ALPHA & OMEGA SEMICONDUCTOR

AOD5N40/AOI5N40

400V,4.2A N-Channel MOSFET

General Description

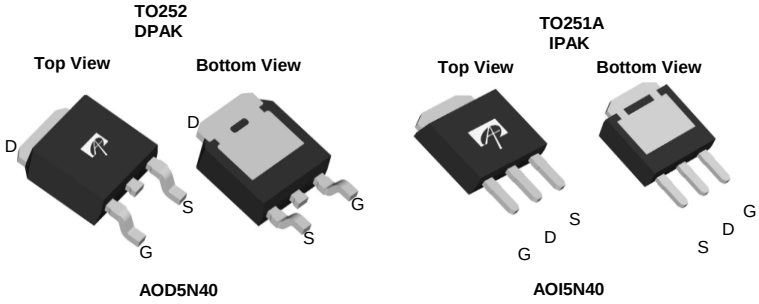
The AOD5N40 & AOI5N40 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.
By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

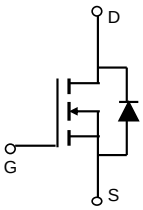
Product Summary

V_{DS}	500V@150℃
I_D (at V_{GS}=10V)	4.2A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 1.6Ω

100% UIS Tested!
100% R_g Tested!

Green Product





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	400	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current[B]	T_C=25°C	I_D	4.2	A
	T_C=100°C		2.8	
Pulsed Drain Current [C]		I_{DM}	10	
Avalanche Current [C]		I_{AR}	1.7	A
Repetitive avalanche energy [C]		E_{AR}	43	mJ
Single pulsed avalanche energy [H]		E_{AS}	86	mJ
Peak diode recovery dv/dt		dv/dt	5	V/ns
Power Dissipation [B]	T_C=25°C	P_D	78	W
	Derate above 25°C		0.63	W/ °C
Junction and Storage Temperature Range		T_J, T_{STG}	-50 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics

Parameter	Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient [A,G]	$R_{\theta JA}$	38	55	°C/W
Maximum Case-to-sink [A]	$R_{\theta CS}$	-	0.5	°C/W
Maximum Junction-to-Case[D,F]	$R_{\theta JC}$	1.33	1.6	°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	400			V
		I_D=250µA, V_{GS}=0V, T_J=150°C		500		
BV_{DSS} /ΔTJ	Zero Gate Voltage Drain Current	ID=250µA, VGS=0V		0.4		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=400V, V_{GS}=0V			1	µA
		V_{DS}=320V, 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	4	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=1A		1.25	1.6	Ω
g_{FS}	Forward Transconductance	V_{DS}=40V, I_D=1A		5		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.77	1	V
I_S	Maximum Body-Diode Continuous Current				4.2	A
I_{SM}	Maximum Body-Diode Pulsed Current				10	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	260	331	400	pF
C_{oss}	Output Capacitance		25	42	60	pF
C_{rss}	Reverse Transfer Capacitance		1.5	3	5.5	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	2	4	6	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=320V, I_D=4.2A	5.5	6.9	8.5	nC
Q_{gs}	Gate Source Charge		1.5	2.0	2.5	nC
Q_{gd}	Gate Drain Charge		1	2.3	3.5	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=200V, I_D=4.2A, R_G=25Ω		16.5		ns
t_r	Turn-On Rise Time			15		ns
$t_{D(off)}$	Turn-Off DelayTime			24		ns
t_f	Turn-Off Fall Time			11.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=4.2A,dI/dt=100A/µs,V_{DS}=100V	125	160	200	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=4.2A,dI/dt=100A/µs,V_{DS}=100V	0.7	0.93	1.2	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 in a TO252 package, 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.
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 µs 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 $T_{J(MAX)}$=150° C.
G.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.
H. L=60mH, I_{AS}=1.7A, V_{DD}=150V, R_G=10Ω, Starting T_J=25° C

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

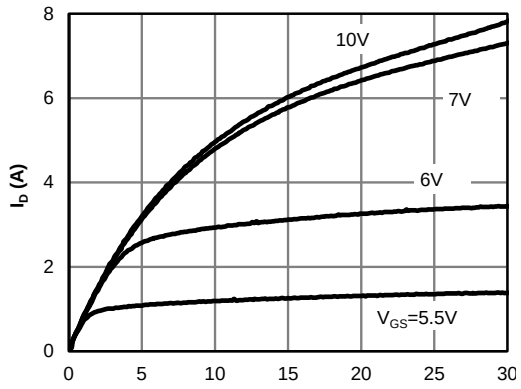


Fig 1: On-Region Characteristics

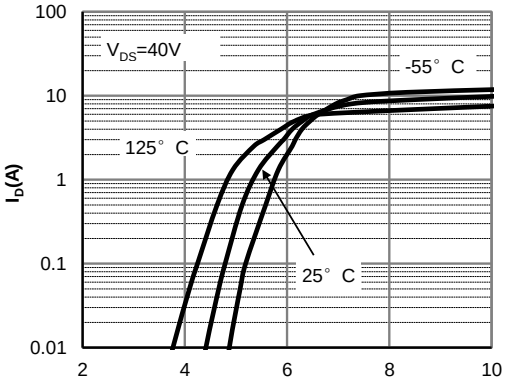


Figure 2: Transfer Characteristics

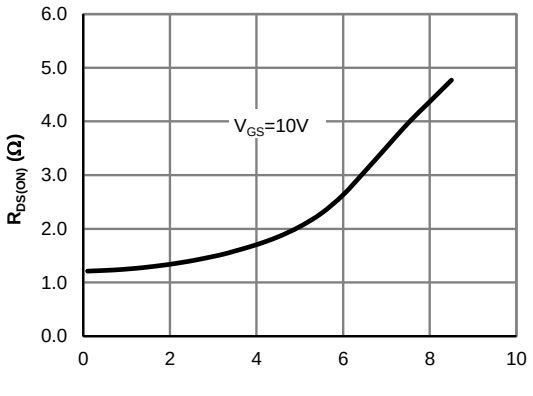


Figure 3: On-Resistance vs. Drain Current and Ga Voltage

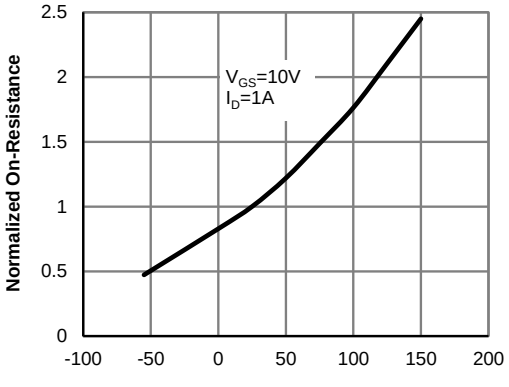


Figure 4: On-Resistance vs. Junction Temperature

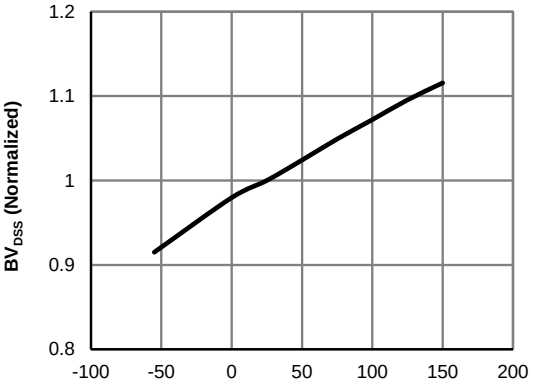


Figure 5: Break Down vs. Junction Temperature

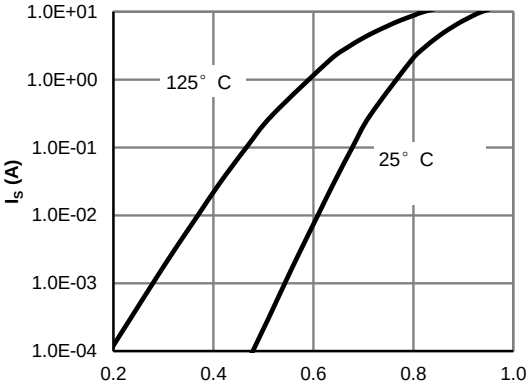


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

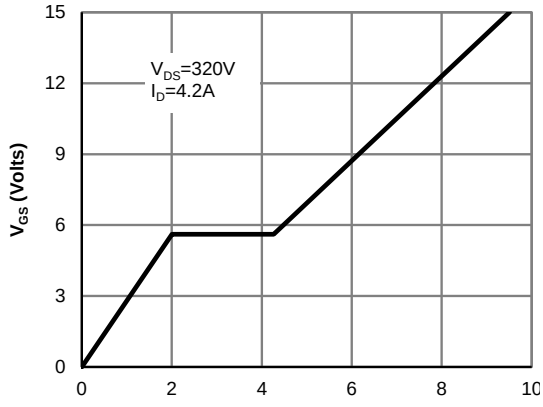


Figure 7: Gate-Charge Characteristics

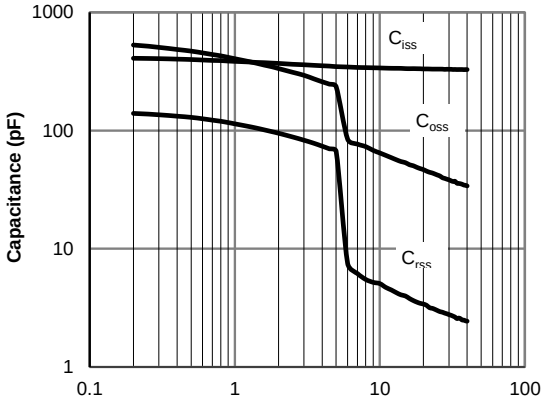


Figure 8: Capacitance Characteristics

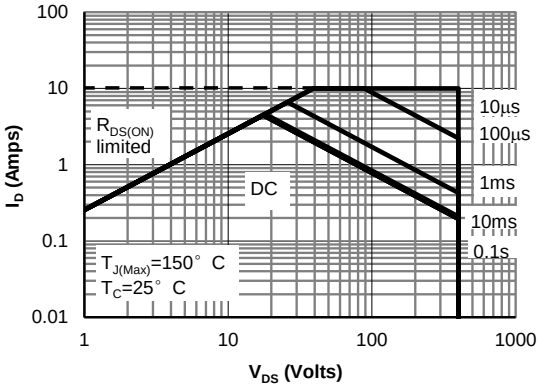


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

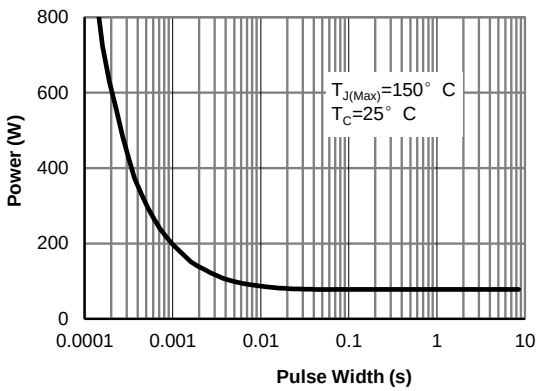


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

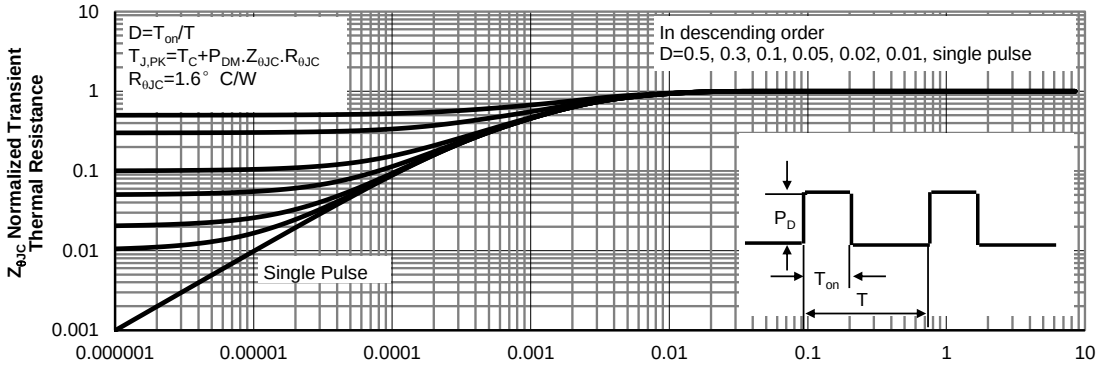


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

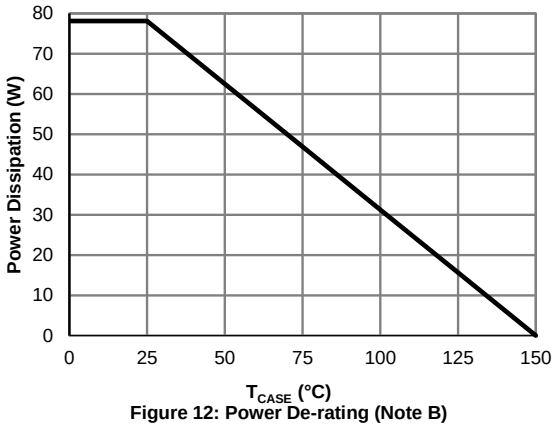


Figure 12: Power De-rating (Note B)

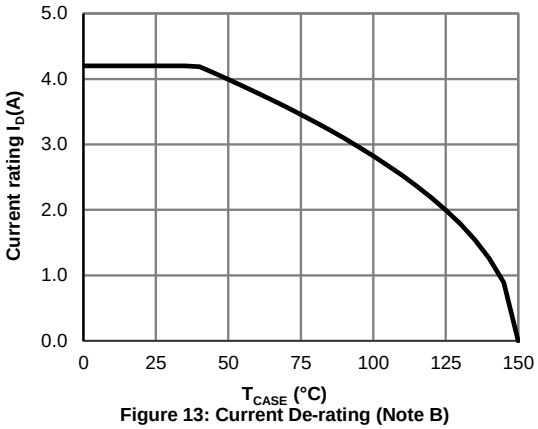


Figure 13: Current De-rating (Note B)

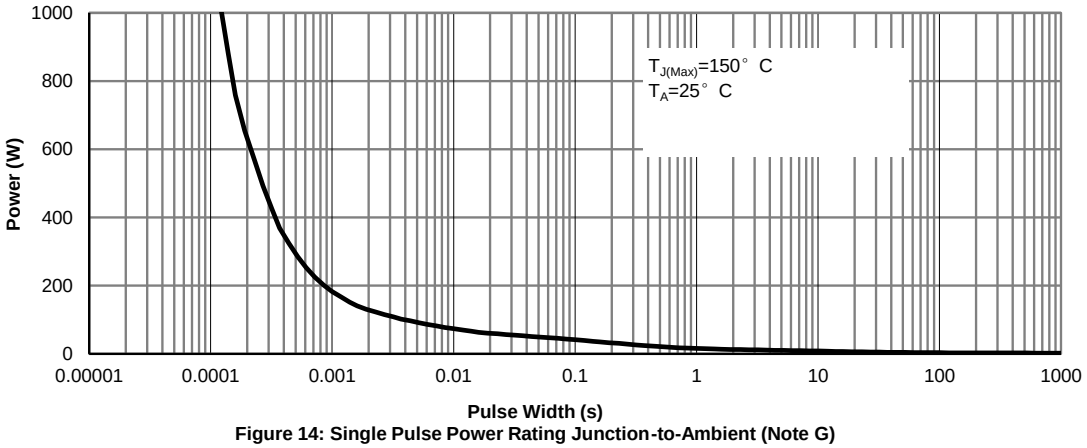


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

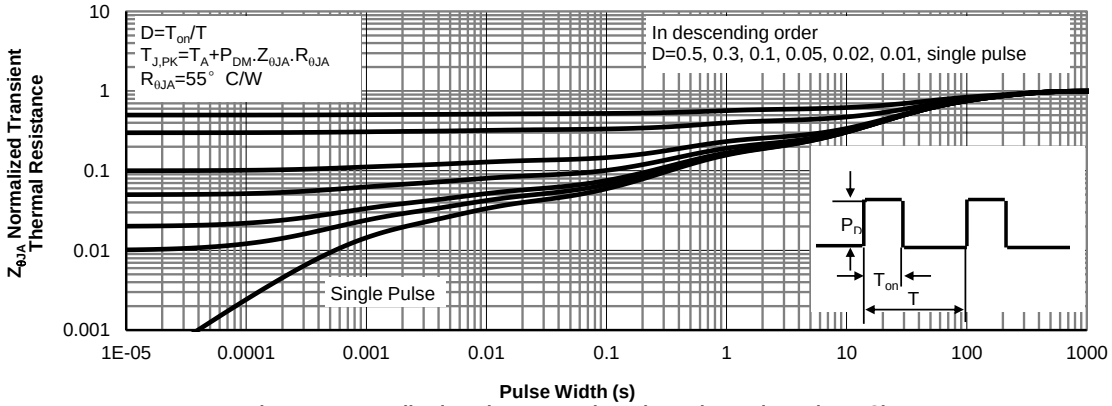
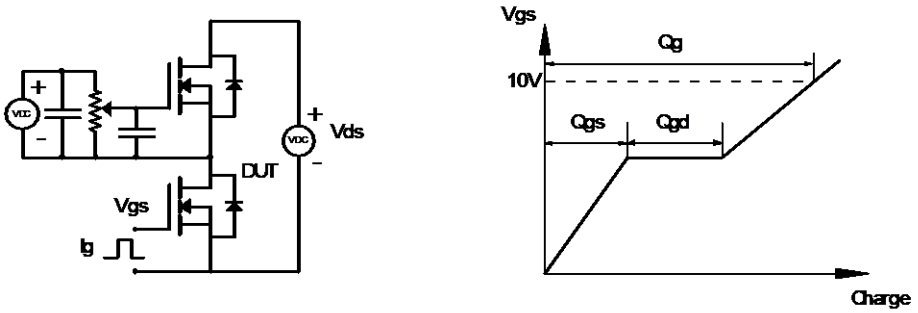
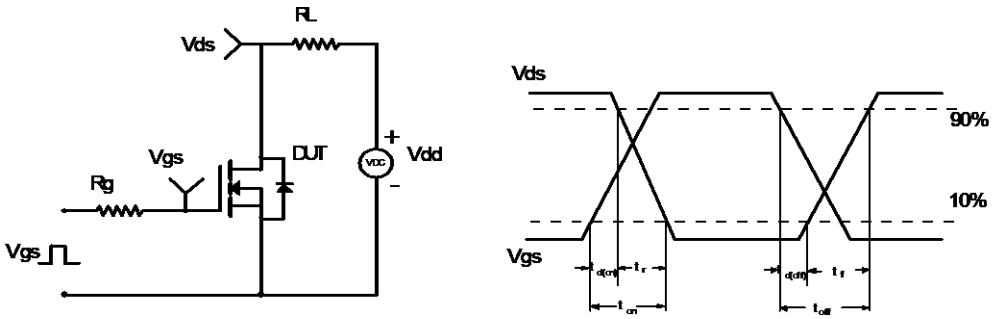


Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

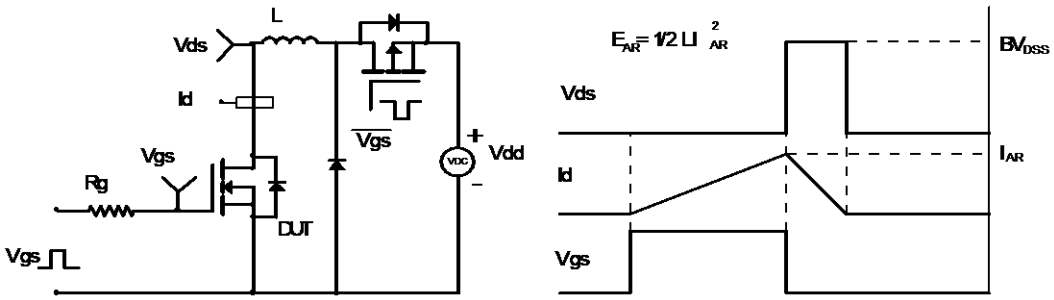
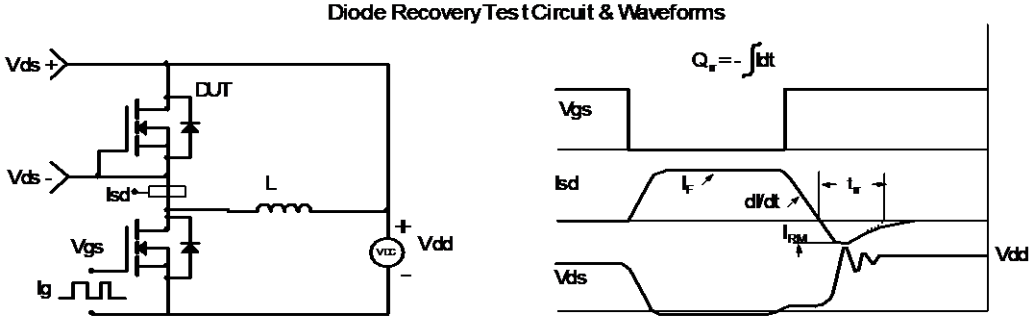
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms