ALPHA & OMEGA SEMICONDUCTOR

AOTF4N90
900V,4A N-Channel MOSFET

General Description

The AOTF4N90 is 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 parts can be adopted quickly into new and existing offline power supply designs.
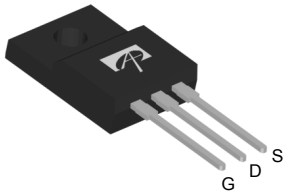
For Halogen Free add "L" suffix to part number: AOTF4N90L

Product Summary

V_{DS}	1000V@150℃
I_D (at V_{GS}=10V)	4A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 3.6Ω

100% UIS Tested
100% R_g Tested

RoHS Compliant

Top View
TO-220F

AOTF4N90
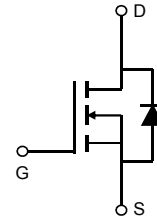
Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOTF4N90	Units
Drain-Source Voltage		V_{DS}	900	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	T_C=25°C	I_D	4*	A
	T_C=100°C		2.5*	
Pulsed Drain Current [C]		I_{DM}	16	
Avalanche Current [C]		I_{AR}	2.3	A
Repetitive avalanche energy [C]		E_{AR}	79	mJ
Single plused avalanche energy [G]		E_{AS}	158	mJ
Peak diode recovery dv/dt		dv/dt	5	V/ns
Power Dissipation [B]	T_C=25°C	P_D	37	W
	Derate above 25°C		0.3	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	AOTF4N90	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	65	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	3.3	°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	900			V
		I$_D$=250µA, V$_{GS}$=0V, T$_J$=150°C		1000		
BV$_{DSS}$/ΔTJ	Breakdown Voltage Temperature Coefficient	I$_D$=250µA, V$_{GS}$=0V		1		V/°C
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=900V, V$_{GS}$=0V			1	µA
		V$_{DS}$=720V, 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	4.1	4.5	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=2A		2.8	3.6	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=40V, I$_D$=2A		6		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V		0.75	1	V
I$_S$	Maximum Body-Diode Continuous Current				4	A
I$_{SM}$	Maximum Body-Diode Pulsed Current				16	A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=25V, f=1MHz	580	728	880	pF
C$_{oss}$	Output Capacitance		41	52	70	pF
C$_{rss}$	Reverse Transfer Capacitance		4.4	5.5	9	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz	2	4	6	Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=720V, I$_D$=4A	14.5	18.4	22	nC
Q$_{gs}$	Gate Source Charge		3.5	4.4	5.3	nC
Q$_{gd}$	Gate Drain Charge		6.4	8	12	nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=450V, I$_D$=4A, R$_G$=25Ω		22		ns
t$_r$	Turn-On Rise Time			46		ns
t$_{D(off)}$	Turn-Off DelayTime			43		ns
t$_f$	Turn-Off Fall Time			39		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=4A,dI/dt=100A/µs,V$_{DS}$=100V	155	196	235	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=4A,dI/dt=100A/µs,V$_{DS}$=100V	3.2	4.05	4.9	µC

A. The value of R$_{\theta JA}$ 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$_{\theta JA}$ is the sum of the thermal impedence from junction to case R$_{\theta JC}$ and case to ambient.
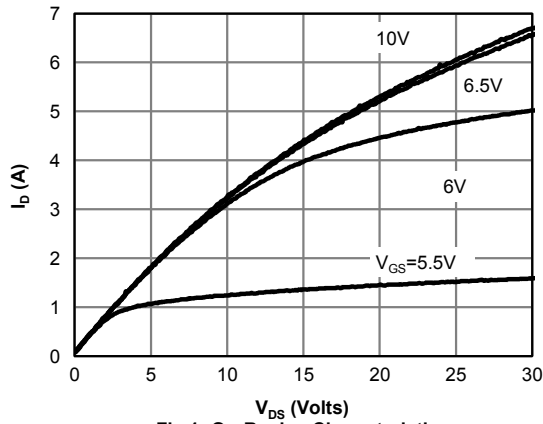E. The static characteristics in Figures 1 to 6 are obtained using <300 µs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
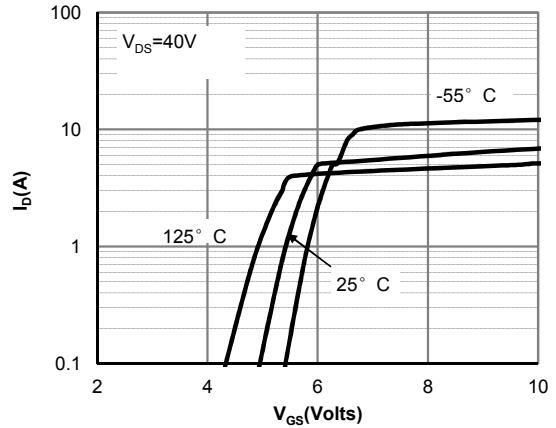G. L=60mH, I$_{AS}$=2.3A, V$_{DD}$=150V, R$_G$=25Ω, Starting T$_J$=25° C
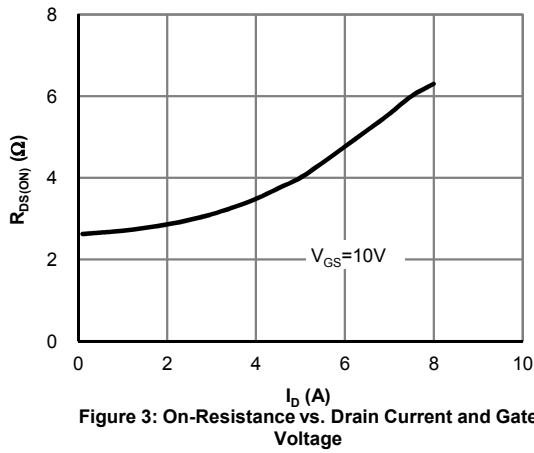
ALPHA & OMEGA SEMICONDUCTOR

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
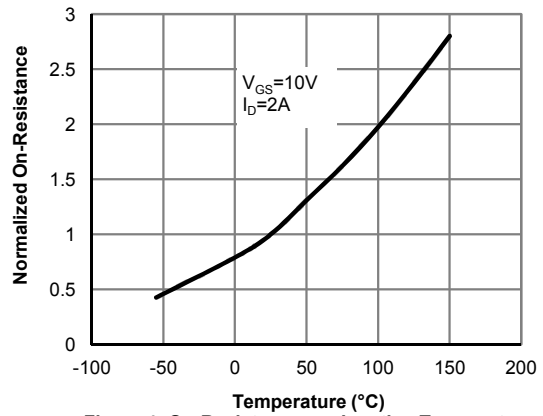

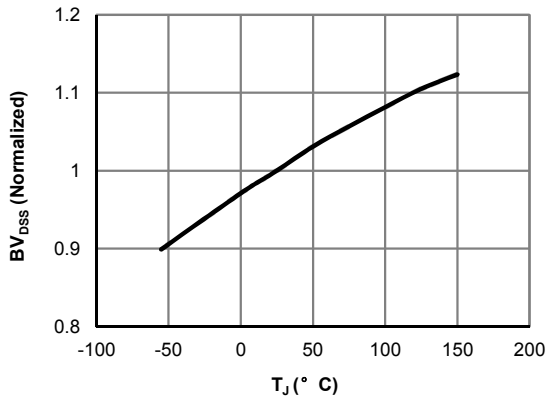
Fig 1: On-Region Characteristics
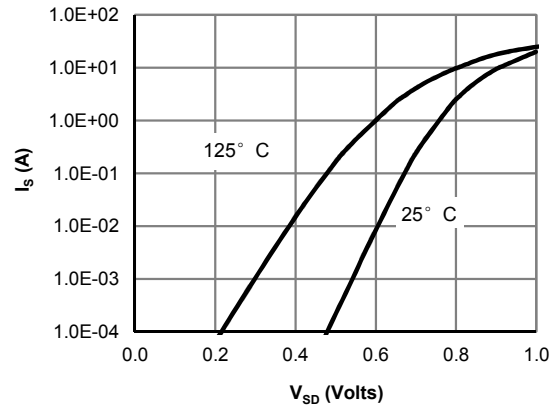

Figure 2: Transfer Characteristics

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

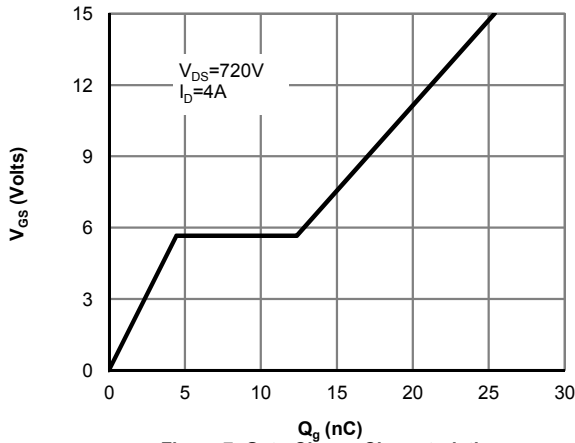**Figure 4: On-Resistance vs. Junction Temperature**
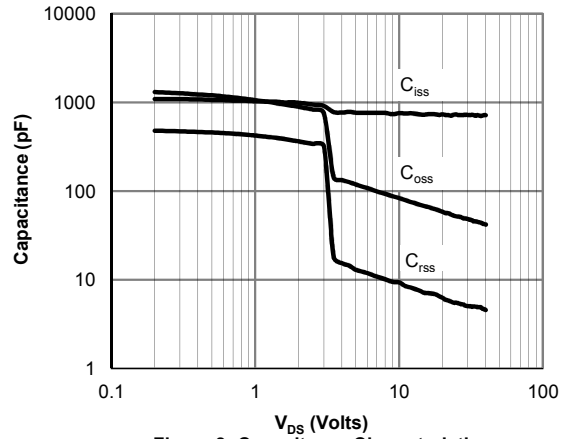

Figure 5:Break Down vs. Junction Temperature
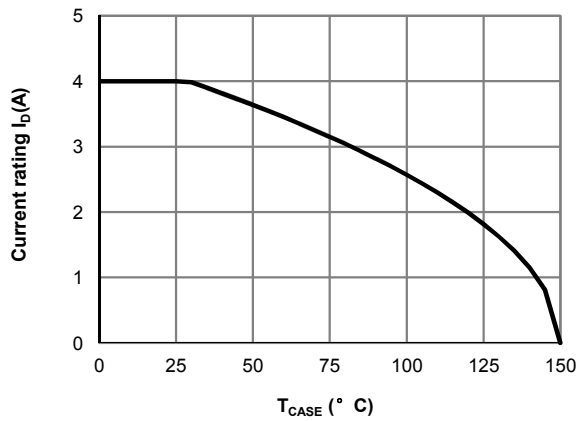

Figure 6: Body-Diode Characteristics (Note E)
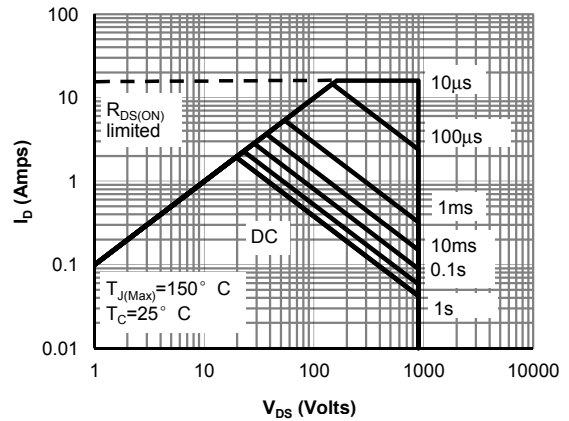
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

V_{DS}=720V
I_D=4A
Figure 7: Gate-Charge Characteristics

C_{iss}
C_{oss}
C_{rss}
Figure 8: Capacitance Characteristics

Figure 9: Current De-rating (Note B)

$R_{DS(ON)}$ limited
DC
10µs
100µs
1ms
10ms
0.1s
1s
$T_{J(Max)}$=150°C
T_C=25°C
Figure 10: Maximum Forward Biased Safe Operating Area for AOTF4N90 (Note F)
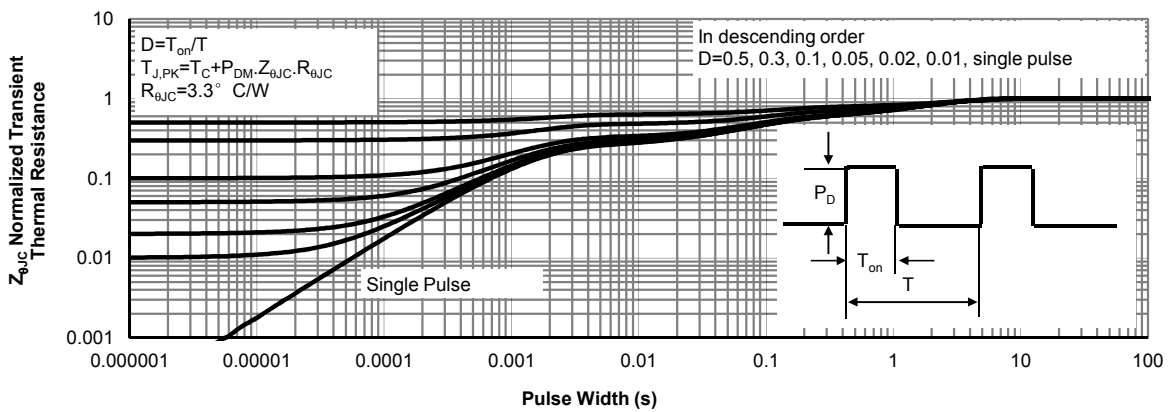
$D=T_{on}/T$
$T_{J,PK}=T_C+P_{DM} \cdot Z_{\theta JC} \cdot R_{\theta JC}$
$R_{\theta JC}=3.3°$ C/W
In descending order
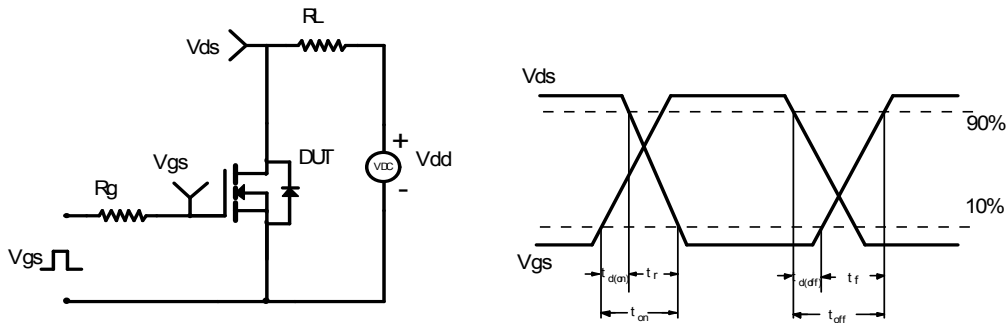D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
Single Pulse
P_D
T_{on}
T
Figure 11: Normalized Maximum Transient Thermal Impedance for AOTF4N90 (Note F)
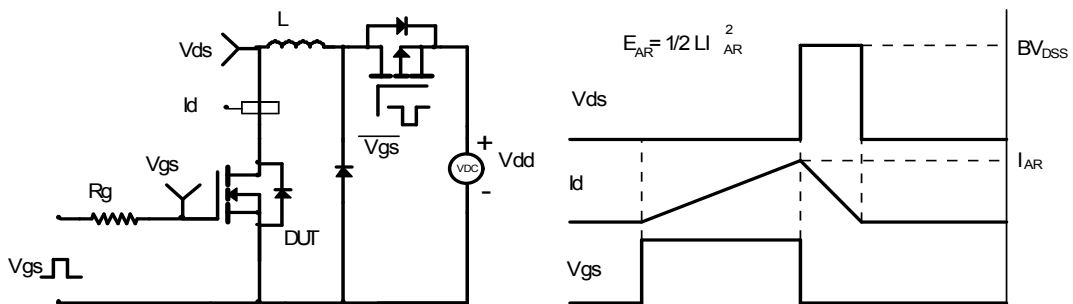
Gate Charge Test Circuit & Waveform
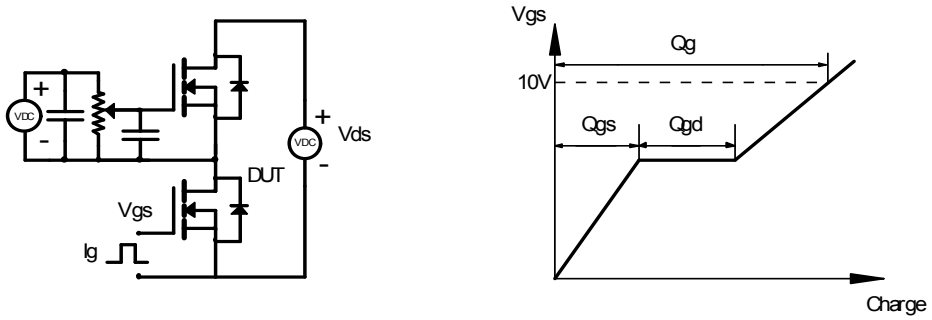
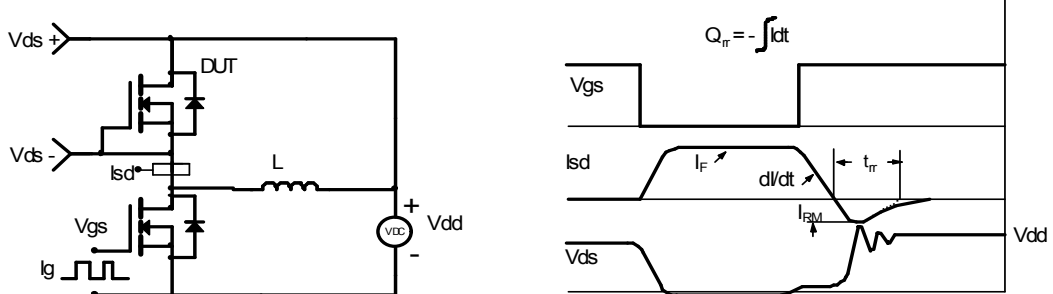Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$$E_{AR} = 1/2 \, LI^2_{AR}$$

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = - \int I dt$$

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