ALPHA & OMEGA SEMICONDUCTOR

AOL1420

N-Channel Enhancement Mode Field Effect Transistor

General Description

The AOL1420 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and low gate resistance. This device is ideally suited for use as a low side switch in CPU core power conversion.
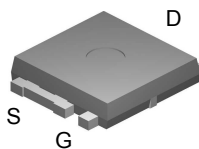
-RoHS Compliant
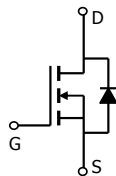-Halogen and Antimony Free Green Device*

Features

V_{DS} (V) = 30V
I_D = 85A (V_{GS} = 10V)
$R_{DS(ON)}$ < 3.7mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 5.5mΩ (V_{GS} = 4.5V)

UIS Tested
Rg,Ciss,Coss,Crss Tested

Ultra SO-8™ Top View

D

Bottom tab connected to drain

S

G

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [B,G]	T_C=25°C [G]	I_D	85	A
	T_C=100°C [B]		63	
Pulsed Drain Current		I_{DM}	150	
Continuous Drain Current [G]	T_A=25°C	I_{DSM}	19	
	T_A=70°C		15	
Avalanche Current [C]		I_{AR}	30	A
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	112	mJ
Power Dissipation [B]	T_C=25°C	P_D	100	W
	T_C=100°C		50	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.08	W
	T_A=70°C		1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	19.6	25	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		50	60	°C/W
Maximum Junction-to-Case [C]	Steady-State	$R_{\theta JC}$	0.9	1.5	°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		30			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=24V, V$_{GS}$=0V				1	μA
			T$_J$=55°C			5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$= ±20V				100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=250μA		1	1.8	3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=10V, V$_{DS}$=5V		85			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=20A			2.9	3.7	mΩ
			T$_J$=125°C		4.4	5.5	
		V$_{GS}$=4.5V, I$_D$=20A			4.4	5.5	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=20A			106		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V			0.72	1	V
I$_S$	Maximum Body-Diode Continuous Current					85	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=15V, f=1MHz			3700	4400	pF
C$_{oss}$	Output Capacitance				700		pF
C$_{rss}$	Reverse Transfer Capacitance				390		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			0.54	0.7	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=4.5V, V$_{DS}$=15V, I$_D$=20A			63	76	nC
Q$_g$(4.5V)	Total Gate Charge				33	40	nC
Q$_{gs}$	Gate Source Charge				8.6		nC
Q$_{gd}$	Gate Drain Charge				17.6		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=15V, R$_L$=0.75Ω, R$_{GEN}$=3Ω			12		ns
t$_r$	Turn-On Rise Time				15.5		ns
t$_{D(off)}$	Turn-Off DelayTime				40		ns
t$_f$	Turn-Off Fall Time				14		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=20A, dI/dt=100A/μs			34	41	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=20A, dI/dt=100A/μs			30		nC

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$_{J(MAX)}$=175°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$_{J(MAX)}$=175°C.

D. The R$_{θJA}$ is the sum of the thermal impedance 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 impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=175°C.

G. The maximum current rating is limited by bond-wires.

* This device is guaranteed green after date code 8P11 (June 1ST 2008)

Rev3: Jun 2008

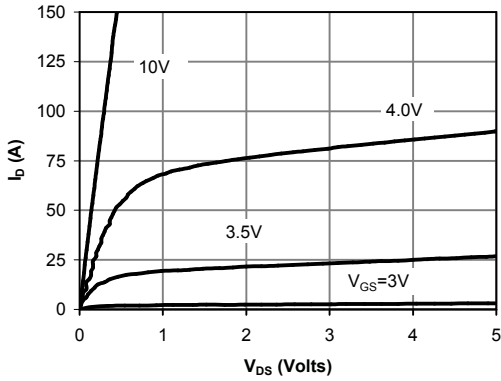**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

