

## AOD452A

### N-Channel SDMOS™ POWER Transistor

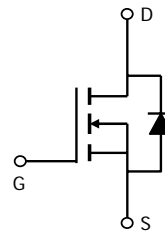
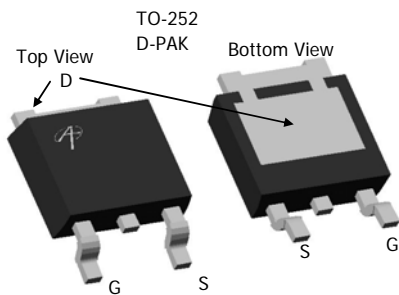
#### General Description

The AOD452A 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.

#### Features

$V_{DS}$  (V) = 25V  
 $I_D$  = 55A ( $V_{GS} = 10V$ )  
 $R_{DS(ON)} < 8m\Omega$  ( $V_{GS} = 10V$ )  
 $R_{DS(ON)} < 14m\Omega$  ( $V_{GS} = 4.5V$ )

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	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>G</sup>	$T_C=25^\circ\text{C}$	55	A
	$T_C=100^\circ\text{C}$	43	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	120	
Pulsed Forward Diode Current <sup>C</sup>	$I_{SM}$	120	
Avalanche Current <sup>C</sup>	$I_{AR}$	35	
Repetitive avalanche energy $L=50\mu\text{H}$ <sup>C</sup>	$E_{AR}$	31	
Power Dissipation <sup>B</sup>	$T_C=25^\circ\text{C}$	50	W
	$T_C=100^\circ\text{C}$	25	
Power Dissipation <sup>A</sup>	$T_A=25^\circ\text{C}$	2.5	W
	$T_A=70^\circ\text{C}$	1.6	
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 <sup>A</sup>	$R_{\theta JA}$	14.2	20	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	39	
Maximum Junction-to-Case <sup>B</sup>	$R_{\theta JC}$	2.5	3	$^\circ\text{C/W}$
Maximum Junction-to-TAB <sup>B</sup>	$R_{\theta JC-TAB}$	2.7	3.2	$^\circ\text{C/W}$

Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	25			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			10 50	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	1.2	2	3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=10\text{V}$ , $V_{DS}=5\text{V}$	120			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=30\text{A}$		6	8	m $\Omega$
		$T_J=125^\circ\text{C}$		8.6	12	
		$V_{GS}=4.5\text{V}$ , $I_D=20\text{A}$		11.5	14	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=30\text{A}$		50		S
$V_{SD}$	Diode Forward Voltage	$I_S=1\text{A}$ , $V_{GS}=0\text{V}$		0.7	1	V
$I_S$	Maximum Body-Diode Continuous Current				55	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance		990	1180	1450	pF
$C_{oss}$	Output Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=12.5\text{V}$ , $f=1\text{MHz}$	210	275	350	pF
$C_{riss}$	Reverse Transfer Capacitance		125	175	245	pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$	1.1	1.7	2.5	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}$ , $V_{DS}=12.5\text{V}$ , $I_D=30\text{A}$	18	21.7	26	nC
$Q_g(4.5\text{V})$	Total Gate Charge		9	11	13	nC
$Q_{gs}$	Gate Source Charge		3	4	5	nC
$Q_{gd}$	Gate Drain Charge		4.5	6.4	9	nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=10\text{V}$ , $V_{DS}=12.5\text{V}$ , $R_L=0.42\Omega$ , $R_{GEN}=3\Omega$		6.8		ns
$t_r$	Turn-On Rise Time			13.8		ns
$t_{D(off)}$	Turn-Off Delay Time			21.5		ns
$t_f$	Turn-Off Fall Time			8.7		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=30\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$	8.4	10.6	13	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=30\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$	13	16	20	nC

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{DSM}$  is based on  $R_{\theta JA}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design, and the maximum temperature of  $175^\circ\text{C}$  may be used if the PCB allows it.

B: The power dissipation  $P_D$  is based on  $T_{J(MAX)}=175^\circ\text{C}$ , 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  $T_{J(MAX)}=175^\circ\text{C}$ .

