

### 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

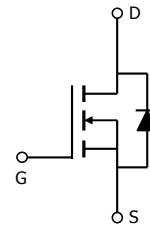
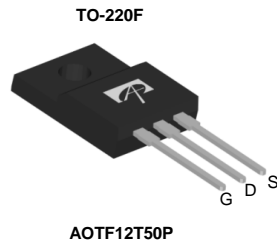
### Applications

- 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 $\Omega$
$Q_{g,typ}$	22nC
$E_{oss} @ 400V$	4 $\mu$ J

100% UIS Tested  
 100%  $R_g$  Tested



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

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

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

\* Drain current limited by maximum junction temperature.

**Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	500			V
		I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C		600		
BV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V		0.47		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V			1	μA
		V <sub>DS</sub> =400V, T <sub>J</sub> =125°C			10	
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =5V, I <sub>D</sub> =250μA	3	4	5	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =6A		0.39	0.5	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =40V, I <sub>D</sub> =6A		10		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.74	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				12	A
I <sub>SM</sub>	Maximum Body-Diode Pulsed Current <sup>C</sup>				48	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =100V, f=1MHz		1477		pF
C <sub>oss</sub>	Output Capacitance				63	
C <sub>o(er)</sub>	Effective output capacitance, energy related <sup>H</sup>	V <sub>GS</sub> =0V, V <sub>DS</sub> =0 to 400V, f=1MHz		50		pF
C <sub>o(tr)</sub>	Effective output capacitance, time related <sup>I</sup>				90	
C <sub>rss</sub>	Reverse Transfer Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =100V, f=1MHz		6.3		pF
R <sub>g</sub>	Gate resistance	f=1MHz		2		Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =400V, I <sub>D</sub> =12A		22	32	nC
Q <sub>gs</sub>	Gate Source Charge			8		nC
Q <sub>gd</sub>	Gate Drain Charge			5.5		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =250V, I <sub>D</sub> =12A, R <sub>G</sub> =25Ω		37		ns
t <sub>r</sub>	Turn-On Rise Time			54		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			46		ns
t <sub>f</sub>	Turn-Off Fall Time			28		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =12A, dI/dt=100A/μs, V <sub>DS</sub> =100V		428		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =12A, dI/dt=100A/μs, V <sub>DS</sub> =100V		6.1		μC

A. The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub>=25°C.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=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<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25°C.

D. The R<sub>qJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> 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<sub>J(MAX)</sub>=150°C. The SOA curve provides a single pulse rating.

G. L=60mH, I<sub>AS</sub>=4A, V<sub>DD</sub>=150V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C.

H. C<sub>o(er)</sub> is a fixed capacitance that gives the same stored energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>(BR)DSS</sub>.

I. C<sub>o(tr)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>(BR)DSS</sub>.

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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

