ALPHA & OMEGA SEMICONDUCTOR

AOL1413
P-Channel Enhancement Mode Field Effect Transistor

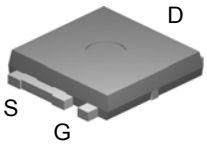
General Description
The AOL1413 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications. The device is ESD protected.

-RoHS Compliant
-Halogen and Antimony Free Green Device*

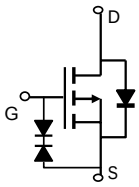
Features
V_{DS} (V) = -30V
I_D = -38A (V_{GS} = -10V)
$R_{DS(ON)}$ < 17mΩ (V_{GS} = -10V)
$R_{DS(ON)}$ < 36mΩ (V_{GS} = -5V)

ESD Protected!

Ultra SO-8™ Top View



Bottom tab connected to drain



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}	±25	V
Continuous Drain Current [B]	T_C=25°C	I_D	-38	A
	T_C=100°C		-27	
Pulsed Drain Current [C]		I_{DM}	-70	
Continuous Drain Current [A]	T_A=25°C	I_{DSM}	-9	
	T_A=70°C		-7	
Power Dissipation [B]	T_C=25°C	P_D	38	W
	T_C=100°C		19	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.1	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	$R_{\theta JA}$	18	25	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		49	60	°C/W
Maximum Junction-to-Case [B]	Steady-State	$R_{\theta JC}$	2.9	4	°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=-250uA, 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}= ±25V				±10	uA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250μA		-1.5	-2.5	-3.5	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V		-70			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-20A			13.5	17	mΩ
			T_J=125°C		18.5	24	
		V_{GS}=-5V, I_D=-20A			28	36	
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=20A			27		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V			-0.72	-1	V
I_S	Maximum Body-Diode Continuous Current					-38	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz			1760	2200	pF
C_{oss}	Output Capacitance				360		pF
C_{rss}	Reverse Transfer Capacitance				255		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz			6.4	8	Ω
SWITCHING PARAMETERS							
Q_g(10V)	Total Gate Charge	V_{GS}=-10V, V_{DS}=-15V, I_D=-20A			30	38	nC
Q_g(4.5V)	Total Gate Charge				11		nC
Q_{gs}	Gate Source Charge				7		nC
Q_{gd}	Gate Drain Charge				8		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-15V, R_L=0.75Ω, R_{GEN}=3Ω			11.5		ns
t_r	Turn-On Rise Time				8		ns
$t_{D(off)}$	Turn-Off DelayTime				35		ns
t_f	Turn-Off Fall Time				18.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-20A, dI/dt=100A/μs			24	30	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-20A, dI/dt=100A/μs			16		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25°C. The Power dissipation P_{DSM} is based on t<10s $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175°C may be used if the PCB allows it.

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 $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 us 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 $T_{J(MAX)}$=175°C. The SOA curve provides a single pulse rating.

