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AOD4146/AOI4146

30V N-Channel MOSFET SDMOS™

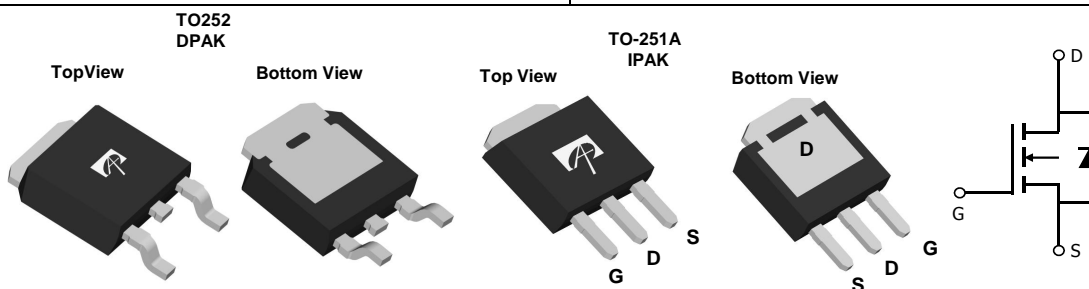
General Description

The AOD4146/AOI4146 is fabricated with SDMOS™ trench technology that combines excellent $R_{DS(ON)}$ with low gate charge. The result is outstanding efficiency with controlled switching behavior. This universal technology is well suited for PWM, load switching and general purpose applications.

Product Summary

V_{DS}	30V
I_D (at $V_{GS}=10V$)	55A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 5.6mΩ
$R_{DS(ON)}$ (at $V_{GS} = 4.5V$)	< 9.5mΩ

100% UIS Tested
100% R_g Tested



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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	30	V
Gate-Source Voltage	V_{GS}	±20	V
Continuous Drain Current ^G	I_D	$T_C=25^\circ C$	55
		$T_C=100^\circ C$	43
Pulsed Drain Current ^C	I_{DM}	190	A
Continuous Drain Current	I_{DSM}	$T_A=25^\circ C$	15
		$T_A=70^\circ C$	12
Avalanche Current ^C	I_{AS}, I_{AR}	50	A
Avalanche energy $L=0.05mH$ ^C	E_{AS}, E_{AR}	63	mJ
Power Dissipation ^B	P_D	$T_C=25^\circ C$	62
		$T_C=100^\circ C$	31
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ C$	2.5
		$T_A=70^\circ C$	1.6
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	15	20	°C/W
Maximum Junction-to-Ambient ^{A,D}		Steady-State	41	50
Maximum Junction-to-Case	$R_{\theta JC}$	2	2.4	°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	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =55°C			100 500	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±20V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	1.6	2.1	3	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	190			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A T _J =125°C		4.7	5.6	mΩ
		V _{GS} =4.5V, I _D =10A		7.4	8.9	
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		50		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.7	1	V
I _S	Maximum Body-Diode Continuous Current				55	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz	1630	2037	2440	pF
C _{oss}	Output Capacitance		260	375	490	pF
C _{rss}	Reverse Transfer Capacitance		130	220	300	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	0.5	1.1	1.7	Ω
SWITCHING PARAMETERS						
Q _{g(10V)}	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A	28	35	42	nC
Q _{g(4.5V)}	Total Gate Charge		13	16	20	nC
Q _{gs}	Gate Source Charge		6.8	8.6	10	nC
Q _{gd}	Gate Drain Charge		2.8	4.6	6.4	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		8.8		ns
t _r	Turn-On Rise Time			26		ns
t _{D(off)}	Turn-Off DelayTime			23		ns
t _f	Turn-Off Fall Time			6		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, di/dt=500A/μs	8	10	12	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, di/dt=500A/μs	12	15	18	nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} 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° 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° C. Ratings are based on low frequency and duty cycles to keep initial T_J=25° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} 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)}=175° 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 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

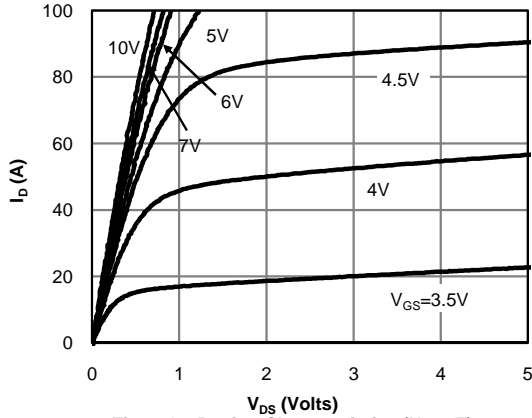


Figure 1: On-Region Characteristics (Note E)

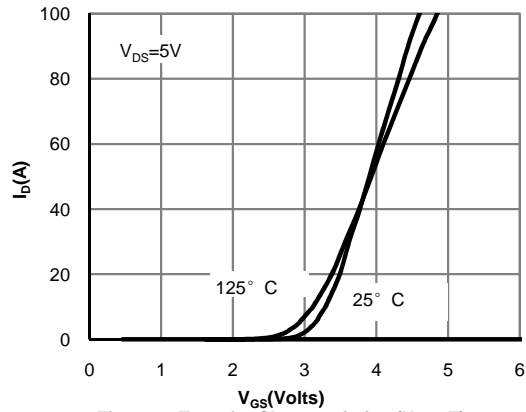


Figure 2: Transfer Characteristics (Note E)

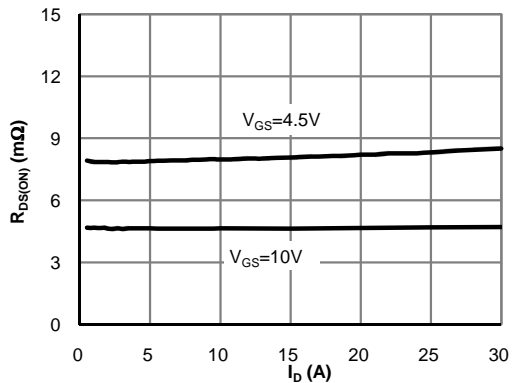


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

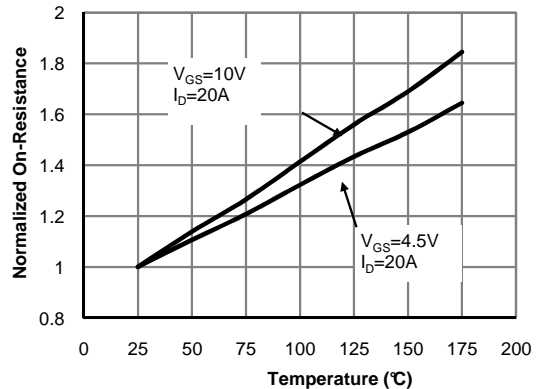


Figure 4: On-Resistance vs. Junction Temperature (Note E)

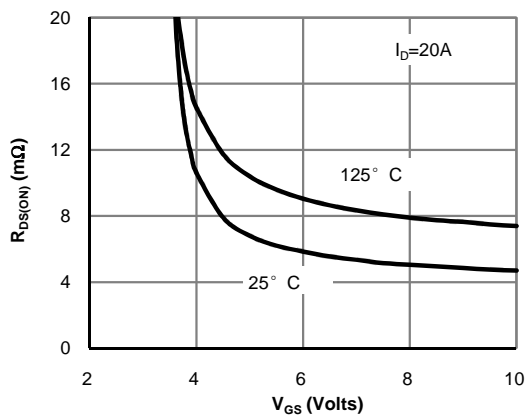


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

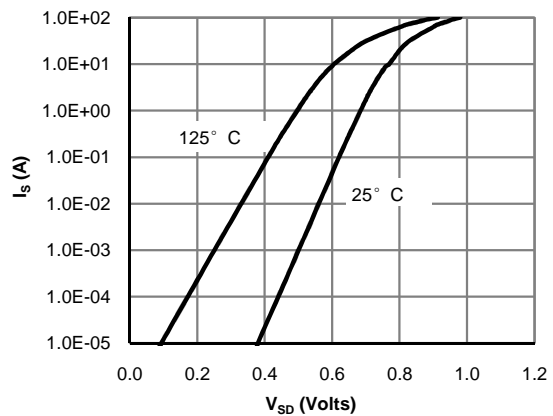


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

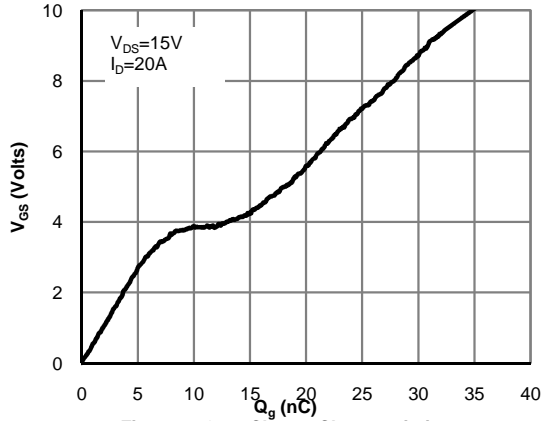


Figure 7: Gate-Charge Characteristics

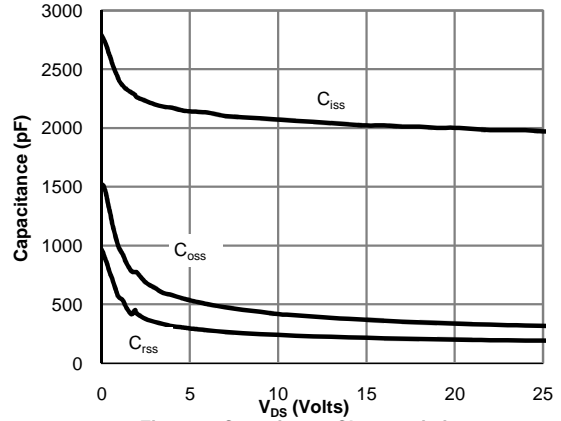


Figure 8: Capacitance Characteristics

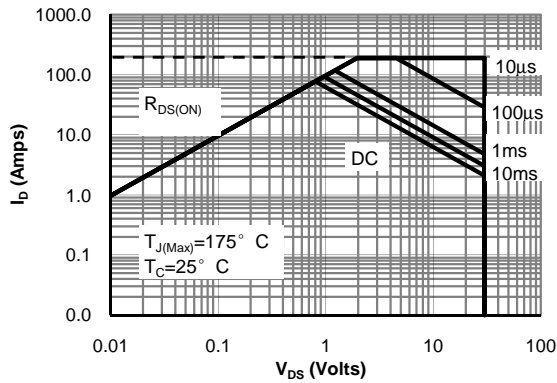


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

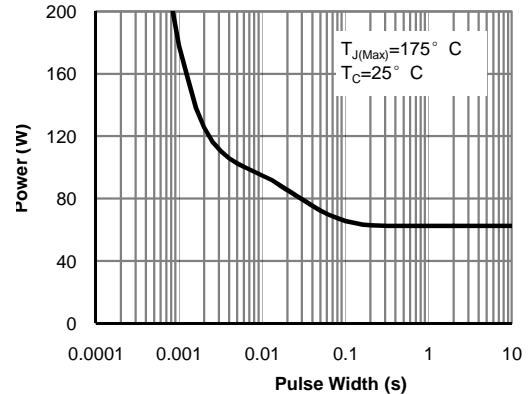


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

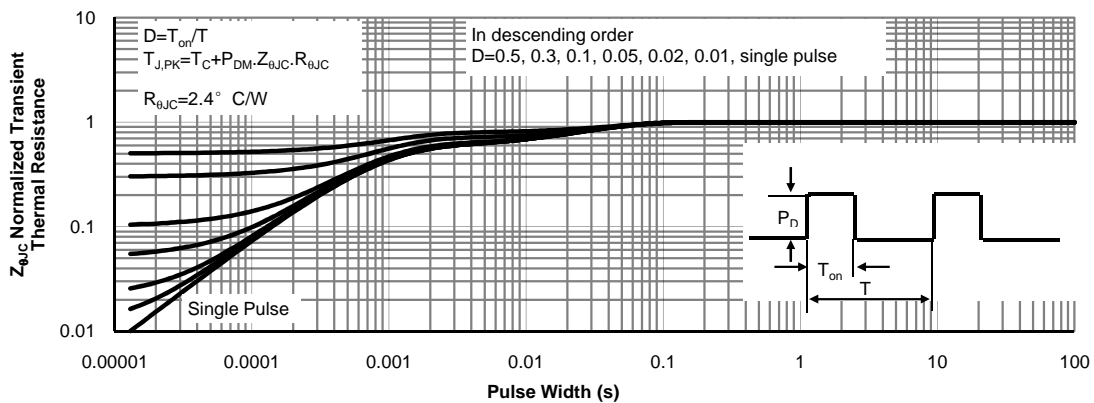


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

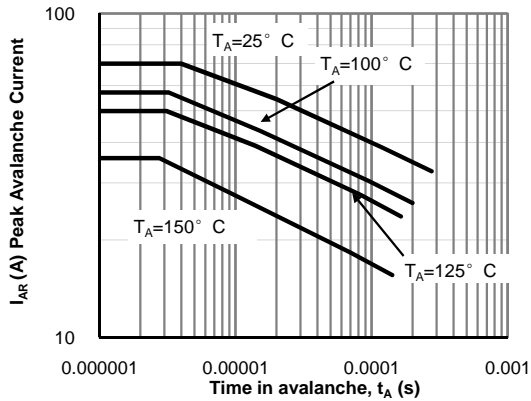


Figure 12: Single Pulse Avalanche capability (Note C)

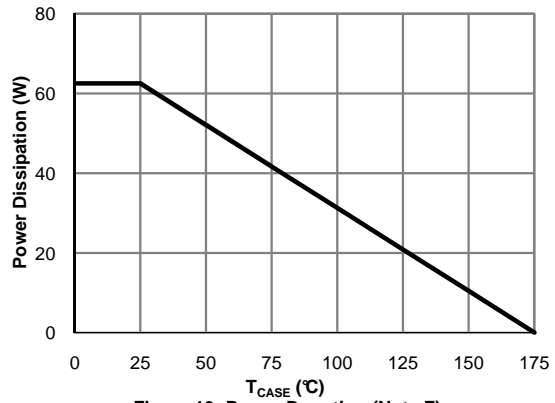


Figure 13: Power De-rating (Note F)

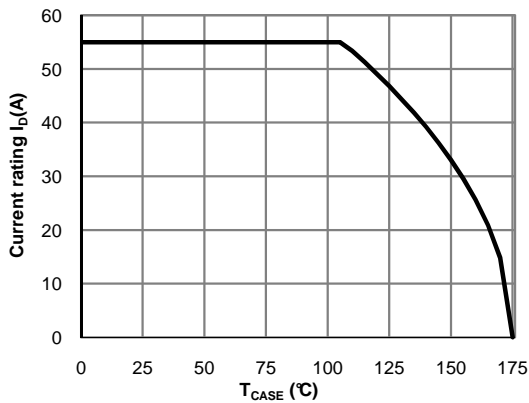


Figure 14: Current De-rating (Note F)

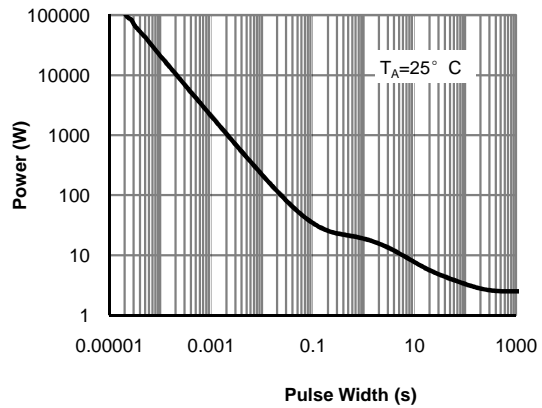


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

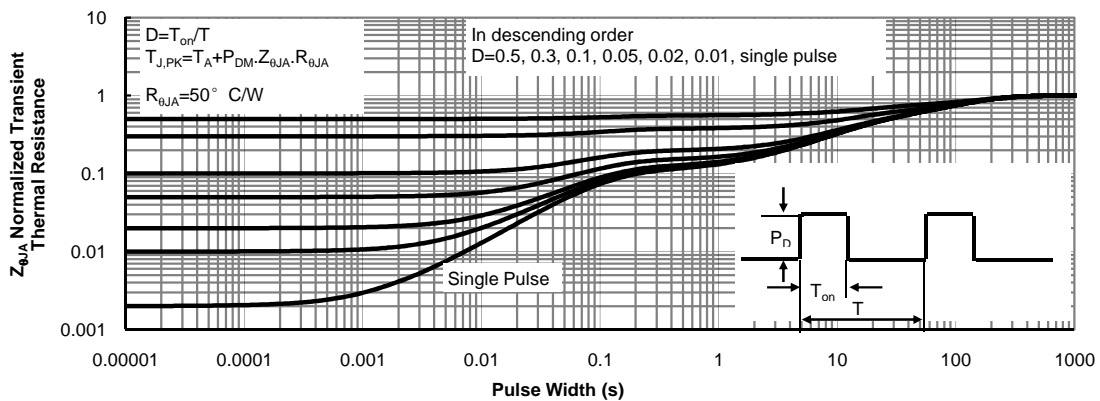


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

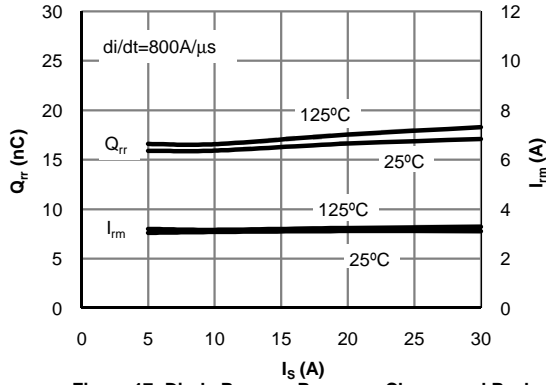


Figure 17: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

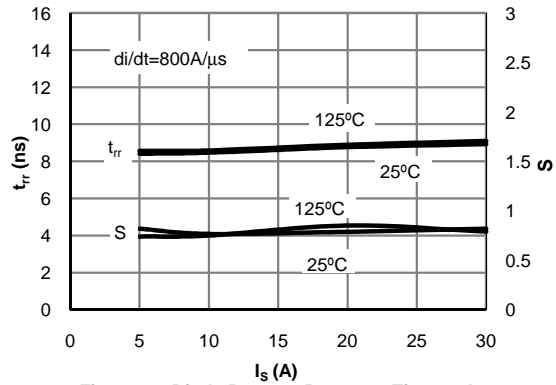


Figure 18: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

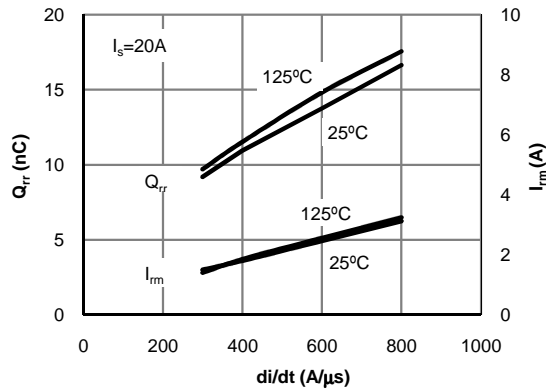


Figure 19: Diode Reverse Recovery Charge and Peak Current vs. di/dt

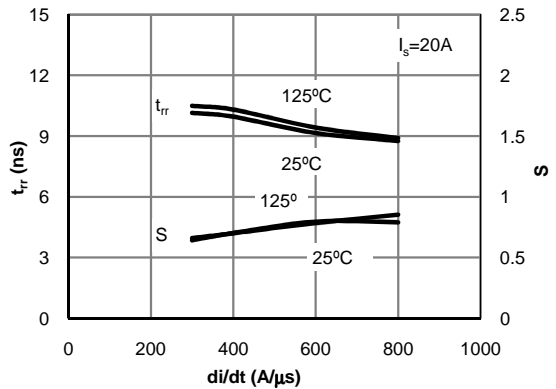
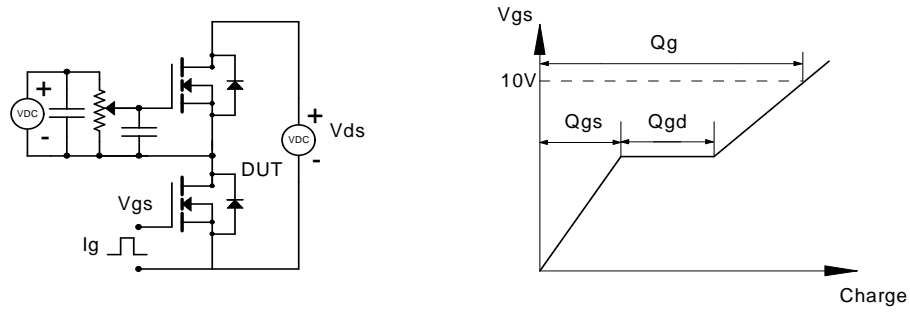
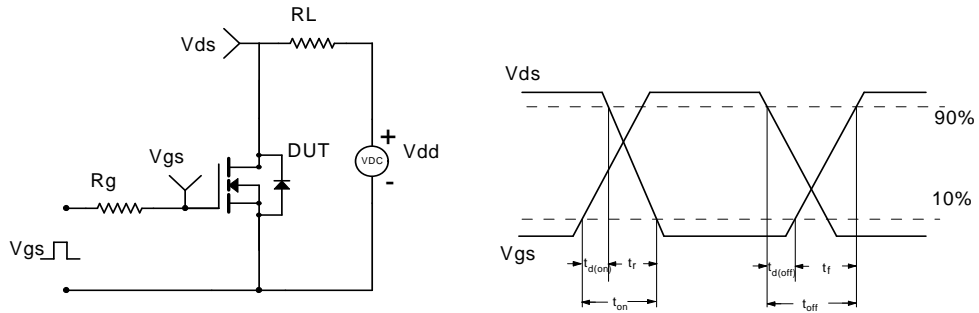


Figure 20: Diode Reverse Recovery Time and Softness Factor vs. di/dt

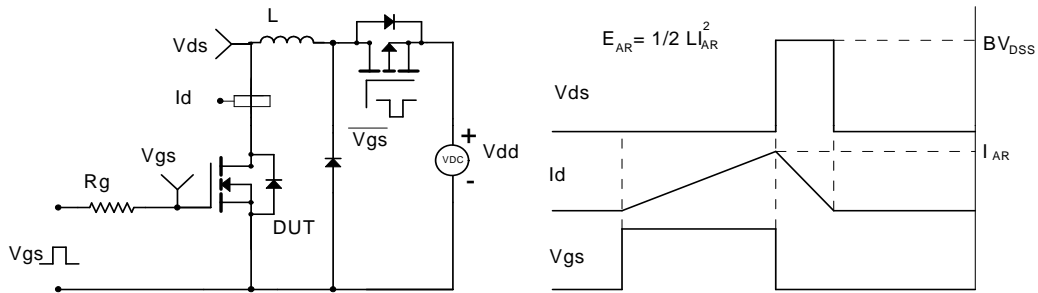
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

