ALPHA & OMEGA SEMICONDUCTOR

AOTF190A60L

600V, αMOS5™ N-Channel Power Transistor

General Description

- Proprietary αMOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

Product Summary

V_{DS} @ $T_{j,max}$	700V
I_{DM}	80A
$R_{DS(ON),max}$	< 0.19Ω
$Q_{g,typ}$	34nC
E_{oss} @ 400V	4.3µJ

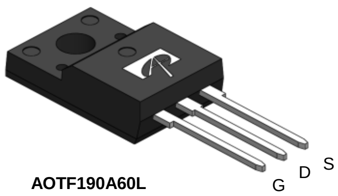
100% UIS Tested
100% R_g Tested

Green Product

Applications

- SMPS with PFC, Flyback and LLC topologies
- Silver ATX ,adapter, TV, lighting, Telecom

TO-220F



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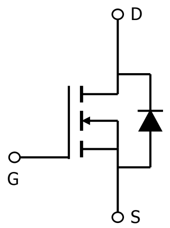


Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOTF190A60L	TO-220F Green	Tube	1000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOTF190A60L	Units
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±20	V
Gate-Source Voltage (dynamic) AC(f>1Hz)		V_{GS}	±30	V
Continuous Drain Current	T_C=25°C	I_D	20*	A
	T_C=100°C		12*	
Pulsed Drain Current [C]		I_{DM}	80	
Avalanche Current [C]		I_{AR}	5	A
Repetitive avalanche energy [C]		E_{AR}	12.5	mJ
Single pulsed avalanche energy [G]		E_{AS}	410	mJ
MOSFET dv/dt ruggedness		dv/dt	100	V/ns
Peak diode recovery dv/dt			20	
Power Dissipation [B]	T_C=25°C	P_D	32	W
	Derate above 25°C		0.25	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	AOTF190A60L	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	65	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	3.9	°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	600	-	-	V
		I_D=250µA, V_{GS}=0V, T_J=150°C	-	700	-	
BV_{DSS} /ΔTJ	Breakdown Voltage Temperature Coefficient	I_D=250µA, V_{GS}=0V	-	0.59	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=600V, V_{GS}=0V	-	-	1	µA
		V_{DS}=480V, T_J=125°C	-	-	10	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V	-	-	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=5V, I_D=250µA	3.2	4	4.6	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=7.6A	-	0.17	0.19	Ω
g_{FS}	Forward Transconductance	V_{DS}=10V, I_D=10A	-	16	-	S
V_{SD}	Diode Forward Voltage	I_S=10A,V_{GS}=0V	-	0.85	1.2	V
I_S	Maximum Body-Diode Continuous Current		-	-	20	A
I_{SM}	Maximum Body-Diode Pulsed Current [C]		-	-	80	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz	-	1935	-	pF
C_{oss}	Output Capacitance		-	55	-	pF
$C_{o(er)}$	Effective output capacitance, energy related [H]	V_{GS}=0V, V_{DS}=0 to 480V, f=1MHz	-	49	-	pF
$C_{o(tr)}$	Effective output capacitance, time related [I]		-	213	-	pF
C_{rss}	Reverse Transfer Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz	-	1.25	-	pF
R_g	Gate resistance	f=1MHz	-	5	-	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=480V, I_D=10A	-	34	-	nC
Q_{gs}	Gate Source Charge		-	12	-	nC
Q_{gd}	Gate Drain Charge		-	11	-	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=400V, I_D=10A, R_G=25Ω	-	49	-	ns
t_r	Turn-On Rise Time		-	40	-	ns
$t_{D(off)}$	Turn-Off DelayTime		-	115	-	ns
t_f	Turn-Off Fall Time		-	26	-	ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=10A, dI/dt=100A/µs, V_{DS}=400V	-	341	-	ns
I_{rm}	Peak Reverse Recovery Current		-	28	-	A
Q_{rr}	Body Diode Reverse Recovery Charge		-	6.8	-	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 impedance from junction to case $R_{\theta JC}$ and case to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300µs 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}=3.7A, 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% $V_{(BR)DSS}$.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