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  $<300\mu\text{s}$  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  $T_{J(MAX)}=175^\circ\text{C}$ .

G: The maximum current rating is limited by bond-wires.

H: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

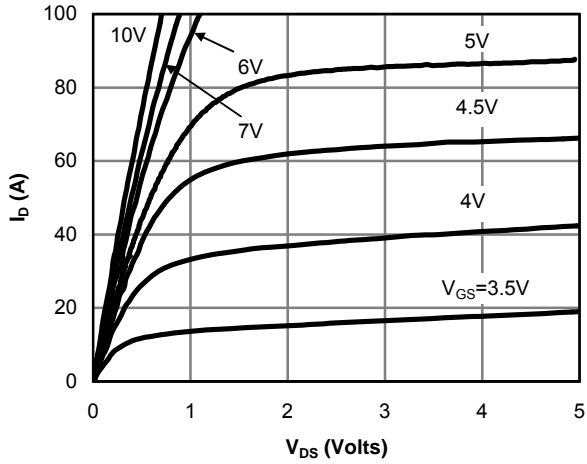


Fig 1: On-Region Characteristics

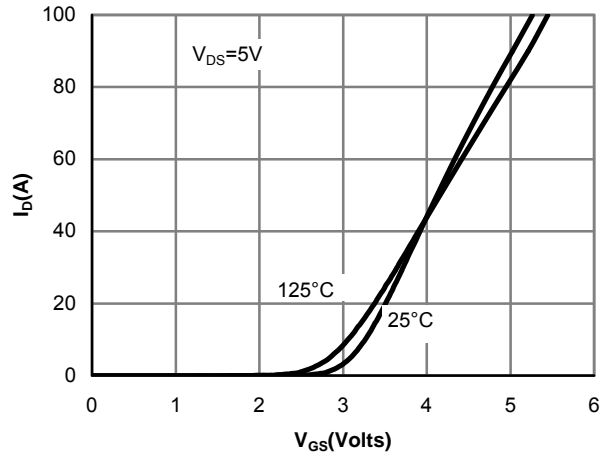


Figure 2: Transfer Characteristics

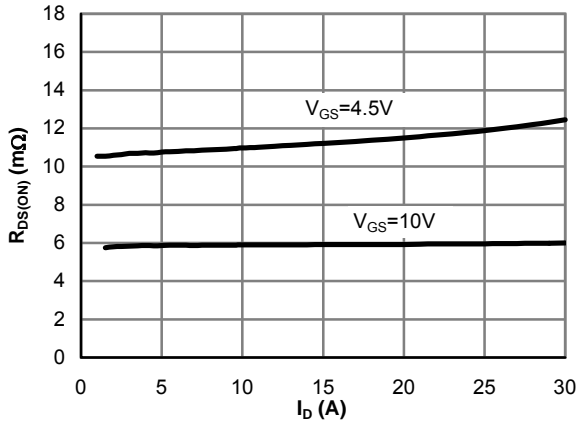


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

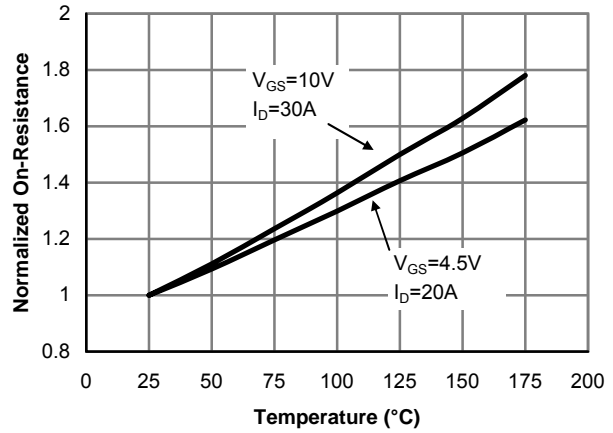


Figure 4: On-Resistance vs. Junction Temperature

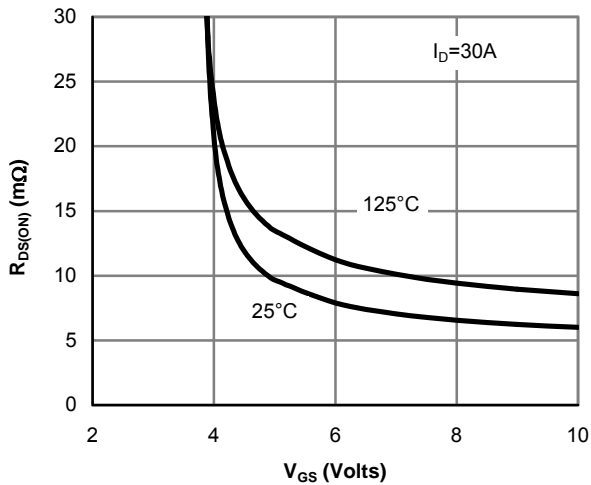


Figure 5: On-Resistance vs. Gate-Source Voltage

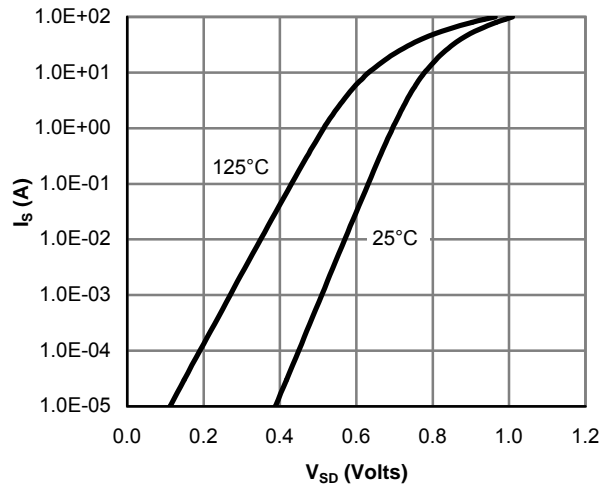


