

AOI452A
N-Channel SDMOS™ Power Transistor
General Description

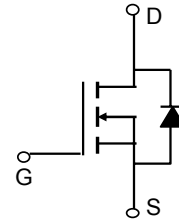
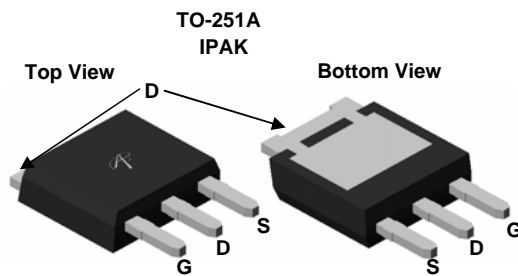
The AOI452A is fabricated with SDMOS™ trench technology that combines excellent $R_{DS(ON)}$ with low gate charge. The result is outstanding efficiency with controlled switching behavior. This universal technology is well suited for PWM, load switching and general purpose applications.

- RoHS Compliant
- Halogen Free

Features

V_{DS} (V) =25V
 I_D = 55A (V_{GS} = 10V)
 $R_{DS(ON)}$ < 7.3m Ω (V_{GS} = 10V)
 $R_{DS(ON)}$ < 14m Ω (V_{GS} = 4.5V)

100% UIS Tested!
100% R_g Tested!


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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	25	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^G	I_D	$T_C=25^\circ\text{C}$	A
		$T_C=100^\circ\text{C}$	
Pulsed Drain Current ^C	I_{DM}	120	
Continuous Drain Current	I_{DSM}	$T_A=25^\circ\text{C}$	A
		$T_A=70^\circ\text{C}$	13
Avalanche Current ^C	I_{AR}	27	A
Repetitive avalanche energy $L=0.1\text{mH}$ ^C	E_{AR}	36	mJ
Power Dissipation ^B	P_D	$T_C=25^\circ\text{C}$	W
		$T_C=100^\circ\text{C}$	
Power Dissipation ^A	P_{DSM}	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
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	$R_{\theta JA}$	$t \leq 10\text{s}$	14.2	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A,D}		Steady-State	39	$^\circ\text{C/W}$
Maximum Junction-to-Case	$R_{\theta JC}$	2.5	3	$^\circ\text{C/W}$

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	25			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =25V, V _{GS} =0V T _J =55°C			10 50	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	1.5	2	2.5	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	120			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A T _J =125°C		6 9	7.3 10.8	mΩ
		V _{GS} =4.5V, I _D =20A		11.1	14	mΩ
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		990	1180	1450	pF
C _{oss}	Output Capacitance	V _{GS} =0V, V _{DS} =12.5V, f=1MHz	210	275	350	pF
C _{rss}	Reverse Transfer Capacitance		125	175	245	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	1.1	1.7	2.5	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge		17	21.7	26	nC
Q _g (4.5V)	Total Gate Charge	V _{GS} =10V, V _{DS} =12.5V, I _D =20A	35	11	13	nC
Q _{gs}	Gate Source Charge		3	4	5	nC
Q _{gd}	Gate Drain Charge		4	6.4	9	nC
t _{D(on)}	Turn-On Delay Time			6.8		ns
t _r	Turn-On Rise Time	V _{GS} =10V, V _{DS} =12.5V, R _L =0.42Ω,		13.8		ns
t _{D(off)}	Turn-Off Delay Time	R _{GEN} =3Ω		21.5		ns
t _f	Turn-Off Fall Time			8.7		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=500A/μs	8.5	10.6	13	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs	13	16	20	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

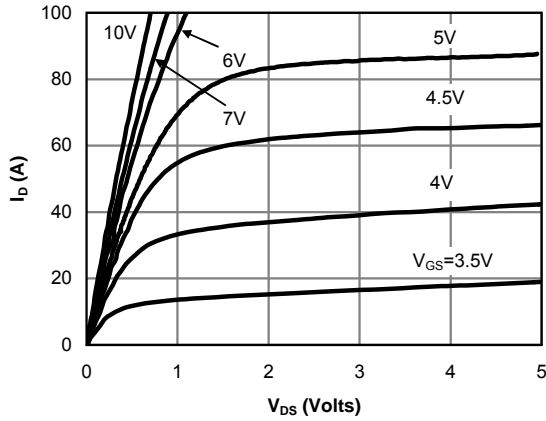


Figure 1: On-Region Characteristics (Note E)

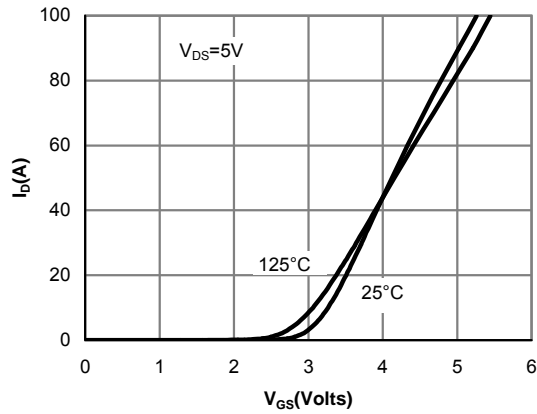


Figure 2: Transfer Characteristics (Note E)

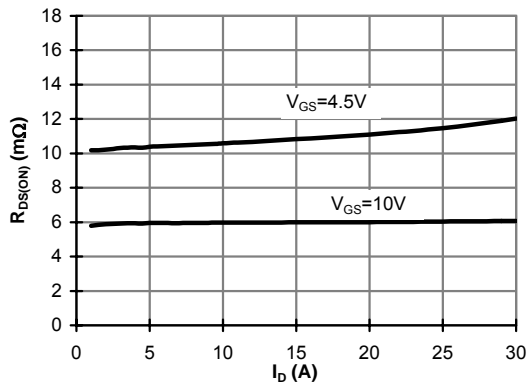


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

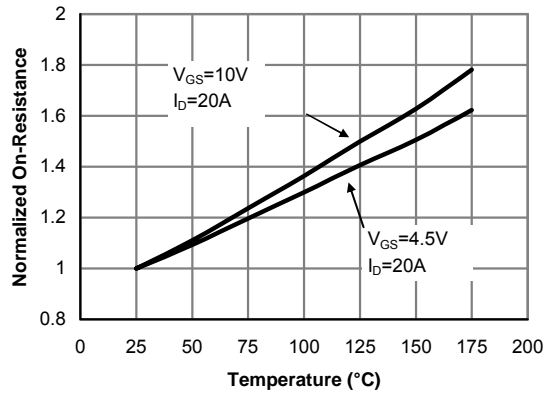


Figure 4: On-Resistance vs. Junction Temperature (Note E)

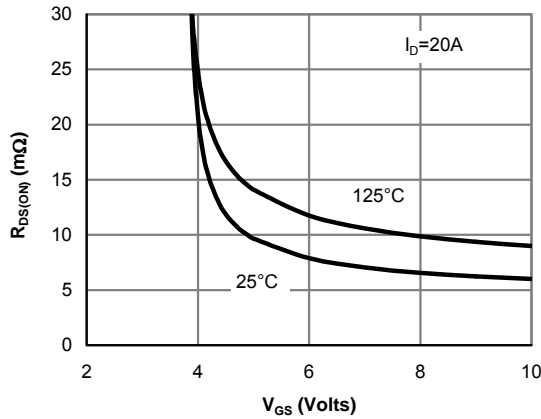


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

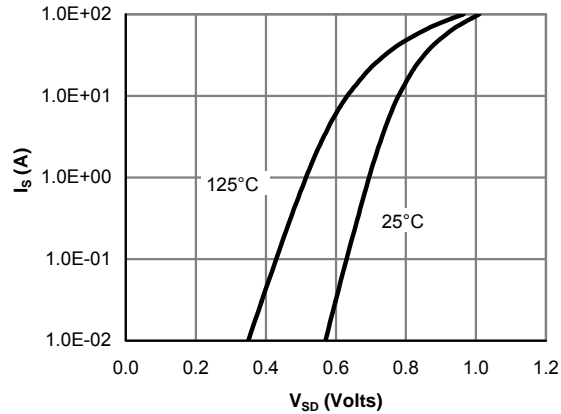


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

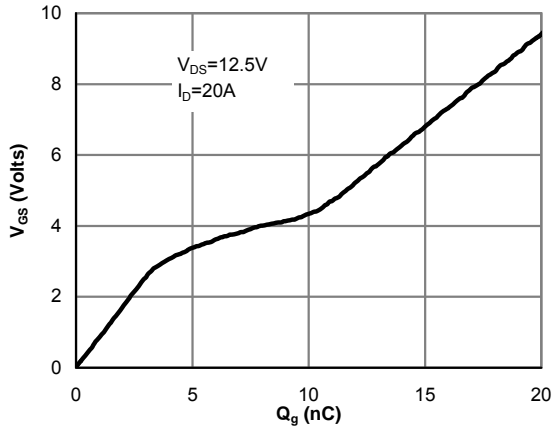


Figure 7: Gate-Charge Characteristics

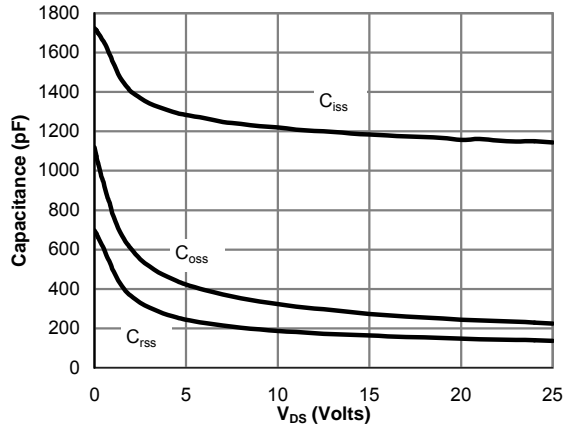


Figure 8: Capacitance Characteristics

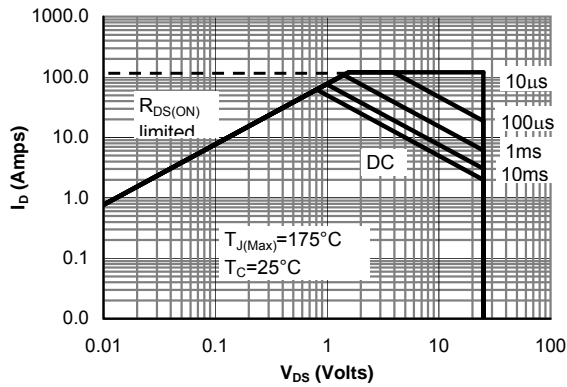


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

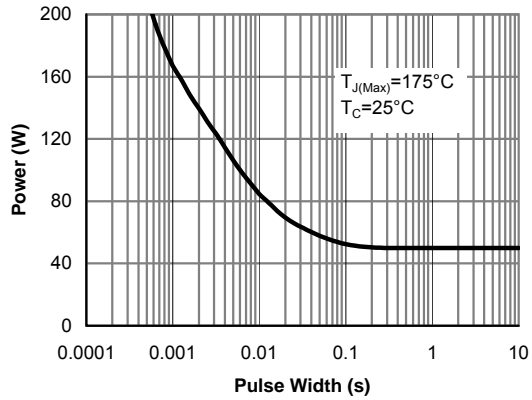


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

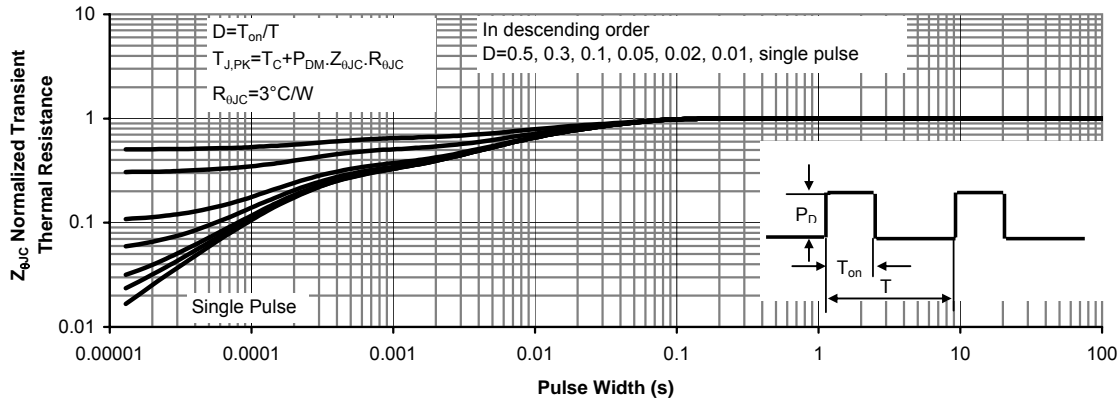


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

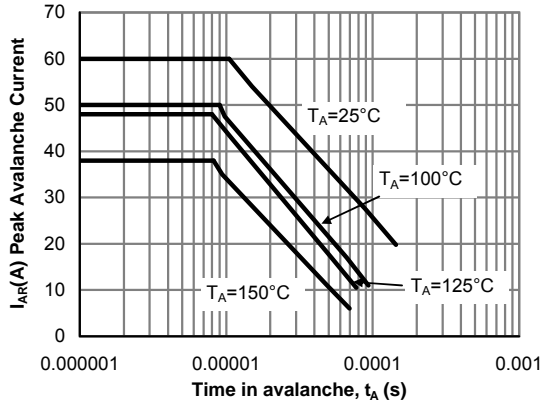


Figure 12: Single Pulse Avalanche capability (Note C)

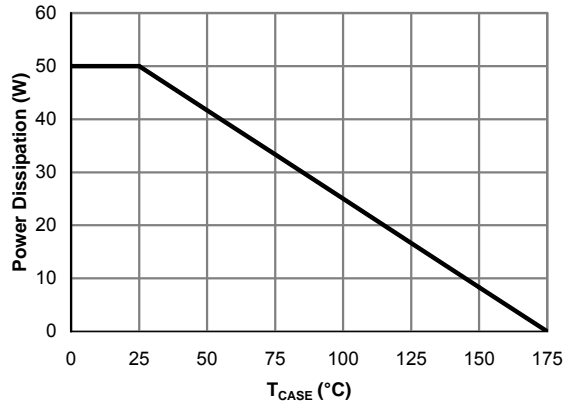


Figure 13: Power De-rating (Note F)

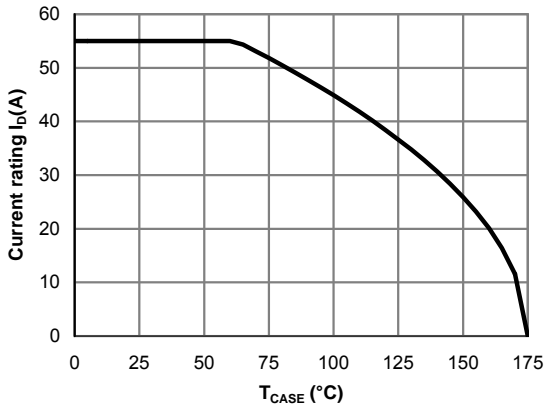


Figure 14: Current De-rating (Note F)

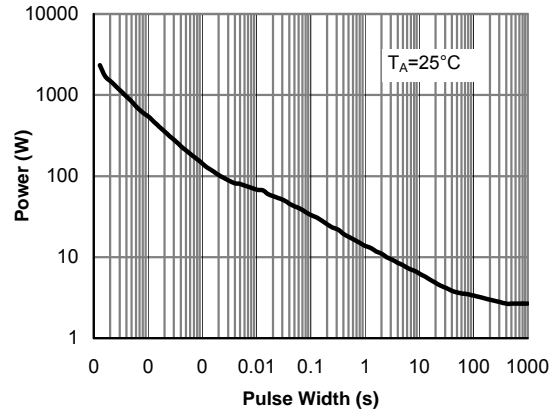


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

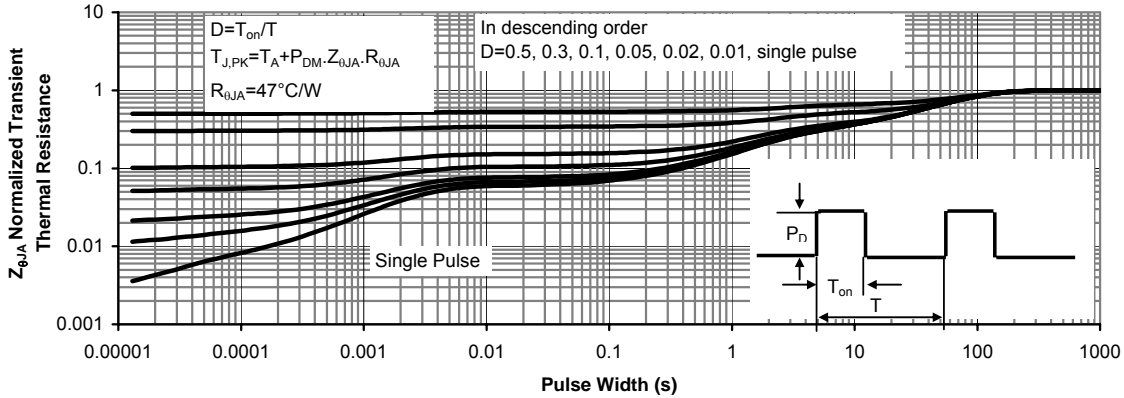


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

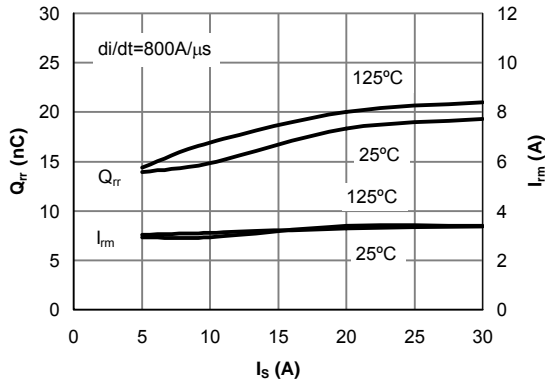


Figure 17: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

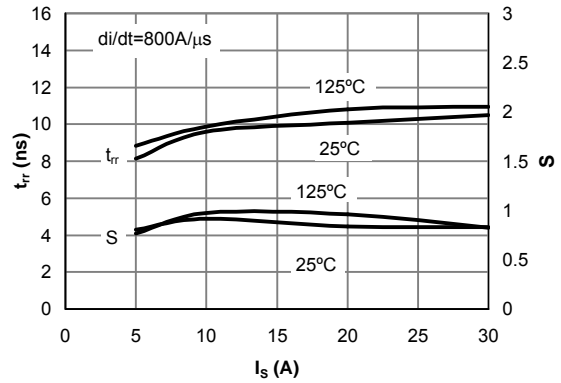


Figure 18: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

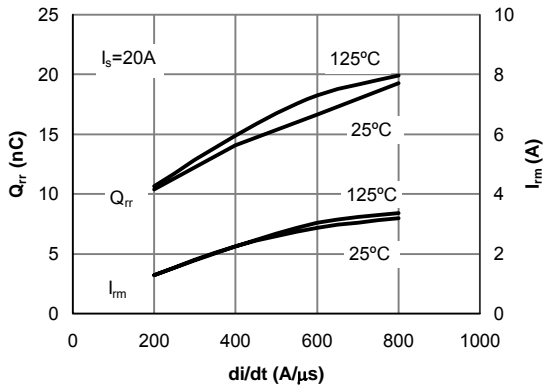


Figure 19: Diode Reverse Recovery Charge and Peak Current vs. di/dt

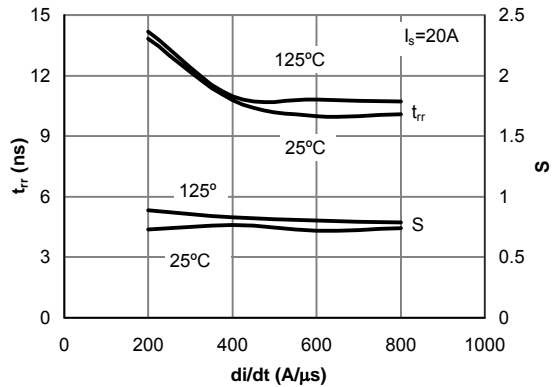
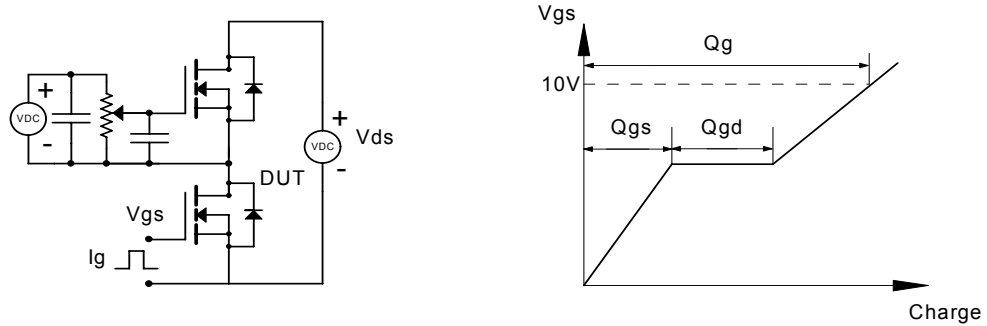
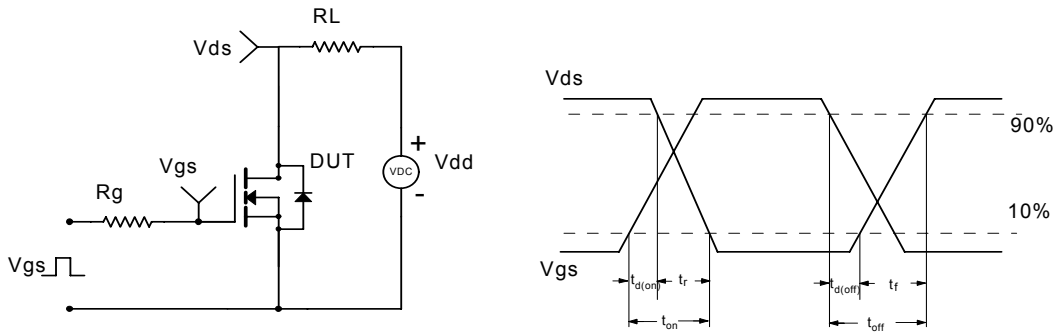


Figure 20: Diode Reverse Recovery Time and Softness Factor vs. di/dt

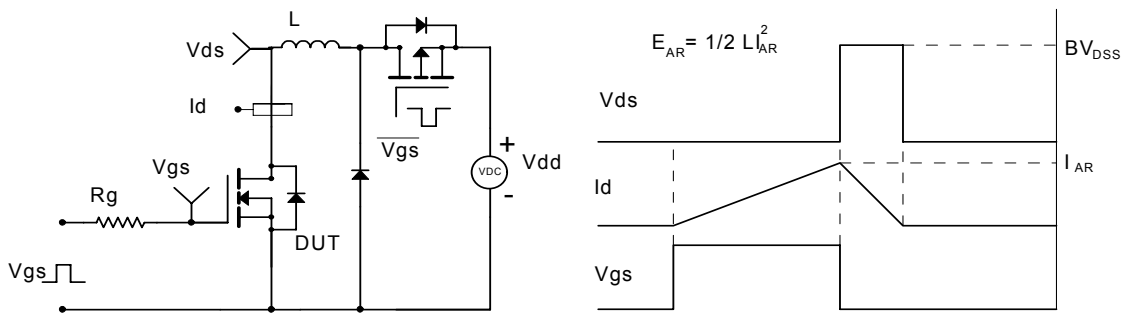
Gate Charge Test Circuit & Waveform



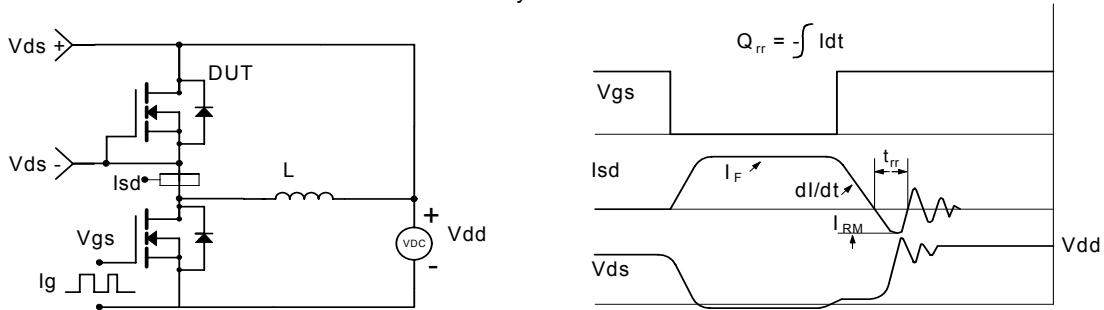
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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