ALPHA & OMEGA SEMICONDUCTOR

AOL1424

N-Channel Enhancement Mode Field Effect Transistor

RoHS Compliant   Green Product

General Description

The AOL1424 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V,while retaining a 20V $V_{GS(MAX)}$ rating. It is ESD protected.This device is suitable for use as a load switch.
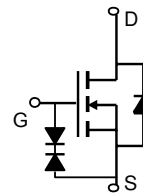
-RoHS Compliant
-Halogen and Antimony Free Green Device*

Features

V_{DS} (V) = 30V
I_D = 70A (V_{GS} = 10V)
$R_{DS(ON)}$ < 6.5mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 9.8mΩ (V_{GS} = 4.5V)

ESD Protected
UIS Tested
Rg,Ciss,Coss,Crss Tested

Ultra SO-8™ Top View

D
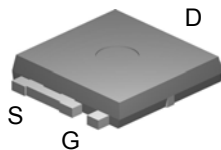
Bottom tab connected to drain

S

G

D

G

S

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]	T_C=25°C	I_D	70	A
	T_C=100°C		50	
Pulsed Drain Current [C]		I_{DM}	120	
Continuous Drain Current [A]	T_A=25°C	I_{DSM}	15	A
	T_A=70°C		12	
Avalanche Current [H]		I_{AR}	30	A
Repetitive avalanche energy L=0.3mH [H]		E_{AR}	135	mJ
Power Dissipation [B]	T_C=25°C	P_D	50	W
	T_C=100°C		25	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.2	W
	T_A=70°C		1.5	
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	$R_{\theta JA}$	20	24	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		45	55	°C/W
Maximum Junction-to-Case [D]	Steady-State	$R_{\theta JC}$	2.5	3.0	°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$_{DS}$=30V, V$_{GS}$=0V				1	µA
			T$_J$=55°C			5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$= ±16V				10	µA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=250µA		1.4	1.8	2.5	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=10V, V$_{DS}$=5V		120			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=20A			5.3	6.5	mΩ
			T$_J$=125°C		7.4	8.9	
		V$_{GS}$=4.5V, I$_D$=20A			7.8	9.8	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=20A			67		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A, V$_{GS}$=0V			0.7	1.0	V
I$_S$	Maximum Body-Diode Continuous Current					70	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=15V, f=1MHz			1803	2170	pF
C$_{oss}$	Output Capacitance				387		pF
C$_{rss}$	Reverse Transfer Capacitance				238		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			1.3	2	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=15V, I$_D$=20A			36	48	nC
Q$_g$(4.5V)	Total Gate Charge				19		nC
Q$_{gs}$	Gate Source Charge				3.9		nC
Q$_{gd}$	Gate Drain Charge				8.7		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=15V, R$_L$=0.75Ω, R$_{GEN}$=3Ω			7.6		ns
t$_r$	Turn-On Rise Time				6.4		ns
t$_{D(off)}$	Turn-Off DelayTime				27		ns
t$_f$	Turn-Off Fall Time				8.5		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=20A, dI/dt=100A/µs			27	33	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=20A, dI/dt=100A/µs			17		nC

A: The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$ =25°C. The power dissipation P$_{DSM}$ and current rating I$_{DSM}$ are   based on T$_{J(MAX)}$=150°C, using steady state junction-to-ambient thermal resistance.

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. These tests are performed with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25°C. The SOA curve provides a single pulse rating.

H. EAR and IAR ratings are based on low frequency and duty cycles such that Tj(start)=25C for each pulse.

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

Rev6: Marchl 2009

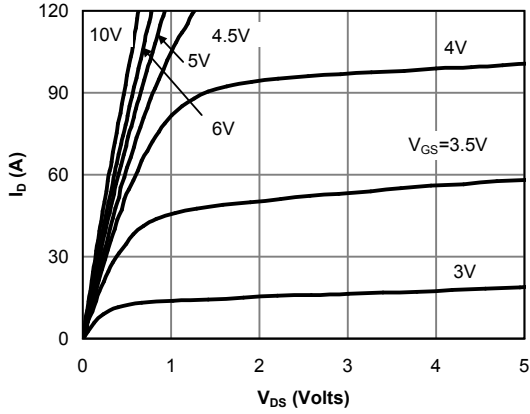## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

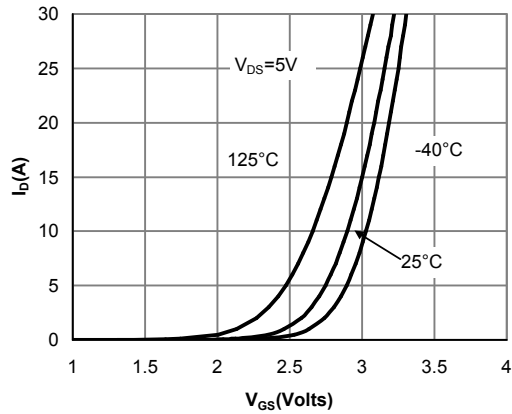**Figure 1: On-Region Characteristics**
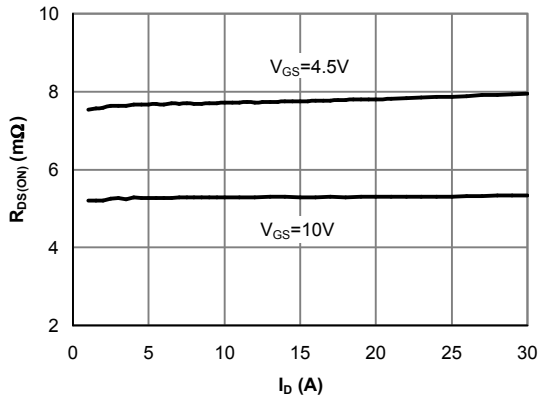
Figure 2: Transfer Characteristics

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

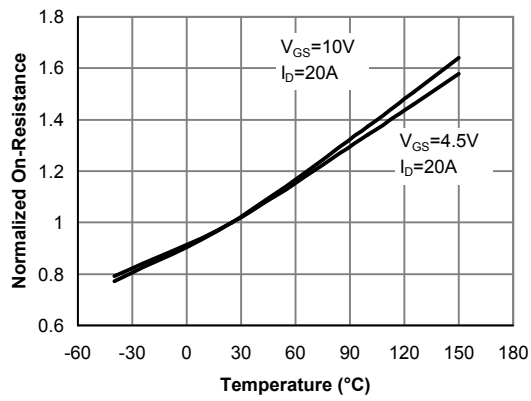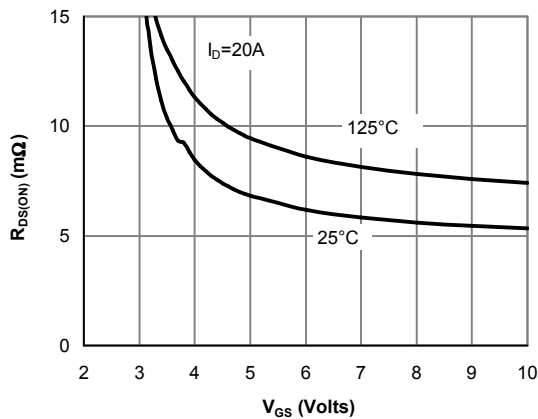**Figure 4: On-Resistance vs. Junction Temperature**

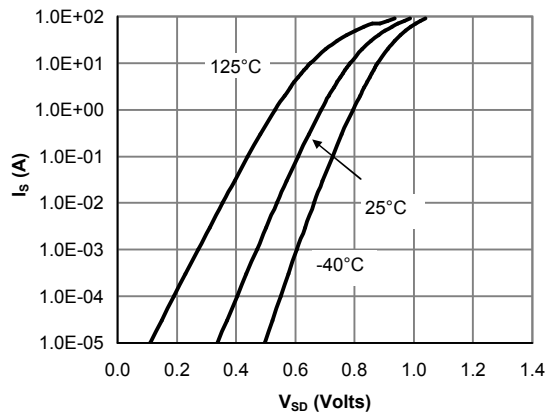**Figure 5: On-Resistance vs. Gate-Source Voltage**

Figure 6: Body-Diode Characteristics

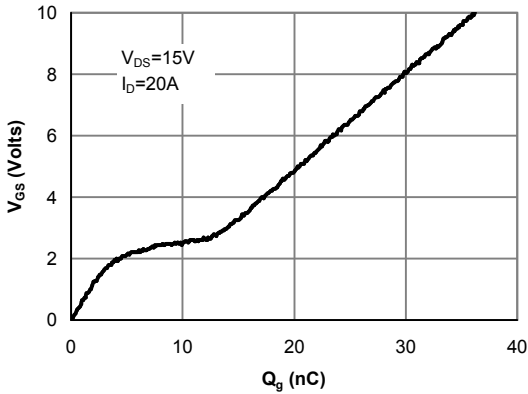## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
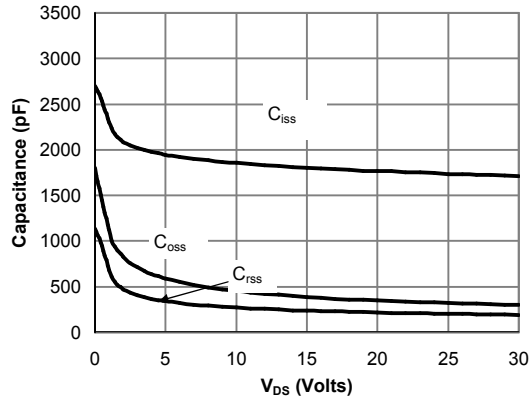
Figure 7: Gate-Charge Characteristics

V_{DS}=15V
I_D=20A

Figure 8: Capacitance Characteristics

C_{iss}
C_{oss}
C_{rss}
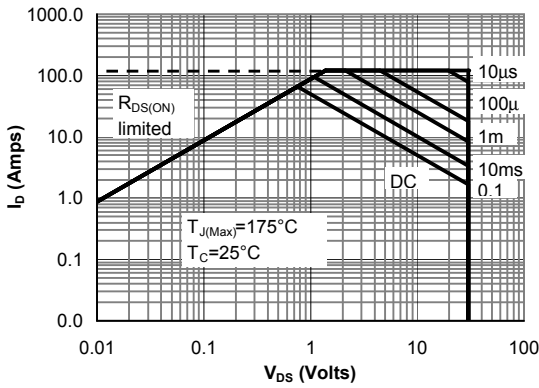
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

$R_{DS(ON)}$ limited
$T_{J(Max)}$=175°C
T_C=25°C
10µs
100µ
1m
10ms
0.1
DC
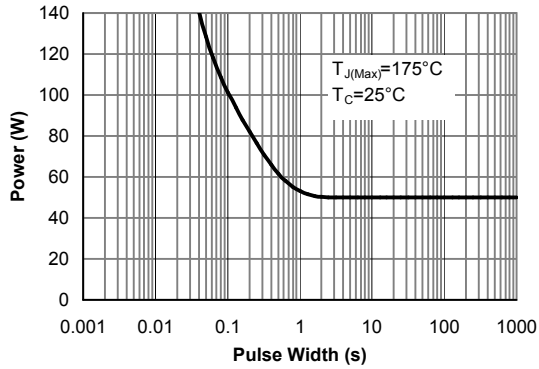
Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

$T_{J(Max)}$=175°C
T_C=25°C
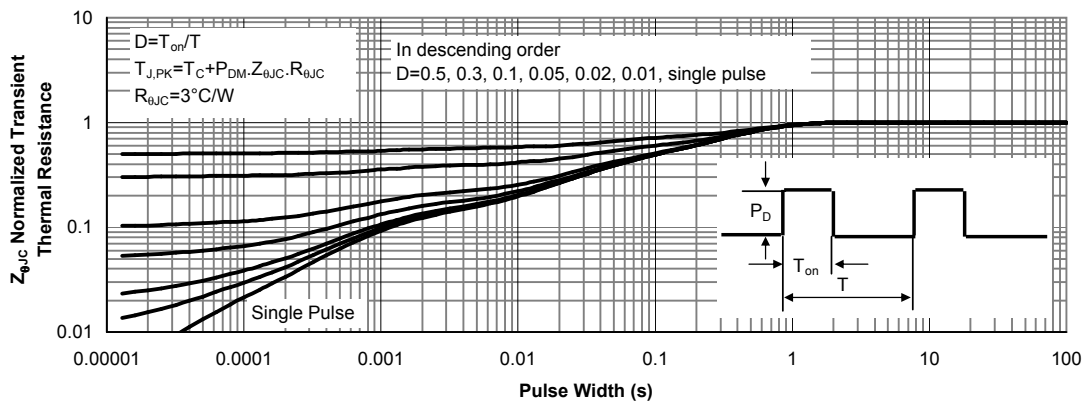
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

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

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

Single Pulse

P_D
T_{on}
T

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
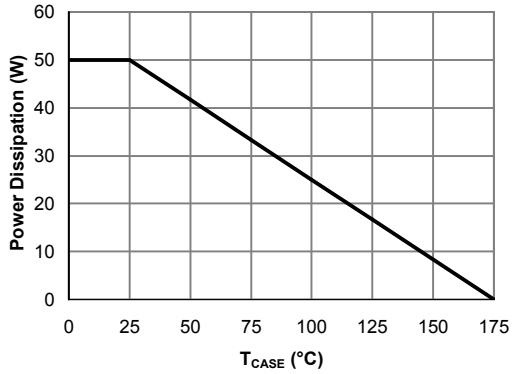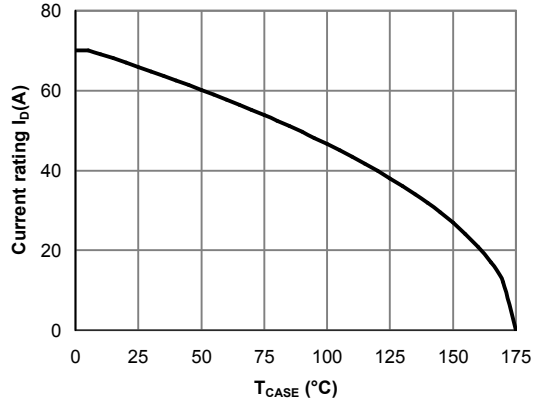

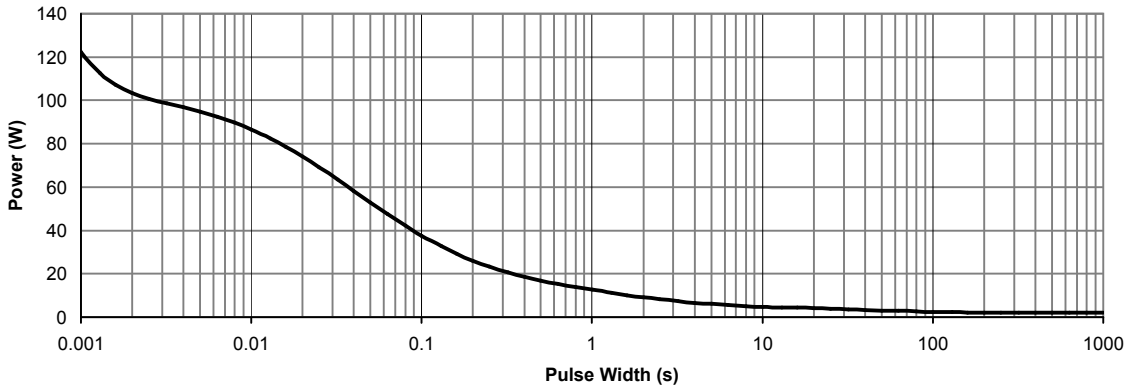Figure 12: Power De-rating (Note B)

Figure 13: Current De-rating (Note B)

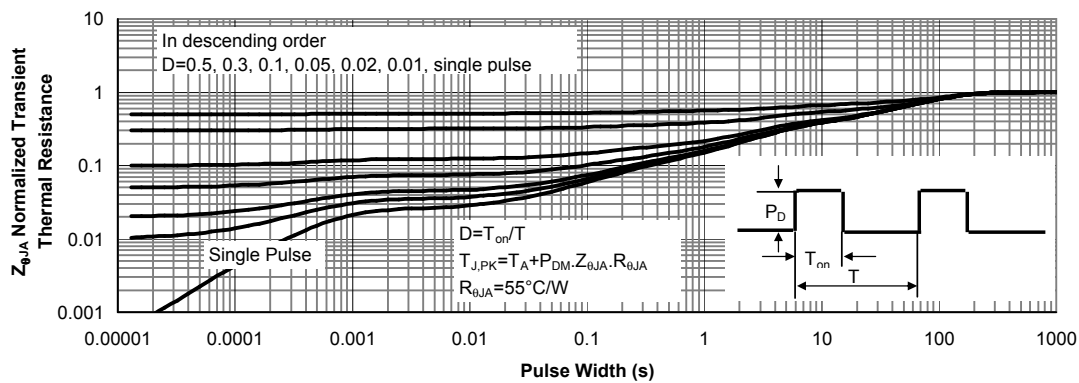Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

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

Single Pulse

$D=T_{on}/T$
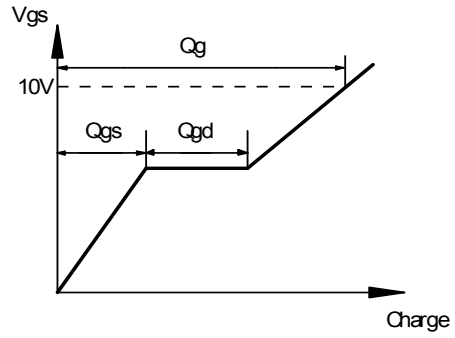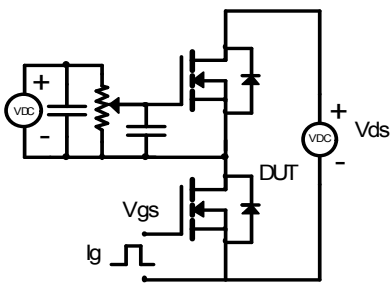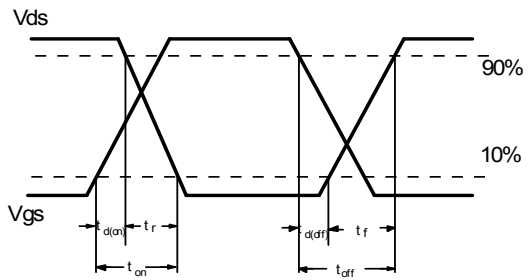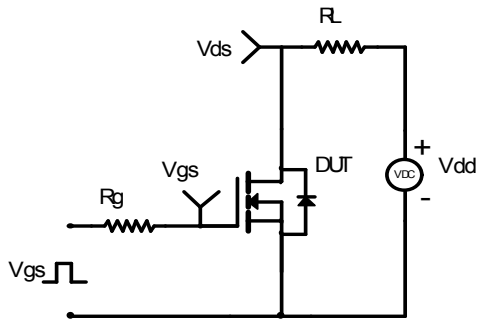$T_{J,PK}=T_A+P_{DM}.Z_{\theta JA}.R_{\theta JA}$
$R_{\theta JA}=55°C/W$
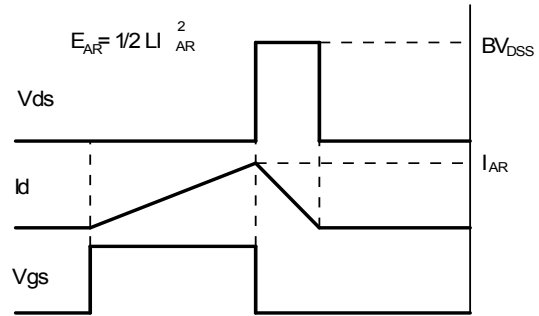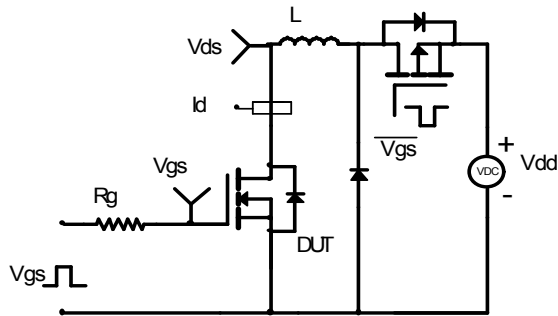
Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

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

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