ALPHA & OMEGA SEMICONDUCTOR

AONV180A60

600V, αMOS5™ N-Channel Power Transistor

General Description

- Proprietary αMOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

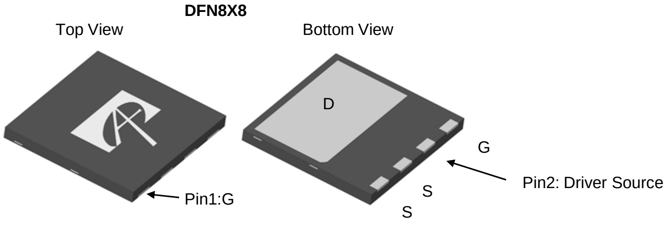
Applications

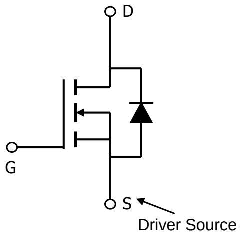
- SMPS with PFC, Flyback and LLC topologies
- Micro inverter with DC/AC inverter topology

Product Summary

V_{DS} @ $T_{j,max}$	700V
I_{DM}	96A
$R_{DS(ON),max}$	< 0.18Ω
$Q_{g,typ}$	46nC
E_{oss} @ 400V	4.9µJ

100% UIS Tested
100% R_g Tested





Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONV180A60	DFN8x8_4L_EP1_S	Tape & Reel	3500

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±20	V
Gate-Source Voltage (dynamic) AC(f>1Hz)		V_{GS}	±30	V
Continuous Drain Current	T_C=25°C	I_D	24	A
	T_C=100°C		15	
Pulsed Drain Current [C]		I_{DM}	96	
Continuous Drain Current	T_A=25°C	I_{DSM}	4.3	A
	T_A=70°C		3.4	
Avalanche Current [C]		I_{AR}	6	A
Repetitive avalanche energy [C]		E_{AR}	18	mJ
Single pulsed avalanche energy [G]		E_{AS}	172	mJ
MOSFET dv/dt ruggedness		dv/dt	100	V/ns
Diode reverse recovery		dv/dt	20	V/ns
V_{DS}=0 to 400V,I_F<=20A,T_j=25°C		di/dt	250	A/us
Power Dissipation [B]	T_C=25°C	P_D	250	W
	Derate above 25°C		2	W/°C
Power Dissipation [A]	T_A=25°C	P_{DSM}	8.3	W
	T_A=70°C		5.3	W/°C
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	12	15	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		40	50	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.31	0.50	°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, T_J=25°C	600			V
		I_D=250µA, V_{GS}=0V, T_J=150°C		700		
BV_{DSS} /ΔTJ	Breakdown Voltage Temperature Coefficient	I_D=250µA, V_{GS}=0V		0.56		V/^{o}C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=600V, V_{GS}=0V			1	µA
		V_{DS}=480V, T_J=125°C			10	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=5V, I_D=250µA		3		V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=12A		0.16	0.18	Ω
g_{FS}	Forward Transconductance	V_{DS}=10V, I_D=12A		20		S
V_{SD}	Diode Forward Voltage	I_S=12A,V_{GS}=0V		0.87	1.2	V
I_S	Maximum Body-Diode Continuous Current				24	A
I_{SM}	Maximum Body-Diode Pulsed Current [C]				96	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz		2340		pF
C_{oss}	Output Capacitance			62		pF
$C_{o(er)}$	Effective output capacitance, energy related [I]	V_{GS}=0V, V_{DS}=0 to 480V, f=1MHz		56		pF
$C_{o(tr)}$	Effective output capacitance, time related [J]			233		pF
C_{rss}	Reverse Transfer Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz		1.3		pF
R_g	Gate resistance	f=1MHz		5.4		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=480V, I_D=12A		46		nC
Q_{gs}	Gate Source Charge			17		nC
Q_{gd}	Gate Drain Charge			14		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=400V, I_D=12A, R_G=5Ω		34		ns
t_r	Turn-On Rise Time			29		ns
$t_{D(off)}$	Turn-Off DelayTime			63		ns
t_f	Turn-Off Fall Time			19		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=12A, dI/dt=100A/µs, V_{DS}=400V		387		ns
I_{rm}	Peak Reverse Recovery Current			30		A
Q_{rr}	Body Diode Reverse Recovery Charge			7.3		µC

A. The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A =25° C.

B. The power dissipation P_D is based on $T_{J(MAX)}$=150° 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 $T_{J(MAX)}$=150° C, Ratings are based on low frequency and duty cycles to keep initial T_J =25° 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 <300µs 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 $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.

