ALPHA & OMEGA SEMICONDUCTOR

AOT414

100V N-channel MOSFET

General Description

The AOT414 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.AOT414 and AOT414L are electrically identical.

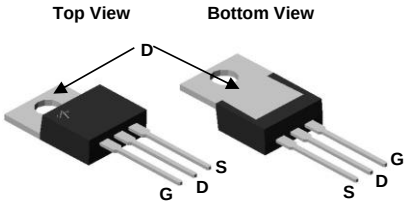
Product Summary

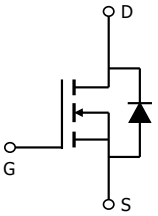
V_{DS}	100V
I_D (at V_{GS}=10V)	43A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 25mΩ
$R_{DS(ON)}$ (at V_{GS} = 7V)	< 31mΩ

100% UIS Tested
100% R_g Tested

RoHS Compliant

TO220





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	100	V
Gate-Source Voltage		V_{GS}	±25	V
Continuous Drain Current [G]	T_C=25°C	I_D	43	A
	T_C=100°C		31	
Pulsed Drain Current [C]		I_{DM}	100	
Continuous Drain Current	T_A=25°C	I_{DSM}	5.6	A
	T_A=70°C		4.5	
Avalanche Current [C]		I_{AR}	28	A
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	39	mJ
Power Dissipation [B]	T_C=25°C	P_D	115	W
	T_C=100°C		58	
Power Dissipation [A]	T_A=25°C	P_{DSM}	1.9	W
	T_A=70°C		1.23	
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]	t ≤ 10s	$R_{\theta JA}$	11.6	13.9	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		54	65	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.7	1.3	°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	100			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=100V, V_{GS}=0V			10	µA
		T_J=55°C			50	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±25V			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA	2	3.3	4	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V	100			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=20A		20.5	25	mΩ
		T_J=125°C		36	43	
		V_{GS}=7V, I_D=15A		25	31	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A		37		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.66	1	V
I_S	Maximum Body-Diode Continuous Current				40	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=50V, f=1MHz	1400	1770	2200	pF
C_{oss}	Output Capacitance		115	165	214	pF
C_{rss}	Reverse Transfer Capacitance		33	55	80	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	0.3	0.65	1.0	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=50V, I_D=20A	14	28	42	nC
Q_{gs}	Gate Source Charge		4	9	14	nC
Q_{gd}	Gate Drain Charge		6	10	14	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=50V, R_L=2.5Ω, R_{GEN}=3Ω		12		ns
t_r	Turn-On Rise Time			4		ns
$t_{D(off)}$	Turn-Off DelayTime			17		ns
t_f	Turn-Off Fall Time			5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, dI/dt=100A/µs	20	29	38	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, dI/dt=100A/µs	25	36	46	nC
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, dI/dt=500A/µs	12	20	26	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, dI/dt=500A/µs	60	82	110	nC

A. The value of $R_{\theta JA}$ 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 $R_{\theta JA}$ and the maximum allowed junction temperature of 175° 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 $R_{\theta JA}$ is the sum of the thermal impedence from junction to case RqJC and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300ms 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 $T_{J(MAX)}$=175° C. The SOA curve provides a single pulse rating.

G. 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

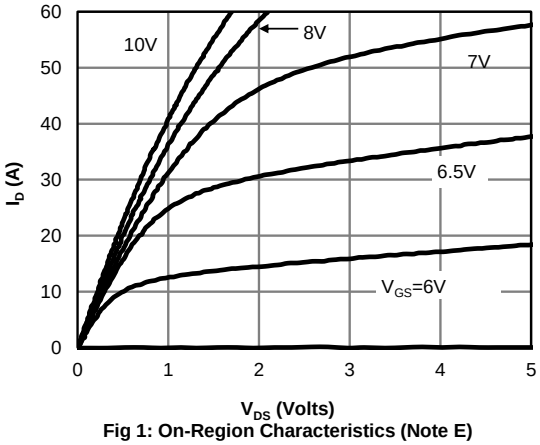


Fig 1: On-Region Characteristics (Note E)

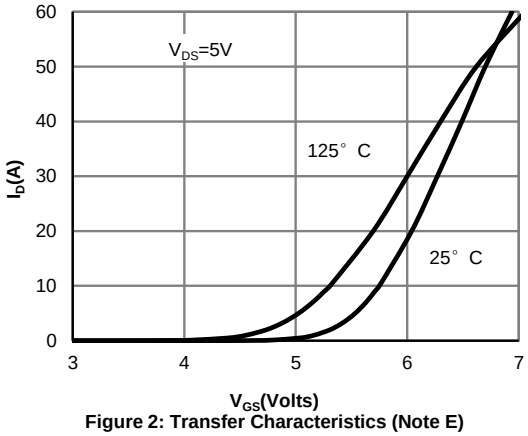


Figure 2: Transfer Characteristics (Note E)

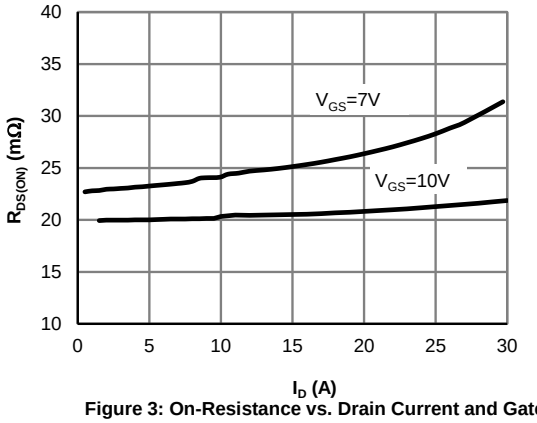


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

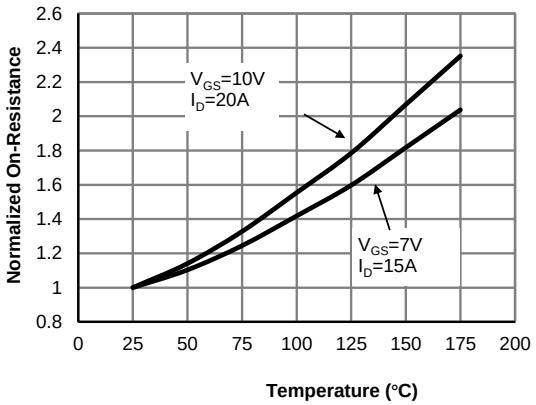


Figure 4: On-Resistance vs. Junction Temperature (Note E)

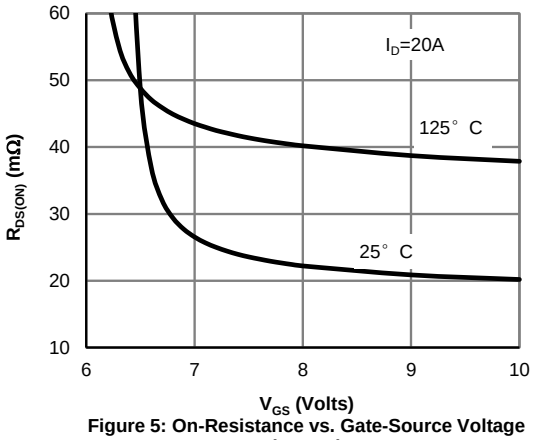


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

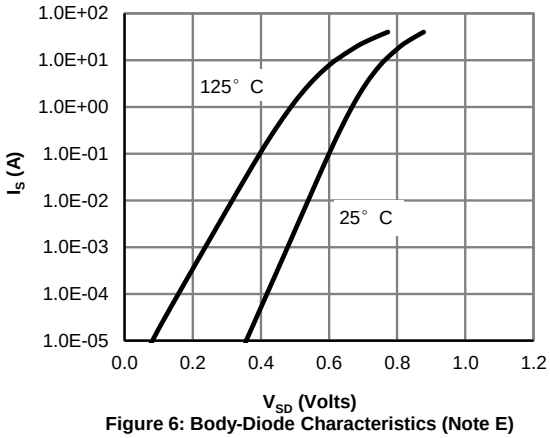


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

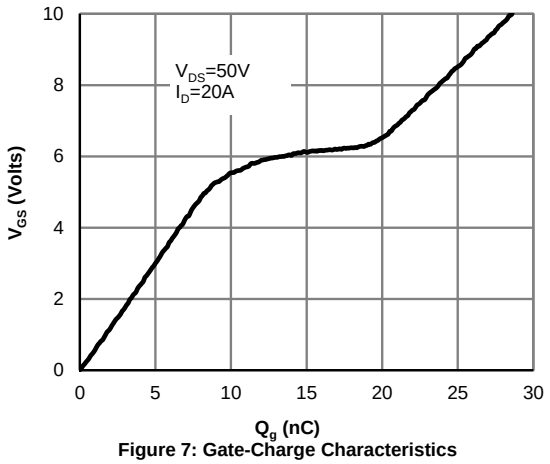


Figure 7: Gate-Charge Characteristics

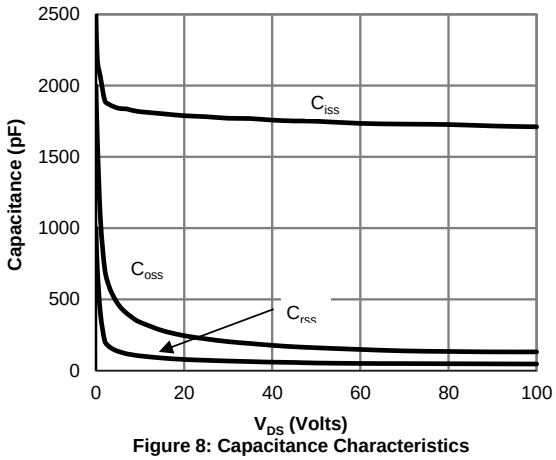


Figure 8: Capacitance Characteristics

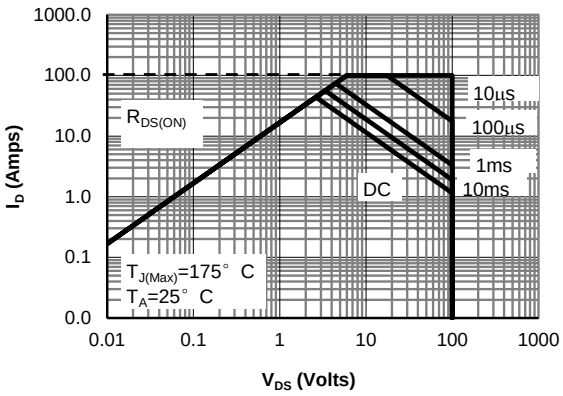


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

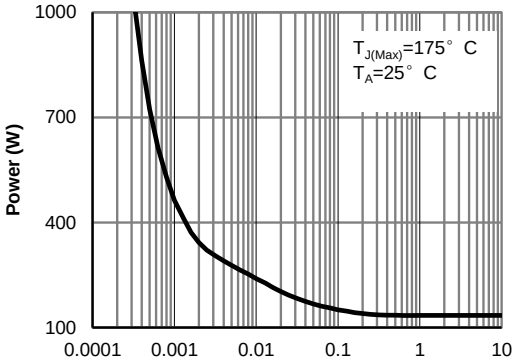


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

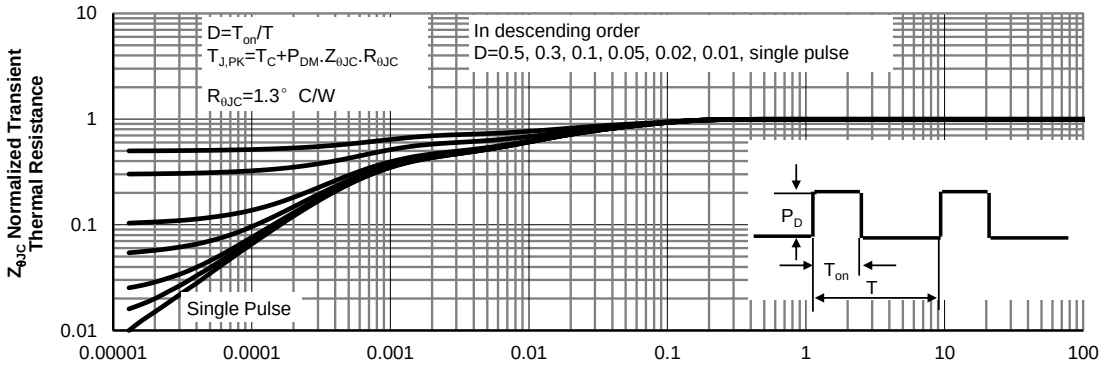


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

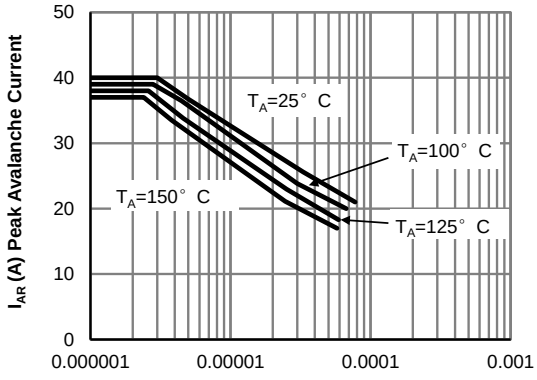


Figure 12: Single Pulse Avalanche capability (Note C)

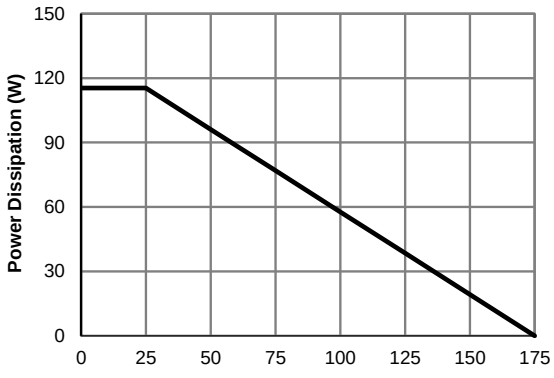


Figure 13: Power De-rating (Note F)

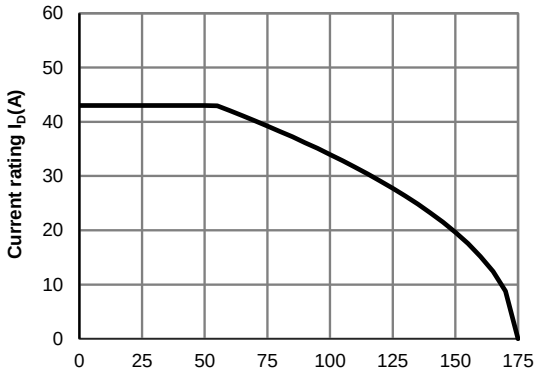


Figure 14: Current De-rating (Note F)

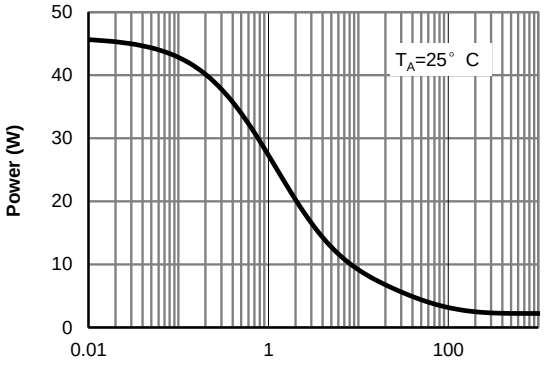


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

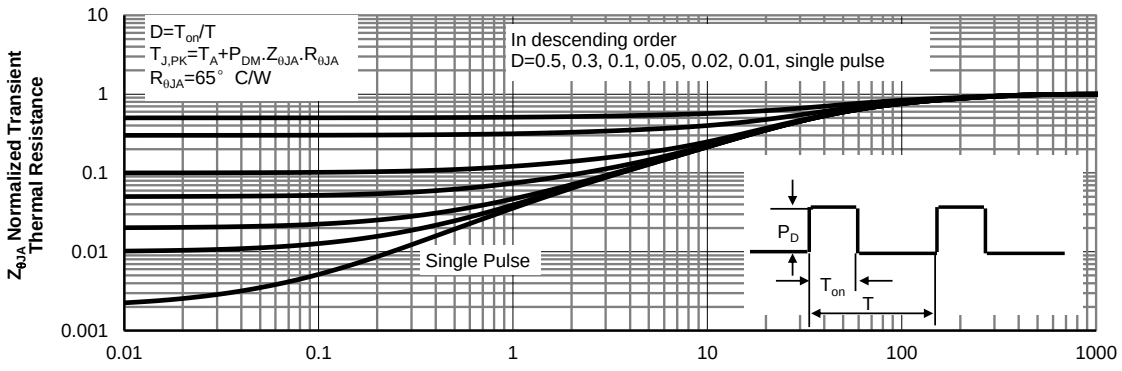


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

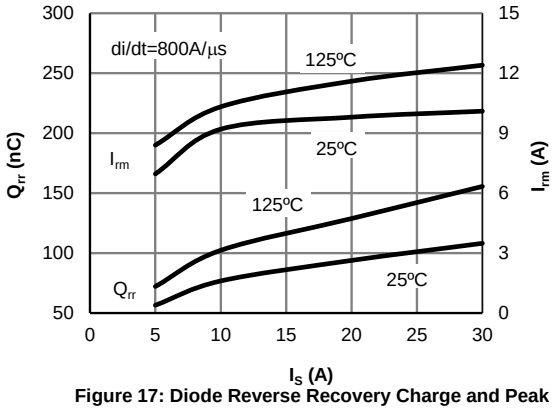


Figure 17: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

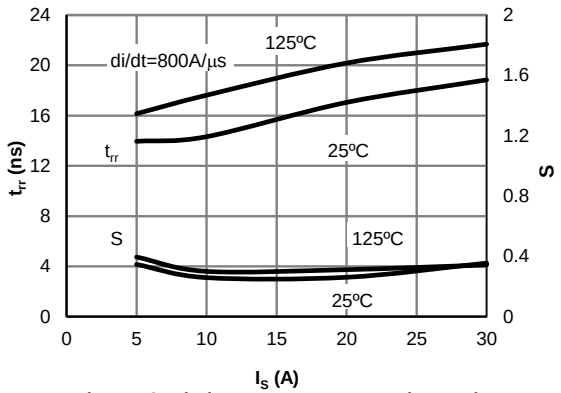


Figure 18: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

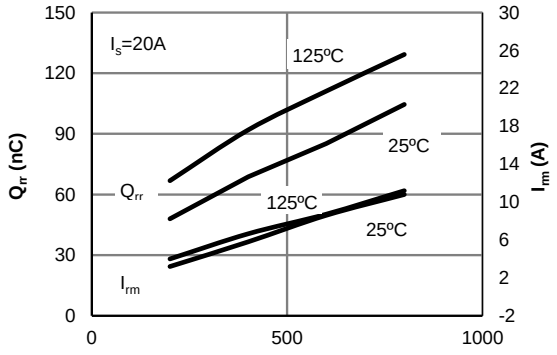


Figure 19: Diode Reverse Recovery Charge and Peak Current vs. di/dt

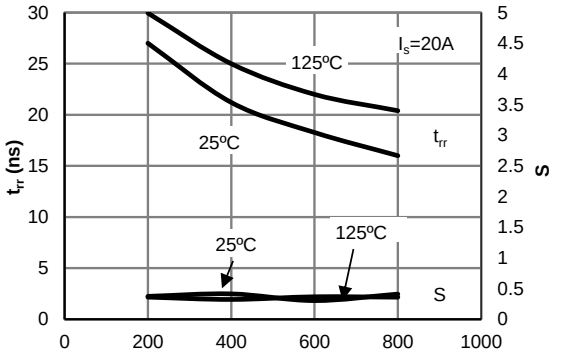
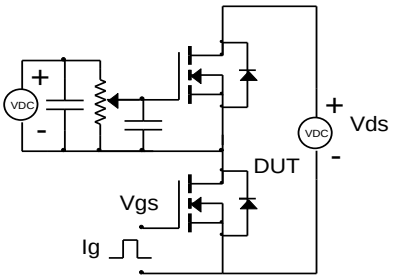
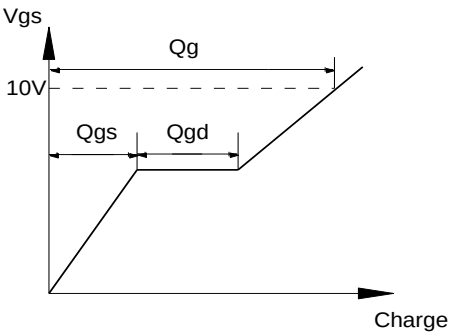


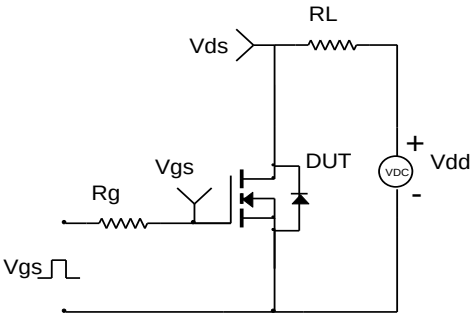
Figure 20: Diode Reverse Recovery Time and Softness Factor vs. di/dt

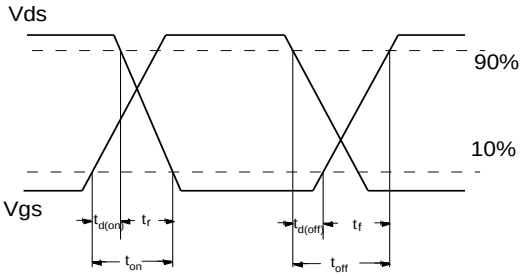
Gate Charge Test Circuit & Waveform



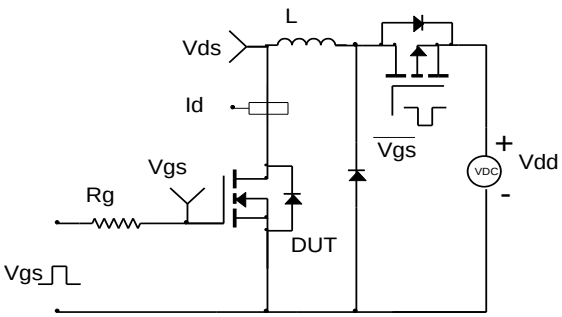


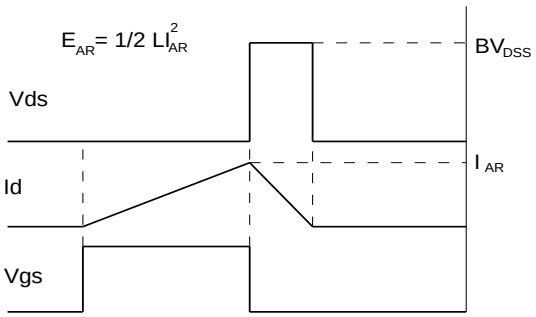
Resistive Switching Test Circuit & Waveforms



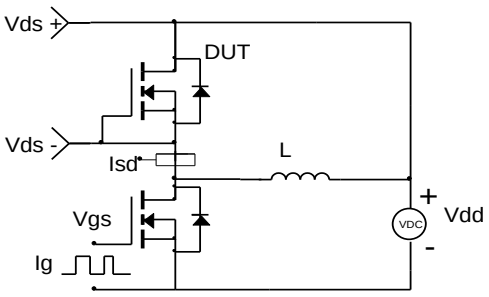


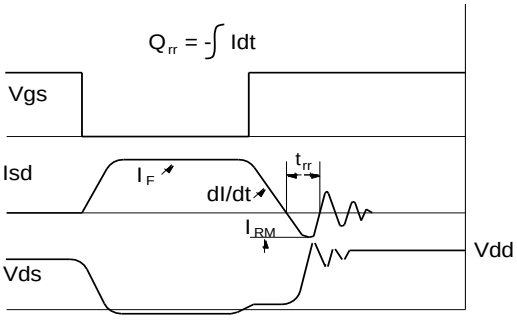
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





Diode Recovery Test Circuit & Waveforms





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