ALPHA & OMEGA SEMICONDUCTOR

AOT1N60
1.3A, 600V N-Channel MOSFET
formerly engineering part number AOT9600

RoHS Compliant

General Description
The AOT1N60 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 these parts can be adopted quickly into new and existing offline power supply designs.

Features

V_{DS} (V) = 700V @ 150°C
I_D = 1.3A
$R_{DS(ON)}$ < 9Ω (V_{GS} = 10V)

100% UIS Tested!
100% R_g Tested!
C_{iss}, C_{oss}, C_{rss} Tested!

Top View

TO-220
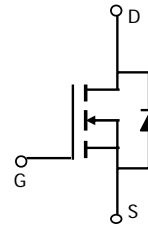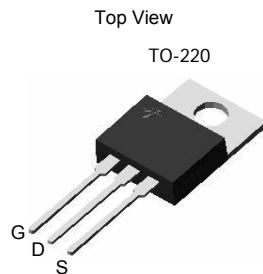
Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum		Units
Drain-Source Voltage		V_{DS}	600		V
Gate-Source Voltage		V_{GS}	±30		V
Continuous Drain Current [B]	T_C=25°C		1.3		A
	T_C=100°C	I_D	0.8		
Pulsed Drain Current [C]		I_{DM}	4		
Avalanche Current [C]		I_{AR}	1.0		A
Repetitive avalanche energy [C]		E_{AR}	15		mJ
Single pulsed avalanche energy [G]		E_{AS}	30		mJ
Peak diode recovery dv/dt		dv/dt	5		V/ns
Power Dissipation [B]	T_C=25°C	P_D	41.7		W
	Derate above 25°C		0.33		W/ °C
Junction and Storage Temperature Range		T_J, T_{STG}	-50 to 150		°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300		°C
Thermal Characteristics					
Parameter		Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient [A]		$R_{\theta JA}$	55	65	°C/W
Maximum Case-to-Sink [A]		$R_{\theta CS}$	-	0.5	°C/W
Maximum Junction-to-Case [D,F]		$R_{\theta JC}$	2	3	°C/W

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		V
BV$_{DSS}$/ΔT$_J$	Breakdown Voltage Temperature Coefficient	I$_D$=250µA, V$_{GS}$=0V		0.6		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$_{DS}$=V$_{GS}$, I$_D$=250µA	3	4.1	5	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=0.65A		7.5	9	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=40V, I$_D$=0.65A		0.9		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A, V$_{GS}$=0V		0.65	1	V
I$_S$	Maximum Body-Diode Continuous Current				1	A
I$_{SM}$	Maximum Body-Diode Pulsed Current				4	A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=25V, f=1MHz	100	130	160	pF
C$_{oss}$	Output Capacitance		11	14.5	17.5	pF
C$_{rss}$	Reverse Transfer Capacitance		1.4	1.8	2.2	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz	2.8	3.5	5.3	Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=480V, I$_D$=1A		6.1	8	nC
Q$_{gs}$	Gate Source Charge			1.3	2	nC
Q$_{gd}$	Gate Drain Charge			3.1	4	nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=300V, I$_D$=1A, R$_G$=25Ω		10	12	ns
t$_r$	Turn-On Rise Time			6.7	8	ns
t$_{D(off)}$	Turn-Off DelayTime			20	25	ns
t$_f$	Turn-Off Fall Time			11.5	15	ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=1.3A,dI/dt=100A/µs,V$_{DS}$=100V		114	137	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=1.3A,dI/dt=100A/µs,V$_{DS}$=100V		0.63	0.76	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 in a TO220 package, 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.

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.

G. L=60mH, I$_{AS}$=1A, V$_{DD}$=150V, R$_G$=10Ω, Starting T$_J$=25°C

Rev0: July 2008

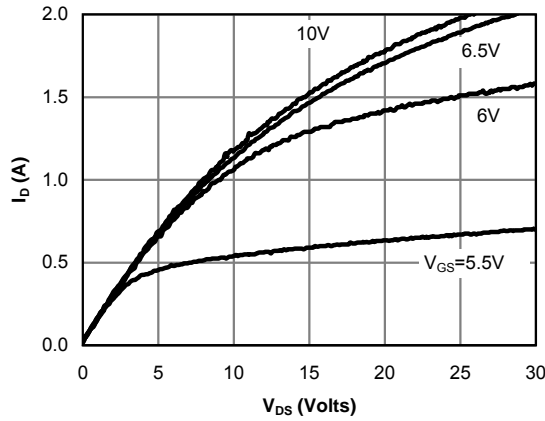**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

