ALPHA & OMEGA SEMICONDUCTOR

AO6601

30V Complementary MOSFET

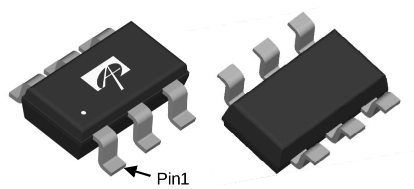
General Description

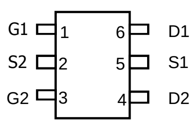
The AO6601 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs form a high-speed power inverter, suitable for a multitude of applications.

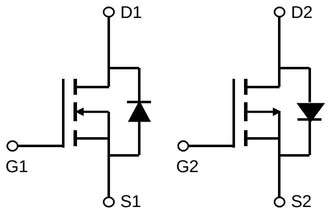
Product Summary

N-Channel	P-Channel
V_{DS}= 30V	-30V
I_D= 3.4A (V_{GS}=10V)	-2.3A (V_{GS}=-10V)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 60mΩ (V_{GS}=10V)	< 115mΩ (VGS=-10V)
< 70mΩ (V_{GS}=4.5V)	< 150mΩ (VGS=-4.5V)
< 90mΩ (V_{GS}=2.5V)	< 200mΩ (VGS=-2.5V)

TSOP6







Absolute Maximum Ratings T_A=25°C unless otherwise noted					
Parameter		**Symbol**	**Max n-channel**	**Max p-channel**	**Units**
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±12	±12	V
Continuous Drain Current	T_A=25°C	I_D	3.4	-2.3	A
	T_A=70°C		2.7	-1.8	
Pulsed Drain Current [C]		I_{DM}	20	-15	
Power Dissipation [B]	T_A=25°C	P_D	1.15	1.15	W
	T_A=70°C		0.73	0.73	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	78	110	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		106	150	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	64	80	°C/W

N-Channel 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				1	µA
			T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±12V				±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA		0.5	1	1.5	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V		20			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=3.4A			46	60	mΩ
			T_J=125°C		73	88	
		V_{GS}=4.5V, I_D=3A			50	70	mΩ
		V_{GS}=2.5V, I_D=2A			62	90	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=3.4A			14		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V			0.75	1	V
I_S	Maximum Body-Diode Continuous Current					1.5	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		185	235	285	pF
C_{oss}	Output Capacitance			25	35	45	pF
C_{rss}	Reverse Transfer Capacitance			10	18	25	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		0.9	1.8	2.7	Ω
SWITCHING PARAMETERS							
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=3.4A			10	12	nC
Q_g(4.5V)	Total Gate Charge				4.7	6	nC
Q_{gs}	Gate Source Charge				0.95		nC
Q_{gd}	Gate Drain Charge				1.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=4.4Ω, R_{GEN}=3Ω			3.5		ns
t_r	Turn-On Rise Time				1.5		ns
$t_{D(off)}$	Turn-Off DelayTime				17.5		ns
t_f	Turn-Off Fall Time				2.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=3.4A, dI/dt=100A/µs			8.5	12	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=3.4A, dI/dt=100A/µs			2.55	4	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 value in any given application depends on the user's specific board design.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° C, using ≤ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initialT_J=25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead 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-ambient thermal impedence which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.

N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

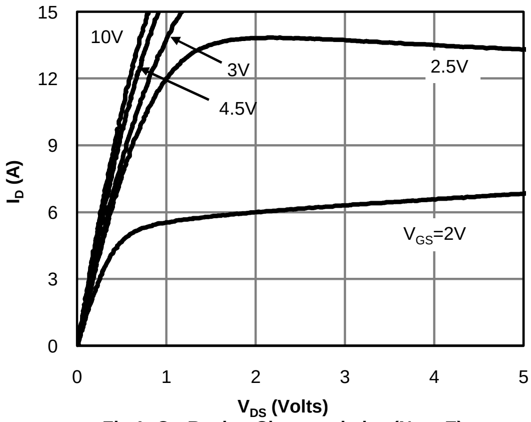


Fig 1: On-Region Characteristics (Note E)