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

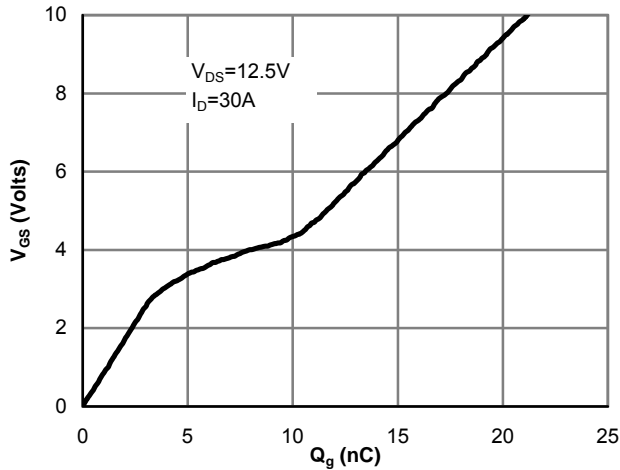


Figure 7: Gate-Charge Characteristics

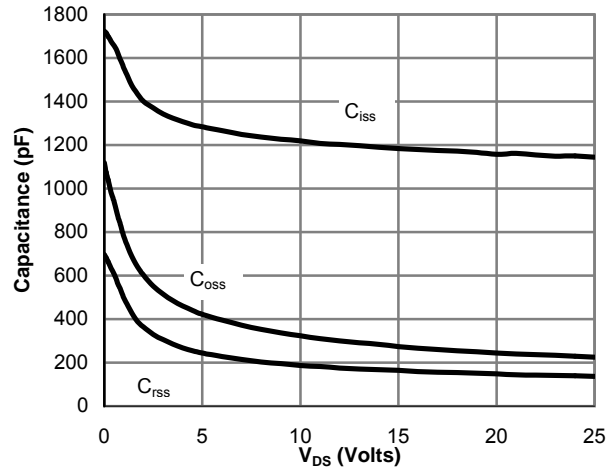


Figure 8: Capacitance Characteristics

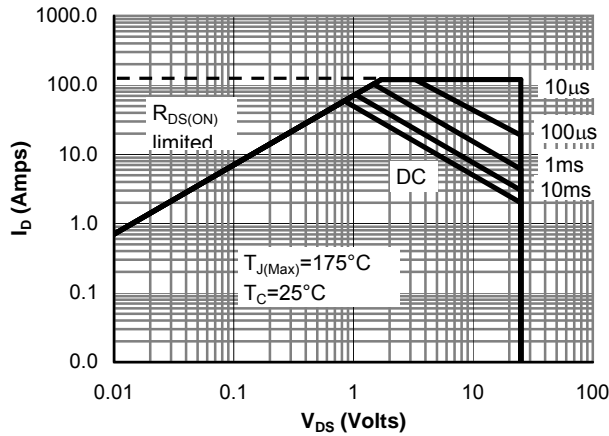


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

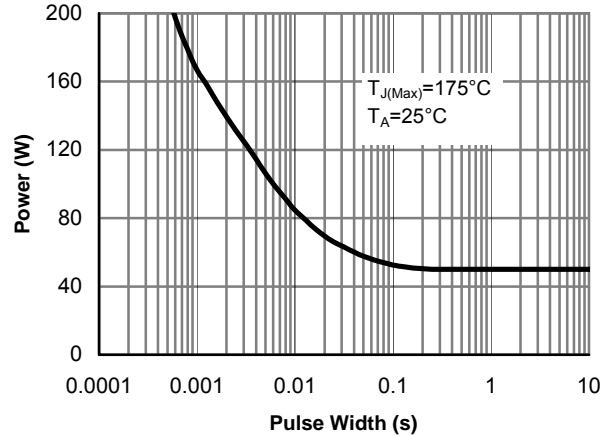


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

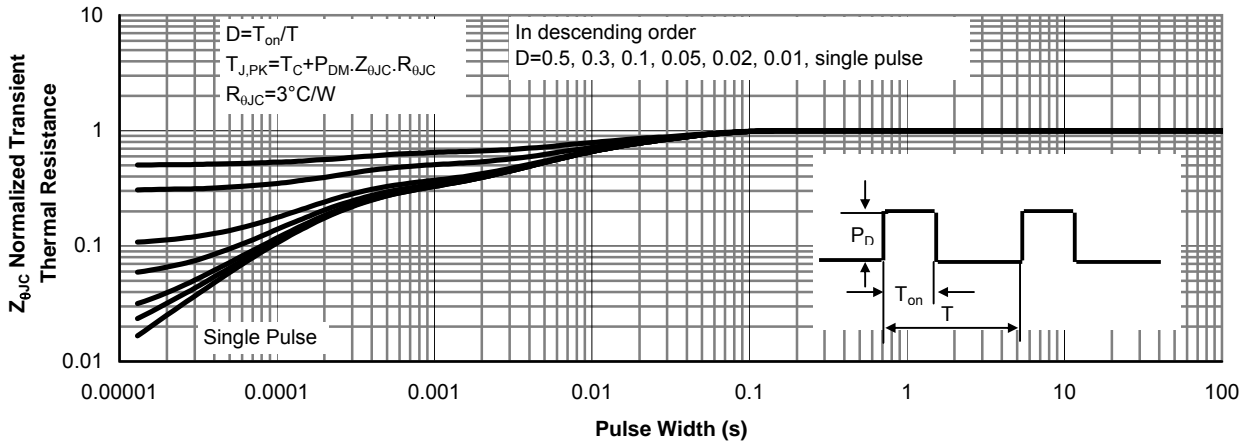


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

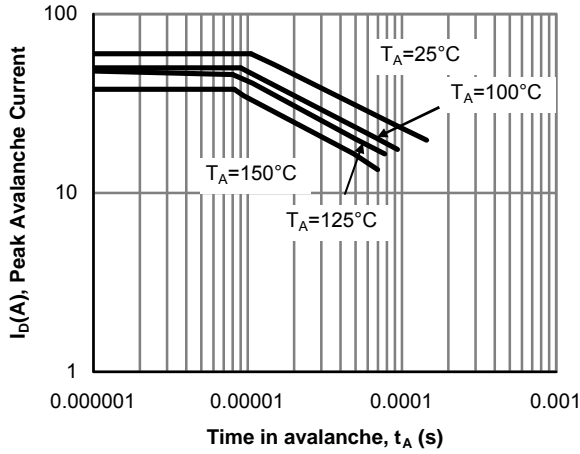


Figure 12: Single Pulse Avalanche capability

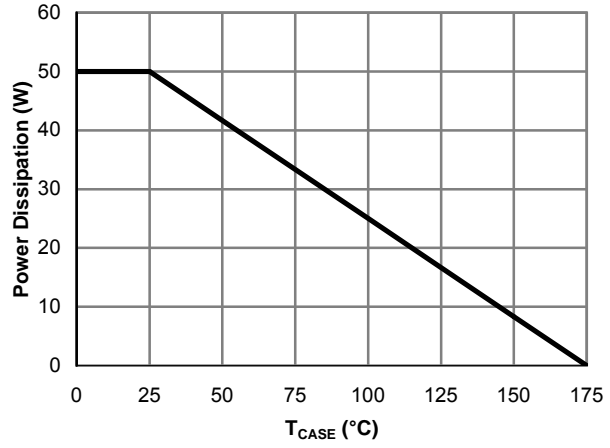


Figure 13: Power De-rating (Note B)

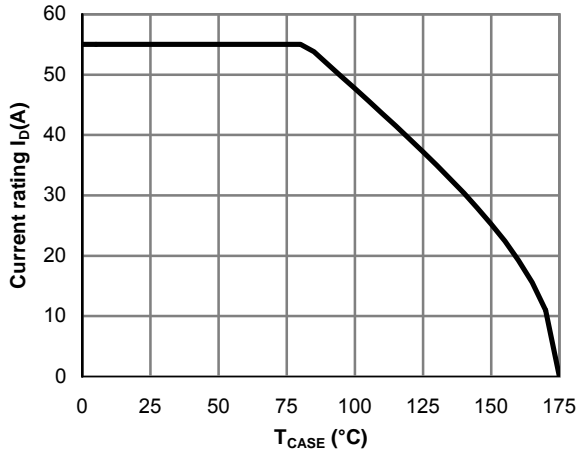


Figure 14: Current De-rating (Note B)

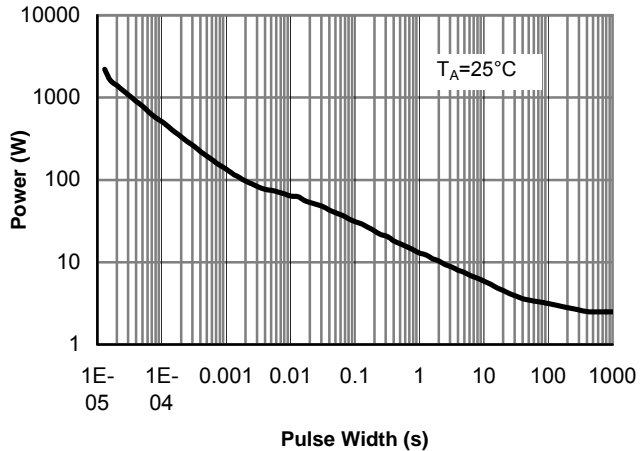


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

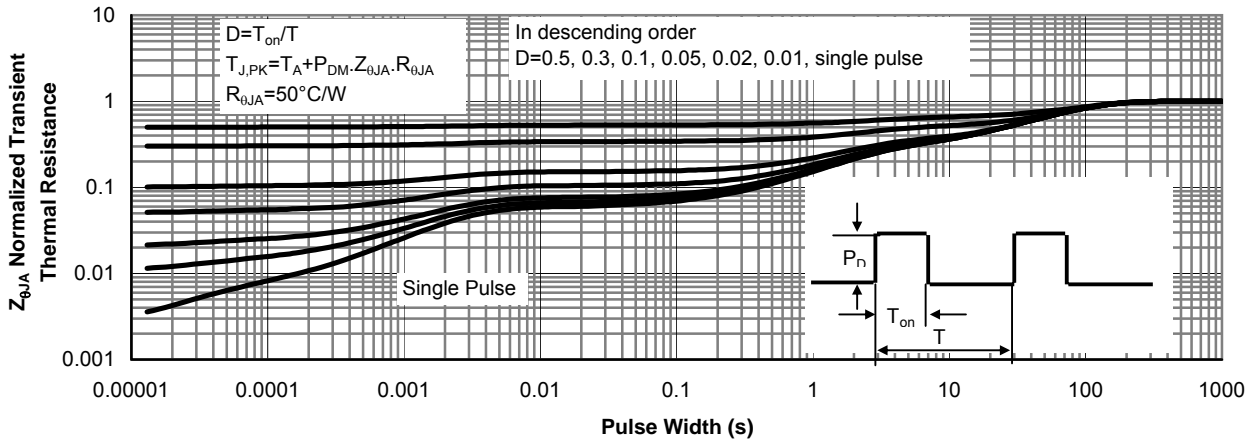


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

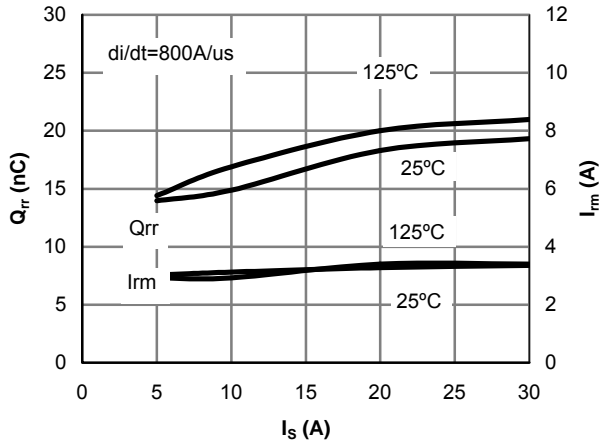


Figure 17: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

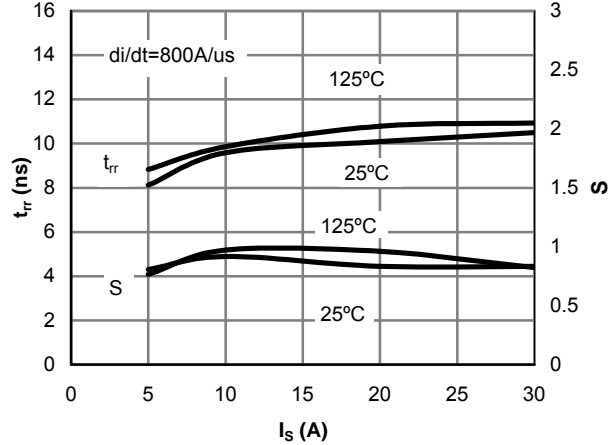


Figure 18: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

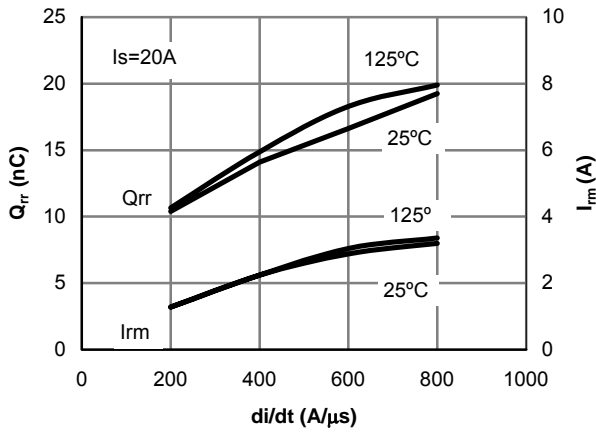


Figure 19: Diode Reverse Recovery Charge and Peak Current vs. di/dt

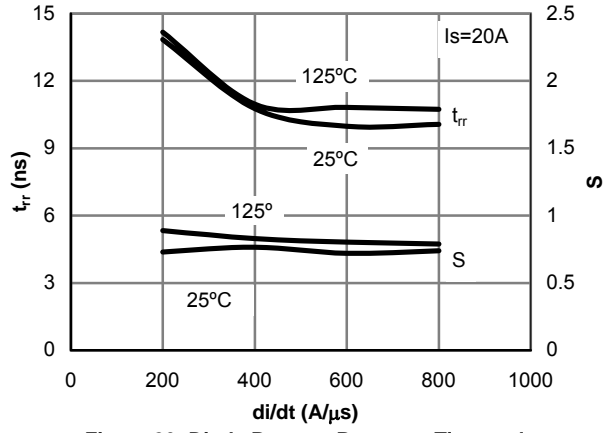
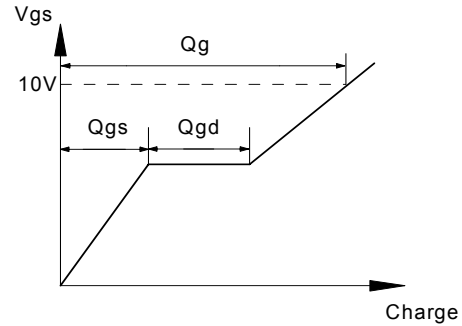
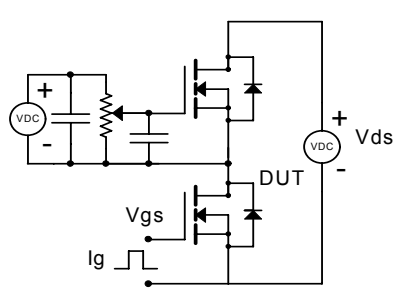
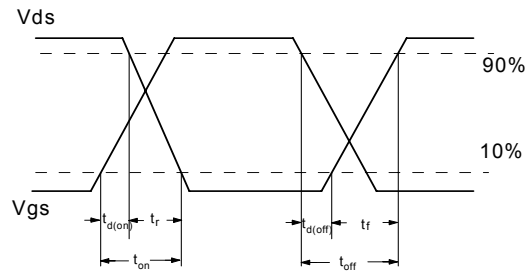
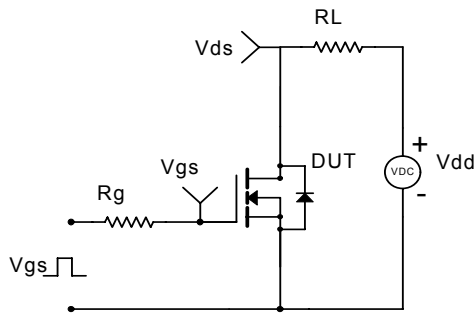


Figure 20: Diode Reverse Recovery Time and Softness Factor vs. di/dt

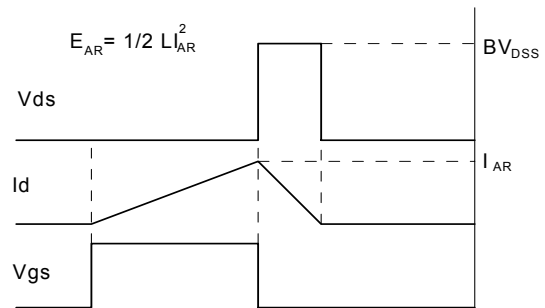
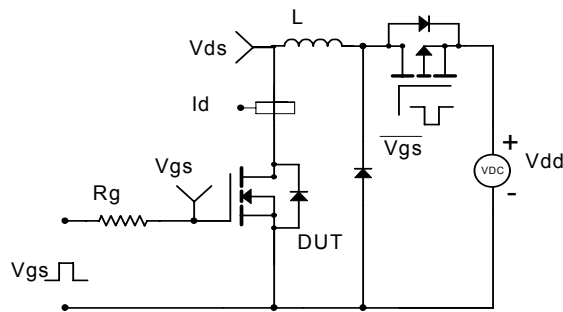
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