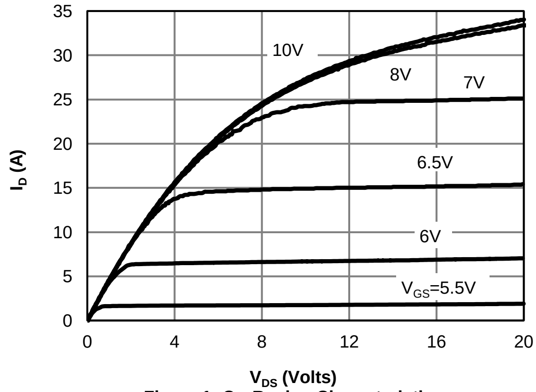


Figure 1: On-Region Characteristics

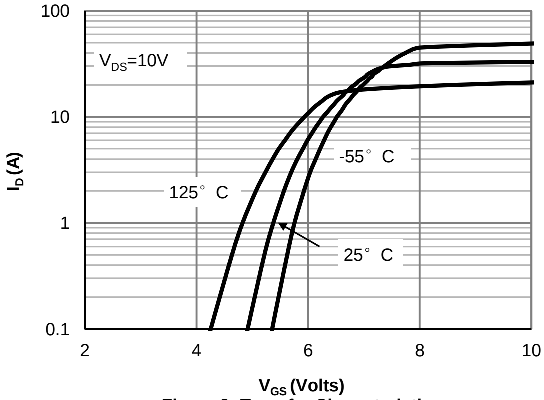


Figure 2: Transfer Characteristics

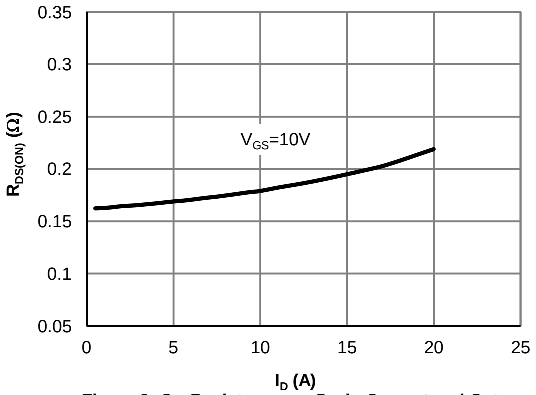


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

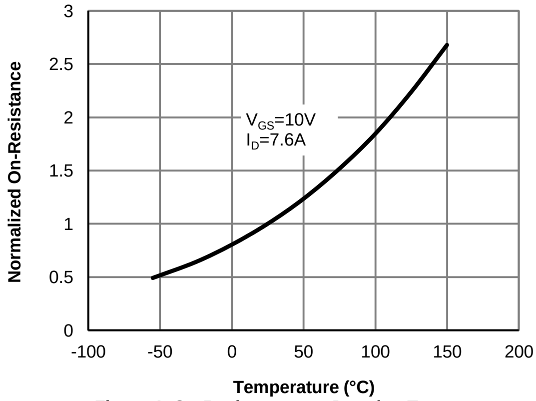


Figure 4: On-Resistance vs. Junction Temperature

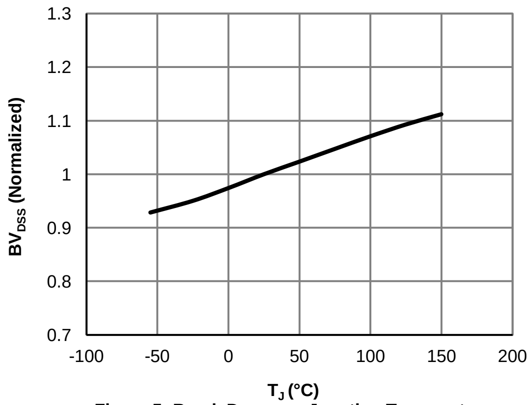


Figure 5: Break Down vs. Junction Temparature

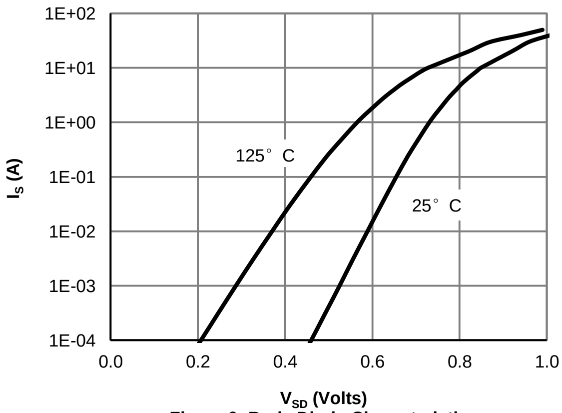


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

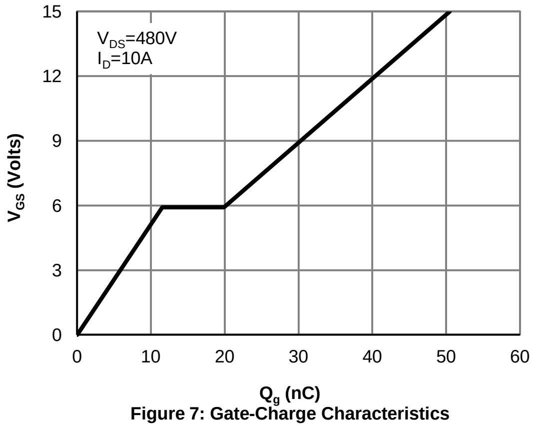


Figure 7: Gate-Charge Characteristics

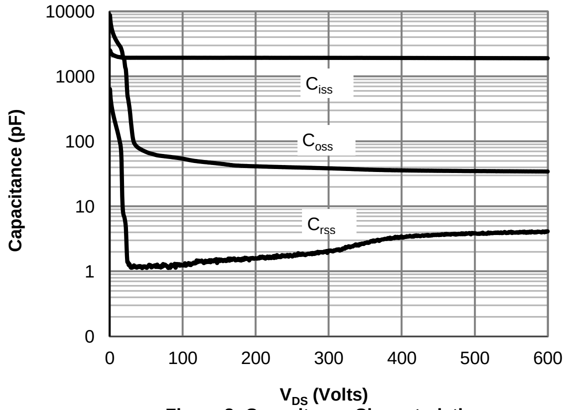


Figure 8: Capacitance Characteristics

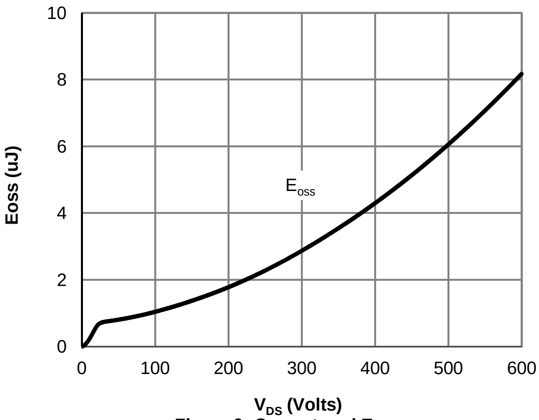


Figure 9: Coss stored Energy

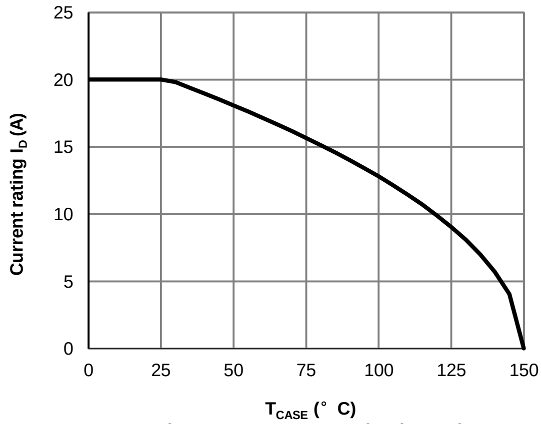


Figure 10: Current De-rating (Note F)

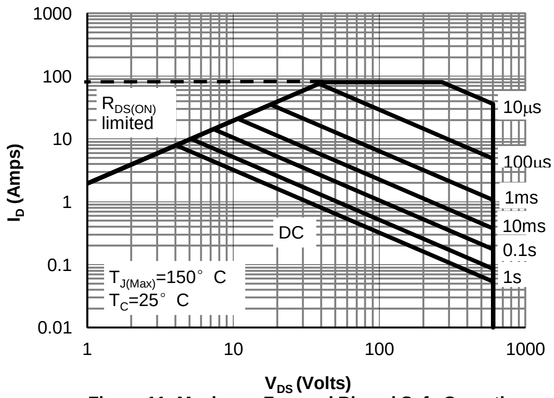


Figure 11: Maximum Forward Biased Safe Operating Area for AOTF190A60L (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

