



**ALPHA & OMEGA**  
SEMICONDUCTOR

## AOTF10N50FD

500V, 10A N-Channel MOSFET with Fast Recovery Diode

### General Description

The AOTF10N50FD 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.

For Halogen Free add "L" suffix to part number:  
AOTF10N50FDL

### Product Summary

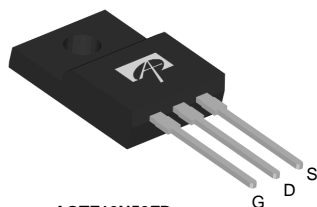
$V_{DS}$	600V@150°C
$I_D$ (at $V_{GS}=10V$ )	10A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 0.75Ω

100% UIS Tested  
100%  $R_g$  Tested

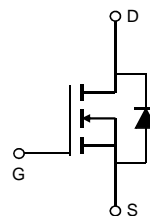


Top View

TO-220F



AOTF10N50FD



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

Parameter	Symbol	AOTF10N50FD	Units
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	±30	V
Continuous Drain Current	$I_D$	10*	A
		6*	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	33	
Avalanche Current <sup>C</sup>	$I_{AR}$	3.8	A
Repetitive avalanche energy <sup>C</sup>	$E_{AR}$	216	mJ
Single pulsed avalanche energy <sup>G</sup>	$E_{AS}$	433	mJ
Peak diode recovery dv/dt	dv/dt	5	V/ns
Power Dissipation <sup>B</sup>	$P_D$	50	W
		0.4	W/°C
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	$T_L$	300	°C

### Thermal Characteristics

Parameter	Symbol	AOTF10N50FD	Units
Maximum Junction-to-Ambient <sup>A,D</sup>	$R_{\theta JA}$	65	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	2.5	°C/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> =10mA, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	500			V
		I <sub>D</sub> =10mA, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C		600		
BV <sub>DSS</sub> /ΔT <sub>J</sub>	Zero Gate Voltage Drain Current	I <sub>D</sub> =10mA, V <sub>GS</sub> =0V		0.56		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V			10	μA
		V <sub>DS</sub> =400V, T <sub>J</sub> =125°C			100	
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	2.5	3.1	4.2	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =5A		0.6	0.75	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =40V, I <sub>D</sub> =5A		10		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =10A, V <sub>GS</sub> =0V		0.93	1.6	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				10	A
I <sub>SM</sub>	Maximum Body-Diode Pulsed Current				33	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	820	1030	1240	pF
C <sub>oss</sub>	Output Capacitance		75	112	150	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		5	10	15	pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	1.7	3.4	5.2	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> =10A	20	26	35	nC
Q <sub>gs</sub>	Gate Source Charge			4.8		nC
Q <sub>gd</sub>	Gate Drain Charge			9.5		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =250V, I <sub>D</sub> =10A, R <sub>G</sub> =25Ω		24		ns
t <sub>r</sub>	Turn-On Rise Time			65		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			69		ns
t <sub>f</sub>	Turn-Off Fall Time			50		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =10A, dI/dt=100A/μs, V <sub>DS</sub> =100V		116	190	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =10A, dI/dt=100A/μs, V <sub>DS</sub> =100V		0.3	0.6	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>θJA</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 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<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

G. L=60mH, I<sub>AS</sub>=3.8A, V<sub>DD</sub>=150V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25° C

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# TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

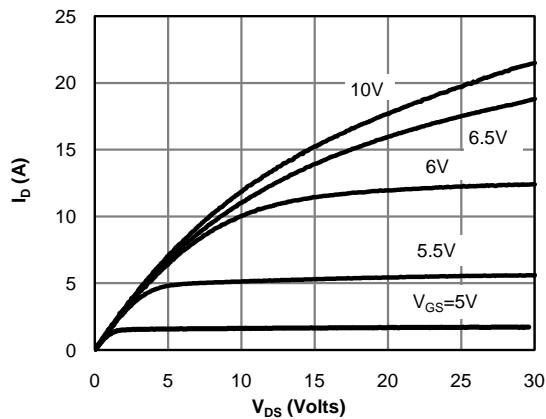


Fig 1: On-Region Characteristics

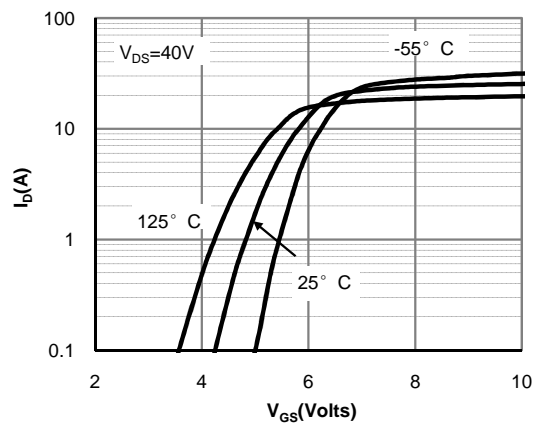


Figure 2: Transfer Characteristics

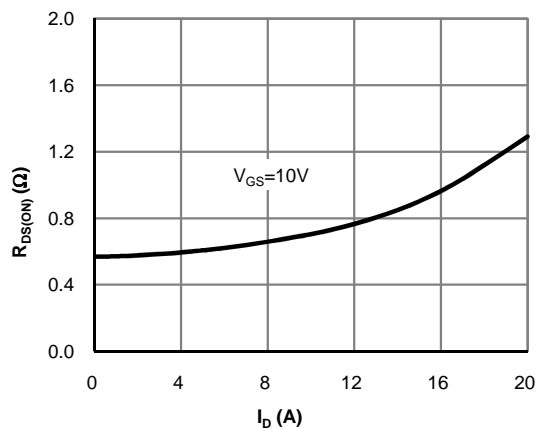


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

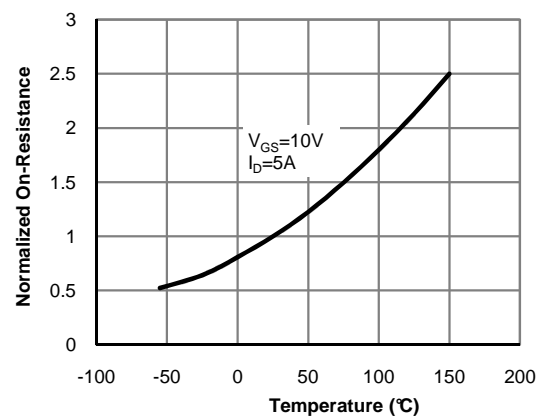


Figure 4: On-Resistance vs. Junction Temperature

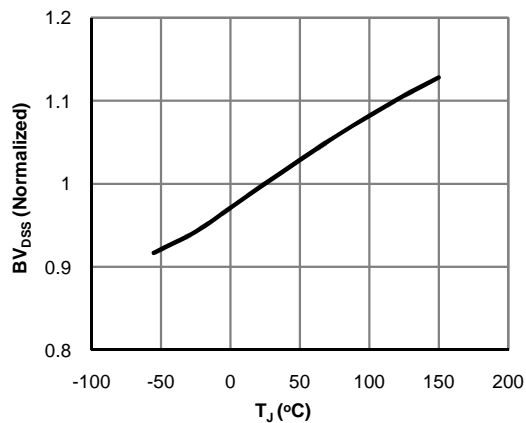


Figure 5: Break Down vs. Junction Temperature

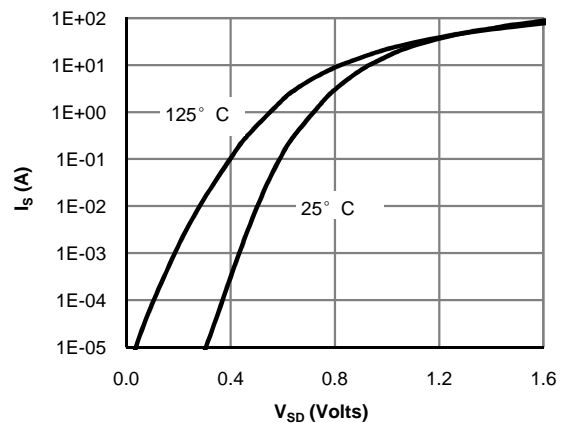


Figure 6: Body-Diode Characteristics (Note E)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

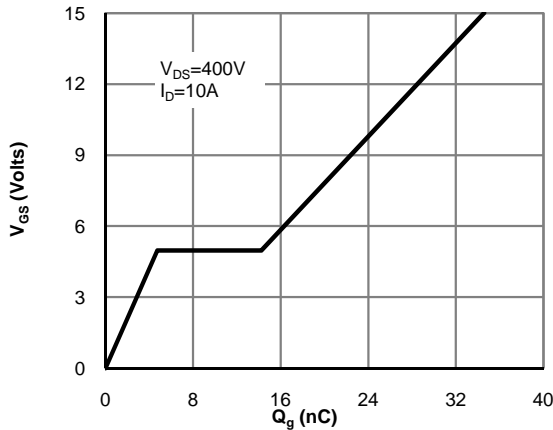


Figure 7: Gate-Charge Characteristics

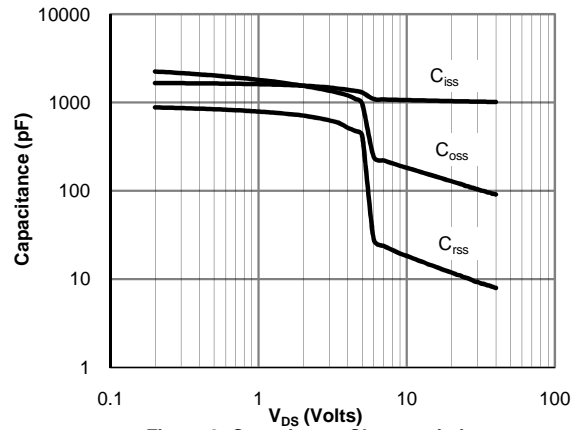


Figure 8: Capacitance Characteristics

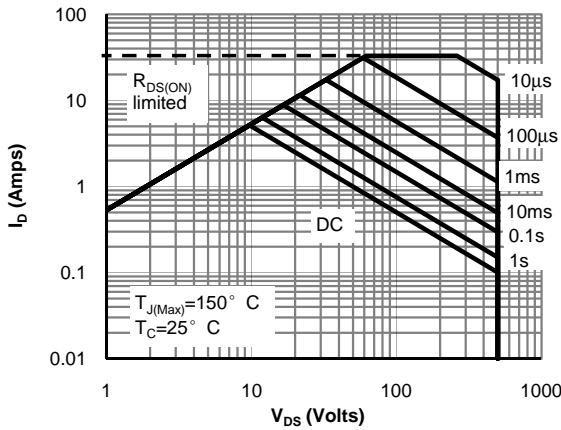


Figure 9: Maximum Forward Biased Safe Operating Area for AOTF10N50FD (Note F)

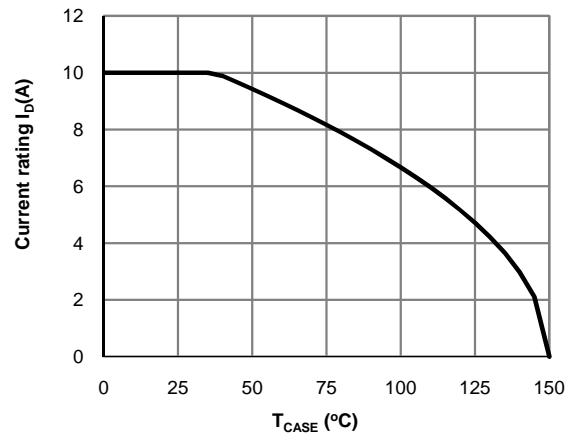


Figure 10: Current De-rating (Note B)

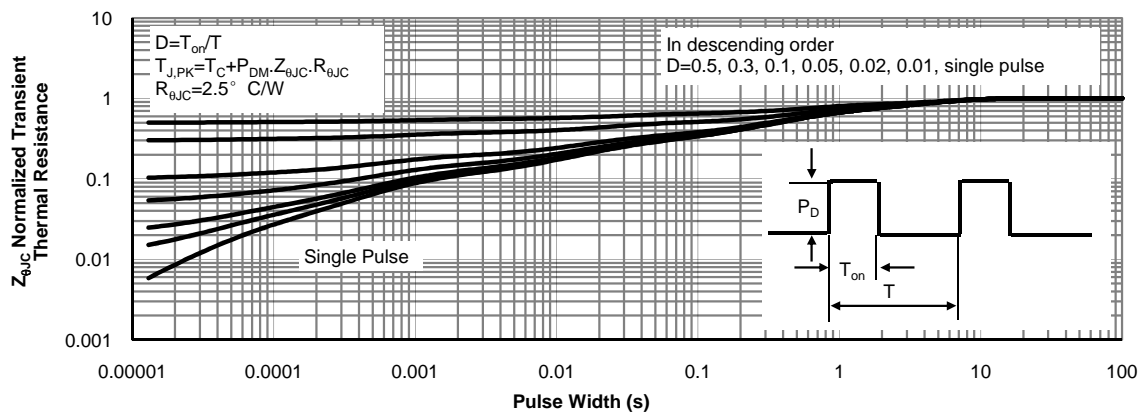
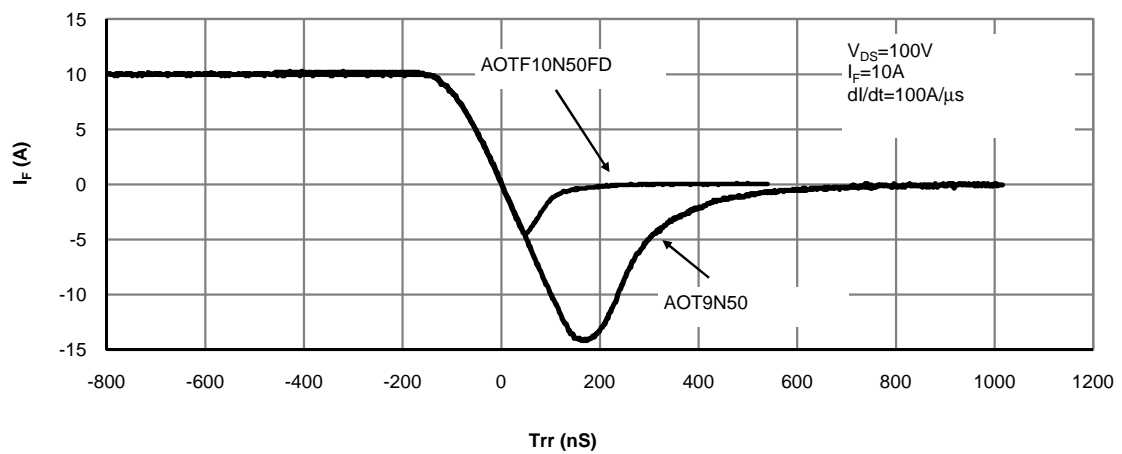


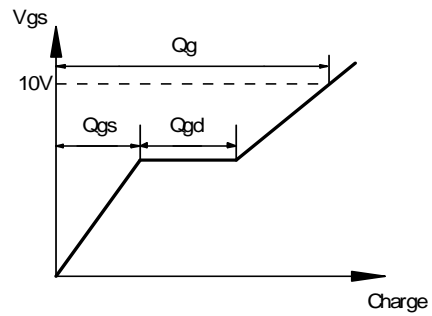
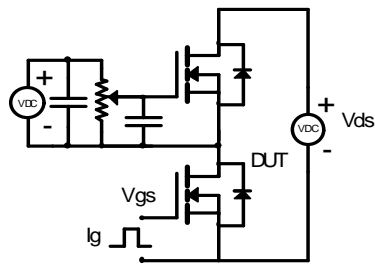
Figure 11: Normalized Maximum Transient Thermal Impedance for AOTF10N50FD (Note F)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

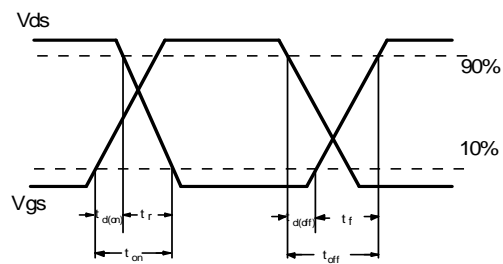
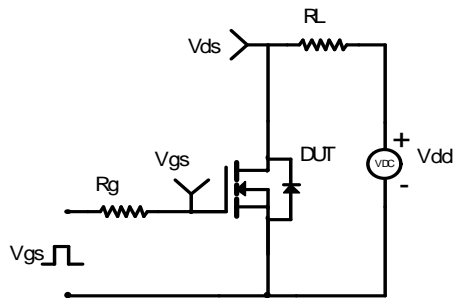


**Figure 12: Diode Recovery Characteristics**

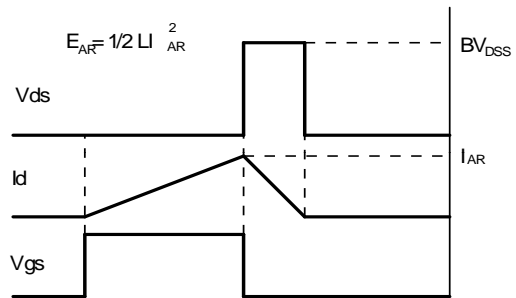
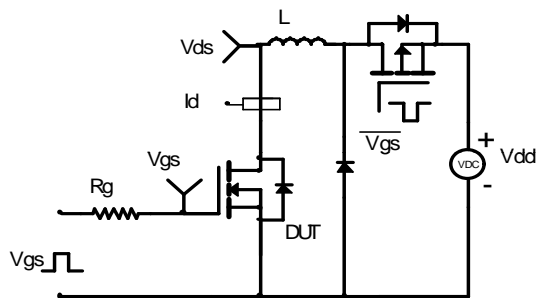
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