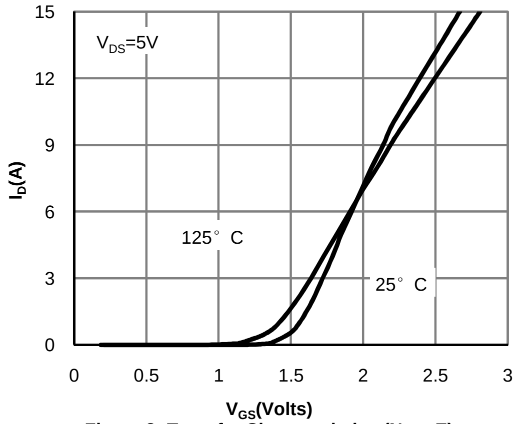


Figure 2: Transfer Characteristics (Note E)

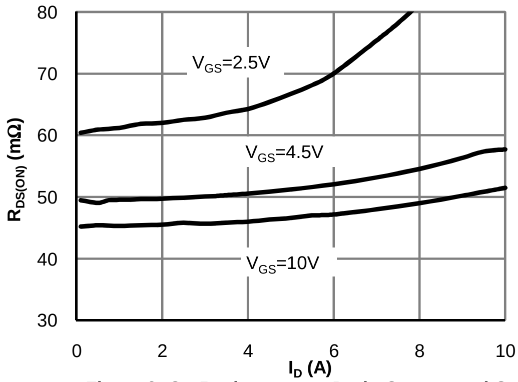


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

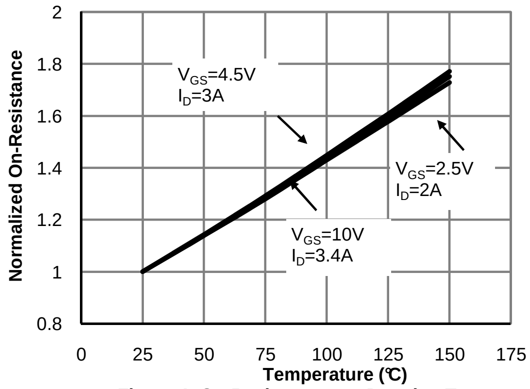


Figure 4: On-Resistance vs. Junction Temperature (Note E)

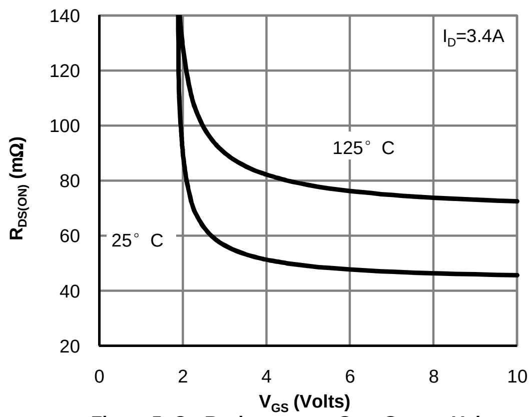


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

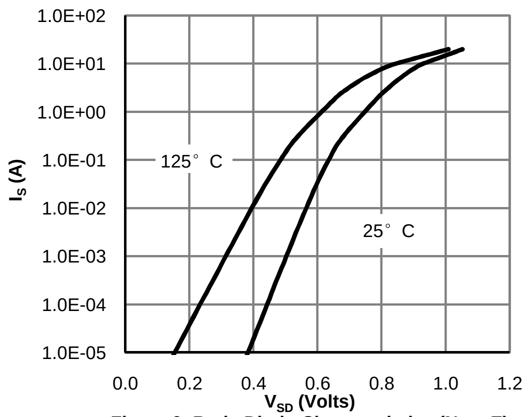


Figure 6: Body-Diode Characteristics (Note E)

N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

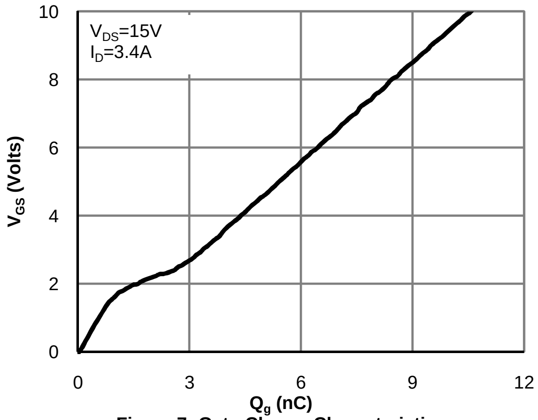


Figure 7: Gate-Charge Characteristics

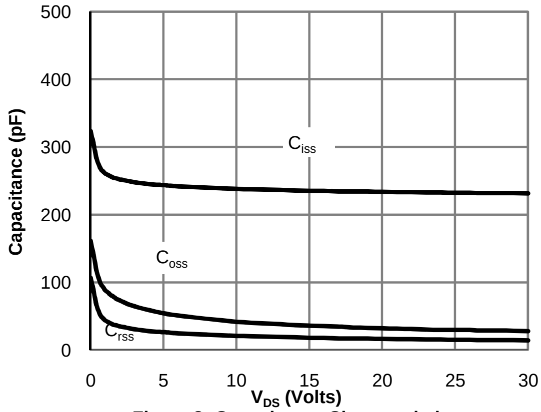


Figure 8: Capacitance Characteristics

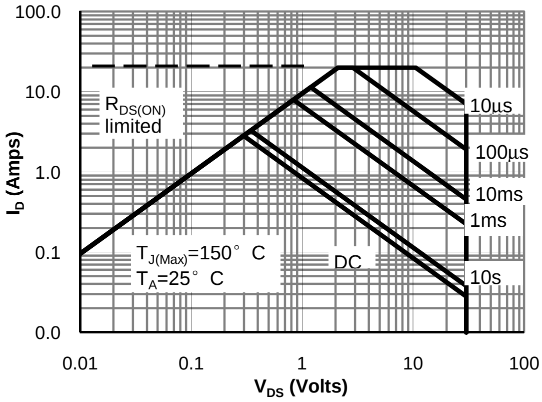


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

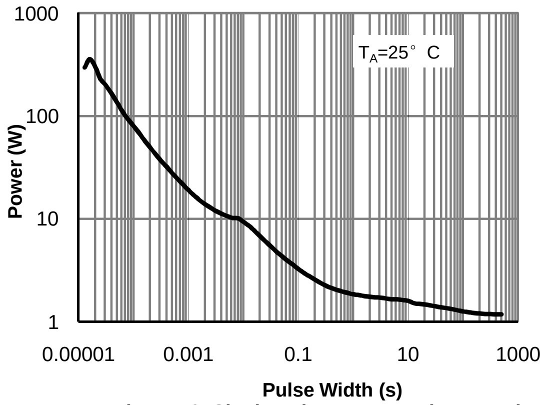


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

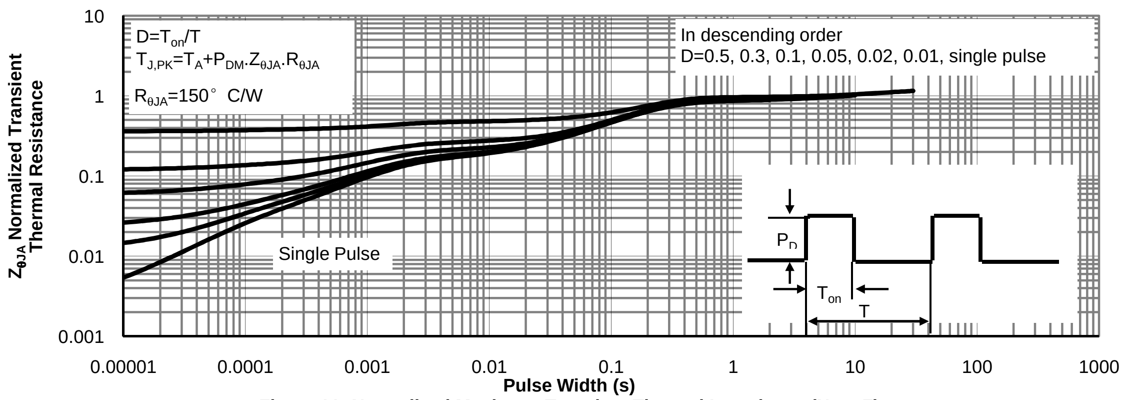
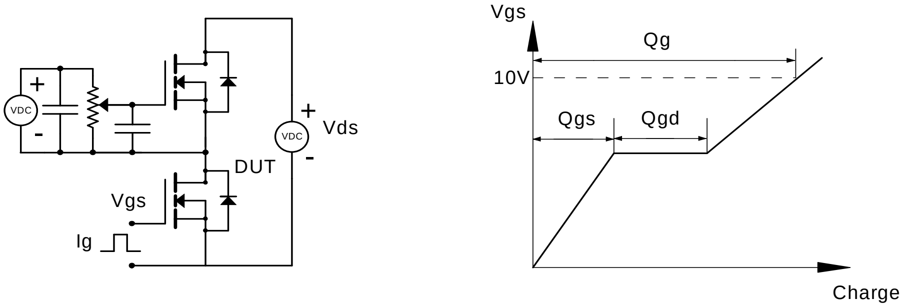
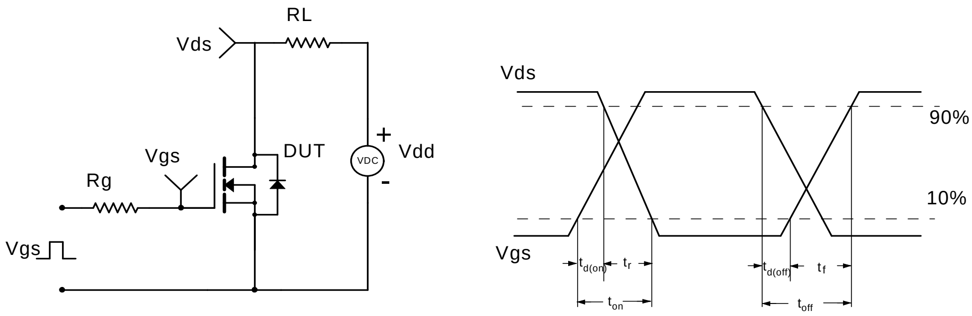


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

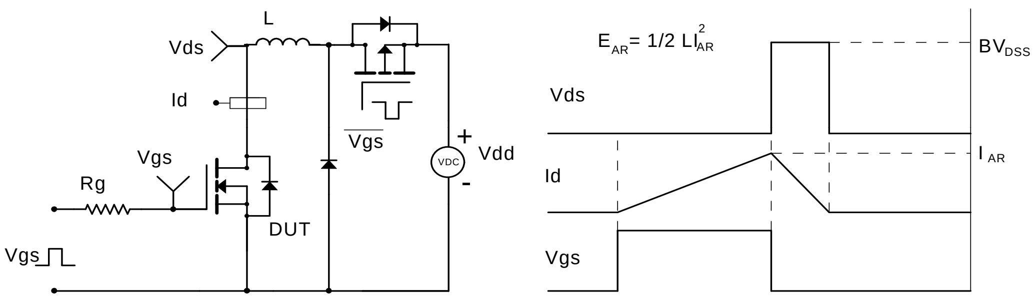
Gate Charge Test Circuit & Waveform



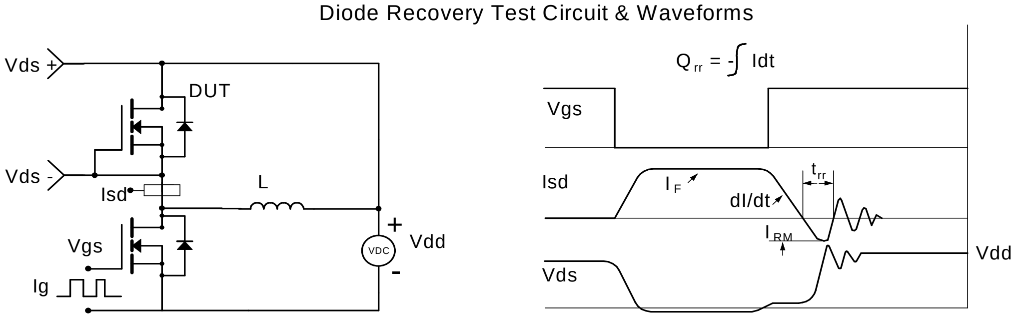
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



P-Channel 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			-1	µA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±12V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-0.6	-1	-1.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-15			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-2.3A		88	115	mΩ
		T_J=125°C		143	200	
		V_{GS}=-4.5V, I_D=-2A		103	150	mΩ
		V_{GS}=-2.5V, I_D=-1A		139	200	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-2.3A		8		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.78	-1	V
I_S	Maximum Body-Diode Continuous Current				-1.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-15V, f=1MHz	205	260	315	pF
C_{oss}	Output Capacitance		25	37	50	pF
C_{rss}	Reverse Transfer Capacitance		10	20	30	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	4	8	12	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=-15V, I_D=-2.3A	4.5	5.9	7	nC
Q_g(4.5V)	Total Gate Charge		2	2.8	4	nC
Q_{gs}	Gate Source Charge			0.7		nC
Q_{gd}	Gate Drain Charge			1		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=-15V, R_L=6Ω, R_{GEN}=3Ω		6		ns
t_r	Turn-On Rise Time			3.5		ns
$t_{D(off)}$	Turn-Off DelayTime			20		ns
t_f	Turn-Off Fall Time			5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-2.3A, dI/dt=100A/µs		11.5	15	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-2.3A, dI/dt=100A/µs		4.5	6	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 value in any given application depends on the user's specific board design.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° C, using ≤ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initialT_J=25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead 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-ambient thermal impedence which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.

P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

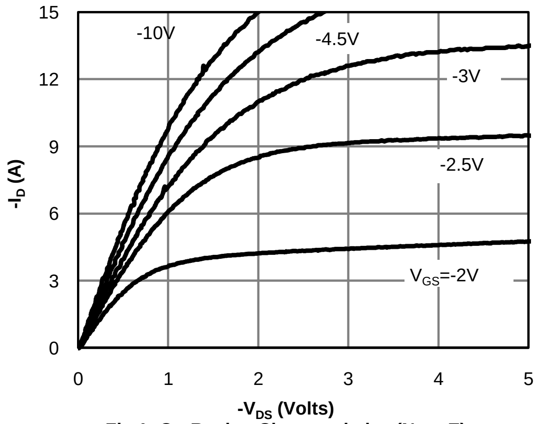


Fig 1: On-Region Characteristics (Note E)

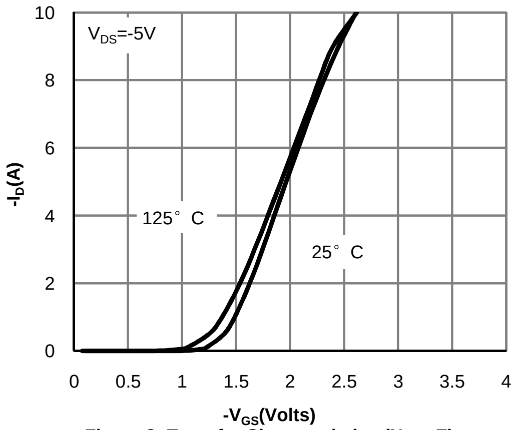


Figure 2: Transfer Characteristics (Note E)

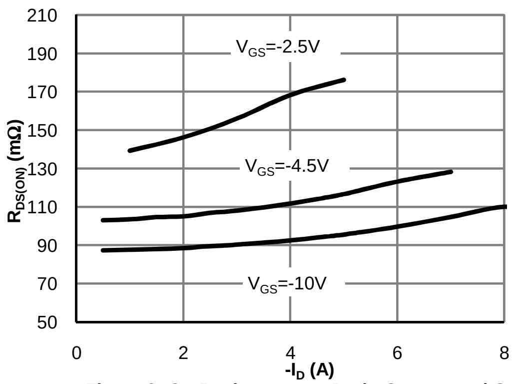


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

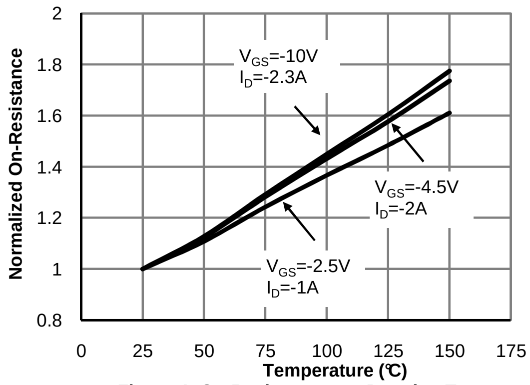


Figure 4: On-Resistance vs. Junction Temperature (Note E)

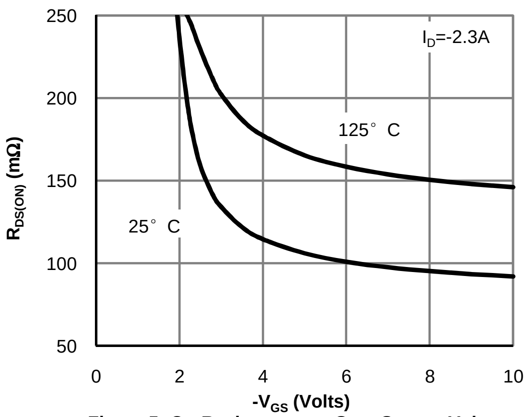


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

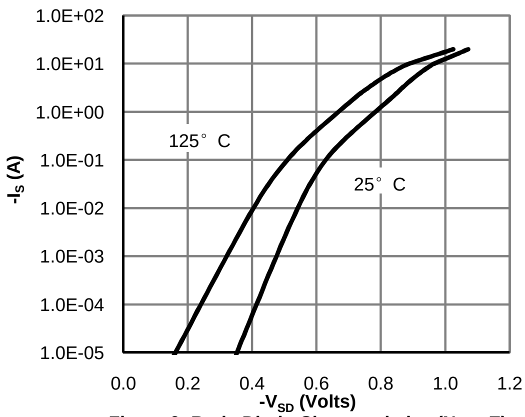


Figure 6: Body-Diode Characteristics (Note E)

P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

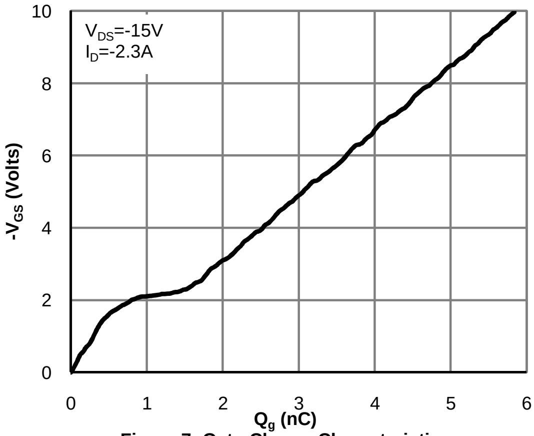


Figure 7: Gate-Charge Characteristics

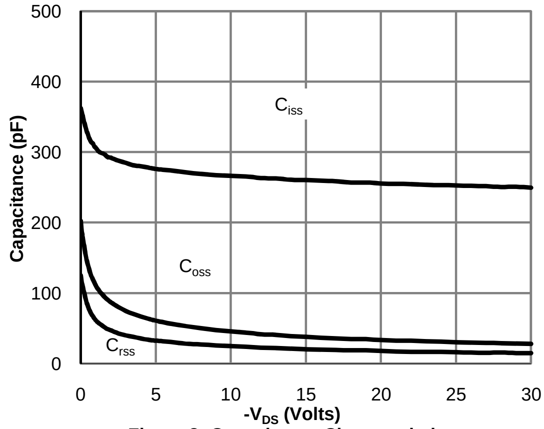


Figure 8: Capacitance Characteristics

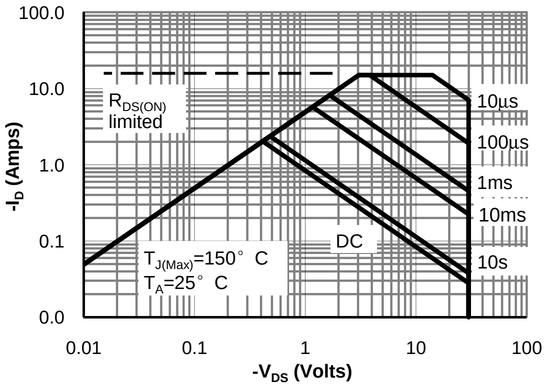


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

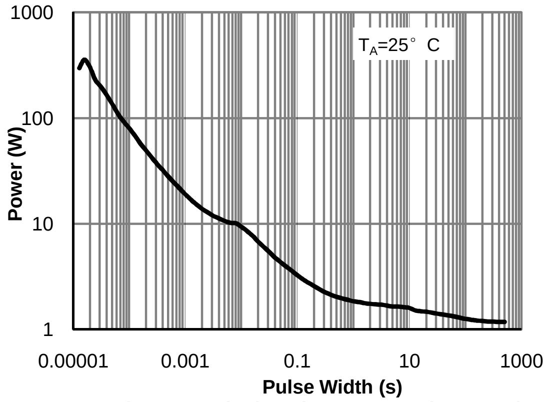


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

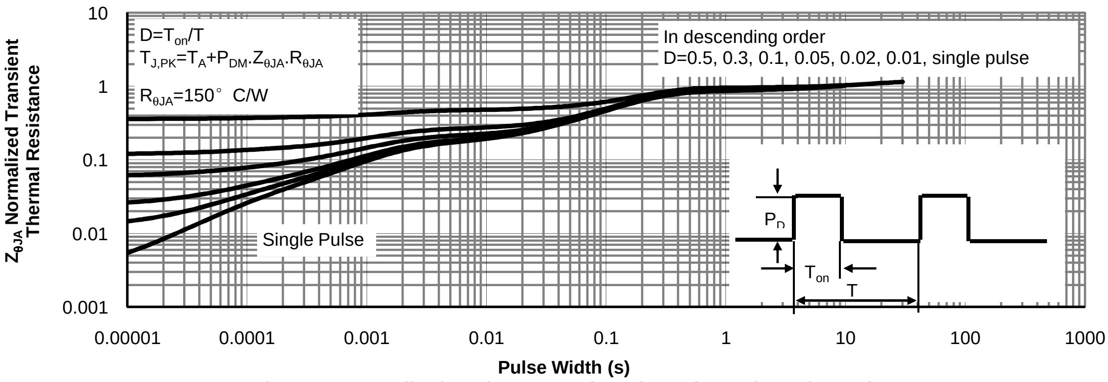
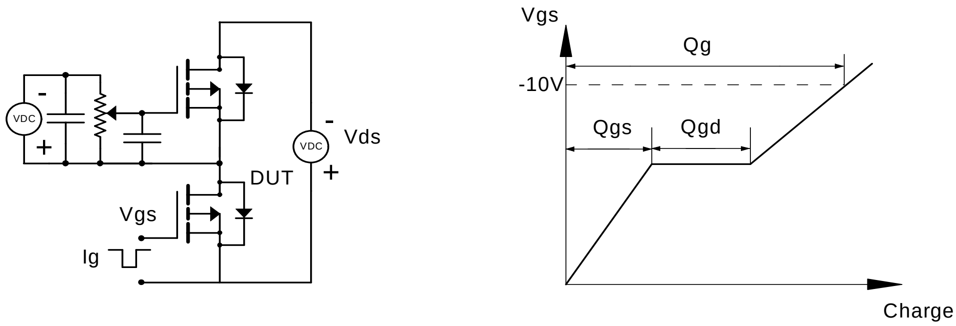
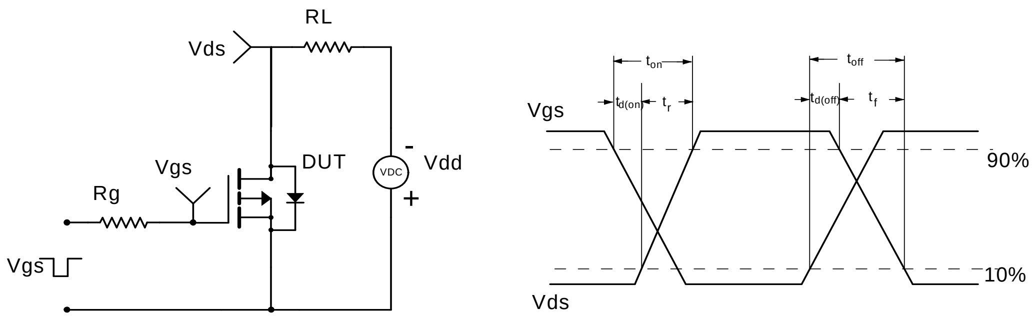


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

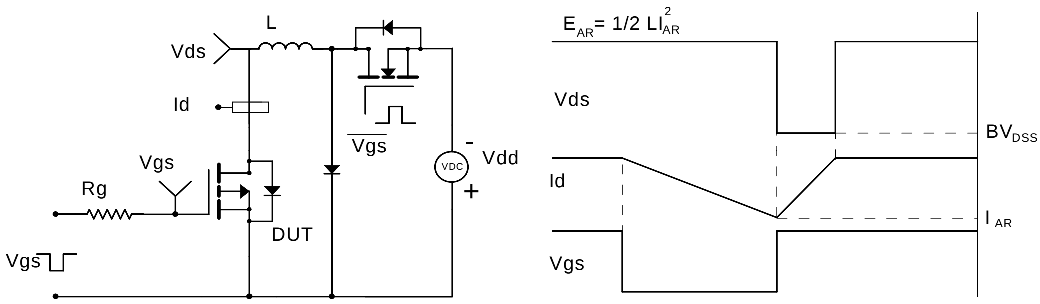
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms