ALPHA & OMEGA SEMICONDUCTOR

AOB12T60P/AOTF12T60P

600V,12A N-Channel MOSFET

General Description

- Trench Power AlphaMOS-II technology
- Low $R_{DS(ON)}$
- Low Ciss and Crss
- High Current Capability
- RoHS and Halogen Free Compliant

Applications

- General Lighting for LED and CCFL
- AC/DC Power supplies for Industrial, Consumer, and Telecom

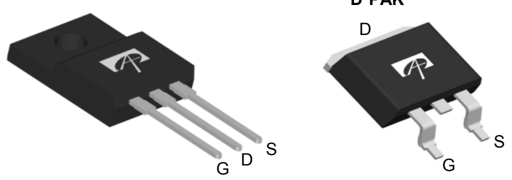
Product Summary

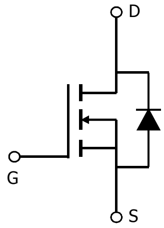
V_{DS} @ $T_{j,max}$	700V
I_{DM}	48A
$R_{DS(ON),max}$	< 0.52Ω
$Q_{g,typ}$	33nC
E_{oss} @ 400V	4.4µJ

100% UIS Tested
100% R_g Tested

RoHS Compliant

Top View





Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOB12T60PL	TO-263 Green	Tape & Reel	800
AOTF12T60P	TO-220F Pb Free	Tube	1000
AOTF12T60PL	TO-220F Green	Tube	1000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOB12T60P	AOTF12T60P	AOTF12T60PL	Units
Drain-Source Voltage		V_{DS}	600			V
Gate-Source Voltage		V_{GS}	±30			V
Continuous Drain Current	T_C=25°C	I_D	12	12*	12*	A
	T_C=100°C		9	9*	9*	
Pulsed Drain Current [C]		I_{DM}	48			
Avalanche Current [C] L=1mH		I_{AR}	12			A
Repetitive avalanche energy [C]		E_{AR}	72			mJ
Single pulsed avalanche energy [G]		E_{AS}	750			mJ
MOSFET dv/dt ruggedness		dv/dt	50			V/ns
Peak diode recovery dv/dt [J]			15			
Power Dissipation [B]	T_C=25°C	P_D	250	50	35	W
	Derate above 25°C		2	0.4	0.3	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	AOB12T60P	AOTF12T60P	AOTF12T60PL	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	65	65	65	°C/W
Maximum Case-to-sink [A]	$R_{\theta CS}$	0.5	--	--	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	0.5	2.5	3.6	°C/W

* Drain current limited by maximum junction temperature.

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		0.58		V/°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}=±30V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=5V, I_D=250µA	3	4.1	5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=6A		0.44	0.52	Ω
g_{FS}	Forward Transconductance	V_{DS}=40V, I_D=6A		11		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.73	1	V
I_S	Maximum Body-Diode Continuous Current				12	A
I_{SM}	Maximum Body-Diode Pulsed Current [C]				48	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz		2028		pF
C_{oss}	Output Capacitance			71		pF
$C_{o(er)}$	Effective output capacitance, energy related [H]	V_{GS}=0V, V_{DS}=0 to 480V, f=1MHz		52		pF
$C_{o(tr)}$	Effective output capacitance, time related [I]			94		pF
C_{rss}	Reverse Transfer Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz		13		pF
R_g	Gate resistance	f=1MHz		2.2		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=480V, I_D=12A		33	50	nC
Q_{gs}	Gate Source Charge			13		nC
Q_{gd}	Gate Drain Charge			10		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=300V, I_D=12A, R_G=25Ω		52		ns
t_r	Turn-On Rise Time			72		ns
$t_{D(off)}$	Turn-Off DelayTime			66		ns
t_f	Turn-Off Fall Time			42		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=12A,dI/dt=100A/µs,V_{DS}=100V		483		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=12A,dI/dt=100A/µs,V_{DS}=100V		7		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 <300 ms 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}=5A, V_{DD}=150V, R_G=25Ω, Starting T_J=25° C.
H. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.
I. $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.
J. I_{SD}≤I_D, di/dt≤200A/µs, V_{DD}=400V, T_J≤$T_{J(MAX)}$.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

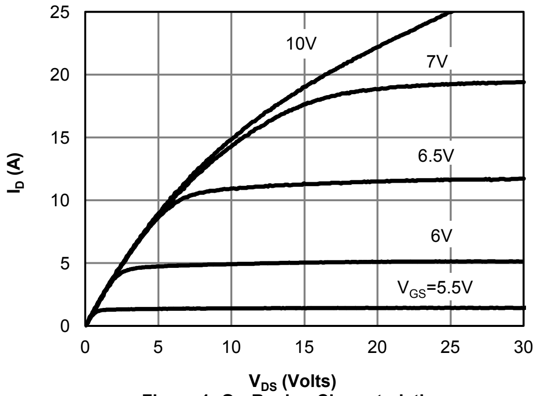


Figure 1: On-Region Characteristics

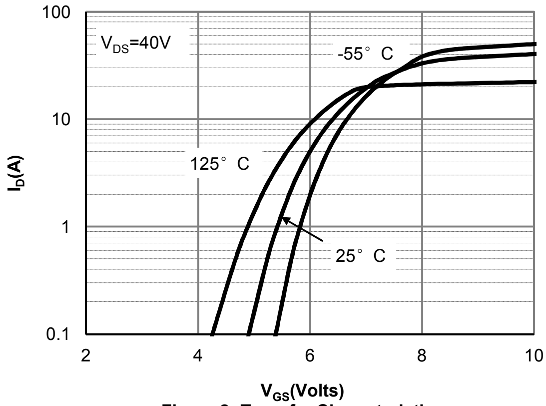


Figure 2: Transfer Characteristics

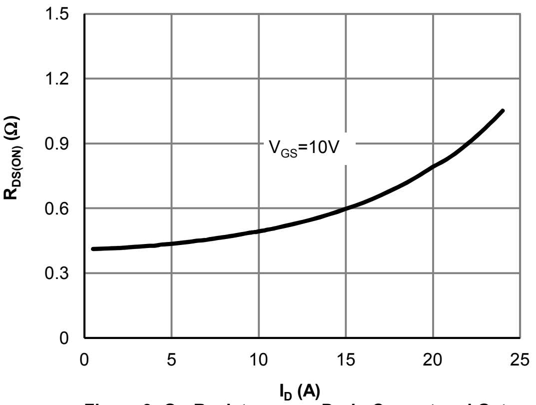


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

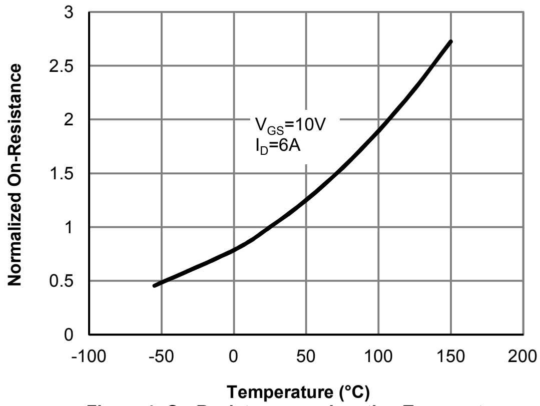


Figure 4: On-Resistance vs. Junction Temperature

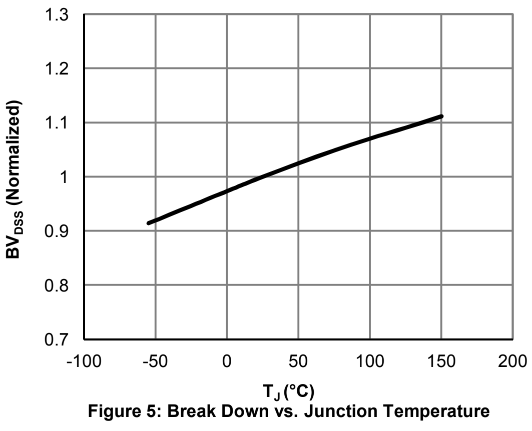


Figure 5: Break Down vs. Junction Temperature

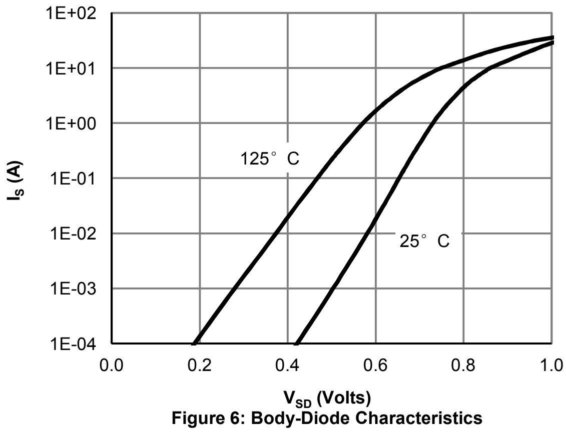


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

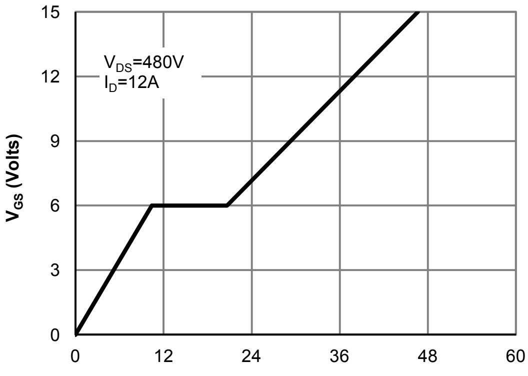


Figure 7: Gate-Charge Characteristics

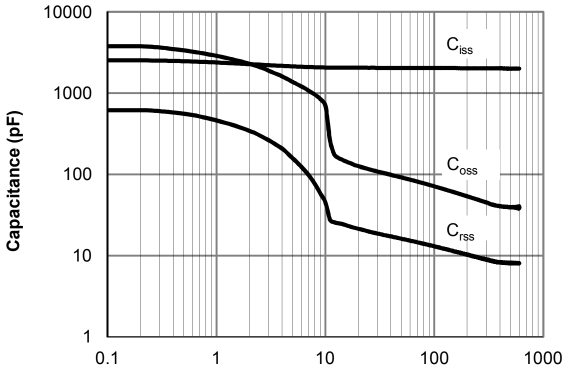


Figure 8: Capacitance Characteristics

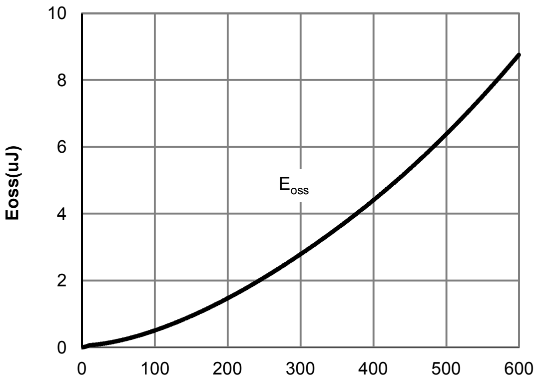


Figure 9: Coss stored Energy

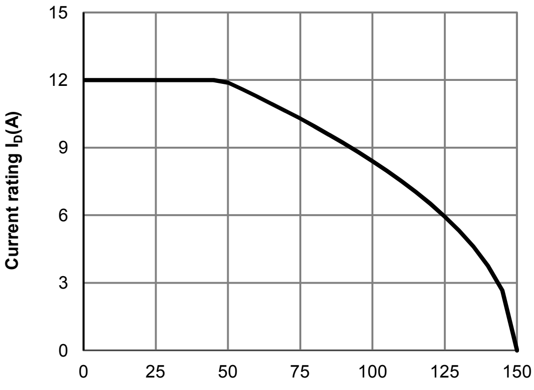


Figure 10: Current De-rating (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

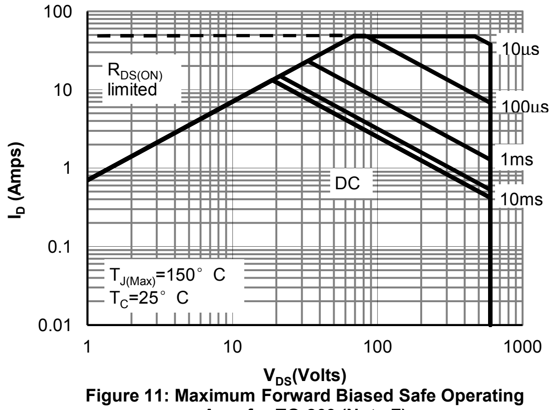


Figure 11: Maximum Forward Biased Safe Operating Area for TO-263 (Note F)

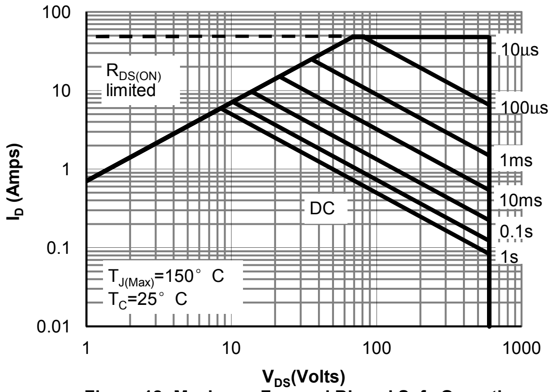


Figure 12: Maximum Forward Biased Safe Operating Area for TO-220F Pb Free (Note F)

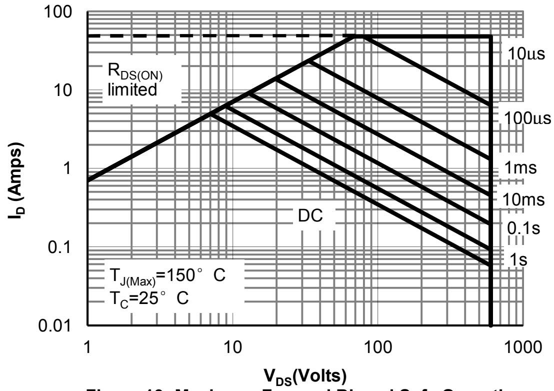


Figure 13: Maximum Forward Biased Safe Operating Area for TO-220F Green (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

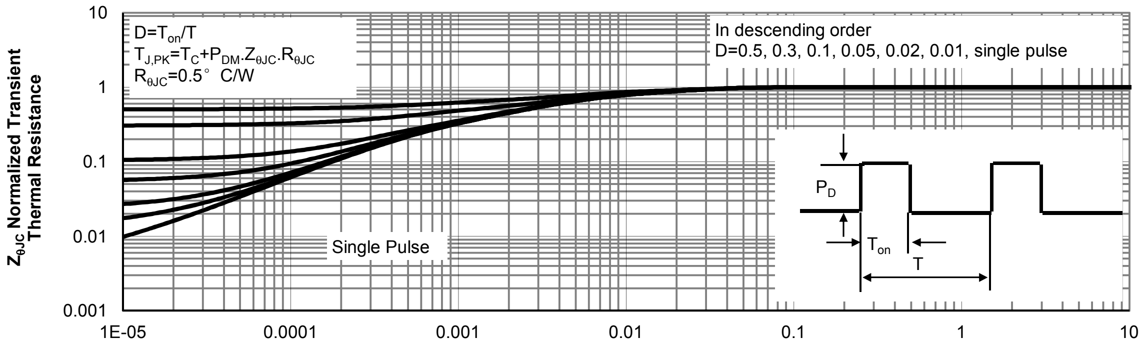


Figure 14: Normalized Maximum Transient Thermal Impedance for TO-263 (Note F)

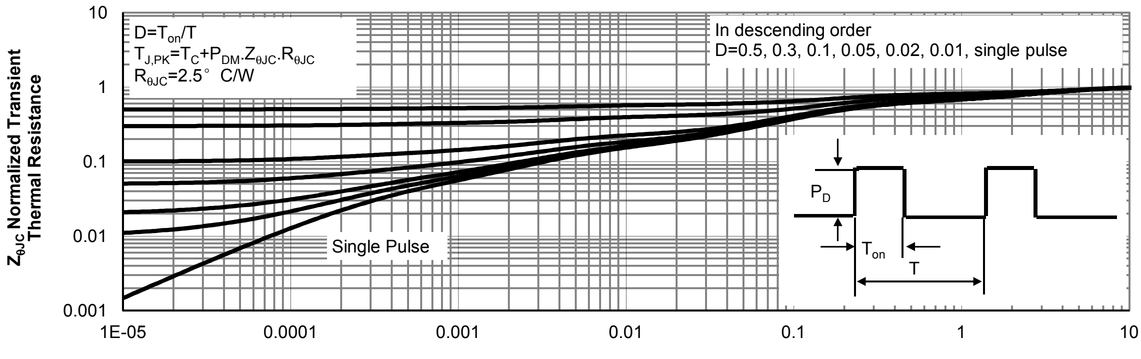


Figure 15: Normalized Maximum Transient Thermal Impedance for TO-220F Pb Free (Note F)

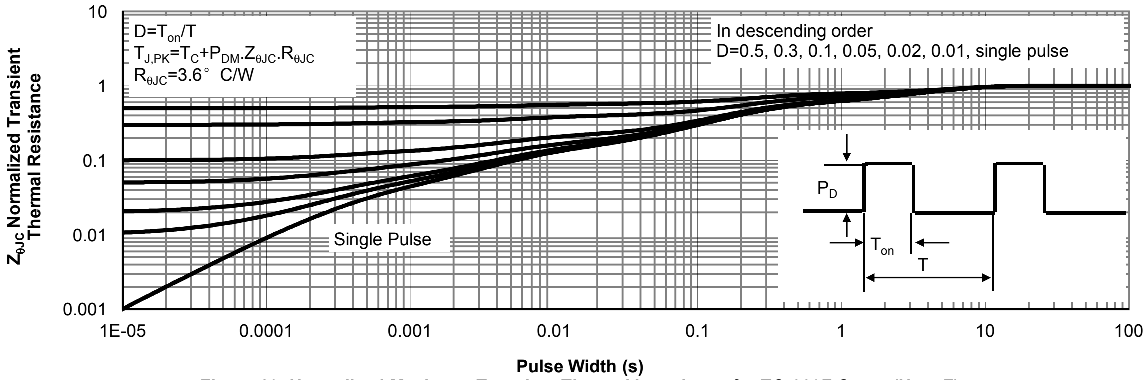
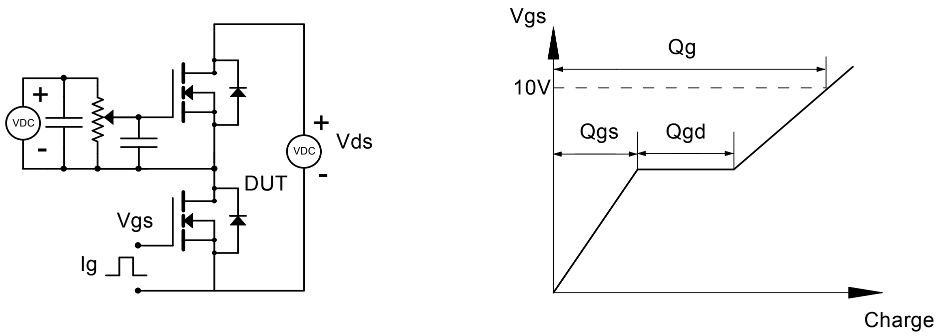
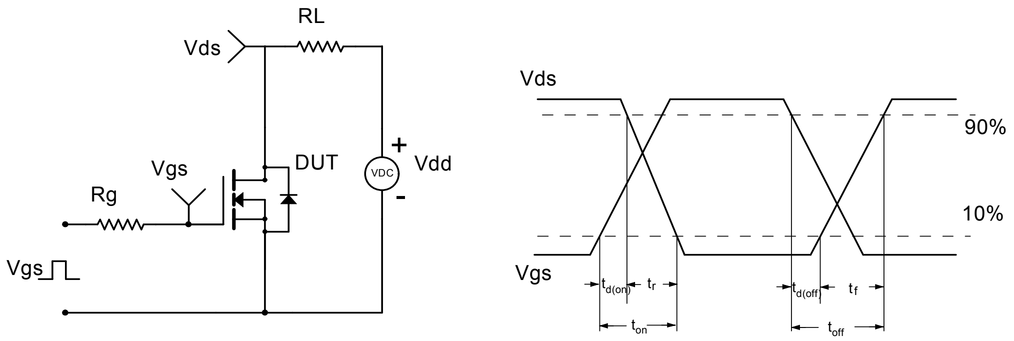


Figure 16: Normalized Maximum Transient Thermal Impedance for TO-220F Green (Note F)

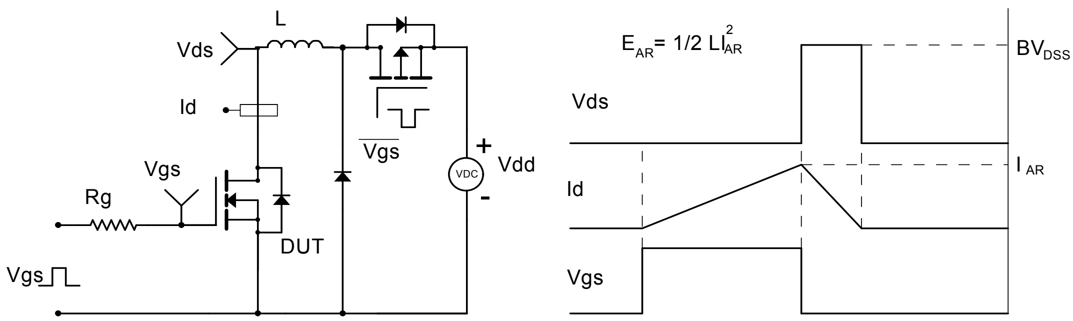
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms