

AOL1413
P-Channel Enhancement Mode Field Effect Transistor
General Description

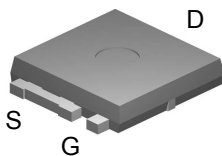
The AOL1413 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications. The device is ESD protected.

- RoHS Compliant
- Halogen and Antimony Free Green Device*

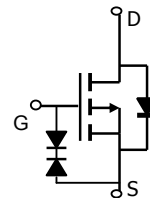
Features

- V_{DS} (V) = -30V
- I_D = -20A (V_{GS} = -10V)
- $R_{DS(ON)}$ < 17m Ω (V_{GS} = -10V)
- $R_{DS(ON)}$ < 36m Ω (V_{GS} = -5V)
- ESD Protected!

Ultra SO-8™ Top View



Bottom tab
connected to
drain


Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	I_D	$T_C=25^\circ\text{C}$	A
		$T_C=100^\circ\text{C}$	
Pulsed Drain Current ^C	I_{DM}	-70	A
Continuous Drain Current ^A	I_{DSM}	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	W
		$T_C=100^\circ\text{C}$	
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	18	25	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A		Steady-State	49	
Maximum Junction-to-Case ^B	$R_{\theta JC}$	2.9	4	$^\circ\text{C/W}$

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}, V_{GS}=0\text{V}$	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-30\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 25\text{V}$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-1.5	-2.5	-3.5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}, V_{DS}=-5\text{V}$	-70			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}, I_D=-20\text{A}$ $T_J=125^\circ\text{C}$		13.5 18.5	17 24	$\text{m}\Omega$
		$V_{GS}=-5\text{V}, I_D=-20\text{A}$		28	36	
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=20\text{A}$		27		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		-0.72	-1	V
I_S	Maximum Body-Diode Continuous Current				-40	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-15\text{V}, f=1\text{MHz}$		1760	2200	pF
C_{oss}	Output Capacitance			360		pF
C_{rss}	Reverse Transfer Capacitance			255		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		6.4	8	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=-10\text{V}, V_{DS}=-15\text{V}, I_D=-20\text{A}$		30	38	nC
$Q_g(4.5\text{V})$	Total Gate Charge			11		nC
Q_{gs}	Gate Source Charge			7		nC
Q_{gd}	Gate Drain Charge			8		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-10\text{V}, V_{DS}=-15\text{V}, R_L=0.75\Omega,$ $R_{GEN}=3\Omega$		11.5		ns
t_r	Turn-On Rise Time			8		ns
$t_{D(off)}$	Turn-Off Delay Time			35		ns
t_f	Turn-Off Fall Time			18.5		ns
t_{rr}	Body Diode Reverse Recovery Time		$I_F=-20\text{A}, dI/dt=100\text{A}/\mu\text{s}$		24	30
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-20\text{A}, dI/dt=100\text{A}/\mu\text{s}$		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 $T_A=25^\circ\text{C}$. The Power dissipation P_{DSM} is based on $t < 10\text{s}$ $R_{\theta JA}$ 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 $T_{J(MAX)}=175^\circ\text{C}$, 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 $T_{J(MAX)}=175^\circ\text{C}$.

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

E. The static characteristics in Figures 1 to 6 are obtained using $< 300\mu\text{s}$ 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 $T_{J(MAX)}=175^\circ\text{C}$. 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 $T_A=25^\circ\text{C}$.

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

Rev2: Dec 2008

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

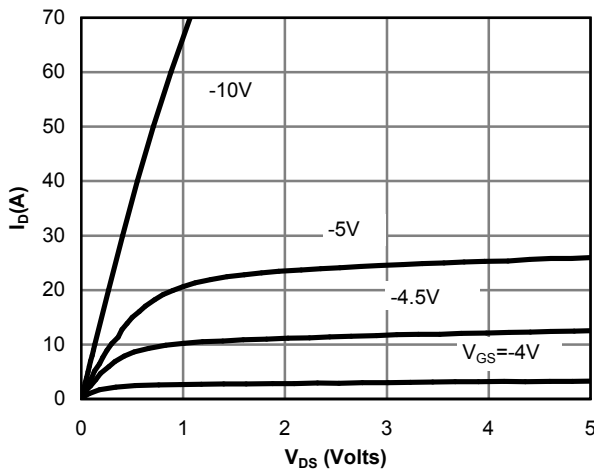


Figure 1: On-Region Characteristics

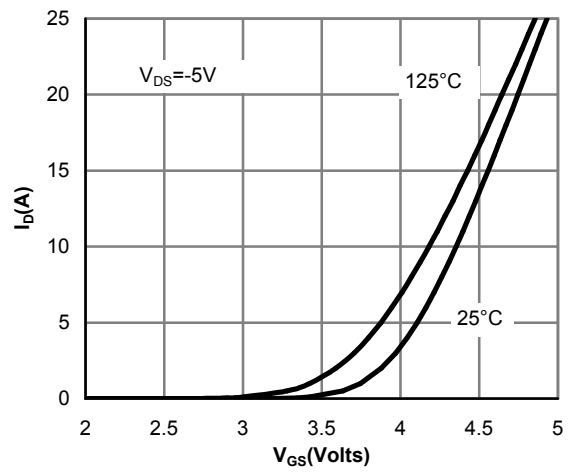


Figure 2: Transfer Characteristics

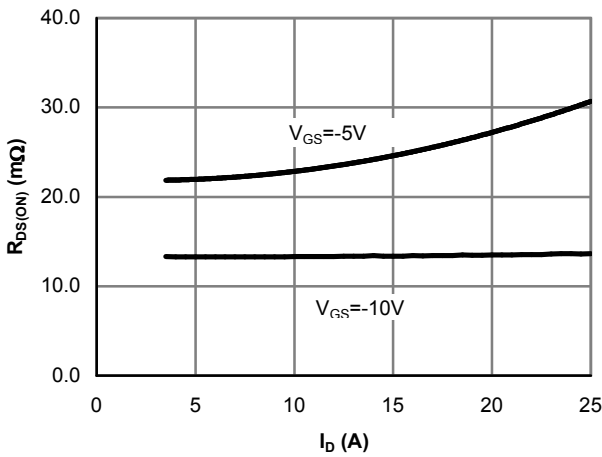


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

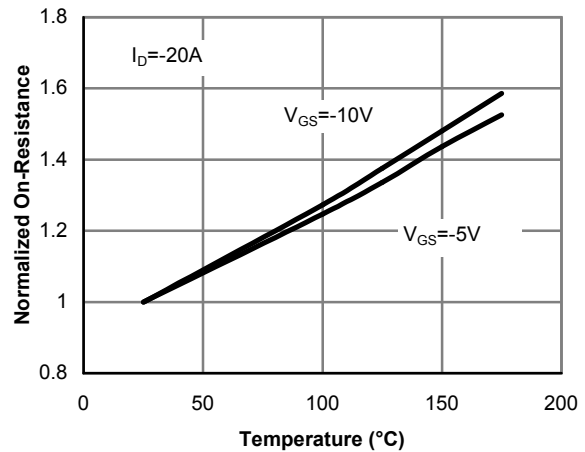


Figure 4: On-Resistance vs. Junction Temperature

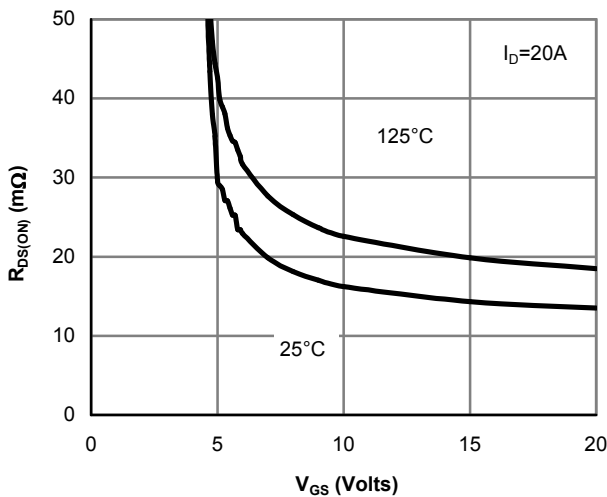


Figure 5: On-Resistance vs. Gate-Source Voltage

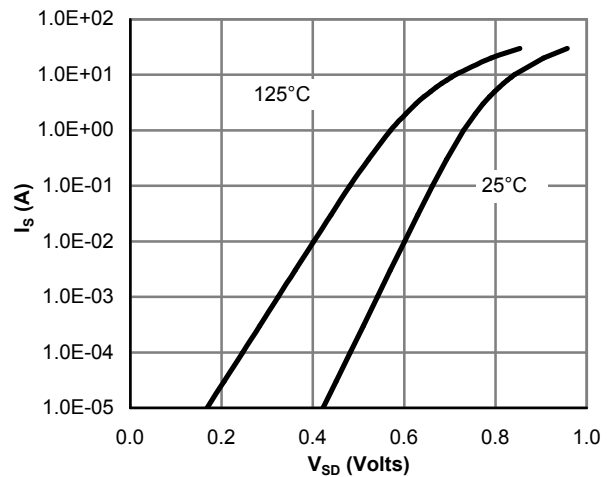


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

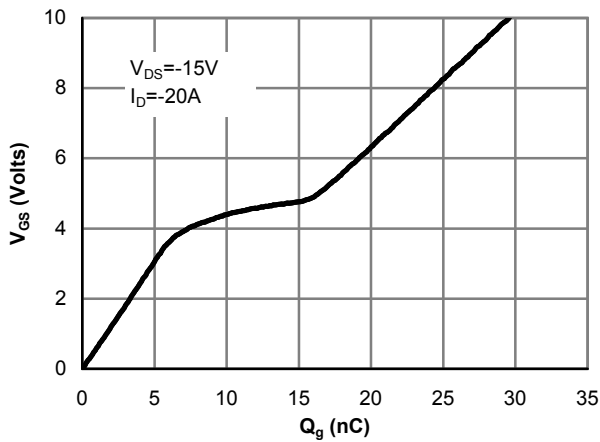


Figure 7: Gate-Charge Characteristics

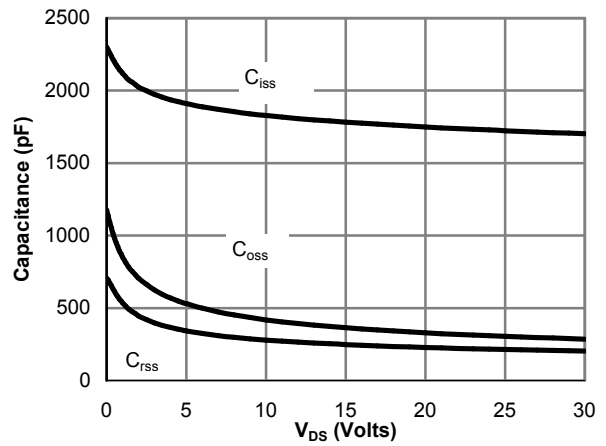


Figure 8: Capacitance Characteristics

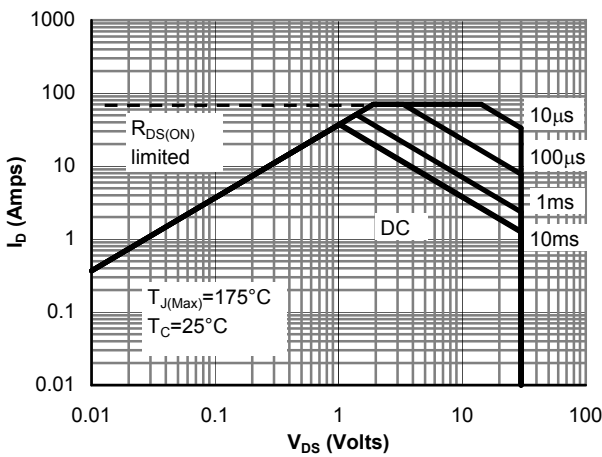


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

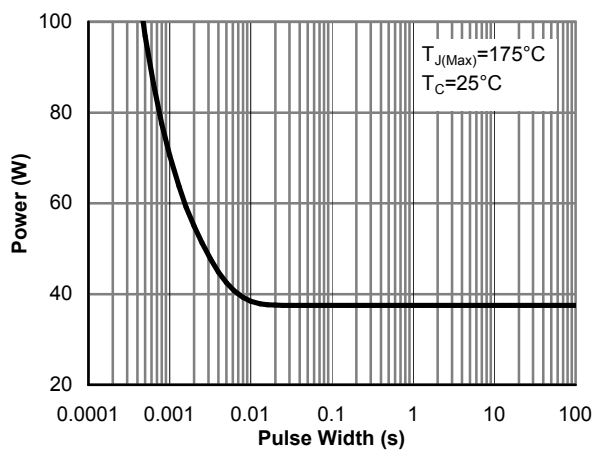


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

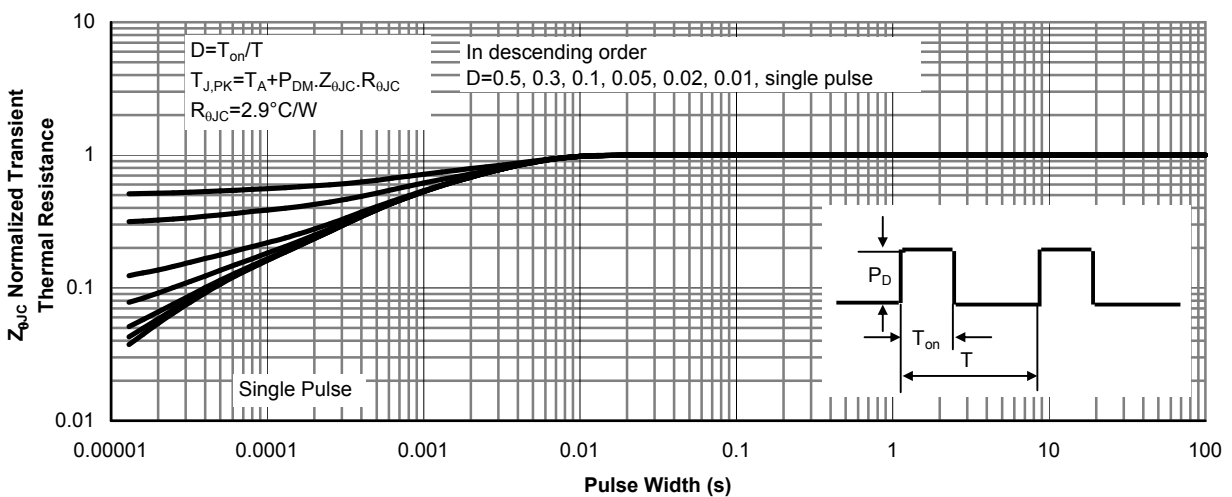


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

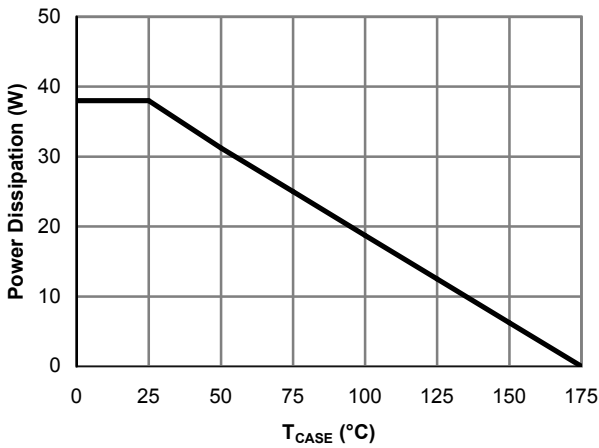


Figure 13: Power De-rating (Note B)

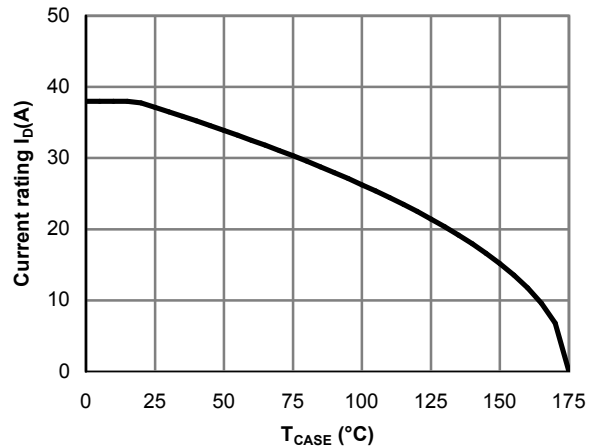


Figure 14: Current De-rating (Note B)

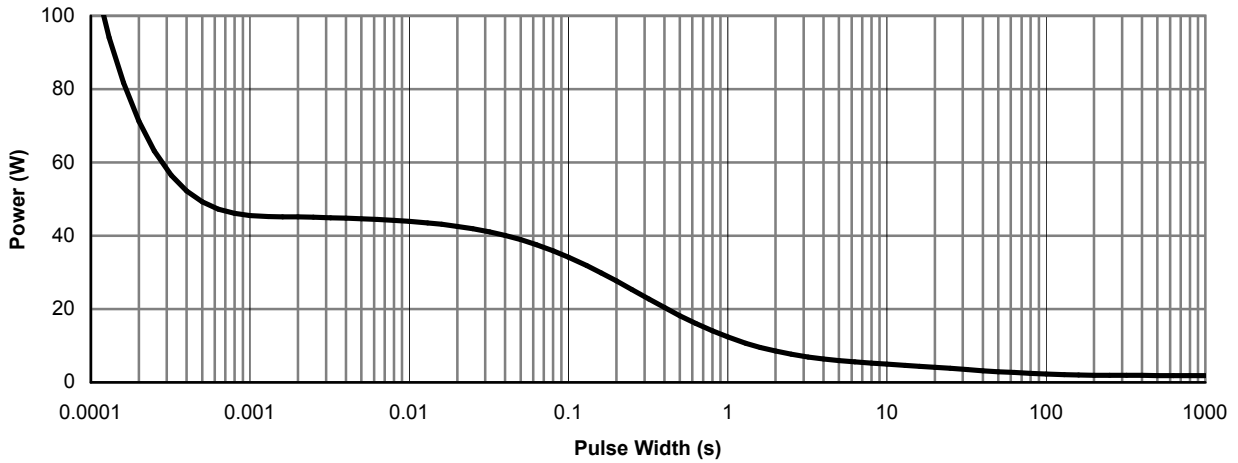


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

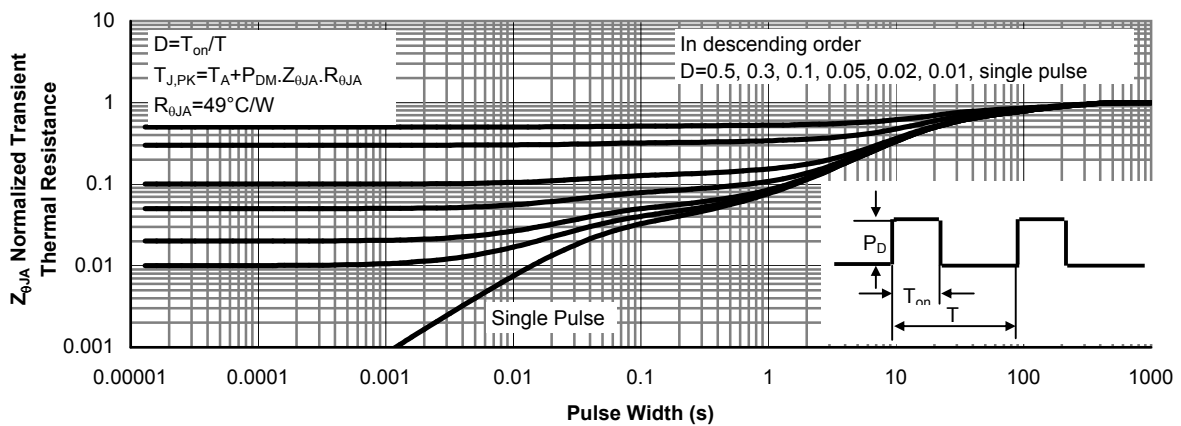
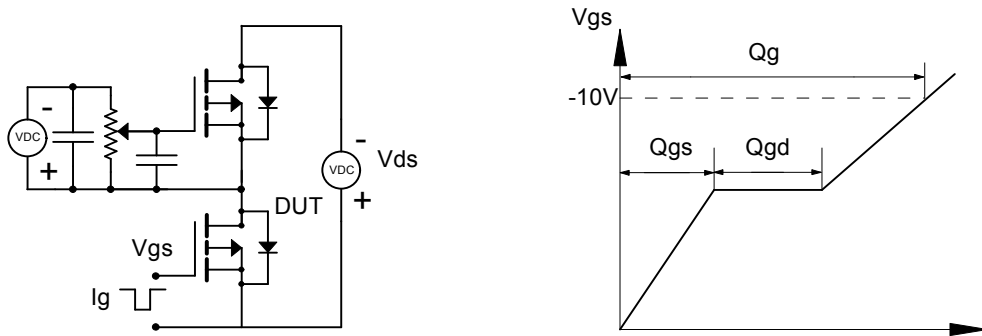
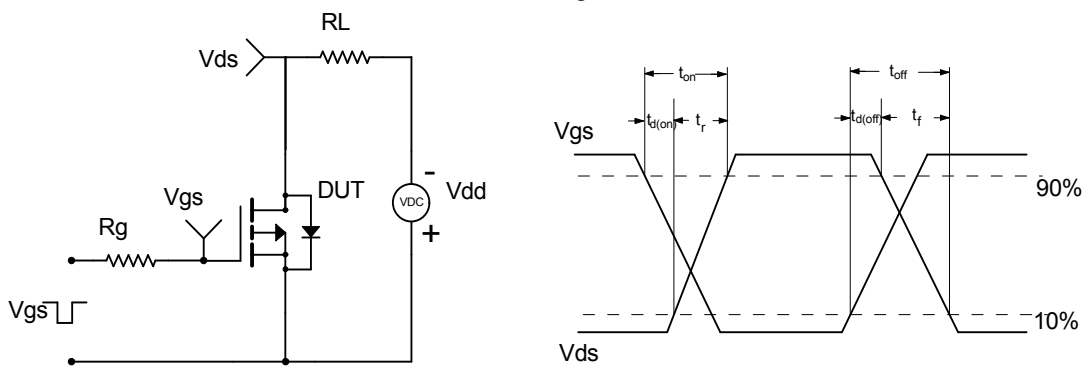


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

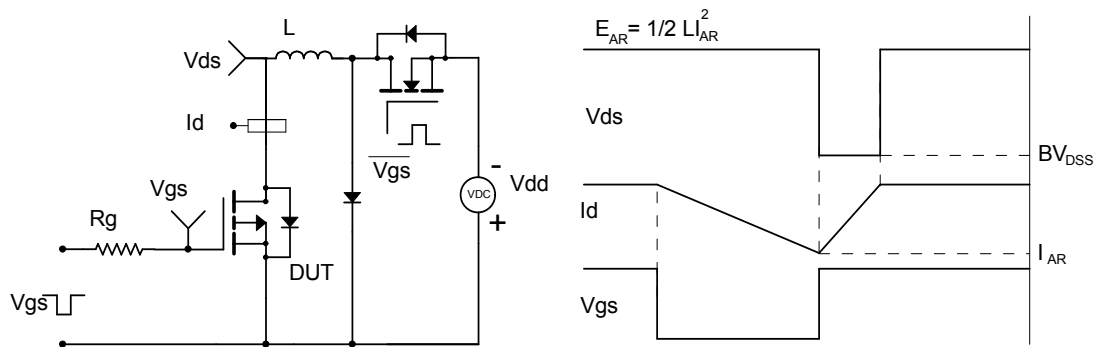
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