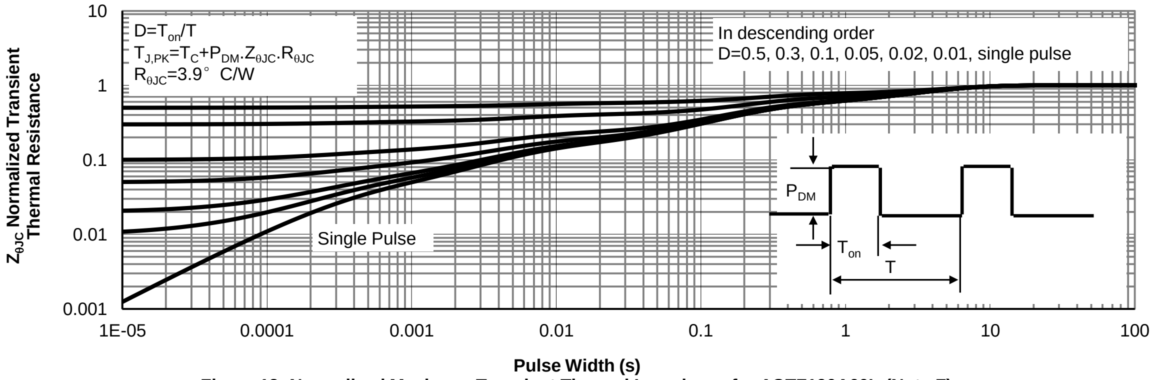
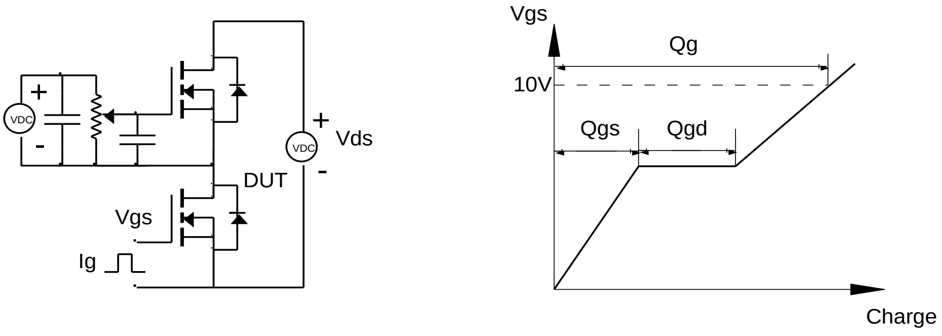
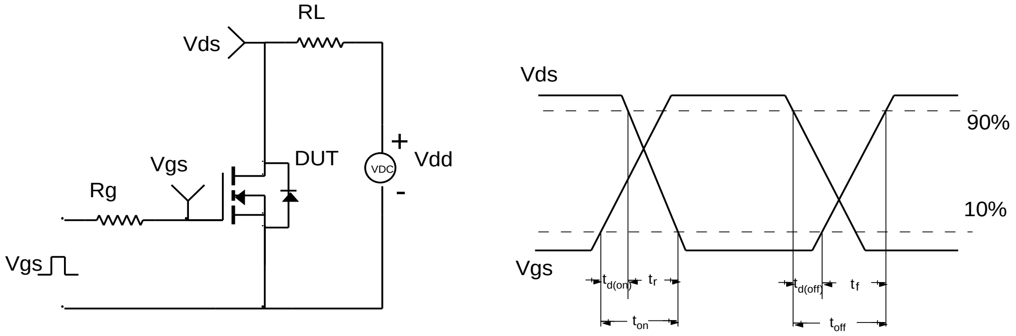


Figure 12: Normalized Maximum Transient Thermal Impedance for AOTF190A60L (Note F)

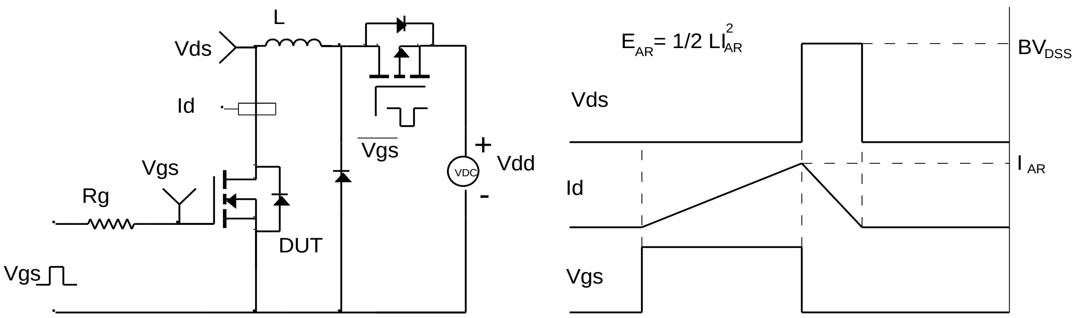
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms