ALPHA & OMEGA SEMICONDUCTOR
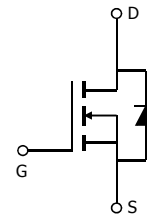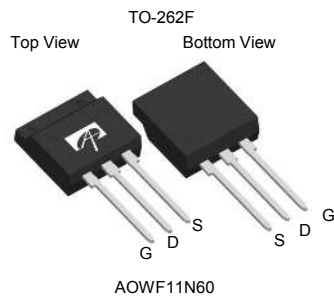
AOWF11N60
600V,11A N-Channel MOSFET

General Description

The AOWF11N60 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 device can be adopted quickly into new and existing offline power supply designs.

Product Summary

V_{DS}	700V@150℃
I_D (at V_{GS}=10V)	11A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 0.65Ω

100% UIS Tested
100% R_g Tested

Green Product

TO-262F
Top View   Bottom View

AOWF11N60

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOWF11N60	Units
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	T_C=25°C	I_D	11*	A
	T_C=100°C		8*	
Pulsed Drain Current [C]		I_{DM}	39	
Avalanche Current [C]		I_{AR}	4.8	A
Repetitive avalanche energy [C]		E_{AR}	345	mJ
Single plused avalanche energy [G]		E_{AS}	690	mJ
Peak diode recovery dv/dt		dv/dt	5	V/ns
Power Dissipation [B]	T_C=25°C	P_D	27.8	W
	Derate above 25°C		0.22	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	AOWF11N60	Units
Maximum Junction-to-Ambient [A,D]	$R_{θJA}$	65	°C/W
Maximum Junction-to-Case	$R_{θJC}$	4.5	°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		0.67		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$_{GS}$=±30V			±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=5V I$_D$=250µA	3.3	3.9	4.5	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=5.5A		0.56	0.65	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=40V, I$_D$=5.5A		12		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V		0.73	1	V
I$_S$	Maximum Body-Diode Continuous Current				11	A
I$_{SM}$	Maximum Body-Diode Pulsed Current				39	A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=25V, f=1MHz	1320	1656	1990	pF
C$_{oss}$	Output Capacitance		100	146	195	pF
C$_{rss}$	Reverse Transfer Capacitance		6.5	11.2	16	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz	1.7	3.5	5.3	Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=480V, I$_D$=11A	24	30.6	37	nC
Q$_{gs}$	Gate Source Charge			9.6		nC
Q$_{gd}$	Gate Drain Charge			9.6		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=300V, I$_D$=11A, R$_G$=25Ω		39		ns
t$_r$	Turn-On Rise Time			58		ns
t$_{D(off)}$	Turn-Off DelayTime			92		ns
t$_f$	Turn-Off Fall Time			42		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=11A,dI/dt=100A/µs,V$_{DS}$=100V	400	500	600	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=11A,dI/dt=100A/µs,V$_{DS}$=100V	4.7	5.9	7.1	µC

A. The value of R$_{θJA}$ 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.

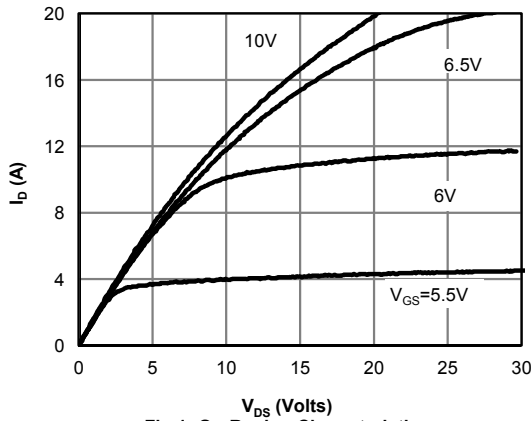D. The R$_{θJA}$ is the sum of the thermal impedence from junction to case R$_{θJC}$ and case to ambient.

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.
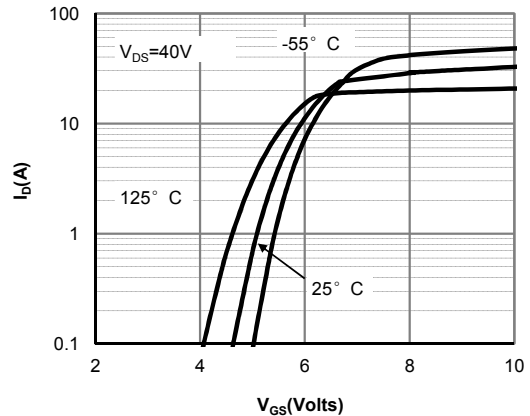
G. L=60mH, I$_{AS}$=4.8A, V$_{DD}$=150V, R$_G$=25Ω, Starting T$_J$=25°C
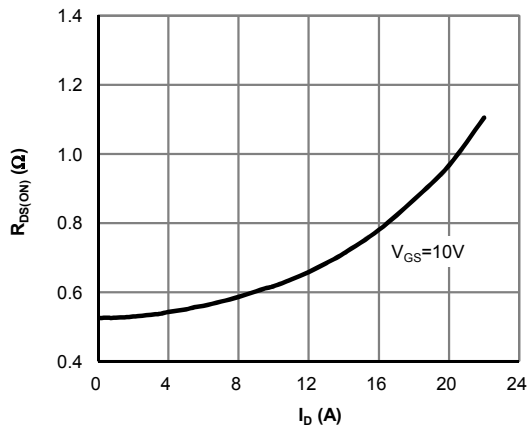
ALPHA & OMEGA
SEMICONDUCTOR

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
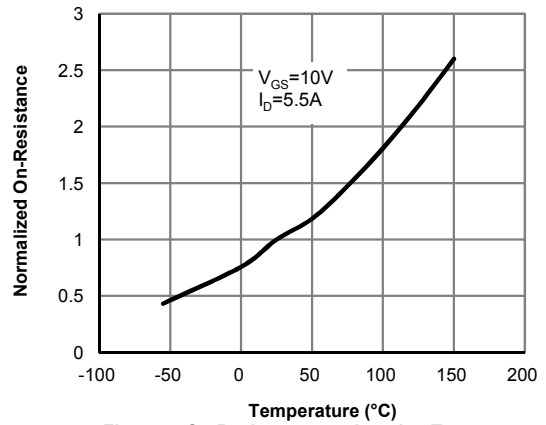

Fig 1: On-Region Characteristics
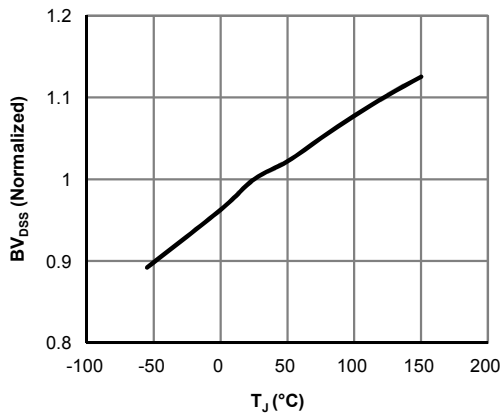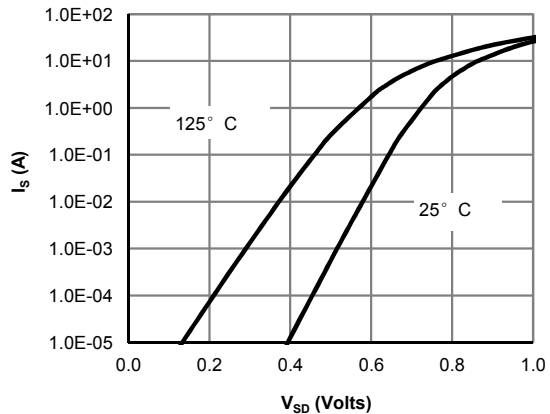

Figure 2: Transfer Characteristics

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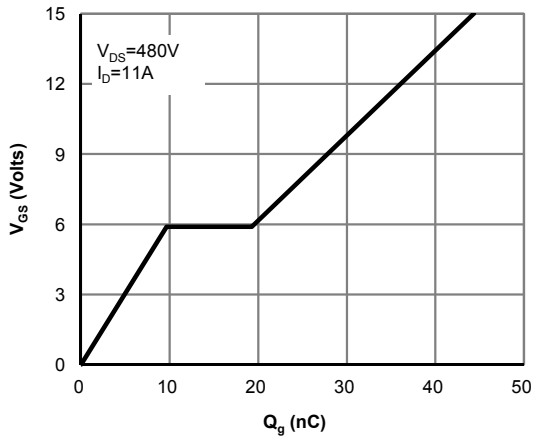

Figure 4: On-Resistance vs. Junction Temperature

Figure 5:Break Down vs. Junction Temperature
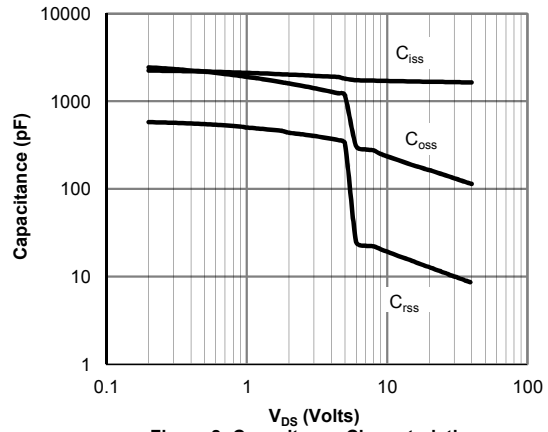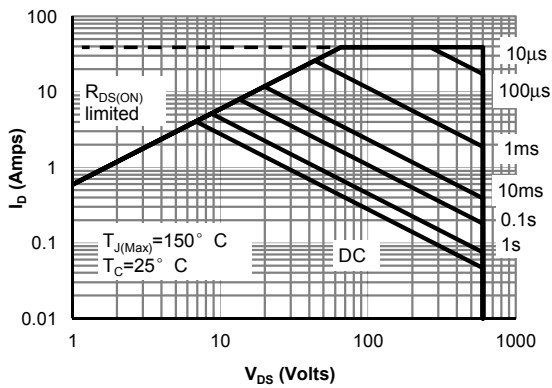

Figure 6: Body-Diode Characteristics (Note E)
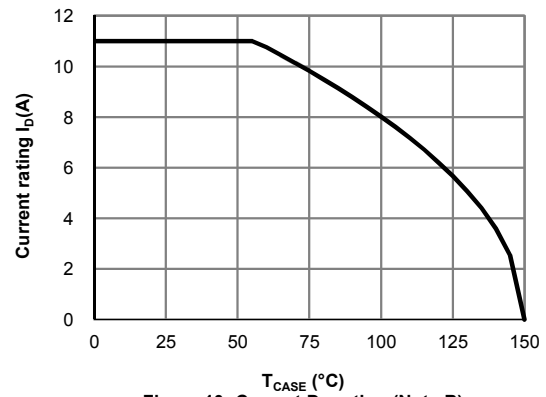
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

V_{DS}=480V
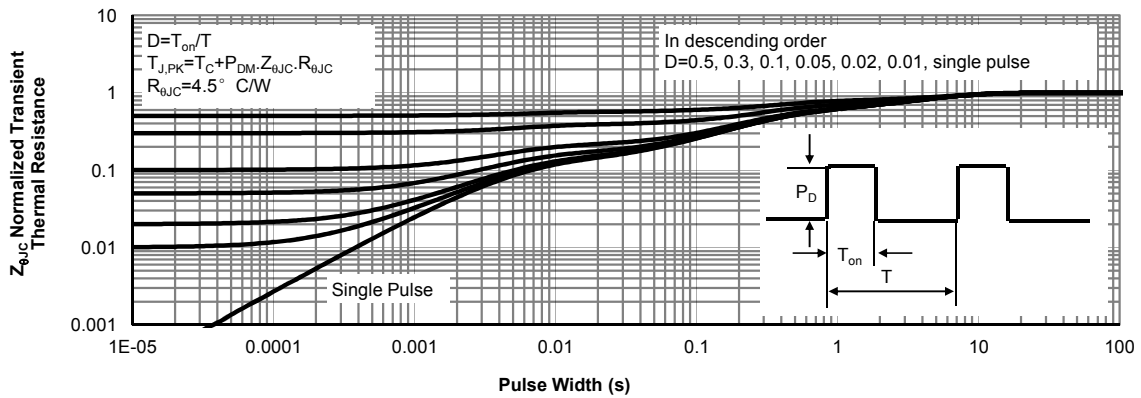I_D=11A

Figure 8: Capacitance Characteristics

C_{iss}
C_{oss}
C_{rss}

Figure 9: Maximum Forward Biased Safe Operating Area for AOWF11N60 (Note F)

$R_{DS(ON)}$ limited
$T_{J(Max)}$=150°C
T_C=25°C
DC
10µs
100µs
1ms
10ms
0.1s
1s
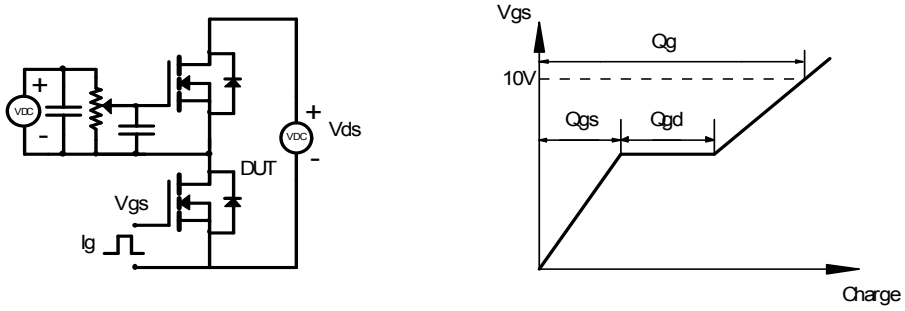

Figure 10: Current De-rating (Note B)

Figure 11: Normalized Maximum Transient Thermal Impedance for AOWF11N60 (Note F)

D=T_{on}/T
$T_{J,PK}$=T_C+$P_{DM} \cdot Z_{\theta JC} \cdot R_{\theta JC}$
$R_{\theta JC}$=4.5°C/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
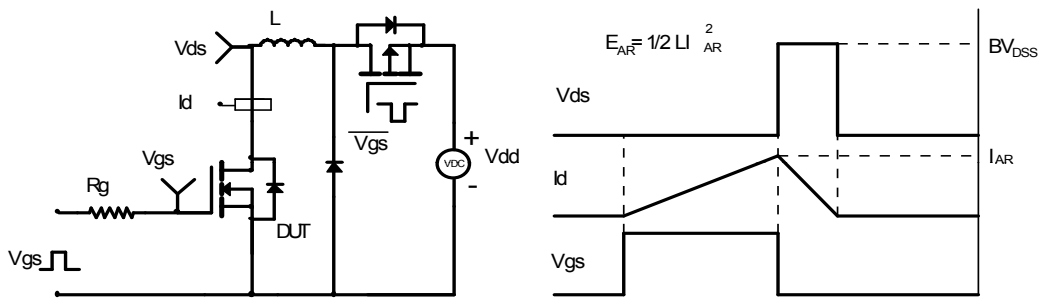
Single Pulse

P_D
T_{on}
T

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms
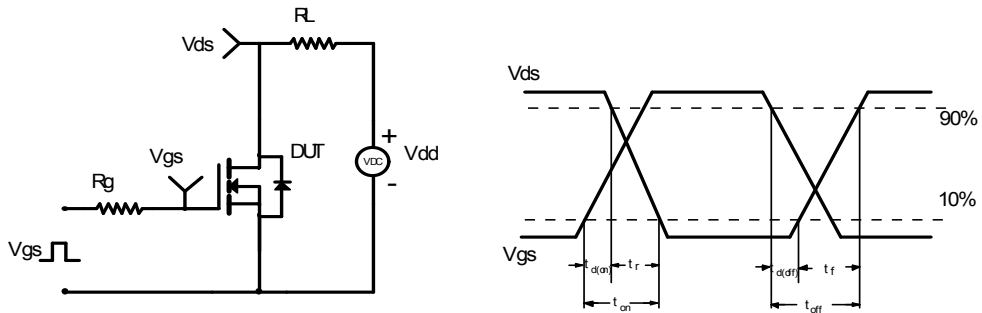
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

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

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int Idt$$