G. L=60mH, I_{AS}=2.4A, R_G=25Ω, Starting T_J=25° C.

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

I. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.

J. $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

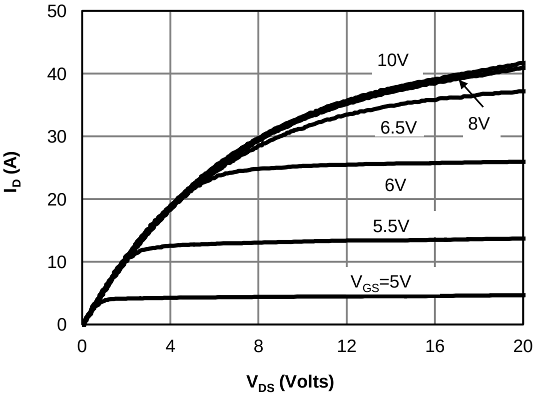


Figure 1: On-Region Characteristics

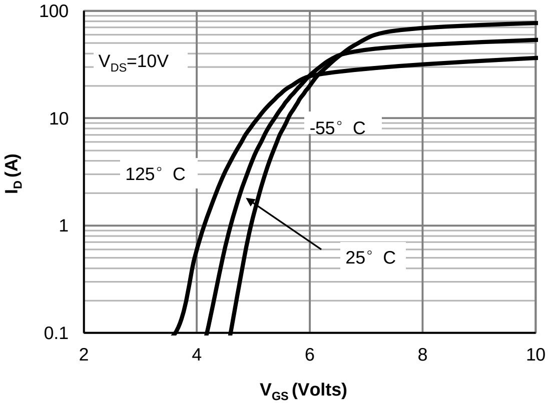


Figure 2: Transfer Characteristics

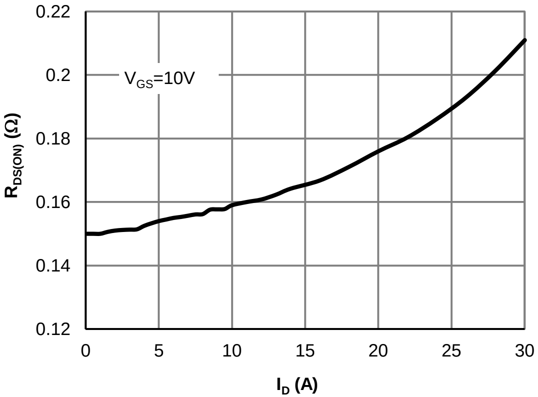


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

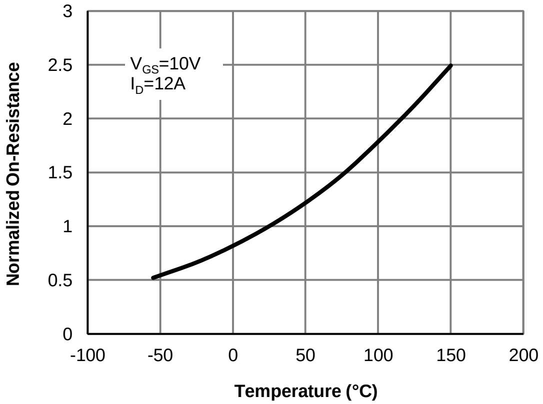


Figure 4: On-Resistance vs. Junction Temperature

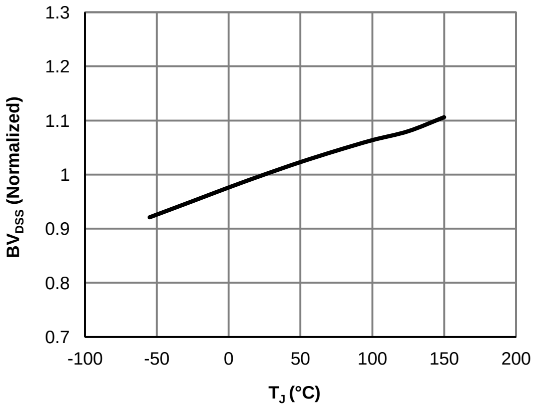


Figure 5: Break Down vs. Junction Temparature

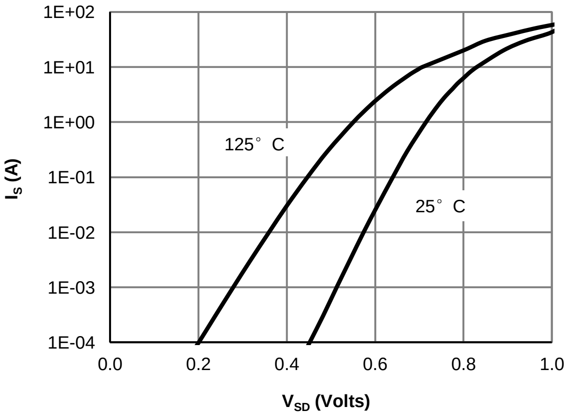


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

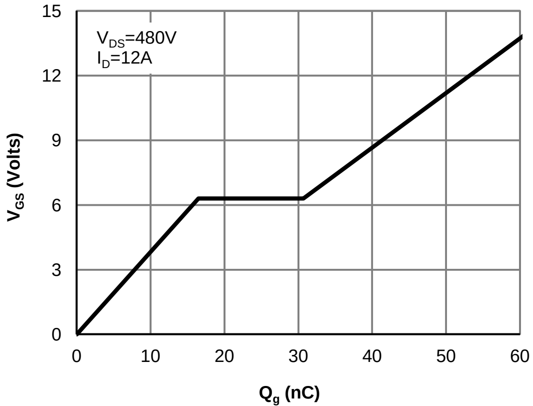


Figure 7: Gate-Charge Characteristics

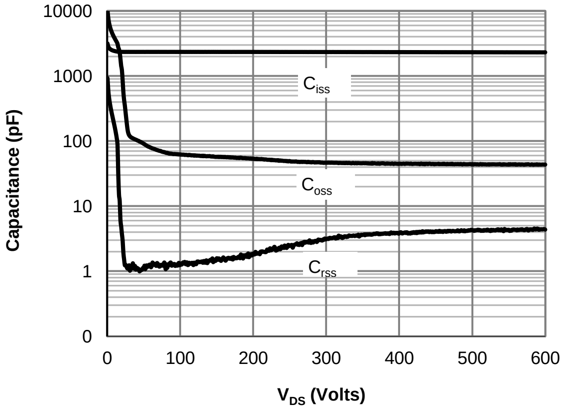


Figure 8: Capacitance Characteristics

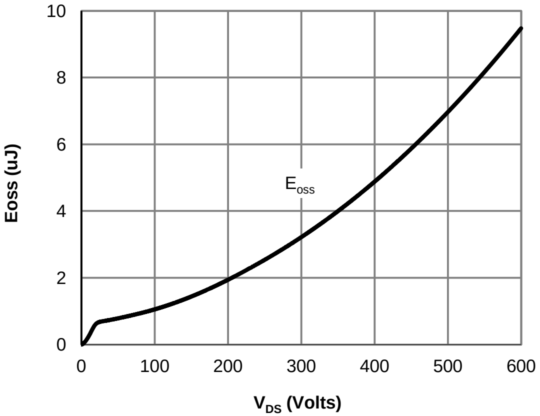


Figure 9: Coss stored Energy

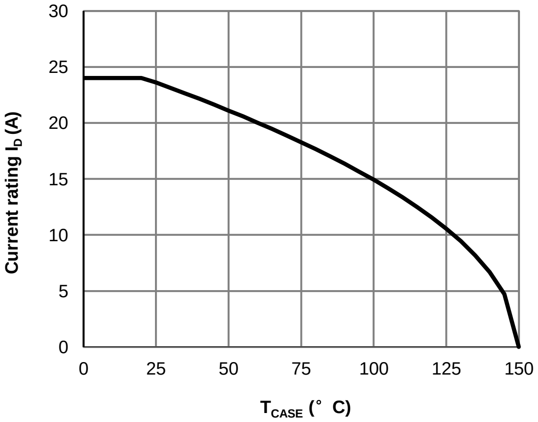


Figure 10: Current De-rating (Note F)

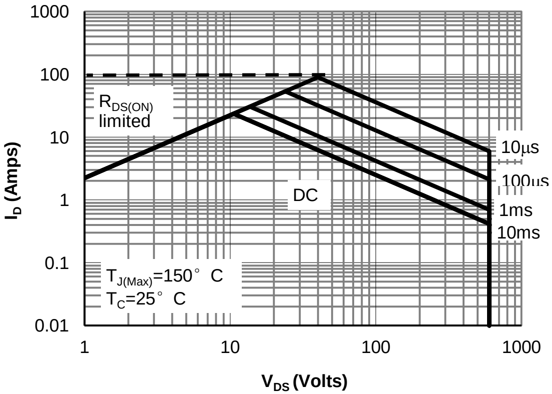


Figure 11: Maximum Forward Biased Safe Operating Area (Note F)

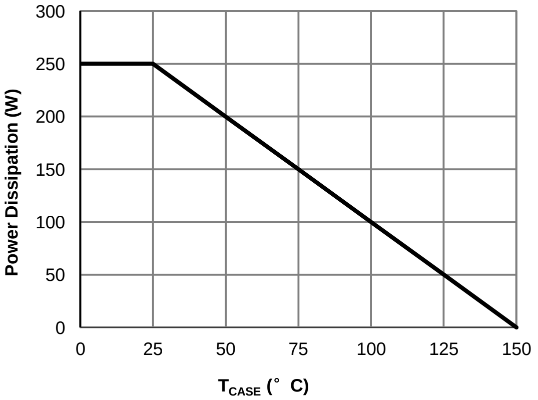


Figure 12: Power De-rating (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

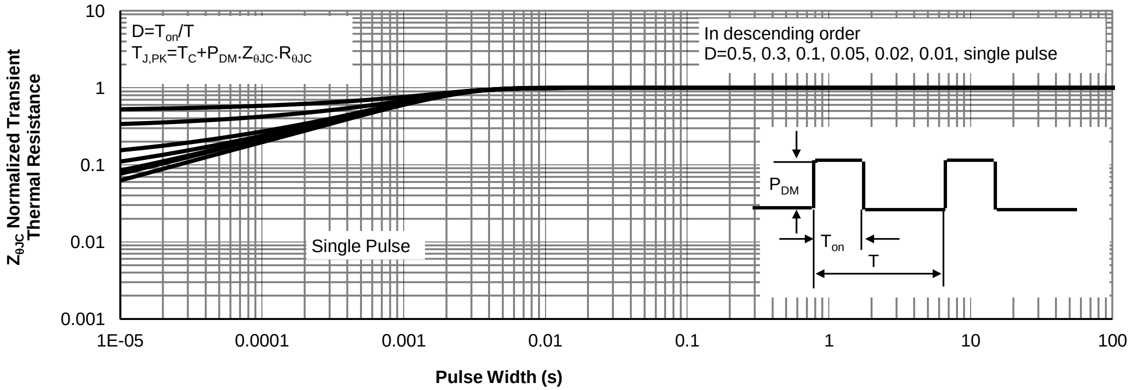


Figure 13: Normalized Maximum Transient Thermal Impedance (Note F)

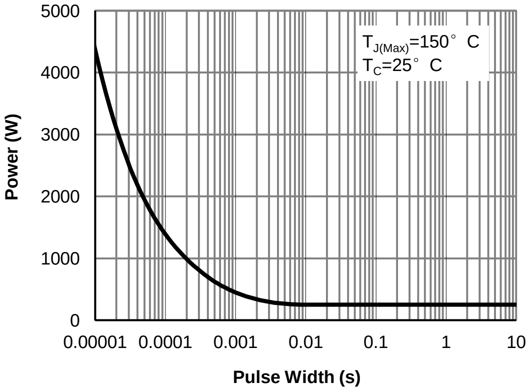


Figure 14: Single Pulse Power Rating Junction-to-Case (Note F)

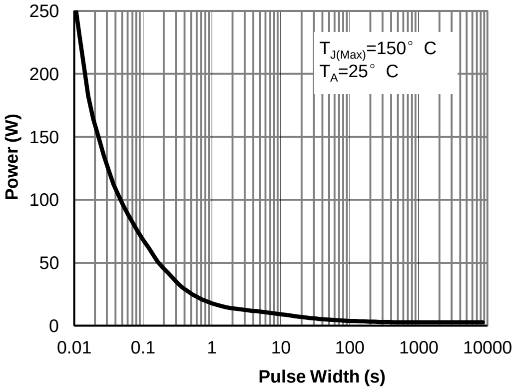


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

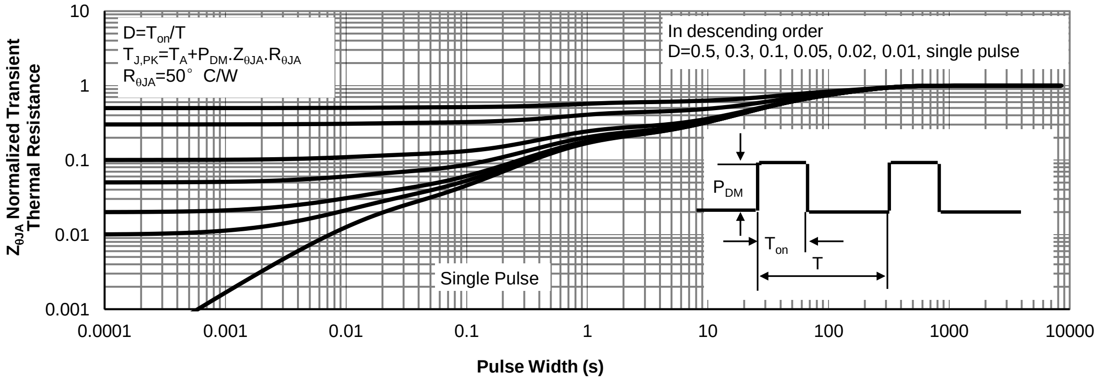
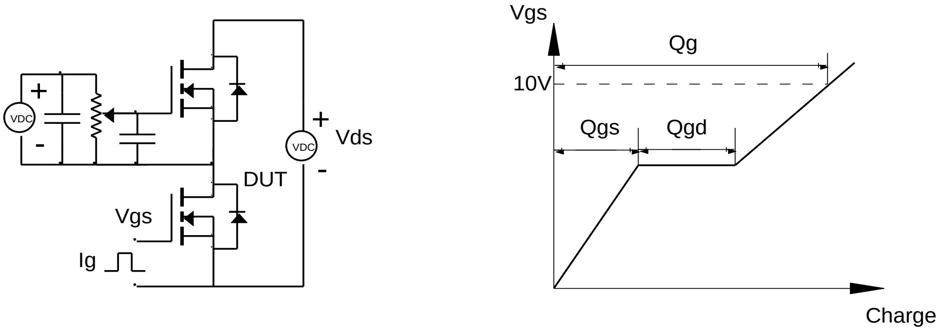
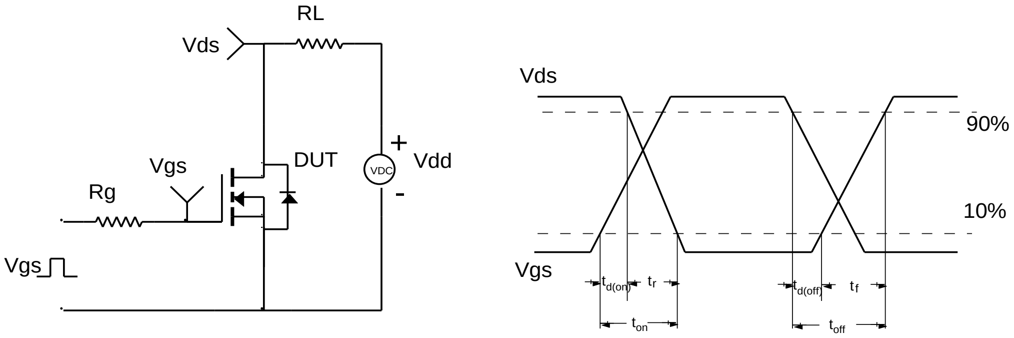


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

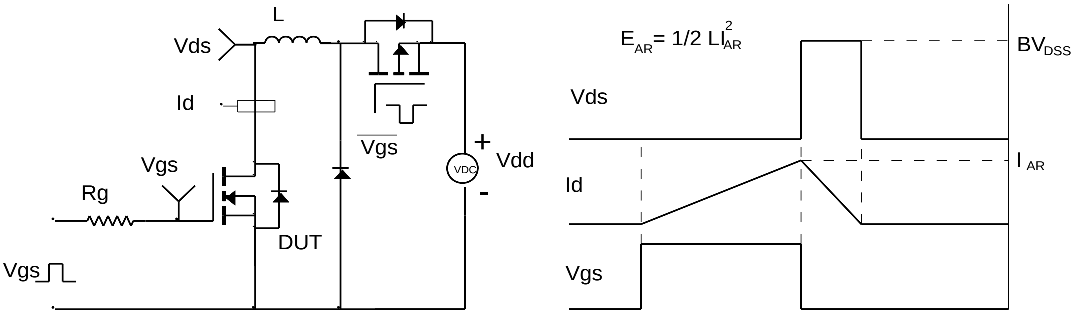
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms