$	< 0.5 Ω
$Q_{g,typ}$	22nC
$E_{oss} @ 400V$	4 μ J

100% UIS Tested
 100% R_g Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOTF12T50P	TO-220F Pb Free	Tube	1000
AOTF12T50PL	TO-220F Green	Tube	1000

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

Parameter	Symbol	AOTF12T50P	AOTF12T50PL	Units	
Drain-Source Voltage	V_{DS}	500		V	
Gate-Source Voltage	V_{GS}	± 30		V	
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	12*	A	
		$T_C=100^\circ\text{C}$	8*		
Pulsed Drain Current ^C	I_{DM}	48			
Avalanche Current ^C $L=1\text{mH}$	I_{AR}	12		A	
Repetitive avalanche energy ^C	E_{AR}	72		mJ	
Single pulsed avalanche energy ^G	E_{AS}	480		mJ	
MOSFET dv/dt ruggedness		50		V/ns	
Peak diode recovery dv/dt	dv/dt	5			
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	43	33	W
		Derate above 25°C	0.3	0.26	
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	AOTF12T50P	AOTF12T50PL	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	65	65	$^\circ\text{C}/\text{W}$
Maximum Junction-to-Case	$R_{\theta JC}$	2.9	3.8	$^\circ\text{C}/\text{W}$

* 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		
BV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D =250μA, V _{GS} =0V		0.47		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} =5V, I _D =250μA	3	4	5	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =6A		0.39	0.5	Ω
g _{FS}	Forward Transconductance	V _{DS} =40V, I _D =6A		10		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.74	1	V
I _S	Maximum Body-Diode Continuous Current				12	A
I _{SM}	Maximum Body-Diode Pulsed Current ^C				48	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		1477		pF
C _{oss}	Output Capacitance				63	
C _{o(er)}	Effective output capacitance, energy related ^H	V _{GS} =0V, V _{DS} =0 to 400V, f=1MHz		50		pF
C _{o(tr)}	Effective output capacitance, time related ^I				90	
C _{rss}	Reverse Transfer Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		6.3		pF
R _g	Gate resistance	f=1MHz		2		Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =400V, I _D =12A		22	32	nC
Q _{gs}	Gate Source Charge			8		nC
Q _{gd}	Gate Drain Charge			5.5		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =250V, I _D =12A, R _G =25Ω		37		ns
t _r	Turn-On Rise Time			54		ns
t _{D(off)}	Turn-Off DelayTime			46		ns
t _f	Turn-Off Fall Time			28		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =12A, dI/dt=100A/μs, V _{DS} =100V		428		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =12A, dI/dt=100A/μs, V _{DS} =100V		6.1		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 ms 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}=4A, V_{DD}=150V, R_G=25Ω, Starting T_J=25°C.

H. 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}.

I. 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

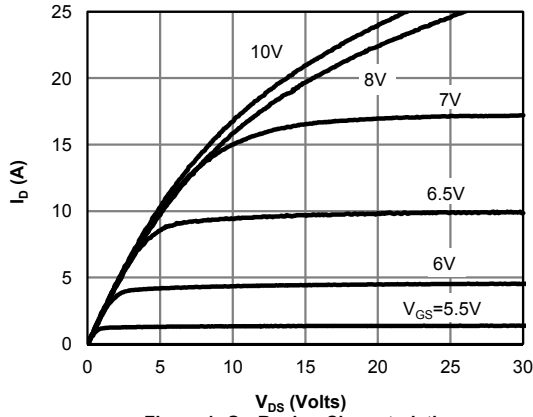


Figure 1: On-Region Characteristics

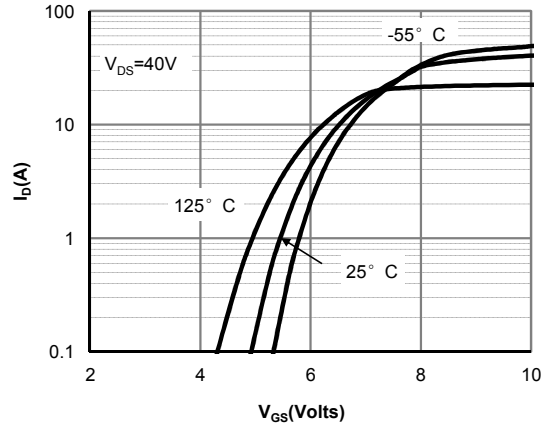


Figure 2: Transfer Characteristics

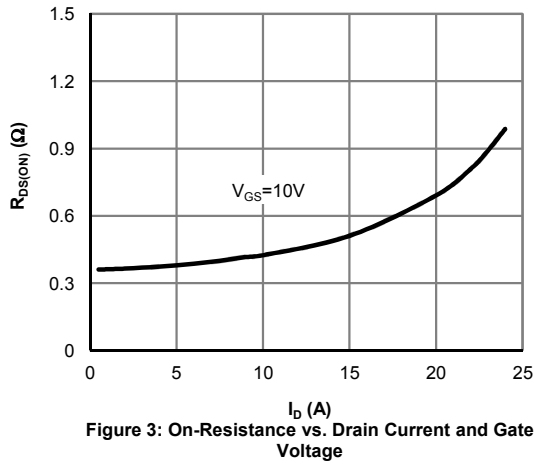


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

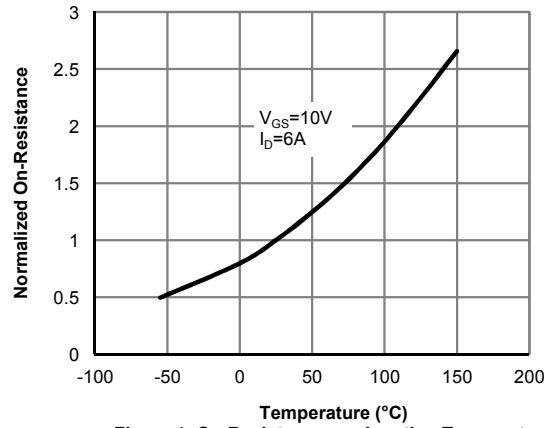


Figure 4: On-Resistance vs. Junction Temperature

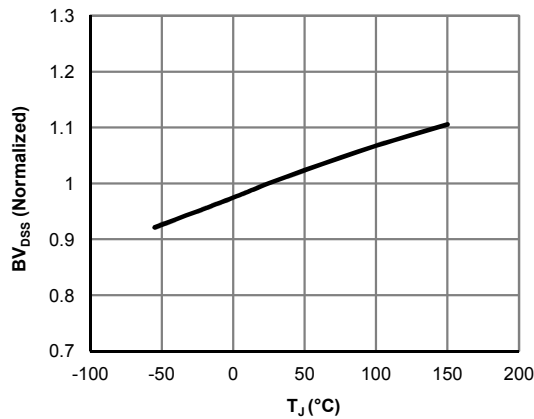


Figure 5: Break Down vs. Junction Temperature

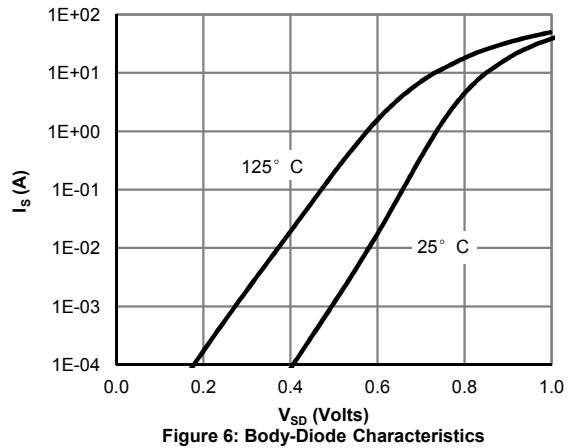


Figure 6: Body-Diode Characteristics

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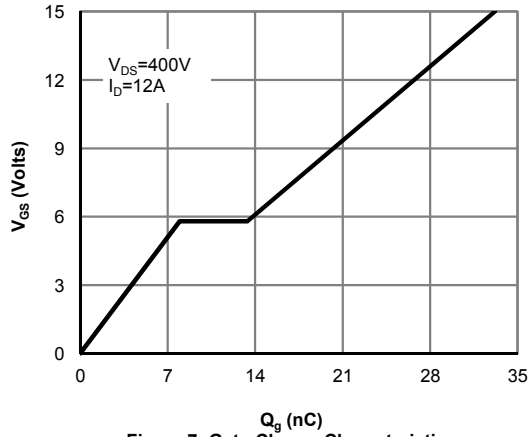


Figure 7: Gate-Charge Characteristics

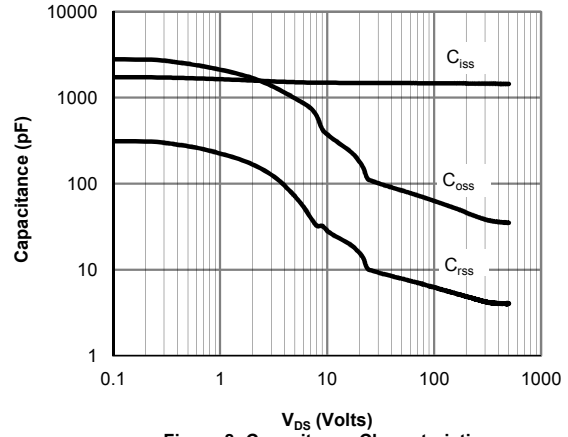


Figure 8: Capacitance Characteristics

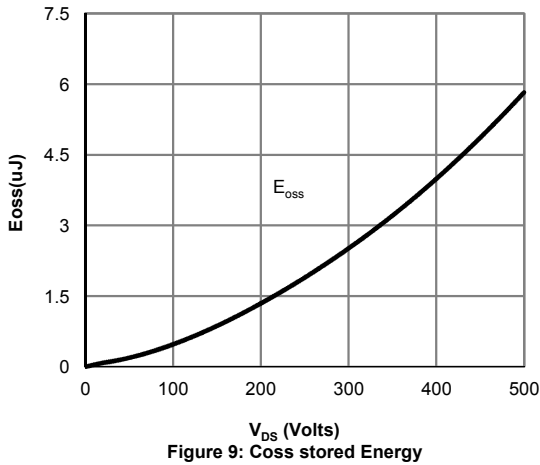


Figure 9: Coss stored Energy

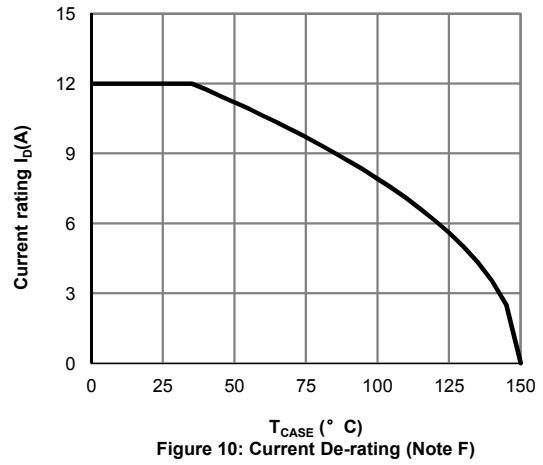


Figure 10: Current De-rating (Note F)

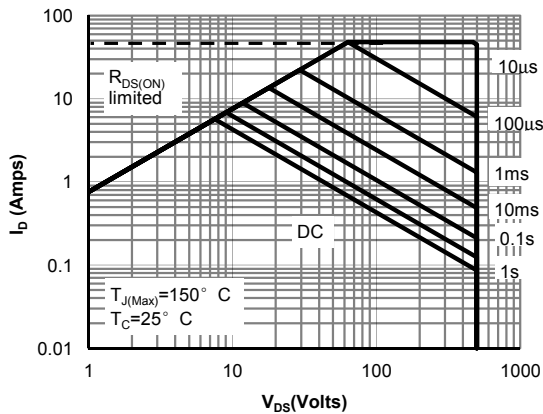


Figure 11: Maximum Forward Biased Safe Operating Area for TO-220F Pb Free (Note F)

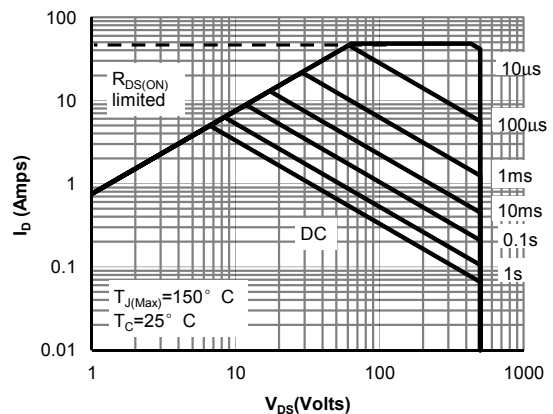


Figure 12: Maximum Forward Biased Safe Operating Area for TO-220F Green (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

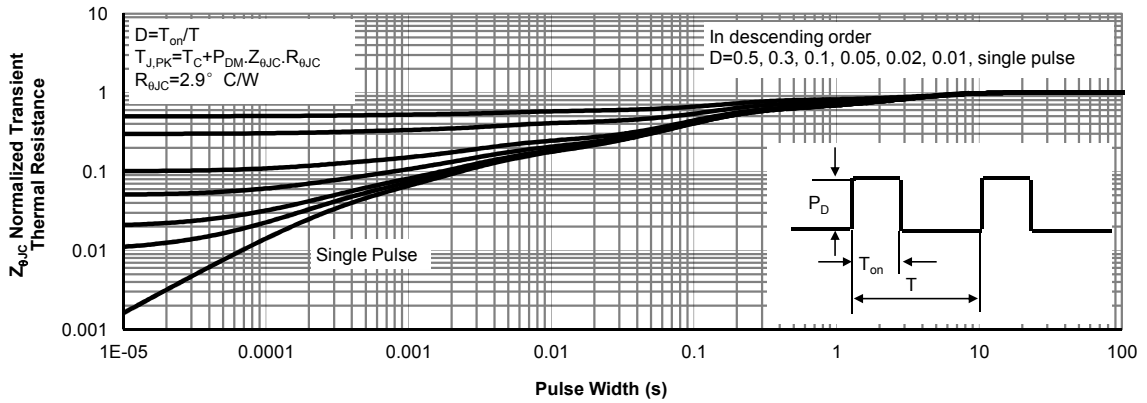


Figure 13: Normalized Maximum Transient Thermal Impedance for TO-220F Pb Free (Note F)

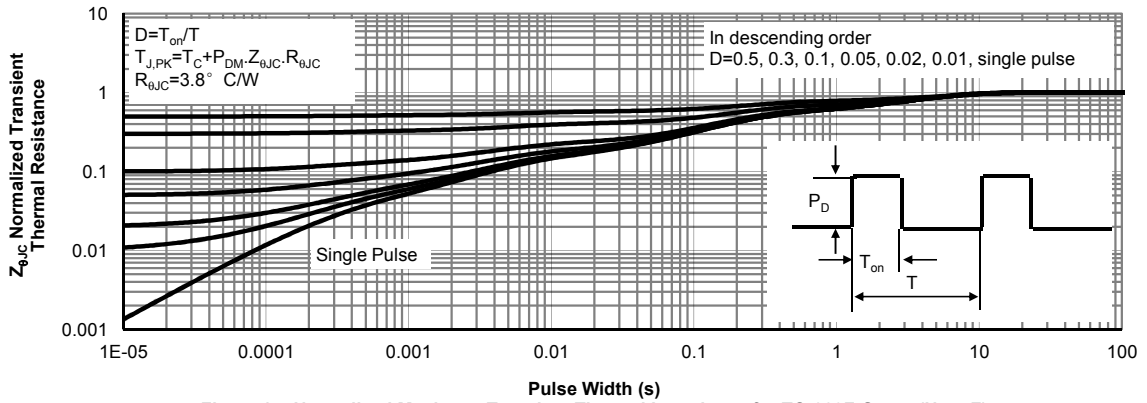
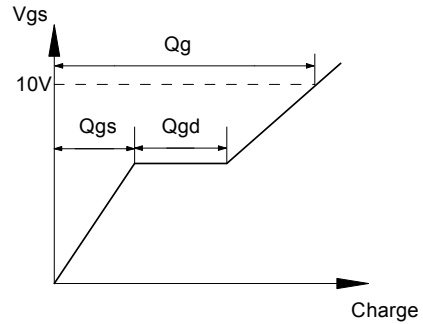
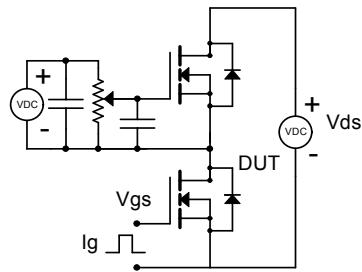
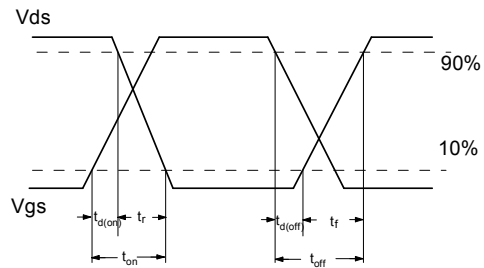
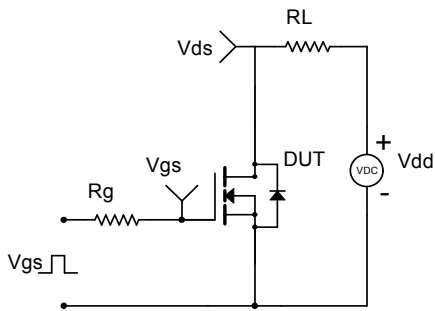


Figure 14: Normalized Maximum Transient Thermal Impedance for TO-220F Green (Note F)

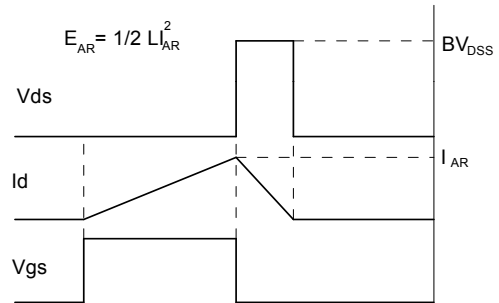
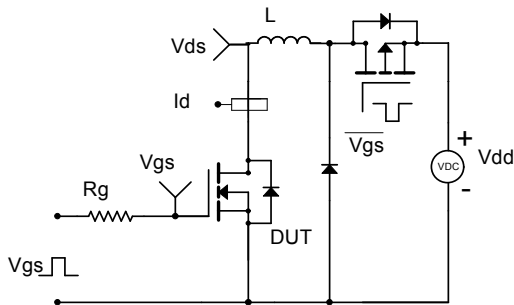
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

