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General Description

- Trench Power MV MOSFET technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- Optimized for fast-switching applications

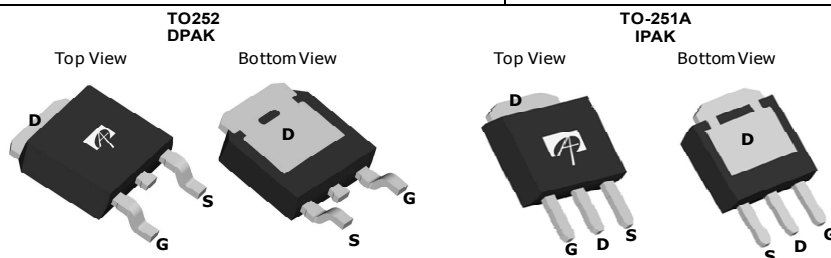
Applications

- Synchronous Rectification in DC/DC and AC/DC Converters
- Industrial and Motor Drive applications

Product Summary

V_{DS}	-60V
I_D (at $V_{GS}=-10V$)	-26A
$R_{DS(ON)}$ (at $V_{GS}=-10V$)	< 40m Ω
$R_{DS(ON)}$ (at $V_{GS}=-4.5V$)	< 55m Ω

100% UIS Tested
 100% Rg Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOD409	TO-252	Tape & Reel	2500
AOI409	TO-251A	Tube	4000

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	-60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current	I_D	-26	A
$T_C=25^\circ\text{C}$		-18	
$T_C=100^\circ\text{C}$			
Pulsed Drain Current ^C	I_{DM}	-80	A
Avalanche Current ^C	I_{AS}	-26	A
Avalanche energy $L=0.1\text{mH}$ ^C	E_{AS}	34	mJ
Power Dissipation ^B	P_D	60	W
$T_C=25^\circ\text{C}$		30	
$T_C=100^\circ\text{C}$			
Power Dissipation ^A	P_{DSM}	2.5	W
$T_A=25^\circ\text{C}$		1.6	
$T_A=70^\circ\text{C}$			
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	$R_{\theta JA}$	16.7	25	$^\circ\text{C/W}$
$t \leq 10\text{s}$				
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	40	50	$^\circ\text{C/W}$
Steady-State				
Maximum Junction-to-Case	$R_{\theta JC}$	1.9	2.5	$^\circ\text{C/W}$
Steady-State				

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	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-60			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-48\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^{\circ}\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.2	-1.9	-2.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	-80			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$, $I_D=-20\text{A}$ $T_J=125^{\circ}\text{C}$		32 53	40	m Ω
		$V_{GS}=-4.5\text{V}$, $I_D=-20\text{A}$		43	55	
						m Ω
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-20\text{A}$		32		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.73	-1	V
I_S	Maximum Body-Diode Continuous Current				-30	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-30\text{V}$, $f=1\text{MHz}$		2977	3600	pF
C_{oss}	Output Capacitance			241		pF
C_{rss}	Reverse Transfer Capacitance			153		pF
R_g	Gate resistance	$f=1\text{MHz}$		2	2.4	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $I_D=-20\text{A}$		44	54	nC
$Q_g(4.5\text{V})$	Total Gate Charge			22.2	28	nC
Q_{gs}	Gate Source Charge			9		nC
Q_{gd}	Gate Drain Charge			10		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $R_L=1.5\Omega$, $R_{GEN}=3\Omega$		12		ns
t_r	Turn-On Rise Time			14.5		ns
$t_{D(off)}$	Turn-Off DelayTime			38		ns
t_f	Turn-Off Fall Time			15		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-20\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		40	50	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-20\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		59		nC

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² 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 $R_{\theta JA} \leq 10\text{s}$ 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. Single 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 package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

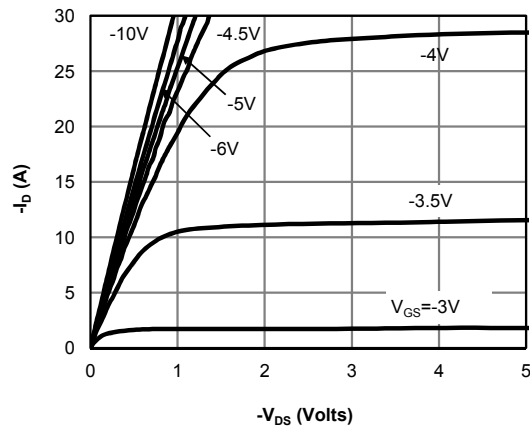


Figure 1: On-Region Characteristics (Note E)

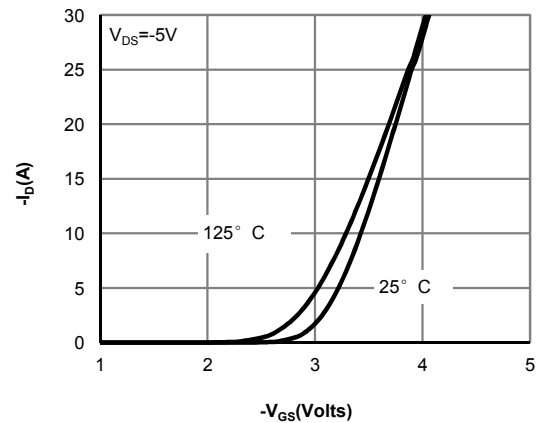


Figure 2: Transfer Characteristics (Note E)

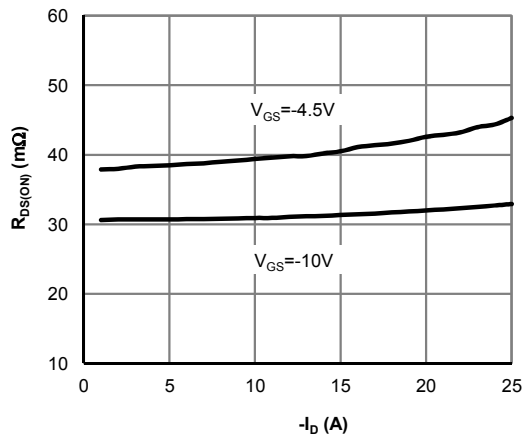


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

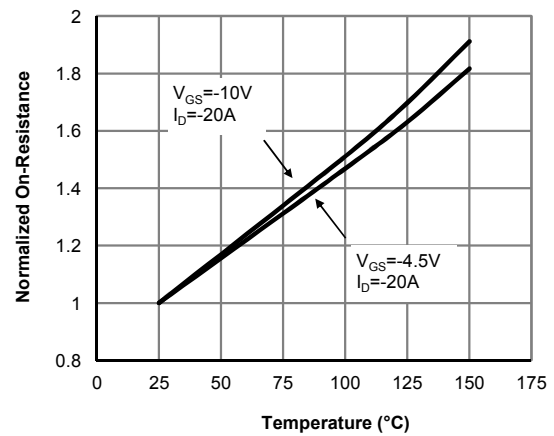


Figure 4: On-Resistance vs. Junction Temperature (Note E)

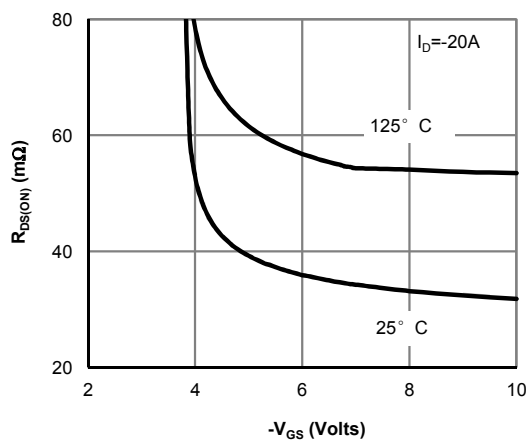


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

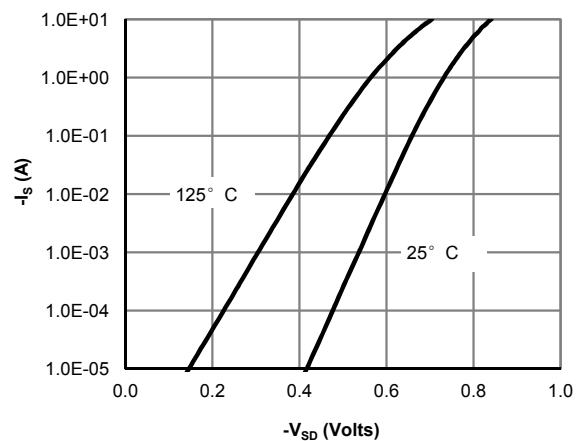


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

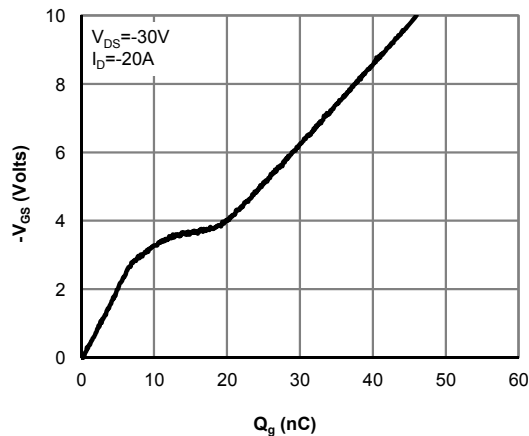


Figure 7: Gate-Charge Characteristics

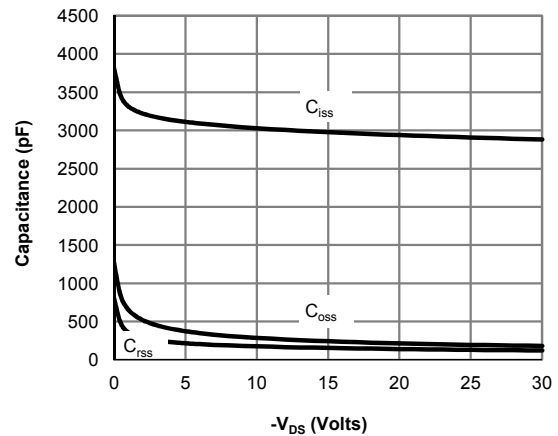


Figure 8: Capacitance Characteristics

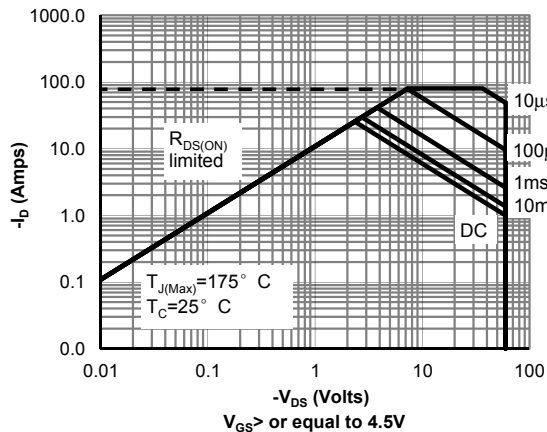


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

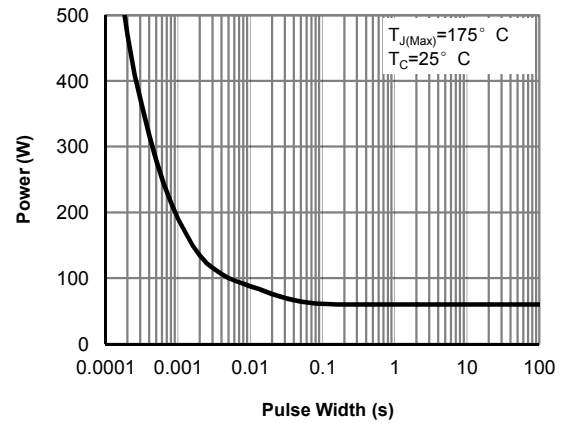


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

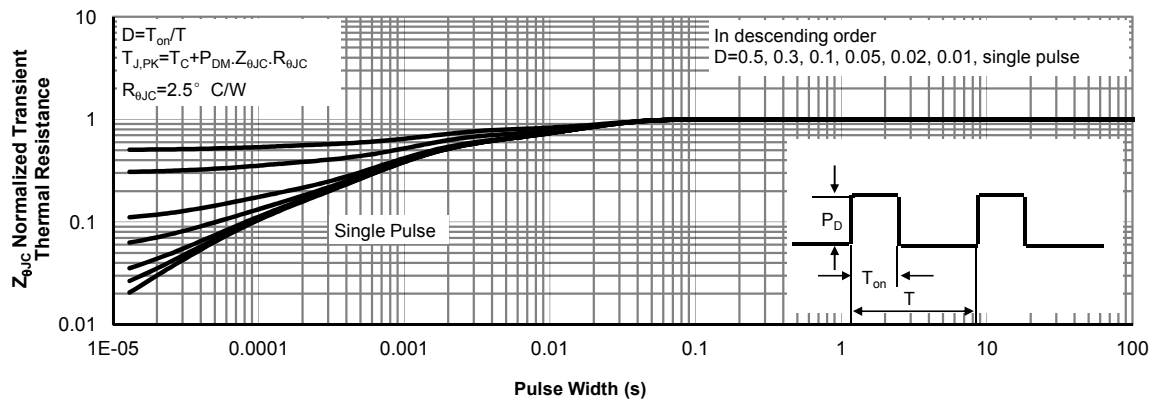


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

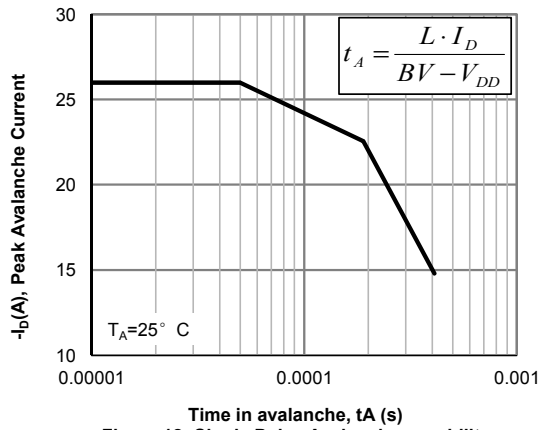


Figure 12: Single Pulse Avalanche capability

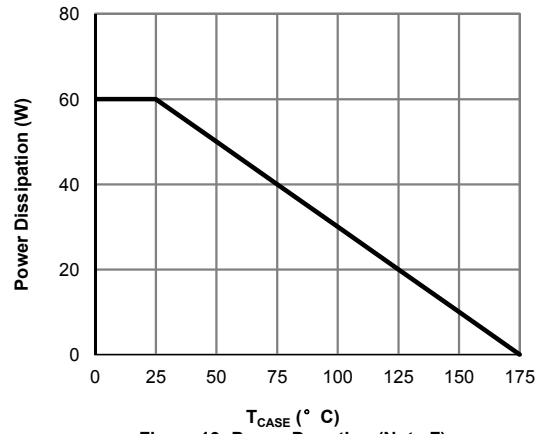


Figure 13: Power De-rating (Note F)

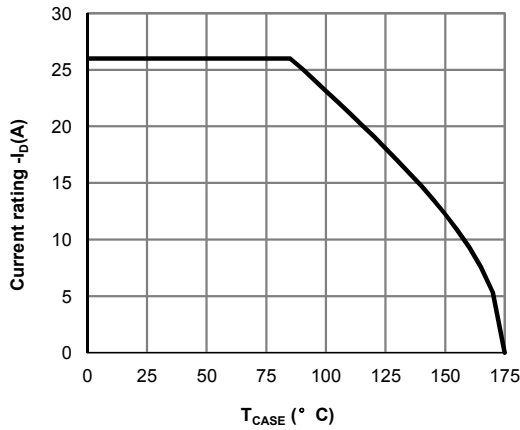


Figure 14: Current De-rating (Note F)

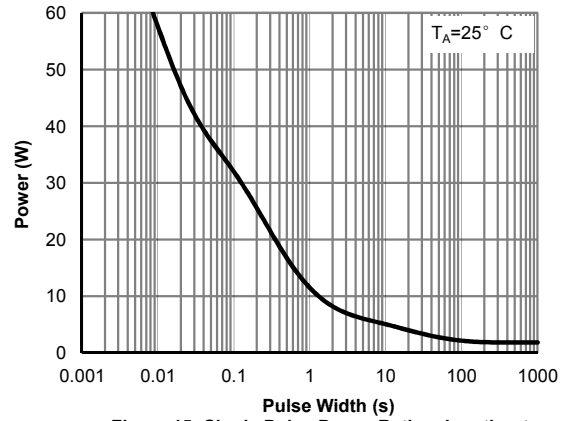


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

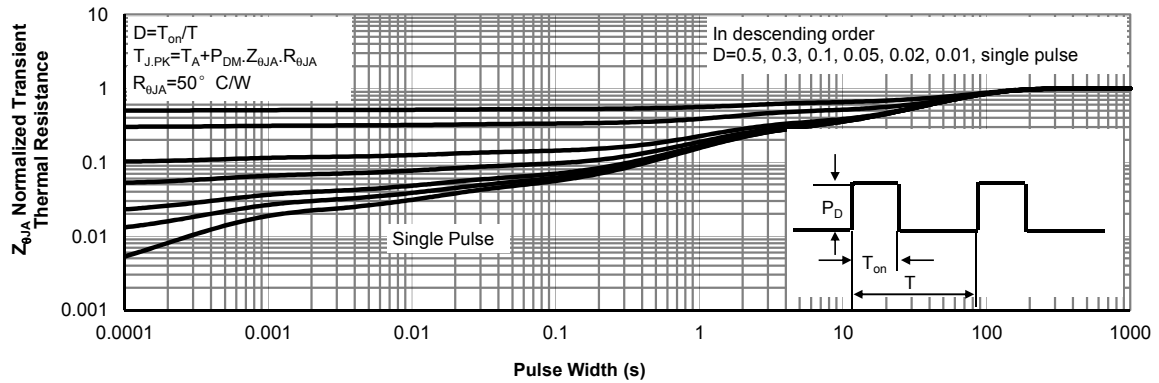
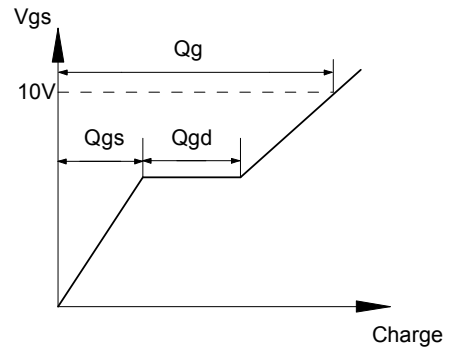
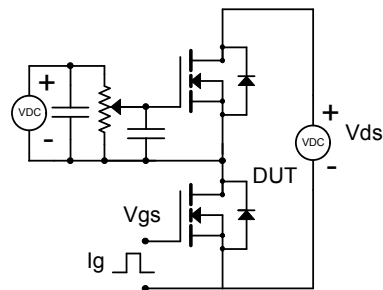
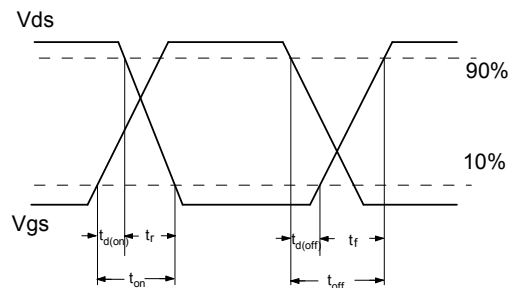
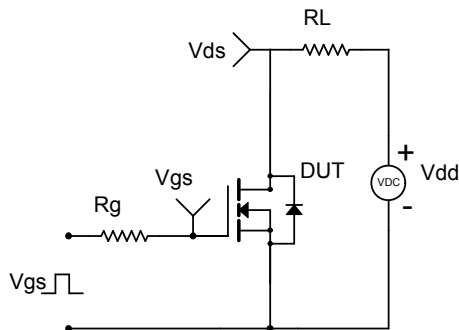


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

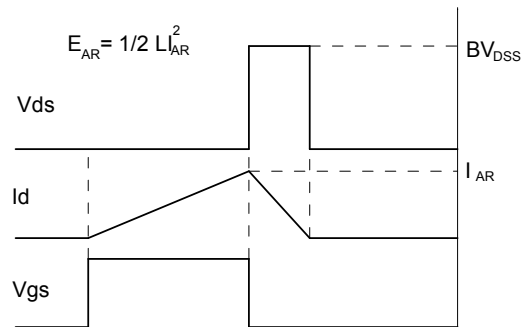
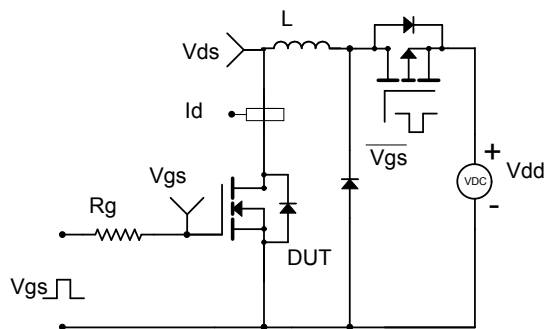
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