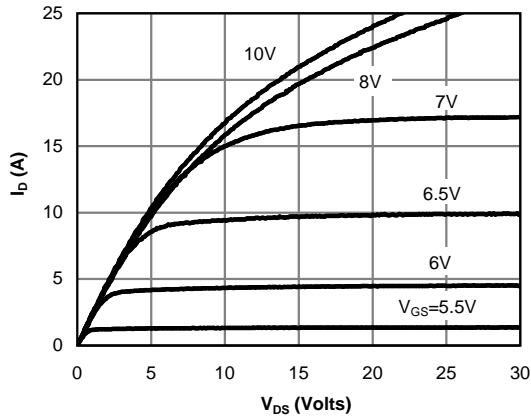


Figure 1: On-Region Characteristics

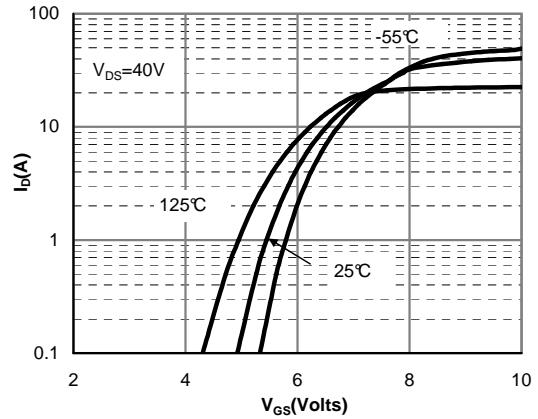


Figure 2: Transfer Characteristics

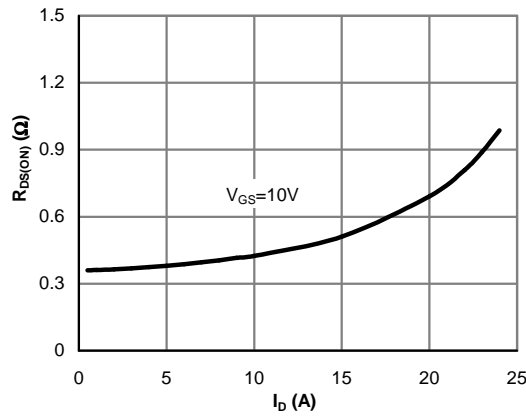


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

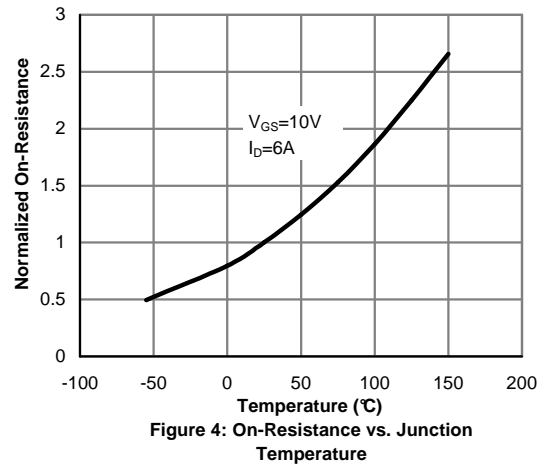


Figure 4: On-Resistance vs. Junction Temperature

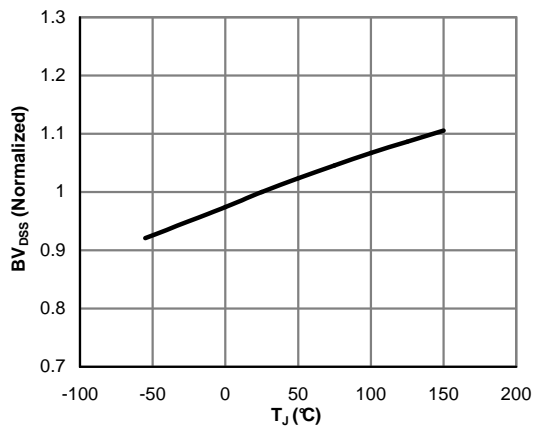


Figure 5: Break Down vs. Junction Temperature

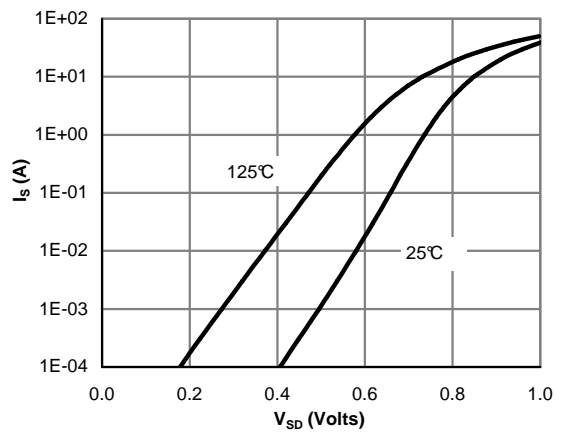


Figure 6: Body-Diode Characteristics

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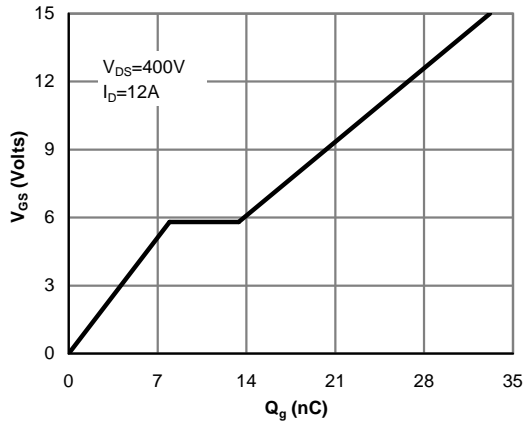


