ALPHA & OMEGA SEMICONDUCTOR 500V, 5A N-Channel MOSFET with Fast Recovery Diode										
General Description			Product Summary							
The AOTF5N50FD has 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 this part can be adopted quickly into new and existing offline power supply designs.			V_{DS} I _D (at V _{GS} =10V) R _{DS(ON)} (at V _{GS} =10V)	600V@150℃ 5A <1.8Ω						
			100% UIS Tested 100% R _g Tested	Green						
	pp View D-220F		G G S S							
	F5N50FD G			o s						
Absolute Maximum										
Absolute Maximum I Parameter	F5N50FD G ^D Ratings T _A =25°C unles	Symbol	AOTF5N50FD	Units						
Absolute Maximum I Parameter Drain-Source Voltage	F5N50FD G ^D Ratings T _A =25°C unles	Symbol V _{DS}	AOTF5N50FD 500	Units V						
Absolute Maximum I Parameter	F5N50FD G ^D Ratings T _A =25°C unles	Symbol	AOTF5N50FD 500 ±30	Units						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain	F5N50FD G^{D} Ratings $T_A=25^{\circ}C$ unles $T_C=25^{\circ}C$	Symbol V _{DS}	AOTF5N50FD 500 ±30 5*	Units V V						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current	F5N50FD G^{D} Ratings T_A=25°C unles $T_{c}=25^{\circ}C$ $T_{c}=100^{\circ}C$	Symbol V _{DS} V _{GS}	AOTF5N50FD 500 ±30 5* 3*	Units V						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current	F5N50FD G^{D} Ratings T_A=25°C unles $T_{c}=25^{\circ}C$ $T_{c}=100^{\circ}C$	Symbol V _{DS} V _{GS} I _D I _{DM}	AOTF5N50FD 500 ±30 5* 3* 13	Units V V A						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C	F5N50FD G^{D} Ratings T_A=25°C unles $T_c=25°C$ $T_c=100°C$	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR}	AOTF5N50FD 500 ±30 5* 3* 13 2.3	Units V V A A A						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche	F5N50FD G^{D} Ratings T_A=25°C unles $T_c=25°C$ $T_c=100°C$ c energy ^C	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR}	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79	Units V V A A M M J						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance	F5N50FD G^{D} Ratings T_A=25°C unles $T_{C}=25°C$ $T_{C}=100°C$ c energy ^C the energy ^G	Symbol V _{DS} V _{GS} 	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158	Units V V A A A MJ MJ MJ						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche	F5N50FD Ratings T_A=25°C unles $T_{C}=25°C$ $T_{C}=100°C$ c energy ^C the energy ^G dv/dt	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR}	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5	Units V V A A M A mJ mJ V/ns						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery o	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=100°C$	Symbol V _{DS} V _{GS} 	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5 35	Units V V V A A M M M J W/ns W						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ c energy ^C the energy ^G dv/dt $T_{c}=25°C$ Derate above 25°C	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR} E _{AS} dv/dt P _D	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5 35 0.3	Units V V V A A M M M M V/ns V/ns W W/ °C						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B Junction and Storage	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=25°C$ $T_{c}=25°C$ $T_{c}=25°C$ Derate above $25°C$ Temperature Range	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR} E _{AS} dv/dt	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5 35	Units V V V A A M M M M V/ns V/ns W						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=25°C$ $T_{c}=25°C$ $T_{c}=25°C$ Derate above 25°C Temperature Range rature for soldering	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR} E _{AS} dv/dt P _D	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5 35 0.3	Units V V V A A M M M M V/ns V/ns W W/ °C						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B Junction and Storage Maximum lead tempe	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=25°C$ $T_{c}=25°C$ $T_{c}=25°C$ Derate above 25°C Temperature Range rature for soldering se for 5 seconds	$\begin{tabular}{ c c c c } \hline Symbol & V_{DS} & V_{GS} & \\ \hline V_{GS} & & \\ \hline I_D & & \\ I_{DM} & & \\ I_{AR} & & \\ E_{AR} & & \\ E_{AS} & & \\ dv/dt & & \\ \hline P_D & & \\ T_J, T_{STG} & \\ T_L & & \\ \hline \end{tabular}$	AOTF5N50FD 500 ± 30 5^* 3^* 13 2.3 79 158 5 35 0.3 -55 to 150	Units V V A A MJ WJ V/ns W W/°C °C						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B Junction and Storage Maximum lead tempe purpose, 1/8" from car Thermal Characteris	Ratings T_A=25°C unles $T_{c}=25°C$ $T_{c}=100°C$ $T_{c}=100°C$ $T_{c}=25°C$ $T_{c}=25°C$ $T_{c}=25°C$ Derate above 25°C Temperature Range rature for soldering se for 5 seconds tics rameter	Symbol V _{DS} V _{GS} I _D I _{DM} I _{AR} E _{AR} E _{AS} dv/dt P _D T _J , T _{STG} T _L Symbol	AOTF5N50FD 500 ± 30 5^* 3^* 13 2.3 79 158 5 35 0.3 -55 to 150	Units V V A A MJ W/ns W/oC °C C Units						
Absolute Maximum I Parameter Drain-Source Voltage Gate-Source Voltage Continuous Drain Current Pulsed Drain Current Avalanche Current ^C Repetitive avalanche Single pulsed avalance Peak diode recovery of Power Dissipation ^B Junction and Storage Maximum lead tempe purpose, 1/8" from car Thermal Characteris	Ratings T_A=25°C unles $T_{C}=25°C$ $T_{C}=100°C$ C $T_{C}=100°C$ $T_{C}=25°C$ $T_{C}=25°C$ Derate above 25°C Temperature Range rature for soldering se for 5 seconds tics rameter -Ambient ^{A,D}	$\begin{tabular}{ c c c c } \hline Symbol & V_{DS} & V_{GS} & \\ \hline V_{GS} & & \\ \hline I_D & & \\ I_{DM} & & \\ I_{AR} & & \\ E_{AR} & & \\ E_{AS} & & \\ dv/dt & & \\ \hline P_D & & \\ T_J, T_{STG} & \\ T_L & & \\ \hline \end{tabular}$	AOTF5N50FD 500 ±30 5* 3* 13 2.3 79 158 5 35 0.3 -55 to 150 300	Units V V A A MJ W/ns W W/°C °C						

* Drain current limited by maximum junction temperature.



Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Тур	Max	Units
STATIC I	PARAMETERS					
BV _{DSS}	Drain-Source Breakdown Voltage	$I_D=10mA$, $V_{GS}=0V$, $T_J=25^{\circ}C$	500			
		$I_{D}=10mA, V_{GS}=0V, T_{J}=150^{\circ}C$		600		V
BV _{DSS} /∆TJ	Breakdown Voltage Temperature Coefficient	I _D =10mA, V _{GS} =0V		0.56		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=500V, V_{GS}=0V$			10	μA
		V _{DS} =400V, T _J =125°C			100	
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±30V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =5V, Ι _D =250μΑ	2.5	3.5	4.2	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =2.5A		1.5	1.8	Ω
g fs	Forward Transconductance	V_{DS} =40V, I_{D} =2.5A		4		S
V _{SD}	Diode Forward Voltage	$I_S=5A, V_{GS}=0V$		0.93	1.6	V
I _S	Maximum Body-Diode Continuous Current				5	Α
I _{SM}	Maximum Body-Diode Pulsed Current				13	Α
DYNAMI	C PARAMETERS					
C _{iss}	Input Capacitance		350	440	530	pF
C _{oss}	Output Capacitance	V _{GS} =0V, V _{DS} =25V, f=1MHz	35	50	65	pF
C _{rss}	Reverse Transfer Capacitance		2.5	4.5	6.5	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	1.7	3.4	5.2	Ω
SWITCH	ING PARAMETERS					
Qg	Total Gate Charge	V _{GS} =10V, V _{DS} =400V, I _D =5A	8	11	15	nC
Q _{gs}	Gate Source Charge			2.7		nC
Q _{gd}	Gate Drain Charge			3.8		nC
t _{D(on)}	Turn-On DelayTime			18		ns
t _r	Turn-On Rise Time	V_{GS} =10V, V_{DS} =250V, I_{D} =5A,		33		ns
t _{D(off)}	Turn-Off DelayTime	$R_{G}=25\Omega$		31		ns
t _f	Turn-Off Fall Time	7		26		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =5A,dI/dt=100A/µs,V _{DS} =100V		87	145	ns
Q _{rr}	Body Diode Reverse Recovery Charge	e I _F =5A,dl/dt=100A/μs,V _{DS} =100V		0.2	0.4	μC

A. The value of R $_{\rm 0JA}$ is measured with the device in a still air environment with T $_{\rm A}$ =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 $T_{J(MAX)}=150^{\circ}$ C, Ratings are based on low frequency and duty cycles to keep initial $T_{J}=25^{\circ}$ C.

D. The R $_{\rm 0JA}$ is the sum of the thermal impedance from junction to case R $_{\rm 0JC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 μ s 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 heatsin k, assuming a maximum junction temperature of $T_{J(MAX)}$ =150° C. The SOA curve provides a single pulse rating.

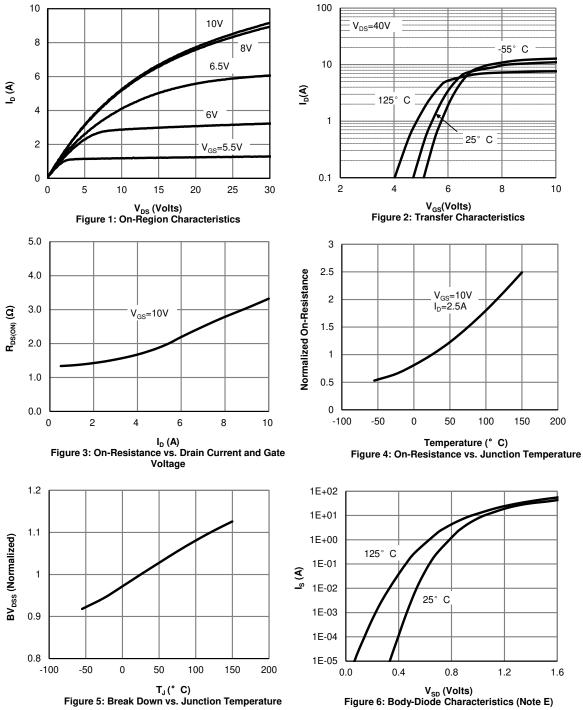
G. L=60mH, I_{AS}=2.3A, V_{DD}=150V, $R_G=25\Omega$, Starting T_J=25° C

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS





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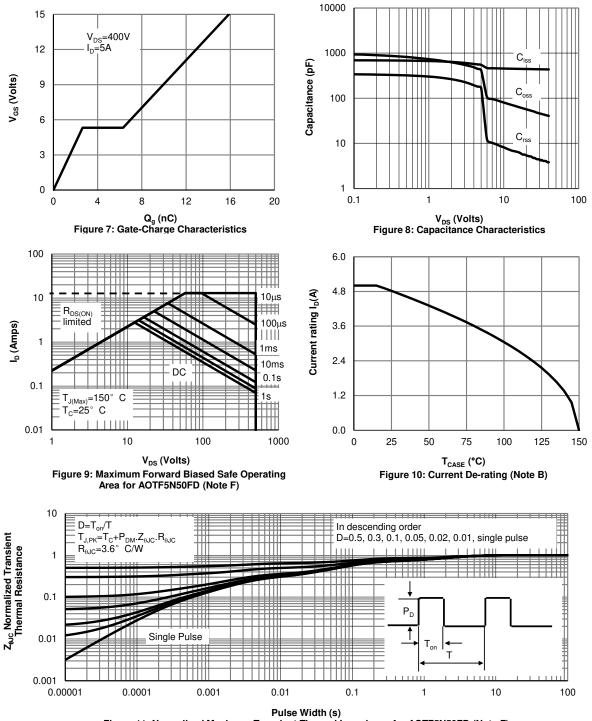
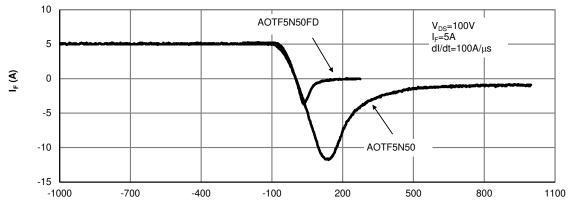


Figure 11: Normalized Maximum Transient Thermal Impedance for AOTF5N50FD (Note F)



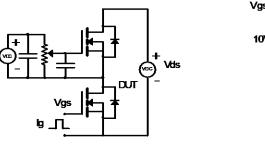
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

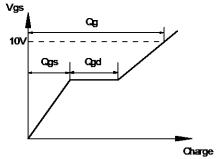


Trr (nS) Figure 12: Diode Recovery Characteristics

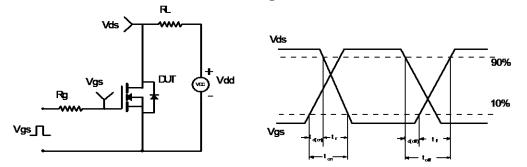


Gate Charge Test Circuit & Wave form

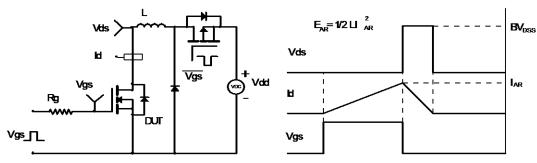




Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