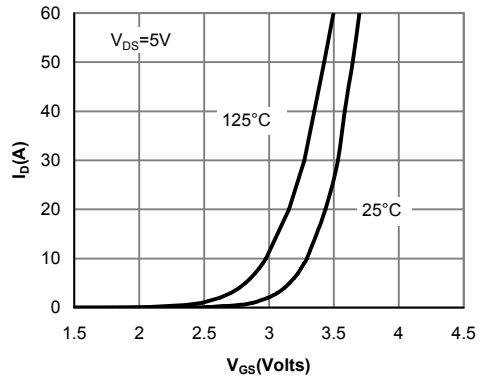Fig 1: On-Region Characteristics
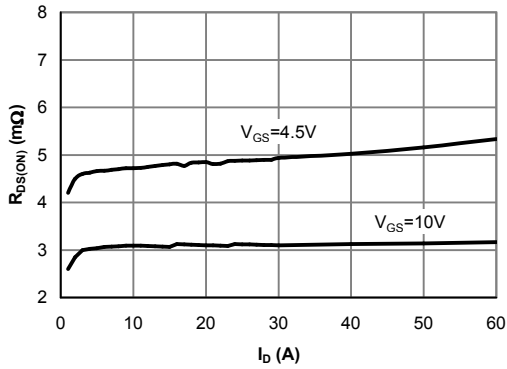
Figure 2: Transfer Characteristics

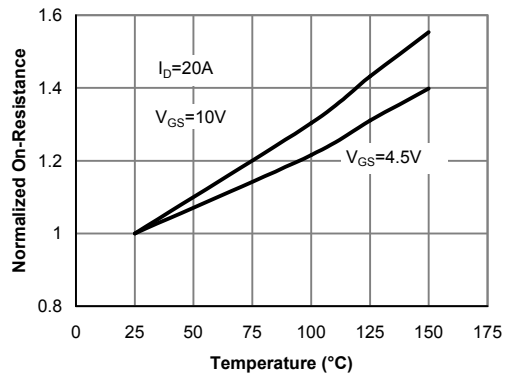Figure 3: On-Resistance vs. Drain Current and Gate Voltage
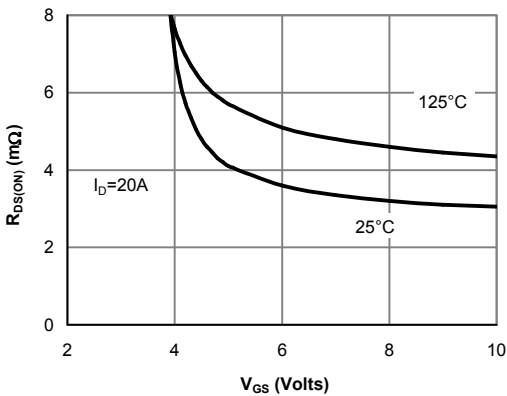
Figure 4: On-Resistance vs. Junction Temperature

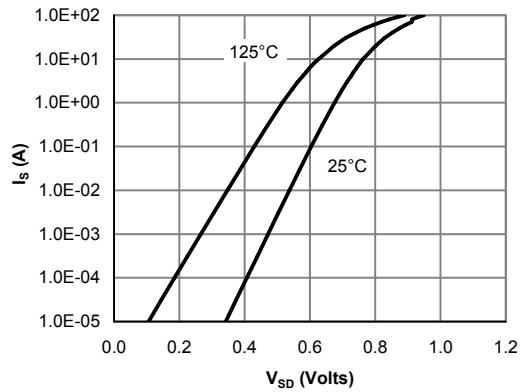Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

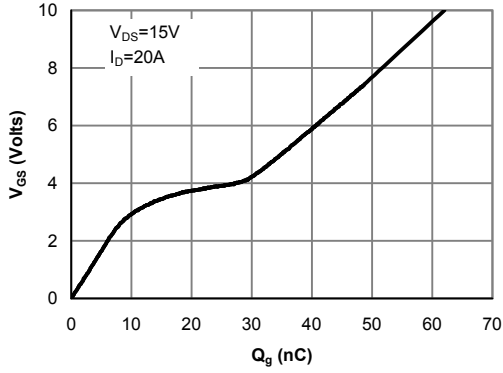## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
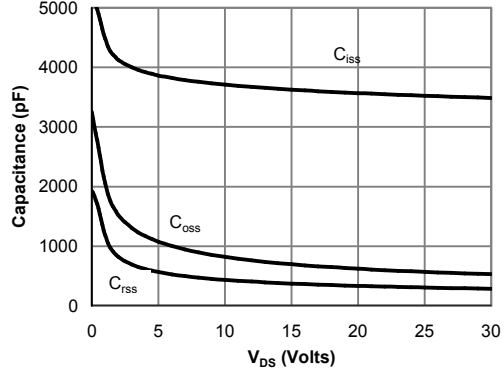
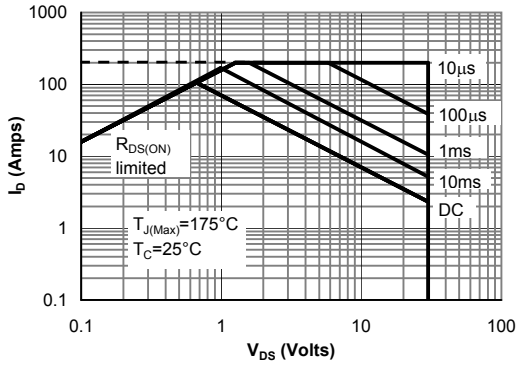**Figure 7: Gate-Charge Characteristics**

Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)
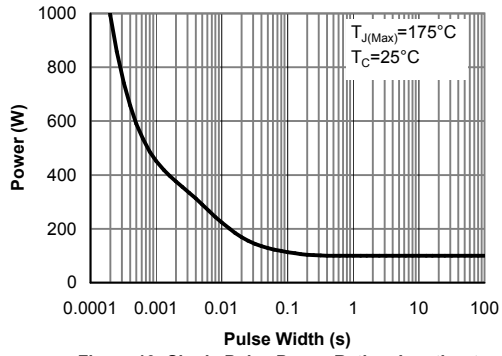
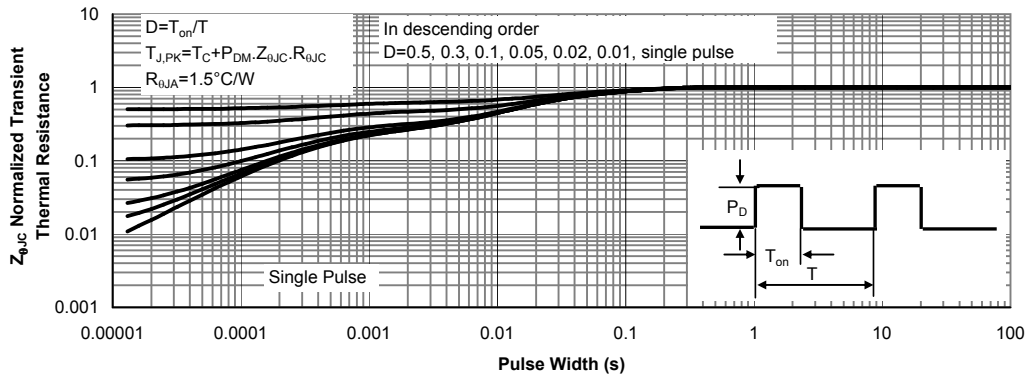**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)**

Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)
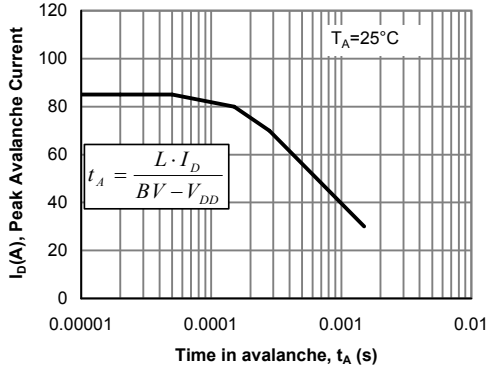
AOL1420
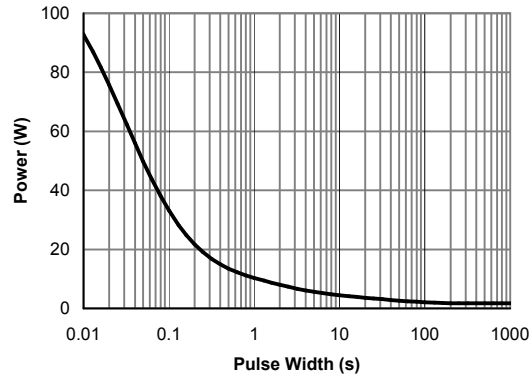
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$$t_A = \frac{L \cdot I_D}{BV - V_{DD}}$$

$T_A = 25°C$

Figure 12: Single Pulse Avalanche capability

$I_D(A)$, Peak Avalanche Current

Time in avalanche, t_A (s)
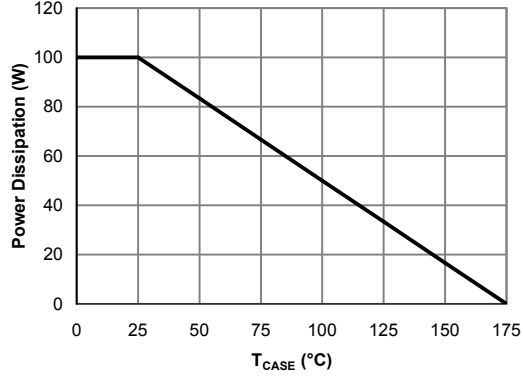
Figure 13: Power De-rating (Note B)

Power Dissipation (W)

T_{CASE} (°C)
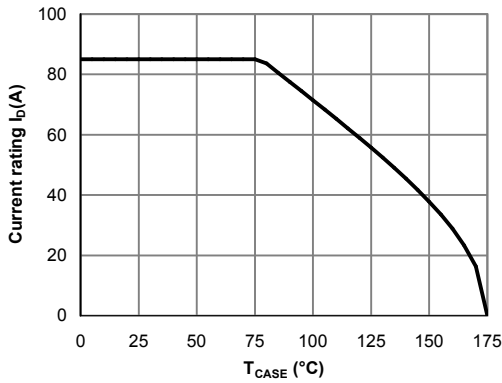
Figure 14: Current De-rating (Note B)

Current rating $I_D(A)$

T_{CASE} (°C)

**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)**

Power (W)

Pulse Width (s)

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

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JA}\cdot R_{\theta JA}$
$R_{\theta JA}=60$ °C/W

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JA}\cdot R_{\theta JA}$
$R_{\theta JA}=60$°C/W

Single Pulse

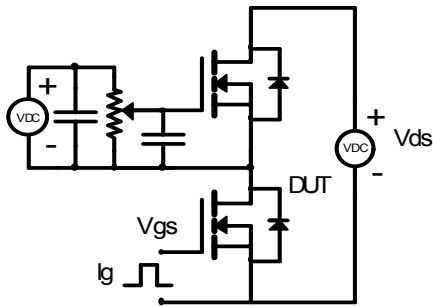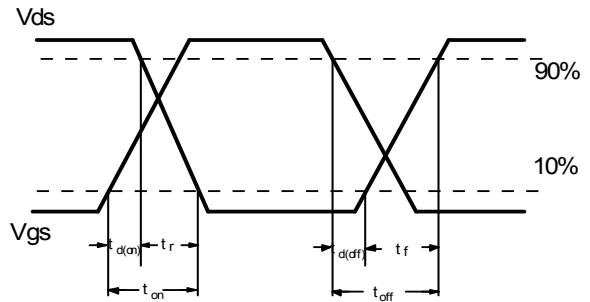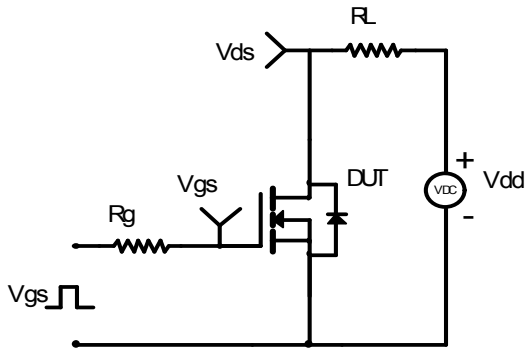$Z_{\theta JA}$ Normalized Transient Thermal Resistance

Pulse Width (s)
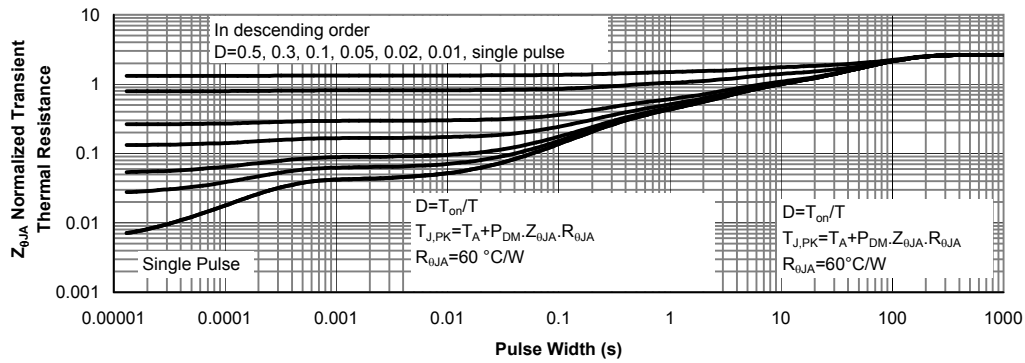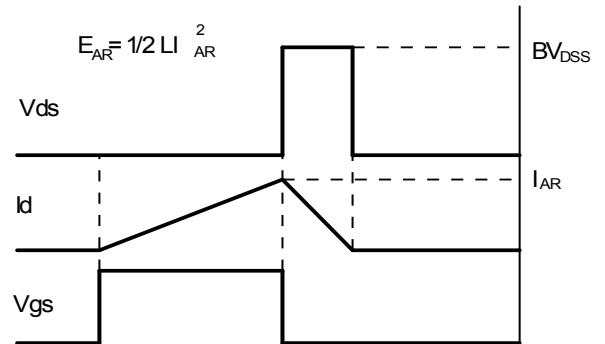
Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)
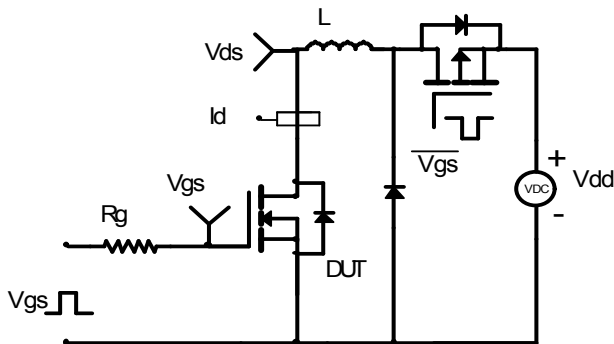
Gate Charge Test Circuit & Waveform
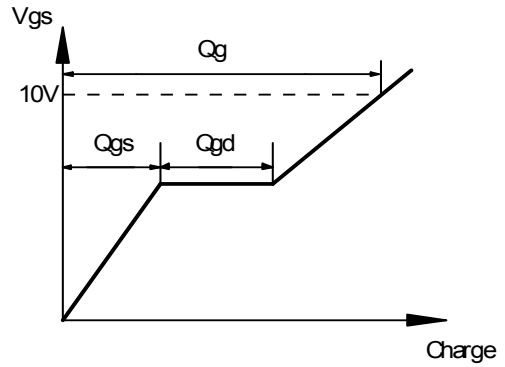
Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

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

Diode Recovery Test Circuit & Waveforms

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