Figure 7: Gate-Charge Characteristics

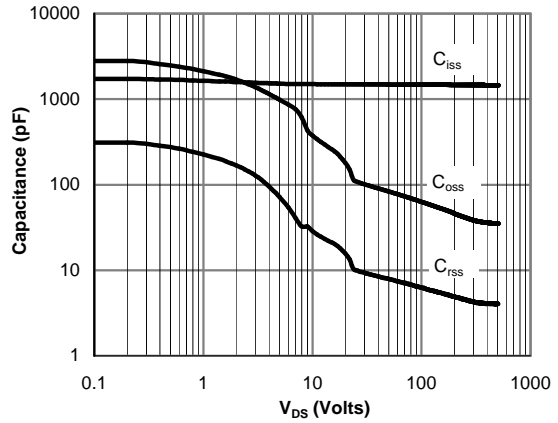


Figure 8: Capacitance Characteristics

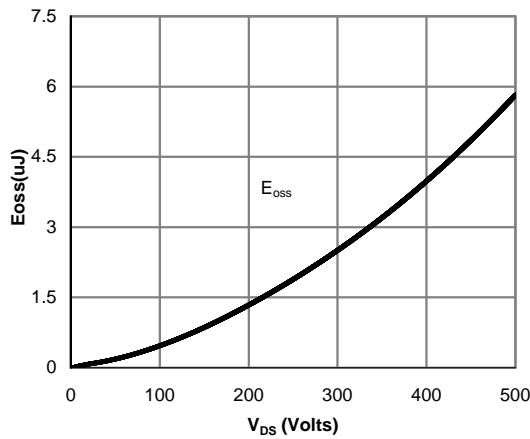


Figure 9: Coss stored Energy

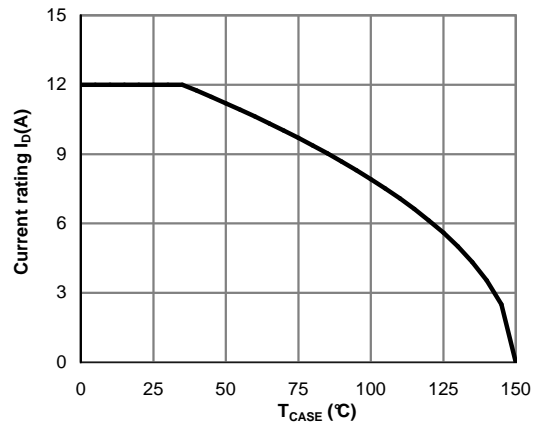


Figure 10: Current De-rating (Note F)

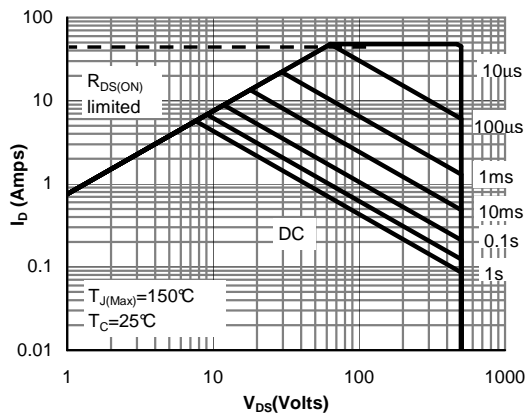


Figure 11: Maximum Forward Biased Safe Operating Area for TO-220F Pb Free (Note F)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

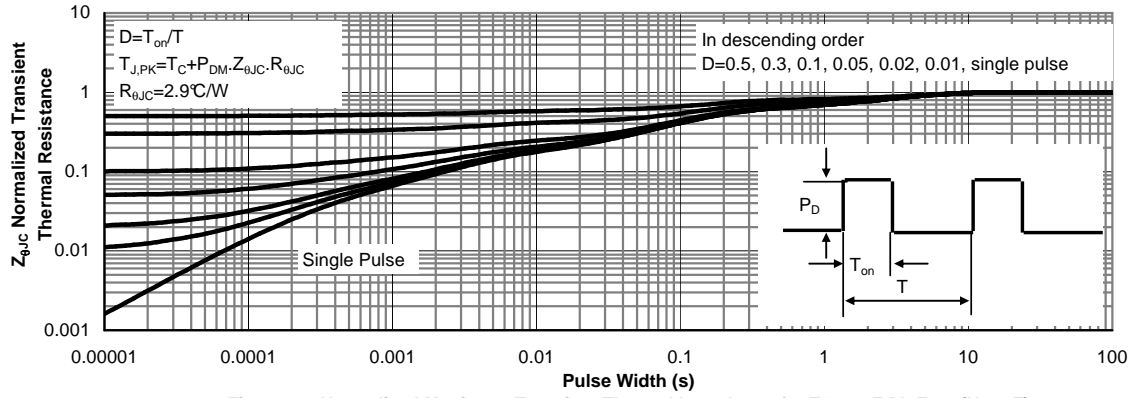
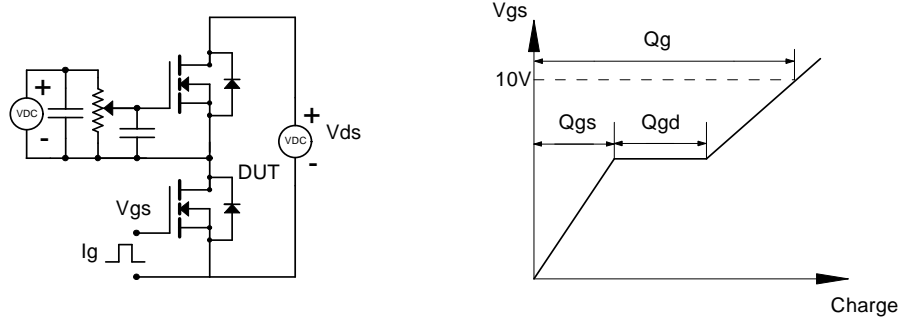
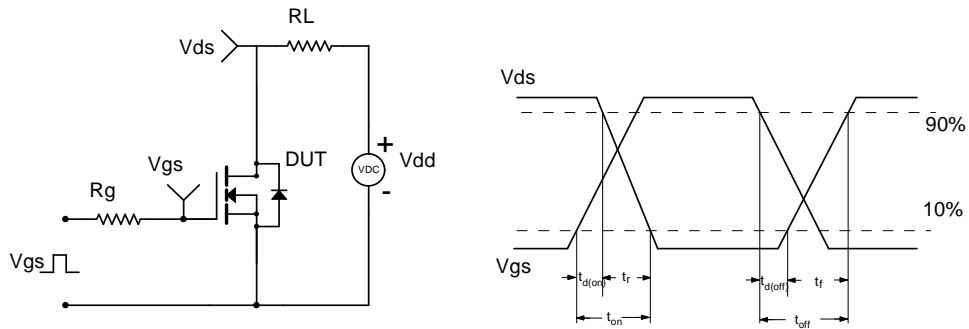


Figure 12: Normalized Maximum Transient Thermal Impedance for TO-220F Pb Free (Note F)

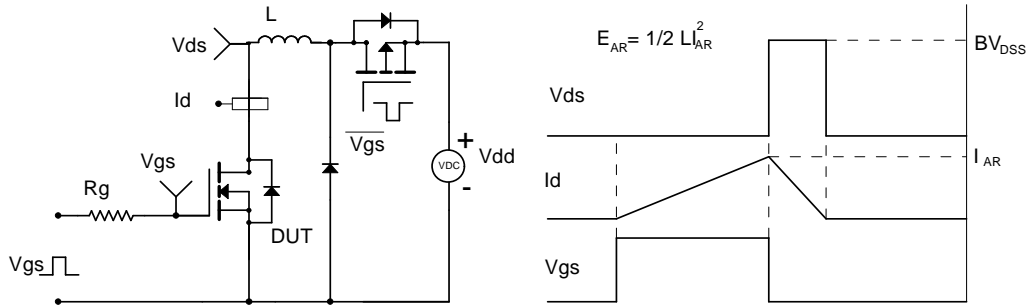
Gate Charge Test Circuit & Waveform



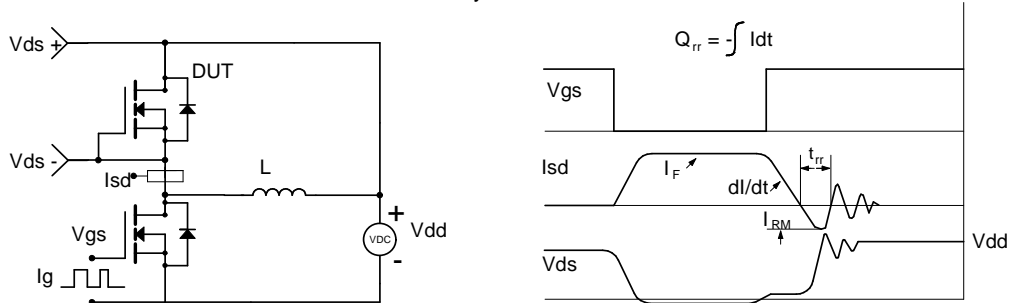
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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