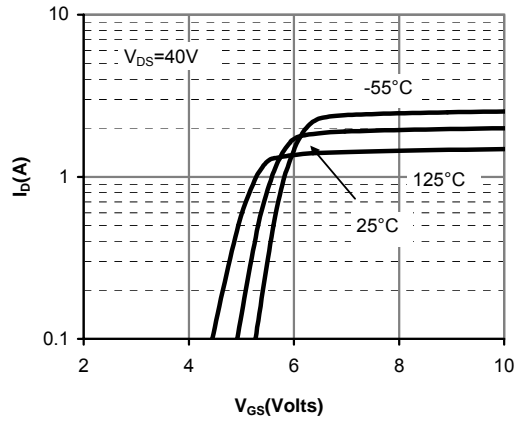**Fig 1: On-Region Characteristics**
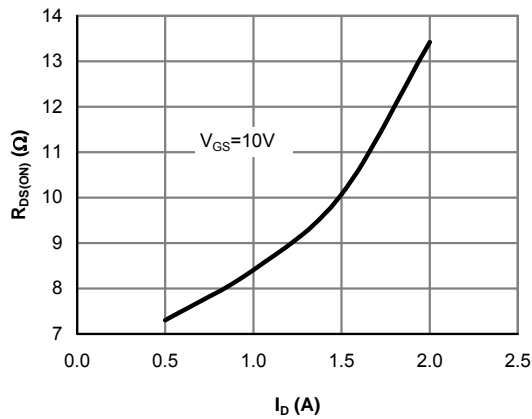

Figure 2: Transfer Characteristics

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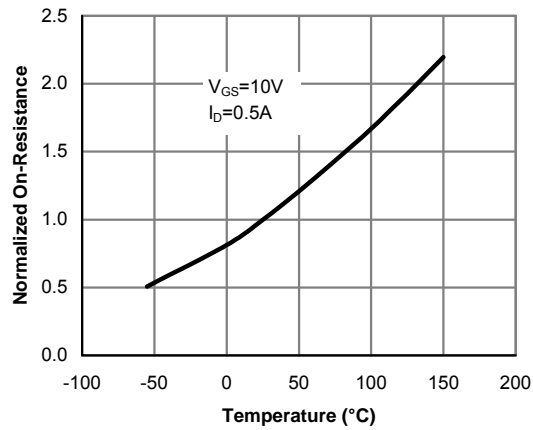

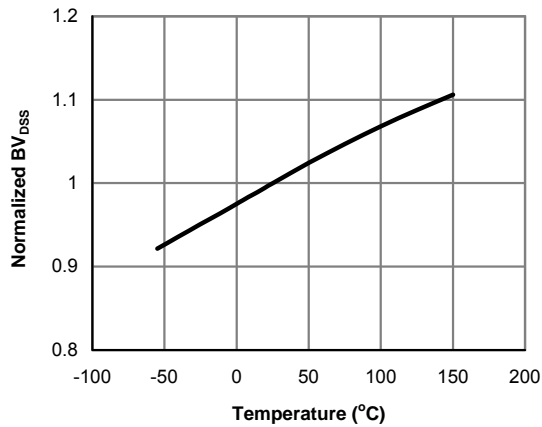**Figure 4: On-Resistance vs. Junction Temperature**
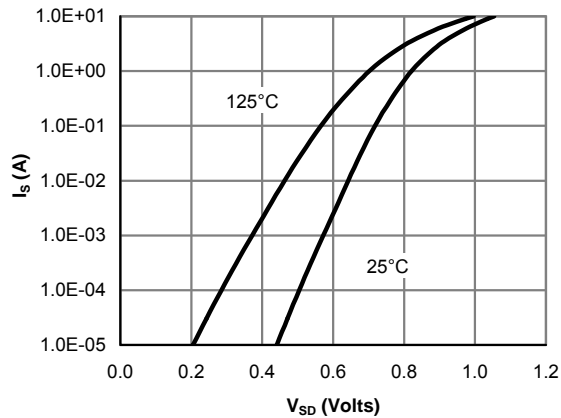

Figure 5: Break Down vs. Junction Temperature

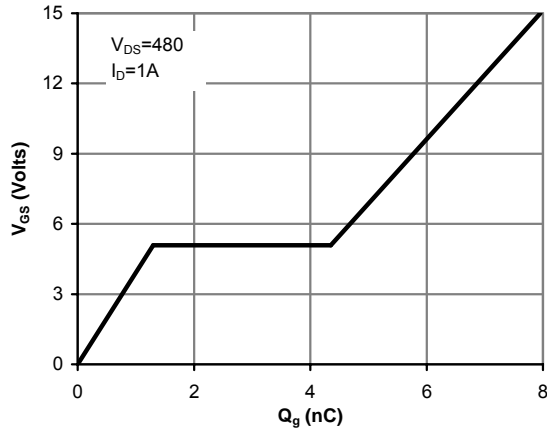**Figure 6: Body-Diode Characteristics**

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

V_{DS}=480
I_D=1A

Figure 7: Gate-Charge Characteristics

C_{iss}

C_{oss}

C_{rss}
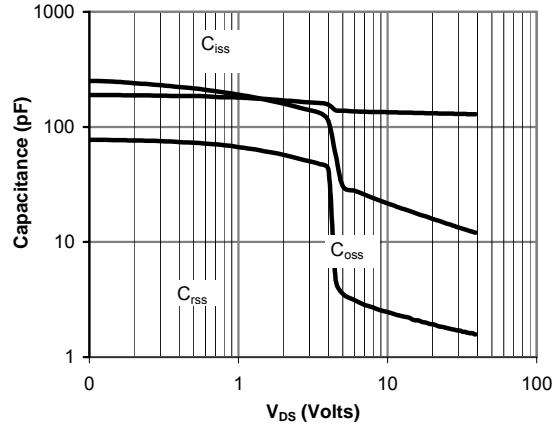
Figure 8: Capacitance Characteristics

10μS

$R_{DS(ON)}$
limited

100μS

10ms
0.1s
DC

1ms

$T_{J(Max)}$=150°C
T_C=25°C
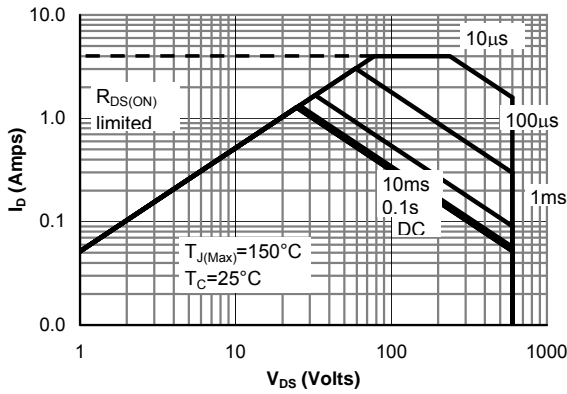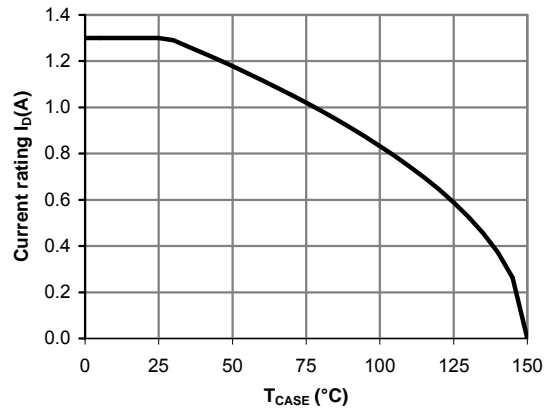
Figure 9: Maximum Forward Biased Safe Operating Area for AOT1N60 (Note F)

Figure 10: Current De-rating (Note B)

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JC}\cdot R_{\theta JC}$
$R_{\theta JC}$=3°C/W

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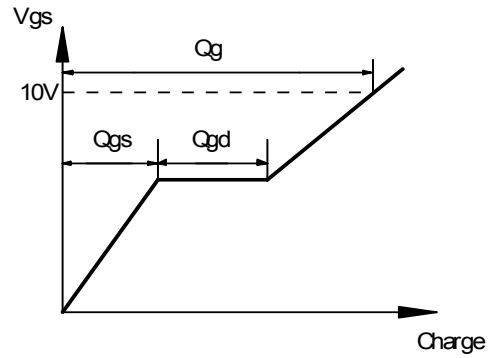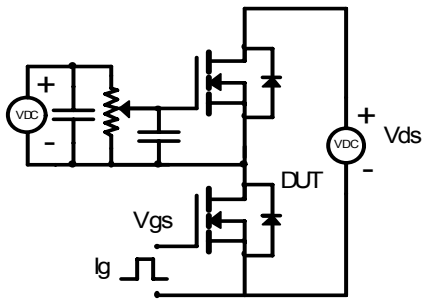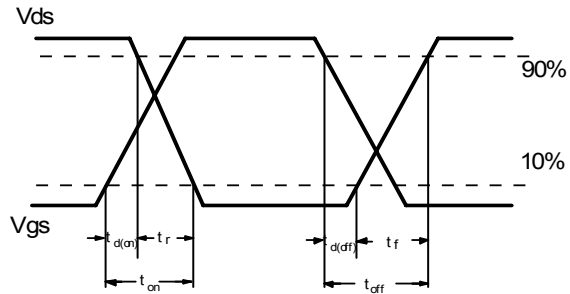D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse
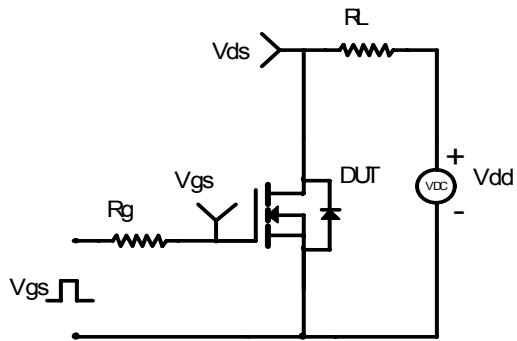
P_D

T_{on}
T

Single Pulse
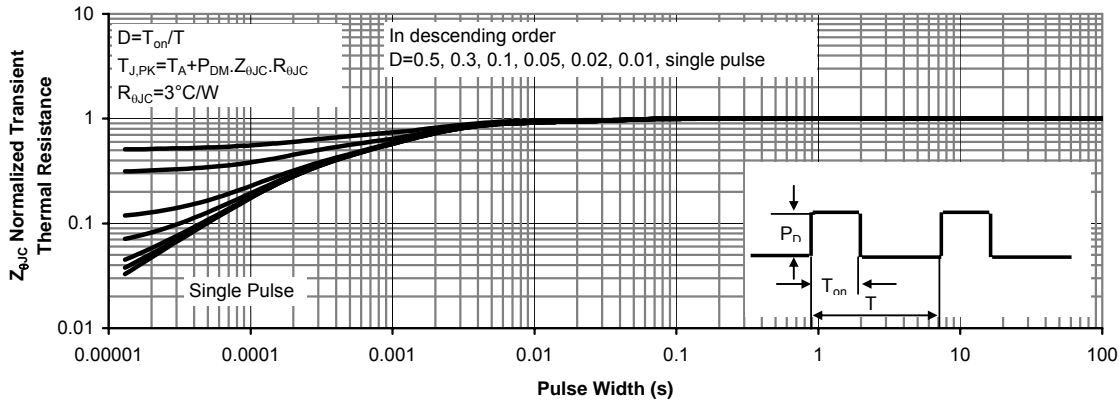
Figure 11: Normalized Maximum Transient Thermal Impedance for AOT1N60 (Note F)
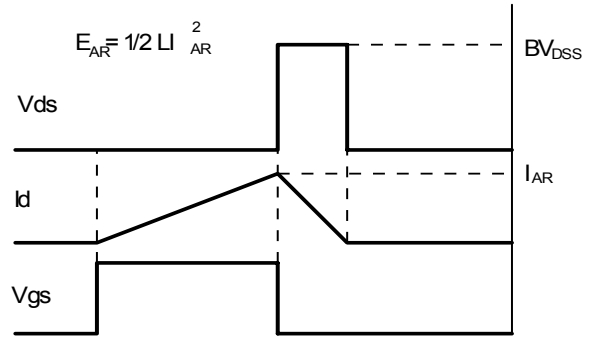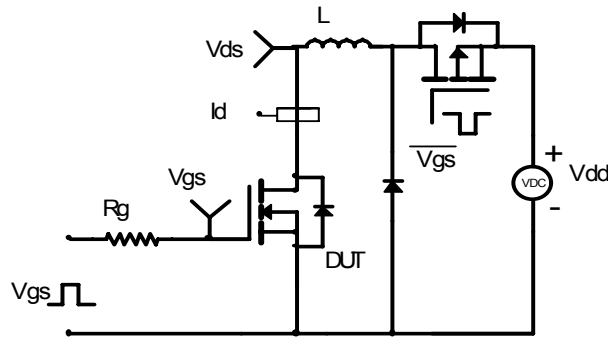
AOT1N60

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

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