ALPHA & OMEGA SEMICONDUCTOR

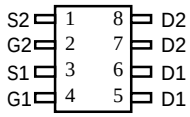
AOP611
Complementary Enhancement Mode Field Effect Transistor

General Description
The AOP611 uses advanced trench technology MOSFETs to provide excellen $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications. *Standard Product AOP611 is Pb-free (meets ROHS & Sony 259 specifications). AOP611L is a Green Product ordering option. AOP611 and AOP611L are electrically identical.*

Features
n-channel	p-channel
V_{DS} (V) = 40V	-40V
I_D = 6.5A (V_{GS}=10V)	-5.5A (V_{GS} = -10V)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 35mΩ (V_{GS}=10V)	< 52mΩ (V_{GS} = -10V)
< 47mΩ (V_{GS}=4.5V)	< 80mΩ (V_{GS} = -4.5V)

ESD rating: 3000V (HBM)

UIS TESTED!
Rg,Ciss,Coss,Crss Tested



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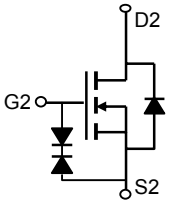
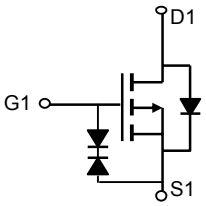


n-channel



p-channel

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage		V_{DS}	40	-40	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current [A]	T_A=25°C	I_D	6.5	-5.5	A
	T_A=70°C		5.3	-4.4	
Pulsed Drain Current [B]		I_{DM}	30	-25	
Power Dissipation	T_A=25°C	P_D	2.5	2.5	W
	T_A=70°C		1.6	1.6	
Avalanche Current [B]		I_{AR}	13	17	A
Repetitive avalanche energy 0.3mH [B]		E_{AR}	25	43	mJ
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics: n-channel and p-channel

Parameter		Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	n-ch	37	50	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		n-ch	74	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	n-ch	28	40	°C/W
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	p-ch	35	50	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		p-ch	73	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	p-ch	32	40	°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	40			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=32V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±20V			1	mA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA	1	2.2	3	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=6.5A		28.5	35	mΩ
		T_J=125°C		40	48	
		V_{GS}=4.5V, I_D=5A		38.5	47	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=6.5A		18		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.76	1	V
I_S	Maximum Body-Diode Continuous Current				3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=30V, f=1MHz		506		pF
C_{oss}	Output Capacitance			106		pF
C_{rss}	Reverse Transfer Capacitance			38		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		2.6	3.9	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=20V, I_D=6.7A		8.4		nC
Q_g(4.5V)	Total Gate Charge			4.1		nC
Q_{gs}	Gate Source Charge			1.6		nC
Q_{gd}	Gate Drain Charge			2.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=20V, R_L=3Ω, R_{GEN}=3Ω		4.8		ns
t_r	Turn-On Rise Time			2		ns
$t_{D(off)}$	Turn-Off DelayTime			17		ns
t_f	Turn-Off Fall Time			2.1		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=6.5A, dI/dt=100A/µs		17.5		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=6.5A, dI/dt=100A/µs		11.1		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 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. The current rating is based on the t≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev 0: October 2006

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

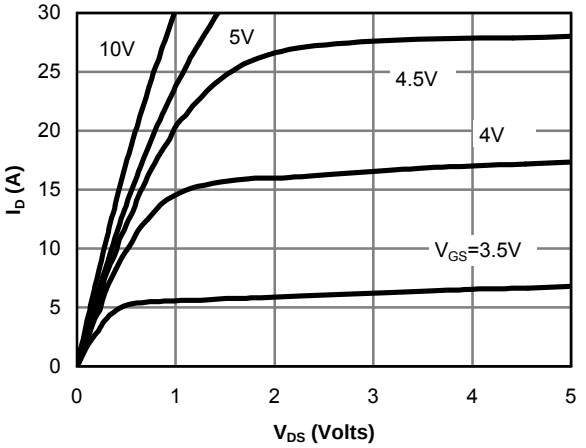


Figure 1: On-Region Characteristics

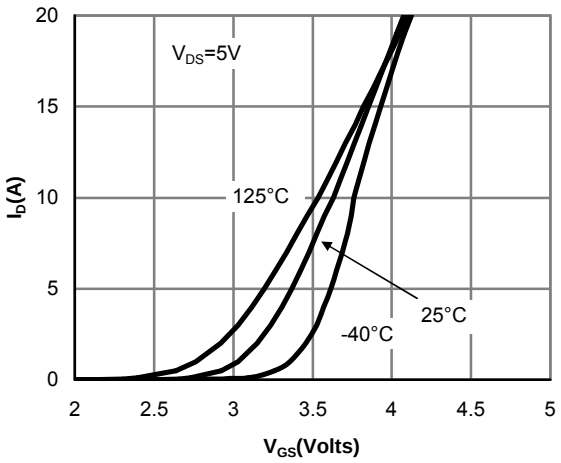


Figure 2: Transfer Characteristics

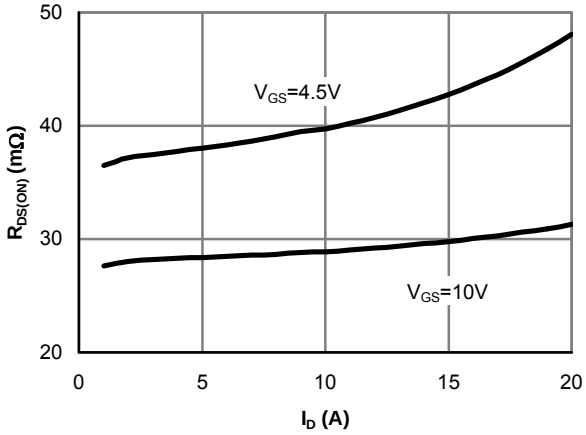


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

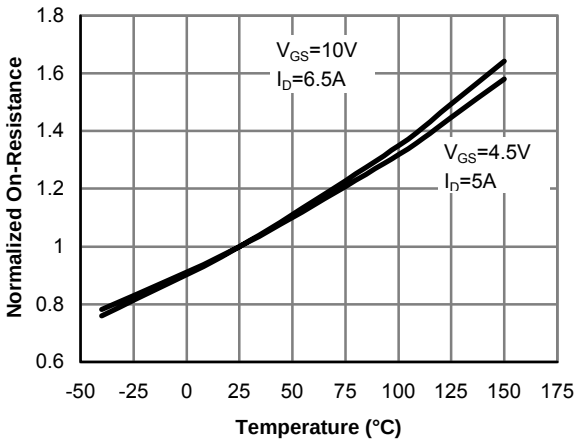


Figure 4: On-Resistance vs. Junction Temperature

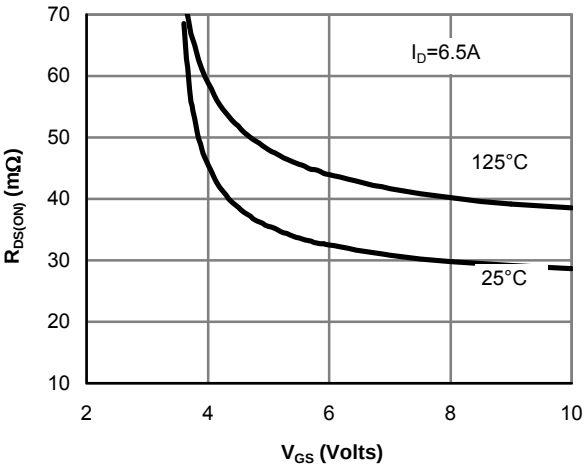


Figure 5: On-Resistance vs. Gate-Source Voltage

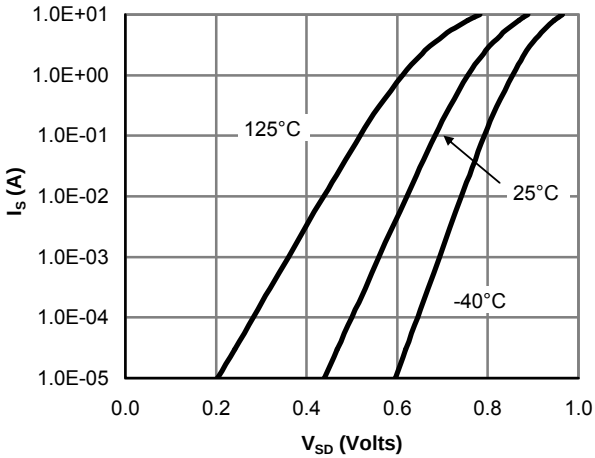


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

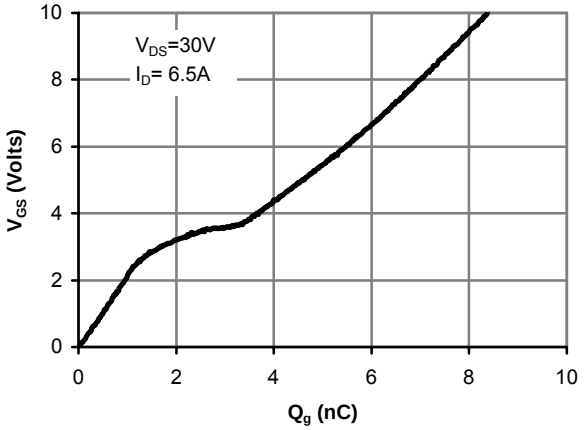


Figure 7: Gate-Charge Characteristics

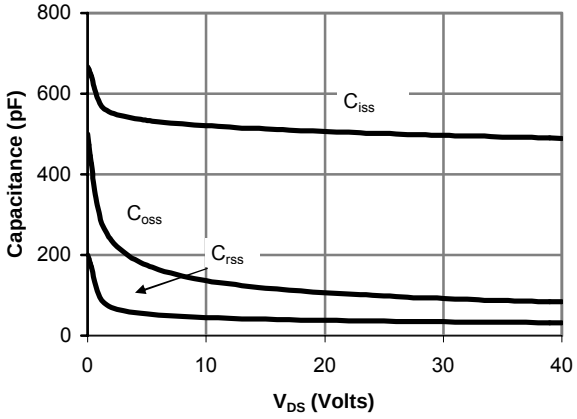


Figure 8: Capacitance Characteristics

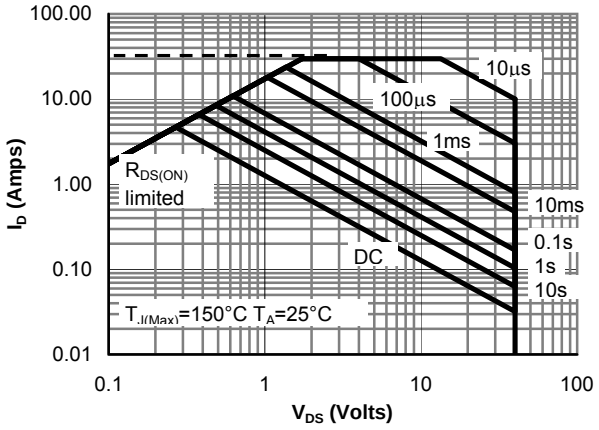


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

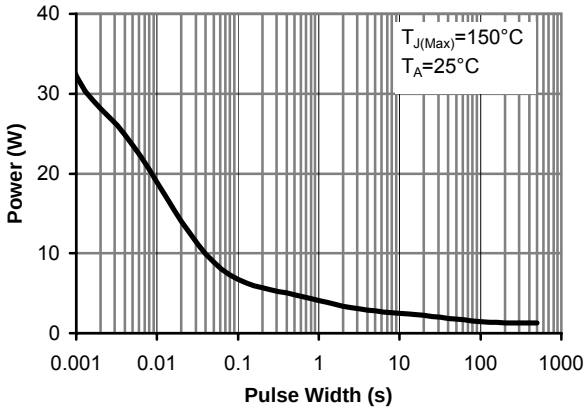


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

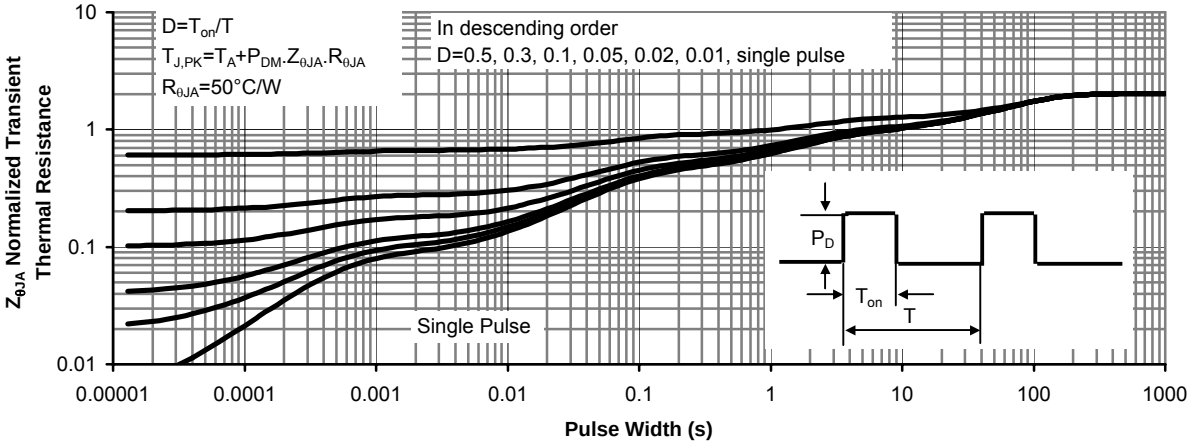


Figure 11: Normalized Maximum Transient Thermal Impedance

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	-40			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-32V, V_{GS}=0V			-1	µA
		T_J=55°C			-5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			±150	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=-250µA	-1	-2	-3	V
$I_{D(ON)}$	On state drain current	V_{GS}=-10V, V_{DS}=-5V	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=-10V, I_D=-5.5A		43	52	mΩ
		T_J=125°C		60	72	
		V_{GS}=-4.5V, I_D=-4.4A		65	80	mΩ
g_{FS}	Forward Transconductance	V_{DS}=-5V, I_D=-5.5A		11		S
V_{SD}	Diode Forward Voltage	I_S=-1A,V_{GS}=0V		-0.76	-1	V
I_S	Maximum Body-Diode Continuous Current				-3.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-20V, f=1MHz		1006		pF
C_{oss}	Output Capacitance			152		pF
C_{rss}	Reverse Transfer Capacitance			77		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		11	16.5	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge (10V)	V_{GS}=-10V, V_{DS}=-20V, I_D=-5.5A		17.4		nC
Q_g(4.5V)	Total Gate Charge (4.5V)			8.8		nC
Q_{gs}	Gate Source Charge			3.3		nC
Q_{gd}	Gate Drain Charge			4.5		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=-10V, V_{DS}=-20V, R_L=3.6Ω, R_{GEN}=3Ω		9.7		ns
t_r	Turn-On Rise Time			6.3		ns
$t_{D(off)}$	Turn-Off DelayTime			35.5		ns
t_f	Turn-Off Fall Time			26		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=-5.5A, dI/dt=100A/µs		22		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=-5.5A, dI/dt=100A/µs		15.9		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 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. The current rating is based on the t≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

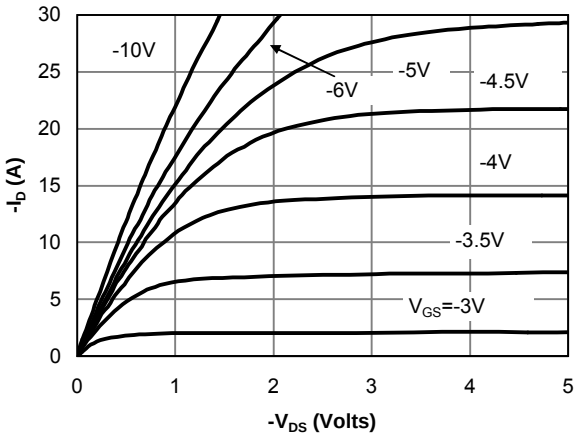
C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev 0: October 2006

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL



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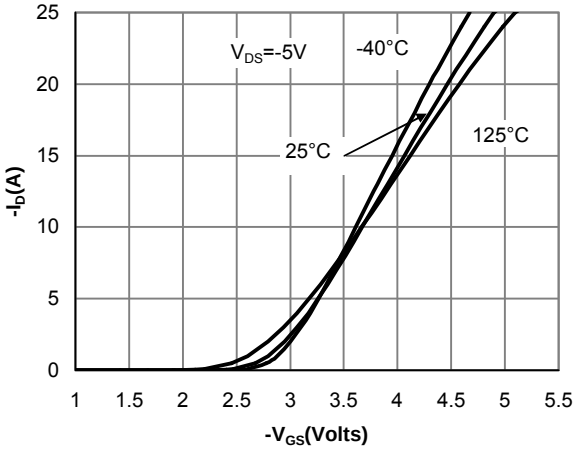

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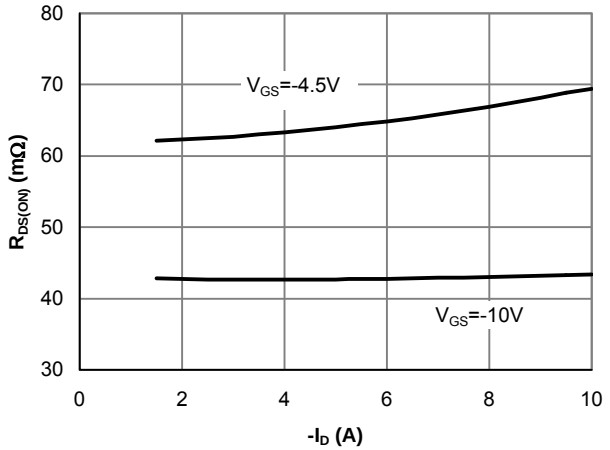

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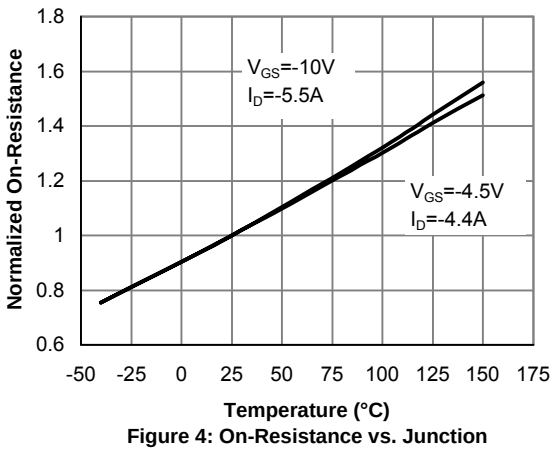
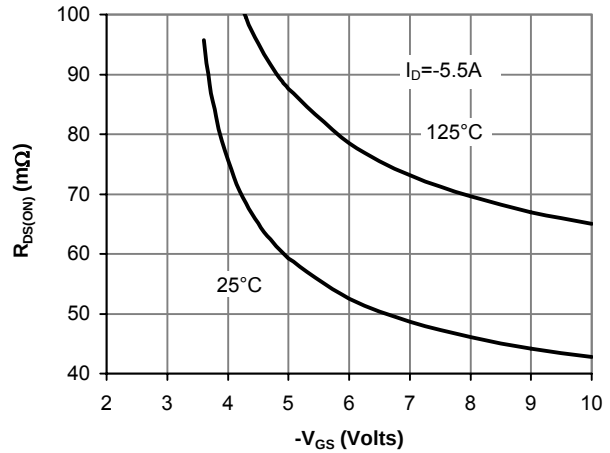


Figure 4: On-Resistance vs. Junction Temperature



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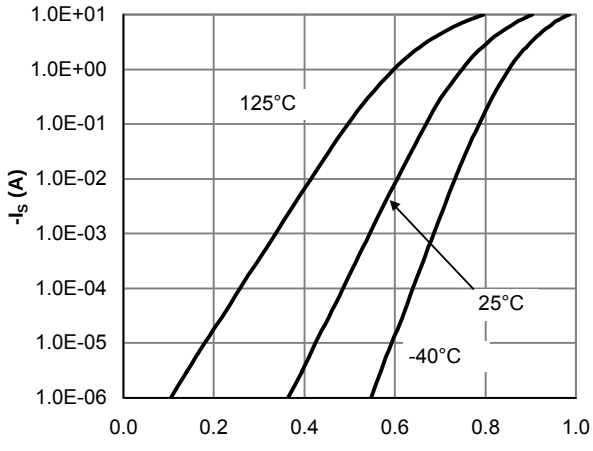

Figure 6: Body-Diode Characteristics

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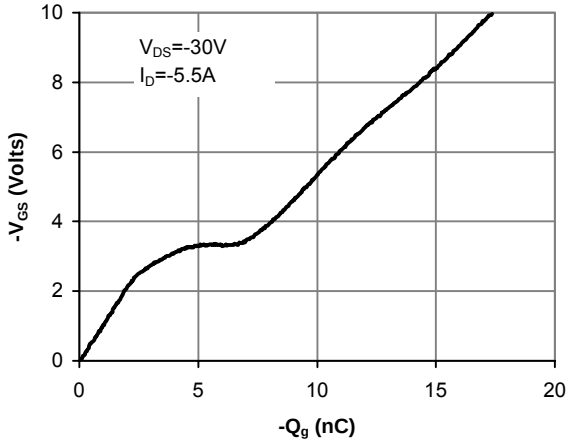

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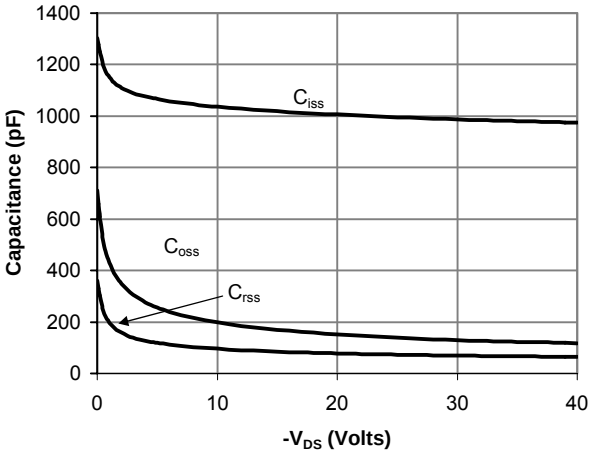

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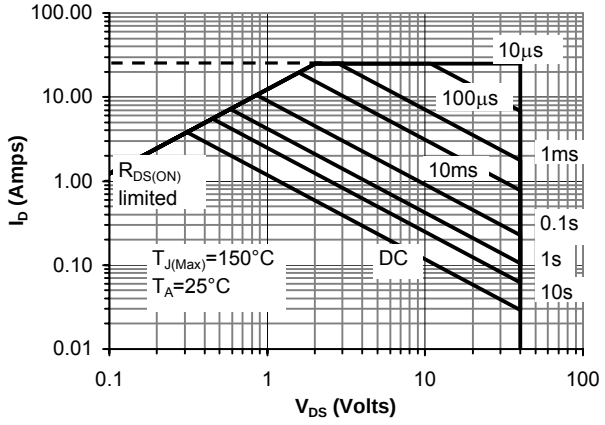

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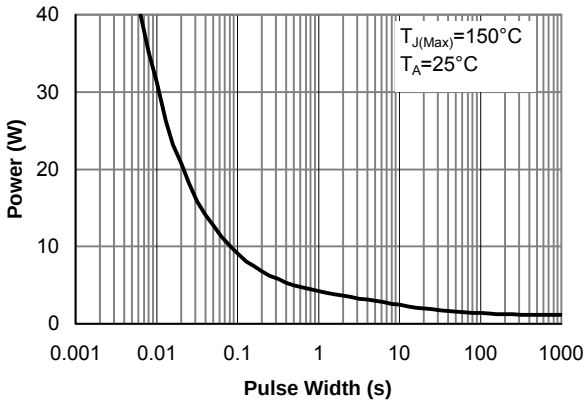

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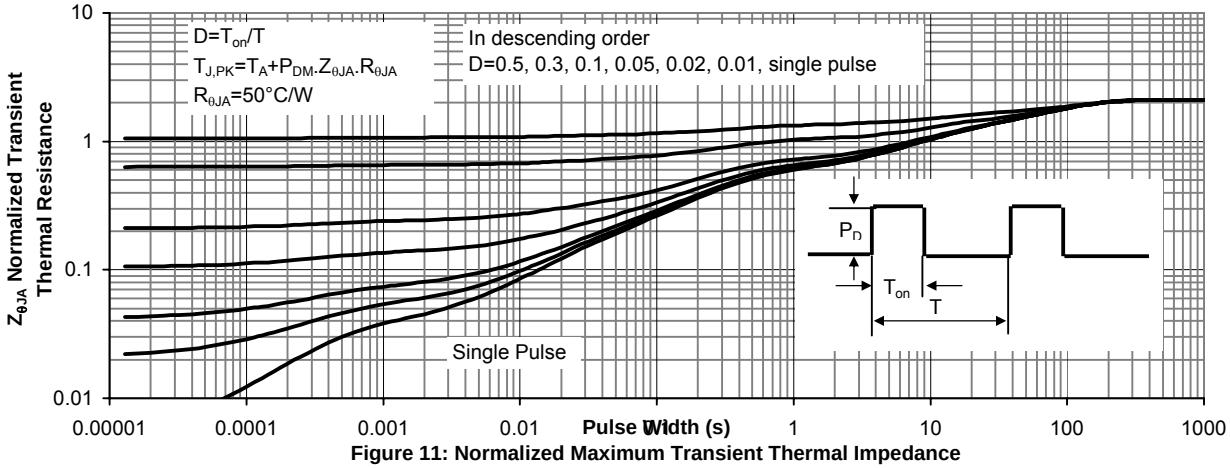

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