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

H. 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.

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

Rev3:April, 2008

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

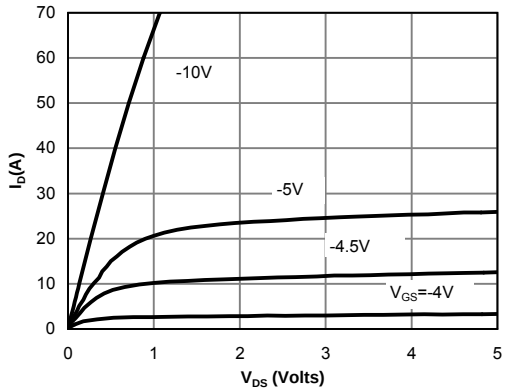


Figure 1: On-Region Characteristics

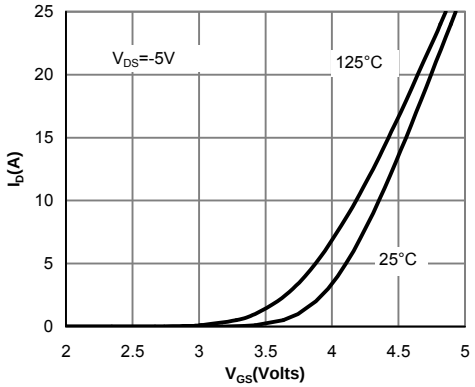


Figure 2: Transfer Characteristics

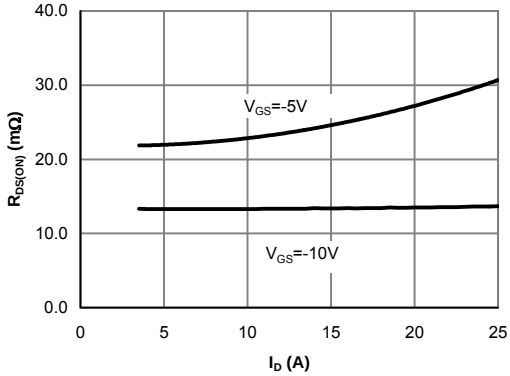


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

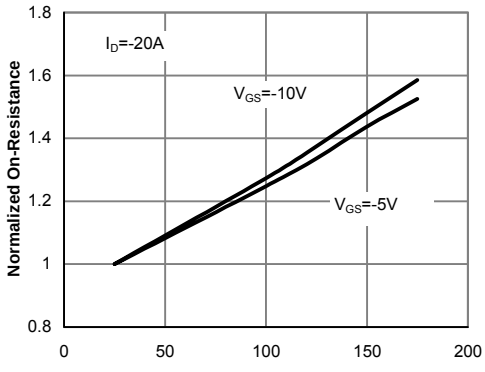


Figure 4: On-Resistance vs. Junction Temperature

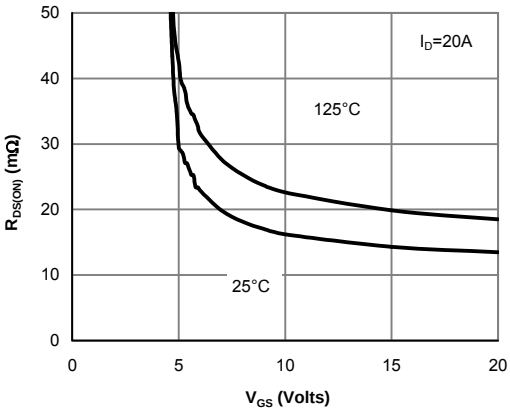


Figure 5: On-Resistance vs. Gate-Source Voltage

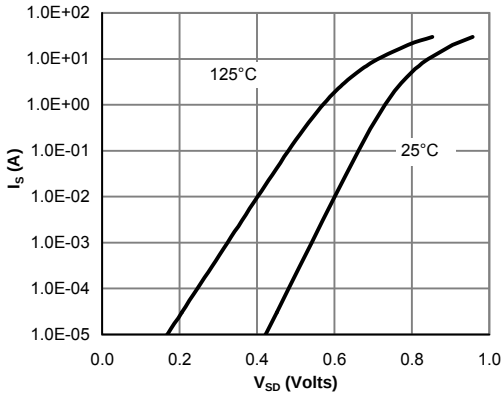


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

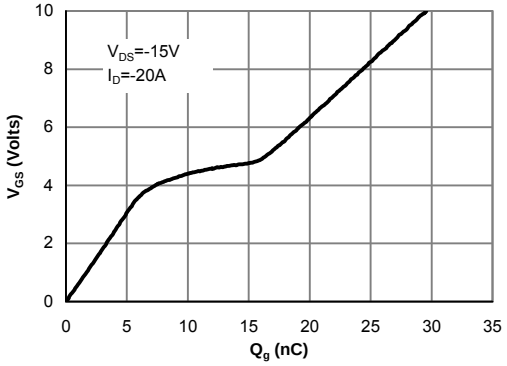


Figure 7: Gate-Charge Characteristics

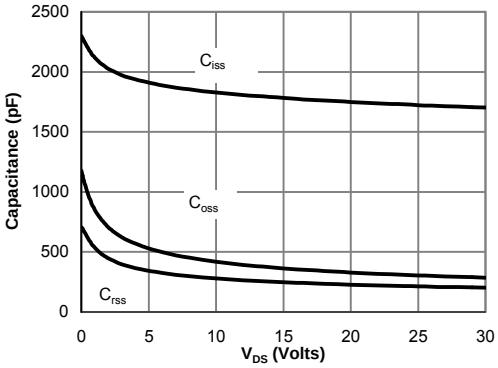


Figure 8: Capacitance Characteristics

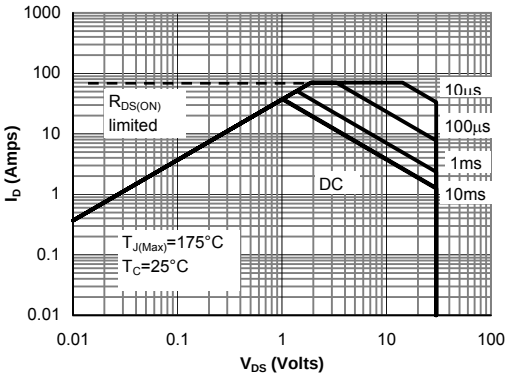


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

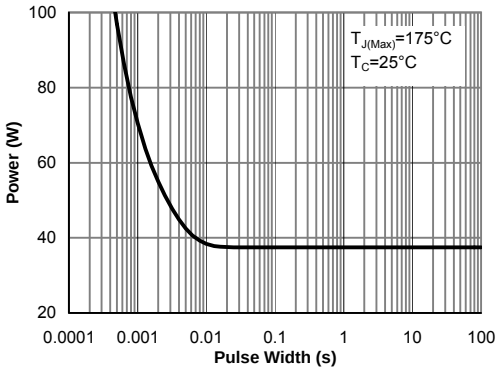


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

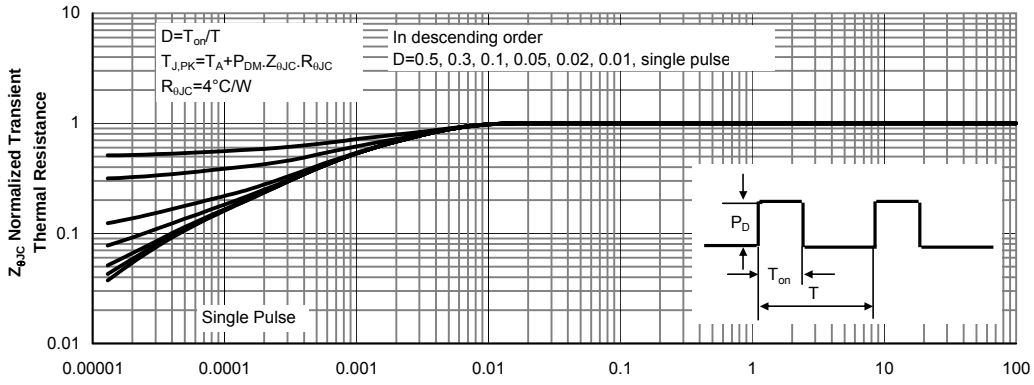


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

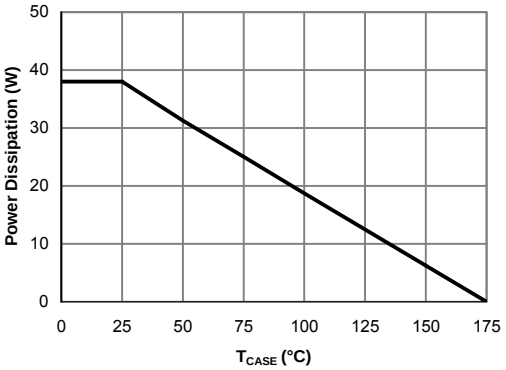


Figure 13: Power De-rating (Note B)

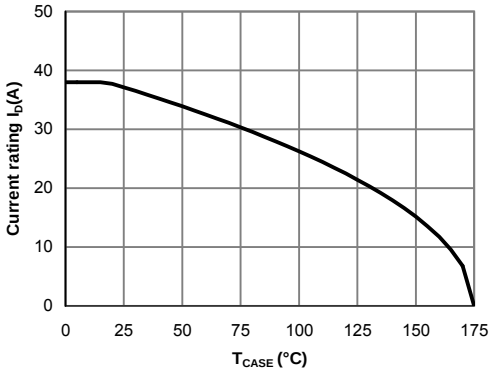


Figure 14: Current De-rating (Note B)

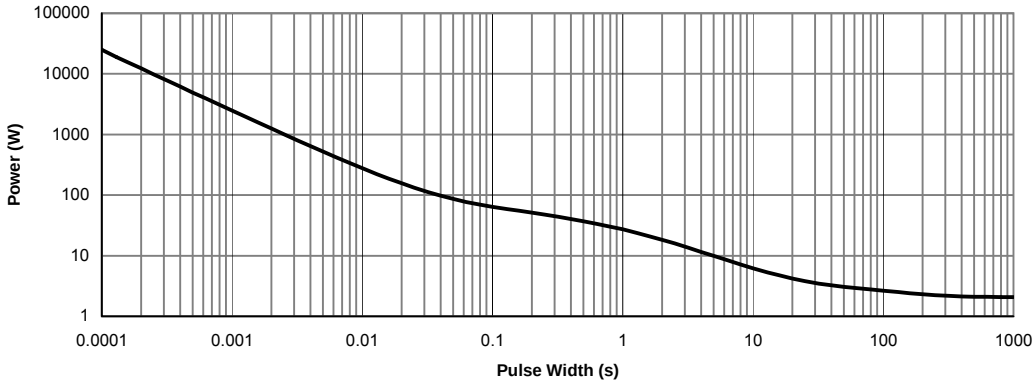


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

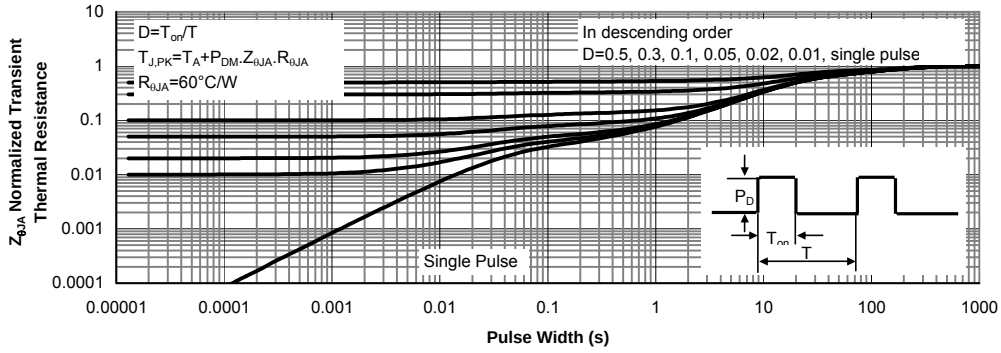
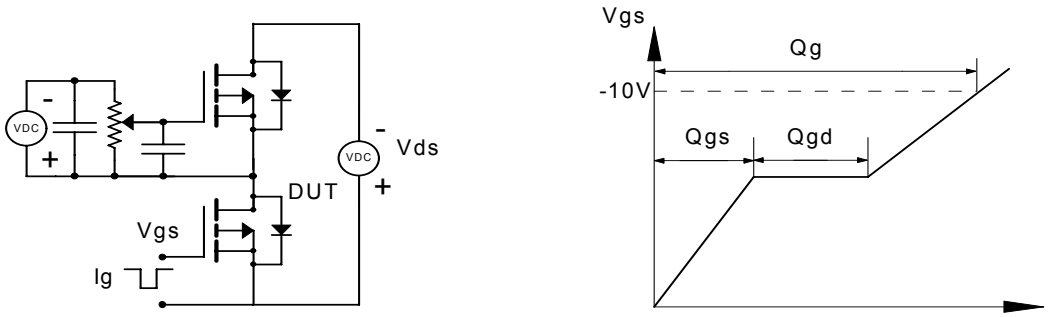
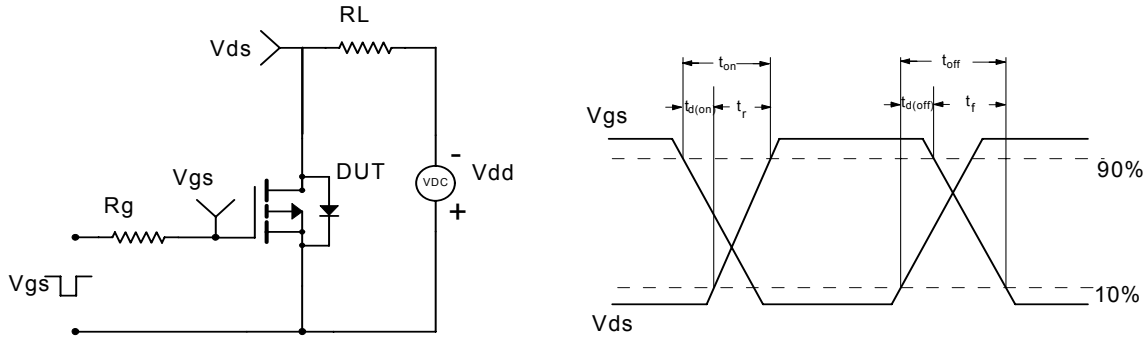


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

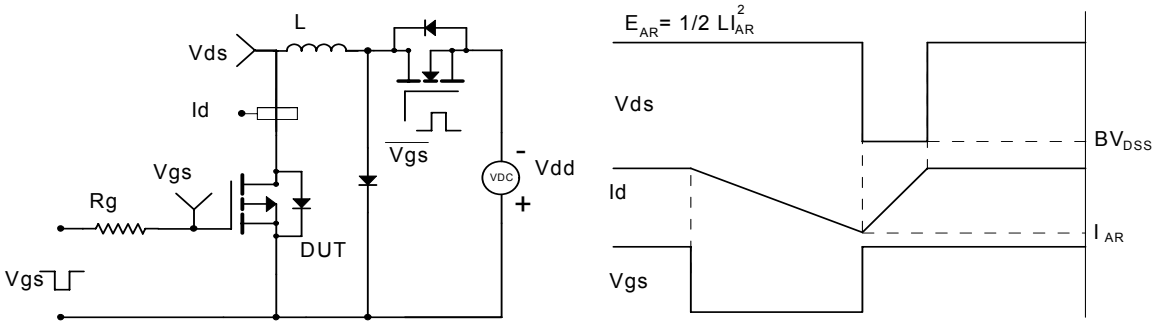
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms